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UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
HAWAII NATIONAL PARK

FILE No.

MONTHLY REPORTS

FISCAL YEAR 1932

July 8, 1932.

The Director,
National Park Service,
Washington, D. C.

Dear Mr. Director:

The following is the administrative report for Hawaii National Park for the month of June 1932:

<u>000 General</u>

The outstanding event in Hawaii National Park was the tragedy in Halemaumau fire pit. This tragedy took the undivided attention and full time of the complete staff of the Park from the Superintendent to the day laborers.

About 7 o'clock on the morning of June 2, Sylvester Nunes, a Portuguese aged 23, employed by the Hilo Gas Company, kidnaped Margaret Enos, a pretty, 17-year-old high school student of the same nationality, from where she lived with her brother-in-law, Manual Furtado, on Kamana Street, Hilo.

With a rented car, Nunes called at the girl's home, entered the house, pointed a gun at her, and ordered her to come with him. The girl was in bed when he called, and she was taken dressed only in her night gown and a red kimono. When Mrs. Furtado attempted to wrench the gun from Nunes' hand, she was shot through the hand, the bullet entering the breast of Margaret Enos, who collapsed. Nunes explained that he would take the girl to the hospital, but instead drove directly to Halemaumau fire pit and, evidently firing another bullet into the body of the girl, jumped with her in his arms into the 900-foot pit.

The love-crazed youth had been contemplating this for some time as he had purchased a revolver on May 16 and secured a permit to carry it from the sheriff's office. He rented the previous night the car that he drove to the volcano, and explained that he was planning a trip to the volcano the following day. He had previously threatened the girl's life because she refused his attentions, but the family did not think that he was serious.

When the police were notified, considerable time elapsed in reporting to the house to get the story and checking up at the hospital, and by the time the word had been sent out to the police officers in the various districts and around the island of Hawaii, Nunes had carried out his intentions. The police overlooked calling the National Park Service, and in fact it apparently did not occur to them to do so, even when they entered the Park to search for the kidnaper. The car was found on the brink of Halemaumau by Captain Lindsay about 10:30 a.m., who from that point telephoned to Captain Hedden of the Kilauea Military Camp in the

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Park for a detail of soldiers to help look for Nunes and Miss Enos, whom he thought would be hiding in some of the caves or lava tubes in the Crater of Kilauea. He asked Captain Heddon to advise us of the tragedy, which was the first information that we had received.

In the car, which was quite badly blood-stained, was found a note on the back seat in Nunes' handwriting, which read, "Six minutes to 8. Margaret died instantly. She did not suffer. Now I must pay." On the edge of the crater was found the Colt automatic 32-caliber revolver and one empty shell. The gun had been placed on safety. There were two cartridges missing from the magazine. There was one shell ejected when the revolver was fired at Hilo, and the second shot evidently was fired into the girl's body before she was thrown into the pit.

Although Captain Lindsay stated positively the bodies were not in the pit, as soon as the rangers got on the job, suspicious looking objects were immediately spotted, and when a telescope was brought they were quickly identified as the bodies of Nunes and Miss Enos.

As soon as the bodies were discovered in the pit, consideration was immediately given to plans to remove them. Many plans were suggested, but practically all of them were impracticable or foolhardy. Many thought that it was impossible to remove the bodies. It should be stated here, however, that the National Park Service ranger force, as well as the organization of the United States Army, lived up to its finest traditions. There were a number of volunteers from both organizations to go down into the pit and secure these bodies if it was determined that they should be removed. Several other offers were received, but I believe the greatest credit is due to the Park staff and the Army staff for their courage in volunteering to make this descent, because they knew what the dangers were while many on the outside did not.

After a complete discussion of the whole problem and the various plans suggested, I created on the following day an advisory board to act as advisors to the Superintendent and to study ways and means if any of removing these bodies. This advisory board consisted of:

E. P. Leavitt, Superintendent, Hawaii National Park
Dr. T. A. Jaggar, Volcanologist, U. S. Geological Survey
Capt. W. A. Hedden, U.S.A., Kilauea Military Camp
H. L. Handley, Engineer, Bureau of Public Roads
John E. Doerr, Jr., Naturalist, Hawaii National Park
Joseph H. Christ, Acting Chief Ranger, Hawaii National Park

The whole project was again discussed and the viewpoints of this advisory council secured, as well as the viewpoints of the members of the various staffs represented who were familiar with conditions. Every plan or suggestion which had been advanced by anyone either in the Council or from outside was carefully discussed and considered, and finally all of them were rejected as unfeasible.

The only plan that appeared feasible without undue risk of life was that of stretching a cable across the pit far enough away from the almost perpendicular edges and talus slopes so that a cage or boatswain's chair could be lowered from this cable without coming in contact with the walls and shelves of rocks and loose boulders where a mere touch of the cable would start avalanches. Some of the members of this advisory council felt that even this was not a practicable plan. All realized that such a plan would require a great deal of cable and apparatus and that it was a matter of skillful engineering with special equipment required, none of which was available in the Park and could not be easily secured. The final decision of this advisory council was that the most sensible, humane, and respectful thing to do would be to hold funeral services on the edge of the pit and bury the bodies where they lay by avalanching loose material on them until they were thoroughly covered.

This council met on the morning of June 3, the day after the bodies had been located. In the afternoon of June 3 the Supervisors of the County of Hawaii called up and said that they had considerable apparatus, men, and engineers, and wanted permission to send their crews and their apparatus to the Park, and endeavor to reach the bodies with grappling hooks. This permission was granted. The crews came up with trucks loaded with windlasses, drums, hoisting apparatus, cable, ropes, pipe, and various other equipment, together with their best engineers and construction men familiar with conditions in the pit, slinging of cables, etc. After inspection of the bodies through high-powered glasses and careful study of the whole situation, various plans were discussed, and the group finally unanimously came to the conclusion that removal of the bodies was entirely impracticable and that burial where they lay was the best solution. The equipment, therefore, was returned to Hilo that same evening.

This pit was so large, 3,500 feet in diameter, and the depth so great, 900 feet, that objects are dwarfed and the difficulties of removing these bodies were not thoroughly realized or understood by the public generally. First, while the walls appear vertical so that the bodies lying on the talus slopes below seemed to be right under the edge, and that a rope or cable from a boom extended over the edge about 40 or 50 feet would seem to clear the talus slopes, it was found by study of the maps which Dr. Jaggar had, and of the profiles of this pit as shown in Volcano Letter No. 369 of January 21, 1932, that the bodies were actually about 300 to 350 feet horizontally inward toward the center of the pit, and this distance was later proven to be correct when the cables were stretched across over the position.

Full report of the situation was sent by radiogram to your office June 2 asking whether or not special or emergency funds for the removal of the bodies could be provided, for which I estimated the cost to be not less than $1,500, and asked permission to bury the bodies where they were if funds for their removal could not be secured, or if it was found impracticable to do so from an engineering standpoint. The only fund available was the budget reserve of $540, which your office immediately released, directing, however, that the removal should be done contractually after advertising, rather than by Park force, and also authorizing the burial of the bodies where they lay if removal by contract was found impracticable and no other solution from an engineering standpoint promised satisfactory results. The only stipulation in this contract was that the proposal and specifications should be drawn up to protect the Federal Government and the landscape.

While fully realizing that the sum provided was far too small to be of practicable benefit in this undertaking, nevertheless I interviewed Mr. Muller, Superintendent of the Bitulithic Paving and Concrete Company, who had the contract for the road work here at Kilauea headquarters, and tried to interest him in the project as a business proposition. Mr. Muller stated offhand that he thought a thousand dollars would be required to remove the bodies, his plan being to rig up cables across the pit. The following day, after more careful consideration had been given and calculations had been made at the pit, and especially after the County of Hawaii engineers had given up, Mr. Muller raised his estimate to $3,000. The following morning, after still more careful figuring, his estimate was raised to $6,000. The latter figure included approximately $2,900 for new cable. Mr. Muller felt that it would be unsafe to use old cable or any that had been in use on sugar plantations because of the danger of strains or wear which could not be recognized and which were likely to break the cable and cause further loss of life. He was unwilling to attempt the job unless all the cable was new. In this $6,000 estimate, he allowed only $500 for profit and contingencies.

About this time offers of cooperation began to come in to the National Park Service from the various plantations on the Island of Hawaii, the Matson Navigation Company, Mana Transportation Company, and others, offering to lend or donate any equipment or other apparatus that they had that would be useful in the removal of these bodies. However, none could be found who was willing to undertake the job on a contract basis, and no one was willing to undertake the responsibility because of the difficulties and dangers involved and the large expense which could not be financed by the National Park Service or the County of Hawaii. The Supervisors who were in regular session asked my advice in the matter and an estimate of the amount that would be required. I told them that with the money that the Park Service had available an appropriation of not less than $1,000 would be required from them to make the project a success. On questioning the police department, they were told that $500 would be ample; therefore, the County Supervisors appropriated $500.

On Saturday afternoon, June 4, Riken Konishi, a Japanese contractor, aged 40, who was about 5 feet tall and weighs less than a hundred pounds, went to the Board of Supervisors in Hilo and offered to recover the bodies for a thousand dollars. He was brought to the Park by Supervisor Cabrinha and Deputy Sheriff Peter N. Pakele, Jr., and repeated his offer. He stated he was willing to sign a contract and give bond, and if the bodies were not recovered no payment would be demanded, and he claimed to have had previous experience in engineering work of this character. His plan was to swing a cable across from which to support a cage which would be lowered to the bottom of the pit. He claimed to be able to remove the bodies within two days.

After he had studied the maps of the crater and the location of the bodies through powerful glasses, had done some figuring with his partner, another Japanese contractor named T. Yamamoto, they raised their bid to $2,000. They explained that the additional $1,000 was made to purchase cable and secure tractors and other equipment which they did not realize would be needed. As this was more money than was available, Supervisor Cabrinha stated that in the discussion that took place when the $500 was appropriated, the feeling was expressed that if necessary they would increase their appropriation to $1,000. Therefore, he was willing to enter into contract with Konishi to the extent of $1,000, but no more.

Under these circumstances it was manifestly impossible for the Superintendent of the Park to enter into any contract with only $540 in Park funds and $500 in County funds, with no positive assurance that additional County funds would be made available.

After further discussion it was suggested that the offer of the various plantations to cooperate be accepted, and on learning from Konishi the amount of cable, the number of tractors, trolleys, etc., that would be required, the Park Service and the County of Hawaii jointly promised to provide this cable and equipment. The contractor then agreed to take the contract for $1,000 as per his original offer. In order to secure prompt action in the matter, I gave written authority dated June 4, 1932, to the County of Hawaii to contract for the removal of these bodies, as follows:

"Permission is hereby granted to Sheriff Henry K. Martin, or to the County of Hawaii, to contract for the removal of the two human bodies in the fire pit Halemaumau in the crater of Kilauea, Hawaii National Park.

"Any contract entered into must save the Government harmless of any responsibility and should provide for safeguarding the landscape features of the Park. All possible assistance and cooperation is promised the sheriff or the County of Hawaii by the National Park Service."

With this authority, Konishi, his attorney, the members of the County of Hawaii police department returned to Hilo, where the contract was signed that night and bond for $500 given.

With Deputy Sheriff Pakele I immediately got busy calling the various plantations on the telephone, secured from them a list of the equipment available, and that night started tractors, cables, winches, drums, and other materials to the pit, some of it having to come 70 miles or more. Everything that the contractor needed was at the pit at 8 o'clock the following morning, and by noon all of the equipment asked for has been delivered.

From Sunday, June 5, until 5 p.m. Sunday, June 12, the contractor worked feverishly at his job with a gang of from 40 to 60 helpers and the volunteer service of the whole Japanese Contractors Association of Hilo. Difficulty after difficulty was experienced. The cables were too short, some were too light, others were too heavy; he did not trust the trolley and had a special trolley of his own made. The cage was made of wood reinforced with iron bands, and test trips with loads of rock and sand were made. The lines became fouled. The supporting cable 4,000 feet long of 3/4-inch thickness was anchored to heavy tractors with a dead man beyond the tractors. One of the tractors was pulled loose in one test. The winches for raising and lowering the cage were not adjustable as to speed, but would only raise at engine speed, which jerked the cable and cage, causing dangerous strains. These had to be changed for drums that had variable and controllable speed both raising and lowering. A system of signals had to be worked out because the operators at the tractors were over the brink of the volcano and could not see what was going on. The crew had to be trained in sending and receiving signals.

In two or three cases, wrong engineering principles were adopted. In one case a system of block and tackle on the cable intended to reduce the strain on the tractor by 25 per cent was wrongly connected up and increased the strain by 100 per cent over normal. This broke the drum. In another case two tractors were pulling on 3/8-inch cable in opposite directions, one pulling the cage across the pit and another supporting the cage and paying out as fast as the other tractor pulled. Because of the inability to see what the other was doing and the great distance, the movements could not be synchronized, and there was great danger of pulling the cable apart and dropping the cage into the pit. All of these important difficulties as well as many other minor ones had to be remedied before the descent could be safely made. Finally, when everything had been corrected and it looked reasonably feasible, I gave the consent to make the trip.

Perhaps the one greatest help was telephone service furnished by the field telephones and equipment by Captain Hedden, who detailed a signal corps group of six men under Corporal Wallace. Konishi took this telephone down into the pit with him and thus was able to talk to his friends at the surface all the way down, while on the crater floor, and on the return.

Anyone of a thousand things could have happened while this cage was being lowered into and returned from the pit, and several serious things did happen. On the downward trip a cable became fouled. Konishi coolly climbed out of his cage and up on top to disengage it. On his return he also had to climb outside of his cage while suspended 900 feet above the floor of the pit and tie the cage to the trolley with a special rope that had been provided. While he was working on the talus slopes recovering the bodies, a terrific landslide occurred only a few hundred yards to one side of him, and rocks rolled down large enough to bury him had he been in the way. The slide was large enough to cause a near panic in the group on top who were watching him and who thought that it was right under their feet. However, the bodies were successfully recovered, and Konishi became a real hero.

While it is not known exactly what his expense was in connection with this undertaking, there is estimated to have been approximately $2,000 or more of cost, so that a fund was immediately started and several benefit shows given. A total of $1,113.80 was raised by the community to reimburse Mr. Konishi for the additional expense that he was put to over and above the $1,000 which he received from the County.

Mr. Konishi is a modest, unassuming man, and he has been honored by the whole Territory. He is a married man, having a wife and five children. One of the interesting things in connection with this whole case was that Mr. Konishi was prompted to undertake this difficult task because of a sense of gratitude for a past kindness shown him by a relative of one of the victims of the unrequited love affair. Deeds of courage and endurance always stir the hearts of men. Admiration for daring and resourcefulness knows no bounds of race or color. Rikan Konishi, undaunted by a series of formidable obstacles, went into the depths of Kilauea's crater and brought forth the two bodies which fell there in a tragedy resulting from strong human passions. In spite of the multitude of precautions, he took and the thoroughness of preparation, he went down into Halemaumau at imminent hazards. He stayed down four hours to make scientific investigations, collect lava specimens for the Volcanologist, and take motion pictures. His feat in bringing back the bodies has earned him well and merited praise. He did what thousands of people thought could not be done and he did it well.

Attached to the report are a number of interesting pictures showing Mr. Konishi and his operations.

020 General weather conditions.

Although the rainfall for the month amounted to only 3.16 inches, there was some rainfall on practically every day. There were 24 partly cloudy days, 6 clear days, and 28 on which 0.01 or more precipitation occurred. The total rainfall to date amounts to 60.14 inches, as compared with 19.5 inches for last year. The mean maximum temperature was 68.9 degrees, the mean minimum 53.7 degrees. The characteristic trade winds varied from light to moderate, but there were occasional periods of very strong wind, particularly June 7 to 11, inclusive, which interfered greatly with the operations of Konishi in his efforts to remove the bodies from the fire pit Halemaumau.

100 Administration

110 Status of work.

The Park was seriously handicapped during June by lack of stenographic assistance as Mrs. Hodges health did not permit her to render any service. As steps had been taken to have her husband, Richmond B. Hodges, transferred from the staff of Dr. Jaggar to the position vacated by Mrs. Hodges on June 30, Dr. Jaggar was kind enough to lend us Mr. Hodges for such time as he could be spared, and he worked for half-day periods for a total of about 11 days. This enabled us to handle only emergency work.

We also got behind because of the demands made on our staff by the Halemaumau tragedy. Chief Clerk Higashida was kept at the switchboard from early morning to late at night, even having his meals brought to him because it was necessary to operate the switchboard in handling calls from the Park telephone at Halemaumau to the Mutual telephone system. Further confusion and delay resulted in moving back from the Commissioner's residence, which had been our temporary office for four months, into our new Administration Building. It always takes some time to get settled and properly arranged following a move of this kind. We have been working overtime, however, and are gradually getting caught up with our work.

120 Park inspections by

121 The Superintendent.

In addition to daily inspections of work under way at Park headquarters, seven formal inspections were made during the month of roads and trails jobs.

A careful fire inspection was made of all buildings in the Park and regular report submitted. The usual monthly inspection was made of the road camp of the Bitulithic Paving and Concrete Company.

Rangers Eaton and Barnett made a trip to the Red Hill rest house on Mauna Loa to repair the stove and to inspect trail conditions. Acting Chief Ranger Christ, with Ranger Lowery, was detailed to accompany Engineer H. L. Handley to Maui on June 15 and to make a new reconnaissance survey of the Haleakala road. This survey was completed by Sunday night, June 19, and I made a trip to Maui on the 19th to go over the line, returning on the 22d. I also conferred with members of the Maui Chamber of Commerce and others interested in the development of that region.

130 Finance and accounts

As this is a statistical report, the figures for which are not available at this time, it is being attached as Statistical Report No. 8. The Park has handled its financial program so that we ended the fiscal year 1932 with all construction work completed, and while there were no deficits, there were no funds left over.

A serious fire in May and the Halemaumau tragedy were special problems that arose that took funds that were badly needed elsewhere, but fortunately through a release of the budget reserve and an allotment of fire-fighting funds in the latter part of the month, the Park ended the year in satisfactory shape.

140 Labor situation

Four new men were added to the per diem organization in June. The unemployment situation is getting more serious every day, both in Hilo and in Honolulu. The completion of the road contract will lay off a large gang that has been steadily employed in the Park for more than a year.

150 Equipment and supplies

The Park secured a new Ford dump truck with combination platform body and a new Wood hoist. This truck is one cubic yard capacity and was purchased through the San Francisco office from roads and trails equipment fund. It was placed in service the day it arrived and has been used every day since. It will be particularly useful in obliterating old roads and in landscaping.

A new Ford station wagon covered truck, half-ton capacity, was also bought from the Park appropriation during the month.

170 Plans, maps, and surveys

The six-year development program for the Park is now receiving special study on the ground. Changes in plans are being noted where they suggest themselves, and additional items are being noted to add to the plan when it is revised this fall.

The plans and the estimates submitted in the 1934 construction estimates have all been made up in the San Francisco office and copies have been forwarded to Washington.

A reconnaissance survey for relocating the Haleakala road was completed during the month and transmitted through regular channels for approval.

A reconnaissance survey of the Uwekahuna road has also been under preparation illustrated with views, and has also been forwarded through official channels for approval.

180 Circulars, placards, publicity bulletins, etc.

Attached are copies of the Volcano Letter issued during the month of June. Because of lack of funds, it has been necessary to reduce this pamphlet in size to a one-page circular and change it from a weekly to a monthly publication. Due to pressure of other matters, there were no issues of Nature Notes in June, but copy has been prepared and we hope to catch up soon with the back issues. An interesting article on Hawaii National Park, describing the eruption of last December and illustrated with photographs, appeared in the Pacific Mutual Life Insurance Bulletin for April 1932, and was given wide distribution.

The Hawaii National Park sprang into the limelight again in connection with the Halemaumau tragedy. This was a sensational story and was sent by the press association practically everywhere. Subsequently the efforts to recover the bodies made interesting reading, and the successful recovery of the bodies will probably react to the benefit of the Park from a publicity standpoint.

200 Maintenance, improvement and new construction

210 Maintenance
The usual maintenance and repair of roads, trails, telephone lines, buildings, signs, and water and sewer systems was carried on during the month.

220 Improvements
Through the Hui o Pele, 120 opera chairs were secured for the Uwekahuna lecture hall at a cost of $444. These chairs were assembled and placed in use just prior to the opening of the summer school classes. They are quite comfortable and will be an important factor in the use of our lecture hall and furthering our educational program.

In order to remove the grass growing on the shoulders of the Chain of Craters road, it was found desirable to kill this grass with a poisoned spray, and after the grass died to remove it so that it would not interfere with the paving operations under way during the month.

It has been found necessary to place some surfacing material on the earth shoulders of our newly-paved roads, particularly in wet regions, so that these shoulders are not too greatly cut up by traffic. This work was started during the month.

230 New construction
231 New Administration Building
The new Administration Building was sufficiently completed by June 20 so that we were able to move in from the temporary offices maintained in the Commissioner's quarters for the past four months. The building is a beautiful structure, well arranged, and well appointed, and we are very proud of it. There is considerable clean-up work to do around the building, and replanting and improving of grounds. As soon as this work is completed, we plan to have a dedication. Pictures of the completed building will be sent in when the outside work is finished.

232 New Commissioner's residence
By moving out of the new Commissioner's residence on June 20, the final touches on that building were made so that the building was completed by the end of June.

233 Tilt cellars
Dr. Thomas A. Jaggar awarded a contract for the building of two more tilt cellars around the fire pit Halemaumau similar to the station that was built last December by the National Park Service for the Geological Survey. The two cellars are being placed entirely underground and will not be visible from the rim of Kilauea Crater.

260 Landscape work: 261 Grounds

The steam crack in front of the Administration Building has been preserved as an interesting feature of our grounds, has been bridged with a concrete slab, and proper protection afforded by building stone walls around it. In the planting, the ideas and suggestions of Dr. E. P. Meinecke, Principal Pathologist of the Bureau of Plant Industry, have been secured as he is an expert [redacted] on varieties to be planted and locations.

262 Roads

Road Project No. 1 from the Volcano House to Halemaumau fire pit, on the east side of Kilauea Crater, was practically completed by June 15, the date of the last road report. Some dressing up remains to be done and some shoulders had to be rolled. Some repairs had to be made in the pavement where there were pavement failures, and the work was practically completed by the end of the month. Very little work was done on Project No. 2, Chain of Craters road, since last month, but it was estimated that not more than two weeks would be required to complete this work. Final completion was resumed on June 20.

Project No. 3-A, around the island road, was the project which received the most attention during the month. Grading was completed, the paving all laid, and the work nicely dressed up. Final dressing up of shoulders and banks and the rolling of shoulders were in progress at last report. This work progressed without trouble except that a volcanic gravel pocket between stations 97 and 99 would not compact under the roller. Fine material was added to the gravel and water applied, but the material continued to be very unstable. It was found necessary to remove it all and replace it with rock.

Project 3-B, calling for shoulder repair on portions of the around-the-island road, was completed some time ago. The lower half of this section of the road, which was put down several years ago as an oil-mixed road, is in very bad condition and it will be necessary to scarify about two miles of this, add oil and new material were necessary, and replace. Funds for the work have been provided from savings made in the roads and trails allotments placed with the Bureau of Public Roads, and work has been authorized under National Park Service force account.

Weather conditions generally have been favorable.

The advice and experience of Dr. E. P. Meinecke were secured in the replanting work contemplated to obliterate old roads and construction scars. He was also consulted concerning the varieties of plants and where they would grow best in connection with landscape work to be done around the new Administration Building. Dr. Meinecke's knowledge of plants, together with his experience and advice, has been of tremendous value to us in this work.

The Kilauea Military Camp is planning considerable landscape work and is anxious to start it. They contemplate planting a screen of trees, shrubs, and plants between the main road and their camp buildings.

300 Activities of other agencies in the Park

310 Public service contractors
The Volcano House operated throughout the month, but they have had one of the lightest business months in their history.

The Kilauea Summer Camp opened up on June 30, but handled practically no business until the summer school opened, when they received seven guests who are taking the courses. Although the company has advertised special summer rates at the Volcano House and Kona Inn, with a special automobile rate of $5 per passenger between the hotels, and the Hawaii Tourist Bureau has carried on an extensive advertising campaign to induce residents of the Territory to spend their vacations on the other islands this year, there has been practically no response to these efforts to increase business, and the company will probably ask permission to close down the Summer Camp and handle the few guests there at the Volcano House. If business does not pick up after the 4th of July holidays, this will probably be authorized.

The Kilauea Military Camp, which provides the equivalent of ~~the~~ a hotel to the enlisted and commissioned personnel of the Army, had a very light month due to the withdrawal of the Army transport Frank, which was placed in drydock. On resuming her schedule toward the end of the month, visitors began to arrive again but in numbers considerably less than last season.

In this connection it is proper to report that Captain Willis A. Hedden, of the 19th Infantry, who has been commander of this camp for the past 18 months, was relieved of his detail on June 30 and was succeeded by Captain Wayne M. Archer, also of the 19th Infantry. Other new officers are Major Norman McL Scott, of the Medical Corps, Lieut. Paul.K. Porch, and Lieut. Robert B. Beattie.

The new commander of the Navy Health and Recreation Camp is Lieutenant McFarland. Assignments to the Navy Camp are usually for three months.

Brigadier General Briant H. Wells visited the Kilauea Military Camp on June and conferred with the Park Superintendent on plans for the development and improvement of the camp. He has in mind new roads, new buildings, and considerable landscaping. I have learned also they are desirous of building a new landing field adjacent to the camp. They also wish to build a theater there and open up an area for the growing of vegetables.

315 New contracts
The grazing contracts of Arthur M. Brown, which expired on March 31 last, and the Hawaiian Agricultural Company, on June 30, have not been renewed. Applications for renewal of these grazing permits have been received from both. If these permits are not renewed, it means building new fences or changing their fence lines in order to keep cattle from trespassing on Park lands, and with the present price of cattle, they are unable or at least reluctant to incur the expense of building fences at this time. The matter will probably be referred to your office for decision soon with full report.

400 Flora, fauna, and natural phenomena

410 Ranger, naturalist, and guide service

The ranger service has been employed on many jobs during the month, including forest protection, handling of traffic, repair of roads and trails, repair of signs, etc. The rangers did all of the electric and telephone wiring in the new Administration Building and assisted in the painting. For the first 10 days during the Halemaumau tragedy their whole time was given over to assisting in recovery of the bodies and handling traffic.

411 Naturalist service

The latter part of June is the beginning of the summer travel season, July and August being the months of heaviest travel to the Park because of vacation season. There is every indication that the number of mainland people visiting the Park this season will be smaller than during the same period last year. The steamship City of Los Angeles has been taken off the run from Los Angeles to Hawaii. This boat made the three-day cruise from Honolulu to Hilo and brought more visitors to the Park than any other steamer. It is probable that the removal of that ship will reduce the number of steamer visitors to the Park. The Army transport Royal T. Frank, running between Honolulu and Hilo, was out of service most of the month; hence few Army people visited the Park. This boat resumed operations on June 28.

412 Summer school

The summer school classes, held in the Park under the joint auspices of the University of Hawaii and the National Park Service, began on June 25 with a registration of 59 people. Two courses are being given. Dr. T. A. Jaggar, Volcanologist of the U. S. Geological Survey, is teaching a two-credit course in volcanology. Mr. Theodore C. Zschokke, University Extension Forester, is teaching a two-credit course in Hawaiian flora. Members of the Park staff are assisting in the work. The course in volcanology is largely a lecture course. The lectures are given between 8 a.m. and 9 a.m. from Monday to Friday of each week, and on Saturday a geology field trip is taken. The Hawaiian flora course is mainly field study, part of the required work being to make a collection of native plants. The Kilauea Summer Camp is used as headquarters for the class.

Seven members of the classes are living at the camp, but all others are commuting. A number of them are living in summer cottages near the Park, while a considerable number drive up from Hilo every morning.

The volcanology lectures are given at the Uwekahuna lecture hall.

500 Use of Park facilities by the public

Navy Camp visitors

During the week ending June 22, Chaplain W. M. Thomas, U. S. Navy, and Chaplain J. C. Rideout, U. S. Army, led a group of 64 boys ages 8 to 17 and 7 adults visiting the Park. The boys were sons of service men at Pearl Harvor and Schofield Barracks.

Park Naturalist Doerr gave them two special lectures, conducted them on nature study trips to Kilauea Crater, Kilauea Iki, Chain of Craters, Thurston Lava Tube, and Bird Park. The boys also visited the Kalapanaand Keauhou stock ranches. Particular effort was made to stimulate interest in natural sciences. Before the group left the Park, a number of the boys could name, identify, and tell the uses of 15 to 20 plants and a common type of rock. Their interest was stimulated by supplying them with a list of the names of the common plants and rocks. Judging from the reaction of the group and the publicity in Honolulu papers, they had a fine time and gained a worthwhile appreciation of the Park.

This is the second year Chaplains Thomas and Rideout have brought a group to the Park. Last year they were here for a week with 40 boys. Chaplain Thomas made the following statement concerning the Park: "Hawaii National Park and its staff has more interesting things to offer than any other place in the islands."

Lecture hall

The 120 seats purchased with Hui o Pele funds were installed during the month and provide a big improvement to the lecture hall.

The tragedy at Halemaumau

During the 11 days the two bodies were being removed from the fire pit, many people visited the Park. Most of the visitors were prevented from going into the crater; hence, many of them parked at the Museum, where they had an opportunity to see the exhibits and attend the lectures. A great many visitors during these days could not speak or understand English; hence probably got very little from the explanations or the lectures.

During the month there was a total of 13 field trips made with an attendance of 351, 9 lectures were given with an attendance of 327, and 725 visitors came to the museum. The total contacts amounted to 1,403 and travel during the month was 19,492.

Park Naturalist Doerr made a summary of the educational activities for the year ending June 30, 1932, which show a total of 238 lectures with an attendance of 10,306. Field trips number 107 with an attendance of 1,524, while the museum attendance numbered 16,751.

Mr. Theodore E. Zschokke was reemployed as Park ranger (naturalist) on June 26 at $1,860 per annum under field agreement, in the same position that he occupied last year. He will be employed for one month.

480 Insect control

Dr. E. P. Meinecke, Principal Pathologist, Bureau of Plant Industry, arrived in the Park on June 9 to make a study of forest conditions. Ranger Everett Brumaghim was assigned to him during the whole of his stay here because of his knowledge of Hawaiian plants. Dr. Meinecke made a careful and painstaking inspection of conditions in the Park, collecting and studying specimens of fungus in all sections of the Park from the sea coast to the timber line on Mauna Loa. He also made a trip around the island studying, observing, and comparing conditions on various sections of the island. He completed his survey here and left for Honolulu on July 4. Dr. Meinecke was particularly impressed with Bird Park and Kipuka Ki. He was able to tell Ranger Brumaghim a great deal about the plants, their characteristics, growth, diseases, etc., and he was impressed with the necessity of eliminating grazing from all of the Park land at the earliest practicable date. He feels that the drouth that the islands have undergone in the last year or two have affected the koa, which is quite susceptible to drouth conditions. A full report on general forestry conditions and other matters that were discussed with Dr. Meinecke will be incorporated in a report which he is preparing at the present time.

In addition to many discussions and several conferences, Dr. Meinecke addressed the Park staff one evening on Park policies, administration, forest protection, etc. He also addressed the summer school class on the first morning of their work. He gave a very interesting talk that was much appreciated.

Dr. Meinecke's visit has been of great value to the Park Superintendent in many ways.

480 Natural phenomena
The following is condensed from the Volcano Letter for the month of June 1932. The report is divided into three main studies conducted by the Volcano Observatory under the Geological Survey.

Volcanology
There were rock slides, emission of fume, formation of sulphur crystals, and opening of cracks at the fire pit Halemaumau in about the usual number or quantity. The specimens of lava collected by Rikan Konishi from the pit bottom on June 12 are described as being shred pahoehoe basalt, black, with brown stain, highly vesicular, glassy without visible olivine, with reddish brown glaze on inner surfaces. At one hot place on the talus where Konishi worked, his rubber soles were burned

Earthquakes
Seven distant earthquakes were registered, mostly from the active earthquake district of southern Mexico, some of which caused slight tidal disturbances in the Hilo Bay. Local earthquakes registered numbered 183, of which the most notable was a shock at 4:51:45 a.m. June 14, which awakened people generally all over the island and was also felt on Maui. A new seismograph station was established at Waikii, on the west side of Mauna Kea, in which an instrument from one of the abandoned stations in Alaska will be installed.

Tilting of the ground
The accumulated tilt at the Observatory since January 1, 1932, is 14.2 seconds south and 1.4 seconds west.

500 Use of Park facilities by the public

510 Increase or decrease in travel
There was a total of 19,492 visitors intering the Park during the month of June, which compares with 7,647 for June of last year. The great increase was due to the interest the general public took in the rescue work in securing the bodies of Sylvester Nunes and Margaret Enos from the bottom of the fire pit Halemaumau. This makes a total travel to date 114,506, compared with 98,895 last year, a gain of 15,627 visitors to date, or 15.8 per cent. Practically all these were local visitors on the Island of Hawaii.

520 Conditions which affect travel, general forest, plant, wild life, and other conditions in the Park
The general economic condition of the whole world has seriously affected steamer travel, so that the number of visitors from the mainland and Oriental ports is farless than usual. The increase in Park travel is due to increase of local travel.

Conditions in the Park are fine. The roads have been paved, plant life is extremely interesting and beautiful at this season of the year, and public service by our rangers and educational system is better than at any time in the history of the Park. In spite of all this and the efforts of the steamship and hotel companies, as well as the Hawaiian Tourist Bureau, to stimulate travel, people simply are not traveling this year.

530 Visitors
Bruce Cartwright, president of the Cartwright Company, Honolulu, and president of the Territorial Board of Agriculture and Forestry, spent two weeks at the Volcano House. He is a great lover of the Park and a fine friend.

General Briant H. Wells, Commanding the Hawaiian Department, from Fort Shafter, is interested in the Park and in the development of the Kilauea Military Camp as a recreation center, and in stimulating patronage of it.

Dr. and Mrs. Clarence Paige, of Berkeley, California, friends of Mr. and Mrs. William Noble, who attended the Rotary Convention in Honolulu.

Dr. Nora L. Auerback, of San Francisco,

Chaplains Thomas and Rideout, from Pearl Harbor and Schofield Barracks.

600 Protection

610 Police protection
Special police protection was necessary during the early part of the month in handling the crowds that came to the Park to watch the rescue work in connection with the bodies in the fire pit Halemaumau and in keeping the public out of the Halemaumau region while the final tests were being made and the bodies recovered. The Hilo police force rendered splendid cooperation all of this time.

An automobile stolen in Hilo was found abandoned in the Park, and was restored to its owner.

640 Destruction of predatory animals
There were 37 wild goats and 7 pigs killed during the month. In the pig hunt in which some of the employees of the Hawaii National Park participated, five dogs attacked one of the wild pigs, and in the scuffle that took place, the pig rolled over an embankment into a deep earthquake crack, carrying four of the dogs with him, and went down out of sight, where it was impossible to recover them. The fifth dog managed to save himself partway down by stretching across the earthquake crack, and was pulled out by the scruff of the neck.

900 Miscellaneous

On June 30 there were 12 permanently appointed members of the Park staff, compared with 8 last year, and 15 per diem employees as compared with 21 last year.

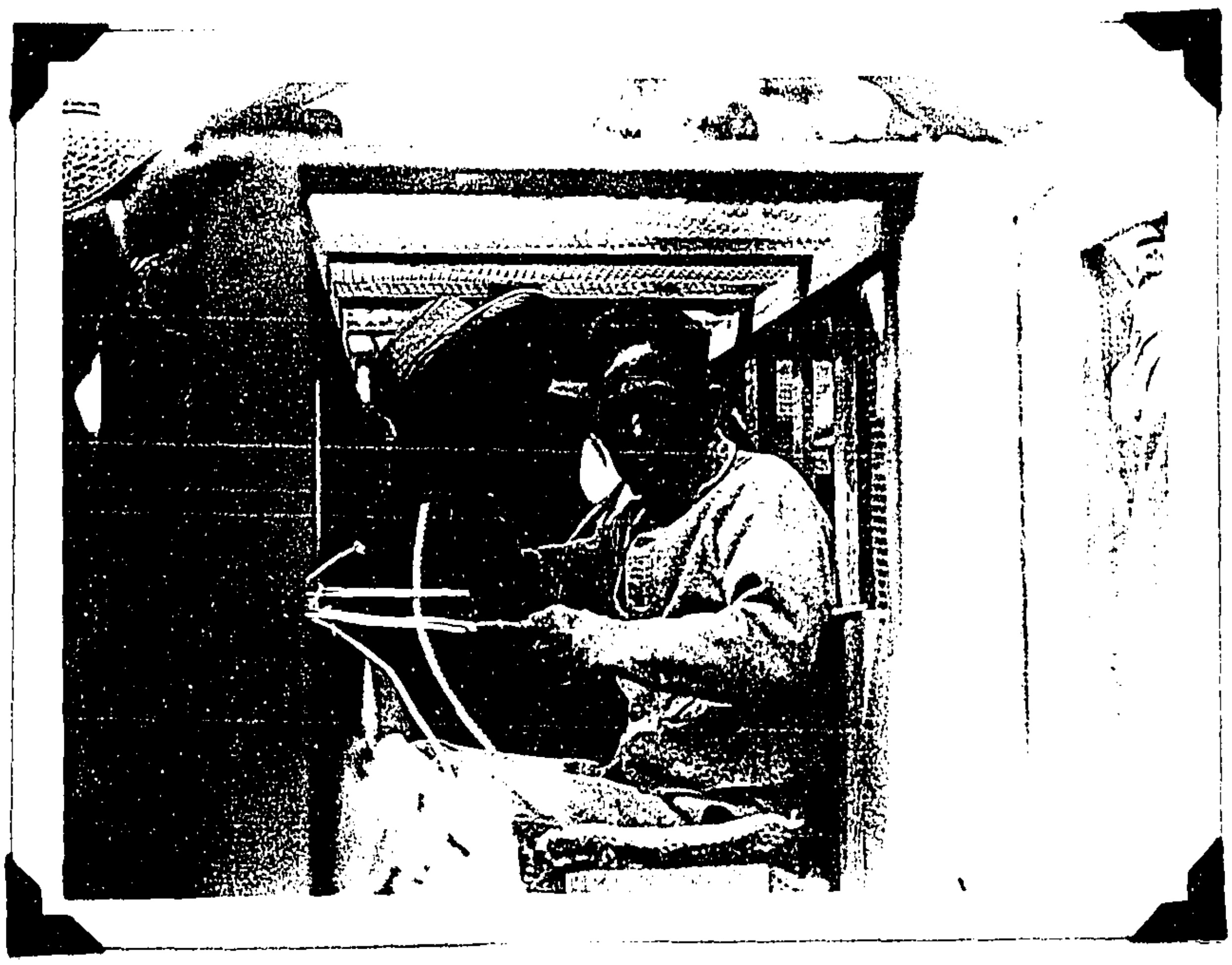
Park Ranger T. G. Barnett was married at the Volcano House in Hawaii National Park on June 8 to Miss Alice M. Parker, of Modesto. The sun parlor of the hotel, which was used for the occasion, was beautifully decorated, and the marriage ceremoney was beautiful and impressive. A Hawaiian atmosphere was given to the affair by a group of Hawaiian musicians and singers. About 70 invited guests were present. Following refreshments, the bridal couple made a honeymoon trip around the island.

6 Very respectfully,

E P Leavitt

E. P. Leavitt,
Superintendent.

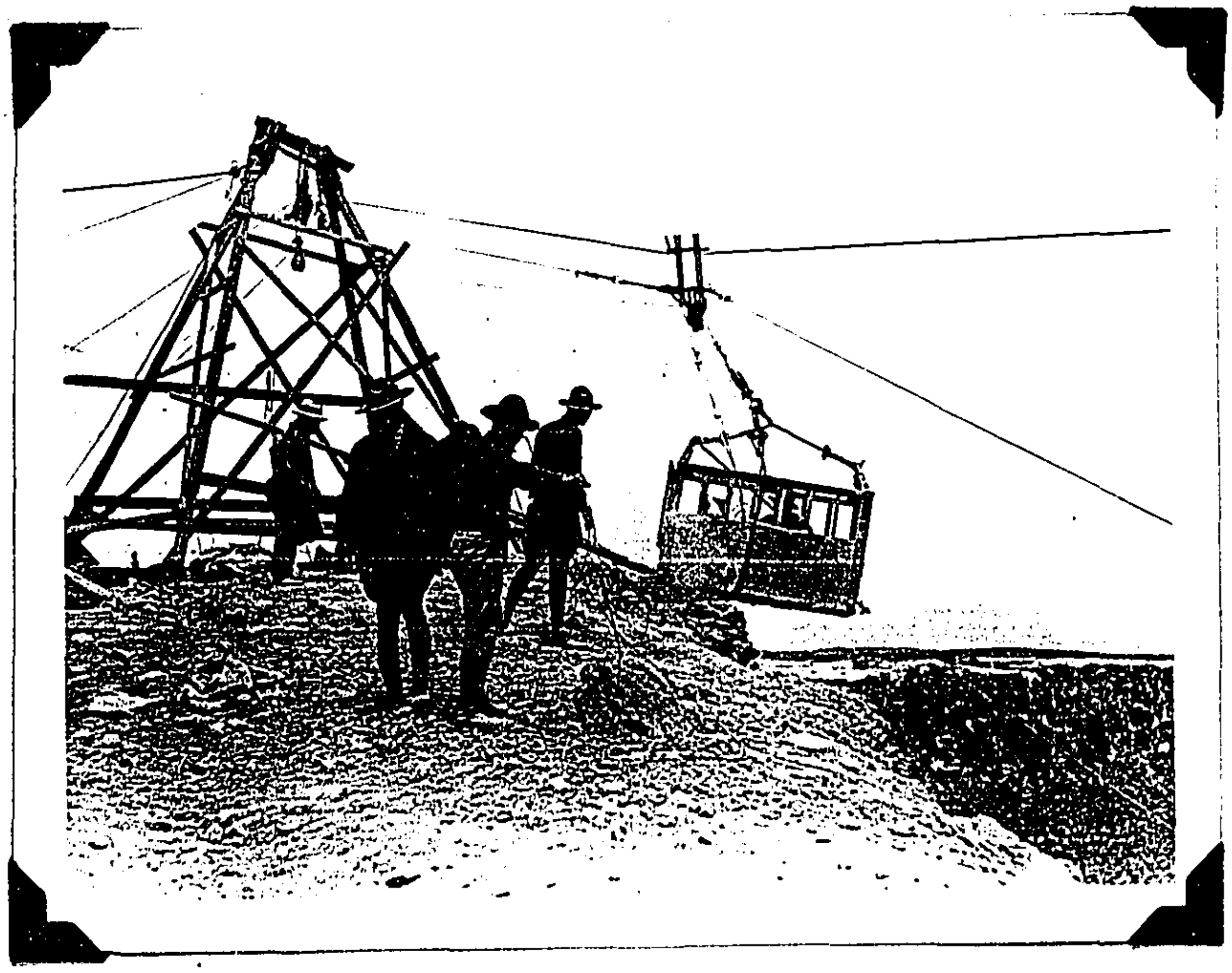
Mr. Hikan Konishi and "Life Cage" used in recovering remains of Miss M. Enos and S. Nunes. June 12th, 1932. Photo by Volcano Photo Studio.



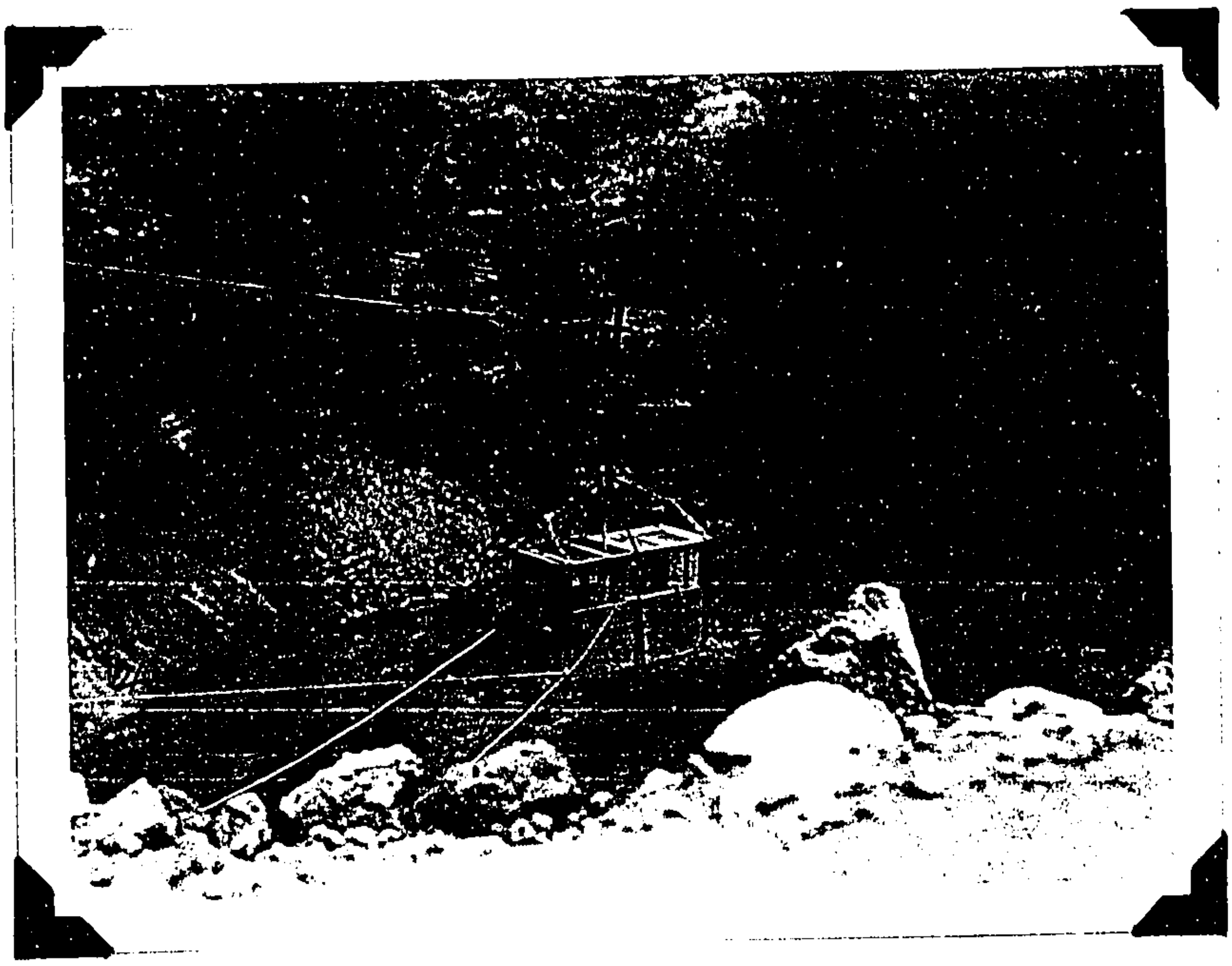
Mr. Rikan Konishi just before descending into pit.
June 12th, 1932 at 10 o'clock.

Photo by Volcano Studio.

1

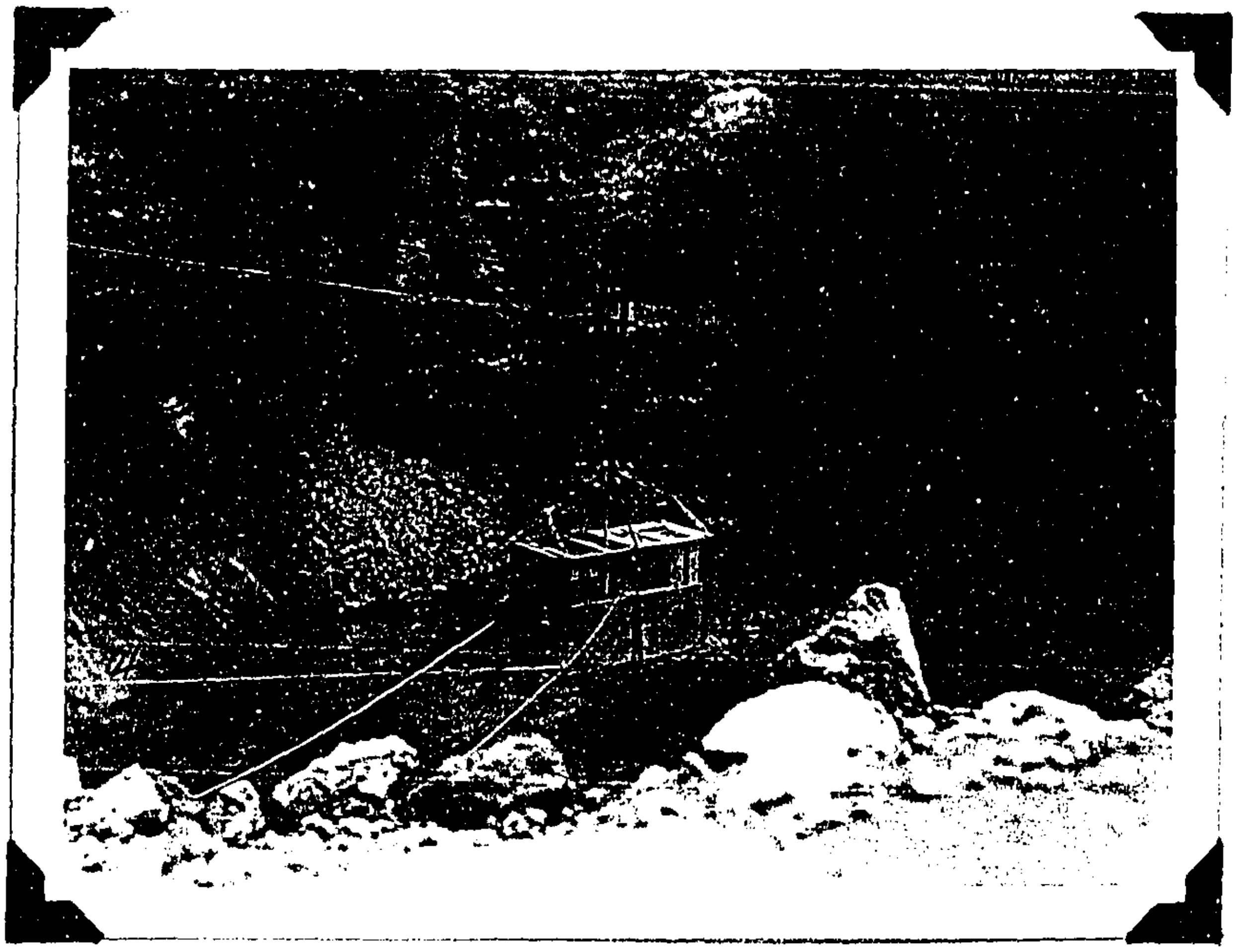


Poised on edge while soldiers lay out telephone line.
Photo by Volcano Photo Studio.



Mr. Konishi's descent.

1. Main cable   2. Return manila rope   3. Descending cable
4. Guide line   5. Life line   6. Telephone line.
7. Guide line   Photo by Volcano Photo Studio.

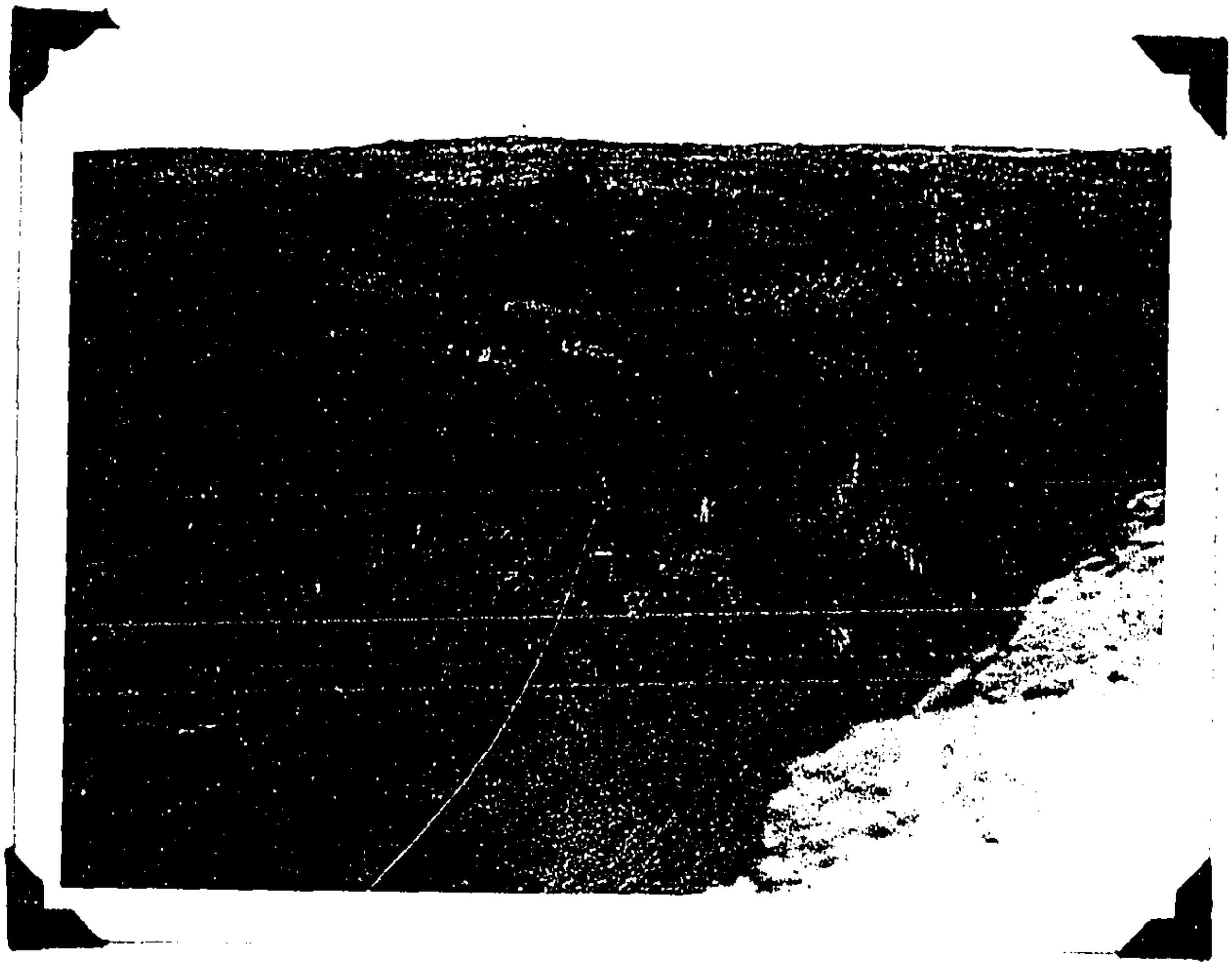


Mr. Konishi's descent.

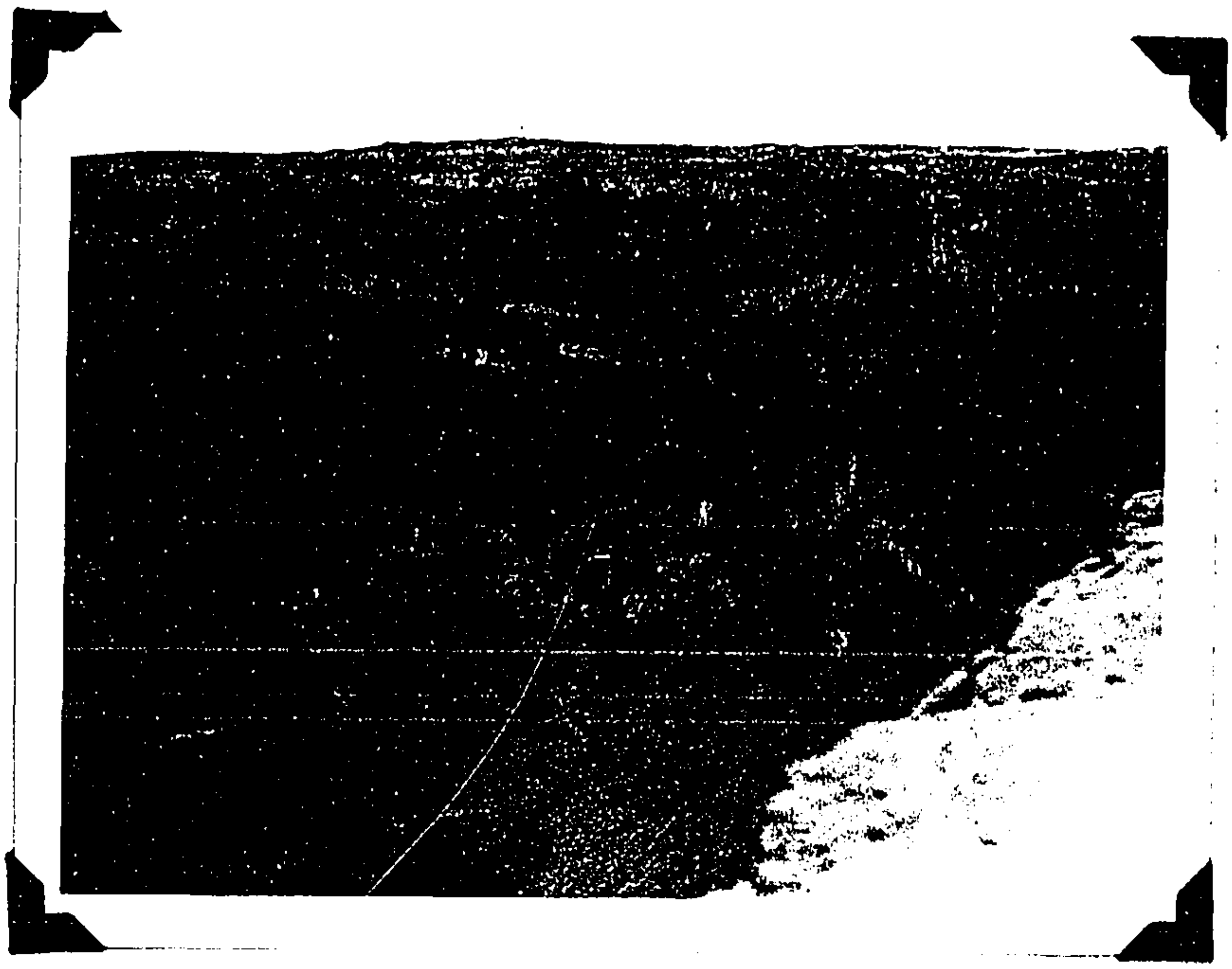
1. Main cable 2. Return manila rope 3. Descending cable
4. Guide line 5. Life line 6. Telephone line.
7. Guide line

Photo by Volcano Photo Studio.

Showing two main supports on Southern rim. Test descents with 650 pounds of sand being run off on Thursday, June 9th, 1932. Photo by Volcano Photo Studio.



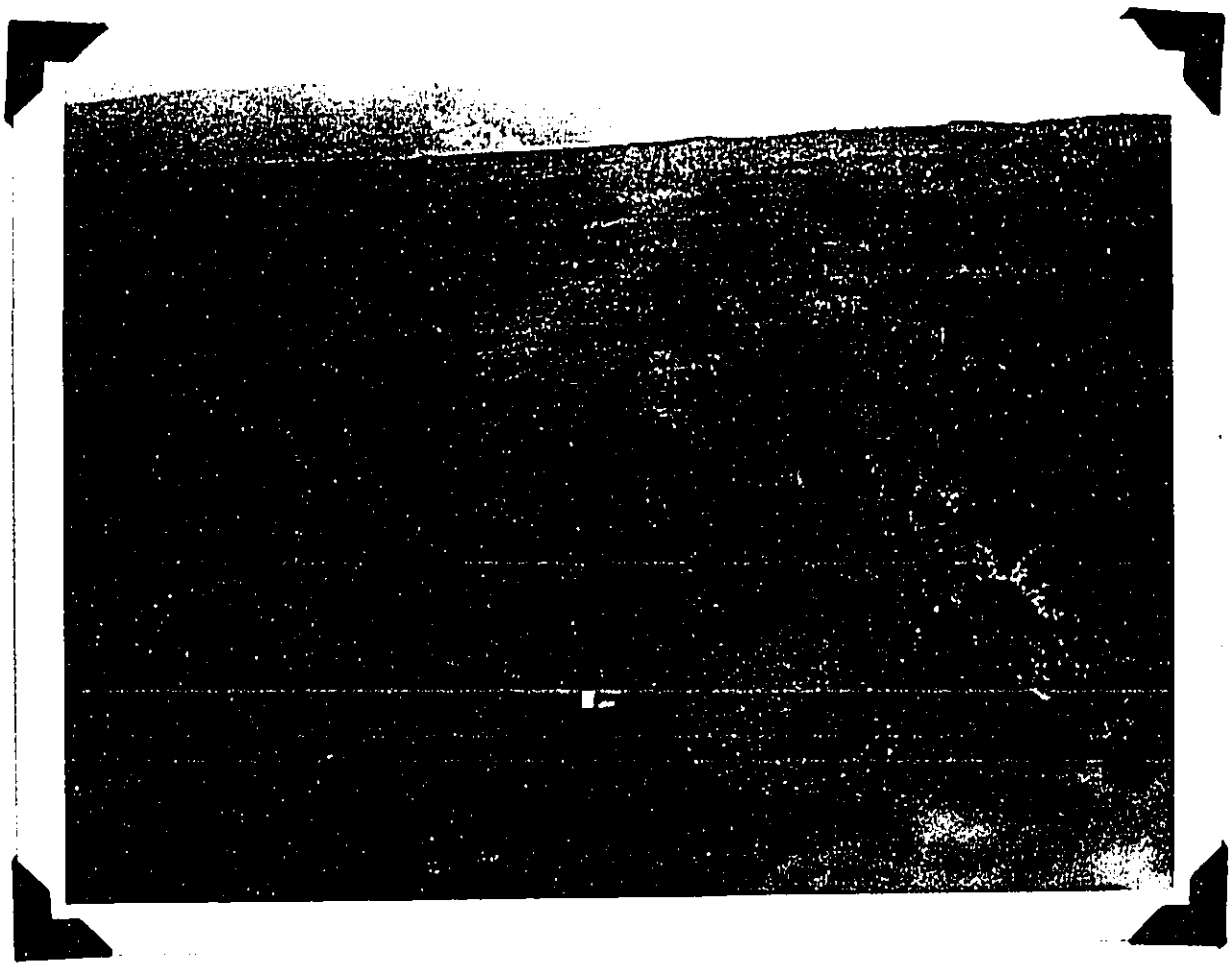
Mr. Konishi silhoutted against the wall. This photo shows the Northern operating stations. Photo by Volcano Photo Studio.



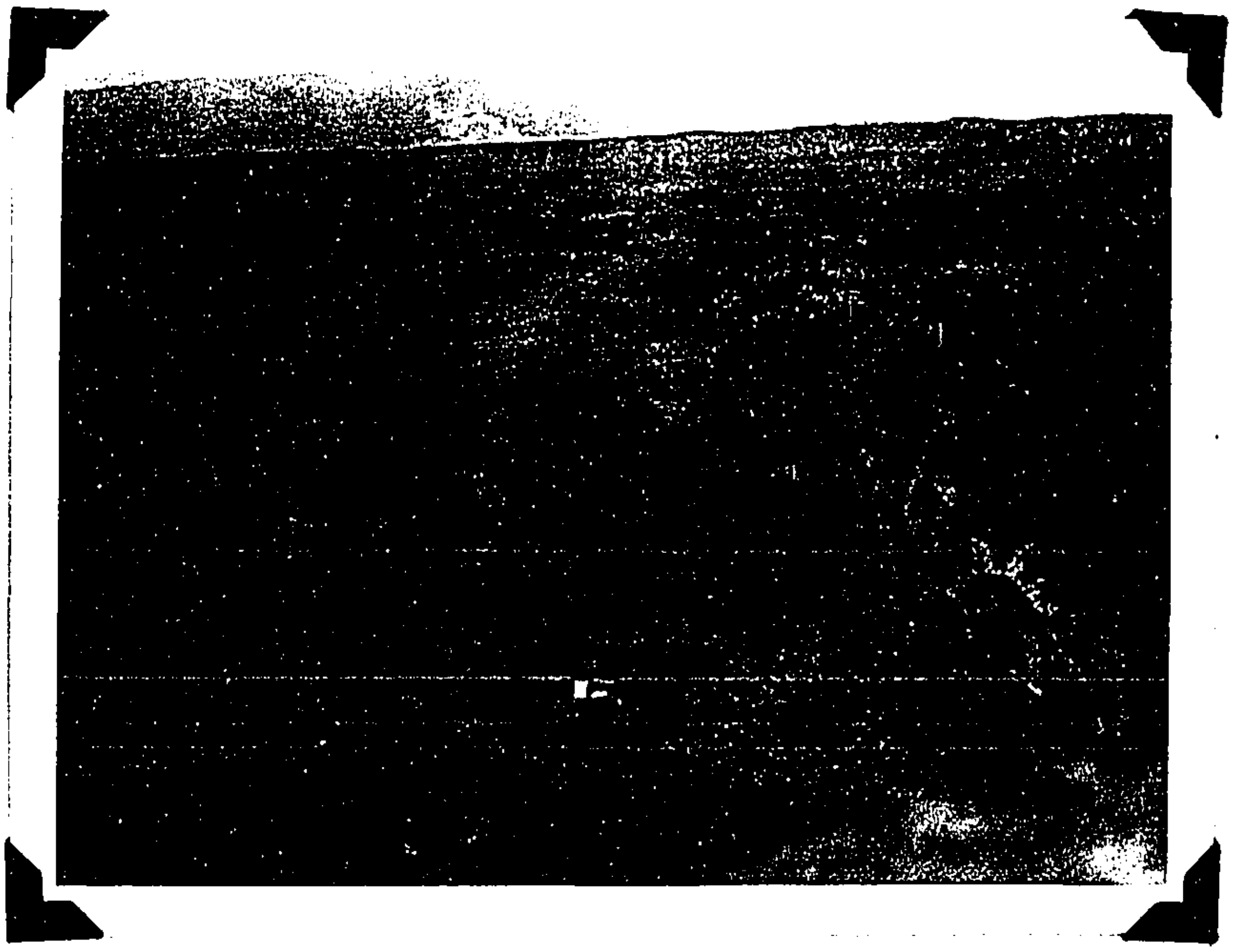
Mr. Konishi silhoutted against the wall. This photo shows the Northern operating stations. Photo by Volcano Photo Studio.

Land slide which occured near Konishi's working place.
Photo by Volcano Photo Studio.

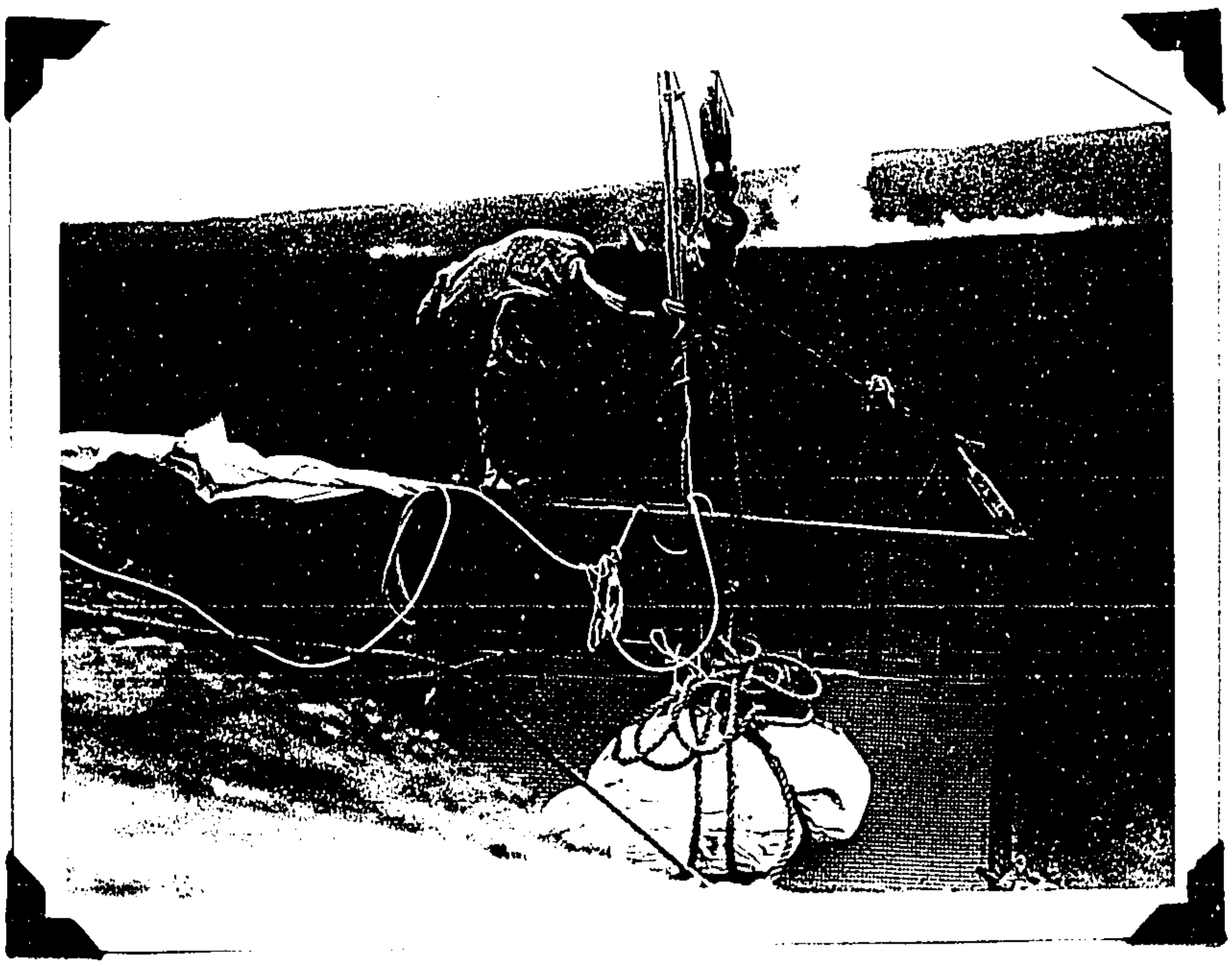
The main operating headquarters. Mr. Isemoto, who supervised safe descent and return of Mr. Konishi. Photo by Volcano Photo Studio.



Mr. Konishi on top of "Life Cage" with the remains tied on each side of the cage. Square white sheet O K flag. Photo by Volcano Photo Studio.



Mr. Konishi on top of "Life Cage" with the remains tied on each side of the cage. Square white sheet O K flag. Photo by Volcano Photo Studio.



Mr. Konishi on top of "Life Cage" on the edge of the pit. Body of Miss Enos in white bundle. Photo by Volcano Photo Studio.

Mr. Konishi and Attorney
Thomas Sakakihara.
Photo by Volcano Photo Studio.

10-157
(July, 1929)

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

TRAVEL REPORT

Hawaii National Park for the month of June, 1932

	This Month	This Travel Year To Date	This Month Last Year	Last Travel Year To Date	Increase for Travel Year Number	Increase for Travel Year Percent
PRIVATE TRANSPORTATION:						
Cars first entry, ...						
Cars reentry, ...						
Motorcycles, ...						
Total motor vehicles, ...						
Persons entering via motor vehicles, ...	18,907	107,117	6,890	90,048	17,069	18.9
Persons entering via other private transportation, ...	248	2,537	320	2,805	- 268	- 9.5
Total persons entering via private transportation, . .	19,155	109,654	7,210	92,853	16,801	18.9
OTHER TRANSPORTATION:						
Persons entering via ~~stages~~ Hotel,	337	4,852	421	6,026	-1,174	-19.4
Persons entering ~~via trains~~ Summer Camp,	----	------	16	16	----	
Persons entering otherwise, . .						
Total other transportation, .	337	4,852	437	6,042	- 1,174	19.4
GRAND TOTAL ALL VISITORS, . .	19,492	114,506	7,647	98,895	15,627	15.8

	This Year	Last Year	~~Increase~~ Decrease Number	~~Increase~~ Decrease Percent
Automobiles in public camps during month, ...	---	1	1	
Campers in public camps during month, ...		4		

10-158

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF AUTHORIZED PROJECTS

Hawaii National Park for the Month of June, 1932

	Description of Projects	Percent Constructed To Date	Percent Constructed This Month	Percent Constructed Last Month	Probable Date of Completion
410	U. S. Commissioner quarters	100	10	90 100	
411	Employees quarters	100	0	100	
412	Employees quarters	100	0	100	
413	Administration building	100	15	85 100	
502.1	Hilina Pali to Halape	100	0	100	
502.2	Uwekahuna-Halemaumau auto trail	98	0	98	
502.3	Mauna Iki extension	100	0	100	
502.4	Haleakala trail	100	0	100	
502.5	Mauna Loa trail	98	0	98	
502.6	Halemaumau trail	98	0	98	
507.1	Kau Belt road	100	0	100	
507.3	Cinder Cone Removal -	98	0	98 100	
507.4	Poisoning grass, Chain of Craters	60	10	50 80	

515 Kau road 86 %

(507.5 — 50 %
Surfacing C of C road shoulders)

E. P. Leavitt
Superintendent

10-159
(May, 1931)

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF PERSONNEL

Hawaii National Park for the Month of June, 1932

	This Month		This Month Last Year	
	Appointed	Non-Appointed	Appointed	Non-Appointed
Number of employees beginning of month	12	11	8	19
Number of additions	1	4	1	4
Total	13	15	9	23
Number of separations	1	0	1	2
Number of employees close of month	12	15	8	21
Number of promotions during month	0	0	0	0
Aggregate amount of annual leave taken	9	0	1	0
Aggregate amount of sick leave taken	0	0	0	0
Aggregate amount of leave without pay	0	0	0	0

One female per diem employee.

10-160

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

REPORT OF PARK REVENUES

Hawaii National Park for the Month of June, 1932

	This Year	Last Year
Park revenue on hand beginning of month,	0.00	0.00
Received,	28.31	0.00
Total,	28.31	0.00
Remitted,	28.31	0.00
On hand close of month,	0.00	0.00

Park revenues received this year to date,	1,807.07
Park revenues received last year to date,	1,225.00
Increase,	582.07
Per cent of increase,	47 %

10-161

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

REPORT OF SALES OF PUBLICATIONS

	Number	Value
GOVERNMENT PUBLICATIONS:		
On hand beginning of month, ...	946	$186.45
Received during month, ...	000	00.00
Total, ...	946	186.45
Sold during month, ...	27	7.80
On hand at close of month, ...	919	178.65
NON-GOVERNMENT PUBLICATIONS:		
On hand beginning of month, ...		
Received during month, ...		
Total, ...		
Sold during month, ...		
On hand at close of month, ...		

Cash on hand beginning of month, ...	$ 4.95
Sales during month, ...	7.80
Total, ...	12.75
Remitted during month, ...	4.95
Balance, ...	$ 7.80

Form No. 1009—Met'l.

U. S. DEPARTMENT OF AGRICULTURE, WEATHER BUREAU

COOPERATIVE OBSERVERS' METEROLOGICAL RECORD:

Month of June, 1932; *Station,* Volcano Observatory; *County,* Hawaii Nat'l Park

Hour of Observation, 9 a.m.

State, Hawaii; *Latitude,* ; *Longitude,* ; *Time used on this form,* Hawaiian Standard

DATE	Temperature: Maximum (1)	Temperature: Minimum (2)	Temperature: Range (3)	Temperature: * Set max. (4)	Precipitation: Time of beginning (5)	Precipitation: Time of ending (6)	Precipitation: † Amount (7)	Snowfall in inches / Humidity (8)	Depth of snow on ground at time of observation / Wind (9)	Prevailing wind direction (10)	Character of day, sunrise to sunset (11)	‡ Miscellaneous phenomena
1	69	53	16	65			.03	90	Mod.	N.E	P.C.	
2	68	52	16	66			.52	90	Lt.	"	"	
3	71	54	17	64			.12	84	"	"	"	
4	72	54	18	69			T	69	Mod.	S.W.	"	
5	72	55	17	64			.24	84	Lt.	N.E.	"	
6	71	56	15	65			.07	85	Mod.	"	"	
7	69	54	15	66			.06	89	Str.	"	"	
8	69	54	15	60			.01	95	"	"	"	Small patch of old snow still on Mauna Loa
9	68	54	14	57			.07	88	"	"	"	
10	68	53	15	61			T	94	"	"	"	
11	66	59	7	61			.22	93	"	"	"	
12	68	53	15	58			.07	90	Mod.	"	"	
13	65	56	9	63			.20	88	"	"	"	
14	64	55	9	61			.40	90	Lt.	"	"	
15	65	53	12	62			.30	94	Str.	"	"	
16	65	53	12	59			.15	93	"	"	"	
17	69	53	16	64			.02	89	Lt.	"	"	
18	68	53	15	63			.09	88	"	"	"	
19	69	53	16	68			.11	85	"	"	"	
20	66	53	13	66			.10	85	"	"	"	
21	70	51	19	64			.05	85	"	"	"	
22	69	51	18	66			.05	84	"	"	"	
23	69	52	17	67			T	85	Str.	"	Clear	
24	70	53	17	64			T	83	"	"	"	
25	65	53	12	59			.02	89	Lt.	"	P.C.	
26	70	53	17	60			.07	95	Str.	"	"	
27	75	53	22	69			.05	82	Lt.	"	Clear	
28	74	57	17	69			.02	94	Mod.	S.W.	"	
29	75	54	21	69			.05	84	Lt.	N.E.	"	
30	70	54	16	65			.02	89	Str.	"	"	
31												
Sum	2069	1611	458	1914			3.16	2653				
Mean	68.9	53.7	15.2	63.8			.105	88.4				

* Reading of maximum thermometer immediately after setting.
† Including rain, hail, sleet, and melted snow.
‡ Thunderstorms, halos, auroras, etc.

______________, *Cooperative Observer.*

(IN TRIPLICATE) See cover for instructions.

8—253
U. S. GOVERNMENT PRINTING OFFICE: 1930

Post Office Address, ______________

MONTHLY SUMMARY

TEMPERATURE

Mean maximum, 68.9

Mean minimum, 53.7

Mean, 61.3

Maximum, 75; date, 27,29

Minimum, 51; date, 21,22

Greatest daily range, 22

PRECIPITATION

Total, ; inches 3.16; greatest in 24 hours .40

Date, June 14

SNOW

Total snowfall, ______ inches

On ground 15th, ______ inches

At end of month, ______ inches

NUMBER OF DAYS—

With .01 inch or more precipitation, 26

Clear, 6; partly cloudy, 24

Cloudy, 0

DATES OF—

Fog: Light, ; Dense,

Killing frost,

Thunderstorms,

Hail: Light, ; Moderate, ; Heavy,

Sleet,

Auroras,

REMARKS:

STATISTICAL REPORT NUMBER 8

HAWAII NATIONAL PARK

FINANCE AND ACCOUNTS:

Symbol		Allotted	Expended & Obligated.	Balance
42/3415	Hawaii National Park 1932-'33:	49,860.00	80.00	49,780.00
42/3406	Forest Protection and Fire Prevention 1932-'33:	430.00	0.00	430.00
41/2415	Hawaii National Park 1931-'32:	52,670.00	52,659.82	10.18
41/2405	Emer. Reconstruction and Fighting Forest Fires 1931-'32:	325.16	325.16	0.00
41/2406	Forest Protection and Fire Prevention 1931-'32:	100.00	100.00	0.00
4X436.15	Roads & Trails in National Parks, non-year:	394,256.30	168,354.00	225,902.30

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
HAWAII NATIONAL PARK
HAWAII

OFFICE OF THE SUPERINTENDENT

June 8, 1932.

The Director,
National Park Service,
Washington, D. C.

Dear Mr. Director:

The following is the administrative report for Hawaii National Park for the month of May 1932:

000 General

The outstanding events of the month were visits of the passengers making the cruise around the world on the S.S.Resolute and the S.S.Franconia. The S.S.Resolute docked at Hilo on the morning of May 4, bringing 240 visitors to the Park. In making the tour of the Park the visitors were contacted by members of the Park staff at the Park entrance, Thurston Lava Tube, Chain of Craters, fire pit, and museum, where an illustrated lecture was given. On the afternoon of May 4 Acting Superintendent Doerr and Mrs. Doerr were the guests of Captain Cruse for tea on board the S.S. Resolute.

The S.S.Franconia docked at Hilo on the morning of May 5, bringing 225 visitors to Hilo and the Park. Similar contacts were made with the visitors from this ship as were made with those from the S.S.Resolute.

During the lunch hour on May 4 and 5 the Kilauea Volcano House Company provided an entertainment of Hawaiian singing and dancing.

020 General weather conditions
Cloudy, rainy weather prevailed during the month with the total rainfall 6.64 inches. This makes the total rainfall to date for the year 56.98 inches as compared with 17.20 for last year. Form 1009 is attached giving full details.

100 Administration

Office work has fallen behind due to the lack of available stenographic assistance during the month and because the Acting Superintendent was occupied with other duties. I returned to the Park on May 21 after an absence of two months attending the conference of Park Superintendents at Hot Springs, Arkansas, and visiting other National Parks and the various Government offices in San Francisco on official business. Mrs. Hodges is no longer available for handling our stenographic work and we find ourselves seriously handicapped particularly at this season of the year.

120 Park inspections by

121 The Superintendent

Regular inspection trips were made of roads, trails, and other construction work in the vicinity of headquarters during the month. The many duties and demands on the Superintendent's time prevented trips being made to the outlying sections of the Park, but such trips were made by the ranger staff on regular patrol.

130 Finance and accounts

See statistical report No. 8 attached to this report.

140 Labor situation

Upon completion of the going jobs under the roads and trails appropriation the forces were disbanded and all our effort has been concentrated on the completion of the new administration building. There has been ample supply of labor for all purposes.

180 Circulars, placards, publicity bulletins, etc.

Copies of the Volcano Letter are attached.

200 Maintenance, improvement and new construction

210 Maintenance

The usual maintenance and repair of roads, trails, telephone lines, buildings, and signs was carried on during the month.

220 Improvements

The service road around headquarters area was surfaced with blue sand from the quarry waste which has made a great improvement. The shelter building at BirdPark was stained. Grass along the shoulders of the Chain of Craters Road has been killed with arsenic poisoning and removed so that the seed will not be carried into the road bed when the paving is laid. In some sections of the road the grass is starting to grow through the newly laid pavement.

230 New construction

231 Administration Building

The new Administration Building was about 80 per cent complete at the end of May. This building presents a very pleasing appearance and when finished and the grounds landscaped will be a real credit to the Park, and will provide ample room for the Park staff for some time to come.

240 Road construction

Fair progress has been made on the around-the-island road, the work being handicapped by rainy weather and the necessity of taking care of travel. Detours have been provided wherever possible.

300 Activities of other agencies in the park

310 Public service contractors

The Inter-Island Steam Navigation Company, Hawaii Transportation Company, and the Kilauea Volcano House Company, in cooperation, have been conducting an advertising campaign to bring visitors to the Island of Hawaii for their summer vacations. Kilauea Volcano House has offered a special rate of $30 a week for room and board which rate has also been adopted by the Kona Inn, and vacationists may stay at either hotel or divide their days between the two hotels at the same rate. This is in effect from June to September. Automobile service between the two hotels, a distance of about 100 miles through one of the most interesting sections of the island, has been fixed at $5 each way. The Hawaii Tourist Bureau has also been conducting a campaign aimed to stimulate interest in residents of the Territory spending their vacations in the Territory this year by visiting other islands.

400 Flora, fauna, and natural phenomena

410 Ranger service

The Park area around headquarters has been divided into ranger districts with a ranger placed in charge of each district whosis responsible for all of the maintenance and improvement of the district. This plan is working out very nicely as each ranger is specially interested in his own area and gives him an opportunity to work in this area whenever he can be spared from special or other duties. Many plans and suggestions have been made which are quite worth while and will be carried out as labor and funds are available.

411 Naturalist service

Seven field trips were made during the month caring for a total of 84 visitors, and 22 lectures were given to a total of 934. There were 1,267 visitors to the museum, making a total of 2,285 contacts for the month. Fifty-two Hui o Pele memberships were sold.

The 18 weeks' University extension course in nature study that was taught by the educational department of the Park was completed on May 16. The class was required to meet 18 times, once each week for a two-hour period, for which the students registered received two credits from the University of Hawaii. The meetings were divided into lecture-discussion sessions, 1½ to 1-3/4 hours long, and half-day field trips in the Park. Thirteen lecture-discussion meetings were held and 5 half-day field trips. The actual time put in by the students amounted to slightly more than the time required. There were 21 students enrolled, most of which were teachers in the public schools in the County of Hawaii in the Pahala district. Consequently it was advisable to hold these lecture-discussion meetings at a point convenient for them to assemble, and five of the meetings were held at the school house at Pahala and five at Naalehu.

The field trips taken in the Park included studies in the following areas:

A rock-collecting trip on the floor of Kilauea.
A study of the Chain of Craters and the Thurston Lava Tube.
A study of the Mauna Iki region.
A study of Bird Park.
A trip through the Uwekahuna Museum, including seeing the slides and motion pictures.

In addition to the actual nature study work, one lecture was given on the National Park system, administration, policies, and another lecture on trails in Hawaii National Park.

The course was developed along the lines of the natural history of Hawaii with a brief consideration of the origin of the earth, the geological history of the earth before the islands began to form, the formation of the islands, the volcanic activity, the migration of vegetation to the islands, plant distribution on the islands, and plant identification. In following this general outline many other phases of natural science were touched upon such as climatology, oceanography, agronomy (soil formation in the islands), bird migration, and seismology.

In summing up this experimental educational project, we feel that each student was well satisfied with the course. The Park Naturalist enjoyed the work, gained considerable knowledge as much of the time spent in study and preparation of this course can be considered as applying to the improvement of the educational work in the park. The University of Hawaii I think also is thoroughly satisfied with the work accomplished. It has been a pleasure to cooperate with them in this work. And finally, some fine personal friendships were established as well as friendships between island people and the National Park.

420 Museum service
The museum is open on all boat days and on Sundays and holidays. Total attendance was 2,285.

480 Natural phenomena
There was very little change in conditions in the volcano during May. Sulphur fume and steam continued to rise from spots in and around the fire pit.

500 Use of Park Facilities by the Public

510 Increase or decrease in travel
A total of 8,034 persons came into the Park during May as compared with 8,746 persons in May of last year. The total for the year to date is 95,014, compared with 91,248 for last year, and represents an increase of 4.1 per cent.

530 Visitors
The following visitors were extended special courtesies during the month:

Mr. Lorrin P. Thurston, President and General Manager of the Honolulu Advertiser and Radio Station KGU.

On May 14 the officers and crew of one of the U. S. Navy submarines visited the Park, and a game of base ball between the submarine team and the Park base ball team was played, in which the Park team won.

Captain F. Cruse, Commander of the S.S.Resolute, making a cruise around the world.

Herr Dr. and Ivan Wilhelm von Opal, Russell Hein, Germany. Herr Opal is a prominent automobile manufacturer in Germany.

Mrs. Ruth Elder Camp, New York City, famous aviatrix.

Mr. and Mrs. C. E. Wallerstadt, Oakland, California. Mr. Wallerstadt is Swedish Consul at San Francisco.

Mr. Raymond C. Brown, Secretary of the Territory of Hawaii. Mr. Brown called on matters relating to the Bureau of Efficiency.

Dr. Elda R. Walker, Professor of Botany, University of Nebraska, Lincoln, Nebraska. Dr. Walker was permitted to collect about 70 plant specimens to be studied at the University of Nebraska.

Robert H. (Bob) Davis, world correspondent of the New York Sun, with Mrs. Davis, arrived on May 31 for a trip around the Island of Hawaii, and spend the night in the Park. He was accompanied by George T. Armitage, Executive Secretary of the Hawaii Tourist Bureau, and Mrs. Ralph E. Woolley. Mr. Davis was gathering material for articles for his paper. He also put on a broadcast program from Kona Inn and planted another monkey-pod tree beside the one planted by Mark Twain

The mercantile marine training ship Nippon Maru, under the command of Captain Osada, arrived May 20 and departed May 25. The officers, students, and crew were brought to the Park on Saturday and Sunday, May 21 and 22.

600 Protection

610 Police protection
During the visits of the around the world boats the County police force from Hilo patrolled the road from Hilo to the Park entrance and assisted in the handling of the traffic.

620 Fire protection

On May 20 about 2 p.m. a grass fire started along the Mauna Loa trail at about the 5,200-foot elevation, and with a strong wind burned over a hundred acres before it could be brought under control. In addition to the rangers and laborers of the Park, men were sent from the Kilauea Military Camp, from the Keauhou Ranch and the Kapapala Ranch. Because of the heavy mat of dead grass and duff on the ground through which grew the current year green grass, the fire burned briskly and was very stubborn to control. The pukeawe bushes burned like they were oil soaked and scattered flaming leaves and embers a long distance in the wind. The koa trees also took fire easily and burned rapidly. It was necessary to patrol the area daily for a week after the fire was extinguished, and on the first and second days it broke away several times underground on roots and duff, etc. There is every reason to believe that the fire was caused by carelessness or ignorance by a group of four soldiers on the Mauna Loa trail before the fire broke out, but they deny responsibility and this could not be proved.

640 Destruction of predatory animals

The following animals were killed during the month:

47 goats
9 pigs

650 Signs

All of the signs in the Park are being gradually repainted.

Very respectfully,

E P Leavitt

E. P. Leavitt,
Superintendent.

May 20, 1932. Grass fire on slope of Mauna Loa at an elevation of 5200 feet. The grass in this area is knee deep and growing on 1 to 1½ feet of humus soil. Picture by Park Naturalist Doerr.

May 20, 1932. Grass fire on slopes of Mauna Loa. The fire is moving through thicket of heather (Cyathodes imbricata) and scattered growth of koa (Acacia Koa) trees. Picture by Park Naturalist Doerr.

May 23, 1932. Burned over area showing the destruction of thickets of heather (Cyathodes imbricata). Picture by Park Naturalist Doerr.

May 23, 1932. Views of Mauna Loa trail showing burned over area on one side of trail. Grass roots and humus soil smoldered for days. Picture by Park Naturalist Doerr.

10-157
(July, 1929)

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

TRAVEL REPORT

Hawaii National Park for the month of May 1932

	This Month	This Travel Year To Date	This Month Last Year	Last Travel Year To Date	Increase for Travel Year: Number	Increase for Travel Year: Percent
PRIVATE TRANSPORTATION:						
Cars first entry, ...						
Cars reentry, ...						
Motorcycles, ...						
Total motor vehicles, ...						
Persons entering via motor vehicles, ...	6,836	88,210	7,297	83,158	5,052	5.7
Persons entering via other private transportation, ...	293	2,289	287	2,485	-196	7.8 Decr.
Total persons entering via private transportation, . . .	7,129	90,499	7,584	85,643	4,856	5.3
OTHER TRANSPORTATION:						
Persons entering via Hotel stages, .	905	4,515	1,162	5,605	-1,090	19.4 Decr.
Persons entering via trains, .						
Persons entering otherwise, . .						
~~Total other transportation~~ .	8,034	95,014	8,746	91,248	3,766	3.9
GRAND TOTAL ALL VISITORS, . . .						

	This Year	Last Year	Increase: Number	Increase: Percent
Automobiles in public camps during month, ...				
Campers in public camps during month, ...				

10-158

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF AUTHORIZED PROJECTS

Hawaii National Park for the Month of May 1932

Description of Projects	Percent Constructed To Date	Percent Constructed This Month	Percent Constructed Last Month	Probable Date of Completion
410 U. S. Commissioner quarters	90	0	90	June 30, 1932
411 Employees quarters	100	0	100	
412 Employees quarters	100	0	100	
413 Administration Building	85	25	60	June 20, 1932
			Number of men employed	10.3
502.1 Hilina Pali to Halape	100	0	100	
502.2 Uwekahuna-Halemaumau auto trail	98	6	92	
502.3 Mauna Iki Extension	100	0	100	
502.4 Haleakala Trail	100	0	100	
502.5 Mauna Loa Trail	98	6	92	
502.6 Halemaumau Trail	98	6	92	
507.1 Kau Belt Road	100	0	100	
507.3 Cinder Cone Removal	98	8	98	
507.4 Poisoning Grass, Chain of Craters Road	50	50	0	
			Number of men employed	2.2

E. P. Leavitt,
Superintendent

10-159
(May, 1931)

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF PERSONNEL

........**Hawaii**.......... National Park for the Month of ....**May 1932**........................

	This Month		This Month Last Year	
	Appointed	Non-Appointed	Appointed	Non-Appointed
Number of employees beginning of month	12	21	6	11
Number of additions	0	0	2	11
Total	12	21	8	22
Number of separations	0	10	0	3
Number of employees close of month	12	11	8	19
Number of promotions during month	0	0	0	0
Aggregate amount of annual leave taken	5	0	0	0
Aggregate amount of sick leave taken	0	0	0	0
Aggregate amount of leave without pay	0	0	0	0

10-160

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

R E P O R T   O F   P A R K   R E V E N U E S

Hawaii National Park for the Month of May 1938

	This Year	Last Year
Park revenue on hand beginning of month, ...	~~xxxxxx~~ 0.00	0.00
Received, ...	147.34	125.00
Total, ...	147.34	125.00
Remitted, ...	147.34	125.00
On hand close of month, ...	0.00	0.00

Park revenues received this year to date, ...	1,778.76
Park revenues received last year to date, ...	1,225.00
Increase, ...	553.76
Per cent of increase, ...	81.1

10-161

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

REPORT OF SALES OF PUBLICATIONS

	Number	Value
GOVERNMENT PUBLICATIONS:		
On hand beginning of month, ...	936	$170.15
Received during month, ...	25	21.25
Total, ...	961	191.40
Sold during month, ...	15	4.95
On hand at close of month, ...	946	186.45
NON-GOVERNMENT PUBLICATIONS:		
On hand beginning of month, ...		
Received during month, ...		
Total, ...		
Sold during month, ...		
On hand at close of month, ...		

Cash on hand beginning of month, ...	7.15
Sales during month, ...	4.95
Total, ...	12.10
Remitted during month, ...	7.15
Balance, ...	4.95

Form No. 1009—Met'l.

U. S. D. rtment of Agriculture, Weather B. eau.

COOPERATIVE OBSERVERS' METEOROLOGICAL RECORD:

Month of May 1932, *192* ; *Station,* ; *County,*

Hour of Observation,

State, ; *Latitude,* ; *Longitude,* ; *Time used on this form,*

DATE.	TEMPERATURE. Maximum. (1)	Minimum. (2)	Range. (3)	* Set Max. (4)	PRECIPITATION. Time of Beginning. (5)	Time of Ending. (6)	†Amount. (7)	Humid (Snowfall in Inches.) (8)	Wind (Depth of Snow on ground at Time of Observation.) (9)	Prevailing Wind Direction. (10)	Character of Day, Sunrise to Sunset. (11)	‡ Miscellaneous Phenomena.
1	70	51	19	61			34	80	Mod.	NE	PC	
2	66	52	14	62			15	83	Str.	"	"	
3	64	53	11	57			50		Mod.	"	Cloudy	
4	66	51	15	57			08	88	Str.	"	PC	
5	68	52	16	61			02	89	"	"	"	
6	66	54	12	60			28	89	Mod	"	"	
7	65	53	12	61			20		Str.	"	"	
8	67	52	15	61			47	94	"	"	"	
9	64	54	10	55			50	100	Mod.	"	"	
10	68	51	17	53			04	74	"	"	"	
11	64	51	13	58			07	89	Str.	"	"	
12	68	51	17	53			01	79	Mod.	"	"	
13	64	53	11	58			49	89	"	"	"	
14	63	50	13	63			07	89	Str.	"	"	
15	62	54	8	56			06	89	Mod.	"	"	
16	64	50	14	61			16	89	Str.	"	"	
17	66	52	14	60			23	100	"	"	"	
18	68	51	17	64			02	82	Mod.	"	Clear	
19	69	49	20	64			07	79	"	"	PC	
20	70	52	18	63			01	95	Str.	"	"	
21	70	52	18	66			01	91	Lt.	"	"	
22	65	57	8	60			11	95	"	"	"	
23	67	58	9	63			06	94	Mod.	"	"	
24	66	58	8	62			65	100	"	"	Cloudy	
25	70	54	16	66			05	88	"	"	PC	
26	66	54	12	60			05	88	"	"	"	
27	63	54	9	61			40	100	"	"	Cloudy	
28	61	59	2	59			74	94	"	"	"	
29	61	53	8	57			46	95	Str.	"	PC	
30	63	53	10	60			13	90	"	"	"	
31	67	51	16	59			19	94				
Sum	2045	1639	407	1879			6.64	2506				
Mean	66	52.8	14	60.6			.21	89.8				

*Reading of maximum thermometer immediately after setting.
†Including rain, hail, sleet, and melted snow.
‡Thunderstorms, halos, auroras, etc.

(IN TRIPLICATE.) See cover for instructions.

______, *Cooperative Observer.*

Post-Office Address, ______

8—253 GOVERNMENT PRINTING OFFICE

MONTHLY SUMMARY.

TEMPERATURE.

Mean maximum, 66

Mean minimum, 52.8

Mean, 59.4

Maximum, 70; date, 1 ff

Minimum, 49; date, 19

Greatest daily range, 20

PRECIPITATION.

Total, 6.64 inches.

Greatest in 24 hours, .74; date, 28

SNOW.

Total snowfall, ____ inches; on ground 15th, ____ inches;

at end of month, ____ inches.

NUMBER OF DAYS—

With .01 inch or more precipitation, 31

Clear, 1; partly cloudy, 26; cloudy, 4

DATES OF—

Killing frost, ______

Thunderstorms, ______

Hail { Light, ______ ; Moderate, ______ ; Heavy, ______

Sleet, ______

Auroras, ______

REMARKS:

STATISTICAL REPORT NUMBER 8

HAWAII NATIONAL PARK

Finance and Accounts

Symbol		Allotted	Expended and Obligated	Balance
42/3415	Hawaii National Park 1932-33	47,860.00	0.00	47,860.00
42/3406	Forest Protection & Fire Prevention 1932-33	430.00	0.00	430.00
41/2415	Hawaii National Park 1931-32	52,130.00	49,287.45	2,842.55
41/2405	Emer. Reconstruction and Fighting Forest Fires 1931-32	200.00	200.00	0.00
41/2406	Forest Protection and Fire Prevention 1931-32	100.00	100.00	0.00
4X436	Roads and Trails in National Parks, no year	392,756.30	148,324.67	244,431.63

The Volcano Letter

Two dollars per year | Ten cents per copy

No. 384—Weekly | Hawaiian Volcano Observatory, National Park, Hawaii | May 5, 1932

Hardened human footprints in the Kilauea ash of 1790, Kau Desert six miles southwest of the crater. The pedestrians were headed north and their bare feet squashed up the mud around the footprints. The mud solidified like cement. The pellets formed by the warm mud rains of the eruption are shown at the right. See Volcano Letter No. 273 and Bulletin Hawaiian Volcano Observatory July 1921.

PROGRESS OF HAWAIIAN VOLCANO RESEARCH

(Continued from Volcano Letter No. 383)

Appendix to Address of T. A. Jaggar, Annual Meeting of Hawaiian Volcano Research Association in Honolulu March 31, 1932.

Publications

In order that the reader of the foregoing review of twenty years of work at the Hawaiian Volcano Observatory may have some references for volcanologic reading, the following list of publications is compiled, first, to show the bulletins of the Hawaiian Volcano Observatory which contain special reviews, lists of publications, and discussions of special subjects, and second, to give references to the scientific papers by the staff which have covered the more important subjects of investigation since 1916. In Bulletin of Hawaiian Volcano Observatory Vol. IV, No. 4, April 1916, was printed a list of publications to that date.

Publications of the Observatory

First Report, Massachusetts Institute of Technology, 1912. Foundation of the Observatory, Kilauea 1909 to April 3, 1912, notes on Mauna Loa.

Second Report, Massachusetts Institute of Technology, 1917. On cyclical variations in eruption at Kilauea, by H. O. Wood.

Special Bulletin Haw'n Volc. Obs'y 1913. Scientific work on Hawaiian volcanoes.

Kilauea and Mauna Loa in 1914 (annual address), Bull. H. V. O. III, No. 4.

Hawaiian earthquake problem, H. O. Wood, III, No. 5, May 1915.

Museum, National Park, publications, etc. (documents), IV, No. 4, April 1916.

Results of six years of work (annual address), V, No. 8, August 1917.

Presidential address by L. A. Thurston (annual meeting), V, No. 10, October 1917.

Index of danger from volcanoes, Jaggar, VI, No. 1, Jan. 1918.

Composition of Hawaiian gases, Shepherd and Allen, VII No. 7, VIII No. 5, IX No. 5, X No. 8, 1919, 1920, 1921, and 1922.

Lava tube at Kilauea, Sidney Powers, VIII No. 3, March 1920.

Fossil human footprints Kau Desert, Jaggar, IX No. 7 anl No. 10, 1921.

Volcano research in Hawaii 1922 (annual address), X No. 4. April 1922.

Progress of boring experiments, X Nos. 5, 6, 7, 9, 10, 1922; XV No. 3, 1927; also Monthly Weather Review March 1924.

Aleutian eruptions December 1922, XI No. 1, Jan. 1923.

Tidal wave at Hilo, XI No. 2, Feb. 1923.

Sulphate stalactites in lava tubes, Finch and Emerson, XII No. 3, Mar. 1924.

Volume relations of explosive eruption of Kilauea, Jaggar, XII No. 12, Dec. 1924.

National standards of volcano and earthquake research (annual address), XIII No. 3, Mar. 1925.

A carbonized tree trunk in New Zealand, Bartrum, XIII No 7, July 1925.

Mauna Kea geology, Jaggar, XIII No. 10, Oct. 1925.

Southwest rift of Mauna Loa, Finch, XIII No. 12, Dec. 1925.

Viscosity of lava, Palmer, XV No. 1, Jan. 1927

Azores earthquake of August 1926, Agostinho, XV No. 2, Feb. 1927.

Opportunity for scientific research in the National Parks of America, Jaggar, address Pan-Pacific Conference, XV No. 4, Apr. 1927.

U. S. Coast Survey cooperation, Wilson, XV No. 6, June 1927.

Gravity anomalies on Hawaii, Wilson, XV No. 10, Oct. 1927 and Goranson, Amer. Jour. Sci. Aug. 1928.

Hilo seismograph station, Wilson, XV No. 11, Nov. 1927.

Review of seismic features for the year, and the Uwekahuna seismograph, Wilson, XV No. 12, Dec. 1927

Lassen Volcano Observatory, Finch, XVI No. 2, Feb. 1928.

A year of tide gauge operation, and Seismic sea waves of 1927. Wilson, XVI No. 3, Mar. 1928.

The amphibian boat "Ohiki," Wilson, XVI No. 4, Apr. 1928.

Seismic sea wave at Hilo June 17, 1928, Wilson, XVI No. 6, June 1928.

Test of Hawaiian-type seismograph, Wilson, XVI No. 8, Aug. 1928.

Magnetism of Lassen lava flows, Jones, XVI No. 9, Sept. 1928.

Aleutian geographic observatory, Jaggar, XVI No. 10, Oct. 1928.

Reviews of progress Hawaiian Volcano Research Association, Volcano Letters Nos. 2, 3, 13, 102, 139, 168, 169, 221, 225, 235.

Publications Outside of the Observatory

Volcanologic investigations at Kilauea, Jaggar, Amer. Jour. of Sci. Vol. 44, Sept. 1927.

Seismometric investigation of the Hawaiian lava column, Jaggar, Bull. Seis. Soc. Amer. Vol. X No. 4, 1920.

The program of experimental volcanology, Jaggar, Proc. First Pan-Pac. Sci. Conf. Part 2, p. 309, 1921, Bishop Museum, Honolulu.

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Results of volcano study in Hawaii, Jaggar, Nature Vol. 101, No. 2525, March 21, 1918, p. 54.

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A plea for geophysical and geochemical observatories, Jaggar, Jour. Wash. Acad. Sci. Vol. 12, No. 15, Sept. 19, 1922.

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Niuafoou Volcano in Tonga; its eruptions and its people, Jaggar, Proc. Haw'n Acad. Sci., Special Pub. 19, B. P. Bishop Museum, p. 9, 1931; also Volcano Letter Nos. 165, 312, and 318.

In addition it should be mentioned that the "Volcano Letter" has been issued weekly since January 1, 1925, and as a four-page leaflet with illustrations, replacing the former "Bulletin" since January 1, 1930. T.A.J.

KILAUEA REPORT No. 1058

WEEK ENDING MAY 1, 1932

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge.

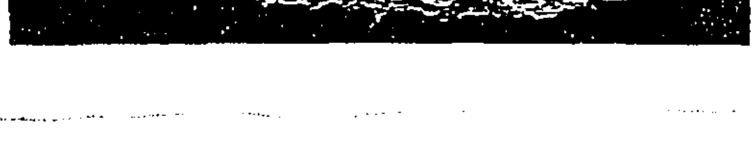
No changes were observed in Halemaumau on April 25, except possible increase in sulphur stain on the floor at the foot of the north talus. Crack measurements on the 26th showed no changes. At 8 p. m. no glow was to be seen. On the 27th fume was as usual and nothing new to been seen. At 10:30 a. m. fume rose on the west side of Halemaumau conspicuously in puffs. On the 28th at 8:30 a. m. fume appeared denser at the southwest talus due to damp, cloudy morning. No change in fume observed on the 29th at 9 a. m. There appeared to have been a small slide over west end of the north sill during the night. On the 30th at 8:45 a. m. there was nothing new and fume was as usual at the southwest talus.

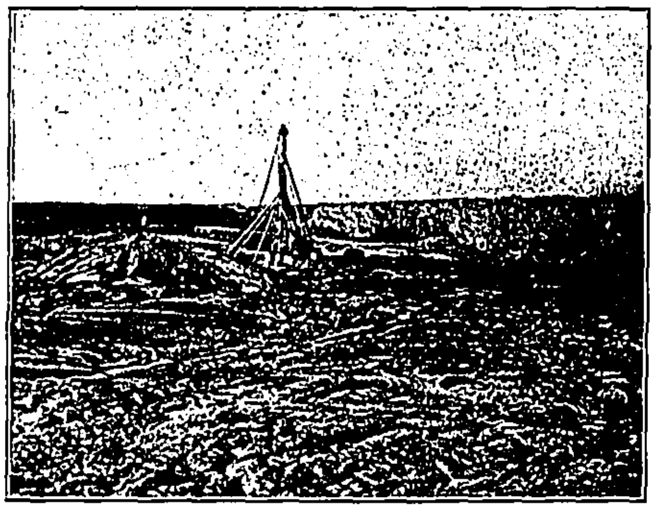
The seismographs at the Observatory recorded 13 tremors, two very feeble shocks, and three feeble earthquakes which were felt. The tremors indicated varying distances, from 23 to 70 miles. The two very feeble shocks showed origin distances 6 and 16 miles. The first of the three feeble earthquakes occurred at 1:59 a. m. April 26. It was felt in Haina, Honomu, Hilo, Kamuela, Kohala, Waikii, and at the Observatory. Its record indicated distance 32 miles from the Observatory, 23 miles from Kealakekua, and 42 miles from Hilo. It is calculated to come from a point five miles below the saddle between Mauna Loa and Hualalai.

The second feeble earthquake was registered at 3:17 a. m. April 28 and was not reported felt by many. The origin was 12 miles from the Observatory. The third feeble earthquake was at 6:24 a. m. May 1, and although probably more generally felt, reports from distant parts of the island have not yet had time to arrive. Reports of perceptibility have come from Honomu, Hilo, and near the Observatory. Records indicate distances 16 miles from the Observatory and 31 miles from Hilo.

Microseismic motion was mainly moderate. Average tilting was slight SE by S.

The Observatory is getting very good cooperation from earthquake observers. Card forms will be furnished anyone willing to report felt shocks.





Churn drill at work on eastern lava field of the floor of Kilauea Crater July 21, 1922. Looking north showing Waldron's Ledge and the Volcano House in the distance. This is one of the numerous temperature wells drilled to shallow depths in the crater floor. These discovered that high temperatures are always on cracks which bring up hot vapor. See Bulletin Hawaiian Volcano Observatory 1922 and 1927.

THE VOLCANO LETTER

The Volcano Letter combines the earlier weekly of that name, with the former monthly Bulletin of the Hawaiian Volcano Observatory. It is published weekly, on Thursdays, on behalf of the section of volcanology, U. S. Geological Survey. It promotes experimental recording of earth processes.

Readers are requested to send articles, photographs, publications and clippings about volcano and earthquake events, instruments and investigations, especially around the Pacific.

HAWAIIAN VOLCANO OBSERVATORY
Founded 1911

This laboratory at Kilauea Volcano belongs to the Hawaiian Volcano Research Association and is leased and operated by the United States Geological Survey.

It maintains seismographs at three places near Kilauea Volcano, also at Hilo, and at Kealakekua in Kona District. It keeps a journal of Hawaiian volcanic activity and publishes occasional Bulletins.

Membership in the Hawaiian Volcano Research Association is limited to patrons of Pacific science who desire personally to aid in supporting the work.

The work of volcano research so supported is in collaboration with the work of the United States Geological Survey, but supplements it with buildings, research fellows, instrumental plants, explorations and special investigations for which there is no governmental provision. The Geological Survey maintains volcano stations in Alaska, California and Hawaii.

Persons desiring application blanks for membership ($5.00 or more) should address the Secretary, Hawaiian Volcano Research Association, 320 James Campbell Building, Honolulu, T. H.

The Volcano Letter

No. 385 Hawaiian Volcano Observatory, National Park, Hawaii May 12, 1932

THE SUSPENSION OF THE VOLCANO LETTER

Among the reductions of governmental appropriation for the fiscal year ending June 30, 1933, is one changing the allotment to volcanology in the U. S. Geological Survey from $35,000 to 15,000. A large proportion of this concerns the Hawaiian Volcano Observatory, which is cooperatively maintained by a personnel chiefly of government employees, and by equipment and expenses, including publication, supplied in large measure by the Hawaiian Volcano Research Association.

The drastic reduction by fifty-seven per cent will permit the continuance of the Hawaiian station and a working staff only by abolishing the weekly Volcano Letter in its present form, as the publication of that periodical has been the largest item of expense from the cooperative fund furnished by the Research Association. This money will be needed to keep alive the work of the Hawaiian Volcano Observatory after July 1, 1932, and therefore it is deemed wise by the Board of Directors of the Association to take action immediately in preparing to reduce the Volcano Letter to a monthly leaflet after the issue of May 26, 1932. As before it will contain reports of the volcano observatories of the U. S. Geological Survey, and volcanologic notes.

As this crisis is a serious one for fundamental research concerning American volcanoes, all friends of volcano research are requested to rally to the support of the Hawaiian Volcano Research Association by subscribing any sum whatever, from one dollar up, and by securing new members and patrons for the Association wherever possible either firms or individuals, and anywhere in the world. The regular annual membership fee of the Association is five dollars, and necessarily the two dollar subscription for the Volcano Letter as a weekly publication is hereby abolished. After July 1, 1932, the monthly Volcano Letter will be sent only to paid up memberships and exchanges.

There will be no suspension of the work done. though the official staffs of the California, Hawaiian, and Alaskan stations will be reduced and some workers eliminated. There will be every effort to enlist new amateur workers who live near volcanoes and in land subject to small earthquakes, and who may be willing to send in official postal cards describing the happenings which come to their notice. The coming year will be an opportunity to bring to publication in scientific journals the material which has accumulated through recording twenty years of varied activities. T.A.J.

NOTICE TO MEMBERS AND SUBSCRIBERS

Honolulu, May 2, 1932.

To Members and Subscribers,
Hawaiian Volcano Research Association.

This communication is ordered by resolution of your Board of Directors on this date, to the following effect:

Resolved:

That the work of the Association shall be carried on, but that every possible avenue of economy shall be followed, including the abolition of the Volcano Letter in its present form. That the Directors approve of the proposed budget as revised for the balance of the current calendar year, with the proviso that further cuts be made, and that every effort be exerted to collect donations not yet received.

Accordingly, this letter is addressed to those who have subscribed two dollars per annum for the Volcano Letter and to regular members and patrons of the Association.

A cut of fifty-seven per cent by the Government, forces us to limit expenses to bare necessities, in order to save the Hawaiian Volcano Observatory.

After May 26, 1932, the Volcano Letter will be reduced to a monthly leaflet, but subscribers will be sent scientific papers from time to time. You are asked to accept this for the good of the cause, but two-dollar subscribers or members who except and require a weekly periodical, and who so notify the Assistant Treasurer, will have their full subscription returned.

Those able to help by enlarging their subscriptions or winning new subscribers, will be benefactors of scientific research in a time of serious crisis.

T. A. JAGGAR,
Scientific Director;
Hawaii National Park, T. H.

L. W. de VIS-NORTON,
Assistant Treasurer,
320 James Campbell Bldg.,
Honolulu, T. H.

KILAUEA REPORT No. 1059

WEEK ENDING MAY 8, 1932

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge

On the forenoon of May 2 Halemaumau pit showed fresh debris which had fallen since the previous day on the floor in the south bay from the wall above. Bluish fume remained constant at the sulphurous cracks at the edge of the floor west. Measurement of southeastern rim cracks showed very slight widening. Inspection at 8 p. m. revealed only a quiet pit and no glow. On May 3 at 9 a. m. the western fume was denser, probably owing to moisture content, as the weather was rainy. At 9 a. m. May 6 some fresh sliding at the south wall of the pit had added to the pile of fragments on the floor.

Progress in construction of the two tilt cellars near Halemaumau west and north shows concrete work in place at the former, and the digging practically complete at the latter

The seismographs recordel three very feeble shocks 23, 28, and 69 miles distant, the last rattling windows at Huehue in North Kona for about 15 seconds May 6 at 5:28 p. m. Twenty-one tremors were registered, one indicating distance 46 miles, and another 9 miles. Tilting of the ground was practically absent, and microseismic motion was moderate.

HAWAIIAN VOLCANO OBSERVATORY

Founded 1911

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The Volcano Letter

No. 386 | Hawaiian Volcano Observatory, National Park, Hawaii | May 19, 1932

KILAUEA REPORT No. 1060

WEEK ENDING MAY 15, 1932

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge

On the forenoon of May 9, with northeasterly squalls and rain, the fume rising from the west edge of the floor of Halemaumau appeared slightly denser than before, and some odor of sulphur was detected at southeast rim of pit. In the afternoon the fume seemed dense and a few wall rocks fell. On May 11, 9 to 10 a. m. the fume was less dense, and some small sliding had taken place at the north. A slide at the south wall in the afternoon agrees in location with a slight opening of the SSE rim cracks recently measured. With damp air May 12 blue fume rose above the rim infrequently.

Experimental runs are now being made with clinoscopes for measuring tilt, in the southeast Halemaumau cellar, by E. G. Wingate.

Observatory seismographs registered one feeble local shock at 10:16 p. m. May 9, felt in Hilo, apparent distance from Kilauea to origin 14 miles. Three very feeble shocks occurred, two indicating distance 18 miles, one a possible distance of 115 miles. Twenty-six tremors were recorded. Microseismic motion was slight to moderate, and tilting of the ground was slight north.

A large distant earthquake May 14 with first preliminary at 2h 52m 57s a. m. H.S.T. (10h 30m slower than Greenwich) indicated distance 5300 miles wsw. This location checks with press report of damage and loss of life at this time in Minahassa, the northern peninsula of Celebes Island, a volcanic area of the Netherlands East Indies.

TILTING OF THE GROUND FOR APRIL

The following figures show the net tilt by weeks at the Observatory on the northeast rim of Kilauea crater, and its direction, computed from the daily seismograms, by plotting a curve smoothed by overlapping seven-day averages. This is the departure of the plumbline in seconds of arc, in the direction given.

March 29-April 4	1.0 second	NE
April 5-11	0.8 second	E
April 12-18	0.8 second	NW
April 19-25	0.3 second	SE
April 26-May 2	0.6 second	SSW

E.G.W.

ERUPTION IN LAKE ROTORUA, NEW ZEALAND

A semi-volcanic eruption up through the bottom of the southern cove of Lake Rotorua occurred about 7:45 p. m. January 18, 1932. The place was about one hundred yards away from the shore off the mouth of the Puarenga Stream, the torrent of warm water that pours northward into the lake from the Whakarewarewa Geysers. The place is directly opposite the town of Rotorua. A column of steam, water, mud and stones was hurled up from an aperture in the solfataric shallows from 200 to 400 feet. There was little noise, and a few minutes after it occurred the surface of the lake was again smooth. The Maoris reported it the largest mud-geyser eruption since the explosion of Waimangu in 1917.

The area covered by the falling mud and stones was several acres. For more than one hundred yards along the shores of the lake, and for many yards back from the water, the ground was coated with thick slimy mud, and the point of land which projects in the direction of the vent under the lake was lengthened by 30 yards. People who happened to be on the balcony of the Ward Bathhouse had a splendid view of the outburst.

This explosion here is not the first. It is in the same general locality as two other outbursts a few months earlier, when the Ngapuna pa was startled by a sensational disruption of the flats, a native garden was engulfed and property was threatened. This area is reputed dangerous. The ground is a mass of brittle and steaming solfataric deposits, which crumble underfoot, there are many hot springs, and occasional patches of quicksand. At Whakarewarewa, a mile and a half away to the south, are the famous geysers and paint pots visited by tourists, in a verdant valley filled with boiling springs of varied aspect, and it seems likely that there are volcanic faults extending down the Puarenga valley to the lake. The whole district is highly volcanic, and the hot magma is probably not far from the surface

T.A.J.

ASH ERUPTION IN THE ANDES

From the 10th to the 13th of April 1932 there were extensive steam-blast eruptions in the Andes of Argentina near the Chilean border, eight volcanoes being named, and the towns Malargue and San Rafael in Mendoza province received the heaviest ash-fall. Ash fell at Buenos Aires in Argentina 800 miles from the source, at Santiago in Chile and at Montevideo in Uruguay. In the mountain towns two to three feet of ash and sand are said to have fallen. Darkness enveloped much of the country, and earthquakes and fissures were reported, and glow from the craters. The volcanoes mentioned are the Descabezado group, Tinguiririca, Tupungato, Juncal, San Jose, Maipu and Peteroa, and probably a volcano in the Neuquen district of northern Patagonia. The volcano Quizapu in the first group has been the subject of anxious observation by the Chilean Seismological Service since April, 1929. The ash blanket covered thousands of square miles and made the mountains look as though covered with snow (Press reports.)

T.A.J.

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The Volcano Letter

No. 387 U. S. Geological Survey, Hawaii National Park May 26, 1932

KILAUEA REPORT No. 1061

WEEK ENDING MAY 22, 1932

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge

Halemaumau, the inner pit of Kilauea Crater has shown no significant changes during the week. Measurements of cracks May 16 at the rim east and south indicated little movement. A dust cloud at the north wall at 10:55 a. m. May 17 during high wind was accompanied by no visible slide. At 4:45 p. m. the blue fume from the western sulphur spot of the bottom was plainly visible above rim of pit as seen from the Observatory. At 9 a. m. May 18 the scar from a slide was visible above the middle of the "canoe sill" in the lower northeastern wall of the pit.

The building of the tilt cellars west and north of Halemaumau has proceeded so that the western one now has the instrument chamber encased with built-up rubble, and the entrance way has been walled up on either side of the stone stairway at the approach. A heavy slab roof of concrete, separated by an air space from the inner chamber, will be built across the top The chamber is thus insulated by air spaces, and will have double doors at the entrance.

Seismic activity has been extraordinarily feeble for the week. Only three volcanic tremors were recorded, one indicating a possible origin at 120 miles distance. There has been much artificial tremor from heavy road-working machinery. One very feeble local seism occurred. A distant earthquake indicating origin 4,400 statute miles away, began at 11h 50m 43s p. m. May 20, 1932, reported location Salvador. Microseismic motion for the week was moderate, and tilting of the ground was slight to the north with tendency eastward

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The Volcano Letter will hereafter be monthly.

ERUPTION OF MERAPI IN JAVA

There are two important volcanoes named Merapi, of which one is in Sumatra. The volcano here considered is in central Java, and started a disastrous eruption November 25, 1930, and permitted a stiff, blocky variety of lava to exude from the crater throughout most of 1931. (Der Ausbruch des Merapi, by N. Van Padang, Zeitsch. für Vulk., 1931 page 135, and Bull. Neth. East Ind. Volc. Surv. 1930-1931.)

Except for the volcano on Bali named Batoer, the flowing of lava is rare in the Dutch East Indies, though the slow push upward there of andesitic domes within craters is well known.

There had been an increase of tremors from January to May 1930 at Merapi, and the temperature of the solfataras was about 600° C. in October 1930, but this was not unusual for this place. In November large and small tremors increased, explosions were heard November 23, 1930, and these continued. When the glowing lava in the crater appeared on November 25, 1930, large tremors, which had been caused by crater avalanches, came to an end.

The lava was very tough and irregular in flowing, its glow was variable, with rough blocks falling from the front, which burst and formed small clouds, that mixed with the general cauliflower clouds of the jets from the crater. This lava formed a short, stubby outflow at the crater gulch. Such sluggish flowing, with small gas concentration, continued until December 18, 1930.

The eruption had characters similar to those of Mount Pelé in Martinique, including hot blasts downward and across country, known, in Martinique as "nuées ardentes" or glow clouds. After December 18 big blasts occurred, throwing out old material mixed with fresh lava, and these emerged from a big, deep chasm or gulch in the slope of the mountain opening from the summit crater. Great avalanches, and streams of blocks rushed down, and followed valleys, along with a drifting cloud of sand, ash and gas. While the debris followed the ravines, the whirling hot sand clouds would keep their own direction, with tornado effects, and make fearful destruction.

The largest such glow-cloud blast descended the mountain on December 19, 1930, killed more than 1,300 villagers, devastated 22 square kilometers of country, and spread more than 10 kilometers from the center. The stream of debris in the valleys was 10 to 50 meters thick, and the sand covering beyond was from 1 to 40 centimeters thick.

There had been lava domes which had arisen during eruptions on the summit of Merapi, beginning in 1883, by rise of andesite lava through broken material in the bottom of a crater 100 meters deep There was renewed rise of the lava in 1888, a dome above the top of the mountain had formed in 1909, side by side with this eastern dome there arose a western dome between it and the crater wall in 1911-13, and in 1922 there came out a lava stream at the western wall crack, the source material of which made a triple dome in the crater along with two earlier ones. The sequence is vividly shown in a series of diagrams by Van Padang. In 1930 a new dome and flow were formed beside the others in November-December, and the great eruption of December 18-19 caused collapse of the older domes, but after a succession of hot blasts thick lava rose again which formed a new dome in the chasm, somewhat away from the center of the mountain. The entire description of this eruption coincides strikingly in quality with that of Santa Maria in Guatemala November 2, 1929. (Volcano Letter No. 356)

In January 1931 lava issued from various parts of the new lava dome, blocks fell noisily from the crust as the dome repeatedly burst, and the mud and debris slides in the valleys ("lahars") solidified and cooled. The rains made water explosions against dry, hot debris in the valleys just as at Soufrière and Pelée in the Caribbee Islands in 1902. The rivers carried quantities of sand. Light seen above the lava dome, which showed only fumarolic action in daytime, was indicated at night to be flame from burning gas. The smell of sulphur dioxide was strong, and temperatures of some known fumaroles, formerly 500° C., had lowered to 60° C. On the other hand, solfataric action was spread over a greater area.

On March 25, 1931, there was an older lava stream of 1930 from the gash under the summit, and a younger one emerged March 10, 1931, and increased after March 15, so that on March 19 the lava tongue was 180 meters lower than the week before. There were many small blasts, with much avalanching, and glowing spots on top of the dome marked places where lava was gushing.

Erosion was now etching rill patterns rapidly in the deep, hot, debris fills of the valleys. Mud geysers were thrown up 50 meters high where eroding streams of water made contact with gravel beds almost incandescent. Measured temperatures recorded 280° C. The fumarole activity at the head of Senowo River, where the temperature in October 1930 had been 610° C., had ceased altogether in April 1931.

Lava flowing and hot blasts continued in May and June 1931. A new local observatory was built 4 kilometers from the summit, at elevation 1,279 meters, on the northwest slope of the mountain, with a tunnel to provide safe refuge against hot blasts. In this tunnel a seismograph was placed. In July and August 1931 lava flow and avalanches continued, and at night dark red glow could be seen at the crater, where in day time vapor arose. T.A.J.

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
HAWAII NATIONAL PARK
HAWAII

OFFICE OF THE SUPERINTENDENT

May 5, 1932

The Director,
National Park Service,
Washington, D. C.

Dear Mr. Director:

The following is a report of the activities and operations in Hawaii National Park for the month ofApril, 1932.

000 General

010 Superintendent Leavitt was on the mainland during the entire month, attending the superintendents' conference at Hot Springs National Park as well as visiting Carlsbad Caverns, Grand Canyon and Yosemite National Parks. The outstanding event of the month was the first visit of the Matson liner Mariposa to Hilo. This new ship was returning from a cruise around the Pacific. The ship brought 200 visitors to the park. These visitors were contacted by members of the staff at the park entrance, Thurston Lava Tube, Chain of Craters, Firepit, and Museum. The Volcano House provided entertainment for the visitors during the noon hour.

020 General weather conditions
Cloudy, rainy weather prevailed during the month, with a total rainfall of 8.3 inches. This makes the total rainfall to date for the year 50.34 inches, as compared with 13.81 inches for last year. Trade winds prevailed during the month.

100 Administrative

110 Status of work
All office work, including disbursing and accounting, was kept current during the month. The final estimates for 1934 were prepared and mailed to the Washington and San Francisco offices.

120 Park inspections by
121 The Acting Superintendent
Regular inspection trips were made of roads, trails and other construction in the vicinity of Kilauea. Due to the great amount of office work and the combined duties of acting superintendent and park naturalist, no inspections were made of trails in the outlying sections of the park other than by members of the ranger staff on regular patrol duty.

130 Finance and accounts
See Statistical Report No. 8 accompanying this report.

140 Labor situation
During April 22 per diem laborers were employed. There has been no difficulty in obtaining sufficient labor, although there appears to be no great unemployment problem on the island of Hawaii. Road construction in the park has given employment to all available labor in the immediate vicinity of the park. A number of applications for temporary or summer work have come in from people on the mainland.

150 Equipment and supplies
A small supply of hand tools, one New Perfection 2-burner stove for the Mauna Loa shelter, and materials for the construction of the administration building were received during the month.

180 Circulars, placards, publicity bulletins, etc.
Copies of the Volcano Letter are attached. During the Produce and Commercial Fair held at Hilo April 29 and 30, approximately 2,500 general circulars were distributed in addition to 1,500 copies of the attached questionaire. Three copies of the National Park-to-Park Highway map were distributed to the public schools at Pahala, Naalehu and Kapapala, also 25 copies of map showing the location of the National Parks and Monuments and principal railroad connections.

200 Maintenance, Improvements and New Construction

210 Maintenance
The usual maintenance and repair of roads, trails, telephone lines, signs and grounds was carried on during the month. No bad storms took place, hence nothing but the usual maintenance work was necessary.

220 Improvements
A 15 KW generator was installed for supplying electric current a few hours each day, particularly during the hours of the peak load. This generator was borrowed from the Kilauea Military Camp.

An extension was added to the equipment shed for housing tractor and one truck. This extension was built by ranger labor from materials salvaged from the old administration building. A 20 by 18 foot wood shed was also built from the salvaged materials. These two minor building improvements improve the usefulness and appearance of the utility area.

Three park trucks received a complete overhauling, ranger labor being used, hende a saving was made in the cost of this work.

Improvements on the Mauna Loa trail were made during the month, the work being 90% complete.

The post construction work of removing bedrock from the ditches along the Kau road was completed.

230 New construction

The new administration building, started during March, is 60% complete. The attached pictures will convey some idea of the construction work.

More was accomplished by the road construction force during the last two weeks of March and the first two weeks of April than in any preceding month, according to the report of Resident Engineer Handley. Ideal weather conditions prevailed during the latter part of March and the majority of the work consisted of surfacing, the crew on this work being particularly well organized. Eight days were lost during the early part of April due to rainy weather. At the present time the main road from the Hilo entrance to the Volcano House is reported ready for surfacing. This section has been closed off for the last two weeks and all traffic detoured onto the Rim Road around the crater. Mr. Handley's report showed the work 68% complete on April 15, with 75% of the contract time having elapsed.

240 Improvement of approaches to the park

The Territory has continued to remove unnecessary vegetation and cut grass on the shoulders of the road between Hilo and the park. Between Pahala and Naalehu (Kau side of the park) the Territory has continued the work of widening the road, particularly at sharp corners, and constructing stone guard rails at the places needed.

300 Activities of other agencies in the park

Lieut. T. G. McFarland replaced Chief Marine Gunner Emory T. Ozabal as commanding officer in charge of the Kilauea Navy Recreation Camp.

400 Flora, fauna, and natural phenomena

410 Ranger service

The rangers have been on duty at the Hilo entrance station, lava tube, headquarters and museum in addition to being occupied with patrol duty, repair and construction work. At times during the month rangers have assisted the park naturalist in conducting field trips.

411 Naturalist service

Fifteen lectures were given during the month with an attendance of 391 and six field trips with an attendance of 55.

The park naturalist met the University extension course class six times, four times for lectures and twice for field trips.

420 Museum service

The museum was open on all boat days and Sundays with a total attendance of 863 .

480 Natural phenomena

There was very little change in conditions at the volcano during April. Fume and steam continued to rise from the firepit, and sulphur deposits on the floor of the pit are enlarging. Eleven local shocks were recorded on the Observatory seismographs, many of which were felt by residents of the district and Hilo, and 118 tremors were recorded during the month. Tilt for the month ranged from S, NE, and E, to W.

490 Miscellaneous

While Hawaii is popularly advertised as having no Hawaiian word for"weather", meaning that there is no change in season, those people living in the park do recognize that spring is a very definite season. During the month it has been interesting to watch spring come up the mountain. Early in April the ohia trees were in full blossom at approximately 1,000 foot elevation. During the month the bright red lehua blossoms and clusters of new red leaves on the ohia trees have appeared at higher and higher elevations. The lehua blossoms will be most numerous around the park headquarters during the latter part of May.

500 Use of Park Facilities by the Public

510 Increase in travel

While patronage of the Volcano House and Military Camp shows a slight decrease from last year, the number of visitors by automobile to the park has increased considerably. A total of 7,554 persons came into the park during April, as compared with 4,476 persons in April of last year. The number recorded for the travel year to date is 86,980, compared with 82,502 for last year, an increase of 5.1%.

530 Visitors

The following visitors were extended special courtesies during the month:

Captain J. H. Trask, captain of the S.S. Mariposa, new Matson boat.

Captain George H. Zeh, captain of the S.S. Calawaii of the Los Angeles Steamship Co.

Mr. and Mrs. R. S. Gray. Mr. Gray is connected with the Los Angeles Steamship Company.

Dr. John Rice Ball, Professor of Geology at Northwestern University, Evanston, Ill.

LeRoy Blessing, Manager of the Honolulu Automobile Club, Honolulu, T. H.

Robert Ripley, New York, editor of "Believe It or Not".

600 Protection

610 Police protection
During the visit of the S. S. Mariposa, the Territorial police force patrolled the road from Hilo to the park entrance.

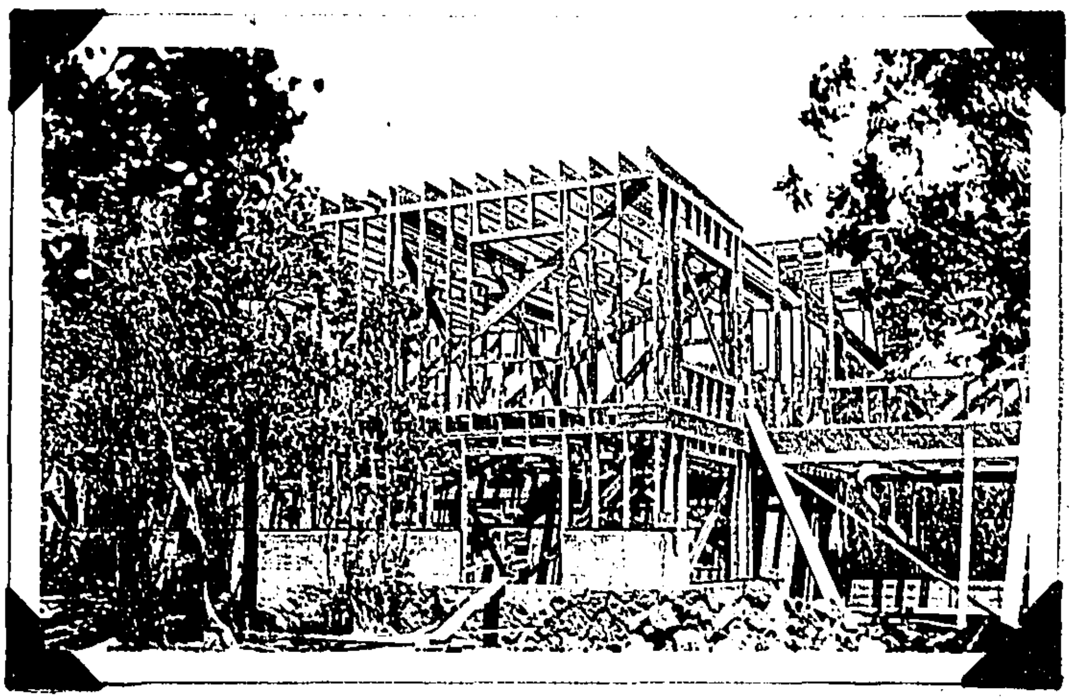
640 Destruction of predatory animals
The following animals were killed during the month:
87 wild goats
11 wild pigs

900 Miscellaneous

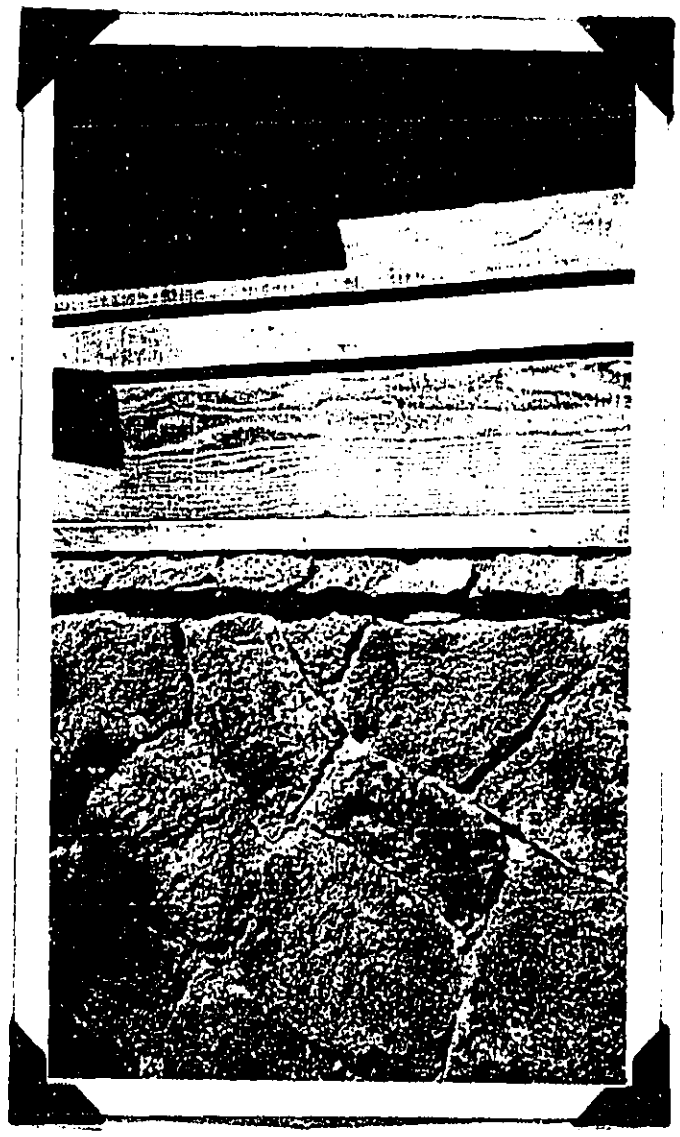
Dr. Arthur H. Compton of the University of Chicago, who is conducting experiments on the cosmic ray, in collaboration with Dr. Milliken of the University of California, established a cosmic ray experimental station on the summit of Haleakala, Maui, on April 2. Over 400 pounds of scientific instruments necessary to the experiment were transported to the Rest House and two days were spent in the work. Dr. Compton will also make experiments in New Zealand and Australia. Similar experiments are being conducted in other parts of the world and scientists of many countries are interested in the outcome.

On April 20-30 the park maintained an exhibit at the Produce and Commercial Fair in Hilo. The space assigned to the park was through the courtesy of the Hilo Chamber of Commerce. The park's exhibit included specimens of plants, lava, minerals and birds, in addition to a good collection of petroglyphs. A complete collection of Hawaiian birds was loaned to the park for exhibit through the courtesy of Mr. and Mrs. Peter Lee. All photographs were by courtesy of the Volcano Photo Studio. Rangers were on duty during the two days of the fair. Approximately 5,000 people visited the exhibits. In addition to 3,500 park circulars distributed, the rangers also gave out a set of questions concerning the park. A copy of the sheet of questions is attached. There is every indication that the park's exhibit stimulated great interest in the park and its natural features.

Very respectfully,
John E. Doerr, Jr.
~~E. P. Leavitt, Superintendent~~
John E. Doerr, Jr., Acting Superintendent.



Rear view of new administration building showing 6" reinforced concrete foundation with 13" stone veneer, partially complete. The footings under each room partition run the full width of the building and are tied into outside walls, thus giving the entire building greater strength to resist earthquake vibration. Picture by Higashida, April, 1932.



Close-up of stone work on new administration building. The stone is basalt obtained from the park's quarry. The pointing of joints is not complete. Picture by Higashida, April, 1932.

Hawaii National Park booth with display of plants and lava specimens at the Future Farmers of America Fair in Hilo, April 29 and 30. Photo by Higashida.

10-157
(July, 1929)

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

TRAVEL REPORT

Hawaii National Park for the month of April, 1932

	This Month	This Travel Year To Date	This Month Last Year	Last Travel Year To Date	Increase for Travel Year: Number	Increase for Travel Year: Percent
PRIVATE TRANSPORTATION:						
Cars first entry, ...						
Cars reentry, ...						
Motorcycles, ...						
Total motor vehicles, ...						
Persons entering via motor vehicles, ...	7,208	81,374	5,719	75,861	5,513	6.6%
Persons entering via other private transportation, ...	130	1,996	211	2,198	- 202	9.1% Dec.
Total persons entering via private transportation, . . .	7,338	83,370	5,930	78,059	5,311	6.5%
OTHER TRANSPORTATION:						
Persons entering via ~~stages,~~ Hotel .	216	3,610	737	4,443	- 833	18.7% Dec.
Persons entering via trains, .						
Persons entering otherwise, . .						
Total other transportation, .	216	3,610	737	4,443	- 833	18.7% Dec.
GRAND TOTAL ALL VISITORS, . . .	7,554	86,980	6,667	82,502	4,478	5.1%

	This Year	Last Year	Increase: Number	Increase: Percent
Automobiles in public camps during month, ...	0	2		
Campers in public camps during month, ...	0	7		

10-158

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF AUTHORIZED PROJECTS

Hawaii National Park for the Month of April, 1932

Description of Projects	Percent Constructed To Date	Percent Constructed This Month	Percent Constructed Last Month	Probable Date of Completion
410 U.S. Commissioner quarters -	90	0	8	June 30, 1932
411 Employees quarters - - - - -	100	0	0	
412 Employees quarters - - - - -	100	0	0	
413 Administration building 9 -	60	55	5	June 30, 1932
502 Trails				
502.1 Hilina Pali to Halape - - -	100	0	0	
502.2 Uwekahuna-Halemaumau auto trail	92	0	0	
502.3 Mauna Iki extension - - - -	100	0	0	
502.4 Haleakala trail - - - - - -	100	0	0	
502.5 Mauna Loa trail - - - - - -	100	0	0	
502.6 Halemaumau trail - - - - - -	95	0	0	
507.1 Kau belt road - - - - - - -	100	0	0	
507.3 Cinder cone removal - - - -	85	35	50	May 15, 1932
Road Survey, BPR Construction - -	68	10	11	July 1, 1932

10-159
(May, 1931)

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF PERSONNEL

Hawaii National Park for the Month of April, 1932

	This Month		This Month Last Year	
	Appointed	Non-Appointed	Appointed	Non-Appointed
Number of employees beginning of month	12	22	5	5
Number of additions	0	0	1	6
Total	12	22	6	11
Number of separations	0	1	0	0
Number of employees close of month	12	21	6	11
Number of promotions during month	-	-	3	0
Aggregate amount of annual leave taken	-	-	-	-
Aggregate amount of sick leave taken	-	-	10	-
Aggregate amount of leave without pay	-	-	-	-

10-160

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

REPORT OF PARK REVENUES

Hawaii National Park for the Month of April, 1932

	This Year	Last Year
Park revenue on hand beginning of month,	0.00	0.00
Received,	25.61	25.00
Total,	25.61	25.00
Remitted,	25.61	25.00
On hand close of month,	0.00	0.00

Park revenues received this year to date,	$1,631.42
Park revenues received last year to date,	1,400.00
Increase,	231.42
Per cent of increase,	14.1%

10-161

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

REPORT OF SALES OF PUBLICATIONS

HAWAII NATIONAL PARK - APRIL 1932

	Number	Value
GOVERNMENT PUBLICATIONS:		
On hand beginning of month,	945	$172.70
Received during month,	-	-
Total,	945	$172.70
Sold during month,	9	2.55
On hand at close of month,	936	$170.15

	Number	Value
NON-GOVERNMENT PUBLICATIONS:		
On hand beginning of month,		
Received during month,		
Total,		
Sold during month,		
On hand at close of month,		

Cash on hand beginning of month,	$4.60
Sales during month,	2.55
Total,	$7.15
Remitted during month,	-
Balance,	$7.15

Form No. 1009—Met'l.

U. S. Department of Agriculture, Weather Bureau.

COOPERATIVE OBSERVERS' METEOROLOGICAL RECORD:

Month of April, 19[illegible] *, 192 ; Station,* Volcano Observatory *; County,* Kau

Hour of Observation, ______

State, Hawaii *; Latitude,* ______ *; Longitude,* ______ *; Time used on this form,* ______

DATE.	TEMPERATURE. Maximum. 1	Minimum. 2	Range. 3	* Set Max. 4	PRECIPITATION. Time of Beginning. 5	Time of Ending. 6	† Amount. 7	Humid (Snowfall, in Inches.) 8	Wind (Depth of Snow on Ground at Time of Observation.) 9	Prevailing Wind Direction. 10	Character of Day, Sunrise to Sunset. 11	‡ Miscellaneous Phenomena.
1	60	51	9	56			23	89	Str.	N.E.	P.C.	
2	63	52	11	58			01	88	"	"	"	
3	66	53	13	59			14	87	"	"	"	
4	69	52	17	60			01	84	"	"	"	
5	64	53	11	56			12	94	"	"	"	
6	62	54	8	58			30	95	Mod.	"	"	
7	67	52	15	61			21	94	"	"	"	
8	67	52	15	60			10	89	"	"	"	
9	62	55	7	57			12	94	Str.	"	"	
10	65	51	14	60			01	85	"	"	"	
11	61	53	8	57			81	93	Mod.	"	Cloudy	
12	61	53	8	57			55	100	Str.	"	"	
13	60	53	7	55			1.10	100	Mod.	"	"	
14	64	52	12	59			1.38	89	"	"	"	
15	63	52	11	58			28		Str.	"	"	
16	67	50	17	63			36	84	Mod.	"	P.C.	
17	70	51	19	65			01	88	Lt.	"	Clear	
18	70	51	19	62			T	79	Mod.	"	"	
19	68	51	19	63			T	88	"	"	"	
20	69	55	14	60			29	89	"	"	P.C.	
21	68	52	16	57			02	89	Mod.	"	"	
22	64	52	12	60			01	89	"	"	"	
23	68	52	16	64			03	80	Str.	"	"	
24	61	53	8	57			30	94	"	"	"	Lt. new snow.
25	64	53	11	58			32	89	"	"	"	
26	67	51	16	65			05	85	Mod.	"	"	
27	69	51	18	64			01	85	"	"	"	
28	65	51	14	64			17	75	"	"	"	
29	65	49	16	65			19	80	"	"	"	
30	64	52	12	61			23	84	"	[illegible]	"	
31	1955	1562	391	1791			3.30	2583				
Sum							8.30					
Mean	65.15	52.61	13.0	59.7			.276	86				

* Reading of maximum thermometer immediately after setting.
† Including rain, hail, sleet, and melted snow.
‡ Thunderstorms, halos, auroras, etc.

______, *Cooperative Observer.*

(IN TRIPLICATE.) See cover for instructions.

Post-Office Address, ______

MONTHLY SUMMARY.

TEMPERATURE.

Mean maximum, 65.1
Mean minimum, 52.6
Mean, 58.8
Maximum, 70 ; date, 17,18
Minimum, 49 ; date, 29
Greatest daily range, 19

PRECIPITATION.

Total, 8.3 inches.
Greatest in 24 hours, 1.38 . date, 14

SNOW.

Total snowfall, ______ inches; on ground 15th, ______ inches;
at end of month, ______ inches.

NUMBER OF DAYS—

With .01 inch or more precipitation, 28
Clear, 3 ; partly cloudy, 22 ; cloudy, 5

DATES OF—

Killing frost, ______
Thunderstorms, ______
Hail { Light, ______ ; Moderate, ______ ; Heavy, ______
Sleet, ______
Auroras, ______

REMARKS:

Remnant snow on mountains throughout the month.

STATISTICAL REPORT NUMBER 8

HAWAII NATIONAL PARK

FINANCE AND ACCOUNTS

Symbol		Allotted	Expended & Obligated	Balance
41/2415	Hawaii National Park 1931-32 - -	$52,150.00	47,550.87	4,599.13
41/2405	Emer. Reconstruction and Fighting Forest Fires - - - - - - - - -	$200.00	200.00	0.00
41/2406	Forest Protection andFire Prevention - - - - - - - - - -	$100.00	100.00	0.00
4 X 456	Roads and Trails, National Parks, No year - - - - - - - - - - -	$384,806.30	128,554.35	256,251.95

6

HAWAII NATIONAL PARK IS YOUR PARK

How much do you know about it?

Have you driven to Pali Hilina yet?
Do you know where the pulu factory is?
Have you been to Napau crater?
Did you ever climb Puu Huluhulu?
GET OFF THE BEATEN TRACK
What is pulu?
How many park trees do you know?
How many different ferns can you name?
Do you know where to find the nearest water?
ASK A RANGER
How many craters do you know by name?
Have you been down into Kilauea Iki?
What is called "The Eel's Eye"?
Goats live in one crater. Which?
VISIT THE PARK MORE OFTEN
Do you know where the free camp ground is?
Throwing things into craters is tabu. Why?
How many of the birds can you name?
Do you know where to find the park telephones?
STAY LONGER NEXT VISIT
How many lava tubes have you explored?
Many berries are good to eat. Which?
Some berries are poisonous. Do you know them?
Did you ever see our volcano movies?
BRING THE KIDS
Mauna Iki is still hot. Have you been there?
Do you know the park regulations?
Have you been to Giant Koa?
Do you know where to look for footprints?
ASK A RANGER
Have you seen Makaopuhi by moonlight?
When was the last eruption?
Where are the lava trees?
Souvenirs may be taken at one spot only. Where?
GO PLACES SEE THINGS
Have you heard the free lecture on volcanoes?
There are lava spatters in trees. Where?
Have you visited our museum?
Have you been to Bird Park?
IT IS ALL FREE

ORGANIZE YOUR FRIENDS AND NEIGHBORS. EXPLORE THE PARK ONCE A MONTH. LET US KNOW IN TIME AND WE WILL FURNISH A GUIDE FOR YOUR PARTY. OUR JOB IS TO HELP YOU.

A L O H A

The Volcano Letter

Two dollars per year | Ten cents per copy

No. 380—Weekly | Hawaiian Volcano Observatory, National Park, Hawaii | April 7, 1932

Construction of Perret's upper station on Mont Pelé proper, November 1930, at Morne Lenard. Photo Perret.

THE NEW DOME OF PELE'E

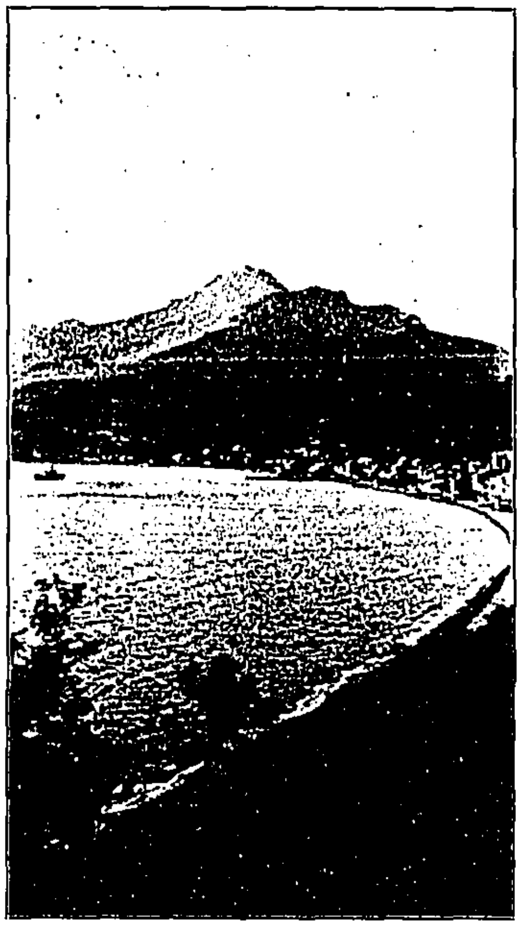
The renewed activity of Mont Pelé was mentioned in Volcano Letter No. 262. Ash eruptions were reported to have begun September 16, 1929. It appears that notes on the evolution of the dome were published in "Comptes rendus" 190-761, 190-623, and 191-1253, 1930-31, by H. Arsandaux. F. A. Perret has added two notes in the same publication, C. R. 193-1342, 193-1439, 1931. These last are reviewed here.

The formation of cone-in-cone structure by dwindling activity of mixed eruption, like Vesuvius in the ring of Monte Somma, is well known. The absence of a chimney in the center of a lava dome makes an interior edifice unexpected. Perret in January, 1930, when he first saw the Peléan dome of 1903, was interested to find it deeply caved in from the explosive process of September 1929. In the center of this cavity was an active eruptive cone.

The new excavation was a depression which widened from southwest to northeast, with a rocky ridge in the wound. The greater part of this was conical, but not the highest part. The explosive phase of eruption which continued in January and February exhibited two sources for steam-blast cauliflower clouds: a large one north, and a smaller and higher one southeast. The undermining produced a horseshoe cup with a medial extension like the latter "E.". With the kernel of the dome surrounded by talus, it was surprising to see the outer shell of weakest material hold itself up in steep walls, while the solid rock of the interior was removed. Evidently eruptive material rose high enough to form a shell whence eruptions diverged before destroying the lateral walls. From the time of the first 1929 eruption, all the explosions were from the inside of the dome of 1902-03.

The inner rocky ridge extended downhill ENE-WSW like a cock's comb, with the lower end a row of needles. Still lower at the ancient opening of the 1902 horseshoe, a series of vents in a line sent up puffs of ash. It could not be determined whether these were in new magma or a rocky remnant of the old dome.

The central ridge was not simple. It was a castellated group of towers. These were round, smooth, and spirally grooved. They appeared tubular, and often lava poured from apertures at the bottom. On the 20th of April, 1930, after an enormous downrush, round columns were left on the dome, black by daylight, but probably incandescent. The towers change rapidly. January 28 they appeared to be destroyed. But the activity appeared rather to be constructive, for on February 3 the towers appeared consolidated into an enlarged mass with the profile of a true dome. On the crest were rudimentary needles. Then came lava activity, that would have been 'Strombolian' if there had been explosive ejection, and this motion never ceased. Such crises were at first rhythmic, and alternating with the cauliflower jets, and they gradually resolved themselves into a regular constructive process, producing numerous needles On all sides of the new dome emerged slender incandescent lava flows, with emission of light transparent vapor. The process was comparable to that of lava cupolas on Vesuvius. The incandescence was dark orange under a thin crust in the darkest places, and elsewhere it was so bright that the illumination reflected on the cloud was visible at Fort-de-France. The flows were liquid a short distance apparently, then presented the well



St. Pierre as it is today, 1932. Photo Perret. Mont Pelé in background.

known "aa" streaming of fragments. The dome grew higher and on February 19 the summit was flat, crowned with small needles, and at the sides were straight talus slopes.

Two mechanisms are involved in the Pelée dome, the spread of lava and the thrusting out of needles. These last tend to rise vertically. This vertical rising is natural enough on the summit, but how about a slope of débris at 35°, where a line of vertical obelisks arises? Why does the internal magma push skyward and through chaotic material? This explanation appears to be the perforating power of rising gas. A fissure holding magma is opened to the surface by gases burrowing upward in a row of aligned chimneys. The magma follows, shells over in contact with the chimney wall, and the pencil so formed is pushed up. The lava flows are similar, but the orifices being more free, the slag remains hot and fluid.

During two months the carapace on the dome was so thin and the mass so fluid that the needles overturned on a pasty base, resembling large pears. The most conspicuous spine began March 25, promptly overturned, and rolled down the slopes. Examination of details at two spines showed one rising a meter per hour, the slope of the dome opening, like a soil clod with a mushroom pushing through. Pasty magma rose in a collar around the needle, then solidified, when the spine was three meters high. In the second case the paste was accompanied by gusts of vapor emerging between the spire and the slope. The needle remained small, but the steam jet continued several weeks. The average height of spines was 12 to 18 meters.

The dome of 1902 grew toward the northwest, overlapping the ridge there (Petit Bonhomme), so that its débris slope extended beyond the ancient crater of the E'tang Sec. The new inner dome has left a gulch on that side, but toward the east and southeast has overtopped the older dome, sent its débris slope down against the wall of the ancient valley on that side, and chilled and ceased activity there, except for fumaroles. In September 1931 the dome was migrating southwest and the long slope of ejecta was overtopping the ridges there so as to threaten the trail to the summit of the mountain. The new dome is 231 meters above Petit Bonhomme, and somewhat higher than was the peak of the old dome.

All the hot blasts (nuées ardentes) emerge from fractures in the dome of 1902 and mostly from the two openings, low north, and high southeast. After the new dome developed, the character of these gushes changed gradually. Four types of downrush are distinguished by Perret. The first is occasioned by an avalanche formed by the squeezing out of a small quantity of magma. It is an imitation *of a true hot blast.* The magma, not being greatly charged with gas, merely makes a heavy tumble of rocks, which slide down the slope, and excavate a trench. Dense, ashy, light-colored cauliflower clouds arise. The second type is occasioned by heavy rain falling on the dome which seems to penetrate it after a quarter hour or more, so as to start ejections of steam charged with dust which descend the slope rapidly as a gaseous emulsion. After heavy precipitation these down-blasts are certain to come, and they are important, some of them in the spring of 1930 following the gorge of the Rivière Blanche and out to sea for several kilometers. The last two types of gushing are avalanches of incandescent blocks without significant dust clouds, and finally a cooler ash phenomenon where blocks of uniform size roll rapidly and far, carrying imperfectly oxidized carbon gases, and emerging from a part of the dome which has partially congealed.

In the southeast part of the new dome there are fumaroles in a horizontal line, due to water, where the old and new domes are in contact beneath. Where the summit of chilled lava is in contact with active lava, bluish transparent vapor emerges at high temperature.

Mr. Perret has used a microphone for determining the variation in mass of the vibrating active dome. His theory is that an active edifice makes a definite note of lower pitch the greater the mass. The combined roar of slides, blowing of vapor, fall of spines, at any given moment make a musical tone, the timbre of which may be defined in terms of mi, fa, sol, la, si, etc., so the augmentation or diminution of the dome may be followed. His upper station was on the flank of Pelée at Morne Lénard.

At the beginning of November 1930 the tone was si flat. Three months later the dome was bigger and the tone was deeper, exactly la. April 13, 1931, it was sol sharp; June 4, sol; June 25, a little below sol; but on August 10 the pitch had risen to sol sharp, and it continued to become sharper, showing that the mass of the dome was decreasing, and that the arrival of new magma, inside, no longer equalled the loss by slides into the valley, and by erosion.

Establishment of a Research Center at St. Pierre

Mr. Perret has sent the following letter to the Hawaiian Volcano Research Association:

February 2, 1932.

"All the world remembers the destruction of St. Pierre, in 1902, by a terrific eruption of Mont Pelé. St. Pierre was not only the commercial center of Martinique, but the cultural metropolis of the Lesser Antilles. Excavations reveal the exquisite taste of the former inhabitants, and the relics unearthed from time to time are of great beauty, and of interest as showing the effects of the blast of hot gas and ash, which it is useful to study. Those objects—instead of being dispersed as found—should be preserved for all time in a collection, along with photographs of the beautiful ruins, fast disappearing in the rebuilding of the town.

"The recent eruption of Mont Pelé has reawakened scientific interest in this volcano, whose special type of activity is almost unique, and the products of eruption—breadcrust bombs, ash, and lava blocks in new forms—are most interesting. A complete collection of these, placed for comparison with the materials of other volcanoes, and with photographic studies of all their phenomena, is a scientific necessity.

"I may say that my own work here has resulted in a further demonstration of the pratical value of volcanology as an applied science. Eighty million francs of invested capital, depreciated to zero by panic and uncertainty, was restored to par value through diagnosis and prediction based on sound scientific deductions, with the help of apparatus devised for these purposes. For the further development of these methods, the creation of standardized instruments, the bringing together and preserving of the materials, etc., I am now founding at St. Pierre this research center, organized as museum—observing station—laboratory.

"A private institution, out of politics, and not governmental; its continuance, after me, is guaranteed by a Fiduciary Committee, consisting of men of the highest standing in the colony, including honorary memberships of the Mayor and Curé of St. Pierre. Its founding at the present time has been extraordinarily facilitated by the cession to me of a most ideal site for its emplacement, on the beautiful Morne d'Orange, 350 feet above the town, but easily accessible, and commanding a superb view over St. Pierre and of the entire massif of the imposing volcano.

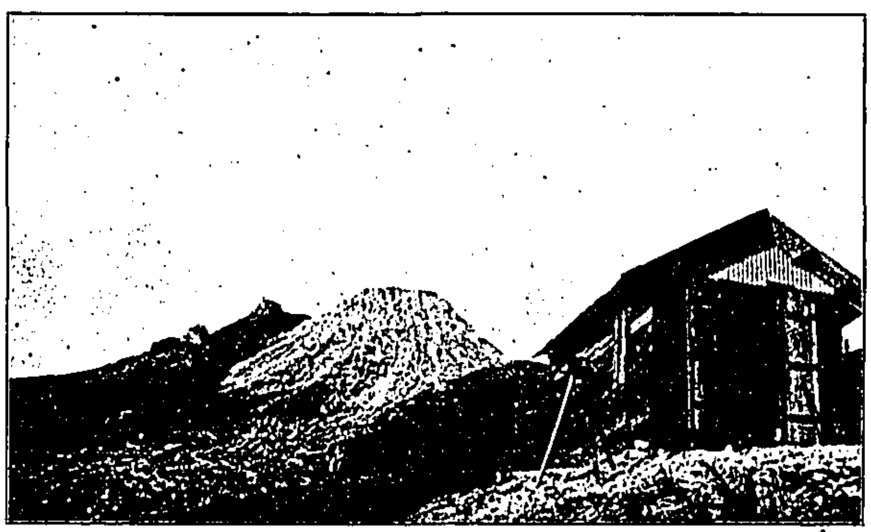
"Construction cost is largely covered by local contributions. This is not to be an American institution, but an American contribution to science in a location where this science can be best developed—a gift to St. Pierre as a continuation of American good will. St. Pierre is visited annually by some thousands of American tourists, whose interest will be quintupled by having a definite goal, where what they most desire to see will be on view.

"The contribution of one thousand dollars, as a minimum, makes the donor a founder of the institution, and the name will be on a marble tablet at the entrance, and upon the stationery of the museum. A few subscriptions are desired, above those already received, when this account will be closed. A total of ten thousand dollars is sought for the foundation.

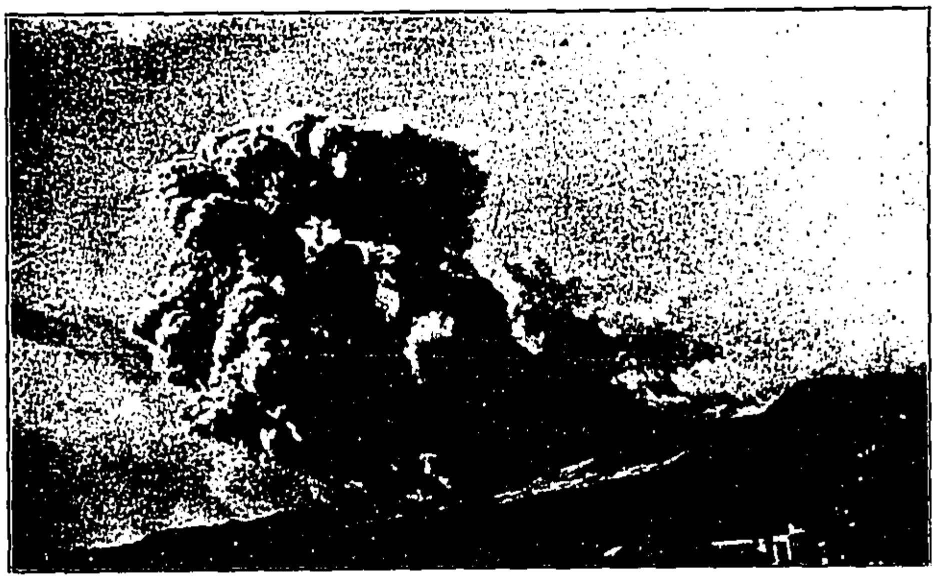
"This work—at once scientific, artistic, and humanitarian—is believed to accomplish more, with a small amount of money, than anything heretofore instituted. It will be selfsupporting through its museum, of direct service by its observation work, and world-contributing in its laboratory research. Contribution involves no obligation of future support.

"You are earnestly invited to become one of its few, distinguished founders."

Mr. Perret has been living at St. Pierre since 1929, and has already started the foundation with contributions from the Carnegie Foundation of Washington, Vincent Astor, and George F. Baker. It is to be hoped that members of the Hawaiian Volcano Research Association will be added to the list of founders, for it was Mr. Perret who camped



The upper station, Mont Pelé, after completion. Photo Perret.



Hot blast from the dome, Mont Pelé, February 9, 1930. Photo Perret.

alone on the edge of Halemaumau pit in 1911, and so started the work which established our Association. T.A.J.

TILTING OF THE GROUND FOR MARCH

The following figures show the net angular tilt by weeks at the Observatory on the northeast rim of Kilauea Crater, and its direction, computed from the daily seismograms, by platting a curve smoothed by overlapping seven-day averages. This is the departure of the plumbline in seconds of arc, in the direction given.

March 1-7	4.6 seconds SSE
March 8-14	3.3 seconds SW
March 15-21	1.5 seconds SW
March 22-28	1.1 seconds SSW

The accumulation of tilt to March 28 since January 1 is 17.4 seconds south, 0.7 second west. This is greater southerly tilting than whole years have produced usually, with the exception of 1924. E.G.W.

KILAUEA REPORT No. 1054

WEEK ENDING APRIL 3, 1932

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge.

On March 28 at 11 a. m. fume was issuing from a crack at the foot of the south talus in Halemaumau, and steam on this talus was abundant 100 feet south of the fume vent. Fume at the yellow vents at the foot of the southwest talus was unusually prominent. A slide at the north wall made dust at 11:53 a. m. Crack movements at rim of pit have shifted from northeast rim, now quiet, to southeast rim, where slight opening of fissures is now measurable. The rest of the week showed no changes.

The Observatory seismographs registered 5 very feeble local seisms, three registering distances of 14, 25, and 46 miles. There were 25 tremors, one indicating origin 18 miles away. Microseismic motion was strong March 31 and moderate at other times. Tilting of the ground was moderate to the south.

THE VOLCANO LETTER

The Volcano Letter combines the earlier weekly of that name, with the former monthly Bulletin of the Hawaiian Volcano Observatory. It is published weekly, on Thursdays, by the Hawaiian Volcano Research Association, on behalf of the section of volcanology, U. S. Geological Survey. It promotes experimental recording of earth processes.

Readers are requested to send articles, photographs, publications and clippings about volcano and earthquake events, instruments and investigations, especially around the Pacific.

Subcription for non-members two dollars per year of 52 numbers. Address the Observatory.

HAWAIIAN VOLCANO OBSERVATORY
Founded 1911

This laboratory at Kilauea Volcano belongs to the Hawaiian Volcano Research Association and is leased and operated by the United States Geological Survey.

It maintains seismographs at three places near Kilauea Volcano, also at Hilo, and at Kealakekua in Kona District. It keeps a journal of Hawaiian volcanic activity and publishes occasional Bulletins.

Membership in the Hawaiian Volcano Research Association is limited to patrons of Pacific science who desire personally to aid in supporting the work.

The work of volcano research so supported is in collaboration with the work of the United States Geological Survey, but supplements it with buildings, research fellows, instrumental plants, explorations and special investigations for which there is no governmental provision. The Geological Survey maintains volcano stations in Alaska, California and Hawaii.

Persons desiring application blanks for membership ($5.00 or more) should address the Secretary, Hawaiian Volcano Research Association, 320 James Campbell Building, Honolulu, T. H.

The Volcano Letter

Two dollars per year — Ten cents per copy

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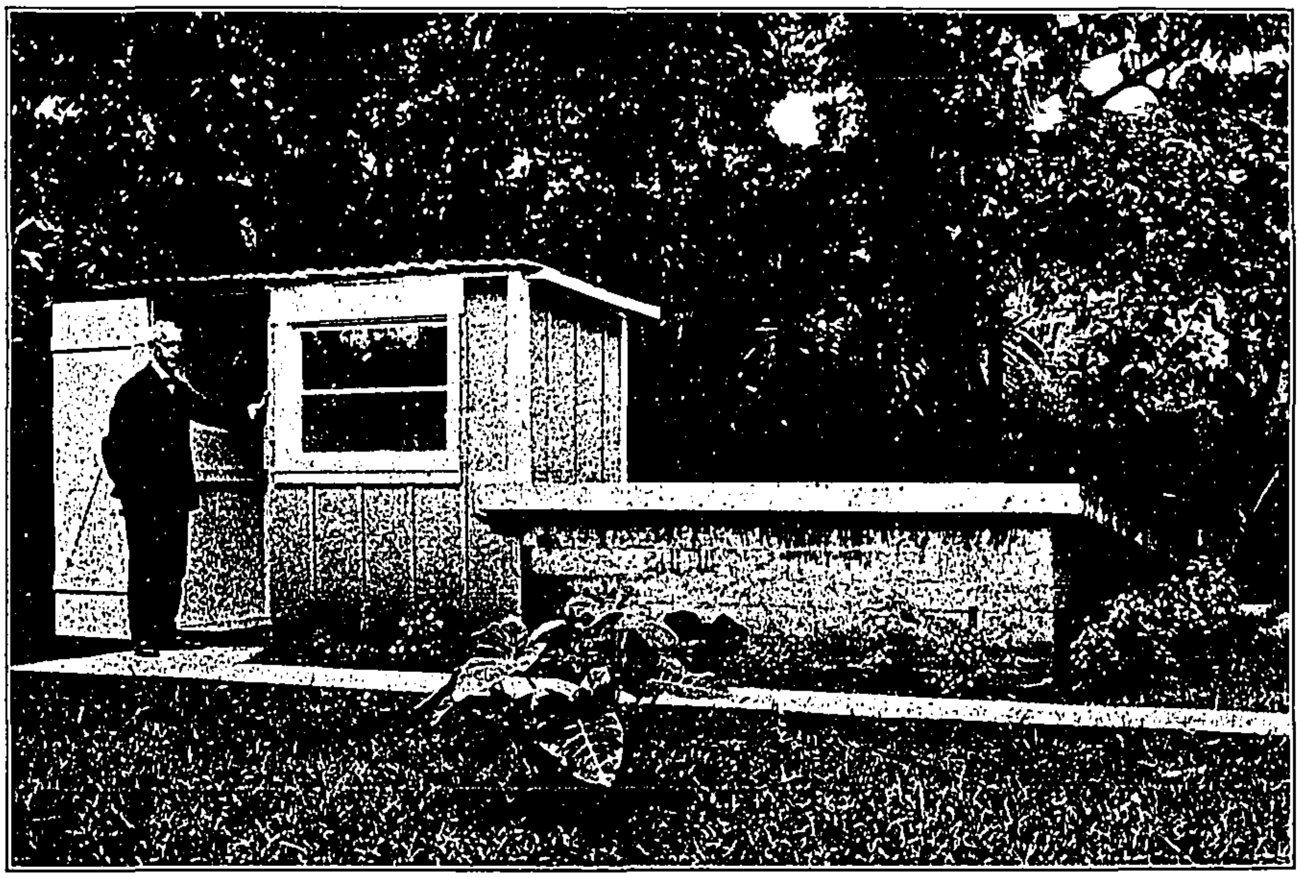


Seismograph cellar of the Hilo station of the Hawaiian Volcano Research Association, built in 1927. Brother J. B. Albert is the observer. The instrument consists of two heavy horizontal pendulums, with clock checked by wireless time signals.

TWENTY YEARS OF VOLCANO STUDY IN HAWAII

Address by T. A. Jaggar at Annual Meeting Hawaiian Volcano Research Association in Honolulu, March 31, 1932.

Administration

The Hawaiian Volcano Observatory was founded by an association formed in Honolulu in 1911 which undertook to finance a geological station on Kilauea Volcano established by the Massachusetts Institute of Technology. Ground was broken for the building on February 15, 1912, when Dr. T. A. Jaggar, who was then Professor of Geology at the Massachusetts Institute, had come to Hawaii for the purpose of establishing permanent volcano research. The Hawaiian society became a chartered corporation named the Hawaiian Volcano Research Association.

In 1919 the work was first assisted by the Government in collaboration with the Hawaiian association, and the governmental supervision was assigned to the United States Weather Bureau. The plant was leased by the Association to the Government at a nominal rental with the understanding that the Weather Bureau would furnish personnel and salaries. Since 1924 this arrangement has been transferred to the United States Geological Survey, which through the interest of the Congress has been enabled to enlarge the work to a Section of Volcanology with small stations in California and Alaska added to the Hawaiian establishment. Routine publication, now carried on through the Volcano Letter, has remained with the original Association.

The objects of the work from the beginning have been: (1) To keep and publish a record of Hawaiian volcanic activity and associated earth movements, (2) to invite specialists to Hawaii or to send them elsewhere for volcanologic studies, and (3) to do everything possible to promote the establishment of permanent volcano stations all over the world.

(1) Recording Hawaiian Volcanic Activity

The preliminary reconnaissance of the Hawaiian field was made by T. A. Jaggar and R. A. Daly in 1909. Mr. Jaggar had been engaged before this time in studies of Mont Pelée and Soufrière in the Caribbee Islands, of

Vesuvius after its eruption in 1906, of the Aleutian Islands in 1907, and through association with F. A. Perret he had been interested in the Messina earthquake. It was evident after the terrible disasters of Messina, Vesuvius, and St. Pierre, along with the earthquake-fire of San Francisco, that more studies of the earth from permanent stations should be made. This had been the subject of a crusade at Harvard and at the Massachusetts Institute of Technology, and a small endowment was obtained at the Institute for geophysical research, having in view the protection of life and property. This is called the Whitney Fund.

With the aid of this fund and through cooperation with the Geophysical Laboratory of the Carnegie Institution of Washington, Dr. E. S. Shepherd of that laboratory along with Mr. Perret, the former a chemist and the latter volcanologist, were induced to spend the summer of 1911 at Kilauea with a view to physical studies of the lava pit. Mr. Perret built a hut at the actual edge of the pit and made weekly reports to the press on measurements of change in the lava column. A cable was stretched across the pit and measurements of temperature of the liquid lava were made with electric thermometers.

The actual foundation of the Research Association was arranged at a luncheon in the University Club of Honolulu, October 5, 1911, when the late L. A. Thurston pointed out that there should be no break in the collection of records at Kilauea, and a subscription list which had been started in 1909 was revived. Mr. Jaggar arrived January 17, 1912, and weekly reports were reestablished. Through special subscriptions raised in Hilo, the present main Observatory building was constructed in February, with the Whitney Laboratory of Seismology in its basement. A topographic map of the proposed Kilauea National Park area was made by the U. S. Geological Survey as a basis for field work. The National Park became a fact in 1916 when Mr. Jaggar went to Washington to draft the final bill. The Volcano Research Association built and gave to the National Park Service the museum on Uwekahuna bluff in 1927.

The keeping of record books at the Observatory has been continuous from 1912 to the present. Mr. H. O. Wood came to the station as seismologist in the summer of 1912, a number of seismographs were set up, and the records were enriched by reports on tremors, earthquakes, and tilting of the ground, which proved to be motions of great interest, when studied in relation to the rising and falling lava.

The year 1912 was a time of vigorous activity in the lava pit, in 1913 the lava column became low and smoky, and thereafter until 1919 there was a steady rise with increasingly good opportunity for making comparative photographs. Mauna Loa broke out in 1914, 1916, and 1919, and these eruptions added to the interest of the work. In the summer of 1912 Doctors Day and Shepherd returned to Kilauea for gas collections at the live lava, and the temperatures proved to be various and somewhat proportionate to the volume of gases discharged by the many fountains. Mr. Jaggar was able to keep up the gas collections in subsequent years and to send the specimens to the Geophysical Laboratory for analysis.

The years from 1912 to 1924, however unfavorable they may have been financially, were fortunate ones from the volcanologic standpoint at Kilauea, in that they represented an eleven-year cycle of extraordinary vehemence for both Kilauea and Mauna Loa, with great variety of action, and a marvelous finale in 1924 when the crater pit of Halemaumau caved in through the recession of the lava, and a steam-blast eruption occupied the month of May 1924 in a fashion not seen here since 1790. The incessant measurements of change in gases, change in temperature, change in elevation of the lava column, and the photographic records accompanied by notes and transit measurements that produced maps of the crater fills and flows, all combined to yield a record of a decade of volcanic activity, in the most primitive volcanoes on earth, such as science had never possessed before. By primitive is meant the quality in a volcano, that exhibits the pure heat and magma, of the material under the primitive earth crust, not complicated with the impure mixtures of sea-bottom sediments and organic life such as occur on the continents. Vesuvius, Lassen Peak, and Katmai are all volcanic heaps made where the blast furnace of the earth crust has discharged through such rocks as limestone, sandstone, and slates. The glowing slag underneath has absorbed unkown amounts of carbon, lime, silica, and alumina.

After 1924 a quiet condition at Kilauea leads people to think the volcano is dead. Instead of this, we are recording some kind of outbreak nearly every year, Mauna Loa had a great eruption and destroyed a village in 1926, and an earthquake crisis on Hualalai in 1929 recalled the wonderful lava flows from that mountain in 1800, a time ten years after the last explosive eruption from Kilauea. The year 1934 will be ten years after the new explosive eruption. Are we to look for more lava flows from Hualalai? The present decade, therefore, is making a record which is a valuable asset, the like of which has not been obtainable since the end of the eighteenth century.

When it comes to earthquakes, the instruments for recording ground movements at Kilauea have been steadily improved, and the experience of 20 years with many ups and downs of the lava column, and outbreaks on Mauna Loa, and big earthquakes on Hualalai, has accumulated thousands of seismograms in the files of the Observatory. These are pieces of smoked paper fixed with shellac, on which automatic pendulums have written a graph of each earthquake or tremor or tilt, and have recorded the clock time. They are all different. Science can interpret from each graph the distance away of the source, the strength of movement, and how the elastic waves passed through the rock. Some of the instruments are in Hilo and Kona, so that when the distances indicated there are compared with the distances from the Observatory, the place underground may be found where the lava split its way upward and made a jolt. As some sets of earthquakes accompanied eruption, on the south flank of Mauna Loa, others on the different flanks of Kilauea, and yet others occurred on Hualalai, it becomes possible to classify Hawaiian earthquakes from their autographs, and the making of this classification promises years of valuable work. Those who think there is nothing to do at a volcano observatory during a quiet time should start studying some of these pieces of smoked paper.

The publishing of results is no small part of the work, and this involves, first, summarizing every week the essential observations at the Kilauea pit, at the seismographs, or on Mauna Loa or elsewhere if activity occurs. These summaries must be published in the papers, and also printed in more permanent form. It is further necessary to assemble observations of like kinds, and coordinate them for understanding the underground processes. An observatory is always a detective, trying to find out what is going on underground, from information the layman does not possess, yielded by a chemical collection, or a measurement with transit, thermometer, level bubble, or pendulum. These assembled observations have been published in scientific journals and it is one of the functions of the Volcano Letter to assemble similar communications from observatories in other lands, in order to make them known to our people here. There is much excellent work in Dutch, Japanese, Italian, French, German, and Spanish from the East Indies, Japan, Europe, and South America, for which a translation institute ought to be endowed, in order to sift out important facts which are now lost to most of the world.

Recording is nothing more than description. It is very hard to use language so as to tell the truth. The reading of any newspaper will prove this. Accurate description is all that is meant by "a theory." Modern physics is not trying to explain the "why," or to explain anything;

it is trying to describe the "how." This is what we are trying to learn about an active volcano, "how" it works. A mere quantitative measurement in figures by itself means nothing. Recording, to be accurate, meaning careful, must be checked all the time by quantitative measurements. These measurements may be put together to make a description, so that the difference between one event and another is dependent on the readings of the measurements, and not on guesswork. When enough of these differences have been collected, it becomes possible to classify events, and then the classifications fall into sequences, and the complete description of a sequence suddenly discovers (or uncovers) what has been going on, in the under-earth, at a place which was invisible. This final description of things unseen is a "theory."

Take in illustration of this the matter of prediction. How can you predict when a volcano is going to erupt? It is first necessary to measure an eruption and to tell the truth as to what an eruption is. If you classify as "eruption" the smoke from an island seen by a mariner, entirely unmeasured, and compare it with the rise of lava for six years measured in Halemaumau pit by scientists, you get nowhere. You do not know whether the mariner's "smoke" happened all the time, or every year, or every six years. You can not describe the "how." In the case of Kilauea, *the scientists continue for another five years and find the* lava going down and out. Then comes a lull for two or three years. They study the records for a hundred years back and find many measured risings for six years, and sinkings for five years, followed by a lull. Then they find that two volcanoes adjoining took part in this sequence. Perhaps they find in separate years that the biggest risings were in the autumn and the sinkings in the spring. This is a measurement by seasons and years, just as other measurements are by heights and depths. They average all the results. The average shows an eleven-year cycle as a probability for that pair of volcanoes. They may even find that this eleven years corresponds with sunspots, and then that the irregularities in numbers of sunspots which depart from the average, correspond with the irregularities in highest rise of the lava during the century. They know nothing about the "why," but here is a very interesting "how." Knowing all these things, they can "predict" that the next "eruption" will occupy eleven years, will begin by rising and end by sinking, will have its annual rising spasms higher in winter, and if the term is not exactly eleven years, it is likely to depart from that figure in the same way that the sunspots do. Knowing the relation of the two volcanoes, they perhaps can say, that in the course of this eruptive cycle, Mauna Loa is sure to help out Kilauea once or twice during the eleven years.

What is now an eleven-year theory, a seasonal theory, a relationship theory, and a sunspot theory, may eventually advance a step farther so as to describe how all these things are related to some bigger processes in the crust of the earth. They will then all become facts and not theories, but the larger process will remain in the realm of theory. Science is merely piled up descriptions.

(2) Studies by Specialists

In addition to work which has already been mentioned, Dr. E. T. Allen of the Geophysical Laboratory spent a season at Kilauea analyzing the vapor at the sulphur vents, and determined it to contain 96% steam and less than 1% of the sulphurous products. Boring indicated that the temperature, 204° F., is extraordinarily constant.

For two seasons Dr. Arnold Romberg worked at the Observatory on seismograph instruments, and set up optical instruments to determine in what direction the wave movements known as microseisms are propagated through the ground at this place. Also special instruments were designed to measure the tilting of the ground, which was found to have a half-daily and semi-annual change. These changes must be allowed for when measuring what tilts are made by the pressure of the lava underground. Some remarkable changes of tilt have coincided with sudden risings and fallings of lava shown by outbreaks of Kilauea and Mauna Loa. The microseismic waves were found to coincide in direction with the high cliffs of the Hamakua coast bombarded by tradewind waves.

Messrs. J. B. Stone and C. K. Wentworth at different times have studied the geology of Hawaii, and Mr. H. T. Stearns and others have produced a Bulletin of the Geological Survey on the geology of Kau. Dr. Howard Powers is at work on the geology of Kona. All of these studies are providing new knowledge of the soils of the island in relation to the lava flows and the deposits of ash from past eruptions. A basis is being laid for classification of formations and interpretation of the past history of the earlier volcanic vents which preceded the active volcanoes of today. Dr. Wentworth has made a special study of the ash, especially the cinder of the many small cones on the slopes of Mauna Kea, and has greatly enlarged our knowledge of how those cones were formed and of the differences between the gas eruption there and the liquid lava eruptions on Mauna Loa at the present day.

Mr. Jaggar has been four times in Japan, three times in Alaska, and once each in New Zealand, Costa Rica and the Tonga Islands for studies of earthquakes and volcanoes. These comparative studies are of value not only in showing how different are the volcanoes of different lands, but also the contacts with men of science tend to encourage the last of the three objects above enumerated, namely, promotion of new volcano observatories elsewhere. Mr. Finch visited volcanoes in the East Indies in 1929 and Mr. Stone explored and photographed several craters in Chile the same year, both of these men being commissioned by the Hawaiian Volcano Research Association.

Messrs. Wood and Finch have completed a bulletin now in press in Washington listing in technical form all the measured earthquakes registered on the seismographs of the Observatory from 1912 to 1923. This list comprises thousands of shocks and is illuminating in showing the large number of earthquakes which accompany sinkings of the lava, the frequency varying with the rapidity and depth of the sinking. An increase of frequency of earthquakes also accompanies sudden risings of the lava in Halemaumau. In Mauna Loa eruptions the freqnency is greater at the beginning of an outbreak, and as the frequency declines the strength of the shocks becomes greater. In general the comparison of times of fewer earthquakes in Hawaii, with times of high frequency, shows that the greatest intensities of quaking (or the strongest shocks) come when the number of shocks is at a minimum.

(To be continued)

KILAUEA REPORT No. 1055

WEED ENDING APRIL 10, 1932

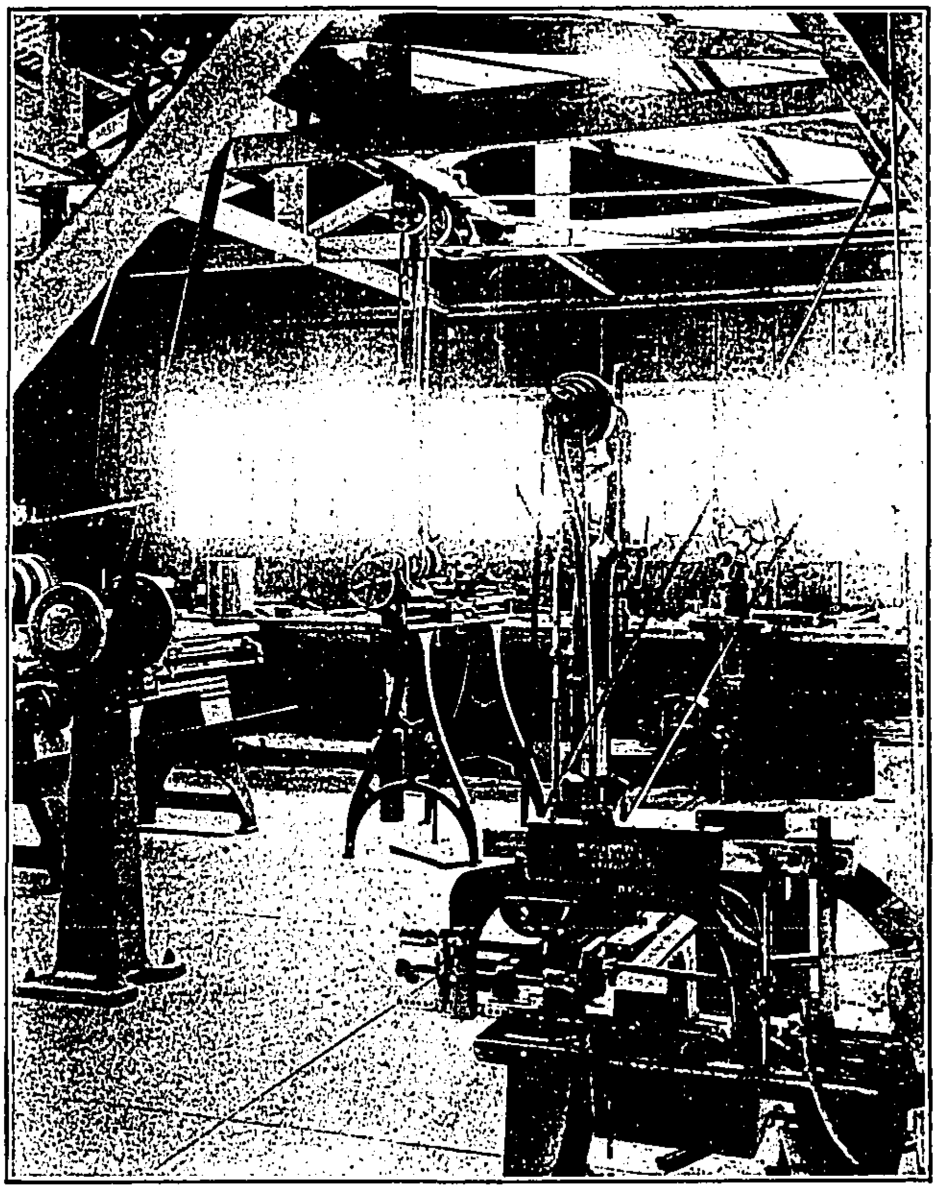
Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge.

Conditions at Halemaumau show little change. The pit was quiet April 4, with slight steam and little variation in fume.

Crack measurements showed very slight changes. On April 6 fume was moderate at the foot of the southwest talus and the spot under the southeast wall and talus still fumed slightly. Brilliant yellow sulphur stain showed at the fume area by the southwest talus. The scar from a small slide was seen on the northeast wall. On April 7 fume at the foot of the southwest talus was dense all day and some fume was visible at the spot under the southeast wall. On April 9 fuming activity had not changed. The seismograph at the pit showed ESE tilt accompanying the earthquake at 5:50 a. m. One tremor showed E tilt

The seismographs at the Observatory recorded 52 tremors, four very feeble seisms, and two feeble seisms. One tremor at 6:25 a. m. April 5 was felt at Waimea and Puuwaawaa and had origin distance 46 miles from the Observatory. One feeble seism at 4:50 a. m. April 9 was felt at the place called "Twenty-nine Miles."

Average tilt for the week was slight NE by N. Microseismic motion was moderate during the first three days of the week, light for the next three days, and moderate on the seventh day.



Machine shop at the Hawaiian Volcano Observatory, installed by the Research Association. There are two lathes, two drill presses, a machine hacksaw, and a grinder, while in the adjacent carpenter shop are power plant, boring machine, and circular saw.

THE VOLCANO LETTER

The Volcano Letter combines the earlier weekly of that name, with the former monthly Bulletin of the Hawaiian Volcano Observatory. It is published weekly, on Thursdays, by the Hawaiian Volcano Research Association, on behalf of the section of volcanology, U. S. Geological Survey. It promotes experimental recording of earth processes.

Readers are requested to send articles, photographs, publications and clippings about volcano and earthquake events, instruments and investigations, especially around the Pacific.

Subcription for non-members two dollars per year of 52 numbers. Address the Observatory.

HAWAIIAN VOLCANO OBSERVATORY
Founded 1911

This laboratory at Kilauea Volcano belongs to the Hawaiian Volcano Research Association and is leased and operated by the United States Geological Survey.

It maintains seismographs at three places near Kilauea Volcano, also at Hilo, and at Kealakekua in Kona District. It keeps a journal of Hawaiian volcanic activity and publishes occasional Bulletins.

Membership in the Hawaiian Volcano Research Association is limited to patrons of Pacific science who desire personally to aid in supporting the work.

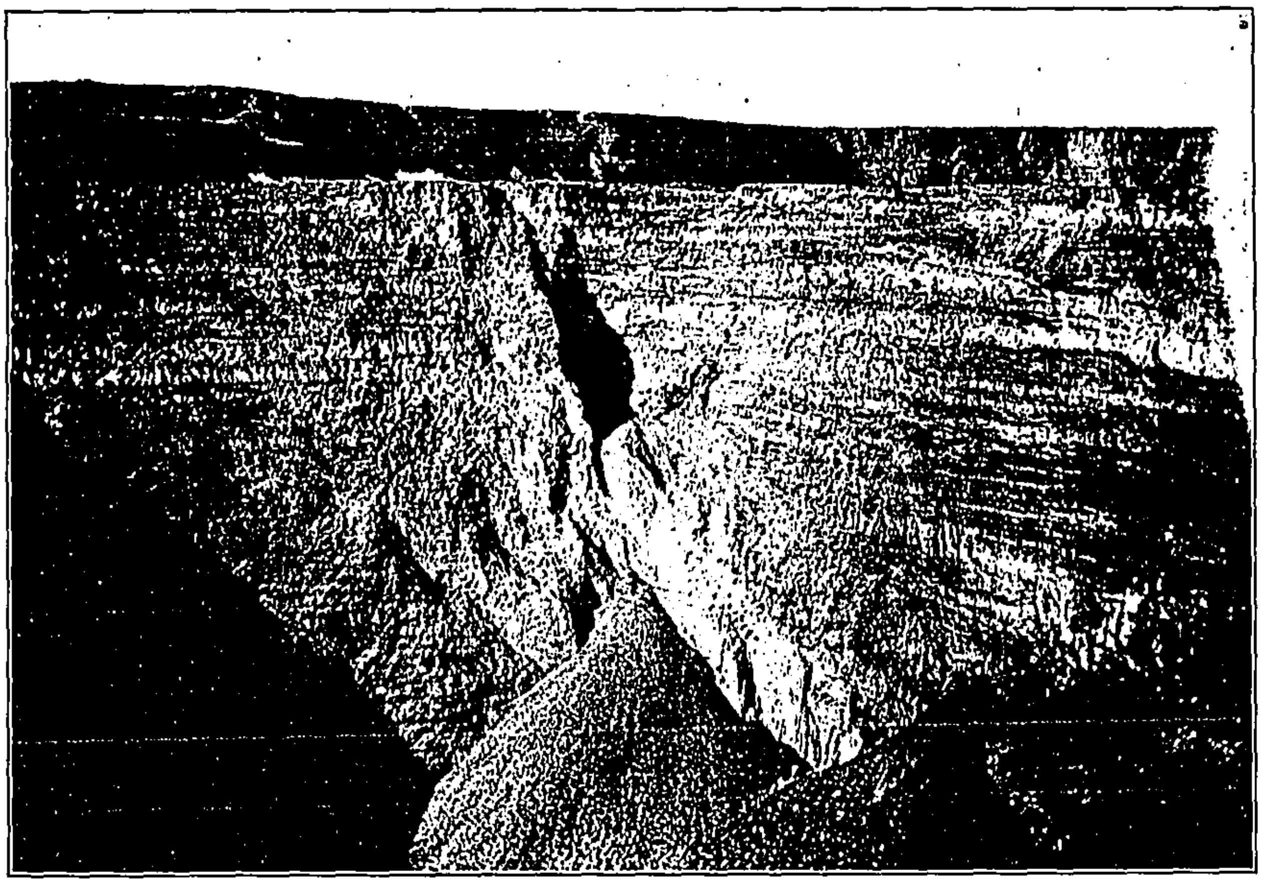
The work of volcano research so supported is in collaboration with the work of the United States Geological Survey, but supplements it with buildings, research fellows, instrumental plants, explorations and special investigations for which there is no governmental provision. The Geological Survey maintains volcano stations in Alaska, California and Hawaii.

Persons desiring application blanks for membership ($5.00 or more) should address the Secretary, Hawaiian Volcano Research Association, 320 James Campbell Building, Honolulu, T. H.

The Volcano Letter

Two dollars per year — Ten cents per copy

No. 382—Weekly — Hawaiian Volcano Observatory, National Park, Hawaii — April 21, 1932



Interior of the present Halemaumau pit, showing the north corner, and behind it the cliff bounding the outer Kilauea Crater. The U-curve of white ledge at bottom is the cross section of a former pit. It shows a talus in cross section above the white ledge. The white ledge was revealed red hot by the engulfment of 1924. The horizontal layers are lava flows, all produced in the nineteenth and twentieth centuries. Photo 1927 by Wilson.

THE RESULTS OF VOLCANO RESEARCH

(Continued from Volcano Letter No. 381)

Second Part of Address by T. A. Jaggar, Annual Meeting Hawaiian Volcano Research Association in Honolulu March 31, 1932.

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(3) World Volcano Stations

In 1926 a seismograph station and observatory were established at Lassen Volcanic National Park in California under Mr. R. H. Finch, who had been in Hawaii. This station has recorded hot spring temperatures and earthquakes, and has served as a base for geological studies in that interesting volcanic region. The work is being extended to other volcanoes of the northwest. Seismograph stations have been placed at two other points in Lassen Park.

In 1927 a seismograph station was established on Kodiak Island, near the Katmai group of volcanoes of the Alaskan Peninsula, and in 1929 a second station was fitted out at Dutch Harbor, on Unalaska Island in the eastern part of the Aleutian chain. In the hands of resident observers these instruments have been operated so that the seismograms are sent for study to the Hawaiian Volcano Observatory. A moderate number of local earthquakes at these stations and at Lassen indicates that some seismic activity accompanies the underground movement of volcanic magma in these places, but there is no such earthquake frequency as exists in Hawaii.

Beginning about 1918 the government of the Netherlands East Indies started a volcanologic service under their Bureau of Mines with headquarters at Bandoeng. This work has steadily grown for 15 years, a small pamphlet each month describes the temperature measurements and earthquakes and volcanic activities at several volcanoes, mostly in Java, and large, beautifully illustrated monographs in the Dutch language, latterly with summaries in English, have been published dealing with important eruptions of several of the great volcanoes and the volcanic islands belonging to the group. A number of small observatories are maintained.

The Japanese Empire has maintained a government earthquake investigation service since 1892, in which Professor F. Omori became the dominant figure. The motive of this service from the beginning was to find out everything possible about local earthquakes with a view to alleviation of disaster. To this end engineers, physicists, seismologists, geologists, and other specialists in universities were employed by the government, largely gave their services free, and published a series of important memoirs continuously in both English and Japanese for 30 years. Professor Omori concentrated on volcanoes during the last 15 years of his life, and his serial monographs on Asama, Sakurajima, Usu, Oshima, and other volcanoes, written in English, are among the most important of his productions. Earthquake investigation was reorganized after his death in 1923, and researches directed particularly to tilt and level changes, and to the needs of engineering, have been elaborated since the Tokyo earthquake. Professor H. Tanakadate has studied volcanoes. Seismographs of many kinds are distributed all over Japan, but a permanent volcano service has not yet been organized.

,In Italy, which established an observatory on Vesuvius in the middle of the nineteenth century, the publications about volcanic activity have been largely separate papers in scientific journals from the workers at the observatory and from seismologists and geologists in the universities. In 1924 a new series of volcanologic bulletins was started under Dr. Malladra, Director of the Vesuvian Observatory through the International Geophysical Union. Also some revival has been made of the Annals of the observatory. Mount Etna has also an observatory building on its high slopes, but the workers dwell at the university in Catania. In Naples Dr. I. Friedlaender has established at private expense a Volcanologic Institute and publishes in beautifully illustrated form a long series of volcano researches in several languages by workers all over the world. The first volume was published January 1914.

There have been a number of disasters due to earthquake and volcanoes in New Zealand, and in 1920 the writer as delegate from the Hawaiian Volcano Research Association gave a series of lectures in the universities of New Zealand on the observatory work in Hawaii and on the opportunity for continuous observation which the New Zealand volcanoes offer. The terrible earthquakes of Murchison in the South Island in 1929 and Napier in the North Island in 1931 have served to concentrate governmental attention in New Zealand on alleviation of disaster. Before these earthquakes Mr. L. Grange had been appointed to act as a volcanologic geologist and had done much mapping in the Rotorua volcanic district. Since the earthquakes, the Hawaiian Volcano Research Association has been able to assist somewhat by supplying simple seismographs for distribution in New Zealand under the government Department of Scientific and Industrial Research.

Seismologic services studying local earthquakes exist in Chile, Greece, Austria, Germany, Mexico, India, and Russia, and in some of these places some attempt has been made to begin the study of volcanoes. The Soviet has organized expeditions in Kamchatka, a little work has been done in Salvador and in the Caribbee Islands, some special expeditions have reported on Iceland and on volcanoes near New Guinea. Excellent studies have been made from the university in Athens of the active volcano Santorin and other volcanoes of the Grecian Archipelago. There are enormous volcano belts in the southwest Pacific, in Africa, the whole length of the west side of South America, and of the west side of Central America, which still await a prophet.

Three activities should be mentioned which deal with volcanoes effectively by the statistical method and by expeditions. The universities of Germany have produced Karl Sapper and F. Von Wolff, each of whom has written a textbook on volcano science. Sapper deals with geography and Von Wolff with geology of volcanoes. The Carnegie Institution of Washington through the workers under Dr. A. L. Day has sent out a series of expeditions and published monographs on Katmai, The Geysers in California, Lassen Volcano, Vesuvius, and some other places, and this work sets standards for analyses of gases, sublimates, and rocks, as well as hot waters, in accordance with critical dicta of physical chemistry. The third activity is the publication of the Geographical Society of Geneva, under th Red Cross, which has been issued quarterly since 1924, dealing with the study of calamities, as subjects of scientific prevision and alleviation (Matériaux pour l'E'tude des Calamités). This organization has had subcommittees in many countries, and the assemblage of facts has been of great value.

Before leaving world volcano stations, the recent work of the American, Frank A. Perret, a distinguished volcanologist who wrote the great monograph of the Carnegie Institution on "Vesuvius," should be mentioned. He has been living at St. Pierre in Martinique since the end of 1929, and has obtained support for a museum and research center at St. Pierre, which it is planned to make self-supporting through charges to tourists who visit the ruins of the great disaster of 1902 by thousands. This will be a private institution, for which an ideal site has been granted by the French government with construction cost covered by local contribution. The idea is a non-national institution created as a gift to St. Pierre, as a continuation of American good will. Each contributor of $1,000 or more will become a founder, and those who have started the foundation are the Carnegie Institution of Washington, Vincent Astor, and George F. Baker. It is to be hoped that the Hawaiian Volcano Research Association will be added to the list of founders, for it was Mr. Perret who started our work here in 1911, and who published on the eruption of Teneriffe in the first memoir of Friedlaender's Zeitschrift in 1914. In many respects Mr. Perret is thus the founder of modern volcanology from an experimental viewpoint.

(4) Results of Volcano Research

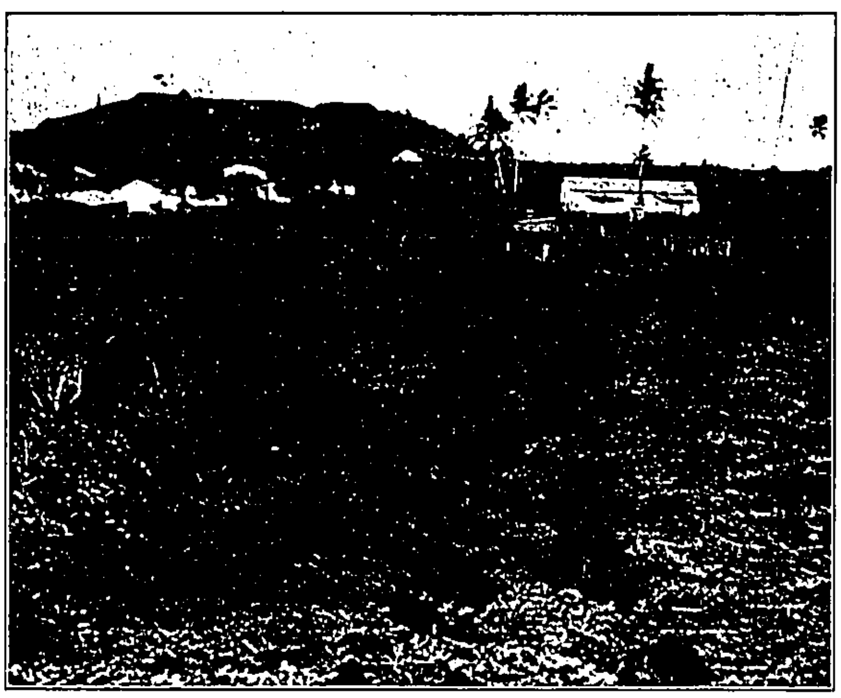
Two principles have been kept in mind, which are unusual in guiding the work in Hawaii: (1) Appeal to people of ordinary education in describing our results; (2) Use people in ordinary life in order to get those results. These mean, first, that the motives should be humane and not highbrow, and the work should be describable as meaning something to business men who want to know why it is done. Secondly, the harnessing of a large piece of country with observations, or instruments, or measurements, can never be done by distributing physicists permanently all over that country. The experts won't go. They prefer the council-chamber of the university. This difficulty may be met only by interesting ordinary people in a method of measuring earthquake or tremors or tiltings, so that they will send us a postcard every week. In order to do this, the method must be simple. The high-brow may sometimes scorn simple methods. And yet Darwin's and Faraday's greatest works were done by simple methods. So it must be in compelling the earth to tell the story of how its breathings in Alaska are different from its breathings in Hawaii.

Here are a few of the facts suggested by work of the last twenty years:

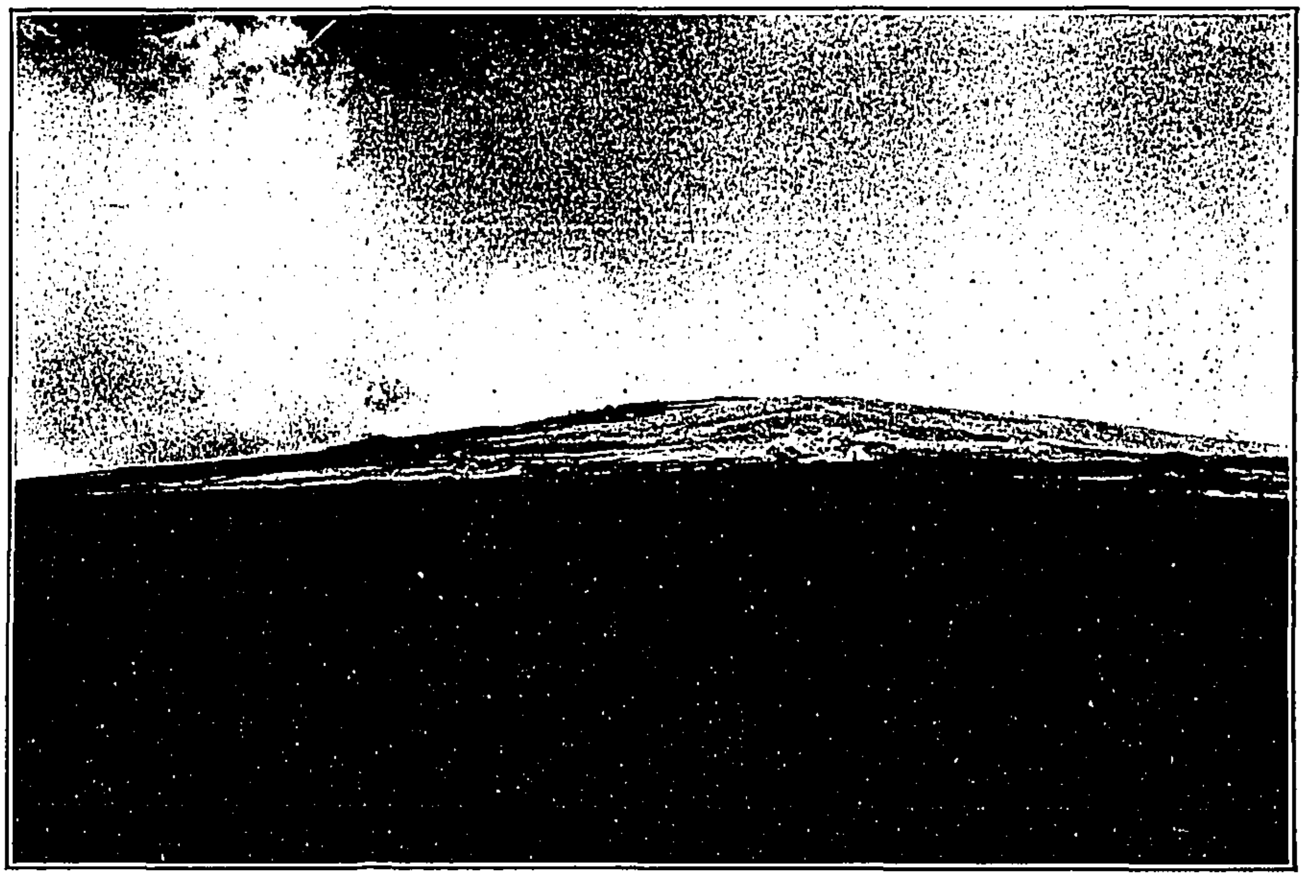
1. That volcanism everywhere has unity.
2. That gas is its prime mover.
3. That hydrogen and olivine basalt are fundamental constitutents.
4. That water is a secondary oxidation product.
5. That sulphur is concentrated at craters.
6. That engulfment is a common process.
7. That explosive eruption is secondary.
8. That major earthquakes may be magmatic in origin.
9. That magma continually presses upward.
10. That cycles are caused by yielding to pressure.
11. That this applies equally to earthquakes and volcanoes.
12. That small crust units involve short cycles.
13. That large crust units involve compound cycles.
14. That these may be of several orders.
15. That a volcanic cycle may exist at intrusions.
16. That intrusions may be studied by tilt and earthquakes.
17. That every volcano has intrusions under it.
18. That submarine outflow of lava is important.
19. That the present is a decadent time in earth volcanism.
20. That from Midway to Hawaii and along the volcanic rift, the crust has thickened and condensed.

We can think of the globe as at some time an incandescent member of the Sun's family. Up cracks as it cooled there piled up lava ridges. Our Hawaiian Territory is one such ridge. Studying the outpouring lava at Kilauea we found it divided into half-hardened, and frothy liquid, portions. We sounded the liquid and found it shallow. The half-hardened stuff was below. We took temperatures and found that the liquid was hottest above, where the most gas was burning. We found that Mauna Loa outbreaks ended with a Kilauea collapse. We found that splitting open the mountain visibly was attended by many earthquakes when lava burst up cracks. It turned out that there was local swelling of the ground. This was greatest at the pit edge. Tilt pendulums showed that it was happening farther away. It proved eventually that there are seasonal and daily tides in the lava and in the swelling of the mountain. The gases rising are mostly hydrogen, carbon monoxide and sulphur. They make flames. Water vapor, carbon dioxide and sulphur dioxide are in the greatest volume, because the burning goes deep. Boring to study ground temperature showed that hot places are due to vapor cracks. In 1924 the steam-blast eruption was preceded by a splitting of the mountain out to seashore, and accompanied by a sinking of lava and engulfment of the walls of the pit. The conviction that the lava escaped under the sea was unavoidable. The groundwater entered the hot hole and exploded. It extended the engulfment and made rhythmic geyser explosions. The last such cataclysm was in 1790. A super-cycle of 134 years was indicated, the interval between two lowerings of lava below the groundwater level for Hawaii.

With this outline for working hypothesis, it is easy to see how interesting it is to be the workers to build tilt and tremor instruments, and try to harness the crater and the island in order to interpret what is going on underground. This is what we are working on today with the instrument, designed at the Observatory, called a "clinoscope." It is a heavy horizontal iron ring, hung on wires, with a light vertical magnifying lever pointing upward in the middle. At the top is a dial. The ground tilts and the pointer wanders away from the center of the dial. This wandering each day is to be read in three cellars 400 feet back from the Halemaumau rim. These cellars are to be kept quiet and at constant temperature If the lava is swelling under the bottom of the pit as a center, the three cellars will show tilt away from the center on the clinoscope readings. If the lava is lowering they will show inward tilt. Eventually we expect to have these cellars wired so that each instrument may be called up by automatic telephone, and the pointer position will report itself electrically to the Observatory. This is the latest result of twenty years of work at the Hawaiian Volcano Observatory.



Kapoho, east point of Hawaii, looking northeast at one of the cones of the Kilauea rift zone near the sea. The fresh cracks in the foreground were produced in April 1924, when "the steam-blast eruption was preceded by a splitting of the mountain out to seashore." Photo Maehara.



Just as the Hawaiian Islands form a lava ridge, so on Mauna Loa the southwest rift is a flat ridge. Here we are looking up the ridge, formed of source cones of many eruptions, from 8,500 feet elevation. These are true "fissure eruptions" and here is a vast experimental laboratory for the volcanology of the future. Photo Emerson 1923.

KILAUEA REPORT No. 1056

WEEK ENDING APRIL 17, 1932

Section of Volcanology, U. S. Geological Survey

T. A. Jaggar, Volcanologist in Charge.

Some fume was visible at the foot of the southwest talus on April 12. Cracks within old roped-off area at the southeast rim showed definite but very slight widening. On April 13 at 10:15 a. m. fume could be seen eastward from the southwest talus area, and slight odor of sulphur could be detected. Countless small steam vents were giving out feathery clouds in Halemaumau after rain, and steam at the larger vents was dense. Fume was also visible under the southeast wall in cracks in the new lava fill. Occasionally rocks trickled down the north wall. On the 14th fume was as usual at the foot of the southwest talus, but was not visible southeast. The northeast rim cracks showed no change On the 15th at 10 a. m. Halemaumau remained without changes. On the 17th the sulphur spot at the southwest fuming area showed increase of stain.

The seismographs at the Observatory registered 15 tremors, two very feeble seisms, and one feeble seism. Two of the tremors showed doubtful origin distances of 42 and 56 miles, respectively; the two feeble seisms, 32 miles and 25 miles; and the feeble seism, 10 miles WNW of the Observatory. This last shock awakened sleepers at the volcano, and in Honomu, Kona and Hilo at 2:55 a. m. April 17.

Microseismic motion was moderate through the week. Tilting of the ground averaged very slight to the east.

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Subcription for non-members two dollars per year of 52 numbers. Address the Observatory.

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The Volcano Letter

Two dollars per year | Ten cents per copy

No. 383—Weekly | Hawaiian Volcano Observatory, National Park, Hawaii | April 28, 1932

The official party April 19, 1927, at the opening and dedication of Uwekahuna Observatory and Museum on the high western bluff of Kilauea Crater. Presented by the Hawaiian Volcano Research Association to the National Park Service. Right to left, the late Hon. Stephen Tyng Mather, Director of the National Park Service, Hon. Hubert Work, Secretary of the Interior, Volcanologist Jaggar, and Hon. Wallace R. Farrington, Governor of Hawaii.

PROGRESS OF HAWAIIAN VOLCANO RESEARCH

(Continued from Volcano Letter No. 382)

Third part of address of T. A. Jaggar, Annual Meeting of Hawaiian Volcano Research Association in Honolulu, March 31, 1932.

We have seen the growth of twenty years of volcano study in Hawaii by the observatory method, the growth of world volcano stations and some scientific results of volcano research in general. It will now be of interest to the members of this society to review the material progress of the work in Hawaii for the past ten years. The work of the first decade was outlined in the Monthly Bulletin in various annual addresses of 1913, 1915, 1916, 1917, and 1922. The year 1920 had started a new five-year program for the Association, with installation of seismographs at Hilo, Hilea, and Kona, and Dr. Omori, who had visited the Observatory with the Pan-Pacific Science Congress of 1920 had advised us to concentrate on the Mauna Loa center so as to interpret the direction, distance, and depth of the original impulses which make our local earthquakes. A second project was to do core drilling in the vicinity of Kilauea Crater for securing new light on temperatures, volcano power, the relation of volcanism to mining, underground water, and the relation of underground heat to gas. The third project was to secure publication of certain voluminous scientific papers which were ready, but unfinanced.

The Science Congress had recommended a central scientific bureau for dissemination of volcano news about the Pacific. This our Association has somewhat done by publication of the Volcano Letter. A second resolution of the Congress to the effect that the dwellers in volcano lands should be educated on the meaning of volcanoes and earthquakes, and on safeguards and insurance against them, has been promoted by the Volcano Letter, and by such magnificent work in America, Japan, the Dutch East Indies, New Zealand, etc., as is summarized in Sapper's book on Volcano Science, von Wolff's book of Vulcanism, and Freeman's book on "Earthquake Damage and Earthquake Insurance." A third resolution was that ecological studies should be carried out dealing with the rehabilitation of lava and lava soil by organisms, and this was started in Hawaii by Dr. Skottsberg under the Bishop Museum with some assistance from us, by marking ten-meter squares on lava flows of known date, and listing the lichens and other organisms found. These were to be reoccupied at future dates. Another study bearing on this subject has been published by Dr. Howard Powers of the Hawaiian Volcano Observatory in association with Messrs. Ripperton and Goto (Bull. 66 Hawaii Ag. Exper. Sta.), whereby the ash and lava soils of Kona have been specially classified for their adaptability to coffee culture. A last resolution of this Congress recommending that a station be placed on the top of Mauna Loa for combined aerology and volcanology remains still as a goal, but some progress toward it has been made by improvement of trail, and surveys for a road, by the National Park.

The year 1921 produced important material progress at the Observatory in a first shop and electric plant, in a revision of crater surveys for years back, in a beginning of monthly maps of the pit, in new crater experiments, in improved photographic apparatus, in computed curves of the lava tide investigation, in new money for an archives building and for boring, and in the discovery, by the topographers of the United States Geological Survey, of probable elevation of the rim of Kilauea Crater by from two to three feet between 1912 and 1921.

In 1922 the boring experiments were begun, were continued with both churn and core drills until May 1923, and were revived with air drills in 1926 and discontinued in the winter of 1927-28. There resulted 34 drill holes on the crater floor and the crater rim of Kilauea, which are valuable assets of the Observatory for all time as places for experiment and for measurement of change in temperature and gas chemistry. The iron Archives Building was built in 1922, furniture and garages were improved, a chemical laboratory was started, and Mr. R. M. Wilson produced a first draft of "the Volcano Local System of Levels and Triangulation," which now in 1932 he is finishing in Washington in order to exhibit the important changes by land moment, precisely measured, which have occurred during activities at Kilauea Crater.

This year 1922, beginning the second decade of our work, was one of extraordinary progress for the Research Association in buildings, seismology, drilling for temperatures, and improved equipment. Machinery, tanks, cabinets for seismograms, chemical laboratory, and shop for instruments were added. Seismograms began to appear from Hilo, Hilea, and Kona. Dr. Allen came from the Geophysical Laboratory in Washington to work on the physical chemistry of the bore-hole steam at Sulphur Bank. Here an iron hut had been set up over the hot wells.

In 1923 Dr. O. H. Emerson was employed as chemist and general assistant, Dr. Jaggar was sent to Japan for three months to investigate the Tokyo earthquake, a remarkable motion picture film was obtained there, he made explorations in Tokyo, Yokohama, Kamakura, Boshu, Oshima, and Hakone, he assisted at some committee meetings of Japanese engineers and seismologists, and it was determined by the United States Government after the disaster that a plan for the new embassy should be referred to the Bureau of Standards. It is of interest to note that the earthquake-proof embassy of the United States in Tokyo is now finished. Mr. Jaggar insisted then as now that the volcano Mihara on Oshima Island, in Sagami Bay close to the seismic center of the great earthquake, one of the few volcanoes in Japan which produces lava in its crater most of the time, is a remarkably important place for a permanent observatory.

The scientific staff of the Observatory at this time consisted of Messrs. Jaggar, Finch, and Emerson. The record books were complete to 1923, and these books, typewritten in loose-leaf covers, including photographs and transcriptions of notebook sketches, were duplicated so that one set was kept in Washington. In the winter of 1923-24 the director of the station went to the eastern United States, read three papers at the American Association meeting in Cincinnati, and gave 26 lectures in Cincinnati, Washington, at Maryland University, in New York, New Haven, Cambridge, Boston, Brooklyn, Chicago, Urbana, and Philadelphia. He published articles, setting forth the work of the Association, in the National Geographic Magazine, the American Magazine, Asia, Scribner's, Popular Science Monthly, Bulletin of the Seismological Society, Monthly Weather Review, and the New York Times and Herald-Tribune. The steam-blast eruption of Kilauea occurred in May, 1924, and was admirably cared for by Messrs. Finch and Emerson, the director returning the end of May. The station was transferred to the Geological Survey July 1, 1924. Mr. Boles of the National Park Service ran levels across the disturbed area of Kapoho in Puna, which were of great value in outlining the down-dropped block of country there, which had lowered about 10 feet. It was at this time that numerous papers were published showing that tides, tilts, and cycles affected the lava of Kilauea.

Up to this time the Massachusetts Institute of Technology had continued to be a valued contributor to the Association. In later days the Institute has transferred its experimental work in geophysics to New England fields, but the highest appreciation should be expressed on behalf of the Hawaiian Volcano Research Association to this solid engineering school for bringing about the foundation of the work in 1911 which the Government and the Association have carried forward.

With the entrance of the United States Geological Survey on the work, the Government cooperation had been in progress, since the execution of a lease of the laboratory, from the Association to the Weather Bureau, April 19, 1919. Every assistance and most sympathetic collaboration was given by Chief Charles F. Marvin to volcanology while it was under the U. S. Weather Bureau. Dr. Marvin is himself a seismologist of note. The Research Association has been left entirely independent as a collaborating organization, but at all times the initiative for new methods, new discoveries, new apparatus, outside stations in Hawaii, and for publications and library, has rested with the Association. Also Research Fellows such as Dr. Romberg and Dr. Emerson, called in for studies of physics and chemistry, have been employees of the Association The regular staff is salaried by the Government, but much of the upkeep and nearly all of the improvement in buildings and apparatus has come from the Association.

During the 15 years since the work was started, the Research Association had seen grow the interest of the Congress of the United States in seismology and volcanology; the interest of scientific journals in Italy, Germany, Holland, Great Britain, France, America, and Japan, and of seismological and volcanological establishments in Geneva, Paris, Oxford, and Naples; the interest of the Carnegie Institution, the Pan-Pacific Union, the Weather Bureau, the Coast Survey, the Geological Survey, the National Geographic Society, and the universities and museums in the United States; and the establishment of bureaus and commissions on volcanoes, especially in Japan, the Dutch East Indies, the Philippines, New Guinea, New Zealand, Mexico, and Costa Rica; and it has seen fresh activity in the national and international geophysical unions and congresses.

The Bishop Museum invited Dr. Jaggar to join an expedition, in September 1924, to the *Howland and Baker* islands in the U. S. S. S. Whippoorwill. This was of geat interest for a volcanologist in view of Darwin's generalizations concerning atolls as representing subsidence. Howland and Baker appear to be the nucleus of an atoll, and as such show no evidence of subsidence, nor of the transition from a previous condition of fringing and barrier reefs. They appear to be accumulations on a submarine bank not significantly related to subsidence, elevation, nor retreat of the sea, but closely related to trade wind and equatorial current.

In 1925 a visit by a Congressional committee headed by Hon. L. C. Cramton of Michigan was destined to advance volcanology immeasurably. Mr. Cramton asked Mr. Jaggar to accompany him in June to Lassen Volcanic National Park and this was the signal for creation in 1926 of enlarged appropriation for a Section of Volcanology to include California and Alaska with Hawaii. Meantime Colonel C. H. Birdseye, in charge of the Topographic Branch of the Geological Survey, undertook to cooperate with volcanology by sending an engineer, Mr. J. C. Beam, for leveling, and for triangulation of the net of proposed bore holes that would determine how the temperature of the crater lava changes horizontally from place to place. In the machine shop we were experimenting with compressed air drills, and have to thank Messrs. W. F. Dillingham and Frank West of the Hawaiian Contracting Company for assistance. Leveling reconnaissance was now indicating that the edge of Halemaumau pit had gone down several feet during the explosions of 1924. Experiments were being tried in the seismological laboratory with earthquakes, with tilt recorders. and with overturning prisms for calibrating strong-motion earthquakes. Mr. E. G. Wingate was surveying Mokuaweoweo Crater, and it is impossible to express all that the Observatory owes to the late Captain A. O. Burkland, in charge of topographic mapping in the Hawaiian Islands.

In 1926 it had become the custom of the Volcanologist, to make a forecast each year, in his report to the Director of the Geological Survey, by way of experimenting with prediction. The report of December 31, 1925, stated that low earthquake frequency and accumulated tilt suggested rising lava and that location of some earthquake centers implied motion in Mauna Loa. This was confirmed by Mauna Loa breaking out April 10, 1926, and producing the Hoopuloa flow. A similar forecast for Halemaumau December 31, 1926, was followed by the outbreak in that pit in July 1927. Forecasting data are growing increasingly accurate.

General reorganization was permitted in 1926. Mr. R. H. Finch in September founding the Lassen Volcano Observatory, Mr. R. M. Wilson becoming engineer and chief assistant at the Hawaiian station, and Mr. R. B. Hodges becoming clerk and disbursing officer. Mr. Beam remained from

December 30, 1925, to May 21, 1926, tested two level lines 1,000 feet long for changes of tilt, releveled old circuits about Kilauea, surveyed the bore hole net, remapped Halemaumau, and triangulated the Wilson net. Japanese workmen were sent from station to station, on the Kilauea floor, for boring holes 10 feet deep and 1,000 feet apart at the corners of equilateral triangles. There were added to the equipment compressor, truck, and drill, some tested thermometers, one of the modern high-speed cameras, and up-to-date surveying instruments from the Survey.

Meantime the Research Association had met the Congressional increase of funds by a drive for $20,000 for an exhibition room, projection apparatus, and furniture on the top of the great western cliff of Kilauea Crater, which was duly built and turned over to the Secretary of the Interior and the Director of the National Park Service in April 1927. At the same time the Association ordered from Japan an exhibition seismograph, and the best of the mineral collections were placed in the museum. The machine shop of the Observatory was enlarged and a skilled machinist secured for one year. A tide gauge had been installed in Hilo, and the Geological Survey cooperated in securing leveling by the Coast Survey from sea-level to the top of Mauna Loa, and in measuring gravity on the island of Hawaii in the autumn and winter of 1926-27. This work was done by Engineers Simmons, Brown, and Bainbridge. In the summer of 1927 Mr. Jaggar went to Alaska, established a seismograph at Kodiak, sailed to the west end of the Aleutian Islands and back, and inspected the Lassen station. Meantime several new seismographs of a distinctive Hawaiian type, large two-component instruments, were built at Kilauea, one of which was placed in a new cellar constructed for it in Hilo. Engineer Wilson entered on new mapping of Halemaumau, improvement of wireless time service, new leveling and triangulation to determine ground movement, measuring marked fissures at Halemaumau pit, and making artificial earthquakes with an oscillating table.

The year 1928 was thus entered upon with the Hawaiian Volcano Observatory, which had been established 16 years before by the Hawaiian Volcano Research Association, as the central headquarters in the middle of the Pacific Ocean, for a Section of Volcanology of the United States Geological Survey, maintaining substations in California and Alaska, and so doing its bit, of observing active volcanoes, at the east, north, and center of the Pacific Ocean. The Volcano Letter, issued weekly, was distributing notes about the world on volcano science, particularly with reference to the Pacific. Seismograms were being studied from four places on the island of Hawaii, and one place each in California and Alaska. The Hawaiian station was equipped with a tide-gauge, a machine shop, a number of permanent bore holes, a chemical laboratory, general laboratory, dark room, fire-proof archives building, library, and vehicles, and the needs of the public had been suitably transferred to the National Park Service by means of a museum and lecture room. Triangulation and leveling had proved elevation and distension of Kilauea Crater before 1924, depression and construction thereafter. Mapping topographically had covered the whole of the island of Hawaii, and was nearly completed for the Territory. Marked cracks were being systematically measured around Halemaumau pit, and at Lassen by stakes at Supan's Springs. New leveling and gravity measurement had extended to the top of Mauna Loa. A project had been formulated for possible cooperation of several Government bureaus in studying the natural history of the Aleutian Islands.

The National Geographic Society was now taking an active interest, after numerous explorations in volcanic fields, from the time of the Caribbean eruptions of 1902 onward. This Society employed Mr. Jaggar in the summer of 1928 to conduct an expedition to explore and map topographically 2,500 square miles around Pavlof Bay, near an active volcano of the same name, one of the beautiful snowy cones of the Aleutian belt on the south side of the Alaskan Peninsula. This expedition was timely, as Dr. Griggs for the Society had conducted a series of expeditions near Katmai Volcano, and our Section was laying a foundation for expeditions in the Aleutian Islands, two of which has already been made, with studies of Makushin, Bogoslof, Korovin, Gareloi, and Chugul volcanoes. In the Pavlof Expedition the topographic map was made by McKinley and published by the Survey, numerous photographs and motion pictures were taken by Stewart, and the geology and volcanology were studied by Jaggar, and a preliminary report published in the National Geographic Magazine.

It had become evident at the Hawaiian station in 1924 that the tremendous slope, to depths of two or three miles in only a few miles distance east and west of Hawaii under the ocean, is an important basal part of the active volcanic system. An outflow to the west under the sea in 1877, singular waves and submarine noises during lava flows from Mauna Loa into the sea, and a probable submarine flow unperceived off the east point in 1924, all made the study of the volcanic sea bottom by new methods a fundamental part of future volcanology. Accordingly, the development of work from boats is essential. The Pavlof Expedition employed a steel amphibian boat built for the National Geographic Society which was afterwards turned over by the society to the Research Association in Hawaii. The activities of such boats were experimented with in 1927 and 1928 on the east and west sides of Hawaii, as they possess the great advantage, where laboratory work is to be considered at a permanent station, of running up the beach on wheels with all their equipment and collections into a suitable house. Their bottoms may thus be altered or mechanized for any kind of sounding, dredging, probing, or tubular bottom photography with artificial lights in shallow water, and the ordinary disadvantages, of a boat exposed to all weathers, at anchor most of the time, with its bottom fouling, are eliminated. There is very important work to be done close to shore in Hawaii in determining the escape of the groundwater through submarine fresh water springs, by bottom sampling and hydrometer tests. Such submarine springs are known in many places on the active volcanic sides of the island, where no springs whatever emerge above sea level. This is true of many of the volcanic islands of the South Pacific, where the coral reef problem is affected by fresh water, from the ground-water surface beneath the rainfall belt of a lava mountain. As the explosive eruption of 1924 was probably occasioned by lava outflow under the sea, and groundwater inflow to the hot void so created under Halemaumau, it will be seen that critical surveys of the sea-bottom near Hawaii are absolutely necessary for the progress of volcanology. Therefore it is proposed to begin with small vessels close to shore, and to develop apparatus for such volcanologic surveys. It is to be hoped that the Navy and other boating organizations of the Government will give assistance in this work. The Board of Harbor Commissioners of the Territory of Hawaii kindly permitted the Association to use a discarded warehouse at Keauhou in Kona as a shelter for the steel boat "Honukai," where this amphibian is kept for explorations on the west side of Hawaii.

Engineer R. M. Wilson was obliged to return to Washington in November 1928, and was replaced by Engineer E. M. Buckingham, who remained until July 1, 1929. His place was taken by a geologist, Dr. H. A. Powers, who came from Harvard University, and entered upon geologic mapping of the west side of Hawaii, in addition to service as general assistant at the Observatory. Mr. Wilson had completed a contour map of Halemaumau after the bottom changes of 1927. Mr. Buckingham made another after the bottom changes of February 1929. Mr. Powers as petrologist started microscopic studies of rocks from Hawaii and Alaska, and also drafted diagrams of tilt from 1913 to 1930. Mr. A. E. Jones was sent to Alaska in 1929 and established a new seismograph station at Dutch Harbor.

Experiments of 1929 at the Hawaiian station dealt with construction of leverless seismographs tested on the oscillating table, of several models of vertical-component seismographs, wherein it was attempted to make the constants equivalent to the Hawaiian-type horizontal-component instrument, and of several different sizes of shock-recorders designed as simple instruments to put into the hands of amateurs. Also mechanical devices were made the subject of experiment for securing smooth smoking of seismogram paper. For many months a seismograph was operated with a restraining bumper against the pendulum arm having in view the elimination of microseisms and tilt.

and the recording of local earthquakes only. The shock-recorders were successfully used at Puuwaawaa in western Hawaii during the extraordinary and disastrous earthquakes of September-October 1929.

In the Lassen station a new Hawaiian model seismograph was set up and the older instrument was transferred to the Loomis Museum near Viola. Messrs. Howel Williams and C. A. Anderson, in addition to Mr. Finch, were at work on problems of the geology of the vicinity of Lassen Volcano. Dr. Wentworth investigated the geology of Hawaii June-September 1929, Dr. Stone the volcanoes of Chile November-January 1929-30, and Mr. Finch attended the Java Science Congress April-June 1929. On January 12 the Director of the U. S. Geological Survey, Dr. George Otis Smith, called a meeting under the Federal Relations Committee of the National Research Council for conference on scientific cooperation in the Aleutian Islands. This was in line with recommendations of the Pacific Science Congress of 1923. Dr. Jaggar addressed the meeting, and was made chairman of a committee to further Aleutian investigations.

This brings the review of volcanologic activities centering about Hawaii up to 1930-31. The buildings of the Hawaiian station were now enlarged and rehabilitated, tilt studies on a larger scale were prepared for, the Volcano Letter was enlarged and illustrated, a course in volcanology was given annually in the summer session of the University of Hawaii, a journey to the active volcano on the island Niuafoou in Tonga, by Mr. Jaggar, secured valuable photographs and records under the Eclipse Expedition of the U. S. Naval Observatory, shock-recorders were placed there and in New Zealand, Mr. Finch explored Akutan Volcano in Alaska and tested a shock-recorder there, the first clinoscope was constructed, Professor H. S. Palmer joined Dr. Powers in studies of shore-line changes on Hawaii, and finally, beginning July 1, 1931, the Congress of the United States enlarged the funds and activities of the Section of Volcanology by adding two scientific workers.

These are Engineer E. G. Wingate and Seismologist A. E. Jones, and the motive for this enlargement of staff is largely to concentrate measurements on tilting of the ground about an active crater in relation to local earthquakes. These motions have been found significant for prediction. There is certainly such tilting around the Kilauea center, there is presumably such tilting around the Mauna Loa and Hualalai centers, and there should be generalized tilting around the outskirts of the island. The formulation of what the local motions are, in direct relation to the passage of time and the coming of activity at a definite volcanic center, and what such motions show as to location and motion of definite lava underground, is the aim of volcanology. This has led to the placing of clinoscopes, as heretofore described, in three cellars around Halemaumau pit.

The Research Association met the enlargement provided by Congress by supplying new and enlarged buildings and laboratories, and greatly increasing the facilities of the Hawaiian station. We have every reason to express our keen appreciation of the invariable assistance and cordial cooperation of Hawaii National Park. The Research Association owes a debt of gratitude to Delegate Houston, Governor Farrington and to Director Smith of the Geological Survey for bringing about our enlarged opportunities, and equally to his successor, Director W. C. Mendenhall, and to the Chief Geologist of the Survey, Dr. T. W. Stanton.

The Scientific Director of the Association takes this opportunity to express his very keen and heartfelt gratitude to the late honored L. A. Thurston, for many years our President, enthusiastic in support of everything which concerned the study and exploration of Hawaiian volcanoes, and skilled as a special pleader and publicist through his extraordinary learning and memory concerning everything Hawaiian. All honor should be paid also by all students of volcanology to the gentlemen of Honolulu who from time to time have served gratuitously and loyally on the Board of Directors of this Association, and especially to the six men in recent years who have served with Mr. Thurston in making for growth of the science through business leadership, public influence, financial judgment, scientific interest, and legal advice, Messrs. Cooke, Atherton, Dillingham, Peck, Dean, and Thayer. Mr. L. W. de Vis-Norton should be especially commended for his long and painstaking service as Secretary and Assistant Treasurer, in attending to the irksome details of the work of recorder, sometime editor, bookkeeper, and correspondent, and in advising with the Scientific Director on all manner of subjects, as well as doing a large amount of literary work which has made volcano research known.

KILAUEA REPORT No. 1057

WEEK ENDING APRIL 24, 1932

Section of Volcanology, U. S. Geological Survey

T. A. Jaggar, Volcanologist in Charge.

At Halemaumau pit of Kilauea Volcano the week has shown little change. The weather has been normal of the trade-wind type, and at 9 a. m. April 18 the yellow fume patch at the west side of the floor showed thin vapor. Crack measurements about the eastern rim showed but slight widening in the measurements of April 19. The fume emitted continued thin, but is always in evidence as a bluish haze over the western half of the pit in early afternoon light. An avalanche from the northern wall of the pit about 10:05 a. m. April 21 was followed five minutes later by a much larger one which appears to have been registered somewhat as a vibration recorded on the seismographs of the Observatory two miles away. The fallen rocks overlapped the January lava floor, the roar was loud, and a dust cloud arose. There were several other slides on this day and one at 4:38 p. m. was observed April 22 at the northeastern rim.

Seismic activity registered at the Observatory was mild. One very feeble shock indicated origin distance close at hand, something over two miles, and 26 tremors were registered during the week, three of which were sufficiently defined seismically to suggest origin distances of 28, 42, and 46 miles. Microseismic motion for the week changed from moderate to light, and tilting of the ground was strong to the west with slight tendency north.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
HAWAII NATIONAL PARK
HAWAII

OFFICE OF THE SUPERINTENDENT

April 8, 1932

The Director,
National Park Service,
Washington, D. C.

Dear Mr. Director:

The following is a report of activities and operations in Hawaii National Park for the month of March, 1932

000 General

010 The U.S. Fleet completed its visit to Hilo and the island of Hawaii during the first week of the month. The program of activities of the park staff in rendering service to the visiting Navy men continued as outlined in the report for February. From February 20 to March 6 a total of 7,409 officers and enlisted men visited the park. Following the departure of the fleet, editorials in local papers recognized the services rendered by the park in helping to entertain the visitors on the "big island".

020 General weather conditions

Compared with the first two months of the year, March was a month of much less rain. The total rainfall for January was 24.55 inches, for February 14.34, and for March 4.15 inches. However, there was only a total of 1.57 inches of rainfall in March last year. The highest temperature during the month was 72 degrees on the 4th, the lowest 44 degrees on March 8 and 9. No storms occurred to cause any damage to roads, trails, telephone lines and other outside fixtures. Patches of snow remained on the top of Mauna Loa during the entire month; the lowest limit of snow was approximately 12,000 feet elevation. A meteorological record for the month is attached.

100 Administration

110 Status of work

On March 20 Superintendent Leavitt left Hilo on the Inter-Island steamer for Honolulu, en route to the superintendent's conference at Hot Springs National Park, accompanied by Mrs. Leavitt, who will visit relatives and friends in California. Park Naturalist Doerr was appointed acting superintendent during Mr. Leavitt's absence of approximately seven weeks.

All office work was kept current during the month in spite of the fact that the personnel and office equipment were moved into temporary quarters so that the construction work on the new administration building could be started.

The superintendent's annual report, copies of which were mimeographed during February for distribution, was published in the leading papers of the islands during March, and has received favorable editorial comment. Weekly reports on park activities were mailed to Superintendent Leavitt on March 26 and April 2.

120 Park inspections by

121 The superintendent

On March 10 Superintendent Leavitt, accompanied by Park Naturalist Doerr, District Ranger H. J. Christ, and Major Frank A. Jones, U.S.A. made an inspection trip of the trail from Uwekahuna to Hilina Pali, via Mauna Iki and the Yellow Cone. The work of making this trail safe for horses was completed during the month and the trail is now in good condition. A three-walled, tin-roofed shelter has been built along the trail near Yellow Cone. Anyone desiring to see many interesting lava formations can now safely travel this trail on foot or horseback.

Superintendent Leavitt made regular inspections of roads, and construction projects during the portion of the month he was in the park.

Acting Superintendent Doerr, accompanied by District Ranger Christ, made inspections of road construction, maintenance projects, post-construction work, the quarry from which stone for the new administration building is being obtained, and the road contractor's camp.

125 Other governmental officers

Seth W. Richardson, Assistant U.S. Attorney General, and party arrived in the Park on March 2 for an inspection as part of their program of investigating conditions in all federal and territorial organizations. Mr. Leavitt and Ranger Christ accompanied Mr. Richardson and his party on a two-day tour of the island, during which park problems were discussed and meeting were held with various officials. Full report of this has been submitted by the superintendent.

130 Finance and accounts

See statistical report No. 8 at the back of this report.

150 Equipment and supplies

Building materials and supplies were received from local contractors during the month for the completion of the commissioner's residence and for the new administration building.
Blacksmith forges, wheelbarrows and hand tools were also received.

180 Circulars, placards, publicity bulletins, etc.

Attached are copies of the weekly issues of the Volcano Letter, and January Nature Notes.

200 Maintenance, improvements and new construction

210 Maintenance

Regular maintenance of roads, trails, telephone lines and grounds was carried on during the month. The headquarters area was divided into districts for purposes of maintenance, one district assigned to each member of the ranger staff. This plan seems to be working satisfactorily at the present time.

220 Improvement and post construction

The work of removing approximately 1,000 yards of clinker lava from the cinder cone near Devil's Throat has been started. The removal of this material was necessary to make way for paving and to prevent slides of material on the road. Invitations for bids for this work were sent out. One bid of $1.00 per cubic yard was sent in but was rejected because of high price. Per diem labor is doing the work for approximately thirty-five cents per cubic yard. Post construction work along the Kau road has been started. This includes repair of shoulders and removal of bed rock obstructions in ditches.

230 New Construction

The commissioner's cottage, started January 9, is now 95% complete. This building is being used at present as the administration building. Work on the cottage will be completed just as soon as the new administration building can be occupied.

Work on the new administration building was started during the month. The old building was rapidly razed. Much of the timber in the building was in poor condition. The new building is approximately 10% complete to date.

According to Engineer Handley's report of March 15, the construction work on roads was 58% complete, with 69% of the contract time elapsed. Weather has been remarkably good for construction work on roads.

300 Activities of other agencies in the park

320 Cooperating governmental agencies

The Hawaiian Volcano Observatory is constructing ~~is constructing~~ cellars to house tilt instruments on the south, west and north sides of the firepit. Plans for these cellars have been approved by the landscape division and the construction work inspected by Superintendent Leavitt.

400 Flora, Fauna, and Natural Phenomena

410 Ranger service

The rangers were on duty at the Hilo entrance, Lava Tube, Chain of Craters and Museum during the visit of the U.S. Fleet, March 1 to 6. During the remainder of the month they have been engaged in patrol duty, repair and construction work. On March 24-25 Ranger Fordyce accompanied Major Frank A. Jones and four enlisted men from the Kilauea Military Camp to the shelter on

Mauna Loa to repair damage thought to have been done by Army men who have made use of the shelter. The Kilauea Military Camp stood the expense of the repair work, which was of a minor nature.

On March 31 Ranger Brumaghim accompanied Major Frank A. Jones on a trip to Halape. Ranger Brumaghim spent some time during the month assisting Park Naturalist Doerr at the museum.

411 Naturalist service

Park Naturalist Doerr gave 19 lectures at the museum and two at the Volcano House. The total attendance at these lectures was 1181. In addition he gave a talk in Hilo to the school principals of central and eastern Hawaii. This talk was on National Park Trails. Four meetings of the Nature Study class were held in Pahala. Four Halemaumau trail trips were taken. Total attendance at the museum was 3343. Many requests for Nature Notes have come in as a result of an article published in the April issue of The Instructor. Park Naturalist Doerr spent considerable time during the month preparing and gathering material for Nature Notes in addition to handling park administration as acting superintendent.

\- 480 Natural phenomena

March was a month of unusual seismic activity at Kilauea, which centered in a spasm of felt shocks on March 4, beginning at 12:53 p.m. and continuing for six hours, the seismographs recording six distinct shocks and much continuous tremor during that time. Avalanching in the walls of Halemaumau followed these earthquakes and the next day a large section of the east rim, about 500 feet long and 50 feet deep, collapsed, carrying with it protecting ropes and the danger sign which had recently been placed there. Fume has been rising from the bottom of the pit continuously since the December eruption and shows no sign of decreasing. Cracks measured on the southwest and northeast sides of the pit show gradual widening. Over 200 tremors were recorded during the month and some fifteen quakes felt locally, all of which were found to have originated within a few miles of the Observatory. Tilt for the month was SSE and SW.

Glowing cracks were visible on the pit floor for several weeks following the earthquake spasm and avalanches.

500 Use of park facilities by the public

510 Increase or decrease in travel

A slight increase in travel is shown during the month, due to the visit of the fleet and the "Empress of Britain" on March 15, which brought over 300 visitors to the island. The patronage of the Military Camp and Volcano House has fallen off slightly, however, as will be noted on Form 10-157.

530 Visitors

Dr. Oskar von Ars and Dr. Hans Frey, geologists from Switzerland.

Seth W. Richardson, Assistant Attorney General, and party.

Rear Admiral H. E. Yarnell, U.S. Navy

Major Frank A. Jones, U.S. Army, in charge of recreation for the Hawaiian Department, U.S. Army

Mr. and Mrs. DeWitt Wallace, editors of the Readers Digest

W. Cameron Forbes, retiring U.S. Ambassador to Japan, accompanied by Mrs. Waldo E. Forbes, Miss Amelia Forbes and Mrs. Dorothy Kendall.

Professor Ernst Vollbehr, University of Berlin, who made a number of sketches of the various volcanic features of the park to be reproduced in oil and exhibited at the Chicago World's Fair.

600 Protection
640 Destruction of predatory animals
The following animals were killed during the month.

46 wild goats
21 wild pigs
3 wild dogs

Very respectfully,

John E. Doerr, Jr

John E. Doerr, Jr.
Acting Superintendent.

10-157
(July, 1929)

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

TRAVEL REPORT

HAWAII National Park for the month of MARCH 1932

	This Month	This Travel Year To Date	This Month Last Year	Last Travel Year To Date	Increase for Travel Year: Number	Increase for Travel Year: Percent
PRIVATE TRANSPORTATION:						
Cars first entry, ...						
Cars reentry, ...						
Motorcycles, ...						
Total motor vehicles, ...						
Persons entering via motor vehicles, ...	7,254	74,166	5,644	70,142	4,024	5.4%
Persons entering via other private transportation, ...	245	1,866	287	1,987	- 121	-6.0%
Total persons entering via private transportation, . . .	7,499	76,032	5,931	72,129	3,903	5.1%
OTHER TRANSPORTATION:						
Persons entering via stages, (Hotel) .	945	3,394	778	3,706	- 312	-8.4%
Persons entering via trains, .						
Persons entering otherwise, . .						
Total other transportation, .	945	3,394	778	3,706	- 312	- 8.4%
GRAND TOTAL ALL VISITORS, . . .	8,444	79,426	6,709	75,835	3,591	4.5%

	This Year	Last Year	Increase: Number	Increase: Percent
Automobiles in public camps during month, ...	0	3		
Campers in public camps during month, ...	0	12		

10-158

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF AUTHORIZED PROJECTS

Hawaii National Park for the Month of March, 1932

Description of Projects	Percent Constructed To Date	Percent Constructed This Month	Percent Constructed Last Month	Probable Date of Completion
410 U.S. Commissioner quarters -	90	8	79	June 30, 1932
411 Employees quarters - - - - -	100	0	0	
412 Employees quarters - - - - -	100	0	0	
413 Administration building - -	5	5	0	June 30, 1932
502 Trails				
502.1 Hilina Pali to Halape - - -	100	0	0	
502.2 Uwekahuna-Halemaumau auto trail	92	0	0	
502.3 Mauna Iki extension - - - -	100	0	0	
502.4 Haleakala trail - - - - - - -	100	0	0	
502.5 Mauna Loa trail - - - - - - -	100	0	0	
502.6 Halemaumau trail - - - - -	95	0	0	
507.1 Kau belt road - - - - - - - -	100	0	0	
507.3 Cinder cone removal - - - -	50	50	0	April 15, 1932
Road Survey, BPR Construction - -	58	11	8	July 1, 1932

10-159
(May, 1931)

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF PERSONNEL

Hawaii National Park for the Month of March, 1932

	This Month		This Month Last Year	
	Appointed	Non-Appointed	Appointed	Non-Appointed
Number of employees beginning of month	12	20	5	5
Number of additions	0	2	0	0
Total	12	22	5	5
Number of separations	0	0	0	0
Number of employees close of month	12	22	5	5
Number of promotions during month	0	0	0	0
Aggregate amount of annual leave taken	0	0	0	0
Aggregate amount of sick leave taken	0	0	0	0
Aggregate amount of leave without pay	0	0	0	0

10-160

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

REPORT OF PARK REVENUES

Hawaii National Park for the Month of March, 1932

	This Year	Last Year
Park revenue on hand beginning of month, ...	0.00	0.00
Received, ...	96.62	25.00
Total, ...	96.62	25.00
Remitted, ...	96.62	25.00
On hand close of month, ...	0.00	0.00

Park revenues received this year to date, ...	$1605.81
Park revenues received last year to date, ...	1375.00
Increase, ...	230.81
Per cent of increase, ...	14.3%

10-161

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

REPORT OF SALES OF PUBLICATIONS

HAWAII NATIONAL PARK , MARCH 1932

	Number	Value
GOVERNMENT PUBLICATIONS:		
On hand beginning of month, ...	949	$165.60
Received during month, ...	15	13.50
Total, ...	964	179.10
(CREDIT) Your Index No. 103223-B	5	4.25
Sold during month, ...	14	2.15
On hand at close of month, ...	945	172.70

	Number	Value
NON-GOVERNMENT PUBLICATIONS:		
On hand beginning of month, ...		
Received during month, ...		
Total, ...		
Sold during month, ...		
On hand at close of month, ...		

Cash on hand beginning of month, ...	$17.90
Sales during month, ...	2.15
Total, ...	20.05
Remitted during month, ...	15.45
Balance, ...	$4.60

Form No. 1009—Met'l.

U. S. Department of Agriculture, Weather Bureau.

COOPERATIVE OBSERVERS' METEOROLOGICAL RECORD:

Month of March, 1932 ; *Station,* Volcano Obsy. ; *County,* Kau

Hour of Observation,

State, ; *Latitude,* ; *Longitude,* ; *Time used on this form,*

DATE.	TEMPERATURE. Maximum.	Minimum.	Range.	* Set Max.	PRECIPITATION. Time of Beginning.	Time of Ending.	† Amount.	Humid (Snowfall, in Inches.)	Wind (Depth of Snow on Ground at Time of Observation.)	Prevailing Wind Direction.	Character of Day, Sunrise to Sunset.	‡ Miscellaneous Phenomena.
	1	2	3	4	5	6	7	8	9	10	11	
1	n61	54	7	57			97	89	Mod.	N.E.	Cloudy	
2	66	53	13	58			18	93	"	"	P.C.	
3	68	52	16	59			07	94	"	"	"	
4	72	50	22	60			01	89	"	S.W.	"	
5	69	55	14	68			T	79	"	"	"	Wind lt. N.E. p.m.
6	58	54	4	55			28		"	N.E.	"	
7	61	45	16	54			02	80	"	"	"	
8	63	44	19	56			T	75	"	S.W.	"	
9	62	44	18	57			25	86	"	"	"	New snow on old
10	66	50	16	58			01	83	Lt.	N.E.	Cloudy	
11	61	51	10	56			19	95	"	"	"	
12	71	47	24	55			T	83	Mod.	"	P.C.	
13	70	47	23	56			T	88	Lt.	"	"	
14	70	53	17	61			T	83	"	S.W.	"	
15	70	55	15	65			T	79	Str.	"	"	
16	69	54	15	60			02	95	"	"	"	
17	66	56	10	60			02	100	"	"	"	Wind str. N.E. 4:30 p.m.
18	65	58	7	60			05	96	Lt.	N.E.	"	
19	65	57	8	59			28	95	Str.	"	"	
20	62	53	9	60			01	83	"	"	"	
21	68	52	16	58			06	88	"	"	"	
22	66	51	15	58			04	89	"	"	"	
23	66	52	14	58			02	88	"	"	"	
24	64	53	11	58			06	93	Lt.	"	"	
25	69	50	19	60			06	84	Mod.	"	"	
26	62	52	10	55			20	94	"	"	"	
27	65	52	13	55			44	93	"	"	"	
28	65	52	13	62			20	78	Lt.	"	"	
29	66	52	14	59			17	89	"	"	"	
30	62	52	10	56			51	87	Str.	"	"	
31	63	51	12	57			03	87	"	"	"	Old snow
Sum	2031	1601	430	1810			4.15	2635				
Mean	65.5	51.6	13.8	58.3			.13	87.8				

* Reading of maximum thermometer immediately after setting.
† Including rain, hail, sleet, and melted snow.
‡ Thunderstorms, halos, auroras, etc.

T. A. Jaggar, *Cooperative Observer.*

(IN TRIPLICATE.) See cover for instructions.

Post-Office Address,

8—263

MONTHLY SUMMARY.

TEMPERATURE.

Mean maximum, 65.5

Mean minimum, 51.6

Mean, 58.55

Maximum, 72 ; date, 4

Minimum, 44 ; date, 8-9

Greatest daily range, 24

PRECIPITATION.

Total, 4.15 inches.

Greatest in 24 hours, .97 date, 1

SNOW.

Total snowfall, inches; on ground 15th, inches;

at end of month, inches.

NUMBER OF DAYS—

With .01 inch or more precipitation, 25

Clear, 0 ; partly cloudy, 28 ; cloudy, 3

DATES OF—

Killing frost,

Thunderstorms,

Hail: Light, ; Moderate, ; Heavy,

Sleet,

Auroras,

REMARKS:

Volcano fumed fairly constantly.

STATISTICAL REPORT NUMBER 8

HAWAII NATIONAL PARK

FINANCE AND ACCOUNTS

Symbol		Allotted	Expended & Obligated	Balance
41/2415	Hawaii National Park 1931-32 - - - - - - - -	$52,130.00	45,955.79	6,174.21
41/2405	Emer. Reconstruction & Fighting Forest Fires	200.00	200.00	0.00
41/2406	Forest Protection and Fire Prevention - - -	100.00	100.00	0.00
4X436	Roads and Trails, National Parks, no year	$384,806.30	107,706.44	277,099.86

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
HAWAII NATIONAL PARK
HAWAII

OFFICE OF THE SUPERINTENDENT

March 2, 1932

The Director,
National Park Service,
Washington, D. C.

Dear Mr. Director:

The following is a report of activities and operations in Hawaii National Park for the month of February, 1932.

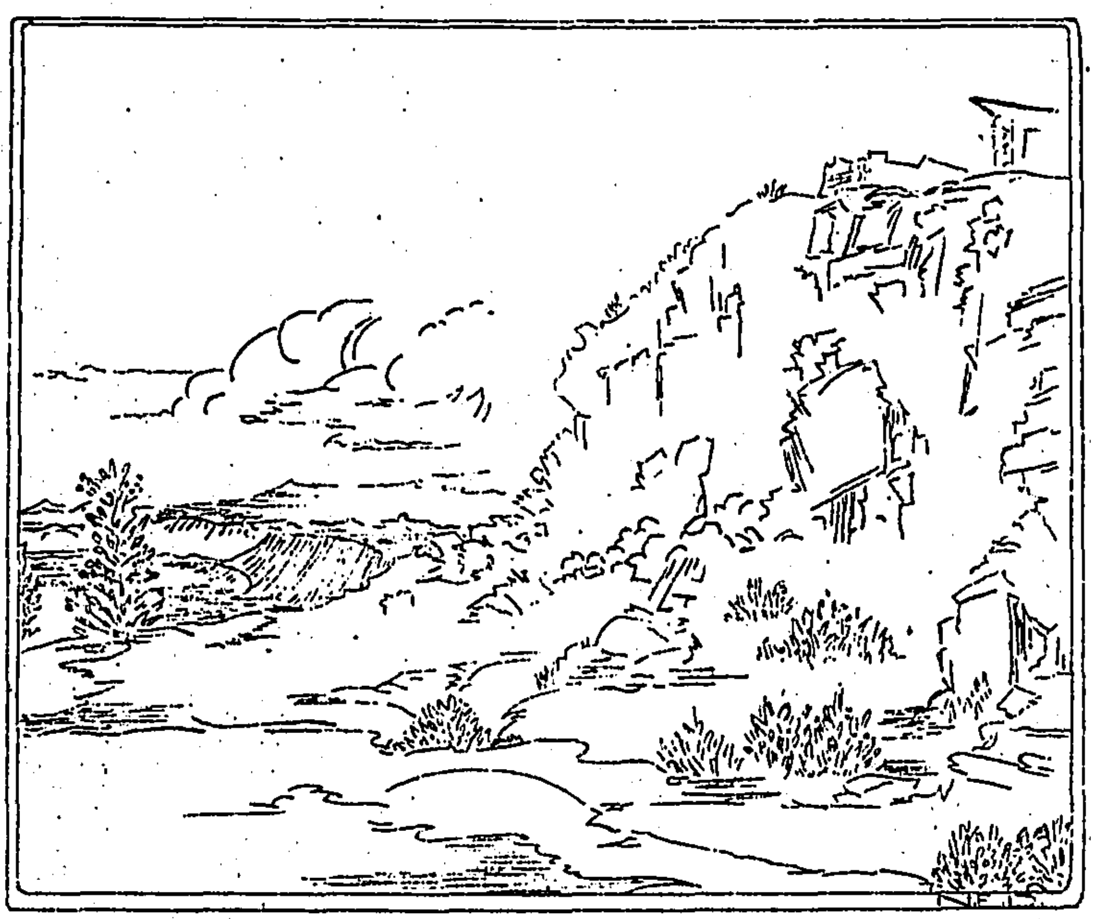
000 General

The outstanding event of the month was the visit of the U.S. Fleet to the Hawaiian islands, which brought to this island between 20,000 and 25,000 men in three weeks time. To date 5,193 men from the fleet have entered the park. The park staff has rendered every possible service to these men. A ranger stationed at the park entrance has distributed park pamphlets and instructed taxi drivers about the route through the park, which includes a trip through the Thurston Lava Tube, chain of craters road, the firepit, and then Uwekahuna Museum, where short lectures were given to the groups of men. From February 20 to 24, after the arrival of the first group of ships of the fleet, the weather was perfect aiding greatly in the elaborate entertainment planned for the Navy personnel which included decorations of the city streets and a mammoth parade on February 22, in which practically every organization on the island took part. Dances and entertainments for the men are given regularly and the entire visit has been most satisfactory from all standpoints. There has been very little cause for complaint in the behaviour of the sailors; as a rule their conduct has been very good.

020 General weather conditions

Weather during February was generally cloudy and rainy, with a brief spell of dry, sunny weather from the twentieth to twenty fourth. Fourteen and thirty four hundredths inches of rain fell during the month, compared with 6.40 inches for February last year, at which time drought conditions prevailed throughout the island. Temperature ranged from 48 to 75 degrees. There was snow on both mountains during the entire month, and an unusual amount of southerly wind, bringing heavy rains which caused much damage in several sections of the island. On February 17 a local thunderstorm damaged one of our telephone circuits so that it has been out of use since. The Honokaa section of the island in the Hamakua district was flooded twice during the month, the roads covered with dirt and debris, culverts and houses washed away, and the water system for the town destroyed.

Nature Notes



Hoolaha Elua Helu Ekahi
Ianuali

HOOKAHIKAUKANI EIWAHANELI KANAKOLUKUMALUA

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

HAWAII NATIONAL PARK
NATURE NOTES

Volume II — January 1932 — Number 1

Nature Notes from Hawaii National Park is a monthly pamphlet edited by the Park Naturalist and distributed to those interested in the natufal history of the park. Free copies can be obtained through the office of the Park Superintendent, Hawaii National Park, Hawaii. Anyone desiring to use articles appearing in Nature Notes may do so. Please give credit to the pamphlet and author.

E.P.Leavitt, Superintendent   John E. Doerr, Jr., Park Naturalist

TABLE OF CONTENTS

THE CHAIN OF CRATERS

Preface

In preparing this article on the Chain of Craters the writer has made use of data published in "The Volcano Letter" of the Hawaiian Volcano Research Association whose scientific laboratory is located on the north rim of Kilauea crater in Hawaii National Park. The data referred to appears in numbers 173, 319, 324, and 329 of "The Volcano Letter". The writer hopes that this article will give the readers of Nature Notes not only an explanation of the formation of the Chain of Craters but also an introduction to the many interesting natural features of the area which will be described in future issues of this pamphlet.

Location of the Craters

Park visitors driving easterly from the summit crater of Kilauea have an opportunity to see along the Chain of Craters Road a series of volcanic pit craters. These pits - one of which is almost 1000 feet deep - are frequently thought of as existing only within the boundaries of the National Park but actually the line of craters or pits extends from the summit of Kilauea to the east point of the island of Hawaii. Green Lake near Kapoho in the Puna district occupies one of the most easterly of the craters in the chain. Figure 1 at the bottom of this page shows the location of the chain of craters within the park.

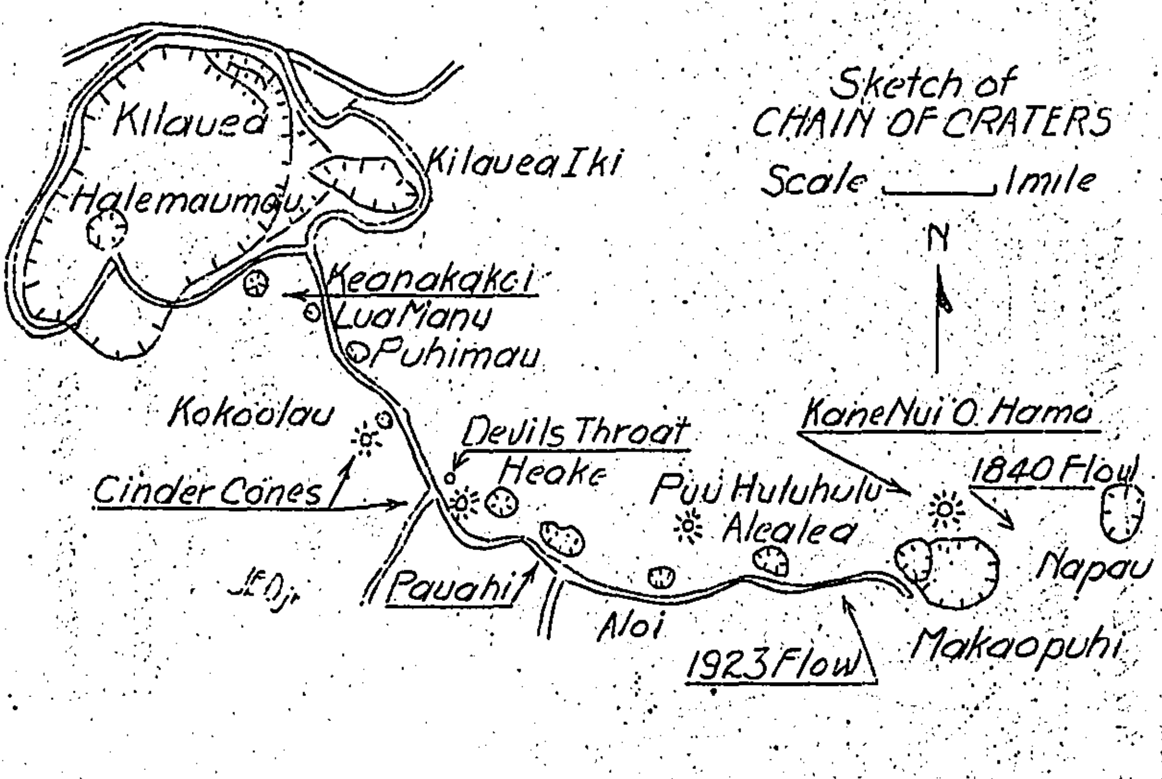
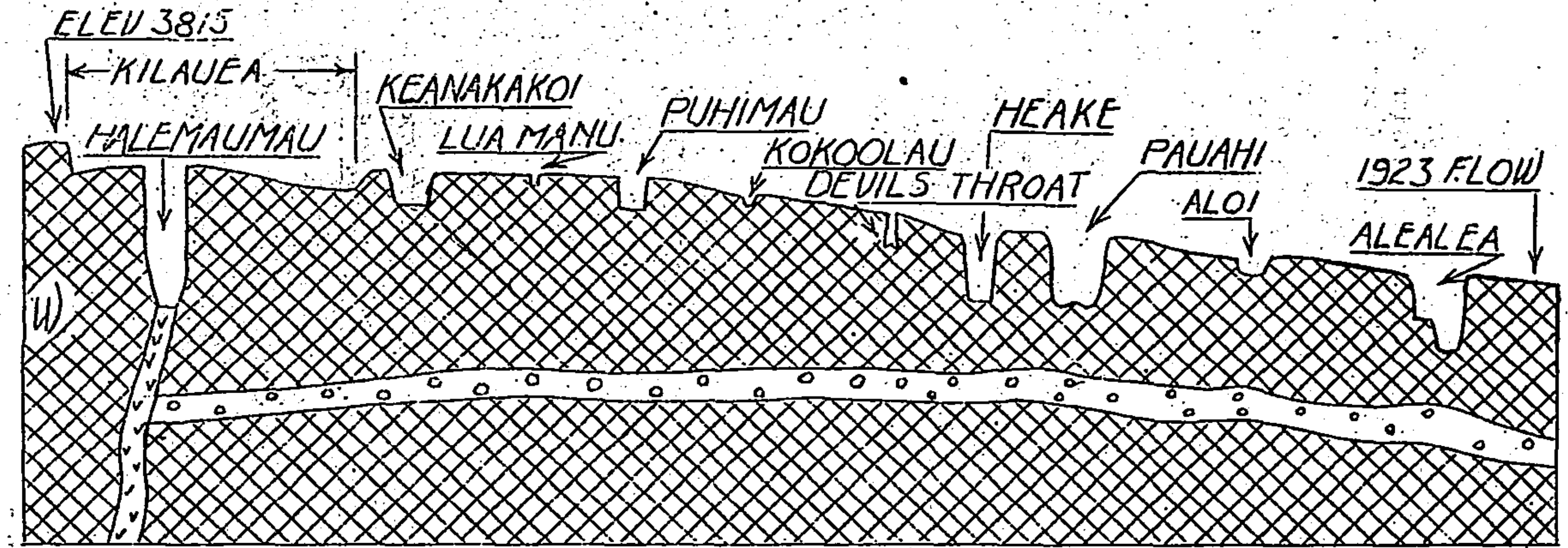
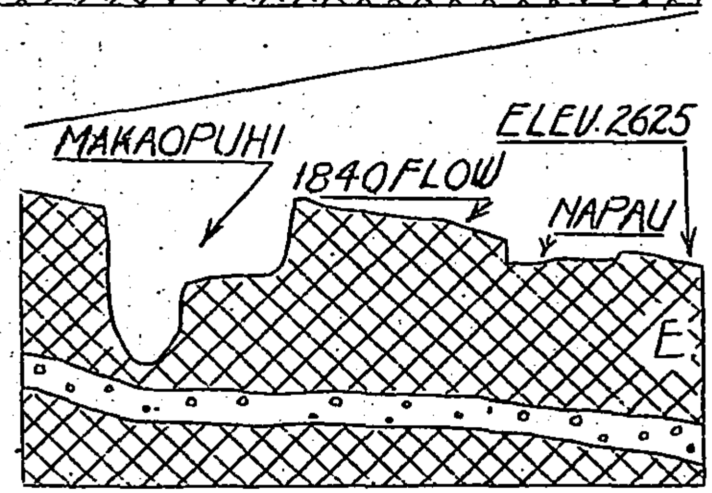


Fig. 1.





PROFILE AND BROKEN LINE CROSS SECTION
OF CHAIN OF CRATERS

SCALE
Horiz. 1 in. = 1 mile
Vert. 1 in. = 1000 ft.

LEGEND
Lava Rock
Conduit of Kilauea
Probable Lava Tube

JED jr

Geologic Features of the Region

These craters represent an important and interesting part of the volcanic activity of Kilauea. They occur along the Puna Rift zone. This rift zone is a crack or series of parallel cracks which essentially divide the volcanic mass of eastern Kilauea into two great blocks. This rift may be thought of as a fracture zone or zone of weakness in the earth's crust; Differential movements between the two blocks have frequently taken place along the rift. The rift zone has been the place of origin of numerous local earth tremors as well as the scene of ancient and recent volcanic activity. In the region of the Puna Rift volcanic activity has made not only pit craters but also cinder cones and surface flows of lava.

The craters are roughly circular, steep-sided depressions in the eastern slope of Kilauea. The largest pit, Makaopuhi, has a maximum diameter of almost a mile and is 950 feet deep. The cinder cones rise above the gradual slope of Kilauea as steep-sided, cone-shaped hills. Puu Huluhulu, the most prominent cone in the park area, rises over two hundred feet above the general elevation of the surrounding area. From the top of Puu Huluhulu one gets an excellent view of several of the nearby pit craters. The cinder cones have been built up by molten lava spattering out of vents in the rift. The scars of lava flows can be distinguished in many places as areas of little or no vegetation, the amount of vegetation depending on the age and thickness of the flow. Ancient flows from this great rift are covered in places by a dense jungle of tropical vegetation. Recent flows support no growth of plants except where the lava is thin in which case plants rooted on the old surface soil beneath the flow have broken through the thin new crusts of black lava.

All of these features of volcanic activity are a part of the activity of Kilauea. Each cone and crater should not be thought of as vents of separate conduits leading to an interior reservoir of molten material but rather as numerous vents of a great subterranean passageway leading from the conduit of Halemaumau, the fire pit of the summit crater of Kilauea, eastward to at least the east point of the island of Hawaii and perhaps even farther eastward beneath the floor of the ocean. Each depression in the line of pit craters shows evidence of having been formed by caving in; the trend of the pits and their caved-in characteristics are strong indications of a great subterranean passageway. The exact nature of the subsurface features of this rift zone will perhaps never be known. In places it is in all probability an actual tunnel of considerable size, in other places a crack and in still other places a fractured or brecciated zone. Regardless of the exact nature of the passageway the rift is a zone of weakness through which molten lava has been forced during periods of Kilauea's volcanic history. On the opposite page is a profile and cross section of the Puna Rift region from Kilauea's summit crater to the eastern boundary of the National Park. The probable subterranean tube is indicated.

The fact that there is a close relationship between volcanic activity along this rift zone and the sinking of lava in Halemaumau is additional evidence of a subterranean passageway in the Puna Rift zone.

Volcanic Activity Along the Rift

In the past ten years there have been three outbreaks of lava along the Puna Rift. Each of the activities was preceded by a subsidence of lava in the fire pit Halemaumau.

During 1921-22 the lava column in Halemaumau rose and subsided three times. The last of the three subsidences - by far the largest- occurred during May 13 to 27, 1922. Following this subsidence Halemaumau was an oval-shaped pit having a maximum diameter of 2000 feet and a depth of 1000 feet. On May 28 molten lava poured into Makaopuhi Crater seven miles east of Halemaumau. The following day lava broke out in Napau Crater two miles east of Makaopuhi. Both of these activities lasted but a few hours. In view of what followed in 1923 one may conclude that the lava in the tube or rift between Makaopuhi and Napau hardened and sealed the zone until such a time when differential movement along the rift would break the seal.

By July 4, 1923 the molten lava column in Halemaumau had risen to a point 127 feet below the pit rim. In August this lava column subsided a distance of 437 feet or to a level 564 feet below the rim. On the 25th of that month a lava flow broke out along a crack just west of Makaopuhi Crater, the scene of the 1922 flow. The 1923 activity being just west of Makaopuhi indicates that the 1922 lava had sealed the rift causing the 1923 lava to rise to the surface between the sealed area and Halemaumau. Park visitors examine the 1923 flow while making the trip along the Chain of Craters Road. Some of the interesting features of the 1923 flow will be described in future issues of Nature Notes.

Following the 1923 flow lava began to rise in Halemaumau and on January 27, 1924 the surface of the molten lake, 2000 feet in diameter, was 121 feet below the rim of the pit. This activity represented a rise of over 800 feet and a volume of new molten lava of over 50 million cubic yards. Between February 15 and 21 this column of lava subsided approximately 280 feet. On April 21 differential movement took place at the extreme eastern end of the Puna Rift. Near the little village of Kapoho the displacement resulting from the movement was sufficiently large to be measured in terms of almost ten feet. On April 28 sudden subsidence in Halemaumau left a pit 1300 feet deep. The faulting or movement at the eastern end of the Puna Rift no doubt opened the rift zone permitting the molten lava to drain from Halemaumau. The great subsidence of lava in the pit was not followed by any outbreak of lava along the known extent of the rift. It is logical to conclude that the rift zone extends along the ocean floor east of Hawaii and that the lava draining from Halemaumau moved through the rift zone to a point beyond the shores of the island. The lava may have broken out on the floor of the ocean beneith a depth of water sufficiently great to conceal the evidence of such a flow of lava.

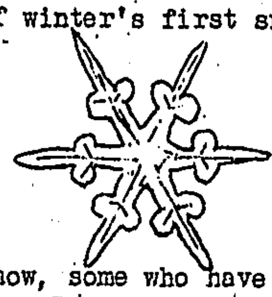
Summary

The great pits along the Puna Rift are depressions made by the caving in of the roof of a great lava tunnel. The debris from the roof of the tunnel has no doubt been remelted and carried along by the various flows moving through the rift zone from Halemaumau. Subsidences of lava in Halemaumau have been followed by outbreaks of lava along the rift. This indicates that there is a great subterranean passageway leading eastward from the summit crater of Kilauea. A temporary blocking of the passage has caused the molten material to rise in the bottoms of some of the pits. The solidification of this lava has resulted in the smooth, flat floors of several of the pits along the chain.

by the Park Naturalist

SNOW IN HAWAII

Many of the readers of Hawaii National Park's Nature Notes have many times experienced that stimulating, exhilarating feeling which is aroused by the first snow-fall of a winter season. In the gray-white darkness of an early winter evening perhaps you have heard the merriment of tinkling voices drifting over a blanket of snow, the merriment that is aroused and carried only by the soft crystal flakes of winter's first snow.



Maybe you live in a land where Jack Frost's artistic hand decorates your window panes with fantastic forms and crystal figures, in a land where it would seem strange not to have snow in winter. If you do it may surprise you to realize that as you read this there are some in Hawaii, also reading this, who have never experienced snow, some who have not even seen it on the distant mountains.

Though occupying a position within the tropic zone, Hawaii too experiences snow on the tops of its highest mountains. During the winter months the tops of Mauna Kea and Mauna Loa, both rising over 13,500 feet above the sea, are frequently capped with blankets of snow - snow-caps which add a touch of beauty to a sunny tropic island. Haleakala, the great volcanic mountain on the island of Maui, at times has its jagged rim decorated with a crown of snow.

One experiencing these tropical snows realizes that snow in Hawaii also gives one a feeling of exhilaration, perhaps a higher degree of exhilaration than the snows of cooler climates, particularly when one stands in the snow at the top of Mauna Loa and looks down the long gentle slope of the mountain to the green fields of sugar cane and tropical palm groves - to the flower-decorated harbor city of Hilo.

The first snow fall recorded on Mauna Loa this season began to fall in the late afternoon of December 1. Precipitation continued for four hours during which time three-quarters of an inch of snow accumulated and covered the bare lava slopes at the top ofthe mountain as well as the floor and high rugged walls of Mokuaweoweo, the summit crater of Mauna Loa.

During the very early hours of December 2 the light of a last quarter moon made weird phantom figures of the volcanic steam rising into the cold thin air - steam rising from the tops of snow-covered cinder cones inside Mokuaweoweo, a crater whose Hawaiian name conveys the meaning of an "island of lurid burning".

To one used to living in a temperature never less then 50 degrees fahrenheit, 22 degrees seems cold, very cold for Hawaii, very, very cold to one who has tried to sleep on the pumice-covered floor of a lava tube at an elevation of 13,000 feet; however, even 22 degrees does not cool ones enthusiastic appreciation of the view from snow-capped Mauna Loa to the somewhat higher snow-capped volcanic ruggedness of Mauna Kea;

even 22 degrees does not destroy ones desire to throw snow-balls at an imaginery lava snow-man. The lava snow-men that can be seen on Mauna Loa have been made by molten materials from the interior of the earth and decorated by the snow from the clouds which encircle the mountain. One has a particular desire to throw snow-balls when at the top of Mauna Loa because it gives one an opportunity to experience the reality of snow-balls in Hawaii.

by the
Park Naturalist
John E. Doerr, jr.

THE COVER

On the cover of this issue is a sketch of the Great Stone Face in Hawaii National Park. This face is at the top of Uwekahuna Bluff; on the west rim of the crater of Kilauea. Looking out over the crater this face has witnessed the liquid fires of Kilauea during many centuries, in fact the face itself is in part the result of the fires of the volcano.

Walking along the ledge directly beneith Uwekahuna Museum one can see the stone face silhouetted against the southern sky. Hawaiian legend describes this stone face as the image of Kamohoalii, brother of Pele, Goddess of Hawaiian Volcanoes. The legends also relate that Kamohoalii is buried at Uwekahuna and that the Goddess Pele has the responsibility of keeping her brother's body covered with volcanic materials. When the rain and wind removes the lava and ash covering Kamohoalii's bones, Pele comes out of her temple, Halemaumau, and deposits a new covering of lava over her brother.

To some of our readers the lettering on the cover may seem like a strange mixture of vowels and a few consonants, but really, they are words - Hawaiian words which mean that this issue of Nature Notes is Volume II, Number 1, January 1932.

Hoolaha means volume, elua means two.
Helu means number and ekahi one.
January translated into Hawaiian is ianuali.
The year, expressed in English with three words,
is beautifully described in Hawaiian in the five
words, Hookahi kaukeni eiwa haneli kanakolukumalua

The sketch and design of the cover is the work of Nancy E. Doerr, the Hawaiian wording is by Ranger E. Brumaghim.

by the Editor

The Volcano Letter

Two dollars per year | Ten cents per copy

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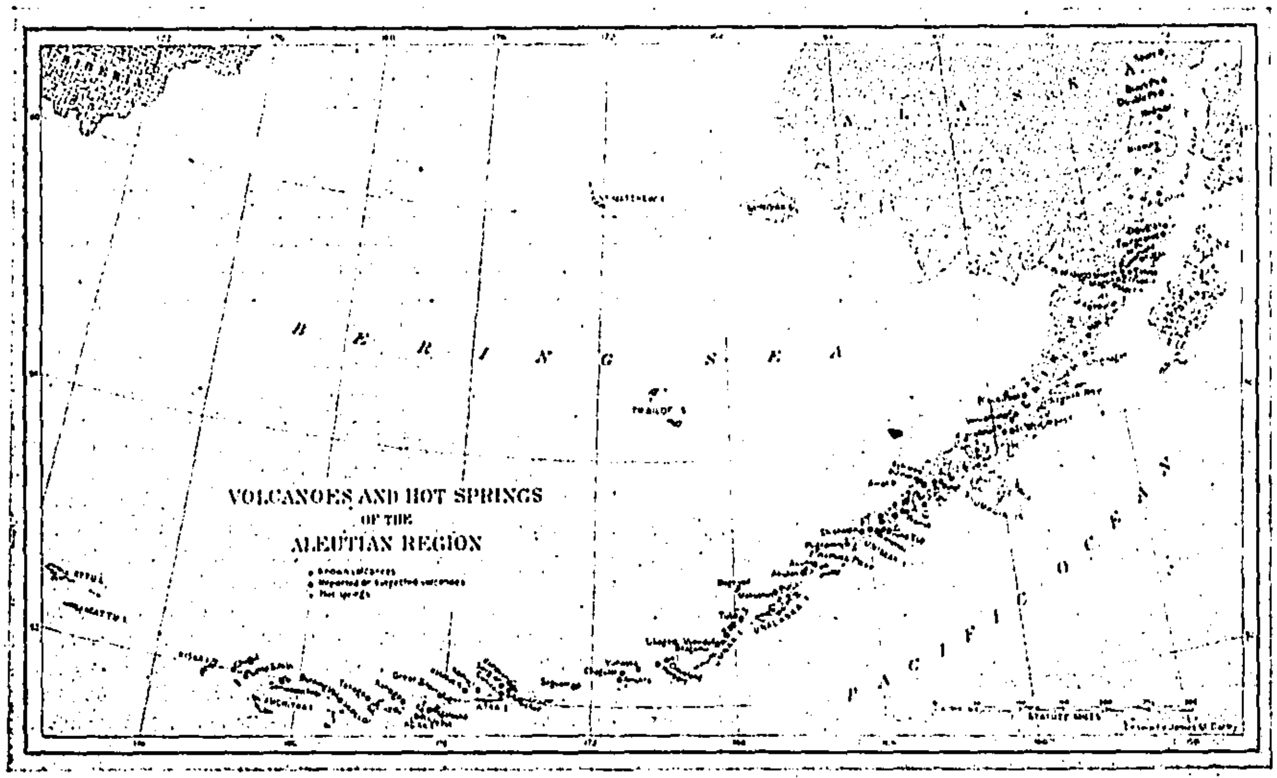


Map of volcanoes and hot springs of the Aleutian region, scale 216 miles to the inch. After Griggs, National Geographic Society, 1922. Black Peak is mislocated at Purple Crater, and Aniakchak is northeast of it.

ALEUTIAN ERUPTIONS 1930-32

Notes on activities in the Aleutian Islands and in the volcanoes on the Alaskan Peninsula were published in Volcano Letter Nos. 246 and 357. The year 1931 appears to have brought to a focus the unrest which appeared in several volcanoes in 1929 and 1930 by producing a considerable explosive eruption from Aniakchak Crater on the Peninsula 45 miles NNE from Chignik. But activity of one sort or another appears to be always present in the restless magma which underlies 1700 miles of arched and faulted Tertiary strata from Mount Spurr to Attu, and if one could picture the ridge in its entirety at any one time, some puffing gas would probably be seen.

Our reports have indicated that Akutan was smoking in 1928 and its lower slopes were covered with ash June 18, 1929. "A mountain to the west of Kanatak" was reported fuming in March 1929, and this description might apply to Chiginagak Volcano on the Peninsula east of Aniakchak. Mount Cleveland and a volcano west of it in the Islands of the Four Mountains were fuming in March 1929 and volcanoes of the Katmai group continued fuming. Shishaldin on Unimak Island was "flaming high" May 28, 1929, and glowing matter overwelled the edge of the crater and rolled down the slopes; it was reported fiery again June 23, 1929, opening three new craters low on the north side. Gareloi in the western Aleutians was said to erupt so violently in 1930 as to change its appearance by lava flows from fissures. To a volcanologist the imperfection of these accounts is their chief baffling characteristic, but the observations of mariners confirm the notion of continuous activity somewhere.

We now come to 1931, when on May 1 Aniakchak erupted, on May 20 Pavlof farther west on the Peninsula made explosions and glow and ashfall, two other volcanoes on the Peninsula were reported fuming, ash from Aniakchak fell a great distance away, and on May 30 a severe earthquake was felt in Attu at the extreme western end of the Aleutian chain.

Our observer at Dutch Harbor, Mrs. Wendhab, reports that Captain Nelson of the Alaska Commercial Company ship "Eunice" passed Tulik Volcano on the east end of Umnak Island March 21, 1931, and its crater was sending up thick black smoke where he has observed only white steam heretofore. He thought its action very unusual and indicative of a coming greater eruption. On March 29 two earthquake shocks of unusual intensity were felt at Dutch Harbor (east end Unalaska). On May 13, 1391, the Umnak eruption was reported by Captain Nelson to be "the volcano on the east end of Umnak Island, fourth peak northwest from Tulik Mountain, pouring out black smoke and heavy clouds of steam," a place that has been dormant until recently. A singular note by Mrs. Wendhab at this time states that Mount Makushin Volcano in the northwest part of Unalaska Island, which has been very active, is now ominously quiet, causing worry." Makushin is usually a crater of quiet steam depositing sulphur. The eruptions of Shishaldin, Pavlof, and Aniakchak are reported by the radio operator at Squaw Harbor on Unga Island in the Shumagin group south of the Alaskan Peninsula to produce a particularly vicious type of static, interfering with radio communication over a wide area.

While not connected with volcanic happenings, it may be of interest to the meteorologists to know that Attu experienced September 30-October 2, 1930, a terrific northwesterly gale for three days, with barometer at 26.40 inches. Two native sod houses and Government buildings were demolished. A still stronger gale in January 1931 was the worst in the history of Attu Island, according to the natives, and drove seas into Chichagof village.

Captain Nelson saw fire issuing from Bogoslof October 31, 1931, and found qauntities of pumice near Umnak Island south of it. This observer believed Bogoslof to be continually smoking, according to his experience, but the "fire" was unusual.

The Eruption of Aniakchak

Aniakchak Crater is one of a chain of remarkable volcanoes spaced out rather evenly about 40 miles apart in the Alaskan Peninsula between Port Heiden on the north and Chignik Bay on the south. Beginning at the southwest end of the series west of Chignik and going northeast, these are Veniaminof (8400 feet), Purple Crater (3020 feet), Aniakchak (4200 feet), Chiginagak (7020 feet), and Mount Peulik (4080 feet). Veniaminof and Chiginagak are covered with glaciers. Aniakchak Crater was mapped by Sargent, described first by W. R. Smith (Professional Paper 132 U. S. Geological Survey, 1925), and mapped geologically by R. S. Knappen (Bulletin 797-F U. S. Geological Survey, 1929). Knappen's colored map is copied in half-tone herewith and shows the even spacing of Veniaminof, Purple Crater, and Aniakchak, and the vast size of the crater bowls, as well as their circularity. Aniakchak Crater has a maximum diameter of six and three-quarter miles, the lowest part of the crater floor is 1100 feet above sea level and contains Surprise Lake, two square miles in area. The walls rise almost vertically 1200 feet to 3000 feet above the bottom of the crater. A large truncated cinder cone rising 2200 feet above Surprise Lake occupies the south central part of the crater floor. Aniakchak River breaks through the east side of the rim of the great crater in a picturesque canyon named "The Gates." The area of the bottom of the crater is 30 square miles. Upper Jurassic sedimentary rocks with fossils occur in the canyon and also quartz diorite, overlaid by layers of lava and agglomerate, while all the valleys of the surrounding country are covered by thick deposits of ash, pumice, and agglomerate. Much of the lava is obsidian.

In the National Georgaphic Magazine for September 1931, Father B. R. Hubbard presents a wonderful series of pictures of the Aniakchak and Veniaminof country made from photographs taken during an exploration in the summer of 1930. Among the most remarkable of these is a picture of curving colunar structure in obsidian, and another of a subordinate crater of crescent shape in the northwestern part of the larger bowl containing an inner cinder cone from which about eight festooned dark-red basaltic lava flows radiated. The festoons were crevassed in concentric arcs. This secondary crater was investigated and hot fumaroles were found, some of which followed a fissure up the sides of a cliff and yielded steam hot enough for cooking. There were multicolored crystals and incrustations surrounding the vents, and solfataric odors of volcanic gases were perceptible. Near Surprise Lake on the west side there is a warm soda and iron bicarbonate spring, and this stains much of the lake shore with orange color. The presence of the warm springs and the hot solfataras indicated that Aniakchak was not dead but sleeping.

Explorations by Father Hubbard in the summer of 1931 (Saturday Evening Post January 2 and 16, 1932) discovered that an observer at Meshik, 20 miles west of Aniakchak, on May 1, 1931, at 10 a. m., saw a dense column of steam shooting up from the volcano. This rose for two hours in billowing clouds, followed by a big blast at noon. A dense black cloud rose over 20,000 feet, spread out like a mushroom, and started to descend. The earth shook, and there was a fiery display of lava bombs making trajectories. Lightning and thunder were added to incessant detonations from the volcano, accompanied by the crash of falling rocks. Then came light cinders at first the size of peas and then larger. Eruptions continued until May 11, when a final blast made it pitch dark for several hours at distances 60 miles away. There was a field of floating pumice with individual blocks 9 or 10 inches across in individual patches five miles in diameter on Bristol Bay, north of the volcano. Dense clouds of gas and smoke continued to rise, and another major eruption May 20 made detonations heard 200 miles away. For several days more the Ugashik cannery, 53 miles NNE from Aniakchak, reported rumbling like distant surf.

At Chignik the fall of ash was reported a pound per hour for each square foot 45 miles SSW from the source. At Ugashik the ashfall was heavier, and in the country between Kodiak and the head of Bristol Bay a mantle of ash a quarter inch deep was formed. Light ash fell in the interior of Alaska at distance of 300 miles. There was much loss of life among wild animals. There were many showers of pisolitic mud balls, and the neighboring snow-covered country and the glaciers were buried under a gray pall.

When the volcano was visited at the end of May, there were clouds of blowing dust and many dust whirlwinds. Everything was covered with ash. The vegetation was gone. Black cinders became coarser at the crater. The water of all streams was muddy. The central inner cone had a crack in its side and gas clouds rising on top. Surprise Lake was choked and muddy. The explosion vent had formed a new crater under the northwest rim, whence rose yellow and brown gas and clouds of steam. A new lava dome was being pushed up above the crater floor, showing large, tumbled blocks. This was like Novarupta at Katmai. Beside the dome was a deep pit. Hydrogen sulphide was strong. Occasional puffs of brown smoke rose with a rumble from the new vent. The interior of this vent was found to be highly colored with yellow, red, and brown stains, and several pits more than a mile in circumference had formed in the crater floor. Quantities of vapor rose from the new lava dome. The ground was very hot near the vent, more than 200° C., and there were green deposits and signs of hydrochloric acid. There were many impact craters made by falling bowlders. The lava dome lay in the center of a depression three miles in circumference. The lava moved somewhat, there were falls of blocks, and there was much sulphur. In an airplane flight, Hubbard noted that Veniaminof Volcano, with its great circle of glaciers, which he had seen the year before snowy white, was completely mantled with dark colored ash. It may be noted in passing that Hubbard reported in his National Geographic article that an ascent to the edge of Veniaminof Crater was made from the north side, and that this crater, which is known to the natives as Black Peak, and is full of ice, was smoking in unusual fashion in the summer of 1930. The source of this smoke was found to be a cone in the center of the ice, "smoking on two sides of its upbuilt rim from slag heaps of lava, and now and then coughing out black ashes over the surrounding white snow." The ice had impressive chasms where the heat had melted the glacier. There were layers of black volcanic ash and sand a few feet thick alternating with glacial ice more than 20 feet thick. Hubbard suggested that some time-scale of Veniaminof's eruptions might be interpreted from such exposures.

On May 2, 1931, the radio operator at Kanatak, 90 miles NE of Aniakchak, reported ashfall there. On May 13 the ash from Aniakchak was more than a half inch deep and very black, falling continuously at Squaw Harbor in Unga, approximately 140 miles SW of Aniakchak. The Katmai group of volcanoes was reported to be active at this time. The Aniakchak ash that fell at a great distance was fine as flour. On May 12 a freighter at sea off the Aleutian Islands received a fall of sand during a storm (locality not given).

Later Eruptions

Captain Nelson of the "Eunice" brought word on January 18, 1932, that Mount Cleveland on Chuginadak Island, a peak 8156 feet high, approximately 150 English miles west of Dutch Harbor, had again broken into eruption, starting about January 1, 1932. It was reported to him that seven great puffs had occurred in one hour, the volcano sending up very dense smoke. Generally only a little steam had been seen at the crater during previous visits. He passes these islands of the Four Mountains three or four times a year in his trading trips for the Alaska Commercial Company. He was suprised to see such dense volumes of black fume when he passed the island in early January, the sky being continuously darkened.

On February 10, 1932, a radio from John Gardner in False Pass informed me that Shishaldin erupted February 1, 1932, the outbreak lasting for several days with glowing material flowing down the mountain. A newspaper dispatch of February 4 called this eruption the "most violent and spectacular seen in the past century" for this volcano. The report from Squaw Harbor described "streams of lava flowing down the sides," but this glowing material is quite as likely to be trains of red-hot bowlders for these Aleutian cones. A strong wind carried the ashes many miles northward over the Bering Sea. A dispatch of February 16 said that Shishaldin had again renewed its activity with boomings coming from the creater at two-minute intervals, the volcano hurling hot rocks thousands of feet into the air.

The general map of the Aleutian belt reproduced herewith shows the distribution of volcanoes as compiled by Griggs (Valley of Ten Thousand Smokes, by Robert F. Griggs, National Geographic Society, 1922, page 60). This will give some idea of the great number of active cones along this curved line, and the geological map by Knappen shows how characteristic are the big volcanic heaps lying in a line adjacent to the coastal plain of Bering Sea on the northern side of the Aleutian ridge. This arrangement extends far to the west in the islands, where, for examples, in both Unalaska and Atka the north half of the island is volcanic and the southern half consists of older rocks. Here in the Aniakchak region the belt of mountains southeast of the volcanoes reaches heights rarely exceeding 3000 feet and consists of gently folded Jurassic and Tertiary rocks, which contain fossil plants and shells, and are overlaid by old volcanic rocks which probably date from the Miocene. The slope under the Pacific to the south reaches abysmal depths, the slope to the north, from Unalaska eastward, is very flat to a shallow sea. The line of volcanoes apparently represents a tension crack at the edge of this shallow fill of Bering Sea, through the folded strata, and following in plan a singularly perfect curve for several hundred miles. To the south of the region here considered there is a trough under the ocean parallel with the Pacific shore more than 20,000 feet deep.

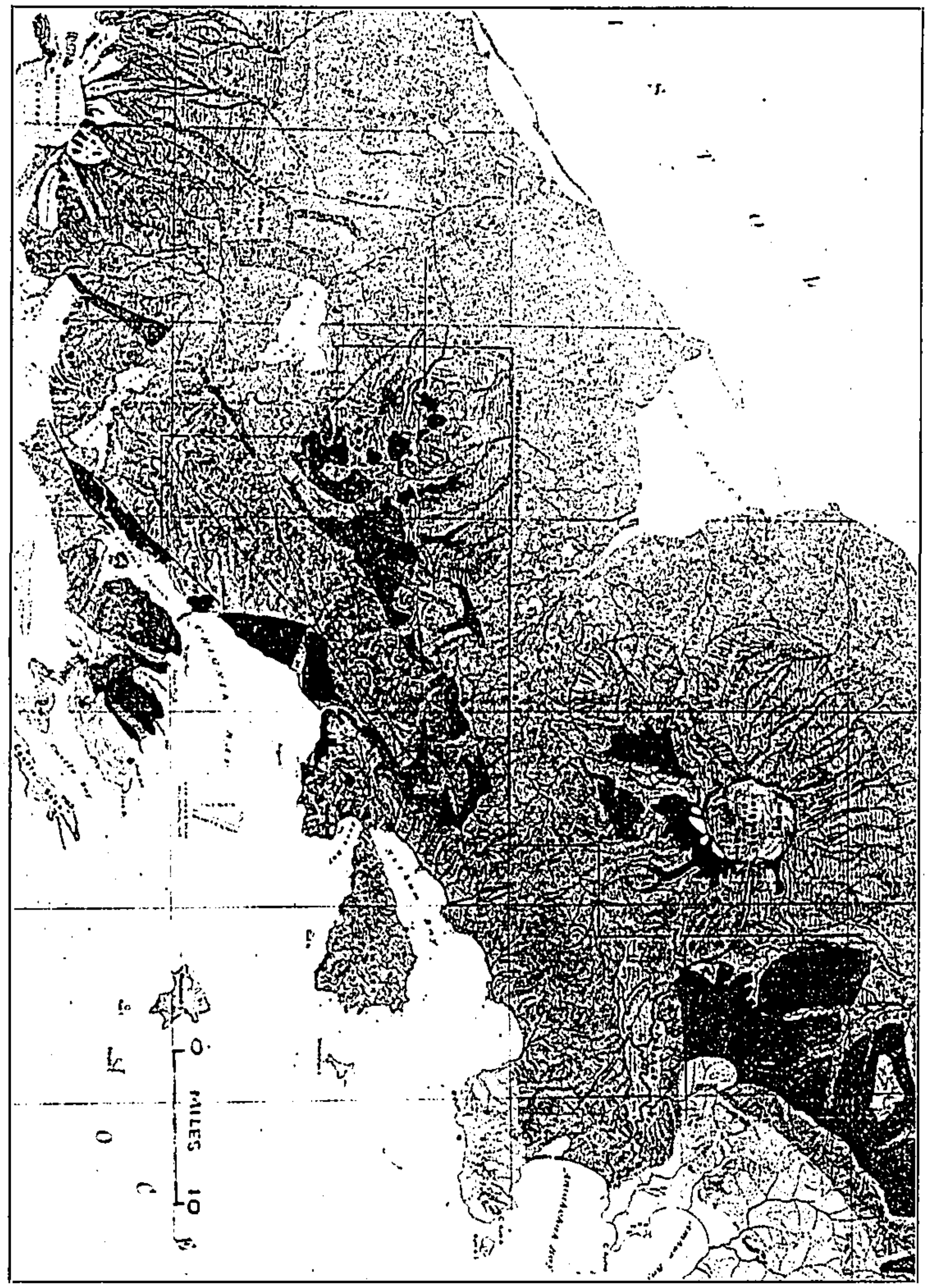
T.A.J.

KILAUEA REPORT No. 1049
WEEK ENDING FEBRUARY 28, 1932

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge.

On February 22 at 9:15 a. m. dust from a slide at Halemaumau pit was seen and another slide was reported at the northeast wall the afternoon of February 21. Blue fume rose from the floor at two places west and southwest. Cracks on the northeast rim continued widening, one of them as much as one-half inch. On February 23 a small slide from the rim at the north wall occurred at 9:55 a. m., cracks SW showed slight widening, and cracks NE and N showed slight to strong widening. February 24 at 9 a. m. fume appeared to have increased and a new crack was found back of the north wall. On February 26 crack No. 31 NE had widened one-qaurter inch in four days. On February 28 after much rain, fume was pronounced SW and much steam rose from the floor.

At the Observatory instruments 45 tremors were recorded, one of them indicating distance exceeding 14 miles. Of nine very feeble shocks, three indicated origin distance 2 miles, two 3 miles, three 4 miles, and one 9 miles. Two feeble shocks of the felt class occurred. One of these February 23 at 1:30 a. m. indicated origin distance 2 miles. One during the noon hour February 26 indicated origin distance only 1 mile. Microseisms caused by windy weather were strong except on February 24 and 28, when they were moderate. Tilting of the ground was moderate SW.



Geological map of Aniakchak district copied from a colored sheet. Geology by R. S. Knappen (Bulletin 797-F, U. S. G. S.), topography by R. H. Sargent. Scale 11 miles to the inch. The three circular areas at the northwest are the volcanoes Aniakchak, Purple Crater, and Veniaminof. Surveyed in 1922-23. The faulted belt at the south and the dark area northeast are Jurassic to Tertiary sediments.

THE VOLCANO LETTER

The Volcano Letter combines the earlier weekly of that name, with the former monthly Bulletin of the Hawaiian Volcano Observatory. It is published weekly, on Thursdays, by the Hawaiian Volcano Research Association, on behalf of the section of volcanology, U. S. Geological Survey. It promotes experimental recording of earth processes.

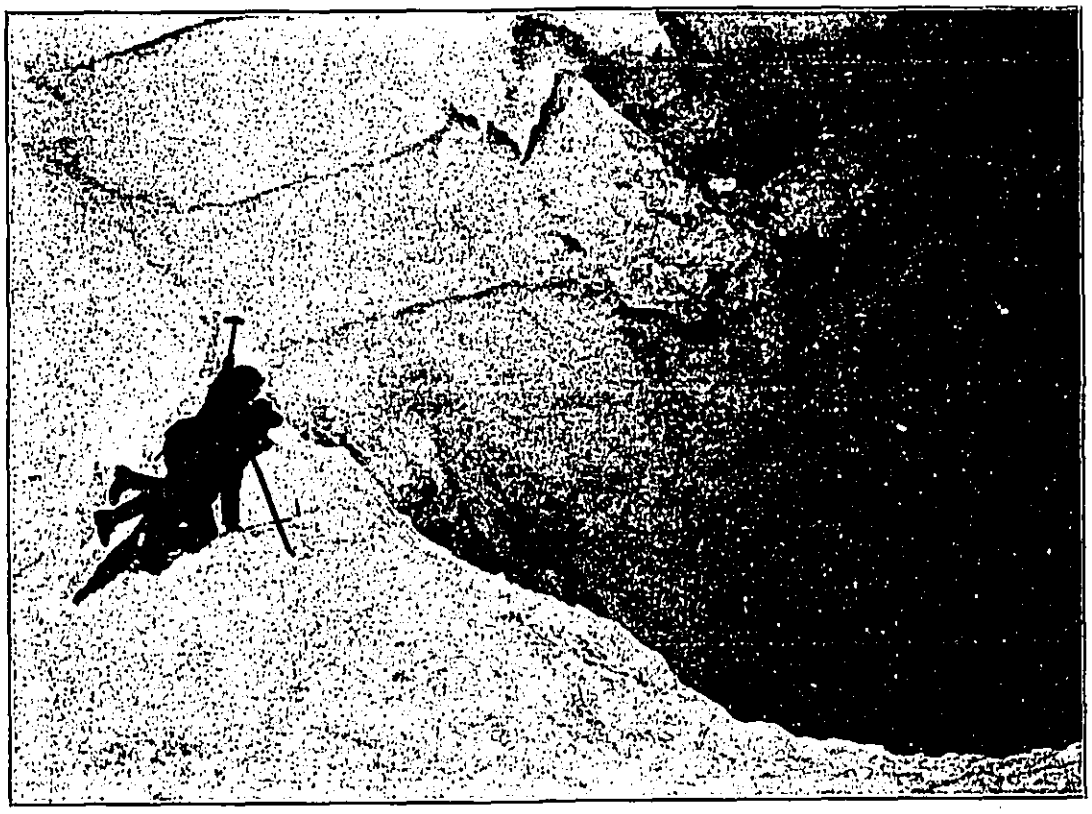
Readers are requested to send articles, photographs, publications and clippings about volcano and earthquake events, instruments and investigations, especially around the Pacific.

Subcription for non-members two dollars per year of 52 numbers. Address the Observatory.

The Volcano Letter

Two dollars per year Ten cents per copy

No. 376—Weekly Hawaiian Volcano Observatory, National Park, Hawaii March 10, 1932



Crater in ice of Makushin Volcano, Unalaska Island, photographed in 1907, and resembling the snow crater on Mount Baker described by Rusk in 1903. Photo Jaggar.

NOTES ON VOLCANOES OF THE CASCADE RANGE

For purposes of the volcanologist, every bit of information concerning craters or heat on mountains known to be volcanoes is of value. In Volcano Letter No. 363 there was published a review with maps concerning some of our northwestern volcanoes other than Lassen Peak. In "Tales of a Western Mountaineer" (Houghton Mifflin 1924) Mr. C. E. Rusk publishes notes made during mountain climbs on some of these volcanoes which are unusual and worthy of quotation.

The crater of Mount Baker or Kulshan is illustrated by a photograph taken about 1900 by the party of John A. Lee. This shows a circular crater opened through snow and ice, with fume rising, and with crevasses extending up a smooth nevé above it. In 1903 Rusk climbed the east side of the main peak of Mount Baker accompanied by George G. Cantwell. They went to Morovits Ranch, and camped at the timber line. The whole east side of the mountain is forbidding and covered with snow and ice. There are two peaks of which the southern is the lower. When well up the slope, on glancing upward, they saw large volumes of smoke rolling from between the two peaks. When they reached the top, it appeared that for several hours the smoke from the crater had been hidden from them by the south shoulder of the main peak. As they emerged from the chimney there burst into view a most thrillingly weird spectacle.

In a bowl-like depression immediately between the two peaks of Mount Baker there was a great orifice in the snow, perhaps 50 feet across. The west side was partly blocked with snow so that the opening was somewhat half-moon shaped. Two hundred feet away a semicircular crevasse swept halfway around the pit. Up from the unknown depths of this abyss black fume boiled out. It drifted away, guided by the shifts in the wind currents, until it dissolved in the upper air. Mr. Rusk speaks of the wild, unearthly loneliness of the scene, which "impressed us profoundly, for its counterpart perhaps does not exist on earth."

This description is astonishingly like that of the ice crater containing sulphur on the summit of Makushin Volcano in Unalaska (Page One). This was photographed and described by the reviewer, and the picture published, in 1908 (Technology Review, Boston, Vol. X, No. 1, Journal of the Technology Expedition to the Aleutian Islands 1907, by T. A. Jaggar, pp. 11-12). "The rim of the greater crater of Makushin was finally reached at 12:45 July 3, 1907. Within was an expanse of snow, probably two miles in diameter, through which three or four steaming vents have maintained openings. We saw a steaming cavity ahead to the right. Examination proved this to be a new crater opening, a vertical cavity in the snow, 75 feet in diameter, with a 300-foot wall of bedded ice and snow behind it and sulphurous steam incessantly rising through it. A great tumble of snow or ice blocks rested in front of it, and, where the steam drifted across these, their white surfaces were yellowed with sulphur. An inner cone of bowlders and sand was seen beyond this pit and south of it. This was visited and found to contain a crater some 2,000 feet in diameter, with very active solfataras working on its northern side, and sulphurous coatings about the vents."

Rusk's climb was 11 hours from the timber line to the top of Mount Baker, and was presumably early in the season of 1903. When photographed in August 1906 by F. H. Kiser, the crater gave no sign of snow orifice, nor of smoke. There was only a slight depression in the snow and the remnant of a crevasse. Professor George Davidson saw Mount Baker in very active eruption in the early fifties.

Mount Rainier or Tacoma Volcano is described by Rusk as having a great crater from a quarter to a half mile in diameter inclosed by bare cliffs 30 or 40 feet high. The bottom is filled with snow which makes of the interior a comparatively level field. Around the rim are many small vents in the rock, from which jets of steam issue. In places, and at times, this steam melts the snow, leaving cavern-like fissures between the snow and the wall of the crater. The highest point of Mount Rainier is a dome of snow just west of the crater. Mr. Rusk writes: "I crossed the crater alone. On the farther side I was surprised to find lichens clinging to the bare rock surface. I found a jet of steam issuing from a small hole in the sloping face of the rock. I stooped to see if I could detect any odor coming from the place and received a little steam-scald for my pains. The rocks were quite warm, and I have no doubt one could place a frying pan over some of these orifices and there do considerable elementary cooking. I scrambled out of the crater and a short, easy climb brought me to Columbia's Crest, the actual summit."

Glacier Peak is a volcano 10,400 feet high, easy to climb, and Mr. Rusk reached the summit at 11 a. m. The old crater is directly on top, from one-quarter to one-half mile in diameter, broken down in many places, leaving craggy pinnacles around the circumference. One of these on the southern edge is the summit. The crater is filled by a big snow field. On the east the snow feeds into a great ice-fall, the chief branch of Cool Glacier. This peak was climbed by I. C. Russell, and is not described as steaming.

In the case of Mount Hood, the only mention of heat by Mr. Rusk is described from the summit, when, looking far below, near Crater Rock, he saw big jets of steam rising into the air and drifting upward to mingle with the fleecy clouds that were idling across the face of the peak.

During the exploration of Mount Adams, Rusk mentions on the north side a dry stream course that produced a glacial torrent. This started running in the middle of the afternoon, kept flowing part of the night, and was dry the next morning as a daily occurrence which is not explained. This is a part of the Klickitat drainage.

Going up Mount Adams by the southern way, Rusk's party found thousands of dead grasshoppers on a snow-filled saddle south of the first summit. There were also other insects as well as a humming-bird and a duck, each occupying its own little depression in the snow. Rusk states on different occassions, while climbing Mount Adams, he had found numbers of such birds and insects; and once his party found a dead mouse at an elevation of nearly 12,000 feet. One often finds live spiders crawling over the snow at high altitudes, and sometimes, but not often, live butterflies and other insects are seen. Rusk believes that the dead organisms are accounted for by gales of wind, or else during high flights these creatures are blinded by snow, when they fall bewildered and chill to death. It is an interesting question whether there could be any volcanic carbon dioxide or other gas to asphyxiate the insects.

From the pictures reproduced, the Klickitat Glacier must occupy the former crater of Mount Adams, between the summit and the Ridge of Wonders. Professor H. F. Reid, who has climbed among these volcanoes, expressed the opinion that some fused fragments of rock appeared less than 100 years old (Rusk, page 98).

The following are Mr. Rusk's comments on heat in the crater region of Mount Shasta. When he was turning down from the summit, in 1923, he writes: "I had read much of the so-called boiling sulphur spring, and when we were a short distance down the talus slope, a little to the west of where we had come up, we heard a mighty gurgling roar and saw steam rising from farther down the slope. This subterranean cataract appears to start well up the talus slope and only a little below the highest summit of the mountain. It rushes down nearly to the foot of the pinnacle and apparently turns and disappears along a depression between the main summit and another near-by peak just to the south. From the noise it makes, there must be a veritable river of it, and it is certainly forced upward through some internal chimney from a cauldron in the heart of the mountain. The whole thing would doubtless be invisible, had not visitors pricked its outer covering. The underground channel is overlaid by several inches of what seems to be a blue clay. Wherever holes have been gouged in this by the points of alpenstocks or other sharp insturments, the boiling water bubbles through, making animated little springs from which the steam floats away. We saw several of these. The loose rocks on top are so hot that it is hardly possible to hold the hand on some of them, and the whole clay surface is uncomfortably warm."

"I caught some of the boiling water in my cup and the taste was agreeable and rather sour, resembling lemonade. I drank a considerable quantity and suffered no ill effects. On the little flat just below where we sat were several rock inclosures that had been piled up for shelter by men who had spent one or more nights at this place. Even in a severe storm it is possible for a man to survive, as the heat of the rocks on the slope above the boiling spring would keep one from freezing." T.A.J.

TILTING OF THE GROUND FOR FEBRUARY

The following figures show the net amount of tilt by weeks at the Observatory on the northeast rim of Kilauea Crater, and its direction computed from the daily seismograms, by platting a curve smoothed by overlapping seven-day averages. This is the departure of the plumbline in seconds of arc, in the direction given.

February 2-8	1.4 seconds	SE
February 9-15	1.6 seconds	SW
February 16-22	2.0 seconds	SW
February 23-29	1.8 seconds	S

E.G.W.

KILAUEA REPORT No. 1050

WEEK ENDING MARCH 6, 1932

Section of Volcanology, U. S. Geological Survey

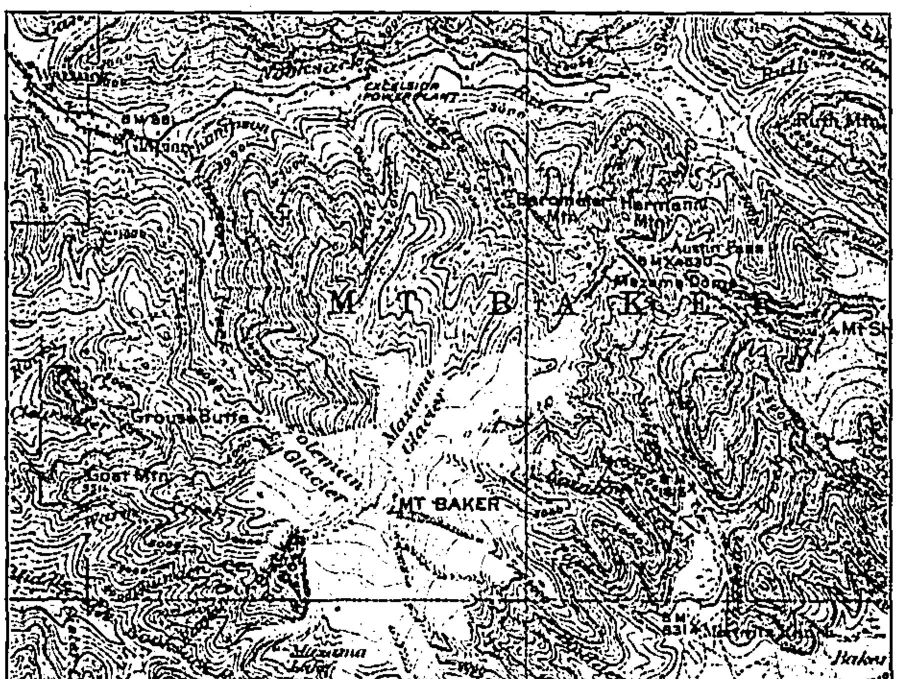
T. A. Jaggar, Volcanologist in Charge.

The widening of crack No 31 NE at the edge of Halemaumau pit has resulted in a crisis of collapse at that portion of the rim. On February 29 there was an avalanche at the northeast wall at 10:17 a. m., and the block in front of crack No. 31 appeared to be instable to judge from the continued widening of the crack. Fume was rather dense under the southwest talus. After a slight earthquake generally felt at 4:43 a. m. March 3, there was seismographic evidence at Halemaumau of strong ESE tilt. The cracks had continued widening and the northeast rim was roped off after an avalanche at 2:10 p. m. There were other avalanches during the day. Fresh debris lay under the northeast wall.

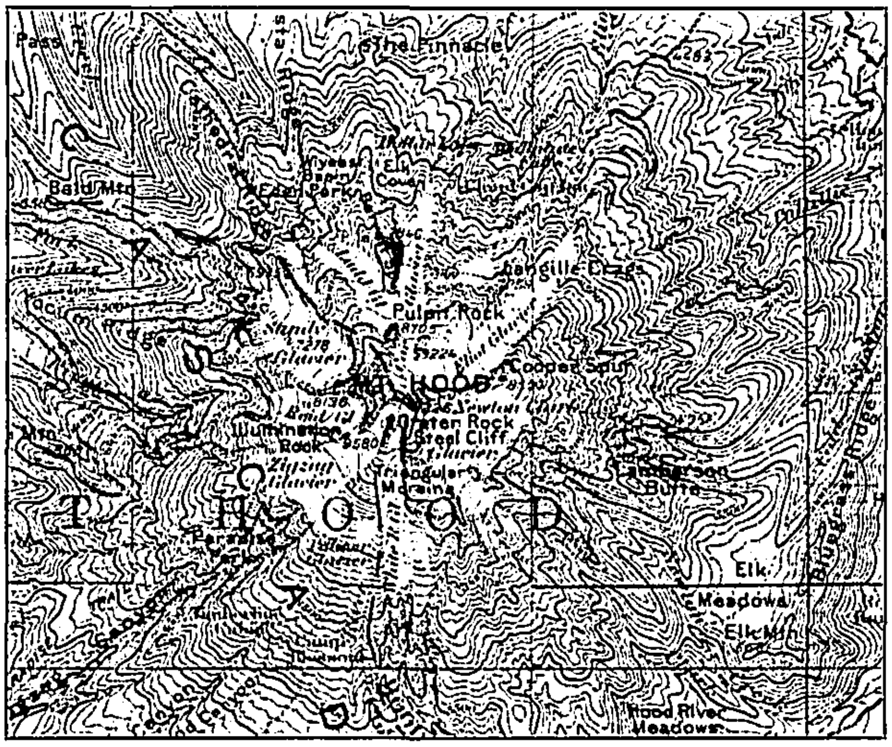
March 4 produced an unusual seismic crisis at Halemaumau and the development of glowing cracks in the January floor. The quaking spasm, which began about 12:53 p. m. and continued for six hours, was strongest for the first hour and a half, and produced eight felt shocks, and much continuous tremor. A visit to the pit showed fresh scars of slides at the west, north, and east walls and small slides were tumbling northeast. Fume was denser than usual, with sulphur odor. There was a large avalanche NE at 2:15 p. m. and others during the afternoon, as well as one NW. Crack No. 31 NE had widened one-half inch in a day. After nightfall two of the deeper cracks in the edge of the lava floor on the east side of the south bay showed distinct glow as though the seismic stress had warped open the thick shell over the still hot January lava.

March 5 produced culmination of the northeastern opening of rim cracks by collapse of the wall. At 11:10 a. m. much new debris was seen under the northeast wall and a small avalanche occurred there. There were numerous fresh cracks, back of the older ones which had been measured. The rim itself had fallen in as far back as the measuring point at crack No. 31. E. G. Wingate ran levels from the sandspit mark in the south end of Kilauea Crater to the northeast rim of Halemaumau and discovered this rim had risen 1.3 feet since the first half of September 1931. This means a swelling upward of the inner dome of the Kilauea floor to accompany the opening of rim cracks. At 3:28 p. m. a section of the northeast rim 500 feet long and 50 feet deep horizontally collapsed in a tremendous avalanche, measuring points Nos. 2, 31, and 35, the danger sign, and the protecting rope were all carried away, and the material overlapped the 1932 lava floor for a length of about 200 feet and a width of 20 feet. Most of this fell after Saturday noon March 5, but the measurements represent the total loss as seen at 9:30 a. m. March 6. The avalanche was accompanied by a small earthquake. Blue fume continued vigorous SW and slight fume rose from the glow cracks which were incandescent as before. A northern slide occurred at 10 p. m. March 6.

The Observatory registered 125 seismic disturbances for the week, including one moderate, 8 slight, 2 feeble, 37 very feeble shocks, and 77 tremors. Of these the spasm of the afternoon of March 4 from 12:53 p. m. to 6:44 p. m. included 1 moderate, 7 slight, 2 feeble, and 31 very feeble earthquakes, and 16 tremors. This spasm indicated mostly



Map of Mount Baker in Washington, scale four miles to the inch, contour interval 200 feet. Surveyed 1907-09, U. S. Geological Survey.



Map of Mount Hood in Oregon, scale two miles to the inch, contour interval 100 feet. Surveyed 1924, U. S. Geological Survey.

a seismometric distance of two miles, corresponding to the distance of Halemaumau. Other indicated distances of the week were 3, 4, 7, and 9 miles, some of which may have been variation in depth under the Halemaumau center. A very feeble shock of 11 p. m. March 1 was felt at Kapapala and the slight shock of 4:43 a. m. March 3, with indicated distance of seven miles from the Observatory, was generally felt on the east side of the island. Microseismic motion was moderate to weak, and tilting of the ground was moderate S to SSE: this tilt was strong for two days prior to March 4, and there were sudden tilts during the earthquake swarm.

THE VOLCANO LETTER

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HAWAIIAN VOLCANO OBSERVATORY
Founded 1911

This laboratory at Kilauea Volcano belongs to the Hawaiian Volcano Research Association and is leased and operated by the United States Geological Survey.

It maintains seismographs at three places near Kilauea Volcano, also at Hilo, and at Kealakekua in Kona District. It keeps a journal of Hawaiian volcanic activity and publishes occasional Bulletins.

Membership in the Hawaiian Volcano Research Association is limited to patrons of Pacific science who desire personally to aid in supporting the work.

The work of volcano research so supported is in collaboration with the work of the United States Geological Survey, but supplements it with buildings, research fellows, instrumental plants, explorations and special investigations for which there is no governmental provision. The Geological Survey maintains volcano stations in Alaska, California and Hawaii.

The Board of Directors includes Arthur L. Dean, President; Frank C. Atherton and Walter F. Dillingham, Vice-Presidents; L. Tenney Peck, Treasurer; Wade Warren Thayer, Richard A. Cooke and Wallace R. Farrington.

Persons desiring application blanks for membership ($5.00 or more) should address the Secretary, Hawaiian Volcano Research Association, 320 James Campbell Building, Honolulu, T. H.

The Volcano Letter

Two dollars per year | Ten cents per copy

No. 377—Weekly | Hawaiian Volcano Observatory, National Park, Hawaii | March 17, 1932

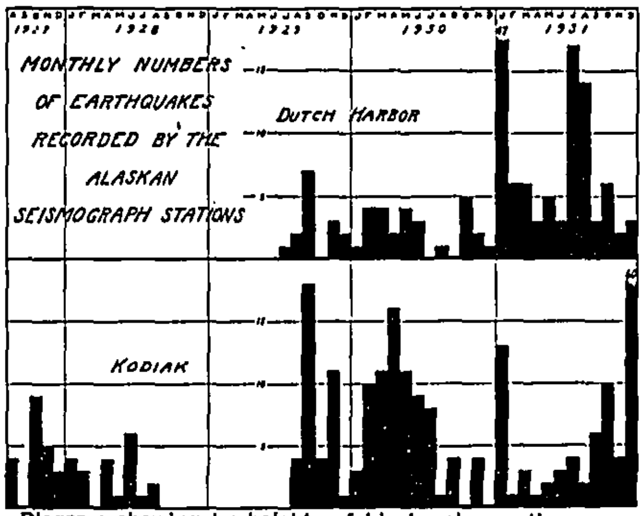


Diagram showing by heights of black columns the comparative frequency of Aleutian earthquakes, by numbers of shocks, per month, at Kodiak and Dutch Harbor (Unalaska) seismograph stations of the Section of Volcanology, U. S. Geological Survey. A. E. Jones.

EARTHQUAKES RECORDED AT THE KODIAK AND DUTCH HARBOR STATIONS

The United States Geological Survey is interested in the seismic activity of the Alaskan volcanoes. Towards that end the Section of Volcanology has placed two seismograph stations at strategic positions. As these places are more than 600 miles apart, neither records the smaller earthquakes local to the other. To facilitate a study of these records, a map of the Alaskan Peninsula and the Aleutian Islands has been prepared which is shown on Pages Two-Three. On this map circles of successive 50-mile distances have been scribed about the two stations. These 50-mile zones aid in the rough location of the earthquakes. With better earthquake reception, or more stations, closer positions could be given. These records are for the purpose of reconnaissance only.

Kodiak Earthquake Registration

The seismograph at Kodiak, Alaska, was put into operation early in August 1927 and was kept in operation until September 1928. It is at the former Agricultural Experiment Station on the hill back of Kodiak village. During this period of 13 months, 35 earthquakes were recorded. The majority of these were local to the Alaskan Peninsula. Fourteen of these quakes originated at distances of 100, 115, and 127 miles and could be attributed to either the nearer active volcanoes of the Aleutian Range or to the steeper part of the ocean bottom. There was one of 520 miles distance, reported from the Yakutat Bay region. Fifteen were teleseisms that were outside the North Pacific area. The remaining 20 shocks were at unassignable distances, but show by the quick period of the long waves that they were local to that area. Probably the 200-mile circle would include them all. Lacking an attendant the station was discontinued for a year.

The next series of records of the Kodiak station begins in the middle of August 1929. During the five months of 1929, six earthquakes were recorded from distances of 20 to 60 miles, two of which were felt by many persons. Thirty-one shocks were recorded that were not teleseisms but show distances of origin otherwise indefinite, but are probably not farther away than 200 miles. There are no teleseisms listed for that period.

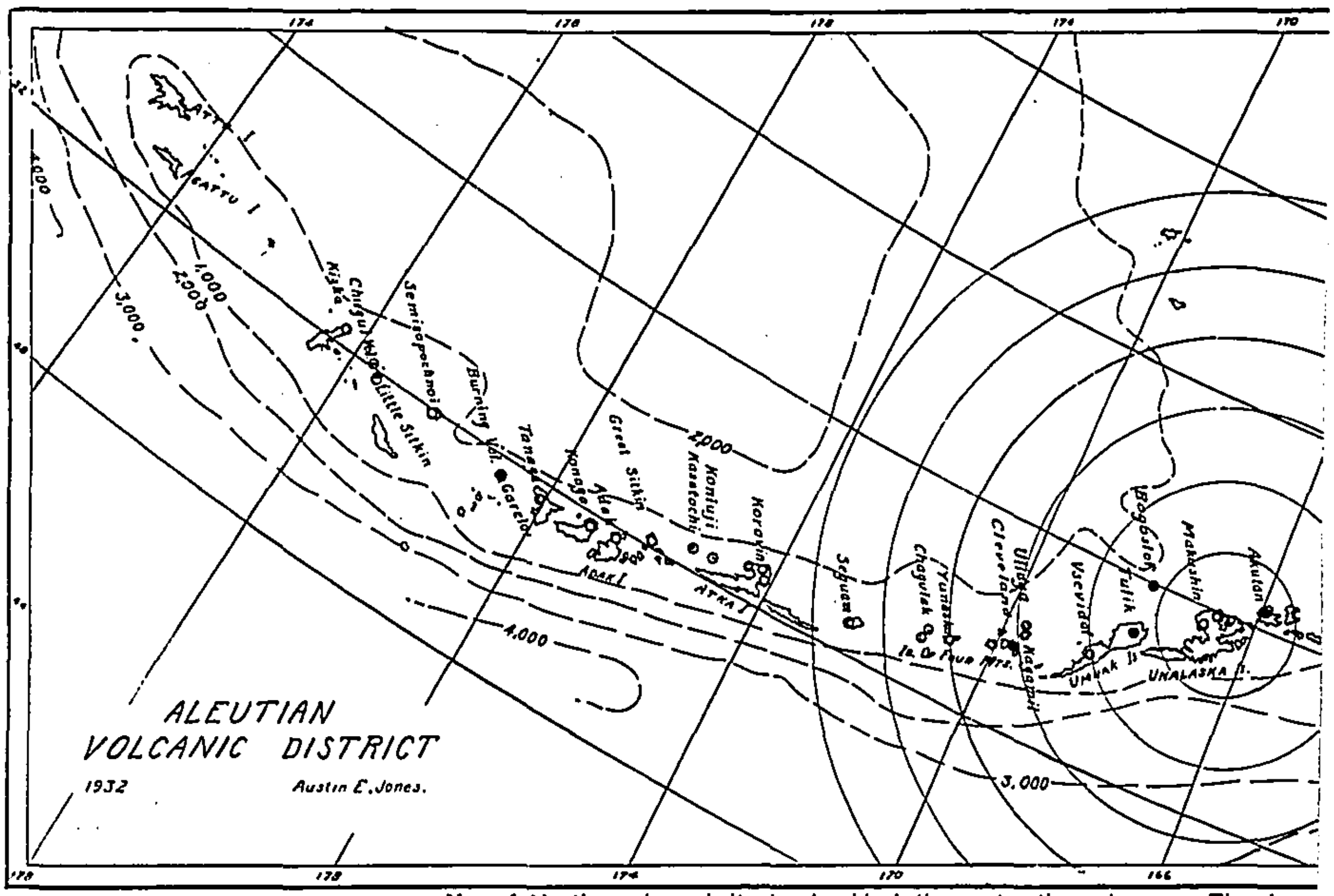
During 1930, 25 shocks came from distances of 20 to 70 miles away. One of these was strong enough to be felt generally; it dismantled the seismograph. Fifty-one local shocks of unknown distances of origin were recorded, and only one of 83 miles distance, that could have originated near Kukak Volcano. Six local earthquakes were apparently strong enough to have been felt, but were not so reported. Only one teleseism is listed for the year.

Time used is Kodiak Standard (K.S.T.), 10 hours slower than Greenwich.

Earthquakes recorded at Kodiak, Alaska

Lat. 57° 48′ 40″ N; long. 152° 24′ 20″ W; elev. 300 ft minus Two Hawaiian-type horizontal pendulums weighing about 70 kg. set up in N-S and E-W directions. Static magnification 135 times with critical oil damping.

1931		Character	K S. T. h. m.	Distance Miles	Remarks
Jan.	1	Tremor	0 30 a.m.		
	2	Feeble	7 40 p.m.	157	
	4	15 Tremors	p.m.	75-115	Two indicate distance.
	7	Tremor	0 30 a.m.		
	7	Very feeble	3 00 a.m.	20	
	8	Very feeble	11 30 p.m.	83	
	9	Very feeble	1 40 p.m.	20	
	9	Very feeble	8 20 p.m.	143	
	11	Very feeble	3 15 p.m.	50	NE-SW.
	11	Tremor	4 30 p.m.		
	14	Teleseism	5 p.m.		Long waves.
	25	Tremor	6 37 a.m.	110	
	27.	Feeble	6 35 a.m.	215	or over. Begins in hour mark. Felt in Seward and Anchorage. Epicenter 61° N 150° W.
	27	Teleseism	11 a.m.		Part of a distant earthquake. Epicenter 31° N 108° E.
Feb.	2	Tremor	6 p.m.	100	



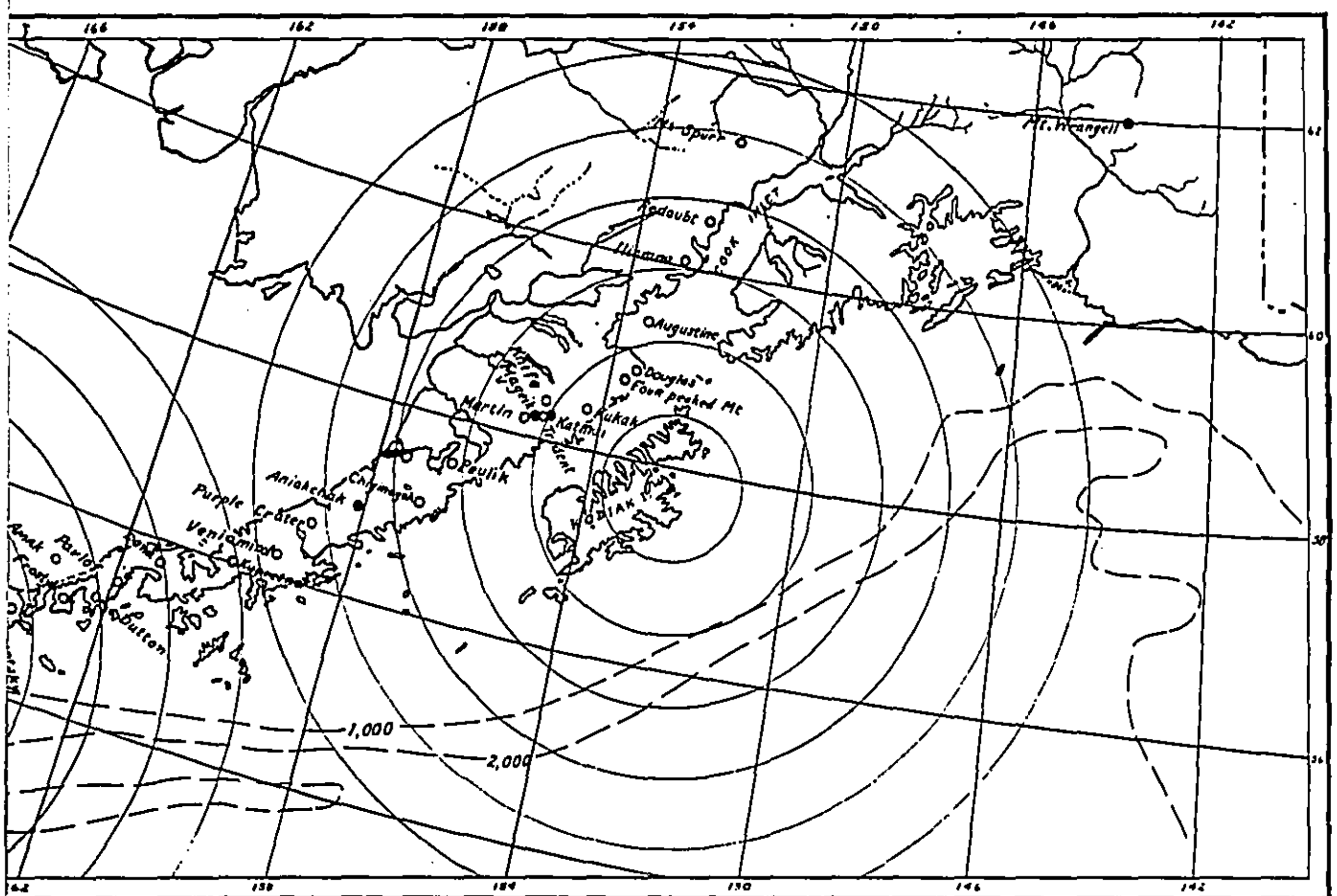
Map of Aleutian volcano belt, showing black the most active volcanoes. The rings
Soundings in Bering Sea at the north and Pac

Mar.	18	Very feeble	5 05 p.m.	100	
	21	Tremor	p.m.	32	or over.
	22	Tremor	a.m.		
Apr.	22	Tremor	p.m.		
May	16	Feeble	10 45 p.m.	147	
	28	Feeble	6? 15 p.m.	320	Epicenter 58° N 158° W.
June	14	Very feeble	7 30 p.m.	32	NW-SE.
	16	Tremor	7 00 p.m.	74	
	27	Very feeble	7 35 p.m.	18	NW-SE.
July	5	Tremor	2 00 a.m.	30	or over.
	26	Tremor	10 17 a.m.	64?	
	26	Tremor	2 15 p.m.	110	
Aug.	1	Tremor	7 15 p.m.		
	22	Tremor	3 00 p.m.		
	27	Teleseism	6 20 a.m.		Long waves, part of earthquake. Epicenter in Baluchistan 30° N 67° E.
Sept.	1	Teleseism	3 50 p.m.	600	or greater—felt locally.
	9	Tremor			
	10	Tremor			
	10	Very feeble	12 00 p.m.	55	NE-SW.
	25	Very feeble	1 30 p.m.	60	
	26	Very feeble	5 00 a.m.	55	NE-SW.
	29	Very feeble	0 55 a.m.	160	or greater.
Oct.	3	Teleseism	10 a.m.		Part of Solomon Islands earthquake, epicenter 10° S 161.°4 E.
	12	Very feeble	3 35 a.m.	46	NE-SW.
	16	Very feeble	3 20 p.m.	64	
	17	Feeble	2 50 a.m.	172	NE-SW.
	18	Feeble	2 15 p.m.	50	NW-SE.
	25	Tremor	p.m.	108	
	25	Tremor	p.m.		
	26	Slight	1 00 a.m.	55	NE-SW.
	29	Feeble	9 45 p.m.	32	NE-SW.
	31	Tremor	2 00 a.m.		
Nov.	17	Tremor	2 40 p.m.		
	20	Very feeble	0 55 a.m.	267	NW-SE.
	20	Tremor	1 25 a.m.		
	25	Feeble	9 50 p.m.	74	NW SE.
Dec.	7	Very feeble	2 50 p.m.	78	
	9	Very feeble	2 30 a.m.	106	Over 30 similar earthquakes having no recognizable P phase between Dec 8 11 p. m. and Dec. 9 7 a. m.
	11	Very feeble	8 30 a.m.	305	20 to 25 tremors during 7:30 to 9:30 a. m.; no distances assignable.

In the above record there were 19 local quakes that originated at distances of 20 to 80 miles. Four of these came from 74 to 78 miles away and could have originated under the near side of the volcanic Aleutian Range. Seventeen occurred at places from 80 to 320 miles away, and it can be estimated that a fair percentage of these were from near volcanoes. There were 13 shocks, mostly graded as tremors, as well as three swarms of 13, 30, and 20, to which there could be assigned no epicentral distance other than that they were not farther away than about 200 miles. Parts of five teleseisms were recorded.

Dutch Harbor Earthquake Registration

The Dutch Harbor seismograph was installed July 1929 and has been run continuously. During the last half of



...odiak and Dutch Harbor seismograph stations are progressive 50 mile distances.
...n at the south are in fathoms. A. E. Jones.

that year one shock was recorded from a distance of 37 miles. Akutan Volcano, about 30 miles to the east, was in eruption during the late summer and autumn, and it is more likely that this earthquake occurred there than under the slope of the ocean deep to the south. Eight shocks occurred in the next zone and can be assigned either to the volcanic island Umnak or to the slope of the deep. Six other local quakes of unknown distances were recorded and one teleseism. No earthquakes were reported as felt.

During 1930 four shocks were definitely from within the first zone. One on November 6, 1930, at 3:20 a. m. local time, was felt very strongly at Dutch Harbor and originated 46 miles away. Six more shocks were from the second zone and two occurred at greater distances. There were also 15 local quakes from unknown distances. Only one teleseism was recorded during the year.

Time used is Pacific Standard Time, (P.S.T.) 8 hours slower than Greenwich.

Earthquakes Recorded at Dutch Harbor

Lat. 53° 53′ 09″ N; long. 166° 32′ 05″ W; elev. 15 ft.

Two Hawaiian-type horizontal pendulums weighing about 70 kg., set up in N-S and E-W directions. Static magnification 135 times with critical oil damping.

1931		Character	P. S. T. h. m.	Distance Miles	Remarks
Jan.	2	Tremor	8 25 a.m.	69	
	3	Tremor	11 00 a.m.		
	6	Tremor	8 35 p.m.	60	
	9	Very feeble			
	11	Tremor	6 45 p.m.	42	
	23	Tremor	4 30 p.m.		
	28	5 tremors	p.m.		
	30	35 tremors	p.m.	23-28-32-37-51 59; one at each distance.	
	31	Tremor	5 02 p.m.		
Feb.	1	Tremor	5 30 a.m.	57	
	3	Tremor	2 00 p.m.	23	
	10	Tremor	5 30 p.m.	64 or 92; according to interpretation of phases.	
	11	Tremor	9 25 a.m.		
	13	Tremor	4 10 p.m.		
	15	Tremor	7 30 a.m.		
Mar.	2	Very feeble	7 30 a.m.	120	
	2	Tremor	11 35 a.m.	46	
	27	Tremor	5 40 a.m.	147	
	29	Feeble ePEN	9 26 28 a.m.		Felt in Dutch Harbor.
		iSE	9 27 01	106	ESE.
	29	Slight ePN	11 13 36 a.m.		Felt in Dutch Harbor.
		iSE	11 14 08	147	
	29	Tremor	0 52 p.m.	120 or over.	
Apr.	3	Tremor	7 25 a.m.	111	
	5	Tremor	4 15 a.m.	64	
	18	Tremor	8 30 p.m.	140 or over.	
May	4	Tremor	10 55 a.m.	51	
	5	Tremor	2 15 a.m.	147?	
	9	Tremor	7 00 a.m.		
	20	Tremor	a.m.		
	20	Tremor	0 10 p.m.	23?	
June	19	Tremor	a.m.		
	27	Very feeble	0 50 a.m.	46	NW-SE?
	27	Tremor	p.m.		
July	12	Tremor	5 30 p.m.	46	
	13	Tremor	1 45 p.m.	50?	
	18	*Teleseism	3 20 a.m.		

* The Jesuit Seismological Association lists the following 1931 distant earthquakes from this region: May 27, Lat. 56° N Long. 168° E, Commander Islands off Kamchatka; May 29, 58° N, 158° W, Bristol Bay west of Katmai; May 30, 52° N, 177° E, near Kiska and disastrous at Attu; July 18, 58° N, 169° E, west of Kamchatka. The May 29 shock was registered at Kodiak, and that of July 18 at Dutch Harbor.

	19	Very feeble	0 05 p.m.	100-200	
	24	6 tremors	p.m.		
	24	Tremor	8 20 p.m.	83	
	29	8 tremors	11 a.m. to		
			12 m.	18	Distance of one only.
Aug.	2	Tremor	0 10 a.m.	46	
	5	Tremor	2 05 p.m.	500?	Part of a distant quake.
	8	Very feeble	4 45 a.m.	97	
	8	Tremor	5 15 p.m.		Part of a distant quake.
	9	3 tremors	p.m.		
	11	Very feeble	6 40 a.m.	88	
	11	Tremor	8 00 a.m.		
	11	14 tremors	4 00 p.m. to		
			8 30 p.m.		
	14	Feeble	a.m.	110	
	14	Tremor	6 00 p.m.	97	
	15	Tremor	4 40 a.m.	120	
	19	Tremor	6 10 a.m.	360?	
	19	Tremor	6 50 p.m.	130	
	24	Tremor	3 30 a.m.	330?	
	31	Tremor	6 00 a.m.	115	
Sept.	2	Very feeble	p.m.	110	
	8	Tremor	8 30 a.m.	42	
	18	Very feeble	a.m.	55	
Oct.	2	Very feeble	4 50 p.m.	100	NE-SW?
	10	Teleseism			
	10	Tremor			
	10	Tremor	6 40 p.m.	37	
	14	Feeble	2 00 a.m.	115	
	17	Tremor	6 35 a.m.		
	17	Very feeble	8 35 p.m.	55	NE-SW
Nov.	22	Tremor	a.m.	64?	
	23	Very feeble	a.m.	60	NE-SW.
Dec.	1	Very feeble	p.m.	125	ENE-WSW.
	6	Moderate	11 10 p.m.	46	NE-SW. Felt by all. Seismographs dismantled; dishes rattled.
	14	Feeble	a.m.	125	ENE-WSW.
	23	Teleseism	9 45 a.m.	900?	

In the above table 13 earthquakes originated in the first zone about Dutch Harbor, while 17 were in the second zone, 11 in the third zone, possibly two in the fourth zone, two outside the zones at 330 and 360 miles, and two more occurred at the probable distances of 500 and 900 miles away. Four teleseisms were recorded completely or in part. One from the Kamchatka region was remarkable for its large single S period. At least 70 local earthquakes were recorded in such small amplitudes that no distance could be determined. During the summer of 1931 there were over 200 artificial disturbances, probably caused by workmen. There were three earthquakes reported felt at Dutch Harbor. The accuracy of the location of earthquakes in these zones is largely dependent on the depth of focus of the earthquake.

During the years 1929-30 the Kodiak station recorded about 2½ times as many earthquakes as the Dutch Harbor station, while in 1931 the Dutch Harbor station recorded 37 per cent more. This would seem for seismicity to parallel Petroff's statement for volcanicity, that when the volcanoes in one part of the Aleutian chain become quiet, others in some other part of the chain become active. This relative localized shift of seismicity also shows in the graph.

Tremors

The numbers of tremors in the tables stand out. Three times as many were recorded by the Dutch Harbor seismograph as were recorded by the Kodiak seismograph, probably because Dutch Harbor is much nearer the subterranean volcanic rift line. They are seismic in character, representing sizable shocks when originating at a distance. They probably could have been felt by any one over, or near, their origin. After having traveled 50 or 100 miles, the earthquake waves have so decreased in size that they are barely registered as tremors on the receiving seismograph. The Kodiak station recorded 36 of these tremors, only 10 being pronounced enough to show distance by the S-P interval. They fall into groups of 30, 70, and 105 miles. The Dutch Harbor station recorded 105 tremors, 35 indicating distance. Most of these originated at distances from 20 to 150 miles away.

The volcanic magma underground on the Alaskan Peninsula near Kodiak may be about as active as that near Dutch Harbor if seismic distance is considered. The latter station is at about 8 and the former at 80 miles distance from part of the Aleutian volcanic rift. If we compare the tremors received at Kodiak from 100 to 115 miles, with those received at Dutch Harbor from approximately the same distance, there are five in each case received on instruments of nearly equal sensitivity. Referring to the map, there are volcanoes at those ranges from each station.

While there are only two indicated 100 miles on each side of Dutch Harbor, there are other smaller craters unlocated, near both Vsevidof and Pogromni, and both Unimak and Umnak islands have produced recent eruptions. The Katmai group is 100 miles from the Kodiak station. (See Volcano Letter No. 375.) A.E.J.

KILAUEA REPORT No. 1051

WEEK ENDING MARCH 13, 1932

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge.

On March 7 fume from near the foot of the southwest talus was as strong as on previous days. The fuming spot under the west wall was inactive. Cracks were measured and showed little change. Two new measuring points were established on the northeast rim back of the area which avalanched last week. A slide occurred from the NE wall at 10:32 a. m. The seismograph at Halemaumau registered sudden tilt in the morning, without tremor, to the east, and a gradual tilt to south. Two glowing cracks reported last week were plainly visible in the evening.

Dust from an avalanche was seen March 8 at 1:13 p. m. from the Observatory. A small quake was felt at Halemaumau at 2:07 p. m. A few rocks were heard falling.

Nothing new was observed during a circuit of the pit on March 9 in the forenoon.

Much dust from big slides was seen about 1 p. m. March 10.

On March 11 much fume was visible from the Volcano House, rising in concentrated puffs during the forenoon. At 10:08 a. m. there was a small slide from the northwest wall. Sulphur stain slowly increases about the fume spots. A slight widening of cracks was noted northeast. The glow from one of the cracks has nearly disappeared. The crack southwest of this continues to be visible at night, but not so bright as formerly.

On the evening of March 12 one glow-crack remained visible. On March 13 fume activity showed no change. A quake at 8:26 a. m. registered stronger on the Halemaumau seismograph than at the Observatory. Moderate tilt to the east was registered during a quake at 1:15 a. m.

The seismographs at the Observatory recorded 41 tremors, 12 very feeble seisms, and one feeble seism at 11:04 p. m. March 8 felt in Hilo. A very feeble seism at 1:15 p. m. March 11 was also reported felt in Hilo. Distance phases of most of the disturbances indicate origins near Kilauea. Microseismic motion was moderate for the first three days of the week, followed by two days of strong microseisms, and decreased to light at the close of the week. Average tilt for the week was strong SSE.

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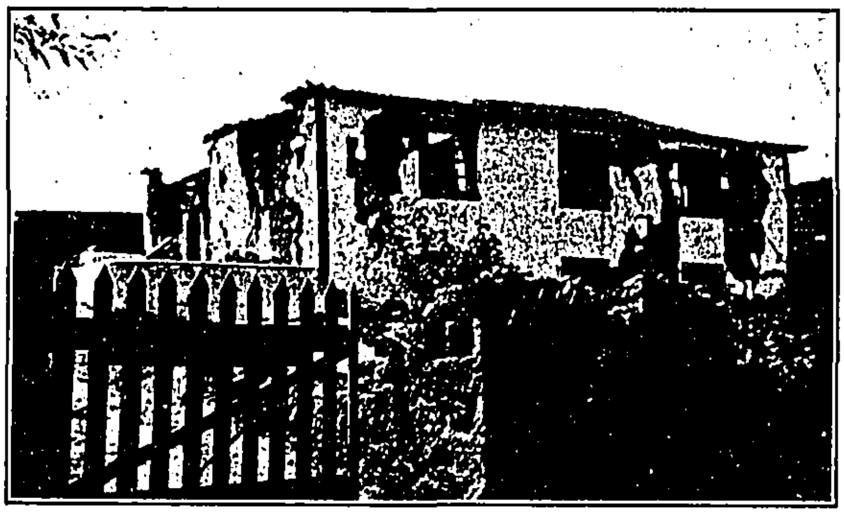
No. 378—Weekly | Hawaiian Volcano Observatory, National Park, Hawaii | March 24, 1932



Stucco building damaged by earthquake of August 31, 1926, in Horta, Azores. Photo Agostinho.

FREEMAN'S BOOK ON EARTHQUAKE INSURANCE

This monumental work of 904 pages ("Earthquake Damage and Earthquake Insurance,' by John Ripley Freeman, McGraw-Hill, 1932) includes "studies of a rational basis for earthquake insurance and of engineering data for earthquake-resisting construction."

The twenty-two chapters cover: the present situation; earthquake causes and motion; measure of earthquake violence; frequency and violence in the United States and Canada; the narrow destruction zone; structural lessons from San Francisco and Charleston; structural safety and local ground; structural lessons from other American earthquakes; earthquake-resisting buildings in Japan 1923; lessons from Italian earthquakes; lessons from Nicaragua and New Zealand; prediction of time, place and damage; figures on earthquake loss ratio; insurance rates by stock companies; affiliation of earthquake and fire insurance; municipal building codes; textbooks on earthquake-resisting design; shaking tables; the motion of the ground in an earthquake; design of earthquake-resisting buildings; data from seismograms; suggestions for a program of earthquake research.

This book by a great engineer, President of the Manufacturers Mutual Fire Insurance Company, is something entirely new in the realm of seismological literature. It is a book which should be in the office of every large corporation interested in insurance of its property, and still more in every office interested in writing property insurance. The earthquakes of California, Japan, Central America, Italy, and New Zealand, in recent years accompanied with conflagration, and affecting large cities containing modern expensive structures, have created a new problem. This problem is the economic one of enforcing adequate construction to resist either earthquake or fire or both. Mr. Freeman states in the introduction:

"The following pages are addressed to structural engineers, insurance executives, and property owners. In the beginning the author was by no means so well convinced of the prudence of writing earthquake insurance as he has become by studying the information accumulated. The facts brought together demonstrate that the actual hazard is really extremely small when considered as a mathematical ratio. Earthquake insurance might advantageously be incorporated in every fire insurance policy at remarkably small additional cost. Local building laws should be remodelled. Destructive earthquakes are infrequent, area of destruction is small, successful resistance of many buildings is remarkable, average proportion of damage is small, and earthquake-resisting buildings can be built at small additional cost."

Construction requirements are summed up as follows: "All buildings in a region liable to earthquake violence, equivalent to that of the known seismic regions of Italy, Japan, and of the United States, should be designed to resist a horizontal earthquake force, applied at each floor level, equal to one-tenth of the weight of all of the structure above that level, plus the weight of the actual contents, resting upon the floors, including the roof."

This amounts to provision for the application of a horizontal force of one-tenth of the weight of superincumbent structure and contents, applied at each portion. Requirement in building codes anywhere, of design to withstand one-twentieth of superincumbent weight horizontally applied suddenly, is recommended as a part of the structural factor of safety against all emergencies of wind or quake. The utmost practicable structural rigidity is desirable. The oscillation period of a building should be as short as possible.

Prediction of time, place, and damage from earthquakes presents a variety of problems. Place and time are wholly generalized with reference to the future. Meteorological, electrical, and astronomical controls are unreliable. Tidal stresses probably have some effect. Earthtilt as a forerunner of earthquakes is coming to be regarded as important in Japan. Location of concealed slipping planes in motion is the subject of an elaborate instrumental investigation near Los Angeles. An engineering survey in advance is quite capable of predicting expectable damage in any locality, in case a great earthquake should occur, by report on the stability of the ground and the quality of design in structures. With reference to maximum expectable violence, it is improbable that anything bigger than the earthquakes of the past will happen. And it must be remembered that fire did most of the damage in several of these.

The earthquake insurance hazard at Los Angeles is probably a very little smaller than that at San Francisco. A region of greatest earthquake frequency may possibly be the safest. A region of fewest earthquakes may give the greatest loss when an earth-slip does come. Certain belts are liable to recurrent great earthquakes. Such places have immunity periods after the last great shock. Soft fluvial or made land deposits are shaken much more violently than rigid ground. Rigid buildings of good design and faithful workmanship will be found practically earthquake-proof. A rigid massive foundation is important. The expected loss ratios on American experience are 3 per cent for steel-concrete and wood-frame on good foundations, 5 per cent for steel-brick and well designed factories of brick in cement mortar, 10 per cent for brick residences not exceeding 4 stories, 25 per cent on brick-veneered buildings with wood or concrete frames, and 50 per cent for concrete-block and hollow-tile buildings. Stone buildings are not mentioned.

The following is Mr. Freeman's probable loss ratio for the United States. The expected average earthquake damage in cents per year for $100 of structural value is:

California, coast	10 cents
California, great valley	5 cents
California, Sierra	7 cents
Washington and Oregon, coast	6 cents
Washington and Oregon, inland	4 cents
Rocky Mountains	3 cents
Northern mid-continent	1 cent
Mississippi bottom lands	2 cents
Great Lakes region	1 cent
Atlantic region, interior	½ cent
Atlantic coast	1 cent

One cent per $100 per year is equivalent to an average damage of $1 per year on a house worth $10,000.

The discussion of insurance is elaborate, by districts, and types of construction. Roughly the total earthquake damage (excluding fire) in the United States and Canada in a hundred years has been forty million dollars. It must be remembered that San Francisco in numerous earthquakes has lost only $20,000,000, as compared to $414,000,000 by four conflagrations. Premiums differ from probable loss in that overhead must be added.

In San Francisco, if the owner insures for not less than 70 per cent of cash value of property against earthquake, he pays a premium rate, per $100 value per year, of from 15 cents to $2.50 progressively from Class I to Class VIII of buildings, and must himself assume loss from 5 per cent to 15 per cent of the total value in such matters as cracked plastering or minor cracks in walls. This proviso enables the insurance company to avoid payment for earthquake damage on a large proportion of all buildings, where the loss does not exceed this percentage.

East of the Rockes there are four rating zones, the highest risks being places of historical earthquakes such as South Carolina, New England, and the New Madrid region of the Mississippi; the lowest are the central states and the Gulf coast. The lowest rate is 4 cents per $100 per year, or $5 per year on a wooden dwelling valued at $12,500. In Zone 1 of greatest risk, this $5 would purchase earthquake insurance of only $5,000 on a wooden house. As before there are several classes of structure of progressively greater risk and higher premium.

The book is profusely illustrated. There are splendid airplane views of the new city district construction in Los Angeles and San Francisco. There are many isoseismal maps of earthquakes, panoramic photographs of conflagrations such as San Francisco, diagrams of the possible roller joints in a design for the basement supports on an earthquake-proof building, diagrams of the displacement effects of earthquakes on buildings, distribution diagrams for severe earthquakes; a discussion with diagrams of the triangulation displacement in California published in 1924, which contained an error of 24 feet of alleged crustal creep, and the correction of this in 1928; pictures of earthquake effects on all kinds of structures in many lands, and very modern photographs of the ruins in Managua and Napier.

Mr. Freeman has been recently in Japan and has been much impressed by the admirable work of the Japanese engineers in reconstruction. He is equally impressed by the inadequacy of much seismological work, as concerned with the needs of theory rather than the needs of humanity and engineers. Mr. Freeman considers the devotion to "acceleration" in mathematical studies of earthquake damage as "worship of a false god." The assumption of harmonic motion, the formula based on amplitude, period and gravity, and the short time within which the maximum change of motion acts, all render this theoretical acceleration of small value where the relatively prolonged racking of building and ground in several directions is involved. Freeman is greatly interested in the experiments on model buildings, with mechanical shaking machinery, made in Japan and at Stanford University. He is everywhere impressed by the lack of real knowledge of the earthquake at the place and time where the damage is done.

He concludes with twenty-two recommendations for a practical program of earthquake research, including systematic study and translation of the Japanese works; study of dominant local oscillations; make research on artificial explosions; extend the shaking-table research; develop a strong-motion seismograph and place it; investigate all factors of public safety in every American earthquake through the U. S. Geological Survey; run levels and straight reference lines in critical places; establish tilt measuring lines; reorganize the Seismological Society of America along the lines of protection of life and property; and get contributions for research from the great power, construction, and insurance corporations. He concludes with an apt quotation from the late President Branner: "The registration of an earthquake two thousand miles away can hardly be expected to interest a man whose family lies buried beneath the ruins of a house built of improper materials upon ground that any geologist might have told him to keep away from." T.A.J.

KILAUEA REPORT No. 1052

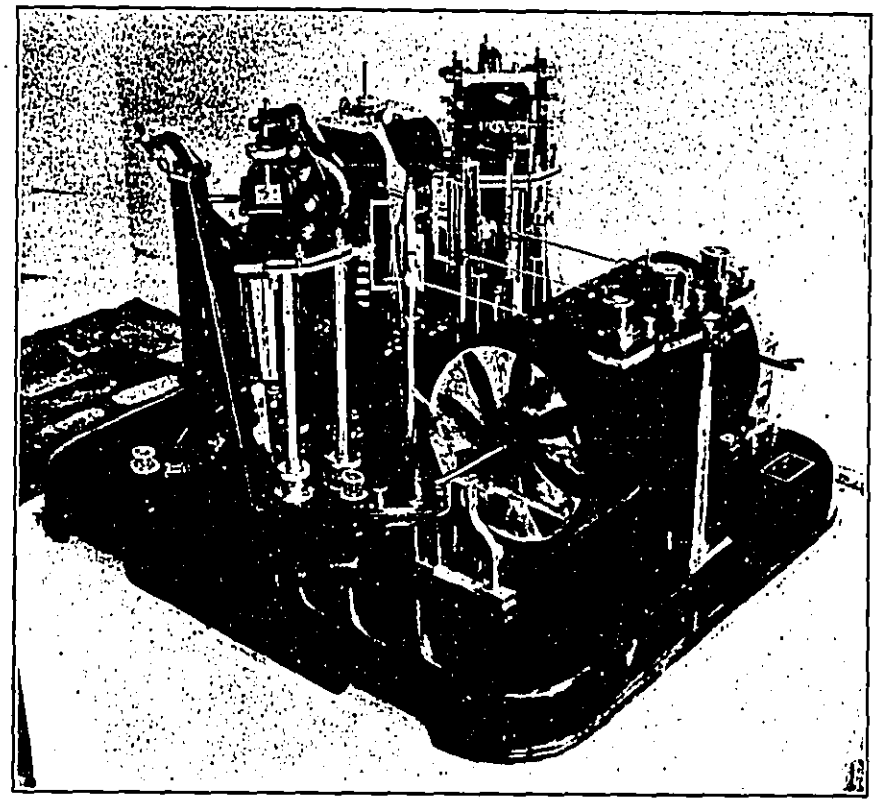
WEEK ENDING MARCH 20, 1932

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge.

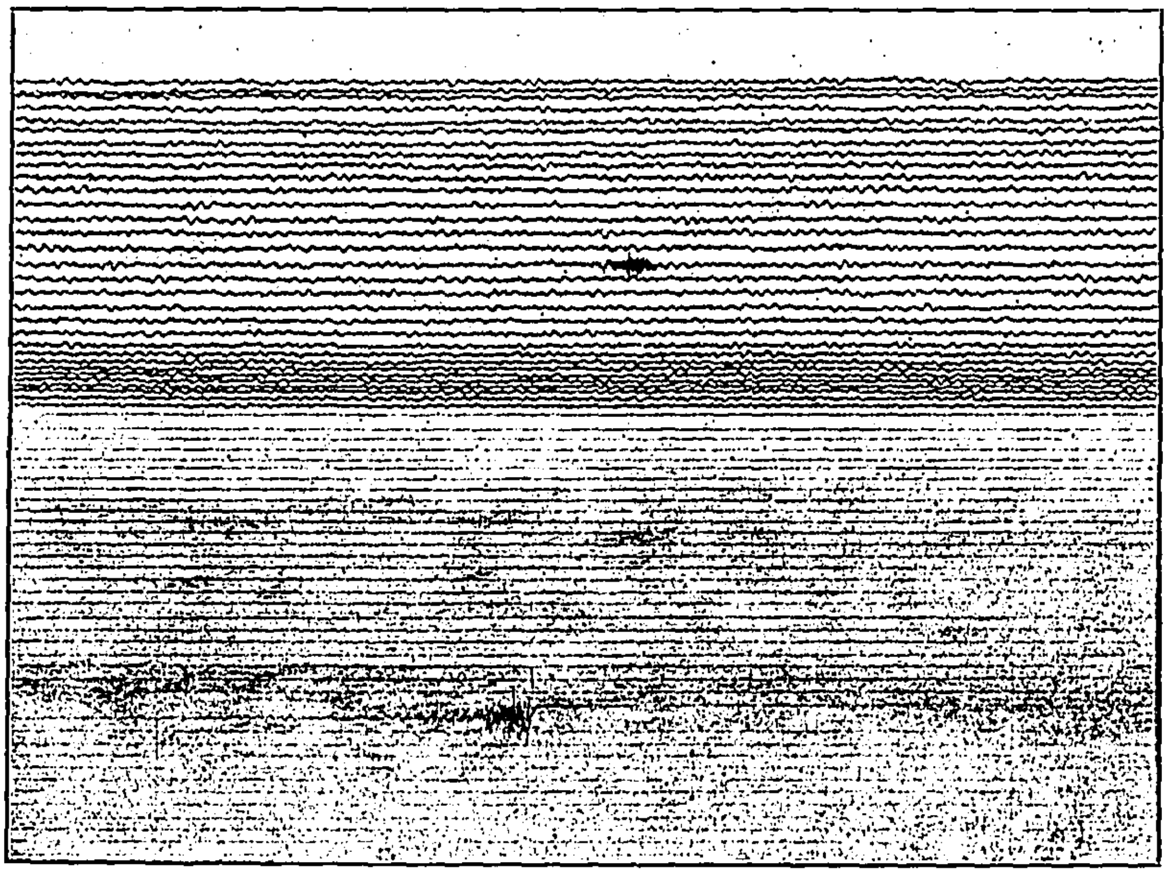
Several slides occurred in Halemaumau during the forenoon of March 14, one larger than the others at 9:37 a. m. over the north wall buttress. Fume appeared about the same. A very slight widening of the northeast rim cracks continued. At night, 8:30 to 9:30, a circuit of the pit was made to locate possible glow spots. Only the one place noted last week, at the southeast, was visible, and this was brighter and larger when viewed from the northeast rim. On March 16 fume showed little change, except that in the forenoon about 11 o'clock none could be seen at the foot of the west wall. At 3:30 p. m. blue fume was plainly visible from the Observatory. On March 17 at 10:15 p. m. fume was again easily visible, and rose from a stained spot by the west talus. At 10:30 a. m. March 18 fume was strong at the same location. On the 19th fume appeared during the forenoon to have decreased slightly. Sulphur stains were quite heavy about the fume spots. Conditions were quiet at Halemaumau. The pit was visited about 7 p. m. and two glowing spots were found at the southeast.

The seismographs at the Observatory recorded 35 tremors, four very feeble seisms, and two feeble seisms. Of the very feeble seisms, one showed origin distance about 4 miles, one about 9 miles, and two about 16 miles. Both feeble quakes showed origin distance about 23 miles. One at 6:31 p. m. March 18 was felt at Kilauea and Hilo; the other at 8:11 p. m. March 19 was felt near Kilauea.

Tilt for the week was strong SW. Microseismic motion was light the first day, moderate the next two days, strong two days, and moderate the remaining two days of the week.



Japanese seismograph designed by Imamura, with three pens writing on a single drum covered with smoked paper. Time marked by lifting pen tips with electromagnets connected with a wall clock. Pendulums record up-down, east-west, north-south motion and are damped with horseshoe magnets.



A seismogram or earthquake autograph written at Kilauea Volcano. The record of crater movement when an eruption stopped. Tremulous upper lines record the eruption. Crowding of lines records tilt. The two groups of crowded oscillations are earthquakes.

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The Board of Directors includes Arthur L. Dean, President; Frank C. Atherton and Walter F. Dillingham, Vice-Presidents; L. Tenney Peck, Treasurer; Wade Warren Thayer, Richard A. Cooke and Wallace R. Farrington.

Persons desiring application blanks for membership ($5.00 or more) should address the Secretary, Hawaiian Volcano Research Association, 320 James Campbell Building, Honolulu, T. H.

The Volcano Letter

Two dollars per year | Ten cents per copy

No. 379 | Hawaiian Volcano Observatory, National Park, Hawaii | March 31, 1932

Novarupta dome of siliceous soda rhyolite, near Katmai in Alaska, which rose in 1912 in the bottom of a new explosion crater in a valley, and developed a heap 800 feet across and 200 feet high. Photo National Geographic Society.

WILLIAMS ON LAVA DOMES

An essay of unusual importance for volcanology, with excellent illustrations and a thoughtful, philosophical summary of conclusions has just been published by Dr. Howel Williams (The History and Character of Volcanic Domes, Bull. Dept. Geol. Sci., University of California, Volume 21, No. 5, Berkeley 1932, 95 pages, 37 figures).

Dr. Williams became interested, in the subject of lava flows which arise so stiffly as to build up at once a plug or dome, by his work at Lassen Volcanic National Park where there are 13 such domes within an area of 50 square miles on an even grander scale than the puys of the Auvergne. Massive protrusions are now known to be common manifestations of volcanic activity. There are plug domes which represent upheaved conduit fillings, domes that grow essentially by expansion from within, and domes built by surface effusion. In the last class the large Hawaiian overflow heapings are better described as "shield volcanoes."

The domes described consecutively are those of the Caribbee Islands including notably the dome and spine of Mont Pelée and the dome at the volcano of Guadeloupe. Next come the Central American domes of Santa Maria in Guatemala, Popocatepetl in Mexico, and some minor ones in these countries. South America has numerous lava domes which are imperfectly known, of which the best example is the acid andesite dome, consisting of viscous hardened lava, having an extremely jagged surface, from which steam and fragmental eruptions continually issue, in the crater of Galeras Volcano. In North America, besides the Lassen domes there are those in the chain of craters south of Mono Lake, California. Here at Panum Crater the obsidian lava was so nearly solid that it rose with essentially vertical walls to about 150 feet without exhibiting a tendency to flow in any direction, so that a deep moat separates the dome from the surrounding rim of lapilli. At the Marysville Buttes in California there are banded rhyolites which form intrusive domes among Tertiary sediments along the flanks of an andesitic laccolith, steep-sided and of oval outline from a quarter mile to a mile in length. They were viscous and contained steam, and the rise of the domes was attended by violent steam explosions, some of which blasted a crater, measuring a mile in diameter, through the core of the laccolith. Next come descriptions of Bogoslof in the Aleutian Islands and its numerous domes, and of the remarkable siliceous dome of Novarupta near Katmai on the Alaskan Peninsula. "The rise of this dome, like that of almost all domes, was preceded by strong pyroclastic explosions, whereby a crater almost three quarters of a mile in diameter was opened," and coarse ejecta measuring eight feet in diameter were flung a quarter mile from their source. The explosive phase was followed by the welling up of viscous magma, which as it was slowly thrust upward broke into huge blocks. It was heaped about 800 feet in diameter and 200 feet high. The glassy lava is banded in general parallel to the margins. "Apparently the magma rose to the surface by the active solution of the country rocks, retaining its heat largely by gas reaction. The original magma was a siliceous soda rhyolite with 75 per cent of silica containing partly fused inclusions of andesite country rock with 62 per cent of silica."

Next come descriptions of Tarumai and Usu domes in Japan, Merapi and Galunggung in Java, and Ruang in the Sangi Islands. A submarine dome during April, 1904, appeared in these islands, and after 1913 three rocks were left emergent above the water. In 1919 a short-lived dome rose above the surface, forming an island 70 meters in diameter and up to 12 meters in height. It consisted of lava blocks of amphibole andesite. There are many other stiff lava domes in the craters of the Dutch East Indies.

Ascension Island in the Atlantic has crater domes of trachyte, and the trachytic eruptions were in all cases preceded by eruptions of basalt. The protrusion of the domes followed long periods of dormancy and was heralded by explosions flinging up obsidian ejecta. The explanation appears to be that after the early outpourings of basalt, the residual magma became differentiated and capped by a siliceous slag. "This sequence of events thus affords another instance of the explosion of a gas-rich, differentiated magma, followed by the quiet upwelling of pasty lava to form" interior heaps in the craters, a sequence apparently common in dome eruptions. The trachytes are poor in vesicles in contrast with the rhyolites and basalts. The diameters of the Ascension Island domes are 400 to 500 meters, and the heights 200 meters more or less. In the Ragged Hill dome, the dome structure is indicated by a pronounced concentric rifting, with plates dipping away 35 degrees, and the platy structure apparently due to thermal contraction. There are inclusions of common basalt in the trachyte. In the case of the Riding School dome, the trachyte flowed over the rim of a basaltic crater after forming a large body in the center of the depression, and then after making a thick flow 700 meters long away from the crater, the surface of the inner dome sank back to form a basin. This withdrawal of magma in the center happened in another dome where the platy structure has an inward dip of from 2 to 5 degrees. At St. Helena there are phonolite domes more deeply eroded than those on Ascension Island, the largest of which, called Great Stone Top, was originally 300 meters high, was fed by a dike only 10 to 15 meters wide, and was accumulated, not in an old crater, but on an almost level floor of basalt. In Samoa there are rhyolite and trachyte domes closely analogous to those of Ascension Island, here also overlying older basalts.

The puys of the Auvergne in France have black basaltic cinder cones with pale-colored craterless domes of trachyte within them, and Scrope in 1825 described them correctly. He observed that basalts tend to yield low, broad cones, because of their high fluidity, whereas lavas of "low specific gravity, especially when combined with a coarse, crystalline texture, will occasion a minimum of fluidity. The trachytic lava seems to have risen upwards from the vent in so pasty or imperfectly liquid a state as to have accumulated above it in the form of a dome or bell, just as would a body of melted wax, or one of moistened clay, if forced outwards through an orifice in the cover of any containing vessel."

The domes of Auvergne are divided into three types, (1) Peléan domes, acid and basic, (2) Peléan domes with craters or with trachyte ejecta, (3) domes with elevated portions of the adjacent rocks. The augite trachyte dome of the Grand Sarcoui has the form of an overturned bowl with a maximum slope of 60 degrees, measures 750 meters across the base, and is 250 meters high. It has a smooth surface and no rock pinnacles, due apparently to the lava having poured uniformly in all directions from a summit vent. On the east flank there are quarries revealing buried talus and the rough structure of an underlying pinnacled dome. This inner heap was of the Pelée type and the overflows at the top were a late phase. In the Puy de Dôme there has been left an irregular truncated pyramid 550 meters high. It is a trachytic protrusion covered by debris from a summit vent. Lacroix explains the sequence by the opening of a fissure in the underlying rocks consisting of granite, gneiss, etc., permitting lava that was partly viscous and partly solid to rise to the surface and build a steep dome. Its crust crumbled, forming great banks of talus cemented by fine dust. Both dome and talus are biotite trachyte. Later eruptions from a new summit crater deposited fragments including pieces of the bedrock pumice, breadcrust bombs, and angular pieces of trachyte. The trachyte ejecta of these final eruptions differed mineralogically from the materials of the dome, and in texture from glassy to coarsely crystalline. The same thing was observed in *the dome of Mont Pelée.*

The Gulf of Santorini, in the island of Thera of the Grecian Archipelago, produced the first dome eruption well known to European geologists. In February 1866 a new islet appeared in this crater bay composed of lava blocks, pumice, and bottom debris. Steam explosions were frequent. The mass grew without earthquake or visible projection of fragments, silently, but so rapidly that it seemed like the blowing of a soap bubble. It seemed like an expansion movement with the rocks incessantly displaced from the center towards the edge. On the second day the growth was from the edge towards the center. The dome above water measured 70 to 30 meters and was 20 meters high. One could walk on top, although the lava was still glowing beneath. There was no summit crater, but rather a confused heap of big blocks grayish in daytime, fuming, and at night lighted by incandescence, while the lower slopes were covered with cooler debris. There were long crescentic fissures, almost complete circles, on top of the dome. Similar cracks have been observed at Novarupta, Alaska, and at Chaos Crags near Lassen. The first Santorini dome was named Georgios, and on February 15 a second dome, Aphroessa, rose quietly above the sea on its flank. Within two days it grew enormously, and in five days its length had reached 380 meters. Its mode of growth, like the first dome, showed nothing but a progressive displacement of lava blocks. There were, however, occasional eruptions of cinders and lapilli which decapitated and flattened the Georgios dome. On March 8 this measured 350 by 100 meters and stood 50 meters high. The blocks were either scoriaceous or compact glassy andesite. There was an incessant crackling noise and a tinkle like broken porcelain. The fumaroles had temperatures up to 300 degrees C. and the vapor contained hydrochloric and sulphuric acid. On March 10 a third dome, Reka, arose still more quietly without any crackling of blocks breaking asunder in cooling. This heap became joined to Aphroessa. Fouqué called these domes cumulo-volcanoes. New hillocks of blocks were piled up and destroyed, the shapes changed, the rates of growth varied, and Georgios developed a pile of blocks on top enclosed by a circular trench. The end of the activity was on Georgios in October 1870, four years and eight months after the beginning of activity, and the new islet finally stood 120 meters above the sea.

Fifty-five years later in September 1925, the same kind of activity was renewed when Fouqué dome appeared near the earlier island, circular in plan, 150 meters in diameter, and 50 meters high above a plateau of new lava on September 19. The shape of the dome continually changed. There were violent eruptions and a continuous redistribution of the loose blocks. The explosions sent up black cauliflower clouds. The temperature of the upper part of the interior of the dome was 700° to 800° C., there was no definite crater, and small jets of white vapor were emitted all over the surface. The vulcanian explosions took place from different places, mostly near the summit, blowing out loose blocks which fell back, and occasionally decapitating the dome. The blocks were solid and angular, dense, vitreous, and black, and there were no well-defined breadcrust bombs. There were concentric crevices which made a thin ring of bright red incandescence, and in daytime semicircular batteries of narrow jets of gray vapor which formed a crown around the dome. The lava flows associated with the dome had blocky crusts over compact vitreous lava free from vesicles. One small dome on the surface of the flow exhibited concentric banding. In the Georgios dome the lava contained many basic inclusions, very little gas, very little combined water, 65 per cent of silica, and may be called a glassy pyroxene dacite.

In 1831 an island formed by submarine eruption near Pantelleria in the Mediterranean appeared on July 16, had become 65 meters high and 3700 meters in circumference early in August, and was washed away by the end of October. The material was volcanic sand, lapilli, and scoriae arranged in strata around a crater. There appears to have been an upthrust of lava in viscous condition and broken at the top, similar to Bogoslof. There was trachytic pumice, but the island was basaltic. There was much carbon dioxide gas.

Other domes are described in the Lipari Islands and in the older lavas of Italy, in the Eifel region and elsewhere in Germany, in the Milos Archipelago of Greece, among the Virunga volcanoes of East Africa, in Kamchatka, in the Philippines, in Iceland, in the Azores, and in several places in California including the flanks of Mount Shasta.

Summarizing the characteristics of dome outflow, the largest are one to two miles across and the smallest only a few meters. In shape most of them are truncated domes and pyramids with lower slopes concealed by talus. Breaking up of crusts during upheaval, and the formation of concentric or radial ridges are characteristic features. Slickensides or scrapings are often to be seen along the walls of fissures. Glassiness is very characteristic of the lava of domes, also porphyritic structure, and and the upwelling of the lava is preceded by explosions flinging out pumice and tuff. There are usually many basic inclusions. The rocks are mostly andesites, trachytes, and rhyolites. The temperatures at times of protrusion are estimated to have been less than 850° C. Shepherd and Merwin estimated that the gas pressure inside the Pelée dome was about 100 atmospheres. Intense solfataric action is seldom conspicuous during and after upheaval. The gas content of the lavas is small, 0.15 per cent by weight at Lassen, 0.10 per cent at Santorini. The breadcrust bombs of Pelée contain six times as much gas as the material of the dome. The gases listed as extracted from rock of Pelée, Lassen, and Kilauea show excessive carbon dioxide, sulphur, chlorine, and fluorine for the former and relatively high hydrogen and carbon monoxide for an aa lava of the latter. Lassen Peak andesites have excessive combined water. One is impressed by the great excess in all these analyses of H_2O, 70 to 96 per cent, as compared with H_2, one per cent or less; CO_2, one to 20 per cent, as compared with CO, measuring from less than one to three per cent; and SO_2, on the other hand, always less than one per cent, is in less amount than the sulphur from which it is derived, which approaches one or two per cent. The unoxidized hydrogen reaching its maximum in the Kilauea lava (6.18 per cent), and the fact that one of Day and Shepherd's analyses of the gas from the liquid lava yielded seven per cent, makes it reasonable to suppose that hydrogen is the fundamental volcanic gas, but that it oxidizes during the rise of magma and consolidation, just as do the metallic ingredients in combination with silica.

The rate of growth of domes is rapid. That at Santa Maria rose 100 meters in a week, the dome of Mont Pelée rose 25 meters in a day, that of Tarumai rose 100 meters in four days. The internal structure may have concentric layering, or it may have fan structure, or it may spread

Lava heap of Bogoslof Volcano in the Aleutian Islands, surrounded by warm salt-water lagoon and ring bars of explosion debris. Activity of 1926-28, photo Wheeler.

In distance Santa Maria Volcano in Guatemala after eruption of November 2, 1929, in middle distance the lava dome which had risen in the crater in the flank of the volcano, and in foreground gigantic bowlders carried with floods of the eruption. Photo Sapper and Termer.

with irregular fissuring and sprouting like aa lava. In most cases talus forms around the border. The propelling force Williams considers to be the expansive pressure of internal gas, and generally the dome is the top of a plug forming a seal to the conduit at the close of an active period. T.A.J.

KILAUEA REPORT No. 1053

WEEK ENDING MARCH 27, 1932

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge.

In Halemaumau pit the afternoon of March 21 the fume at the foot of the southwest talus appeared denser than usual. Scars of two small slides had appeared on the south wall; one over the northwest talus at 2:24 p. m. raised a cloud of dust. On March 22 at 10:55 a. m. a sound like floor cracking was heard. Slide dust arose at 12:30 p. m. March 23, and a larger avalanche at 1:40 p. m. dumped fresh debris on NW talus. At 2 p. m. dust continued to rise. The avalanche tremor was registered by the pit seismograph. This avalanche fell directly from the rock of the northwest rim for a length of 150 feet, and left large bowlders below. On March 26 glow was still reported visible in evening in crack at south edge of Halemaumau floor.

Observatory seismographs registered 66 tremors for the week, and two very feeble local seisms, one of which indicated origin 16 miles away. A distant earthquake was recorded beginning at 1:36:32 p. m. Hawaiian time (10 hrs. 30 m. slower than Greenwich) March 25, of probable distance 2980 miles from Hawaii. Tilting of the ground was very slight to the east, and microseismic motion was generally moderate.

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125 Other governmental officers
E. S. Wheeler, Chief Highway Engineer of the Bureau of Public Roads, Honolulu, arrived on February 27 for an inspection of road construction work in the park and other sections of the island, and returned to Honolulu February 28.

130 Finance and accounts
As this data is not available at the present time it will be found at the back of the report as Statistical Report No. 8.

150 Equipment and supplies
Saddles and miscellaneous hand tools were received during the month, besides materials for the construction of the U.S. Commissioner's residence.

180 Circulars, placards, publicity bulletins, etc.
Copies of the Volcano Letter are attached. There was no issue of Nature Notes this month, due to the press of other business but it is hoped that two numbers may be published during March. Copies of press memoranda are attached to the back of this report.

200 Maintenance, improvement and new construction

210 Maintenance
The usual maintenance and repair of roads, trails, telephone lines and grounds was carried on during the month. Wind, rain, and thunderstorms have made some additional maintenance work necessary.

230 New construction.
The commissioner's cottage, started January 9, is now 85 per cent completed.

According to Resident Engineer Handley's report, the construction work on roads now in progress is 47 per cent completed, with 61 per cent of the contract time having elapsed. Due to heavy rains at headquarters, the contractor has shifted his activities to the lower and drier section of the park where more work could be accomplished.

240 Improvement of approaches to the park
County officials are now taking up with Federal authorities the advisability of building a road 22 feet wide through the Puuwaawaa section on the round-the-island road, as is specified, and of limiting the grade of the Kohala Mountain section to 6 per cent. These are both isolated districts where traffic is never heavy and it is believed that by constructing a narrower road, with steeper grades where necessary, the entire sections may be paved, instead of paving only half the distance with higher standard roads and having to leave the other half of the projects incomplete.

260 Landscape work
Copies of reports have now been obtained of previous visits of members of the Landscape Division, for our information and study. Mr. Wosky is now at work on a report of his recent visit to the park, with plans for future development.

300 Activities of other agencies in the park

310 Public service contractors

The annual report submitted by the Kilauea Volcano House Company shows considerable loss for the year's operations. Rates for 1932 were approved for $8 a day instead of $9 a day, which was previously charged.

The Manoa and Wilhelmina, two of the oldest passenger boats of the Matson line, have been withdrawn from service following the launching of the new liner "Mariposa". Several other new passenger ships will soon be launched to take care of the passenger travel to the islands. The Bark Superintendent was a guest of the Honolulu Chamber of Commerce at luncheon on the Marippsa on February 10, when it came to Honolulu for the first time.

400 Flora, fauna, and natural phenomena

410 Ranger service

The rangers have been on duty at the Hilo entrance station, Lava Tube, firepit and Museum during the visit of the fleet to maintain order, give information, etc. During the early part of the month they were engaged as usual in patrol duty, repair work and some construction work.

411 Naturalist service

Twenty four lectures were given at Uwekahuna, with an attendance of 1,945, two at the Volcano House with an attendance of 48, and three trips were made across the crater floor with a total of 23 visitors. Museum attendance for the month totaled 5,473, most of which were sailors.

The University extension course being taught by the Park Naturalist with an enrollment of 21 persons in the Pahala district, had three meetings during the month, all of which were most satisfactory.

480 Natúral phenomena

There was nothing during the month to indicate any movement of lava. A few local shocks were recorded originating from three to 26 miles distant; several slides occurred in the walls of the firepit, and cracks on the north-eastern rim were found to be gradually widening. Tilt for the month was E, SE and SW.

500 Use of park facilities by the public

510 Increase or decrease in travel

There was a slight decrease in patronage of the hotel and recreation camps during the month, as compared with last month and this month last year but the number of Navy men visiting the park has more than made up for this deficiency, the total number of visitors being 10,145 for the month, as compared with 6,453 for February 1931. The total number of visitors this travel year to date, is 70,982, compared with 69,126 for last year, an increase of 2.6%.

530 Visitors

Admirals McNamee, Taussig and Schofield, with their staffs were escorted through the park by the Superintendent and shown every courtesy.

600 Protection

610 Police protection

During the visit of the fleet the Hilo police force has been patroling the Volcano road systematically. Shore patrols have also been provided from the ships in harbor to aid the local police in maintaining order.

630 Accidents

The Government Studebaker sedan, which was badly damaged by an accident in January, has now been repaired and is in good running order. The damages amounted to $285, which was paid by insurance of Dr. D. M. Roberts, of Kilauea Military Camp, who was responsible for the accident.

640 Destruction of predatory animals

The following animals were trapped and killed during the month:

68 wild goats
11 wild pigs

900 Miscellaneous

While in Honolulu the Superintendent was invited by the Hawaii Tourist Bureau to attend a free showing of scenic motion pictures which is given for the benefit of tourists at the new Pawaa Theatre. Preceding the pictures, Mr. Leavitt was invited to make a short talk on Hawaii National Park, and gave those present a description of the points of interest, scenic attractions, and the character of service rendered to the public by the staff of the park.

Seth W. Richardson, Assistant U.S. Attorney General, arrived in Hilo on February 29, by airplane, accompanied by a party of officials who are making investigations following the recent "crime wave" in Honolulu. The party will make their headquarters at Kilauea Military Camp in Hawaii National Park early in March, while conducting investigations throughout the island.

Very respectfully,

E P Leavitt

E. P. Leavitt,
Superintendent.

Total rainfall to date for the Volcano district is 38.89 inches compared with 8.32 inches for February last year.

100 Administration

110 Status of work

All office work, including disbursing and accounting, was kept current during the month. Mimeographed copies were made of the Superintendent's annual report and sent to the various parks and the Washington office.

120 Park inspections by

121 The Superintendent

On February 2 Assistant Landscape Architect John B. Wosky, Park Naturalist Doerr, Superintendent Leavitt and District Ranger J. H. Christ started their inspection of the Haleakala section of the park, accompanied by three members of the Maui Chamber of Commerce. One night was spent at the rest house but the party did not go down into the crater. The following morning they proceeded to the White Hills area, the proposed terminus of the new road, where they found an excellent building site for a rest house or hotel, and a much better view on all sides than is found at any other location on the crater rim. The line of the new road survey was traversed on foot from the White Hills section to the lower boundary of the park, and carefully studied from all viewpoints, Mr. Wosky suggesting

ing

several changes that seemed advisable.

This was Mr. Doerr's first visit to the Haleakala section and after some study of the region he was much impressed with its possibilities from an educational standpoint, as it is rich in historic interest.

On February 5 the Superintendent and Mr. and Mrs. Wosky proceeded to Honolulu and the remainder of the party returned to Hawaii. In Honolulu Mr. Wosky was shown all the principal points of interest and taken around the island. He met many of the leading business men who are interested in the development of the national park and in tourist travel. Conferences were held with Mr. E. S. Wheeler, Principal Highway Engineer of the Bureau of Public Roads, regarding the new roads under construction and proposed roads for the park. Mr. Wosky was given much aid on the subject of Hawaiian architecture by Mr. A. O. Thompson and Mrs. Catherine Jones Richards, architects, who furnished him with blueprints and drawings and pointed out to him various styles of Hawaiian buildings.

A conference was held with Governor Lawrence M. Judd regarding the appointment of William B. McLean, who was nominated by the Governor for the position of U. S. Commissioner, and several other matters.

Regular inspections were made of the roads, trails and other construction in the park, and weekly trips were made to Hilo on official business. A horseback trip through the seacoast section of the park was made on February 16, in company with Park Naturalist and Mrs. Doerr and District Ranger Christ.

10-157
(July, 1929)

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

TRAVEL REPORT

HAWAII National Park for the month of FEBRUARY, 1932

	This Month	This Travel Year To Date	This Month Last Year	Last Travel Year To Date	Increase for Travel Year Number	Increase for Travel Year Percent
PRIVATE TRANSPORTATION:						
Cars first entry, ...						
Cars reentry, ...						
Motorcycles, ...						
Total motor vehicles, ...						
Persons entering via motor vehicles, ...	9,458	66,912	5,648	64,498	2,433	3.6%
Persons entering via other private transportation, ...	156	1,621	245	1,700	- 79	4.6%
Total persons entering via private transportation, . . .	9,614	68,533	5,893	66,198	2,335	3.4%
OTHER TRANSPORTATION:						
Persons entering via ~~stages~~ Hotel, .	531	2,449	560	2,928	- 479	1.6%
Persons entering via trains, .						
Persons entering otherwise, . .						
Total other transportation, .	531	2,449	560	2,928	- 479	1.6%
GRAND TOTAL ALL VISITORS, . . .	10,145	70,982	6,453	69,126	1,856	2.6%

	This Year	Last Year	Increase Number	Increase Percent
Automobiles in public camps during month, ...	0	1		
Campers in public camps during month, ...	0	8		

10-158

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF AUTHORIZED PROJECTS

HAWAII National Park for the Month of FEBRUARY 1932

Description of Projects	Percent Constructed To Date	Percent Constructed This Month	Percent Constructed Last Month	Probable Date of Completion
410 U.S. Commissioner quarters	85	82	3	30 June 15, 1932
411 Employees quarters - - - -	100	0	0	
412 Employees quarters - - - -	100	0	0	
413 Administration building -	0	0	0	June 30, 1932
502 Trails:				
502.1 Hilina Pali to Halape -	100	0	0	
502.2 Uwekahuna-Halemaumau auto trail - - - - - - - - - -	92	0	2	March 31, 1932
502.3 Mauna Iki extension - - -	100	0	0	
502.4 Haleakala trail - - - - -	100	0	0	
502.5 Mauna Loa trail - - - - -	100	0	0	
502.6 Halemaumau trail - - - -	95	0	0	
507.1 Kau belt road - - - - - -	100	0	0	
Road Survey, BPR construction -	47	8	3	July 1, 1932

10-159
(May, 1931)

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF PERSONNEL

HAWAII National Park for the Month of FEBRUARY, 1932

	This Month		This Month Last Year	
	Appointed	Non-Appointed	Appointed	Non-Appointed
Number of employees beginning of month	12	19	5	4
Number of additions	0	2	0	1
Total	12	21	5	5
Number of separations	0	1	0	0
Number of employees close of month	12	20	5	5
Number of promotions during month	0	0	0	0
Aggregate amount of annual leave taken	0	0	1	0
Aggregate amount of sick leave taken	0	0	0	0
Aggregate amount of leave without pay	0	0	0	0

10-160

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

REPORT OF PARK REVENUES

Hawaii National Park for the Month of February, 1932

	This Year	Last Year
Park revenue on hand beginning of month,	0	0
Received,	$41.44	0
Total,	$41.44	0
Remitted,	$41.44	0
On hand close of month,	0	0

Park revenues received this year to date,	$1,509.19
Park revenues received last year to date,	1,350.00
Increase,	159.19
Per cent of increase,	10.5%

10-161

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

REPORT OF SALES OF PUBLICATIONS

HAWAII NATIONAL PARK
FEBRUARY, 1932

	Number	Value
GOVERNMENT PUBLICATIONS:		
On hand beginning of month,	957	$168.05
Received during month,	0	0
Total,	957	$168.05
Sold during month,	8	2.45
On hand at close of month,	949	$165.60
NON-GOVERNMENT PUBLICATIONS:		
On hand beginning of month,		
Received during month,		
Total,		
Sold during month,		
On hand at close of month,		

Cash on hand beginning of month,	$15.45
Sales during month,	2.45
Total,	$17.90
Remitted during month,	00.00
Balance,	$17.90

STATISTICAL REPORT NUMBER 8

HAWAII NATIONAL PARK

FINANCE AND ACCOUNTS

Symbol	Name	Allotted	Expended & Obligated	Balance
41/2415	Hawaii National Park 1931-32 -	$52,130.00	$40,689.66	$11,440.34
41/2405	Emergency Reconstruction and Fighting Forest Fires - - - -	$ 200.00	$ 200.00	0.00
41/2406	Forest protection and fire Prevention - - - - - - - - - -	$ 100.00	$ 100.00	0.00
4 X 436	Roads and Trails, National Parks No Year - - - - - - - - - -	$ 384,806.30	$93,493.09	$291,313.21

Form No. 1009—Met'l.

U. S. Department of Agriculture, Weather Bureau.

COOPERATIVE OBSERVERS' METEOROLOGICAL RECORD:

Month of February, 1932, *192* ; *Station,* Volcano Observatory ; *County,* Kau

Hour of Observation, 8:30 A.M.

State, Hawaii ; *Latitude,* ; *Longitude,* ; *Time used on this form,*

DATE.	TEMPERATURE. Maximum. (1)	Minimum. (2)	Range. (3)	* Set Max. (4)	PRECIPITATION. Time of Beginning. (5)	Time of Ending. (6)	† Amount. (7)	Humid. (Snowfall, in Inches.) (8)	Wind (Depth of Snow on Ground at Time of Observation.) (9)	Prevailing Wind Direction. (10)	Character of Day, Sunrise to Sunset. (11)	‡ Miscellaneous Phenomena.
1	69	49	20	56			05	88	Mod.	N.E.	P.C.	
2	69	49	20	60			T	93	"	"	Cloudy	
3	64	51	13	57			58	93	"	"	P.C.	
4	59	50	9	55			06	95	"	"	"	
5	62	52	10	57			04	92	"	"	Cloudy	Thunder P.M.
6	63	54	9	62			1.16	79	Lt.	"	"	
7	55	54	1	55			1.54	93	Str.	"	"	
8	57	48	9	51			71	100	Mod.	"	"	
9	62	51	11	57			39	88	"	"	"	New snow on mountains
10	61	55	6	59			45	93	"	"	"	
11	61	55	6	58			40	93	"	"	"	
12	59	54	5	55			30	100	"	"	"	
13	62	51	11	57			45	88	"	"	"	
14	67	51	16	61			09	85	"	S.W.	"	Sun early A.M.
15	67	52	15	57			27	78	"	"	P.C.	
16	68	50	18	56			05	85	"	"	"	
17	68	54	14	59	4	12 N	1.32	100	V. Str.	"	"	Hard rain A.M. &
18	69	51	18	55			1.43	85	Mod.	"	Clear	Thunder - Hail
19	65	50	15	59			T	82	Str.	"	P.C.	
20	70	49	21	53			T	85	Mod.	N.E.	"	
21	66	54	12	59			03	88	Str.	S.W.	"	
22	75	53	22	57			01	87	Lt.	N.E.	"	Snow on mountains
23	74	51	23	58			T	85	"	S.W.	"	
24	63	59	4	60			18	94	Str.	"	Cloudy	Wind N.E. P.M.
25	63	57	6	61			09	89	Mod.	"	"	
26	60	55	5	57			90	94	Str.	N.E.	"	
27	60	55	5	58			19	93	Mod.	"	"	
28	61	55	6	57			2.28	100	"	"	"	
29	64	55	9	57			1.37	94	"	"	"	
30												
31												
Sum	1835	1024	339	1693			14.34	2618				
Mean	64.2	[illegible].25	11.6	55.5			4.94	90				

* Reading of maximum thermometer immediately after setting.
† Including rain, hail, sleet, and melted snow.
‡ Thunderstorms, halos, auroras, etc.

T. A. Jaggar, *Cooperative Observer.*

Post-Office Address,

(IN TRIPLICATE.) See cover for instructions.

MONTHLY SUMMARY.

TEMPERATURE.

Mean maximum, 64.3

Mean minimum, 52.5

Mean, 58.5

Maximum, 75 ; date, 22

Minimum, 48 ; date, 8

Greatest daily range, 23

PRECIPITATION.

Total, 14.34 inches.

Greatest in 24 hours, 2.28 ; date, 28

SNOW.

Total snowfall, ... inches; on ground 15th, ... inches;

at end of month, ... inches.

NUMBER OF DAYS—

With .01 inch or more precipitation, 25

Clear, 1 ; partly cloudy, 11 ; cloudy, 17

DATES OF—

Killing frost,

Thunderstorms, 5, 17

Hail: Light, ; Moderate, ; Heavy,

Sleet,

Auroras,

REMARKS:

Kona storm 17. Wind velocity increased at noon, when rain ceased. Wind damage to trees and buildings. Lightning entered observatory twice by phone wires and put phone out of order.

Press Memorandum
For Immediate Release

By John E. Doerr, Jr.
Park Naturalist

Hawaii National Park, Feb. 8, 1932

John B. Wosky, Assistant Landscape Architect of the National Park Service, has recently completed a five weeks study of landscape problems of present and future developments in Hawaii National Park. During the past week Mr. Wosky and Park Superintendent E. P. Leavitt, accompanied by John E. Doerr, Jr., Park Naturalist; J. H. Christ, District Ranger; and H. L. Handley, Resident Engineer for the Bureau of Public Roads, made a field study of the proposed plans for developing the Haleakala section of the park.

The plans for Haleakala include the construction of a paved automobile road leading to the summit of Haleakala, and at the park entrance the construction of a combination administration building and ranger quarters, as well as a utility building to house cars, horses and equipment. The park road connecting with the territorial road now under construction, will terminate at White Hills on the west rim of the crater. The White Hills area is the most favorable place from which to view Haleakala, central and west Maui, and neighboring islands. Climatic conditions and topographic features favor the White Hills area as the terminus of the road. With that in view the park officials considered plans for locating the summit rest house in that region.

While on Haleakala Mr. Wosky studied the location of the proposed road, which has already been surveyed. In general Mr. Wosky was satisfied with the proposed location. He did, however, suggest certain minor changes to eliminate some cuts and fills. Mr. Wosky made complete notes and pictures of the points where these changes will be necessary and his notes and pictures will be thoroughly studied so that the final road plans will meet with the approval of the landscape division of the National Park Service. In constructing roads, The National Park Service has in view maximum serviceability and safety with as few artificial scars as possible in the natural landscape features.

Accompanying the park officials to the top of Haleakala were Mrs. John B. Wosky; Dave Rattray, president of the Maui Chamber of Commerce; Ed Walsh, chairman of the Maui Chamber of Commerce National Park committee and proprietor of the Grand Hotel; J. H. Foss, chairman of Maui Chamber of Commerce Roads committee; Al Burdick, Resident Territorial Engineer; Manuel Miguel and W. L. Lythe, who acted as guides.

While on the mountain the party experienced fine weather which afforded many excellent views. Freezing temperature at night was recorded, but no snow, although some members of the party reported snow on the mountain a few days previous to the inspection trip.

While on Maui the park officials were conducted on tours to points of interest in Wailuku, Lahaina, Iao Valley and Hana. The entire party agreed that Maui has much to interest the tourist. The scenic beauty and historic interest of Iao Valley particularly impressed the visitors. Mr. Wosky stated that Iao Valley has excellent possibilities for developing a territorial park.

The Maui people are showing much interest in the development of Haleakala. The Maui Chamber of Commerce is active in the work of developing the island and the Haleakala section of the National Park.

Mr. Doerr, Park Naturalist in charge of the educational development of the park, is most enthusiastic over the educational possibilities of Haleakala and the surrounding region. Anyone staying overnight on the rim of Haleakala can not help but gain a better appreciation and a more thorough understanding of the natural features of the islands.

Superintendent Leavitt is eager to carry out the plans for developing Haleakala and hopes that the economic depression will not necessitate any delay in the work scheduled for 1932.

The Volcano Letter

Two dollars per year — Ten cents per copy

No. 371—Weekly | Hawaiian Volcano Observatory, National Park, Hawaii | February 4, 1932

REVIEW OF EARTHQUAKE RECORD KILAUEA 1931

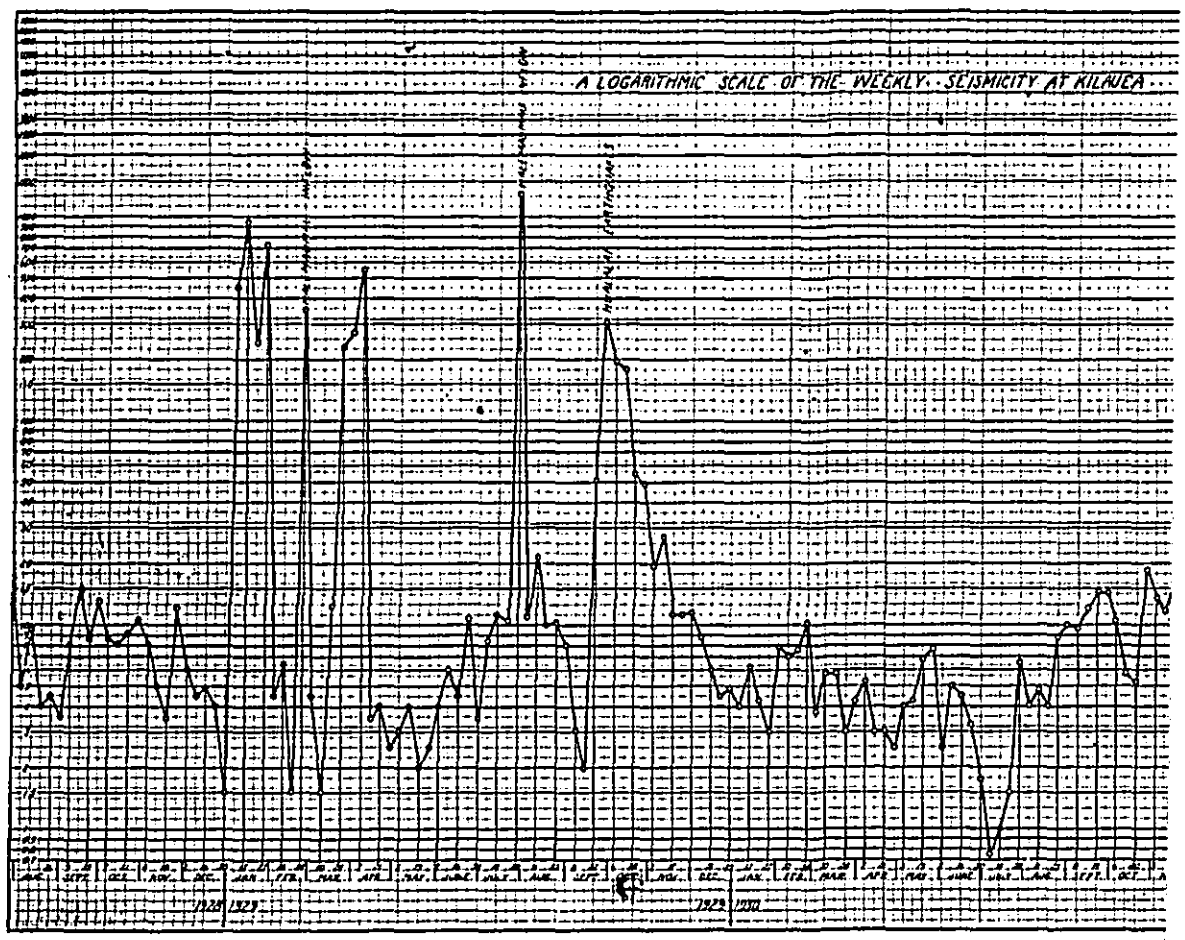
tr—tremor, value ¼ Rossi-Forel
vf—very feeble, ½ Rossi-Forel
f —feeble, 1 Rossi-Forel
SSRF—seismicity summation R.F.
sl —slight, value 2 Rossi-Forel
mod—moderate, 3 Rossi-Forel
tel —teleseism, or distant earthquake, no value for local seismicity.

Week ending 1931	tr	vf	f	sl	mod	tel	SSRF	log
Jan. 5	55	1	1	0	0	1	15.25	1.183
12	27	3	0	0	0	0	8.25	0.917
19	22	5	0	1	0	2	10.00	1.000
26	30	14	0	0	0	0	14.50	1.162
Feb. 2	40	27	1	1	0	0	26.50	1.423
9	11	2	1	0	0	1	4.75	0.677
16	12	2	0	0	0	0	4.00	0.602
23	19	1	0	0	0	0	5.25	0.721
Mar. 2	25	2	1	0	0	0	8.25	0.917
9	16	2	0	1	0	0	7.00	0 845
16	34	3	0	0	0	0	10.00	1.000
23	22	2	0	1	0	3	8.50	0.929
30	29	3	0	0	0	1	9.75	0.989
Apr. 6	55	5	1	0	0	1	17.25	1.237
13	17	0	0	0	0	0	4.25	0.628
20	18	6	1	1	0	0	10.50	1.021
27	23	3	0	0	0	1	7.25	0.861
May 4	33	4	2	0	0	0	12.25	1.088
11	38	0	0	0	0	1	9.50	0.978
18	29	1	0	0	0	0	7.75	0.889
25	25	1	0	0	0	0	6.75	0.829
June 1	33	1	0	0	0	0	8.75	0.942
8	29	1	0	0	0	0	7.75	0.889
15	27	6	0	1	0	0	11.75	1.071
22	26	1	1	0	0	0	8.00	0.903
29	22	0	0	0	0	0	5.50	0.740
July 6	34	2	0	0	0	0	9.00	0.954
13	18	5	0	0	0	0	7.00	0.845
20	18	3	0	0	0	0	6.00	0.778
27	19	2	0	0	0	0	5.75	0.760
Aug. 3	16	1	1	0	0	0	5.50	0.741
10	39	6	0	0	0	1	12.75	1.105
17	22	6	0	0	0	1	8.50	0.929
24	24	3	0	0	0	0	7.50	0.875
31	19	1	2	0	1	0	7.25	0.861
Sep. 7	36	5	0	0	0	0	11.50	1.061
14	56	5	1	0	0	1	17.50	1.243
21	43	1	2	0	0	0	13.25	1.128
28	26	4	1	0	0	1	9.50	0.978
Oct. 5	20	2	0	0	0	1	6.00	0.778
12	28	8	0	0	0	1	11.00	1.042
19	40	2	0	0	0	0	11.00	1.042
26	11	1	0	0	0	0	3.25	0.512
Nov. 2	40	3	2	0	0	0	13.50	1.131
9	59	0	0	0	0	0	14.75	1.169
16	81	6	0	0	0	0	23.25	1.367
23	51	2	0	0	0	0	13.75	1.138
30	22	2	0	0	0	0	6.50	0.810
Dec. 7	24	3	0	0	0	0	7.50	0.875
14	46	9	1	0	1	0	20.00	1.303
21	28	6	0	0	0	0	10.00	1.000
28	6,531	9	1	0	1	0	1641.00	3.215
1932								
Jan. 4	10,080	3	1	0	0	0	2522.00	3.419
11	2,544	4	0	0	0	2	638.00	2.805
18	63	5	0	0	0	0	18.25	1.260
25	29	0	1	0	0	0	8.25	0.915

A CHART OF KILAUEA SEISMICITY

The accompanying diagram exhibiting seismic motion of the ground is a compilation of earthquake activity, representing one of many attempts to show in a single graph a combination of the number and intensity of earthquakes for a given time. What is called seismicity, or the earthquake shakiness of a country, is compounded of tremors and small shakes and big shakes, with many of the smaller phenomena and very few of the big ones. If all are a release of some form of underground energy where magma is moving under a volcano, it is reasonable to think of a single big earthquake as in some way the equivalent of many small ones. (See discussion of Earthquake Intensity Scales, Volcano Lettetr No. 223, April 4, 1929.)

At the Hawaiian Volcano Observatory the weekly descriptions of local seisms or quakes describe them as very feeble, slight. moderate, etc., and these words are not colloquial, but are systematic. The word "slight" means relatively big as compared with "very feeble." By giving a weight or value in terms of the Rossi-Forel scale to each descriptive word, we can add together these values for the number of earthquakes of each grade for each week and secure a figure standing for the combined shakiness of that week. The following is the table of weights:



Curve of rising and falling earthquake and tremor activity, expressing combined weekly frequency and inte measured at the Observatory on northeast rim of Kilauea Crater from August 1928

Observatory Scale	Weight	Description
Tremor	¼	Can barely be seen on the seismograph records; when continuous the unit is the minute of duration.
Very Feeble	½	A slightly larger shock, not ordinarily felt by people even when very close to the origin. Rarely reported felt by persons lying down.
Feeble	1	Felt by few or none, an earthquake on the border line between being instrumental and felt. No. I Rossi-Forel scale.
Slight	2	No. II Rossi-Forel scale. Felt slightly.
Moderate	3	No. III Rossi-Forel scale. Felt moderately.
Strong	4	No. IV Rossi-Forel scale. Felt strongly.

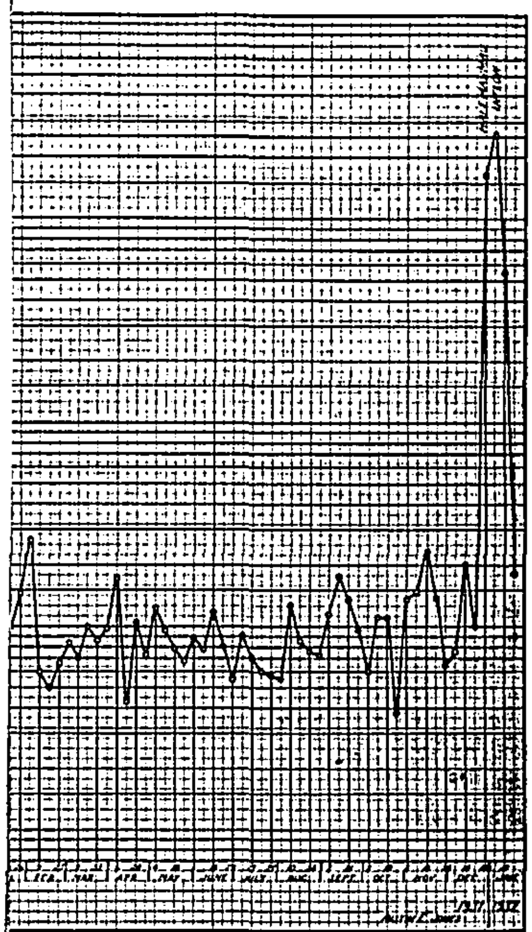
An earthquake felt strongly is still in the weak class, but from the point of view of instrumentalists, operating seismographs that magnify the earth's motion one hundred times, this quake is strong because it always dismantles the connecting bars of a sensitive seismograph. This does not mean that it breaks anything.

These grades are weighted roughly in terms of the Rossi-Forel scale as ¼, ½, 1, 2, 3, 4, and mathematically, in terms of accelerations, the Rossi-Forel scale is logical in that Grade II is twice as big as Grade I, etc., up to Grade IV. Beyond Grade IV the progression is not arithmetical.

If in one week we have 10 tremors or 10 minutes of tremor (value 2½), three very feeble shocks (1½), a slight earthquake (2), and a moderate earthquake (3), the resulting index of that week's seismicity is the summation of these values equal to 9. Thus in the accompanying tabulation the week ending July 6, 1931, had that value because of the very large number of tremors.

If we were to have several days of continuous tremor, each day would produce 1,440 minutes of tremor, or an index of 360. Such an example can be shown for the last eruptive period of Halemaumau beginning in December of 1931. During the week ending December 31, 1931, there were 11 tremors, 9 very feeble shocks, 1 feeble one, and a moderate earthquake preceding the eruption which began on December 23. The summation index to this point is 11.25. This was followed by four days and a half of tremor, the index of which amounted to 1630. The total index of seismicity for the week is obtained by adding together the two figures and amounts to 1641 units.

If this were platted on uniform coordinate paper, the figure 1641 would be about 180 times as great as that for the week mentioned above having the index of 9, so that if inches were used as units on the paper, the line would rise 135 feet. To avoid this difficulty the logarithms of



ocal earthquakes, and duration of local tremors.
ry 1932. By A. E. Jones.

all index numbers have been taken and platted for the number of units involved vertically above each date. In the accompanying table the logarithmic figure is shown in addition to the seismicity figure. On the curve a logarithmic scale has been drawn across the diagram with the seismicity sums R. F. on the left. These read from 0.7 to 9000 and the sheet is thus adequate to contain all the peaks and hollows for the three and a half years from July 1928 to January 1932.

To judge by the height of the peaks, during eruptions of lava flowing into Halemaumau in February and July 1929, November 1930, and December 1931, making a pronounced rise of the curve in each case, determined largely by continuous tremor, evaluated for each minute arbitrarily as one-quarter unit, it seems likely that this arbitrary value is much too great. The method, however, has the advantage of exhibiting an effect of these eruptions on the seismicity curve with much vividness. A.E.J.

DISCUSSION OF SEISMICITY CURVE 1928-32

The table which was used by Mr. Jones in compiling the curve described above, will be better understood if it is presented in full for this past year 1931 in order to show how the curve was drawn for the right-hand side of the diagram. The table is on Page One.

Curves of earthquake frequency by months and by three-day units have been experimented with at the Hawaiian Volcano Observatory as follows: By Jaggar, monthly local earthquake frequency compared with maximum intensity from 1912 to 1916, in "Seismometric Investigation of the Hawaiian Lava Column," Bull. Seis. Soc. Amer. Dec. 1920, p. 259, when it appeared the peaks were at rythmic intervals of about nine months and increasing along with a series of Mauna Loa events. Next a study by Wilson Bull. Haw'n Volc. Obs. Dec. 1927, fig. 47, wherein the three-day frequency was smoothed by overlapping means, did not include harmonic tremor (nor did the one above), and analogy with the lunar half-month was suggested. Taking frequency alone, there was no peak accompanying the July eruption of Halemaumau 1927, but a comparative symbol indicating intense earthquakes showed a swarm of them not reflected in frequency curve, but occurring at the beginning and the end of the eruption. Thus Wilson's curve, compared with the new method by Jones, would have shot up for the 1927 eruptive period, had it embodied an integration of harmonic tremor and intensity along with frequency, as has been done in the new type of curve. In a diagram compiled by Finch for comparison with tilt (Bull. Seis. Soc. Amer. Mar. 1929, p. 41), marked peaks in monthly earthquake frequency for the years 1913-1925 are shown to accord with drops in the lava of Halemaumau and with Mauna Loa outbreaks, the highest frequency according with the tremendous drop of 1924. In 1916 when there was a sudden drop of the Halemaumau lava immediately following an outhbreak of Mauna Loa, there were two peaks of earthquake frequency side by side accompanying these events (Jaggar, Amer. Jour. Sci. Apr. 1917, fig. 2 p. 259).

The outstanding features of the curve for seismicity at Kilauea from 1928 to the beginning of 1932 are the high peaks of suddenly increased seismic activity that accompanied the four outbreaks of Halemaumau. By consulting the last number of the Volcano Letter, January 28, 1932, the reader may learn the details of these eruptions February 28, 1929, July 25, 1929, November 19, 1930, and December 23, 1931. It was there stated that in general these eruptions were progressively more intense and more enduring, and it is clear from the chart that the four peaks of seismicity are progressively higher and wider. Mr. Wilson's curve mentioned above showed a composite peak of earthquake frequency in December 1927 immediately preceding the very mild outbreak of January 1928, and this was made up of much tremor accompanying avalanches in Halemaumau pit and the widening of some cracks on the edge. If that episode were added to the left-hand side of our diagram, we should find a still smaller peak for the actual eruption week of 1928 and a big complex peak preceding it. So for the seven weeks preceding the February eruption of 1929 there is a composite and enduring peak of seismicity which was accompanied by widening of cracks and numerous avalanche tremors, as well as other seismic events distinctly premonitory to the lava inflow of February 20.

Not so clear is the explanation of the third peak between March 10, the time of low tremor following the eruption, and April 14, when general decline began. The only events of note during this time were rather protracted spasms of tremor, a certain number of avalanches, and some rather strong tilting. It seems likely that this peak in seismicity represents a distinct slump in the lava column following the eruption, but its qaulity of gradual rise and sudden fall to a point below normal is unusual.

If we look at the curves on either side of the other Halemaumau eruptive periods as shown in our diagram, there is nothing analogous to these peaks of preparation and of aftermath.

The Hualalai earthquake crisis of September-October 1929 is developed as a very sudden rise in the seismicity curve, followed by a stepwise decline for 17 weeks, and this curve is quite in accord with the facts of observation, for the strong intensity and the strong frequency showed maxima soon after the beginning. It will be seen that this is a true earthquake curve of sudden intensity, followed by swarms of aftershocks, and quite unlike the steep bilaterial curves that accompanied the Halemaumau outbreaks.

When it comes to the general curve of seismicity in the diagram, disregarding the high peaks, it is evident that this curve as a whole tended to fall below the figure 10 from 1928 to July of 1930, and that then there was a pronounced rise in seismicity, and thereafter the small crests tended to rise above that figure. The minima approached low levels right while the maxima were reaching high ones about February 1929, again in September of that year, and the lowest of all was reached in July of 1930. In the whole diagram there is possibly some suggestion of a wave *movement* with troughs of minima 16 months apart. When it comes to the small oscillations, there is a marked tendency to troughs from two to six weeks apart, possibly corresponding to the lunar month and half-month. This tidal effect for both seismicity and lava movement has been discussed before. The fact of the diagram are 20 cases of complete periods occupying four to six weeks, 20 occupying three weeks, and 14 occupying two weeks. The mean is 3.4 weeks, which is near enough to the lunar month for such crude results over a short interval of time.

There are many questions raised by this diagram as to the comparability of local seisms, spasmodic tremor, harmonic tremor, and avalanche tremor, and the equivalence of the units used in terms of acceleration, or of whatever product of amplitude and period properly constitutes seismic intensity. It should be noted, however, that this is not an intensity curve, but is rather an intensity-duration curve, and this taking account of frequency is new, and the seismologist of this station is to be congratulated on the experiment. T.A.J.

KILAUEA REPORT No. 1045

WEEK ENDING JANUARY 31, 1932

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge

Nothing remarkable has happened at Halemaumau pit suggestive of movement of lava. The new floor is hot and a high cumulus occasionally forms above the pit. On January 26 in the forenoon no single vents on the floor could be identified as emitting fume, there had been sliding from southerly walls as shown by numerous bowlders and fresh debris on the 1932 floor SE. and red material on floor S. The northeast rim cracks continued to widen slightly by measurement. *At 11:18 a. m. a slide from* the northeast wall, beginning near the top, made dust.

The seismologist reports 1 very feeble local seism January 28 at 8:18 a. m. with indicated distance 6 miles. Forty-eight local tremors were recorded, 3 suugesting origin distance 9, 18, and 23 miles. A distant earthquake registered January 29 at 3 h 21 m 12 s a.m., indicating approximate origin distance 3100 miles, began too indefinitely to show direction of origin.

Microseismic motion has been moderate, and tilting of the ground moderate to the east.

THE VOLCANO LETTER

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Subcription for non-members two dollars per year of 52 numbers. Address the Observatory.

HAWAIIAN VOLCANO OBSERVATORY
Founded 1911

This laboratory at Kilauea Volcano belongs to the Hawaiian Volcano Research Association and is leased and operated by the United States Geological Survey.

It maintains seismographs at three places near Kilauea Volcano, also at Hilo, and at Kealakekua in Kona District. It keeps a journal of Hawaiian volcanic activity and publishes occasional Bulletins.

Membership in the Hawaiian Volcano Research Association is limited to patrons of Pacific science who desire personally to aid in supporting the work.

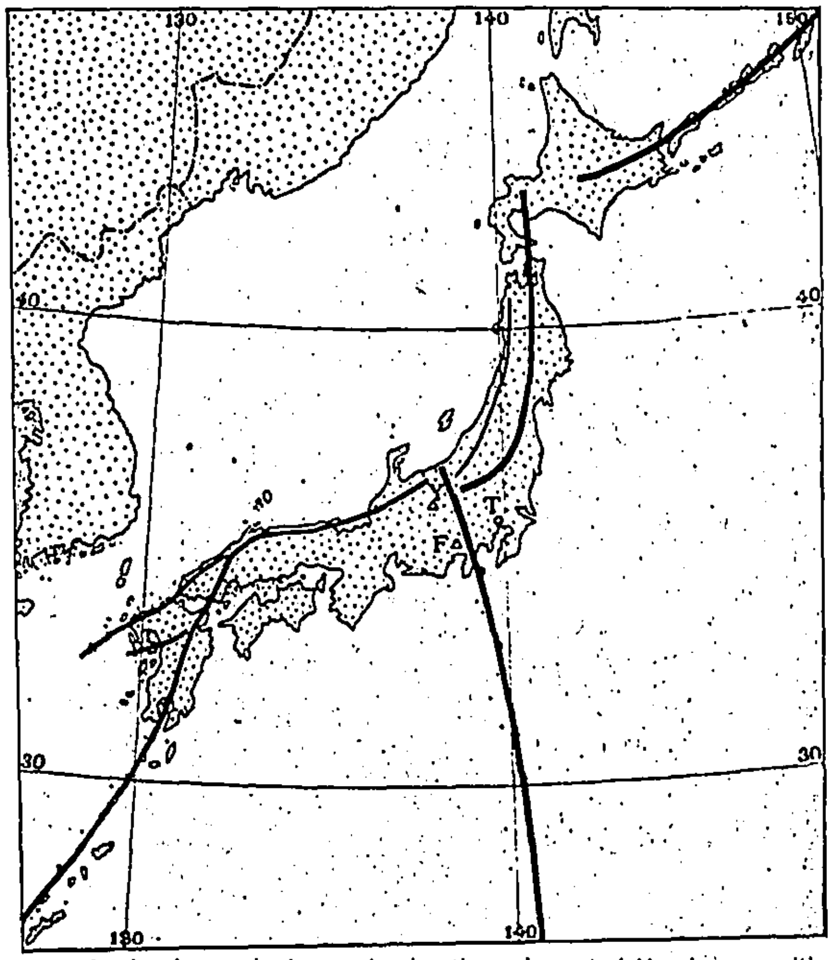
The work of volcano research so supported is in collaboration with the work of the United States Geological Survey, but supplements it with buildings, research fellows, instrumental plants, explorations and special investigations for which there is no governmental provision. The Geological Survey maintains volcano stations in Alaska, California and Hawaii.

Persons desiring application blanks for membership ($5.00 or more) should address the Secretary, Hawaiian Volcano Research Association, 320 James Campbell Building, Honolulu, T. H.

The Volcano Letter

Two dollars per year | Ten cents per copy

No. 372—Weekly | Hawaiian Volcano Observatory, National Park, Hawaii | February 11, 1932



Map of volcanic arcs in Japan, showing the main central Honshu arc, with the Kurile arc at the northeast and the Ryukyu at the southewest. T=Tokyo, F=Fujiyama, Y=Yakedake. The Fujiyama zone extending to the south leads through the Ogasawara Islands. By Omori.

RECENT ERUPTIONS IN JAPAN

An impressive series of arcuate fissures in the crust of the earth, each 1200 to 1500 kilometers long, including the Ryukyu islands, the three mainland islands of Japan, the Kurile Islands at the north, and the Ogasawara line of islands south from Fujiyama, makes up the volcano domain of Japan. In all, this involves 5,000 kilometers or 3100 miles of scattered volcanoes, amid hills and mountains built above the fractures, so that as cracks they are concealed.

The eruptions from 1924 to 1931 have been tabulated by Tanakadate (Japan Jour. Astron. and Geophys. Vol. IX, No. 1, 1931, p. 47).

The activities are divided into smoke explosions, ash explosions, explosive eruptions, pumice flows, mud flows, submarine eruptions, and "increase of normal activity." This normal activity in volcanoes like Aso, Oshima, Tarumai, and Asama involves lava in the crater pit. Lava flows are rare in Japan because the andesites are siliceous and viscous, and the gas or steam of an "eruption" effervesces explosively through the incandescent slag that plugs the crater. "Fire phenomena," or "pumice flows," or "flows of lava blocks," or "glowing lapilli" are frequently described, as seen from a distance. These descriptions means an internal intrusive magma disrupted. (See Tanakadate, "Eruptive Types," Volcano Letter No. 323, March 5, 1931.)

The activity of the seven years speaks volumes for what Japan has to offer to the student of volcanology. Professor Tanakadate has made a very striking compilation of the facts, the upshot of which is that there are only a few months of each year without reported eruptions in some of the volcanic zones.

There are large shiftings from one zone to another.

There was in Japan a striking rise in distributed frequency in 1927-28, and in intensity in 1929, with a lower Japanese volcanicity before and after these three years.

It happens that these were years of sunspot maxima (see Volcano Letter No. 326), and 1928-29 produced extreme volcanicity elsewhere including the Dutch East Indies, Tonga, Chile, Guatemala, Martinique, and Italy.

Reviewing each year for Japan and beginning with September 1924, we get smoke explosions from Asamayama in central Honshu, followed in the next three months by Yakedake a short distance farther west.

In 1925 Yakedake, Asosan in south Japan, and Shirane in central Honshu were all performing in January, blowing fume and dust, and Yakedake kept it up throughout the year. Asama increased activity in May. Suwanose in the Ryukyu Islands erupted in March, Asosan made increasing explosions in July, November, and December. And in the aut-mn came a submarine eruption, with floating pumice fields, at Hatoma in the south end of the Ryukyu Island line. Kamchatka had eruptions the same year.

In 1926 Yakedake was active but quieter, while Tokachi in the north island *made a big explosive eruption* in May and continued in the autumn. Tarumai in the same island erupted in October. Asama in central Japan renewed fume explosions preliminary to increasing demonstrations in succeeding years, and Asosan in the south did the same but more violently throughout the last half of the year. The north island, the central island, and the south island were now all in action together, and Aleutian volcanoes also broke out.

This continued and increased in 1927 with Asosan, Yakedake, Asama, and Tokachi (from south to north) the main performers, and all on the main islands of Japan. All four had ash explosions, chiefly in April-May, but Asama reached such maxima at the end of the year.

While in 1928 the number of explosive incidents was less, the diversity of location of intense episodes was greater. Matuwa, an island in the northen Kuriles, broke out in February, Tarumai in the north island had three eruptions, and nearby Tokachi had one; all of these concern the northern area. For central Honshu, Asama was fiercely active the first half of the year, Shirane again blew out crater holes, and Oshima near Tokyo revived in the summer. Yakedake slept. Asosan in Kyushu had four eruptive spasms, of which one was an ash eruption and one was accompanied with mud flow.

The year 1929 produced two major explosive eruptions, Komagadake in the north island in June, and Asama in central Japan in September. Tarumai had another outburst, Yakedake had two, and Asosan had two, of which the last was an ash explosion in October. Komagadake had a revival in September, and Asama had fume explosions four times, in addition to its major eruption. Kamchatka volcanoes were active.

A marked dwindling occurred in 1930, with Asama, however, making ash explosions four times in summer and autumn. Matuwa in the Kurile Islands again exploded in its favored month, February. Yakedake had two explosions in the spring, and Asosan one in the autumn. The Aleutian region reported two eruptions.

The late spring of 1931 produced outbreaks in Asama, Yakedake and Asosan, and the same season was notable for activities in the Aleutian Islands and a major eruption at Aniakchak on the Alaskan Peninsula.

Now let us consider the details of some of the Japanese events. The Tokachi eruption beginning May 7, 1926, was in the center of the north island at a sulphur mine operated at a solfatara on the side of a peak 2,077 meters high. Explosions with fume and sulphur flame increased in violence at a place not historically known to be strongly active. But this is in the Ainu wilderness, and merely shows, as elsewhere in all the solfataric belts of the world, that sulphur and heat may anywhere develop a volcano.

On May 24 three persons were killed in a preliminary burst, debris covering the slope and overwhelming a hot-spring bath house. Then at 4:10 p. m. a tremendous explosion upset five million tons of the mountain flank. This material rushed down in two mud flows devastating forests and farms. The dead numbered 144, the wounded 207, and twenty-five square kilometers of country were devastated. Lava lumps of new magma appeared later as bombs in the debris, and eruptions continued but diminished in 1927 and 1928.

Komagadake, 1140 meters high, is near the city of Hakodate, and is an impressive volcano like Vesuvius at the south end of the north island. It has a record of big *eruptions, some as recent as 1905* and 1919. There was an ash explosion in July of 1924. Beginning June 16, 1929, a large destructive eruption began "which ranks next in importance after the 1914 eruption of Sakurajima."

At midnight June 16 a small explosion originated at cracks and fissures extending radially from a small lava hill in the central part of the main crater. Ash fell next morning at the southern foot of the mountain. At 9:30 a. m. June 17 enormous cauliflower clouds arose resembling huge masses of wool and emitting continuous flashes of lightning. The column reached an altitude more than six miles above sea level. At 10 a. m. there were tremendous detonations, roarings, and tremblings, followed by smoke columns that carried blocks of rock, lapilli, sand, and ash which were showered over the country. The ground was almost continuously in vibration, and distinct earthquakes were recorded at the seismograph of the meteorological station at Hakodate, 33 kilometers south from the crater. At 11 a. m. blocks of pumice and small stones were falling at the southeastern foot of the volcano where the forest was devastated, while the village of Sikabe, 13 kilometers to the southeast, had its fields and fishing grounds covered with three or four feet of lapilli.

In the afternoon at frequent intervals glowing masses of pumice blocks ran down the radial valleys in several directions, resembling the glowing blasts (**nuées ardentes**) as described at Mont Pelee in Martinique. These pumice flows traveled in places more than five miles from the crater. At 7 p. m. "fire columns" hung over the crater in the smoke cloud with continuous lightning flashing. The eruptive activity culminated about 10 p. m., after which it gradually declined and towards midnight ceased.

Extraordinary changes took place in the caldera crater of the volcano. The floor was elevated by tumescence, to which relief was added by accumulation of lumps of lava. Three main vents were formed on the domed floor; a round craterlet at the west, a T-shaped fissure at the north, and twin craterlets at the southeast corner, all pouring out white fume. In addition there were numerous minor fissures on the dome.

Quantities of ejectamenta consisting of acidic andesite covered 538 square kilometers of country. Pumice flows in addition, occupying several valleys, covered 27 square kilometers. One person was killed, four were wounded, 65 domestic animals were destroyed, 3500 acres of farm lands were ruined, and about 87,000 acres of pasture and forest were devastated.

There was a renewal of explosive cauliflowers accompanied by tremblings the afternoon of September 6.

Asamayama is the Vesuvius of Japan, characterized by explosions with rumbling, quaking, and air shocks, the projectiles consisting of ash, lapilli, bombs, and blocks several tons in weight. Tanakadate says, "Most of the ejecta are considered as not being juvenile" or magmatic, but the reviewer would question this, for the bottom area in the crater which he saw in 1907, appeared to be a typical andesitic aa lava.

After eruptions and earthquakes in 1924, 1927, and 1928 of increasing vehemence at Asama, there came a great eruption on September 18, 1929, at 1 a. m. which began with roarings followed by detonations. The villagers saw glowing smoke clouds ascending from the crater more than a half mile high. Red-hot blocks of lava were hurled up, and atfer three paroxysmal explosions accompanied with such fire phenomena, the energy of the eruption gradually declined, but rumbling continued. Air shocks were unusually strong, ash rain fell to the east, lava blocks were scattered about the crater, the eastern part of the crater wall was destroyed, and new pits were left in the floor of the crater. About 3.4 million cubic meters of material were thrown out.

Other explosions of Asama and earthquakes followed in 1930. On August 20 of that year a sudden explosion accompanied by a heavy downpour of projectiles killed six persons who had ventured too near the crater rim. On September 5 the explosion clouds were accompanied by incandescence, and the ash rain fell in Tokyo 140 kilometers to the south. Some of the earthquakes, centering at Asama, are registered at Tokyo.

The eruptions of Yakedake and Asosan are of the same general character as those described for Asama, with occasional "fire" and much damage to rice fields by showers of ash, and of fine cindery sand called "yona" in the Aso district. In all cases there is more or less trembling and lightning and earthquakes. The flinging out of red-hot breadcrust bombs which make new landmarks on the edges of the craters, and repeated changes in the configuration of the bottoms, are characteristics of Japanese eruptions.

After our experience at the Kilauea Observatory in trying to decide what physical phenomena may be measured all the time near an active crater, and what active craters are most useful for continuous observation, it is of great interest to study these Japanese records. The seven-year table here under discussion shows 26 incidents for Asama, 25 for Yakedake, and 24 for Asosan, with Yakedake dominant 1924-25, Asosan dominant 1926-27, and Asamayama dominant 1928-31. Oshima which fumes all the time in Sagami Bay, and has a red-hot vent in the lava cone of its inner crater, is only mentioned as throwing up ash once August 7-8, 1928, and showing fire at night to the villagers. Yet Oshima with its basaltic lava is for many reasons the ideal volcano for an observatory. It is well placed near the Tokyo center of research, it was near the center of the terrible earthquake of 1923, and it is near the middle of all the volcano belts. A headquarters observatory at Oshima could maintain substations at Asama, Tarumai, Yakedake, and Asosan, and would thereby cover well all the zones. It is a very striking fact that Aso, Yakedake, Asama, and Tarumai all lie at the intersections of two volcanic belts, and it seems likely on this account that the angle between two crustal fissures is the place of most continuous emission. T.A.J.

TILTING OF THE GROUND FOR JANUARY

The following figures show the net amount of tilt by weeks at the Observatory on the northeast rim of Kilauea Crater, and its direction computed from the daily seismograms, by platting a curve smoothed by overlapping seven-day averages. This is the departure of the plumb line in *seconds of arc, in the direction given.*

January 5-11	0.6 second	S
January 12-16	0.4 second	NNE
January 19-25	2.1 seconds	ESE
January 26-February 1	1.6 seconds	S

E.G.W.

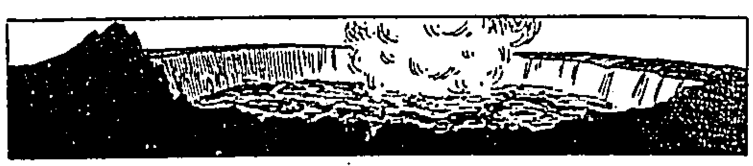
KILAUEA REPORT No. 1046

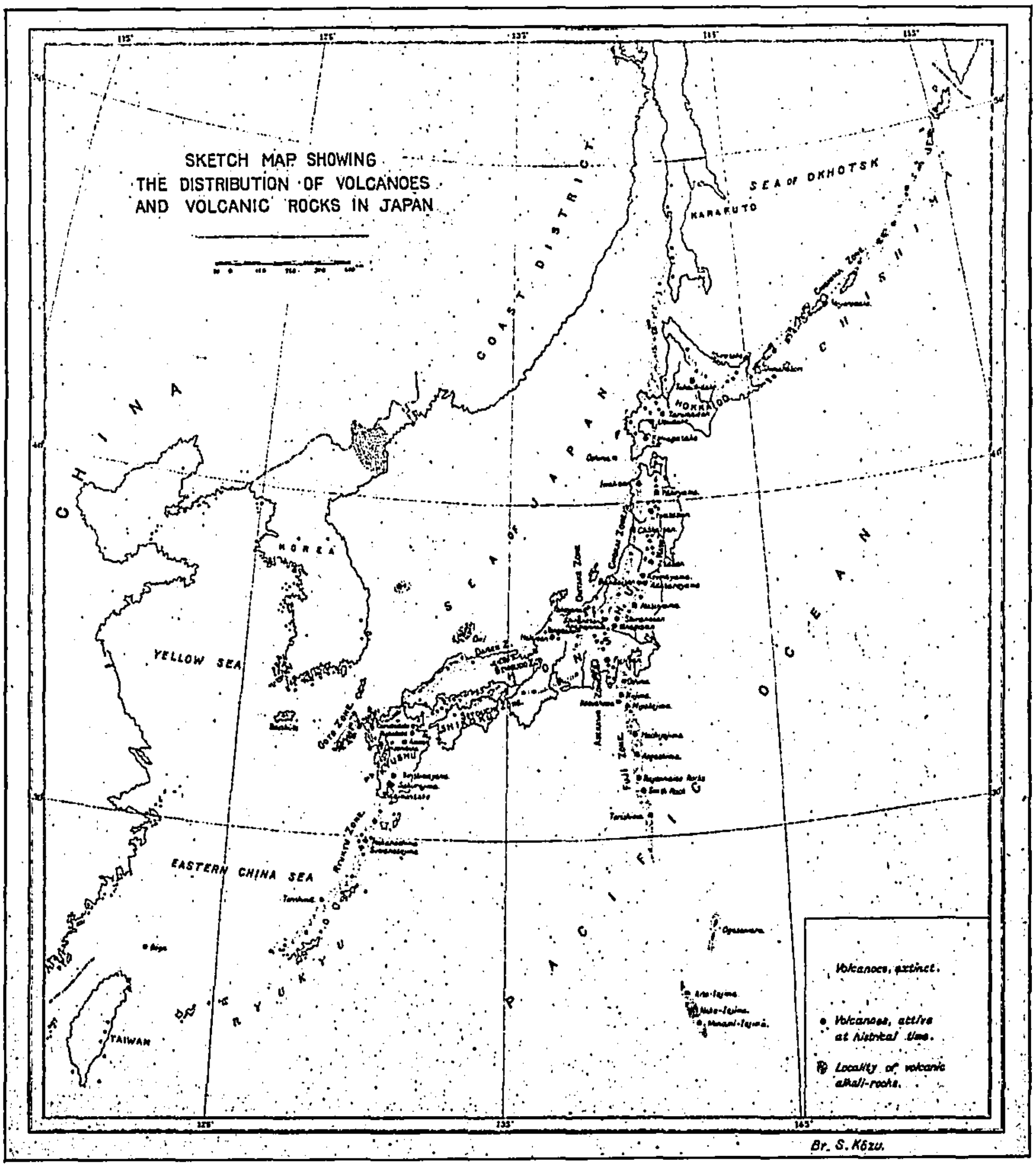
WEEK ENDING FEBRUARY 7, 1932

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge.

Halemaumau continues dormant. In the forenoon February 1 two or three rocks fell from the walls. Cracks on the northeast rim continued slight widening. Five vents emitting slight blue fume were counted on the floor. On February 2 rocks were falling almost continuously and slight widening of rim cracks continued. Surveys showed that the greatest amount of vertical shrinking in the new January lava floor of Halemaumau amounts to between 40 and 50 feet in the southern part. The lava here now stands 30 feet above the top of the former 1930 cone, whereas when it was liquid January 5 the depth was estimated over 70 feet. The edges of the flood have remained stationary, and the average vertical shrinkage out in the middle is between 10 and 20 feet. The average depth of fill is about 110 feet.

The seismographs recorded 1 very feeble shock with indicated origin distance 4 miles. Sixteen tremors were registered, one showing distance 23 miles. There was prolonged tremor for 4 minutes February 3 and for 18 minutes Febraury 6, this latter indicating origin distance 18 miles probably NW. Microseismic motion was moderate, and tilting of the ground moderate SSW.





Map of active and extinct volcanoes in Japan by S. Kozu. Hatoma is at the extreme southwest near Taiwan, and Matuwa is north of the middle of the Chishima zone.

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No. 373—Weekly | Hawaiian Volcano Observatory, National Park, Hawaii | February 18, 1932

Big Steamer at Supan's Springs June 13, 1931. Photo from Finch.

LASSEN REPORT No. 31
WORK OF LASSEN VOLCANO OBSERVATORY IN 1931

Mineral, California
R. H. Finch, Associate Volcanologist

Outlying Seismographs

Besides the main station at Mineral, placed in the Forest Reserve three miles outside of Lassen Volcanic National Park to the southwest, seismographs are operated at Viola, seven miles outside the accompanying map at the northwest, and at Mount Harkness in the forest lookout station at the southeast corner of the Park. These seismographs are all of the horizontal pendulum type, those at Mineral and Mount Harkness being Hawaiian type instruments, made in the shop of the Hawaiian Volcano Observatory.

The seismograph at the Loomis Museum near Viola was started in operation for the summer on June 20, 1931, and operated by Mrs. F. J. Hermann, wife of the Park Naturalist. Except during occasional clock trouble, the seismograph registered continuously until September 25.

The seismograph on Mount Harkness was kept in operation from June 30 until October 23 by A. J. Free, Park Service fire lookout. This instrument gave some excellent records of distant earthquakes, and the seismograms were loaned for stuly to the seismographic station of the University of California.

Tilting of the Ground

It will be remembered (Volcano Letter No. 336) that in the report of the Lassen Observatory for 1930 that the accumulation of tilt to the southwest at Mineral, (that is, away from Lassen Peak), was less during 1930 than in former years, and that the Harkness station when first set up indicated southeast tilt, which also is in general away from the Lassen center of volcanism. The correction for accumulated tilt on all seismographs operated by the Lassen Observatory in 1931 was less than during 1930.

Local Earthquakes

Nearly all of the earthquakes, registered on the instruments at Lassen, appear to originate under the big volcano itself. The seismograph at Mineral registered 38 earthquakes during the year 1931. The distribution of these shocks by months was as follows:

January	7 shocks	July	0 shocks
February	2 "	August	9 "
March	1 "	September	2 "
April	3 "	October	4 "
May	2 "	November	4 "
June	3 "	December	1 "

The numbers of shakings recorded during each of the last five years are as follows:

1927	266 shocks
1928	37 "
1929	96 "
1930	74 "
1931	38 "

Rainfall

The total rainfall and the total snowfall for 1931 compared with previous years were as follows:

Rainfall		Snowfall	
Year	Precipitation	Winter	Snowfall
1927	43.32 inches	1926-27	168 inches
1928	42.10 "	1927-28	106 "
1929	38.65 "	1928-29	130 "
1930	38.94 "	1929-30	138 "
1931	46.30 "	1930-31	64 "
		1931-32	114 " to Jan. 1, 1932

It will be seen by these tables that the variation in the rainfall is less than that of the snowfall, and that the latter was extraordinarily different for the season 1930-31. only 64 inches, as compared with 1926-27 when 168 inches accumulated. The winter of 1931-32 is another time of very heavy snows, and Mr. Finch has recently written under date December 30, 1931, "For the past two weeks, it has been about all that I could do to keep up the ordinary routine. We have had over 78 inches of snow during that time. I climb down a flight of stairs, cut in the snow, to get into the office, and to the instrument shelter. So far I have not been able to get any help in removing the snow, but hope to find someone within a few days. It is still snowing and there is considerable possibility of our getting snowed in." The Mineral station is in the midst of big evergreen trees, high in the mountains, and has recently been something of a resort. for winter sports, for people from the Sacramento valley (T.A.J).

In June 1931 some data on slump scarps were obtained. Many examples of this type of cliff can be found in northern California. A note for publication on this subject is being prepared.

Hot Springs Temperatures

Temperature measurements for comparison with the records of former years (as recorded in the 'Bulletin of the Hawaiian Volcano Observatory' and in the 'Volcano Letter' from time to time,), the measurements being made with corrected maximum Fahrenheit thermometers as part of the routine of the station, resulted as follows:

Big Steamer at Supans Springs

(Southwest part of Park west of Diamond Peak)

Date	Temperature
June 13, 1931	190° F.
July 11	195° F.
August 8	196° F.
August 30	199° F.
October 11	194° F.

Bumpass Hell

(Southwest part of Park, south of Bumpass Mountain)

On August 24, 1931, the highest temperature was 198° F. at a mud pot in the center of the area, measured at a depth of 8 feet. The highest temperature of any of the boiling springs was 196° F.

Lassen Crater

(At the summit of Lassen Peak shown in the map above the word "Lassen" in the middle of west end of Park)

On September 1, 1931, the air temperature was 78° F. and there was no snow in the crater The following were the temperatures of the several vents:

Northwest vent	130° F.
North vent	110° F.
Northeast vent	110° F.
South vent	136° F.

Morgan Springs

(Outside the Park, southwest corner of map)

On October 30, 1931, measurements of the several springs were as follows:

No. 3 Larvae Pool	156° F.
No. 14 North	152° F., flowing vigorously
No. 17	200° F.
No. 20	200° F.
Upper Geyser	202° F.

Boiling Lake

(South side of Hot Springs Creek, southern part of Park)

On September 7, with air temperature 66° F., the lake was high within four inches of the outlet. The following measurements were made:

Northwest edge	120° F.
Large mud pot, west	201° F.
Boiler, south end, water	170° F.
Boiler, south end, mud	199° F.

Devil's Kitchen

(Upper Hot Springs Creek, southern part of Park)

The following were measurements of September 7, 1931:

Small pool north side	194° F.
Mud pot north side (thick mud, surface exposure)	144° F.
Small hole at side of pool north side	200° F.
Mud pot northwest	196° F.
Pyrite pool northwest	190° F.

New Steam Vent

(South slope of Diamond Peak southwest part of Park)

The discovery of this vent was described in Volcano Letter No. 362. It is in an ancient solfataric area and had a temperature of 198° F. when it was measured October 14, 1931.

Changes at Supan's Springs

No movement was detected at the line of stakes which had been set up to measure movement, in the landslip area of Supan's Springs, near the bend in the road on Sulphur Creek west of Diamond Park, where for many years there have been fresh cracks across the valley indicating a creep of surface materials. As reported in 1930, the earlier stakes had been broken off, and a new set of iron stakes was installed in that year. New measurement in 1931 showed that no movement could be detected parallel with the valley, nor on the transit line laid out for repeated observations across the valley. There were signs of chemical erosion. The basin at the Big Steamer at Supan's Springs had moved westward a few feet. The volume of the basin had increased by about 50 cubic feet without any surface outflow to account for mechanical loss of eroded material.

On his trip to investigate Akutan Volcano and to inspect seismopragh stations in the Aleutian belt of Alaska, Mr. Finch was absent from the Lassen station from June 25 to September 13. Mr. C. A. Huff operated the station during his absence.

EARTHQUAKE IN THE SOLOMON ISLANDS OCTOBER 1931

We reported registering on seismographs (Volcano Letter No. 355) a large distant earthquake approximately 3750 miles away to the southwest, and another estimated 3500 miles away, the dates being October 3 and October 9, 1931. It has since been reported (Volcano Letter No. 361) that the first of these earthquakes wrought damage in the British Solomon Islands and was followed by a disastrous seismic sea wave, which recorded on the tide gauge at Hilo eight hours after the earthquake occurred in the Coral Sea. Northeast of this Coral Sea lies a line of active volcanoes extending through the New Hebrides, the Santa Cruz Islands, the Solomon Islands, and New Mecklenburg, the whole belt extending northwest in the region between New Guinea and Fiji, and lying between the Micronesian Islands of the western Pacific and the Coral Sea which lies outside of the Great Barrier Reef of northeastern Australia. The inhabitants of this volcanic belt are Melanesians.

The "Church of England Newspaper" January 8, 1932, publishes a report by Dr. Fox, Principal of All Hallows School, Pawa, Solomon Islands, saying the earthquakes lasted more than 15 days. On Sunday October 4 at 5:45 a. m. there was a very big earthquake lasting four and a half minutes, and then a prolonged quiver for two hours, and then small quakes every half hour or so day and night for 15 days. But there was a second big one, worse than the first, on October 10, at 11 a. m., followed by a succession of big shocks every few minutes, till the worst of all came at 3 p. m., a violent wriggling followed by convulsive waves, when it was hardly possible for a man to keep his feet. Then smaller qaukes occurred every hour gradually getting milder.

All the mission tanks were thrown down, two of the plate timbers of the house were broken, and a wall was torn out. The boys' houses leaned over and another house had a list. The chapel survived the shock best. The tower swayed violently back and forth, and the flag-pole snapped and was thrown down. A Dover stove was smashed anl much small stuff was broken.

The mission staff slept on the shore in a leaf house, but continued to conduct services in the chapel. The boys slept on the shore, as the hill country rocked violently. During the earthquake of 3 p. m. October 10, the ocean suddenly receded from the bay to much beyond the lowest low-tide mark, and in about three minutes swirled back to about four feet above high tide mark. This happened twice, and then the water remained at high-tide level for hours when it should have been low. Dr. Fox, watching it, reported that the wave seemed to come from the east or northeast and judged the origin to be a hundred miles or so away, and wondered whether it was created by a submarine volcano.

A similar report from a station at Aitape in New Guinea (United Empire, London, January 1932) described what is presumably the October 10 quakes of 11 a. m. as occurring at 11:40 a. m. of the local time, when suddenly a rumble came from the sea. Everything heaved and swayed, chairs and other things were overturned, coconuts fell from the trees, cement piles were cracked, and water tanks telescoped and split. Cracks opened in the ground. A trestle bridge was thrown out of alignment. The first shock lasted 40 seconds, followed by other severe ones, while small shocks and tremors continued for a fortnight.

Another Solomon Islands earthquake was registered on seismographs November 20, 1931, and one in the New Hebrides January 9, 1932. T.A.J.

KILAUEA REPORT No. 1047

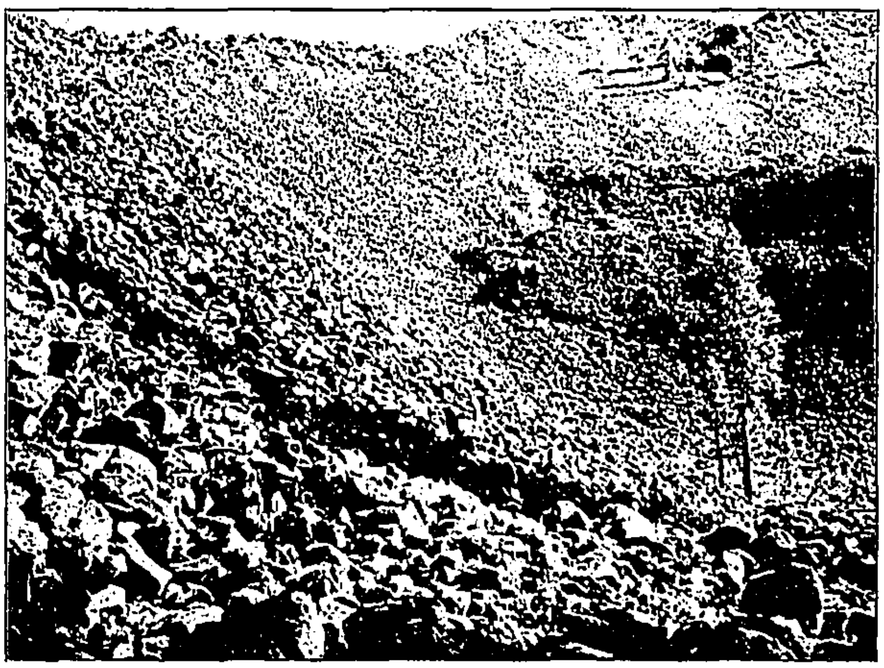
WEEK ENDING FEBRUARY 14, 1932

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge.

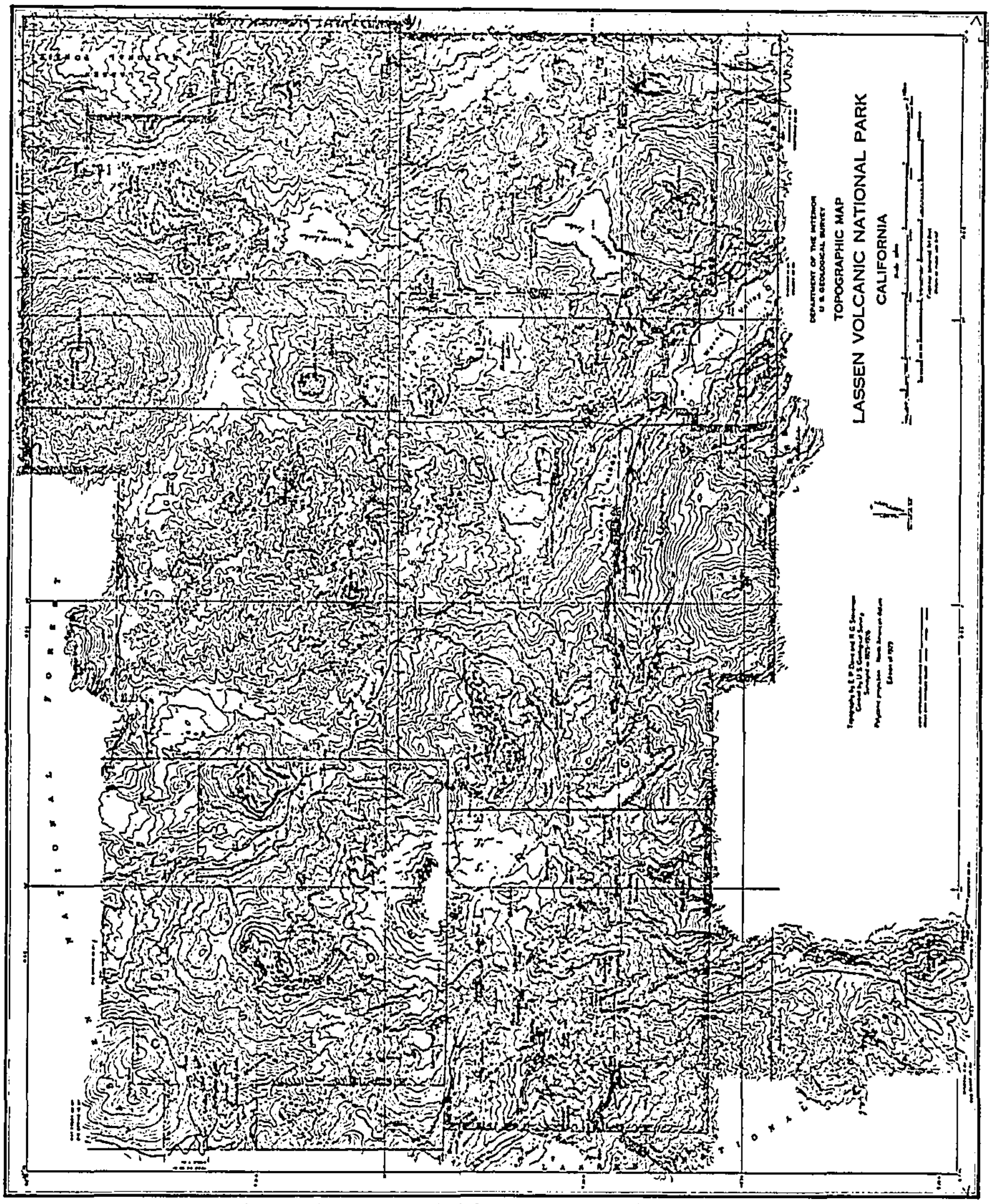
On February 8 fume was noticed at a spot under the west wall of Halemaumau and in a spot in the center of the pit. A small slide fell from the north wall at 9:46 a. m., and rocks fell intermittently. Cracks measured showed slight widening, especially on the northeast rim. On February 12 afternoon a new spot was found fuming in puffs at the west end of the southwest talus on the edge of the talus and floor. Sulphur has been forming there. Moderate fume was noted at the spot under the west wall, and slight fume was issuing from the center of the floor. At 4:10 p. m. a roar of an avalanche was heard at Uwekahuna. Its debris fell from the wall above the southwest bay and appears to be the largest since the recent lava activity. On February 14 there was no change in fuming. At 10:20 a. m. a large avalanche was heard from Uwekahuna by Park rangers. Dust obscured part of one side of the pit.

The seismographs at the Observatory recorded 23 tremors and 3 very feeble local seisms. One of the tremors originated at 14 miles distance, two of the seisms 18 miles, and one seism 14 miles. Two of the latter class were reported felt at Kapapala.

Microseismic motion was moderate throughout the week. The average tilt movement was slight SE.



Edge of glassy lava flow on the west side of Glass Mountain October 19, 1931. These obsidian flows are 80 miles north of Lassen and the rocks are being studied by Dr. C. A. Anderson. Photo from Finch.



Map of Lassen Volcanic National Park, U. S. Geological Survey. Lassen Peak is in the center of the western half with name erased.

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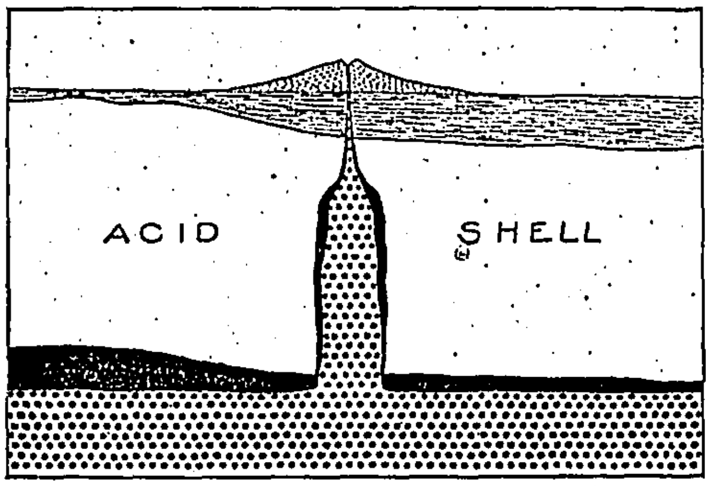
The Volcano Letter

Two dollars per year | Ten cents per copy

No. 374—Weekly | Hawaiian Volcano Observatory, National Park, Hawaii | February 25, 1932



Diagramatic section through the earth's crust showing sediments under a volcano, supposed siliceous continental shell, black solidified layer of basalt, and dotted liquid basalt of the substratum extending up into the fissure leading to the volcano. The cone is represented as 5,000 meters high. After Daly.

TYRRELL'S BOOK ON VOLCANOES

Dr. G. W. Tyrrell, lecturer in geology in the University of Glasgow, has recently produced a very readable book entitled, "Volcanoes." (No. 152 in the Home University Library, 1931, Thornton Butterworth, Ltd., London.) This is a small book of 252 pages divided into eight chapters and a bibliography. The introductory chapter describes the general facts about volcanoes. The following is an interesting paragraph:

"The most feasible method of harnessing volcanic energy in the service of man is by utilizing steam jets and hot springs. In Iceland hot springs are used by housewives for cooking and laundry purposes. A beginning has been made in that country on a project for supplying Reykjavik and other towns with a hot water supply from boiling springs. In Tuscany, natural steam power has been used for three-quarters of a century. Over an area of 100 square miles are numerous hot springs and steam jets, which yield boric acid. These natural springs and fumaroles have been largely extended and changed by industrial development. Shallow wells have been bored to tap the steam, which in one of the borings is yielded at the rate of 52,800 lb. per hour at a pressure of one atmosphere (14.7 lb. per square inch), or 28,600 lb. of steam per hour at a pressure of five atmospheres. The steam is often superheated, as its temperature varies between 100° C. and 190° C. A deep boring has now (1928) tapped steam at a pressure of 75 lb. per square inch, which can be directly used to drive turbines. Calculations based on the total production of boric acid in relation to steam, indicates that several million pounds of steam per day are now available in this field.

"Of a somewhat similar nature is the steam-well field which is now being exploited at The Geysers in California. Observations and tests prove that at this locality there is a great store of hot steam, which increases with depth. The first well was drilled in September 1922, and steam from this well furnished the power for boring the second well which was completed in July 1923. From all indications the steam both in Tuscany and California is of deep-seated origin and of practically inexhaustible quantity."

In discussing cycles, Dr. Tyrrell is impressed with the longer geological cycle, as is natural in the viewpoint of a geologist, and he makes the following statement concerning the phases of a long-term cycle:

"If volcanic manifestations are considered in relation to geological time they are found to fall into definite cycles. These cycles seem to have begun with vast floods of basalt lava, with which are usually associated swarms of dikes, and, in proportion to the bulk of lava erupted, were accompanied by an insignificant amount of explosive activity resulting in fragmental products. These enormous lava floods are therefore believed to have been emitted from fissures, and to have rushed up directly from the superheated liquid stratum which at times is formed immediately beneath the crust.

"As the cycle progresses the volcanic activity becomes localized at definite points, which develop into central volcanoes. Lava is still poured out in great bulk, and central volcanoes in this early stage build up enormous flat domes consisting mainly of basalt. At the present day these shield volcanoes occur in Hawaii and Samoa, and also in Iceland. In the earlier stages of the present volcanic cycle, the flows from adjacent shield volcanoes linked up to form great spreads of lava only inferior in size to those from fissures.

"With the waning of the volcanic cycle, the direct uprise of magma from the depths is checked. It collects in underground chambers, and its contained gases now come into full play in determining the kind of volcanic activity at any center. Hence the volcanoes typical of this stage of the cycle are those in which explosive activity takes a prominent part. The resulting central volcanoes are naturally smaller than shield volcanoes as the supply of magma is now limited. The cones are of mixed composition, partly lava, partly fragmental products of volcanic explosion, and are known as **strato-volcanoes** because of their well-bedded or stratified structure. Vesuvius, Etna, and Fuji-san are well known examples of strato-volcanoes. With the progress of solidification (crystallization) in the magmatic chamber the amount of lava yielded by the volcano gradually lessens, and its composition may change, while the activity of gases correspondingly increases, resulting in an increase in the amount of fragmental material ejected. A purely explosive stage is ultimately reached; and if a new vent is drilled at this stage the resulting volcanic cone will be built up entirely of fragmental materials. Some small volcanic cones of this character (e.g. Monte Nuovo near Naples) are due to a single explosive outburst. The gases which are liberated in this late stage of the volcanic cycle consist chiefly of steam, and the explosions may be of such violence as partly to destroy the cone built up in earlier stages, (Katmai, Alaska; Bandaisan, Japan.)

"As the explosive activity gradually dies away, the final stage of the volcanic cycle is reached with the relatively quiet discharge of steam and other gases from jets or fumaroles (Tuscany, Iceland, California, New Zealand), associated with erupting springs or geysers, boiling or hot springs, and the emanation of carbon dioxide and sulphuretted hydrogen from fissures."

The second chapter deals with the products of volcanism, gaseous, liquid and solid. In this the author follows the usual and regrettable geological dictum that steam is more important than hydrogen as a fundamental volcanic gas. Other chapters deal with the phenomena of volcanic eruption, the shield volcanoes of Hawaii and Iceland, strato-volcanoes such as Etna and Vesuvius, decadent volcanoes such as Katmai and Lassen Peak, the roots of volcanoes and ancient volcanoes, and finally, distribution of volcanoes and origin of igneous rocks. In this last the author follows with interest the theories of Joly and Holmes to the effect that the ultimate causes of igneous activity in general are to be traced to the known facts of storage of heat through the radioactivity of the rocks.

A reading of the book shows that the author has studied carefully some up-to-date volumes on volcanic eruptions such as Perret on Vesuvius, Griggs on Katmai, and Koto on Sakurajima, that he is influenced by the time-honored but trite work of Judd on Krakatoa; and is perhaps without access to the remarkable series of modern monographs of the Dutch East Indies Volcanologic Service; that he is thoroughly acquainted with the work of the petrographers on ancient volcanoes and on the rocks collected from fossil intrusive bodies, but that he is insufficiently acquainted with the seismometric side of the subject as expounded in the big volumes by Omori on Asama, Usu, Oshima, and Sakurajima. The geodetic and engineering side of volcanology is hardly touched. The notion that intrusive volcanism is in progress today, and may be measurable in hot spring districts, does not appear in the book, but there is ample recognition that the study of volcanoes has entered upon a new phase with the establishment of volcanological observatories. The scholarship of the modern German and Italian workers, as recorded in Friedlaender's Zeitschrift and in Sapper's book, is not much quoted. The style is excellent and the author is at his best in the chapter on "The Roots of the Volcanoes." The following is a sample:

"Fissure eruptions occur at the present day only as minor phenomena of central volcanoes, especially those of the shield type. Various lines of evidence, however, lead to the belief that fissure eruptions played a leading part in volcanic action at the beginning of the present volcanic cycle, and in more remote geological periods." (This appears to mean the cycle which has become decadent since the Miocene.) "Basaltic lavas have been poured out on a colossal scale, accompanied by only the most insignificant explosive activity relatively to the effusive mode of action, and usually with swarms of associated dikes, some of which must be regarded as the feeders of the flows. There are no signs of volcanic cones at all commensurable with the size of these eruptions. *These* stupendous floods of basalt cover areas of the order of 200,000 square miles, and may be thousands of feet thick. Naturally, accumulations of relatively hard rocks such as basalt are extremely durable, and remain in and on the earth's crust as witnesses to volcanic events the magnitude of which has not been approached at the present time.

"The youngest basalt flood is that of the Columbia Plateau in the northwestern United States, which occupies an area of over 200,000 square miles mostly in Washington and Oregon. The Columbia region was formerly mountainous, but in Miocene times it was levelled up by enormous floods of basalt lava, and the former mountains now appear as islands and peninsulas projecting from a monotonous plain of lava. The Columbia and Snake rivers (see Page Four) have cut deep gorges through the plain which expose in places almost the entire thickness of the formation. The plateau is built of a large number of thin, confluent, interlocking flows, between which occur slaggy surfaces, thin sheets of ash, and beds of lacustrine sediments. The supposed feeding dikes are numerous and narrow, seldom reaching 150 feet, and averaging less than 30 feet in width. Igneous activity has continued almost to the present day, especially in Oregon and Idaho, with the production of youthful-looking cones and craters, and fresh, slaggy, lava flows. The average thickness of the plateau is estimated at 3300 feet, and it is known to reach a maximum thickness of at least 5200 feet. Hence the total volume of lava emitted must be of the order of 120,000 cubic miles. Great basaltic plateaux of about the same age as the Columbia plateau occur in Syria and Arabia.

"Another enormous basalt flood is that of the Deccan in Peninsular India, which occupies an area of 250,000 square miles. As this formation is nearly 10,000 feet thick on the Bombay coast, and thins out toward the east and north, it is thought to have had an equally large extension in the adjacent foundered parts of the Indian Ocean. Its total area may therefore have been 500,000 square miles . . . . in one place a boring encountered 29 distinct flows with an average thickness of 40 feet. Large dikes and other intrusive masses are found at a number of places around the margins of the basalt region The eruption appears to have taken place towards the end of the Cretaceous period, or at the beginning of the succeeding Eocene."

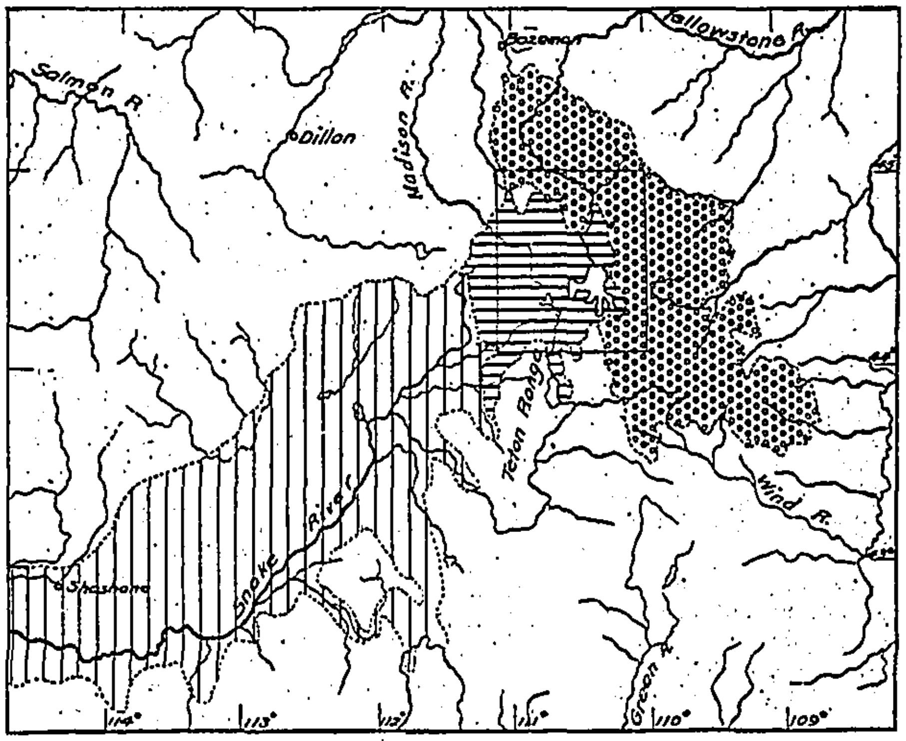
"The Stormberg basalt lavas of South Africa, which occupy an area of 20,000 square miles in Basutoland alone, and there form the great mountain scarp of the Drakensberg, are regarded by Dr. A. L. du Toit as mainly due to fissure eruptions. One hundred and fifty volcanic vents have indeed been found, and many more await discovery; but the greater number of these are filled with pulverized sedimentary material, and have never emitted lava; and the remaining active centers pierce the lowermost basalts only. The average thickness of the plateau appears to be about 3,000 feet, and individual flows are from 100 to 150 feet thick. Correlated basalt extrusions make up the 300-mile-long Lebombo range in the eastern Transvaal, and also a large area of country around the Victoria Falls in Rhodesia. The extrusion of these great masses of lava probably took place in early Jurassic times. The Stormberg lavas are intimately connected with the Karroo dolerite sills; and the relatively small lava fields of this episode, as compared with others, may be due to the fact that a greater part of the activity took place underground.

"In recent years it has become clear that exact analogues to the Stormberg lavas and Karroo dolerites exist in the Parana region of South America. The basalt flows here cover an area of over 300,000 square miles with an estimated bulk of 50,000 cubic miles. They are associated with intrusive masses which are found in a further area of 75,000 square miles. Basaltic lava plateaux of the same age as those of South Africa and South America (mid-Mesozoic) are known also in Tasmania, Antarctica, Peninsular India, and in the eastern United States."

With regard to major cycles in Europe and Asia, Dr. Tyrrell points out that crustal movement (page 228) has worked up to at least four great climaxes during known geological time, and that in the intervals minor disturbances have occurred. The geological cycle begins with the comparatively-sudden emergence of continental land masses, which rapidly become broad and high, with the simultaneous production, especially near their margins, of long ranges of fold-mountains in which the rocks are intensely compressed. The oceans at this stage are relatively small and deep. Igneous and earthquake activity is at a maximum, and on the continents there is extensive glaciation and desert formation. Climatic conditions are thus severe and extreme. At the present day the earth appears to have not long emerged from one such phase of the geological cycle. This revolutionary stage is followed by a protracted period of relative quiet, both as regards earth movement and igneous activity. The continents gradually become small and low owing to the combined effects of erosion and the gradual advance of shallow seas over their margins. The general quiescence is occasionally broken by local disturbances during which igneous activity may again become prominent. Earth movement is finally limited to a gentle up-and-down heaving over wide regions, igneous activity dies away completely, and climatic equability ensues over the greater part of the earth. But beneath the apparent quiet the revolutionary earth forces gather strength, and the geological cycle is terminated by a renewed paroxysm of mountain-making and continental uplift. . . . The explanation of igneous activity is thus closely bound up with the explanation of earth movements and the geological cycle."

Errors in the book are largely copied from the original works on which it is based. If on page 55 the statement, "Torrential rains accompany volcanic eruption," means condensing steam, this is dubious. On page 60 the formation of Pele's hair is attributed to "strong winds," when in reality it is the bluster of the gases rushing through the fountains and convection currents which may occur in perfectly still air. On page 93 the "Death Gulch" of the Yellowstone Park is placed in Arizona. On page 67 and following, the discussion of volcanic earthquakes attributed to "explosive subterranean release of magmatic gases" is quite erroneous and inadequate. There is the usual erroneous distinction from tectonic earthquakes, without explanation or discussion of depth or mention of isostasy. The statement on page 84, "Hawaian explosive activity is of a mild type, caused by the rapid emission of gases from the surface of a lava lake," certainly needs modification if the steam blast activity of 1924 is "explosive." On page 87 Pelée and Soufriére are stated to be characterized by the "intermittent ejection of white-hot clouds composed of an emulsion of glowing gas and solid particles, which, instead of rising into the air were projected downwarls." These were exceptional and not characteristic, and the downward-directed cloud in the major explosion in each case was but one component, most of the clouds being directed vertically, and in no case being "white-hot." Down-rushing blasts are common elsewhere. The belief of Penck quoted on page 109 that the 1789 eruption of Kilauea "marked the inception of the volcano" might well have been omitted.

T.A.J. and R.H.F.



Region of eastern part of the great Snake River basalt fields as related to the early Tertiary rhyolites (horizontal lines) and andesites (circles) of the Yellowstone Park, itself a place of boiling springs and Tertiary volcanoes. After Daly.

KILAUEA REPORT No. 1048

WEEK ENDING FEBRUARY 21, 1932

Section of Volcanology, U. S. Geological Survey

T. A. Jaggar, Volcanologist in Charge.

On February 15 at 9:30 a. m. the slide of the previous day was found to have fallen from the north wall between the north and northwest taluses, causing a fresh scar on the wall and a mound of new debris on the floor. Debris added at 1:20 p. m. February 16, from the same place, built the mound to from 50 to 100 feet high. Fume was strongish at the foot of the southwest talus and under the west wall. The northeast rim cracks continued slight widening. A small scar formed during the night of the 15th from a slide at a point just west of the top of the northwest talus. Fume was quite strong from a spot at the foot of the southwest talus and came from two points about 50 feet apart. Rocks and small slides were heard falling from the north walls more or less continuously about every five minutes from 2 to 4 p. m. On February 17 the district was visited by a southwesterly rain and wind storm which caused some water to enter the seismograph cellar at Halemaumau. The pit during the forenoon was a huge cauldron of steam. Sulphurous fume was blown over the tourist stand. Keanakakoi had seven waterfalls. A lake a thousand feet long and two to three hundred feet wide formed on the southwest Kilauea floor. A little hail fell during the storm, and there was thunder and lightning near. Many trees were uprooted and a garage was blown over.

On February 21 at 10 a. m. the pit had blue fume. The north wall showed a fresh scar from an avalanche and few rocks were heard falling.

The seismographs at the Observatory recorded 11 tremors and two very feeble local seisms. One of the tremors indicated origin distance 25 miles and another about four miles. The two seisms indicated distances of 9 and 32 miles. None was reported felt. High winds during the week caused unusually strong microseismic motion, the Kona storm of the 17th being responsible for vibrations of four seconds' period. The average tilt movement for the week was moderate SW by W.

THE VOLCANO LETTER

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HAWAIIAN VOLCANO OBSERVATORY
Founded 1911

This laboratory at Kilauea Volcano belongs to the Hawaiian Volcano Research Association and is leased and operated by the United States Geological Survey.

It maintains seismographs at three places near Kilauea Volcano, also at Hilo, and at Kealakekua in Kona District. It keeps a journal of Hawaiian volcanic activity and publishes occasional Bulletins.

Membership in the Hawaiian Volcano Research Association is limited to patrons of Pacific science who desire personally to aid in supporting the work.

The work of volcano research so supported is in collaboration with the work of the United States Geological Survey, but supplements it with buildings, research fellows, instrumental plants, explorations and special investigations for which there is no governmental provision. The Geological Survey maintains volcano stations in Alaska, California and Hawaii.

Persons desiring application blanks for membership ($5.00 or more) should address the Secretary, Hawaiian Volcano Research Association, 320 James Campbell Building, Honolulu, T. H.

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
HAWAII NATIONAL PARK
HAWAII

OFFICE OF THE SUPERINTENDENT

February 4, 1932

The Director,
National Park Service,
Washington, D. C.

Dear Mr. Director:

The following is a report of operations and activities in Hawaii National Park for the month of ~~December~~, 1931: January 1932

000 General

Activity ceased in Halemaumau at 5 P.M. January 3, 1932, after thirteen days. This is said to have been the strongest and most spectacular inflow of lava since 1924, and over thirty thousand visitors viewed the impressive sight. The Inter-Island steamer bringing a group of tourists and Mr. and Mrs. John D. Wosky of the Landscape Division in San Francisco and Mr. and Mrs. John E. Doerr from Honolulu, arrived the morning after activity ceased, which was a great disappointment to all, as their plans had been hastily changed in order to enable them to come to this island immediately to see the volcano.

Extensive plans were made during the month for the visit of the U. S. Navy fleet which will bring between twenty and twenty five thousand men for maneuvers in Hawaiian waters during February. Rates and schedules for transportation of the Navy personnel have been carefully worked out by the Hilo Chamber of Commerce and the park superintendent cooperated in the making of these plans.

020 General weather conditions

Weather during January was cold and rainy, making outdoor work practically impossible. More important details are given below, with full information on Form 1009 of the Weather Bureau, attached to this report.

Maximum temperature, January 7 - - 74
Minimum temperature, January 18 - - 49
Mean temperature for month - - - - 58.3
Rainfall during January, 1932 - - - 24.55
Rainfall during January, 1931 - - - 1.92
Total rainfall to date this year - 24.55
Total rainfall to date last year - 1.92
Average humidity during month - - - 90

100 Administration

110 Status of work

The routine office work, disbursing and accounting, were kept current during the month.

Preliminary estimates for construction items and for forest protection and fire prevention for 1934 were prepared and submitted during the latter part of the month.

120 Park inspections by

121 The superintendent

In company with Mr. John B. Wosky, Assistant Landscape Architect of the field headquarters in San Francisco, the park superintendent and Ranger Christ inspected the entire park area in order that Mr. Wosky might become thoroughly familiar with the park before making definite plans for its development. On January 22 Mr. Wosky, Superintendent Leavitt, Ranger Christ and Resident Engineer Handley made a trip to the Rest House at Red Hill on the Mauna Loa trail. On January 24 this same party, with the exception of Mr. Handley, started on a trip around the island, returning two days later. On January 31 Mr. and Mrs. Wosky, Superintendent Leavitt, Mr. Doerr, Mr. Handley and Ranger Christ left on the Inter-Island steamer for an inspection of the Haleakala section of the park, on the island of Maui.

125 Other governmental officers

E. S. Wheeler, Chief Highway Engineer of the Bureau of Public Roads, Honolulu, arrived on January 29 for a periodic inspection of the road construction work in the park and elsewhere on the island, returning to Honolulu on January 31.

130 Finance and accounts

Statement regarding the finances of the park will be found at the back of this report as statistical report No. 8.

150 Equipment and supplies

Several office chairs for the office of the Park Naturalist, a Franklin Stove for the Park Naturalist's quarters, and several other miscellaneous supplies were received during the month.

180 Circulars, placards, publicity bulletins, etc.

Copies of the Volcano Letter and Hawaii Nature Notes are attached to the back of this report.

200 Maintenance, improvement and new construction

210 Maintenance

The usual maintenance and repair of roads, trails, telephone lines and grounds was carried on during the month. Heavy rains and strongwind made additional telephone and trail repair necessary.

220 New construction

250 New construction

Work was started on the residence for the U.S. commisioner on January 9. Due to rainy,weather, however, the excavation has not yet been completed.

The report on road construction for the month ending January 15 by Resident Engineer Handley shows that work is about 39% completed. Fifty four percent of the contract time has elapsed, and the rate of progress is given as poor. The contractor's representative has been advised that it will be necessary for additional equipment to be provided and work speeded up so as to insure completion of contract on time.

260 Landscape work

Mr. John B. Wosky, Assistant Landscape Architect, arrived in the park on January 6 and the major part of the month was spent in thoroughly inspecting the park and surrounding areas, and in going over construction and development plans. Work on the commissioner's residence was started under Mr. Wosky's supervision and much consideration was given to the plans for the new administration building.

300 Activities of other agencies in the park

Chief Marine Gunner Emory T. Ozabal relieved Lieut. A. G. Bleisener as commander of the Navy Recreation Camp in Hawaii National Park on January 9.

400 Flora, fauna, and natural phenomena

410 Ranger service

The ranger force was employed on construction work during the month when not on their regular patrol, trail and telephone repair, warehouse and electric light plant duty.

411 Naturalist service

Seventeen lectures with a total attendance of 853 people, were given at the Uwekahuna Observatory during the month; one lecture, with an attendance of 13 at Halemaumau; and one at the Volcano House with an attendance of 65. This latter lecture was given on the occasion of the visit of the Hilo Woman's Club on January 13. The monthly meeting of this club was held at the Volcano House with Mrs. Leavitt and Mrs. Gandy as hostesses, and the main address was given by the Park Naturalist on the educational features of the park, and an invitation given to all island residents to become more familiar with their park.

415 Educational service

On January 17 Dr. F. E. Peterson, Director of Extension of the University of Hawaii, came to the park for a conference on the educational work of the park this spring, which will include an extension course to be given by the park staff. He was accompanied by Dr. T. M. Livesay, Director of the summer session, who discussed plans for the summer school classes in the park with Superintendent Leavitt and Park Naturalist Doerr.

It was decided to give two courses in the park this summer, two university credits to be allowed for each. The course will cover a period of four weeks, and the two courses will be botany and geology. It is hoped that Prof. Theodore C. Zschokke will handle the botany class again this year, and efforts are being made to secure Dr. T. A. Jaggar of the volcano observatory to teach the class in geology. If Dr. Jaggar is not available, the class will be taught by Park Naturalist Doerr.

480 Natural phenomena

Activity in Halemaumau continued until January 5, then stopped, leaving a large cone in the southwest corner. The fountain in this cone had played steadily until the fifth, when action became rather intermittent. Tremor on the seismographs at the volcano observatory showed spells of increase and decrease and about 6 P.M. ceased, after which the fountain also subsided. Glowing cracks were still visible on the pit floor for several nights afterward, and the crackling sound of the cooling lava was plainly heard. The lake settled somewhat after cooling, but the depth of new lava is estimated to be about 100 feet. Since the end of the activity tremor has been slight and a few very feeble local earthquakes registered. Full details may be found in the Volcano Letters attached.

500 Use of park facilities by the public

510 Increase or decrease in travel

Visitors for the month of January numbered 20,714, as compared with 6,763 for January last year. Travel for the year to date is 60,837 compared with 62,673 for last year, a decrease of 2.9%. A few more days of volcanic activity would have more than made up for this deficiency, however.

540 Public camps.

An inquiry was received from Mrs. Clarence Ash, of Honolulu, who is planning to bring a group of 25 children to Hawaii for a vacation summer school next summer. The group is planning to spend several weeks at sea level then wishes to come to the park for a few weeks to camp and conduct classes. The inquiry was referred to the Inter-Island Steam Navigation Company, with the idea that the Kilauea Summer Camp would be more appropriate to their needs than the public camp grounds of the park.

600 Protection

630 Accidents

On Friday January 15 Superintendent Leavitt was returning from an official trip to Hilo in the Government Studebaker sedan, when a car passing from the rear, driven by Major D.M. Roberts of the Kilauea Military Camp, ran off the road to the left. In trying to get control of his car Major Roberts ran it over to the right, bumping the Studebaker, and swerved in sharply ahead of it, so that the Superintendent was forced to run off the road, overturning the car in a ditch at the side of the road. Aside from bruises and scratches no one in the Studebaker was hurt but the car was badly broken up and the garage estimated damages at$275. Major Roberts was covered by insurance which will pay for repairs to the Government car.

900 Miscellaneous

The Volcano Golf Club has been making good progress with the reconstruction of the course, which is partly inside of park boundaries. A meeting was held on January 28 to elect officers and adopt a constitution and by-laws. A hundred or more persons in Hilo and neighboring districts have indicted a desire to join this club.

A Koae (white tropic bird) was found near the pit after a heavy wind storm by Ranger Brumaghim, a broken wing giving evidence that it had been blown against some wall or cliff and killed. These birds are often seen flying around inside of the firepit and there was much interest in seeing one at close range. Ranger Brumaghim stuffed and mounted the bird and it now has a place in the administration building. It is a graceful gull-like bird, with webbed feet and its tail is a single feather nearly 15 inches long. It is always a question here why those birds, evidently water birds, make their home in the barren walls of the firepit.

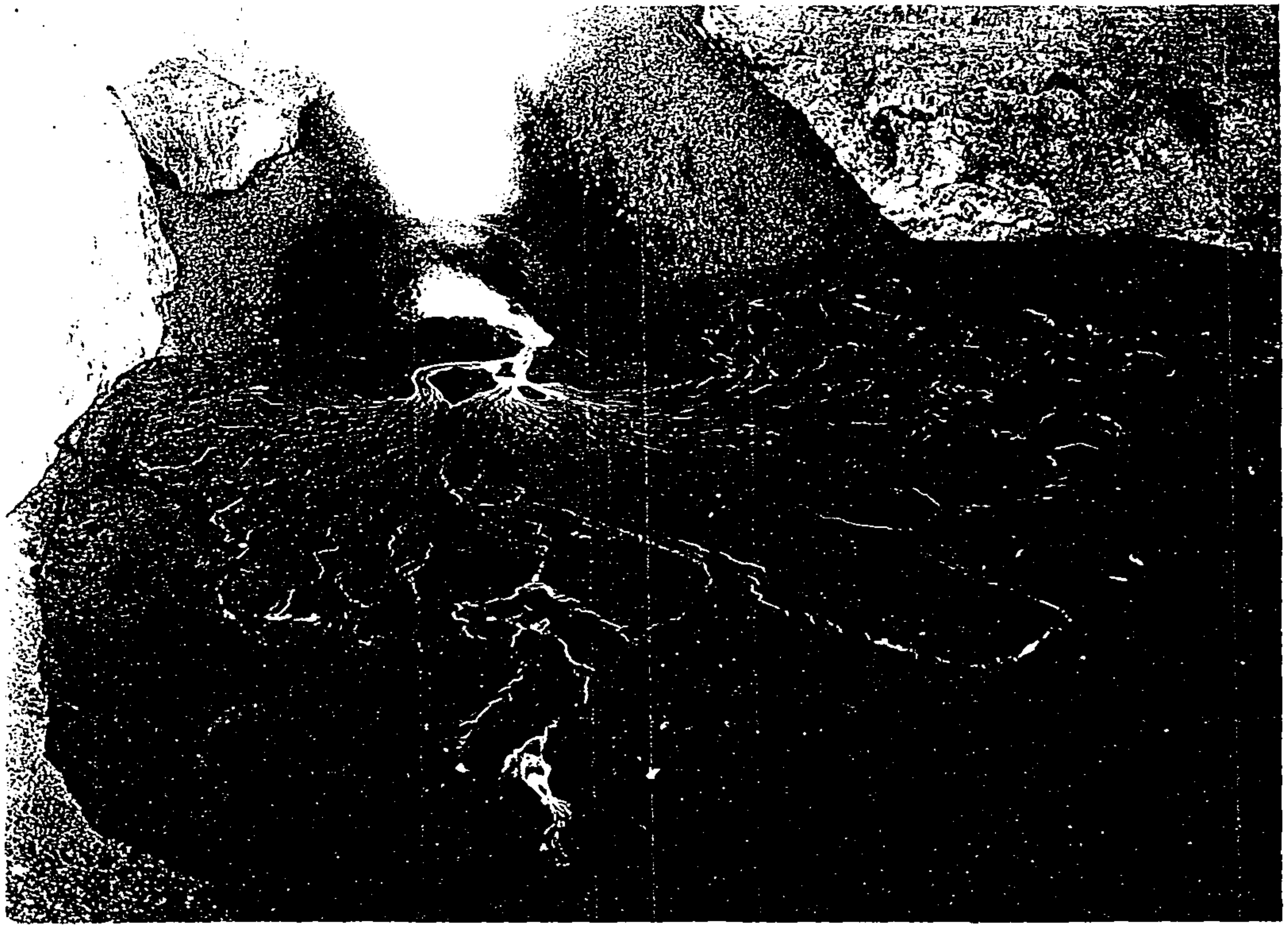
Ranger and Mrs. Donald H. Eaton became the parents of a baby girl on January 20. Miss Eaton weighed 8 pounds and 13 ounces at birth and was named Phoebe Ann.

A reception and dinner were given in honor of Park Naturalist Doerr and his bride, formerly Miss Nancy H. Elliott of Des Moines, Ia., on January 16. Members of the park force were present with their families and following the dinner a gift was presented to the couple with good wishes for their future happiness.

Very respectfully,

James K. Higashida

E. P. Leavitt, Superintendent
By James K. Higashida, Acting
Superintendent.



View of Halemaumau on January 5, just before activity ceased. Photo by Dr. [illegible]

10-157
(July, 1929)

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

TRAVEL REPORT

HAWAII National Park for the month of JANUARY, 1932

	This Month	This Travel Year To Date	This Month Last Year	Last Travel Year To Date	Increase for Travel Year: Number	Increase for Travel Year: Percent
PRIVATE TRANSPORTATION:						
Cars first entry, ...						
Cars reentry, ...						
Motorcycles, ...						
Total motor vehicles, ...						
Persons entering via motor vehicles, ...	19,613	44,744 57454	5,825	58,850	-14,106	.239%
Persons entering via other private transportation, ...	557	1,465	268	1,455	10	.6%
Total persons entering via private transportation, . . .	20,170	46,209 58,919	6,093	60,305	-14,096	.30.5%
OTHER TRANSPORTATION:						
Persons entering via ~~stages~~ Hotel, .	544	1,918	670	2,368	- 450	1.9%
Persons entering via trains, . .						
Persons entering otherwise, . . .						
Total other transportation, .	544	1,918	670	2,368	- 450	1.9%
GRAND TOTAL ALL VISITORS, . . .	20,714	60,837	6,763	62,673	- 1,836	2.9%

	This Year	Last Year	Increase: Number	Increase: Percent
Automobiles in public camps during month, ...	8	8		
Campers in public camps during month, ...				

10-158

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF AUTHORIZED PROJECTS

Hawaii National Park for the Month of January, 1932

Description of Projects	Percent Constructed To Date	Percent Constructed This Month	Percent Constructed Last Month	Probable Date of Completion
410 U.S. Commissioner quarters	3	3	0	March 31, 1932
411 Employees quarters - - - -	100	0	0	
412 Employees quarters - - - -	100	0	0	
413 Administration building -	0	0	0	June 30, 1932
502 Trails:				
502.1 Hilina Pali to Halape - -	100	0	0	
502.2 Uwekahuna-Halemaumau auto trail - - - - - - - - -	92	2	0	March 31, 1932
502.3 Mauna Iki extension - - -	100	0	0	
502.4 Haleakala trail - - - - -	100	0	0	
502.5 Mauna Loa trail - - - - -	100	0	0	
502.6 Halemaumau trail - - - -	95	0	0	
507.1 Kau belt road - - - - - -	100	0	0	
Road Survey, BPR construction -	39	3	9	July 1, 1932

10-159
(May, 1931)

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF PERSONNEL

Hawaii National Park for the Month of January, 1932

	This Month		This Month Last Year	
	Appointed	Non-Appointed	Appointed	Non-Appointed
Number of employees beginning of month	12	15	5	7
Number of additions	0	6	1	1
Total	12	21	6	8
Number of separations	0	2	1	4
Number of employees close of month	12	19	5	4
Number of promotions during month	0	0	1	0
Aggregate amount of annual leave taken	0	0	0	0
Aggregate amount of sick leave taken	0	0	0	0
Aggregate amount of leave without pay	0	0	0	0

10-160

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

REPORT OF PARK REVENUES

HAWAII National Park for the Month of JANUARY 1932

	This Year	Last Year
Park revenue on hand beginning of month,	0.00	0.00
Received,	$1,184 .77	1,075.00
Total,	$1,184.77	1,075.00
Remitted,	1,184.77	1,075.00
On hand close of month,	0.00	0.00

Park revenues received this year to date,	$1,467.75
Park revenues received last year to date,	1,350.00
Increase,	117.75
Per cent of increase,	8%

10-161

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

REPORT OF SALES OF PUBLICATIONS

January 1931
Hawaii National Park

	Number	Value
GOVERNMENT PUBLICATIONS:		
On hand beginning of month, ...	971	$170.50
Received during month, ...	10	8.50
Total, ...	981	179.00
Sold during month, ...	24	10.95
On hand at close of month, ...	957	168.05
NON-GOVERNMENT PUBLICATIONS:		
On hand beginning of month, ...		[illegible]
Received during month, ...		[illegible]
Total, ...		[illegible]
Sold during month, ...		
On hand at close of month, ...		

Cash on hand beginning of month, ...	$4.50
Sales during month, ...	10.95
Total, ...	15.45
Remitted during month, ...	0.00
Balance, ...	15.45

Form No. 1009—Met'l.

U. S. Department of Agriculture, Weather Bureau.

COOPERATIVE OBSERVERS' METEOROLOGICAL RECORD:

Month of January, 1933 , 192 ; *Station,* Volcano Observatory ; *County,* Kau

Hour of Observation, ...

State, Hawaii ; *Latitude,* .... ; *Longitude,* .... ; *Time used on this form,* ....

DATE.	TEMPERATURE. Maximum.	Minimum.	Range.	* Set Max.	PRECIPITATION. Time of Beginning.	Time of Ending.	† Amount.	Humid. ~~Snowfall, in Inches.~~	Wind ~~Depth of Snow on Ground at Time of Observation.~~	Prevailing Wind Direction.	Character of Day, Sunrise to Sunset.	‡ Miscellaneous Phenomena.
	1	2	3	4	5	6	7	8	9	10	11	
1	64	54	10	57			.07	89	Lt.	N.E.	P.C.	Electric storm evening
2	68	52	16	64			.32	87	"	"	Cloudy	Snow on mountains
3	69	50	19	66			.07	79	Mod.	SW	P.C.	
4	69	58	11	60			.01	84	"	"	Cloudy	
5	69	52	17	62			.25	85	"	NE	P.C.	
6	70	52	18	67			.02	81	"	"	"	
7	74	58	16	61			.01	90	"	"	"	
8	65	57	8	62			.01	84	"	"	"	
9	63	55	8	59			.26	90	"	"	Cloudy	
10	65	56	9	59			.80	89	"	"	"	
11	61	55	6	58			.40		Lt.	"	P.C.	
12	65	51	14	57			.21	77	Str.	"	"	
13	65	53	12	57			.38	89	Mod.	"	Cloudy	
14	64	55	9	61			.23	100	"	"	P.C.	
15	65	54	11	59			.20	89	"	"	"	
16	69	49	20	57			.04	90	Lt.	"	"	
17	63	49	14	59			.10	89	Mod.	N.W.	Cloudy	
18	64	50	14	50			4.10	100	"	N.E.	"	
19	59	51	8	57			2.42	94	"	"	"	
20	64	44	9	57			5.28	90	"	"	"	
21	67	55	12	59			.34	94	"	"	"	
22	62	55	7	58			.31	88	"	"	"	
23	61	52	9	59			.40	89	"	"	"	
24	60	51	9	58			.23	94	"	"	P.C.	
25	62	49	13	58			.50	89	"	"	Cloudy	
26	60	52	8	55			1.32	93	Str.	"	"	Thick snow on mountains
27	58	52	6	54			1.53	96	Mod.	"	"	
28	57	51	6	54			2.10	96	"	"	"	
29	59	42	7	56			1.40	100	"	"	"	
30	65	50	15	59			.60	89	"	"	"	Thunderstorm N.E.
31	69	51	18	62			.57	100	Lt.	"	"	
Sum	1999	1633	359	1821			24.55	2407				
Mean	64.3	52.4	11.6	58.7			.79	90				

* Reading of maximum thermometer immediately after setting.
† Including rain, hail, sleet, and melted snow.
‡ Thunderstorms, halos, auroras, etc.

..................................., *Cooperative Observer.*

(IN TRIPLICATE.) See cover for instructions.

Post-Office Address, ...

MONTHLY SUMMARY.

TEMPERATURE.

Mean maximum, 64.3

Mean minimum, 52.4

Mean, 58.3

Maximum, 74 ; date, 7

Minimum, 40 ; date, 16,17,25

Greatest daily range, 20

PRECIPITATION.

Total, 24.55 inches.

Greatest in 24 hours, 5.28 ; date, 20

SNOW.

Total snowfall, ... inches; on ground 15th, ... inches;

at end of month, ... inches.

NUMBER OF DAYS—

With .01 inch or more precipitation, 31

Clear, 0 ; partly cloudy, 13 ; cloudy, 18

DATES OF—

Killing frost, ...

Thunderstorms, 1 and 30

Hail { Light, ... Moderate, ... Heavy, ...

Sleet, ...

Auroras, ...

REMARKS:

STATISTICAL REPORT NUMBER 8
HAWAII NATIONAL PARK

FINANCE AND ACCOUNTS

Symbol	Name	Allotted	Expended & Obligated	Balance
41/2415	Hawaii National Park 1931-38 - -	$52,130.00	$39,229.16	$12,900.84
41/2405	Emergency Reconstruction and Fighting Forest Fires - - - - -	200.00	200.00	0.00
41/2406	Forest protection and fire prevention	100.00	100.00	0.00
4 X 436	Roads and trails, National Parks, No year - - - - - - - - - - -	384,806.30	79,743.79	305,062.51

NATURE NOTES

HAWAII NATIONAL PARK

VOLUME II
NUMBER 7
DECEMBER 1931

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

HAWAII NATIONAL PARK
NATURE NOTES

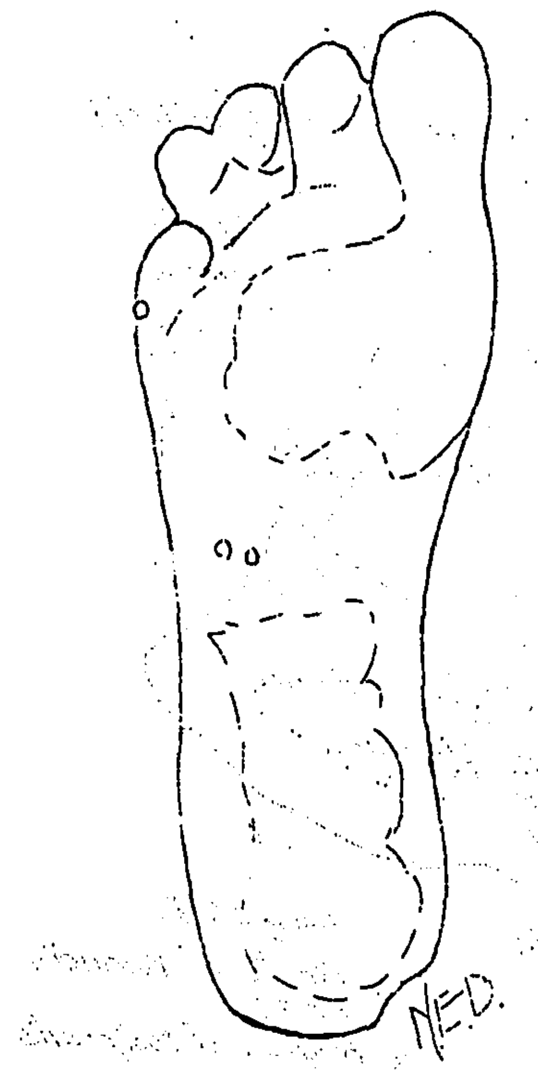
Volume I | December 1931 | Number 7

Nature Notes from Hawaii National Park is a monthly pamphlet edited by the Park Naturalist and distributed to those interested in the natural history of the park. Free copies can be obtained through the office of the Park Superintendent, Hawaii National Park, Hawaii. Anyone desiring to use articles appearing in Nature Notes may do so. Please give full credit to the pamphlet and author.

E. P. Leavitt, Superintendent   John E. Doerr, jr, Park Naturalist

TABLE OF CONTENTS

THE FOOTPRINTS IN KAU



When Captain James Cook discovered the Hawaiian Islands in 1778, Kalaniopuu was king of the island of Hawaii. Kalaniopuu reigned as king of the island until his death in 1782. Before his death he provided that his son, Kiwalao, should succeed him as king of the island. Kalaniopuu gave to his nephew, Kamehameha, the powers of high chief over the districts of Kona, Kohala, and Hamakua. These districts include the western and northern parts of the island as indicated on the map on page 53.

Soon after Kiwalao assumed the duties of king of Hawaii, his half-brother, Keoua, showed dissatisfaction with the divisions of power and land made by the late king. With the help of the new king, Keoua led forces against Kamehameha. In a battle fought at Mokuohai, Kiwalao was killed. Keoua fled to Kau, the district on the south side of the island, and there declared himself king of the island of Hawaii.

Skirmishes between Keoua and Kamehameha continued until 1790. During that year Kamehameha invaded the island of Maui. With the help of cannon furnished by white men, he gained several victories over the Maui warriors.

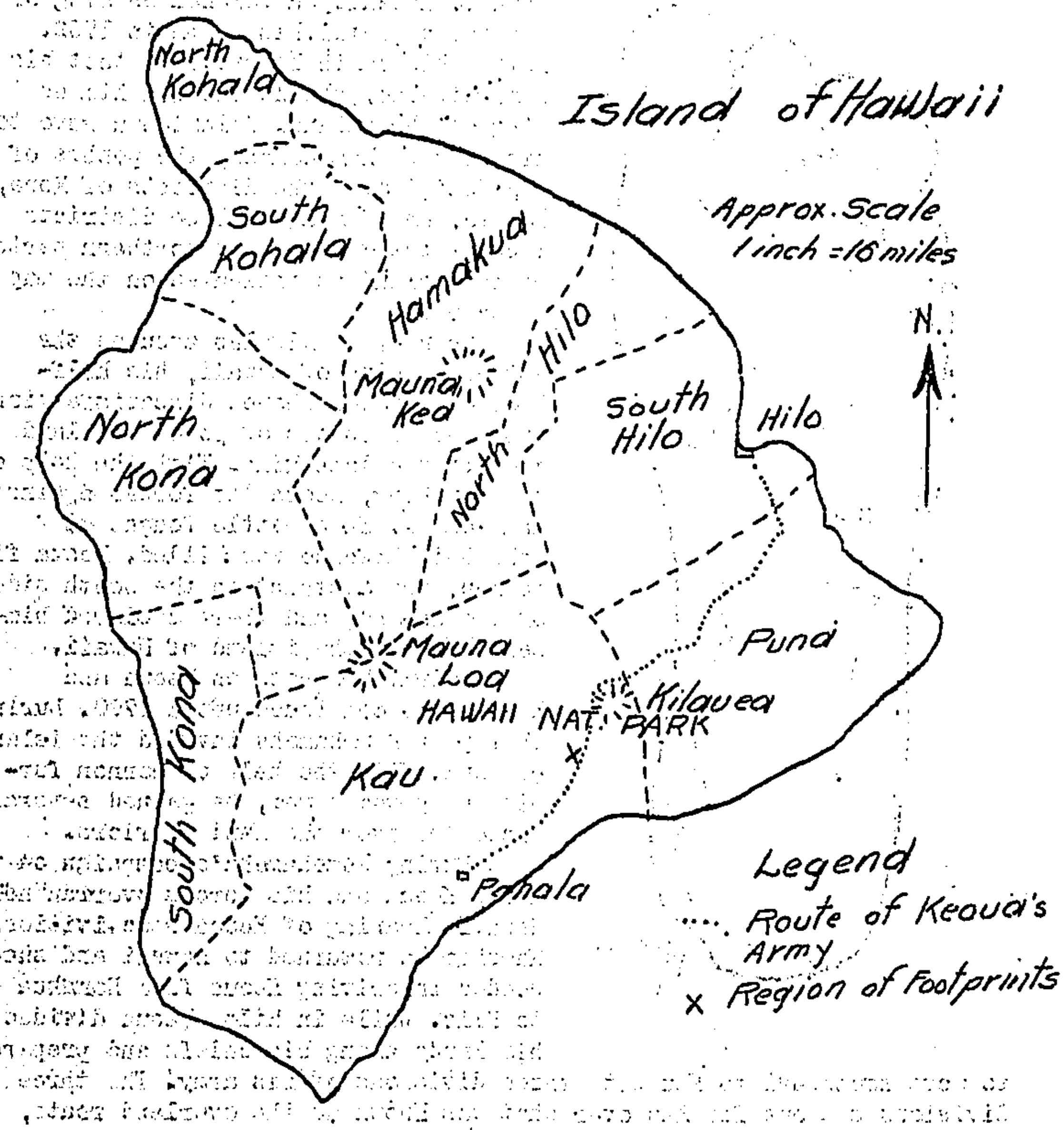
During Kamehameha's campaign on Maui, Keoua and his forces overran north Hawaii. Hearing of Keoua's activities, Kamehameha returned to Hawaii and succeeded in driving Keoua from Hamakua to Hilo. While in Hilo, Keoua divided his lands among his chiefs and prepared to move southward to Kau with three divisions of his army. The three divisions set out for Kau over what was known as the overland route, a route leading passed the volcanic crater of Kilauea. To-day the around-the-island road from Hilo, through the National Park, to Pahala follows essentially the route taken by Keoua's army.

The overland route proved to be a disast rous one for Keoua and his followers. While in the region of the crater of Kilauea, the volcano suddenly erupted with a violent explosion. Great quantities of rock and ash were thrown into the air; falling to earth these volcanic products killed everyone (about eighty people) in one division of Keoua's army.

The accounts of this disaster vary somewhat. In the "Journal of William Ellis"*, the disaster is described as taking place at night

*Ellis, William, Journal of, A Narrative of a Tour Through Hawaii in 1823, Honolulu 1917.

while the army was camped near the volcano. Other accounts indiacte that the first division of the army had safely passed the volcano and that the explosion occurred while the second division was passing through the vicinity of the crater.*



The footprints preserved in the volcanic ash of the 1790 explosion are evidence of the fact that the army of Keoua was on the march when the explosion took place. The footprints, preserved in the ash for one hundred and forty-one years, silently tell many things outstanding among which is that they were made by highly excited people wandering around - lost in the darkness of the falling volcanic ash cloud. Some of the footprints tell a story of a mother looking for a lost child, of children running to keep up with their parents, of people stumbling and falling in the ash. These footprints are evidence that entire families accompanied the warriors on the march for one can distinctly see the footprints of men women and children. The imprints of shoeless

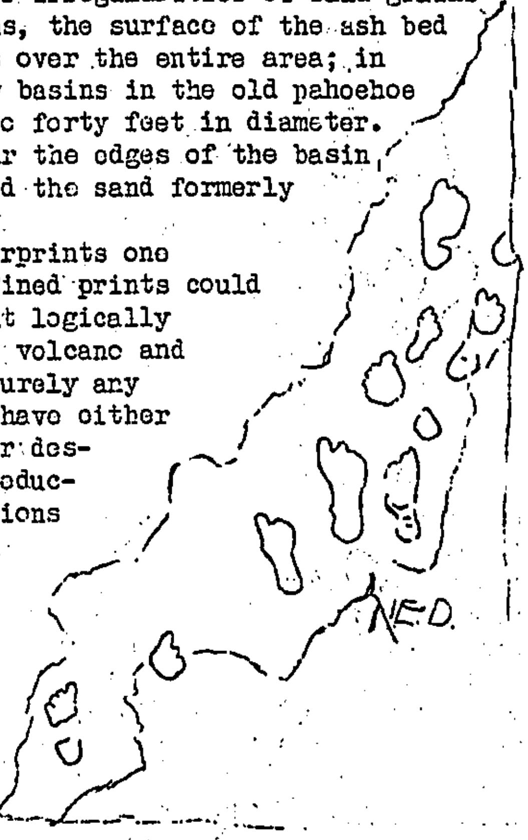
*Taylor, Albert P., Under Hawaiian Skies, A Narrative History of Hawaii, Honolulu, 1926.

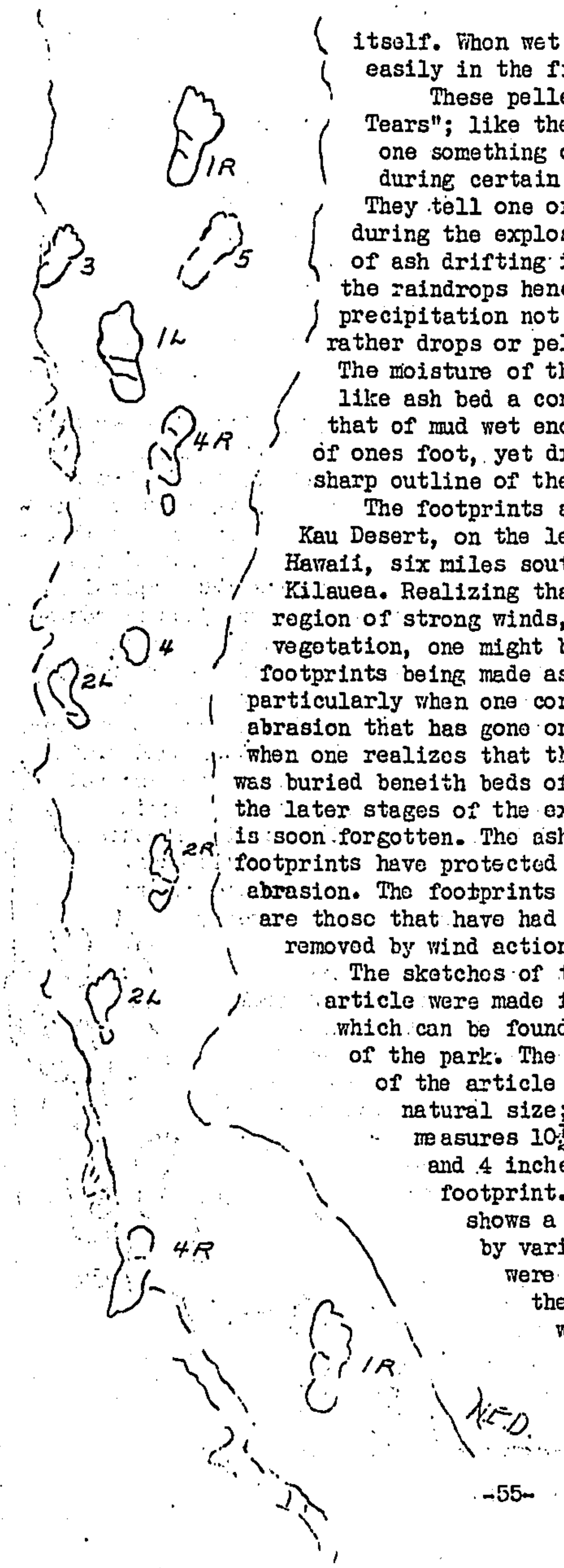
feet tell of many torturous journeys over hard lava surfaces; one can distinguish the deformities of the feet of people who did not know the use of shoes.

Keoua's greatest loss during the disaster was probably not in terms of the number of people killed but rather in terms of the destroying of his people's faith in his cause. Armies and nations at war have a faith in a supreme power and trust that their supreme power is on their side. Keoua and his followers certainly had faith in Pele, their Hawaiian Goddess whose temple is the fire-pit of the volcano. To have their Goddess suddenly appear as the smoke, fire, thunder and ashes of the eruption and destroy part of their people must have been a strong indication to many that Pele did not approve of their cause; at least it was evidence to Kamehameha that Pele, the Goddess of Volcanoes, was on his side.

The footprints made by the second division of Keoua's army may be seen to-day along the National Park's trail which leads from the Kau road (nine miles south of the park headquarters) to the Mauna Iki lava flow of 1920. The footprints are preserved in a bed of buff-colored, silty, clay-like volcanic ash. The bed has an average thickness of $1\frac{1}{2}$ inches. This particular bed of ash represents the finer materials thrown out during the early stages of the 1790 explosive eruption of Kilauea. Beneith it are from one to three feet of course sand or rocky ash resting on a very slightly weathered pahoehoe (smooth) lava surface. When dry the clay-like bed of ash is brittle, breaking like polygons of sun-dried clay; moisture reduces the brittleness of the bed to a condition of crumbling under the pressure of ones fingers. Except for the minor irregularities of sand grains and the shallow footprint depressions, the surface of the ash bed is smooth. The bed is not continuous over the entire area; in most cases the bed occurs in shallow basins in the old pahoehoe surface. These basins are from ten to forty feet in diameter. The best footprints can be found near the edges of the basin structures where the wind has removed the sand formerly covering the ash bed.

On first examination of the foorprints one wonders why and how such sharply defined prints could have been preserved in what one might logically think was dry dust thrown out by the volcano and carried several miles by the wind; surely any post-depositional wind action would have either obliterated footprints in dry dust or destroyed their sharpness of outline, reducing them to the mere shallow depressions such as are made by a person walking in dry sand. Examining closely a cross-section of the thin ash bed one finds disseminated through it small, well rounded pellets, 1/16 to 3/8 of an inch in diameter, composed of the same material as the matrix of the bed





itself. When wet the pellets crumble easily in the fingers.

These pellets are called "Pele's Tears"; like the footprints, they tell one something of what was happening during certain stages of the eruption. They tell one of the rain that fell during the explosion. The finer particles of ash drifting in the air collected in the raindrops hence one might picture a precipitation not of drops of rain but rather drops or pellets of ash or mud. The moisture of the rain gave to the clay-like ash bed a consistency comparable to that of mud wet enough to take an impression of ones foot, yet dry enough to retain the sharp outline of the impression.

The footprints are in what is called the Kau Desert, on the lee side of the island of Hawaii, six miles southwest of the crater of Kilauea. Realizing that the Kau Desert is a region of strong winds, little rain and scant vegetation, one might be skeptical about the footprints being made as long ago as 1790, particularly when one considers the probable wind abrasion that has gone on in the area; however, when one realizes that the foot-printed ash bed was buried beneith beds of ash deposited during the later stages of the explosion, ones skepticism is soon forgotten. The ash beds deposited over the footprints have protected them from wind and water abrasion. The footprints that can be seen to-day are those that have had their protecting cover removed by wind action during the past few years.

The sketches of the footprints in this article were made from actual footprints which can be found in the Kau Desert area of the park. The sketch at the beginning of the article (page 52) was drawn $\frac{1}{2}$ natural size; the actual impression measures $10\frac{1}{2}$ inches from heel to toe and 4 inches across the ball of the footprint. The sketch on page 54 shows a group of footprints made by various people all of whom were traveling in essentially the same direction or southwest away from the crater of the volcano. The impression showing the ball and toes of a right foot suggests a man running; the impression of the left and next footfall of the man has been obliterated or is covered by course sand.

On the outcrop sketched on the opposite page one can distinguish the footprints of probably five individuals four of whom were moving north-easterly toward the crater, the fifth was moving in the opposite direction away from the volcano. The figures at the side of the sketched impressions indicate the footprints evidently made by the same person.

Number one's (both left and right) feet measure 11 inches from heel to toe and $4\frac{1}{2}$ inches across the ball of the impression. Number two's feet (probably the footprints of a woman) measure $7\frac{1}{2}$ by 3 inches. Number three's imprint, (of which there is only one) measures 9 by $3\frac{1}{2}$ inches; number four's impression measures 10 by 4 inches; and number five's footprint, also only one impression, measures 10 by $4\frac{1}{2}$ inches.

Seeing these footprints and realizing the fear that native Hawaiians had of Kilauea, the home of the Goddess of Volcanoes, one can easily picture the warriors and their families frantically trying to free themselves from the falling blanket of death, a cloud-blanket which they knew was the anger of the unforgiving Goddess Pele.

by the Park Naturalist
John E. Doerr, jr.

"MARK TWAINS" STRANGE DREAM
Concluded

"As I walked along, I even half expected to see my solemn guide step out from the nook in the lofty wall, and beckon me to come on. At last when I reached the place where I had first seen him in my dream, I recognized every surrounding object, and there, winding down among the blocks and fragments of lava, I saw the very trail I had traversed in my vision! I resolved to traverse it again, come what might. I wondered if in my unreal journey I had 'blazed' my way, so that it would stand the test of stern reality, and thus wondering, a chill went to my heart when I came to the first stony rojection I had broken off in my dream, and the esh new fracture, and the dismembered fragment ing on the ground! My curiosity rose up and banished all fear, and I hurried along as fast as the rugged nature of the trail would allow me. I looked for my other 'blazes' and found them, found the cleft in the wall; recognized all its turnings, walked in the light that ascended from the glowing furnaces visible far below; sweated in the close hot atmosphere, and breathed the sulphurous smoke. I at last stood hundreds of feet beneith the floor of Kilauea, in the ruined chamber, and in the presence of the mysterious boulder!

"'This is no dream' I said, 'this is a revelation from the realm of the supernatural; and it becomes not me to longer reason, conjecture, suspect, but blindly to obey the impulses given me by the unseen power that guides me.' I moved with slow and reverent step toward the stone and bore against it. It gave perceptibly to the pressure. I brought my full weight to bear and surged against it. It yeilded again but I was so engulfed by the toilsome journey that I could not overthrow it. I rested a little and then raised an edge of the boulder by a strong steady pressure, and placed a small stone under it to keep it from sinking back into its place. I rested again and then repeated the process. Before long I had added a third prop, and had got the edge of the boulder considerably elevated. The labor and the close atmosphere together was so exhausting, however, that I was obliged to lay down, then, and recuperate my strength by a short season of rest. And so, hour after hour I labored, growing more and more weary, but still upheld the fascination which I felt was infused into me by the invisible powers whose will I was working.

"At last I concentrated my strength in a final effort and the stone rolled from its foundation.

"I can never forget the overpowering sense of awe that sank down on my spirit at that moment. After a solemn pause to prepare myself, with form and uncovered head, I slowly turned my gaze till it rested on the spot where the great king had laid.

"THERE WASN'T ANY BONES THERE!

"I just said to myself, 'Well if that ain't the blamedest, infernalist swindle that ever I've come across'.

"You can't bet anything on dreams.

The End.

The original of "Mark Twains Strange Dream" may be found in the volume of the "Volcano House Visitors Records", dated 1865 to 1873. The original article in the record book of visitors is written in ink and was signed by Mark Twain. Unfortunately some collector of autographs has removed the portion of the page containing the signiture of the famous writer.

In view of the torn edges of the pages on which the original of the story appears, it has been necessary to supply in a few places the missing words, just as you have had to guess at parts of words in reading the story in Nature Notes.

The editor of Nature Notes wishes to thank Mr. J. N. Gandy, Manager of the Volcano House, for the use of the visitor's records containing the interesting story of "Mark Twains Strange Dream".

by the Park Naturalist
John E. Doerr, jr.

VOLCANIC EXCITEMENT

About the time this issue of Nature Notes should have come off the mimeograph press housed at Uwekahuna Bluff, a high bluff overlooking the crater of Kilauea, "The Volcano", (meaning Kilauea) suddenly became active. If you have witnessed Kilauea as an active volcano you will fully appreciate why the work on Nature Notes was suddenly postponed. The desire to see the eruption from all points of observation and during all hours of the day and night was too great. The December issue was pushed aside in the excitement of the volcanic activity. It was not the excitement of getting away from Kilauea but rather the excitement of getting as close to the active fire pit of the crater as possible, the excitement of conducting visitors across the crater floor at night and assisting people in gaining a full appreciation of the volcano and surrounding region.

Letters from friends who have as yet not seen Kilauea express sympathy for the people living in the region of the volcano. The sympathy should be envy for to-day volcanic activity in Hawaii is a time of great rejoicing. Eruptions bring special steamers and airplanes from Honolulu to Hilo. Hundreds of cars bring thousands of people to the very rim of the fire pit and among them there is no one who has the slightest fear of danger or destruction as they stand on the rim and look down to the spraying fountains sending great, fiery red, molten lava streamers arching through the air - streamers which rise two hundred, three hundred feet and then fall back with a splash into the molten lava lake at the bottom of the fire pit.

Only twice in Kilauea's history have eruptions made approach to the fire pit dangerous; once in 1790 and again in 1924. Explosive eruptions such as occurred in 1790 and 1924 are not at all common for the type of volcano existing in Hawaii. Even the 1924 explosive eruption attracted thousands of people to the outer rim of the crater. It is true that periods of volcanic activity are generally preceeded by earth tremors but they are neither dangerous nor destructive; and too, during stages of an eruption sulphur fumes do issue from the fire pit of Kilauea but even they can be avoided by those approaching the pit. The dependable northeast trade winds carry the fumes over the desert section of the park, a treeless, uninhabited region.

Answering questions - there were hundreds of them - added to the joyous excitement of the eruption. Visitors at an active volcano can ask more questions than a college professor quizzing his class on the facts absorbed during a year course in geology. Like some of the professor's questions, it was not always easy to determine just what information was wanted. There were questions which amused, questions which human knowledge can not answer, questions which could be answered by a "Yes sir" or a "No ma'm", and questions requiring lengthy explanations of geology.

To a National Park Service man a question represents a park visitor's desire for information. Park Service men welcome questions. To answer questions is to render service to park visitors. By asking questions visitors not only obtain information but also help the park staff in giving better service. The holiday activity of Kilauea proved to Hawaii National Park's staff that there is nothing more exciting than rendering service during a period of volcanic activity.

by the Park Naturalist

The Volcano Letter

Two dollars per year | Ten cents per copy

No. 377—Weekly | Hawaiian Volcano Observatory, National Park, Hawaii | January 7, 1932

The large northeastern fountains of lava in the bottom of Halemaumau pit, Kilauea Volcano, on the evening of the first day of the eruption, December 23, 1931, from the north-northwest rim, 7:30 p. m. Photo Higashida.

JOURNAL OF HALEMAUMAU ACTIVITY DECEMBER 28-JANUARY 3, 1931-32

It is now evident that the activity of the bottom of Halemaumau in the current eruption is stronger, and the lava fill more voluminous than in any outbreak since 1924. The current week brings to a close the eleventh day of the eruption with the fill at the highest southwestern side of the bottom of the pit at an elevation 110 feet above the corresponding floor of 1930. The progress of the week has determined a concentration of all visible inflow at the big southwestern grotto, where the lava piles up a horseshoe cone with an open cup overflowing to the floor of the pit. The topmost spatter of this cone stands 280 feet above the highest summit of the cone of 1930, and only 650 feet below the tourist station at the southeast rim of the pit. The line of central fountains disappeared after December 29, when it became evident that the southwest border of the floor was to become the top of a new mound from which flows would radiate across a swollen heap of fresh lava in the pit, and these flows have themselves developed a lake at the top of the mound bordered by a rampart of crusts which divides the lake at the southwest from the slope down to the edge of the floor at the northeast. This lake is continually fed by the torrents of lava from the fountaining craterlet, and from time to time the lake breaks through its rampart with overflows that flood the northern slopes of the mound. Seismic activity as usual has dwindled since the magma was released, harmonic tremor from the fountains is continuous, and the change in tilt from northeast to southwest at the Observatory is what would be expected with the lava ejection relieving upward pressure and replacing it by heavy weight of new fill.

December 28

At 11:20 a. m. the concentration of activity at the big southwest fountain was sending frothy jets 350 to 400 feet high and spattering halfway up the west talus. The material appeared to be basaltic froth, and in dimensions and structure the whole cone and fountain were like the Alika source cone of 1919 on Mauna Loa (Volcano Letter 348, Page Three). Heat was strong on the edge of the pit, and this grotto fountain played like a jet from a hose, swinging slowly around a central vertical position, and dropping its light spatter first on one side, then on another. The resemblance to the Mauna Loa source cone was increased by the action of the minor fountains in the central lake and the two explosive vents, at the north, of the fountain line, which are making extraordinary flings of ropy lava to a great height, and detonations accompanied by puffs of blue gas. Just these things happened in the northern cones of the Alika rift, in contrast to the big fountain, with its frothing pool, farther south.

The central fountain was a bubbling pool which occasionally sent up a string of slag even higher than the steady spray of the southwest cone, and this string would loop and bend at the top, and then fall with a slap on the pool below. Both the central fountain and the one farther north made explosive bursts with loud thudding detonations, some of which sounded like a chemical explosion. At the area of the northern fountain there were three definite streams pouring northward on a downhill slope from an edge of crust, indicating that a lake had formed within a slag heap. About 18 fountains of small size extended from the center to the southwest.

The whole area of the northern edges of the floor was cracked and mashed into pressure ridges like the slopes of the mound of 1930. There were four or five jets of blue fume in this slope area. A wide patch of crust made an island about where the big cone of 1930 had been. The lake was leaf-shaped with the southwest fountain at the stem, and the latter was building a high, cracked half circle of its hardened flings on the uphill side against the talus behind it. The inside of its cup would continually cave in revealing red-hot walls. Measurements had shown a gain in height of the built-up bottom of 100 or more feet at the southwest, and only 40 feet to the northwest of the center of the pit, showing that there was development by both overflow and tumescence around the region of maximum fountaining. A cloud of blue fume was always rising from the big fountain, and smaller amounts of it came from the other fountains.

A nationwide broadcast was sent out from the edge of the pit describing the activity for the half hour following 10:45 a. m., by KGU of the Honolulu Advertiser. A microphone attached to the end of a long timber was thrust inside the pit so that listeners might hear the roar of the big fountain and the explosive bursts of the central and north central vents. The arrangement of this apparatus, with wires for relays by radiophone, had been accomplished in less than a day, and was of interest as showing what could be done for securing assistance in case such a volcanic happening were disastrous.

New cracks were discovered in the bottom lava of Ki-

Panorama of the bottom of Halemaumau at 10 a. m. December 24, 1931, looking northwest. This shows the condition when the line of central fountains was in action, the liquid was a continuous lake except for a narrow border rampart, and the southwest grotto at the left was small. Photo Jaggar.

lauea Crater outside of Halemaumau, occasioned by the stresses which produced this eruption at the time of the earthquake of December 23, as follows: Three cracks concentric with the rim to the northeast and seven cracks concentric with the rim to the northwest within 500 feet of distance. Close under Uwekahuna bluff in the same direction appeared nine similar cracks as though the inner heap of Kilauea Crater were broken by motion on the fault of which the Uwekahuna bluff is the trace. The west, southwest and south outer country of the Kilauea floor showed widening of old cracks and development of some new ones. Large blocks of spatter from the fountains were found to leeward of the pit, and a wounded tropic bird was picked up which had been dashed against the pit wall by the wind and was bleeding. The earthquake of December 23 had dislodged a bowlder three feet in diameter from the Uwekahuna wall and rolled it 200 feet out on the Kilauea floor. Several new steam vents were noted about the inner talus heaps of Halemaumau.

At 4 p. m. the southwest grotto fountain had a quiet spell jetting only about 50 feet high, and along the inner belt there were only two sluggish small fountains southwest of the center. Sluggish lava flowed from the grotto. At 9 p. m. for about a half hour the southwest grotto was merely bubbling, but later it renewed activity. The rift fountains in the lake had almost disappeared.

December 29

At 8:30 a. m. the southwest fountain had completely revived, the pit had been bright at night, and the central fountains had gone out of action. Flows were pouring over the floor in two streams from the southwest half-cone, and at this time the northern edges of the floor appeared slumping inward, and the southern edges were being built up and the southern half of the floor was evidently becoming a mound. The flows spreading out on the floor were meandering in leaf-like forms and there was nothing that could be called a lava lake except the pool surrounding the fountain inside the cone, which was hemmed in by an island of half-hardened lava that divided the two streams in front of it. At 8 p. m. the situation remained the same except that only the western of the two torrents from the cone was open.

Elevations above sea level of various points inside Halemaumau were as follows on December 29:

Summit Southwest Grotto	2860 feet
Edge lava in front of grotto	2764 feet
Southwest floor level of pit	2763 feet
Small cone center of pit	2761 feet
West bay of floor	2744 feet
Northwest bay of floor	2743 feet
Northeast bay of floor	2740 feet
Interior floor northwest	2738 feet

It will be seen by these figures that the southwest grotto was 96 feet high, the small central cone was seven feet high by a measurement taken on a point beside it (2754 feet), and the maximum relief of the bottom area between a sagged portion of the northwest floor and the top of the southwest grotto was 122 feet. There had been a slump of from 5 to 10 feet over most of the northern floor and overflows were slowly filling the collapsed area.

December 30

At 8:30 a. m. the fountaining at the southwest grotto continued to fluctuate and as on the previous evening the torrent from the craterlet was pouring to the west of the island in front of it and spreading over the crusts of previous flows. There were some trickling flows at the northwest edge of the new fill, but otherwise the northern floor was now inactive. The last gas puffs from the central vents had been noticed on the afternoon of December 29.

At 3 p. m. the two torrents from the southwest craterlet, cascading on each side of the island in front of the open eruptive amphitheater, had reasserted themselves as glowing streams, the eastern one pouring from under a crust. The puddled flows in front showed the usual bright-line pattern radiating from the two inflows, with numerous islets of accumulation, and enough building around the edges of the big puddle (covering the greater part of the southern half of the floor) to produce the effect of 20 overflow streams out from the edges of the lake of lava. This was to develop into a definite leaf-shaped lake with ramparts about its border, and with the southwest grotto for its source well.

At 8 p. m. the fling of the big fountain was continually falling on the outside of the cone, while the bombardment and overweighting of the inside caused red-hot avalanches into a pool beneath. Two torrents poured east and west of the island in front, but the western one was now arched over with crust at its narrowest part, with a cascade pouring from the froth pool in under the crust.

During these days a single, thin column of blue smoke from the fountain rose high above the west rim of the pit making a cumulus of rain moisture above, thin on a sunny morning, thick and spectacular in the moist evenings. The sun in late afternoon here and in Kona appears like a red ball through the fume. The nights show spectacular glowing cloud effects over the pit, with the glow waxing and waning. No fume obscures the view.

December 31

At 9:30 a. m. it was evident that the area of flows was widening in front of the southwest fountain, and that the cone was growing. Only the west cascade appeared as an open channel. Some jets from the fountain appeared to go up 400 feet. There were frontal streams at the north and northeast edges of the heap. The activity appeared somewhat greater than on the previous evening.

January 1

At 11 a. m. the lake over the southwestern part of the floor continued to enlarge. The floor was now getting to be a mound with concentric ridges and ramparts within the northern half of the area and many cracked areas. The outer edge is like a spoon with some inward slope. The top of the mound is at the southwest and the big fountain is building it up with a lake at the crest. Much pumice has been found in the country outside of Halemaumau to the southwest, some of the pieces two to three inches across. In the night following this day the glow over the pit was very bright, and was added to by the development of electrical storms on the mountains which produced snow on Mauna Loa and Mauna Kea.

January 2

At 9 a. m. the activity appeared to be as strong as ever. At 10:30 a. m. it was evident that the lake in front of the fountain had definite border ramparts where some lava spilled over, the pool covering about one-third of the floor. The spatter rims of the grotto had built out about 150 feet from the large western talus, forming a typical Mauna Loa horseshoe cone with the main channel about 100 feet wide above where it divides about islands into cascades. Apparently the weight of the lake accumulations was causing the sunken northern area to rise, and measurements detected slight rising against the walls of the pit. This is the isostatic effect, frequently noticed a decade ago, when *the bench magma is weighted down on one side and the* other side rises. At 3 p. m. the fountain was smaller and more like normal Kilauea lava. The lake was scalloped with two big flows through its rampart. At 8 p. m. there was much cracking and foundering of crusts in large fields of half-hardened lava to the north of the lake. The lake overflows were in wide streams on top of these fields.

January 3

At 11 a. m. a single wide cascade was flowing toward the east, the ramparts around the lake were continually pushing out and being overflowed, and the fountain was more sluggish.

T.A.J.

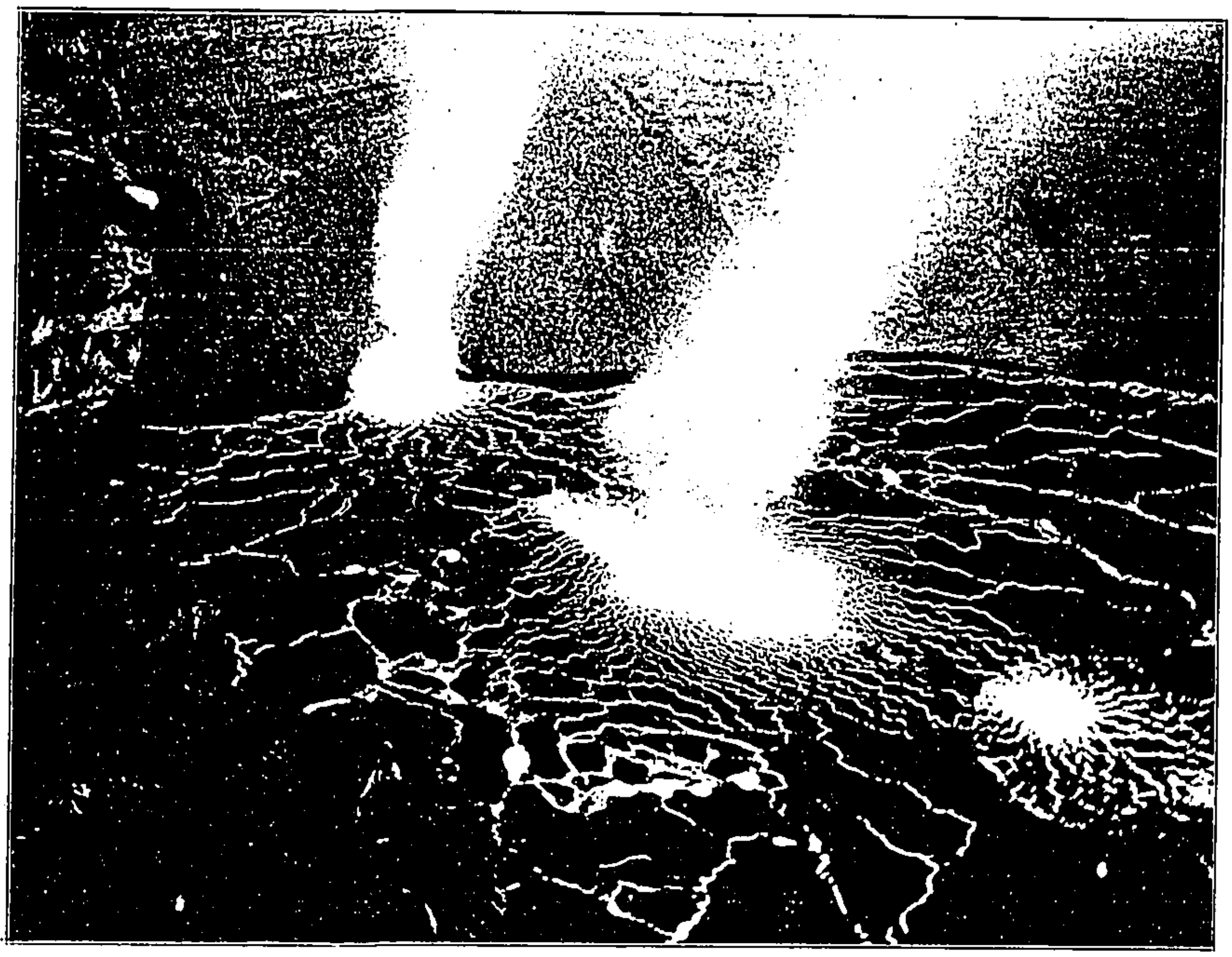
KILAUEA REPORT No. 1041

WEEK ENDING JANUARY 3, 1932

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge

The outbreak of Halemaumau pit in Kilauea Crater which began December 23, 1931, has produced a more voluminous fill than in any outbreak since 1924, and has brought the middle of the floor to an elevation less than 900 feet below the tourist station on the rim of the pit. The fill at the southwest on the eleventh day of the eruption was 110 feet above the corresponding floor of 1930, and the highest spatter on the talus beside the big source cone is about 650 feet below the southeast rim of the pit.

The central fountains disappeared December 29, the southwest grotto became a source cone for flows which built up the floor into a mound, and this activity still continues, with a lake built in front of the cone across the southern half of the bottom of the pit. The cone became an armchair niche 100 feet high with cascades pouring out



Halemaumau by evening light at 5:30 p. m. December 26, 1931, looking west, showing the growth of the southwest grotto at the expense of the central fountains and the concentration of the lake in a crescent in front of this grotto. Photo Powers

Halemaumau pit as a whole seen from the highest west bluff of Kilauea Crater on the first evening of the eruption of December 23, 1931, about 5 p. m., when blue-brown fume was puffing up from the big northeastern fountains in intolerable clouds of sulphurous gas. This stopped early the next morning. Photo about two and a quarter hours after the outbreak by Maehara.

of it to make a golden pattern of streaming across the lake. The latter made overflows about its edges, and so weighted down the heap as to cause some swelling up on the opposite side of the bottom area. On December 29 there was difference of elevation across the bottom so that the southwest cone was 122 feet higher than the northern floor. The inflow fountain diminished in size.

Harmonic tremor at the seismographs has been incessant. One feeble local seism December 30 at 11:18 p. m. was felt and indicated origin distance 14 miles. It was felt strongly at Puu Ulaula on northeast slope of Mauna Loa at elevation 10,000 feet. Three very feeble shocks occurred, of which one was felt. time 2:20 a. m. January 3. Microseisms have been heavy, and tilt was moderate SW.

THE VOLCANO LETTER

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Readers are requested to send articles, photographs, publications and clippings about volcano and earthquake events, instruments and investigations, especially around the Pacific.

Subcription for non-members two dollars per year of 52 numbers. Address the Observatory.

HAWAIIAN VOLCANO OBSERVATORY
Founded 1911

This laboratory at Kilauea Volcano belongs to the Hawaiian Volcano Research Association and is leased and operated by the United States Geological Survey.

It maintains seismographs at three places near Kilauea Volcano, also at Hilo, and at Kealakekua in Kona District. It keeps a journal of Hawaiian volcanic activity and publishes occasional Bulletins.

Membership in the Hawaiian Volcano Research Association is limited to patrons of Pacific science who desire personally to aid in supporting the work.

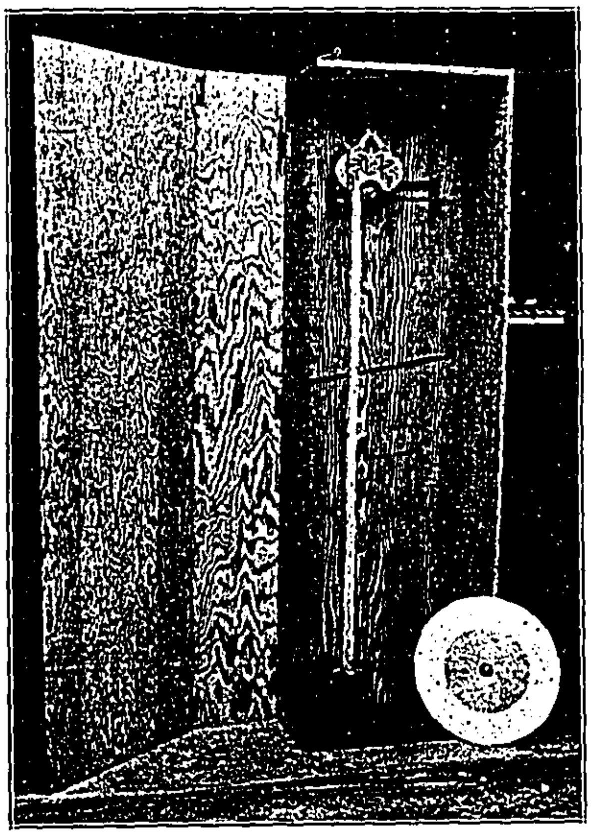
The work of volcano research so supported is in collaboration with the work of the United States Geological Survey, but supplements it with buildings, research fellows, instrumental plants, explorations and special investigations for which there is no governmental provision. The Geological Survey maintains volcano stations in Alaska, California and Hawaii.

Persons desiring application blanks for membership ($5.00 or more) should address the Secretary, Hawaiian Volcano Research Association, 320 James Campbell Building, Honolulu, T. H.

The Volcano Letter

Two dollars per year — Ten cents per copy

No. 368 — Hawaiian Volcano Observatory, National Park, Hawaii — January 14, 1932



Case and shock-recorder, with cardboard seismogram and aluminum disc removed, showing the general assembly.

EDITOR'S NOTE

In November 1929 the Scientific American published an article entitled, "Amateur Seismology," describing a simple instrument in the form of a horizontal pendulum consisting of a lead weight hung on a pinched hacksaw blade with an aluminum boom and pen writing on a smoked paper disc, revolved and moved along by a simple clock after the fashion of a gramophone record. A number of experimenters in the United States have made modifications of this instrument, and at the Hawaiian Volcano Observatory we have continued to experiment.

The text herewith is a set of instructions with appropriate illustrations to accompany eight new model shock-recorders which have been sent for service in New Zealand, under the Department of Scientific and Industrial Research. These differ from the original horizontal pendulums in that the mass and boom stand upright from the wall bracket which supports them, so that the entire case may be screwed against a cellar wall in the position of an upright clock. The necessity of having a large tabular surface is avoided and the clock rollers fall into the plane of the spring barrel, which simplifies the mechanism. T.A.J.

JAGGAR SHOCK-RECORDER
VERTICAL OR WALL MODEL 1931

Instructions for Assembling

Each shock-recorder should have made for it a case, like a wall clock, a box 48 inches high, 15½ inches wide, 6½ inches deep, inside measure, with sides and cover made of 3-ply wood, the ends and back-board of more substantial planed lumber; and the metal parts are as follows:

2 narrow pieces of channel iron bolted together to form a basal support for the pendulum, and to be screwed against the back-board of the box at the bottom.

A heavy mass with two flat springs, anchored in lead inside a short iron pipe, and protruding from its side. These springs are pinched between the two channel irons about one eighth inch from where they enter the heavy mass. The heavy mass thus stands above the channel iron bracket as an inverted pendulum.

A long balsa-wood boom with a light pen at the upper end and attached at the bottom by aluminum plates and braces screwed into appropriate holes on the face of the heavy mass so that the boom stands upright.

A pair of tracks screwed against the back-board of the box at the top to hold the clockwork which rolls itself along on these tracks.

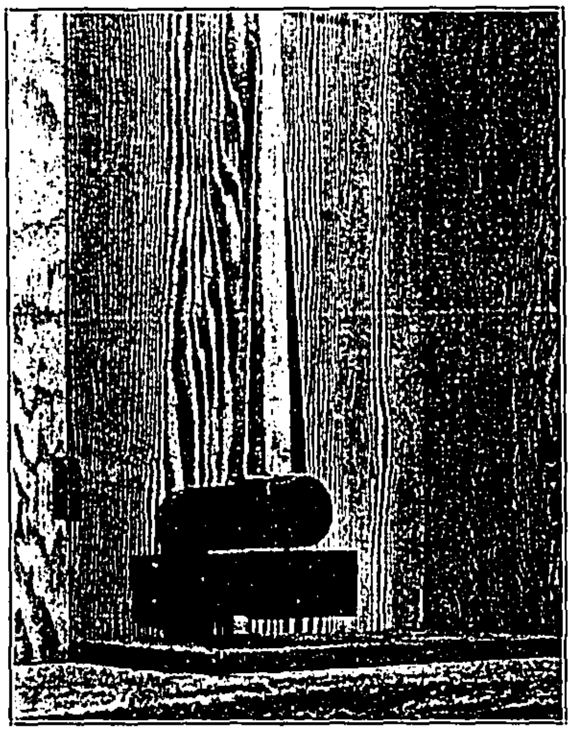
The clockwork equipped with rollers to fit the tracks, the double rollers on the back track and the single roller on the front track. The clock moves from left to right as you face it and is regulated so that its central spindle rotates once an hour when it is working.

Aluminum disc with central sleeve to fit spindle of clock, and central thumbscrew for handling the disc and for clamping to the face of the disc a circular card of white Bristol board 11 inches in diameter, punctured in the center to fit the pin of the thumbscrew cap. A smaller disc 3½ inches in diameter is clamped over the card only for smoking, in order to keep the card clean in the center.

Assemble tracks as shown on drawing, screwing the track rods on the angle bracket and placing at the back the track covered with rubber tubing. As the box is not supplied with the instrument, the placing of the parts on the back-board should be scaled from the drawing.

Clamp the flat springs of the heavy mass in the channel iron support, leaving ⅛ inch of spring between support and mass. Screw the channel irons against the back-board (1 inch round-headed brass wood screws) with the heavy mass uppermost. The lower edge of the channel irons stands ½ inch from the lower extremity of the back-board inside the box, and 4 inches from the left side of the back-board.

Lay out 36¼ inches vertically from the upper side of the channel irons to the angle of the bracket supports on the back-board, and draw a horizontal line as guide for placing these bracket supports. It is understood that the box stands upright against the wall like an old-fashioned clock. The left track bracket stands 2⅝ inches from the left side of the back-board.



Foot of case showing bolted channel iron pinching the two clock springs which are cast into the heavy mass. The boom of balsa wood is screwed to the top of the heavy mass by appropriate braces of aluminum.

Screw the balsa wood boom with its braces onto the mass, so that it stands vertical. The clock is set on the tracks with the small roller in front.

For removing and placing the disc on the spindle, the pen at the top of the boom is laid back, and the clock is simply slid well to the right, where the disc will be clear of the pen. Here the disc may be pressed by friction on the spindle or gently pulled off it by a slight rotation.

The period of the pendulum, set swinging by hand and timed with a watch, should be about ½ second to the right, and ½ second to the left, or a total of 1 second complete period. The longer the spring exposed between the clamp and the heavy mass, the longer the period. Count the number of swings for a full minute.

Needless to say, the adjustment should be such that the boom stands exactly plumb, and the arc of the needle when the point drops over against the carboard disc should bring the point, at about 45 degrees, on a horizontal line passing through the center of the disc, and about 2 inches to the left of the center.

It is possible to bend the supporting springs slightly in order to make the boom vertical, but it is undesirable to do so If these springs break, ordinary clock spring is obtained to replace them, the lead in the pipe which makes the heavy mass is melted and poured off, the springs are straightened and clamped in position, and the melted lead poured back into the pipe.

The weights and channel irons are lettered alike, in pairs. The left side of the shock-recorder box should be hinged against back-board and hooked forward top and bottom, when closed. The cover should be hinged to this side broad. Thus the left side of the instrument may be laid wide open for adjustments.

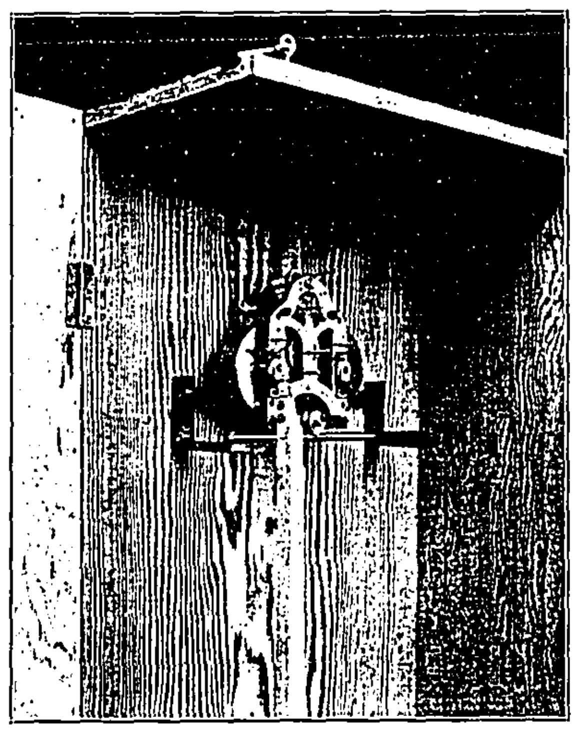
Operation of Shock-Recorder

Wind clock by removing it from tracks and place it back on the tracks. Screw a card disc on front of aluminum disc, by placing over the card the smaller disc, with its handle outward, and clamping with black rubber thumbscrew. Hold this by the back and twirl it slowly over a smoking kerosene flame (a lamp turned up to vigorous smoking of the chimney, kept for this purpose), with the card face downward until the whole card is an even light brown. Do not be afraid of putting card directly in flame provided it is kept twirling. The resulting brown if touched should streak with the finger showing pure white card. It is this brown film on which the shock-recorder pen writes a white line round and round the card during 24 hours. An earthquake interrupts these lines with a zigzag pattern. The disc is its own clock-hand, as explained below. The smoked card should be handled entirely by the central rod so as not to smudge and disfigure the edges. Let the card, if warped by the flame, straighten itself out by cooling thoroughly.

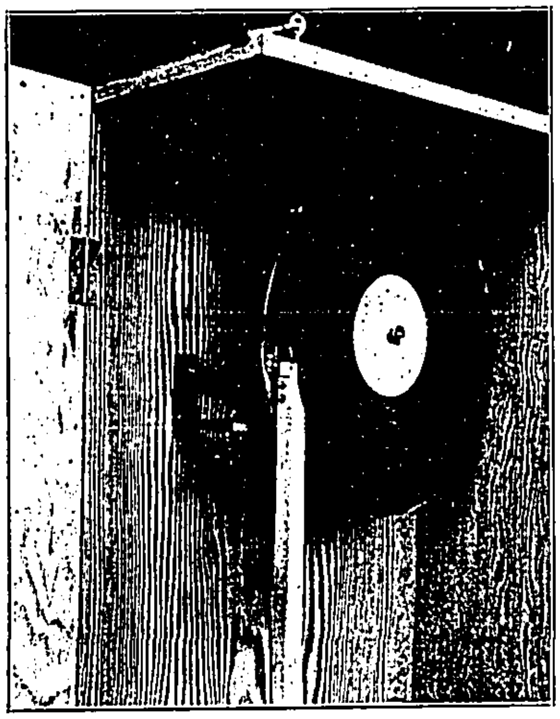
The disc is now pushed on to the clock spindle, with clock at right side of tracks, so that the edge of card is inserted behind the boom. The clock is now slid bodily to the left on the tracks until top of boom is 2 inches to the left of center of card, that is, opposite the inner part of the smoked band. Now tip the pen over, its point resting on the smoked surface. Use a stick like a painter's maul to rest the wrist on, and write with a dry point on the smoke the date, hour, and minute of starting, beside the white line which the pen makes. An ordinary pen without ink is good for this, scraping white figures on the smoke.

The machine is now at work for 24 hours and is left in *complete quietness. It is vital that the wall be in a quiet* cellar. Any upstairs wall will be affected by opening and shutting doors. The case should be screwed to a cellar wall where nobody goes except the operator once a day. Air currents, carpenters at work, an automobile on the ground close to the building, or a nearby engine, may make an artificial earthquake record. For good seismological work, complete quiet to the location is essential. Also look out for spiders and cockroaches.

Have a regular hour, say 8 a. m., for tending the shock-recorder. When the 24 hours is ended, mark the date and time beside the pen point, tip back the pen, slide the clock to the extreme right, gently remove the disc from the



Top of case showing driving clock on its tracks, impelled by rollers and turning the central spindle once per hour. Lateral movement 3 millimeters per hour.



Top of case with seismogram in place, showing brass pen and lines written on smoked card after 24 hours' work.

spindle by a slight right-hand rotation, and pull on the knob while the left hand holds the clock on the track.

The day's record must now be fixed for permanent keeping. Lay disc on table and carefully remove card from disc, touching card only by the edges. Prepare a flat pan, at least one foot in diameter, containing a solution of one part commercial liquid white shellac and fourteen parts denatured alcohol. This must be kept in a bottle between operations, as it evaporates rapidly. Holding the card by the edges between the two hands, pass it face downwards under the liquid once only, and hang it up to dry with a thumb tack. Data about the record, felt earthquakes, wind or weather, and the names of place and operator, may be written in ink on the white center of the seismogram card. This is now a permanent record of that day's seismical happenings at that place.

To get the time of an earthquake registered on one of the hour lines of the seismogram, it is essential that the disc rotate exactly once an hour. The clockwork may be regulated by the lever at the top in the usual manner, marked S for slower and F for faster. Prepare a tracing-cloth circle to put over the disc for reading time. Divide this circle in ink into 60 parts by tracing an ordinary clock face at the watchmaker's shop. Draw radial lines for each minute and heavier ones for each 5-minute point. Number these 0, 5, 10, etc., backwards as compared with an ordinary clock.

Suppose you started at 8:10 a. m. and the card disc is so marked at the inner first line of the spirals written round the disc by the day's work of the instrument. Set your radius 10 over that point with the tracing cloth centered over the seismogram. Suppose you have an earthquake recorded that was felt at 10:20 that forenoon. The first 0 reading around the line on the inner circle is 9 a. m., the second 0 is 10 a. m., and following on right to left counterclockwise 5, 10, 15, 20 minutes, the earthquake trace will lie under the 20 (10:20 a. m.) at its maximum amplitude; and the unfelt preliminaries will appear a fraction of a minute before the 20. The tail of the earthquake, or the dying away, will appear as a continuing vibration for several minutes.

By regulating the driving clock with some care for a few weeks, the amateur seismologist may get time within a minute by keeping track of the error of the clock as recorded at the end of each day's run. If the error is a constant, it may be best to leave the clock unregulated, and divide the error for 24 hours by the number of minutes in 24 hours. This gives you the error per minute. This applied to the number of minutes from the time of starting to the time of the earthquake corrects the card time for the earthquake.

A good operator should keep a good timepiece by which to mark the seismogram at the beginning and end of each day. Accuracy to the minute is probably near enough for such a rough machine, but persons with physical or astronomical training, receiving time by radio, can use this instrument as a timepiece if they are ingenious. It is customary to set up the shock recorders so that the face of the case is toward the north or south, and the pendulum thus swings east and west.

Erratum. The number of last Volcano Letter (377) should be changed to 367.

KILAUEA REPORT No. 1042

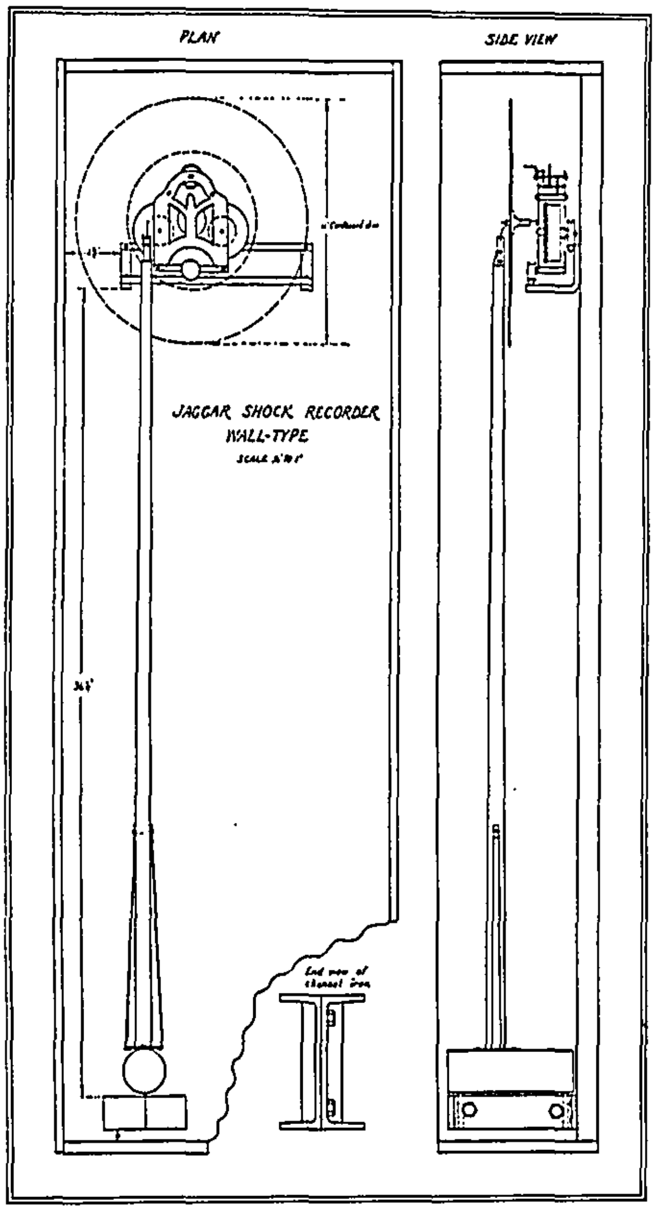
WEEK ENDING JANUARY 10, 1932

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge

Activity in Halemaumau continued until January 5, then stopped, leaving a floor with a big cone at one side, as in 1930. January 4 there were three streams from the cone, and an overflowing lake below occupying one third of the floor. January 5 the fountain had spells of stopping in the early morning, though the fume column was brightly lighted. At 10 a. m. there was the usual puffing and splashing, lake ramparts were overflowing east, and 3 rapid cascades poured eastward from the channel. At 2 p. m. the big fountain stopped and a little one formed in front of it: two streams gave place to one. Some booming was heard at 2:20 p m. Tremor on the seismographs at the Observatory was showing spells of increase and decrease. There was some backstreaming from the new fountain over the black lava of the interior of the cone. During the afternoon the cascades narrowed and the fountaining fluctuated, with booming. About 6 p. m. tremor at the Observatory ceased and the fountaining stopped gradually. At 8 p. m. there was very dull red glow, the pattern of lake and cone was outlined in glow cracks, the overflows were dull, and a few glow spots appeared at north edge of floor. The channel fountain made a few spurts of sparks, and a small glow chamber broke open at the central conelet. There were noises of cracking slabs, of small southern slides from the wall, and of hissing with the spurts.

January 6 the lake had slumped leaving hummocks. There were crackling sounds. The inner wall of cone flaked away leaving glow exposed. A little fume came from the east base of cone and other points. Steam rose at southern taluses. January 7 there were two small slides northwest and northeast about 11 a. m. January 9 rain made a hissing on the new floor. There were fume spots around the lake edge and at the cone. Some rocks fell and a small slide occurred at 11:10 a. m. New debris of reddish color had added 40 feet of width to the northwest talus. January 10 a crust ridge at southeast margin of bottom emitted blue fume which showed above the whole pit in afternoon light, cumulus cloud still formed above the pit at higher levels due to heat, and a few points of glow still showed at night.

The seismographs registered 24 tremors, one indicated a probable origin distance 18 miles, 4 very feeble local seisms suggested origin distances of 6, 32 and 42 miles, and teleseisms were registered at 3:53 p. m. January 4 and at 46 seconds after midnight the morning of January 9; this last indicated a doubtful origin distance of 880 miles. Microseismic motion was mostly moderate, and tilting of the ground was moderate to the south. The harmonic tremor from the fountaining lava in Halemaumau increased between 1 and 2 p. m. January 5, and then decreased until it disappeared at about 6 p. m. in remarkable coincidence with the cessation of lava inflow.



Front and side elevations of shock-recorder and end view of channel-iron bracket supporting the mass. Cardboard disc 11 inches diameter.

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It maintains seismographs at three places near Kilauea Volcano, also at Hilo, and at Kealakekua in Kona District. It keeps a journal of Hawaiian volcanic activity and publishes occasional Bulletins.

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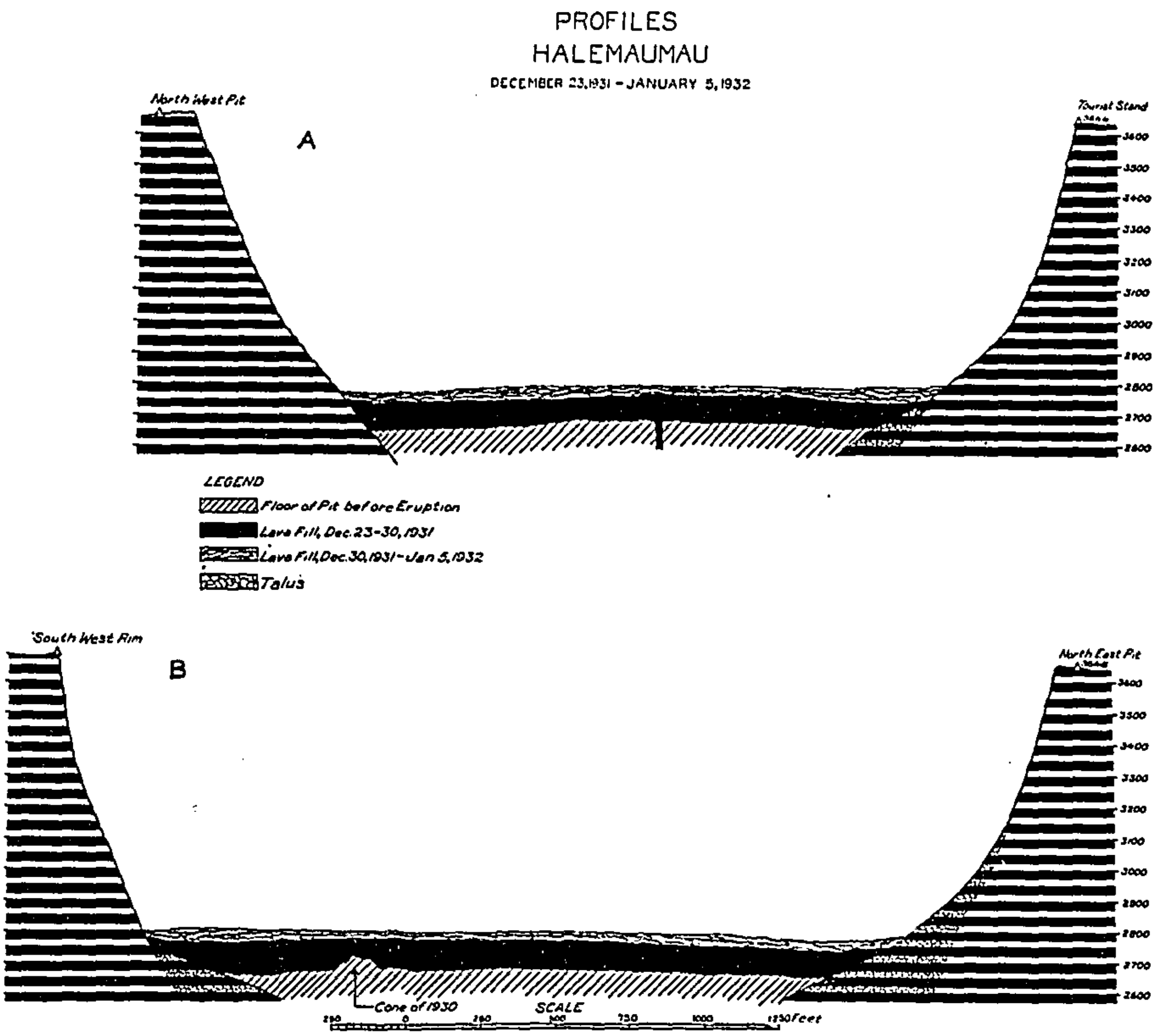


Profile sections of Halemaumau pit at the end of the eruptive period December 23, 1931, to January 5, 1932, showing topography of bottom left by the eruption. See discussion in text, and map on Page Four. Drawn by E. G. Wingate.

JOURNAL CONCLUDING HALEMAUMAU ERUPTION JANUARY 4-10, 1932

The eruption which began in Halemaumau pit of Kilauea Volcano December 23, 1931, finished its apparent surface activity the evening of January 5, 1932, after somewhat more than thirteen days of inflowing lava.

Elevations of the parts of the surface of the new bottom when the lava lake was highest, 9:30 to 11:30 a. m. January 5, 1932, reported by E. G. Wingate, were as follows:

Area over 1930 conelet filled 73 feet..........elevation 2793 feet
Southwest bay filled 134 feet..........elevation 2792 feet
Lake under southwest cone filled 125 feet..elevation 2798 feet
Lake southwest of center filled 107 feet..elevation 2777 feet
West bay filled 113 feet..........elevation 2773 feet

The amount of filling over the whole floor was about 115 feet, or some 25 feet more than was shown by the measurements of December 29-30, 1931. The accompanying section profiles show the later fill light colored and the earlier solid black. December 29 was the day when central fountains stopped. At the end the principal mound was the southwest cone itself, at the edge of the lava floor, not shown in the profile. The average bottom elevation 2789 feet, is 855 feet below the tourist station at the southeast rim of the pit.

The final heaping up of the border cone, with the fountain in its midst sending multiple cascades of lava to spread out on the floor, was quite like the closing stages of the eruption in November-December 1930. The cessation was rapid and quiet, without any marked down-sinking, within a few hours. The flowing simply stopped, the surface solidified, and the tremor at the seismographs stopped simultaneously with the end of fountaining.

January 4

The flow of lava from the southwest cone out over the floor of the pit continued as before, but there was no longer a single lake of lava filling the bottom of the pit as there had been during the first days of the eruption. The line of fountaining vents across the middle of the pit no longer appeared. Everything had been concentrated in an upflow at the big cone at the base of the southwest talus. There were doubtless intrusions going on within the heap covering the bottom of the pit, but their only effect at the surface lay in what was revealed by the surveys with transit showing differences of level of different parts of the bottom. Other effects of piling up, which produced differences of level, were due to the puddled flows from the cone as shown in the accompanying map, which have collectively been called a lake, because of a definite rampart bordering the pool in scallops and numerous islands of clustered crusts. The thickness of the new fill is various, both because of irregular heaping up, with a maximum near the southwest cone, and because of irregular topography of the mound of lava of 1930 which the new fill covered. This variability is shown in the profiles in their relation to the map.

On this morning at 7:30 a. m. there was the usual convection cloud of rain moisture due to the heat rising from the lava fountains and lake. At 8 a. m. three streams were forking from a wide river at the open side of the cone. Rapid cascades carried black crusts past two small islands in the central rivulet. The fountain was variable, as a whole not so high as at the beginning of the previous week, at times somewhat sluggish, and then developing a spurt of high jets with a roar. There were occasional brilliant slides as the red-hot sides of the cone caved in.

At 3 p. m. the fountains were bubbling steadily in the cone and spouting up from 50 to 75 feet. One river of lava poured out from the center of the horseshoe, its course at first northeast, and then deflected to the east by the slaggy slope which had been built up as a mound straight in front of the cone, when the river in earlier days had forked both east and west around an island. The western torrent no longer showed, whatever it may have been doing in tunnels, and the eastern one now divided into three streams surrounding three islands. The whole distributary system radiated out with bright lines and surfaces covered with satiny skins into a lake that covered about a third of the floor and was confined in a well defined rampart. On the west side there was much overflow amid crust islands and one small overflow stream poured from the lake to the east. Back of this was a large island which had been a remarkably persistent feature throughout the eruption, and perhaps marked the site of the cone of 1930. The rest of the floor showed pressure ridges and mounds and irregular hardened flow patterns, with chasms and cracks particularly conspicuous near the borders at the north.

January 5

Surveys were made from 9:30 to 11:30 a. m., and before this at 8 a. m. it was seen that the flow had lessened, but the fountain was still central in the cone, though weaker. The volume of outflow had lessened considerably as shown by the size of the streams, and the lake on the floor was smaller and the overflows through the ramparts had dwindled. Most of the filling appeared to be in the south bay. The river flowing from the cone forked into two streams with rapid cascades, and the islets were tending to become peninsulas. Fume above the pit had increased at 8:40 a. m. At 10 a. m. it was seen that the increased fuming was due to a revival of the fountain, which appeared quite normal with much puffing and splashing. Heat from the lake was strong at the south edge of the pit. The lake had vacated its ramparts on the west, and was overflowing ramparts to the east.

The scarp or heap in front of the main channel appeared brick-red and rusty on its upper surface. Three rapid cascades poured eastward from the channel, and over the pool on the floor of the pit there was streaming with radial zigzag bright lines fanning out to the east and northeast. Three island accumulations divided the cascades. The north floor of the pit showed scallop rampart patterns over its surface, and some pressure ridges. A remarkable feature was a group of four crevasses trending northeast toward the dike in the northeast wall of the pit. These were on the line of the first fountains of December 23, and where the line of fountains had been buried up by subsequent flows. The hardened surface, however, had become cracked on the line of the original rift and was apparently gaping open by tumescence.

The new floor of the pit was now against the rock wall between the taluses at the NE, NNW, WNW, S, and at two places on the E. The old rock wall at the southeast which had extended to the 1930 floor as a triangular ledge parting two taluses was now entirely buried. The cone and crater around the big fountain appeared to be in adjustment, and the noise of the cascades was a steady crackling.

The afternoon of January 5 created a new situation, with reports of avalanches, of a new position of the fountain, spells of excessive harmonic tremor at the seismographs alternating with very weak tremor, and dwindling of the cascades. The details of these changes were as follows, proving important as on this evening the eruption stopped:

At 2 p. m. the big fountain central to the cone went out of action and was replaced by a small fountain in what had been the main stream northeast from the craterlet. Inquiry from bystanders indicated that the large fountain was still erupting at 1 p. m. when the activity during 15 minutes migrated into the channel and about 1:15 the large fountain stopped. At 2 p. m. small streams were pouring down both cascades, but at 2:15 only the southern stream was visible leading from the channel fountain. It was at this time that heavy tremor at the Observatory was replaced by very weak motion.

At 2:20 p. m. booming noise was heard continuing for five minutes, and the northern cascade reasserted itself. It stopped, and the lava in the pot appeared to be rising and flowing back over part of the black lava where the central fountain had been. This action increased. At 2:42 p. m. the channel fountain appeared to be migrating northeast, somewhat smaller than before, and the streams were darker colored. Booming noise was repeated 2:58 to 3 p. m. and again at 3:15, when the cascades were small, duller in color, and flowing more slowly. At 3:24 there was a spell of vigorous fountaining. At 3:30 there was intermittent spurting with some booming. The southern cascade was very narrow and most of the outflow poured through the northern channel. At 3:55 there was a spell of rather heavy fountaining.

During the course of these changes the crater margins in the cone had caved in, the pool on the lake floor was lowering and becoming dotted with many islands and crusted lumps, and there were some fuming patches about its borders. The dwindling of inflow appears to have been gradual from 4 to 6 p. m., though at the beginning of this time the fountain sent up some spurts 50 feet high. The cessation of the tremor at 6 p. m. probably coincided with actual cessation of inflow.

At 8 p. m. there was very dull red glow over the pit, hardly perceptible on the walls as seen from a distance, and almost none on the cloud above. When the pit was visited, it was found that the pattern of the lake was outlined in bright glow cracks, that of the overflows was less bright, and the cone was clearly outlined by incandescent fissures. There were a few glowing spots at the north edge of the floor. Gas activity still asserted itself in occasional spurts of sparks from the site of the channel fountain. There were hissing noises at these times. A small central cone in the floor which had been the last remnant of the central fountains caved in about 8:15 p. m. revealing a glowing chamber inside and making a noise of cracking slabs. There were some slides heard at the south wall of the pit. It was observable that the glow pattern of the floor showed colors in blue, purple, and red, *suggesting the* presence of some small flames through the cracks.

January 6

At 6 a. m. there was no visible flowing lava, and cracking sounds were nearly continuous with spells when they were louder. This suggested that cooling and slumping were going on. There were numerous glowing points like a bed of coals. Occasionally a cascade of cinders would fall from the inner walls of the cone showing glow underneath. There were some squeaking noises like rubbing slabs. Where the lake had been there were parts of the outlying rampart and numerous hummocks. A little fume rose at several places in the bottom of the pit, but was not noticed at the cone. There was steam from the talus slope above. Later in the day slight fuming was noticed at the top of the new cone and still more near its eastern base. The lake surface had evidently been slumping. Vapor was noticed on the southeast talus.

January 7

The end of this eruption, as in 1930 and the other short-lived fills within Halemaumau which have occurred since 1924, showed no sinking of the entire lava column. Such sinking was a characteristic of the end of eruptive episodes between 1916 and 1924. The explanation of the difference appears to be a difference in continuity of inflow and volume of material in the upright shaft that remains fluid. These small annual eruptions of the last few years appear to come up a crack in the bottom of the pit, cover the former floor with a layer of paste which more or less congeals with the term of the eruption, the inflow concentrates at one well, and this material also congeals and forms a plug. There may be more or less pastiness and incandescence to the bottom of the temporary fill, and loss of gas from this viscous fluid accounts for some slumping of the surface, also volume is diminished by crystallization. But there is no sign of sudden back-flow into the depths, such as caused lowerings of hundreds of feet in 1916, 1919, etc. The evidence seems rather to favor the supposition that there is a steady upward pressure of magma at present released by an occasional breaking through.

On this day, January 7, the floor of the pit was very irregular and hummocky and all sounds of settling had ceased. Two small wall slides were heard at the northwest and the northeast about 10:50 a. m. Otherwise the bottom was still and motionless just as the congealing lava had left it.

January 9

During rain in the forenoon there was a slight hissing sound from the hot floor. There were fume spots chiefly about the borders of the recent lake and at the south side of the cone. Rocks fell from the walls and a small slide occurred at 11:10 a. m. The rim cracks at the northeast continued to show slight widening such as had been noticed prior to the recent eruption.

January 10

Blue fume was observable over the pit when the sun passed behind the rising vapors, especially at the southeast, and much of this came from a smoking ridge of crust at the southeast margin of the floor. Cumulus was still forming in the high air above the pit, and a few points of glow in the floor were visible at night. T.A.J.

KILAUEA REPORT No. 1043

WEEK ENDING JANUARY 17, 1932

Section of Volcanology, U. S. Geological Survey

T. A. Jaggar, Volcanologist in Charge

Volcanic activity at Halemaumau pit remains dormant, and the most interesting development of the week for the Hawaiian Volcano Observatory has been the completion of a new seismograph hut erected for the Geological Survey by the Park force. This hut is close to the southeast rim of Halemaumau, in the same location as the former hut, but capable of housing two or more instruments, for more complete measurement of local earthquakes, tremor, and tilt.

On January 12 new fallen material was observed under the southeast wall and the floor appeared more hummocky. January 13 three slides were reported near the southwest rift crack in the wall during the forenoon, and in the afternoon fume was conspicuous, especially at the southeast hummock, rocks were heard falling, and rim cracks showed slight widening. Sulphur stain appeared in spots. Rather sudden northwest tilt had appeared at the Observatory. At 8:30 p. m. January 17 a glowing crack was seen near the southwest fuming hummock and one spot of glow in front of the new cone. Occasional rocks fell from the walls and a small slide from the north wall occurred at 8:50 p. m.

The seismographs registered 63 spasmodic tremors, two indicating origin distance 18 miles, one 42 miles, and one 46 miles. Five very feeble local seisms indicated distance chiefly 14 to 18 miles. Microseismic motion was moderate, and tilt slight NW.

TILTING OF THE GROUND FOR DECEMBER

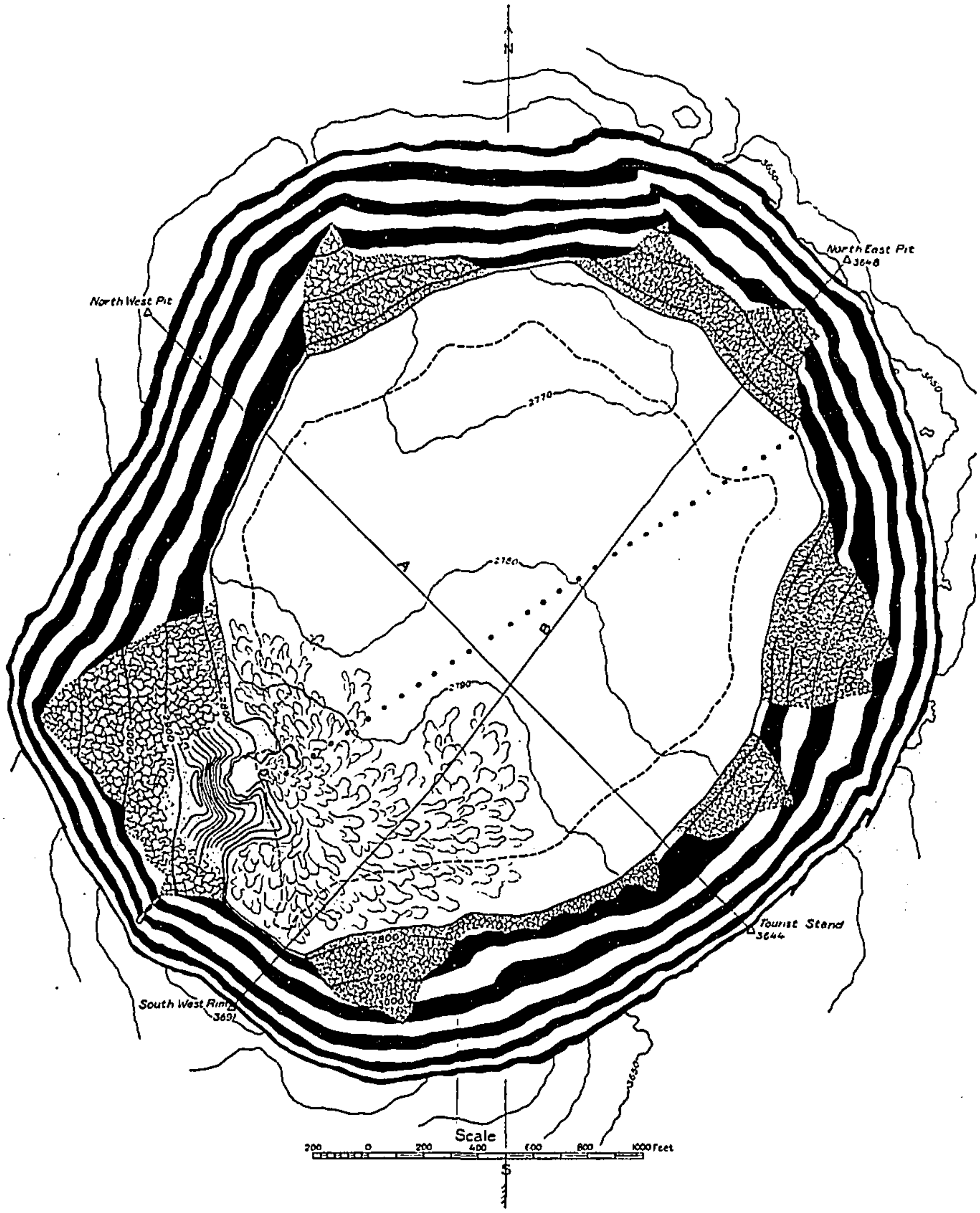
The following figures show the net amount of tilt by weeks at the Observatory on the northeast rim of Kilauea Crater, and its direction computed from the daily seismograms, by platting a curve smoothed by overlapping seven-day averages. This is the departure of the plumbline in seconds of arc, in the direction given.

November 30-December 6, 1931	1.4 seconds	ENE
December 7-13	0.8 second	NE
December 14-20	3.2 seconds	NE
December 21-28	2.8 seconds	WNW
December 29, 1931-January 4, 1932	2.0 seconds	WSW

Tilt on both N-S and E-W components of the seismograph, as shown by the daily plat, had at the end of the eruption of Halemaumau pit, which occurred December 23 to January 5, indicated a return to a point on the seasonal curves almost identical with the points recorded immediately before the sharp NE tilts, indicated above as occurring just before the outbreak.

This would appear to indicate that these northeast tilts beginning 10 days before the outbreak were due to tumescence that was preparing to split open the lava of the bottom of the pit. These effects were so strong in their northing at the Observatory for the first half of the week December 21-28 indicated above as to make the average tilt show some north, though the actual swing of the pendulums on the day of the outbreak December 23 was strongly south and west. It will be seen that for the time of eruption the averaged tilt of the fortnight was strongly westerly, which is a direction towards Mauna Loa. E.G.W.

HALEMAUMAU



Map of January 5, 1932 to accompany profiles A and B, showing new southwest cone. Dotted line was floor of 1930.

THE VOLCANO LETTER

The Volcano Letter combines the earlier weekly of that name, with the former monthly Bulletin of the Hawaiian Volcano Observatory. It is published weekly, on Thursdays, by the Hawaiian Volcano Research Association, on behalf of the section of volcanology, U. S. Geological Survey. It promotes experimental recording of earth processes.

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New floor of Halemaumau, looking southwest 11 a. m. January 5, 1932. Lava stream pouring from conelet on southwest talus. In left foreground tension cracks on rift. Note burial of talus slopes as compared with 1927 Page Four. Photo Powers.

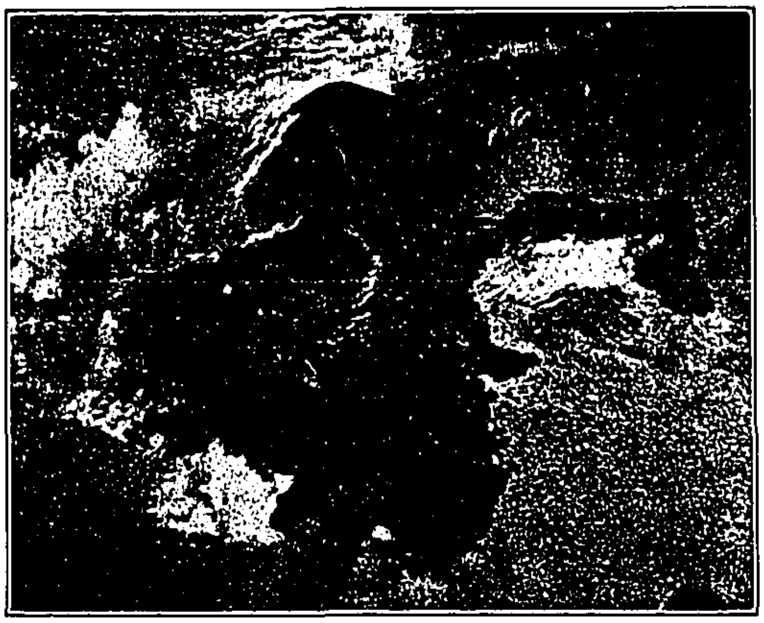
COMPARATIVE DATA ABOUT RECENT ERUPTIONS

The conclusion of the eruption in Halemaumau pit from December 23, 1931, to January 5, 1932, makes it of interest to review the data concerning recent eruptions of Halemaumau in Kilauea Volcano, which have tended to become annual. It was stated in Volcano Letter No. 366 that there had been a series of events tending to forecast the recent outbreak. Besides the expectable interval of about a year, there was accumated tilt away from the center suggesting upward pressure, there was a week of excessive tremors and earthquakes 10 days before the outburst, there was opening of measured cracks by unusual amounts leading to a rim-block avalanche at Halemaumau December 7, there was a strongish earthquake December 13 when Park rangers reported rumbling noises and slabs falling down cracks on the Kau Desert rift southwest of Kilauea, and there was an unusually strong shock on this same rift, within the crater, the forenoon of the day the eruption began. Features accompanying the eruption were the steady harmonic tremor which started and ceased in coincidence with lava inflow, occurrence of the crisis a year and 34 days after the outbreak of 1930, the sudden change of tilt accumulation at the edge of Kilauea Crater, from a tendency away from the center, to an inward tilting as soon as the gas and lava released the upward pressure; the gushing up along a straight crack on the rift line; the concentration to a conelet at one end of this crack; the accumulation of 115 feet of fill; and the duration of only 13 days.

This was all stated to resemble the incidents of former years, and it will now be profitable to compare these incidents systematically, in order to find out what was characteristic of each prelude, in how far these preludes resembled each other, and in what respects the eruptive sequences resembled each other.

Lava Inflow of 1924

The first volcanic event here following the great explo-



First lava eruption in bottom of Halemaumau after explosive crisis of May 1924. Cone and flows under west talus July 22, 1924, with lava flow spreading on bottom of pit. Photo Emerson.

sive engulfment which enlarged Halemaumau pit in May 1924, was the inpouring of lava at the bottom of that pit July 19-31, 1924. The pit was left in a condition of great instability with many avalanches and small earthquakes in June, and red-hot walls far down where intrusive rocks were exposed. A local seismic spasm led to a strong shock June 13 of grade about Rossi-Forel VI, when outside the north rim of Kilauea Crater new cracks were produced in the soil. The seismograph station is on the northeast rim of Kilauea Crater, and showed strong northeast tilts twice during the three weeks preceding the lava outbreak. Blue fume shot up from the pit at noon July 19, this at 1:45 p. m. was a jet spraying up through a vent in the southwest talus, making a small trickle of lava which collected in a puddle in the cup of talus that formed the pit floor. The jet became a fountain 125 feet above the bottom of the pit, the puddle spread about in leaf form with some internal fountaining, the cone became over a hundred feet high around the source, but the floor coating was only 25 feet thick. Harmonic tremor at the seismographs lasted from July 20 to 29.

Mauna Loa Eruption 1926

Mauna Loa broke out near the summit April 10, 1926, at 3 a. m., spread down the southwest rift its splitting action with frothy lava outflow, and sent a torrent to the sea which quickly ceased, but upland flows on the mountain ridge endured until April 30. At Kilauea there were numerous earthquakes indicating origins at Mauna Loa distances during several preceding months, there was a large increase in earthquake frequency during the Mauna Loa eruption, at Halemaumau there were rock slides due to quaking, and new cracks back from the rim broke the surface soil. Harmonic tremor at the Kilauea Observatory sympathized with the maxima of the Mauna Loa eruption April 10 to 22. At the same station there was slight accumulation of east tilt away from Mauna Loa during 1925-26, and very strong east tilt accordant with the Mauna Loa flowing April 11-24, and a reaction to moderate west tilt throughout May after Mauna Loa ceased.

Halemaumau Inflow 1927

After midnight July 7, 1927, a new outbreak of fountains in the bottom of Halemaumau split across the floor of 1924 in a line trending northeast-southwest, with the southernmost fountain some distance up the debris slope as before, and this was the only one which kept working more than a day. The line of four fountains lay but slightly to the west of the rift tunnel line shown by dikes in the wall of Halemaumau. Half the lava of the eruption came in during the first hour. The lake rose around the vents with the exception of the southern cone standing 120 feet above lake level. The area of new lava, shaped like a leaf with the cone at its stem, was 1760 feet long by 1420 feet wide. The new fill was about 110 feet deep when the last gushing ceased July 20, but the cone summit stood much higher.

On March 20 there had been a deep-seated strong earthquake felt generally throughout the Territory, and objects were thrown down and broken in Hilo shops. On June 8 a small shock was felt about the island of Hawaii, and a strange light was seen believed to be a meteor. On the day of the outbreak July 7 a moderate earthquake at 3:21 a. m. came about three hours after the lava inflow began.

Cracks on the Halemaumau rim had widened excessively at the northeast side of the pit June 22 and thereafter, so that visitors were warned away from the edge. There was no widening after the eruption began. Tilt was to the north a fortnight before the eruption, and to NW and WNW thereafter. This westing of the tilt after the beginning of Kilauea outbreak has appeared repeatedly. Harmonic tremor at the Observatory appeared in a short spell at 10:55 p. m. July 6 about an hour before the outbreak, then was continuous for 24 hours July 7-8, and showed temporary recurrences July 10-12.

Halemaumau Inflow 1928

This eruption was very small, and its occurrence as lava upflow through cracks across the 1927 floor, in coincidence with a landslip from the northwest which compressed that floor, was explained at the time as a "false eruption" merely due to the squeezing up of 1927 lava still liquid under the crust. There is reason to revise this theory.

What happened on January 11, 1928, about 12:30 a. m. (just after midnight or midday appears to be a favorite time for eruptions), was the appearance of red glow from liquid lava in Halemaumau just after a monstrous avalanche from the northwest wall which caused a big tremor on the seismograms at 12:26 a. m. It was found that new lava had spouted up at three places on the floor corresponding approximately with the sites of the two northern fountains of 1927. How much the rosy glow seen at first was due to fountaining is not known, but it disappeared in 20 minutes and at 1 a. m. the lava areas were flows glowing through cracked crusts with some blue flame at one vent. The northwest talus cone of the bottom of the pit had been overridden by a big fall of rocks from the wall so that the entire mass of debris slid forward and out on the lava floor in a pointed heap covering a sector of the northwestern surface. Two of the outflows were near the tip of this heap, welling up cracks and flowing away from the heap, and the other was at the north some distance from the debris. If the phenomena had been wholly a squashing down of the crust and a welling up of the liquid around the crushed area, the flowing should have been toward the debris heap. The flows cooled off within a day and the avalanches thereafter ceased, a remarkable fact, for these avalanches from this uneasy wall, and also from other walls of the pit, had been tumbling for a month.

The *strongest reason for considering* this a true lava outbreak is found in the seismic record of the preceding month December 1927. During this month 243 local earthquakes were registered, the roars from loud avalanches were frequently heard at the Observatory two miles away December 17-28, the slides were from the northern and the southern walls notably in the vicinity of the rift belt, and the eastern cracks at the edge of the pit showed measured widening of 2 to 3 inches increasing toward the north. The July floor became overlapped with debris all around, about 8 seconds of southerly tilt accumulated at the Observatory during the month preceding the outbreak, and the December record suggested a lowering of the pit bottom. However, this may have been an error, for on January 7 the WNW rim of Halemaumau showed new cracks breaking the sod 50 feet back from the rim, and large deep cracks three feet or more wide gave up hot steam. Such widening of cracks, preceding other eruptions, appears to have indicated localized swelling under the pit, whatever may be happening to the outside rim of the greater crater, where the Observatory measures tilt. It was precisely at this WNW rim where the big avalanche occurred at the time of lava outbreak. With the release of the liquid lava the tilt at the Observatory changed from strong southwest to slight northerly. Seventy-eight local earthquakes had occurred December 2-4, more than a month before the outbreak, and the number of general shocks indicating origin distances 15 to 30 miles away, during December and early January, suggests that seismic conditions were affected by a deep-seated cause. The high frequency of local shakings changed to normal abruptly after January 11. All of this evidence goes to show that a change in magmatic pressure under Kilauea Volcano produced extraordinary seismic conditions for six weeks, there was unusual motion on the rift belt along the west side of Halemaumau pit, and the adjustment of a deep-seated block there, both released the eruption and brought the avalanching period to a close.

Halemaumau Inflow February 1929

At 12:46 a. m. February 20 molten lava gushed up in a big fountain at the northwest edge of the bottom along a straight fracture 1370 feet in length. A great lake filled the bottom east of the fracture line, some 60 feet in depth, the southern vents quickly became submerged in the lake, and the northern one built a half-cone of pumice with jets of the Mauna Loa type shooting 225 feet into the air. Pellets of basaltic pumice and Pele's hair fell outside of the pit. The pit seismograph registered tilting, accompanied by small earthquakes, two hours before the eruption was noticed, and straight away from the center. At the same instrument continuous strong volcanic tremor was written during the period of fountaining. This all ceased when the eruption ended about 1 p. m. February 21, and strong tilt was indicated back toward the center of the pit during four hours preceding the cessation of action. The eruption left a net gain of 5 seconds tilt away from the pit.

The prelude to this eruption, as shown by tilt instrument at the Observatory, was strong southerly seasonal tilt throughout the weeks before and after the outbreak, but with a gradual change from east to west. There had been tremor January 5-9 and 16-28, probably occasioned on January 5 by much avalanching, accompanying excessive opening of cracks at the tourist station on the southeast rim of Halemaumau. This necessitated changing the trail and making a new viewpoint. The climax was reached January 10, when slides became fewer. On February 5, 15 days before the outbreak, an earthquake occurred at 2:25 a. m. felt throughout the island of Hawaii.

Halemaumau Inflow July 1929

On July 25 about 4:35 a. m. the seismographs at the Observatory registered a series of very small earthquakes a few minutes apart, each accompanied by tilt to the east. Then strong continuous harmonic tremor developed. Lava again broke out at the west edge of the floor in the bottom of Halemaumau. The center was a fracture through the talus, tangential to the bottom plug, making big fountains at the base of the west talus. The seismograph at the pit showed inward tilt the first day, outward tilt thereafter, *and tremor registered continuously* while the lava fountains were in action. The eruption ceased the evening of July 28 and the liquid lake reached a depth of 94 feet, followed by settlement of 20 to 30 feet after solidification.

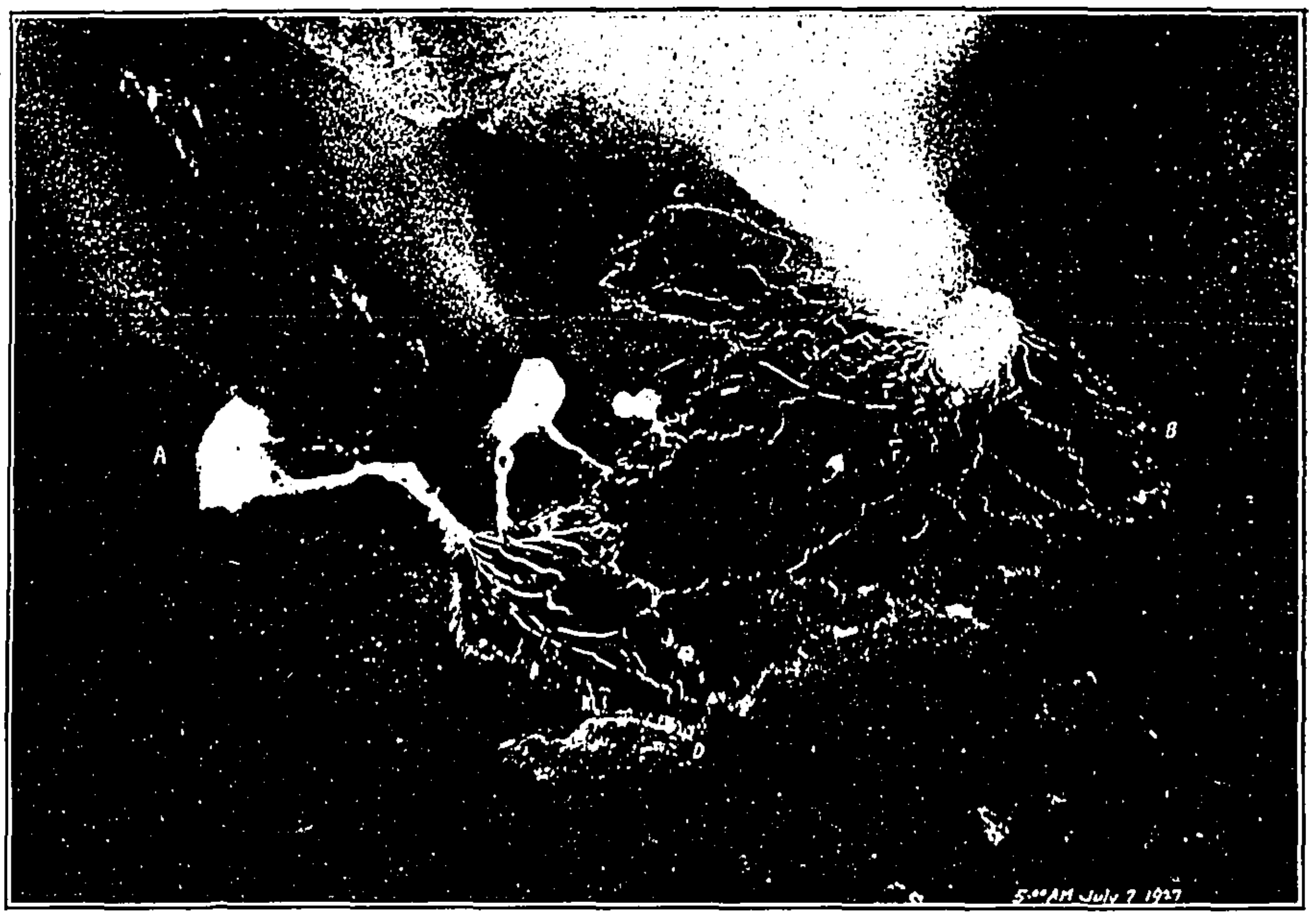
The ground tilted moderately north at the Observatory during the week preceding the eruption, and the tilt changed to southwest on the day of the eruption, becoming moderate south for the week. Cracks at the east edge of the pit had shown by measurement tendency to open since May 15 There had been two strongy felt earthquakes on the morning of June 18, occasioning avalanches on the west bluff of Kilauea Crater as well as in Halemaumau.

Halemaumau Inflow 1930

It should be here recorded that an extraordinary seismic crisis about Hualalai Volcano occurred in October 1929 which appeared to indicate a new shift of magma from under Mauna Loa in the direction of Hualalai. No lava outflow coordinate with this movement has yet appeared.

At 1:29 p. m. November 19, 1930, lava broke through the 1929 floor of Halemaumau in three fountain groups south of the central region, two of these being of small size which disappeared during the first two days, the third continuing to spout vigorously and build up a cone. The lava spread over the 1929 floor, then built a central lake of molten lava surrounded by ramparts, through which overflow on three sides removed the new lava as rapidly as it was supplied, and completely covered the former floor of the pit. After two weeks of action the lake area was 500 by 800 feet, the cone was 75 feet high and 200 feet in diameter at the base, the entire new bottom area was 2300 feet by 1700 feet, and the new mound stood above the former bottom 175 feet at the cone, 100 feet at the lake, and at the north side of the floor about 50 feet. The eruption ended December 7. Tremor accompanied the eruption as before and died away at the end. Tilt change was from moderate northeast November 10-16 to moderate southwest after the outbreak began, with a return to strong north and northeast in December. The pit seismograph had recorded tilting of the ground away from the pit and many small tremors a week before the outbreak. On the day of the outbreak this instrument recorded 18 small shocks culminating in a very feeble earthquake ot 11:06 a. m. with a slight tilt toward the pit. This was followed by a series of 30 small shocks and other earthquakes. Moderate and slight felt earthquakes and avalanches had occurred in September and October.

Reviewing the seven Halemaumau inflows in seven years, a typical eruption may be said to be heralded by one or more strongish earthquakes a few weeks before the outbreak, or by unusual seismic frequency, and 1931 produced a smart earthquake a few hours before inflow. Cracks on the rim of the pit are apt to exhibit distension of the edifice by spreading open, and so loosening the inside walls as to make avalanches. This is likely to occur along with centrifugal tilt just before the eruption. All of these eruptions appear influenced by the northeast-



Eruption in bottom of Halemaumau July 7, 1927, at 5 a. m. Shows the four main vents in line, that on the left being the high cone which persisted. Looking west-northwest. The floor of 1932 is against the wall at the top of the picture. Photo Wilson.

southwest rift belt which crosses Kilauea Crater; the final gushing splits the former floor and rapidly concentrates at one vent. There is temporary inward tilting and continuous tremor while the gas foaming of the fountains is going on. The whole series of eruptions marks an upward pressure accumulating. The eruptions have increased in volume of output and violence of effervescence, but their duration has been variable from 1 hour to 18 days, with the last two outbreaks the most enduring. T.A.J.

KILAUEA REPORT No. 1044

WEEK ENDING JANUARY 24, 1932

Section of Volcanology, U. S. Geological Survey

T. A. Jaggar, Volcanologist in Charge

The settling down of the Halemaumau floor, the bottom of the inner pit of Kilauea Crater, is all that has happened during the past week, and the cracks in the new lava of the recent eruption are no longer seen glowing at night. After excessive rainfall for several days, the hot lava fill on January 20 was seen to be steaming from hundreds of small vents all over the surface, the new cone was ringed by steam, there was steam on the taluses and walls, and vertical lines of vapor vents could be followed up the western and southern walls. These are upright cracks in the wall where the east and west fault blocks are marked above by steam cracks parallel with rim of pit. On January 18 at 8:30 a. m. after 4.10 inches of rain in 24 hours a steam cloud rose from Halemaumau and water cascades poured from Uwekahuna. At 2 to 3 p. m. some rocks were heard falling, rim cracks N and NE showed very slight widening, a central vent in the floor showed much blue fume, and eight others showed less, and new debris overlapped the lava floor at the base of the talus slopes. January 22 the pit was absolutely quiet.

One feeble local earthquake occurred 2:06 a. m. January 19, origin distance 32 miles. There were 29 spasmodic tremors, some indicating origins 2, 6, 20, and about 35 miles away. Microseismic motion was moderate, and tilting of the ground moderate ESE.

THE VOLCANO LETTER

The Volcano Letter combines the earlier weekly of that name, with the former monthly Bulletin of the Hawaiian Volcano Observatory. It is published weekly, on Thursdays, by the Hawaiian Volcano Research Association, on behalf of the section of volcanology, U. S. Geological Survey. It promotes experimental recording of earth processes.

Readers are requested to send articles, photographs, publications and clippings about volcano and earthquake events, instruments and investigations, especially around the Pacific.

Subcription for non-members two dollars per year of 52 numbers. Address the Observatory.

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
HAWAII NATIONAL PARK
HAWAII

OFFICE OF THE SUPERINTENDENT

January 6, ~~1931~~ 1932

The Director,
National Park Service,
Washington, D. C.

Dear Mr. Director:

The following is a report of operations and activities in Hawaii National Park for the month of December, 1932 1931

000 General

Outbreak of lava in Halemaumau firepit on December 23 not only stimulated tourist and local travel to the park and provided good material for much park publicity, but gave the new members of the park personnel valuable experience in handling both of these phases of park activity under emergency conditions.

020 General weather conditions

There were two clear days in the volcano district during December, 22 partly cloudy, and 7 cloudy. Three and twenty one hundredths inches of rain fell, compared with 4.01 inches for December last year. The rainfall to date is 66.32, while that for last year was 107.47 inches. The maximum temperature was 70 degrees on December 1, and the minimum 47, on December 8. Humidity ranged from 79 to 100, and the wind varied from NE to SW. Snow was visible on Mauna Loa and Mauna Kea several days during the early part of the month.

100 Administration

110 Status of work

A preliminary estimate for administration, protection and maintenance, amounting to $54,311 was prepared during the month and submitted on December 30.

The routine office work and disbursing and accounting work were kept current during the month.

120 Park inspections by

121 The Superintendent

Thorough inspections of all roads in the park were made on December 15 and 18, and the seismograph pit being erected for the use of the Geological Survey, at Halemaumau, was also inspected on the latter date. One or two trips each week were made to Hilo on park business; one on December 14 for the purpose of conferring with Gwynne Matthias, who is at the head of a committe working for the renewal of use of the Kilauea golf course.

125 Other governmental officers.

Fifty members of the Federal Business Association of Hilo, with their wives, attended the quarterly meeting of the association, which was held in Hawaii National Park. The party left Hilo at 12:30 P.M., arriving at the park office between 1:30 and 2 o'clock. The entire park staff was at the administration building to receive them, after which an inspection was made of the Volcano Observatory of the Geological Survey, the National Park office and activities, Kilauea Military Camp, and Uwekahuna Observatory, where the regular lecture was given to the guests. The visitors were given much useful and interesting information as to the functions of the park and the organizations operating within it. Dinner was served at 6 P.M. at Kilauea Military Camp, at a cost of $1.00 a plate. The dining hall was attractively decorated and a fine meal was served, after which a short business session was held in the recreation room with Oren C. Wilson, President of the Assosiation, in charge. A motion was made and carried to make this an annual inspection and outing for the Association.

130 Finance and accounts

Statement regarding the finances of the park will be found at the back of this report as statistical report No. 8.

150 Equipment and supplies

Two steel form cabinets and three kerosene heaters were received during the month.

170 Plans, maps and surveys

180 Circulars, placards, publicity bulleting, etc.

Mr. Lorrin P. Thurston, President of the Advertiser Publishing Company and owner of Station KGU, of Honolulu, and Marion A. Mulroney, manager and chief engineer of KGU, arrived in the park on December 26, after having obtained permission from the park superintendent to broadcast from the rim of Halemaumau a description of the volcanic activity. A shelter was erected at the tourist lookout point and wiring was done in cooperation with the Signal Corps of the Army. A local program was broadcast that night from 8:30 to nine as an experiment and the results were excellent. The following night a territorial program was broadcast from 8:30 to 9:30 P.M., with description of the activity by Ezra Crane, The opening address was by Dr. H. B. Elliot, president of the Hilo Chamber of Commerce which sponsored the program, after which Mrs. P.C. Beamer sang "The Song of the Islands" and other Hawaiian music was played. The park superintendent gave a short talk, copy of which is attached to the back of this report. After more Hawaiian music Park Naturalist Doerr made an address which was followed by music and a description of the activity in Hawaiian by Mrs. Beamer. On December 28 at 10:45 A.M. a description of the activity, with Ezra Crane announcing, was broadcasted over KGU AND NBC, followed by an interview with Dr. Jaggar. Reports from New York and San Francisco showed that this was a great success.

Moving pictures with sound effects of Halemaumau in eruption were made on December 30 and will be released through Paramount, Pathe, Fox News, and Consolidated Amusement. The films were made in color, under the direction of Earl Schenck of Honolulu. Mrs. P.C. Beamer and her troupeof Hawaiian dancers ~~who~~ chanted, sang and danced for the photographers. Several one-minute talks by Dr. Jaggar were taken at the Volcano Observatory.

News of the volcanic activity, needless to say, occupied the front pages of all territorial newspapers during the eruption.

Four hundred copies of Nature Notes were mimeographed, bound and mailed during the month.

Copies of the Volcano Letter for December are attached.

200 Maintenance, improvement and new construction

210 Maintenance

The usual maintenance and repair of roads, trails, telephone lines and ground was carried on during the month. Due to heavy traffic to and from Halemaumau the Uwekahuna Bluff-Halemaumau road had to be dragged and kept in constant repair to facilitate this travel.

230 New construction

A new seismograph cellar located on the site of the old one at Halemaumau firepit is being constructed by the Park Service at the expense of the Geological Survey. Work was started on December 16 after permission had been received from Washington to proceed. This building will extend only a few feet above the surface of the ground and will be finished and trimmed to harmonize with the other park buildings nearby.

The road construction at headquarters for the month ending December 15 showed fair progress. Weather during the month was most favorable for this work. The additional roller requested in order that sub-grading couldi be finished during favorable weather did not materialize. The base is almost complete, although there are some places where it will be necessary to put down base and where the contractor has not yet prepared the sub-grade to receive it. Laying of the emulsified asphalt macadam surface sourse was started on December 9 and this surface sourse has been laid back to Station 11 - 33.9. An average of about 650 lineal feet per day has been maintained on this surfacing work. The condition of the work is reported as satisfactory; percentage of total contract time elapsed, 47%; percentage of entire contract completed, 36.5%.

The county engineer's department received instruction on December 17 from [illegible] highway engineer, to proceed with the survey and plans for the North Kona section of the belt road around the island, following the revised alignment, which calls for a 22 foot roadway instead of an 18-foot roadway. This is known as federal aid project number 10-A. The revision was decided upon by R. N. Hendry of the Department of Public Works, following an inspection of the project on December 2.

As no bids were received either in New York or in Hilo for the County of Hawaii's $400,000 public improvement bond issue, all projects contemplated for construction are indefinitely postponed. Not only will the County lose the $400,000 involved in the bond issue, but also about $300,000 of federal aid money, which would have made available enough money to complete the round-the-island road and also to complete bridge construction in the Hamakua district.

The Hawaii Tourist Bureau furnished the County of Hawaii with 25 markers to be placed at scenic and historic points on this island. These markers are made of metal, colored red, orange and white, and bear the likeness of the head of a Hawaiian chief wearing a helmet. Below this head is the name plate, and the signs will be mounted on a pipe set in concrete. Hilo organizationshave been asked to suggest points of historical interest that should be marked.

260 Landscape work

A radiogram from field headquarters on December 4 advised that John D. Wosky, assistant landscape architect, would visit the park early in January. Tentative plans were drawn up for Mr. Wosky's itinerary during the several weeks he was expected to be in the islands. Due to volcanic activity, however, this itinerary was cancelled and it was decided advisable for Mr. and Mrs. Wosky to come directoto Hilo in order to see Halemaumau in eruption and visit the Haleakala section of the Park, on Maui, on their return to Honolulu after inspecting the Kilauea section.

<u>300 Activities of other agencies in the park</u>

310 Public service contractors

The Mutual Telephone Company, which last month started inter-island radio telephone service, initiated trans-Pacific radio telephone service on December 21. Rate schedule for inter-island and trans-pacific service is attached.

The Volcano House Company furnished refreshments at the close of a large party given at the hotel by Mrs. Gandy and Mrs. Leavitt for the children of the community, on December 23. A fine program of Japanese, Hawaiian and Spanish dancing and singing, with Christmas carols and a beautifully decorated Christmas tree were enjoyed by all in the district. Ranger Barnett, as Santa Claus, distributed gifts and candy to the kiddies and the adults were later served with refreshments.

A dinner dance was given at the Volcano House on Christmas Eve - their first dance in three years time. The dinner was patronized by over a hundred guests and many more came later for dancing. The dining room was attractively decorated with Christmas trees and wreaths of red berries and evergreen, and the long,open porch used for dancing lined with giant treefern branches. Moonlight on the crater and Mauna Loa, and the flame-colored cloud over the pit made a striking picture that the dancers will not soon forget. Dancing ceased at midnight and many of the guests went down to the pit for a view of the fire fountains before returning home. A ranger on duty in the hotel lobby reported one or two cases of intoxication between 1 and 2 A.M. after the dance but everything was orderly and there were no indications of drinking during the party. The charge was $2.50 each for dinner and dancing, or $1.50 for dancing only.

A Christmas program was given by the Kilauea Military Camp on Christmas night for members of their personnel, visiting enlisted men, and the park personnel.

Captain Waine Archer, Mrs. Archer and Miss Elizabeth Archer arrived on December 20. Captain Archer succeeded Lieut I. A. Robinson as adjutant of Kilauea Military Camp, and was previously stationed at Schofield Barracks, T.H.

400 Flora, fauna, and natural phenomena

410 Ranger service

Twelve miles of telephone line were rebuilt by the ranger force during the month, completing 32 miles of lines and all are in excellent condition. During the last week of December the rangers were on traffic duty at Uwekahuna and the firepit, and not a single accident was reported. Aid was given to four motorists whose cars broke down in the park.

Ranger Barnett was on duty at Uwekahuna Museum and gave the lectures during the absence of Mr. Doerr the latter part of the month.

411 Naturalist service

A group of 61 students attending an inter-Island school conference was given special attention by Mr. Doerr on December 12.

Mr. Doerr gave a ten-minute talk over the radio from station KGU in Honolulu on December 31, at 12 o'clock noon, describing the volcanic activity in Halemaumau and the activities of the educational department of the park.

415 Educational service

Plans for the summer school classes in natural history are still awaiting the return of Dr. David C. Crawford, president of the University of Hawaii.

420 Museum service

Seventeen lectures were given during the month at the museum, with an attendance of 737. A total of 1100 persons visited the museum during the month.

480 Natural phenomena

Conditions at the pit were very quiet during the early part of December, with slight increase in sulphur fume and continued gradual widening of the cracks on the northeast rim. There was considerable increase in avalaching during the week ending December 13, and a perceptible earthquake at 10:20 A.M. December 8 started three slides, followed by a great increase in tremor and small avalanches.

A strong local earthquake occured at 10:38 A.M. December 23 and was felt by everyone in this district as a wrenching motion from beneath the ground. A party of soldiers reported that they were crossing the Krater on the Halemaumau trail when the shock occurred and were thrown off their feet and also quite frightened by the avalanches of rocks from the outer rim of the crater as well as in the firepit. Mr. E. G. Wingate of the Geological Survey staff went down to the firepit immediately to take measurements of any changes caused by the quake and was close to the edge of the pit when the outbreak of lava occurred at 2:46 P.M. He heard a rumbling noise and ran to the edge of the pit, and looking in saw heavy fume clouds filling the interior, and lava fountains starting at the southwest corner. The floor of the pit cracked open from southwest to northeast in less than half a minute. A strong wind which had been blowing for several days blew the fumes downward, nearly asphyxiating observers so that it was necessary to block the roads to keep visitors from going down and endangering their lives. Crowds came up from Hilo during the afternoon and evening but were not allowed to pass the blockade. The only safe approach was by the Halemaumau trail from the Volcano House, a three-mile walk but many parties took this trip after 8 P.M. when it was discovered the fumes were not so strong at that point. The lava flowed into the pit in tremendous volume. The following morning the wind died down and automobile traffic by both roads to the pit was permitted. A new line of fountains developed at right angles SW-NE rift, making a gorgeous display both day and night. On December 27 there were threee main fountaining areas which flowed to the northwest in concentric horseshoe patterns. The smaller fountains gradually died down until on December 30 the fountain at the foot of the southwest talus was the only one left but action was very strong and spectacular in this fountain which was throwing out rock to a height of from two to four hundred feet. Thousands of local people as well as tourists from the special excursion boats witnessed the activity each night, fascinated by the bright fountains and the ever-changing patterns on the pit floor.

The estimated depth of new lava at the close of December 27, was 90 feet, and the area covered 84 acres. The volume of lava was estimated at 250 million cubic feet, or about 20 million tons.

An earthquake was felt in Hilo and the volcano district at 1:30 A.M. December 31, and was determined to have originated about 14 miles away, or on the flank of Mauna Loa.

Indications were, at the end of the month, that activity in the pit would continue at least for several days, although the exact duration could not be determined. The seismographs showed no decrease or variation in tremor.

500 Use of park facilities by the public

510 Increase or decrease in travel

A total of 26,508 visitors came into the park during the month of December, as compared with 7,291 for last month, and 9,690 December, 1930. This great increase was due to volcanic activity which, even at the holiday season, attracted many tourists from the mainland and other islands in the group. Total travel to date for this year is 40,123, as compared with 55, 910 last year, a decrease of 28.2%.

The hotel and military camp had good patronage during the month, due to extra trips of the inter-Island boats, special excursions, and changed schedule of the Army transport to accommodate those wishing to see the eruption. The airplane schedule was changed so that two round trips were made daily from Honolulu instead of one.

530 Visitors

Twenty seven Navy seaplanes and seven minesweepers from the Pearl Harbor Naval Base arrived in Hilo on December 8 for maneuvers. Many of the officers and men from these craft were visitors in the park.

Gene Sarazen and Johnny Farrell, noted golfers, arrived in the park on December 23, having come from Honolulu by airplane, and returned two days later.

540 Public Camps

During the Christmas holidays the Botany Department of the University of Hawaii, under the direction of Dr. Howard St. Johns, conducted botanical field studies on the island of Hawaii. Dr. St. Johns and his party of nine used the Kilauea summer camp as their headquarters for the five days that they were in the park collecting species of Hawaiian plants.

Twenty eight persons made use of the rest house on the Mauna Loa trail during the month.

A total of 308 cars made the trip to the Bird Park, with an estimated total of 1,386 persons.

600 Protection

610 Police protection

No assistance was needed from the Hilo police force during the eruption. The ranger staff handled the traffic without difficulty and no accidents occurred within the park. Two motorists were reprimanded for disorderly conduct and four cars which had developed engine or tire trouble were taken care of.

In spite of police patrol of the Volcano Road between Hilo and the Park entrance, there were many accidents especially on week ends and holidays. None of these accidents were fatal and nearly all were caused by careless driving or excessive speed.

640 Destruction of predatory animals
The following animals were trapped or killed during the month:

42 mongooses
6 rats
1 cat
46 goats
11 pigs

900 Miscellaneous

The Volcano golf course was reopened on December 20 after having been cleaned up and top dressed, and an open handicap tournament was held with a turkey as the prize. Over 80 persons took park in this tournament in spite of the drizzling rain which lasted all day.

The Keakealani School in the volcano district put on a fine Christmas program on December 19, presenting several short plays and musical numbers by the pupils of the school. Many of the park staff were present and a short talk was given by Superintendent Leavitt at the close of the program. Ranger Barnett as Santa Claus later distributed gifts and candy and apples. The party was sponsored by the local Parent-Teachers Association, of which Ranger Joseph H. Christ is president.

The National Park baseball team, which was organized in November, played its first game with the Kilauea Military camp team on December 6, and won by a score of 8 to 2. A meeting of the recreation committee was held on December 15.

A community New Year's Eve party was given jointly by the Volcano House and the Military Camp, with music furnished by the 11th Field Artillery Orchestra and a large crowd was present.

Park Naturalist John E. Doerr left Hilo by airplane on December 30 and was married in Honolulu on January 2 to Miss Nancy Elizabeth Elliott, of Des Moines, Iowa.

Very respectfully,

E P Leavitt

E. P. Leavitt,
Superintendent.

10-157
(July, 1929)

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

TRAVEL REPORT

Hawaii National Park for the month of **December, 1931**

	This Month	This Travel Year To Date	This Month Last Year	Last Travel Year To Date	Increase for Travel Year: Number	Increase for Travel Year: Percent
PRIVATE TRANSPORTATION:						
Cars first entry, ...						
Cars reentry, ...						
Motorcycles, ...						
Total motor vehicles, ...						
Persons entering via motor vehicles, ...	25,151	37,841	8,927	53,025	-15,184	28.6%
Persons entering via other private transportation, ...	637	908	346	1,187	- 279	23.5%
Total persons entering via private transportation, . . .	25,768	38,749	9,273	54,218	-15,463	28.5%
OTHER TRANSPORTATION:						
Persons entering via ~~stages,~~ Hotel .	740	1,374	417	1,698	- 324	18.4%
Persons entering via trains, .						
Persons entering otherwise, . .						
Total other transportation, .	740	1,374	417	1,698	- 324	18.4%
GRAND TOTAL ALL VISITORS, . . .	26,508	40,123	9,690	55,910	-15,787	28.2%

	This Year	Last Year	Increase: Number	Increase: Percent
Automobiles in public camps during month, ...	4	0		
Campers in public camps during month, ...	14	0		

10-158

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF AUTHORIZED PROJECTS

Hawaii National Park for the Month of December, 1931

Description of Projects	Percent Constructed To Date	Percent Constructed This Month	Percent Constructed Last Month	Probable Date of Completion
410 U. S. Commissioner quarters	0	0	0	March 31, 1932
411 Employees quarters - - - - -	100	0	0	
412 Employees quarters - - - - -	100	0	0	
413 Administration building - -	0	0	0	June 30, 1932
502 Trails				
502.1 Hilina Pali to Halape - -	100	0	0	
502.2 Uwekahuna-Halemaumau auto trail - - - - - - - - - -	90	0	10	March 31, 1932
502.3 Mauna Iki extension - - -	100	0	0	
502.4 Haleakala trail - - - - - -	100	0	0	
502.5 Mauna Loa trail - - - - - -	100	6	44	
502.6 Halemaumau trail - - - - -	95	0	65	January 31, 1931
507.1 Kau belt road - - - - - -	100	0	0	
Road Survey, BPR construction - -	36	9	4	July 1, 1932

10-159
(May, 1931)

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF PERSONNEL

Hawaii National Park for the Month of December, 1931

	This Month		This Month Last Year	
	Appointed	Non-Appointed	Appointed	Non-Appointed
Number of employees beginning of month	12	19	5	8
Number of additions	0	1	0	5
Total	12	20	5	13
Number of separations	0	5	0	6
Number of employees close of month	12	15	5	7
Number of promotions during month	0	0	0	0
Aggregate amount of annual leave taken	5	0	6	0
Aggregate amount of sick leave taken	0	0	0	0
Aggregate amount of leave without pay	0	CO	0	0

No female per diem employees.

10-160

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

REPORT OF PARK REVENUES

Hawaii National Park for the Month of December, 1931

	This Year	Last Year
Park revenue on hand beginning of month,	0	0
Received,	20.75	25.00
Total,	20.75	25.00
Remitted,	20.75	25.00
On hand close of month,	0	0

Park revenues received this year to date,	$282.98
Park revenues received last year to date,	275.00
Increase,	- 7.98
Per cent of increase,	- 2.8%

10-161

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

REPORT OF SALES OF PUBLICATIONS

December 1931
Hawaii National Park

	Number	Value
GOVERNMENT PUBLICATIONS:		
On hand beginning of month,	980	$175.00
Received during month,	0	0.00
Total,	980	175.00
Sold during month,	9	4.50
On hand at close of month,	971	170 $1[illegible].50
NON-GOVERNMENT PUBLICATIONS:		
On hand beginning of month,		
Received during month,		
Total,		
Sold during month,		
On hand at close of month,		

Cash on hand beginning of month,	$50.95
Sales during month,	4.50
Total,	55.45
Remitted during month,	50.95
Balance,	$4.50

Form No. 1009—Met'l.

U. S. Department of Agriculture, Weather Bureau.

COOPERATIVE OBSERVERS' METEOROLOGICAL RECORD:

Month of December, 1938, 192 ; Station, Volcano Observatory ; County, Hawaii

Hour of Observation, ;

State, Hawaii ; Latitude, ; Longitude, ; Time used on this form,

Humid Wind

DATE.	TEMPERATURE. Maximum.	Minimum.	Range.	* Set Max.	PRECIPITATION. Time of Beginning.	Time of Ending.	† Amount.	Snowfall, in Inches.	Depth of Snow on Ground at Time of Observation.	Prevailing Wind Direction.	Character of Day, Sunrise to Sunset.	‡ Miscellaneous Phenomena.
	70	59	26	60	5	6	03	86	Med.	8?10	P.C.	
1	69	54	15	58			08	95	Lt.	NE	Cloudy	
2	61	54	7	59			49	94	Med.	"	"	
3	65	56	9	60			31	83	"	SW	P.C.	Snow on Mountains
4	61	53	8	58			02	88	Lt.	NE	"	" " "
5	66	50	16	60			T	85	Med.	"	"	
6	61	50	11	57			09	83	"	NE	"	Thick steam in pit
7	65	47	18	55			T	78	"	"	"	Old snow
8	64	48	16	60			T	78	"	"	"	
9	67	56	11	60			21	89	Lt.	NE	"	
10	68	57	11	58			04	83	"	NE	"	
11	68	57	11	61			07	92	Med.	NE	Cloudy	
12	65	53	12	58			25	85	"	"	P.C.	
13	70	50	20	60			T	83	"	"	Clear	
14	70	53	17	63			T	87	"	SW	P.C.	
15	58	51	7	55			27	83	"	NE	"	
16	60	47	13	54			02	88	"	"	"	
17	59	50	9	53			04	89	"	"	"	
18	57	51	6	53			09	98	Str.	"	Cloudy	
19	58	51	7	54			42	100	"	"	"	
20	59	51	8	58			15	83	"	"	"	
21	64	50	14	57			14	88	"	"	P.C.	
22	61	52	9	57			05	100	"	"	"	Eruption Kilauea 2:40 PM
23	59	53	6	57			02	93	Med.	"	"	
24	63	52	11	55			07	92	Str.	"	"	
25	63	51	12	56			01	89	"	"	"	
26	65	50	15	62			02	84	Med.	"	Clear	
27	65	58	7	59			07	100	"	"	Cloudy	
28	64	51	13	61			03	70	"	"	P.C.	
29	64	51	13	56			01	85	"	"	"	
30	63	52	11	57			27	88	"	"	"	
31	2121	1609	363	1791			3.21	2682				
Sum	63.6	51.9	11.7	57.7			.10	86.5				
Mean												

*Reading of maximum thermometer immediately after setting.
†Including rain, hail, sleet, and melted snow.
‡Thunderstorms, halos, auroras, etc.

T. A. Jaggar
, Cooperative Observer.

(IN TRIPLICATE.) See cover for instructions.

Post-Office Address,

MONTHLY SUMMARY.

TEMPERATURE.

Mean maximum, 63.6

Mean minimum, 51.9

Mean, 57.75

Maximum, 70 ; date, Dec. 1

Minimum, 47 ; date, Dec. 8

Greatest daily range, 20

PRECIPITATION.

Total, 3.21 inches.

Greatest in 24 hours, .49 date, Dec.3

SNOW.

Total snowfall, inches; on ground 15th, inches;

at end of month, inches.

NUMBER OF DAYS—

With .01 inch or more precipitation, 25

Clear, 2 ; partly cloudy, 22 ; cloudy, 7

DATES OF—

Killing frost,

Thunderstorms,

Hail: Light, ; Moderate, ; Heavy,

Sleet,

Auroras,

REMARKS:

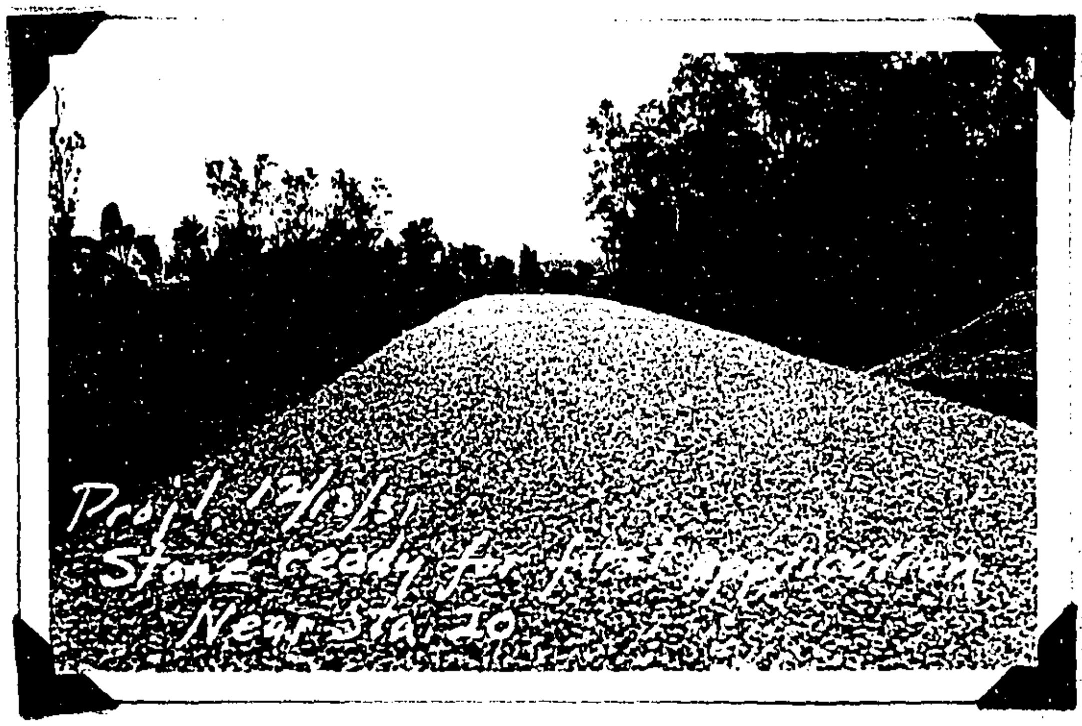
Halemaumau erupted under great pressur December 23, 2:40 pm. Action dwindled December 24, 2 am to December 29. Steady flow thereafter - one fountain.

STATISTICAL REPORT NUMBER 8
HAWAII NATIONAL PARK

FINANCE AND ACCOUNTS

Symbol	Name	Allotted	Expended & Obligated	Balance
41/2415	Hawaii National Park 1931-32 - - - - -	$52,130.00	$36,900.70	$15,229.30
41/2405	Emergency Reconstruction and Fighting Forest Fires - - - - - - - - - - - - -	200.00	200.00	0.00
41/2406	Forest Protection and Fire Prevention-	100.00	100.00	0.00
4X436	Roads and Trails, National Parks, no year - - - - - - - - - - - - - - - - - -	$384,806.30	$74,496.82	$310,309.48

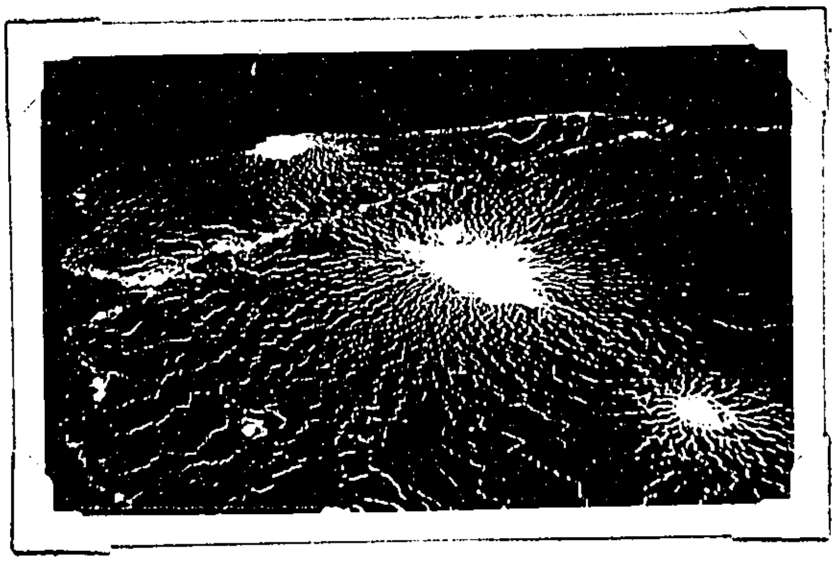

12/13/31
Proj. - Applying 2nd application
of Bitumuls.


Proj. 1
Stone ready for first application
Near Sta. 20

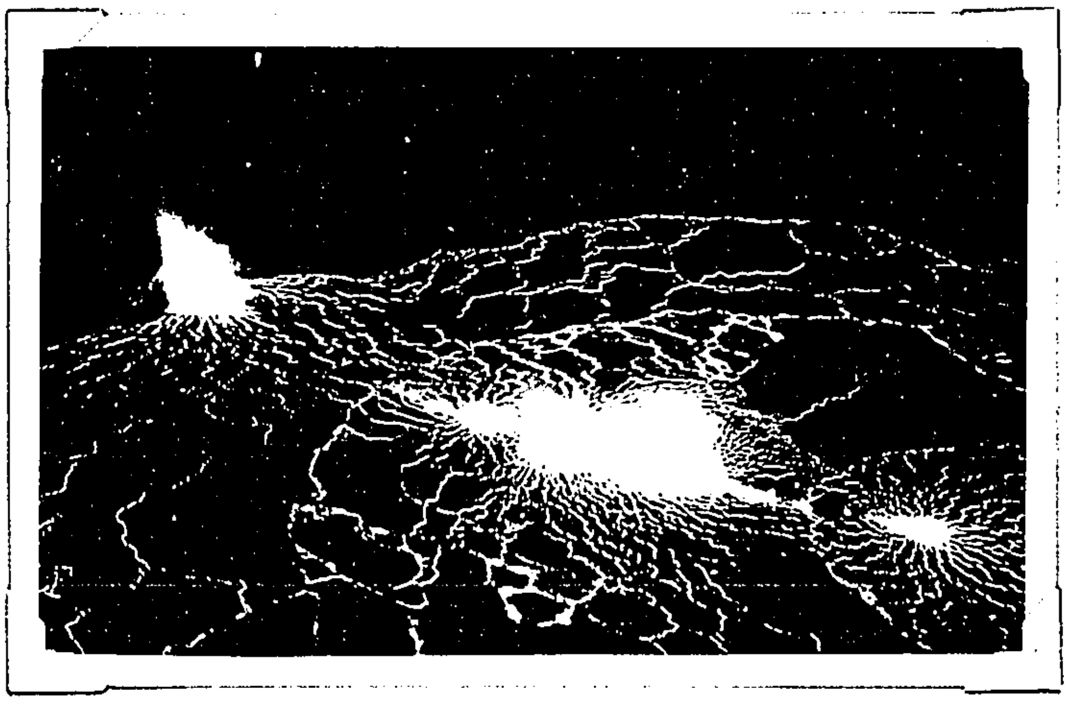

12/12/31
Proj. 1. - Sta. 39
back
of Bitumuls


Proj 1, -Sta. 24 ... ead, 12/18/31
First and Second Application.

Picture of Halemaumau pit at 7:30 P.M. Dec. 23, 1931 - the first night of the eruption. Note there were about six very large fountains playing along a rift running NE & SW across the floor of the pit and a score or two of smaller ones. Picture taken from northeast corner, by Chief Clerk James K. Higashida.



Halemaumau Pit as it looked at 6 A.M. December 24, 1931. Note the new rift at right angles to the NE and SW rift. The floor of the pit was completely covered with lava, and when measured at 10:10 A.M. December 24, after 19½ hours flow, was 76 feet deep. This was more lava than had poured into the crater during the three weeks period of the 1930 flow. The crater floor is about 2400 feet wide and 3400 feet long. Photo by Chief Clerk James K. Higashida.



Picture of the pit at 5 A.M. December 27, 1931. It had changed some but five fountains still going strong. Photo by J. K. Higashida.

Picture at 5:45 A.M. December 27, with more light showing fumes and wall of crater. Picture taken from lookout point by James K. Higashida.

December 27, 1931

Radio Talk by Superintendent Leavitt from Halemaumau, over station KGU.

Good evening friends: The Hawaii National Park was established on August 1, 1916, and its administration by the National Park Service began in 1922. It was a modest beginning with a small appropriation. The staff of the park was necessarily very small and very little could be done in rendering service to the public or in making improvements.

However, year by year some progress has been made and the year just past has been one of the best the park has ever had. To crown the accomplishments of the year just about to close, Madam Pele presented to the park and to the Territory of Hawaii a magnificent Christmas gift in the way of a renewal of volcanic activity in the firepit Halemaumau. It is the strongest and most spectacular eruption since 1924.

As I am a new superintendent of this park, this is the first volcanic activity I ever saw. At 10:38 A.M. on December 23, we had quite a sharp earthquake which opened up fresh earthquake cracks around the firepit Halemaumau and widened and extended existing ones, and caused a number of avalanches in the pit and on the cliffs of Kilauea Crater, but there was no special indication of volcanic activity. There was no apparent increase in sulphur fumes.

At 2:40 P.M. it was reported suddenly that Halemaumau was in action. I went out to see and saw a large rose colored dust cloud rising from the pit. I thought at first it was a dust cloud from an avalanche. It rose to a height of several hundred feet above the crater. While I was watching, however, a great big puff of dense, blue, sulphur smoke arose from the pit like the smoke from a locomotive. Then I knew there must be some activity. The fumes were so strong that it was dangerous to permit the public to visit the pit until several hours later and I arrived there about 7 P.M. with the first party and looked into the crater from the northeast corner. It was a sight I will never forget. The floor of the pit was split by a crack extending northeast and southwest out of which gushed a series of fountains of white hot liquid lava, four or five of the larger fountains throwing the lava 200 to 300 feet in the air. There were a large number of smaller fountains, possibly some 15 or 20 in all. The floor of the pit was already covered with molten lava. The pit was as light as day from the glare of the liquid fire.

All that has ever been said about this volcano in describing its grandeur, majesty, and beauty, I found to be true, but it does not adequately paint the picture. You must see it for yourself. It is a sight worth coming thousands of miles to see and one you too will never forget. It is an experience of a lifetime.

However, in spite of the interest the volcano has for the park visitors, the point I should like to impress upon my hearers tonight is that the park has many other things to offer to make the visit well worth while. One of the most interesting places to visit is the Thurston Lava Tube, which is a typical and interesting example of one of the many phases of volcanic activity here. Likewise a trip along the Chain of Craters Road viewing the seven craters that are openings into a large lava tube far underground, bring into view many different phases of volcanic activity which are interesting. There are many other things to see. The volcanic ash deserts, the lava flows from Mauna Loa, the steam cracks, sulphur banks, tree molds, etc. are all interesting and each has a story to tell.

The beautiful Ohia forests, the fern forests and tropical jungles; the rare and beautiful trees of old Hawaii still growing in Bird Park, are also scenic attractions.

To help our park visitors understand the story which nature tells in such an interesting way on every hand, our educational department has been formed and is now functioning in a fine manner under the leadership of our Park Naturalist, John E. Doerr, Jr., who will appear later on this program and tell you something about how it can serve you.

Our park staff has been increased from 5 to 18 employees, 5 new permanent and four seasonal rangers being added to our ranger department this year.

The major improvements of the park this year either completed or under way are, paving 13 miles of roads at headquarters, a new administration building, a house for the new United States Commissioner, yet to be appointed, 40 employees quarters, a warehouse, and a telephone system.

Many miles of new trails have been built; many of our old trails improved. There is now a new trail to the top of Mauna Loa and we hope in a few years to have a modern road up there. The National Park Service road to the top of Haleakala on the Island of Maui will be started next year.

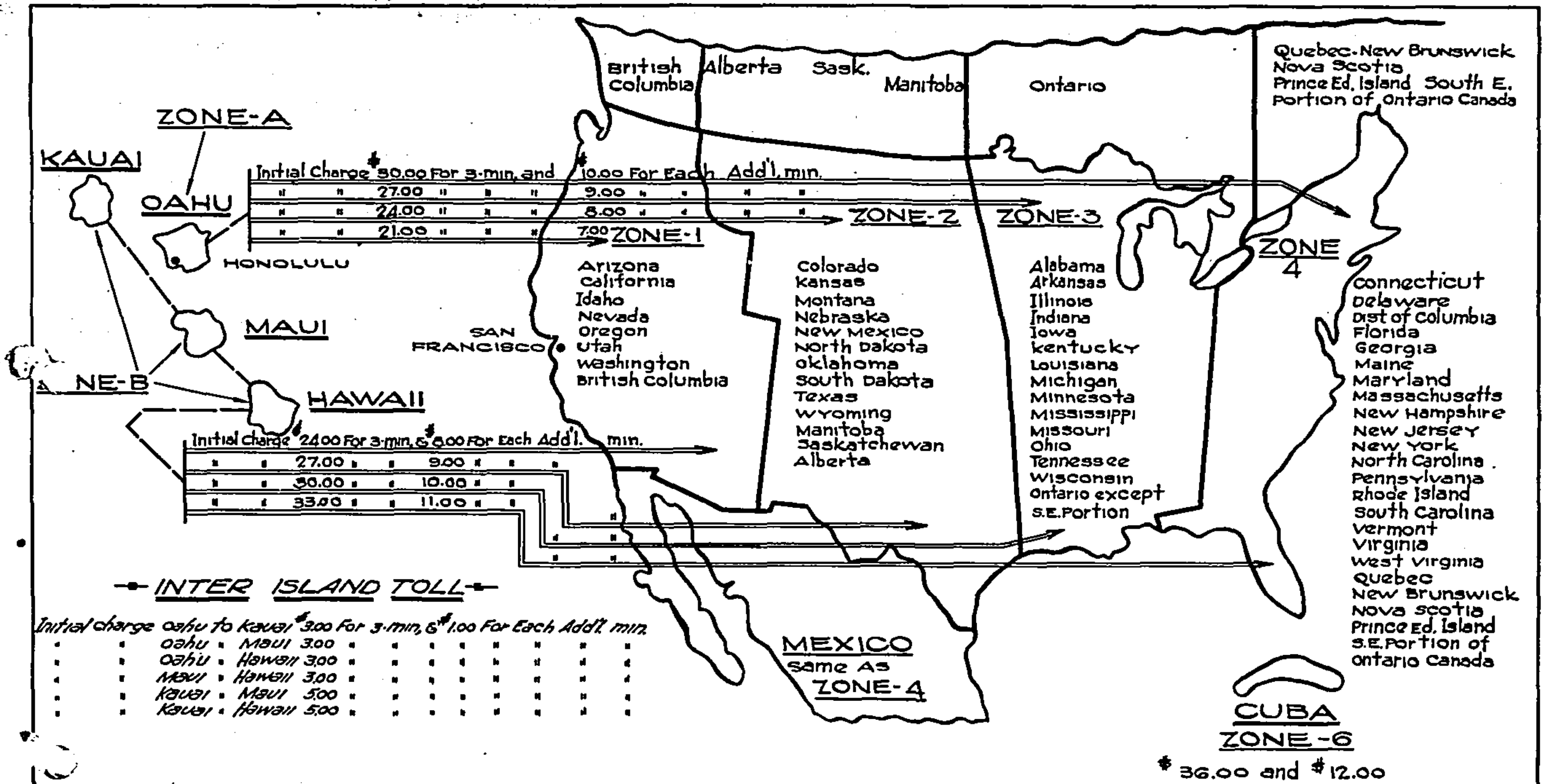
The Hawaii National Park is one of the finest assets the Territory of Hawaii has. Those who have not visited the park should do so. Those who have been here before, perhaps many times, should come again and learn of our new activities and improvements. Send your friends over by all means. Every tourist visiting this park sends more tourists. The tourist industry of this territory which now ranks third may some day be first in importance.

The National Park Service extends a cordial invitation to you all to visit the park and promises you an interesting and delightful visit. Let us have the pleasure of serving you.

Aloha.

By E. P. Leavitt, Superintendent, Hawaii National Park, by KGU, remote control from brink of Halemaumau firepit on Territorial broadcast at 8:30 P.M. December 27, 1931.

DOCUMENT CAPTURED AS RECEIVED



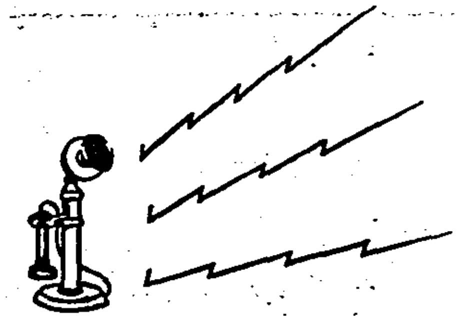
ZONE-4 NEW YORK	1.30	2.30	3.30	4.30	5.30	6.30	7.30	8.30	9.30
ZONE-3 CHICAGO	12.30	1.30	2.30	3.30	4.30	5.30	6.30	7.30	8.30
ZONE-2 DENVER	11.30	12.30	1.30	2.30	3.30	4.30	5.30	6.30	7.30
ZONE-1 SAN FRANCISCO	10.30	11.30	12.30	1.30	2.30	3.30	4.30	5.30	6.30
ZONE-A HONOLULU	8.00 A.M.	9.00	10.00	11.00	12.00	1-P.M.	2.00	3.00	4.00

RATE SCHEDULE

— FOR —

TRANS-PACIFIC & INTER-ISLAND RADIO TELEPHONE SERVICE

MUTUAL TELEPHONE CO.
HONOLULU T.H.
DECEMBER 21 - 1931



RATE SCHEDULE

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TRANS-PACIFIC AND INTER-ISLAND RADIO TELEPHONE SERVICE

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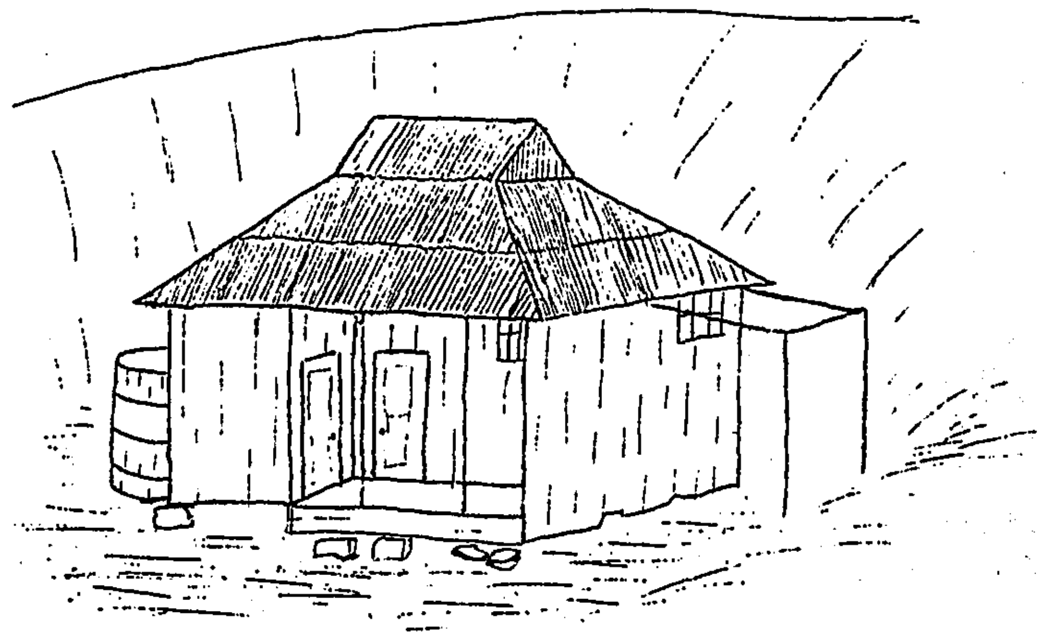
MUTUAL TELEPHONE CO.

HONOLULU, T. H.

OPENING OF
TRANS-PACIFIC SERVICE
DECEMBER 21, 1931

NATURE NOTES

HAWAII NATIONAL PARK



Puu Ulaula Shelter

VOL. I. NOVEMBER 1931 NO. 6.

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

HAWAII NATIONAL PARK
NATURE NOTES

Volume I November 1951 Number 6

Nature Notes from Hawaii National Park is a monthly pamphlet edited by the Park Naturalist and distributed to those interested in the natural history of the park. Free copies can be obtained through the office of the Park Superintendent, Hawaii National Park, Hawaii. Anyone desiring to use articles appearing in Nature Notes may do so. Please give credit to the pamphlet and author.

E. P. Leavitt, Superintendent John E. Doerr, jr, Park Naturalist

TABLE OF CONTENTS

THE TRAGEDY OF ALEALEA

The title may suggest to some that this might be a mystery story. No, this is a story (true) of the courage, patience and endurance of men and beast. The men in the story are Rangers Fordyce, Christ, and Eaton; the beast is a large "billy" goat which was given the name, "The White Goat" because the color of his hair was individual among the herd of which he was leader. The scene of the story or tragedy is Alealea Crater in Hawaii National Park, a steep-walled pit crater some 400 feet deep which has long been famous as the home of wild goats.

There have been times when rangers in the park have been called upon to rescue people from the depths of the craters but never before has it been necessary to risk ones life in attempting to rescue a goat.

A short time ago visitors at the Kilauea Military Camp stood at the lookout at Alealea Crater and noticed a large white goat high up on the far wall of the crater. On succeeding days other observers noticed the goat in the same position. Realizing that goats are excellent climbers and that other goats were climbing on the ledges near the conspicuous white "billy", it seemed almost impossible that this particular goat, whose age indicated that he had had much climbing experience, could have reached a ledge from which he could not return.

A careful examination of the goat's position showed that he had gone down from the crater rim to the particular ledge on which he had been for almost a week, and that he could neither climb out from the crater nor descend to the crater floor. One can only speculate as to the thoughts of the goat occupying the narrow ledge during those days and nights; thirty feet above him was the rim of the crater and the wide world; four hundred feet below, the floor of the crater over which he had roamed undisturbed with his companions. Certainly he thought of food for he had cleaned the ledge of its growth of young ferns, ohelo bushes and ohia trees.

On the fifth day of the goat's lonely vigil, Ranger Fordyce summoned the aid of Rangers Christ and Eaton to rescuethe animal. Getting the location on the rim directly above "billy", Ranger Fordyce was then lowered on a rope down the wall of the crater. As Ranger Fordyce approached the ledge occupied by the goat, "billy" gained courage to make leaps to lower ledges, leaps which he had evidently contemplated during his stay on the cliff. Seeing the goat leap from one ledge to another, twelve to fifteen feet below, certainly aroused ones admiration for "billy's" courage and ability.

With 100 feet of rope out it was impossible for Ranger Fordyce to descend farther. His presence on the wall as well as the small avalanches of rock which fell beneith him were sufficient to encourage the goat to continue his leaps from ledge to ledge. Hugging close to the sides of the cliff, "billy" was able to dodge the avanlanches of stones and yet the stones whizzing by stimulated him to make some most spectacular leaps. Even in his precarious position on narrow ledges the goat exemplified a spirit of nonchalance by eating the foliage of the vegetation growing in the crevices in the wall.

For a time it seemed as though "billy" would reach the lower slopes safely, there to continue his life in the peaceful environment of Alealea Crater. Arriving at the end of a ledge, "billy" did not in the great plain that skirts the Halemaumau. I stood in a sort of twilight that softened the . tone of surrounding objects, and still left them tolerably distinct. A gaunt muffled figure stepped out from the shadow of a rough column of lava, and moved away with a slow and measured step, beckoning me to follow, I did so. I marched down, down, hundreds of feet, upon a narrow path which wound its torturous course through piles and pyramids of seamed and blackened lava, and under over- hanging masses of sulphur formed by the art hand of nature into an infinitude of fanciful shapes.

"The thought croped my mind that possibly my phantom guide might lead me down among the bowels of the earth, and then disappear, and leave me to grope my way through its mazes, and work out my deliverance as best I might, and so, with an eye to such a contingency, I picked up a stone and "blazed" my course by breaking off a projecting corner occasionally, from lava walls, and finally we turned into a cleft in the craters wall, and picked our way through its intricate windings for many a fathom toward the home of the subterranian fires, our course was lighted all the way by the ruddy glow which filtered up through inumerable cracks and crevices, and which afforded occasional glimpses of the flood of molten lava boiling and hissing in the profound depths below us. The heat was intense, and the sulphurous atmosphere suffocating, but I toiled on in the foot-steps of my stately guide and made no complaint. At last we came to a rugged chamber whose sombre and blistered walls spoke with mute eloquence of some fiery tempest that had spent its fury here ages ago. The spectre pointed to a boulder at the father extremity - stood and pointed silent and motionless, for a few fleeting monments and then disappeared.

"'The Grave of the Great Kameahameaha!'
The words swept mournfully by, from unknown source and died away in the distant corridors of my prison, and I was alone in the bowels of theearth, in the house of desolation, in the presence of death!

"My frightened impulse was to fly, but a stronger impulse arrested me and implelled me to approach the massive boulder the spectre had pointed at. With hesitating step I went forward and stood beside it - nothing there; I grew bolder and walked around and about it, peering shrewdly into the shadowy half-light that surrounded it - still nothing. I paused to consider. While I stood irresolute I chanced to brush the ponderous stone with my elbow, and lo! it vibrated to my touch! I would as soon have thought of starting a kiln of bricks with my feeble hand. My curiosity was excited, I bore against the boulder with my whole strength, and it toppled from its foundation with a crash that sent the echoes thndering down the avenue passages of the dismal cavern.

CORRECTION

THE PRECEDING DOCUMENT(S) HAS BEEN REPHOTOGRAPHED TO ASSURE LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

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For a time it seemed as though "billy" would reach the lower slopes safely, there to continue his life in the peaceful environment of Alealea Crater. Arriving at the end of a ledge, "billy" did not hesitate to leap to a very narrow ledge about six feet below. He landed safely, there was a split second pause and suddenly the rocks gave way under his weight, hurling his white form through space to death on the jagged rocks 150 feet below.

"The White Goat's" last leap resulted in a distinct lose to the park. Being the only white goat inhabiting Alealea Crater, its white hair made it easily descernible to the many visitors stopping at the crater lookout to see the goats.

Inspired by the courage of three Park Rangers and "The White Goat of Alealea".

"MARK TWAIN'S" STRANGE DREAM

Continued from the October Nature Notes

"- and from that day to this the resting-place of the lion-king's bones is an unsolved mystery. But years afterwards, when the grim prophetess Wiahowakawaka lay on her death-bed, the Goddess Pele appeared to her in a vision and told her that eventually the secret would be revealed, and in a remarkable manner, but not until the great Kauhuhu the Shark God, should desert the sacred cavern Ana Puhi, in the island of Molokai, and the waters of the sea should no more enter it and its floors should become dry.

"Ever since that time, the simple confiding natives have watched for two signs. And now after many and many a summer has come and gone, and they who were in the flower of youth then have waxed old and died, the day is at hand! The great Shark God has dessorted the Ana Puhi. A month ago, for the first time within the records of the ancient legends, the sea has ceased to flow into the cavern, and its stony pavement has become dry! As you may easily believe, the news of this great event spread like wild-fire through the islands, and now the natives are looking every hour for the miricle, which is to unviel the mystery, and reveal the secret grave of the dead hero.

"After I had gone to bed, I got to thinking of the volcanic magnificence we had witnessed and could not get to sleep. I hunted up a book and concluded I would pass the time in reading. The first chaptor I came upon related several instances of remarkable revelations, made to men through the agency of dreams, of roads and houses, trees, fences and all manner of land-marks showed in visions and recognized afterward in waking and which served to point the way to some dark mystery or other. At length I fell asleep, and dreamed that I was abroad in the great plain that skirts the Halemaumau. I stood in a sort of twilight that softened the . tone of surrounding objects, and still left them tolerably distinct. A gaunt muffled figure stepped out from the shadow of a rough column of lava, and moved away with a slow and measured step, beckoning me to follow, I did so. I marched down, down, hundreds of feet, upon a narrow path which wound its torturous course through piles and pyramids of seamed and blackened lava, and under over- hanging masses of sulphur formed by the art hand of nature into an infinitude of fanciful shapes.

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And there, in a shallow excavation over which it had rested, lay the crumbling skeleton of King Kameahameaha the Great, thus sepulchured in long years, by supernatural hands! The bones could be none other, for with them lay the rare and priceless crown of pulamalama coronet sacred to royalty, and tabu to all else besides.

"A hollow groan issued out of the - I woke up. How glad I was to know it was all a dream! This comes of listening to the legend of the noble lord - of reading those lying dream revelations - of allowing myself to be carried away by the wild beauty of Kilauea at midnight - of gorging too much pork and beans for supper. And so I turned over and fell asleep again - and dreamed the same dream precisely as before; followed the same phantom guide - blazed the same course - arrived at the grim chamber - heard the sad spirit voice - overturned the massive stone - beheld the regal crown and the decaying bones of the Great Kameahameaha!

"I woke up and reflected long on this curious and singularly vivid dream, and finally muttered to myself, 'This is becoming serious!' I fell asleep again, and again I dreamed the same dream, without a single variation. I slept no more but tossed restlessly in bed and longed for daylight. And when it came I wandered forth, and descended to the wide plain in the crater. I said to myself, 'I am not superstitious but if there is anything in that dying woman's prophecy I am the instrument appointed to unravel this ancient mystery.

To be continued.

The Editor

HOW PELE BECAME APOTHEOSIZED

Pele, with her many brothers and sisters settled in the region of Kilauea's crater. The reports of Pele's character and many fine qualities spread through the islands. Kamapuaa, a rough, stalwart man with black, bristly hair, heard of this famous lady and decided to visit her. Arriving at Kilauea, Kamapuaa made advances to Pele to become her suitor. She rejected all of Kamapuaa's proposals, calling him a "son of a hog". This vile name aroused Kamapuaa to the point of fighting. Pele with her family and eighteen other women and children fled into the darkness of a lava tube, closing the entrance behind them.

Kamapuaa, discovering their hiding-place, started to bore a hole from the surface through to the tube. Just as Kamapuaa was about to reach the tube in which Pele was hiding, a flow of lava poured out of the nearby crater, driving the besiegers away. Kamapuaa believed that Pele and her followers had been destroyed. Because the lava eruption coming just when it did, the people believed that Pele had the power of calling up fire hence they glorified her as Pele, The Goddess of Volcanoes.

by Renger E. Brumaghim

THE COVER

On the cover of this issue is a sketch, drawn with cold fingers, of the Rest House on the Mauna Loa Trail. In some localities this "wrinkle-tin" roofed house would pass for nothing more than a much weather-beaten "shack", but in its location nestled in the small crater of the red cinder cone known as Puu Ulaula or Red Hill, it is a house, a house which has meant shelter food and sleep for those who have travelled the Mauna Loa Trail.

The exterior of its board walls have experienced the heat of the sun burning through the thin air of an elevation of 10,000 feet; strong winds whirling inside the crater have hurled particles of volcanic ash and pumice against its walls; snow and ice too are not unknown to the exterior walls of the Rest House in Puu Ulaula. Inside, its smoked stained walls tell of over-heated oil stoves; the floor, pitted by dragging hobnail boots, is stained by spots of grease from skillets with hand-burning handles. A hole in the floor tells the story of a mountain-traveling mouse which came up from below in a bale of hay or a sack of oats. On the shelf above the table are pots, pans and tinware cleaned by the last visitors sheltered by the Rest House. Corn beef in cans are evidence of a desire to lighten ones load on the down journey and some Rest House guest's good faith that other visitors will leave something for someone who by chandehas run short of food.

Arriving at Puu Ulaula one has no time for noticing the lack of luxury in the house. Around the house are other cinder cones of various sizes and shapes, countless numbers of spatter cones built up by lava fountains which have played along a great crack are there to be examined; if one should tire of exploring the caves lined with many-colored, jagged stalactites, there are the more distant views of nature to impress and inspire one. To the north beyond the fog-filled valley is Mauna Kea , whose rugged volcanic peaks change color as they catch the last rays of the sun setting in the Pacific to the west and the first rays of the sun rising from the Pacific to the east.

Six thousand feet below and to the east is Kilauea whose gentle slopes are partially buried by the lava flows from Mauna Loa. To the west and south rise the higher slopes of Mauna Loa up which the visitor at the Rest House has or will travel.

by the Park Naturalist

CRATER OF KILAUEA

On the opposite page is a copy of an ancient map of the Crater of Kilauea as it was known to old Hawaiians. The original map is in notes by King David Kalakaua who ruled as King of the Islands from January 29, 1874 until his death on January 20, 1891.

Legend

A - A steam crack on the north rim of the crater. Near this crack the ancient Hale Hoomaha stood. (Nature Notes, Vol. I, No. 3, p. 21) This steam crack furnished heat for cooking the food of the people who came to worship the Goddess Pele at her temple, Halemaumau.

B - The location of Lord George Anson Byron's hut stood. The hut was destroyed by a lava flow in 1832. To-day the location is known as Byron's Ledge.

C.- Image of Kamohoalii, brother of the Goddess Pele. Legend tells us that his body is buried on this cliff and that when erosion uncovers his bones Pele comes with lava and volcanic ashes and covers them again. The image of Kamohoalii can be seen to-day on this pali.

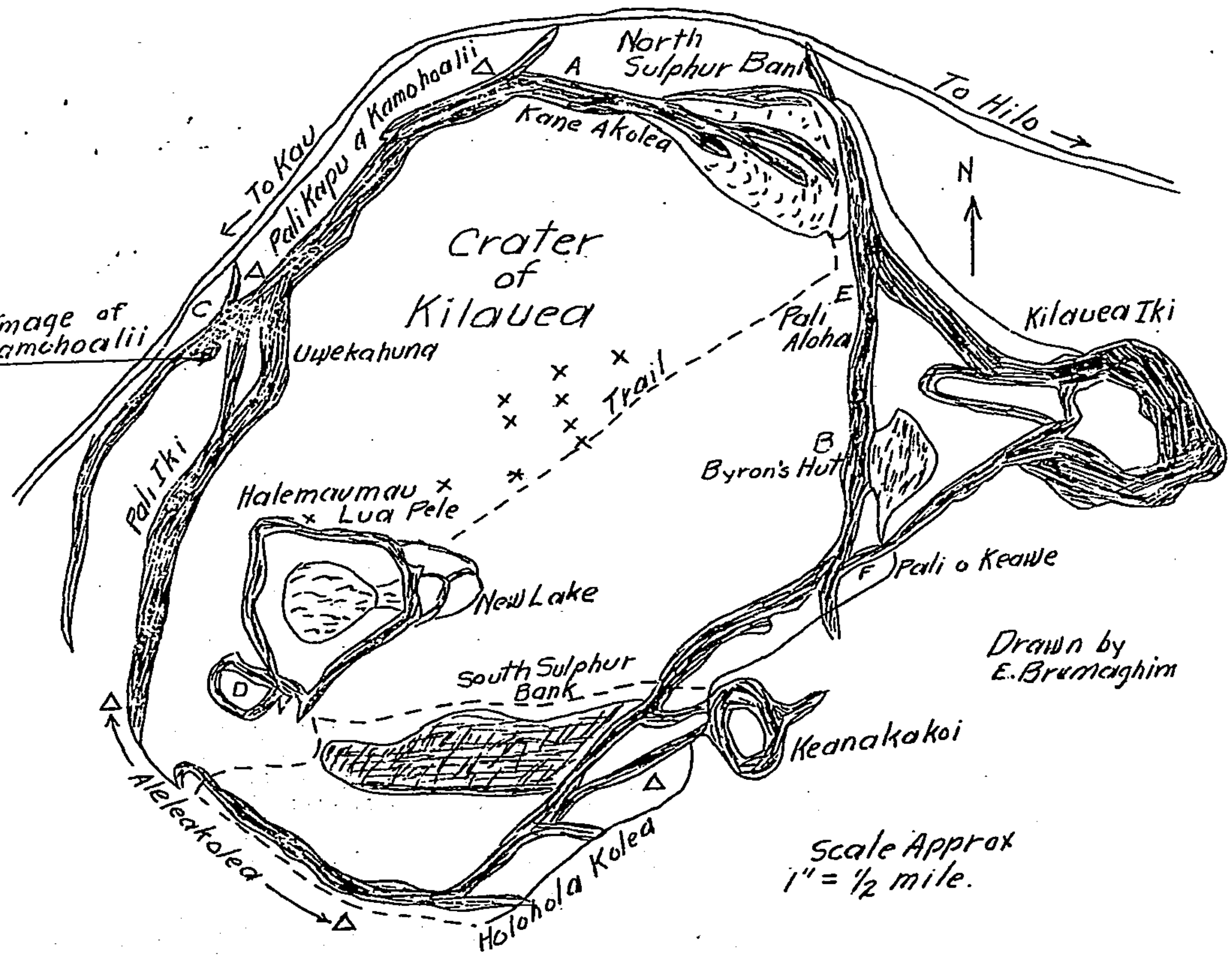
D - A crater in which Amaumau ferns grew. This crater does not exist now.

E - Marks the spot where Pele met and fell in love with Lohiau.

F - Where Princess Kapiolani had her camp.

x - Spatter cones on the floor of the crater. Only Little Bogger remains to-day.

by Ranger E. Brumaghim


North
Sulphur Bank
To Hilo
A
Kane Akolea
To Kau
Pali Kapu a Kamohoalii
N
Crater
of
Kilauea
Image of
Kamohoalii
C
Uwekahuna
E
Pali
Aloha
Kilauea Iki
Trail
B
Byron's Hut
Pali Iki
Halemaumau
Lua Pele
New Lake
F
Pali o Keawe
Drawn by
E. Brumaghim
South Sulphur
Bank
D
Keanakakoi
Aleleakolea
Holohola Kolea
Scale Approx
1" = 1/2 mile.

The Volcano Letter

Two dollars per year Ten cents per copy

No. 362—Weekly Hawaiian Volcano Observatory, National Park, Hawaii December 3, 1931

New steam vent discovered on south slope of Diamond Peak in southwestern part of Lassen Volcanic National Park. The locality is solfataric but was not known to be steaming prior to the autumn of 1931. Photo taken October 14, 1931, by R. H. Finch, Lassen Volcano Observatory.

CHEMICAL ANALYSES OF KILAUEA LAVAS

One phase of the study of volcanoes which attracts no public attention, but nevertheless is of utmost scientific importance, is the study of the changes which take place in the composition of the lava during the life cycle of a volcano. Geologists may express the composition of a rock either in terms of the kind and amounts of the different minerals which make up the rock, or in terms of the kind and amounts of the different chemical elements contained in the rock. Of course the mineral composition and the chemical composition depend on each other so that a statement of either kind of analysis gives a picture of the composition of the rock. Since an analysis of the chemical composition can be made more accurately and can be expressed in more definite quantitive terms, more attention is paid to determining the chemical composition of different lavas of the important volcanoes which are studied.

Scientists have been studying the chemistry of the lavas of Hawaiian volcanoes for many years. Geologic literature contains first rate analyses of over a hundred different specimens of lava from the several volcanoes of the islands. Part of the work of the Geological Survey is to carry on with this collection of quantitative data. During the past two years, chemical analyses have been made of six different lavas from Kilauea and two from Mauna Loa. These new analyses are given in Table I at the end of this article.

It is obvious that these eight different lavas show very little difference in their chemical composition. Furthermore, the same lavas are decidedly similar in their mineral composition. They all belong to a class of rocks known as basalt. The Hawaiian lavas contain porphyritic crystals of olivine in a groundmass of about equal parts of plagioclase and pyroxene, with glass only in the quickly cooled surface phases (see Volcano Letter No. 348). Not only do the different basalts from Hawaii show a similarity in composition, but they also are remarkably like basalts from other volcanoes in the Pacific islands and basalts from the huge volcanic fields of India, Iceland, and other islands of the north Atlantic, Patagonia, and the Columbia River plateau of North America. This similarity in composition of basalts the world over, together with some other technical reasons, has led many geologists to believe that the whole surface of the earth is underlain by a layer of eruptible basalt of fairly uniform composition. This parent basalt is considered to be the original material of all volcanoes, and the many other kinds of lava with different compositions have all been derived from this basalt by some process of differentiation. The average of 16 analyses of Kilauea basalts, and the average of several other types of this parent basalt, are given in Table II.

The different lavas from Kilauea do not show any great variation from this average basaltic composition. That would mean that no great amount of differentiation has taken place in the lavas during the life of the volcano. This should logically be the case when we consider that Kilauea is a relatively young volcano and probably has lived only part of its normal life cycle. The same is true of Mauna Loa, and the lavas from the present active Mauna Loa do not show very much variation in their composition. It is in the older volcanoes of Hawaii which have completed their life cycle that we would expect to find the greatest change in composition of the lavas, and such is the case. The lava of Puuwaawaa is almost true pumice and obsidian with a chemical composition of trachyte (62 per cent silica, 12 per cent alkalies soda and potash). Also many flows on Kohala and Mauna Kea approach trachyte in their chemical composition.

One of the many problems confronting us is to determine, if possible, how and why this change in composition takes place. The most alluring reason for desiring a solution to this problem is that gold and many other precious metals are associated not with basaltic rocks but with rocks, like the above, which approach a granite in chemical composition. It thus is essential to understand the origin of these ore-bearing rocks in order to learn more of the origin of the valuable ores themselves.

TABLE I
Lavas, Hawaii

1. Olaa. Mauna Loa aa flow, road cut on government road at south boundary of Waiakea Forest Reserve. Analyst J. J. Tahey.
2. Reservoir. Mauna Loa pahoehoe flow, from reservoir at Piihonua. Analyst J. J. Tahey.
3. Quarry. Kilauea pahoehoe flow, National Park quarry, on Hilo road one mile from Observatory. Analyst J. J. Tahey.
4. 1917 Halemaumau. Splash from lava lake. Analyst J. J. Tahey.
5. 1919 Halemaumau. Splash from lava lake during eruption of Alika flow from Mauna Loa. Analyst J. J. Tahey.
6. 1919 Halemaumau. Pahoehoe flow NE edge of floor of Kilauea Crater. Analyist, J. J. Tahey.
7. 1921 Halemaumau. Pahoehoe flow S edge of floor of Kilauea Crater. Analyst L. T. Richardson.
8. 1929 Halemaumau. Scoria from lava fountain. July 1929. Analyst R. E. Stevens.

	1	2	3	4	5	6	7	8
SiO_2	50.41	52.14	51.35	50.14	50.37	50.52	50.85	51.00
Al_2O_3	12.37	13.60	13.36	13.93	14.20	13.85	15.30	13.03
Fe_2O_3	1.94	2.31	1.32	0.57	1.28	0.98	0.28	1.83
FeO	9.56	8.80	9.85	10.07	10.10	9.77	10.42	10.02
MgO	7.68	7.26	7.62	8.25	7.75	7.07	7.80	6.76
CaO	12.56	10.14	10.74	11.17	11.24	11.33	11.45	12.40
Na_2O	1.68	2.02	1.93	1.29	2.20	1.51	.70	2.02
K_2O	0.40	0.48	0.50	0.41	0.56	0.47	.58	0.73
$H_2O+110°$ C.	0.22	0.16	0.29	0.03	0.06	0.04	.18	0.35
$H_2O-110°$ C.	None	0.06	none	none	none	none	trace	none
TiO_2	2.26	2.20	2.50	3.20	2.33	3.63	1.55	2.33
P_2O_5	0.57	0.29	0.28	0.23	0.02	0.22	.22	0.14
Cr_2O_3	0.05	0.02	0.03	0.07	0.05	0.06	.05	0.008*
						less than		
NiO	0.004	0.005	0.025	0.002	0.008	0.001	.002	trace
MnO	0.06	0.07	0.07	0.06	0.14	0.14	.10	0.18
	99.76	99.55	99.86	99.42	100.31	99.59	99.48	100.80

*Quantity of sample insufficient.

TABLE II

	K	D	O	T
SiO_2	49.9	50.6	50.0	47.5
Al_2O_3	12.7	13.6	13.7	13.9
Fe_2O_3	1.45	3.2	2.4	3.6
FeO	10.0	9.9	11.6	9.4
MgO	9.9	5.5	4.7	6.8
CaO	10.5	9.5	8.2	9.8
Na_2O	2.0	2.6	2.9	2.9
K_2O	.45	.7	1.3	1.0
TiO_2	2.7	1.9	2.8	2.7
P_2O_5	.25	.4	.8	.4
MnO	.12	.16	.24	.22

K. Average of 19 analyses Kilauea lavas. 13 from H. S. Washington, Petrology of Hawaiian Lavas. (Amer. Jour. Sci.)

D. Average of 11 analyses Deccan (Western India) lava. H. S. Washington, Deccan Traps and other Plateau Basalts. (Geol. Soc. Amer.)

O. Average of 6 analyses Oregon basalts, H. S. Washington, Deccan Traps, etc. (Geol. Soc. Amer.)

T. Average of 33 Thulean (Iceland-Britain-Greenland) basalts. H. S. Washington, Deccan Traps, etc. (Geol. Soc. Amer.)

H.A.P.

LASSEN REPORT No. 30
NEW DIAMOND PEAK STEAM VENT
R. H. Finch, Asociate Volcanologist

A new steam vent was discovered in the Lassen Volcanic National Park during the early autumn of 1931. It is located just below Diamond Peak on the ridge between East and West Sulphur Creeks. This is in the southwestern part of the park near the new road which crosses the mountain mass. The vent was discovered by National Park workmen, and is shown in the photograph on Page One, taken October 14, 1931. As the steam appeared in a clump of trees, the workmen thought at first that they had discovered a forest fire. Adjacent to the new vent, especially on the slope just below, are old solfataric areas. It appears, however, that there has been no activity in this locality for a great many years. Steam escapes from a small vent in the center of an area over which sulphates, chiefly alum, are being deposited. The temperature of the steam is 198 degrees Fahr. The photograph was taken with a view to making later pictures that will show changes in chemical erosion, etc.

The map shown on Page Four is a reduced copy of the topographic map of Lassen Volcanic National Park surveyed by E. P. Davis and R. G. Stevenson of the U. S. Geological Survey in 1925-26. The new road between Upper Meadow and Helen Lake has been completed since the map was made. Mineral, headquarters of the Lassen National Forest, where the volcano observatory is located, is three miles outside of this map to the southwest. Lassen Volcano is in the middle of the west part of the park, the Loomis Museum (where seismograph No. 2 is located) is at Reflection Lake inside the park northwest, and Mount Harkness (where seismograph No. 3 is in the forest ranger station) is just inside the park at the southeast. Cinder Cone and its lava flows lie between Snag Lake and Butte Lake in the northeast corner of the park. The principal hot and boiling spring areas, and the solfataric deposits, and steam jets which accompany them, are in the south-

western part of the park amid the mountains of the northwestern end of the Sierra Nevada above which Lassen Peak stands as an imposing volcanic cone 10,453 feet high.
R.H.F.

KILAUEA REPORT No. 1036

WEEK ENDING NOVEMBER 29, 1931

Section of Volcanology, U. S. Geological Survey

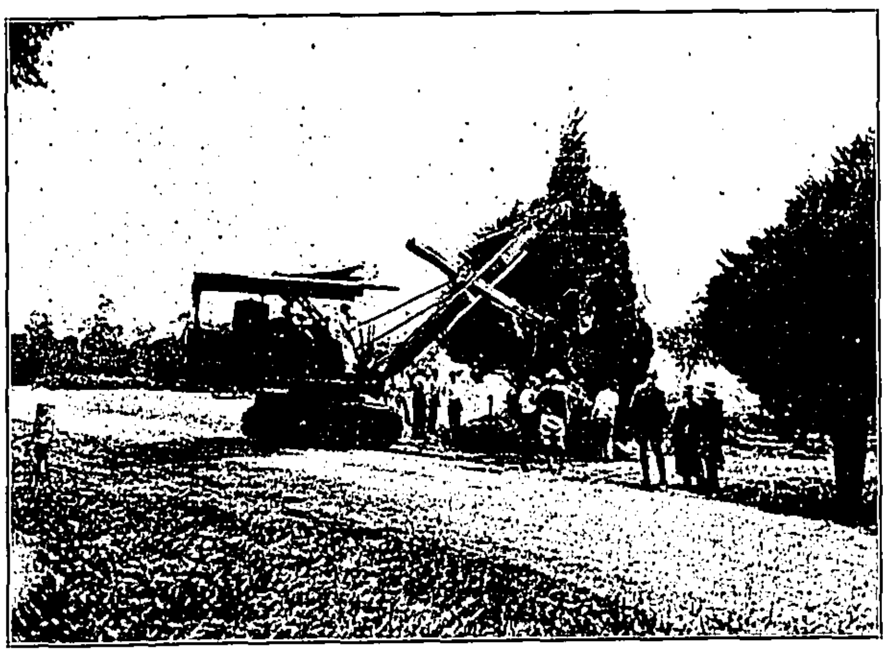
T. A. Jaggar, Volcanologist in Charge

No significant changes in the bottom of Halemaumau pit have occurred. The crack at the northeast edge, No. 25, opened three-quarters of an inch November 20-30. Measurements show a lowering of the rim block adjacent to the crack about one foot between October 26 and November 23. At 10:35 a. m. November 24 an avalanche producing much dust occurred at the northeast wall of the pit under this crack.

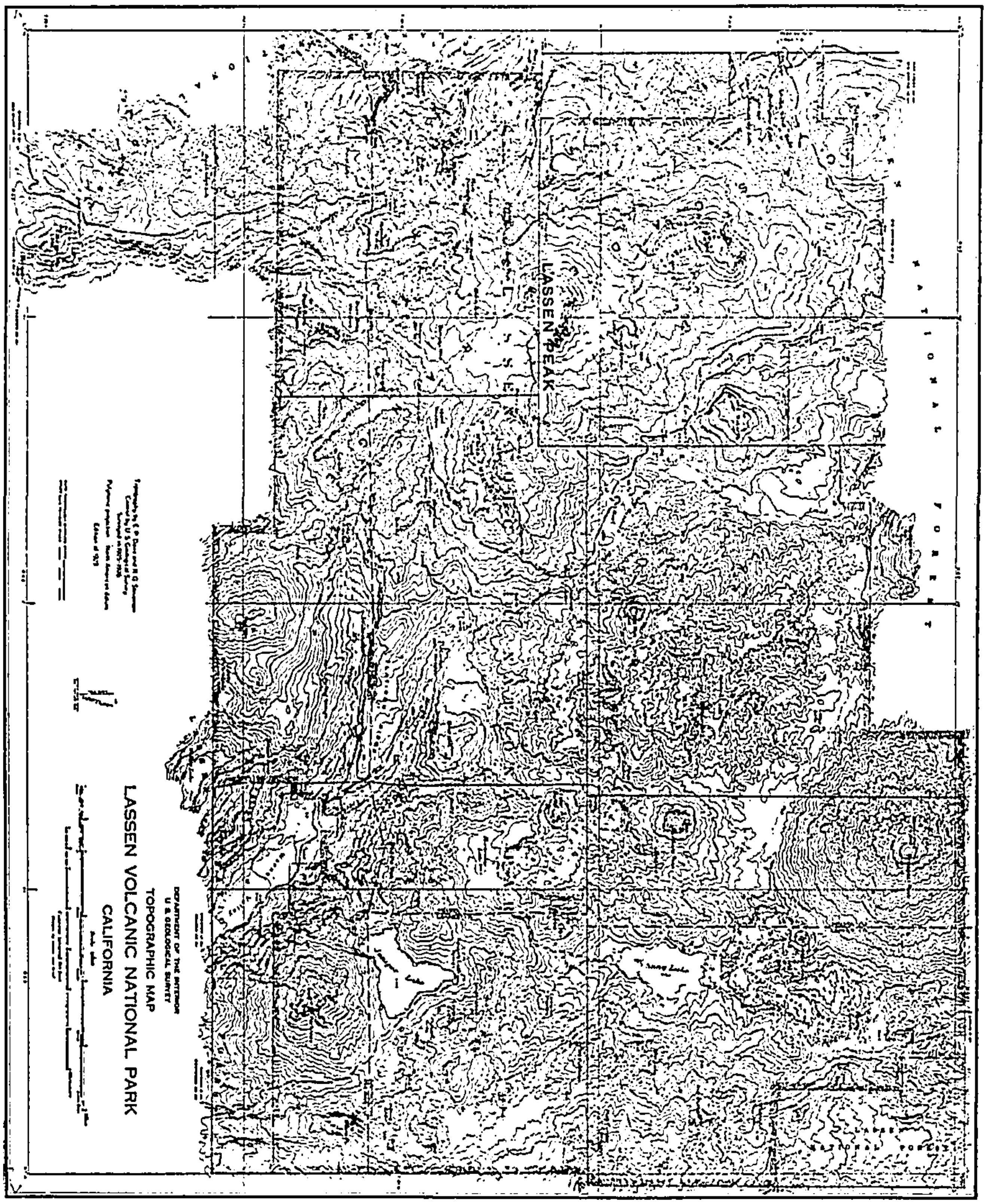
Designs have been drawn and preparations made for rebuilding the seismograph hut at Halemaumau with the cooperation of the National Park Service.

During the week 22 volcanic tremors were registered at the Observatory on the northeast rim of Kilauea Crater as compared to more than 50 of the next preceding weeks. Four gave evidence of distance of origin, one 20 miles, and the others 40 miles. There were two other disturbances possibly of artificial origin, but doubtful.

Two very feeble local seisms were registered, one indicating origin distance about 1 mile, the other about 20 miles. Microseismic motion has been very heavy during the week, probably owing to ocean waves pounding the steep shores of the island, as there has been some strong wind. Tilting of the ground has been very slight NNW. General conditions indicate volcanic quiet, the tremors show about the same distance of origin as the week before, and one of the very feeble shocks indicates origin close at hand, the other far enough away to have occurred under Mauna Loa.



Contractor moving cypress and Japanese cedar trees back from the road front, for purposes of new road construction, Hawaiian Volcano Observatory. Large pits were dug to receive the trees, black fertilizer and loam mixtures were prepared in the pits, and the power shovel with caterpillar treads lifted each trunk with its ball of soil and deposited it at its destination. Photo Jaggar.



Map of Lassen Volcanic National Park, U. S. Geological Survey 1925-26. Seismographs of the Section of Volcanology are maintained northwest. southwest, and southeast of Lassen Peak, as described in the text.

The Volcano Letter

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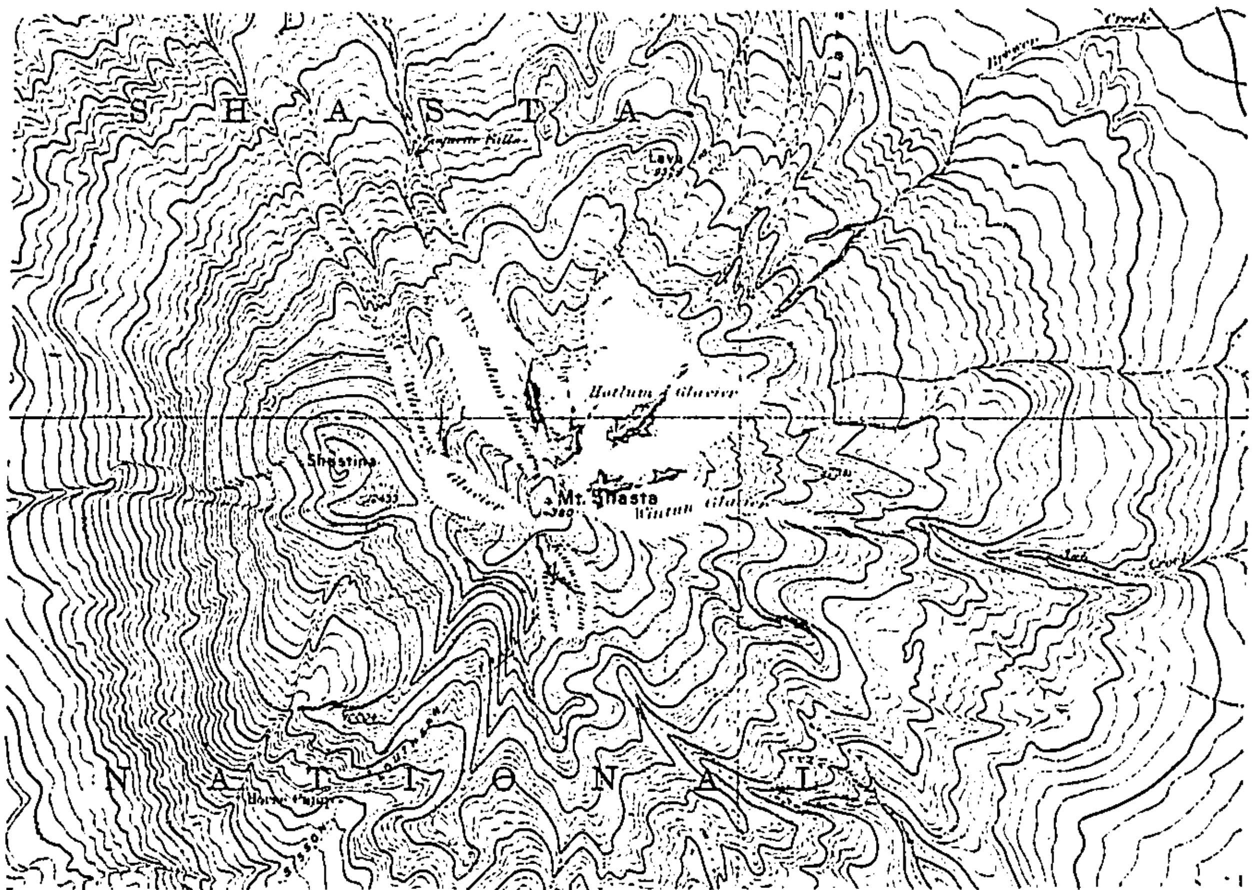
No. 363—Weekly — Hawaiian Volcano Observatory, National Park, Hawaii — December 10, 1931



Map of the cone of Mount Shasta in California, an isolated volcano in the southern part of the Cascade Range, with hot springs and steaming vents, and well marked old lava flows about the flanks. Like most of these cones, remnant glaciers surround the summit, which stands 14,380 feet above sea level.

THE ACTIVE AND RECENTLY EXTINCT VOLCANOES OF NORTH AMERICA

Review by G. L. Chang

The most prominent fact brought out by a study of the geographical distribution of volcanoes is that, with but few exceptions, they are mostly situated on the borders of continents or on the ocean's floor.

The volcanoes of North America form a part of a great system of volcanic vents which may be said to surround the Pacific Ocean. This chain of fire beginning in Terra del Fuego extends along the west border of South America, where its course is marked in the Andes by some of the loftiest igneous mountains in the world; it is narrow and well defined on the west border of Central America and far into Mexico, where still steaming craters, some of which are among the highest summits on the continent of North America, define its position. The volcanic belt broadens in the northern part of Mexico and the United States, but is marked by few active craters. Again contracting and approaching close to the ocean's shore, and in several instances marked by island volcanoes, the igneous belt follows the coast of British Columbia and Alaska, and extends westward throughout the length of the Aleutian Islands. Still active craters in Alaska show the positions of earth fractures which unite the volcanic belt of the new world with the still more energetic volcanoes of Kamchatka, Korea, Japan, Formosa, the Philippine Islands, New Guinea, New Caledonia, New Hebrides, and New Zealand. The length of this vast system of active volcanoes, from the southern end of South America about the Northern Pacific to New Zealand, is about 30,000 miles. Within the embrace of the great curve, and rising from the deeply submerged floor of the Pacific, are many volcanic islands and still active craters.

A branch of the western arm of the volcanic system just referred to embraces Java and Sumatra. A corresponding offshoot of the eastern arm is marked by the volcanoes of the West Indies.

It is a matter of observation that the loftiest mountains of a continent face the largest ocean washing its shores. In a similar way it may be remembered from a study of the distribution of volcanoes that the largest volcanic belt in the world embraces the largest ocean. Whether this association indicates an essential or genetic connection between the height of mountains, the prevalence of volcanoes, and the extent of water bodies, remains to be shown.

The volcanic areas of North America form a part of the great Pacific belt, but include an exceptional portion of it, since from central Mexico to southeastern Alaska there are chiefly dormant vents. In this interval of some 4,000 miles, however, there are many recently extinct craters, as well as hot springs and geysers. It is in this break in the chain of steaming craters that the breadth of the volcanic belt is greatest. This coincidence is significant of some subterranean change.

An examination of the map of North America, in which the positions of most of the active and recently extinct volcanoes are indicated, will show that active volcanoes are confined to the western portion of the continent, and for the most part to the immediate border of the Pacific. No volcanoes sufficiently recent to be recognized by their topographic forms occur east of the sharply defined eastern border of the Cordilleran mountain series. The central and eastern portions of the United States, the central, eastern, and northern portions of Canada, and much of Alaska excepting its immediate southern border, are without evidence of recent volcanic activity. No active or recently extinct volcanoes have been discovered in the Greenland region. Iceland, as is well known, is an active volcanic center.

The most recent volcanic rocks in all of the vast region just referred to—east and north of the Cordilleran series and embracing five sixths of North America—are, so far as known, confined to the Atlantic border and occur in the Newark system. They were poured out in part as molten lavas during the mesozoic era, or the middle age of the earth's geological history. Erosion has been so great since the volcanoes from which they came were in activity that scarcely a vestige of the cinder cones or of the mountains they formed now remains. The preservation of such records as still exist is due to the facts that volcanic rocks were buried beneath sedimentary deposits and, for a very long period, so depressed that they were below the ocean's level, and thus escaped removal by erosive agencies.

Still more remote in the earth's history, volcanic eruptions on a grand scale occurred in what is now the Appalachian region and in the Lake Superior basin These ancient volcanoes illustrate the fact that even in the remote past volcanoes were situated on continental borders. When the vents from which the rocks were derived were in activity, the continent had increased but little from its original Archaean nucleus, and the sea occupied the whole of what is now the Mississippi Valley and the northward extension of the same interior basin to the Arctic regions.

The volcanic mountains of the west are nearly all of post-Tertiary age. Some of the lava flows of Idaho, Washington, and California were poured out during the Tertiary and were buried beneath the sediments of great lakes, the date of which is recorded by the fossils they contain.

A portion of the Pacific volcanic belt is only a score of miles wide in Central America, but broadens in the central part of Mexico somewhat abruptly to about 800 miles, and touches both the Gulf and Pacific coasts. A gradual increase in breadth occurs north of Mexico, and in the latitude of San Francisco and Denver it attains its maximum width about 1,000 miles. When followed northward, it again contracts, and in Alaska is as narrow and sharply defined as in Central America. The narrow tapering southern extremity of this volcanic belt curves eastward; its similar northern extremity, which also contracts in breadth towards its extremity, curves westward.

It is in the narrow, curved extremities of this volcanic belt that volcanic eruptions have occurred most recently, and here most of the still active volcanoes of North America are situated. In the broader and less curved central portion chiefly dormant volcanoes occur. (Russell, Volcanoes of North America.)

THE VOLCANOES OF THE CASCADE MOUNTAINS

Review by C. B. Crawford

The Cascade Mountains extend from northern California across Oregon and Washington. Lassen Peak is situated at the extreme southern end of the range; the northern extremity extends past Mount Baker into British Columbia. This range, 500 miles long and 50 miles wide, runs parallel with the Pacific Coast about 120 to 200 miles inland, and its peaks rise 5,000 to 14,000 feet above sea level. The eastern border shows monoclinal structure due to the tilting of fault blocks. Russell suggests that the lava composing the Cascade Mountains, more especially in Washington, is an extension of Columbia lava, which was poured out in successive sheets and afterwards broken, and the blocks thus formed tilted at various angles. However, they are not wholly composed of lava; there are Tertiary rocks of unknown age beneath the lava which have been raised and tilted by the same disturbances. Much of the northern portion of the range is free from lava, the rocks being largely granite and schist, showing that the range as a whole is not of volcanic origin.

The great volcanic peaks hereinafter discussed are of a later date than the uplifting of the main Cascade Range, and owe their origin to the escape of molten material through fractures which were formed at the time of the disturbances. The conclusion that these peaks are of volcanic origin rests in some instances on their general appearance and their occurrence *in a volcanic region. None* of them is an example of very fresh volcanic activity with the exception of Lassen Peak. Most of these peaks have craters at their summits or on their flanks. They are for the most part the result of Tertiary eruptions and have been modified by erosion, have developed glaciers, and dominate the neighboring mountains.

Mount Shasta is probably typical of the peaks of the Cascade Range. It is a volcanic mountain which has suffered from erosion caused by streams and glaciers. It is 14,380 feet above sea level and its summit is 4,000 feet above the timber line. Small glaciers are still present on its sides. On the west end, 2,000 feet from the summit, is a cone with a crater in its top known as Shastina. On the lower slopes are similar craters, some built of cinders, some of lava. The mountain itself is composed of lava flows with a minor quantity of scoria. On the flanks of Shasta are well defined lava streams which still retain their original rough surface. The longest and most copious of the more recent streams that flowed from Mount Shasta started at an elevation of 5,500 feet. This stream divided into two branches, one of which was 12 miles long. The other entered the canyon of the Sacramento River and reached a distance 50 miles from its source before it cooled. This stream is of ancient date as is shown by the erosion the river has been able to perform in making a new gorge 100 feet deep through the flow. These lava streams, however, show no evidence of having been glaciated, and are considered as being of more recent date than the time when the glaciers starting from the summit reached the plain below; they are subsequent to the glacial epoch. Besides the two principal vents, there are numerous subsidiary ones. There is no history of eruption within memory of man.

Lassen Peak, the most recently active volcano in continental United States, is 10,453 feet above sea level at its summit and marks the terminus of the Cascades. The Lassen Peak district is crossed from northwest to southeast by a belt of volcanic cones about 50 miles long and 25 miles wide. The Cinder Cone is closely connected with Mount Lassen and shows at least two periods of eruption separated by a time sufficiently long to allow 10 feet of infusorial earth to accumulate on the ancient bottom of Lake Bidwell. The first period was one of explosive eruptions which formed the Cinder Cone and ash field; the second of quiet effusion of a large mass of lava. The whole aspect of the Cinder Cone is new, but the evidence demonstrates that the earliest eruption occurred before the beginning of the 19th century. Its age is shown by the relation of the old and new forest trees to the volcanic sand of the first eruption. The living trees grew on the top of the sand but the dead ones were standing at the time of the eruption and grew from the soil beneath the sand. This evidence was thought by Russell to show that the first eruption occurred some 200 years ago and the second more than 75 years ago. The most recent activity occurred 1914-1917 at Lassen Peak in the form of an explosive eruption. Ash was thrown out and large steam clouds were observed. The crater floor was upheaved, rough lava overtopped the rim, and an explosion hole 1,000 feet in diameter was formed. These eruptions were accompanied by blasts from the crater which leveled trees in their path.

The history of Mount Pitt in southern Oregon is similar to that of Shasta. It forms a beautifully regular volcanic cone which shows the remnant of a crater at the summit.

Mount Hood, 11,225 feet above sea level at its summit, is in northwest Oregon. Its summit retains only a portion of the crater walls. In 1888 it was reported that there were still fumaroles on the northeast slope and steaming rifts on the side near what is known as Crater Rock. Sulphurous fumes were very strong. A peculiar phenomenon was noticed in the occurrence of a fumarole in the deeply snow-filled crater. Mount Hood was reported in eruption in 1859 and 1865 (Jillson, Geog. Review, June 1917). A resident reports there was fume from Mount Hood the whole summer about 1886.

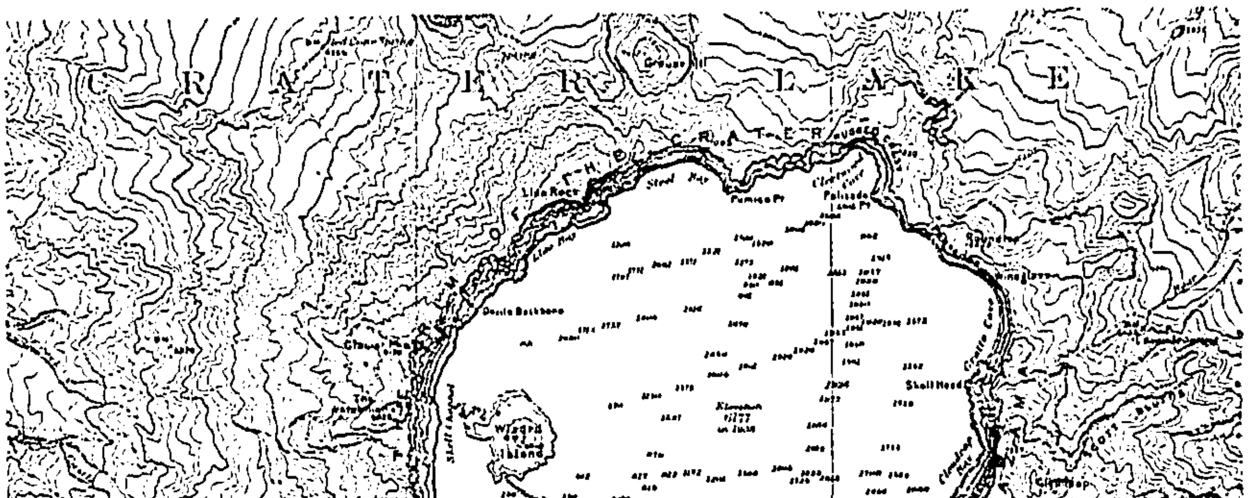
Mount Adams, 30 miles north of the Columbia, is deeply truncated at the summit and its slopes are scarred. It is very broad—possibly due to the great size of the original crater, or possibly to the blowing away of the top. Authentic history is unavailable, as it has not been much studied. It has radiating glaciers.

Mount St. Helens (9,671 ft. high) is of regular conical form, which suggests that it may be younger than Mount Adams. Reports of frontiersmen say that it was in activity in 1841-42. There is apparent from a distance the track of a lava flow which cut its way through the forest for miles. There is also discernible a lava flow northward for about 20 miles through the timber. This flow left many interesting tree molds in its path. When the last flow took place the lava appears to have passed over wet places or areas where the steam generated escaped at the surface leaving what are termed "blow-holes."

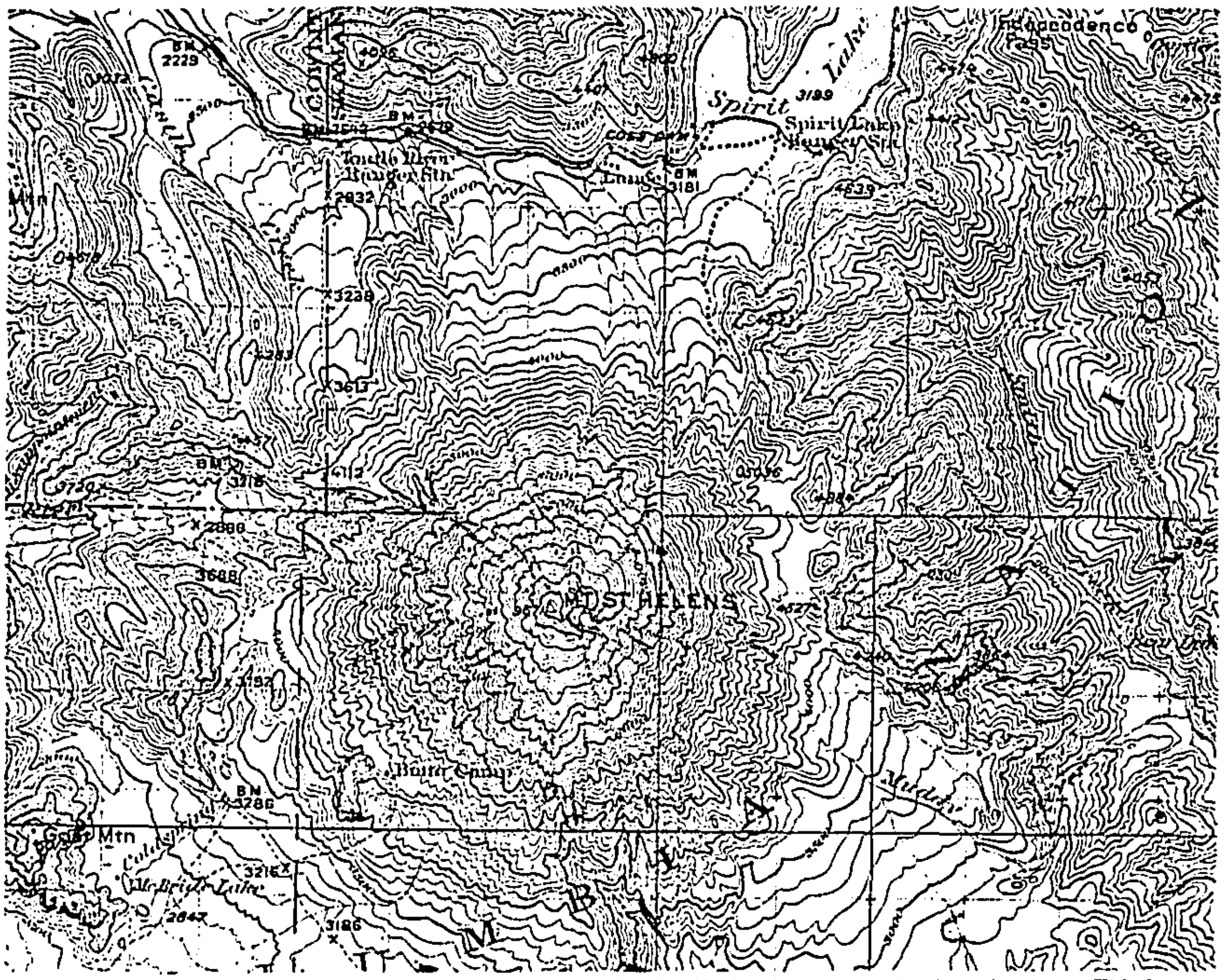
Mount Rainier has a bowl-shaped crater almost circular in form and now filled with snow. Adjoining it are the remains of an earlier crater in the interior of which the more recent one has built itself. There are exposed areas of black lava free from snow which show evidence of internal heat at no great depth below the surface. Countless small jets of steam and gas are present around the interior rim of the crater. No recent eruptions are recorded.

Mount Baker is the most northerly of the volcanic mountains of the Cascade Range south of the Canada line. (See Volcano Letter No. 334 for British Columbia volcanoes.) Little can be said of the history of Mount Baker. The summit is broken, whether due to erosion or volcanic explosions can not be said. Indians state that an eruption occurred about 1843 sympathetic with that of *Mount St. Helens*, and covered the whole country with ashes, and that the waters of the Skagit River became hot enough to cause the death of all the fish.

Thus the history of the great peaks of the Cascade Range proves to be that of active volcanoes, but now of very slight heat. The history is fragmentary and incomplete. (Largely after Russell.)



Map of the Crater Lake in Mount Mazama at Crater Lake National Park in Oregon, farther north than Mount Shasta. The west rim of this engulfment crater stands 8,156 feet above sea level, and the lake 6,177 feet. The greatest depth of water is 1,996 feet.



Map of Mount St. Helens in Washington State at the Columbia National Forest north of Lewis River. This is a volcano with a record of activity in historic time, elevation 9,671 feet, with radial glaciers, and radial lava flows which have dammed the drainage. Maps U. S. Geological Survey.

KILAUEA REPORT No. 1037

WEEK ENDING DECEMBER 6, 1931

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge

The bottom of Halemaumau remains unchanged, with one fuming sulphur spot and steam on the talus almost absent. Widening continues at a single northeast rim crack where the edge is evidently breaking down. Dust from an avalanche rose at the north rim at 9:08 a. m. December 6.

At the Observatory 24 volcanic tremors occurred, 4 of which indicated origin distances respectively of 2, 4, 46, and 53 miles. Three very feeble local seisms indicated distances of 9 miles for two of them, and 23 miles for the other. Microseismic motion in the middle of the week increased from strong to very strong, and tilting of the ground was moderate ESE.

THE VOLCANO LETTER

The Volcano Letter combines the earlier weekly of that name, with the former monthly Bulletin of the Hawaiian Volcano Observatory. It is published weekly, on Thursdays, by the Hawaiian Volcano Research Association, on behalf of the section of volcanology, U. S. Geological Survey. It promotes experimental recording of earth processes.

Readers are requested to send articles, photographs, publications and clippings about volcano and earthquake events, instruments and investigations, especially around the Pacific.

Subcription for non-members two dollars per year of 52 numbers. Address the Observatory.

HAWAIIAN VOLCANO OBSERVATORY
Founded 1911

This laboratory at Kilauea Volcano belongs to the Hawaiian Volcano Research Association and is leased and operated by the United States Geological Survey.

It maintains seismographs at three places near Kilauea Volcano, also at Hilo, and at Kealakekua in Kona District. It keeps a journal of Hawaiian volcanic activity and publishes occasional Bulletins.

Membership in the Hawaiian Volcano Research Association is limited to patrons of Pacific science who desire personally to aid in supporting the work.

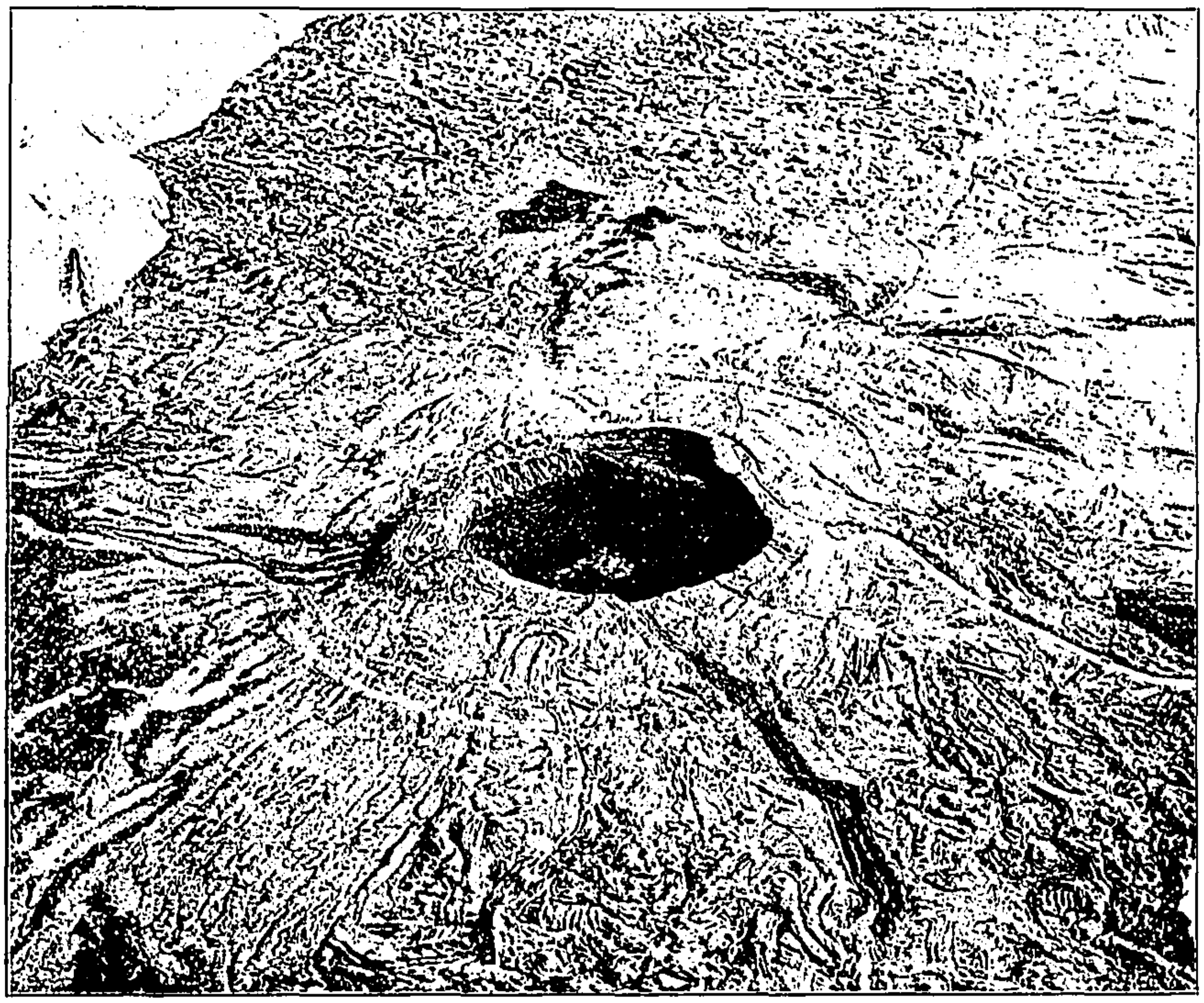
The work of volcano research so supported is in collaboration with the work of the United States Geological Survey, but supplements it with buildings, research fellows, instrumental plants, explorations and special investigations for which there is no governmental provision. The Geological Survey maintains volcano stations in Alaska, California and Hawaii.

Persons desiring application blanks for membership ($5.00 or more) should address the Secretary, Hawaiian Volcano Research Association, 320 James Campbell Building, Honolulu, T. H.

The Volcano Letter

Two dollars per year Ten cents per copy

No. 364—Weekly Hawaiian Volcano Observatory, National Park, Hawaii December 17, 1931



Kilauea Crater 1913 looking north. Showing detail of Halemaumau pit when 1,300 feet in diameter. The outer crack of the Postal Card Rift was the trace of the rim of 1894. There was a subsided shelf at the northeast, and huts were maintained at the north rim by the Hawaiian Volcano Research Association. Photo of Curtis model at Harvard University.

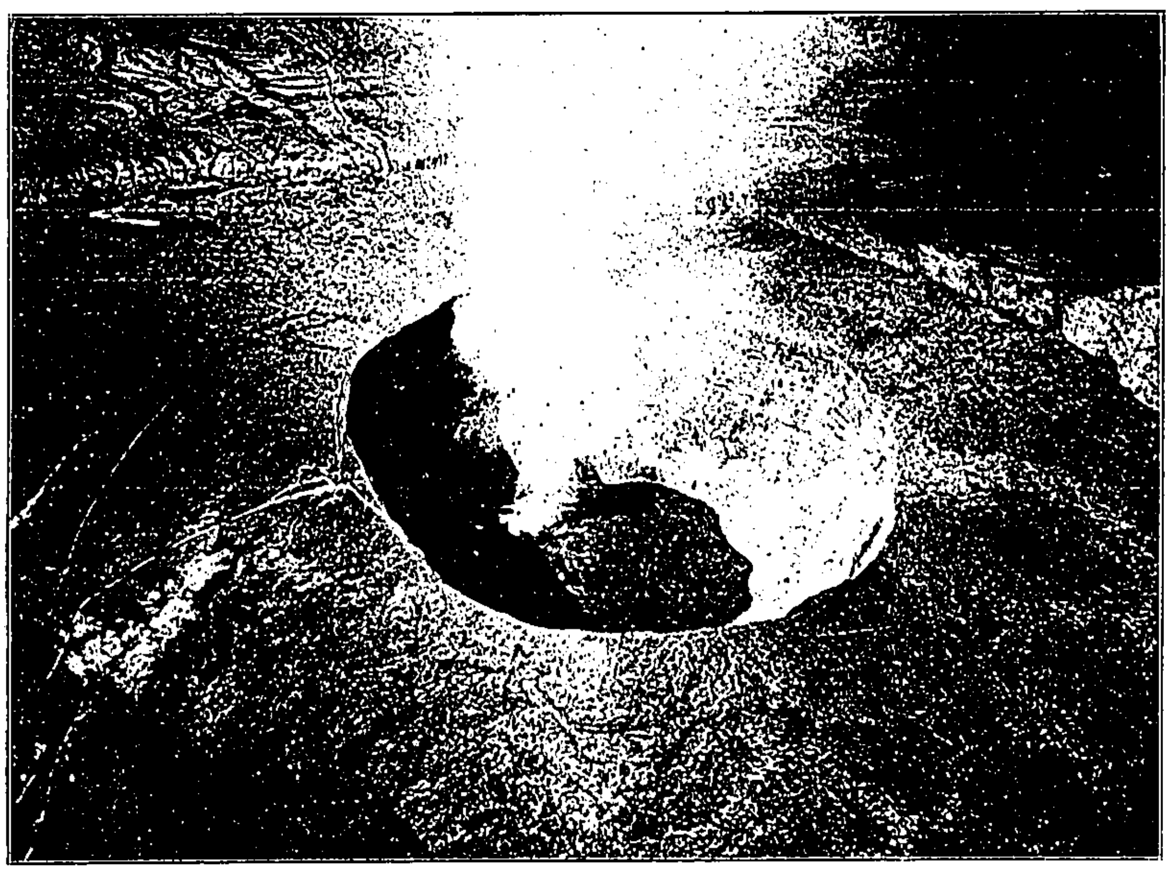
THE CRATER OF KILAUEA

The illustrations of this number are arranged to show the evolution of Kilauea Crater from 1913 to the present time. The cycle 1913-1924 (see Volcano Letters 319, 320, 325, and 326) filled the inner pit, overflowed its rim to build up the floor of the outer crater, and then withdrew the lava, and the inner pit was enlarged by collapse. This 11-year cycle marked for the island of Hawaii the end of a volcanic supercycle of about 132 years, which reached its peak of lava flowing in 1858, and thereafter declined in pulsations of less outflow for both Mauna Loa and Kilauea

Referring to the recently published pictorial review of the evolution of the summit crater of Mauna Loa (Volcano Letter No. 360), it was shown that Mokuaweoweo is the product of merging pits at the angle where two rift lines meet. In like manner the accompanying map indicates that Kilauea Crater has been enlarging by the merging of pits at the angle where two rift lines meet. The rift lines are the southwest Kau Desert cracks that produced the Mauna Iki flows of 1920 far down the mountain flank, and the Chain of Craters fissure that produced flank activities in 1922, 1923, and 1924. The Kilauea angle is almost a right angle shown at the north corner of Kilauea Crater and at the fault cliffs farther north back from the crater's rim. In both Kilauea and Mauna Loa we have to deal with a sector of the mountain flank that has collapsed about its tip at the mountain summit.

The inner pit Halemaumau is the vent that happens to be open near the tip of the sector for the present epoch of activity. Within the last century both Keanakakoi and Kilauea Iki have taken part in this emission and withdrawal of lavas that we call "activity." There were great collapses of Halemaumau in 1840, 1868, and 1886, and in the early part of the 19th century the greater crater of Kilauea was all a large pit with its bottom more than a thousand feet below where it is now. As shown in the contour map, Halemaumau at the peak of the recent cycle was

Airplane photograph of Halemaumau pit November 9, 1923, taken vertically with the sun at the east. The earlier pit had been overflowed in 1919, its rim built up, and then had collapsed to a longer diameter of about 2,000 feet. This diameter is approximately coincident with the Kau Desert rift line trending southwest. Photo 11th Photo Section from elevation 4,000 feet. U. S. Army.



Present pit of Halemaumau 3,500 feet in longer diameter, photographed from the air, looking west, November 25, 1930, during the new activity of that period tending to fill the bottom of the pit. The road terminus is entirely new and 700 feet back of the former one. Compare oval cracked area outside of pit to the south with the same in cut above. Southwestern rim of Kilauea Crater and Kau Desert cracks are shown. Photo Air Corps, U. S. Army, 11th Photo Section.

at the top of a new heap built up since 1886, which had overflowed extensively in 1894, 1919, and 1921. The cut on Page One shows the large outer circle of cracks which had been the pit rim in the early nineties, but was built up by the action of a smaller inner pit in 1894, until the inner heap had overflowed the outer rim, and all that remained of this earlier wall was a scar. The tendency of a building period to make the pit smaller is what may be expected through the congealing of lava on the older walls of collapse. The same thing happened between 1913 and 1919, the rim shown in the first cut became more perfectly circular and smaller, as shown on the map on Page Four, and the lip of the cauldron was built up about 30 feet, so that the pit was replaced by a heap, with lava lakes on top.

It will be observed in Cut 1 that two crescent niches in the rim of Halemaumau northeast and west were filled up and disappeared during the overflows of 1918-21 (compare map Page Four). In the same way there had been extensive niches and outlying small pits extending the Halemaumau of the decades next preceding 1894. These niches are the sites of subordinate pits that are formed by the rise and fall of lava up and down cracks extending from, and close to, a larger pit. The development of an outlying vent which is at first a crack leads to a concentric structure *about a vertical shaft, owing to the tendency of lava* to freeze in the narrower portions of the crack, and to enlarge the vent circularly in the wider portions. The remarkably perfect circularity of the structure reaches its best development in an active lava slag-pool within a surrounding bench of its own semi-cooled substance, where by pulsations up and down, the central shaft is finally shaped like a paste-tube, and the convectional circulation builds the marginal rampart equally at all points about a center.

We now come to the phenomena of subsidence illustrated by the two airplane photographs on Page Two. It will be remembered that the culmination of constructional overflow was in 1919, and that from 1920 on, the bottom of Halemaumau subsided strongly, while the lava which it had contained flowed out repeatedly from the flank of Kilauea Mountain. Again and again the lava in the pit frothed up to the rim or nearly so, one such rise making the spasmodic and tumultuous overflow of 1921. The overflow or outflow was each time followed by bigger and bigger collapse at the pit. This collapse was dominantly guided by the deep rift in the mountain to the southwest, so that the resultant enlargement of Halemaumau was to an oval in plan extending the pit in that direction. This is illustrated by the first of the two photographs, taken November 9, 1923, and showing the results of the tremendous subsidence accompanied by avalanches which in May 13-27, 1922, enlarged the pit from a maximum diameter of 1,400 feet to 2,000 feet. The floor of Kilauea just outside of Halemaumau to the southwest had been heating, fuming, building cones, and flowing from cracks for four years. It was undermined by tunnels along the line of the Kau Desert rift, and the largest portion of these tunnels, close to the pit, caved in and engulfed a crescent of rim rock, as shown in the picture.

An object of great interest in this picture is the three-armed lake of lava, which was building up the inner floor in the autumn of 1923. An island stands at the meeting point of the three arms. This clover-leaf arrangement of the inner lakes had happened repeatedly during many years prior to this time. It appears to mark a tendency of the inner heap to fracture by tumescence into three sectors, and there is some reason to suspect that the larger domes of Kilauea and Mauna Loa have tendency to a similar breakage. Thus about the Mauna Loa center there are cracks to the northeast, the southwest, and towards Hualalai; about the Kilauea center there are cracks to the southwest, to the east, and towards Kulani north, (a cone in the forest between Kilauea and the northeast rift of Mauna Loa).

The second airplane photograph of Halemaumau, taken November 25, 1930, again during a period of activity of the bottom, exhibits the enormous pit left by the explosive engulfment of 1924. This is also an oval, its greatest length determined underground by the Kau Desert cracks, which appear in the background. It has now become 3,500 feet long, and a very striking feature of this picture is the tendency to concentric rim cracking, shown especially at the left by faint lines of black close to the rim of the pit, these cracks showing clearly the effort of nature to make a perfect circular funnel. This is the more remarkable as the rock which is so breaking is more than 700 feet back from the edge shown in the upper photograph. This enlargement will be realized if the reader will compare the irregular elliptical broken area of the outside lava surface at the south, which in the picture of 1923 lies away from the rim, and in that of 1930 is on the rim. The road terminus of 1930 is entirely different and far to the left of the road loop shown in the 1923 picture. This older loop would now lie far inside the pit, if it were redrawn on the photograph of 1930. The tendency to circularity by collapse, like the tendency to circularity by upbuilding, must be occasioned by a highly centralized shaft.

This picture of 1930 shows the inner dome of the Kilauea floor surrounding Halemaumau pit, and this dome expresses not only the overflows of the peak of the cycle, but also the tendency to swelling which had been characteristic of that time. This tendency to swelling is also a characteristic of the larger volcanic edifice, and its measurement with tilt instruments is one of the most fundamental scientific procedures for interpreting what is going on inside a volcanic mountain.

The history of pulsations of rising and falling lava, as creating a constructional smaller pit of effusion, and then a destructional larger funnel of subsidence, and this within a short cycle of 11 years, is indicative of the larger process that has made the greater craters through larger ages of activity. The crescent niches at the border of Halemaumau, in the pit of 1913 and the pit of 1923, are closely imitated in the lunate platforms of the Mauna Loa crater, and the two similar ones at the northeast (Sulphur Banks flat) and southwest ends of Kilauea Crater. To such extent as the Mauna Loa niches represent outlying lava pits, they are like Keanakakoi and Kilauea Iki outside of Kilauea at the east. There is a tendency for the walls of the Halemaumau funnel to assume at times a rounded pentagonal outline in plan; the same thing is true of the general plan of Kilauea Crater, and of the inner cauldron of Mokuaweoweo. All of these features are also characteristic of many of the craters on the moon, so that to a volcanologist there is no appeal in the impact theory of lunar craters. T.A.J.

TILTING OF THE GROUND FOR NOVEMBER

The following figures show the net amount of tilt by weeks at the Observatory on the northeast rim of Kilauea Crater and its direction, computed from the daily seismograms by platting a curve smoothed by overlapping seven-day averages. This is the departure of the plumbline in seconds of arc, in the direction given.

November 2-8	2.3 seconds	NE
November 9-15	0.7 second	ESE
November 16-22	1.2 seconds	ENE
November 23-29	1.0 second	SE

E.G.W.

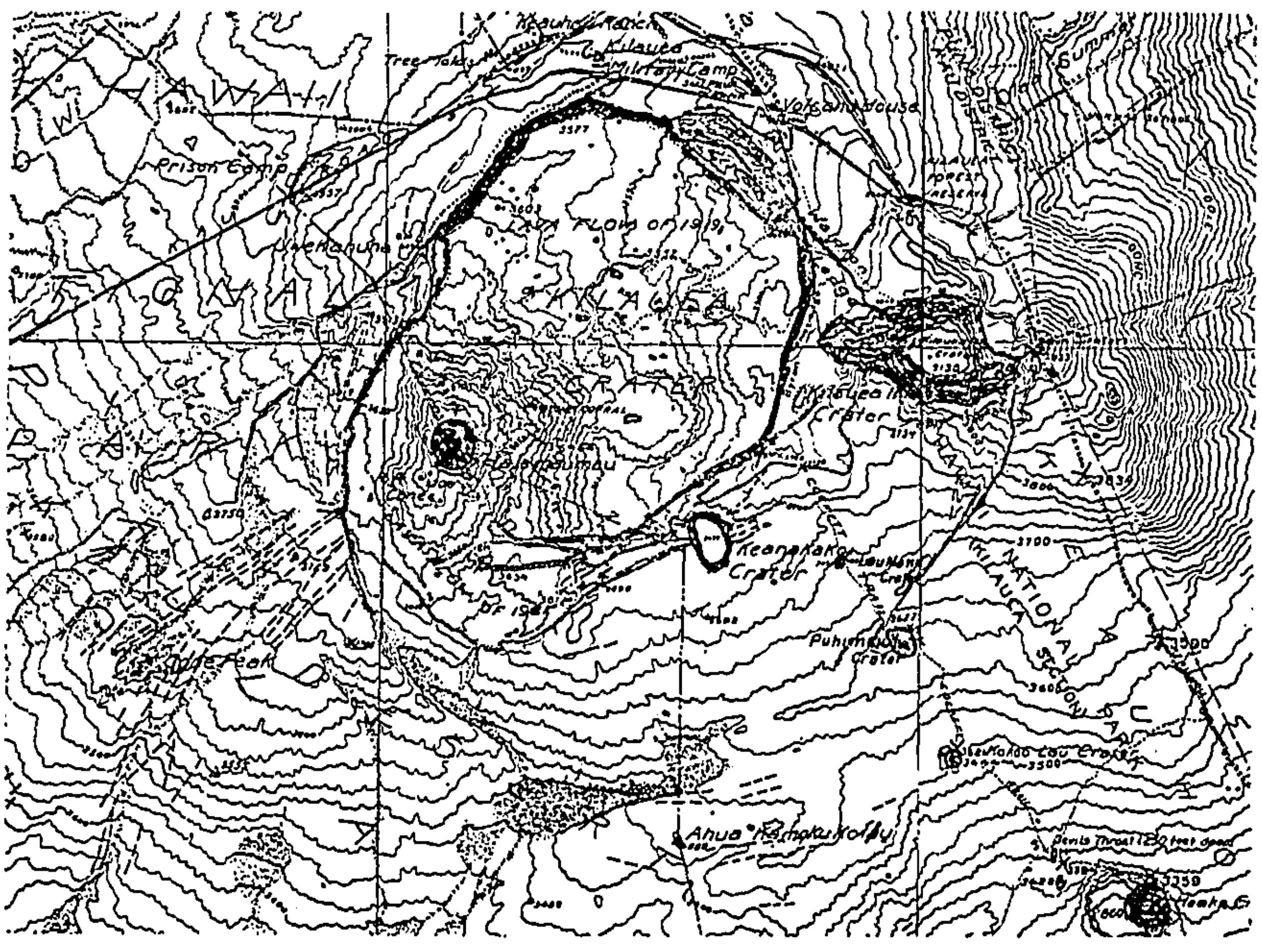
KILAUEA REPORT No. 1038

WEEK ENDING DECEMBER 13, 1931

Section of Volcanology, U. S. Geological Survey

T. A. Jaggar, Volcanologist in Charge

On December 7 at 9:50 a. m. there were the usual steaming cracks about Halemaumau pit and on the Kilauea floor which are always seen during damp and cool weather. The fume at the principal sulphur patch on the bottom of the pit appeared denser and rising in puffs. The crack No. 25 at the northeast rim of the pit, which has recently widened, with subsidence of the block on the inner side of it, showed further widening as did other cracks. A small slide fell here at 10:06 a. m. At 3:30 p. m. this rim block fell completely and made an avalanche. A block of the rim fell in from 100 to 150 feet long and from 1 to 20 feet wide. New cracks appeared in the ash for 250 feet



Map of Kilauea Crater, U. S. Geological Survey, showing Halemaumau August 13, 1921, prior to the first collapse and enlargement shown in Cut 2, but after the overflows which had obliterated the conditions of Cut 1. The lava flow of 1919 had filled north corner of Kilauea Crater about 60 feet, and the lava flow of 1921 had filled the south corner and slightly overflowed through a gap as shown by dotted line. From the Postal Card Rift (Cut 1) had arisen flows to the north which created the Postal Caverns. The hot cracks had originally been used by tourists for browning postal cards.

to the north but not to the south. Several small slides were observed after 4 p. m. at the northeast wall, and fresh bowlders lay on the northeast talus. The perceptible earthquake of 10:20 a. m. December 8 dislodged three slides, respectively SW, SE, and NE of the pit, the last the largest. The quake was perceptible at the SE pit rim as a NW-SE swaying. On December 10 in calm weather the fume from the sulphur spot on the bottom of the pit rose in sufficient volume to be seen from a distance rising above rim of pit. This had diminished December 12. After the slides of December 8 the crack widening ceased and some cracks showed a slight closing.

The seismographs at the Observatory recorded 57 disturbances, including twice as many tremors and three times as many small earthquakes as occurred in previous weeks. There were 46 volcanic tremors, 9 very feeble shocks one of which was felt, 1 feeble shock at 12:30 p. m. December 13, and 1 moderate earthquake 10:22 a. m. December 8 that dismantled instruments. This indicated origin 14 miles from the Observatory and persons near Mauna Iki in the Kau Desert reported noise seemingly from Mauna Loa progressing underfoot, and rocks were heard falling down cracks. The tremors indicated origin distances of 6, 9, and 14 miles, the other earthquakes distances of from 9 to 23 miles. Microseismic motion for the week was moderate, and tilting of the ground was light NE.

THE VOLCANO LETTER

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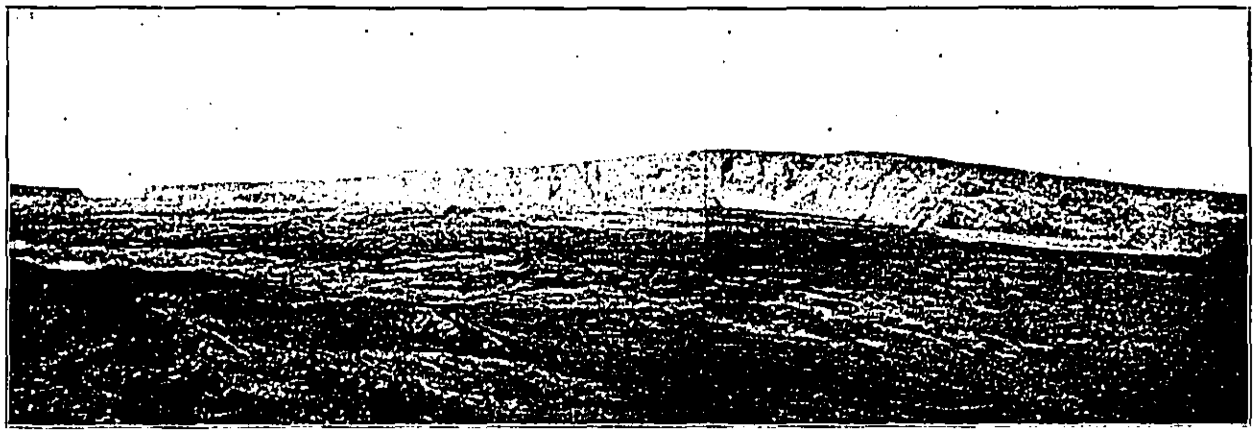
The Volcano Letter

Two dollars per year Ten cents per copy

No. 365—Weekly Hawaiian Volcano Observatory, National Park, Hawaii December 24, 1931



Mokuaweoweo Crater December 1, 1931, looking southwest from the rim salient between it and the northeast embayment. The smooth lava in the left foreground is the floor of the crater, described in the text, which broke out years ago simultaneously with one on the rim behind the camera. Photo Doerr.

SUMMIT OF MAUNA LOA 1931

Through the courtesy and cooperation of Superintendent Leavitt and Chief Ranger Christ of the Hawaii National Park, two members of the Volcano Observatory staff were enabled to make the ascent and spend two nights at the summit of Mauna Loa observing volcanic conditions and making preliminary geologic investigations. As no Observatory party has been to the summit crater since R. M. Wilson's trip in 1927, and as the close of one of Mauna Loa's four and one-half year cycles has passed (the last activity being in the spring of 1926), and renewed activity may be expected at any time, it was deemed advisable to make an inspection at the present time before the winter snows set in.

The party which left the Park headquarters at 6:10 a. m., November 30, 1931, was composed of Naturalist Doerr of the National Park, in charge, Powers and Wingate of the Observatory staff, and Rangers Brumaghim and Lee of the National Park. The party went by automobile as far as the Ohaikea tanks, where Levi, packer and guide, had the riding horses and pack animals ready for the trip. Chief Ranger Christ was on hand to superintend the start.

The path from Ohaikea leads across country for about a half mile where it joins the new Park trail, from Brown's ranch and the Bird Park, to the summit. The new trail as far as the Rest House at Puu Ulaula is an excellent one, crossing two tongues of the Keaumoku flow and continuing upward through lovely, grassy glades and groves of koa, mamane, and ohia. Ohelo, aalii, and pukeawe are shrubs which are found in abundance. The stone wall marking the upper boundary of the Kapapala grazing lands was passed at 9 a. m., and from that point the vegetation quickly thins out. At the Rest House, elevation 10,000 feet, which was reached at noon, only a little scattered grass and some stunted ohelo and pukeawe are to be found.

Rangers Brumaghim and Lee left the party at this point to make camp at the Rest House for several days while marking the upper part of the trail. The rest of the party, after a short rest for lunch, continued on to the summit which was reached at 5 p. m. Camp was made in the "Hotel de Jaggar," a partly collapsed lava tube on the northeast rim of Mokuaweoweo. The guide returned to the Rest House with the animals which he reached about 8:30 p. m., after a trying trip in the dark.

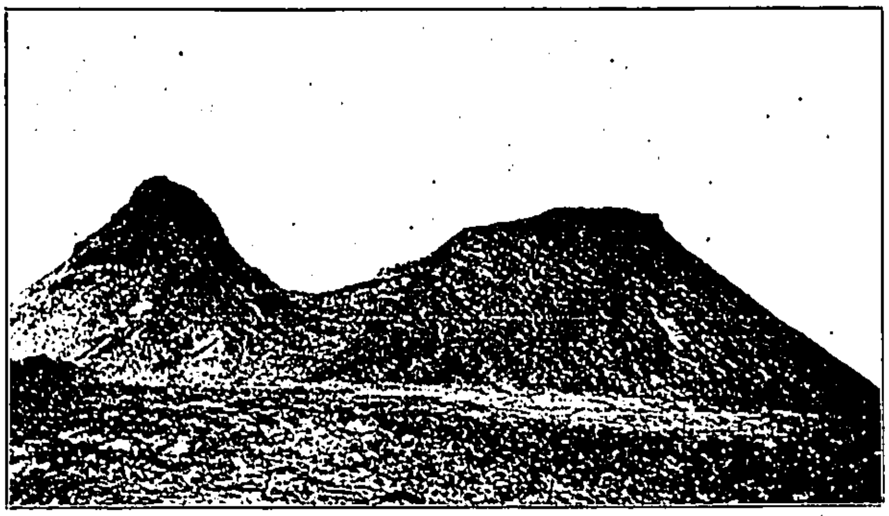
The "Hotel de Jaggar," which has been used for a camp by parties staying overnight at the crater, and by Wingate's topographic party in 1925, was found in rather shabby condition. No attempt at policing the camp apparently had been made for some time.

Due to lack of precipitation on the mountain in the last few years, cracks which held a quantity of ice in 1925 were nearly dried up and such moisture as remained was frozen solid to the bottom. An ample supply, however, was chipped out with a small pick and melted over the fire, for water for the party.

The topographic party in 1926 and 1925 used two small, one piece, kerosene stoves for cooking at the summit camp. On the present trip, charcoal was carried up for fuel and readily proved its superiority, being much easier to pack, and making a more even fire for cooking, as well as being cleaner and less offensive.

December 1 was given to an exploration of the east side of the north embayment, and along the east rim of Mokuaweoweo as far as Wilkes camp ruins, from which point the return to camp was made by following the outlying fault cracks which parallel the east rim of the crater. The party had intended to continue to the south end of the crater, and the head of the upper 1926 flow, but the sky, though clear until noon, had become overcast and threatening, and by 2:30 p. m. snow was falling. During the rest of the afternoon and the evening of December 1 about three-fourths of an inch of snow fell.

The observations made, from a volcanic standpoint, show some changes since 1926, but nothing significant was



Hanalei Peak December 1, 1931, one of the huge cones of frothy lava and slag built up along the northeast rift by the fountains at the source of one of the recent "rift flows." Photo Doerr.

noted. The principal change appeared to be the shifting of the main fuming area from the central part of the crater, in the vicinity of and to the west of the cones of 1903, to the area of the main cone of 1914 in the southwest part of the crater. This cone was steaming strongly and considerable fume was visible at the sunken area west and south of it, and along a few cracks to the east. On the northwest part of the sunken area west of the cone, new patches of sulphur have appeared which are brilliant yellow in color. Steam appeared over this entire area.

Some steam and a little fume were visible in the central part of the crater, which Mr. Doerr said was less than on his visit of November 10 of this year.

Steam along the northeast rift appeared in about the same places and amount as in 1926. Three spots on the floor of the northeast embayment were seen steaming in cloudy weather, and steam appears at one point on the south lunate platform.

As a base for reports by future visitors, a map was prepared showing the locations of the above points with the approximate strength of steam and fume recorded, based on the assumption that very voluminous fume might become visible from the Volcano House, 22 miles away, on a clear day. It is hoped that by this means some check may be kept on visitors' data at the summit crater.

A number of striking geological formations were hurriedly examined. The trail approaches the northeast end of the crater for the last quarter mile over a very shelly pahoehoe flow, which is mantled with khaki-colored pumice and lava froth. The pumice was formed by lava fountains in the northeast rift from which the lava was extruded. This surface flow was formed before the northeast embayment of the crater had reached its present size and shape. It is plainly seen that the walls of the crater are being extended by cracking and slumping of the lava at the edge, and the blocks of wall, which have dropped down most recently, are made up of the same pumice-covered pahoehoe which forms the rim. The floor of the northeast embayment is covered with younger lava which laps up on, and partly buries, some of the huge blocks which have fallen in from the wall. The southwest wall of the northeast embayment slopes rather gradually in its upper part, then is cut off sharply by a cliff down to the lava floor. A small gush of lava has broken out through the loose blocks of the sloping part of the wall and flowed down into the crater. However, this flow is cut off sharply at the cliff. Apparently this small side flow poured out at a time when the crater was filled with lava to the level of the top of the present cliff. Since then, the whole floor of the embayment has sunk many feet, leaving the small feeding flow suspended far above the present floor.

In the southeast side of the northeast embayment is a pit almost circular in shape, much like Halemaumau only a great deal smaller and a little over a hundred feet deep. This pit does not appear on a map of the crater made in 1872, but is shown on one drawn in 1885 (see discussion by T. A. Jaggar in Volcano Letter No. 360). On the east wall of this pit are several patches of cascade lava, remnants of a large lava fall which spilled over the east rim into the pit. This pahoehoe flow came from several large cracks in the outer rim of the main crater about a half mile to the south, and at 200 feet higher elevation. The lava poured out from the cracks, flowed north down the steep slope till it reached the northeast wall of the northeast embayment. Here it piled up high on the wall, then spilled over westward into the small pit. As the lava flowed into the pit, the level of the pond receded about 20 feet, leaving a "high lava mark" of crust and splash along the northeast bank. Part of this same flow tumbled westward over a 200-foot cliff into the main crater. At the same time that the flow was pouring out of cracks on the top of the rim, another flow with its fountains was pouring out from cracks in the sloping floor of the main crater 200 feet below and almost beneath the fountains of the rim flow. The lavas from the two vents, one 200 feet above the other, flowed together on the floor of the main crater. This same strange phenomenon took place in the 1851 eruption from the southwest side of the main crater, only here the difference in elevation, between the floor fountains and the rim fountains was over 300 feet.

While at the summit all of the party suffered from severe headaches and to a slight extent nausea, possibly in part due to charcoal fume.

The lowest temperature recorded on the trip was 22° F at 6 a. m. on December 2.

Very few goats were seen either on the ascent or descent. The descent was made without event, though rain fell over most of the region below the Kapapala stone wall. Park headquarters was reached at 6:30 p. m. December 2.

E.G.W. and H.A.P.

KILAUEA REPORT No. 1039

WEEK ENDING DECEMBER 20, 1931

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge

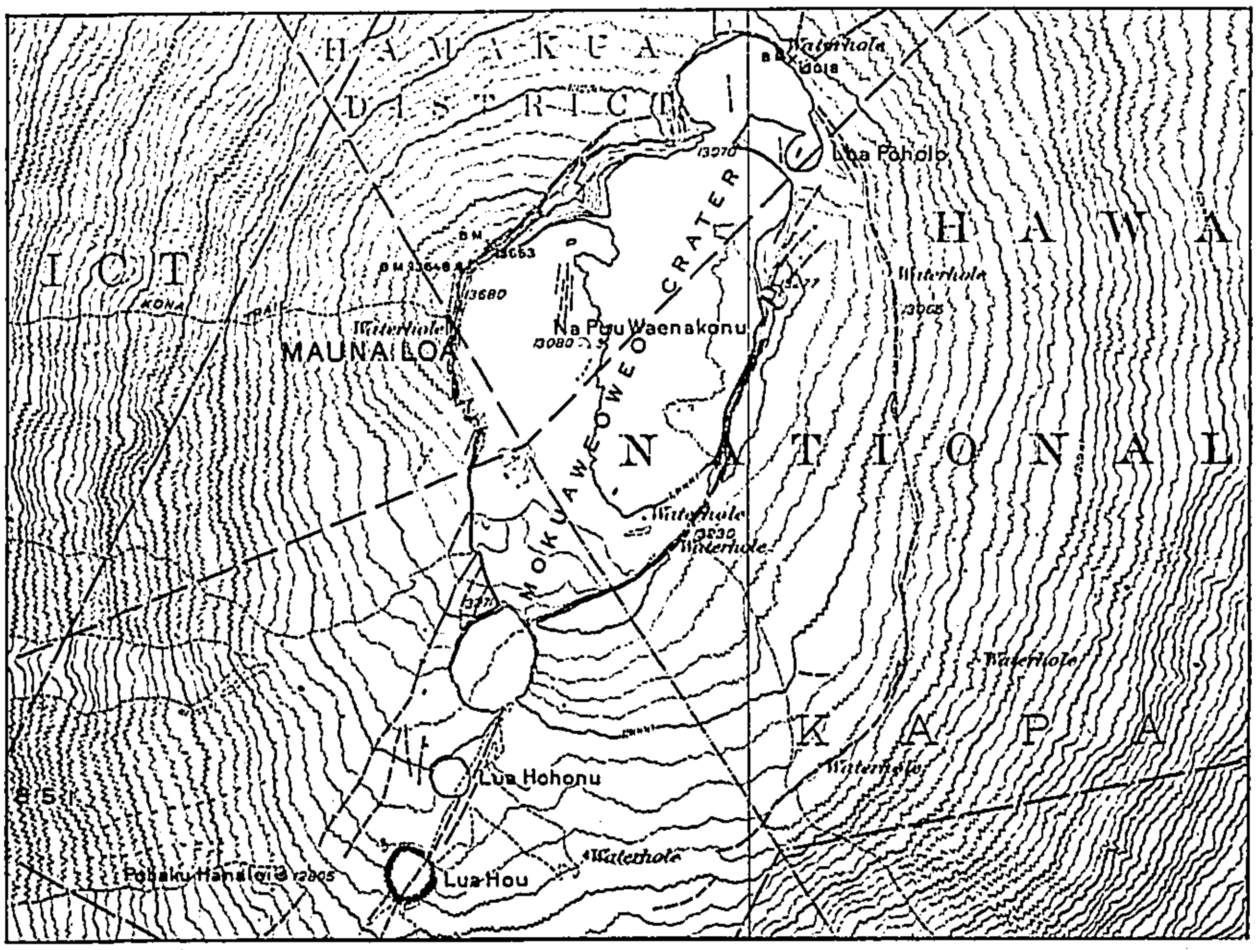
Halemaumau pit remains stationary and inactive and the increased seismic activity of the previous week proved temporary. At the pit a few rocks were heard falling at the northwest wall at 9:55 a. m. December 14. Crack measurements showed a decrease of width SE, and slight widening E and NE. Crack mark No. 25, which recently showed excessive widening, is now stationary. A noisy avalanche was heard at 4:10 a. m. December 16, and subsequent inspection of Halemaumau showed fresh debris on NE talus. There were other fresh scars on the walls NW, S, and SE. Crack measurements showed no change in the rim.

During this week the Park force has excavated a new seismograph cellar near Halemaumau and construction is in progress.

Thirty-four seismic disturbances were registered at the Observatory, of which 28 were tremors, and 6 were very feeble earthquakes, of which four indicated origin distances of 4, 9, 14, and 18 miles. The last at 10 minutes past midnight the morning of December 16 was felt at Kapapala Ranch. Its duration was approximately 15 seconds and its estimated origin distance agrees with the ranch distance within a mile.

Microseismic motion was heavy December 14-16, moderate to heavy December 17-19, and very heavy December 20. This was probably due to heavy *seas on the Hamakua* cliffs. Tilting of the ground was moderate ENE, with increase and change to the east beginning December 16.

Hotel de Jaggar, the collapsed lava tube which is used as a camp by parties staying at the summit. The "bedroom" extends back about 20 feet behind the men in the "kitchen." Photo Doerr, Dec. 1, 1931.



Map of Mokuaweoweo, the summit crater of Mauna Loa, by E. G. Wingate, surveyed in 1925-26, U. S. Geological Survey.

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The Volcano Letter

Two dollars per year | Ten cents per copy

No. 366—Weekly | Hawaiian Volcano Observatory, National Park, Hawaii | December 31, 1931

The outporing of lava November 19, 1930, which prepared the floor for the eruption of December 23, 1931. The bright fountain at the left built a big cone, and the high half-dome against the talus at the back was the grotto of 1929. The new crack of 1931 extends straight across the middle of the floor between these two, and the new fill covers all of what is here shown by about 100 feet.

JOURNAL OF HALEMAUMAU ERUPTION DECEMBER 23 27, 1931

There is much about this eruption identical in character with those of 1927, 1929, and 1930, each of which tended to add 50 to 60 feet to the bottom of the pit after the lava had shrunk and solidified, and each tended to break out along a crack either diagonally across the former floor or tangentially along the former edge of the floor. The duration of these eruptions varied from a day to three weeks; it is quite in order for such an eruption to develop increased violence of fountaining even when it is dwindling, as the spurting fountains are indicative of clogging vents.

There has been a series of events pointing to the coming of this eruption. The interval average for seismic and volcanic crises in Hawaii during the last 20 years has been one year, and the average of outbreaks of Halemaumau since 1924 has been one a year. The last outbreak ended December 7, 1930, so that now an eruption was expectable. The tilt instrument near the southeast edge of Halemaumau has shown 50 seconds of tipping of the ground away from the center of the pit since the last eruption, suggesting upward pressure. The tilt instrument at the Observatory on the northeast rim of Kilauea Crater has shown tilt away from the crater center of 5.4 seconds to the northeast between November 30 and December 20, 1931, suggesting upward pressure in the mountain. Finally came the rim block avalanche on the northeast edge of Halemaumau December 7 and the excessive number of seismic disturbances for the week ending December 13, 1931, followed on December 23 by the smart local earthquake in the forenoon that left 15 scars of avalanches on the big west bluff of Kilauea Crater, and left the walls of Halemaumau pit continually sliding for hours. This was undoubtedly the actual rending asunder of the inner heap which constitutes the floor of Kilauea Crater.

December 23.

When the dust cleared after the earthquake of 10:38 a. m., Wingate saw that avalanches had fallen around the northern walls of the pit, scattering debris and dust on the 1930 floor. There were scars on the walls and in some places rim rock had fallen, while 15 whitish scars on the great west wall of the big crater marked places where avalanches had fallen. Before the earthquake the rim cracks measured had shown no opening and the sulphur patches on the 1930 floor shown no fume, this being attributed to dispersal by strong northeast wind. After the earthquake there was no visible increase in fume. Sixteen crack points on the edge of Halemaumau were measured and showed increases in width up to more than an inch in places. A large block on the east rim had moved as a whole, and fresh cracks in the dirt appeared along the north, east, and south rims. Small slides were continuous for hours. After 2:15 p. m. six large slides were counted *in 20 minutes*. About 2:40, when he was working at surveying stations back of the rim, Wingate heard a low, rumbling noise not like an avalanche. He ran to the edge, where heavy fume clouds had already reached the rim level and were spreading about the interior of the pit. The whole floor was rapidly cracking open along a straight line athwart the middle of the bottom beginning at the southwest under the rift tunnels. Lava fountains there started up and spread to the northeast along the crack. Voluminous fume followed immediately after the first cracking, and the molten lava appeared following the fume. The whole time consumed for the break was probably less than half a minute. It was just at this time, 2:36 to 2:39 p. m., that the seismographs at the Observatory showed sudden development of continuous harmonic tremor from slight to strong.

Wingate reported visibility bad, but the botttom crust appeared rather to be pulled apart than to be heaved up and broken. There was undoubtedly tumescence. He was in imminent danger of asphyxiation, but went to the Park phone and could get no answer. He returned to the rim for a few seconds and saw spatter from the fountains blown high over the rim wall. Some of this from later fountains has been collected, light brown basaltic pumice like the "thread-lace scoria" of the Kilauea Iki region, and like the first ejecta of the Mauna Loa cones. Hasty count showed him 17 large fountains with the two strongest at the northeast end of the crack across the bottom of the pit. Then he ran for his car, badly gassed, and succeeded in escaping to the Keanakakoi sandspit where the air was clear. The sun was obscured for a time, appearing as though viewed through smoked glasses, bluish over the pit against a dark background, and reddish brown in transmitted light where it blew away and was seen against the sky. This was the first time that a scientific observer here watched details of first outbreak inside the pit, and it will be remembered that it was Mr. Wingate's party, engaged in topographic surveys, that was camped nearest to the place of summit outbreak on Mauna Loa in 1926.

The outbreak at the Observatory was observed by the change from rising dust to rising fume, and by the sudden development of harmonic tremor at the instruments. Also there was sudden change at the time of the earthquake in tilting of the ground from northeast to south.

At 4 p. m. the volume of fume rising was greater than in any recent eruption since 1924, and the eddying tornado effects due to convection from the large number of fountains, including the four enormous dome fountains at the north end of the bottom crack, coupled with the high wind from northeast, submerged the road terminals under clouds of sulphur dioxide. The fume and grit were bad on the roadway from Uwekahuna to leeward of the pit. From the north lip of the pit about 30 fountains were counted making a great roar, in a nearly straight line, after darkness began to fall between 5 and 6 p. m., but the seeing was poor. There was already a great lake with bright lines between the skins, spreading out over the whole of the inner mound of 1930 lava. At 4 the glowing froth had been seen flowing away from the fountain line, at 5:30 it was already a flat lake covering the irregularities of the 1930 floor. Therefore the volume of inflow in the first three hours was enormous. The poisonous blue fume tended occasionally to spread in a low layer to the eastward, so that it was necessary to make a wide detour. A fortunate photograph at 7:30 p. m. by Higashida showed four large fountains at the corners of a square under the northeast sill, with a small fountain in the middle, and a grotto fountain against the bank, while the line of smaller fountains extended southwestward across the middle of the lake in the line of the two eastward big gushers of the square. The crack proved to be very slightly offset to the west from the rift tunnels in the southwest Halemaumau wall. The inward convectional draft was from the north and west, and the brown clouds boiled up and rolled off over the desert to the southwest and southeast. Spurts from the big fountains were probably several hundred feet high, but they could not be measured. Pellets of pumice and Pele's hair fell to leeward. The line of smaller fountains were partly merged, and partly isolated, and there were some outlying fountains, with concentric patterns of bright lines clear to the edges of the big lake. where there were outward-pushing toes and some minor grotto fountaining. The illumination at night was so brilliant that every detail of the ground could be seen by pedestrians.

December 24

At 2 a. m. the amplitude of the continuous tremor diminished to about half, and at 5 a. m. increased slightly, and thereafter continued. This was the index of the cessation of the big northeastern fountains. At 3 a. m. Powers reported the fountaining almost stopped except for a few bubbling spots along the rift line. The bright-line pattern of the lake surface extended to the edge of the new fill. The liquid lava had reached the rock cliff, covering the low talus NNW. Both 1929 and 1930 spatter cones appeared to be covered.

At 10 a. m. the botttom appeared to be a continuous leaf-shaped lake with nearly flat floor, the line of fountains making a short belt of big domes southwest of the center. This was extended by small bubble fountains in both directions, ending at the southwest in a small grottto fountain at the bank which was increasing in size. There were traces of crust islands at the southeast about where the 1930 cone had been. The shore line of the lake had made a nearly continuous rampart of congelation and piled crusts, interrupted at one place between the northwest and west taluses where the liquid lava appeared to be nearly against the rock wall. There was a cross line of small fountains, nearly straight and at right angles to the main fountaining line between the central group and the southwest grotto. There was another straight line of fountains parallel with the central line across the northwest part of the lake. The crust nortwestward from the central fountains showed a pattern like a flow or belt of streaming. Small islets were forming in front of the southwest grotto, and the central fountains showed signs of migrating southwestward during the day. There were concentric skins of pahoehoe pattern. The northwest edge showed some cliffs in the rampart facing inward. The southeast edge showed toes of flowing through the rampart. The brightness at night was moderate.

December 25

At noon the nature of the activity was in general as before, but the gas pressure at the fountains was increasing and there was apparent a change in the cross line of small fountains to become the arc of a circle concentric with the lake instead of a straight rectilinear belt. The southwest border fountain was building a higher grotto against the talus, bright lines were radial from this grotto, and there was a clifflet or infacing scarp along the northeast rampart. Rapid moving puffs of blue fume rose up the west wall from the fountains. The liquid lava about the central fountain belt made slow waves outward. The fountaining waxed and waned, some individual spurts going up 200 feet during a time of high pressure, and the noise was like surf on rocks. There was a fine-meshed pattern about the central fountains bounded by a U-shaped curve of contact to the southwest with a broad horseshoe of coarse-meshed bright lines extending from the southwest grotto as a center away to the east and west so as to envelop the central more liquid pool. It was evident that the northeastern region was cracking and solidifying so that the rampart belt was widening inward, and measurements later proved that the southwest was becoming a center of elevation with individual pools about the several fountains. and these tended to stream and make overflows northeastward, over something that was solidifying below. The lake was definitely against the WNW wall of the pit, without any rampart.

December 26

At 9 a. m. a new fountain had developed to the northeast of the elongated central belt, and the southwest grotto was now dominant with a large crescent niche behind it built against the talus. The lake edge was here irregular. At noon it was apparent that the northeastern fountain was sending streams radially outward to the northeast and that the central fountains occupied the most liquid portion of the floor with a fine greenish pattern to the skins. This area was a thick crescent with two horns northward. The big strong fountains of the southwest grotto had built up a high canopy of spatter on the bank, a crescent wall with overhang which broke down from time to time and immediately built up again. A coarse bright-line pattern extended out to the north and east from this grotto with a surface in daylight like black satin. The central fountains were smaller and more separated. There were fresh overflows between the rampart and the talus at the east.

December 27

Measurements by the Observatory engineer on this day showed that lava covered the top of the 1930 cone to a depth of 50 feet, and the depths of the new covering on the irregular relief of the 1930 mound were as follows:

West Bay, 85 feet
North Bay, 96 feet
Northeast Bay, 98 feet
Southwest Bay, 115 feet

As there are shallower places over the big 1930 cone, the average depth of the new fill was about 90 feet, its size 2600 feet long northeast-southwest and 1950 feet wide, covering an area of about 80 acres. Its volume is estimated at 260 million cubic feet, which would amount to some 20 million tons. If this had been distributed over the interval from the beginning it would mean about 45,000 cubic feet per minute from all the vents. The height of lava lake above sea level at southwest grotto was 2773 feet, making the depth of the pit from the southeast rim 971 feet.

At 10 a. m. December 27 fountaining was more violent and the lava from the central group of fountains had encroached on the southwestern crusted belt and on the northeast fountain pool. The later was fountaining steadily but with decreased strength.

At 3 p. m. the northeast margin of the floor for perhaps one eighth of the area had become bench lava. Marginal overflowing was active SE and N. The southwest horseshoe lake was feeding flows at the edges, and the middle lake was spilling over a bench magma slope at the northeast. At 5:30 p. m. the northeast fountain was making only a sluggish gushing, but the southwest grotto had become a very powerful continuous fountain with a high grotto behind it, and this was beginning to develop the true Mauna Loa type of spraying jet. Detonations now accompanied some of the viscous bursts of the central area.

At 11 p. m. the southwest fountain was sometimes 400 feet high, overflow continued southeast, the lake was shrinking, and gas bubbles burst with loud reports. T.A.J.

KILAUEA REPORT No. 1040

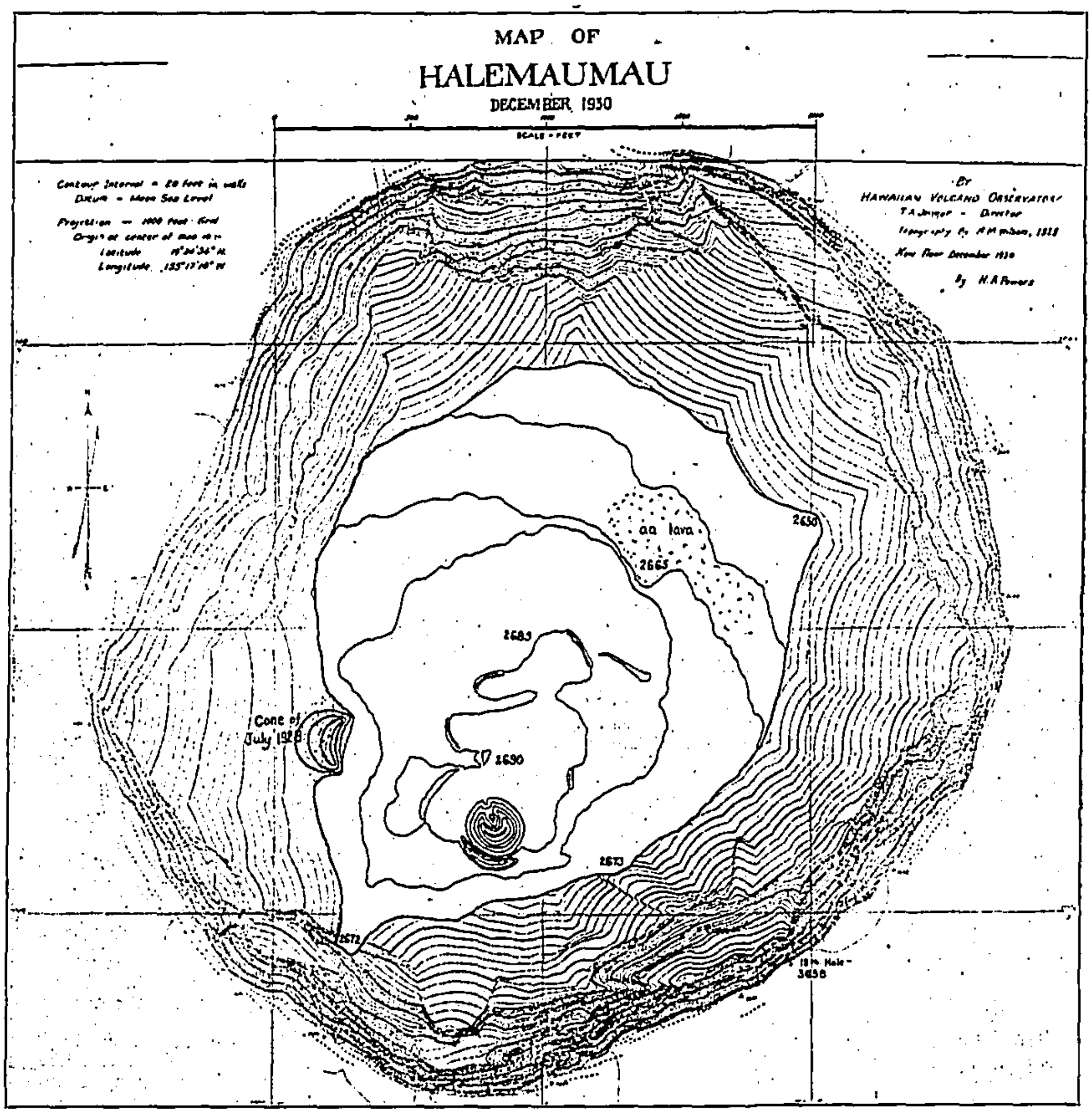
WEEK ENDING DECEMBER 27, 1931

Section of Volcanology, U S. Geological Survey
T. A. Jaggar, Volcanologist in Charge

The past week has produced a new outbreak of lava in the bottom of Halemaumau pit about 2:36 p. m. December 23. This was preceded at 10:38 a. m. by a strongish earthquake highly localized and not generally felt at other points on the island. Mr. E. G. Wingate was close to the pit when the outbreak occurred, and heard a low rumbling which led him to look over the edge, where he saw heavy fume clouds filling the interior, and lava fountains starting at the foot of the southwest talus. The floor cracked open from southwest to northeast in less than half a minute. The floor broken appeared to be *pulled apart with some* tumescence. Spatter from the fountains was blown high over the rim wall, and 17 large fountains were counted with the two largest at the northeast end of the crack. Then a gale of dust, sand, and fume overran the tourist station and it was necessary to retreat to avoid asphyxiation by sulphur dioxide. The sun was obscured by a brownish cloud seen to be blue in reflected light. Lava during the next 11 hours foamed into the pit in enormous volume estimated 6500 cubic feet per second, and the density of the fume cloud was very great for Kilauea. The two or three enormous fountains at the northeast end of the line inside the pit ceased action about 2 a. m. December 24, the fume diminished, and normal conditions were restored whereby the southeast road terminal became accessible. The fountaining continued in a belt of big central gushers and a grotto fountain at the talus at the southwest end of the line. Before the cessation of the big fountains, the brilliancy of the pit at night exceeded anything seen thereafter, and about 30 fountaining points were counted along the straight line of vents that crossed the middle of the bottom of the pit in the direction of the Kau Desert rift.

On December 24 there was a line of small fountains straight across the south end of the lake at right angles to the main rift, and another line parallel to the main rift across the northwest part of the lake. Islets of crust appeared about where the 1930 cone had been. On December 25 a more liquid pool was defined about the central fountain, there had now developed a rampart all about the lake, and the southwest fountain was building a grotto. There were brilliant radial and concentric patterns about the main fountains, and the gas pressure was increasing so as to fling up individual spurts 200 feet into the air. December 27 there were three principal fountaining areas with streaming northeastward in concentric horseshoes. The gas pressure was still stronger and tending to concentrate southwest in spraying jets sometimes 300 feet high, building a huge spatter niche, while the central fountains made detonating puffs of blue fume. Measurements showed the average fill to be 90 feet deep above the 1930 floor and about 260 million cubic feet of new lava had poured in.

Prior to the eruption there were 11 tremors and 7 very feeble earthquakes recorded. Four indicated origin distance four miles. The earthquake of 10:38 a. m. December 23 was strong enough to overturn some objects, especially on Uwekahuna Bluff, and would rank as grade IV R. F. Two very feeble shocks occurred after the eruption. Traces of continuous volcanic tremor appeared after the 10:38 a. m. earthquake, became quite continuous at 2:36 p. m. December 23, reached a maximum at 2:39 p. m., and continued so until 2 a. m. December 24, when the big fountains stopped, and the continuous tremor diminished in amplitude. December 24 at 5 a. m. this tremor increased slightly and has continued ever since. Microseismic motion has been moderate to heavy, and tilt changed suddenly at the time of the strongish earthquake from moderate ENE to strong S. The pit seismograph has for months been indicating tilt away from the center.



Map of the lava floor of December 1930 with 10-foot contours for the bottom area, showing the big 1930 cone and solidified lake at the south, from which the rest of the bottom sloped away as a mound. The cone of July 1929 is shown at the left. All of this is now buried by the new eruption, and the grotto center of 1931 is just south of the 1929 cone.

THE VOLCANO LETTER

The Volcano Letter combines the earlier weekly of that name, with the former monthly Bulletin of the Hawaiian Volcano Observatory. It is published weekly, on Thursdays, by the Hawaiian Volcano Research Association, on behalf of the section of volcanology, U. S. Geological Survey. It promotes experimental recording of earth processes.

Readers are requested to send articles, photographs, publications and clippings about volcano and earthquake events, instruments and investigations, especially around the Pacific.

Subcription for non-members two dollars per year of 52 numbers. Address the Observatory.

HAWAIIAN VOLCANO OBSERVATORY
Founded 1911

This laboratory at Kilauea Volcano belongs to the Hawaiian Volcano Research Association and is leased and operated by the United States Geological Survey.

It maintains seismographs at three places near Kilauea Volcano, also at Hilo, and at Kealakekua in Kona District. It keeps a journal of Hawaiian volcanic activity and publishes occasional Bulletins.

Membership in the Hawaiian Volcano Research Association is limited to patrons of Pacific science who desire personally to aid in supporting the work.

The work of volcano research so supported is in collaboration with the work of the United States Geological Survey, but supplements it with buildings, research fellows, instrumental plants, explorations and special investigations for which there is no governmental provision. The Geological Survey maintains volcano stations in Alaska, California and Hawaii.

The Board of Directors includes Arthur L. Dean, President; Frank C. Atherton and Walter F. Dillingham, Vice-Presidents; L. Tenney Peck, Treasurer; Wade Warren Thayer, Richard A. Cooke and Wallace R. Farrington.

Persons desiring application blanks for membership ($5.00 or more) should address the Secretary, Hawaiian Volcano Research Association, 320 James Campbell Building, Honolulu, T. H.

December 5, 1931

The Director,
National Park Service,
Washington, D. C.

Dear Mr. Director:

The following is a report of operations and activities in Hawaii National Park for the month of November, 1931.

000 <u>General</u>

November was a quiet month as to travel, but a busy month as to park activities.

020 General weather conditions

There was one clear day in November; 20 party cloudy, and 9 cloudy days. On 23 days .01 inch or more of rain fell. The total for the month was 8.58 inches, which compares with 8.51 for last November. The greatest precipitation in 24 hours was 2.07 on the 15th. The maximum temperature was 74 degrees on the 26th, and the minimum 48 degrees on the 30th. The mean maximum was 67.2 and the mean minimum 54.9. The total rainfall to date is 63.11 inches, which compares with 103.46 for last year.

On November 1 there was a brilliant lightning display with flash after flash of lightning which lighted up the summits of Mauna Loa and Mauna Kea and the surrounding country. There was no thunder nor rain. On November 14 there was a terrific rainstorm in Hilo and the Puna district, and 11.34 inches of rain fell in 24 hours. Roads were flooded and automobiles were stalled everywhere. The Park Superintendent and Naturalist Doerr were caught in this storm and were delayed two hours near Mountain View before they could cross a river of water that was running over the road in that section.

100 <u>Administration</u>

110 Status of work

Work in the park generally is going along according to schedule. In the office work has been kept current but has been particularly heavy during the month. The final construction report on the Chain-of-Craters road completed in 1926, which had never been made up, was sent in and this completes all reports that are due, except for the work of the current year. A revised five-year development program was sent in during the month in accordance with Supplement No. 1 to Office Order No. 228.

This was accompanied by maps showing roads, trails, telephone lines and park boundaries, both existing and proposed. A special trail map was prepared and forwarded to Mr. Kittredge's office. The final report for the calendar year was sent in November 30.

The purchasing, accounting and disbursing work is current.

120 Park inspections by

121 The Superintendent

Seven formal inspections of roads and trails projects were made during the month, with various members of the staff, including Ranger Christ, and Engineer Handley. Informal inspections were made oftener. On November 18 inspection was made of the Mauna Loa trail. On November 21 the Ainahou Ranch road and grounds and the park telephone line leading to that region were inspected. Periodical trips were made to Hilo on park business, one trip on the 23rd being to confer with the Hilo Federal Business Association on a committee on personnel transfer and detail. One visit was primarily devoted to discussion with Mr. O. C. Bockus, Managing Editor of the Hilo Tribune Herald, on publicity material from the park. On November 25 a second inspection was made of the Mauna Loa trail and the Ohia Kau trail to the old buildings formerly used by cowboys. One of these has been donated to the park service for use as a trail shelter and will be moved over to the Mauna Iki trail and used for that purpose.

130 Finance and accounts

As this is a statistical report, the figures for which can not be secured at the time this report is dictated, it will be found attached to the back of the report as statistical report No. 8.

150 Equipment and supplies

Tires and tubes for the second quarter were received during the month and other supplies purchased consisted of hay, grain, powder, gasoline, etc.

170 Plans, maps and surveys

1933 appropriation: A radio message outlined the amount authorized by the budget for Hawaii National Park for the fiscal year 1933. This allows no increase over the total amount appropriated for the current year and is a matter of keen disappointment although it is realized that expenditures are being curtailed in order to eliminate the growing deficit in Federal finances. A wire was sent asking that two employees quarters and a shed for the Haleakala section might be secured if consistent and practicable. Any construction work authorized will assist in relieving the unemployment situation, which is now beginning to be felt more in the islands than heretofore.

180 Circulars, placards, publicity bulletins, etc.

The park has received a great deal of favorable publicity during the month from articles prepared by this office. This includes news items and special articles by the Superintendent, together with the Nature Notes, which have all been published in the newspapers of the Territory and there have been several fine editorials regarding the park's activities. Copies of the publicity bulletins and Volcano Letters are attached.

200 Maintenance, improvement and new construction

210 Maintenance

The usual maintenance and repair of roads, trails, telephone lines and grounds was carried on during the month. Our warehouse is gradually being put in better order, racks being provided for tools and bins for supplies. A system requiring all equipment to be signed for when taken from the warehouse has been installed and considerable headway has been made in inventorying and marking the equipment in the warehouse and in the various quarters, as well as on the jobs that are under way. The water tank at the superintendent's residence was drained and cleaned on November 7.

220 Improvements

A 3,000-watt Delco electric light plant borrowed from the Kilauea Navy Camp was installed this month as an auxiliary to the 5-kilowatt plant borrowed from the Kilauea Army Camp. The 3,000-watt plant is operated during periods of light load and the 5-kilowatt plant during periods of heavy load. The plant was operated 235 hours during the month, at a cost of $21.92. Three hundred and ninety three kilowatt hours were purchased from the Volcano House at a cost of $27.51, making the total cost for the month $49.43. The cost of Government operation is believed to be slightly less than when purchased through the hotel, not counting labor, but we do not have a watt hour meter for recording the Government's actual output. However, the Volcano House service is so poor that any improvement that can be made is justified within reasonable cost.

Twenty miles of telephone circuit in the park has been practically rebuilt during the month. These lines were originally built on trees which, due to the swaying, have given us such poor service that the tops of the trees had to be cut off and the trunks converted into posts.

Eighteen new signs were made and erected along roads, trails, shelters and at points of interest.

The Halemaumau trail between the Volcano House and the floor of Kilauea Crater has been rebuilt and relocated from the upper end to eliminate the steep grades. Part of the trail has been relocated. It now passes in close to the face of the cliff under the Observatory, through an area that is rich in tropical vegetation, including tremendous treeferns and other plants and shrubs. The new trail is a big improvement over the old one and landscape features have been preserved.

230 New construction

Mauna Loa trail: In relocating this trail care was taken to get the best views, the shortest course, and keep the best grades so as to provide safe and easy passage for pack and saddle animals and foot travelers. This trail starts at Bird Park, leads through ohia forests, past tree molds, over old aa lava flows, then through tropical vegetation; past the Giant Koa Tree, then into meadows of rolling land, across other lava flows, beds of pahoehoe lava and aa rifts and pit formations to the Rest House, better known as Red Hill. At the 8,000-foot elevation, a few Silverswords of a different species from those growing in Haleakala may be seen. Groves of ohia trees tweisted into fantastic shapes by heavy winds are to be seen. The standard trail specifications were followed. The minimum width is 30 inches, the maximum grade 15 per cent. The work has all been done by the park organization, using native labor. The first section of this trail from the crater of Mokuaweowoo to the rest house, was built in 1930. That section was gone over again this year to repair the trail where necessary and put in better marking. Through the forest and meadow land all of the grass, shrubs, roots, rocks, etc. were removed from the pathway. Through the pahoehoe lava blasting was necessary in some places. The rock that was taken out in excavation was used for ducking the trail or making fills. Through the aa lava sledge hammers were used in breaking down and smoothing out the surface of the trail. On top of this fine cinders and dirt were used to surface over the rough material. A shelter of scrap material was built at the 6,400 foot elevation for protection to visitors from weather and to provide water for man and beast.

<u>Headquarters roads</u>: For the month ending November 15, construction work made little progress. While weather conditions were good from October 23 to November 3, the contractor failed to take full advantage of it and considerable time was lost later by rain.

All of the rough grading has been completed on Project I between Stations 0.00 and 3.50. All shovel work has been completed on the whole job and the shovel moved off. The remaining grade work will be done by grader and scarifier or by hand.

At Station 60.00 to 62.00 a fill in the roadway was made which, after it was nearly completed, caused the foundation of the fill to give way and became quaky. It was necessary to remove this fill and about four feet of sour material under the fill was found. The removed material was used in filling out deficiencies on embankments along the line. To obtain material to replace the fill it was necessary to lower the grade slightly between Stations 64.00 and 66-77.6.

The quarry and rock crusher were ready for operation on October 20 but work was not started until about the 10th of November. Many yards of stone have been quarried and piled ready for crushing. Material for a base course between Stations 1 and 60 on the Crater Road has been placed. Change Orders numbered 1 to 6 have been submitted covering changed deemed necessary on Projects I and 3A. As a result of these changes and additions, Project No. I shows a balance saved of $6,426.26, while Project 3A shows a deficit of $2,153.18, resulting in a net saving on the contract of $4,273.08. Revision of quantities on final cross sections will probably take up some of this balance. The contractor employed about 100 men on the job, six trucks, three wheeled scrapers, one tractor, two graders and a steam shovel and gravel loader.

The progress on the entire contract may be summarized as fair, condition satisfactory; percentage of total contract time elapsed, 40; percentage of entire contract completed, 27. Resident Engineer H. L. Handley is giving the job fullest supervision, with a survey crew of one instrumentman and two chainmen.

Fifteen Japanese cedars and Monterey cypress on Dr. Jaggar's lot were removed from the road right-of-way and replanted farther back on the lot. This work was done by the road contractor with a steam shovel. Assistant Territorial Forester L. W. Bryan supervised the transplanting and indications are that most of the trees will live. This transplanting job was covered by an extra work order.

Where electric, telephone, or water lines cross any of the roads being improved by the Bitulithic Paving and Concrete Company, conduit pipe has been laid to permit placing these lines under the road at some future date. This was done by the National Park Service force account with post-construction roads and trails funds.

In the vicinity of Koanokekoi crater, the contractor is operating a gravel loader to secure gravel for dressing and grading the road bed. This gravel is being taken off the surface in a section where there is practically no vegetation and the contractor has agreed to smooth up the area when the job is completed. In this way unsightly borrow pits are being avoided.

240 Improvement of approaches to the park

Press dispatches from Washington under date of November 18 advised that ten routes had been agreed upon for the Hawaii road system by officials of the Bureau of Public Roads and Governor Lawrence M. Judd. The routes of interest to the park are Route 6, Island of Hawaii, from Hilo via Hawaii National Park to Honuapo, 65 miles; Route 7, Island of Hawaii, from Honuapo via Papa, Kamuela, Honokaa, to Hilo, 170 miles; Route 8, Island of Hawaii, from Kamuela to Mahukona, with connection to Port Kawaihae, 37 miles. The total of the Federal aid system is 531.6 miles.

260 Landscape work

Considerable landscaping has been done by the Volcano House in re-sodding the areas where the widened road cut into the gardens in front of the hotel. Exotic plants that were removed due to road widening, were not replaced.

300 <u>Activities of other agencies in the park</u>

310 Public Service contractors

The Mutual Telephone Company started their inter-island radio telephone service on November 2. This is of interest to the park because a new circuit for radio telephone business only is being constructed between Hilo and the Volcano House. The completed project cost $350,000. Rates for calls between Hawaii and Oahu are $5 for three minutes with $1 for each additional minute. Report charge is $1.

Travel to the park was very light, consequently the Volcano House had a very small business. There was a total of 293 guests registered during the month.

The Kilauea Volcano House Company has, up until last February, been operating the Kilauea Golf Course, when it was abandoned on account of the retrenchment program and the laying off of employees. However, the course had not been kept up and very few played on it. This course is partly in on land of the park and partly on land of the Bishop Estate leased by A. M. Brown. Recently a committee from Hilo has attempted to re-establish the golf course by forming an association and they are working with this end in view. Such a course would be a great asset to the park and to the local community.

Auditors from Honolulu made their periodical check of the accounts of the Volcano House on November 21.

312 Cooperation with the superintendent

A friend of Mrs. Gandy in Honolulu sent her a puppy to be kept at the Volcano House but permission to keep the dog was refused by the superintendent and the dog was immediately sent out of the park.

340 County legislation affecting the park

The Supervisors of the county of Hawaii are planning to revise the traffic regulations. A special committee has been appointed by the Hilo Chamber of Commerce and the park superintendent was invited by this committee to meet with them and discuss proposed new regulations. As the superintendent has recommended that the automobile regulations of the county be applicable on the park roads so far as they do not conflict with the special automobile regulations of the park, this legislation is of interest to us. The superintendent is urging a revision of the laws to provide

(a) That pedestrians walk on the left-hand side of the road facing traffic.
(b) That automobiles not be permitted to stop or park on the paved or main traveled section of the highway unless it is impossible for them to keep going because of breakdown.
(c) That more strict headlight regulations be adopted.
(d) That more care be used in issuing operators certificates and records kept of those who are habitually breaking traffic regulations or having accidents.

400 <u>Flora, fauna, and natural phenomena</u>

410 Ranger service

A school of instruction for the new ranger force was started November 2. Meetings were held at the superintendent's residence every Monday evening, in which the whole park staff was present. The Ranger Manual was thoroughly gone over and instructions given to the rangers on the performance of their duties, contacts with the public, etc.

On Saturday afternoons, Sundays and holidays, one ranger is stationed on duty at administration headquarters to check automobile traffic operate the telephone switchboard, and furnish information to visitors. Another ranger is on duty at the museum for checking automobile traffic and conducting visitors through the museum. Most of these visitors are local people, many of whom have never visited the museum and know very little about the park. A register has been established so that those who visit the museum and care to may register.

411 Naturalist service

Supplementing the school of instruction given by the superintendent, Park Naturalist Doerr has started a series of lectures on geology for the for the benefit of the park staff. The first meeting was at the museum on November 6, at which time the regular park lecture and picture "Volcanoes" was shown, afterwards followed by a general discussion, Mr. Doerr answering questions asked by the various employees. On November 9 Ranger Christ and Naturalist Doerr made a three-day trip to the summit of Mauna Loa. Trail Foreman MacKenzie, working on the Mauna Loa trail, was picked up and taken with them. This was MacKenzie's 100th trip to the crater. Sulphur and steam were issuing from the cracks in the crater of Mokuaweoweo in considerable quantity. The minimum temperature at the Rest House at Red Hill was 38 degrees Farenheit. Four inches of ice was found in a water hole at the north end of the crater. The weather was excellent on this trip with no wind and no rain. On November 29 Park Naturalist Doerr with Dr. H. A. Powers and E. G. Wingate of the Geological Survey, accompanied by Ranger Brumaghim and seasonal Ranger Lee, with Levi Kaiako, made another trip to the summit of Mauna Loa. Doerr, Wingate and Powers spent two nights at the crater, seeking shelter in a cave. It snowed while on this trip and a strong wind was blowing all the way, so that the trip was not nearly as pleasant as the previous one. However, much of scientific interest was learned.

415 Educational service

At the invitation of Mrs. W. H. Beers, President of the Principal's Club of East Hawaii, the superintendent and Park Naturalist Doerr attended a reception and tea at the Hilo Yacht Club on November 14 in honor of W. C. Crawford, Superintendent of Public Instruction. After the reception and tea Mr. Crawford conducted a business session with the principals and after that held a special meeting with the park Superintendent, Mr. Doerr and Mrs. Beers on the educational program of Hawaii National park and ways and means by which it could be made useful to the teachers of the Territory and particularly to those on the Island of Hawaii. Their interest and cooperation in the nature study classes to be held next summer were promised and methods of popularizing the Kilauea Summer Camp for use of vacationing school teachers discussed. The following day Mr. Crawford and Mrs. Beers were the guests of the Hawaii National Park. They were taken over the park roads to points of interest, shown the pictures and had the lecture explained to them. Information was provided regarding the distribution of Nature Notes and Mr. Crawford has promised his hearty cooperation in furthering the program for next summer. Space for an article in Territorial educational magazine on the educational activities of the park has been promised.

Plans for the summer school classes of the University of Hawaii are being forwarded by correspondence with the University. On November 19 an outline of policy and responsibility of each organization to the other and to the students taking this course was drafted and forwarded to the University for study. Dr. Livesay, in charge of the summer session, is sure that a workable program can be worked out agreeable to all concerned, but as there are many matters of policy, he is waiting now to discuss the matter with President D. L. Crawford on his return from the Orient within the next few weeks.

Miss E. A. Pond, University of Hawaii extension worker, called on November 27 to ask the National Park Service to give an extension course this spring to teachers on the island of Hawaii, those in the Olaa or Pahala districts. This course would probably be on the science that the park is best prepared to teach. It offers a wonderful opportunity to the park to be of service to the teachers of the community and to broaden our contacts and develop good will.

420 Museum service

Park Naturalist Doerr made a fine collection of lava specimens and other exhibit materials pertaining to the region, which has been loaned to the Hawaii Tourist Bureau for exhibit purposes in their new offices. It makes a good display, the first real exhibit of its kind, and has attracted much attention.

The Silversword turned over to Mrs. Charles E. Walcott last summer to be exhibited in the Smithsonian Institute, reached there in good condition and is now on exhibit. It is the only specimen they have.

421 Lectures

Fourteen lectures were given at the museum to a total of 258 persons. A new service is that which is given for groups of enlisted men visiting the Kilauea Military Camp. Heretofore many of the enlisted men could not hear the lecture or see the motion picture reel because lectures given on boat days conflicted with their meal hours at the camp. Every incoming group is now given a special lecture during the morning after their arrival in the park. This makes it possible for all the men to attend the lecture at a time convenient to them and before they have had a chance to explore the park. The Military Camp as well as the educational department has been highly pleased with the reaction to these special lectures. Contacting these groups early during their visiting period makes it possible for them to more fully appreciate the natural features and also to become acquainted with the functions of a national park. It is believed that this particular educational activity will have some very worth while results. The attendance at the museum totaled 400 during the month, the park naturalist contacting 309 and the rangers 91. Three field trips were made with a total of 31.

422 Nature Notes

Four hundred copies of the October issue of Nature Notes were mimeographed and distributed in November.

440 Insect control

Identification of the insects attacking the ohia and koa trees of the park has been made by the Bureau of Entomology in Washington and control measures suggested. Experiments will be conducted next year when funds are available to see what can be done in controlling these pests. On the Mauna Loa trail it is noticed that many of the koa trees are apparently dying and are covered with ~~a~~ lichens . Many of the ohia trees are covered with a black fungus resembling soot.

460 Birds

Seven wild peacocks were seen in the Haleakala section of the park near Paliku station by RangerChrist in July.

480 Natural phenomena

Strong steam and sulphur fumes were noted in the crater of Mokuaweoweo by Park Naturalist Doerr on his two trips to Mauna Loa during the month.

Halemaumau remained inactive during November. Steam and sulphur fumes were almost entirely absent during the month except during periods of heavy rainfall. Measurement of the rim cracks showed no change except on the northeast side, where at two locations the crack measured widened half an inch between October 24 and 31 and five-eighths of an inch between November 12 and 20, which would indicate a shifting of the ground at that point. Tilt during the month was northeast and east-southeast. One earthquake was felt locally at 6:46 P.M. November 22, and an avalanche occurred in the pit on the morning of November 18.

On November 3 Kyushu, Japan experienced one of the heaviest earthquake shocks in 30 years, according to press reports.

490 Miscellaneous

Authority has been received to establish registers on Maunaloa, Mauna Kea, and Hualalai, the highest mountain peaks on the island. We are interested first in Mauna Loa, and ways and means of establishing these registers are being considered.

500 Use of park facilities by the public

510 Increase or decrease in travel.

There was a total of 7,291 visitors to the park in November this year, compared with 38,383 for last year. The total travel to date is 13,615, , compared with 46,220 last year, a decrease of 32,605, or 70.5per cent. The great increase last year was due to the renewal of activity in the Halemaumau pit last November and the great crowds of local people, and there has been, of course, a falling off in regular tourist travel this year. The largest group to come into the park at any one time was 22 on the Steamship City of Los Angeles, on the 17th. On many days there has been only one visitor and on a few occasions none at all.

ERA foreman in charge of the Mauna Loa trail crew reports 31 visitors going to the top of Mauna Loa during the month.

530 Visitors

Mr. and Mrs. George Steare, of Van Nuys, California, were in the park on November 16. Mr. Steare is the head of a large milling company and was interested in the use of molasses which is now a waste product of the sugar mills.

Mr. and Mrs. A. Lewis, of Honolulu, spent a week in the park during the middle of the month. Mr. Lewis is a financier, director of many corporations including the Inter-Island Steam Navigation Company and the Volcano House Company, and expressed his keen interest and pleasure in the activities of the National Park Service in providing something for the visitors to do. He was particularly interested in our educational program and the walks across the crater.

Mr. and Mrs. S. H. Kauffman of Washington, D. C. arrived in Honolulu on the Matsonia November 24 to spend a week, according to press reports, with the expressed intention of visiting the national park. Notice of his coming was also sent from Washington. As the week has passed and he failed to arrive he probably returned to the mainland without coming to the park. Mr. Kauffman is editor of the Washington Evening Star, and had a special invitation from the superintendent, which was transmitted through Governor Farrington of the Honolulu Star Bulletin.

Mr. and Mrs. Bailey and daughter of Honolulu spent the month at the Volcano House. He has been in business in the islands for 37 years, is a member of the Chamber of Commerce and Rotary Club, a Boy Scout executive, and a great park booster.

600 Protection

610 Police protection

William T. Kirn, Second Lieutenant, 11th Field Artillery, while a guest at the Kilauea Military Camp, shot at one of the park signs on the road opposite the camp, damaging it considerably. He was reprimanded by Captain W. A. Hedden, Camp Commander, and sent to this office to make his apologies and pay for the damage done. We assessed Lieut. Kirn the cost of purchasing and replacing the damaged sign with a new one, amounting to about $4.65.

620 Fire protection

A fire drill was held at headquarters on November 5, in which the staff of the National Park Service and the Volcano House Company took part. The drill was successful and all of the fire fighting apparatus of the hotel premises were emptied and recharged. The Park Service took over their equipment including the Evinrude pumper which was started without difficulty.

A special report on fire extinguishers, chimneys, stoves and electric wiring was sent in during the month and the annual fire report for the calendar year 1931 was sent in on November 30.

630 Accidents

Joe Vincente, garage boy at the Volcano House, was seriously injured on November 7. He was thrown from a saddle horse which bolted with him and threw him in front of an automobile, which passed over him. He was given first aid at the Kilauea Military Camp Hospital and sent to Olaa, 20 miles distant, where X-rays were taken, then to the Hilo Memorial Hospital. He received a fracture of the back, his floating ribs were broken and torn away and one kidney was crushed and for a while it was thought that a major operation would be necessary but the internal injuries proved to be not as serious as first indicated and the boy is now making a slow but satisfactory recovery.

640 Destruction of predatory animals

During the month 8 mongooses, 2 cats, 1 dog, 5 wild pigs and 26 wild goats were killed.

660 Sanitation

Dr. C. R. Eskey, Bubonic Plague specialist of the U. S. Public Health Service is making a survey of plague conditions on the island of Maui, near the Haleakala section of Hawaii National Park.

900 Miscellaneous

Governor L. M. Judd and Lyman H. Bigelow, Superintendent of Public Construction, have been in Washington during the month conferring on road matters and other business of the Territory. A press item from Washington quoting Governor Judd on the Park Service road program of two million dollars for the national park stimulated much interest and was the subject of several editorials.

Major Stewart Wilder, former aide to Governor Judd, and a great park booster, who participated in both of the goat drives here last spring, died at the Walter Reed hospital in Washington, D. C. following a major operation as a result of an airplane accident several years ago.

Armistice Day was observed generally as a holiday throughout the Territory. All banks and business offices were closed.

The Hole-in-One Club established some years ago to which one qualified by driving a golf ball into the Halemaumau pit, has been discontinued. The cooperation of the transportation companies and the Hawaii Tourist Bureau was obtained last spring. All signs were taken down and the tee removed. This was done because the older Hawaiians resent throwing things into this pit as sacrilegious to Madame Pele, the goddess of volcanoes, and because there is a certain element of danger in spectators rushing to the brink of the pit to see how far the golf ball would go. It is still permitted if a visitor who has learned about it has asked specially for the privilege but is in every other way discouraged. Visitors are invited to join the Hui O Pele, which is more dignified, and provides a button and a certificate of membership to the member and the net revenue is used in park improvement.

On November 15 a birthday party was given at the Volcano House in honor of Park Naturalist John E. Doerr, Twenty six persons were present.

On Thanksgiving Day a group of 16 park service employees and members of their families arranged for a special dinner at the Volcano House. This was followed later by a dance and entertainment provided by a group of young people who were guests of the hotel.

On November 24 the National Park Recreation Club was formed to provide tennis, volley ball, basket ball, horseshoes and baseball as a means of recreation for the growing staff of the park and others living in the community.

Very respectfully,

E P Leavitt

E. P. Leavitt,
Superintendent.

10-157
(July, 1929)

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

TRAVEL REPORT

Hawaii National Park for the month of November, 1931

	This Month	This Travel Year To Date	This Month Last Year	Last Travel Year To Date	Increase for Travel Year: Number	Increase for Travel Year: Percent
PRIVATE TRANSPORTATION:						
Cars first entry, ...						
Cars reentry, ...						
Motorcycles, ...						
Total motor vehicles, ...						
Persons entering via motor vehicles, ...	6,806	12,710	37,993	44,098	-31,388	71.1%
Persons entering via other private transportation, ...	193	271	495	841	- 570	67.7%
Total persons entering via private transportation, . . .	6,998	12,981	38,488	44,939	-32,048	71.3%
OTHER TRANSPORTATION:						
Persons entering via stages, .	293	634	897	1,281	- 647	50.5%
Persons entering via trains, .						
Persons entering otherwise, . .						
Total other transportation, .	293	634	897	1,281	- 647	50.5%
GRAND TOTAL ALL VISITORS, . . .	7,291	13,615	39,385	46,220	-32,605	70.5%

	This Year	Last Year	Increase: Number	Increase: Percent
Automobiles in public camps during month, ...	1	0	1	100
Campers in public camps during month, ...	2	0	2	200

10-158

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

S T A T U S O F A U T H O R I Z E D P R O J E C T S

Hawaii National Park for the Month of November, 1931

Description of Projects	Percent Constructed To Date	Percent Constructed This Month	Percent Constructed Last Month	Probable Date of Completion
410 U. S. Commissioner quarters	0	0	0	March 31, 1932
411 Employees quarters - - - -	100	0	0	
412 Employees quarters - - - -	100	0	2	
413 Administration building - -	0	0	0	June 30, 1932
502 TRAILS				
502.1 Hilina Pali to Halape - -	100	0	0	
502.2 Uwekahuna-Halemaumau auto trail	90	10	80	March 31, 1931
502.3 Mauna Iki extension - - -	100	0	10	
502.4 Haleakala trail - - - - -	100	0	0	
502.5 Mauna Loa trail - - - - -	94	44	50	January 31, 1932
502.6 Halemaumau trail - - - -	95	65	30	December 31, 1931
507.1 Kau belt road - - - - - -	100	0	0	
Road Survey, BPR Construction -	27	4	23	July 1, 1932

10-215
(July, 1928)

45334

UNITED STATES
DEPARTMENT OF THE INTERIOR
National Park Service

Hawaii National Park

REPORT OF NON-APPOINTED PERSONNEL
(TEMPORARY)

Changes outside the District of Columbia for the month of November 19 31

	Total at beginning of month	Additions	Separations	Net Gain or loss (a)	Total at ending of month
Permanent	12	0	0	0	12
Temporary	19	1	1	0	19
Total	31	1	1	0	31

(a) If loss, indicate by minus sign.

10-159
(May, 1931)

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF PERSONNEL

Hawaii National Park for the Month of November, 1931

	This Month		This Month Last Year	
	Appointed	Non-Appointed	Appointed	Non-Appointed
Number of employees beginning of month	12	19	5	12
Number of additions	0	1	0	7
Total	12	20	5	19
Number of separations	0	1	0	11
Number of employees close of month	12	19	5	8
Number of promotions during month	0	0	0	0
Aggregate amount of annual leave taken	7	0	0	0
Aggregate amount of sick leave taken	0	0	0	0
Aggregate amount of leave without pay	0	0	0	0

10-160

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

REPORT OF PARK REVENUES

Hawaii National Park for the Month of November, 1931

	This Year	Last Year
Park revenue on hand beginning of month,	0	0
Received,	137.23	125
Total,	$137.23	$125
Remitted,	127.23	125
On hand close of month,	0.00	0.00

Park revenues received this year to date,	$262.23
Park revenues received last year to date,	250.00
Increase,	12.23
Per cent of increase,	4.7%

10-161

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

REPORT OF SALES OF PUBLICATIONS

NOVEMBER 1931
HAWAII NATIONAL PARK

	Number	Value
GOVERNMENT PUBLICATIONS:		
On hand beginning of month,	991	$177.00
Received during month,	0	00
Total,	991	$177.00
Sold during month,	11	2.00
On hand at close of month,	980	$175.00
NON-GOVERNMENT PUBLICATIONS:		
On hand beginning of month,		
Received during month,		
Total,		
Sold during month,		
On hand at close of month,		

Cash on hand beginning of month,	$48.95
Sales during month,	2.00
Total,	50.95
Remitted during month,	.00
Balance,	50.95

Form No. 1009—Met'l.

U. S. Department of Agriculture, Weather Bureau.

COOPERATIVE OBSERVERS' METEOROLOGICAL RECORD:

Month of November, 1931 , *192* ; *Station,* Volcano Observatory ; *County,* Kau

Hour of Observation, 8 A.M.

State, Hawaii ; *Latitude,* ; *Longitude,* ; *Time used on this form,* Haw.

DATE.	TEMPERATURE. Maximum. 1	Minimum. 2	Range. 3	*Set Max. 4	PRECIPITATION. Time of Beginning. 5	Time of Ending. 6	†Amount. 7	Humidity. Snowfall, in Inches. 8	Wind Depth of Snow on Ground at Time of Observation. 9	Prevailing Wind Direction. 10	Character of Day, Sunrise to Sunset. 11	‡Miscellaneous Phenomena.
1	69	51	18	61			01	95	Mod	NE	PC	
2	69	56	13	65			09	90	"	"	"	
3	71	58	13	63			02	89	Str.	"	"	
4	65	59	6	63			40	94	Mod.	"	Cloudy	
5	66	54	12	60			42	84	Str.	"	PC	
6	66	55	11	62			01	69	Mod.	"	"	
7	67	55	12	60			14	95	"	"	"	
8	66	58	8	60			46	95	Str.	"	Cloudy	
9	62	56	6	59			70	93	Mod.	"	"	
10	66	57	9	60			121	93	"	"	"	
11	67	58	9	60			78	93	"	"	PC	
12	62	58	4	60			10	93	"	"	Cloudy	
13	64	56	8	59			57	93	"	"	"	
14	66	52	14	60			01	94	"	"	"	
15	63	56	7	58			207	90	Lt.	"	"	
16	64	57	7	62			26	89	Mod.	"	"	
17	66	55	11	62			07	93	Str.	"	PC	
18	67	54	13	61			22	83	Mod.	"	"	
19	68	54	14	61			04	85	"	"	"	
20	67	53	14	60			83	83	"	"	Clear	
21	67	53	14	60			T	85	"	"	"	
22	67	56	11	63			T	84	"	"	"	
23	69	52	17	60			05	84	"	"	"	
24	72	49	23	60			T	84	Lt.	"	"	
25	71	51	20	59			T	83	"	"	"	Changeable to SW
26	74	59	15	58			T	83	Mod.	"	Clear	
27	73	58	15	63			T	79	"	SW	PC	
28	70	57	13	59			08	89	"	NE	"	
29	66	52	14	59			04	83	"	SW	"	
30	68	48	20	57			T	89	"	"	"	
31												
SUM	2018	1647	371	1820			858	2656				
MEAN	67.2	54.9	12.3	60.6			.286	88.5				

*Reading of maximum thermometer immediately after setting.
†Including rain, hail, sleet, and melted snow.
‡Thunderstorms, halos, auroras, etc.

, *Cooperative Observer.*

(IN TRIPLICATE.) See cover for instructions.

Post-Office Address, Hawaii National Park

MONTHLY SUMMARY.

TEMPERATURE.

Mean maximum, 67.2

Mean minimum, 54.9

Mean, 61.0

Maximum, 74 ; date, 26

Minimum, 48 ; date, 30

Greatest daily range, 23

PRECIPITATION.

Total, 8.58 inches.

Greatest in 24 hours, 2.07 date, 15

SNOW.

Total snowfall, inches; on ground 15th, inches;

at end of month, inches.

NUMBER OF DAYS—

With .01 inch or more precipitation, 23

Clear, 1 ; partly cloudy, 20 ; cloudy, 9

DATES OF—

Killing frost,

Thunderstorms,

Hail { Light, Moderate, Heavy,

Sleet,

Auroras,

REMARKS:

Statistical Report No. 8.

FINANCE AND ACCOUNTS

HAWAII NATIONAL PARK - NOVEMBER 1931

Symbol	Name	Allotted	Expended	Balance
41/2415	Hawaii National Park 1931-32 - - -,- - - -	$52,130.00	$36,705.86	$15,424.14
41/2405	Emer. Recon.& Fighting Forest Fires, National Parks, 1932-32 - - - - - - - - - -	200.00	200.00	00.00
41/2406	Forest Protection & Fire Prevention 1931-32	100.00	100.00	00.00
40/1415	Hawaii National Park 1930-31 - - - - - - -	34,625.00	34,618.02	6.98
4X436	Roads and Trails, National Parks, no year	384,806.30	57,349.59	327,456.71

November 12, 1931

Memorandum to the Press:
By E. P. Leavitt, Superintendent.

Hawaii National Park, Nov. ___, 1931

Park Naturalist John E. Doerr, Jr., Acting Chief Ranger Joseph H. Christ, and Trail Foreman Albert L. MacKenzie, completed a three-day trip to the summit of Mauna Loa, returning yesterday.

While this was Mr. Doerr's first trip to the summit, it was Mr. MacKenzie's 100th visit. Mr. Doerr was greatly impressed by the attractions that Mauna Loa and the crater of Mokuaweoweo have to offer. "I wouldn't have missed that trip for anything" said Mr. Doerr. "The Mountain looks tame from Kilauea, but after you have climbed it you realize what a tremendous mountain it is, and while it is not particularly dangerous or a man-killer, it is much more rough and rugged than it appears and I can now understand how an inexperienced mountaineer or a traveler unfamiliar with the country, might get lost or confused. However, the new trail is such a great improvement over the old one and so well marked with ducks of rocks, that anyone can follow it easily. It is in a better location than the old trail, passes all the principal points and objects of scenic interest, shortens the distance both in mileage and time required to travel over it, and altogether it is a distinct improvement."

"The Crater of Mokuaweoweo has more attractions and more scenic and interesting features than Kilauea, in my estimation, especially while the latter is inactive, and I strongly recommend that a road be built to the summit of the mountain for the great attraction it will have for park visitors."

During the two nights spent at the rest house at Puu Ulaula, a record of temperatures was kept and the lowest reading of the thermometer was 38 degrees Fahrenheit. The weather was excellent. There was no rain and no wind on the mountain, although at Kilauea it rained day and night for the first two days they were out. In the water hole at the north end of the crater four inches of ice was found.

Doerr and MacKenzie hiked into the center of the crater and found a great deal of blue smoke and sulphur fumes rising from the lava cracks.

November 14, 1931

Memorandum for the Press
By E. P. Leavitt, Superintendent

Hawaii National Park, Nov. ___, 1931

Travel to the national parks passed the three million mark this year and broke the previous record by 14%, a ccording to Horace M. Albright, Director of the National Park Service. For official purposes the travel year for the national parks and monuments ends September 30, and figures on all the parks for the past year have just been received by E. P. Leavitt, Superintendent of Hawaii National Park.

The total number of visitors was 3,152,845 as against 2,774,561 last year. For the sixth consecutive year Yosemite led all others with 461,855 visitors. Hawaii was number 12, with 124,938 visitors.

November 14, 1931

Memorandum for the Press:
By E. P. Leavitt, Superintendent.

Hawaii National Park, Nov. ___, 1931

Director Horace M. Albright of the National Park Service at Washington, D. C., has announced tentative plans to hold another conference of national park superintendents next spring, probably about March first, at the Hot Springs National Park in Arkansas, according to information just received by E. P. Leavitt, Superintendent of Hawaii National Park.

These conferences bring the Washington and field officers together for discussion of park problems and for an exchange of ideas, and are always interesting and helpful. It is expected that development programs, greater efficiency in operation and methods, and ways of relieving the unemployment situation will be topics of special attention.

November 17, 1931

Memorandum to the Press
By E. P. Leavitt, Superintendent

Hawaii National Park, Nov. __, 1931

W. C. Crawford, Superintendent of Public Instruction, and Mrs. W. H. Beers, President of the Principals' Club of Hilo, were guests of the Hawaii National Park on November 15th.

They were invited to the park to become familiar with the educational program the National Park Service is providing for park visitors, and to discuss ways and means by which this educational work might be made useful to the schools of the territory, and particularly to those on Hawaii. The First step will be to familiarize the principals and teachers of the island schools with the service the educational department of the park is prepared to render. They will be urged to visit the park singly or in groups where they will receive special attention from Park Naturalist Doerr, who will show them the new motion picture "Volcanoes" and deliver his lecture which covers not only volcanology and seismology but the flora and interesting features of the region, all of which is illustrated by lantern slides. For those who have time, a trail trip across Kilauea Crater will be provided under the guidance of the park naturalist, who will point out the many interesting things to be seen along the "Wold's Weirdest Walk" and tell something about them. Some of these interesting things were described in the September Nature Notes, which the Park Service will mail to any teacher of the Territory who is interested. School classes will also be given special attention and a program arranged for their benefit.

The nature study classes conducted under the joint auspices of the National Park Service and the University of Hawaii last summer, which were composed largely of teachers, were a success, and plans are under way to continue these classes next summer on a larger scale. University credits will be granted and the new classes should appeal to many teachers who are desirous of extending their education.

The Park Service hopes later to be able to have members of its staff visit the schools and give illustrated lectures where this can be arranged, not only on Hawaii National Park but on parks on the mainland.

The Park Service wants the local communities to be thoroughly familiar with their park and its new activities, especially in the field of education, and will welcome opportunities to be of service.

November 23, 1931

Memorandum for the Press:
By E. P. Leavitt, Superintendent

Hawaii National Park, Nov. __, 1931

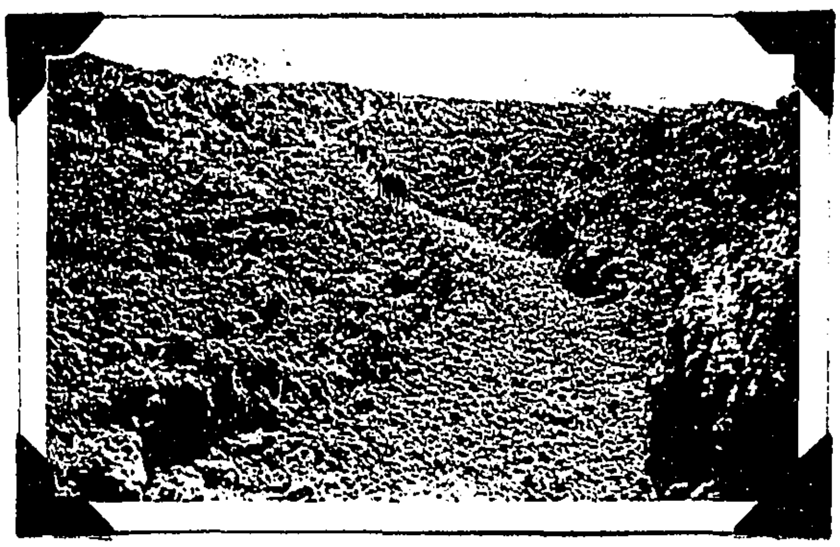
The efforts of the National Park Service this past summer to save the Silversword of the Haleakala region of Hawaii National Park from extinction because of attacks from insects, promise to be successful.

The plants that were sprayed with insecticide last June and July were found, on a recent trip of inspection by Park Ranger Christ, to be apparently healthy and thriving, and there was no evidence that insects were damaging them.

The blossoming plants which were protected by covering with cheesecloth, matured a good crop of seed, which was carefully gathered and sowed in places that are best suited for this rare plant. Some of the seed was brought to headquarters, and planted in the nurseries of L. W. Bryan, Assistant Forester at Hilo, and is now growing nicely. Some of this seed was also sent to Dr. A. W. Hill, Director of the Royal Botanical Gardens, at Kew, England.

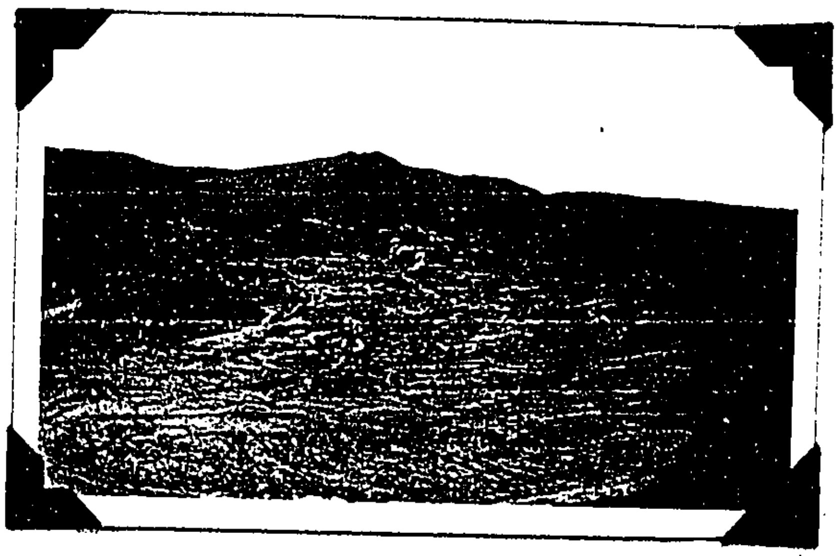
Power shovel of the Bitulithic Paving and Concrete Company being used to move Montery cypress and Japanese cedar trees farther back onto Dr. Jaggar's lot, in order to provide room for road right-of-way and to eliminate a blind corner at an important junction. November 6, 1931. Photo by Dr. Jaggar.

Moving Monterey cypress and Japanese cedar trees farther back onto Dr. Jaggar's lot in order to provide room for road right-of-way and to eliminate a blind corner at an important road junction. November 6, 1931.



Mauna Loa trail leading through an Aa lava flow.
Picture by Park Naturalist Doerr, November 10, 1931

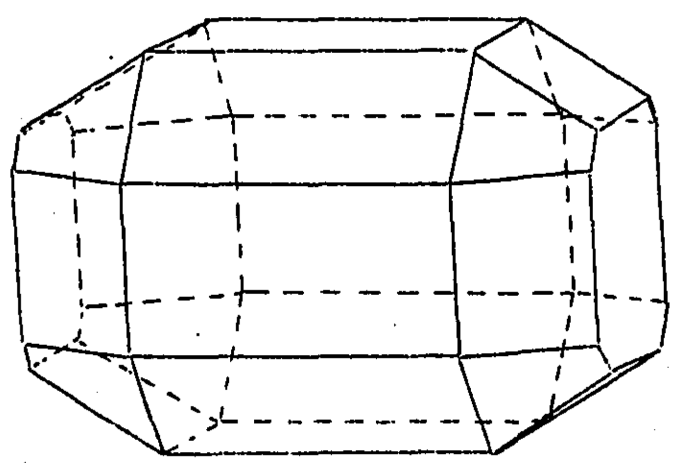
Crew at work on Mauna Loa trail. Elevation 4,700 feet.
Photo by Park Naturalist Doerr, November 10, 1931.



Mauna Loa trail on Pahoehoe lava. Elevation 9,700 feet.
Rest house located in cinder cone in center background.
Photo by Park Naturalist Doerr, November 10, 1931.

NATURE NOTES

HAWAII NATIONAL PARK



OLIVINE CRYSTAL

OCTOBER 1931

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DEPARTMENT OF THE INTERIOR
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HAWAII NATIONAL PARK
NATURE NOTES

Volume I October 1931 Number 5

Nature Notes from Hawaii National Park is a monthly pamphlet edited by the Park Naturalist and distributed to those interested in the natural history of the Park. Free copies can be obtained through the office of the Park Superintendent, Hawaii National Park, Hawaii. Anyone desiring to use articles appearing in Nature Notes may do so, Please give full credit to the pamphlet and author.

E.P.Leavitt, Superintendent John E. Doerr, Jr.,Park Naturalist

TABLE OF CONTENTS

THE COVER - OLIVINE

Madam Pele, The Ancient Goddess of Hawaiian Volcanoes, has decorated the evidence of her fiery wrath, (her palace, the fire pit of Kilauea, and the lava flows which have spread out on the slopes of the mountains) with gems. Visitors in Hawaii National Park may see the crown jewels of the Ancient Goddess. They are "diamonds", "Pele's Diamonds", and may be seen scattered in the rocky ash of volcanic explosions, or disseminated through the lava flows. Many large boulders thrown out during periods of Pele's violent wrath are studded with "diamonds", and in places the waves washing up on the shores of Hawaii have concentrated those gems into sparkling green beaches.

Jewelers recognize these "diamonds" as "evening emeralds" and use them as semi-precious gem stones. The student of mineralogy knows these gems by the general name of olivine, with the names chrysolite and peridot being used to designate olivines having particular shades of color.

As a mineral, olivine occurs abundantly in rocks resulting from the crystallization of lavas or magmas having distinctly a basic chemical composition, that is, lavas composed of an abundance of magnesia and iron, and relatively low amounts of silica. The volcanic rocks of Hawaii being chemically basic, it is not surprising that olivine is one of the common minerals in the region. The greater the amount of magnesia and iron in lava coming from the interior of the earth, the greater the number of olivine grains in the rock resulting from the crystallization of the lava; in fact, there are places in the world where nature has so adjusted the amount of magnesia, iron and silica in lava that solidification has resulted in a rock composed entirely of olivine. Such a rock is called a dunite. Though some of the rocks in Hawaii are very rich in olivine, none can be classed as dunite.

Chemically olivine is composed of magnesium, iron and silica, the proportion of iron and magnesium varying. Because of its composition it is recognized as one of the ferromagnesian minerals. One can easily identify olivine by the physical properties of color, luster, hardness, and shape. Bottle-green is the characteristic color of the mineral; frequently one finds Hawaiian Olivines having various shades of green, greenish-yellow, and black. The olive-green variety is called peridot, the greenish-yellow to yellow varieties are called chrysolite. The vitreous or glassy luster of olivine is also characteristic. Testing its hardness one finds that the mineral will scratch glass, which means that it is harder than glass as well as much harder than many other minerals; however, compared to topaz, diamond, ruby, and emerald, olivine is soft. Locally olivine occurs as rounded to sub-angular grains rarely having a maximum dimension of as much as one centimeter (0.39 of an inch) and perfect crystal form. A diagram of a perfect crystal of olivine is shown on the cover of this issue.

Olivine has long been used as a gem stone and as such is classed as semi-precious along with garnet, topaz, opal, and many other stones. Most gem olivine comes from Zeboiget, an island in the Red Sea; other producing localities are Burma, Ceylon, Australia, Brazil and New Mexico.(1) In these areas the individual crystals or grains of the mineral are much larger than any that have been found in Hawaii; it is reported that some of the olivines from Ceylon are as large as a turkey egg. In regions where lava crystallizes rapidly, the grains of olivine are likely to be small; the forces accompanying rapid crystallization, (forces within the cooling mass) have a tendency to create strains within the grains of olivine, olivine being one of the first minerals to form during the process of solidification. The shattering of mineral grains during sudden earth shocks would also tend to decrease the value of such stones as gems. Hawaiian Olivines have been subject to such conditions.

Olivines having a bottle-green color have been the most popular variety used in jewelry although stones of other shades are quite common. As a gem stone olivine is rather soft hence when cut and polished and suject to wear, it does not retain its sharp edges and vitreous luster.

by the Park Naturalist.

THE CIRCULAR OF GENERAL INFORMATION REGARDING

HAWAII NATIONAL PARK

With this issue of Nature Notes you will find a copy of the Park's circular of general information which contains a brief description of the National Park System, pictures of views in Hawaii National Park, descriptions of the natural phenomena in the area, information pertaining to accommodations for visitors, and the Park's regulations. On pages 10 and 11 of the circular is a map which indicates Hawaii's location in the Pacific Ocean, the important islands in the Hawaiian group, and a sketch of the roads, trails, and points of interest in the Kilauea area. It will be of interest to island people to know that in addition to the roads indicated on the sketch, there is a road leading around the west rim of Kilauea from Uwekahuna Observatory to the fire pit, Halemaumau. This road makes it possible for park visitors to see a portion of the Kau Desert and the large earthquake cracks in that area. Using this road one can drive around the entire crater of Kilauea. It is also possible to drive from the Devil's Throat (on Chain of Craters Road) nine miles south-westerly to Hilina Pali at which place one gets an excellent view of the ocean and south shore of the island of Hawaii, and has the use of a shelter, water, and phone service.

If friends of the readers of Nature Notes desire copies of the

(1) Kraus, E.H., and Holden, E.F., Gems and Gem Materials, McGraw-Hill Book Co., 1925.

Park's circular of general information for reference and educational purposes, kindly send us their names and addresses and we shall be very glad to mail copies to them. Send requests to, The Superintendent, Hawaii National Park, Hawaii.

by The Editor

HALEAKALA

Arriving on horseback at the Summit Rest House, 10,000 feet above the sea, tired but happy, there, last but not least one beholds the view of views as one stands on the rim of the great, dormant volcano, Haleakala, which legend tells us is the peak on which Maui stood when he lassoed the sun. From this dwelling place of the sun one marvels at the significance of the visible forms of nature. Imagination runs backward to a past age, back to the time when this great temple of nature was being raised to meet the sun and clouds. No language can describe nature's wonders, and who dares to say where or who is the Grand Architect.

One is awed by the extent and ruggedness of the crater with its full beauty revealed beneith the wreath of encircling clouds. Nature has created a painting more beautiful than any artist can ever dream. The entire crater is visible in its minutest detail; each cone, far and near, appears in spectacular clarity, cones rising above the floor of this great volcanic crater as monuments to the forces of nature. Crowning and guarding the beauty of Haleakala are the silver-colored blades of the Silver Sword.

To the southeast, across Alenuihaha Channel, is Hawaii whose skyline is marked by the peaks of Mauna Loa, Mauna Kea, Hualalai, and Kohala; in the north and west are the islands of Lanai and Molokai.

Then a sunset - colored rays of light filtering through oceans of fleecy clouds; then the moonlight building shadows in the depths of the crater. In the darkness of the valley below, towns spring to life like clusters of stars.

In Arizona, nature has made a Grand Canyon; in California, Yosemite has been carved deep in rocks of granite; nature's paint brush has decorated Utah's Zion-Bryce. To Maui in Hawaii nature has given her one and only HOUSE OF THE SUN - HALEAKALA!

by Ranger J. H. Christ

MARK TWAIN'S STRANGE DREAM

Preface

To preface something written by Mark Twain, seems, even to the writer, to be the boldest audacity. The writer hopes you will permit him this rare privilege.

Taylor, in his delightful narrative history of Hawaii, "Under Hawaiian Skies", describes Hawaii as; "----a land of romance and adventure. It has been the playground of poets and prose writers, of painters and musicians." (1) Not the least of this group was Mark Twain, whose arrival on board the S.S. Ajax is dated January 27, 1866. To know that Mark Twain describe Hawaii as, "The loveliest fleet of Islands that is anchored in any ocean."[2] is to know that he absorbed the romantic spirit of all Hawaii.

Those who read Mark Twain's Strange Dream, those who have caught the spirit of Kilauea and know the full meaning of "The Mountain", "The Volcano", when referring to Kilauea, Hawaii's most famous volcano, will realize that Mark Twain too caught the spirit of Kilauea's moods and legends.

In faded ink, on finger-stained, time-yellowed, tattered-edged pages of the volume of "The Volcano House Visitor's Records", dated 1865 to 1873, appears the following entry:

'"The following was written by 'Mark Twain'
I have a letter acknowledging its authorship
(Signed) L"' (3)

"Mark Twains" Strange Dream

"All day long I have sat apart and pondered over the mysterious occurences of last night. There is no link lacking in the chain of incidents - my memory presents each in its proper order with perfect distinctness, but still - However, never mind those reflections - I will drop them and proceed to make a simple statement of the facts.

"Towards eleven O'clock it was suggested that the character of the night was peculiarly suited to viewing the mightiest Active Volcano on the Earths surface in its most impressive sublimity. There was no light of moon or star in the inky heavens to mar the effect of the craters gorgeous pyrotechnics.

"In due time I stood with my companion on the

(1) Taylor, A.P., Under Hawaiian Skies, Honolulu, 1926.
(2) Idem.
(3) The editor was not able to ascertain who signed the "L", probably one of the managers of the Volcano House. The last name of several of the managers begins with L.

wall of the cauldron which the natives, ages ago, named 'Halemaumau', the abyss wherin they were wont to throw the remains of their chiefs to the end that no vulgar feet might ever tread above them.

"We stood there, at the dead of night, a mile above the level of the sea, and looked down a thousand feet upon a boiling, surging, roaring ocean of fire! shaded our eyes from the blinding glare, and gazed far away over the crimson waves with a vague notion that a supernatural fleet, manned by demons and freighted with the damned, might presently sail up out of the remote distance; staring when tremendous thunder-bursts shock the earth; and followed with fascinated eyes the grand jets of molten lava that sprang high up toward the zenith and exploded in a world of fiery spray that lit up the sombre heavens with an infernal splendor.

"What is your little bonfire of Versuvius to this?

"My ejaculation roused my companion from his reverie and we fell into a conversation appropriate to the occasion and surroundings.

"We came at last to speak of the ancient custom of casting of casting the bodies of dead chieftans into this fearful cauldron, and my companion, who is of the blood royal, mentioned that the founder of his race, Old King Kamechamenha the first - that invincible old pagan Alexander - had found other sepulture than the burning depths of Halemaumau. I grew interested at once; I knew that the mystery of what became of the corpse of the Warrior King had never been fathomed; I was aware that there was a legend connected with this matter, and I felt as if there could be no more fitting time to listen to it than the present. The descendant of the Kameahameaha said.

"The dead King was brought in royal state along the long, winding road that descends from the rim of the crater to the scorched and chasm-riven plain that lies between the Halemaumau and those vertical walls yonder in the distance. The guards were set and the troops of mourners began the wierd wail for the departed. In the middle of the night came the sound of innumerable voices in the air, and the rush of invisible wings, the funeral torches wavered, burned blue, and went out!

"The mourners and watchers fell to the ground, paralysed with fear, and many minutes elapsed before any one dared to move or speak, for they believed that the phantom messengers of the dread Goddess of Fire had been in their midst.

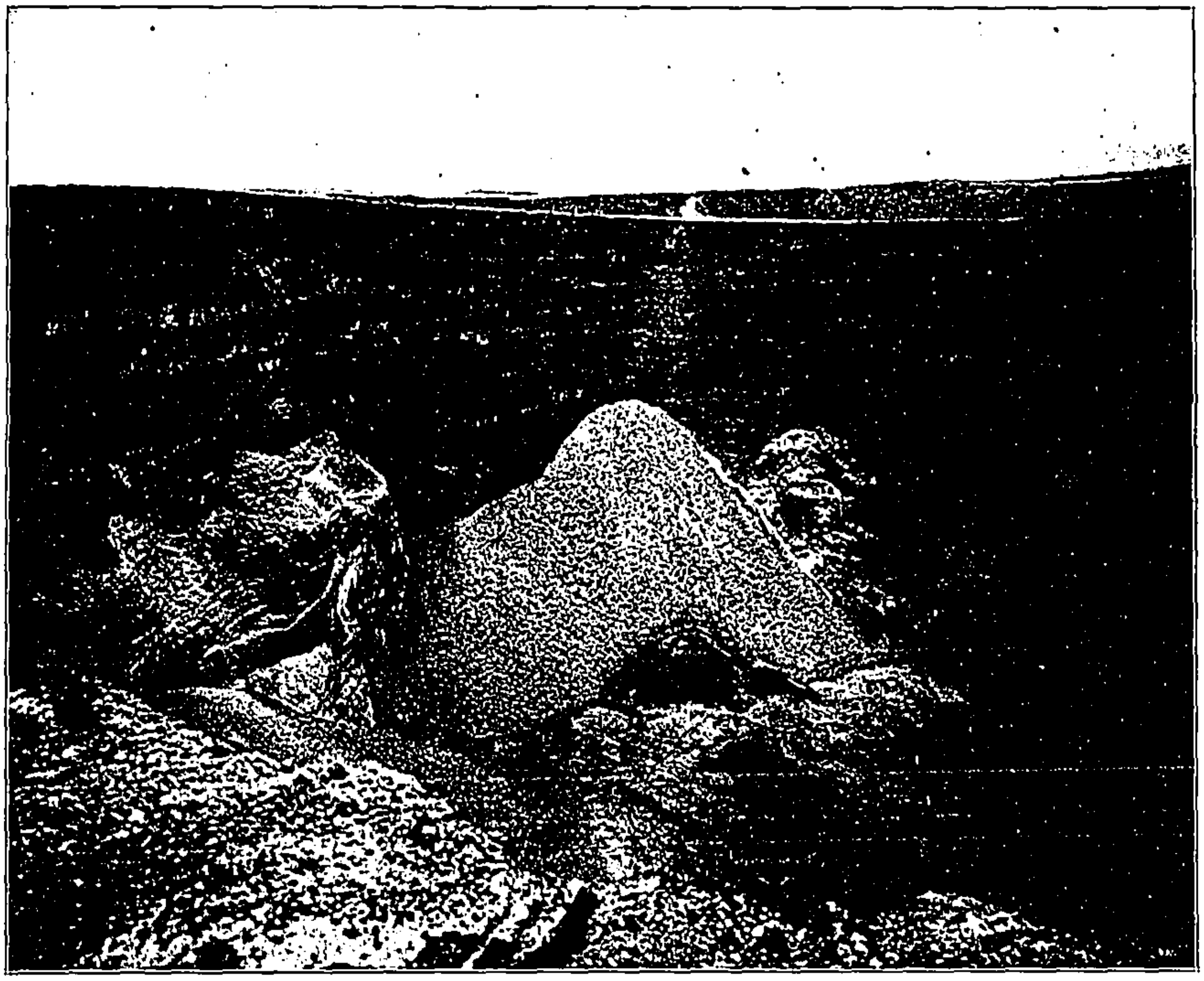
"When at last a torch was lighted the bier was vacant the dead monarch had been spirited away! Consternation seized upon all, and they fled out of the crater. When the day dawned the multitude returned and began the search for the corpse. But not a foot-print, not a sign was ever found. Day after day the search was continued and every cave in the great walls, and every chasm in the plain, for miles around was examined, but all to no purpose -

To be continued

The Volcano Letter

Two dollars per year — Ten cents per copy

No. 358—Weekly — Hawaiian Volcano Observatory, National Park, Hawaii — November 5, 1931



Lava floor of 1929 showing the large half-dome against the west talus left by the fountaining grotto of about July 25, 1929. This half-dome still protrudes at the edge of the floor left by the activity of November-December 1930. Photo Baker.

REVIEW OF HAWAIIAN EARTHQUAKES 1929-1930

The Volcano Letter has recently reviewed the cycles of volcanic activity at Kilauea, showing a tendency to eleven-year periods, and indicating that the present cycle began with the return of lava to Halemaumau pit in July 1924. From time to time we have reviewed the earthquake frequency, showing that recently the Kilauea station registers about 1,000 disturbances per year due to local cause. The following was the record of 1929:

By weeks ending on the dates listed, the following were the frequencies of local earthquakes for 1929:

Date	Number for Week	Notes
Jan. 2, 1929	2 very feeble	
Jan. 9	8 very feeble	Some continuous tremor.
Jan. 16	8 very feeble	
Jan. 23	1 feeble	Several continuous tremors.
	21 very feeble	
Jan. 30	10 very feeble	Less continuous tremor.
Feb. 6	1 moderate	Felt Feb. 5 Hilo and Kohala.
	9 very feeble	
Feb. 13	7 very feeble	Some spasmodic tremor.
Feb. 20	17 very feeble	Continuous harmonic tremor Feb. 20 with outbreak of lava.
Feb. 27	3 slight	
	5 very feeble	Tremor ended when lava stopped Feb. 21.
Mar. 6	1 slight	
	1 feeble	
	4 very feeble	
Mar. 13	4 very feeble	
Mar. 20	17 very feeble	Five prolonged tremor spasms.
Mar. 27	20 very feeble	Seven tremor spasms.
Apr. 3	16 very feeble	Irregular very feeble tremor.
Apr. 10	5 very feeble	Tremor ceased after April 6.
Apr. 17	9 very feeble	
Apr. 24	8 very feeble	
May 1	8 very feeble	Some very faint tremor.
May 8	4 very feeble	

Date	Number for Week	Notes
May 15	1 feeble 6 very feeble	
May 22	3 very feeble	
May 29	7 very feeble	
June 5	8 very feeble	
June 12	16 very feeble	
June 19	2 moderate Several very feeble	One prolonged tremor.
June 26	1 moderate 7 very feeble	One tremor spasm.
July 3	8 very feeble	
July 10	1 feeble 28 very feeble	
July 17	2 feeble 16 very feeble	One tremor spasm.
July 24	19 very feeble	Numerous tremor spasms July 21 and harmonic tremor accompaning lava flow began to be steady the morning of July 25.
July 31	17 very feeble	Harmonic tremor ended July 28 when fountain went out of action.
Aug. 7	2 feeble 27 very feeble	One period of spasmodic tremor.
Aug. 14	28 very feeble	Some continuous tremor.
Aug. 21	1 feeble 19 very feeble	
Aug. 28	1 slight 16 very feeble	
Sept. 4	15 very feeble	
Sept. 11	4 very feeble	
Sept. 18	1 feeble 8 very feeble	
Sept. 25	221 earthquakes and tremors	Violent earthquake disturbances near Hualalai. Some long tremors at seismograph.
Oct. 2	244 earthquakes and tremors	Many more felt in North Kona.
Oct 9	129 earthquakes and tremors	The two strongest shocks were September 25 and October 5.
Oct. 16	97 earthquakes and tremors	North Kona crisis declining.
Oct. 23	3 feeble 9 very feeble	41 prolonged tremors. Total 53 seismic disturbances as compared with 97 for the previous week. The orgin continued to be near Hualalai.
Oct. 30	1 feeble 39 very feeble 56 tremors	Hualalai origins continue active.
Nov. 6	1 feeble 21 very feeble 35 tremors	Hualalai origins continue active.
Nov. 13	2 feeble 28 very feeble 32 tremors	Hualalai origins continue active.
Nov. 20	16 very feeble 12 tremors	Hualalai crisis dwindling.
Nov. 27	2 feeble 12 very feble 18 tremors	Hualalai crisis dwindling.
Dec. 4	2 feeble 13 very feeble 10 tremors	North Kona still feeling shocks.
Dec. 11	8 very feeble 9 tremors	Five indicated North Kona origin.
Dec. 18	9 very feeble 4 tremors	Five indicated North Kona origin.
Dec. 25	3 very feeble 10 tremors	Felt in North Kona.
Jan. 1, 1930	1 feeble 8 very feeble	Five indicated North Kona origin.

The year 1929 as recorded seismically above for Kilauea, was notable volcanically for actual inflow of lava at Halemaumau pit February 20-21 and July 25-28, and for such subterranean disturbance at Hualalai Volcano that intense shaking affected the North Kona District and much of the island of Hawaii from September 19 to the end of the year. These three events are clearly reflected in the harmonic tremor produced by the Halemaumau eruptions at the Kilauea Observatory, and in the great excess of earthquakes and tremors of all classes which accompanied the Hualalai disturbance beginning with the week which ended September 25. Seismically the frequency and intensity of the Hualalai spasm were both at a maximum during the first fortnight and declined rather evenly thereafter. No lava outflow was determined as occurring under the sea or anywhere during the Hualalai crisis. If we compare the seismic record shown above with the earthquake freqency and intensity that accompanied the explosive eruption of Kilauea in May 1924 (diagram Page Four Volcano Letter No. 328), it is apparent that the seismic maximum at Kilauea was toward the end of the eruptive period, and both frequency and intensity increased as this maximum was approached. There is good reason to think that the Kilauea steam blasts of 1924 were occasioned by an outflow under the sea. Therefore it seems improbable that any submarine outflow occurred at Hualalai in 1929, for the seismic behavior was exactly the opposite of that of Kilauea. It seems more likely that lava flowed in under Hualalai with an upward pressure, splitting open deep rifts, and preparing for eventual outflow somewhere to the north of the Mauna Loa center.

After this gradual dwindling of the Hualalai earthquakes at the end of 1929, it will be of interest to examine the frequencies of *local earthquakes* at the Kilauea Observatory for 1930, by weeks ending on the dates listed:

Date	Number for Week	Notes
Jan. 5, 1930	8 very feeble	Five indicated North Kona origins.
Jan. 12	7 very feeble 12 tremors	One indicated North Kona origin.
Jan. 19	5 very feeble 5 tremors	One indicated North Kona origin.
Jan. 26	3 very feeble 6 tremors	One indicated North Kona origin.
Feb. 2	1 slight 6 very feeble 7 tremors	North Kona origin. Three indicated North Kona origins.
Feb. 9	4 feeble 2 very feeble 8 tremors	Three probably North Kona origin.
Feb. 16	7 very feeble 16 tremors	One indicating North Kona origin.
Feb. 23	1 slight 9 very feeble 13 tremors	
Mar. 2	3 very feeble 8 tremors	Two indicating North Kona origin.
Mar. 9	1 feeble 7 very feeble 5 tremors	Three indicating North Kona distances.
Mar. 16	1 feeble 5 very feeble 9 tremors	
Mar. 23	5 very feeble 2 tremors	
Mar. 30	4 very feeble 9 tremors	
Apri. 6	5 very feeble 12 tremors	
Apr. 13	1 very feeble 12 tremors	
Apr. 20	3 very feeble 6 tremors	
Apr. 27	3 very feeble 4 tremors	
May 4	5 very feeble 6 tremors	
May 11	3 very feeble 11 tremors	
May 18	8 very feeble 11 tremors	
May 25	1 moderate 2 feeble 3 very feeble 5 tremors	Probably in Puna. Probable origin North Kona.
June 1	1 very feeble 9 tremors	

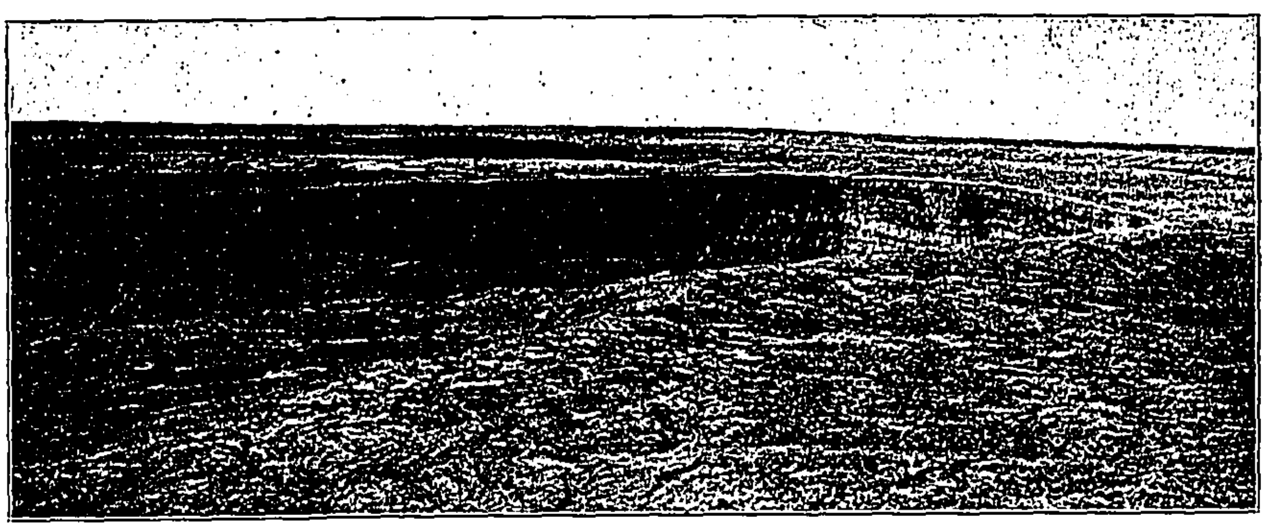
Date	Number for Week	Notes
June 8	3 feeble 1 very feeble 6 tremors	One probably Hualalai.
June 15	1 slight 3 very feeble 4 tremors	
June 22	6 very feeble 7 tremors	
June 29	1 very feeble 5 tremors	
July 6	3 tremors	
July 13	4 very feeble 4 tremors	
July 20	6 very feeble 6 tremors	
July 27	1 moderate 5 very feeble 4 tremors	Strong in North Kona.
Aug. 3	3 very feeble 10 tremors	
Aug. 10	2 feeble 3 very feeble 5 tremors	Several tremors notably at Halemaumau.
Aug. 17	3 very feeble	Several tremors.
Aug. 24	1 feeble 3 very feeble 25 tremors	
Aug. 31	5 very feeble 31 tremors	
Sept. 7	6 very feeble 26 tremors	
Sept. 14	1 very feeble 46 tremors	
Sept. 21	5 very feeble 49 tremors	
Sept. 28	1 moderate 2 feeble 7 very feeble 23 tremors	
Oct. 5	1 feeble 3 very feeble 25 tremors	
Oct. 12	3 very feeble 17 tremors	
Oct. 19	1 moderate 2 very feeble 17 tremors	
Oct. 26	1 moderate 1 very feeble 57 tremors	
Nov. 2	1 slight 3 very feeble 42 tremors	
Nov. 9	1 feeble 44 tremors	
Nov. 16	10 very feeble 48 tremors	
Nov. 23	1 feeble 8 very feeble 24 tremors	Harmonic continuous tremor accompanied lava outbreak at Halemaumau November 19.
Nov. 30	None	Harmonic volcanic tremor continuous along with lava inflow at Halemaumau.
Dec. 7	2 very feeble 4 tremor spasms	Harmonic tremor and lava action ceased December 7.
Dec. 14	3 very feeble 33 tremors	
Dec. 21	1 feeble 3 very feeble 36 tremors	
Dec. 28	1 feeble 42 tremors	

The year 1930 as here recorded seismically for Kilauea was notable as retaining traces of the Hualalai seismic spasm in North Kona until March, and thereafter the seismicity may be considered normal as compared with past years. Volcanically there was registered continuous tremor accompanying lava outbreak in Halemaumau from November 19 to December 7 with one week in the middle of this activity showing no local earthquakes at all. It may be said that, except for phenomena of volcanic tremor and tilt, the three lava inflow eruptions of Halemaumau in 1929-30 were notably quiet seismically, and this characteristic was observed in 1927 and at other times. Rising below a sealed vent may make strong preliminary shocks some time before the eruption, but through an open vent like Halemaumau the movement of lava does not make earthquakes.

The totals for the two years were 1,516 local disturbances at the Hawaiian Volcano Observatory for Kilauea seismographs in 1929, and 1070 disturbances for 1930 To show the difference in a distance of 50 miles for a localized seismic spasm, compare the 1929 figure for Kilauea with the 6,211 shocks that were registered in the vicinity of Hualalai between September 21 and October 16, 1929. The Kilauea total for the same period was about 691 shocks, many of them felt.

The totals of seismic disturbances at Kilauea per year since the explosive eruption of 1924 have been:

1925	922
1926	1778
1927	1149
1928	1034
1929	1516
1930	1070



The vast lava pit of Halemaumau taken from the high western bluff of Kilauea Crater. This is the pit the bottom of which has been gradually filling since the tremendous engulfment of 1924. Photo Baker.

The high total of 1926 was due to the Mauna Loa eruption in April, just as that of 1929 was due to the seismic spasm on Hualalai. It is of interest to note that for the 20 days of this Mouna Loa eruption the maximum of both frequency and intensity of earthquakes was reached during the first week in the registration at Kilauea, and in this it was similar to the happenings on Hualalai, and in like manner was contrasted with the seismic record of the Kilauea subsidence and steamblast eruption of 1924. This is further evidence favoring the supposition that the Hualalai disturbance marked an upward lava pressure which suddenly disrupted the mountain by intrusion of lava which has not yet been evacuated.

It will be seen that the average of the last six years at Kilauea is 1278 local disturbances per year, including tremor spasms, whereas the record from 1914 to 1925, inclusive, (Volcano Letter No. 54) showed an average per year of 1022 local earthquakes, wherein all the tremor spasms were not counted, and wherein also the very exceptional total for the year 1924 of 5877 shocks was included In general the figures for the eight years of continuous lava activity in Halemaumau pit between 1914 and 1923, inclusive, omitting 1916 and 1919 when Mauna Loa introduced complications, averaged 410 local shocks per year, which is less than the average at the present time. The figures are not strictly comparable as the listing of tremor spasms greatly increases the totals at present. Nevertheless it appears certain that free lava flow in the pit causes a decrease in numbers of earthquakes. T.A.J.

KILAUEA REPORT No. 1032

WEEK ENDING NOVEMBER 1, 1931

Section of Volcanology, U. S. Geological Survey

T. A. Jaggar, Volcanologist in Charge

Crack measurements on October 26 found no changes. Two new measuring points were marked on the northeast side of Halemaumau, where freshly broken ground was discovered on October 24. By October 31 one of these points had moved open nearly one-half inch. Fume and steam were absent. On the 27th both fume and steam were fairly thick after rain. Conditions at Halemaumau were quiet seismically. The pit was visited on the 29th after a felt earthquake at 5:45 a. m., and fume appeared strong and steady. There was no apparent avalanching from the shock. The seismograph at the pit showed tilt away from Halemaumau, which would appear to indicate tumescence. A second felt earthquake occurred at 11:34 p. m. October 31.

The records from the instruments at the Observatory were obscured during the daylight hours by artificial tremors caused by road machinery. There were also numbers of disturbances from blasts. Forty known tremors were counted, and 16 that were either artificial or natural. Of three very feeble seisms, one was very local and another was probably from Mauna Loa. Two feeble shocks were felt as noted above. The first showed distance about five miles from the Observatory and the second about 10 miles. Parts of two distant earthquakes were recorded feebly November 1 at 2:12 p. m. and 11:45 p. m.

Tilt for the week was slight WNW. Microseismic motion was moderate to heavy.

THE VOLCANO LETTER

The Volcano Letter combines the earlier weekly of that name, with the former monthly Bulletin of the Hawaiian Volcano Observatory. It is published weekly, on Thursdays, by the Hawaiian Volcano Research Association, on behalf of the section of volcanology, U. S. Geological Survey. It promotes experimental recording of earth processes.

Readers are requested to send articles, photographs, publications and clippings about volcano and earthquake events, instruments and investigations, especially around the Pacific.

Subcription for non-members two dollars per year of 52 numbers. Address the Observatory.

HAWAIIAN VOLCANO OBSERVATORY

Founded 1911

This laboratory at Kilauea Volcano belongs to the Hawaiian Volcano Research Association and is leased and operated by the United States Geological Survey.

It maintains seismographs at three places near Kilauea Volcano, also at Hilo, and at Kealakekua in Kona District. It keeps a journal of Hawaiian volcanic activity and publishes occasional Bulletins.

Membership in the Hawaiian Volcano Research Association is limited to patrons of Pacific science who desire personally to aid in supporting the work.

The work of volcano research so supported is in collaboration with the work of the United States Geological Survey, but supplements it with buildings, research fellows, instrumental plants, explorations and special investigations for which there is no governmental provision. The Geological Survey maintains volcano stations in Alaska, California and Hawaii.

Persons desiring application blanks for membership ($5.00 or more) should address the Secretary, Hawaiian Volcano Research Association, 320 James Campbell Building, Honolulu, T. H.

The Volcano Letter

Two dollars per year | Ten cents per copy

No. 359—Weekly | Hawaiian Volcano Observatory, National Park, Hawaii | November 12, 1931

Interior of Soufrière crater, St. Vincent, from southwest rim May 31, 1902, showing boiling pools in the bottom after the great eruption of May 7, 1902, and before the later eruptions, which tended partially to fill the inner bowl with ash surrounding a circular lake at higher level. This filling followed a series of geyser-like gushes in March 1903. Photo Jaggar.

THE CRATER OF SOUFRIERE VOLCANO

A remarkable feature of the volcanic eruptions in the Caribbee Islands made famous by the destruction of St. Pierre by the volcano Pelée in Martinique in 1902, was the fact that a great steam-blast eruption at St. Vincent, 100 miles south of Martinique, occurred at 1:30 p. m. May 7, 1902, and the next morning, about 8 o'clock, occurred the cataclysm at Mont Pelée. There was clearly sympathy along the subterranean rift above which the line of islands has been built. The writer visited both volcanoes in May 1902, and was with the first party that made the ascent of Soufrière Volcano on May 31. He made a sketch map of the crater and a photographic panorama reproduced herewith. We shall here examine the evolution of this crater, which contained a lake before the eruption of May 7, showed boiling water in the bottom immediately afterwards, and refilled to about the former lake level during the following year.

It may be well at the outset to describe the crater as it appeared during our visit of May 31. We ascended the mountain following the spurs which had been swept bare on the southwest side. The mountain is a rugged cone deeply trenched by radial gorges and charted as being 4048 feet high. The old slopes had been steepened by rapid wash and landslides, the luxuriant vegetation was swept away, the slopes were furrowed with feathery patterns of rill drainage cut in the muddy ash covering, and each spur was like a very steep roof with a smooth pathway along the divide and erosion corrugations at the sides. Here and there huge stumps remnant from the former jungle lay prone or jutted upward with limbs charred and sharpened to dagger points by the volcanic sand-blast. At 1610 feet elevation the smooth spurs changed to a steep tumble of mud clots, sometimes knee deep and sticky, with blocks of rock two feet or more in diameter scattered about by the eruption.

After nearly three hours of climbing we came to the crest and looked down into an enormous cauldron, almost circular, showing on the opposite side a wall striped with horizontal bands of columnar intrusive lava, and the peak of the mountain beyond rising high into steam clouds. On the right was a black precipice falling away 2,000 feet almost sheer, and on its face there purled upward from the bottom a long, noise-less column of steam which broke away in billows. Down at the bottom was a pale green muddy pool sending up a hundred tails of steam and boiling vigorously. On the opposite shore of the pool springs from the wall trickled across a flat making red and sulphurous stains, and uniting into a brook which had built a small delta. The middle bands in the wall were of gray lava, one of these showing a funnel-shaped section as though the slag had filled an upright fissure that spread out above into a drooping mushroom. Farther down there were reddish brown tuffs made of fragments A large dike filled a fissure from bottom to top of the wall on the left, and at the top the northern crater edge was seen to be backed by a higher ridge. Between the two occurs the crater of 1812 which is a subsidiary cup or flat that was filled with debris by the eruption of 1902. These features may be seen in the photograph on Page One. The bottom of the crater was 2550 feet below the highest distant summit, and 1660 feet below the rim. The upper diameter is 4870 feet, and the western rim where the photograph was taken stood 2735 feet above sea level. The old chart indicated 2013 feet for this elevation. The figures here given were obtained by rough angular measurements from the ends of a base line paced off on the edge of the crater. The eastern rim of the bowl stood over 2000 feet above the boiling pool. This pool was about 1200 feet across from east to west and was *incessantly changing. It is probable that the oval* of the crater had a greater dimension of more than a mile diameter north and south. The north-northwest corner had been blown away or had collapsed so as to notch the rim outward. The column of steam rose from a point south 18 degrees east from the center of the cauldron and was about 50 feet wide. The base of the steam column marked that part of the lake which was in most violent ebullition, sputtering fiercely and occasionally sending up spurts of black mud and rock fragments a few feet above the bottom of the crater. Jets of steam were seen to come directly from rock fissures on the southern side. The level of the lake was about 1100 feet above the ocean and some 800 feet lower than the lake surface that existed in this crater before the eruption. The pool of boiling water appeared shallow, for the slopes of slide rock shelved off into it at low angles and mud islets rose in the middle.

The crater lake of the Soufrière, before the eruption. was described as a pearly green sheet of water, set in sloping verdant crater walls, smelling of sulphuretted hydrogen, and the water was cold. A native trail crossed the mountain and people had bathed in the lake. The level of the lake surface was 1,930 feet, so that the southern wall over the water had been 1100 feet high, and the northern about 1700 feet. There was no known outlet. Soudings of 43 fathoms near the shore and about 88 fathoms near the center indicated that the bottom of the depression had its deepest part to the north of the center and the bottom must have been over 1600 feet below the southern lip of the crater. In other words, the rock bottom left by earlier eruptions was not very different from what the 1902 eruption produced. The former crater was described as nearly circular, with its northern lip 3623 feet above sea level and about 600 feet higher than the southern lip. The edge of the crater had been an irregular knife edge with inward and outward slopes both of from 30 to 40 degrees, and the crater depression was due to engulfment and erosion. It had not been difficult, with the aid of bushes and small trees, for passers-by to descend to the edge of the lake.

The eruptions of May 1902 disrupted the bottom of this cauldron and somewhat enlarged it, but the small crater under the crescent ridge on the north took no part in them. The phenomena were quite like those of Mont Pelée, gigantic cauliflower clouds, a downblast at the southwest, heavy accumulations of broken rock, sand, and dust 50 to 80 feet deep in the gulches, and this material so hot that the subsequent revival of spring waters made explosions in the valleys where the streams made contact with the banks of hot gravel. These banks were crusted over by a shell of rain mud which tended to retain the heat. Down some of the gulches there were doubtless combinations of flood and blast, similar to those described at Santa Maria in 1929 (Volcano Letter No. 356). Glow appears to have been seen above the crater in certain eruptions, and we may conclude that glowing magma lay under the crater lake, but it never reached the stage of lifting a crater plug as on Mont Pelée.

Just after a notably disastrous explosion of Pelée August 30, 1902, Soufreière followed with a damaging eruption that took no lives. This occurred on September 3 in a series of pulsations with detonations. They reached their climax in 20 hours, sending up a black cloud alive with electric displays and accompanied by some earthquakes. Mud flowed down one of the valleys and there was a heavy fall of ash to leeward. An inspection of the crater September 22 showed newly ejected blocks down to 400 feet below the summit, the great pit was 150 feet deeper than it had been, the lip had been lowered on the west, and banks of ash were piled against the northern and eastern walls. Steam rose from a fissure at the south. At the bottom was a small lake of stone-colored liquid in ebullition and sending up steam clouds.

An intense eruption occurred October 14, 1902, with preliminary clouds of dust-laden steam and the rumbling of avalanches at 8 p. m. followed by violent detonations at midnight. By 12:30 a. m. "a ball of fire" was followed by an incandescent hurricane, or cloud, or blast, down the Larikai valley west-northwest from the crater. At Chateau Belair southwest of the volcano stones began to fall about 2 a. m. October 15 and continued for two hours along with strong electrical displays and the rumbling of thunder. Mud fell at 2 a. m., the detonations died away at 5 a. m., there were several earthquake shocks, and volumes of dust-laden vapor rose from the crater for two days. Dust was carried to Barbados, and coarse debris fell to windward.

An ascent of Soufrière October 28, 1902, was made, and volumes of steam were found rising from the crater. Numerous cones of ashes were being thrown up to a height of 40 feet over a fissure close to the southern wall, and the lake was boiling near the center.

A phenomenon of interest November 26, 1902, was a mud flow down the Rabaka River which leads from under the crescent summit of the mountain to the southeast, as an extension of the Larikai valley on the opposite side of the volcano. This river had been completely blocked by ash avalanches during five months of heavy rainfall. Probably a lake formed in the higher reaches of the river. When the dam broke, two raging steaming torrents descended the valley, destroying the remains of a sugar mill, and blocking up the old stream bed near the sea, so that the river now runs in a new channel to the north of the old one.

An examination of the crater by Sapper February 6, 1903, showed that landslides had deepened the gap at the north, that the diameter of the crater was 1320 meters, that the longer diameter was WNW-ESE, and that the lake had dimensions 540 by 340 meters and its height above sea level was 585 meters or 1919 feet, agreeing with the old chart. In other words, the water had come back to the old level. The lake water was boiling in the center and at the southeast corner.

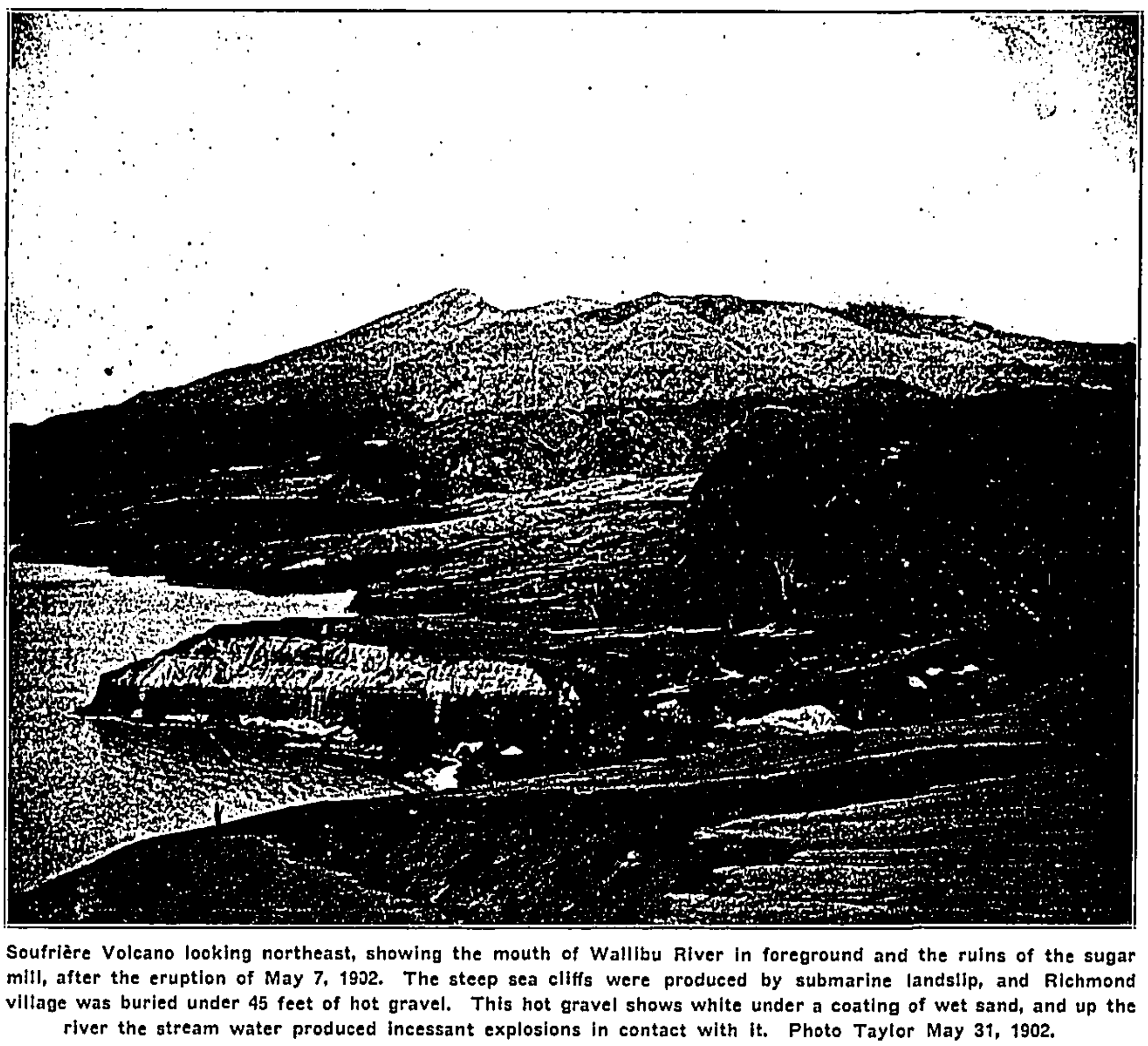
There was not much saddle left between the northern craterlet and the big pit, this region was deeply covered with ejecta, the smaller crater contained a shallow lake 230 feet in diameter, and fumaroles were found in the main crater rim in two places. It is an interesting and unexplained condition that in both Pelée and Soufrière there are main craters forming profound pits well below the summit on one flank of the mountain, just as at Santa Maria in Guatemala, and minor flat cups containing ephemeral shallow ponds close to the summit. Apparently the great active craters are on a radial fracture line and the little summit cups are adjacent to an old outlying lip of some former engulfment, as at Monte Somma on Vesuvius.

Lacroix and Hovey visited Soufrière crater March 3, 1903, hot mud ejections upward through the crater lake were happening from time to time, and these as photographed by Lacroix strongly recall the mud geyser explosions of the Waimangu crater in New Zealand. A sudden descent of a torrent of mud was seen in one of the western valleys. The condition of the slopes was unstable and a cloudburst could easily produce phenomena of this kind. Avalanches were falling at the crater, there was an increase in quantities of small stones and large ejected blocks of old rock on the slopes outside the crater, and the water of the lake was quiet and yellow with mud between spells of ebullition. When agitated it became more gray in color. The geyser-like gush which was photographed arose from the center of the lake as a mass of inky mud entangling blocks of rock. One photograph shows it as seen from the south-southeast rim in process of rising, like sheaves of rockets, with upward jetting shreds in the profile and rounded undersurfaces to each sheaf. At this stage it was a thousand meters high above the lake. A photograph made 20 seconds later shows the nodes expanded into steam clouds and the beginning of showers of backfall. The mass of mud, which rose noisily, fell heavily back with a roar, followed from below by a fresh column of vapor. A heavy shower of mud fell at the rim of the crater. These explosions were seen 50 miles away, and were precursors of the last considerable eruption. Hovey, who had seen the crater in 1902, comments on the rapidity of erosion since the first eruption, estimates that 25 million tons had been carried out to sea by the one valley Wallibu at the southwest, and notes many andesite bombs up to three feet in diameter among the ejecta.

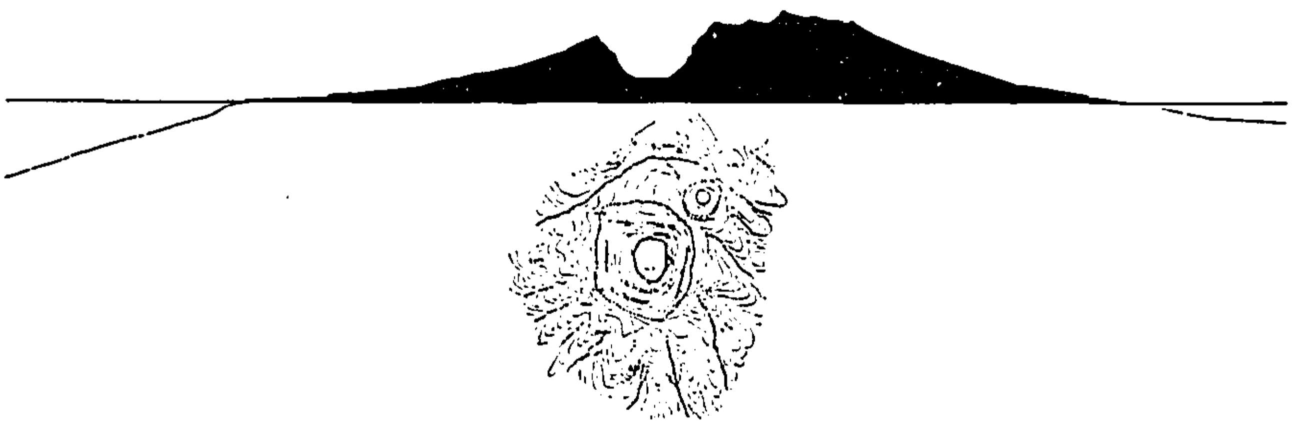
On March 21, 1903, Soufrière crater emitted much steam, on March 22 at 7:25 a. m. an explosive black cloud appeared, of cauliflower shape, rising to a tremendous height and then passing away in all directions. Detonations ceased about 10 a m., but there were later noises from the crater and there were several earthquakes during the morning. Dust-laden vapor continued to rise for nine days. A few inches of dust had fallen at the west coast, and 20 feet of new gravel in one of the ravines, with a hot bomb, weighing 75 pounds, on top of an ash layer. Some illumination at the crater was seen on the evening of March 30.

A visitor at the beginning of April 1903 described the inside of Soufrière crater as changed in appearance with the bottom filled up with chocolate-colored ash to about the old water level. In the center of this new deposit was a narrow funnel, which gradually widened in later months. The southern lip of the crater had been built up with new ash, much of the northeastern wall had caved in, and fissures in the new bottom deposit were steaming.

In the spring of 1907 Tempest Anderson revisited



Soufrière Volcano looking northeast, showing the mouth of Wallibu River in foreground and the ruins of the sugar mill, after the eruption of May 7, 1902. The steep sea cliffs were produced by submarine landslip, and Richmond village was buried under 45 feet of hot gravel. This hot gravel shows white under a coating of wet sand, and up the river the stream water produced incessant explosions in contact with it. Photo Taylor May 31, 1902.



Profile section and map of Soufrière crater made by a sketch survey May 31, 1902, by T. A. Jaggar. Vertical and horizontal scales the same, 0.64 mile to the inch. Bottom of crater 2550 feet below summit, 1660 feet below rim. Diameter crater lip 4870 feet. Coast benches east 60 and 200 feet above sea level. Depth of ocean in profile 125 fathoms east, 530 fathoms west. Profile on line north 66 degrees east.

Soufrière (Report on Soufrière, Part I, 1903, Part II, 1908, Phil. Trans. Roy. Soc. Lon., Vols. 200 and 204), and from his review much of the above is taken. He obtained a *new and excellent picture of the inner ash terrace of the* crater bottom and the enlarged funnel, containing the lake, restored as a circular pool. The topography was as represented on the older chart. The walls are nearly vertical, consisting of alternate layers of tuff and compact rock dipping outwards from the crater. The rock layers are either lava flows or intrusive sheets, and two dikes were seen cutting them. One layer is several hundred feet thick and columnar. The broad bench around the lake, formed by the ejecta of March 1903, is widest on the north and east, and has a talus forming on it by falls from the cliffs above. The lake is something over half a mile in diameter, of uniform light green color, at about the level indicated in the old charts, which is presumably the groundwater level of the mountain. A very little vapor was seen in 1907 from two spots near the foot of the crater walls south and east. There appeared to be more stones on the ground northeast of the crater than elsewhere, and the deposit of new ash a few feet thick on the southern lip was deeply trenched by rain rills and sloped inward evenly at 30 degrees. The upper section of the northern walls shows continuous tuff beds, while the lenses of andesite below interlock, like a pile of flat fish. (See cut Page One.)

T.A.J.

TILTING OF THE GROUND FOR OCTOBER

The following figures show the net amount of tilt by weeks at the Observatory on the northeast rim of Kilauea Crater, and its direction, computed from the daily seismograms by platting a curve smoothed by overlapping seven-day averages. This is the departure of the plumbline in seconds of arc, in the direction given.

September 28-October 4	0.4 second N
October 5-11	0.1 second W
October 12-18	1.9 seconds NNE
October 19-25	0.5 second N
October 26-November 1	0.3 second SSW

E.G.W.

KILAUEA REPORT No. 1033

WEEK ENDING NOVEMBER 8, 1931

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge

Conditions at Kilauea are quiet. Crack point No. 25 on the northeast rim of Halemaumau continues to move open steadily at the rate of about one-half inch per week. Dust from an avalanche was observed from the Observatory at 1:50 p. m. November 3. Fume and steam were absent from Halemaumau except on November 4. On this day in thick fog and mist fume showed steadily at the central sulphur spot, and steam occurred on both the south talus and southeast rock slope.

Road work near the Obseravtory has lessened so that there are fewer artificial disturbances on the records. There were 59 tremors, a few probably of artificial origin. There were no other earthquakes of any class.

Tilt for the week was moderate NE. Microseismic motion was moderate at the beginning of the week, increased to strong on the 3rd, and decreased the following day to moderate for the remainder of the week.

THE VOLCANO LETTER

The Volcano Letter combines the earlier weekly of that name, with the former monthly Bulletin of the Hawaiian Volcano Observatory. It is published weekly, on Thursdays, by the Hawaiian Volcano Research Association, on behalf of the section of volcanology, U. S. Geological Survey. It promotes experimental recording of earth processes.

Readers are requested to send articles, photographs, publications and clippings about volcano and earthquake events, instruments and investigations, especially around the Pacific.

Subcription for non-members two dollars per year of 52 numbers. Address the Observatory.

HAWAIIAN VOLCANO OBSERVATORY
Founded 1911

This laboratory at Kilauea Volcano belongs to the Hawaiian Volcano Research Association and is leased and operated by the United States Geological Survey.

It maintains seismographs at three places near Kilauea Volcano, also at Hilo, and at Kealakekua in Kona District. It keeps a journal of Hawaiian volcanic activity and publishes occasional Bulletins.

Membership in the Hawaiian Volcano Research Association is limited to patrons of Pacific science who desire personally to aid in supporting the work.

The work of volcano research so supported is in collaboration with the work of the United States Geological Survey, but supplements it with buildings, research fellows, instrumental plants, explorations and special investigations for which there is no governmental provision. The Geological Survey maintains volcano stations in Alaska, California and Hawaii.

Persons desiring application blanks for membership ($5.00 or more) should address the Secretary, Hawaiian Volcano Research Association, 320 James Campbell Building, Honolulu, T. H.

The Volcano Letter

Two dollars per year — Ten cents per copy

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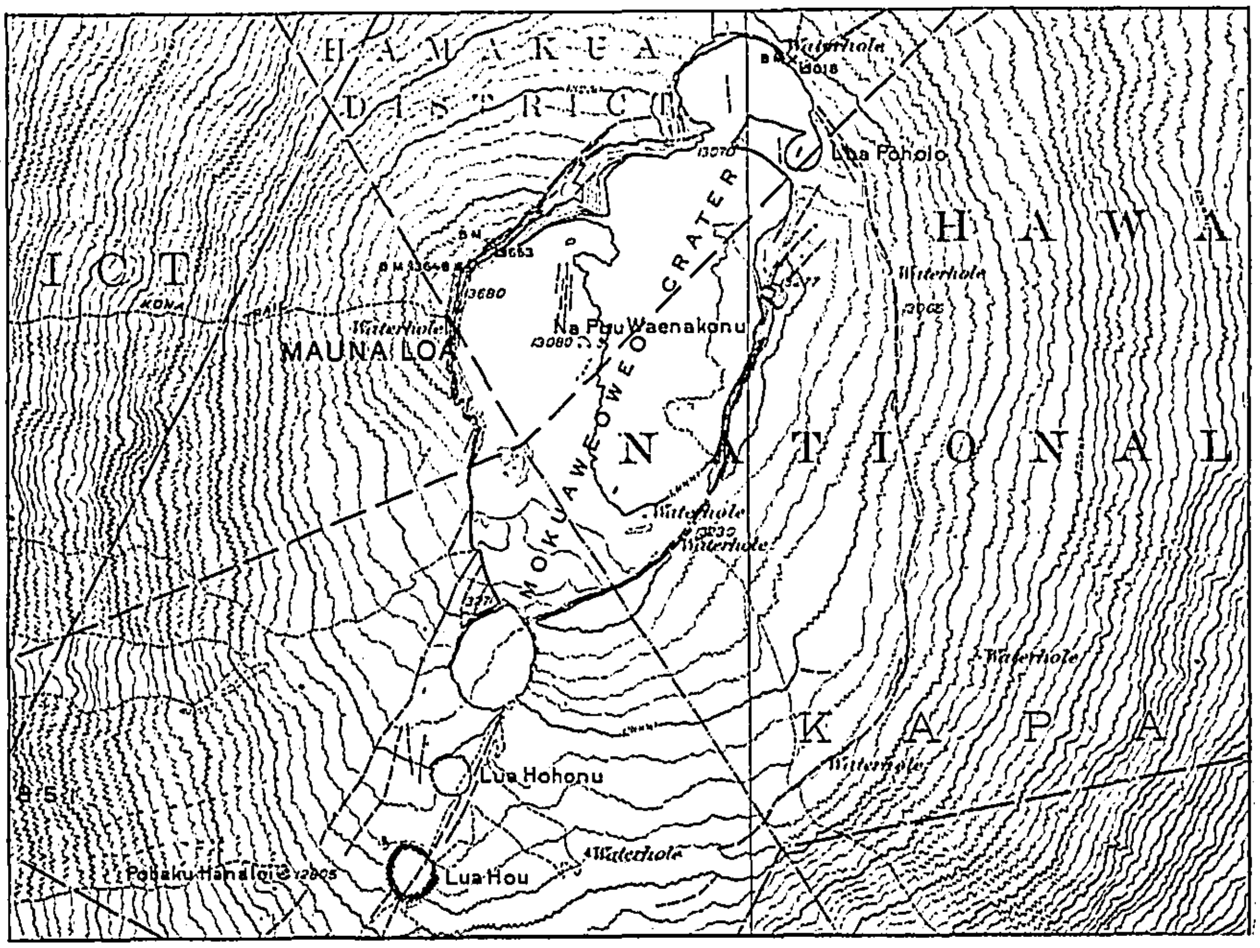


Map of Mokuaweoweo in 1926, topography by E. G. Wingate, scale 1 inch to the mile, contour interval 50 feet outside of the crater, contours largely omitted on the inside. Shows the arrangement by which the crater is a group of coalescing pits in a straight line.

THE CRATER OF MAUNA LOA

The summit crater of Mauna Loa is a sink-like depression or caldera at the meeting point of two fissure belts, the one trending approximately S. 30° W. from the south end of the crater, the other N. 65° E. from the north end of the crater. The crater itself extends these fractures into its western walls, but if the walls were considered extensions of the rifts they would each have to be bent westward, for the west wall of the crater in plan makes an angle of 120° 1.5 kilometers to the northwest of the center of the caldera. The meeting point of the two larger rift systems on the mountain is really at the north embayment of the crater, making an angle as indicated by the above trends of about 145°. The southern rift therefore really extends the whole length of the crater in the direction following the line of pits N. 28° E., thus departing from the northern rift belt 37°. As shown by the modern map on Page One (U. S. G. S. Mokuaweoweo quadrangle) the crater Mokuaweoweo, as the summit crater of Mauna Loa is called by the Hawaiians, really consists of five depressions, of which the second from the north is the large caldera; and this in turn is made up of three parts described as the north and south lunate platforms, and the central more or less circular sink with a group of cones in the middle. It is debatable whether the two lunate platforms were ever themselves separate circular pits in the history of the collapse and merging of the row of pits which has created the crater. It seems likely that they were, for stages of growth of such merging are represented by the order, south pit, north embayment, north lunate, and south lunate, progressively more and more obliterated as distinct circles.

It will be remembered that the Kilauea Crater is at a rather sharp angle between the eastern row of pits and the southwest rift. In like manner on the map of Hawaii the Mauna Loa crater is at a very open angle off to the west of Kilauea, between its northeast and southwest rifts. Both are sinks or subsidence cauldron at the apex of southeastern sectors of the respective domes. The resemblance of both in detail to the craters on the moon, when due allowance is made for scale and gravity differences, will be discussed in another place. In both Mauna Loa and Kilauea the cauldrons lie immediately under the summit points, which in each case stand at an angle of the western wall. The generation of the largest summit pit, therefore, by pulsations of rising and sinking lava, and the overflow of that lava, is directly related to the highest heaping of the lava pile.

In Volcano Letter 325 and 326 the cycle of 132 years in Hawaii after 1792 suggested a building up of increasing lava outflows to 1858, a decline thereafter to 1924, and throughout the cycle a tendency to big collapses occasionally which may have been produced by submarine outflow. It is of interest to examine the old maps of Mokuaweoweo, the greater center of all this activity, to discover when its floor built up, and when it subsided.

Such imperfect maps as exist have been collated by the writer in four drawings on Pages Three and Four, reduced to a common scale, and drawn with contours of 20 meters interval. The four mappings were by Wilkes in 1841, Lydgate in 1874, J. M. Alexander in 1885, and B. Friedlaender in 1896. To these some details have been added from sketches by other observers. On Page One is reproduced the map abridged from Wingate on the engraved sheet of the U. S. Geological Survey to show without the original details the outline of 1926. In the Wilkes map of 1841 the original summit elevation has been retained on the ground that total subsidence was probable in the half century following, and in any case Wilkes reported a summit point farther north than Alexander, at the main bend of the west wall where there was subsequent caving in. The other maps on Pages Three and Four are drawn to conform to the Alexander summit level. Lydgate's map of 1874 appears disproportionately large, and the size and depth of the south pit is dubious for both Lydgate and Alexander, but it may have been deeper than it is now.

The north embayment in 1841 contained a pit at its western end; in 1874 it was as a whole an elongate pit; after 1885 it contained a pit at its eastern end. The main cauldron contained changing small pits and cones and lava lakes. The conspicuous changes in the crater which the maps show are a breaking back of the western walls to the main fractures originally indicated by Wilkes, and a pronounced deepening by subsidence between 1841 and 1874, followed by filling of the bottom thereafter, and overflowing of the two lunate platforms by this central filling. That the walls cave in was reported by Stearns in August 1924. This was just after the great collapse at Kilauea (U. S. G. S. Water-Supply Paper 616): "During the week at the summit avalanching of rocks from the walls was common, especially on the east side, and made climbing in and out of the great caldera dangerous. At 12:10 a. m. August 23 two smart earthquake shocks were felt in quick succession. The first shock had intensity 4 R. F. and the second intensity 8 R. F. The camp was 40 feet from the rim S. E., and when the earthquakes occurred tons of rock avalanched from the wall in front of the camp, sending up a cloud of dust that was clearly visible in the starlight. Other avalanches were heard thundering to the bottom of the caldera, especially a short distance northeast of the camp. In the morning the pass to the floor, a quarter mile northeast of the camp, was no longer recognizable. A thin section of the rim had fallen down and left a vertical cliff, and a new crack several hundred feet long and over a foot wide had opened a few yards from the brink. Avalanching was frequent all that day, especially at east pit."

Wilkes made the crater a line of four pits and two big platforms. and the circularity of the main cauldron was never afterwards so marked, and it was then the deepest part of the crater. The floor of the cauldron was made of flat sheets of pahoehoe, with ridges 3 to 15 meters high, many fissures trending NNE., and some deep chasms. Wilkes shows a crescent escarpment concentric with the main cauldron in the surface rock of the country separating the south lunate platform from the south pit. This does not appear today, and is of interest in connection with the southeastern plateau shown on the modern map (Page One), bounded by curved fractures on the east and south, which suggests an old greater crater that has been filled up on that side. If these fractures extended around to the southwest, they have been obliterated by later floods of lava, and the crack shown by Wilkes was one of them. In the south pit Wilkes counted 70 horizontal layers, a cascade of frozen lava extended from the lunate platform of the big crater into the south pit, and a great steam crack extended down the mountain southward, and others trended northeast. The only activity was vaporing, especially on the west side of the floor of the main cauldron, and Wilkes mapped 14 cinder cones, one of the inner ones being 61 meters high. Wilkes indicated the cracking, the lava sputter that built cones, the concentric subsidence that built pits, and the sinking fault blocks that connected the pits. He showed that the in-breaking area was a wide isosceles triangle with hinge line at the southeast and apex at the northwest.

Lydgate's survey 33 years after Wilkes, followed five outflows and also the great crisis of 1868 when Mauna Loa had started anew, after an unknown interval, to discharge lava from its low southern slopes. The western wall of the cauldron is a third higher, and the eastern wall twice as high as in 1841. Severance in 1870 had reported the eastern wall still higher (366 meters). Lydgate reported a maximum depth of 320 meters. The southern pit was larger and deeper than that reported by Wilkes. The northern embayment had become a long elliptical pit with two cones on its floor, and Lydgate's report indicated two cones in the main cauldron also. The lunate platforms had sunk deeper and changed proportions. A new southwest extension of the main crater floor contained the active lava pool of June 1874, 153 meters in diameter, and the scene of lava fountains for years after 1872. The floor was rising owing to repeated overflows, and the crisis of 1868 appears to have been a turning point from crateral subsidence to upbuilding of the floor. A subsidence of 27 meters for the summit of the mountain (based on Alexander 1885) is quite conceivable, if there was a sinking of approximately nine square kilometers of crater flooring to a depth of 100 meters between the times of Wilkes and Lydgate. There was 25 years of outflow *from 1843 to 1868, implying* withdrawal of matter from within the mountain. At least 165 kilometers of lava flow, measured longitudinally as radial ribbons of varying width, was discharged down the mountain slope. Subsiding crest of the dome may follow subsidence of crater floor due to relief by outflow in excess of that balance of pressure of rising lava, which by sill intrusion might keep the crater stationary.

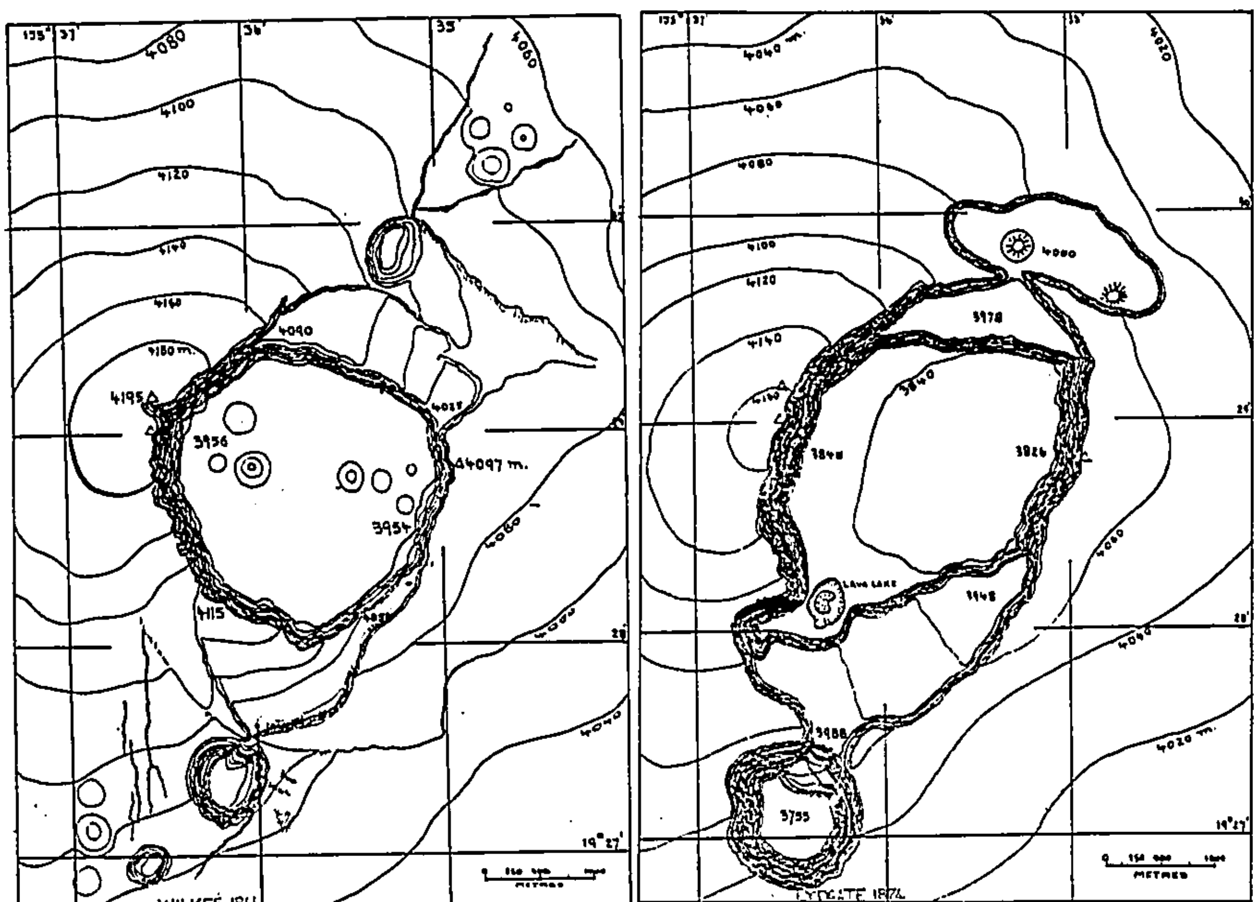
The question of actual height of Mauna Loa is important, for this summit over live lava certainly fluctuates over pressing intrusive magmas which recurrently exude through fissures. Menzies in 1794 made the elevation 13,564 feet (4134 meters); Wilkes 1841 made it 13,760 feet (4194) meters); Alexander 1885 made it 13,675 feet (4168 meters), "obtained with a spherical signal on the summit accurately determined by triangulation from more than 20 stations on Mauna Kea, Hualalai, and in South Kona." The U. S. Geological Survey (U. S. Coast Survey data) made it 13,680 feet (4170 meters) by precise levels from Hilo tide guage in 1926, showing stationary conditions after 1885. Apparently the summit rose between 1794 and 1841, and sank between 1841 and 1885. There may have been some vast outflows of Mauna Loa in the last half of the eighteenth century preceding the great Kilauea eruption of 1790, which accounted for the low level of the summit measured by Menzies.

In July 1880 Brigham reported at Mokuaweoweo fresh lava spread over the central floor, obliteration of the inner walls of the lunate platform, talus suggesting recent earthquake, and a lava flow away from the crater on the southwest rim which came from fissures near the brow of the cliff. The flooding of the summit crater with lava from 1872 to 1876 was accompanied by repeated laldings, crater flows, and fountains, and no recorded outflows, except that in 1877 there was a submarine lava flow at Kealakekua Bay. The lava flow of 1881 produced 68 linear kilometers of streaming, starting in November of 1880 after summit effusions in the spring of that year, and taking its origin on the northeast rift 10 km. ENE. from the north embayment of Mokuaweoweo and 3350 meters above sea level. There is a large pit crater where this flow emerged, and the lava divided into two streams, one flowing towards Kilauea, the other towards Mauna Kea, and this latter again divided and its longer arm reached Hilo after nine months of activity.

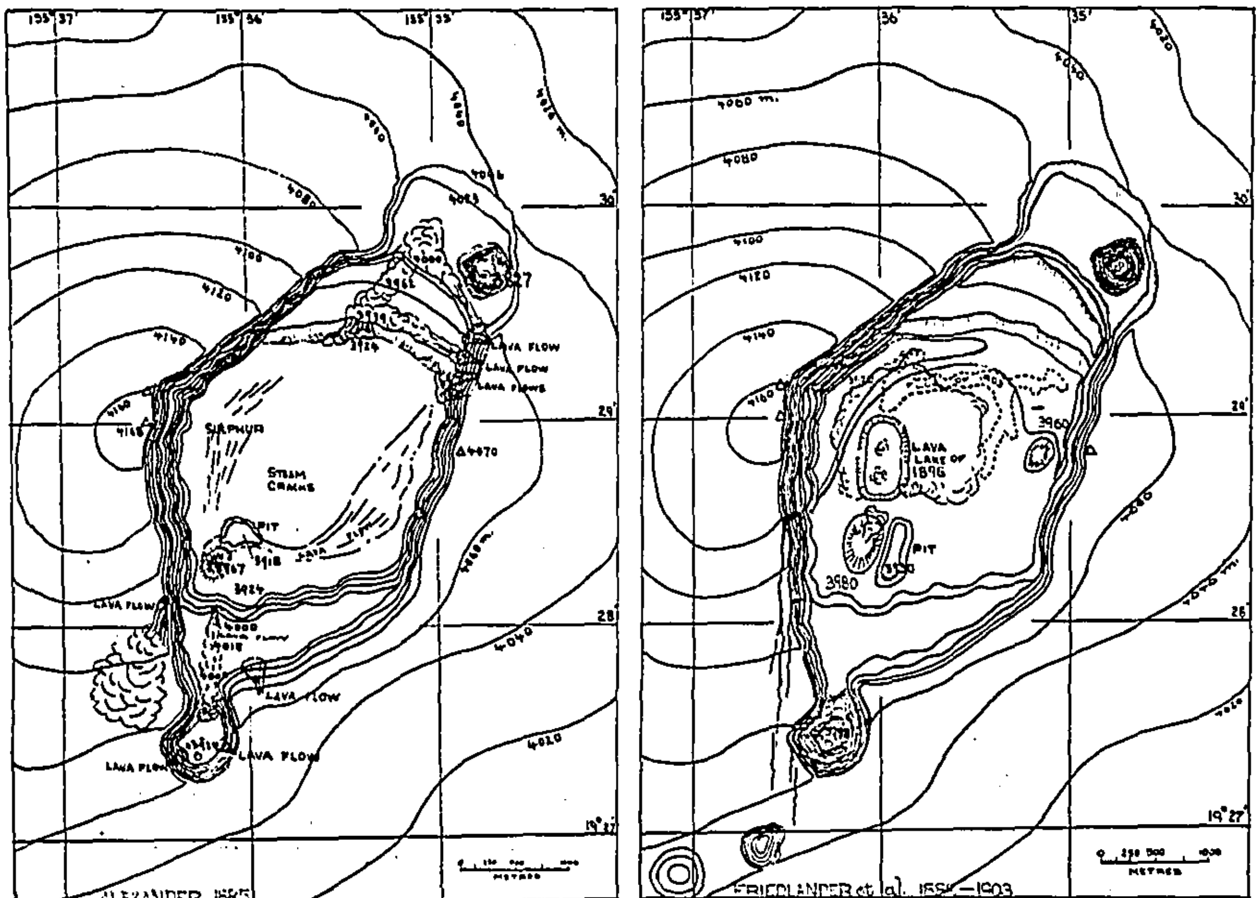
Alexander in 1885, eleven years after Lydgate, mapped great changes of building up. The south pit was smaller, filled by lateral inflow from wall fissures and from the gateway. The south lunate platform had less relief and was smaller. A fresh lava flow had poured across the platform into the south pit and lava cataracts from cliff-edge fissures had flowed onto the platform. The main floor had been built up to new high levels from a vent in the southwest corner. This vent migrated northward 600 meters after 1874; the lava filled 100 meters of depth on the north and east, 80 meters on the west, and 40 meters on the south. The floor apparently sloped away to the northeast from a lava lake at the south just as at Kilauea. The walls had changed, but the northwest angle at the high summit remained the controlling feature of the crater. Alexander saw vaporing from hundreds of cracks in the floor, from the cone at the southwest corner, and from the wall fractures at the heads of the lava cataracts. The floor cracks were streaked with sulphur, the cone was of hot friable lava and pumice 43 meters high, north of it was a solidified lava pool surrounded by a rim six meters high, and the lava of the greater crater floor was pahoehoe. The north lunate platform was overflowed, the promotories had crumbled back, the northern embayment had changed to become a second and higher platform, the western cone was replaced by a lava flow, and the eastern one by a circular pit 183 meters deep and 305 meters across, with a central cone on its floor emitting vapor.

Wood in 1915 (Am. Jour. Sci. May 1916) describes the changes since 1885 as a building up of the floor, submergence under lava of the lunate platforms, and as products of the floor eruption of 1903 a central cone and lava flow, with a NNE rift east of it representing the fresh cones of 1914. The lava flows of 1914 on the floor had covered large portions of the two platforms and the central cauldron. Wood mentions blade lava of extraordinary quality unlike anything in Kilauea, the blades characterizing the texture of the surface of both pahoehoe and aa. Stearns in 1924 indicates the geology of the crater as distributing fresh recent lava, mostly since 1832, all along the line of the crater pits, this widening out into fans of flows at the NNE and SSW slopes of the mountain. He mapped fissures, spatter cones, cinder cones, pit craters, faults, water and ice holes, trails, and fumaroles. The principal scene of eruptions in Mokuaweoweo is a fissure zone about one and one-half miles long extending northeastward from the southwest side of the main crater, and along this zone lie chains of cones. The 1914 cone stands in the southwest part of the floor 100 feet high, is still steaming, and southwest of it is a small crater which contained the lava lake of 1903. Hot yellow pumice lies northwest of it in a field from which dense, blue, sulphur fumes ascend. North of this is a depression 15 or 20 feet deep covered with pahoehoe having islands of aa. Heat radiates from cracks in the floor and rim of this craterlet. Northeast of it is a line of driblet and pumice cones 10 to 75 feet high. The large cone of 1903 near the center of the greater crater, has the remains of another lava lake near it with a hot solfatara west of this lake which is depositing crystalline sulphur. This large 1903 cone lies west of the fissure of 1914.

The fissure zone passes across the south platform up to the rim of the caldera and may be seen in the crater wall. On the rim 200 feet above the platform is a small driblet cone and the lava actually shows as a dike in the cliff below. Southwest from the crater rim is a line of driblet cones which poured out lava that cascaded over the vertical wall of the caldera and spread out on the floor, showing that lava was being extruded on the floor and on the cliff above at two levels different by 300 feet. According to the map by Stearns, which is based on Wingate's topographic map, the country rock east and west of the crater is older basalt showing explosion debris in two marked accumulations northwest and southeast of the central cauldron. T.A.J.



Maps of the summit crater of Mauna Loa by Wilkes and Lydgate in 1841 and 1874, respectively. Adapted by T. A. Jaggar to a common scale and contour intervals of 20 meters. Lydgate's map supplemented by notes of Hall in 1873 and Brigham's discussion of 1880. Lydgate's summit elevation adopted from Alexander in 1875.



Maps of the summit crater of Mauna Loa by Alexander and Friedlaender in 1885 and about 1896, respectively. Friedlaender's outline is based on the Alexander map and is here supplemented with notes by Merritt and Baker in 1888, Guppy in 1879, and Ridgeway in 1903. Adapted by T. A. Jaggar to a common scale and contour intervals of 20 meters.

KILAUEA REPORT No. 1034

WEEK ENDING NOVEMBER 15, 1931

Section of Volcanology, U. S. Geological Survey

T. A. Jaggar, Volcanologist in Charge

The only noteworthy changes, at Halemaumau are a steady tilt away from the pit, as indicated by the Halemaumau seismograph, and continuous widening at crack point No. 21. Measurements indicate that this point has moved one and one-half inches from October 26 to November 12.

Fume and steam were thin on November 9. Fume increased on November 10 and was thick November 12 after rain.

Because of wet weather road work slackened, and consequently there were fewer artificial disturbances on the records of the Observatory. Of 81 tremors registered, one gave distance 4 miles, 4 gave 15 miles, one gave 18 miles, and one gave 42 miles. Eight tremors were probably of artificial origin. Of six very feeble local seisms, one with indefinite phases showed distance 18 to 28 miles from the Observatory; the others had obscure phases.

Tilt for the week averaged light ESE. Microseismic motion was moderately strong at the beginning of the week, decreased to light on the 14th, and was light to moderate on the 15th.

THE VOLCANO LETTER

The Volcano Letter combines the earlier weekly of that name, with the former monthly Bulletin of the Hawaiian Volcano Observatory. It is published weekly, on Thursdays, by the Hawaiian Volcano Research Association, on behalf of the section of volcanology, U. S. Geological Survey. It promotes experimental recording of earth processes.

Readers are requested to send articles, photographs, publications and clippings about volcano and earthquake events, instruments and investigations, especially around the Pacific.

Subcription for non-members two dollars per year of 52 numbers. Address the Observatory.

HAWAIIAN VOLCANO OBSERVATORY
Founded 1911

This laboratory at Kilauea Volcano belongs to the Hawaiian Volcano Research Association and is leased and operated by the United States Geological Survey.

It maintains seismographs at three places near Kilauea Volcano, also at Hilo, and at Kealakekua in Kona District. It keeps a journal of Hawaiian volcanic activity and publishes occasional Bulletins.

Membership in the Hawaiian Volcano Research Association is limited to patrons of Pacific science who desire personally to aid in supporting the work.

The work of volcano research so supported is in collaboration with the work of the United States Geological Survey, but supplements it with buildings, research fellows, instrumental plants, explorations and special investigations for which there is no governmental provision. The Geological Survey maintains volcano stations in Alaska, California and Hawaii.

The Board of Directors includes Frank C. Atherton and Walter F. Dillingham, Vice-Presidents; L. Tenney Peck, Treasurer; Wade Warren Thayer, Arthur L. Dean, and Richard A. Cooke.

Persons desiring application blanks for membership ($5.00 or more) should address the Secretary, Hawaiian Volcano Research Association, 320 James Campbell Building, Honolulu, T. H.

The Volcano Letter

Two dollars per year Ten cents per copy

No. 361—Weekly Hawaiian Volcano Observatory, National Park, Hawaii November 26, 1931

Kapele lagoon at east end of Kula fault where a block of land subsided April 21-23, 1924, at the east point of the island of Hawaii. Along with earthquakes and cracking open of the country, this shore line subsided 10 to 12 feet so that these coconut palms, on the date of this photograph, June 9, 1924, and ever since, were submerged with their butts under 8 feet of water. Photo Finch.

PUNA SHORELINE SUBSIDENCE

The Puna District of Hawaii in the vicinity of Kapoho, the east point of the island, was the scene of destructive seismic activity in the spring of 1924. This activity was recorded in Bull. Hawaiian Volcano Observatory April 1924 and in Bull. Seis. Soc. Amer. Dec. 1924. Photographs of the region affected are reproduced in these articles and in the Bulletin of the Observatory for January 1926.

On April 21, 1924, there began a prolonged mild quaking in the Kapoho district, approximately 88 felt earthquakes were counted, and on April 22 and 23 extensive cracks began to open near Kapoho. About 20 pronounced chasms were mapped by an Observatory party. Leveling surveys were run along the railroad by Superintendent Boles of Hawaii National Park, and these indicated a new profile 9 feet lower than before, south of the quarry at Kula, and one foot lower than before at Kapoho station. The block of country between the Kapoho hills and the Kula fault where the greatest downthrow occurred sank in varying amounts from one foot to over 11 feet. At the ocean end of the Kula fault a new lagoon running 200 feet inland was formed, and coconut trees were found standing in 8 feet of water (see cut Page One).

The earthquakes were quite localized and were not felt in Kalapana, about 12 miles to the southwest, nor were any changes in elevation or cracking of the ground noticed in the country south of Kapoho.

Reports, however, have come from time to time during the last few years to members of the Observatory staff of a gradual subsidence of the Puna coast as far south of Kapoho as Kaimu and Kalapana. After a recent conversation with Mr. Henry Lyman of Kapoho, a trip was made through the Puna District for the purpose of verifying, if possible, these reports and gathering further evidence, as well as for locating likely points for future observation and measurement.

The trip was made November 12, 1931, and residents were interviewed at Kapaahu, Kalapana, Kaimu, Opihikao, Pohoiki, and Pahoa; Mr. Richard Lyman of the last place gave information concerning Kapoho and the general conditions of the district. The following was the evidence from different places:

Kapaahu, Kalapana, Kaimu;

Four families were interviewed. None had noticed any change in shore elevation. The washing of waves over the black sand beach and piling back of the sand was thought to be the result of changing currents and unusually high waves. A mark was placed at Punaluu Pond in Kapaahu, and this will be observed from time to time.

Opihikao;

Only one family found at home and these proved to be newcomers.

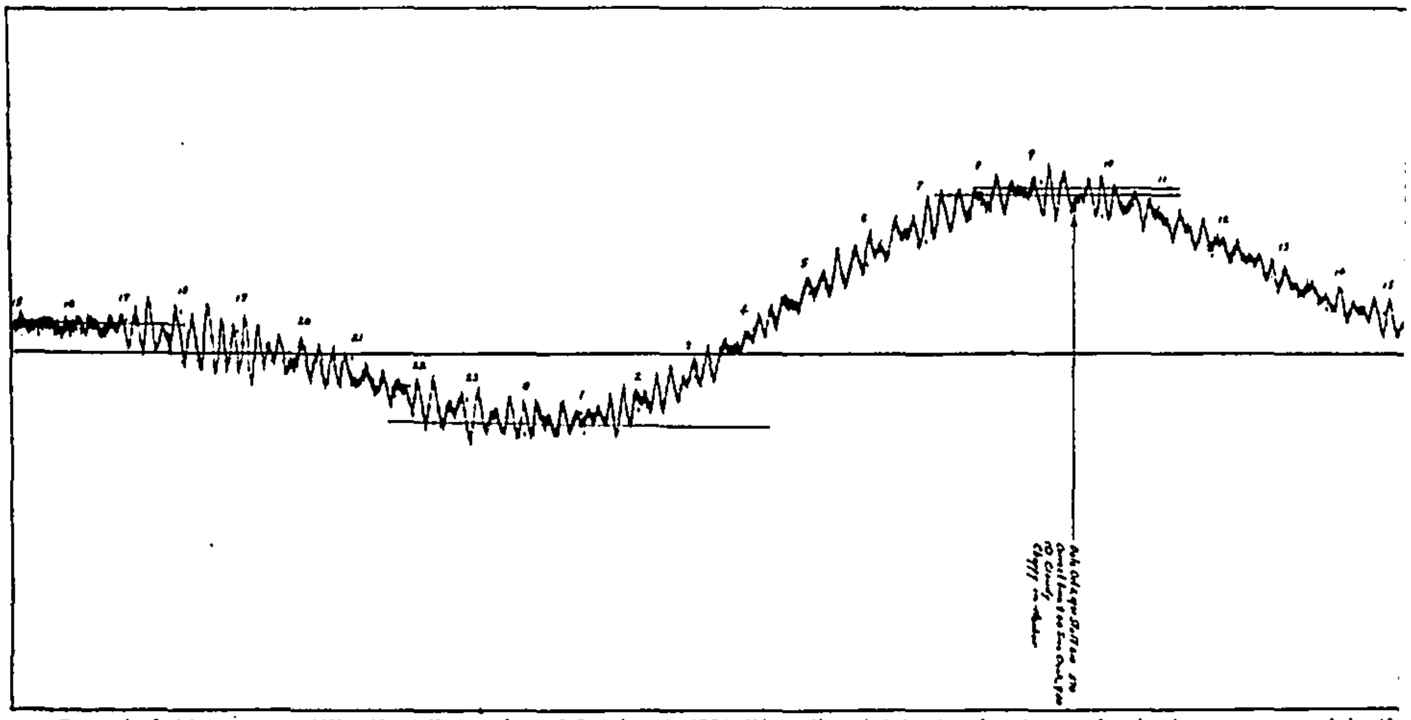
Pohoiki;

One family named Mioi was interviewed. They state as common knowledge in that district that the land has lowered, but are certain that the drop took place during the Kapoho earthquakes of April 1924. They do not connect this tradition with the shore line.

Kapoho;

Mr. Richard Lyman thinks that the sinking occurred entirely at the time of the destructive earthquakes of 1924.

Kapoho crater was visited and it was found that the



Record of tide gauge at Hilo, Hawaii, evening of October 3, 1931 (Hawaiian date), showing trace of seismic sea wave originati
wave something over 8 hours. The range of the wave movement shown at the be

middle one of the three pit craters which formerly had a moderate sized pond with water lilies, had gone practically dry. This is due probably to an unusually dry year. Puu Kukii, which in 1922 was covered with growing cane, is now overgrown with guava except where the 1924 disturbance left a bright red scarp. The Kula fault and Koae were also visited, but showed nothing new.

The investigation indicates that probably shore subsidence has extended from Kula as far south as Pohoiki and perhaps Kaimu, and that this subsidence occurred all at once in 1924 and is not a continued slow movement. The down-faulting corresponds on a smaller scale with that of 1868 in this same district (see Memoirs Bernice Pauahi Bishop Museum Volume 2 No. 4 1909). E.G.W.

Erratum

In Volcano Letter No. 359, Page Four, map of Soufrière Crater, the scale is 0.64 inch to the mile, and contour interval 100 feet. In Volcano Letter No. 360, Page Four, line 8, read "crack point No. 25."

EARTHQUAKE AND SEA WAVE OF OCTOBER 3, 1931

On the morning of October 3 the seismographs of the Hawaiian Volcano Observatory showed the record of a big earthquake somewhere, and indicated that possibly a seismic sea wave might arrive at the shores of Hawaii. On October 22 the London Times reported that a severe earthquake occurred on October 4 (the equivalent of October 3 in Hawaii on the western side of the date line) in the central and eastern areas of the British Solomon Islands. The damage was not serious in the central part of the group, but in the island of San Christoval the earthquake was followed by a seismic sea wave which destroyed 18 native villages with a loss of life estimated at 50. The center of the disturbance was believed to have been in the vicinity of Rennell Island, one of the southernmost of the group.

"The British Solomon Islands protectorate consists of the southern islands of the Solomon group, lying to the southeast of New Guinea. The native population is estimated at 150,000, and Europeans and Asiatics between 400 and 500. The principal articles of trade are copra, green snail, and trochus shell, ivory nuts, pearl shell, and tortoise shell.

"The earthquake was recorded by instruments in England, Italy, Australia, and New Zealand," and all around the Pacific. It was a world-shaking earthquake of great energy.

The primary or P wave of the earthquake arrived at the Hawaiian Volcano Observatory at 8:52:06 a. m. Hawaiian standard time. The secondary or S wave arrived at 8:59:35 a. m. The interval was 7 minutes 29 seconds which by the tables indicated 3680 miles as the distance to the origin. The indicated time of occurrence was 9 minutes 27 seconds prior to the arrival of the first preliminary wave, which would make the big earthquake at the source region 8:42:39 a. m. by Hawaiian time.

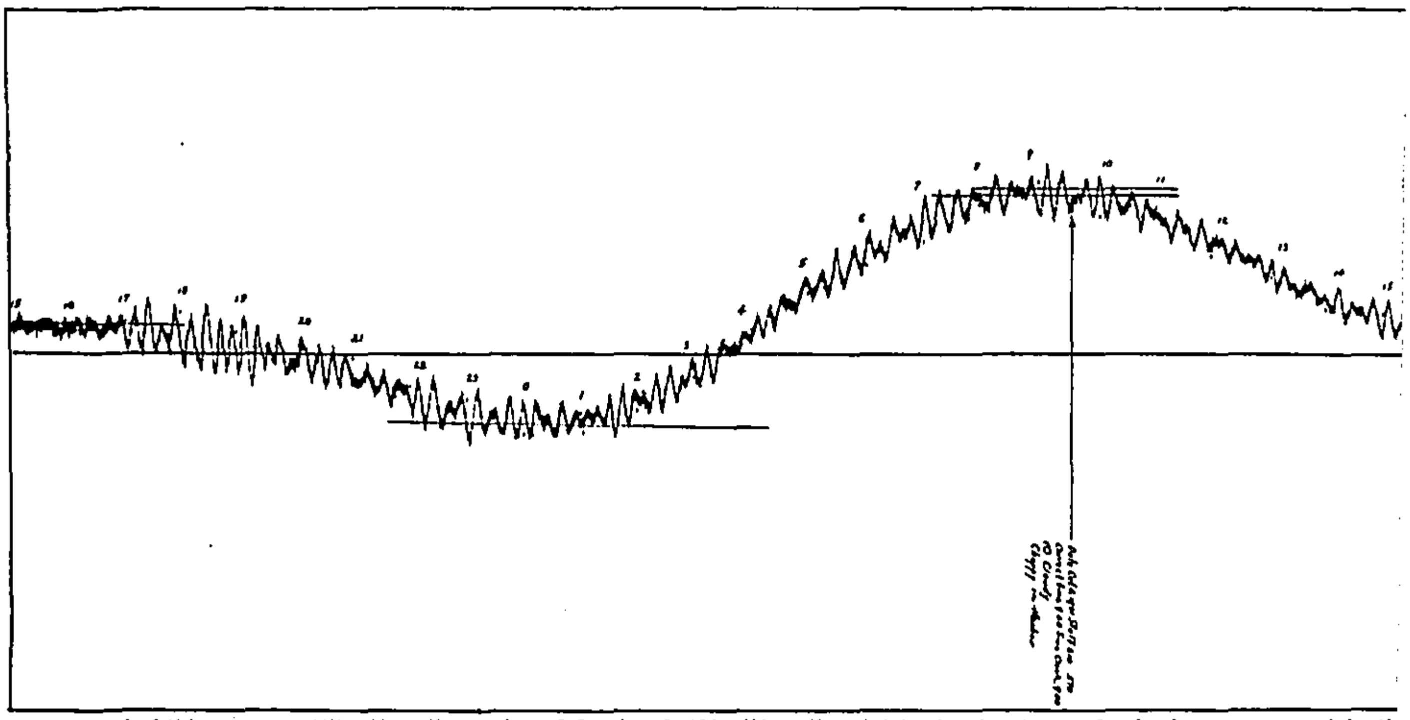
For some little time we expected a sea wave, but nothing arrived sufficient to excite notice without the aid of the tide gauge. As the velocity of such an ocean wave has been found to be about 450 statute miles an hour, it should arrive about 5 p. m. of the same day. It should take a little over 8 hours to travel to the Hilo tide gauge.

By an inspection of the records the direction of the earthquake origin was found by the direction of the first disturbance of the pendulums to be approximately northeast or southwest 3680 miles from the island of Hawaii. To the northeast the origin would be in the center of North America and accordingly there would not be a water wave. To the southwest the origin would be off New Zealand or New Caledonia and there should be a sea wave. As there were a number of shielding island chains in that direction, and from what we know by previous experience here, it was decided that a wave would likely be damped out by their shielding action, and in any case not be dangerous. Accordingly no warning was sent out.

Later findings verified these rough estimates. The Coast and Geodetic Survey announced the first tentative location of the earthquake center as latitude 14°south and longitude 160°east, and the time of occurrence as 8:42:48 a. m. H. S. T. The Jesuit Seismological Association gave a second tentative epicenter as latitude 10° south, longitude

CORRECTION

THE PRECEDING DOCUMENT(S) HAS BEEN REPHOTOGRAPHED TO ASSURE LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING



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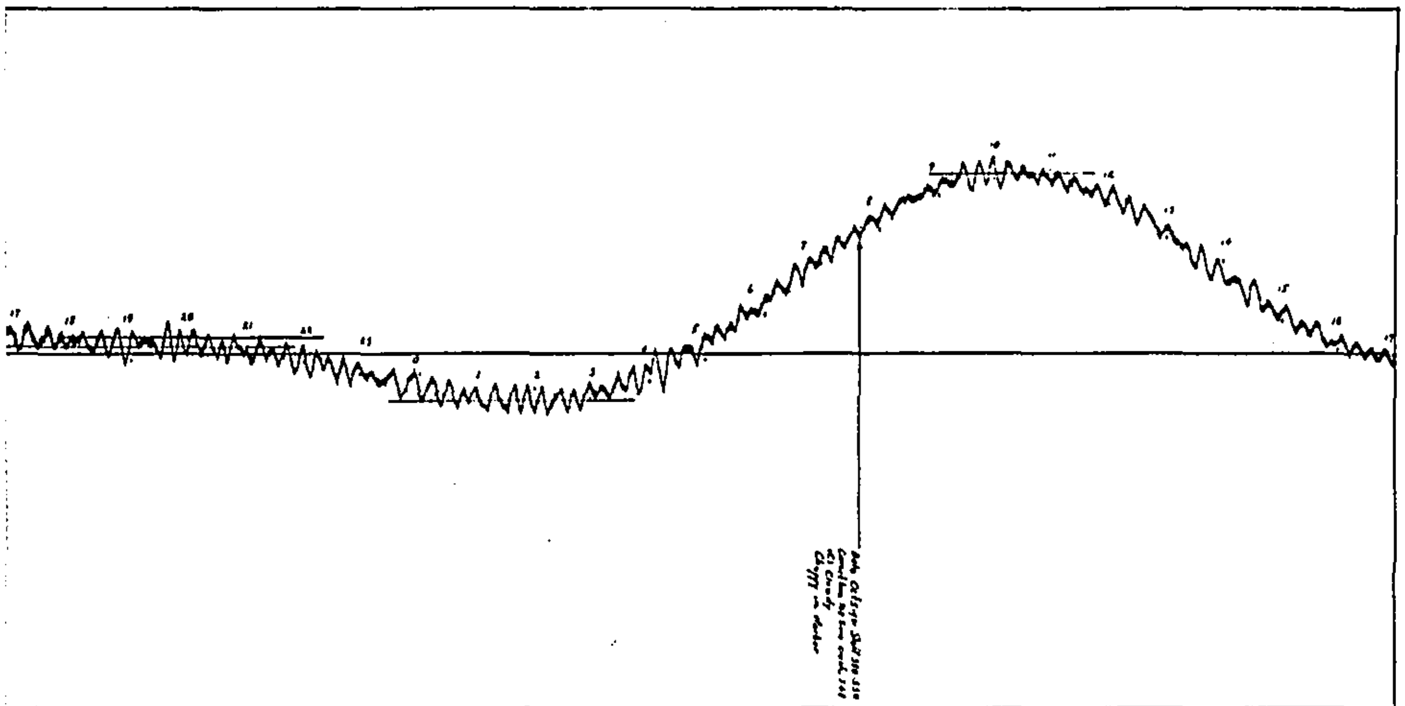


the Solomon Islands in a large submarine earthquake. The earth wave took about 9 minutes to reach Hawaii, and the water of the disturbance is about 6 inches on the tide staff at Pier One, Kuhio Wharf.

161.4° east, and the time of occurrence as 8:43.10 a. m. H. S T.

These placed the epicenter in or near Solomon Islands. The report above quoted verifies this and announces a big tidal wave.

The tide gauge in Hilo bay on the east side of the island of Hawaii shows that the waves began to arrive within 3 minutes after 5 p. m. October 3 H. S. T. The water in the bay rose and fell every 15 minutes for the next 48 hours. The rise and fall averaged about half a foot total range and the motion was so slow as not to be noticed by the casual observer. The record, however, is plainly shown on the marigram (see cut Pages Two-Three), and the very long duration of it is unusual. There was first a lowering of one-quarter of a foot followed by a rise of three-eighths of a foot, with somewhat irregular seiches thereafter for two days.

These waves are so flat that they can not be seen on the open ocean. Since they travel at the rate of 450 statute miles an hour, and 15 minutes apart, they will measure 112 miles from crest to crest, and being less than half a foot high on the open ocean they are not perceptible.

Such seaquake waves in the water, or tsunamis as they are technically called, have been known to continue even for two or three days with slowly diminishing amplitude (Dutton, Earthquakes, page 280). In R. M. Wilson's account (Bull. H. V. O. XVI June 1928) of a tidal wave arriving at Hawaii from the coast of Mexico, the maximum risings exceeded a foot, and there were several recurrences of the smaller waves at intervals, the whole lasting for 24 hours.

In this sea wave of October 4, 1931, the oscillations lasted for 48 hours. There are several ways to account for this long endurance of water disturbance, for some sea waves last only a few hours. There may be reflections or echoes from the coasts near the origin of the earthquake, which would have the effect of adding to the number of wave trains. In this case the waves, large at the source, may have broken up into numerous small ones by the groups of islands and shallows that they pass through. Again, a large body of water, such as is inclosed in any bay or small sea, if once set in motion is very slow to stop and would vibrate in its natural period for a long time after being disturbed. It is difficult to say in what proportions these possible causes affect the lengthening of the record. (See Bull. H. V. O. March 1928, Monthly Weather Review March 1924, and Volcano Letter No. 274 March 27, 1930.)

A.E.J.

KILAUEA REPORT No. 1035

WEEK ENDING NOVEMBER 22, 1931

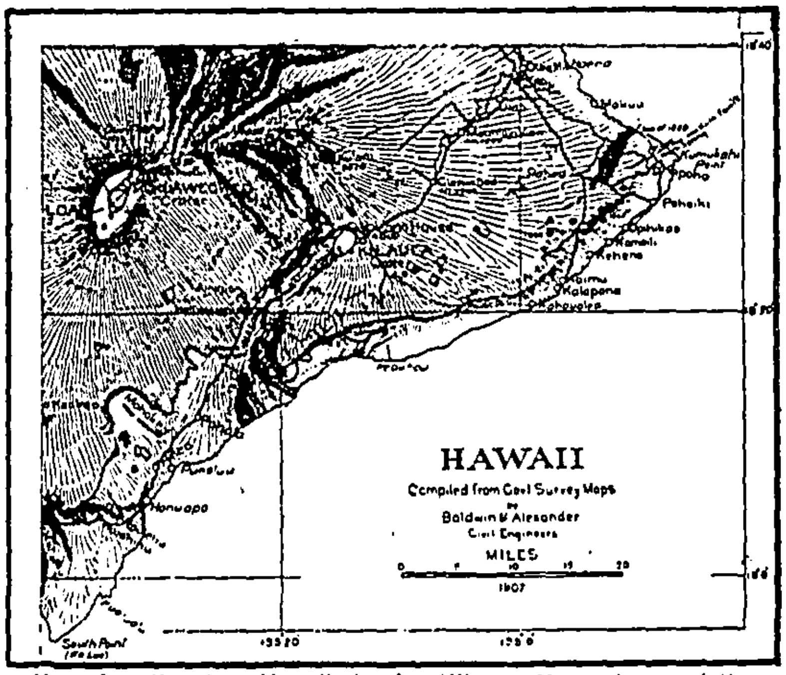
Section of Volcanology, U. S. Geological Survey

T. A. Jaggar, Volcanologist in Charge

Kilauea continues inactive. Halemaumau pit shows no significant changes, the fume and steam on the floor varying in visibility according to the temperature and the amount of recent rainfall. A few rocks were observed falling from the northeast wall on the forenoon of November 18. Crack point No. 25 shows a widening of the rim fissure here ⅝ inch between November 12 and November 20, 1931. On November 20 new fallen fine debris was seen on one of the northern taluses. The crack above mentioned is where the rim is breaking down at the northeast by adjustment of the pit circle where a year ago there was heavy avalanching and excessive cracking back of a very precipitous part of the wall.

Artificial disturbances were fewer on the records of the Observatory. Fifty-one tremors were recorded, four of which indicated approximate distances of from 40 to 60 miles. On the 19th occurred part of a teleseism without definite phases. A feeble seism at 6:46 p. m. November 22 was felt locally. Its epicenter was 5 miles from the Observatory. At 5:10 p. m. a very feeble seism was registered with a distance of about 12 miles.

Tilt for the week was slight NE. Microseismic motion was moderate, becoming strong at the end of the week. The tilt or ground movement indicates a quiet condition. What slight tilt has occurred can be attributed to seasonal effects. The number of recorded shocks is less than occurred during the preceeding week. The shocks appear to have originated at greater distances than those of last week.



Map of southeastern Hawaii showing Kilauea, Mauna Loa, and the Puna fault cliffs extending northeast to the Kula fault, where the land on the south side subsided in April 1924. The photograph on Page One is looking seaward on the south side of the Kula fault cliff where it enters the ocean.

Black sands of Kaimu beach in November, 1931, showing invasion of the coconut grove and roadway by the sea. The road is being moved back. Photo Powers.

THE VOLCANO LETTER

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Betty

begin
July 26 ~~27~~
(NW31KP)
going
back

November 5, 1931

The Director,
National Park Service,
Washington, D. C.

Dear Mr. Director:

The following is a report of activities and operations in Hawaii National Park for the month of October, 1931.

000 General

The unemployment situation in the Hawaiian Islands, which has been less of a problem than on the mainland, has now reached such a state that Governor Judd has named a committee for formulating plans for coordinating the work on programs and welfare efforts. Mr. Ralph E. Woolley, President of the Honolulu Chamber of Commerce, is chairman of the committee. It is the plan to have city, county, and territorial and private employers spread out their work programs so that fluctuations in employment can be reduced to a minimum. The work of the National Park Service here by force account and by contract is furnishing employment to approximately 125 to 150 men who would not otherwise be employed.

020 General Weather Conditions

Weather during October was almost ideal in Hawaii National Park, there being very little rain and the air cool and invigorating. Rainfall for the month measured only 5.19 inches, as compared with 13.83 inches for October last year. The total rainfall to date is 54.53 inches, considerably less than last year's precipitation of 94.95 inches. The maximum temperature recorded was 74° on the 30th; the minimum 54° on the 16th, the greatest daily range being 17°. There was one clear day, 25 partly cloudy and 5 cloudy. Snow was visible on Mauna Kea on the 31st of October, which, according to popular tradition is an omen of prosperity for the island when occurring at this time of the year. A local thunderstorm occured at 1 P.M. on the 26th.

100 Administration

110 Status of work

The detailed statistics for the 1931 travel report were sent off on the first of the month. The general information circular for 1932 was also revised and forwarded, as was the revision of the park rules and regulations. A special report of the accomplishments of the 1931 season in the way of construction work was transmitted, with pictures, for the use of the Director before the Bureau of the Budget in supporting the estimates for 1933.

The purchasing, accounting and disbursing work has been heavier than ever before but at the end of the month all work was current. The five-year development program was also submitted during the month in preliminary form and considerable attention has been given to the revision of this report after receipt of Supplement No. I to the original instructions, and this will be ready for transmittal on November 15.

1 120 Park inspections by

121 The Superintendent

Regular inspection was made of all park activities, particular attention being given to the road improvement work by the Bitulithic Paving and Concrete Company, also to the trail construction by force account of the Park Service. One trip was made to the Mauna Loa trail and the layout of the new trail approved. Several trips were made to Hilo during the month on official business. One meeting was with the Hilo Chamber of Commerce, in which revised traffic regulations for the County were discussed. A good part of the month, however, was spent in the office compiling the various special reports that are due at this time.

Ranger Christ was sent over to the Haleakala section on October 7, returning on the tenth. He made a trip through the crater on Haleakala gathering ripened Silver Sword seed that was saved this year by protecting the plants with cheesecloth covers. The younger plants which were sprayed during the summer appear to be in excellent condition and there was no evidence of insects on them, indicating that the spray was effective. A small quantity of this seed was sent to Dr. A. W. Hill of the Royal Botanical Gardens, at Kew, England, through a request received from Professor St. John of the University of Hawaii.

While at Haleakala Ranger Christ employed four men for several days in order to make repairs to the trails.

125 Other Governmental officers

Principal Highway Engineer E. S. Wheeler, of the Bureau of Public Roads, Honolulu, arrived on October 24 for inspection of the road work on this island, particular attention being given to the work of the Bitulithic Paving and Concrete Company in the park.

130 Finance and accounts.

As this is a statistical report the figures for which can not be secured at the time this report is dictated, it will be found attached to the back of the report as statistical report No. 8.

140 Labor situation

As Hawaii National Park is a park that is in operation throughout the year and construction work can be carried forward at any time, the work this winter of the Park Service and the road contractor is doing a great deal to take care of the otherwise unemployed in this section.

150 Equipment and supplies

A typewriter, an office desk, two typewriter stands, a costumer, two kerosene water heaters, one kerosene oil range, a desk lamp, and other small office appliances were received during the month.

We bought 65 gallons of lubricating oil from the Associated Oil Company under the Navy contract, at a price of 18 cents per gallon, delivered at Hilo, as against a local price of 60.5 cents per gallon. This makes a saving of approximately $180 during the year.

170 Plans, maps and surveys

The revised plans for the U. S. commissioner's cottage were returned to the Chief Landscape Architect approved on October 5, with suggestions for minor modifications. These have been made and the Landscape Division is now getting out the working plans for this building. Plans for the administration building were held up while a new map of the area was prepared showing the general layout and the new plan, with minor modifications, was returned toward the end of October to the Chief Landscape Architect.

A map showing the layout of sites for quarters was also sent to the Chief Landscape Architect's office and a blueprint of our telephone system layout, copies of which were also forwarded to your office.

Engineer E. S. Wheeler brought with him from Honolulu the plans, specifications and estimates for the Haleakala road, the total mileage of which will be 12.315, at an estimated average cost per mile of $45,543.87, making the total cost $560,871.21. Mr. Wheeler has divided the work into three units, A, B, and C. The first estimated cost is $466,781.77, the second $77,857.44, and the third $16,231.76. He has also worked out various combinations. The plans and specifications have been approved and Mr. Wheeler so advised by letter.

There are no special landscape problems involved in the construction of the Haleakala road as the forest cover is principally brush. Rock for surfacing is expected to be obtained from gulches where the quarries will be hidden from view of those traveling the roadway.

180 Circulars, placards, publicity bulletins, etc.

Attached to the report are copies of the September issue of Nature Notes and Volcano Letters for the month of October.

200 Maintenance, Improvements and New construction

210 Maintenance

The usual maintenance and repair of roads and trails, telephone lines, etc. has been carried on during the month. There was the usual trouble on the telephone line due to the rapid growth of vegetation, causing interference, and the line is being gone over and improved where necessary

220 Improvements

The Halemaumau trail is being improved for the entire distance of three miles, making it easier to walk over and follow during periods when the weather is misty or foggy. The work was 60 per cent completed at the end of the month and consisted mostly of surfacing. From the edge of the crater to the Volcano House the grade in some places is more than 20 per cent and the trail is to be relocated so as to reduce these grades and provide more interesting country through which to travel.

The Canadian Thistle is spreading quite rapidly in the Bird Park section and along the Mauna Loa trail and the rangers cleared out a great many of these from the Bird Park to the Giant Koa. A strip of 12 feet on each side of the trail was entirely cleared and as time and labor will permit, more work will be done in the meadows in Bird Park area later.

At Haleakala, the Maui Chamber of Commerce has made a number of improvements by repairing the leaky roof of the rest house and providing the following new equipment:

6 Wood folding tables 3' by 3'
6 Canvas folding chairs
1 Two-burner kerosene stove
1 Kerosene warming stove
12 Pillows
1 Table with drawer for visitors register book
5 or 10 wool blankets

The electric service furnished by the hotel has been so poor and so unsatisfactory, and with the constantly increasing load being added by the Park Service, it has been necessary to try to provide our own electric light service, at least during the evening hours. A surplus motor and 5-kilowatt generator and switchboard have been loaned to us by Captain W. A. Hedden of the Kilauea Military Camp. We are able to furnish better lights with our own plant but it will probably cost more to operate it than to purchase from the hotel company.

230 New Construction

Progress on the Mauna Loa trail during the month has been satisfactory. Ten men have been regularly employed and the trail from the 9,000 foot level to the Bird Park is about 60 per cent completed. This trail shortens the distance and goes through a more interesting country than the old trail.

The Bitulithic Paving and Concrete Company made much better progress during October. Up to the middle of the month, the date of the Bureau of Public Roads report, about 87 per cent of the rough grading on Project 1 had been completed. The power shovel had completed all shovel work on Project 1 and moved on to Project 3-A, where it had practically completed all of the shovel work by the end of the month. The last half of September frequent rains kept the grade in sloppy condition and impeded progress, although only one day was lost on account of rain. The weather during the first half of October was almost ideal. Some trouble was experienced in getting the contractor to properly drain the completed rough grading and in spite of repeated orders has failed to properly maintain the roadbed. This would be a serious situation if it were not for the fact that all tourist travel is routed over the Uwekahuna road. This is more satisfactory to the tourist and makes it much easier for the contractor.

On Project I between Station I at the administration building and Station No. 63, no rock at all was encountered. The material is loamy and does not form a suitable base on which to lay a top course. The base course which was provided for the road in the Keanakekoi section has been found unnecessary at that point and will be laid between Station I and Station 63. Between Stations 140 and 279 vegetable loam is present in small quantities but here fine material is encountered. It is volcanic gravel, which forms an excellent base. An elaborate crushing plant has been installed and was ready to operate by the end of the month. The quarry face was cleaned up and all overburden stripped off. A large quantity of rock has been shot down in the quarry ready to be crushed. The emulsified asphalt has arrived and is in storage tanks in Hilo. Resident Engineer H. L. Handley is giving the project close attention and is assisted by three employees of the survey crew.

The cut-off road in this contract is being eliminated. The savings thus made will be used in other places on the project.

During the visit of Engineer Wheeler on October 25, a definite program was laid out and agreed to by the contractor and the various change orders and extra work orders have been computed so that they can be properly written up and executed.

240 Improvement of approaches to the park

The Territorial Haleakala road is continuing to make slow progress. Although the contract calls for the completion of this road in February, 1932, indications are now that the road will not be completed until July.

Governor Lawrence M. Judd, accompanied by James Lloyd, Budget Director, and Lyman H. Bigelow, Territorial Highway Engineer, left for the mainland on October 14 for conferences with the Bureau of Public Roads regional office in San Francisco and in Washington on revision of the Territorial Federal highway aid system. Word was received from the Governor in San Francisco stating that the entire belt road on the island of Hawaii was being proposed for inclusion in the Federal aid plan and this calls for diversion of $30,000 proposed for the Kalapana road and $25,000 for Hilo sewer system which, with $55,000 for bridges, makes a total of $110,000 available by the county and, if matched with a like amount of Federal aid, would make a total of $220,000, most of which will probably be spent in replacing the bridges on the Hamakua coast. To this proposal the supervisors agreed and the matter is now receiving consideration by Washington officials.

300 <u>Activities of other agencies in the park</u>

310 Public service contractors

E. J. Walsh, proprietor of the Grand Hotel, at Wailuku, Maui, took over the operation of the saddle train business at Haleakala by purchasing the stock and renting the base camp at Olinda from Worth O. Aiken, who handled this business for about 30 years.

The Volcano House had a very small business during the month. Up to October 1929 they handled 14,302 guests. In 1930 there were 10,725 guests, and in 1931 8,297 guests. This is a decrease of 2,428 compared with last year and 6,105 for the year before.

Mrs. James N. Gandy, wife of the manager of the Volcano House, who had been barred from the park for about a year, was permitted to return under the following conditions, which were acceptable both to Mr. and Mrs. Gandy and to the officers of the Inter-Island Steam Navigation Company.

1. That Mrs. Gandy live in one of the cottages near the hotel and apart from the hotel proper.
2. That she take no part whatever in the management of the hotel, which is a distinct function and responsibility of her husband.
3. That she refrain from criticizing the personnel of the park to guests or park visitors and its management and policies.
4. That her conduct in the park at all times must be satisfactory to the park superintendent.
5. If any of the above conditions are not faithfully observed in letter and in spirit, it is to be understood that the park superintendent will recommend that the Volcano House management be changed and will insist on prompt compliance.

Mr. K. Maehara, proprietor of the Volcano Studio, attended the Eastman Kodak School for professional photographers held in Honolulu during the month, at which lectures and demonstrations in up to date photography were given.

The Hawaii Transportation Company, furnishing automobile Service between Hilo and the park, is trying out a new schedule. The schedule was in operation before the Park Service was consulted and it eliminates the railroad trip from the dock at Hilo to Laupahoehoe and return on the Hawaii Consolidated Railroad, of which Mr. A. J. Lafferty is manager. Inter-Island tourists are placed in automobiles at the dock and taken along the Hamakua coast by automobile, passing Onomea Arch and on to Akaka Falls, returning to Hilo, visiting Rainbow Falls, then driving to Hawaii National Park, arriving about 11 A.M. They are driven directly to Uwekahuna where the park lecture is given and motion pictures shown, which occupies about one hour. This lecture was formerly given at 4 P.M. After lunch at the Volcano House those who desire to take the walk across the Kilauea crater under the guidance of the Park Naturalist leave about 1:15, arriving at Halemaumau pit about 3;15, at which point they are met by the automobiles and taken down the Chain-of-Craters road, visiting the Fern Jungle, Thurston Lava Tube on their return, which gets them back to the hotel between 5 and 6 P.M. The following morning they leave about 8:30 or 9 for the Puna district by way of Olaa, Pahoa, to Kapoho, Green Lake and Kalapana, returning by way of Pahoa to Olaa and Hilo. They get to Hilo in time to sail at 4 P.M.

Mr. Thomas Strathairn, manager of the Inter-Island office in Hilo states that this change has been made because their passengers complained of dissatisfaction with the railroad trip which takes about three and a half hours, from 8 A.M. until 11:30, and it has been customary to kill time around Hilo or at the Hilo Hotel until after lunch when the start is made for the park. According to Mr. Strathairn, they felt that they had not seen enough or kept traveling enough during their visit here so that the Kalapana trip has been added as an extra feature without any increase in expense to the tourist. The change as it affects the Park Service is that it moves the lecture from 4 P.M. to 11 A.M. and makes the trip across the crater in the afternoon instead of the following morning. Contact at the hotel during the evening by the Park Service is still possible. This new schedule at present does not affect the Wednesday Inter-Island visitors, who have only one day to spend in the park and who do not take the railroad trip anyway, but it does affect the Saturday and Sunday tourists to a marked degree. The Company is handling only their Inter-Island passengers on this schedule at present but overtures have been made to the Matson Navigation Company and the Los Angeles Steamship Company to have their passengers also routed on this schedule.

Mr. A. J. Lafferty, Manager of the Hawaiin Consolidated Railroad Company is vitally affected by this change and has protested to the Inter-Island and is taking the matter up with the Matson and Los Angeles companies in an effort to hold the business which they now route over his line.

It also eliminates the luncheon at the Hilo Hotel and enables the Volcano House to provide all the service from luncheon on the day of their arrival to a box lunch on the day of their departure. This schedule has been approved as a tentative arrangement but if it proves satisfactory, it is the plan to eliminate the railroad trip entirely and route all tourists over the changed schedule.

314 Complaints

Mr. and Mrs. Carl C. Thompson, 93 Carl Street, San Francisco, who visited the park October 13 and 14, complained quite bitterly to Park Naturalist Doerr about the high prices charged at the Volcano House and how little one gets for his money.

400 Flora, fauna, and natural phenomena

410 Ranger service

Ranger Joseph B. Fordyce arrived and entered on duty October 6. This completes our ranger staff except for the appointment of a chief ranger, which must be postponed until both quarters and funds for his salary are available. As soon as all of the rangers had reported for duty, meetings of the park staff were started. These are held once each week in the Superintendent's quarters where the Ranger Manual has been gone over very carefully with comments and suggestions made by the superintendent and, in some cases, general discussions of the points brought out. In addition to the seven rangers the chief clerk, general foreman and park naturalist have been present and all have benefitted by the meetings and discussions that follow.

Arrangements have been made for Park Naturalist Doerr to give a series of lectures for the benefit of the park staff in the fundamentals of geology, after which Dr. T. A. Jaggar is to give a series of lectures also on geology so that each park employee will have a good ground work in this important study and will be able to furnish visitors with accurate and reliable information

411 Naturalist and guide service.

October is one of the months of poorest travel and has been no exception this year. The Inter-Island boats have arrived a number of times without any visitors whatever and the maximum number of visitors during the month on any one boat was 12.

On three Sundays the museum at Uwekahuna was open to visitors. The contacts made with island people on these days were most satisfactory. It is apparent from these contacts that some island people are not as familiar with their national park as they might be. Evening lectures were started during the month at the Volcano House. Six lectures were given on evenings that boat groups were in the park. These lectures have covered various phases of plant life, a general description of park features, the Moon, and a description of the World's Weirdest Walk. The park naturalist is planning to develop a number of these lectures to be given at the hotel and by varying the subject matter it will be possible to stimulate and keep the interest of local people who are frequent overnight visitors.

The park naturalist spent several days making a detailed study of the Halemaumau trail which is the most popular trail in the park and the September issue of Nature Notes is devoted exclusively to this trail. An investigation of the remains of the old Hawaiian Pulu factory along the Napau crater trail was started during the month.

Dr. and Mrs. Wilbur G. Foye and sons, William and Howard, of Middletown, Conn. visited the park on October 18. Dr. Foye is Professor of Geology at Wesleyan University. The park naturalist conducted them on a general tour of the park. Dean Benj. O. Wist of the Teachers College, University of Hawaii, and Professor Geo. S. Brown, University of Melbourne, accompanied this party on a tour of the park.

Harvey L. Freeland, Superintendent of Public Instruction, Territory of Hawaii spent part of three days in the park. During that time the educational department made a particular effort to show Mr. Freeland the educational activities of the National Park Service.

Two hundred and seventy seven copies of the September number of Nature Notes were mailed during the month and approximately 100 copies were distributed locally.

The educational department received the following equipment during October:

- 1 Underwood Standard typewriter (13 inch carriage)
- 1 Typewriter table
- 1 Desk lamp
- 1 Acco punch
- 1 Portable electric lantern for use in the Thurston lava tube.

The last item was a gift from R. J. Chandler, Vice President and General Manager of the Los Angeles Steamship Company. Mr. Chandler's secretary, Mrs. Lillian Frasher was a park visitor in September and through her the gift was made possible.

The Nature Notes are receiving favorable comment from many sources and very fine publicity. Articles by Ranger Lee and Ranger Williams in the

August issue were printed in full on the front pages of the Hilo Tribune Herald on October 4.

Negotiations with the University of Hawaii for nature study classes for 1932 have been started and we have their assurance of continued cooperation in these classes.

460 Birds

Ranger Brumaghim reports seeing 200 California quail at Kipuka Hali Lua and two wild geese on the Mauna Loa trail. Ranger Christ says that pheasants and quail are quite plentiful on the Mauna Loa trail and reports seeing a flock of them several times on his various trips. On one occasion a flock of wild turkeys was noted.

480 Natural Phenomena

Two local shocks were felt very distinctly by residents of the Volcano district and Hilo toward the latter part of the month, the former at 5:45 A.M. on October , showing a distance of 5 miles, and the latter, at 11:33 P.M. on October 31, showing a distance of 11 miles from the Observatory. Two small slides occured in the pit, the first at 7:30 A.M. October 2 and the second at 4 P.M. October 12. A larger avalanche was noted at 8:30 A.M. on October 24 which caused much dust to rise. Measurement of rim cracks around the pit showed no change. Ninety-eight tremors were recorded during the month, and tilt varied from NNE, NNW, NNE, to N.

500 <u>Use of park facilities by the public</u>

510 Increase or decrease in travel

The total number of visitors entering Hawaii National Park during October was 6,324, a slight decrease from the previous month, when 6,829 visitors came to the park, and 6,837 during October, 1930. Full travel details are shown on form 10-157, attached.

550 Visitors

Early in October, Brother Albert Holtman, in charge of the seismograph station at Hilo, Hawaii, and Brother William Ambrose, a high school teacher in St. Joseph's school at Yokohama, Japan, both members of the Order of the Brothers of Mary, called at this office to pay their respects and to inquire about a trip through the park. They also desired to get a few specimens of park lava as Brother William Ambrose is building a museum in his school and is intensely interested in geological work.

L. W. Bryan, Assistant Territorial Forester, was a visitor during the month and has agreed to assist in the transplanting of 15 Monterey cypress and Japanese cedar trees on the grounds of the Volcano Observatory. These trees must be moved from the right-of-way because of road widening and improvement and about 15 of the largest trees will have to be destroyed.

600 <u>Protection</u>

610 Police protection

At the request of Captain W. A. Hedden of the Kilauea Military Camp, James Bingham, of Hilo, was arrested for driving while drunk. The arrest was made at our request by the police force in Hilo, who took Mr. Bingham into custody and he was fined $75 and costs and his drivers license revoked for a period of 30 days.

620 Fire protection

On October 16 a small campfire left burning at Kipuka Nene was extinguished by Ranger Brumaghim and Forest Ranger Bright.

630 Accidents

. Sabas Leanes, driving a jitney bus loaded with boys and girls, ran over a road drag operated by the Park Service on the Chain-of-Craters road. The operator saved himself by jumping out of the way. Leanes was severely reprimanded and permitted to go.

Dionicio Billianvera, a Filipino, entered the park driving at such a fast rate of speed that he crashed into a truck of the road contractor, doing considerable damage to his car. Two employees loading the truck from the rear narrowly escaped serious injury by jumping as the car struck the truck.

On October 17, L. A. Redden, driving a Graham truck, belonging to the Kapapala Ranch, had the spindle bolt on the right front wheel give away, causing him to lose control of the truck and crash into the lava bank on the left side of the road, bringing the cab down on top of the driver and rendering him unconscious. Considerable damage was done also to the front end of the truck. Rangers Brumaghim and Fordyce came along, rendered first aid, and carried the driver to the Kilauea Military Camp hospital where his injuries were treated and he was taken home by the ranch manager who also towed in his damaged truck.

640 Destruction of predatory animals

On October 5 a goat drive was staged at the Kahuku Ranch in the Kau district adjoining the park by L. W. Bryan of the Territorial Forestry Department, in which 125 persons participated and approximately 500 goats were captured. The animals were afterwards slaughtered and some taken by the Filipino laborers for meat.

Two stray dogs, 12 wild goats and 3 hogs were killed by Ranger Brumaghim, and a few more goats were killed by the park staff as opportunity permitted. Goats are not very numerous in the Hilina Pali district since the successful drive of last spring. They are apparently increasing rapidly along the Mauna Loa trail.

900 Miscellaneous

Three positive cases of bubonic plague in infected rats were found on the island of Maui during the month, in a district where they might easily have caused human cases. A rat trapping campaign has been carried on following the death of a Japanese boy from bubonic plague last summer. Twenty two men are engaged in this work.

An inquiry has been received from Mr. John H. Peters, an attorney of Honolulu, concerning the U. S. commissionership for this park, and Governor Judd has nominated for this position William B. McLean, of Honolulu. The qualifications of these nominees are being investigated.

There were eleven permanent employees at the beginning of October, with one addition during the month, making a total of twelve permanent employees at the end of the month. Seventeen temporary employees were on the roll at the beginning of the month, with four additions and two separations, making a total of nineteen at the end of the month.

Very respectfully,

E P Leavitt

E. P. Leavitt,
Superintendent.

10-157
(July, 1929)

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

TRAVEL REPORT

HAWAII National Park for the month of OCTOBER 1931

	This Month	This Travel Year To Date	This Month Last Year	Last Travel Year To Date	Increase for Travel Year Number	Increase for Travel Year Percent	
PRIVATE TRANSPORTATION:							
Cars first entry,							
Cars reentry,							
Motorcycles,							
Total motor vehicles,							
Persons entering via motor vehicles,	5,905	5,905	6,105	6,105	-200	.032	Decrease
Persons entering via other private transportation,	78	78	348	348	-270	.775	"
Total persons entering via private transportation,	5,983	5,983	6,453	6,453	-470	.072	"
OTHER TRANSPORTATION:							
Persons entering, via hotel ~~stages~~	341	341	384	384	- 53	.138	"
Persons entering via trains,							
Persons entering otherwise,							
Total other transportation,	341	341	384	384	- 53	.138	"
GRAND TOTAL ALL VISITORS,	6,324	6,324	6,837	6,837	-513	.075	"

	This Year	Last Year	Increase Number	Increase Percent
Automobiles in public camps during month,	0	1	- 1	
Campers in public camps during month,	0	2	- 2	

10-158

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF AUTHORIZED PROJECTS

Hawaii National Park for the Month of October, 1931

Description of Projects	Percent Constructed To Date	Percent Constructed This Month	Percent Constructed Last Month	Probable Date of Completion
410 U. S. commissioner quarters	0	0	0	March 31, 1932
411 Employees quarters	100	0	10	
412 Employees quarters	100	2	98	
413 Administration building	0	0	0	June 30, 1932
502 Trails				
502.1 Hilina Pali to Halape	100	0	0	
502.2 Uwekahuna-Halemaumau auto trail	90	10	80	March 31, 1932
502.3 Mauna Iki extension	100	0	0	
502.4 Haleakala trail	100	0	0	
502.5 Mauna Loa trail	60	50	10	January 31, 1932
502.6 Halemaumau trail	30	30	0	December 31, 1931
507.1 Kau belt road	100	0	0	
Road Survey, B.P.R. Construction	28	23	2	July 1, 1932

10-215
(July, 1928)

45334

UNITED STATES
DEPARTMENT OF THE INTERIOR
National Park Service

HAWAII National Park

REPORT OF NON-APPOINTED PERSONNEL
(TEMPORARY)

Changes outside the District of Columbia for the month of October 19 31

Total at beginning of month		Additions	Separations	Net Gain or loss (a)	Total at ending of month
Permanent	11	1	0	1	12
Temporary	17	4	2	2	19
Total	28	5	2	3	31

(a) If loss, indicate by minus sign.

10-159
(May, 1931)

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF PERSONNEL

..................Hawaii..... National Park for the Month of .....October, 1931.............................

	This Month		This Month Last Year	
	Appointed	Non-Appointed	Appointed	Non-Appointed
Number of employees beginning of month	11	17	5	19
Number of additions..................................	1	4	0	0
Total..	12	21	5	19
Number of separations................................	0	2	0	7
Number of employees close of month........	12	19	5	12
Number of promotions during month.........	0	0	0	0
Aggregate amount of annual leave taken	0	0	0	0
Aggregate amount of sick leave taken....	5	0	0	0
Aggregate amount of leave without pay..	0	0	0	0

10-160

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

REPORT OF PARK REVENUES

Hawaii National Park for the Month of October, 1931

	This Year	Last Year
Park revenue on hand beginning of month,	0	0
Received,	0	0
Total,	0	0
Remitted,	0	0
On hand close of month,	0	0

Park revenues received this year to date,	$125
Park revenues received last year to date,	125
Increase,	0
Per cent of increase,	0

10-161

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

REPORT OF SALES OF PUBLICATIONS

OCTOBER 1931

HAWAII NATIONAL PARK

	Number	Value
GOVERNMENT PUBLICATIONS:		
On hand beginning of month,	1001	$178.00
Received during month,	0	
Total,	1001	$178.00
Sold during month,	10	1.00
On hand at close of month,	991	$177.00
NON-GOVERNMENT PUBLICATIONS:		
On hand beginning of month,		
Received during month,		
Total,		
Sold during month,		
On hand at close of month,		

Cash on hand beginning of month,	$47.95
Sales during month,	$1.00
Total,	$48.95
Remitted during month,	0.00
Balance,	$48.95

Form No. 1009—Met'l.

U. S. Department of Agriculture, Weather Bureau.

COOPERATIVE OBSERVERS' METEOROLOGICAL RECORD:

Month of October, 1931, *192* ; *Station,* Volcano Observatory ; *County,* Kau
Hour of Observation,
State, Hawaii ; *Latitude,* ; *Longitude,* ; *Time used on this form,*

DATE.	TEMPERATURE. Maximum.	Minimum.	Range.	* Set Max.	PRECIPITATION. Time of Beginning.	Time of Ending.	† Amount.	Humid	Wind	Prevailing Wind Direction.	Character of Day, Sunrise to Sunset.	‡ Miscellaneous Phenomena.
	1	2	3	4	5	6	7	8	9	10	11	
1	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	Mod.	N.E.	P.C.	
2	70	57	15	62			03	85	Lt.			
3	71	57	14	65			05	09	Mod.	"	Cloudy	
4	65	59	06	67			37	91	Str.	"	"	
5	70	56	14	63			02	81	Mod.	"	P.C.	
6	73	59	14	64			02	90	"	"	"	
7	72	58	14	63			10	85	Lt.	"	"	
8	72	59	13	63			03	91	Mod.	"	"	
9	73	59	14	63			12	84	"	"	"	
10	73	59	14	67			01	89	"	S.W	"	
11	71	60	11	65			50	90	"	NE	Cloudy	
12	69	60	9	67			2.16	91	"	"	"	
13	71	56	15	68			01	85	Str.	"	P.C.	
14	71	56	15	63			T	80	"	"	"	
15	71	55	16	67			[illegible]	77	Mod.	"	"	
16	71	54	17	64			T	80	"	"	Clear	
17	69	56	13	66			T	85	"	"	P.C.	
18	72	59	13	66			26	76	"	"	"	
19	68	57	11	63			04		Str.	"	"	
20	69	56	13	61			T	84	"	"	"	
21	68	58	10	64			02	86	"	"	"	
22	73	58	16	65			12	84	Mod.	"	"	
23	70	58	12	62			05		"	"	Cloudy	
24	69	55	14	61			33	91	Str.	"	P.C.	
25	68	56	12	64			01	89	Mod.	"	"	
26	73	58	15	67			02	78	"	"	"	
27	73	56	17	65			11	92	Lt.	SW	"	
28	69	58	11	61			19	84	Mod.	"	"	
29	69	61	8	65			T	85	Lt.	"	"	
30	74	60	14	66			15	809	Mod.	"	"	
31	70	59	11	62			22	89	"	"	"	Snow on Mauna Kea
Sum	2184	1786	398	1983			5.19	2459				
Mean	70	57.6	12.8	64			.167	85.8				

* Reading of maximum thermometer immediately after setting.
† Including rain, hail, sleet, and melted snow.
‡ Thunderstorms, halos, auroras, etc.

U.S.G.S. Volcano Observatory, *Cooperative Observer.*

(IN TRIPLICATE.) See cover for instructions.

Post-Office Address, Hawaii National Park

MONTHLY SUMMARY.

TEMPERATURE.

Mean maximum, 70
Mean minimum, 57.6
Mean, 63.8
Maximum, 74 ; date, 30
Minimum, 54 ; date, 16
Greatest daily range, 17

PRECIPITATION.

Total, 5.19 inches.
Greatest in 24 hours, 2.16 date, 12

SNOW.

Total snowfall, inches; on ground 15th, inches;
at end of month, inches.

NUMBER OF DAYS—

With .01 inch or more precipitation, 25
Clear, 1 ; partly cloudy, 25 ; cloudy, 5

DATES OF—

Killing frost,
Thunderstorms, 26, 1 P.M.
Hail: Light, Moderate, Heavy,
Sleet,
Auroras,

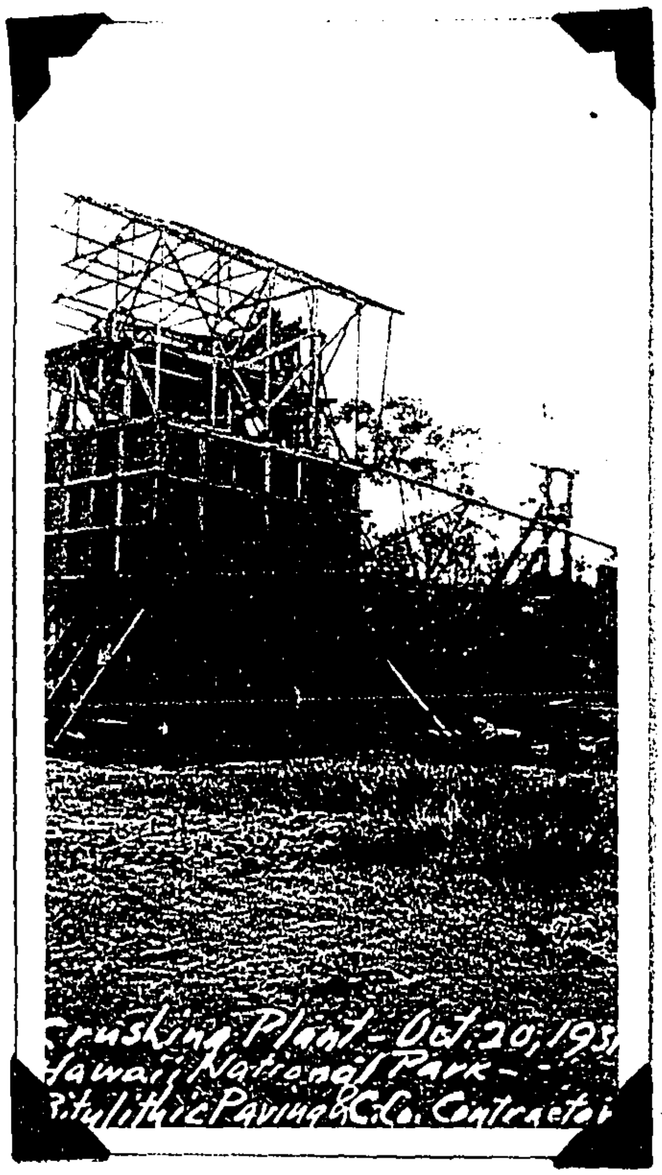
REMARKS:

FINANCE AND ACCOUNTS

HAWAII NATIONAL PARK - OCTOBER 1931

Symbol	Name	Allotted	Expended & Obligated	Balance
41/2415	Hawaii National Park 1931-32 - - - - - -	52,130.00	36,894.93	15,235.07
4X436	Roads and Trails, National Parks, no year	384,806.30	45,888.75	338,917.55
41/2405	Emer. Recon. & Fighting Forest Fires, National Parks, 1931-32 - - - - - -	200.00	200.00	0.00
41/2406	Forest Protection & Fire Prevention 1931-32	100.00	100.00	0.00
40/1415	Hawaii National Park 1930-31 - - - - - -	34,625.00	34,618.02	6.98
40/1406	Forest Protection & Fire Prevention 1930-31	990.00	989.00	1.00

Quarry and rock crushing plant of the Bitulithic Paving and Concrete Company, Hawaii National Park, October 20, 1931.



Rock crushing plant of the Bitulithic Paving and Concrete Company,
Hawaii National Park, October 20, 1931.

NATURE NOTES

HAWAII NATIONAL PARK

Ohia Lehua

Vol. I No. 4

September 1931

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

HAWAII NATIONAL PARK
NATURE NOTES

Volume I September 1931 Number 4

Nature Notes from Hawaii National Park is a monthly pamphlet edited by the Park Naturalist and distributed to those interested in the natural history of the park. Free copies can be obtained through the office of the Park Superintendent, Hawaii National Park, Hawaii. Anyone desiring to use articles appearing in Nature Notes may do so. Please give credit to the pamphlet and author.

E. P. Leavitt, Superintendent John E. Doerr, jr.,Park Naturalist

TABLE OF CONTENTS

"THE WORLD'S WEIRDEST WALK"

What is the most famous nature trail in our National Parks? The answer is this. There are just as many "most famous trails" as there are naturalists and rangers in the National Park Service, for each one no doubt has his favorite trail over which he has conducted people from all walks of life and from many countries of the world. Now that each of you has selected your "most famous nature trail", Hawaii selects its well known Halemaumau Trail as the most famous. This nature trail, known as "The World's Weirdest Walk", was being traveled during Civil War days. It has undergone many changes, changes that man has made, changes that nature has made. If you walked this trail forty, twenty, ten, or five years ago, yes, even a year ago, another trip will show you these changes, new things, because this trail leads down into Kilauea's crater, down into an active volcano. Lava flows, crustal movement and volcanic ash have obliterated old land marks in the crater and in doing so have made new ones.

Part of the trail's fame may be attributed to the fact that along it nature frequently places new displays on exhibit. The older kamaainas (those who have lived in the Islands a long time) will tell you that at a certain placethere used to be a lava tube, a lava cascade, an earthquake crack, or a boiling pot. One respectfully envies the kamaainas for the changes they have witnessed, but any disappointment soon vanishes, for the last volcanic flow has also built its lava tube, spatter cone, and lava rivers, which, in years to come, you too will describe as, "what used to be", and then there will be new flows with ropy structures, new pahoehoe and aa surfaces, new steam cracks, and beds of ash - new formations which tell the story of Kilauea's seething caldrons of liquid lava.

The weird walk's fame is not merely the fame of its ever changing lava formations. Countless numbers of people have traveled this trail that they might feel the heat from Kilauea's fiery throat, or get a close view of some playing fountain of lava, or pick up fresh, wind-combed Pele's Hair. Many have walked along this trail in the crisp, mountain air of early morning hours; many have felt the mid-day heat of the sunIs rays reflected from the black, glassy flows; some have picked their way among the earthquake cracks with only the light - the fascination of some distant lava fountain to guide them - to lure them on; others have seen the trail in the moonlight, moonlight which adds a touch of velvety softness to the clouds of steam rising from the crater floor, steam which silently speaks of a fiery monster working its way up from the depths below.

Hawaii can boast of this trail because it is a living trail, an active, ever-changing trail, a trail along which the forces of nature are launching attacks and counter attacks against each other. One descending into the crater may witness this battle, a battle which, in Hawaii, will some day end; a battle, the end of which you will never see, yet you can leave the weird field of nature's war knowing that the forces on one side will be the victor.

Pitted against the roaring, hot, molten lava, the shrapnel of flying rocky bombs, the blankets of ash, and the gases of the volcano, are the silent, swaying, creeping flowers, ferns and trees. It is the battle between the mineral kingdom, under Kilauea's leadership, and the plant kingdom, which, guided by the hands of time, will disintegrate the minerals to the point of submission. As the blankets of ash settle to the earth, and the lava flows drive deep salients into the territory covered with a jungle of vegetation, it seems as though the volcano would ever rule supreme, yet time will lead the plants on to the flows and the dust will ultimately make food for the flowers.

Like all volcanoes of past geologic ages, Kilauea will tire from its sudden hot attacks, its fiery temper will be subdued, and what were once bare, glassy pahoehoe and aa lava flows will be a garden of vegetation. The sharp vertical walls of the fire pit, Halemaumau, will be softened by accumulating talus and that in turn by tropical plants adjusting themselves to the new territory they have conquered. In mass the crater of Kilauea will stand for ages of time, stand - like Diamond Head - as a monument of a once active volcano. When it does, its flower-covered walls and floor will silently tell the story of "what used to be", tell its story to the people hiking the Halemaumau Trail.

by John E. Doerr, Jr.
Park Naturalist

THE HALEMAUMAU TRAIL
"The World's Weirdest Walk"

Park visitors taking the walk across the Crater of Kilauea, on the Halemaumau Trail, begin their hike in an atmosphere which stimulates them to observe and appreciate nature's wonders. The atmosphere is in part one of history, the history of a hotel which has been located, since 1868, at the beginning of this famous trail, on the north rim of Kilauea. The hotel - always known as "The Volcano House" - has undergone many changes from the first grass-thatched structure to the present modern building. While the hotel as a building has seen many alterations, its historic atmosphere seems to always be present; one feels this atmosphere when reading old registers in which people have recorded their names, impressions, and experiences while at the volcano. The pictures on the walls tell their story, also the views from the lanai (porch); even the Hotel's location on "the mountain" seems to comfort those who visit it each year, as well as those who are viewing the volcano for the first time. One experiences the feeling that even the mountain trails of the ancient Hawaiians crossed at Kilauea. The historic atmosphere is one of excited crowds, crowds eager to drop their hastily packed luggage so that they can be off on the Halemaumau Trail - off to see Kilauea's fire pit, Halemaumau, in action. The hotel's lobby has in it an atmosphere of satisfied, weary people returning from an awe-inspiring night in the crater. The walls of the building seem to echo , "THE VOLCANO IS ACTIVE", the echo of excited voices hurrying people out of bed so that none shall miss the spectacle of Kilauea's fire.

Around the fireplaces of the hotel one seems to see and hear the people gathering on their return from the crater, people laughing at the clothes someone has hurriedly put on in the rush to see the fire in the pit, people telling each other what they saw, asking, "did you see the north wall slide in", or " the big fountain break out?" One feels that bond of friendship which the fires of Kilauea create among strangers who have visited the fire pit, Halemaumau.

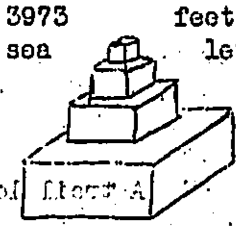
And so, leaving the Volcano House, we begin the hike along the Halemaumau Trail with this background of historic atmosphere, with THE ROMANCE THAT IS HAWAII!

The Volcano House

From the garden in front of the hotel one can see Mauna Loa's rounded dome, and framed by a low saddle in the Ohia trees are Mauna Kea's volcanic peaks. There in the morning sunlight is the sea of lava in Kilauea Crater, and beyond the south rim of the crater is the ocean - the South Pacific! Usually before the group leaves the garden, "Iki", the Persian cat, may be seen calmly sharing a cage with "Polly", the parrot.

Steam Crack

B M Elevation 3973 feet above sea level



White Gingerlily
The fragrant flower of the ginger makes a beautiful lei

Amaumau fern. The priests who formerly lived near the volcano used the fronds of the Amaumau fern for thatching their huts.

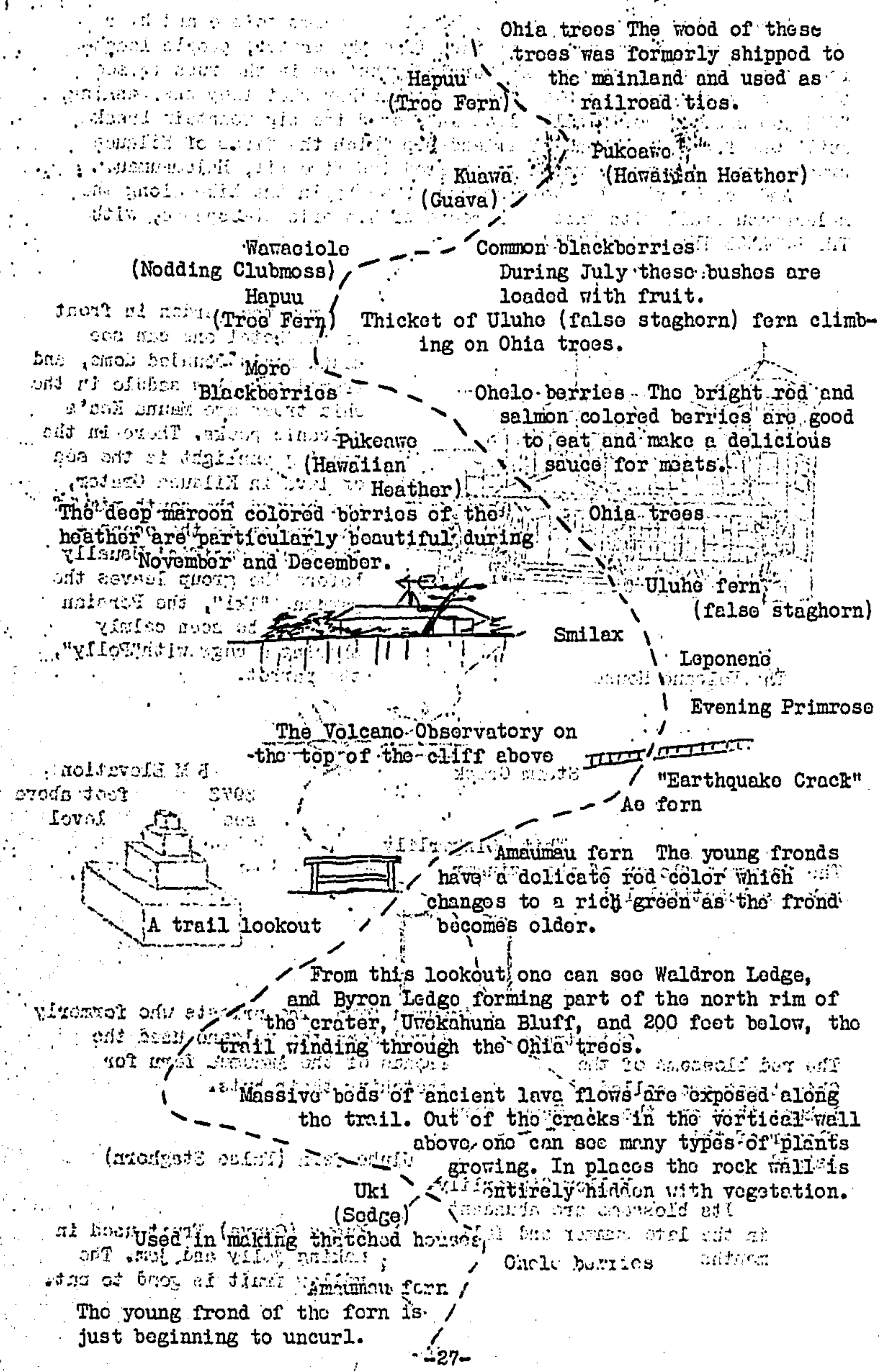
Ohia trees
The red blossoms of the Ohia trees are called Lehua; they are the flower of this island

Hapuu fern

Uluhe fern (False Staghorn)

Yellow Gingerlily
Its blossoms are abundant in the late summer and fall months

Kuawa (Guava) Fruit used in making jelly and jam. The yellow fruit is good to eat.


Ohia trees The wood of these trees was formerly shipped to the mainland and used as railroad ties.
Hapuu (Tree Fern)
Pukeawe (Hawaiian Heather)
Kuawa (Guava)
Wawaeiole (Nodding Clubmoss)
Common blackberries During July these bushes are loaded with fruit.
Hapuu (Tree Fern)
Thicket of Uluhe (false staghorn) fern climbing on Ohia trees.
More Blackberries
Ohelo berries - The bright red and salmon colored berries are good to eat and make a delicious sauce for meats.
Pukeawe (Hawaiian Heather)
The deep maroon colored berries of the heather are particularly beautiful during November and December.
Ohia trees
Uluhe fern (false staghorn)
Smilax
Lepanene
Evening Primrose
The Volcano Observatory on the top of the cliff above
"Earthquake Crack"
Ae fern
Amaumau fern The young fronds have a delicate red color which changes to a rich green as the frond becomes older.
A trail lookout
From this lookout one can see Waldron Ledge, and Byron Ledge forming part of the north rim of the crater, Uwekahuna Bluff, and 200 feet below, the trail winding through the Ohia trees.
Massive beds of ancient lava flows are exposed along the trail. Out of the cracks in the vertical wall above, one can see many types of plants growing. In places the rock wall is entirely hidden with vegetation.
Uki (Sedge)
Used in making thatched houses.
Ohelo berries
Amaumau fern
The young frond of the fern is just beginning to uncurl.

NATIONAL PARK SERVICE
IT IS UNLAWFUL
TO INJURE SHRUBBERY
TO PICK FLOWERS FERNS
TO BREAK OR REMOVE
FORMATIONS
TO DEFACE BUILDINGS
OR SIGNS
DEPARTMENT OF THE INTERIOR

Jungle of Ohia trees, Uluho fern, Hapuu fern, Amaumau fern, and Painiu lily

Trail Sign

Smilax

Wawaeiolo (Nodding Clubmoss)
In early geologic time this creeping clubmoss grew to be large trees sometimes 100 feet high.

Looking up one can see a vertical cliff 50 feet high. On the face of the cliff massive lava flows are exposed. Growing out of the crevices in the cliff are small Ohia trees, Amaumau ferns, Ohelo bushes, Pukeawe (Heather), Uki (sedge) and Ae ferns. One wonders how the plants find enough food in the crevices.

Evening Primrose

Kuawa (Guava) Its fruit is ripe during the late summer and fall months.

Iliahi (Sandalwood)

Ohia trees

Wide, leather leaf fern

The Ohia is the most common tree in the Islands.

Young Ohia tree growing on the trunk of a Hapuu tree fern. Seeing the young Ohia trees growing in this manner, the natives believed the Hapuu to be the parent of the Ohia trees.

Hapuu Fern
The soft mat of fiber on the stem of the fronds of the Hapuu is called Pulu. Formerly the pulu was gathered and used as packing in pillows.

Amaumau fern with a trunk 5 feet high

VOLCANO HOUSE
KILAUEA CRATER

SANDALWOOD TRAIL
MAIN ROAD
MILITARY CAMP

Direction Signs

A future issue of Hawaii National Park's Nature Notes will take you along this trail.

Ohia trees 25 to 30 feet high, 1 to $1\frac{1}{2}$ feet in diameter at the base of the trunk. In areas where the trees have more room to grow they are much larger.

Palaa fern (Lace fern)

Iliahi (Sandalwood)

Iliahi (Sandalwood)

When trade began with the Islands sandalwood was one of the main exports. This resulted in very rapid cutting of the trees, so rapid in fact that for a time it was thought that the trees would become extinct. Careful protection by the park service has made it possible to get a number of young sandalwood trees to grow.

Lalii

Leponene

This plant is easily recognized by its long creeping branches and shiny black berries.

Sward fern

Pukeawe

The berries of this heather are white when they first come out and as they mature their color changes to a deep maroon. Clusters of these berries are used as Christmas decoration.

The guard rail and flag pole on the cliff 250 feet above are in the yard of Park Superintendent Leavitt's home. From there one gets a fine view of the crater.

Along this portion of the trail one hears the merry chirp of many Apapane (small red bird). It is difficult to see them because they are the same color as the Lehua blossoms from which they gather honey.

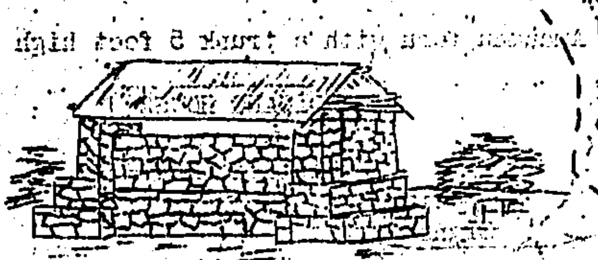
Wawaeiole (Nodding Clubmoss) Its long stems creeping along the ground attach themselves to the earth at various places by sending down clusters of roots; at places along the stems upward growing branch stems are sent out.

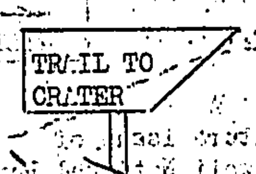
Iliahi (Sandalwood) The Hawaiians used to pay their taxes in sandalwood which the chief of the tribe would export.

Puka

(Hole)

Ohelo berries. These berries were once kapu (forbidden to be eaten). The berries were picked an thrown into the fire pit of Kilauea as an offering to the Goddes Pele to whose palace this trail leads.





Hui O Pele Shelter

Contributions to Hui O Pele Hawaii have been used to build shelters along park trails. From this shelter one gets a fine view of a portion of the crater floor, Byron Ledge, and Kilauea Iki. Many people vacationing at the Volcano House enjoy the short hike down to this shelter.

Painiu lily

The silky white skin on the uppor surface of the blados of this lily were formerly usod in making the hula skirts.

Ohelo

Kaulcau

Smilax

Ukiuki

(Dianella lily) The clusters of palo blue borrios of this lily were once used for dye.

Sword forn

Uluhe forn (False Staghorn)

Uki (Sodge)

Iliahi (Sandalwood)

Along this portion of the trail there is a luxuriant growth of Amaumau forns, and Painiu lilios. Somo of the forns are 12 foot high. The clusters of yellow borrios are the fruit of the Painiu lily. Many people in the Islands use the clustors of berrios to make a very attractivo table decoration.

Above is a cliff 300 foot high.

Ohia trees 50 feet high. According to an old legend, picking the red Lehua blossoms of the Ohia trees brings rain, except when picked as one returns to his home. The Lehua is the flower of the island of Hawaii. In places one can find yellow blossoms on the Ohia trees. The red and yellow blossoms interwoven with Palaa forns make a very beautiful lei.

Large boulders that have rolled down from the 350 foot cliff above. On some of the boulders one can find young Ohia trees, sword-forns, as well as other species of plants growing.

Jungle of Uluhe forns. This vine-like fern is a fire hazard in some parts of the island.

Iliahi (Sandalwood) Here one finds the largest sandalwood tree along the trail. It is about 20 feet high and one foot in diameter at the base of the trunk. The tree is easily recognized by its weak green foliage and ovate leaves. Among the deep green foliage of the Ohia trees, the sandalwoods stand out distinctly.

Aalii Kumakani A low bush the wood of which is very hard. The juice of the bright red borrios of this plant was once used as a dye.

From the Volcano House to this point, the Halemaumau Trail leads through a very dense growth of vegetation, so thick in places that to step off the trail would mean going into an almost impenetrable jungle of ferns and trees. Suddenly the thickness of vegetation changes and from here to the edge of the lava on the floor of the crater, 200 feet below, one can see only stunted species of plants. They are the same species that can be found higher up along the trail but they show evidence of a great struggle for existence. The abundance of rocky ash which is as yet but slightly decomposed, and the rapid erosion by rain water will account for the sudden change from luxuriant to stunted vegetation. The species growing in the rocky or lithic ash may be thought of as the advanced guard of the armies of the plant kingdom which will someday invade the crater of Kilauea.

KILAUEA IKI

A good trail and very interesting.

Waldron Lodge and Byron Ledge on the north rim of Kilauea from the junction of the Halemaumau and Kilauea Iki Trails.

7 foot exposure of volcanic ash

Aalii

Kumakani

At this sharp turn in the trail one obtains the first good view of the sea of black lava 125 feet below.

Oheao bush

Amaumu fern - The natives used to use the fronds of this fern as a table decoration.

1919 FLOW
PAHOEHOE LAVA
FIRE PIT 2 MI.

This is the base of the pali or north rim of the crater of Kilauea and the edge of the floor of the volcano. In a distance of one mile the trail has descended approximately 600 feet. The edge of the floor is the lowest place on the trail. From here the trail leads across the lava floor which is a broad, gentle dome rising about 200 feet in two miles. In the top of this dome is the fire pit, Halemaumau. From here to the pit the walk is a weird one because the trail leads over black, shiny pahoehaoe(smooth) lava flows, over hot steam vents, over crusts beneith which are lava tubes, through "frozen" aa (rough) lava rivers, into the mouth of a lava tube, passed a spatter cone, and through the area of basalt boulders thrown out during the 1924 explosive eruption, to the edge of the fire pit where one looks down a thousand feet to the black lava and sulphur patches in the bottom of Halemaumau. It is a weird walk because one is actually on the floor of an active volcano.

Ropy structures on the surface of the black, tary-looking pahoehaoe lava.

TEST
YOUR ECHO

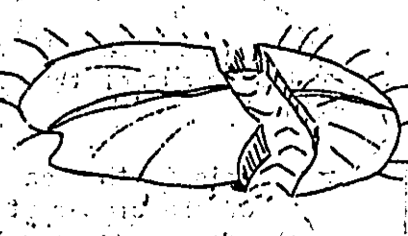
Here the roof of a small lava tube has caved in

The brittle crunching lava reminds one of snow on a frosty morning.

The small piles of stone mark the trail across the lava. One need have no fear of ones shoes, the 1919 lava is smooth.

Here is an "island" in the 1919 lava flow. The "island" is 1868 lava. Notice the difference in the luster of the older flow and that of the 1919 lava. The younger flow has a shiny black luster while the older is a dull brownish black. On the "island" one can see an Amaumau fern, a sword fern and an Ohia tree but on the 1919 lava no vegetation has started.

Here is another "island" in the 1919 flow. The 1919 material is actually higher than the highest part of the "island" yet the old lava was not covered. The large crack which seems to have broken the "island" dates back to 1887. The 1919 flow has partially filled the crack.



Gnarled ropes of lava on an "island" in the 1919 flow. A number of sword ferns have taken root on this "island".

Ohelo bush and a small ohia tree growing in a contraction crack in the 1919 lava. The wind has probably carried dirt into the crack and the wind-blown seeds have taken root.

Steam Crack

Many of the cracks along this portion of the trail do not steam during the middle of the day. If one holds a lighted match or a cigarette near the crack it will steam. The fact that steam comes out of these cracks does not mean that there is liquid lava below; rain water getting in the cracks comes in contact with warm rocks and comes back out as steam. During a rain many of these cracks steam.

Along the steam cracks there are patches of brown and white material which is evidence of the oxidation of the lava along the steam cracks. One notices no odor of gas although there is no doubt a certain amount of sulphur in the steam.

Lava toes

Here is the edge of the 1919 flow. At this point one readily recognizes flows of three different periods of activity; they can be distinguished by the amount of surface disintegration and decomposition. The surface of the oldest flow (1868) is sandy and supports a scattered growth of stunted Ohia, Ohelo, Amaumau, and sedge. The 1919 flow, the youngest, still has its black, shiny luster while the intermediate flow (1894) has lost its former shiny surface luster.

Snakes of lava

The 1919 flow came from the fire pit. Some flows break out along cracks in the floor.

The floor appears to be a billowy sea.

In places the lava seems to have been pushed up into large domes by some tremendous force from below. Many of these domes have cracked open. As the lava comes in under the floor there is a doming of the floor; during this uplift many of these cracks open.

Here is a small Ohia tree, 15 years old, the base of the trunk is $1\frac{1}{2}$ inches in diameter.

Hollow Crusts

Aa (clinker or rough) lava formed during the 1921 activity. A casual glance over the entire field of aa lava makes one think of a freshly plowed field of black dirt, but soon one realizes that the jagged cinder masses have been subjected to processes far more violent than peaceful plowing unless it is perhaps that the Gods of Fire have stirred up this portion of the crater floor. The aa is distinctly a clinker surface; chemically it is the same as the pahoehoe lava. The forming and massing of microscopic crystals in the molten flow has caused this rough lava. It might be compared to the irregular blocks of ice in a frozen river.

1921
LAVA RIVER

Picking up a fragment of aa lava one can notice glassy, green grains of olivine, an iron, magnesium silicate. Olivine (Hawaiian or Pele's Diamond) is one of the few minerals that can be recognized in the volcanic material; the other minerals are so microscopic that they can not be distinguished without the aid of a powerful microscope. The glassy and aphanitic textures of volcanic rocks such as are found in this region indicate that cooling and crystallization have been very rapid. Because of the fine texture and the basic composition the rocks are classed as basalt.

ONE MILE
TO CRATER

Storm Cracks

Peacock or Rainbow Lava

Palaa (Delicate lace fern)
In the aa lava this fern grows in the warm steam cracks.

Uki (Sedge)

Pteris (Fern)

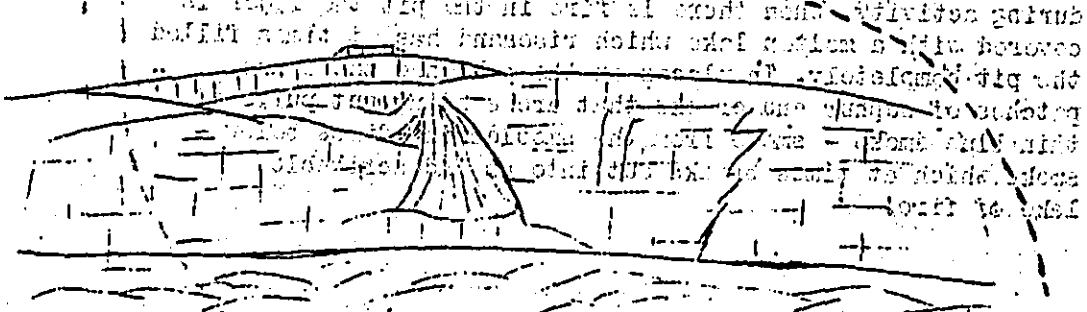
1894 PAHOEHOE LAVA
1921 AA LAVA
NO CHEMICAL DIFFERENCE

Snakes of lava

Place where an attempt was made to drill through the lava floor. The numerous underground cracks made drilling difficult.

Heavy, grayish green boulders thrown out during the 1924 explosive eruptions. This boulder was thrown over $\frac{1}{4}$ of a mile from the pit. Nearer the pit the trail goes through an area where the floor is covered with such rocks.

A view of Uwekahuna Bluff and Museum from the Halemaumau Trail



TO SOUTH
← RIM OF
FIRE PIT

ELEPHANT HEAD
PICTURE FRAME
BATH ROOM

Lava tube formed in 1894. The roof of the tube caved in and part of the flow cascaded into the opening. The "frozen" cascade is shaped like an elephant's head.

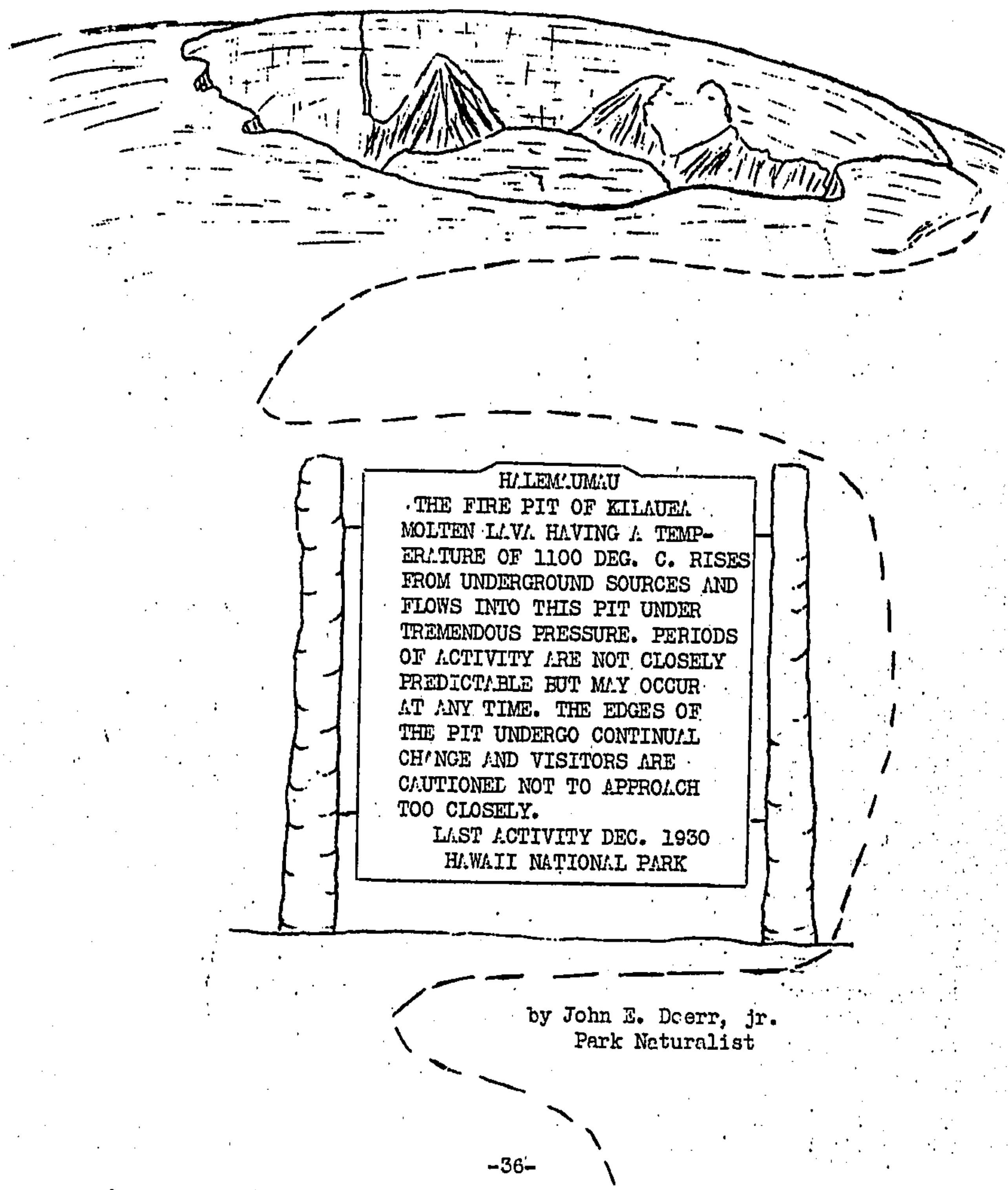
LITTLE BEGGAR
SPATTER CONE
1884

Area covered with basaltic bouldders of all shapes, sizes and colors, and volcanic ash thrown out during the 1924 explosive eruption. The boulders have a high density as compared with the scoracious lava along other parts of the trail. The largest boulder weighed 12 tons; it has since fallen back into the pit. Kilauea is usually classed as a quiet type of volcano; twice in its history explosions have occurred, the first in 1790, the second in 1924.

Olivines in the explosive ash and basalt boulders

Even a small stone thrown into the pit may cause a rock slide and endanger life, and too, the fire pit is an ancient temple of holy worship, the home of the Goddess Pele.

Kilauea's Fire Pit Halemaumau! Having hiked what seems to be much less than three miles, one now stands at the very rim of Kilauea's volcanic throat, a circular pit over 3000 feet in diameter and approximately 1000 feet deep. A most fascinating pit when one realizes that it is the opening of a passageway which leads toward the center of the earth. It is into and out of this pit that the lava pours during periods of activity. Except for some talus, its walls, built up layer on top of layer by flows, are vertical. In places the walls seem ready to cave in; at times slides do occur. The pit's floor, covering over 40 acres, is composed of black pahoehoe lava except during activity. When there is fire in the pit the floor is covered with a molten lake which riseand has at times filled the pit completely. In places on the pahoehoe there are patches of suphur and cracks that are sending out puffs of thin blue smoke - smoke from the smouldering fires below - smoke which at times breaks out into an indescribable lake of fire!



by John E. Doerr, jr.
Park Naturalist

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Steep summit between the craters of Turrialba Volcano, Costa Rica.

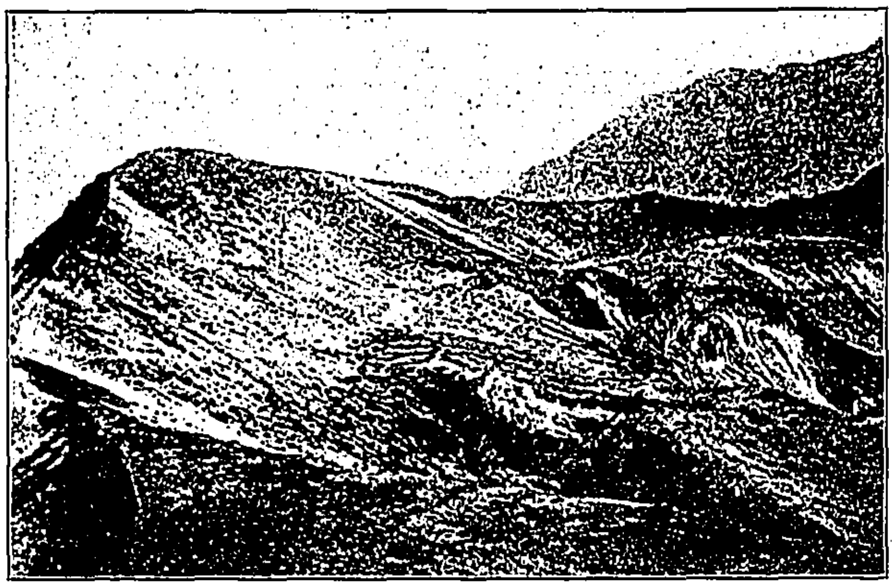
ACTIVE VOLCANOES OF COSTA RICA

Pittier describes the mountains of Costa Rica as divided into a southeastern system of old eruptive rocks without volcanoes, and one peak reaching an elevation of 12,467 feet; and a northwestern system with active craters. This chain of volcanoes begins with the conical peak of Turrialba, rising in an uninterrupted slope from the Santa Clara plains to a height of 10,965 feet. Going west from Turrialba we pass Irazu, Barba and Poas volcanoes, and from there northwestward the range diminishes in height past the less conspicuous volcanoes Tenorio, Miravalles, La Vieja, and Orosi, when we reach the Nicaraguan boundary (Costa Rica, Vulcan's smithy, by H. Pittier, Nat. Geog. Mag. June 1910).

Dr. Jaggar visited Costa Rica in the early summer of 1910 in order to study the effects of the terrible earthquake of May 4, 1910, at Cartago. He visited the craters of Irazu and Poas. President Jimenez kindly furnished the following account of a visit to the crater of Turrialba in 1864. The account states that at that time Poas, Barba, and Irazu were "not altogether dead," but Turrialba was in complete activity, and had been so for many years, sending out thick and high columns of smoke mixed with plenty of sulphur so as to destroy the vegetation on the slope of the mountain. Large deposits of sulphur of great purity were said to exist on the northeast side.

The biggest craters, more than 300 feet deep, showed black and yellow walls leading into the depths where more than a hundred mouths five to six feet in diameter, fringed with yellow layers of sulphur were hissing and sending up vapor with a noise like steam boilers. The roar of the steam was terrifying especially on the east and west corners of the crater where two larger vents sent up excessive vapor with a rush. All of the vents together made a large column of fume at the lip of the crater over 90 yards in circumference, and this made a high column above the mountain in calm weather as seen from the town of Heredia. The vapor was said to increase in winter time after heavy rain. There is an eastern extinct crater adjacent to the active one, and yet a third to the northeast where water collects in winter time. Between the three craters are three sharp ridges meeting in peaks of which th northern and eastern are the steeper. (See cut Page One). The circumference of the crater region is about 1,800 yards. Its shape is somewhat elliptical and irregular. Its inside walls are nearly vertical, covered in places with yellow layers of sulphur, and on account of the noxious fumes and the loose ground the descent is dangerous, and to return might perhaps be impossible. The outer wall of the crater to the west is peculiarly dangerous to walk upon; wherever one digs with a stick a small smoking chimney is created with deposits of sulphur and other salts, and in a short time the heat rising from the hole so made is excessive. The ground on the plateau about the summit is covered with lava fragments, sand, clinker, sulphur, and various salts, and there is little vegetation except to the south where the ground is not reached by fume. Here there are dwarf scrub and creeping plants. The walls show layers of rock of many different colors exhibiting the structure of the mountain, and there is sign of lava flows toward the north, where also the greatest devastation has been brought by fallen materials.

Pittier (1910) describes Turrialba as having a beautiful crater, forming a narrow elongated basin, in constant activity through the ejection of sulphurous vapors mixed with sand seen escaping noisily during recent years from the broad vent at its westernmost extremity. The only known violent eruption of Turrialba occurred in 1869 when



Crater of Irazu Volcano, showing part of cup and inner pits.

it threw out much explosive material and fine sand carried by the trade winds far to the west.

Irazu is about 360 feet higher than Turrialba, and a portion of its open crater, containing several interior pits, is shown on Page Two. The following is from my journal of 1910, when we started for the summit from a beautiful dairy ranch in the forest high on the mountain flank:

On June 3 we were up before the dawn, our hostess served coffee, and accompanied by a guide we mounted our beasts and entered a steep winding woodland path. Mr. Alfaro pointed out a rather large quick-flying bird which gave a plaintive whistling call: it was that rara avis the Quetzal which in Guatemala is regraded as the national bird. We passed from the tree line to a zone of shrubs and here the glorious summit view burst upon us, the Caribbean Sea far to the east and a dark Pacific loom under the clouds to the west. We were standing on one of the dividing peaks of the Central American watershed and viewing both oceans at once! Below us stretched the fair and fertile plains of Paraiso, Cartago, and San José, too far away to show any sign of the recent tragedy. Beyond to the south were the calm, dark mountains, as still, silent, and emblematic of terra firma as though earthquakes had never been. More tumultuous were the moving clouds, especially over the Pacific where they caught the high roseate lights and dark shadows of the dawn. Looking eastward towards Limon the rising sun made a trail of tropical glory along dim misty waters and pale pearl-gray clouds below, the foothills piercing the clouds like islets in a billowy sea.

As geologist I noted the much greater fall of the eastern streams, such as the Raventazon, as contrasted with the extended gently falling drainage of the broad valley to the west occupied by San Jose, San Domingo, Heredia, and Alajuela and other towns. The Raventazon shows a gorge just east of Paraiso and it is clear that if any massive uplift of this country is going on which causes the drainage to cut deeper, the maximum uplift is on the eastern side of the country. If the movement is a tilt, then it is a tilt up on the east, down to the west. This agrees with the appearance of elevated coral shelves and forelands in British Honduras and at Limon in Costa Rica, in that such raised oceanic formations give evidence of elevation on the east cost. And the west coast shows drowned valleys.

As one looks down from the summit of Irazu on Cartago and Paraiso, these towns appear to lie on an intramontane plain, and all about them are the evenly rectangular tilled fields of a fertile agricultural land. They are really on the pediment of the volcano, where the outwash from the gulches has built fan-cones of soil and bowlders onto the floor of a broad valley which originally drained westward; ie., towards San Jose and the Pacific. The evidence of this change of drainage is shown by a barbed stream beyond (S. E. of) Paraiso, in a deep gorge which now joins the Raventazon at an acute angle headwards, whereas its original junction with a normal west-flowing drainage was at an acute angle mouthwards. In other words, the Raventazon and its tributaries has robbed the waters of formerly west-flowing rivers and thereby has forced the continental divide to shift from a former position east of Paraiso to a present position west of Cartago. Cartago is thus practically on the continental divide, in territory where the divide is, so to speak, disputed by a conquering eastern drainage, which is cutting deep canyons, and a conquered western drainage which has lost volume and is losing rapidly its basin lands. This physiographic change may have significance as one of the many causes which serve as trigger to the earth stresses which make the earthquakes.

Continuing our climb, now in the bushy zone of the high summit, we came to bare patches of soft black cinder with new fractures in the earth. These fractures were marked by rows of caving holes—in one place two feet wide and another six feet wide and the rows trending WNW. Such cracks are not unusual in the crater region of a volcano and these in Irazu are not necessarily the product of the recent earthquake disturbance. The WNW trend is about parallel to the main fissure system which must underlie the chain of volcanoes of which Irazu is a part.

The summit of Irazu was soon reached. This is on the south side of the crater and is merely the highest point of its rim. The crater north of us, as we stood on the peak in an uncomfortably stiff breeze, appeared to be an irregular drainless depression over a mile wide with two broad shelves of lava within it, one over the other like steps, on the side toward us, and a quantity of irregular deep pits in the opposite or northern side of the hollow. The effect is as though the whole cauldron had once been filled with lava to the level of the highest step; the lava seems thereafter to have hardened and tumbled in on the north and amid the tumbled blocks new explosion craters were formed at different times, making the several roundish or elliptical pits. The lower step would by this explanation be a piece of the frozen lava lake which had slipped down toward the convulsed northern half of the bowl. On the east there is the largest of the pits, which reaches almost the dignity of a subordinate crater. The northern rim is very low, and the northern side of the mountain is profoundly eroded in deep, steep furrows by the headwater branches of a muddy river, known as the Rio Sucio, by reason of its turbid waters. This river is undoubtedly the main drain of the crater by underground channels. The crater had some shrubby and herbaceous vegetation. There is nothing immediately suggestive of recent activity or earthquake slides. The ground on the crater rim is covered with angular fragments of andesite and blackish gravel. The walls of the steps and of some of the pits show bedded sections of lava, hard rock, while the "treads" of the step-like terraces have "playas," dried mud ponds, on their surfaces. There are seven or eight pits, mostly choked at the bottom visibly by slide-rock, but one or two extend below into black holes which continue indefinitely. There is a shallow pond of milky water in one of the pits.

To the east rises Turrialba, a beautiful flat-topped cone, said by those who live on its flanks to be the theater of hollow murmurings from the bowels of the earth. These "retombos," or terrestrial grumblings, we heard described by all our friends resident in the vicinity of San Jose, and the residents had become so sensitive to these noises that they heard them constantly even during the time of our stay. We never succeeded in hearing them, or if we heard them, in distinguishing them from thunder, which we heard nearly every afternoon. We were also unfortunate in being unable to perceive any of the aftershocks of the earthquake, though they were felt by others and instrumentally recorded at the observatory.

At the headwaters of the Rio Sucio on the north side of Irazu there are bare brown landslide surfaces occasioned by the tropical rains and the steep slopes. The river has cut a canyon with vertical walls a short distance below the summit cone. A tributary waterfall cascades over the eastern cliff of this gorge. Just below the north rim of the outside surface of the mountain, and on the flanks of one of the gulleys that lead into the Sucio, there is a patch of bare sulphur-covered rock extending 200 yards down the mointainside. Mr. Alfaro informed us that the solfataric activity which generated this patch began about 1888 and that the sulphur, which may be removed in fairly thick cakes, is deposited from gases which emerge from pores of the rock. We saw no hot water or visible vapor, but recent photographs and records by other observers indicate that solfataric steam is ejected from time to time.

Some days later we took horses from the village of San Pedro for the ascent of Poas Volcano. Through country lanes we climbed, with the volcano ahead appearing as a mass of densely wooded hillocks. We entered the jungle by way of a narrow path over muddy hillslopes and muddier tangles of enormous roots. We frequently had to dismount and whip up the animals ahead of us. This jungle was remarkably different from the open groves of Irazu. There are here great trees with hanging vines, aerial parasitic flowers, some orchids, immense horn flowers and ferns, and all kinds of dense, shrubby undergrowth. We came upon a jaguar trap, and the guide told us that two of these cats had been caught in it. It consisted of a rectangular pen made by driving heavy sticks into the ground and roofing them with logs. A freshly killed fowl was placed as bait inside the pen, and provision was made for a heavy shutter to fall and close the opening when the bait was touched. Twice during the ascent we came to open meadows surrounded by elevated land which are possibly old craters. We passed wild cattle. Finally we dismounted and entered

Lake of steaming water, usually in effervescence, in crater of Poas Volcano. Photo Jaggar 1910.

upon the last stage of the journey on foot. The jungle thinned somewhat to a scrubby growth probably determined by occasional ashfall from the volcano. Poas is much lower than Irazu, its elevation approximately 8,000 feet. Bushes became open with a gravely soil between them, and then we came out on the edge of the greater crater at first obscured by clouds. We could smell sulphurous acid.

After a visit to a higher cold lagoon which fills a subsidiary crater, we returned to the edge of the greater crater and found it free from cloud. It proved to be a big cauldron filled with whitish water in constant ebullition, and bordered by bare, low banks of clay and bowlders radially trenched by hundreds of rain rills. The upper lip appeared to be half a mile in diameter; the depth from the rim to the water surface was perhaps 800 feet, and the distance across the pool 1,500 feet. On the north side of the crater a hill appeared, somewhat higher than the one we were on (see cut Page Three). Toward the west from the water-filled basin there is an irregular tract of "bad lands" drained westward by a gulch which shows a bedded section of agglomerates and tuffs towards its head. This gulch does not drain the boiling pool at the present level of the water, though it would do so if that level were raised a very few feet. There was evidently much relatively new sand and dust and gravel from the eruption of January 25, 1910.

The water in the muddy pool was bubbling up chiefly at one spot near the eastern side of the pool. It rose in a small dome of ebullition from time to time. There were sheets and tails of vapor rising from all over the surface of the water and the color was a pearly gray. The water appeared to be hot but not boiling hot, and the ebullition appeared to be the escape of vapors from a vent below. The eruptions of Poas are described by Pittier as geyser eruptions, and the column of steam and water, when a big jet occurs, is said to reach heights of thousands of feet, and to constitute the greatest geyser in the world. It is doubtful whether such eruptions may be described as a true geyser, for this volcano throws out bombs, ash, and mud, and the gases which rush upward through the water are highly sulphurous, and probably are not steam in the sense of being occasioned by the boiling of this same water column. It appears to be merely a case of a volcanic eruption making its way through a crater lake. In the bigger eruptions the lake is probably discharged completely. Such was the eruption of January 25, 1910, when stones fell on the edge of the crater, and the finer dust fell at San Jose, 20 miles to the southeast. Pittier states that the water of the crater lake "tastes like strong vinegar."

There was good evidence of the recent eruption on the rim of the crater. Lumps of gray ash, clotted by rains into the appearance of portland cement, were to be seen under the bushes where they had gathered in the branches and fallen off to the ground beneath. There were pumiceous bombs, large blocks of rock, which had fallen from great heights into the soft earth of the hillside. They had punched holes in the ground and buried themselves. We dug up several of these, in size from a few inches to two feet in diameter; one was found buried 38 inches below the surface of the ground. There were many stones coated with sulphur.

Pittier describes the eruption in question as follows: "At 5 p. m. January 25 a smoke-like column rose from Poas to prodigious height, estimated at no less than 13,000 feet. After reaching its higher point, the column spread into a mushroom-shaped grayish cloud, which, carried by the trade winds, soon covered like an immense screen the whole valley of San José."

"An hour after the first indication of eruption a rain of ash began to fall, increasing in coarseness as well as in quantity as the eruption proceeded.

"Near the crater volcanic mud was mixed with stones and the latter broke thick limbs and roots of trees and penetrated deep into the ground. When visited after the eruption, the boiling of the crater lake had ceased.

"This eruption was followed on April 13 by a serious earthquake over all the central plateau of Costa Rica, just after midnight. Everyone ran into the streets. There were numerous shocks the next day, and several public buildings were badly wrecked. Ground was rent and fissured in the neighborhood of Cartago. On May 4, at 6:50 p. m., came the terrific jolt from the east which wrecked the city of Cartago, just at the foot of Irazu Volcano. This was one of the most intense earthquakes of modern times." (See Jaggar and Spofford, Costa Rica earthquakes, Jour. Assoc. Eng. Socs. 46, No. 2, (Feb. 1911). T.A.J.

KILAUEA REPORT No. 1028

WEEK ENDING OCTOBER 4, 1931

Section of Volcanology, U. S. Geological Survey

T. A. Jaggar, Volcanologist in Charge

Fume was fairly strong at the floor vents of Halemaumau early in the week, appearing irregularly in puffs, probably due to the strong NE wind. Heavy rain increased steam activity in the pit. Accumulation of water in a pool near the Halemaumau seismograph caused deceptive tilt of that instrument away from the pit.

On October 1 fume was plentiful at the SE sulphur spot. Two small slides from the north wall were observed at 7:35 and 7:40 a. m. There was the usual increase of steam after rain on this day and the next. A small slide also occurred on October 2 at 7:30 a. m. A faint smell of sulphur was noticed on the west side of the pit.

The instruments at the Observatory recorded a total of 19 very feeble tremors, one showing easterly tilt; 3 very feeble local seisms, one at 8:40 a. m. October 3 showing distance 4 miles and another showng easterly tilt; and a distant earthquake at 8:45 a. m. October 3 (uncorrected H. S. T.). The record of this shock is much larger than the Napier disaster of February 2, though the distance, 3750 miles, is not so great. Phases were as follows:

eP 8:53:42 a. m.
eS 9:01:17 a. m.

The average of accumulated tilting of the ground at the Observatory was slight ENE. Microseismic motion was slight

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No. 355—Weekly | Hawaiian Volcano Observatory, National Park, Hawaii | October 15, 1931

Lake Amatitlan and Agua Volcano in Guatemala.

VOLCANO ACTIVITY OF CENTRAL AMERICA

In some early numbers of the Volcano Letter the question was reviewed as to what constitutes comparative volcanic activity for different districts. Different methods suggested have been Von Wolff's "Index of decadence," where an index number is applied to the percentage of extinct volcanoes for the total number of new districts; the total number of historical "outbreaks;" the number of volcanoes active for the aggregate length of the volcanic zone; volume of output of lava; and lastly volume of output of explosive materials. It was found that the volume of output makes the most consistent table for a list of regions, but that the output of lava is at the opposite end of the list from the output of explosive material. Thus Iceland leads all other districts in output of lava and the Dutch East Indies lead the world very greatly in output of fragmental deposits for the period of human history. The oceans and subarctic regions are the great lava producers, the continental borders and the equatorial belt produce much explosion.

Reading by explosive output alone, we get the following series by Sapper's revised tables (Zeitschr. Vulk. XI, Heft 3, 1928):

		Cu. Km. Fragmental
1.	Java belt	185.0
2.	Central America	58.0
3.	Alaska-Aleutian	30.0
4.	Iceland	10.0
5.	South America	9.5
6.	Japan	8.2
7.	Philippines-Molucca	6.5
8.	Kamchatka-Kurile	6.0
9.	New Zealand-Tonga	4.1
10.	North America-Antilles	3.5
11.	Mediterranean	3.5
12.	Melanesia	3.1
13.	Atlantic Ocean	2.2
14.	Indian Ocean-Africa	2.0
15.	Central Pacific	1..5

Contrast with this the following list in the order of lava output:

		Cu. Km. Lava
1.	Iceland	15.5
2.	Central Pacific	11.0
3.	Indian Ocean-Africa	8.0
4.	Atlantic Ocean	5.5
5.	Mediterranean	5.1
6.	Kamchatka-Kurile	5.0
7.	Japan	3.5
8.	Alaska-Aleutian	2.0
9.	New Zealand-Tonga	2.0
10.	North America-Antilles	1.5
11.	South America	1.2
12.	Philippines-Molucca	1.2
13.	Central America	0.6
14	Java Belt	0.5
15.	Melanesia	0.1

If we compare these two columns it is evident that for the geologist to whom explosive violence is characteristic of terrestrial activity, the Dutch East Indies stands at the top. And to him for whom magmatic outflow is all important, Iceland and Hawaii are the leaders, though Hawaii comes at the bottom of the list based on explosiveness. Japan occupies nearly the same position (Nos. 6 and 7) in the two lists, and the districts occupying the same position in both lists are New Zealand-Tonga and North America. It is clear that explosive violence and lava outflow are opposed, and that if either of these qualities is to be used as a measure of volcanic activity, the other should be in the nature of a measure of decadence.

If we grant that engulfment and the admission of ground water is what leads to explosion, and that on the other hand the rise of primitive magma and exclusion of ground water is what leads to lava flow, then it would appear that only the latter magmatic happening can be construed as a measure of pure volcanicity. Any magmatic vent in the earth-crust may enter into an explosive phase through the recession of the magma, this has happened in Iceland and Hawaii, and the fragmental output thus produced is merely a rearrangement of broken rocks.

On the other hand, it is quite possible that some volcanic regions are charaterized by intrusive magma in just as great volume as anything poured out in Iceland or Hawaii. These places would make steaming solfataras and boiling waters, would deposit much sulphur and other salts along cracks, and if the intrusive magma receded, would generate explosive eruptions, followed by an exhibit of little or no lava at the surface. The little lava exhibited might be a stiff plug or dome of highly siliceous magma at the crater. It happens that just such andesite or dacite domes are well known at many explosive volcanoes. This proves that these volcanoes are truly magmatic, but that they do not make lava flows.

Decadence of volcanism, then, as interpreted by explosion, may mean merely a transition from basaltic flow lava to andesitic intrusion lava. In this connection Central America is very interesting. Sapper lists 26 active volcanoes between Costa Rica and the Mexican border, averaging one every 50 kilometers when this line of activity is treated as a single belt. Central America ranks thirteenth in lava output among volcanic regions, but is second only to the Dutch East Indies in explosive output.

In a recent article on the most active "volcanic regions," Dr. Sapper has compared the strongly active districts of the world by density of clustering of volcanoes, by frequency, and by output, and makes the following remarks on the resulting tables:

"Iceland in the period since 1500 A. D. has exceeded all other places in output of lava, in that it has poured out a third of the world's lava output, or about 16 cubic kilometers out of a total of 50 cubic kilometers. Hawaii comes next to Iceland in lava output.

"In the production of broken material the Dutch East Indies have produced more than half of the 325 cubic kilometers ejected on earth since 1500 A. D., with Central America coming next and the Aleutian-Alaska system third." (These figures differ from the tables in Volcano Letter No. 12, owing to the inclusion of a large volume for Katmai in 1912. This illustrates how quickly proportions may change through a single volcanic event.) If one considers the great length of the Java-Sumatra and the Aleutian belts, respectively, as compared with the shorter Central American belt, and thus includes density of clustering as a measure of activity, it is found that the output of Central America per hundred kilometers of length is 4.6 cubic kilometers of explosive material, whereas that of the Dutch East Indies is only 3.7. This would make the Central American region the most productive of explosive material per unit of area, with the Dutch East Indies second and the Alaska-Aleutian belt third. It further appears that when these belts are examined in detail, the two ends are less productive than the middle. It is remarkable that the three most important regions on earth for throwing up explosive material, and so giving evidence of cycles of intrusive activity at the present time, all lie in inter-continental districts—Java between Asia and Australia, the Aleutian Islands between North America and Asia, and Central America between North and South America. The Central American belt is strikingly different in its volcanic activity from the much weaker volcanism of the mainland of North and South America. By this demontration, Sapper makes the Central American region one of the most important on earth.

In the map on Page Four there are shown many volcanoes between Turrialba in Costa Rica and Tacana near the Mexican border of Guatemala The last Volcano Letter discussed the moderate activities of the Costa Rican group. In Salvador and Guatemala there are volcanoes producing lava flows, and others producing extrusive lava domes. In Nicaragua there are volcanoes of first magnitude and very frequent activity represented by Masaya, whereas Momotombo and Coseguina are both distinguished for some of the greatest eruptions of history. It is worthy of note that two of these are on opposite sides of Managua, where the recent earthquake occurred, and that the proposed route of the Nicaragua Canal is in the midst of an earthquake and volcano belt.

In Volcano Letters Nos. 87 and 262 some description has been given of Santa Maria Volcano in Guatemala near the city of Quetzaltenango. This is the most interesting active vent of the Central American group at the present time, and will be treated in the next number. The illustration on Page One shows Agua Volcano, one of the beautiful cones near the capital, Guatemala City. There are three in this group, Agua, Fuego, and Acatenango. Here again it should be noted that some of the terrific earthquakes of history occurred right at the foot of all these volcanoes, and both of the cities named were recently wrecked, Quetzaltenango in 1902, and Guatemala City in 1917. Here and at Managua it is legitimate to inquire whether intrusive magma does not strain the earth-crust to make great earthquakes. There is no reason whatever for expecting simultaneous "activity" at the nearby volcanoes if an intrusive mass, by spreading laterally far underground, suddenly breaks or splits the earth shell subterraneously.

Acatenango, elevation 3960 meters, is a double cone close to Fuego, and at the end of the nineteenth century it exhibited slight fumarole activity in its southern summit crater. At 8 p. m. December 18, 1924, an explosive eruption broke out and lasted 20 minutes. A crack opened about 300 meters north of this summit, in the saddle between it and the northern peak called Tres Marias. (See cut Page Three.) The crack was right on the line connecting the two cones. Fiery glow was seen and products of the eruption were water, sulphur vapor, and fine gray ash. There were 15 cups along a rift 75 meters in length; bright yellow sulphur deposits were formed along the crack. There were light falls of ash in three towns. An ascent of the volcano by residents January 5, 1925, discovered the straight line of vents steaming like an engine ending at the south with a new large crater 60 meters in diameter and 80 meters deep. The steam rushed out violently so as to eject small stones. The west slope was covered with ash, and one's feet sank in it 20 centimeters at each step. The individual fumaroles were 2 to 4 meters across and up to a meter and a half deep. The ash was dark and muddy and there were sulphur stains. The big new crater sent up dark, yellow, sulphur vapor, whereas at the north end of the row of small cups pure steam was rising. At the southern summit crater there was no participation in the eruption, but a little white vapor rose at the west edge.

The second outbreak occurred February 10, 1925, at a large crater in the middle of the north slope of the southern peak. This also lasted 20 minutes, with wind in different direction from the first one. There was hissing from the new fumaroles, but the explosion was not so strong as before. On February 22 there was decrease of activity, and a new ash field made a conspicuous white object for 200 meters on the east slope of the summit. A new pit had been formed 50 by 40 meters in size, on the rim of which lay many stones in the midst of the ash, of 50 centimeters diameter. There was further activity at 4 a. m. March 4 and again at 2 p. m., so that a new ashfall occurred, and when the peak was visited March 13 some of the fumaroles had increased their activity. There was wet ash around all the openings, some blocks of rock a meter in diameter were found during the ascent, and trees were broken down. A compass needle showed no disturbance on Acatenango, whereas Fuego at its summit produced great irregularities in magnetic declination. At this time Fuego also was showing increased fumarole activity.

On May 7 a strong outbreak of ash again occurred at Acatenango, and it was found that trees 30 centimeters in diameter were broken off one meter above the ground, only the eastern of the saddle fumaroles were active weakly, while the western ones had caved in to form a large hole where gas was escaping. A small channel had formed connecting different openings. From the mid-slope crater on the north side of the southern peak steam arose feebly, but from the summit rose big steam jets mixed with ash, and a part of the crest had fallen in. All these facts suggested a gradual increase of activity from the beginning of the year 1925.

A later note (Zeitschr. Vulk., Vol. XI, Heft 3, p. 188) states that Acatenango in 1926 after September was in continuous light activity from the same vents, and March 30, 1927 a great rumbling occurred heard in the neighboring towns. Some fine gray ash fell March 31 and April 1 while thick steam clouds rose from the peak. Then the activity died away and nothing more was heard from this peak. Steam was occasionally seen. On the other hand Fuego in August 1927 had increased its activity, 25 irregular fumaroles were in action on the southern peak and about 10 on the east side. There was much sulphur at the peak of Fuego. Out of the crater steam puffs shot up every 10 minutes, and during two hours there were six slides heard in the crater, which is from 300 to 400 meters deep. The east-west diameter is 150 meters and the south-north 75 meters. The northeast rim consists of ash and is higher than the southwest margin, which shows bedrock.

T.A.J.

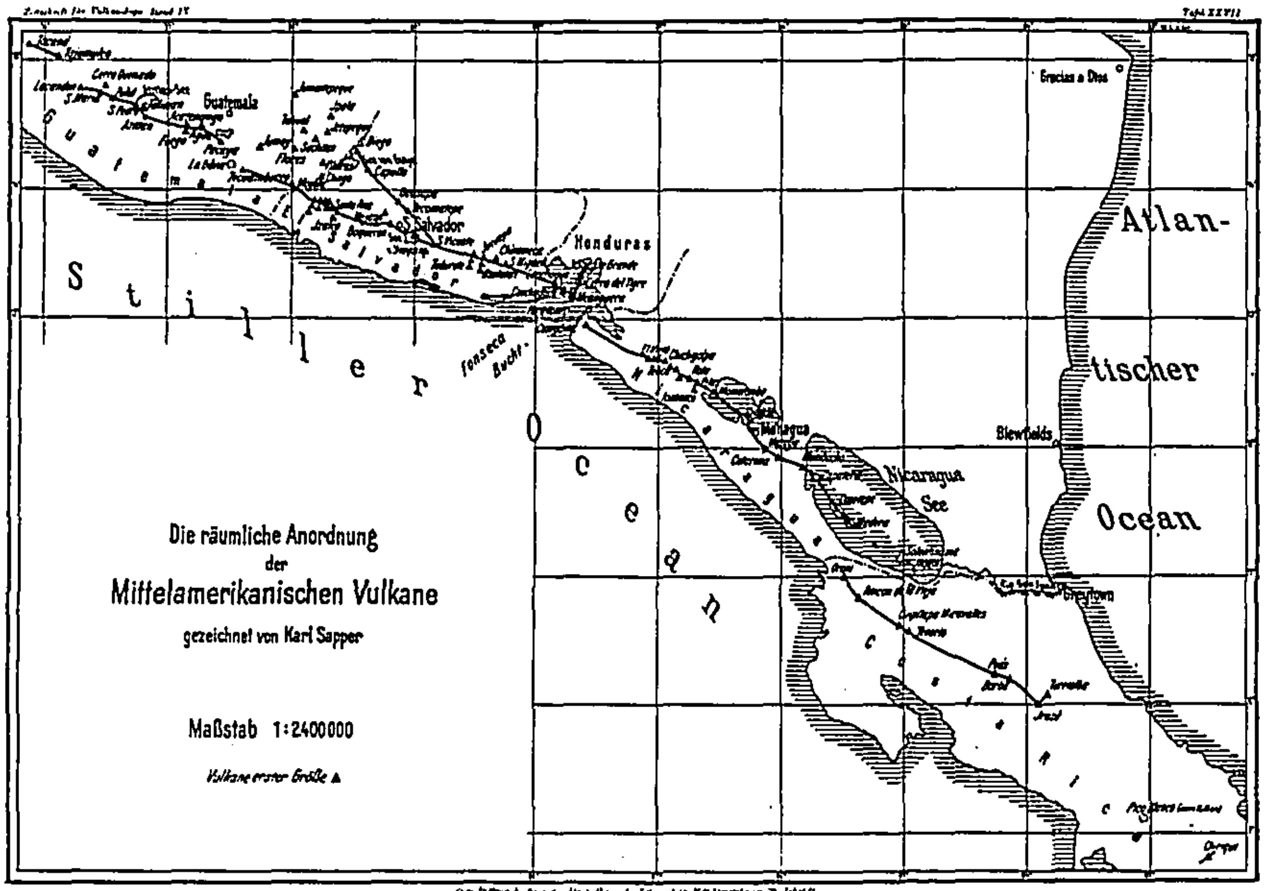
TILTING OF THE GROUND FOR SEPTEMBER

The following figures show the net amount of tilt by weeks at the Observatory on the northeast rim of Kilauea Crater, and its direction, computed from the daily seismograms by platting a curve smoothed by overlapping seven-day averages. This is the departure of the plumbline in seconds of arc, in the direction given.

August 31-September 6	1.1 seconds	SW
September 7-13	1.7 seconds	NE
September 14-20	0.5 second	E
September 21-27	1.4 seconds	ENE

E.G.W.

Looking south from Tres Marias at the main peak of Acatenango in 1925. After Sapper.



Map of Central America, showing the belts of active volcanoes, from Costa Rica on the east through Nicaragua, Hondura, Salvador, and Guatemala. After Sapper.

KILAUEA REPORT No. 1029

WEEK ENDING OCTOBER 11, 1931

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge

At Halemaumau blue fume in the bottom was thin throughout the week. Steam activity also decreased very noticeably. The east rim cracks were measured on October 5 but no changes were found. On the 6th the seismograph at the pit indicated very quiet conditions. On the 8th a few quick-period tremors were recorded. On the 9th a distant earthquake was recorded at 2 p. m.

The seismograps at the Observatory recorded during the week 28 tremors, of which only one gave indication of distance—10 miles. Of a total of eight very feeble local seisms, one showed distance 4 miles, one 6 miles, three 9 miles, one 28 miles, and two 42 miles from the Observatory. One in the third group was felt at Uwekahuna at 3:41 p. m. October 6. There were no stronger shocks.

One teleseism, distance 3500 miles and lasting 1 hour 45 minutes on the record, was registered at about 2 p. m. October 9, the origin not even approximately known as yet. The teleseism of October 3 reported last week was tentatively located by the Honolulu station of the U. S. Coast and Geodetic Survey at 14° S lat., 160° E long., in the Coral Sea near Rennel Island at SE end of the Solomons.

Average tilting of the ground for the week was slight NNW. Microseismic motion was moderately strong.

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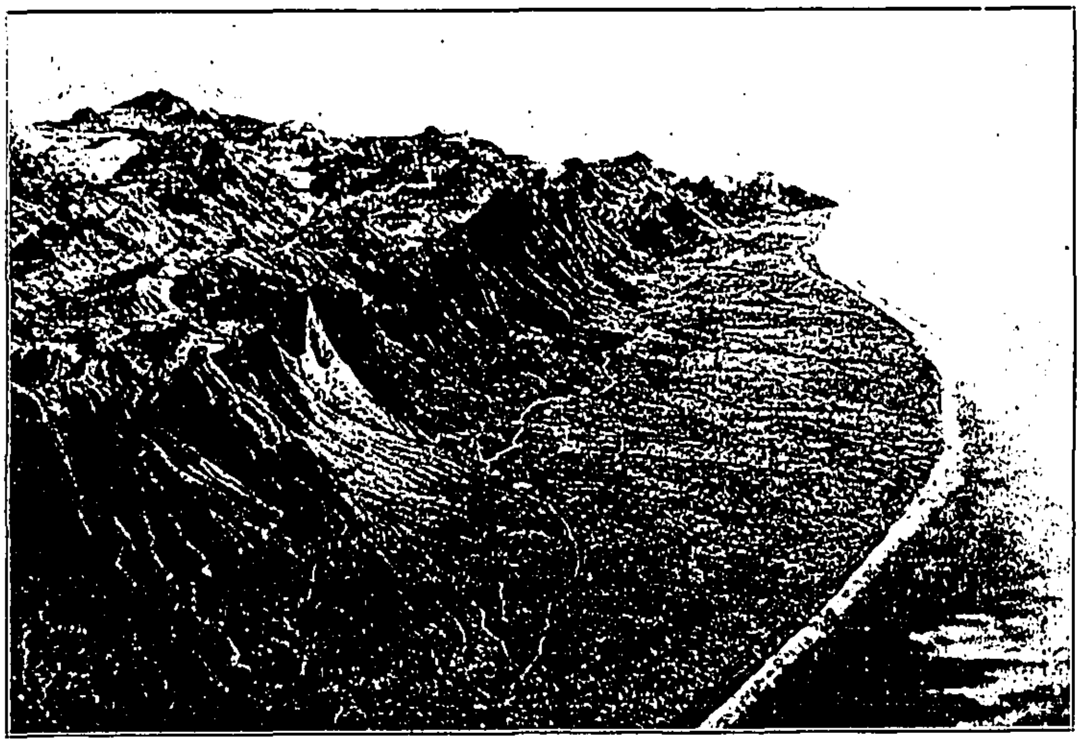
No. 356—Weekly | Hawaiian Volcano Observatory, National Park, Hawaii | October 22, 1931



Photograph of a large model of Guatemala, looking southeast along the Pacific coastal plain, which has been uplifted at the base of the line of active volcanoes. Great vertical exaggeration. Santa Maria Volcano with hole in its side from the eruption of 1902. At the left the mountainous plateau of Guatemala, a region of fertility, and one of the coffee belts of the world. Adjacent to this volcanic rift have occurred some of the biggest earthquakes of history.

ERUPTION OF SANTA MARIA NOVEMBER 1929

Santa Maria Volcano in western Guatemala has become a key vent of great importance in connection with the seismic and volcanic activity surrounding the Caribbean Sea. (See Volcano Letters 87 and 262). Heilprin states (The Eruption of Pelée, Lippincott, Philadelphia, 1908) that there was no recorded eruption prior to 1902, and in this apparently Sapper concurs. The 1902 outburst in October split open a great hole in the southwest flank of the mountain (see cut Page One) at about 6,500 feet elevation, the chasm being about the same size as the present Halemaumau, 3,300 feet across, and 800 feet below the rim stood a geyser-like lake of boiling water spouting and making sulphurous fumes until after 1906. Then the volcano became quiet until 1922 when at the end of June new explosive eruptions began and a dome of hornblende-hypersthene andesite lava rose through a fissure in the bottom of the crater and in August of that year had grown until it stood 300 feet above the downhill rim of the cauldron. Thereafter the dome kept growing until in 1925 there was a big castellated heap 1,600 feet high and 4,000 feet across. The growth was replaced by solfataric activity which continued until May 14, 1928, along with the slow development of a second swollen dome on the north and northwest sides of the former dome (Termer, Zeitschr. Vulk. XII Heft 2/3, p.231). About the site of this new plug eruption a short-lived explosive eruption occurred May 14, 1928, throwing ash over the country to the depth of a few millimeters.

Heilprin (l.c. page 71) believed the events of 1902 indicated that in a region like the Caribbean, volcanic and seismic phenomena over distances as great as 2,000 miles are related, that the deep-seated strain of magma might make great earthquakes such as geologists call "tectonic," that the slipping, upheaval and torsion of surface formations in the rock of the earth's crust might be resultants of the jarrings already given to the deeper earth-crust by magma, that the seismo-volcanic condition of the crust is proved to be connected with electro-magnetic phenomena as shown by the magnetic storms all over the earth accompanying the Pelée eruption, and that there is marked synchronism or close following of major disturbances, as has been proved at different periods for eruptions and great earthquakes far removed from each other. The striking illustration of these facts was a destructive earthquake at Quetzaltenango in Guatemala April 17, 1902, synchronous with the first outbreak of Pelée in Martinique at the other end of the Caribbean Sea 2,100 miles away. Two hundred miles south of Quetzaltenango, Izalco Volcano broke out in Salvador and was in full eruption May 10, two days after Pelée had destroyed St. Pierre. Sourière in St. Vincent had broken out more than 100 miles south of Pelée the day before the St. Pierre catastrophe. Both Soufrière and Pelée continued their eruptions in concert into the autumn of 1902, and during this time Masaya Volcano in Nicaragua started eruptions which continued for two years. And finally Santa Maria in Guatemala developed its unprecedented eruption October 24-November 15 and devastated the coffee lands. If there were any doubt about the sub-crustal sympathy of the magma in these leaps from the volcanic fissure of Guatemala to the great rift of the Caribbee Islands and back, it should be dispelled by the fact that in September 1929 Pelée broke into explosive eruption again just after Santa Maria in 1928 had renewed explosive activity which came to a crisis in November of 1929. It is of interest in comparing Soufrière of St. Vincent with Santa Maria, to note that both these volcanoes in 1902 were left with boiling crater lakes. Now Santa Maria has exterminated this lake and replaced it with a lava dome: will Soufrière eventually do the same?

The photograph on Page Three has much in common with the scenes pictured on the northeast slope of Lassen Peak after its eruption of 1915, and this photograph represents part of a stream bed in the forest below the crater of Santa Maria as it appeared after the new catastrophe of 1929 which destroyed human life and wrecked plantations with an incandescent down-rushing cloud of ash, and torrential floods which transported gigantic bowlders. In both Lassen and Santa Maria volcanoes, as well as at Pelée in 1902, the source of the down-blast was a crater partially filled with a stiff plug of lava.

In the evening of November 2, 1929, in the vicinity of Santa Maria, there had been no forewarning of the coming danger. It was sultry and there was a dry lightning storm, but there had been such electrical phenomena in that vicinity of the lava dome frequently. At Las Animas, close to the volcano on the downhill side, about 9:30 p. m. November 2, persons sleeping on the plantation were suddenly awakened and saw a glowing rain and a flood rushing from the heights of the volcano. Alarming underground noises followed each other in quick succession, then glowing sand and ash fell on the roofs. Those who were so fortunate started to flee finding it difficult to breath the hot air. The bell was rung to awaken the laborers and all hastened toward the Rio Concepcion, where the river bed was found full of boiling mud erroneously called "lava" by the peasants. This was beginning to overflow the adjacent land. They made for another branch of the stream and found it equally in flood so that they were penned on a peninsula between the two torrents and the volcano. They spent the night in the plantation house; when there was a pause in the rumblings shrieks of the sufferers and calls for help could be heard. When they attempted to go to the rescue they found that the cries came from natives who were already engulfed in boiling mud. Nothing could be done. Early the following morning when daylight enabled them to see the devastated land, they improvised a bridge of logs across the stream and about 25 persons were rescued. The wounded were taken to a house on the main road where a relief commission soon began the work of rescue. Bodies were seen protruding from the hardened mud and some persons were trapped in the wreckage of houses. The residence house of one plantation was found totally destroyed and in many places it was necessary to lay down boards in order to cross the excessively hot mud and ash. The manager of this second plantation reported hearing a terrible thundering, and on looking up toward the crater he saw red-hot masses weighing tons being hurled into the air and breaking to pieces when they struck the earth so that glowing fragments and sparks bounced away. Then came subterranean rumblings and fiery streams seemed to pour down from the crater in winding avalanches of incandescence. The illumination was like daytime. Ash and sand fell in a dense rain, the temperature rose, and flight became imperative. Here also the bell was rung for the laborers and at the bank of the Rio Tambor, which had a channel 100 meters deep and 80 meters wide, the river was found in flood and so incandescent with the dry accumulations on its upper surface that they lighted the bank. This is a very remarkable statement, but quite believable, and accounts for phenomena observed in many of the explosive eruptions of Java and elsewhere, when stream floods have been confused with lava flows. It is easy to believe that light pumiceous ash will make a dry bed on top of a mud stream, capable of holding incandescent fragments so as to remain luminous while it flows. Throughout this eruption of Santa Maria the natives thought the contents of the river beds were lavas.

The River Tambor had almost reached the top of the bridge, the under irons were bent, but as yet they had not given way. A smaller stream, the San Jeronimo, was visited and was found to be flowing backwards owing to the fact that this stream pours into the larger river Concepcion, which by reason of its greater height and viscosity due to ash sent a backwater flood up the smaller stream. This was an added danger to the plantation as soon as the backflood poured into the lands and about the buildings.

There was no time to be lost. The laborers were panic stricken and demoralized. Twenty-six of them escaped over the bridge. The man describing the event said his chauffeur wished to go back to the garage to get the automobile and he had to use force to prevent his doing so and snatch the key out of his hand. While he was trying to persuade him to come across the bridge there was a sudden rush of the fiery mud across the slope at the bridge head; this liquid, by its great weight and stickiness, grasped the man's legs and dragged him downstream into the hot torrent. There was only a single heartrending cry and he was gone. Half of the laborers had delayed and were still in the plantation, and now streams of overflow could be seen making their way through the hamlet. The man remaining on the bridge called to them as loudly as possible, but his voice was drowned in the thunder of the cataclysm. He saw his residence collapse, and his automobile torn out and tossed like a toy on the surface of the stiff flood. More thon 25 of those who had remained in the grounds perished. The narrator saw there was nothing for him to do but to save himself, and he ran across the bridge just in time to see it carried away, leaving the plantation cut off. Then the ruins of his house disappeared.

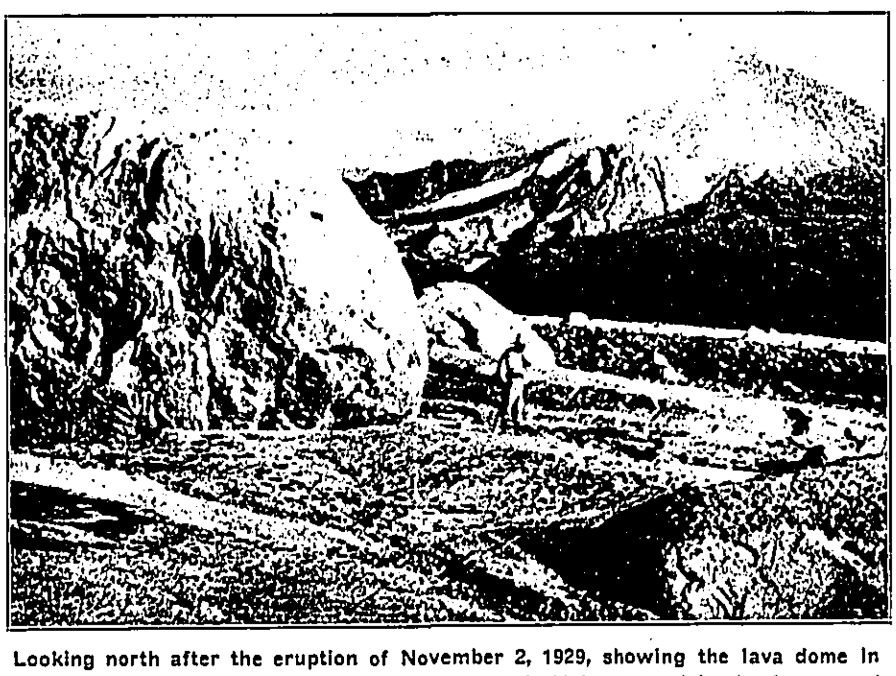
Dr. Sapper concludes that this was a true fiery down-blast of the Pelée type such as destroyed St. Pierre. If this eruption is compared with the first outbreak of Santa Maria October 24, 1902, there are marked differences. The 1902 explosion was enormously bigger in output of material, and while the loss of life was not greatly different, the destruction of property was much less in 1929. The area covered in 1929 was comparatively small, whereas hundreds of square kilometers were buried in 1902. The thickness of ash in 1929 was from 2 to 10 centimeters as against 10 to 20 meters in many places in 1902. Whereas in the earlier eruption earthquakes were numerous and big, in 1929 they were few and unimportant. The noise in 1902 was heard several hundred kilometers away, whereas in this recent eruption it was confined to the immediate neighborhood.

On the other hand, the devastation in the immediate path of the fiery blast was terrific in 1929, though probably not so great as that which destroyed St. Pierre in Martinique. There was the same deep booming noise, the electrical phenomena in the sky, the hurling out of glowing masses, the carrying of big bowlders on the flood paste of the streams. A notable difference lay in the fact that the Martinique eruption was by daylight at 8 a m., whereas the 1929 eruption at Santa Maria was at night so that light phenomena were conspicuous. The lava dome of Santa Maria glowed with reddish incandescence and glowing masses rolled into the gulches. The force of the blast was much greater at Mount Pelée accompanied with hurricane violence so as to carry big stones like cannon balls. In the Guatemala outbreak the glowing sand and ash masses flowed downwards simply by gravity. There were heat phenomena in both blasts, but the Pelée blast did damage to much greater heights, for there were hills in the path of the hot blast of Santa Maria where vegetation and houses stood uninjured above the level of the destructive cloud. There were at least two distinct blasts in the 1929 eruption. The contents of the ash cloud consisted of hot stones, sand, and dust which retained their heat a long while, and the same was true in 1902 at Soufrière and Pelée. The killing of people in Martinique was due to hot steam mixed with ash, and no case was identified of true asphyxiation. In Guatemala there were more cases apparently due to unbreathable gas, a fact confirmed by many accounts indicating that the people died without any outcry. The breathing of intensely hot air might produce this effect, particularly if it were charged with dust, and the reviewer would point out that incandescent substances driven through vegetation would very quickly generate enough carbon monoxide for instantaneous poisoning. There were cases in both eruptions where the bodies were burned beneath relatively uninjured clothing, owing to death by scalding rather than incineration.

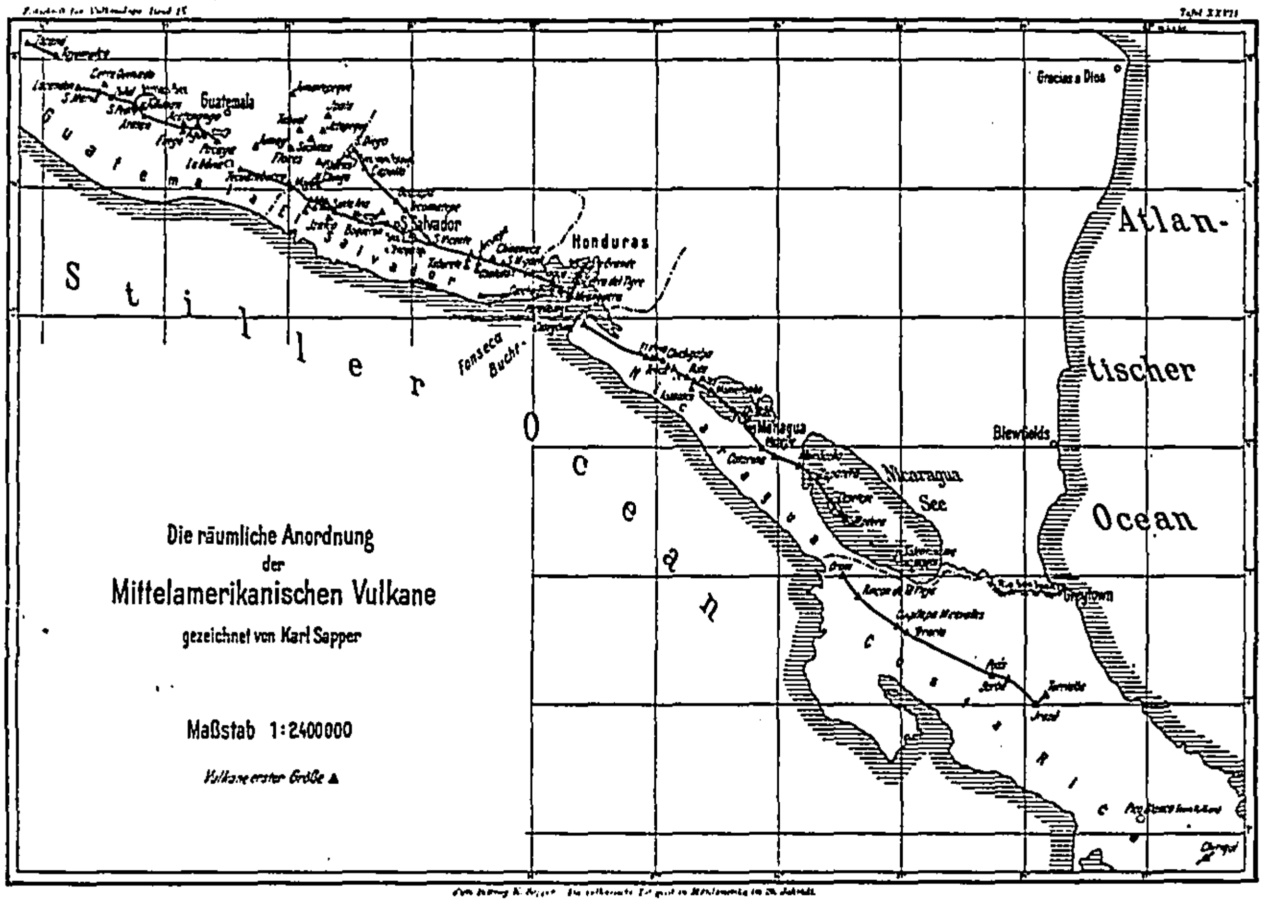
At the place nearest to the Santa Maria crater roaring and whistling of the blast were heard, but in distinction from the Martinique happening an inrushing reverse wind was conspicuous, blowing toward the crater, trees showed scour on the side way from the crater, and in some cases were scorched on the side remote from the volcano. This recalls the indraft at Vesuvius in 1906, when stones broke windows on the sides remote from the volcano. A peculiarity of the Guatemala happening was the wetness of the climate and the occurrence of the eruption at the end of the rainy season. Thus it came about that glowing stones and sand clogged the streams and caused their waters to boil, greatly increasing the volume of the liquid, and in places the valleys were filled with solids so that the flood swept through the intervening lands. It happened that the downblast coincided with the drainage system. There is no reason to suppose that the gigantic bowlders (photograph Page Three) were thrown to the position where they now lie any more than in the case of the flooding of Hat Creek in the Lassen cataclysm of 1915. These big stones were carried with the mud jumble.

Very little pumice fell at the beginning of the eruption. There was much reddish ash. An analysis showed the presence of sodium chloride with three per cent of lime sulphate and traces of silica. Petrographic investigation of a rock sample from the lava dome gulch at elevation 1,800 meters above sea level determined the magma to be a hypersthene-hornblende andesite containing 55 per cent of plagioclase, hypersthene in well bounded crystals, hornblende deeply corroded and showing dense borders of magnetite granules. Three ash somples of various coarseness were examined, with splinter outlines of irregular shape generally showing colorless glass, but sometimes none, and otherwise containing fragments of feldspar, red brown hornblende, and rare rhombric pyroxene. Otherwise there was some augite and a moderate amount of magnetite.

The place of origin of the 1929 blast was the lava dome of 1922. This dome had begun to glow some days before the outbreak. A rift was formed in the south side of the dome where earlier small glowing discharges had taken place. The place was thus prepared for a glowing avalanche along a gash into the valley below. Somewhere along the middle of the dome an elongate crateriform depression was seen after the eruption, its alignment almost due south. (See cut Page Three.) Here after the main eruption a steep-sided bulbous lava mass welled up, the



Looking north after the eruption of November 2, 1929, showing the lava dome in the midst of the crater in the side of Santa Maria Volcano, and in the foreground the flood waste occasioned by the eruption. The ash torrents mingled with flood waters carried the huge bowlders shown. The downblast originated in a rift in the lava dome. There is new lava in the rift. Photo from Sapper and Termer.



Volcanic map of Central America showing the position of Santa Maria Volcano at the west end of Guatemala. From Sapper, Zeitschr. Vulk. IX.

avalanches from the slopes of which produced almost no dust, in contrast to the outer avalanches of the older dome which stirred up great quantities of the dust from the recent eruption. (Zeitschr. Vulk. XIII Heft 2, August 1930. K. Sapper and F. Termer, Outbreak of Santa Maria 2-4 November, 1929. In German.) T.A.J.

KILAUEA REPORT No. 1030

WEEK ENDING OCTOBER 18, 1931

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge

There is nothing new to report at Halemaumau. During observations throughout the week very little fume and steam were noted, except a slight increase October 12 after heavy rain. On this day at 4 p m. an avalanche north was seen making very little dust because of the wet walls. A few rocks were heard falling at 9:15 a. m. October 16.

The instruments at the Observatory recorded 40 tremors and two very feeble local seisms. There were only two tremors of any length, one lasting five minutes and the other a minute and a half. The latter, judging by the period of its wave, may have been part of an earthquake with a focus near the Island of Hawaii. A seism at 12:32 p. m. October 14 showed distance to origin 6 miles; one at about 5 p. m. October 13 was obscured by the hour mark, but appeared to be less than 30 miles from the Observatory. Spasmodic tremor occurred for more than nine hours October 16 and about six hours October 17. There were no felt shocks.

Tilt was moderate NNE. Microseismic motion was moderate.

THE VOLCANO LETTER

The Volcano Letter combines the earlier weekly of that name, with the former monthly Bulletin of the Hawaiian Volcano Observatory. It is published weekly, on Thursdays, by the Hawaiian Volcano Research Association, on behalf of the section of volcanology, U. S. Geological Survey. It promotes experimental recording of earth processes.

Readers are requested to send articles, photographs, publications and clippings about volcano and earthquake events, instruments and investigations, especially around the Pacific.

Subcription for non-members two dollars per year of 52 numbers. Address the Observatory.

HAWAIIAN VOLCANO OBSERVATORY
Founded 1911

This laboratory at Kilauea Volcano belongs to the Hawaiian Volcano Research Association and is leased and operated by the United States Geological Survey.

It maintains seismographs at three places near Kilauea Volcano, also at Hilo, and at Kealakekua in Kona District. It keeps a journal of Hawaiian volcanic activity and publishes occasional Bulletins.

Membership in the Hawaiian Volcano Research Association is limited to patrons of Pacific science who desire personally to aid in supporting the work.

The work of volcano research so supported is in collaboration with the work of the United States Geological Survey, but supplements it with buildings, research fellows, instrumental plants, explorations and special investigations for which there is no governmental provision. The Geological Survey maintains volcano stations in Alaska, California and Hawaii.

Persons desiring application blanks for membership ($5.00 or more) should address the Secretary, Hawaiian Volcano Research Association, 320 James Campbell Building, Honolulu, T. H.

The Volcano Letter

Two dollars per year | Ten cents per copy

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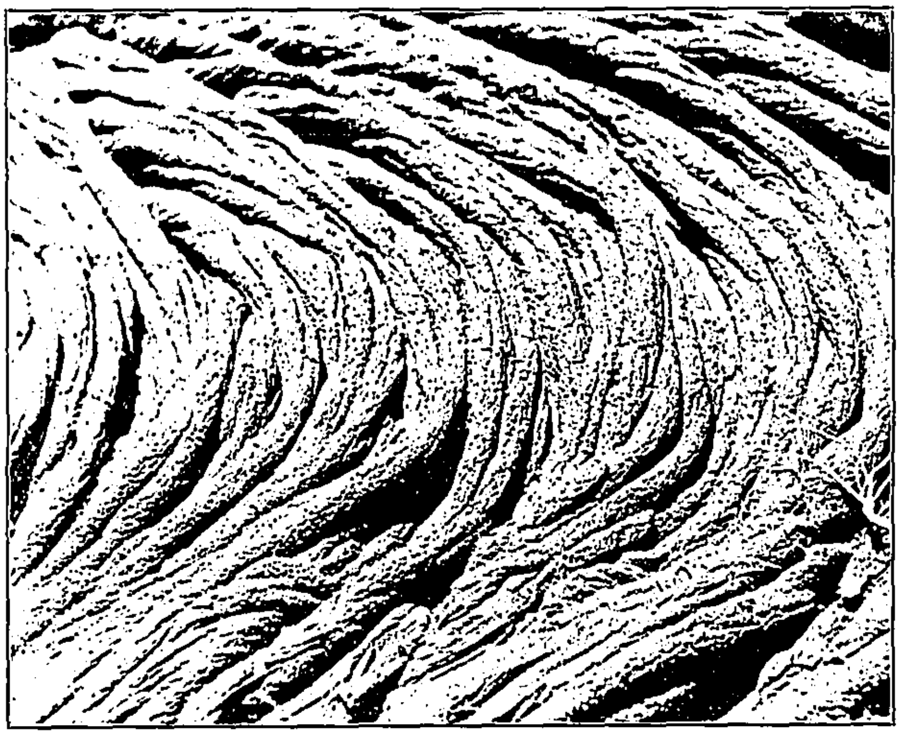


Ropy festoons of pahoehoe basaltic lava, on the Mauna Iki trail southwest of Kilauea Crater. Shows the wrinkling mechanism by which lava flows in the direction of the arching, with twisting of the wrinkles where the middle belt flows the faster. Photo 1931 by Lewis M. Werth.

THE VISCOSITY OF LAVA

By Jean Kinsley

Little experimenting has been done dealing with the viscosity of lava. Viscosity has been defined as the resistance to flow. Where lava is the chief product of a volcano, the shape of the dome may depend on the viscosity of the lava, as well as on its copiousness in different stages of the upbuilding of the dome. The rate of flowing will depend on viscosity, and on change of viscosity as the lava cools. Highly basic lava is more liquid and less viscous that the less fusible acid lava, rich in silica, such as rhyolite or trachyte. Some basic lavas like basalt are fluid enough to run down a one per cent slope, and form flat domes with slopes of from four to ten degrees. Mauna Loa is an example of such a dome, immense in size, yet flat in profile. The andesitic lavas of Japan and Central America are much more viscous, forming cones with slopes of from 25 to 35 degrees, though this production of slope is often complicated with fragmental materials. What effect viscosity actually has, has been little experimented with.

Dr. George F. Becker (Some inquiries into rock differentiation, American Journal of Science, January 1897, page 29) discusses viscosity in connection with theories of diffusivity. Becker estimates the rate of flow of the Kilauea lava stream of 1840 at 22 feet a minute down a two per cent slope. The flow was fed from fissures for a considerable part of its length, thus maintaining a fairly constant temperature. Water according to Becker would flow 24 times as fast. Since lava is 2.5 times as dense as water, it would then be 24 times 2.5, or 60 times as viscous as water.

Becker refutes the possible assertion that lava underground is more fluid before it erupts. Viscosity increases with pressure, and underground magma is under great pressure and close to the melting point. It can not be superheated, according to Becker, or it would melt the surrounding rock and be reduced in temperature. Therefore he concludes that, owing to the pressure, viscosity must be greater before eruption than afterwards. To this statement may be added the heating effects occasioned by gases released from solution, which would diminish viscosity when eruption begins.

Dr. H. S. Palmer (The viscosity of lava, Bulletin Hawaiian Volcano Observatory, January 1927, Vol. XV, No. 1) assumes that Becker based his measurements upon progress of the first front of the flow of 1840, which would be slower than the streaming after a channel has been established. Hence Becker's estimate of the viscosity is too high. That is, he makes the lava too stiff.

No general law connecting temperature with viscosity has been found, though there are several interpolation formulae permitting computation of the variation of viscosity with temperature for any given liquid. In case of water, the decrease of viscosity per degree of rising temperature is greater at the lower temperatures. Becker says that fluid lava need not necessarily be superheated above its melting point, and this agrees with observed facts of measurement in the Kilauea lava lakes which indicates that they are undercooled. Viscosity varies with the molecular weight, and the heavier basic lavas, other things being equal with reference to relation of temperature to fusing point, should be more viscous by reason of their density. But chemical composition and crystallinity play important parts, and the quantity of gas bubbles may act as ball bearings in increasing mobility.

Dr. T. A. Jaggar estimated the Alika flow of 1919 on Mauna Loa in its established channel near the source to be moving 15 miles an hour. Four miles west of the source it was moving three miles an hour. The source lava was pahoehoe, the other aa. The lava feeding the fields moved through the stream forks in the channel about 200 feet an hour, but the field itself moved about two feet an hour. Dr. Palmer thinks that Dr. Jaggar observed a surface thread of lava in the middle of the channel, which would have a velocity 5 to 15 per cent greater than the mean velocity of the inner lava river for its full width. (See photograph of lava festoons Page One.)

The rate of flow of the Alika stream Palmer assumes to have been steady with a force 1.4 times greater driving the lava stream to overcome its viscosity, than would drive a comparable water stream, since the specific gravity of the gas-charged live lava is 1.4. He writes: "If streams of two fluids were alike in all respects except specific gravity, the driving forces would be in the same ratio as the specific gravity. And if the velocities were the same, the viscosities would be proportional to the specific gravities; that is, to the driving forces. Since the velocity of a stream is inversely proportional to the viscosity, we may write the equation

$$\text{Viscosity} = \text{a constant} \times \frac{\text{specific gravity}}{\text{velocity}}\text{"}$$

From this formula he concludes that the viscosity of the Alika flow was about 15 times greater than that of water. He conceded the possibility of error in comparing the Alika flow with a similar stream of water, from uncontrolled conditions of the channel and grade.

Jaggar in 1921 (for Alika flow details see Bulletin Hawaiian Volcano Observatory, October 1919, pp. 127, 133-4, 156; also February 1921, pp. 28-9) made an experiment at Halemaumau comparing the viscosity of live lava in a rift cone, and in the lava lake. He attempted to avoid stream errors by measuring the rate of entry of live lava through an aperture in a vessel immersed in it. The apparatus was a metal cylinder 27 inches long of 3 inches inside diameter, on which was a cap with an opening 1.5 inches in diameter. This on the end of a long pipe was immersed about a meter in the molten liquid in the cone and left there for 4 minutes. On withdrawal, the cylinder was found to be about one-third full of pahoehoe lava.

The same experiment was tried in the bubbling lake, with the result that the cylinder was incompletely filled, but in larger volume than before. The current in the molten slag carried the cylinder irrestibly sidewise so as to prevent it from remaining vertical. Large gas vesicles were found in the glassy lava inside the vessel, showing that gas vesiculation had played a part in permitting the lava to enter. A defect in these experiments was the cooling effect of the iron on thrusting it into the lava without preheating to the lava temperature.

In the first experiment, 1180 cubic centimeters of lava weighing 1656 grams had entered the cylinder, filling it 33 per cent. In the second lake experiment, 2500 cubic centimeters entered with a weight of 3500 grams, filling it 83 per cent. The viscosity was thus greater in the spatter cone lava. The density of ordinary Hawaiian lava is from 2.7 to 3.0, but the vesicular lava of the experiment had specific gravity of only 1.4, owing to the large proportion of gas. The radius of the orifice was 2.9 centimeters, and the time of flow 240 seconds. The temperature of the lava in the first experiment was 1100 degrees C., in the second experiment 1200 degrees C., as might be expected from the lower viscosity of the highly effervescent lake lava.

TWO SURFACE FORMATIONS NEAR MAUNA IKI

The photograph on Page One is relevant to what was said above about viscosity of basaltic lava. The ordinary small pahoehoe lava flow has the form of a leaf, with the feeding stream considered as the stem. This stem or feeding thread of molten slag skins over on its upper surface and quickly divides itself into at least three belts of motion, consisting of two drawn-out *curtains* at the sides, and a belt of festoons in the middle arching downstream. These festoons are at first merely wrinkles, then they cluster together and pile up into folds, then the different speed of flowing of the faster central belt and the two lateral belts tends to twist the contact wrinkles into ropes. Finally the whole structure forms a crust and the incandescent stream inside flows under the bridge of festoons. This stream later escapes at the lower skirts of the flow and leaves the arch of festoons a hollow shell which is apt to cave in and reveal a cavern. The presence of arched festoons is a sure sign of the original direction of flow with the crest of the arches pointing downstream. It often happens that the hardened shells exhibiting such festoons become swollen up in the later history of a flow puddle so that the surface slopes backward in the opposite direction from the slope that made the festoons.

The photograph on Page Three exhibits the detail of a footprint made by a barefooted Hawaiian in the ash mud of 1790 east of Mauna Iki. This is one of the hundreds of footprints which mark the old trail of that time, the material being a pisolitic ash with some small angular pebbles. The pisolites or mud raindrops of the period are the small, round, whitish objects seen at the left of the picture. The footprint shows the five toes and the spread-out effect as the foot squashed down in the mud of that period, which has since hardened like cement so as to preserve the footprints from erosion throughout nearly a century and a half.

T.A.J.

NOTES FROM THE ALEUTIAN ISLANDS

The seismograph observer, Mrs. Wendhab, reports from Dutch Harbor that the trader Mr. Schroder, who owns the store at Chichagof Harbor in Attu, came back from one of his voyages at the end of August and reported that on May 30, 1931, about 12 midnight (following), a very severe earthquake was felt at Attu. He had himself experienced the California earthquake of 1906 and he thought that this one was very nearly as severe. Everything on the shelves was dislodged, dishes were broken, and there was general havoc. Aftershocks continued every few days accompanied by a distinct roaring noise which preceded the shock and grew in volume as though something was coming closer with great rapidity. Then would come the shake, the roaring accompanying it, followed by a passing on of the movement and a dwindling of both tremor and sound.

Our seismograph records at Kilauea did not show any registration of a large distant earthquake at that time.

Mr. R. H. Finch reports that Aniakchak Volcano on the Alaskan Peninsula was exploding in May 1931 and scattered ashes over a hundred miles from the center. The material that fell at a great distance was very fine and looked like flour under a pocket lens. Some account of this Aniakchak eruption has recently been reported by the explorer Father Hubbard. Katmai Volcano was observed to be smoking early in July. Pavlof was smoking nearly all summer and according to the Reverend D. Hotovitsky of Belkofsky this volcano was in active eruption about May 20, 1931, making a noticeable ashfall, and at times glow was discernible at the crater. Two other volcanoes on the Peninsula were reported fuming.

Gareloi Volcano, a peak 5,334 feet high far to the west in the Aleutian Islands, was very active during the spring and summer of 1930. The appearance of half of the island was said to be changed by lava flows from fissures, and a hut was destroyed belonging to fox farmers. R.H.F.

KILAUEA REPORT No. 1031

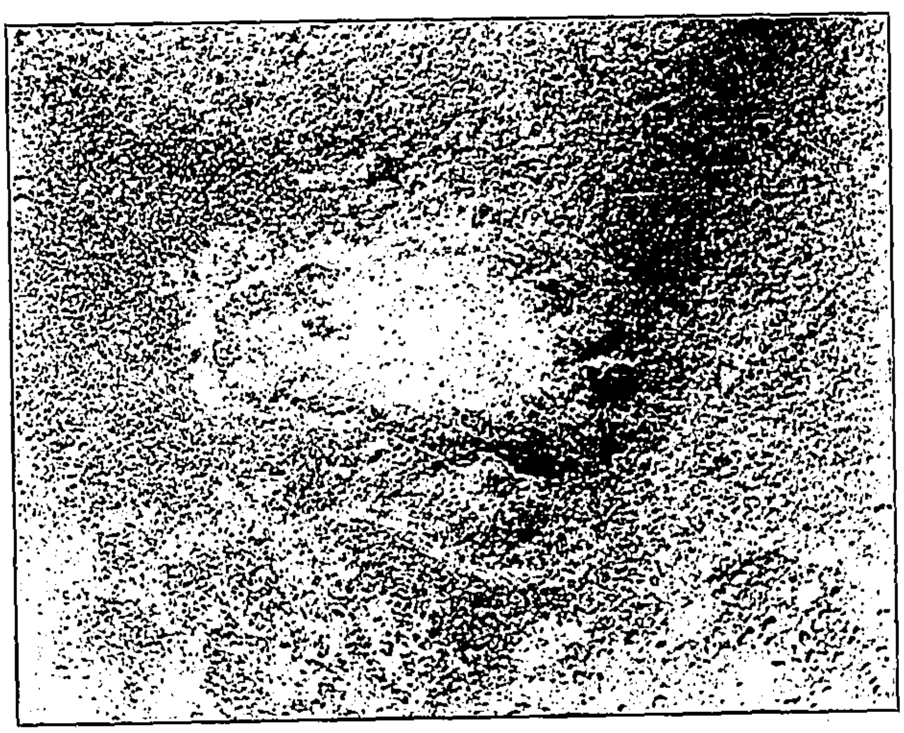
WEEK ENDING OCTOBER 25, 1931

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge

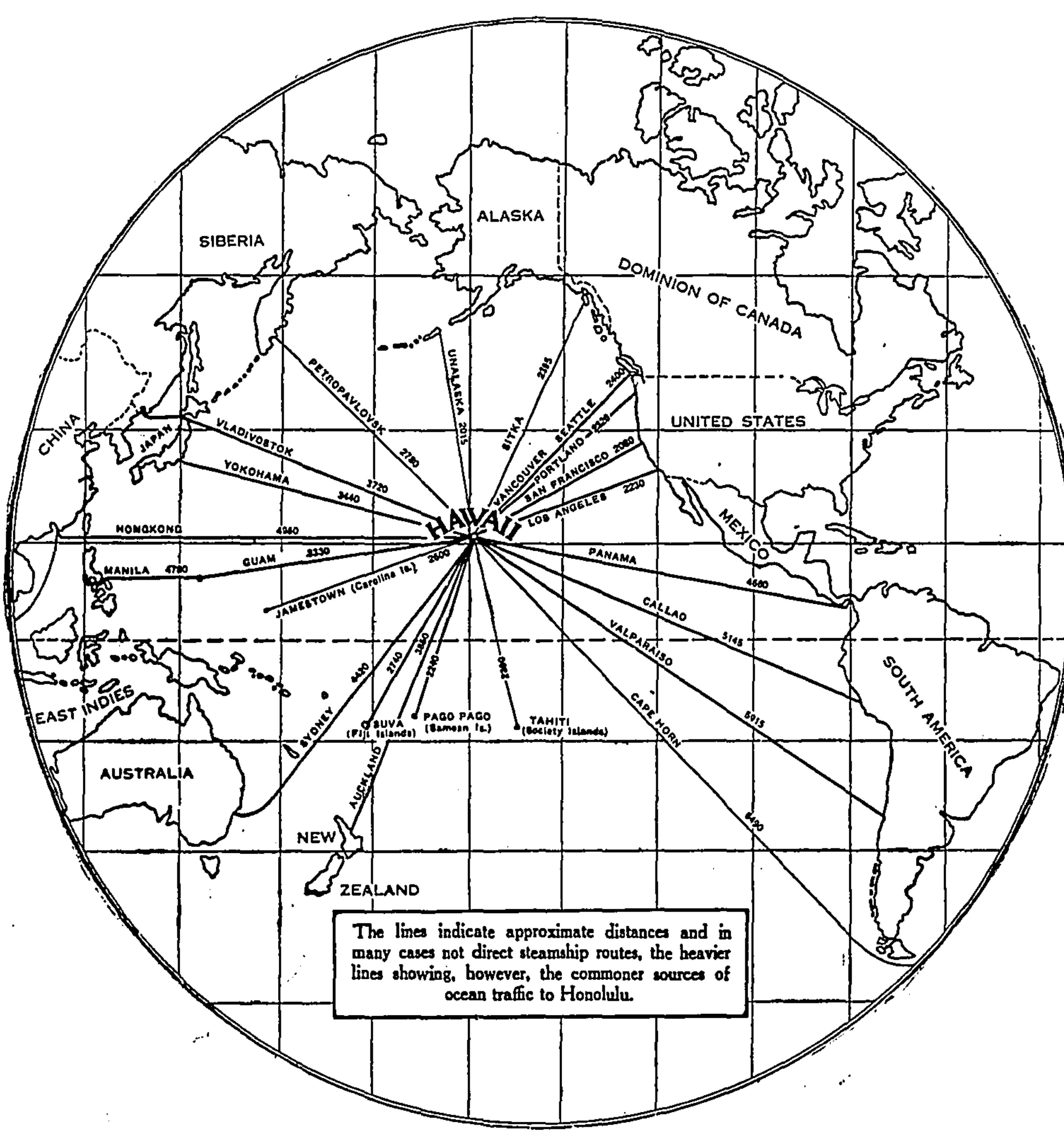
The fume area on the Halemaumau bottom appeared inactive on October 19, and only thin fume and steam were noticeable on the 20th. After light rain on the 21st there was some increase of fume. On the 22d both fume and steam were entirely absent. The seismograph at Halemaumau showed quiet conditions and practically no tilting. There are two new large bowlders on the pit floor between the south and southeast taluses. On October 24 at 8:30 a. m. there was a large avalanche north causing much dust. Crack measurements on October 20 showed no changes.

The seismographs at the Observatory registered 11 tremors, three of which were doubtful, and one very feeble shock, with good phases, from a distance of about 37 miles. In addition during the first two days of the week there were 46 spasmodic tremors, possibly artificial due to road machinery. There has been so much vibration from this cause as to obscure the records during daylight hours. The heavy machinery working in the neighborhood of 100 yards causes periods of one-tenth second and a half millimeter amplitude.

The average of tilt was slight N, and of microseismic motion moderate.



Footprint in ash east of Mauna Iki remnant from the native trails of the eighteenth century. Shows pisolites on the left and small stones on the right. The natives walked in volcanic mud of the time, which has since hardened. Photo 1931 by Lewis M. Werth.



Map of the Pacific Ocean. Attu Island is the westernmost of the islands extending towards Kamchatka from Unalaska, and Aniakchak in on the outer part of the Alaskan Peninsula east of Unalaska. Pavlof is still farther west on the Peninsula, and Gareloi is an island midway between Unalaska and Attu.

THE VOLCANO LETTER

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October 9, 1931

The Director,
National Park Service,
Washington, D. C.

Dear Mr. Director:

The following is a report of activities and operations in Hawaii National Park for the month of September 1931.

000 General

Territorial schools opened on Wednesday, September 2, with a total of about 80,000 children out of a population of 387,000 persons in the Territory.

The Hawaii Tourist Bureau made its annual trip to all of the various islands during the latter part of August and early September and visited the island of Hawaii September 2, 3 and 4. Mr. George Armitage, executive secretary of the Bureau, was in charge, with Mr. Charles R. Frasier chairman. Each island had a representative. They arrived at the park the evening of September 3, and motion pictures and a special entertainment at the Volcano House were provided and plans for stimulating and handling tourist travel were discussed. The following morning the party was taken on a tour of inspection to see the improvements and facilities of the park, and visited the utility area where the new buildings were under construction, drove over the road being improved to the Thurston Lava Tube, Fern Jungle, and Halemaumau pit and returned via the Uwekahuna Museum and Observatory, where the park picture was run for their benefit. A visit was also made to the Kilauea Military Camp and an inspection made of their facilities for recreation for the officers and enlisted men of the United States Army and Navy.

The party left about 11 o'clock for Kalapana. That afternoon they met with the Board of Supervisors and in the evening a joint dinner was given by the Hilo Chamber of Commerce and the Rotary Club with the members of the Tourist Bureau as special guests.

One of the interesting matters brought up and discussed was that of having a metal marker to show each point of interest along the roads on the various islands. The marker is an attractive, gaily colored metal figure of a Hawaiian warrior pointing toward the object and the name or other data inscribed beneath. These markers are to be used to mark points of scenic or historic interest and the Hawaii Tourist Bureau will stand the expense of furnishing the markers provided the Board of Supervisors will have them installed.

The visit of Governor Lawrence M. Judd, on September 11, 12, and 13 was also an outstanding event of the month. Governor Judd had as his guests Allan Hoover, the son of President Hoover, and William Thompson of the American Factors Limited, of Honolulu. The other members of the official party included Lyman H. Bigelow, Superintendent of Public Construction, and Territorial Highway Engineer, and Col. W. R. Dunham, Aide to the Governor.

The party arrived in Hilo Harbor Friday morning, September 9, on a Naval destroyer. A special reception Committee, headed by Samuel M. Spencer, Chairman of the Board of Supervisors of Hawaii, and including the park Superintendent, met Governor Judd and his party on the destroyer as it came into the harbor and escorted him to the Hilo hotel.

That day was spent in discussing various matters with the Board of Supervisors of Hawaii, the one of greatest interest, however, being the proposed additions to the seven per cent Federal aid system and the distribution of the $860,000 Federal aid funds authorized for Territorial road improvement.

A banquet was held that evening at the Hilo Yacht Club at which seventy prominent Hilo leaders were present, at which Governor Judd was the principal speaker. After the dinner, which was typically Hawaiian, a special Hawaiian program was given at the Haili community hall. Mr. Allan Hoover was the honored guest, sharing with the Governor many special courtesies. Mr. Hoover made a short address.

The following day the party drove around the island, spending the night at Kona Inn, where the Board of Supervisors joined the party for further discussion of road matters and on Sunday, September 13, the party arrived in the park about 12:30 P.M. Two park rangers on motorcycles met them at the Kau gate and escorted them to the Volcano House, where a special luncheon had been prepared and arranged by the Park Superintendent. Mr. Allan Hoover stayed over at the Atherton Richards ranch to spend a week, dropping out of the party on Saturday. The luncheon party consisted of Governor L. M. Judd, his aide Col. Walter R. Dunham, Territorial Highway Engineer L. H. Bigelow, Mr. William Thompson, Chairman Samuel L. Spencer of the Board of Supervisors, A. M. Cabrinha, Supervisor, and County Engineer E. L. Wung, also Supervisor August S. Costa.

The Park Service was represented by the superintendent, Park Naturalist John E. Doerr, Jr., and H. L. Handley, Resident Engineer for the Bureau of Public Roads. Manager James N. Gandy of the Volcano House was also present.

Following the luncheon an inspection trip was made over the park roads noting the improvement work under way, which interested the party very much. Visits were made to the Thurston Lava Tube, Fern Jungle, Halemaumau pit, and Uwekahuna Museum, where park Naturalist Doerr showed the picture and made a short address. A visit was then made to the park utility headquarters and improvements under way and contemplated were discussed. The whole party then visited the Superintendent's quarters for a social hour and tea was served.

That evening Governor Judd and his official party, with the Superintendent, were guests of Captain and Mrs. W. A. Heddin of the Kilauea Military Camp for a buffet supper.

The following morning a personal conference was had by the park Superintendent and the Governor on matters pertaining to or affecting the park. Road improvements were discussed, not only in regard to the park but the roads leading to the park, including the Kalapana road. In all of these matters Governor Judd was greatly interested and assured us of his cooperation in every possible way. Governor Judd was particularly interested in the construction of the Mauna Loa road, which he hoped would be started as soon as the Haleakala road was finished. Possible changes in park boundaries were discussed, the acquisition of privately owned land containing the Thurston Lava Tube, tourist travel, hotel and transportation accommodations, and many other things.

The party left the park about 9:30 A.M. to inspect the National Guard encampment at Hilo, where they were luncheon guests, and in the afternoon returned to Honolulu by Naval hydroplane.

020 General Weather Conditions

It rained every day during the month of September. While there was only a trace of rain on the first three days, every other day had sufficient rainfall to be recorded and the month closed with a total of 5.44 inches on the last day, making the total rainfall for the month 14.55 inches. This compares with a thirteen year normal average of 6.29 inches. The total rainfall to date is 49.34 compared with 81.12 inches last year. The maximum temperature recorded was 82° on September 3, and the minimum 54° on the 26 and 29. There were no clear days, 18 being partly cloudy and 12 cloudy. Full details are shown on Form 1009 Metl., attached.

100 <u>Administration</u>

110 Status of work

The description and appraisal of quarters in Hawaii National Park was forwarded by air mail on September 5. The annual travel report was sent in the night of September 30, by radio. The five-year development program for the park was sent in at the end of the month. A start was made on the revision of the information circular and park rules and regulations for 1932. The public utility rates for 1932 were secured and transmitted.

A park map showing roads and trails existing and proposed, was prepared and forwarded to Chief Engineer Kittredge. A special report on road and trail work that could be carried forward during the winter months thus helping to relieve the unemployment situation, was submitted to Chief Engineer Kittredge in San Francisco by radio for consideration by the Director.

The office work is growing constantly heavier as our activities expand in many directions and as our organization is increased and construction, maintenance and operation work increases.

The office work has been kept up to date by considerable overtime and all work is practically current at the present time.

I was much disturbed to learn from Governor Judd that the General Accounting Office was still planning to combine all disbursing work in the Territory of Hawaii under one employee to be stationed in Honolulu. This suggestion was presented to this office by General Accounting Office representatives in May but I objected so strenuously, pointing out the difficulties and objections to the plan, that I understood that it would not be considered further. A strong protest to our Washington office was sent in by radio September 15 and it was learned that they too had recommended against any change. It is to be hoped that no change in the present plan of having alocal disbursing agent will be made. There are no advantages to be gained in changing the plan and many disadvantages would result.

120 Park inspections by

121 The Superintendent

The superintendent made regular inspection of all park activities, giving particular attention to new construction work both by National Park Service force account and by contractors engaged on road improvement. In addition to more or less periodical trips to Hilo on Park business, several special trips were made during the month.

On September 1 the park Superintendent and his wife were guests of Captain S. Oba, of the Imperial Japanese Government training ship "Taisei Maru" in Hilo Harbor, at an entertainment which included jujitsu, kenjutsu and music. An opportunity was given to inspect the ship, which was a four masted bark with 13 officers, 42 members of her crew, and 83 cadets from the Tokio Nautical College.

On September 4 the Superintendent attended the Federal Business Association quarterly meeting in Hilo and was gratified to report large savings made to the Government in the cooperative purchasing of gasoline, oil and kerosene, which was initiated in this association by the National Park Service. This was the first meeting of the association under the new officers elected last July and consisted of the appointment of committees and the considering of correspondence and other miscellaneous matters from the area coordinator on fifteen different subjects. The park superintendent was appointed a member of the executive committee.

On September 7 the park superintendent visited the Herbert Shipman ranch at Keeau. This is a lovely island home distinguished for its beautiful setting and wonderful collection of trees, plants and flowers. The visit was made primarily for the purpose of securing fifty or a hundred coconut trees to be planted on the seashore along the southern coast of the park as a means of providing shade, food and water for members of the park staff or others who may visit that region and run out of water or food. A small coconut grove was started here a few years ago and is making fair growth. Mr. Shipman has a fine flock of the Hawaii wild geese, Nene, which he has domesticated and we hope, through him, at some future time to reintroduce this native goose to the park area where it was formerly very plentiful, but is now almost extinct. Park Naturalist Doerr was taken on this trip and a group of friends from the Kilauea Military Camp. Mr. Shipman has recently been appointed a member of the Board of County Park Commissioners.

On September 9 a visit was made to the Kapapala Ranch for the primary purpose of securing some water tank material and lumber that was no longer used by the ranch and which could be used to good advantage in park development. Mr. Sumner very kindly gave his consent. Mr. Sumner is a great friend of the park and is constantly helping out in various ways. Recently he donated a truck and driver for transporting two park horses from Naalehu to the park, a distance of 60 miles.

124 Other Interior Department Officers
His Excellency, Governor Lawrence M. Judd and official party visited the park on September 13, as has been described in the opening paragraph of this report.

125 Other Governmental officers
Principal Highway Engineer E. S. Wheeler visited the park on September 4 and made a trip around the island accompanied by Resident Engineer Handley.

Dr. Samuel B. Grubbs, Medical Director, U. S. Public Health Service, Honolulu, accompanied by C. H. Bowman, Division Supervisor of the Board of Health of the County of Hawaii, made an official visit on September 2.

Mr. Byron W. Mattison, Senior Highway Engineer of the U. S. Bureau of Public Roads, regional office in San Francisco, arrived on the Malolo on September 25 and was met at the dock by Engineer Handley and taken to the park. Mr. Mattison was sent over to make a special investigation and report of road conditions in the Territory, particularly with reference to the roads to be added to the 7 per cent system. His visit was a confidential one in view of the great controversy between the Government and the Territorial Highway Engineer and the Supervisors of the various counties. Mr. Mattison and Engineer Handley were taken to Kalapana by the park superintendent that afternoon as Mr. Mattison was anxious to see this road in view of the pressure being brought to bear to have it included in the Federal aid system.

The following morning Mr. Mattison was taken over the road from the Military Camp to the Uwekahuna Observatory, down to the Halemaumau pit and to the end of the Chain-of-Craters road, returning via the same route to the hotel, where Mr. E. S. Wheeler of the Honolulu office of the Bureau of Public Roads, who had arrived on the morning boat, was met and the whole party then went over the road from the park administration building to the Thurston Lava Tube and Fern Jungle, to the Halemaumau pit, which are being reconstructed and improved by the Bitulithic Paving and Concrete Company. From the pit the return was made via the Uwekahuna Observatory road and down to the quarry site at the old prison camp about a mile below the Kilauea Military Camp, where the site was carefully inspected and the work in progress by the road contractor. At this point Mr. Wheeler and Mr. Mattison took a special car and continued around the island, spending the night at Waimea and returning to Hilo Sunday September 28 in time to take the 4 o'clock steamer for Maui, where the road to the top of Haleakala and other roads on the island would be inspected.

130 Finance and accounts.

As this is a statistical report, the figures for which can not be secured at the time this report is dictated, it will be found attached to the back of the report as statistical report No. 8.

140 Labor situation

Between the Park Service and the road contractor, local labor is being fairly well employed but the unemployment situation, which has been felt less in the islands than anywhere else in the United States, is now being felt to some extent and the Governor has appointed a special committee to relieve the situation as much as possible.

150 Equipment and supplies.

Two kerosene oil cook stoves, bed, dresser, tents, pack saddles, and two horses were bought during the month. The horses are required for packing on trail work. One is three years old, purchased for $40 and the other four years old purchased for $45. As the rental rate is $5 per day per horse, the horses will pay for themselves in a week's time.

After the Standard Oil Company had agreed to furnish gasoline to the Hawaii National Park and Geological Survey at the same rate as furnished to the Kilauea Military Camp of the U. S. Army, a radio was received September 18 to the effect that the paymaster general of the Navy has had advice that the Standard Oil Company of Callifornia stated that it was not possible to extend delivery of gasoline to Hawaii.As they are already delivering gasoline in this area this telegram is not understood and it seems further complicated by the first authorization which was granted by the Standard Oil Company of California after it had been taken up by their local representatives here.

As the saving is such a material one, we propose to take advantage of the special rate as long as the Standard Oil Company is willing to make delivery locally at this rate.

170 Plans, maps and surveys

The revised sketch plans for the commissioner's residence and the new administration building were received the latter part of the month from Chief Landscape Archètect Vint. With one or two minor suggestions, the plans for the commissioner's residence were promptly approved and returned for the making up of working drawings. We are still giving further study to the administration building layout and arrangement. The location plan of the building contained a number of important errors and we are making a topographic map of the area to return with the plans. As it will be necessary to tear down the present administration building in order to build the new, it is proposed to move our office temporarily into the commissioner's quarters when this building has been completed.

A great deal has been done in making a complete survey and record of our roads, trails, buildings, water, sewer, sanitation and electric system together with the system of signs for the park. All of this data will be useful in our 1934 estimates and copies will be furnished for the records of the Washington office.

200 Maintenance, improvements and new construction

210 Maintenance

Maintenance of our telephone lines throughout the month has been heavy due to the stormy weather and wind and there have been a number of crosses and shorts and our ranger force has been kept busy clearing up trouble and making repairs.

The heavy rain at the end of the month did considerable damage to the Chain-of-Craters road, which was washed in several places and the rim road around the south and west sides of Kilauea crater was also damaged. Culverts were washed out in a number of places, making considerable repair work necessary. The Kilauea road on the north and east sides of the crater, which has been under reconstruction by the contractor, has been impassable to tourist traffic and it has been practically impossible for the greater part of the month to get over the road except with a very light car. This has made it necessary to eliminate the Thurston Lava Tube from the itinerary of several of the groups of visitors but the pit and Chain-of-Craters and Fern Jungle area are accessible via the Uwekahuna bluff road.

220 Improvements

By tearing down some old toilet buildings, enough lumber and galvanized iron was secured to make a small shelter for horses back of the warehouse. One of the horses developed a bad cold from exposure to the wind and rain, and a suitable stable and barn should be built as soon as practicable.

Considerable study and time has been devoted to the proposed water system asked for in the 1933 estimates. The location of the water shed, the elevation above headquarters, and the amount of pipe to convey the water to headquarters have all been receiving special attention during the month.

230 New construction

With post-construction funds, the shoulders on the round-the-island road west of the Kilauea Military Camp were brought down to grade by the Park Service by the use of a grader and the road now looks a hundred per cent better than it did. The job has received the approval of Resident Engineer Handley and Engineer Wheeler of the Honolulu office of the Bureau of Public Roads. This work, together with the drainage ditches that were built, proved their worth in the heavy rainstorms that occurred during the month. For the first time the Kau road was not damaged during a period of heavy rainfall and this has been due to the putting in of drainage ditches and the lowering of the shoulders so that the water drains from the crown of the road to the sides.

With a special allotment of $8,000 from roads and trails funds, work on the Mauna Loa trail was started on September 20 with a gang of nine men, although official approval of the trail program has not yet been received from Washington. This work is a continuation of the improved trail built from the summit of Mauna Loa to a point below the resthouse in 1930 and the work was continued where it left off last year and it is hoped, with approximately $4,000 that the trail can be completed to its junction with the road at Bird Park. It was necessary to start this work immediately if it was to be done this fall, as the men started work at an elevation of approximately 9,000 feet. It is cold at that elevation and the month has been very stormy, thus interfering to some extent with the work, but as they are starting at the upper end and working down, every day sees them at a considerably lower elevation.

The work of the Bitulithic Paving and Concrete Company on the major road improvement at headquarters consisted almost entirely of grading on Project #1 between the Volcano House and the crater. Additional men were put on the job. A new gang was placed on the job of dressing up the roadway after the shovel and additional equipment was placed on the job. Mr. Handley's reports to Engineer Wheeler in Honolulu are sent in on the fifteenth of each month so that, quoting from this report, we note that there was a marked improvement in the progress of the work during the last ten days. A change was made in the shovel foreman. Some time was lost on account of rain. The grade was in a muddy, sloppy, wet condition most of the month. Costs to date have been higher than the estimates. When Engineers Wheeler and Mattison were here on September 26 Engineer Wheeler again urged the speeding up of the work and faster progress and took the matter up with the officers of the company at headquarters in Honolulu. Based on the amount of money earned, they are way behind schedule but the company maintains with the laying of pavement this will soon be corrected and that they are up to the schedule they contemplated.

240 Improvement of approaches to park

Engineer Wheeler made a special inspection trip on the first of September and found that all Federal aid projects in Hawaii financed by emergency road appropriations made last December were completed, with one exception. This was the Kahuku road project on Oahu and that was 83 per cent complete. Of special interest to the Kilauea section of Hawaii National Park was an expenditure of $28,029.85 on the first section of the South Kona road and $25,005.75 on the second section. On the island of Maui, the lower end of the Haleakala road was improved to the extent of $33,913.01 on one contract and $16,083.25 on a second contract. Six and four tenths miles of road were improved on Hawaii, and three and four tenths miles on Maui.

260 Landscape work

Due to lack of travel and the necessity of cutting expenses at the Volcano House, a considerable number of exotic plants and flowers were removed during the month and the area sowed to grass. The elimination of exotic plants and flowers and the planting of native plants and flowers are being encouraged, but most of the native plants are not as striking or flowery as those which have been introduced.

300 <u>Activities of other agencies in the park</u>

310 Public service contractors

The Kilauea Summer Camp, authorized to close on the first of September was, through a misunderstanding on the part of the manager, kept open until September 12.

The Inter-Island Airways is experimenting with a radio telephone and one airplane has already been equipped. The first experiments have proved satisfactory.

During the visit of the Hawaii Tourist Bureau to Hawaii the Board of Supervisors urged that they sponsor the plan of sending tourists to the Puna district, including the black sand beach at Kalapana and as a result of this, the Inter-Island has started this service, having part of the visitors that they handle in their automobiles take this trip. The train trip from the dock at Hilo along the Hamakua coast to Laupahoehoe has been discontinued. The visitors are now taken by automobile to Onomea Arch and Akaka Falls, which includes a portion of the Hamakua coast, then to Rainbow Falls above the city of Hilo, and from there to the park. They are due to arrive about 11 A.M and the afternoon is spent visiting the points of interest and at 9 A.M. the following morning they are taken over the Puna trip, reaching Hilo around 2:30 or 3 o'clock in the afternoon in time to sail on the 4 o'clock boat. This trip at present is given only to the Saturday and Sunday visitors of the Inter-Island but if it proves successful, will probably be adopted as the regular itinerary for all. During the period from 11 to 12 A.M. they will receive the lecture at Uwekahuna by our park naturalist and in the afternoon the trip across the crater of Kilauea will be made. This is a change from the 4 o'clock lecture to 11 A.M. and the trip across the crater at 1:15 P.M. in the afternoon was formerly taken in the morning of the second day. While the number taking the trail trip is not large, it does give an opportunity for making fine contacts and making friends for the park staff and the National Park Service. This plan is tentative for the present and if necessary the itinerary may be changed.

The latter part of September Mr. George Lycurgus, owner of the Hilo hotel and formerly owner of the Volcano House for a period of more than twenty years, came to the park and told me that he was negotiating with the Inter-Island Company to purchase the Volcano House and that a price of $112,000 had been agreed upon. This information was forwarded to your office in a code message of September 23 and followed by a letter of details dated September 24, outlining the interview with Mr. Lycurgus, and one of September 27 outlining an interview with Mr. Stanley Kennedy, secretary of the Volcano House Company and the Inter-Island Company. The Inter-Island Company intimated that they were not anxious to sell and would not sell at this price and Mr. Lycurgus later stated that he did not think he would carry negotiations further. There have been no new developments since that time.

313 Schedules of rates

The schedules of rates for the Volcano House for 1932 have been submitted for approval. The company is changing its past rate of $9 per day, American plan without bath, to $8 per day, with proportionate reductions in other rates. The company secured an estimate of $8,000 for the installation of a hot water heating system in the hotel rooms but decided that they would not authorize this work at this time because of lack of travel.

330 Cooperating non-governmental agencies

The Hawaii Tourist Bureau continues to give splendid cooperation in connection with travel to the park and the newspapers are giving good publicity to our nature notes and news items.

400 Flora, fauna, and natural phenomena

410 Ranger service

Three new permanent rangers reported for duty during the month. Ranger Donald H. Eaton , of Fresno, with Mrs. Eaton, arrived and entered on duty September 15. Theodore H. Barnett and Vernon Lowery, both of Yosemite, arrived and entered on duty on September 26. Gilbert Lee, who was employed as seasonal park ranger, was dropped from the ranger rolls at the close of September. A ranger night patrol started early in August, was continued during September and a ranger put on duty in the superintendent's office Saturday afternoons and Sundays to handle the telephone switchboard, answer inquiries and other incidental duties.

411 Naturalist and guide service

Eleven field trips were conducted, with a total attendance of sixty, and sixteen lectures were given with a total attendance of 374. Four hundred and two visitors entered the museum, making a total of 836 contacts for the month. Three special parties were given attention by the park naturalist. These were Governor Judd's party on September 13; Allan Hoover and party on September 17 and 18, and the passengers on the steamship Malolo on the round-the-Pacific cruise on September 25.

On the evening of September 18 the park naturalist gave a talk to the Hilo Rotary Club, his topic being the recreational, inspirational and educational value of our national parks, with particular reference to the educational work of the park service.

Three hundred and forty five copies of the August issue of Nature Notes were distributed and articles from this publication are receiving good space in the local papers. Full details of the accomplishments of the educational division are to be found in the summary of educational activities forwarded to Chief Park Naturalist Hall.

440 Insect control

An interesting letter was received from Mr. Otto H. Swezey describing the insect pests that were found on the samples of the Silver Sword fern sent from the Haleakala section of the park, and copies were forwarded to Washington. A special report on the insects that injure the ohia trees and the Mamani and koa trees was sent in on August 26, together with samples of the insects that are attacking these trees. These reports furmed the basis for an allotment for insect control work during the year 1932.

460 Birds

During the month two native wild geese were seen and six wild turkeys on a trip to Mauna Loa, and thirty doves and eleven pheasants were reported.

480 Natural phenomena

Conditions were very quiet at Kilauea during September, with the exception of several feeble earthquakes on September 9 and 12. Over a hundred tremors were recorded on the seismographs but a small proportion of these at least were caused by blasting in the vicinity. Measurement of the rim cracks near the pit showed little or no change. Weekly tilt during the month was North, Southwest, East, and Northeast.

Dr. Jaggar's staff has been increased this season by the appointment of Mr. E. G. Wingate, as Associate Topographic Engineer whose duties include the correlation of leveling and tilt, drafting and research in maps of crater, recording Hilo tide data, special investigations of Mauna Loa and topographic mapping wherever required. Mr. Austin E. Jones was appointed assistant seismologist in charge of operation of seismographs, measurement of seismograms, and preparation of earthquake bulletins.

Copies of the weekly Volcano Letter are attached.

490 Miscellaneous

Some interesting Silver Sword ferns have been found on Mauna Loa by our trail foreman that, according to his report, appear to be similar to those found in the Haleakala section and some of the Silver Sword seed has been sown at 10,000 feet elevation in the hope that the number of our Silver Sword ferns may be increased.

500 Use of Park Facilities by the Public

510 Increase or decrease in travel

The total number of visitors entering Hawaii National Park in September amounted to 6,829, compared with 7,950 last year. However, the total visitors to the end of the travel year September 30, 1931, amounted to 124,932, which breaks all records. This compared with 89,578 last year. The increase was all due to the large number of visitors last November and December when there was volcanic activity in Halemaumau pit for a period of approximately three weeks during which twenty five or thirty thousand visitors came to the park.

In analyzing our travel records, it should be understood that all cars entering the park are counted whether they visit the park proper or continue through the park using the round-the-island road. These are not, strictly speaking, park visitors, although of course they are using one of the main roads. Due to lack of staff it has not been possible to make an absolute count of the private car visitors but these figures are based on checks that are made intermittently and the average used as a basis for arriving at an estimate of private car visitors. All tourists coming in by the regular lines and staying at the hotel, summer camp or Military Camp are actual count. Form 10-157 attached to the report, gives full details.

520 Conditions which favorably or unfavorably affect travel

The business depression throughout the world for the past two years has had an unfavorable effect on travel and this is felt in Hawaii National Park, where the tourist travel comes by steamer. Many of the mainland parks showed an increase in travel this year in spite of the depression because it was easy for automobile owners to secure inexpensive vacations in the national parks especially where the public camp grounds were utilized.

530 Visitors

On September 6 eleven Japanese Y.M.B.A. students from Tókio visited the park.

Governor Lawrence M. Judd and party visited the park on September 13 and 14, as has previously been described.

Mr. Allan Hoover, son of the President, who came to Hilo as a member of Governor Judd's party on September 11, dropped out of the party to spend a week at the ranch of Atherton Richards. With Mr. Richards and Mr. H. K. Castle, Mr. Hoover arrived in the park and spent September 23 and the morning of September 24 in the park. Due to the illness of the park superintendent, who was confined to his quarters by a light attack of flu, Park Naturalist Doerr met the party when it arrived and spent the evening with them and the next day accompanied them on a trip through the park, visiting all points of interest. Mr. Hoover joined the Hui O Pele while here, securing certificate of membership No. 12,350. A press notice of his activities in the park was sent out and was published in all local papers. The superintendent, however, had an opportunity of greeting Mr. Hoover when he arrived in Hilo with the Governor's party the week before.

Dr. B. L. Falconer, formerly senior examiner of the U. S. Civil Service Commission and now retired, presented a letter of introduction from the Secretary of the Board of Civil Service Examiners in Honolulu on September 23 and received special attention during his stay in the park.

600 Protection

610 Police protection

On September 6 it was discovered that someone had broken into the cottage owned by E. N. Holmes, located on one of the leased lots in the park, and had gone through the house, but whether anything was stolen could not be determined until Mr. Holmes had made an inspection and inventory. There has been a great deal of housebreaking and petty thievery in the park and vicinity during the past summer. The party gained entrance by breaking through the back porch window and the door from the kitchen to the living room was also broken through. Evidently a man and a woman were involved, as indicated by footprints.

630 Accidents

Mr. Oren C. Wilson, Internal Revenue agent at Hilo, his wife and daughter, were forced to spend the night in their automobile on the Hilina Pali road on September 8, due to motor trouble. Although Mr. Wilson walked several miles to the nearest telephone to call for help, the telephone system was out of order and no one could be raised. Except for the discomfort, no harm was done.

640 Destruction of predatory animals

Seven wild pigs, one dog, and fifty three wild goats were killed during the month.

900 Miscellaneous

On September 10 the park Superintendent gave a talk before the Hilo Woman's Club on the national parks, outlining the birth of the national park idea and the early history of the national park movement up to the creation of a bureau of national parks in 1916.

Because of the extended construction period of the Bitulithic Paving and Concrete Company in carrying out their contract for road improvement, Resident Engineer H. L. Handley of the Bureau of Public Roads had Mrs. Handley and his son Dick come to the park from their home in Utah and they arrived on the Malolo on September 25.

Dr. T. A. Jaggar, volcanologist of the Hawaiian Volcano Observatory, returned to the park after giving a three weeks course in volcanology at the University of Hawaii summer school.

Major General Briant T. Wells assumed command of the Hawaiian Department on September 16, relieving Major General William Lassiter, who was retired. General Wells has visited the Hawaii National Park and the Kilauea Military Camp and is friendly and sympathetic in his attitude toward both.

Two changes in the staff of the Kilauea Military Camp were made this summer. Major D. M. Roberts of the Medical Corps relieved Captain Best, and Lieut. Whitely has arrived recently, with Mrs. Whitely, to relieve Lieut. Sinclair.

During the month there were Naval aircraft maneuvers over the bay of Hilo which brought to that city approximately 1,000 men and a great many were visitors at the Kilauea Military Camp and the park. The National Guard encampment at Hilo also brought a large number together from various parts of the island and from this group a considerable number visited the park.

There were nine permanent and nine temporary employees at the beginning of September, with three additions and one separation from the permanent roll and twelve additions and four separations from the temporary, making a total of eleven permanent and seventeen temporary employees at the end of the month.

Very respectfully,

E P Leavitt

E. P. Leavitt,
Superintendent.

10-157
(July, 1929)

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

TRAVEL REPORT

HAWAII National Park for the month of SEPTEMBER 1931

	This Month	This Travel Year To Date	This Month Last Year	Last Travel Year To Date	Increase for Travel Year: Number	Increase for Travel Year: Percent
PRIVATE TRANSPORTATION:						
Cars first entry, ...						
Cars reentry, ...						
Motorcycles, ...						
Total motor vehicles, ...						
Persons entering via motor vehicles, ...	5,903	116,510	6,587	75,510	41,000	.351
Persons entering via other private transportation, ...	418	4,125	338	3,343	782	.189
Total persons entering via private transportation, . . .	6,321	120,635	6,925	78,853	41,782	.346
OTHER TRANSPORTATION:						
Persons entering via Hotel ~~stages~~, .	508	8,297	1,025	10,725	- 2,428	-.226
Persons entering via trains, .						
Persons entering otherwise, . .						
Total other transportation, .	508	8,297	1,025	10,725	- 2,428	-.226
GRAND TOTAL ALL VISITORS, . . .	6,829	128,932	7,950	89,578	39,354	.282

	This Year	Last Year	Increase: Number	Increase: Percent
Automobiles in public camps during month, ...	0	0	0	0
Campers in public camps during month, ...	0	0	0	0

10-158

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF AUTHORIZED PROJECTS

Hawaii National Park for the Month of September 1931

Description of Projects	Percent Constructed To Date	Percent Constructed This Month	Percent Constructed Last Month	Probable Date Completion
40 - Comm Residence new adm bldg				
411 Employees Quarters - - - - - -	100	10	10	
412 Employees Quarters - - - - - -	98	18	80	
502 Hilina Pali-Mauna Iki Trail Extension	95	0	05	
502 Kipuka Bihopa boundary Trail, Improvement ; and extension - - - - - - - - -	100	0	0	
502 Extension of Auto Trail Uweka-huna to Halemaumau - - - - - -	100	0	0	
502.4 Hil. Pali				
Road Survey, B.P.R. Construction -	5	2	5	

502.5 Mauna Loa Trail

502.6 Halemaumau Trail

10-215
(July, 1928)

45334

UNITED STATES
DEPARTMENT OF THE INTERIOR
National Park Service

Hawaii National Park

R E P O R T O F N O N - A P P O I N T E D P E R S O N N E L
(TEMPORARY)

Changes outside the District of Columbia for the month of September 1931

Total at beginning of month		Additions	Separations	Net Gain or loss (a)	Total at ending of month
Permanent	9	3	1	2	11
Temporary	9	12	4	8	17
Total	18	15	5	10	28

(a) If loss, indicate by minus sign.

10-159
(May, 1931)

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF PERSONNEL

Hawaii National Park for the Month of September, 1931

	This Month		This Month Last Year	
	Appointed	Non-Appointed	Appointed	Non-Appointed
Number of employees beginning of month	9	9	5	21
Number of additions	3	12	0	6
Total	12	21	5	27
Number of separations	1	4	0	8
Number of employees close of month	11	17	5	19
Number of promotions during month	0	0	0	0
Aggregate amount of annual leave taken	0	0	0	0
Aggregate amount of sick leave taken	0	0	0	0
Aggregate amount of leave without pay	0	0	0	0

10-161

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

REPORT OF SALES OF PUBLICATIONS

	Number	Value
GOVERNMENT PUBLICATIONS:		
On hand beginning of month,	1012	$ 180.00
Received during month,	00	00.00
Total,	1012	180.00
Sold during month,	11	2.00
On hand at close of month,	1001	178.00

	Number	Value
NON-GOVERNMENT PUBLICATIONS:		
On hand beginning of month,		~~$ 45.95~~
Received during month,		~~2.00~~
Total,		~~47.95~~
Sold during month,		
On hand at close of month,		

Cash on hand beginning of month,	$ 45.95
Sales during month,	2.00
Total,	47.95
Remitted during month,	0.00
Balance,	$ 47.95

10-160

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

REPORT OF PARK REVENUES

Hawaii National Park for the Month of September 1931

	This Year	Last Year
Park revenue on hand beginning of month,	0.00	0.00
Received,	75.00	75.00
Total,	75.00	75.00
Remitted,	75.00	75.00
On hand close of month,	0.00	0.00

Park revenues received this year to date,	$125
Park revenues received last year to date,	$125
Increase,	0.
Per cent of increase,	

FINANCE AND ACCOUNTS

HAWAII NATIONAL PARK * SEPTEMBER 1931

Symbol	Name	Allotted	Expended & Obligated	Balance
41/2415	Hawaii National Park 1931-32 - - - - - - - -	$52,130.00	$36,738.56	$15,391.44
41/2406	Forest Protection & Fire Prevention 1932-32	100.00	100.00	0.00
41/2405	Emer. Recon. & Fighting Forest Fires, National Parks, 1931-32 - - - - - - -	200.00	200.00	0.00
40/1415	Hawaii National Park 1930-31 - - - - - - - --	34,625.00	34,624.49	0.51
40/1406	Forest Protection & Fire Prevention 1930-31	990.00	989.00	1.00
40/1405	Emer. Recon. & Fighting Forest Fires, National Parks, 1930-31 - - - - - - -	17.25	17.25	0.00
4X436	Roads and Trails, National Parks, no year -	384,806.30	26,920.77	357,885.53

Form No. 1009—Met'l.

U. S. Department of Agriculture, Weat[illegible] Bureau.

COOPERATIVE OBSERVERS' METEOROLOGICAL RECORD:

Month of September [illegible], 192 ; *Station,* Volcano Observatory ; *County,* Hilo

State, Hawaii ; *Latitude,* ; *Longitude,* ; *Hour of Observation,* ; *Time used on this form,*

DATE.	TEMPERATURE. Maximum.	Minimum.	Range.	*Set Max.	PRECIPITATION. Time of Beginning.	Time of Ending.	†Amount.	Snowfall, in Inches. (Humid)	Depth of Snow on Ground at Time of Observation. (Wind)	Prevailing Wind Direction.	Character of Day, Sunrise to Sunset.	‡Miscellaneous Phenomena.
	1	2	3	4	5	6	7	8	9	10	11	
	77	60	17	65			T	91	Mod.	N.E.	P.C.	
1	76	59	17	67			T	—	"	"	"	
2	82	59	23	65			T	88	Lt.	Var.	"	
3	66	61	5	71			05	70	Mod.	N.E.	"	
4	73	60	13	67			01	96	"	"	"	
5	76	57	19	69			03	81	"	"	"	
6	74	57	17	67			20	83	"	"	"	
7	67	59	8	62			123	90	"	"	Cloudy	
8	71	56	15	67			07	77	"	"	P.C.	
9	66	56	10	64			14	89	"	"	Cloudy	
10	67	57	10	63			63	89	"	"	"	
11	69	57	12	66			189	90	"	"	"	
12	63	50	13	63			30	94	"	"	P.C.	
13	70	56	14	65			00	92	"	"	"	
14	70	57	13	68			01	94	Str.	"	"	
15	68	59	9	63			03	96	"	"	"	
16	73	56	17	64			07	70	Mod.	"	Cloudy	
17	66	55	11	63			193	89	"	"	"	
18	65	55	10	61			41	94	"	"	"	
19	73	59	14	60			07	89	"	"	P.C.	
20	72	57	15	65			03	94	"	"	"	
21	73	58	15	65			05	83	Lt.	"	"	
22	70	59	11	67			03	89	Mod.	"	"	
23	72	56	16	64			11	89	"	"	"	
24	67	55	12	69			53	94	Str.	"	"	
25	65	54	11	60			79	69	Mod.	"	Cloudy	
26	63	53	10	60			33	79	Str.	"	"	
27	64	55	9	58			34	94	"	"	"	
28	69	54	15	65			10	84	Mod.	"	"	
29	67	57	10	59			544	—	"	"	"	
30												
31	2121	1700	421	1905			14.65	2506				
Sum	70.7	56.6	14	63.5			.425	86.5				
Mean												

*Reading of maximum thermometer immediately after setting.
†Including rain, hail, sleet, and melted snow.
‡Thunderstorms, halos, auroras, etc.

U.S.G.S. Volcano Observatory, *Cooperative Observer.*

Hawaii National Park, *Post-Office Address.*

(IN TRIPLICATE.)

See cover for instructions.

8—253 GOVERNMENT PRINTING OFFICE

MONTHLY SUMMARY.

TEMPERATURE.

Mean maximum, 70.7

Mean minimum, 56.6

Mean, 63.6

Maximum, 82; date, 3, 4

Minimum, 54; date, 26, 29

Greatest daily range, 23

PRECIPITATION.

Total, 14.65 inches.

Greatest in 24 hours, 5.44; date, 30

SNOW.

Total snowfall, inches; on ground 15th, inches;

at end of month, inches.

NUMBER OF DAYS—

With .01 inch or more precipitation, 27

Clear, 0; partly cloudy, 18; cloudy, 12

DATES OF—

Killing frost,

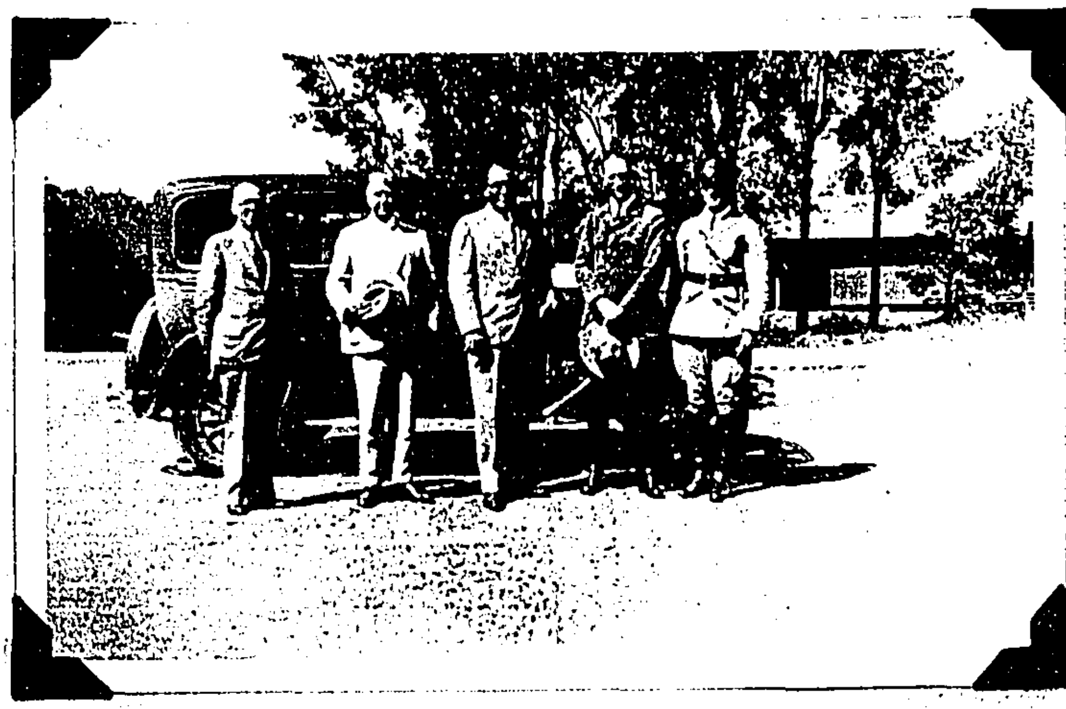
Thunderstorms,

Hail: Light, ; Moderate, ; Heavy,

Sleet,

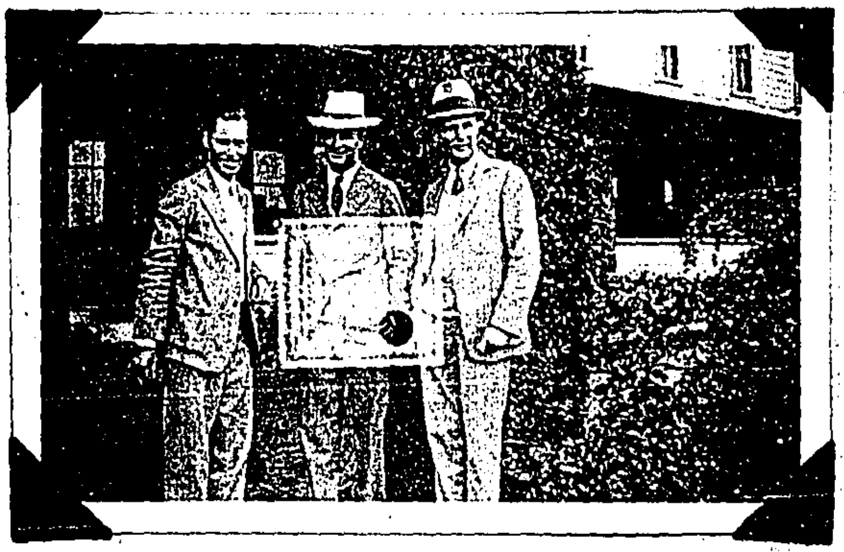
Auroras,

REMARKS:



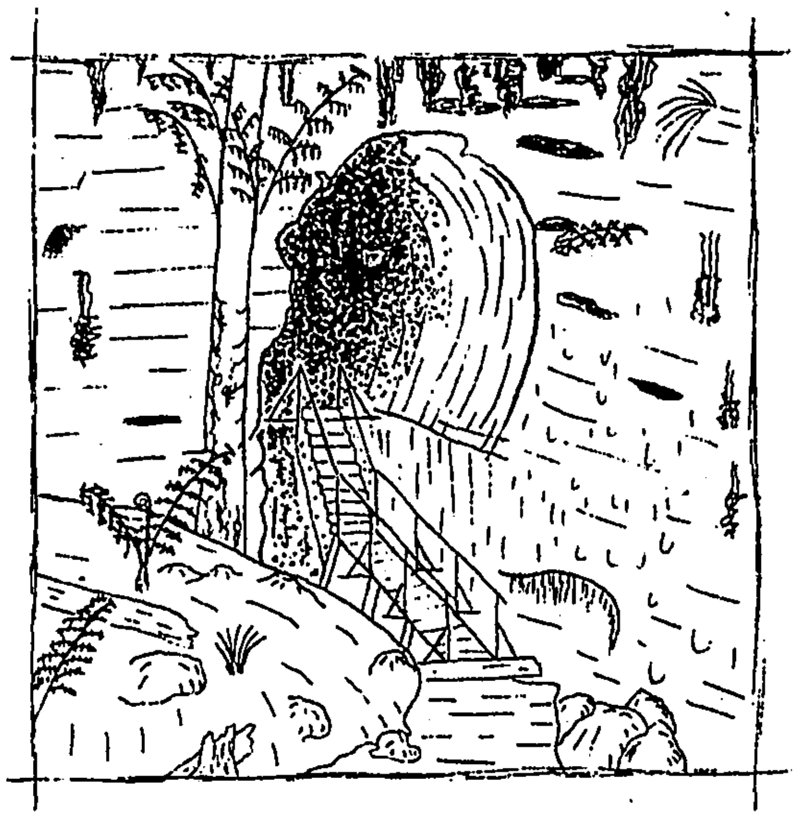
Governor Judd's party, left to right, H. L. Handley, Resident Engineer, U. S. Bureau of Public Roads; Lyman H. Bigelow, Superintendent of Public Construction and Territorial Highway Engineer; Lawrence M. Judd, Governor of Hawaii; E. P. Leavitt, Superintendent of Hawaii National Park, and Col. Walter R. Dunham, Aide to Governor Judd. Picture taken September 13, 1931.

Superintendent Leavitt with Governor Judd's party at Uwekahuna Observatory. Picture by Park Naturalist Doerr. September 13, 1931



Allan Hoover and party in Hawaii National Park. Left to right: Atherton Richards, H. K. Castle, and Allan Hoover. Picture by Park Naturalist Doerr, September 18, 1931.

HAWAII NATIONAL PARK
NATURE NOTES



Vol. I. August 1931 No. 3.

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

HAWAII NATIONAL PARK
NATURE NOTES

Volume I August 1931 Number 3

Nature Notes from Hawaii National Park is a monthly pamphlet edited by the Park Naturalist and distributed to those interested in the natural history of the park. Free copies can be obtained through the office of the Park Superintendent, Hawaii National Park, Hawaii. Anyone desiring to use articles appearing in Nature Notes may do so. Please give credit to the pamphlet and author.

E.P.Leavitt, Superintendent John E. Doerr, jr., Park Naturalist

TABLE OF CONTENTS

- Aloha -

A TRIP THROUGH THE

THURSTON LAVA TUBE

WITH RANGER WILLIAMS

"How do you do?

"This is known as the First Twin Crater. Its Hawaiian name is Kalua Iki. If you will walk up to the lookout, I think you will agree that the view is well worth a pause.

"Yes, Madam, it is called Twin Crater because there is another just like it, but without the tube, about a quarter of a mile away.

"Yes, Miss, most of our visitors share your enthusiasm. The sun's rays filtering through the Ohia foliage to the giant ferns below, have caused many of our guests to call this place the Garden of Eden, without the serpent, of course.

"We will now walk down into the crater, to the lava tube on the other side, if you please.

"There are many varieties of ferns growing in this crater. This one is called Amaumau. The larger ones are tree ferns, called Hapuu and Hapu-ii. They grow as high as forty feet. This brown, silky floss which you see at the base of the fern fronds is Nature's protection for the young shoots until they are ready to unfurl themselves. It is called pulu in Hawaiian. Until about fifty years ago it was used extensively to stuff pillows and mattresses. In one year over half a million pounds of pulu were exported from the islands. A small quantity is still used locally for fancy cushions. No, Madam, there is none exported now. The demand for pulu ceased when they found that it powders up when dry; the powdered pulu, if breathed in, is a detriment to health.

"Usually, the first vegetation to appear on a new lava flow is this common fern, the Amaumau. Birds, or other agencies, deposit the seed of the Ohia Lehua on some part of the fern, sometimes high up on the trunk. When the seed starts to grow, the young tree sends its roots down the fern trunk into the ground. As the Ohia grows, its roots ultimately choke out the fern, leaving the tree standing with a series of slitted roots. Here is a stately old fellow, near the entrance of the lava tube, which is a good illustration. The trunk is perched on its roots almost ten feet above the ground.

"This lava tube was accidentally discovered in 1913, by the late Lorrin A. Thurston, of Honolulu, and it bears his name. The Hawaiian name of the tube is Keanakakina, keana, meaning tunnel or cave, kakina being Mr. Thurston's Hawaiian name. The tube is about 1800 feet long, but do not be alarmed, we shall walk through only about 400 feet.

"[illegible], Madam, those are not stalacti[illegible]s; they are roots from the tr[illegible]s above. Some of the roots hang[illegible] from the roof of the tube are over twelve feet long. Looking at the roof you can see how the hot gases whirling along the roof of the tube have melted out these bell or dome-shaped cavities.

"This horizontal line that you see along the wall reminds one of the cream mark on the inside of a milk jug; it indicates the elevation of the stream of molten lava just before the tube was finally drained. The hot lava flowing away suddenly left this tube.

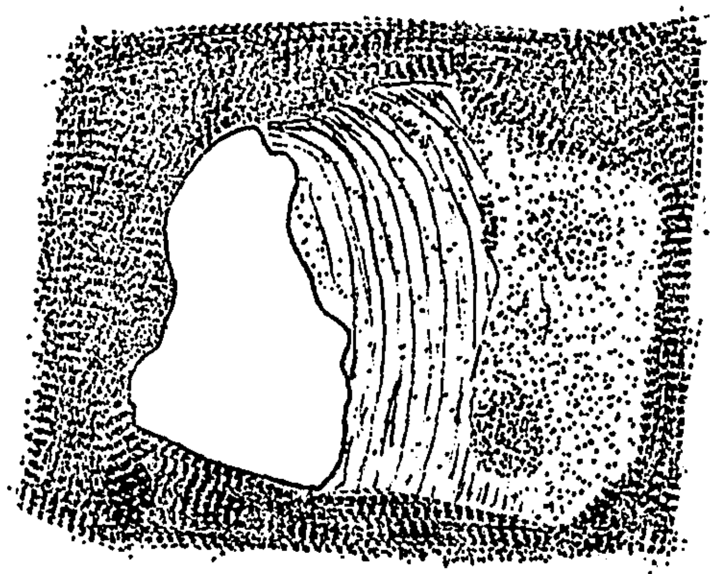
"Look back toward the entrance a mo ment. See the moss clinging to the side walls? What a picture those ferns make, framed in the mouth of the tube.

"You tall gentlemen mind the low bridge just here. See how this particular dome in the roof resembles Liberty Bell; even the famous crack is there. You can judge from that that this tube was made in 1776, and your guess is as good as anyone's.

"Here we ascend to the surface. Beyond this point the tube extends a distance of 1400 feet, there is no exit at the far end. Many people make the trip back there at their own risk; it is interesting but rather rough underfoot and somewhat uncertain overhead.

"This trail leads to your automobiles, Ladies and Gentlemen. Good afternoon."

by Ranger K. J. Williams



Looking back at daylight from a point 200 feet inside the entrance of the Thurston Lava Tube

Through the Thurston Lava Tube
AS IT SOMETIMES OCCURS TO US

RANGER: "How do you do?"
TOURIST: "What is this place?"
RANGER: "This is ---
TOURIST: "Do we have to get out of the car?"
RANGER: "Yes, Madam, it is only a short dist---
TOURIST: "What is there to see? How far do we have to walk?"
TOURISTESS: "Now Elmer, bring the camera. If there is anything to see, we'll see it. We paid enough for this trip, what with the service one gets on the boat, goodness knows."
RANGER: "This is known as the First Twin Crater."
TOURISTESS: "Now Elmer, listen to what the man is saying. Hope it is'nt anything like those twins on the boat. As I said to their mother only last night, if they were MY children! Now Elmer, how often must I tell you to pay attention to what the man is explaining? Is this what they call a crater? Is it safe for people to walk down in it? I've heard these things explode sometimes. But I guess it's safe or they wouldn't lead people into it. We must see. Mr. Ranger, what is this thing? Oh, it's WHAT you've just been explaining. Well, I did'nt hear you young man, and I am sure we all paid the same price and are all entitled to the same amount of attention though some people seem to get more than their share walking the deck every night with some man or other till all hours when respectable people ought to be in bed, and what all those men see in HER."
RANGER: "This lava tube was discovered in 1913 by -
TOURISTESS: "Why did'nt they find it before? By the looks of those trees it must have been here long before that. If they looked around they could not have missed it. IT's big enough, goodness knows, though not as big as the subway, and we have come all those miles to see it when we could have stayed right at home and saved all the money."
RANGER: "Those ferns -
TOURISTESS: "That's what I want to find out about. Do they grow by seeds? Is this the seed? I want some to take home to our place."
RANGER: "You are not permitted to break the ferns, nor to pick the flowers."
TOURISTESS: "Elmer, did you hear that man barking at me? Just one little flower that I didn't want anyway. I'm sure I never refused a flower to anybody and what with all these wild flowers along the road one would think that these people would not be so mean, goodness knows -.
RANGER: "This trail leads to your car. Goodbye."

by Ranger K..J. Williams

A DIAGRAMMATICAL STORY OF THE FORMATION OF A LAVA TUBE

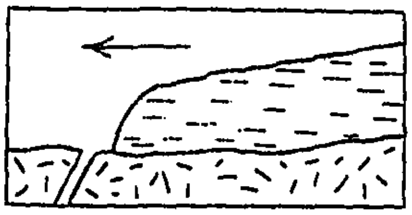


Fig. 1 - Molten lava flowing down the slope of volcano; thickness and width of flow may vary from a few feet to many feet.
Lava flow
Old lava on slope of volcano

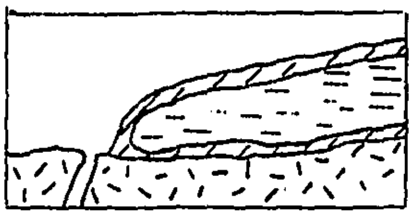


Fig. 2 - Rapid cooling on the surface and bottom of flow causes a crust to form over the liquid lava; hot molten lava inside hard crust.

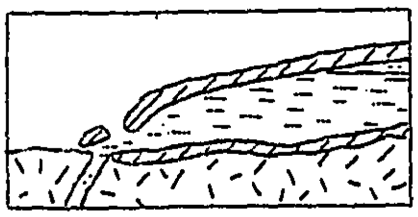


Fig. 3 - Crust breaks open permitting molten lava to flow out from inside the crust. Lava may run into crack in old lava flows.

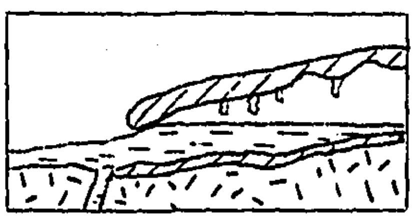


Fig. 4 - Molten lava continues to drain out from inside the crust; hot gases occupy space evacuated by lava; gases hot enough to melt out bell-shaped cavities in roof; melted lava from roof drips down forming stalactites.

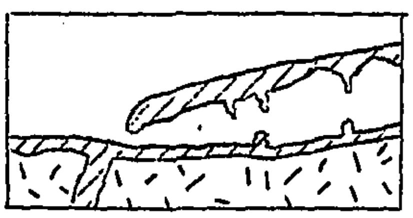


Fig. 5 - Molten lava completely drained away leaving tunnel or tube. Continued drip from roof forms stalagmites on floor. Gases escape. Last flow solidified.

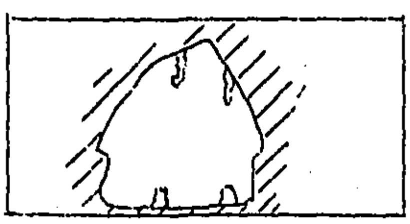
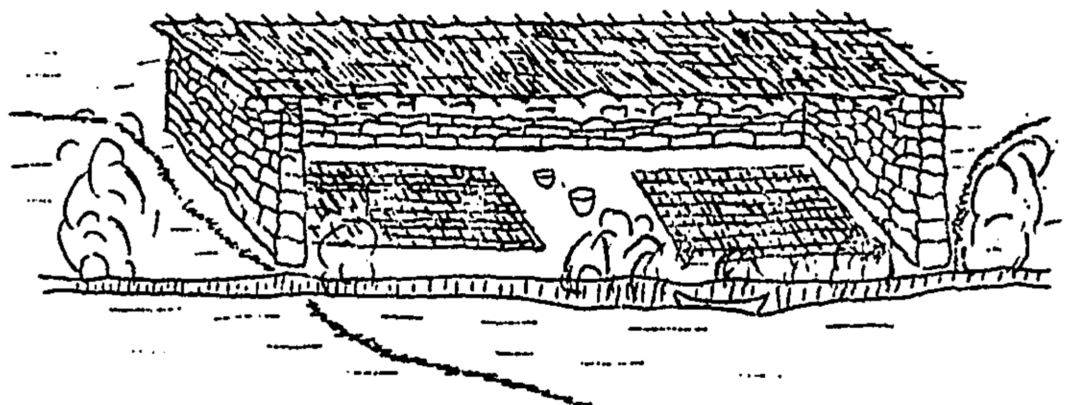


Fig. 6 - Cross section of a lava tube; diameter may vary from a foot or two to 30 or 40 feet. Bench marks along the wall show levels of surface of molten lava as it drained away.

by the Park Naturalist



AN ANCIENT HALE HOOMAHA AND STEAM CRACK

Many years ago a very ancient Hale Hoomaha or rest house was situated at the steam crack near the rim of Kilauea, about $\frac{3}{4}$ of a mile west of the Volcano House. This steam crack, now one of the attractions to tourists hiking along the Steaming Bluff Trail, served as a cook stove for travelers in olden times. In days gone by, when roads were mere trails and the only means of conveyance on land was by pack animal, Hawaiians from all the islands came to Hawaii to worship their Goddess Pele. They brought their food with them and cooked it in the steam crack near Kilauea.

For a time the people who came to worship at Pele's fiery temple had no shelter to protect them from the cool winds and the mists on the mountain. Realizing that the hot steam was a source of heat, the worshipers decided to construct a rest house or shelter over the steam crack. When completed, the house was about eighty feet long, twenty feet wide and six feet high; its was a three-walled structure, the lee or south side facing Kilauea Crater being left open. The walls were made of stone, the roof of interwoven sticks and grass. The rock floor was covered with grass and lauhala mats.

Having no cooking utensils, two eight foot canoes served as cooking vessels. One canoe was placed on one side of the steam crack, the other canoe on the other side. Before placing the food to be cooked in the canoe, the Hawaiians "olied" or chanted with great reverence. Puaa (pig) chicken, fish and sweet potatoes wrapped in ti leaves were then placed in one canoe, yams, taro, and the hearts of the hapuu fern being placed in the other. All this preparation was done in the morning so that the steam would cook the food while the people were spending the day in worship at the fire pit of Kilauea. On returning to the shelter in the evening the people made a great ceremony of eating the food which had cooked in hot steam during the day.

The last time food was prepared in this steam crack in the manner of the ancient Hawaiians was in July 1891. Peter Lee (father of the writer) then manager of the Volcano House, hearing that Queen Kapiolani and her followers were coming from Kalapana to the Volcano House, hustled his servants to prepare a Hawaiian feast of puaa, fish, sweet potatoes, yams, taro, and hapuu. The food was placed in Koa canoes and cooked in the steam crack as in former days. The Queen and her party arrived at the local hostelry in the early evening and found that great preparations had been made in honor of her visit to the region which had long been sacred to her people.

Today only the steam crack, sending out great clouds of steam, remains as a marker of the place where the Hawaiians gathered when visiting the fiery palace of their Goddess Pele. The older Hawaiians and kamaainas can recall the grass-thatched, stone Hale Hoomaha and the two canoes which served as an oven.

In former days only trails led to Hale Hoomaha, today one may drive on paved roads to the very edge of the steam crack which furnished heat for warmth and cooking. The stones that made the walls of the Hale were used in building the roads, the canoes have long since decayed.

by Ranger Gilbert W. Lee

CAMPING IN THE PARK

During the last week in August, forty members of the Beretania Chinese Church of Honolulu, were visitors in Hawaii National Park. The twenty-eight boys in the party, under Mr. L. T. Hooley's direction, camped at the auto camp ground on the east rim of Kilauea Crater; the twelve girls with Mrs Ann Pfaender made their headquarters at Hale Aloha, near the twenty-nine mile road. Such an outing is an annual event for the various clubs from the church. The trips made in past years have made it possible for the club members to visit many of the islands of the Hawaiian group. This year's trip was their second visit to Hawaii. While in the park the party attended the lecture on volcanoes given at Uwekahuna Museum and were conducted by the park naturalist on nature study trips to the bottom of Kilauea Iki, a crater approximately 800 feet deep; the Thurston Lava Tube; the Fern Junglewhere many interesting species of ferns were examined; the Chain of Craters, an area of volcanic craters, cones and lava flows in which tree molds were studied; the Sulphur Banks; the Halemaumau-Sandalwood-Steaming Bluff Trail; Mauna Iki, where the foot prints were examined and sticks burned in the hot volcanic cracks; and Bird Park, an area of old trees, poha and thimbleberries.

The trip to Bird Park was particularly interesting, not only from the standpoint of the opportunity it afforded to study the vegetation of that section of the park, but also from the standpoint of entertainment. Following the picnic lunch, Superintendent Leavitt talked on National Parks with particular reference to Yosemite; several Chinese songs and dances were presented, and T. Y. Char, Professor of Chinese at the University of Hawaii, gave an interesting description of the Chinese theatre.

by the Park Naturalist

The Volcano Letter

Two dollars per year Ten cents per copy

No. 349—Weekly Hawaiian Volcano Observatory, National Park, Hawaii September 3, 1931

Marked crack where it emerges at southeast rim of Halemaumau, showing method of measurement with wooden callipers at painted spots.

VERTICAL AND HORIZONTAL GROUND MOVEMENT

"Tilting of the ground as recorded by the slow and persistent wandering of the recording pens of the seismograph has been found through past years at the Observatory to be well worth observation. Such tilting away from the pit of Halemaumau has in general been correlated with rising of the lava column, while tilting towards the pit has usually come with retirement of the lava or at times of general collapse. The tilt at the Observatory appears to have a normal annual range of about 10 seconds of arc towards the pit (southwest), during the first half of the year, and a recovery during the second half. This normal movement and some other shorter period variations may not be strictly due to volcanic causes. General temperature changes either of the instrument room, of the ground upon which the Observatory stands, or of the face of the cliff near the Observatory may produce tilting effect and so account in part for this annual change, though experiments show that it certainly is not a purely local movement. Volcanic conditions are known to produce tilt also, and these volcanic tilt effects are superimposed upon the tilts produced by other causes." (R. M. Wilson in "Review of Local Seismic Features for the Year," Monthly Bulletin of the Hawaiian Volcano Observatory, Vol. XV. No. 12, December 1927.)

Quantitative measurements of the uplift and depression of the Kilauea dome have been made on several occasions in the past by means of precise spirit levels and horizontal movement detected by a careful retriangulation of a network of stations about the pit also connected by precise levels. The first spirit levels were run in 1912 by the U. S. Geological Survey and subsequent runnings of this line by the same organization in 1920 and the U. S. Coast and Geodetic Survey in 1927 have shown the value of spirit levels as a means of detecting even small amounts of vertical displacement. The methods used are fully described in Monthly Bulletin of the Observatory Vol. XV, No. 6, 1927.

The net of triangulation stations about Kilauea was first established in 1920 and the connecting levels run during the same period. Final adjustments of both surveys by the method of least squares was made by the computing section of the Geological Survey in Washington, D. C.

In 1927 and 1928 Mr. R. M. Wilson, engineer and mathematician of the Observatory at that time, who was also the author of the 1920 surveys, made an identical resurvey of this net. The results correlated satisfactorily with the general breakdown and depression of the Kilauea dome during the seven-year period which they covered. Horizontal movement was shown to be a general pull-in of all points towards Halemaumau as a center.

Similar repetitions of surveys have also been extensively made by the Japanese government in their quake-stricken provinces and the U. S. Coast and Geodetic Survey has retriangulated the area along the San Andreas rift in California. ("Earth Movements in California," by William Bowie, U. S. Coast and Geodetic Survey Special Publication No. 106.) The results of these measurements as of those in Hawaii show clearly and accurately the amount of displacement of the earth's crust which took place during the period of the cataclysm. Now as has been said some of these displacements were very small and required the most accurate of modern engineering methods to detect, also the surveys were made after the greatest movement had occurred. The question arises since such small movements have been measured after a quake has occurred, would it not be possible to apply these same methods to the prediction of quakes, or as more closely concerns us in Hawaii, the rise of the Kilauea or Mauna Loa lava columns?

The measurements in California and Japan have been concerned partly with quakes of tectonic origin, and as such quakes are caused by continued long strain and warping of the earth's crust over a number of years until it has reached the breaking point. it would seem that here a periodic survey of known active fault areas would be of value. This in Japan is called "chronic tilting" by Imamura. (Topographical changes accompanying earthquakes or volcanic eruptions, by A. Imamura, Publ. E. I. C. No. 25, Tokyo, 1930.)

Here in Hawaii any such measurements would have to be correlated with data from the seismograph or tilt-meter and continued through two or more active phases, since the actual tilt of the ground from day to day is small and not perceptible except by magnification. However, cumulative tilt is undoubtedly a measurable quantity and since accumulated tilt away from the pit has been shown generally to precede an active period, it is possible that measurements of the relative change in elevation of established bench marks together with the measurement of the horizontal angular change between such points would give a more firm basis for prediction.

With this end in view, and for general engineering use, four new stations marked with standard U. S. B. M. tablets have been established about the rim of Halemaumau. One is a few feet from the seismograph cellar at the pit and the other three form a rough square spanning the crater. Triangulation of these points has been made for any immediate emergency. Later they will be connected by precise levels to the 1927 circuit and a more accurate triangulation made with perhaps an especially measured base.

Horizontal angles are observed by a repetition with a Berger transit graduated to 20 seconds. Each angle is observed 12 times, six times in a clockwise direction, three settings made with telescope direct, and three reversed, both verniers being read. The angle is then *measured in a similar manner but in a counter-clockwise* direction, the mean of the 12 readings giving the correct angular value free from instrumental errors. Horizon closures are made in the same way. Particular care must be given to the centering of the instrument over the station and of the signals over their respective marks.

The larger net of Kilauea stations will also be reoccupied and identical angles measured as the loss of any lines from the previously adjusted figure would necessitate an almost complete new adjustment and much of the value of the work lost from its intended purpose, a comparative study with the two older surveys, together with the accumulated data for the same period from the seismographs.

A similar resurvey with the spirit level would give a means for study of any relative changes of elevation among the several stations in the net.

The measurement of rim cracks about Halemaumau has in the past proved of interest, as well as of value to the public in marking off weak or dangerous sections about the pit. The measurements, however, have not been very refined, instrumental errors amounting to as much as two or three millimeters due partially to uncertainty of exact points of measurement as well as the inaccessibility of some of the points. These measurements are to be resumed with new points added from time to time and the methods of measuring revised. Tumescence of the Kilauea dome as the result of rising lava has its effect on the more deep-seated fractures; a lift of this lava column before eruptions in 1927 and 1929 caused a widening of the superficial rim cracks with sections breaking off and avalanching into the pit.

Kilauea, due to its accessibility, is ideally situated for observation and measurement of tilt. Mauna Loa, on the contrary, presents a problem. Previously established triangulation points of suitable accuracy are scarce, and the precise spirit levels to the summit run by the U. S. Coast and Geodetic Survey in 1926 provide the only accurate datum bench marks on the entire mountain.

Mauna Loa above timber line alone comprises an area of over 500 square miles and is really accessible only by means of three trails; one on the Kona or west side and two on the southeast side. Water is obtainable only at the summit from melted ice or snow in the cracks and from scattered water holes along the forest edge.

Most of the historic activity, however, with a few exceptions has occurred along the two rift zones or ridges and at the summit crater, and all of the flows since 1881 have commenced within a relatively small area along the southwest rift a few miles above Puu o Keokeo, though generally preceded by an eruptive period of several hours at the summit.

The establishment of a net of triangulation about the whole mountain similar to the Kilauea net would be of immense value for future study, but the expense of surveying such a net would be more or less prohibitive. Astronomic azimuth observations would have to be made, a base line measured, the present transit replaced by a repeating or direction theodolite, and the net carefully connected to the recent inter-island triangulation by the Coast Survey. However, small independent nets spanning the most active parts of the rift zones as well as the summit crater would not be prohibitive in cost, and like the small Kilauea net would be readily subject to periodic remeasurement and hence comparative study. Extension to these nets of the existing levels could be made and vertical displacement measured from time to time.

Mauna Loa as a whole presents a problem of absorbing interest as yet practically untouched. Some sort of auto road to the summit and one from the Kona side to the southwest rift would go a great way towards overcoming the obstacles encountered by any one attempting observations on the mountain. The roads would also open an entire new field to the tourist. Seismograph and tiltmeter stations would be established at critical points and proper attention given them.

With its present inaccessibility Mauna Loa can be perhaps best studied through the means of small triangulation nets connected by levels and the construction of tiltmeter stations with a tiltmeter devised which would record its readings at the distant Observatory and require but infrequent field inspection. Dr. Jaggar is at present working on plans for such an instrument.

The Puna District and Hualalai have been scenes of recent severe shocks and also present fields for the study of tilt problems.

The above notes represent an outline of some of the work the Observatory has done in the past and what the writer hopes to take up in the future in the investigation of the horizontal and vertical movements or tilt of the ground about the several active volcanic regions in Hawaii.

E.G.W.

KILAUEA REPORT No. 1023

WEED ENDING AUGUST 30, 1931

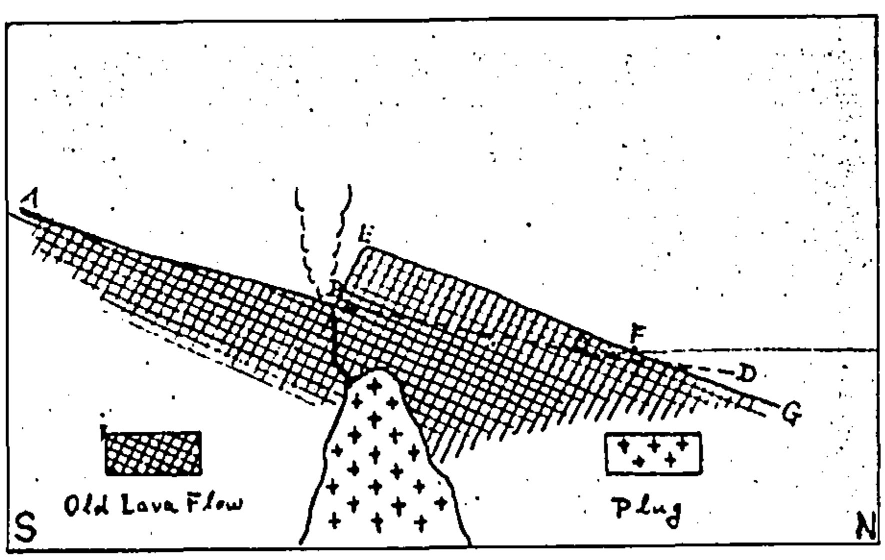
Section of Volcanology, U. S. Geological Survey

T. A. Jaggar, Volcanologist in Charge

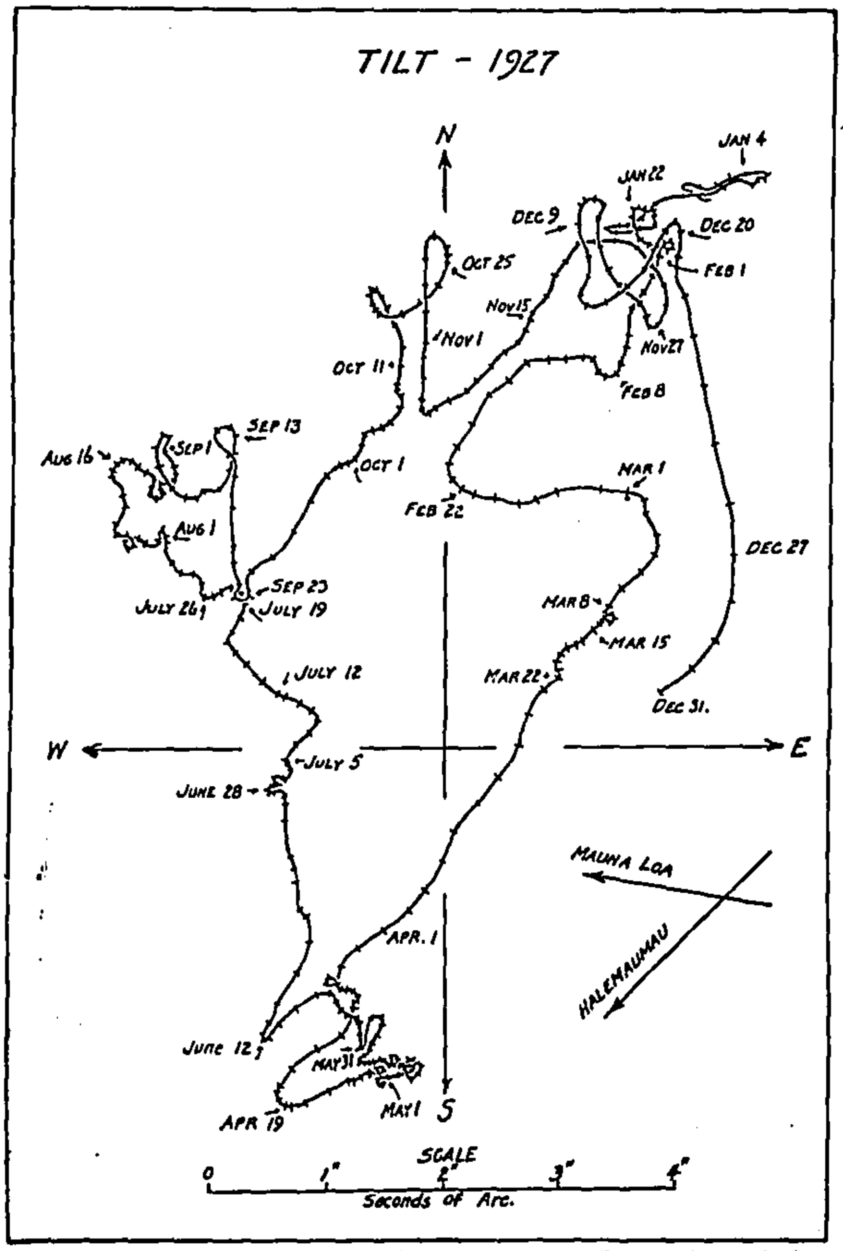
At Halemaumau pit slight fume was observed rising from a sulphur spot on the north side of the 1930 cone on the afternoon of August 23. Steam was notably absent August 24. A slide from the wall occurred about 9:40 a. m. August 26, and fume was observed on the floor. About 7 a. m. August 30, soon after the moderate earthquake recorded below, an avalanche at the pit on the northeast side sent up a thick cloud of dust.

The seismographs at the Observatory registered 19 tremors and 4 local seisms. Of these one at 2 a. m. August 25 was very slightly perceptible and indicated distance of origin 14 miles. A stronger earthquake was felt generally on the island at 7:53 a. m. August 30, dismantling instruments in Kona, Hilo, and at Kilauea, indicating distance of origin 15 miles from Kilauea and 35 miles from Hilo. It was felt as a slight and prolonged tremor near Kilauea, and more strongly in Hilo, Olaa, and Kona. The facts suggest an origin under the northern part of Mauna Loa, and this is confirmed by the vertical component seismograph which indicates an origin northwest of the Kilauea Observatory.

The average tilt for the week was moderate to the N, and microseismic motion was slight.



Profile of north slope of Usu Volcano in Japan where during a single eruption the block shown was lifted 500 feet and the whole mountain was affected by elevation and tilting. After Ouinoue.



Tilt diagram, Hawaiian Volcano Observatory, for 1927. On the scale in seconds shown, the line beginning January 1 in the northeast corner indicates daily amounts and directions of changes of a plumb line for the year, with tilting to the southwest in spring and to the northeast in autumn. The data are caculated from seismograph records. The bend northwest July 8 corresponds to an outbreak of Halemaumau the previous day. Arrows indicate directions of Mauna Loa and Kilauea from the Observatory. Comparing January 1 and December 31, net change for the year was four seconds south.

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The Volcano Letter

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No. 350—Weekly — Hawaiian Volcano Observatory, National Park, Hawaii — September 10, 1931

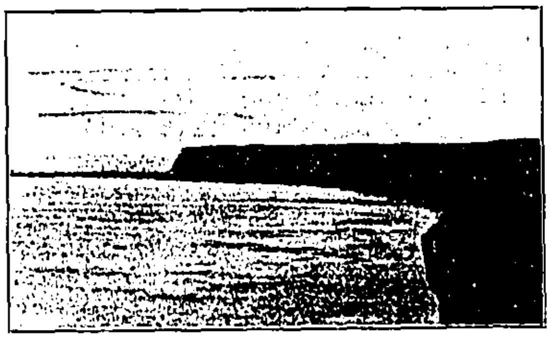


Figure 1. Looking north along the west-facing fault cliff, north of Ka Lae, Hawaii. In the main cliff may be seen the edges of many lava flows. The top of the lava cliff is backed by a gently-sloping terrace, back of which is a low cliff cut in loess. Back of the loess cliff is gently rolling loess grassland. In the distance, at the left, is down-faulted western block. Photo H. S. Palmer.

LOESS AT KA LAE, HAWAII

Ka Lae, the southermost point of the Island of Hawaii, may be reached by leaving the main highway about four miles west of Waiohinu, and driving southward about twelve miles over secondary roads. One first goes through the Kamaoa homesteads and then across open, strongly wind-swept grasslands to the Lighthouse Reservation at the extreme tip of the island. Ka Lae is bounded on the west by a west-facing fault cliff which, though low at the south end, increases in height inland to 500 feet or more (figure 1). The fault cliff extends inland at least ten miles from Ka Lae and is said by fishermen to extend also some distance southward under the sea. The block west of the fault has sunk and has thus formed a depression into and along which lava flows have poured on several occasions within historic times. The block east of the cliff, in contrast, has been freer of lava flows in recent times because of its greater elevation. Its coastline runs northeastward from Ka Lae and has been built out into the sea by prehistoric lava flows.

The block east of the fault cliff is entirely covered by variable thicknesses of a fine grained, yellow-brown material. In some places this has been drifted into sand dune ridges which parallel the direction of the prevailing trade wind (see figure 2). Along the top of the big fault cliff this upper fine grained deposit has been cut back slightly from the edge. This forms a small secondary cliff in which different layers of the upper material are exposed.

At many places there are small lenses of coaly or carbonaceous material at horizons in the little cliff which are below the present surface. Each coaly lens represents an accumulation of vegetable matter in a chance depression in what formerly was the land surface, but which has since been buried by new layers of silt. For the most part, nothing can be made out as to the nature of the plants that supplied the vegetable matter, but one block was found bearing the clear impression of a dicotyledonous leaf. The presence of the leaf print, as well as the presence of the coaly lenses, proves that the fine-grained material has been carried in in some way, and that it is not a residual soil formed by the weathering of the lava in place. Moreover, the fine-grained material rests on rather fresh lava rock and does not show the transition from surface soil to fresh rock, through various degrees of weathering, that residual soils show. Since wind is the only transporting agent that can be conceived of as having operated here, the material is properly classified as loess, a term that was originally applied in Germany to fine-grained wind deposited sediments.

For some miles east of the Lighthouse Reservation at Ka Lae, the actual shore line is of lava rock, largely pahoehoe lava. It is exposed as a rather uneven rock terrace, in places submerged and in places making a clifflet two or three feet high along the water's edge. The terrace rises inland to heights of four to six feet above sea level, and is from ten to a hundred feet wide. Back of the lava terrace is a single or compound loess cliff. In the few places where it is a single cliff it is in general about six feet high. Where it is a double cliff, the lower cliff is about four feet high and exposes a red-brown loess. The upper cliff is four to eight feet back of the top of the lower cliff and is about two feet high. It is composed of yellow-brown loess. In places there are low dune ridges of sand a short way back of the top of the upper cliff and resting on the finer-grained, yellow-brown loess (see figure 3).

The upper cliff is protected at its upper part by a good turf, the roots of which effectively bind the top few inches of loess and greatly retard its erosion. The lower part of the loess is not thus bound and therefore is readily cut away by windblown sand. Thus the turf layer is slowly undermined and is forced to collapse by the removal of its support.

In many places the red-brown loess cliff is double instead of single. The top of the lower red-brown cliff seems to be due to the slightly greater resistance to erosion offered by the remains of an old turf layer (see figure 3).

The ability of the lower or red-brown loess to resist erosion presented a different problem, for it lacks the protective network of roots, except at the one horizon mentioned in the preceding paragraph. Samples were taken near the top and near the base of the yellow-brown layer, and near the top, near the middle, and near the base of the red-brown layer. The samples were numbered from 1 to 5, in the order just named. Fair-sized portions of each were weighed and then dried to constant weight at 108° C., to determine the amount of moisture they contained. Smaller portions of each were then weighed out and leached with a fairly large volume of distilled water to extract the soluble salts. The extract was then analyzed

Figure 2. Low, grass-bound sand dunes, between and around which the road wanders, about five miles north of Ka Lae. Photo H. S. Palmer.

for chlorine, and the equivalent salt content of the original sample calculated. The results of these determinations are given in the following table.

Moisture and Salt Contents of Loess Samples from Ka Lae

Sample number	Position of sample	Per cent water lost at 108° C.	Per cent salt (NaCl) in sample
1	Top of yellow-brown loess	4.64	0.79
2	Base of yellow-brown loess	13.72	1.26
3	Top of red-brown loess	24.40	5.31
4	Middle of red-brown loess	22.36	5.46
5	Base of red-brown loess	21.62	2.16

It is clear that the red-brown loess is much moister than the yellow-brown loess. Except for its basal portion, it is also saltier than the yellow brown. The conclusion seems inevitable that salt water is carried up by capillary action into the red-brown zone. The upper limit of capillary rise appears to be the top of the red-brown loess. There appears to have been some reaction of the salt which has oxidized the iron of the loess so that the red-brown color has developed. The nature of the reaction is not known, but is presumably like the proverbially bad rusting of iron by salt spray. The new iron compounds thus formed seem to cement the red-brown loess a little and thus to give it some resistance to erosion.

Reference to the table will show one inconsistency in the preceding discussion, for the base of the red-brown loess is less than half as salty, though almost as moist, as the middle and top parts. One might expect the base to be the saltiest and moistest as it is nearest to the source of supply of salt water. A reasonable explanation of the greater saltiness above is that, as capillary action raises water and its dissolved salt, subsoil evaporation removes the water and leaves the salt behind. Thus there is a progressive accumulation of salt to such depth as evaporation can reach. In the lowest layer exaporation is virtually inoperative and no such concentration of salt has taken place.

The slightly greater moisture content of the middle and top as compared with the base of the red-brown loess is perhaps due to some retention of water by the hygroscopic action of the salts.

The accumulation of the loess has taken place in part since the occupation of the Hawaiian Islands by human beings. At one place, a hundred feet or so east of the Lighthouse Reservation, there is exposed in the loess cliff a pavement of wave-rounded bowlders. That they got here through the activity of human beings is shown (1) by their rather regular arrangement, (2) by the fact that the pavement consists of only one layer of bowlders, and (3) by the fitting of coral fragments into the chinks between the lava bowlders. All of these features are characteristic of the platforms made by the Hawaiians so often along the shores for use in ceremonies in connection with fishing operations. Waves would not select bowlders of such uniformity of size; they would not select coral for chinking; and they would not make a uniform layer only one bowlder deep. Clearly the platform is man-made, yet it is overlain by loess, so part at least of the loess has been made since the platform was made and therefore since human occupation of Hawaii.

The horizon of the bowlder pavement or platform is traceable as a somewhat pebbly and shelly layer for about a hundred feet. The pebbles and shells may well have been scattered by the persons who made and used the platform. If so, it is a sort of fossil kitchen midden.

It happens that the bowlder pavement lies between the yellow-brown and the red-brown horizons of loess. This may be purely accidental, but *it may be that the coarse* layer breaks up the capillary channels so that the reddening and cementing actions are stopped at their level.

The fact that the loess cliff is within ten to a hundred feet of the water's edge suggests that it is a wave-cut cliff. However, on July 12, 1930, there was a place at which some initials had been cut in the red-brown loess cliff. The date was illegible as it had been cut away by a little vertical groove due to run-off from above. At other places the cliff was similarly grooved. It appears, then, that waves are doing less at such places than is run-off. One might expect the energy of storm waves to be dissipated largely in crossing the lava rock terrace. In ordinary weather waves do not come near the cliff, even at high tide. Where the lava bench is narrowest (see figure 3) the loess is being cut back by storm waves, it would seem, and makes a single cliff in both the red-brown and yellow-brown loess layers.

Outcrops of the loess on top of lava rock are continuous along almost all of the shoreline from Ka Lae northeastward to Kaalualu. Puu o Mahana, three miles northeast of Ka Lae, is a tuff cone, the seaward part of which has been cut away by waves. Loess makes a rather deep mantle on its lower windward slopes, but seems not to have lodged readily on its upper windward slopes nor on its leeward slopes. Whether any loess underlies the tuff is not known.

About a mile and a half northeast of Ka Lae there is a young flow of aa lava, which divided a mile or so inland and reached the shore as two flows, leaving a kipuka in between. Underneath the southwestern of the two arms there is some loess, the precise relationships of which were not ascertained. This loess is believed also to underlie the northeastern arm of the aa flow. Much fuller observations were made on a similar occurrence of loess beneath another young lava flow about half a mile southeast of Kaalualu.

On the west side of Paiahaa Bay, the small bay just west of Kaalualu Bay, the shore line is cut for some distance in a pahoehoe flow which has the usual somewhat irregular upper surface. On this pahoehoe flow lies a bed of loess with a smooth wind-made upper surface. Since the lower surface of the loess follows the irregularities of the upper surface of the pahoehoe flow, the thick-

Figure 3

The ridge forming the sky-line is a sand dune ridge, resting on the yellow-brown loess, which extends down to the level of the man's belt. The separation of the loess horizons is lost in the shadow behind the man. At the left of the picture the uppermost clifflet is in yellow-brown loess, below which *are two clifflets in red-brown* loess. The lowest clifflet is in front of a broad bench and leads down to the terrace cut on pahoehoe lava. Quiet pools of sea water occupy depressions in the pahoehoe terrace. At the right, coral fragments and shells have been piled against the loess cliff. Photo H. A. Powers.

ness of the loess varies from eight to ten feet. The loess bed and the underlying pahoehoe curve downward in both directions till they are hidden beneath a heap of boulders at the foot of the cliff. This loess is older than most of the loess along the Ka Lae-Kaalualu shoreline. At a typical point its red-brown, lowest zone is about two feet thick and reaches an elevation of about seven feet above sea level. It is overlain by about six feet of loess which shades upward from darker to lighter yellow-brown. The topmost six-inch layer of the loess is very dark gray, in fact nearly black, in color because the vegetable matter that it once contained has been charred or carbonized by the heat of the pahoehoe lava that flooded over it.

Immediately overlying the loess is a pahoehoe flow about three feet thick; on this there is an aa flow, also abou three feet thick; and at the surface there is about two feet of loess which is continuous with the layer of loess that is so extensive. Perhaps the two lava flows are of approximately the same age as the artificial bowlder pavement at Ka Lae for the thicknesses of both the overlying and the underlying loess deposits are about the same at both places.

The lower loess deposit is much weaker than the overlying pahoehoe flow and has therefore been cut back farther so that for a distance of about a hundred feet the pahoehoe overhangs as a ledge with an average width of two and half or three feet. Thus between 250 and 300 square feet are exposed, which give some clues as to the nature of the older loess at the time that the pahoehoe lava flooded over it. A rather cursory examination revealed over 30 molds of trunks and limbs of trees. Half a dozen of the molds are vertical and represent growths which the pahoehoe surrounded but did not destroy. The largest of these erect molds has an elliptical cross-section which is 10 by 12 inches at a level 12 inches above the former ground level. The tree that made the mold had a gently fluted trunk. The other erect molds are from one to four inches in diameter. The erect molds extend through the three feet of pahoehoe but are capped by the overlying aa. They imply, without doubt, the existence of half a dozen trees or saplings in the 250 or 300 square feet.

Prostrate molds greatly outnumber the erect molds, and represent either dead wood that was lying on the ground or stems and trunks that were knocked over by the advancing lava. They range in diameter from one to three inches. One prostrate mold is two inches in diameter and five and a half feet long. Since some of the prostrate molds may well be the relics of trees that were alive until they were pushed over by the advancing lava it seems probable that the 250 or 300 square feet bore more than the half dozen that are definitely implied by the erect molds. There must, therefore, have been a fairly thick cover of trees at this place. This conclusion is supported by the presence of much charred vegetable matter in the black loess immediately underlying, far more than could be produced by the charring of the turf that now grows in this region.

We can reconstruct the following events in the history of this small area southwest of Kaalualu. Soon after the eruption of the lower pahoehoe flow volcanic activity ceased temporarily and was succeeded by wind work which brought in 8 to 10 feet of loess. The loess formed a fertile soil in which a fair growth of trees took root. The climate must have been somewhat moister than it now is to permit the growth of good-sized trees. Short-lived volcanic activity followed, and made two thin lava flows, the first of pahoehoe and the second of aa. Since then there has been no volcanic activity at this particular place, and winds have brought in two feet more of loess which supports a fair growth of turf-making grass. At present, wind is adding slowly to the upper surface of the loess, and is also, with the help of waves, exposing the edges of the various rock layers as a low cliff.

I am indebted to Dr. Howard A Powers, of the Hawaiian Volcano Observatory, for much help in the field study on which this paper is based. It is in fact a question where he or I should have written it.

Harold S Palmer.

KILAUEA REPORT No. 1024

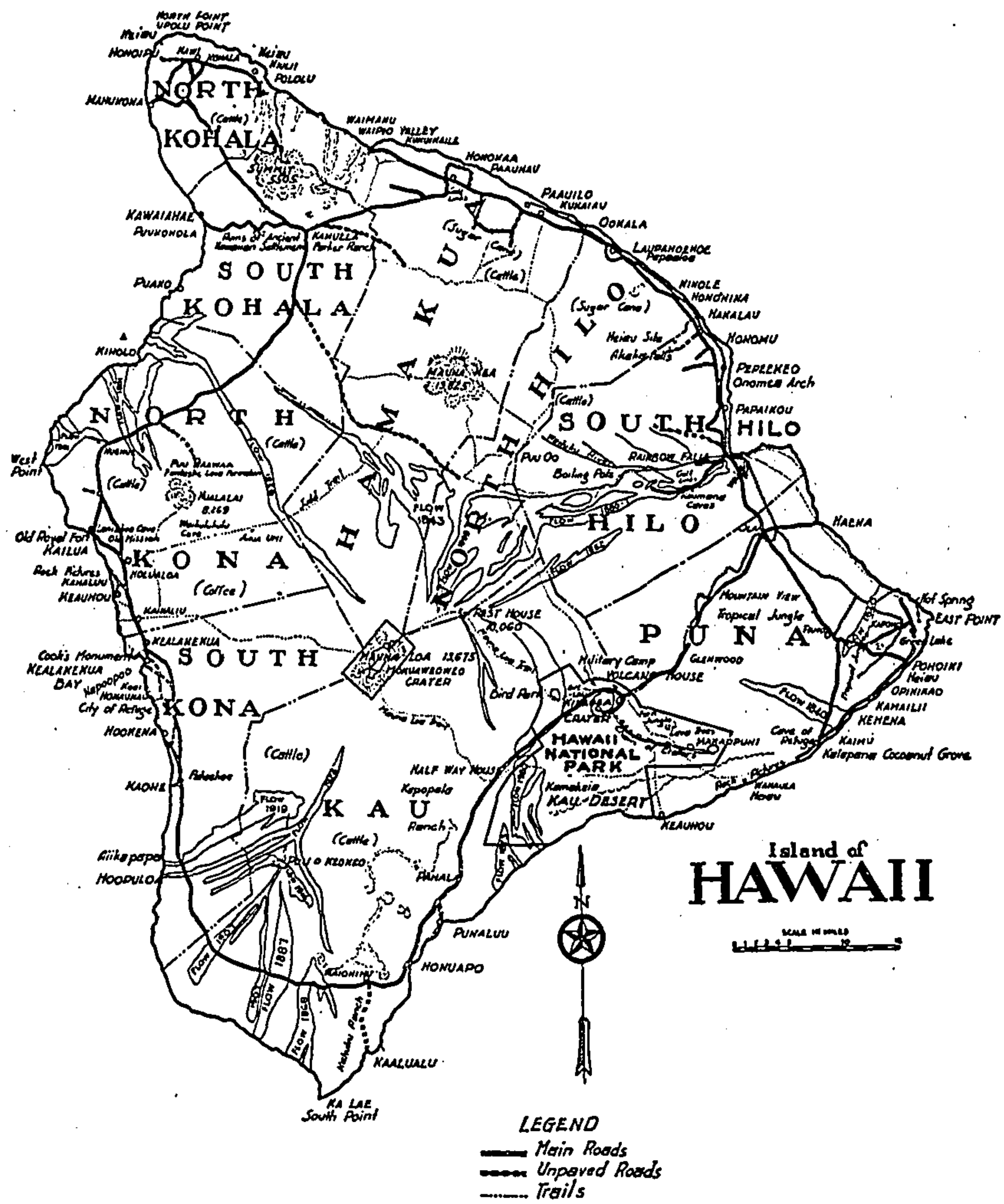
WEEK ENDING SEPTEMBER 6, 1931

Section of Volcanology, U. S. Geological Survey

T. A. Jaggar, Volcanologist in Charge

Halemaumau pit continues to remain quiet with about a dozen stained spots on the floor of 1930, one of these yellow with sulphur showing very slight bluish fume. Older spots are whitish and dead ones are brown. After rain vapor mixes with the fume and very light vapor appears at the south talus. Measurement of rim cracks August 31 showed no widening.

Three tremors at the pit seismograph about September 5 indicated slight tilt away from the pit. The Observatory seismographs on the northeast rim of Kilauea Crater registered 37 tremors, of which one was accompanied with east tilt and another lasted two minutes. Five very feeble local seisms were registered, of which three indicated origin only four miles away. Average tilting of the ground was slight SW, and microseismic motion was slight.



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The Volcano Letter

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No. 351—Weekly | Hawaiian Volcano Observatory, National Park, Hawaii | September 17, 1931

Newly acquired Engineering Building of the Hawaiian Volcano Observatory, standing back in the forest east of the Volcano House garage. Photo Maehara.

VOLCANOLOGIC OPERATIONS OF THE U. S. GEOLOGICAL SURVEY AND THE HAWAIIAN VOLCANO RESEARCH ASSOCIATION, 1930-1931

The Geological Survey covers stations at Hawaii, Lassen, Kodiak, and Dutch Harbor; the Research Association supplements the work at Kilauea with stations at Kona and Hilo. The eruption at Kilauea November 19 to December 7, 1930 added 70 feet of lava to the bottom of Halemaumau. Such eruptions have averaged one a year at Kilauea for six years. The flow from Mauna Loa in 1926 and the earthquake spasm of Hualalai in 1929 add to the evidence that the Hawaiian volcanic system is fully alive. Mauna Loa in the twentieth century has had an outbreak once in four years, so that there is reason to be prepared for live lava in Hawaii within the next year.

Lassen station reports declining tilt and earthquakes. In the Aleutian belt Pavlof, Aniakchak, and Tulik have been reported active. The circum-Pacific region has produced disastrous earthquake at Napier, Oaxaca, Managua, and in the Izu Peninsula near Yokohama, and volcanic disturbances in northwestern Argentina, not far from the south Chile volcanoes investigated by the Research Association through Dr. John B. Stone. All the disasters mentioned are close to active volcanoes.

Growth of the Section of Volcanology leads to division in subsections as follows, with T. A. Jaggar directing the work, the Kilauea laboratories of the Hawaiian Volcano Research Association serving as headquarters, and a somewhat increased staff appearing in 1931-32:

Volcanology of Hawaii

T. A. Jaggar, Volcanologist in Charge
- Observation of volcanoes
- Designing and building instruments
- Preparation of publications
- Administration

Seismology of Hawaii

E. G. Wingate, Associate Topographic Engineer, in Charge
- Correlation of leveling and tilt
- Drafting and research in maps of crater
- Recording Hilo tide data
- Special investigations of Mauna Loa
- Special topographic mapping wherever required

Seismologic routine

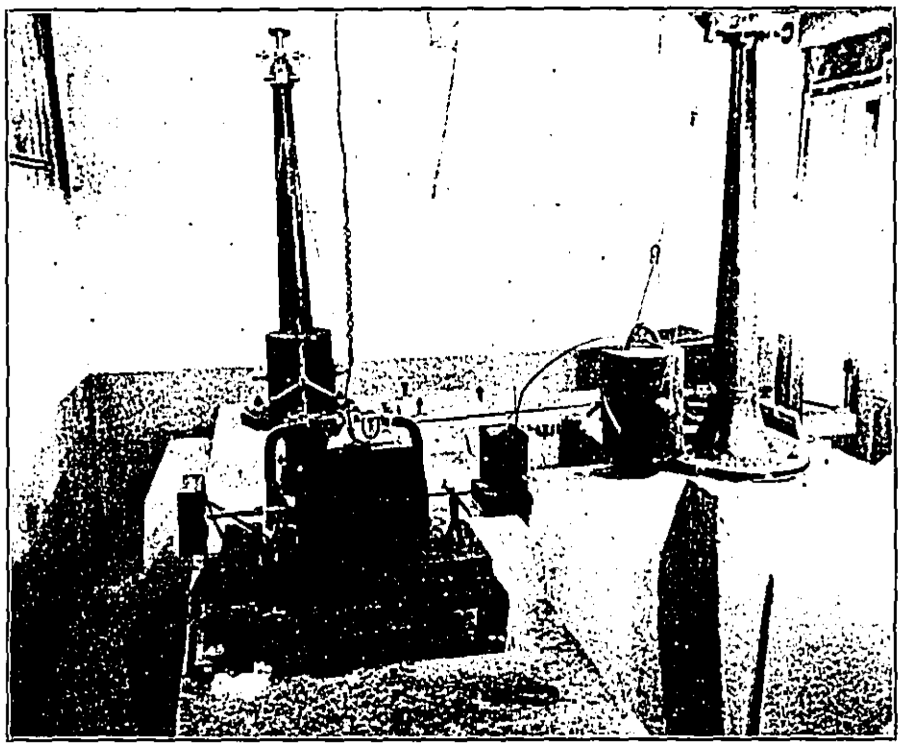
A. E. Jones, Assistant Seismologist, in Charge
- Operation of seismographs
- Measurement of seismograms
- Preparation of earthquake bulletins

Volcanologic Surveys of Hawaii

H. A. Powers, Assistant Geologist in Charge
- Field mapping of lava and ash formations
- Petrologic study of specimens and analyses

Volcanology of Northwestern United States and Alaska

R. H. Finch, Associate Volcanologist in Charge
- Operation of Lassen Volcano Observatory
- Operation of Alaska stations
- Investigation of northwestern volcanoes
- Installation of new seismometric stations



Bosch-Omori seismograph rebuilt at the Hawaiian Volcano Observatory with high-speed drum, damping tanks, both arms writing on a single smoked paper, and pen tips lifted by an electromagnet for marking minutes. This instrument has been most satisfactory for many years for registering tilt and local earthquakes in the cellar at Kilauea, and the records of this machine are the basis for new studies, of tilt, and depth and distances of earthquake origins. Photo Maehara

The Volcanologist has given a course in Volcanology at the summer sessions of the University of Hawaii for three years past, many of the students being teachers in schools in Hawaii. These persons will be useful volunteer seismologic observers. The Volcanologist represented the Geological Survey on the Naval Eclipse Expedition and studied the volcano Niuafoou in the autumn of 1930, leaving a shock-recorder there and supplying another to the Dominion Astronomer of New Zealand, Dr. C. E. Adams.

Messrs. Wingate and Jones joined the staff in July and September 1931. Dr. Powers has studied the shore line changes with Dr. Palmer, has mapped soils and loose deposits all over the island Hawaii, but especially in Kona in collaboration with Mr. J. C. Ripperton of the U. S. Agricultural Experiment Station, and has mapped in detail the lava flows and volcanic ash of the west slopes of Hualalai and Mauna Loa. As a petrologist he is studying these materials microscopically. This work of a geologist has in view extending our knowledge of the structure of Hawaii. (See Geology and Water Resources of Kau District, by Stearns, Clark and Meinzer, Water-supply Paper 616, 1930, U. S. G. S., and also Products and Structure of Kilauea, by J. B. Stone, Bishop Museum Bull. 33, 1926, Honolulu.)

The remaining members of the staff of the Hawaiian station are: R. B. Hodges, clerk and disbursing agent; Tai On Au, mechanic; H. Yasunaka, janitor; and M. F. Lacerdo, tide gauge operator at Hilo. R. V. Woods and J. B. Albert operate the seismographs at Kealakekua and Hilo.

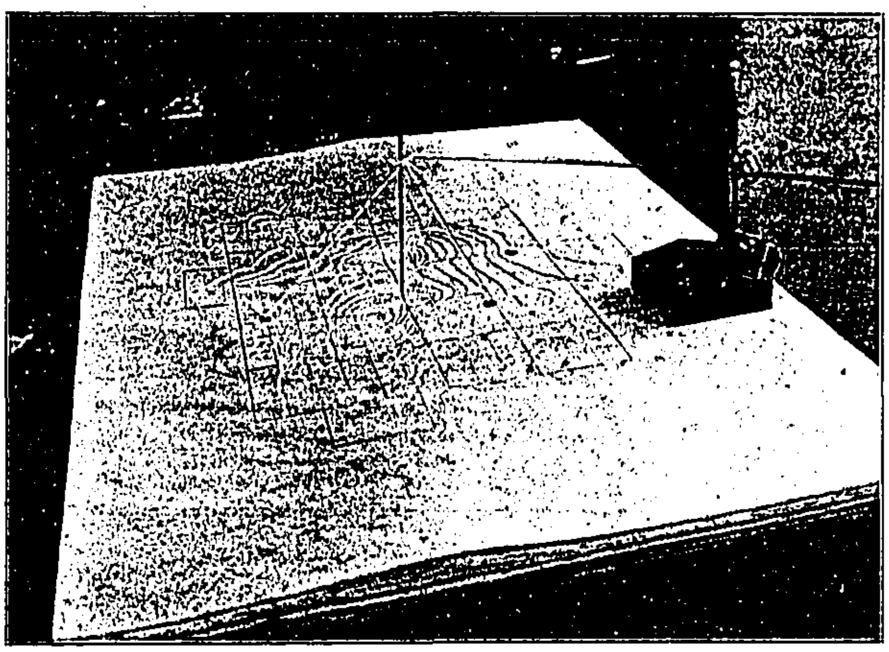
Associate Volcanologist Finch operates three seismograph stations near Lassen and with assistants studies the hot vents and the geology of old lava flows in northern California. The instrument at Mineral is operated throughout the year; those at Viola and Mount Harkness are discontinued in winter. Mr. Finch has spent the summer of 1931 inspecting the Aleutian seismograph stations, and making an exploration of Akutan Volcano and its hot crater. He left Kodiak for Seattle on September 6.

The study of local tilting of the ground in Hawaii, as correlated with faults, with earthquakes, and with volcanic centers of tumescence, has justified more men and instruments. One of the interesting developments has been the registration of "tilt earthquakes." These are seismograms of local earthquakes showing at several different instruments, not all at the same place, that the ground has tilted and offset the pens in the same direction, at the moment when the local shock occurred. In other words the creaking action of the motion of the fault block has been accompanied by a slight tipping. The direction of this tipping is a discovery of prime importance, and the coordination of many such tippings at the same place, occurring simultaneously with earthquakes, indicates the manner of action of the net tilt for a given period. It is obvious that to discover the geographic boundary of such tilting, distributed instruments are necessary, and these instruments should be simplified as much as possible so as to show graphically without computation the direction of the tilt, as well as its angular amount.

With this in view, an observation made several years ago with a small plumb line to which a vertical lever was attached was utilized in the spring of 1931 as basis for construction of a new tiltometer. The instrument was at first placed in a shallow well in concrete in the seismograph cellar of the Observatory, the device consisting of a heavy mass hung vertically on piano wires, with a magnifying boom rising vertically from the center of the mass so suspended and counterpoised that the faintest deviation of the mass as a plumb bob would be highly magnified at a pointer moving in a horizontal plane at the upper end of the sytem. This pointer is free to move in all directions in accordance with the absolute direction of tilt which disturbs the heavy mass as a plumb bob, and the linear amount of its motion radially from its adjusted center is a measure of the angle of tilt.

Another line of experimental investigation which was set in motion in January 1931 promises much for the location of earthquake centers. The determination of depth of origin for local earthquakes on the Island of Hawaii has puzzled us for many years. Mathematical methods of determining depth of origin for more distant or stronger earthquakes are in vogue in California and Japan, dependent on exact time-keeping. Omori used a simple method of determining distance by the preliminary tremor at several stations, and figuring the depth of centrum by the overlap of these distances beyond their point of intersection on a map. In other words, if the distances indicated are greater than their meeting point in plan, the origin is not in the horizontal plane, but is below the horizontal plane by the amount in which the distances are excessive. The determination of the meeting point of these lines underground, and the depth of that point below the local topography, is somewhat troublesome where a large number of earthquakes have to be investigated. The method, however, is good when the formulae for determining distance by the preliminary tremor have been checked for a given terrain.

In order to determine the depth of origin graphically by this method in Hawaii, a model was built showing the island as a hollow shell, as though the topography were seen from below. (See cut Page Three.) On this shell the several seismograph stations are accurately located and threads are carried through holes at these stations to weights hanging below. These several threads are drawn together at one point on an adjustable carrier which may be moved around until the lengths of the threads correspond to the centrum distances for a given earthquake indicated by the several seismographs. The threads are marked in miles to the scale of the model. A rod similarly marked may thus be placed against the meeting points of the threads, and this indicates vertically the depth of a given earthquake center, and the position of the epicenter, after the straight threads have been adjusted for any given earthquake. Thus the shell model (upside down) graphically exhibits the hollow space inside the island on a table, and the threads may be quickly adjusted to exhibit the point in space corresponding to the earthquake center, and their angles of emergence at the model should correspond to the angle of emergence of the earthquake wave. Tests with this model will show at once whether the several computed distances meet at a point or not, and so serve to check the theory of distance as applied to the preliminary tremor. Also the azimuth of the graphically determined center from each station may be checked against the theoretical azimuth determined



The inverse contour model of Hawaii, perforated to receive weighted threads at the spots marking seismograph stations The scriber shown has the three threads drawn together. By moving this junction point around until the three distances on the threads, on the scale of the model. correspond with the three distances to origin indicated by three seimograms for the same earthquake, the location of the centrum is determined graphically as though the observer were under the island. A brass scale rod as shown then determines the epicenter and the depth. The horizontal and vertical scales are identical in the model. Photo Maehara.

seismometrically. The preliminary trials of this graphic method for the same earthquake as registered in Kona, at Kilauea, and at Hilo have yielded promising results.

The third activity in our shops by way of seismometric experimentation has been the renewal of construction of shock-recorders as reported in 1929 in connection with the campaign of the Scientific American for enlisting amateurs in seismology, and in connection with assisting New Zealand in her earthquake difficulties. This last cooperation was given added zest by the terrible disaster at Napier in February 1931. after which the minister for scientific research, Dr. Marsden, of the New Zealand government, telegraphed to me asking for shock-recorders of my design. Through the Hawaiian Volcano Research Association, which furnished the materials, I at once set about new tests of an improved shock-recorder which registered several local earthquakes in our basement. The Research Association will supply the New Zealand government with eight of these instruments, and incidentally the Hawaiian Volcano Observatory will profit by this investigation, which is along the lines of what I did with similar instruments at Niuafoou in the South Seas on the Eclipse Expedition of 1930. Both in Alaska and in Hawaii it is becoming inceasingly evident that we need distribution of simple instruments, and in Hawaii there is a new demand through the school teachers who are distributed here, who have taken my course in Volcanology during three summers at the University of Hawaii.

The Research Association has added to the buildings of the Volcano Observatory the house shown on Page One, to be used for offices of the engineer and geologist. With this there is water supply and a garage. In addition a garage and carpenter shop have been rebuilt near the main observatory building.

A publication of interest to students of volcanology is Bulletin No. 77 of the National Research Council, "Physics of the Earth: I, Volcanology," Washington, 1931, by Day, Sapper, Friedlaender, and Jaggar. Dr. Day writes the Introduction; Dr. Sapper, "Volcanoes, their activity and their causes," covering the geographical aspects of the science particularly; Dr. Friedlaender, "The Present Condition and the future of Volcanology," reviews methods and theories; and Dr. Jaggar, "The mechanism of volcanoes," discusses experimental work, gas mechanism, and the relation of earthquakes to volcanic magma. There are long lists of references. T.A.J.

KILAUEA REPORT No. 1025

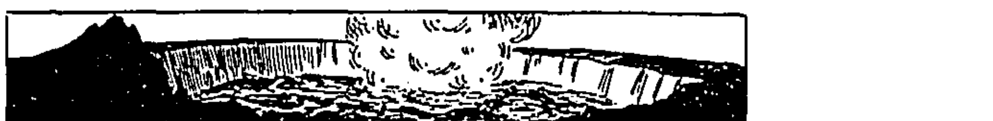
WEEK ENDING SEPTEMBER 13, 1931

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge

The bottom of Halemaumau pit shows nothing remarkable. Fume continues to emerge at a spot west of the 1930 lava pool. Vapor rises at the north end of the south talus and at the south wall above the floor. Dust rose from the pit at 9:20 a. m. September 7. The bottom fume smelled of sulphur at the southeast rim September 8. On this day new points were located at the rim cracks and an improved caliper was applied to these cracks. This work is in charge of E. G. Wingate, who has recently located *datum stations near the pit for triangulation and leveling.*

At the Observatory instruments 54 tremors were registered, but some of these may be occasioned by blasting by the road workers. One distant earthquake weakly recorded began at 10:18 a. m. September 9. One feeble local seism occurred at 5:19 p. m. September 12, was felt locally, and came from an origin close at hand. A very feeble shock was felt at 10:29 a. m. September 12. Four other very feeble seisms were registered, several showing easterly tilt, and two indicating origins very near. On September 7 nine tremors at the Halemaumau seismograph occurred in close succession, all indicating inward tilt toward the pit.

Tilt for the week at the Observatory was slight E, and microseismic motion was slight.



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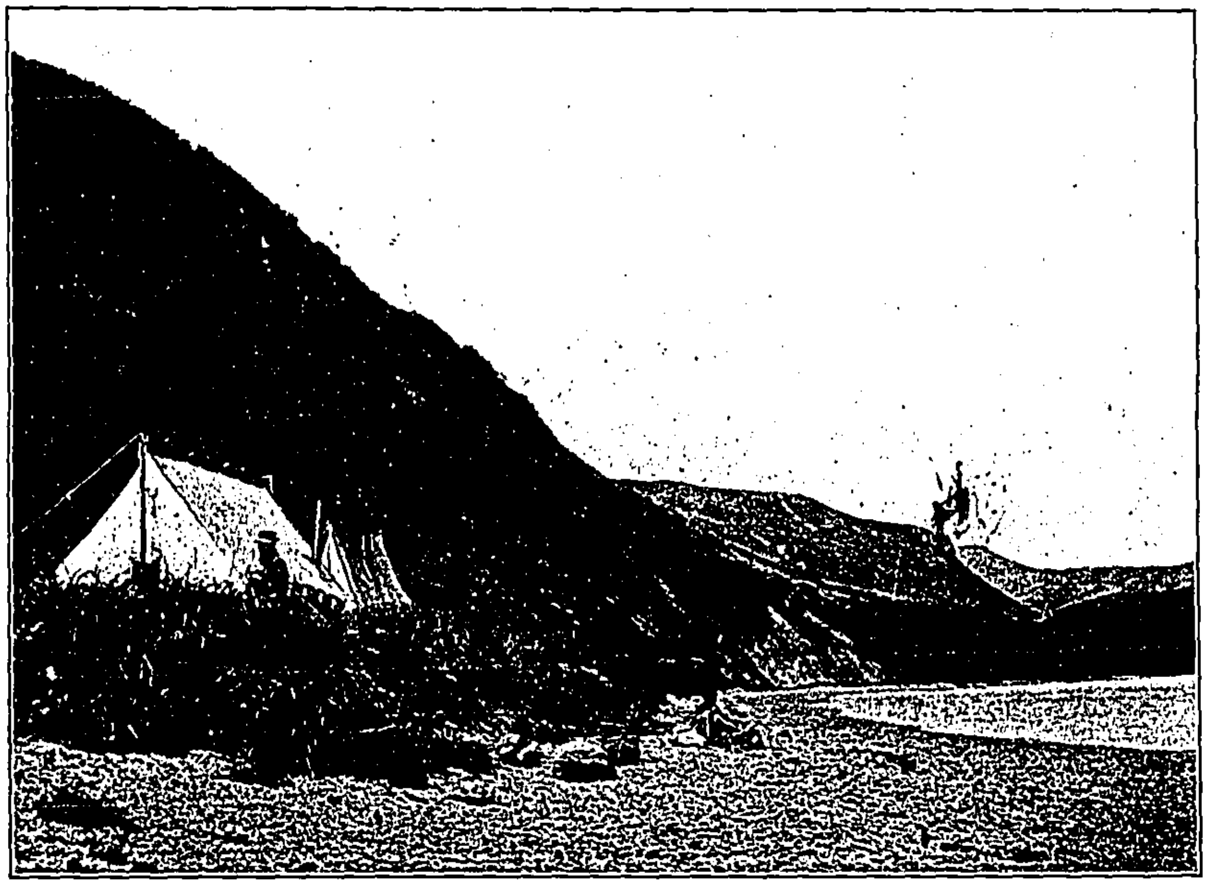
The Volcano Letter

Two dollars per year | Ten cents per copy

No. 352—Weekly | Hawaiian Volcano Observatory, National Park, Hawaii | September 24, 1931



A camp in the Aleutian lands showing country quite simi'ar to Akutan. (Captain Harbor, Natl. Geog. Exped. 1928)

ALEUTIAN EXPLORATION 1931

The increase in work permitted to the Section of Volcanology of the U. S. Geological Survey by Act of Congress in 1931, as shown in the organization outlined in Volcano Letter No. 351, is based in part on recognition of the importance of the Alaskan Peninsula and the Aleutian Islands. These are essentially a long interrupted line of volcanoes, many of them active, adjacent to the great Aleutian Deep where many major earthquakes occur. This is an extension of the series of Japanese and Kamchatkan volcanic arcs, and offers a most fruitful field of study, in which at present it is possible to do only the barest preliminary work, but this work should be done as a foundation for more systematic and detailed investigations in the future.

The Lassen Observatory will expand its work in the volcano areas of California and Oregon, and during each summer, field work is provided for, on one of the volcanoes of Alaska, combined with inspection of seismograph stations at Kodiak and Dutch Harbor. The volcano on Akutan Island was selected for exploration this year and Mr. R. H. Finch did the work, taking with him as guide and packer John Gardner of False Pass.

Akutan is the volcano, like Stromboli, which is often seen smoking by mariners, on the left of Unimak Pass as the ships for Nome pass through to Bering Sea. It is not far from the middle of the Aleutian arc, counting Iliamna as the easternmost volcano far up the Peninsula. The peaks of Akutan are 3170 and 4100 feet high. The island is 17 nautical miles long, and it lies next NE of Unalaska Island. As a volcano it is relatively accessible as compared with great snowy peaks like Shishaldin, it is close by Dutch Harbor, it possesses a village, a harbor and a whaling station, and close at hand is the hot sulphurous deposit of Akun Island. It is just north of the 54th parallel and in longitude 166° west.

Mr. Finch took the steamer "Catherine D.," thanks to the courtesy of the Pacific American Fisheries of Bellingham, leaving that port July 1, 1931. Arrived at King Cove, the seat of one of their salmon canneries, near the west end of Alaskan Peninsula, he embarked on the mail steamer "Starr" July 16, Gardner joined him at False Pass, and the two disembarked at Akutan July 17. Two ascents were made to the summit crater, and on the second the party was caught in a fog cloud, which is a serious matter in these mountains.

The ascent of July 24 proved very interesting and Mr.

Finch secured some good photographs. The crater is some two miles in diameter with a cone about 600 feet high near the center. "The cone is quite uniformly hot, though but little steam is escaping. The heat appears as a dry heat. The outer crater contains a lake in the southwest side. On one side of the lake there is ice, with small icebergs breaking off occasionally, while the temperature of the water on the other side averages 119° F., with small localities showing even higher temperatures, and there is boiling action."

"One vent in the central cone is still open. Rumbling was heard on August 11. Very recent lava flows occur in the crater."

Finch reports that he secured the services of Alec McGlassan, a resident of Auktan, to act as additional packer for a trip around the island on foot during the first week in August. Many photographs were obtained and most of the island was sketched topographically. A Jaggar shock-recorder was operated for ten days on Akutan, but on July 26 no earthquakes had been recorded so far.

Finch sailed on the "Starr" for Unalaska August 10th, inspected and overhauled the needs of the seismograph at *Dutch Harbor, operated at the Naval Radio Station, then* returned to Akutan on the "Victoria" August 16th. This gave him two days more to finish operations on Akutan, which island he left for the trip back to Kodiak on the "Starr" August 18th. He remained at Kodiak overhauling the seismograph there, in charge of Mrs. M. V. Watkinson, until September 5, when he sailed for Seattle on the Admiral Line steamer. His full report on the mapping of Akutan and the seismological work, with photographic illustrations, will be awaited with interest. T.A.J.

IMPROVED JAGGAR SHOCK-RECORDER

The photograph on Page Four shows a new form of the shock-recorder described first in the Scientific American, November, 1929. The original machine was set up horizontally, as though left side of picture were the bottom, a 10-pound lead cylinder being cast about two flat blades clamped in a vertical plane. This made a sensitive small horizontal pendulum hung like a door, with the blades as hinge, and a boom extending out from the weight has a brass pen pivotted at its outer end resting on a smoked cardboard disc. A common clock movement rotates the disc and moves itself along slowly so that a day's registration is like a gramophone record. The disc is changed every day, and fixed with shellac. The disc itself is a timepiece for subdivision into minutes.

This machine was of great service counting the hundreds of earthquakes that occurred near Hualalai in 1929. It was tested in the South Seas in 1930 and some models like it have been made in New Zealand. In Niuafoou I set up two complete weighted arms and clockworks at right angles to each other on the concrete floor of a warehouse. As each box was three feet long, this took much space. The object was to record separately east-west and north-south earthquake motion. There was also recorded the motion of rats, kittens, chickens, cockroaches and spiders, and these were not planned for. The apparatus must therefore be housed in a tight case, and tending such an extensive machine each day on the floor is laborious. Horizontal surfaces of the smoked cards are hard to examine and are tempting to insects.

An improvement in the machine, with the principle of action but slightly changed, is shown in the cuts. The cylindrical mass has its two flat hinge blades clamped horizontally below, the boom protrudes upward, and the recording disc is in a vertical plane like an ordinary clock. The pivotted pen on the top of the boom is arcuate and long, and may be tipped over against the smoked card at about 45 degrees to the disc surface. The blades are stiff enough to give the system a free period of nearly one second with only about one eighth inch of spring blades exposed between the lead cylinder and the clamps. At this period the inverted pendulum is stable and upright. If the exposed part of blades is shortened the period becomes shorter. This inverted pendulum system oscillates only in the azimuth at right angles to the hinge line, which was also true when the system was swung as a horizontal pendulum.

The advantages of the new system are that the clock can now roll along on pulleys on a rubber-shod track in the plane of the clock-work wheels. These pulleys are attached to the spring barrels and given a diameter appropriate to the travel-speed desired. The center sleeve of the disc plate slides on the minute-hand spindle, so that the card makes one revolution per hour. The whole apparatus is enclosed in an upright clock-case with glass front (not shown) and screwed against the wall. The boom is of balsa wood. The clock may be slid sideways on its tracks so as to move the disc under or away from the pen. When disc is removed the clock is wound, a new disc is smoked and screwed by a central button to the plate, and is slid back to the starting position under the pen. With a steel point the date and the time of starting and stopping are marked on the smoke. The card is smoked by twirling it over a smoking kerosene lamp until it is an even brown. The rear suspension of the clock is a free pulley on a second track. The pen and the top of the boom may be seen at the right in the cut on Page Three. A final advantage of this machine is that in the corner of a room two complete shock-recorders may be set up at right angles on the two walls, with their two dials side by side. Obviously the handling of the discs is easy, and almost no floor-space is required.

Several earthquakes have been registered and the seismograms are good. It is necessary to choose a very quiet cellar wall, as the instrument is extremely sensitive to the opening and closing of doors. T.A.J.

KILAUEA REPORT No. 1026

WEEK ENDING SEPTEMBER 20, 1931

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge

There are no essential changes in the bottom of Halemaumau pit. There is a little fume on the floor and vapor at the edges of the floor, and these increase in visibility after rain. Measurement of the rim cracks shows little change.

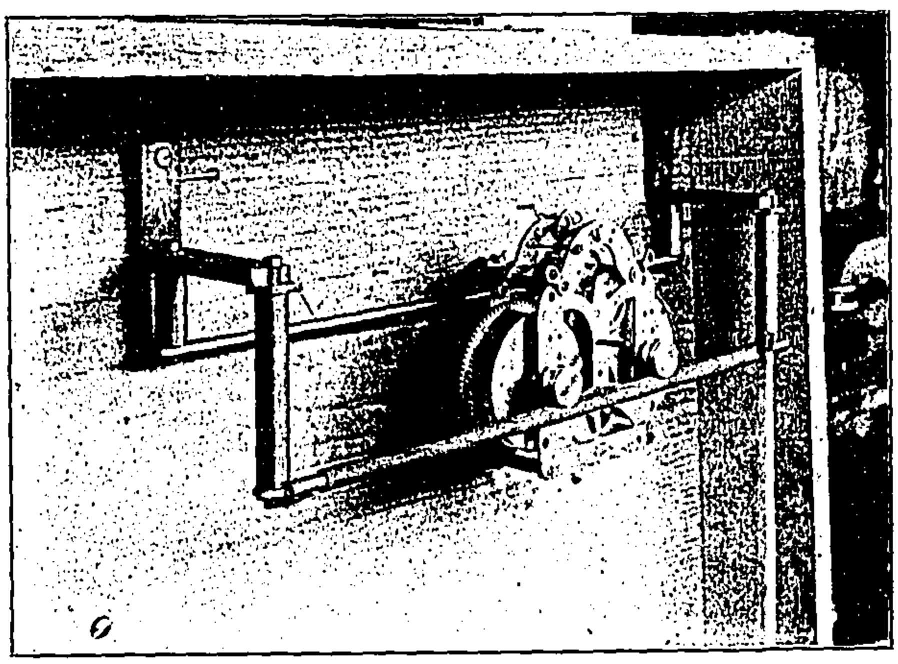
The seismographs at the Observatory registered 43 counted tremors, of which three were continuous, and one of these spells lasted from 6:33 to 7:50 p. m. September 20. There were many smaller tremors September 18.

Two feeble earthquakes were felt at Kilauea at 4:23 a. m. September 18 and 6:14 a. m. September 19. These indicated origin distances of six and four miles from the Observatory. The first was accompanied by tilt away from the pit at Halemaumau. Neither was observed in Kona, and the indications suggested Kilauea origins. There was one very feeble quake September 14. Tilt for the week was slight NE, and microseismic motion was slight.

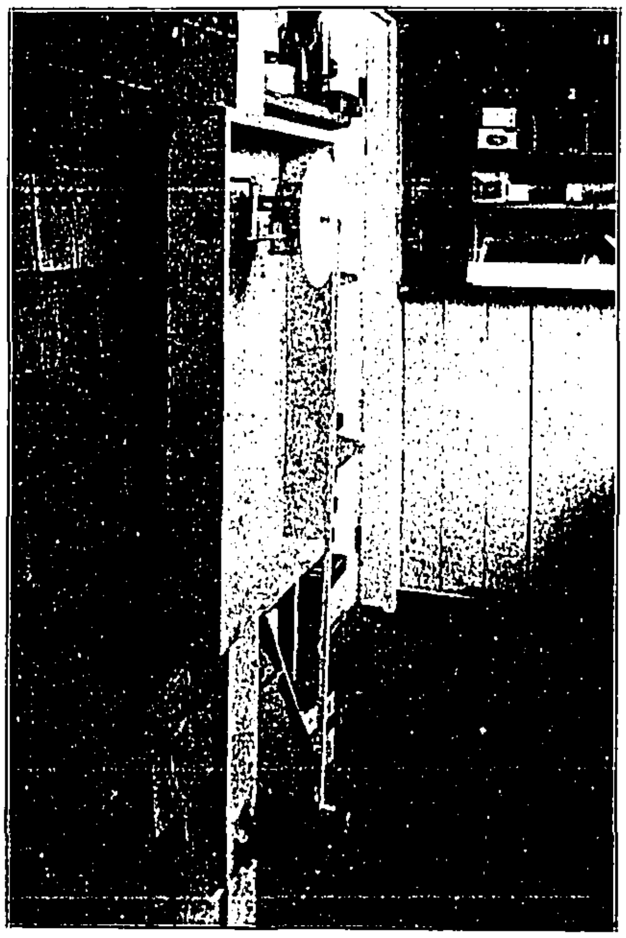
TILTING OF THE GROUND FOR AUGUST

The following figures show the net amount of tilt by weeks at the Observatory on the northeast rim of Kilauea Crater, and its direction, computed from the daily seismograms by platting a curve smoothed by overlapping seven-day averages. This is the departure of the plumbline in seconds of arc, in the direction given.

August 3-9	1.3 seconds NE
August 10-16	0.4 second W
August 17-23	1.4 seconds NNE
August 24-30	1.0 second WSW



Seth Thomas clock on tracks with Jaggar shock-recorder boom and pen on right. A card disc is affixed to the central spindle, and the pen falls over on its smoked surface recording time and size of earthquakes. Photo Maehara.



New model Jaggar shock-recorder without case. Cylindrical weight below attached by flat springs to angle-iron clamps on wall. Boom and pen rise from weight, to write on revolving disc above. Clock and disc move along slowly so as to write circle in circle like a gramophone. An earth shock writes a zig-zag, and the clock disc times the occurrence.

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No. 353—Weekly Hawaiian Volcano Observatory, National Park, Hawaii October 1, 1931

Gorely Volcano seen smoking during its eruption January 1, 1931. View from Petropavlovsk, 67 km. from the volcano. The summit of Gorely is behind the range, and the conspicuous cone is Vilutchinsky, which is nearer. Photo I. Larin.

KAMCHATKA VOLCANOES IN 1931

Professor P. T. Novograblenof, Director of the Kamchatka Museum at Petropavlovsk, under date June 24, 1931, has kindly sent us the accompanying photographs and a description of volcanic activities in Kamchatka during the winter and spring. This material is of great value as hitherto the world of science has heard but rarely from this great volcanic region. In Volcano Letter No. 314 it was noted that the Academy of Sciences of U. S. S. R. is doing volcanological work in Kamchatka. Also the eruption of Gorely Volcano was mentioned, lasting from September 1929 to March 1930 and covering much of southern Kamchatka with ash. Also there was activity of Kluchevskaya and Shiveluch in 1929 and 1930. An excellent account of travels in Kamchatka, 1920-22, with two valuable maps and numerous photographic illustrations has been published in German by Sten Bergman entitled, "Volcanoes, Bears, and Nomads" (Strecker and Schroeder, Stuttgart, 1926).

The active volcanoes of Kamchatka extend NNE-SSW along the eastern side of the peninsula, and near the middle of the belt is Kluchevskaya in the midst of a mighty group of volcanoes rising to a height of 4,861 meters. About 60 km. to the south lies Tolbachinsky Volcano. Petropavlovsk, the capital, with a population of something over a thousand people, is on the north side of a bay in the southeastern part of the country, and across the bay from it to the southwest the southern end of Kamchatka is occupied by a belt of great volcanoes, and this is prolonged farther south in the arc of the Kurile Islands. Several of these big cones are in full view from Petropavlovsk, the most conspicuous being the pure cone of Vilutchinsky Volcano shown in the photographs. The white steam from Mutnovsky shown in the photograph on Page Three is about 66 km. from Petropavlovsk, where the picture was taken.

The following is an account by Bergman of his visit to Mutnovsky Volcano:

"On this day we reached an elevation of a thousand meters on the volcano which is here surrounded by a lava plateau which extends as a shoulder around the greater part of the volcanic mass. Here we were at the upper limit of vegetation, where the last scrubby alder thickets gave out. The crater of Mutnovsky lay on the other side of the cone, and we had now to follow this shoulder around the mountain until we were immediately under the crater.

"Toward evening a mischance that we had most feared occurred: the weather which during the day had been misty, closed in dense and it began to rain. Impenetrable clouds veiled the entire mountain. We were in a waste of lava, where there was not a stick of wood, and where it would not do to be overtaken by night. So we climbed down through rain and fog to the upper limit of the bushes and found after a long search a small thicket where we succeeded in pitching our tent, and after much labor ignited a fire. Since, however, our silk portable tent was not adapted for plateau rains, particularly where there was no opportunity to draw the surfaces tight, we were soon as wet as though we had been immersed in a lake with our clothes on. In order to give the drops of rain as little chance to accumulate as possible, we sat huddled together surrounded by our sleeping bags and rain coats throughout the entire night, and had abundant time to repent us of our sins. I thought of my warm bed at home in Sweden, and during the long hours of this sleepless night had opportunity to appreciate how little we realize our blessings.

"Not until morning did the rain cease, but the fog still hung over the mountain, though not so low as on the preceding day. We saw nothing of the volcano, but the plateau shoulder of lava was free from cloud. We were about an hour getting a fire to going so that with its help and numerous cups of tea we acquired some warmth inside and out. We were not afraid of catching cold for we had long since proved that we were quite immune to such disease in that fine air free from bacteria. If it were not so it seems probable we would never have gone home to Sweden.

"After ridding ourselves of our wet clothes and donning from the packsacks some relatively dry ones, we were ready for the march. The weather cleared and a fresh breeze sprang up so that after some hours our outer clothing became perfectly dry.

"We had not proceeded far before the first bear appeared and I attempted to photograph him. He headed straight for us. Taking advantage of the unevennesses of the ground and crouching down, I succeeded in getting within 20 meters of him and made an exposure with my camera in one hand and the rifle in the other. As soon as I snapped the shutter the bear saw me and made off. Above the bushes the snow-buntings appeared, fluttering about and showing up sharply and beautifully in contrast to the black lava. We gave the day to studies of birds and enlarged our acquaintance wth them as compared with another volcano previously visited. The birds of the two volcanoes were strikingly alike.

"Just as on the previous evening we pitched our tent in the uppermost alder bushes, but we had made good headway toward the crater after this day of trudging across the treacherous lava waste. On the following mornng it was still cloudy, but the volcano was clear. We could have no question about the position of the crater, whence rose a frightful column of smoke. We headed for the crater at once, which was about 500 meters above our camp ground and 3 to 4 km. away. The sun came out during our climb and showed us a completely new and magnificent landscape, which had been hidden from us during the days of fog and rain.

"The nearer we came to the crater the more noticeable was the smell of sulphur, so that finally breathing was difficult, and made us all cough, including our little dog Kuma. In places fume came out of cracks in the ground which was so porous that it seemed as though we might break through and burrough underground like a sand crab. The extraordinary colors of the ground varied from sulphur yellow to deep red. At last we stood on the rim of the gigantic crater, the smoke of which we had so often seen from the window of our house in Petropavlovsk. The crater is not quite at the summit of the volcano, so that we could climb still farther and from above look down obliquely at the colossal spectacle; a frightful cauldron of boiling vapor. From this lava pinnacle we were able to see still more: adjacent to the smoking crater there was a still larger abyss where far below we saw a glacier and a small waterfall. These were several hundred meters down, and the cliff above them was almost vertical. Then the fog closed in on us and it was with great difficulty that we made our way back to the vegetation line."

Mr. Eric Hulten, botanist of the expedition, on another trip after waiting for many days for clouds and rain to cease, succeeding in reaching the crater with his party and in getting a better view of Mutnovsky and its outlook. The smoking crater lies on the west rim of a large cauldron, and the party followed a small ridge on which stands a number of knobs. From the highest of these the clouds were seen rolling in from the sea, and the volcanoes were beginning to don their cloud caps.

"It was a wild and wonderful panorama. Not less then 14 big volcanoes were in sight, from Schupanowa, ten miles north from Petropavlovsk, down to Kambolnaja, the southernmost volcano of Kamchatka. For a time the smoke of the crater blew directly over us, and a fine dust rain fell consisting of milky drops, which made small white spots on our clothing, presumably sulphur.

"As the wind veered and the smoke went in another direction we obtained a view that I shall never forget. It was as though we were permitted a glimpse of the workshop of the gods, where gigantic forces are at work such as began millions and millions of years ago when the first strokes of creation fashioned the earth. White jets of steam shot whistling and blustering out from holes in the cliff, hot water ran down from the walls and melted its way through a glacier whose sharp-edged broken green and crevassed blocks of ice were heaped together in a jumble at the mouth of a huge canyon that led away from this Hell cauldron. In the midst of the ice two mighty steam jets arose, and through the crooked tunnels that had been melted out of the ice one could see the bedrock of the mountain. Higher up the cauldron wall where its edge stood several hundred meters above the glacier the younger crater belched its smoke upward, as though a thousand locomotives were clustered together opening their safety valves—and yet we knew that this was but a weak imitation of what Mutnovsky once was.

"And how describe the cliffs themselves? They had not the common gray color of a mountain, but were painted over in fantastic shades. We sat on a minor cliff of bright colors which gave place below to a terra cotta precipice, and showed on the right a row of sharp pointed gray-blue pyramids which stood on an underpinning of white spotted with baked dark carmine and indigo blue points. Beyond the wall of the kettle was bright blue with big yellow areas of pure sulphur, which were bordered with green and orange rings. All of this, along with the gray-white rifted snow covering of the glacier, on which diamond shaped small black pyramids were strewn, and also the sharp green-blue ice pinnacles, left us with a memory never to be forgotten. Bornachoff, one of our companions, who had never known fear, became suddenly very anxious and careful, and it was with difficulty that I persuaded him to follow us down the yellow-white cliffs of the gorge. Possibly there awakened in him a trace of the terror his ancesters felt for the 'smoking mountains' that one dared not approach too near, lest the 'Gamuli,' the mountain spirits, might be cooking their whales, which nighttimes they go down and fetch up out of the sea, one on each finger, and flying bear them home.

"The stream pouring out below was buried under snow and ice blocks, and we reached the tunnels and got under the upright walls which lead down into the crater, out of the rifts of which small and furious jets of steam escape. There rose a thin knife-edged slice of rock out of the ice, from the walls and base of which hundreds of steam jets shot up. Warm water ran down carrying red-brown mud, and a grayish-yellow brook broke its way through the ice, the melted green walls of which could be seen transparent behind the vapor. The jets of steam so hissed and roared that it was necessary to shout in order to be heard. In such an environment one may believe anything, and none of us would have been astonished to look up and see an ancient mountain spirit of the Kamchadals sitting astride one of these cliffs holding out a whale on a spit wherewith to cook it in a steam jet.

"This devil's canyon under the glacier was near the summit. The veil of smoke hid whatever the crater might conceal in its depths, but there was no lava lake nor incandescence, but rather numerous holes some hundreds of decimeters across as sources of jets of steam."

1931 ACTIVITES

During the winter three big volcanoes, Tolbachinsky, Kluchevskaya, and Gorely, were in activity, all situated on the eastern shore of the peninsula.

Tolbachinsky, elevation 3730 m., had a magmatic explosion March 4, 1931. Its cone and the vicinity were covered with ash. In the village Tolbachik, 41 km. from the volcano, the ash was a few millimeters thick.

Kluchevskaya, elevation 4861 m., had a severe eruption on March 25, 26, and 27, 1931. All day March 25 this beautiful volcano was quiet, but after sunset in the village Kluchi, 32 km. from the crater, was heard a crash, and then a column of fire appeared upon the summit. The rumbling increased in successive periods of noise, and during the night the volcano thundered and several loud explosions were heard. In Kluchi next morning ash fell and the air darkened. The volcanic ash and sand were falling during three days. All traveling by dog sledge became impossible. The strip of country covered with ash on top of the snow was 240 km. long and 50 km. wide; the average depth of the ash was 1 cm.; therefore during this short eruption Kluchevskaya threw out approximately 120 million cubic meters of ash on the northern side only.

Professor Novograblenof describes the ash as consisting of freshly broken pieces of different sizes, a small portion of them appearing rounded as though melted. There are pieces of lava glass and pumice and fragments of the minerals pyroxene, magnetite, plagioclase, and colored undetermined substances.

Gorely Volcano, elevation 1831 m., has continued in activity since 1929. In the summer of 1930 it was more or less quiet, but in the autumn its eruptions were renewed. For example, on September 30, 1930, it threw out clouds of vapor and ash in large quantity. The dark blue masses of ash fell in South Kamchatka over a vast area. January 1, 1931, the column of gases and ash over the summit of Gorely was more than 5,000 meters high. The eruption lasted until January 17, when the column was 6,000 meters high. The volcano smoked like a battleship (cut Page One). The smoke extended toward the northeast for a distance of more than 90 km. (cut Page Three). There was some reflection of fire seen on the summit. When the atmospheric pressure was very low the activity increased.

Mr. V. S. Kulakof, geologist of the Kamchtka volcanological expedition under Professor A. N. Zavaritsky, visited Gorely in May. He states that on the summit there are five and possibly six craters. Only one of these, 250 m. in diameter, is in activity, and no lava flows poured from this last eruption. Bombs, lapilli, sand and ash fell. Ash was falling mixed with snow. One hundred meters from the edge of an eruptive crater a thermometer thrust into ash showed -2° C. Under the ash there were layers of snow. The bottom of the crater could not be seen owing to the clouds of fume rising from the chasm. We are greatly indebted to Professor Novograblenof for this information.

T.A.J.

KILAUEA REPORT No. 1027

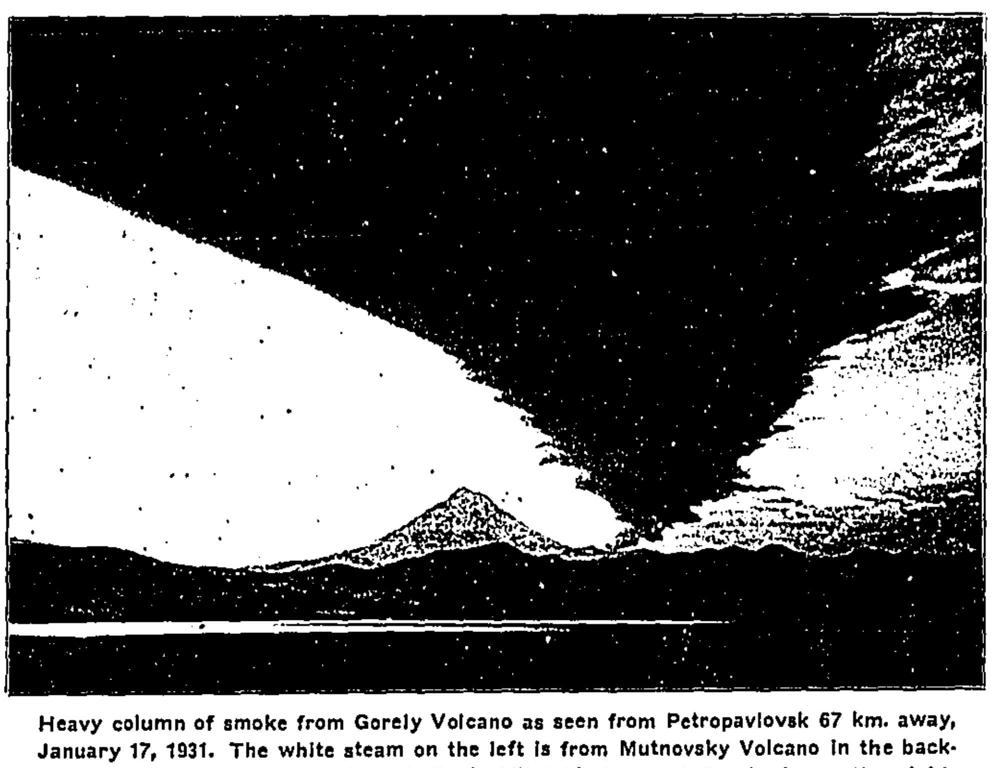
WEEK ENDING SEPTEMBER 27, 1931

Section of Volcanology, U. S. Geological Survey

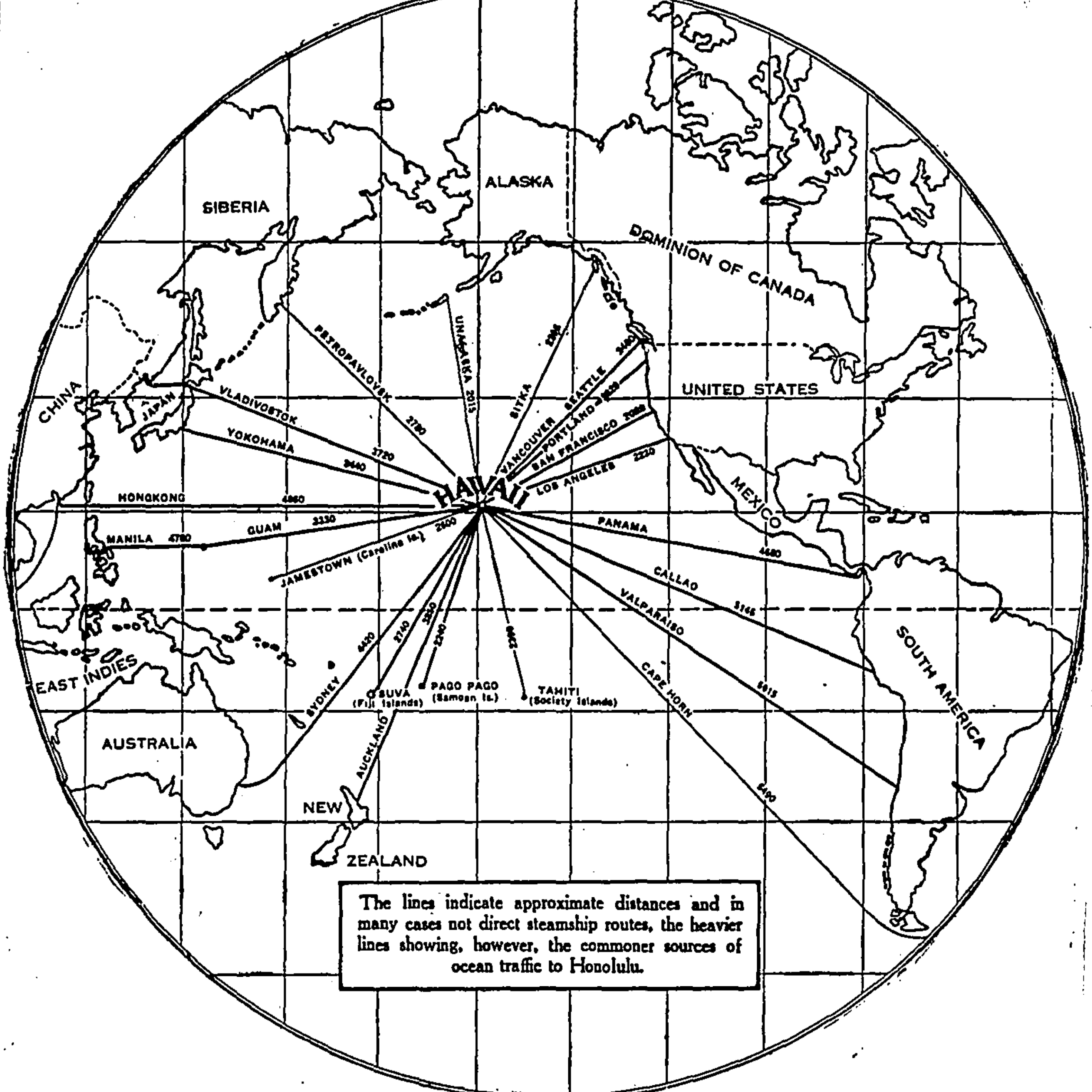
T. A. Jaggar, Volcanologist in Charge

At 10 a. m. September 21 there was very little fume at the sulphur spot on the floor of Halemaumau and what there was appeared to emerge in puffs. A very little vapor came out of the rock of the wall of the pit southeast just above the bottom. Measurement of rim cracks showed no widening. There have been no other changes during the week. Surveys are in progress to determine a profile of the pit which may be used when lava returns.

The seismographs at the Observatory registered 26 tremors, of which one was prolonged, and two were accompanied by easterly tilt. One doubtful distant earthquake was weakly recorded at 3:15 a. m. September 21. Four very feeble local seisms were registered, showing tendency to easterly tilt and origins very near. Tilting of the ground for the week was slight E and microseismic motion was slight.



Heavy column of smoke from Gorely Volcano as seen from Petropavlovsk 67 km. away, January 17, 1931. The white steam on the left is from Mutnovsky Volcano in the background, the sharp cone in the middle is Vilutchinsky, and Gorely is on the right. Photo I. Larin.



Map of the Pacific showing position of Kamchatkan Peninsula.

THE VOLCANO LETTER

The Volcano Letter combines the earlier weekly of that name, with the former monthly Bulletin of the Hawaiian Volcano Observatory. It is published weekly, on Thursdays, by the Hawaiian Volcano Research Association, on behalf of the section of volcanology, U. S. Geological Survey. It promotes experimental recording of earth processes.

Readers are requested to send articles, photographs, publications and clippings about volcano and earthquake events, instruments and investigations, especially around the Pacific.

Subcription for non-members two dollars per year of 52 numbers. Address the Observatory.

September 10, 1931

The Director,
National Park Service,
Washington, D. C.

Dear Mr. Director:

The following is a report of activities and operations in Hawaii National Park for the month of August, 1931.

000 <u>General</u>

020 General weather conditions

August in the park was generally fine and cool. There were 26 days on which there was .01 of an inch or more precipitation, the total for the month amounting to 4.89 inches, as compared with 24.46 inches during August last year, and an average for the past thirteen years of 6.28. The total rainfall to date is 34.79 inches, as against 71.50 last year, and a normal of 66.09. The maximum temperature was 77° on August 15, and the minimum 54° on August 11. Prevailing winds were the trade winds from the northeast. Nearly every day was partly cloudy. Full details are shown on Weather Bureau Form 1009 attached.

100 <u>Administration</u>

110 Status of work

The office work was heavy during the month because of construction activities being carried on and additional services being rendered to park visitors. The annual report to the Director of the National Park Service was submitted on August 14, and an annual report submitted to Governor Lawrence M. Judd on August 7. A map showing proposed road and trail improvement and construction for the office of the Chief Engineer has been delayed because of lack of maps. These were recently received from the Geological Survey and the report called for will soon be ready. Considerable time and attention was given to the description of and appraisal of rental value of quarters, and also to a report on roads and trails jobs that might be continued to provide further employment during the rest of the year.

120 Park inspections by

121 Superintendent

The superintendent made periodical trips to Hilo on park business during the month and kept in close touch with the road construction under the Bureau of Public Roads, as well as buildings and trails, etc. being constructed by force account. On August 9 a trip was made over the Mauna Loa trail as far as the Giant Koa. Bird Park was visited three times during the month. On

August 17 a three-day trip around the island of Hawaii was made to study road conditions and accommodations offered travelers, as well as to become familiar with the points of interest. A detailed report of this trip was submitted on August 25. A horseback trip was made from the Uwekahuna Observatory to Mauna Iki past the lava flow of 1920 and Kipuka Pepeiau, to Hilina Pali, 22 miles, where a truck met us and brought us back to headquarters. Ranger Christ and Park Naturalist Doerr accompanied me on this trip, which was for the purpose of inspecting a new section of the park over which a trail has been marked by ducks of rocks, but only the first six miles are constructed.

On August 30 a trip was made to Kalapana with Engineer Wheeler of the Bureau of Public Roads and Resident Engineer Handley with a view to looking over the road system and studying the proposed Kalapana-Hawaii National Park road.

130 Finance and accounts
The following is a list of the funds appropriated for work in Hawaii National Park with the unexpended balances shown as of the close of August 31, 1931.

Symbol	Name	Allotted	Expended	Balance
41/2415	Hawaii National Park 1931-'32 - -	$52,130.00	$36,097.51	$16,032.49
41/2406	Forest Protection & Fire Prevention 1931-'32 - - - - - - - - - - - -	100.00	100.00	0.00
41/2405	Emergency Reconstruction & Fighting Forest Fires Natl. Parks, 1931-32	200.00	200.00	0.00
40/1415	Hawaii National Park 1930-31 -- - -	34,625.00	34,624.49	0.51
40/1406	Forest Protection & Fire Prevention 1930-'31 - - - - - - - - - - - -	990.00	989.00	1.00
40/1405	Emer. Recon. & Fighting Forest Fires Natl. Parks, 1930-'31 - - - - - -	17.25	17.25	0.00
4X456	Roads and Trails, National Parks, no year: - - - - - - - - - - - -	376,806.30	18,721.75	358,084.55

150 Equipment and supplies
The principal items of new equipment received during the month were 12 one-quart and 8 pint-size Pyrene fire extinguishers, and one rocker and one straight chair, two dressers and one bed table. The principal supplies purchased were the cement, lumber, millwork, plumbing, roofing, fixtures, water tank material and paints, etc. for the second four-room cottage, job No. 418. Six Ford batteries were purchased for the electrical plant at the museum, lumber for culverts, and other minor items.

Arrangements were completed for the Hawaii National Park and the Geological Survey to purchase gasoline under the Navy contract at a cost of $.105 per gallon. The local bid was $.16. This results in a saving of $.055 per gallon and on 9,000 gallons to the Park Service means a saving of $495, and on 2,800 gallons used by the Geological Survey, a saving of $154. A special price of $.12 per gallon on kerosene oil was secured, as compared with a price of $.19 last year. This is a saving of $.07 per gallon which, on 2,500 gallons used by the park amounts to $175 and on 300 gallons used by the Geological Survey amounts to $21. Great savings will also be made on lubricating oil also purchased under the Navy contract.

170 Plans, maps and surveys

A telegram was sent to Chief Landscape Architect Vint on August 31 urging return of revised plans for the commissioner's residence in order that we might keep our carpenter force steadily employed. We are also waiting for the revised plans of the new administration building.

180 Circulars, placards, publicity bulletins, etc.

Copy of the July issue of Hawaii Nature Notes is attached. Articles in these notes have been printed by some of the papers in the islands and a large mailing list has been secured with new requests coming in every few days. It was necessary to make 100 additional copies of the first issue in order to supply the demand. The weekly issues of the Volcano Letter published by the Volcano Research Association are also inclosed.

200 <u>Maintenance, Improvements and New Construction</u>

210 Maintenance

The usual maintenance and repair of roads, trails, bridges, buildings, etc. was carried on during the month.

220 Improvements

The road from Uwekahuna Observatory to Halemaumau firepit, which was badly damaged by a heavy rainstorm in July, was repaired with part of the special allotment of $200 made available for this work, and considerable further improvement in the road made from roads and trails funds and with the cooperation of the Bitulithic Paving and Concrete Company. The road was widened, drainage ditches constructed along the sides, wooden culverts were put in at the most necessary places, the surface was smoothed up and the grades reduced. The section of the road from the pit to the first pali was graveled. This road has been heavily traveled since the contractor started improvement between the Fern Jungle and Thurston Lava Tube, as the construction work has made the road very rough and difficult to drive over. The contractor expects to use this road when hauling stone from the rock quarry because it will save him a haul of about three miles, and for this reason he cooperated in its improvement. This road has been recommended as a logical unit in the road system here at headquarters and the recommendation has been concurred in by Chief Landscape Architect Vint. I am hoping that in some way funds may be provided to build this four mile unit while our other roads at headquarters are being rebuilt and improved, so that the job can be finished at one time.

230 New construction

231 Kilauea headquarters

Roads: As has been previously reported, the Bitulithic Paving and Concrete Company were very slow in getting started on the job. There was considerable delay in starting to work and for a long time afterward work was carried forward with a small gang and insufficient equipment. The necessary machinery finally arrived and was put into operation. The camp for housing and feeding the men was erected on the site of the old Crater Hotel just outside the Hilo entrance to the park and was finally opened up on August 12, after 77 days of the contract time had elapsed. Work is now progressing very satisfactorily although costs are running excessively high. This will probably be corrected as soon as a capable foreman has been placed in charge.

The power shovel has completed the rough grading in all cuts of any size between Stations 135 and 177. Practically all of this material was handled without the use of explosives. It consisted mostly of volcanic cinder. Some basalt was expected to be encountered in this area. While this has not affected the balance of material for balance points seem to be working out very nicely, [redacted] it may have some effect upon the road foundation and it may be found necessary to place some sub-base in this area.

Telephone line: With materials and supplies on hand, the park rangers constructed a metallic telephone line from the Devil's Throat to Hilina Pali, installing telephones at Kipuka Nene, where a small trail shelter was put up, and at Hilina Pali. This is a very valuable and important extension to the park system.

Ranger cottages: Ranger cottage #2, job No. 411, was started in August and was about 70 per cent complete by the end of the month. These two employees' quarters were built from plans that were used last year.

232 Haleakala road

The Bureau of Public Roads' surveys from the park boundary to the edge of Haleakala crater completed last June, had the road terminating at the present rest house instead of at the White Hills, or Pakaoao section, 2½ miles farther, which is a much better site. The matter was taken up with Landscape Architect Vint by radio and authorization secured to make the additional surveys. I have been unofficially advised by Engineer Wheeler that preliminary estimates of the cost of this road for approximately 12.8 miles will be $660,000. The amount of money allotted for the job is $184,000.

240 Improvement of approaches to park

Haleakala section: The contractors latest estimate on this approach road to the Haleakala section is that it is 60 per cent complete.

Kalapana-Hawaii National Park road: The Board of Supervisors of Hawaii desires to have this road included in the road projects to be built under the Federal 7 per cent system, in which case the money spent by the county will be matched with an equal amount of Federal money. This plan is advocated by the Hawaii Tourist Bureau, Former Governor Farrington, and other prominent and influential people. However, Governor Judd has taken exception to the item of $30,000 in the present bond issue for extending the Kalapana road on the ground that it is not essential at this time and that the funds might better be diverted to the rebuilding of bridges on the Hamakua coast road. For many months there has been a rather bitter controversy over the roads that should be included in a revised Federal aid system, and has been particularly bitter over the allotments to the various islands of the $880,000 authorized for Federal aid projects by the last Congress. This money does not have to be matched by an equal amount of Territorial money, as it is a matching by the Federal Government of funds expended by the Territory for road construction before the Territory was entitled to share in Federal aid money. As the

Kalapana road is an approach road to the Hawaii National Park, recommendations were made to the Bureau of Public Roads that it be included in the Federal aid system, as well as the road from Kailua to the Kau entrance, a distance of about 65 miles. While the former road has not yet been constructed, the latter is a part of the main belt road around the island, which passes through the park and it is an important approach road because a large percentage of park visitors take the complete tour of the island. The road between Hilo and the National Park is already a Federal aid road and is the best road on the island of Hawaii at the present time.

300 Activities of other agencies in the park

310 Public service contractors

The Kilauea Volcano House is doing a consistently smaller business than in 1930, having handled 870 guests this August as compared with 1060 last August and 1550 in August 1929. To date there has been a decrease of 2,033 guests compared with last year. There has been no improvement in the character of service rendered to the public as requested by the Government and apparently the company is not inclined to do anything at this time.

On August 13 former Governor Wallace R. Farrington made a very fine radio address over station KGMB urging better hotel facilities for the Hawaii National Park. He contrasted the facilities here with those elsewhere in the United States and particularly in the other National Parks, and he outlined the problem as a community problem.

The Kilauea Summer Camp operated throughout August with a very small number of guests in spite of the advertising campaign carried on this year. While the camp was authorized to close on August 31, I understand that it is remaining open until September 15.

General Mose H. Sherman, president of the Los Angeles Steamship Company, visited the park for a few hours on August 26. It was purely a vacation trip with his family and he was reluctant to talk of business. Mr. A. G. Budge, vice-president of Castle and Cooke of Honolulu, accompanied him. I lunched with the group and took them on a brief tour of inspection of the park, pointing out the many improvements that the Government was making, and outlining the plans for the future. I explained to General Sherman the need of better hotel accommodations for the fine class of tourists now being brought to the island and the large numbers which were to be brought by the new passenger liners now under construction, and urged that he assist in improving conditions if he could.

The price of the Matson and Lassco lines for the popular two-day tour from Honolulu to Hilo, visiting the Hamakua coast by rail and the Hawaii National Park by auto, is $64.50, and the de luxe tour, which in addition to the popular tour includes an automobile trip around the island of Hawaii, is $101. These rates are high in comparison with costs of similar mileage elsewhere.

Direct passenger service between San Francisco and Kahului, Maui, will be inaugurated by the Matson Company liners, except the Malolo, on a regular weekly schedule beginning after October 1. This is provided by a stopover of one day between Honolulu and Hilo. This provides a new and greatly improved service, not only between Maui and the mainland, but also between Kahului and Hilo, which will be equally convenient for residents of the islands and for tourists.

314 Complaints

Mrs. Charles D. Walcott, one of the members of the Board of Indian Commissioners, and affiliated with the Smithsonian Institute, complained bitterly about the poor accommodations at the Volcano House, and the excessively high rates that were charged

330 Cooperating non-governmental agencies

The Hawaii Tourist Bureau has issued a new booklet on the islands, which is beautifully illustrated.

Mr. K. C. Ingram, manager of the San Francisco office of Lord & Thomas & Logan, came to Hawaii during the month to secure approval of a 1932 travel advertising campaign in which Hawaii will spend $107,000 for space in 27 leading national magazines. While here, Mr. Ingram visited all of the islands, accompanied by Mr. George Armitage, executive secretary of the Hawaii Tourist Bureau, and spent a day in Hawaii National Park. This trip was for the purpose of becoming better acquainted with what the islands have to offer the tourist traveler.

A specimen of the Silver Sword fern from Haleakala was loaned to the Hawaii Tourist Bureau for exhibition in their new offices and it is attracting a great deal of attention.

During the last week in August the Hawaii Tourist Bureau executive board made its annual visit to all of the islands to discuss plans for advertising and to personally acquaint themselves with conditions on the islands and accommodations and attractions that are available.

400 Flora, fauna, and natural phenomena

410 Ranger, naturalist and guide service

Sixteen field trips were conducted during the month, with a total attendance of 282, and thirteen lectures were given, with a total attendance of 729. Eight hundred visited the park museum. This made a total of 1811 contacts with park visitors, which numbered 8,997. Tourist travel fell off during the month as compared with July.

On August 25 to 30 a group of 40 Chinese boys and girls from the Beretania Street Chinese Church in Honolulu camped at the public auto camp grounds in the park and were given special attention. On August 26 the Taisei Maru, Japanese training ship, docked at Hilo and the officers, cadets and crew visited the park on August 29 and 30. Special lectures were provided.

The closing of the nature study classes and their activities in the park received a great deal of publicity during August.

Telegraphic advice of the appointment of four new permanent rangers was received August 25 and all have been directed to report for duty at the earliest practicable date.

440 Insect control
Insect control work in connection with the Silver Swords in the Haleakala section was continued intermittently with the trail work under way there. A request for additional funds to continue this work was turned down because there were none available. This has prevented us from doing all that might have been accomplished but we are doing what we can with the regular park funds.

460 Birds

470 Animals
Four wild donkeys and about 50 wild goats were seen by park rangers near Pepeiau.

480 Natural phenomena
Conditions were quiet during the month at Halemaumau firepit, but the seismographs showed a decided increase in seismic disturbances. There were 98 tremors recorded during the month, and one perceptible earthquake at 4:22 P.M. August 8. These disturbances were estimated to have originated from 14 to 23 miles from the Observatory, and it is the opinion of Dr. Jaggar that their origin is under Mauna Loa. A small avalanche occurred in the pit on August 15, at 9 A.M. The tilt of the ground was NNW early in the month, changing to NE, NNE, and N.

500 Use of park facilities by the public

510 Travel
There was a total of 8,997 visitors during the month, compared with 10,594 for August last year. The total travel to date now numbers 118,103, compared with 81,628 last year. The increase, as has previously been explained, was all due to the volcanic activity last November and December.

530 Visitors

Mrs. Charles Doolittle Walcott,
1743 -22nd Street,
Washington, D. C.

Member of Board of Indian Commissioners and affiliated with the Smithsonian Institute. Visited the park August 22 and 23. Mrs. Walcott was very much interested in the flowers and took back with her some exhibit material for the Smithsonian Institute.

Captain S. Oba, Commander,
Imperial Japanese Government Training Ship "Taisei Maru" .

Visited the park August 29.

Naraji Ono, Chief Officer,
"Taisei Maru" of the Nautical College, Tokyo, Japan.

Visited the park August 29.

Mr. Richard Smart,
Parker Ranch,
Kamuela, Hawaii

Visited the park on August 18, with Mr. Frank Hayden Stuart.

Dr. Samuel B. Grubbs, Medical Officer in Charge,
U.S. Public Health Service,
Honolulu, T. H.

August 31.

Prof. E. Lawrence Palmer,
Cornell University,
Ithaca, New York.

August 22.

Prof. Harold S. Palmer, Professor of Geology,
University of Hawaii,
Honolulu, T. H.

Spent July and August in the park and nearby regions making geological investigations.

Charles Judd, Territorial Forester,
Honolulu, T. H.
August 24, with a party of five other persons.

Mr. Bernard H. Linden, Supervisor of Radio for the 6th Radio district with Mrs. Linden, visited the Park on August 24.

General Mose H. Sherman, President,
Los Angeles Steamship Company,
Los Angeles, California.
August 24.

Supervisors James Campsie and Gavien Bush and Tony Cabrinha, of the County of Hawaii, called on August 21 and conferred with the park superintendent on Federal aid roads and the Kalapana Road.

C. H. Bowman, District Supervisor of the Hawaii Board of Health, and H. K. Klemme, city sanitary inspector of Hilo, called on general health matters and to make a joint inspection, with the park service, of the camp of the Bitulithic Paving and Concrete Company.

Mr. Wendell Howe of Arcada, California, teacher of geology and botany at Humboldt State Teachers College, and a ranger naturalist in Yosemite National Park for the season of 1930, spent several days in the park early in August.

Miss Marguerite Peck, assistant superintendent of the Shriners Hospital in San Francisco, was a one-day visitor to the park on August 4.

600 Protection

610 Police protection

Because of the continued reports of house breaking and petty theivery, a night ranger patrol was inaugurated during August and there were no further complaints. Mr. George K. Richardson, chief of detectives, conferred with the superintendent on August 4 and asked the Board of Supervisors to make an appropriation to assign an officer for patrol of the residential district just outside the park. An allotment of $40 per month for four months was authorized but the appointee has not been selected. Considerable attention has been given to the contractor's camp just outside the park to prevent liquor being brought in there and to keep quiet and order, and in this we have had the full cooperation of the contractor and his staff. One of the contractor's officers has been appointed a peace officer, empowered to make arrests within the camp if necessary.

While Ranger Christ was in Haleakala, he and his crew were endangered by the action of hunters in the park who either mistook them for goats and fired at them, or were very careless in their shooting. Ranger Christ arranged to have all applications for shooting in the park filed with Forester William Crosby, as Mr. Crosby's territory adjoins the park, he has knowledge at all times of where the men are working and he has been authorized to issue hunting permits.

640 Destruction of predatory animals.

Seven pigs and 47 wild goats were killed during the month.

900 Miscellaneous

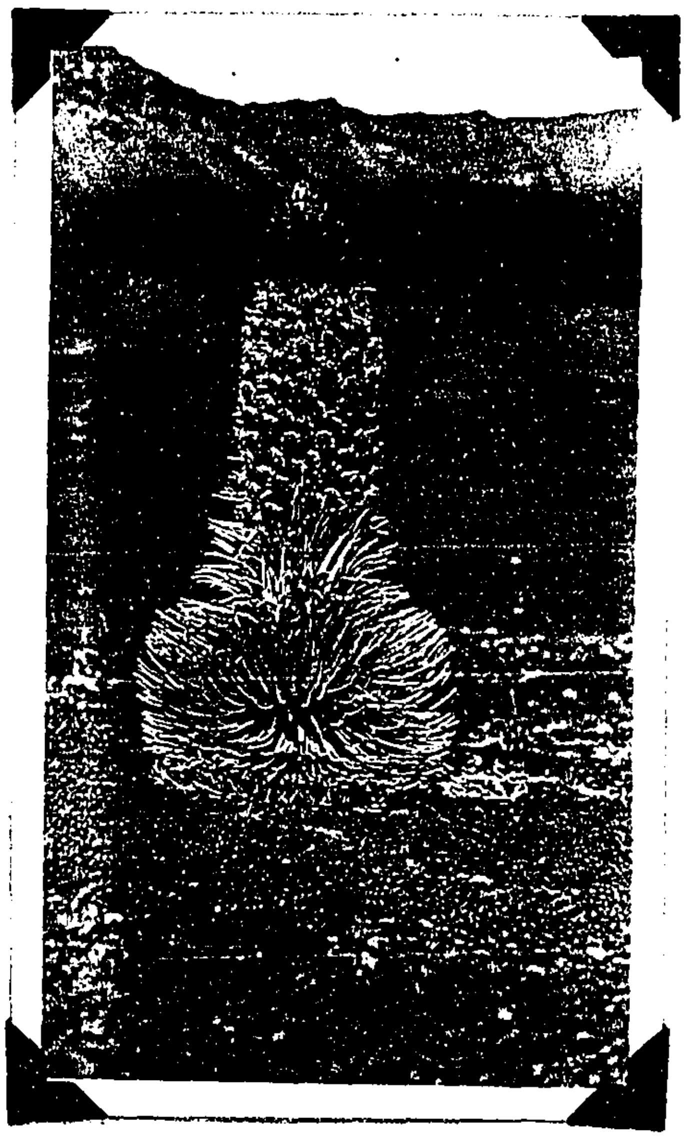
A thirteen year old Hawaiian-Japanese boy in the Kula district, Maui, died on August 1 from Bubonic plague. Dr. F. E. Trotter, president of the Territorial Board of Health, left immediately for Maui and made an extensive survey of the district. A number of rat trappers were engaged in a plan to eradicate rats from the district. This is the first case of bubonic plague to occur on Maui since 1900, although the disease has appeared from time to time along the Hamakua coast on this island. No new cases have developed nor has any evidence of the disease been found among the hundreds of rats that have been killed.

There were 10 appointed and 23 temporary employees at the beginning of August, with no additions and separations of one employee from the permanent and 14 from the temporary staff, leaving a total of nine permanent and nine temporary employees at the end of the month.

Very respectfully,

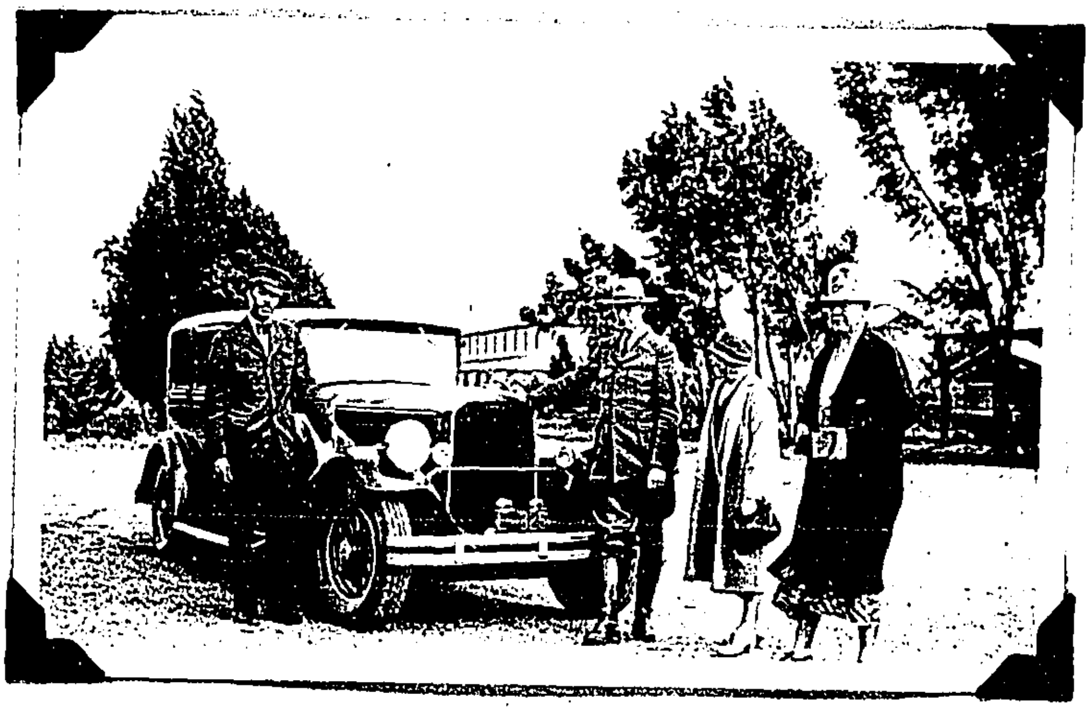
E. P. Leavitt

E. P. Leavitt,
Superintendent.



Silver Sword in bloom in Haleakala section of Hawaii National Park. This specimen is five feet high. Picture taken in July, 1931, by Ranger Christ.

Silver Sword fern in Haleakala section of Hawaii National Park covered with cheesecloth to protect it while in bloom from the trypetid fly, which lays its eggs in seed pods. The larvae feed on the seed. As the plant dies after blooming, the lack of seed is causing these rare and interesting plants to gradually disappear.



Mrs. Charles D. Walcott, member of the Board of Indian Commissioners, Washington, D. C. and her friend, Mrs. Isaac M. Cox, of Honolulu, taken at the time of their visit to the park on August 22 and 23, 1931.

10-157
(July, 1929)

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

TRAVEL REPORT

Hawaii National Park for the month of August, 1931

	This Month	This Travel Year To Date	This Month Last Year	Last Travel Year To Date	Increase for Travel Year: Number	Increase for Travel Year: Percent
PRIVATE TRANSPORTATION:						
Cars first entry, ...						
Cars reentry, ...						
Motorcycles, ...						
Total motor vehicles, ...						
Persons entering via motor vehicles, ...	7,770	106,607	9,330	68,923	37,684	.354
Persons entering via other private transportation, ...	454	3,707	420	3,005	702	
Total persons entering via private transportation, . . .	8,224	110,314	9,750	71,928	38,386	
OTHER TRANSPORTATION:						
Persons entering via ~~stages,~~ Hotel .	631	7,489	844	9,700	- 2,211	
Persons entering via ~~trains,~~ Summer Camp .	142	300				
Persons entering otherwise, . . .						
Total other transportation, . .	773	7,789	844	9,700	-2,211	
GRAND TOTAL ALL VISITORS, . . .	8,907	118,103	10,594	81,628	36,475	

	This Year	Last Year	Increase: Number	Increase: Percent
Automobiles in public camps during month, ...				
Campers in public camps during month, ...				

10-158

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF AUTHORIZED PROJECTS

HAWAII National Park for the Month of AUGUST 1931

Description of Projects	Percent Constructed To Date	Percent Constructed This Month	Percent Constructed Last Month	Probable Date Completion
411 Employees Quarters - - - - -	90	10	80	
412 Employees Quarters - - - - -	80 98	78	02	
502 Hilina Pali - Hauna Iki Ext.	95	05	90	
502 Halemau, Rest House trail Ext.	50	00	50	
502 Kipuka Bihopa Trail, Improvement and extension - - - - -	100	00	20	
502aExtension of Auto Trail Uwekahuna to Halemaumau - -	100	00	05	
Road Survey, B.P.R. Construction -	3 5	00	03	

10-159
(May, 1931)

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF PERSONNEL

Hawaii National Park for the Month of August, 1931

	This Month		This Month Last Year	
	Appointed	Non-Appointed	Appointed	Non-Appointed
Number of employees beginning of month	10	23	6	26
Number of additions	0	0	0	0
Total	10	23	6	26
Number of separations	1	14	1	5
Number of employees close of month	9	9	5	21
Number of promotions during month	0	0	0	0
Aggregate amount of annual leave taken	4	0	0	0
Aggregate amount of sick leave taken	0	0	0	0
Aggregate amount of leave without pay	0	0	0	0

10-160

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

REPORT OF PARK REVENUES

Hawaii National Park for the Month of August, 1931

	This Year	Last Year
Park revenue on hand beginning of month,	0.00	0.00
Received,	0.00	0.00
Total,	0.00	0.00
Remitted,	0.00	0.00
On hand close of month,	0.00	0. 00

Park revenues received this year to date,	50.00	0.00
Park revenues received last year to date,	0.00	
Increase,	50.00	
Per cent of increase,		

10-215
(July, 1928)

45334

UNITED STATES
DEPARTMENT OF THE INTERIOR
National Park Service

Hawaii National Park

REPORT OF NON-APPOINTED PERSONNEL
(TEMPORARY)

Changes outside the District of Columbia for the month of August 19 31

Total at beginning of month		Additions	Separations	Net Gain or loss (a)	Total at ending of month
Permanent	10	0	1	- 1	9
Temporary	23	0	14	-14	9
Total	33	0	15	-15	18

(a) If loss, indicate by minus sign.

10-161

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

REPORT OF SALES OF PUBLICATIONS

	Number	Value
GOVERNMENT PUBLICATIONS:		
On hand beginning of month, ...	299	$ 47.00
Received during month, ...	725	$143.20
Total, ...	1024	$190.20
Sold during month, ...	12	$10.20
On hand at close of month, ...	1012	$ 180.00
NON-GOVERNMENT PUBLICATIONS:		
On hand beginning of month, ...		
Received during month, ...		
Total, ...		
Sold during month, ...		
On hand at close of month, ...		

Cash on hand beginning of month, ...	$35.75
Sales during month, ...	10 10.20
Total, ...	$45.95
Remitted during month, ...	0.00
Balance, ...	$45.95

Form No. 1009—Met'l.

U. S. Department of Agriculture, Weather Bureau.

COOPERATIVE OBSERVERS' METEOROLOGICAL RECORD:

Month of August, 1951; *Station,* Volcano Observatory; *County,* Kau

Hour of Observation,

State, Hawaii; *Latitude,* ; *Longitude,* ; *Time used on this form,*

DATE.	TEMPERATURE. Maximum.	Minimum.	Range.	* Set Max.	PRECIPITATION. Time of Beginning.	Time of Ending.	† Amount.	Humid.	Wind	Prevailing Wind Direction.	Character of Day, Sunrise to Sunset.	‡ Miscellaneous Phenomena.
	1	2	3	4	5	6	7	8	9	10	11	
1	74	54	20	69			T	73	Mod.	S	P.C.	
2	74	60	14	70			05	79	Lt.	N	Cloudy	
3	66	60	6	62			36	94	Mod.	NE	"	
4	68	55	13	62			24	93	Mod.	NE	P.C.	
5	72	55	17	64			08	90	"	"	"	
6	70	56	14	61			26	89	Str.	"	"	
7	70	56	14	64			09	90	Mod.	"	"	
8	69	57	12	64			04	85	"	"	"	
9	71	57	14	62			07	89	"	"	"	
10	67	58	9	63			06	89	"	"	Cloudy	
11	69	53	16	61			45	90	Str.	"	"	
12	71	54	17	61			04	89	Mod.	"	P.C.	
13	67	60	7	65			03	90	Lt.	"	"	
14	72	57	15	64			06	86	Str.	"	"	
15	77	58	19	71			T	82	Mod.	"	Cloudy	
16	71	60	11	66			75	91	"	"	P.C.	
17	73	58	15	67			19	89	"	"	"	
18	68	62	6	67			37	86	"	"	Cloudy	Wind SE PM
19	68	62	6	63			1.30	94	"	"	P.C.	
20	71	60	11	64			11	90	Str.	"	P.C.	
21	73	56	17	66			T	80	"	"	"	
22	71	57	14	62			05	94	"	"	"	
23	72	57	15	69			T	81	"	"	"	
24	71	57	14	62			01	89	"	"	"	
25	73	56	17	66			T	81	Mod.	"	"	
26	70	59	11	62			10	93	"	"	"	
27	73	57	16	64			06	82	Str.	"	"	
28	70	58	12	66			03	81	Mod.	"	"	
29	71	58	13	64			T	87	"	"	"	
30	72	57	15	67			06	89	Str.	"	"	
31	73	58	15	64			03	90	Mod.	"	"	
Sum	2197	1782	415	2002			482	2705				
Mean	70.8	57.4	133	64.5			15.7	87				

*Reading of maximum thermometer immediately after setting.
†Including rain, hail, sleet, and melted snow.
‡Thunderstorms, halos, auroras, etc.

U.S. Volcano Observatory *Cooperative Observer.*

(IN TRIPLICATE.) See cover for instructions.

Post-Office Address, Hawaii National Park

MONTHLY SUMMARY.

TEMPERATURE.

Mean maximum, 70.8

Mean minimum, 57.4

Mean, 64.1

Maximum, 77; date, 15

Minimum, 53; date, 11

Greatest daily range, 20

PRECIPITATION.

Total, 4.89 inches

Greatest in 24 hours, 1.30; date, 19

SNOW.

Total snowfall, ______ inches; on ground 15th, ______ inches;

at end of month, ______ inches

NUMBER OF DAYS—

With .01 inch or more precipitation, 26

Clear, 0; partly cloudy, 25; cloudy, 6

DATES OF—

Killing frost,

Thunderstorms,

Hail: Light, ; Moderate, ; Heavy,

Sleet,

Auroras,

REMARKS:

NATURE NOTES

HAWAII NATIONAL PARK

HAWAII

HUI O PELE

UWEKAHUNA

VOLCANO HOUSE

BIRD PARK

MILITARY CAMP

HALEMAUMAU

NPS

JULY 1931

Vol. I. No. 2.

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

HAWAII NATIONAL PARK
NATURE NOTES

Volume I July 1931 Number 2

Nature Notes from Hawaii National Park is a monthly pamphlet edited by the Park Naturalist and distributed to those interested in the natural history of the park. Free copies can be obtained through the office of the Park Superintendent, Hawaii National Park, Hawaii. Anyone desiring to use articles appearing in Nature Notes may do so. Please give credit to the pamphlet and author.

E. P. Leavitt, Superintendent John E. Doerr, Jr., Park Naturalist

TABLE OF CONTENTS

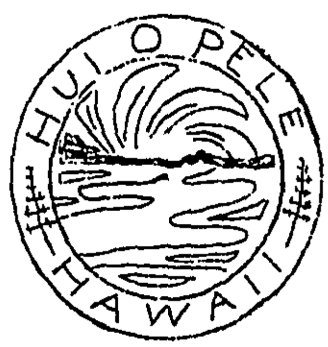
THE COVER

Those who have visited Hawaii National Park will recognize on the cover of this issue of Nature Notes, the outline of the shield-shaped plaques which have been placed at lookouts, shelters, and other locations in the Park. These plaques - commonly referred to as "Hui O Pele Shields" because the centers of the shields display facsimiles of Hui O Pele Hawaii certificates - are made of wood faced with glass. Under the glass covering and around the central unit, (the Hui O Pele certificate) geographical, historical, scientific, statistical, and regulatory information is arranged. The type of information of each shield is to a certain extent determined by the place at which the plaque is located. Anyone wishing to obtain information while visiting a lookout or shelter may do so by referring to the shield at the particular location.

The names on the cover indicate the locations of some of the shields. Shields are also located at Pauahi Crater, Public Auto Camp Ground, and Pali Hilina.

by the Park Naturalist

HUI O PELE HAWAII



"------------ having visited the Volcano Kilauea, in Hawaii National Park on the Island of Hawaii, Hawaiian Islands, Territory of the United States of America, and having made offering acceptable to Pele, Goddess of Volcanoes, at her fiery palace Halemaumau, which is called House of Everlasting Fire, is entitled to full active life membership in the Hui O Pele Hawaii, and is hereby granted all rights, privileges and benefits appertaining thereto. In testimony thereof we have caused the seal of our Realm to be affixed."

The above is part of the wording on the certificate of membership in the Hui O Pele Hawaii, which means, Society of Pele, Pele being the ancient Hawaiian Goddess of Volcanoes whose dwelling place is in Halemaumau, the fire-pit of Kilauea Volcano.

One legend tells us that the smouldering fire of the volcano is the head of Pele's youngest sister, Kaohelo, whose body was scattered on the slopes of Kilauea and other volcanoes in the Islands. Kaohelo's body may be found today in these regions as the ohelo berry. These berries were one of the propitiatory offerings acceptable to Pele. The fruit served as food for the Goddess, its cool juice relieved the parched condition of Pele's fiery throat.*

In 1824 Queen Kapiolani defied the Goddess Pele by refusing to make the offering of ohelo berries while standing at the very edge of the boiling, raging, molten lava in the throat of Halemaumau. Instead of throwing the berries into the fiery furnace of the volcano, Queen Kapiolani ate them. Her demonstration of courage within the dwelling-

*Reference - Kahele, Jos. K. Story of the Ohelo. Memoirs of the Bernice Pauahi Bishop Museum of Polynesian Ethnology and Natural History, vol. V - Part III, pp 576-582. Bishop Museum Press, 1919.

place of the ancient Goddess, led to the deliverance of her people from dread and superstition. Today the ohelo berries may be eaten with no fear of the "kapu", (sacred restrictions).

Hui O Pele Hawaii has been established to perpetuate the memory of the ancient homage to the Hawaiian Goddess of Volcanoes. The society is the result of a suggestion made by Charles C. Moore of San Francisco, in an address before the Honolulu Ad Club in May 1922. Mr. Moore, President of the Pan-Pacific Exposition in 1915, not only suggested the founding of the society but backed up his suggestion with a contribution of one hundred dollars toward establishing Hui O Pele Hawaii.

Shortly after Mr. Moore's address the Honolulu Ad Club appointed a committee to make plans for the society. Mr. Harold Yost, at that time Assistant Secretary of the Hawaii Tourist Bureau, served as chairman of the committee. Ex-Governor Wallace R. Farrington, the late Lorrin A. Thurston, and L. W. de Vis-Norton were among those who took an active interest in organizing the "Hui". The first certificate was issued in October 1923 to Charles C. Moore of San Francisco, the originator of the "Hui" and its first honorary member. The list of other honorary members includes, Ex-Governor Wallace R. Farrington, Honolulu; the late Lorrin A. Thurston; the late Stephen T. Mather, former Director of the National Park Service; Gilbert Grosvenor, National Geographic Society, Washington, D. C.; Dr. T. A. Jagger, Volcano Observatory, Hawaii National Park; and Thomas Boles, former Superintendent, Hawaii National Park.

Today there are over 12,000 members representing every state and territory of the United States, as well as many other countries in the world. Just recently a visitor from Bolivia, South America, became a member of Hui O Pele Hawaii. The life membership fee of one dollar gives to each member an attractive certificate and recognition pin.

Aside from the nominal cost of operation, the funds of the "Hui" are being used to equip the museum and lecture hall at Uwekahuna Bluff, and build numerous shelters and lookouts in the Park. The members of the Hui O Pele Hawaii Committee whose untiring efforts and active interest in the society are contributing much to the development of Hawaii National Park are, L. W. de Vis-Norton, Honolulu, Chairman; Henry Bredhoff, Honolulu, Treasurer, and E. P. Leavitt, Supt. Hawaii National Park, who serves as Kuhina Nui, (Great Officer).

by the Park Naturalist

MYTHOLOGY OF THE VOLCANOES
(Continued from the June issue of Nature Notes)

Of the fourteen members of the Volcano Family, the Goddess Pele was the most exacting in her demands for sacrificial offerings. When the people from the seashore came to Kilauea to pay homage to the Hawaiian Goddess, they brought fish as an offering to her. If the supply of fish was too small to satisfy Pele's enormous appetite, she would go to the seashore as fire and lava. The fire would kill the fish in the ocean and the lava would fill up the shallow places, thus destroying the fishing places.

When the members of the Volcano Family - representing fire, thunder, lightning, clouds and destruction - were seen outside their usual dwelling places, it was an indication that the Gods and Goddesses were angry because they never left their houses except to receive offerings or execute vengeance.

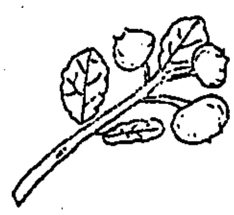
Hogs were also among the offerings acceptable to the Gods. "Na lau, na lau, na lau, na puaa i kiola ia no lakou", meaning "four hundred, four hundred, and four hundred of hogs were thrown to them", is the Hawaiian method of saying that hundreds and hundreds of hogs were given as offering. Both live and cooked animals were thrown into the crater during periods of activity. When making offerings the priests would descend into the depths of the volcanoes; approaching the most fiery parts of the craters, they would cast the gifts upon the molten lava, saying, "Here Pele, is food", specifying the nature of the offerings. After making all the offerings the priests would return to the people standing on the rim of the crater and all join in prayer.

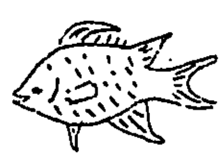
Locks of human hair were also offered to Pele by those who passed through the region of Kilauea. The stories tell us that during the destructive eruptions human beings were sacrificed. No one knows how many human sacrifices were made to Pele. Even before the arrival of the first Christian missionaries on April 4, 1820, Kamehameha the Great had abolished the practice of making human sacrifices to the volcano. Today one may occasionally see small offerings being made to the members of the ancient Hawaiian Volcano Family.

"pau"
(meaning the end)

By Ranger E. Brumaghim

(The story of the Mythology of the Volcanoes is from notes given to Ranger E. Brumaghim by grandparents and others. These notes date back to 1788)



NATURE STUDY

Hawaii National Park serves as a school room! During July the University of Hawaii offered for the first time a course in Nature Study in Hawaii National Park. Mr. Theodore C. Zschokke, Extension Forester from the University, was in charge of the group. The group was composed of teachers from various schools in the Islands and students from the University of Hawaii. Assisting Mr. Zschokke was Park Naturalist, John E. Doerr, Jr. and Ranger E. Brumaghim. The Summer Camp, located on the east rim of Kilauea Crater, offered good living and working accommodations, being so situated that a friendly camp atmosphere prevailed.

Every phase of natural science that is possible to observe in the region was included in the work. The group concentrated the major portion of its attention on botanical and geological sciences. The study of the origin and distribution of the Hawaiian flora was particularly interesting to the group.

The fact that the Hawaiian Islands have been formed by volcanic activity during relatively recent Geologic time, and that they are almost 2000 miles from any other land, presents the interesting problem of the origin of the Hawaiian flora. There is no proof that the Islands have ever been less distant from, or a part of any other land mass, hence we must conclude that the great variety of vegetation, a large portion of which is endemic, on the Islands is the result of transportation, cross-pollination, and geographic isolation, together with the morphological and physiological changes resulting from variations in climatic conditions and marked differences in elevations above sea level. The Park is particularly well situated for studying plant ecology. A portion of the Park is in the region of abundant rainfall while in other parts desert conditions prevail. Within the area one may go from sea level to an elevation of 13,675 feet.

Shortly after volcanic eruptions built these islands above sea level, nature's methods of transportation such as wind, ocean currents, and birds began to bring species of plants to the shores of Hawaii. Needless to say, these adventuring species were of the type that adapt themselves to such methods of transportation with the exception of those which may have come attached to driftwood. Man has also been an important agent of transportation. The founders of the Hawaiian race, coming to these islands in their double canoes, no doubt brought many plants with them. Many varieties of plants have been introduced since Captain Cook discovered the Islands in 1778.

Through cross-pollination of the early endemic plants, as well as among the introduced ones, many new species have been produced. The great distances to other land areas have made it difficult for these new species to migrate beyond the Islands. The variations of from 30 to 180 inches of annual rainfall within a distance of less than twenty miles, have played an important part in the changes that plants have undergone in adapting themselves to environment. Variations of temperature from the tropical warmth of coastal regions to the freezing cold on the tops of the highest mountains have likewise been an important influence in the development of new species.

The nature study class had an excellent opportunity to study and collect numerous plant specimens in the Park. Some members of the class identified and mounted over 100 plants. Most of the individual collections made will be used as laboratory material in the schools in which the members of the class teach. The Park received a mounted specimen of each plant collected. This collection makes a valuable addition to the museum exhibits and reference library.

Of particular interest and value to the group was the lecture given by Dr. H. A. Powers of the United States Geological Survey, on the origin of the soils of the Island of Hawaii. Dr. Powers pointed out the relationship between the rate of soil formation and amount of rainfall in regions of various types of volcanic materials. Four types of volcanic materials were considered, namely; lava having a pahoehoe (smooth) surface, lava having an aa (clinker) surface, lithic ash (broken rock fragments) and glassy ash (formed by the rapid solidification of molten lava thrown into the air). Summarizing his subject, Dr. Powers stated that from the standpoint of origin, the soils of Hawaii are for the most part of two types - volcanic and humic. In regions of abundant rainfall the aa lava breaks up more rapidly into soil because of the porous nature of the surface and the ease with which oxidation takes place. Frequently the surface of an aa flow is altered by oxidation before the flow has completely solidified. The clinker appearance of aa lava is a surface phenomenon. Because of the glassy surface of the pahoehoe flows, soil does not form readily from this type of lava even though rainfall is abundant. Lithic ash breaks up into soil very slowly. Glassy ash decomposes more readily than any other type of volcanic material. Pumice and "Pele's Hair" are examples of glassy ash.

The extensive areas of sugar cane are in regions where glassy ash has fallen. The best soils are found in regions of abundant rainfall where decomposed glassy ash mantles an aa surface. The porous surface of the aa lava serves as an excellent sub-surface reservoir for water which can be obtained by the plant roots. Decomposed glassy ash mantling pahoehoe lava frequently results in a boggy soil because the glassy, impervious character of such lava can not be penetrated by water.

Hawaii National Park being an area of active, dormant and extinct volcanoes, the class room and field studies in geology were confined to the subjects of volcanoes, volcanic products and associated phenomena. Thes subjects were approached through a study of the origin of the earth, the probable nature of the earth's interior, structural trends of the Pacific Ocean region, the formation and classification of the rocks in the area, the weathering of volcanic rocks, and the origin of the Hawaiian Islands. Each member of the class made a collection of rocks in the Park. Some of the students were particularly interested in collecting samples of olivine. Olivine is abundant in several of the flows as well as in the debris thrown out during the explosive eruption in May 1924.

During the month the class visited practically every section of the Park. The following areas proved particularly rich in natural history material; Bird Park, Kilauea Iki, Mauna Iki, Napau Crater, Kilauea Crater, Kau Desert, Fern Jungle, and Thurston Lava Tube.

At the end of the Napau Crater Trail the group was treated to a "luau", prepared, served and eaten in true Hawaiian style. Ranger E. Brumaghim acting as official chef, spared no effort to make the feast a great success; the quantities of food consumed indicate his ability to prepare a Hawaiian meal and the three lusty cheers given him after the feast expressed the group's appreciation of his efforts.

The month's study closed officially with a trip to the top of Mauna Loa, a trip participated in by Mr. Zschokke and Miss van Loben Sels, with Alec Lancaster acting as guide.

The month was not entirely one of lectures, field trips, mounting specimens and study. "PLEN-N-N-N-N-N-N-N-TY FUN" (The longer you hold the "N" the greater the quantity of fun; space does not permit carrying the "N" to sufficient lengths). The nicknames acquired by members of the class are in themselves sufficient evidence that the camp was a happy one. Loads were always lighter and trails always shorter because of some fully appreciated joke and "yarn". The one and only "Yarn Spinner" has promised to spin one or two of his choice ones for a future issue of Nature Notes.

The following people attended the Nature Study class.
Edwin K. Lindsey, Mrs. E.E.E.K. Luke, Walter E. Short, of Kohala; Mrs. T. L. Chong, Mrs. S. L. Kong, Miss N. Y. Chong, Miss E. Rickard, Mrs. Margaret F. Brown, of Hilo; Louis M. Worth of Honolulu; and Miss Elizabeth von Loben Sels of Vorden, California.

Those who had the privoledge of working with Mr. Zschokke during the month, sincerely appreciate his untiring efforts and ability to successfully conduct nature study classes. The members of the class, as well as the park staff, are unanimous in the opinion that the month was enjoyable and profitable to all concerned.

by the Park Naturalist

STEAM CLOUDS

Between the hours of 8 AM and 5 PM July 21, 1931, the rain-gage at the Volcano Observatory, on the north rim of Kilauea, recorded a fall of 6.12 inches of rain.* Using this figure the estimate shows that during the nine hour period 437,163,307 gallons - 1,821,513 tons - of water fell in the crater of Kilauea.

Those who were fortunate enough to be in the vicinity of Kilauea late in the afternoon, had the opportunity of seeing a most interesting display of steam rising from Halemaumau and the crater floor. From Uwekahuna Bluff one could see a great column of steam, 3000 feet in diameter, swirling and rolling up from the depths of the fire pit, Halemaumau. Hundreds of pools of water were visible on the floor of Kilauea and equally as many steaming vents sending out soft, white clouds of water vapor. Darkness only added to the phantasy of steam rising from this slumbering volcano.

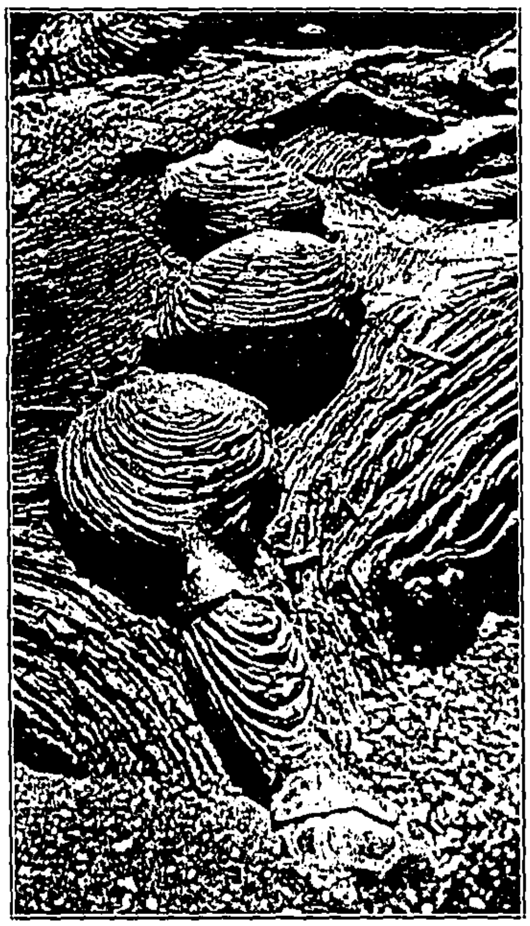
by the Park Naturalist

* Hawaiian Volcano Observatory, Hawaii National Park.

The Volcano Letter

Two dollars per year | Ten cents per copy

No. 345—Weekly | Hawaiian Volcano Observatory, National Park, Hawaii | August 6, 1931



Toes of pahoehoe lava on north floor of Kilauea in 1919 lava. Photo Maehara.

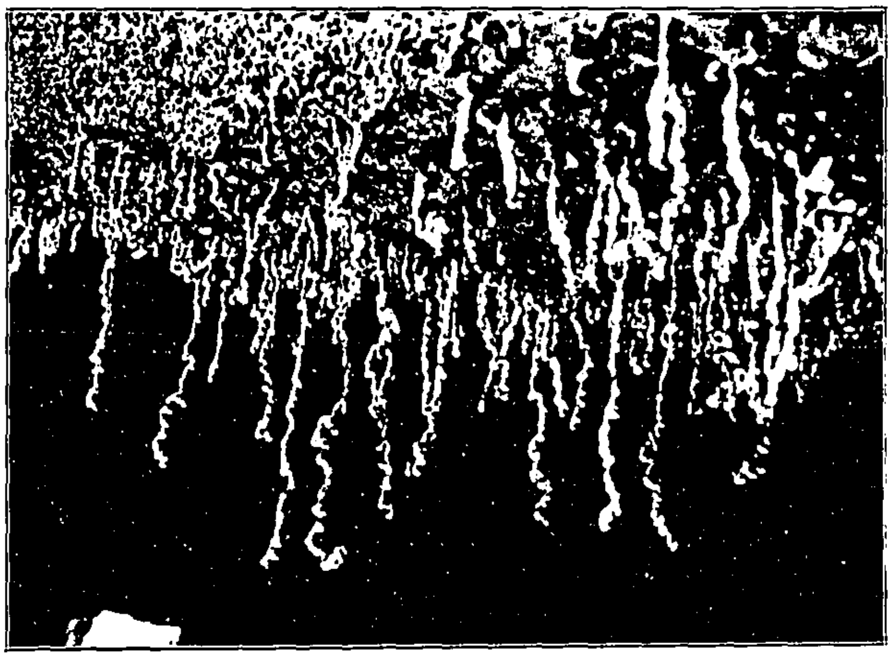
LAVA STALACTITES, STALAGMITES, TOES, and "SQUEEZE-UPS"

In Volcano Letter No. 300 Professor Colton described "squeeze-ups" in lava fissures whereby basaltic magma plastic like stiff clay has been forced up a crack several feet into the air, with sides of the solidified paste grooved like slickensides as it scraped past the roughnesses of the walls of the fractured rock. As something of this kind occurs in Hawaii on both big and small scales, and in addition we have stalactites and stalagmites of entirely different origin which have been erroneously attributed to water, it would seem of interest to review the subject.

The supreme "squeeze-up" of history is the Pelee spine in Martinique. All lava dome eruptions are similar in origin and one may quite justifiably inquire whether "squeeze-ins" as well as "squeeze-ups" do not constitute many of the intrusions of geology. The hydrostatic pressure of granitic intrusions at Schneeberg in Germany is such that it split folia in slate, penetrated between the thin paper-like layers of the slate, and recrystallized the clay to hornstone. The Pelee spine was a central pencil of paste in a cumulo-dome, scored vertically on the outside as it scraped the walls of its container and rose 1,000 feet into the air. Then its top curled over and spalled off. It was never sucked back, but flaked away to a stump. Its composition was a hypersthene andesite, and so it was more viscous and refrectory than basalt.

In the history of "bench magma" inside Halemaumau pit there have been many occasions when the crags of semi-solidified basaltic paste at 900° C., forming the walls of the container of the lava lakes—not the walls of the pit—have risen as separate pencils of paste within other material of greater hardness. When they did this they showed scraped surfaces. When the entire lava column of this bench material has lowered rapidly, it has fractured into terraces on the insloping funnel wall of old rock, and the terrace faces show scraping made by the sinking block of the next terrace below.

In the filling of basins with pahoehoe lava by overflow



Worm stalactites from glaze of roof of cavern, Kilauea floor. Photo Maehara.

In the larger craters, there are built "schollen-domes" or hillocks of swelling crust. What was a puddled flat. with ropy lava shell, begins in the course of hours to swell up. A laccolith of basalt paste is rising inside, because of some equation between resistance to further spreading and resistance to upward lift. If upward lift is the easier for the onflow of the feeding stream which is pouring through a tunnel to feed the flat, there will be no further escape of "toes" pushing out from under the skirt of crust. When the swollen dome, 50 to 100 feet across, lifts a shell 3 feet thick, there finally arises a star-shaped opening between sectors in the top of the dome. The dome gets to be 10 or 15 feet high. Then the paste "squeezes up" through the opening on top. It either trickles down and skins over, or it sputters up and builds a spatter cone. If it has partially crystallized inside the heap it may rise as an "aa" or clinker lava pudding and so produce a stiff plug or spine or "squeeze-up," to use Colton's expression.

The picture on Page One shows four toes with festooned skins of pahoehoe lava which has welled up from a crack in the floor of Kilauea Crater in 1919. Each toe is derived by squeezing out from under the skirt of the toe next preceding. The festoons are convex downstream. The farther toe welled up a crack, the next two were progressively formed by swelling and rupturing fronts, and the long one in the foreground is double and exhausted the lava available. While incandescent and in action these toes or "pushes" as Brigham called them resemble a bag of red jelly. They are a foot or two in diameter.

Stalactites and stalagmites in grottoes and caverns tell quite a different story. Here again there are some which are products of splash phenomena, and are nothing more than lava drip where a stream has vacated its banks and left pointed glassy shreds hanging from shelves. Not so with such vermiform or rod-like stalactites and driblet spires as are shown on Pages Two and Three. These photographs were taken by flashlight in a cavern on the Kilauea Crater floor. Such caverns were in 1919 red hot and full of flowing lava. They were formed by streams which crusted over and then kept on flowing under a bridge of crust. These same streams in tunnels of their own congealment are what lead at the front of a flow to the escape of toes such as are depicted on Page One.

But there comes a time in every flow where the supply of lava diminishes. In such case the amount flowing from the source does not equal the capacity of the tunnel. Accordingly the river of melt bubbling along inside the tube lowers so that the upper half of the pipe is full of gas or air, the walls are of bright yellow incandescence, and the gases escaping from the lava are continually burning to maintain a very high temperature on the ceiling of the cavern. With this temperature above 1,200° C., air being sucked in below as the hotter gas escapes through cracks and windows in the roof, there is set up a blast furnace condition often maintained for weeks or months on the inner rock lining of the cupolas in the ceiling and of the side walls of the tunnel. This flow of gas quietly burning with great volumes of excess oxygen dragged up the tunnel from innumerable holes, cracks, and pores, melts the tunnel walls to a glaze of quite different crystallinity from normal lava.

In 1919 it was repeatedly possible to go to the "windows" of collapse in the roof of the "Postal Rift Tube," where from Halemaumau a torrent of lava was flowing through a tunnel, and to look inside and see an orange-hot cavity with a golden river sweeping by underneath, little bubbles continually breaking the surface of the glowing stream, and adding gas to the evenly brilliant walls. On these walls hung motionless stalactites, some like currants, some like grapes, some like walking sticks, and some like worms. These are what are shown in the photographs. They are the material of the gas-melted glaze. They form very slowly. When incandescent they may be rocked back and forth like macaroni before it has dried.

If the heat has fallen below their formation temperature, a touch will break them off. They do not trickle. They form by accretion.

If we take one of the worm stalactites and examine it with a lens, its outer skin has very delicate tracery of ripples in a silvery coating of magnetic oxide of iron. If we break a worm stalactite it has vesicles inside lined with crystals of feldspar and augite. If we make a thin section of a solid part it is crystalline, but different in texture from crystalline basalt. If we break a rod stalactite it may be hollow like a pipe-stem. The stalagmites underneath must be made by drip in some early high-temperature stage of the stalactite formation above them. I have never seen worm stalactites so hot that they were visibly dripping. In any case the drip is melted rock, and has nothing to do with water. These stalactites are sometimes two feet long.

There are two kinds of extrusion within caverns which are direct squeezings of molten slag. One is a "miniature volcano" of the cavern floor. Types of these are seen in the innermost recesses of Thurston's tube at Hawaii National Park. It is cone or pie-shaped with slopes like a miniature Vesuvius. Another is the "barnacle stalactite" squeezed through pores or cracks in the cavern walls while all are incandescent. These things are all products of pressure adjustment between cracking shell of cavern and molten matter in the flow beyond the shell. The barnacle stalactite has striations on the sides and may even be a thin papery layer which has oozed through a small crack and stands out from the wall. Lastly, there are glaze stalactites which take massive forms like udders and teats.

T.A.J.

KILAUEA REPORT No. 1019

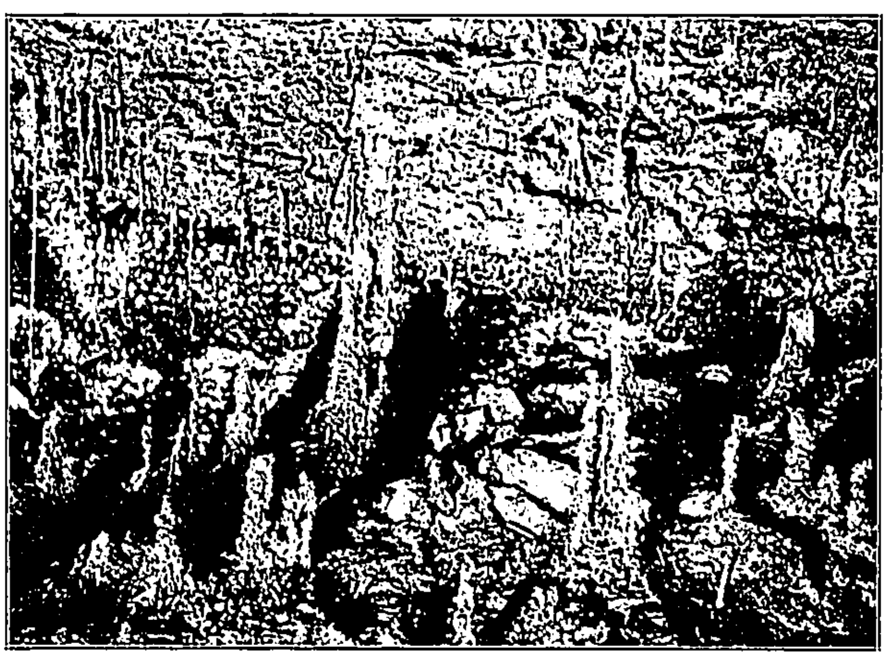
WEEK ENDING AUGUST 2, 1931

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge

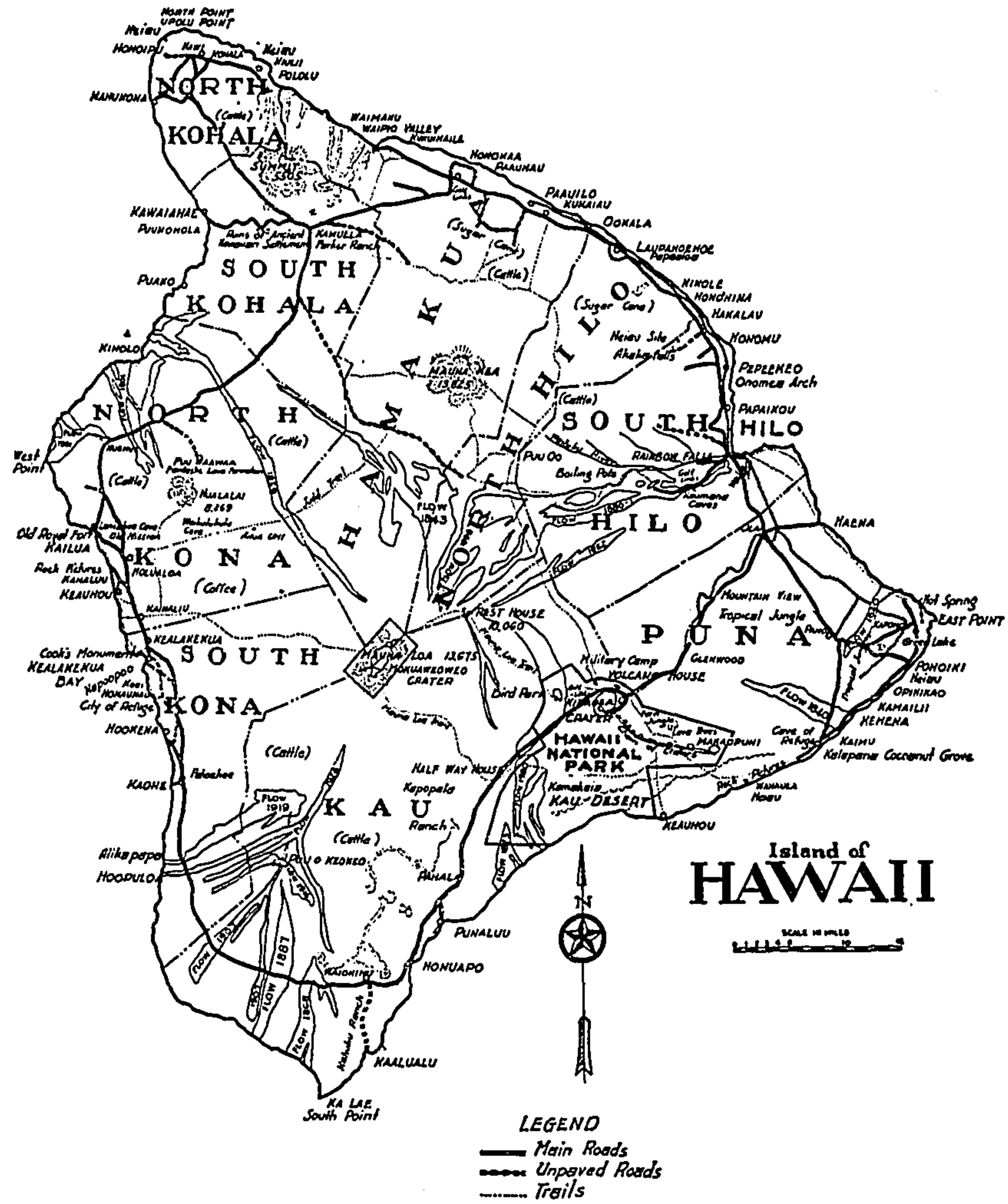
The volcano remains inactive. On July 27 some sulphur spots on the Halemaumau bottom seemed a little brighter yellow. No steam or fume was detected. Crack measurements near the southeast rim showed no noteworthy changes. A local earthquake at 2:43 p. m. July 30 was felt at the Observatory and by a few people in the near vicinity. It has not been reported felt elsewhere on the island.

The instruments at the Observatory registered 15 tremors, one very feeble seism, and one feeble seism. In addition there was one spell of continuous tremor 4:43 a. m. to 5:09 a. m. July 30.

The avarage tilt movement for the week was slight NNW. Microseismic motion was slight.



Worm and rod stalactites, and stalagmite spires below, inner recesses of cavern, Kilauea floor. Photo Maehara.



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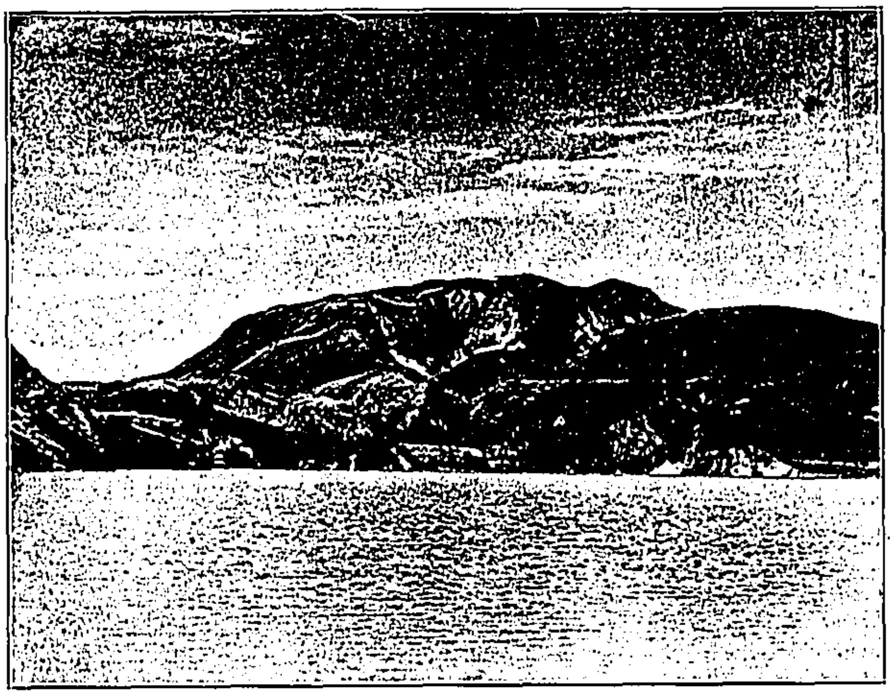
No. 346—Weekly | Hawaiian Volcano Observatory, National Park, Hawaii | August 13, 1931



Tarawera Volcano and the Tarawera chasm of 1886, showing the refilled Rotomahana Crater in the foreground. Country covered with ash. Photographed in 1925 by Baker.

ERUPTION OF TARAWERA

In June of 1886 a steam-blast eruption took place from the old volcanic mountain Tarawera and the geyser basin Rotomahana. This event in the thermal springs district of the North Island of New Zealand is worthy of review. The volcano region lies 60 miles to the west of Napier, which was stricken by earthquake February 3, 1931 (Volcano Letter No. 327).

Tarawera lies in the Taupo volcanic zone trending N. 38° E. from Ruapehu to White Island. This zone is famous for many hot springs, geysers, mud volcanoes, and solfataras. Masses of heated magma must exist at no great distance below the surface. Ruapehu, Ngauruhoe, and Tongariro, in the southern part of the zone, are definitely active volcanoes 5,500 to 8,900 feet high. Lake Taupo is in a subsided area north of these volcanoes and covers 242 square miles. About midway between Lake Taupo and the Bay of Plenty is Tarawera Lake, northeast from Lake Taupo. Tarawera Mountain is next to the lake, a flat-topped mass of porous rhyolite lava of light gray color, standing 3,606 feet above sea level, and 1,040 feet above the lake. It was not known to be an active volcano, but studies of its structure show that it is a true cone, with beds dipping outwards, lava streams on its lower slopes, and a plug of what was viscid lava from a former eruption in a NE-SW fissure on its top. There is something of concentric structure in this lava cap.

The warm lake Rotomahana lay two miles southwest of Tarawera, bordered by hot springs and jets of steam. The siliceous sinter of the White and Pink Terraces was on ground which sloped down to the shores of this lake. Water which overflowed the terraces boiled as geyser in the basins above. Rotomahana with its terraced sculpturing, azure warm waters, flocks of dainty terns, and greenery amid steam jets was one of the fairylands of the globe.

At the top of the White Terrace was a snow-white geyser bowl 90 feet broad full of clear blue water boiling up violently in gushes 15 feet high. The basin became dry when south wind blew, but filled again when the wind changed. When the basin was almost full on these occasions, columns of boiling water 20 feet in diameter were hurled 60 feet into the air. In November 1885 there were unusual eruptions of this geyser sending a column of water up 150 feet and of steam 1,020 feet, unheard of in the experience of the resident Maoris. This was the prelude to the great eruption eight months later. The acid waters of the crater basin on White Island Volcano in the Bay of Plenty disappeared in the middle of 1885, leaving the bed dry. In April of 1886 Ruapehu sent up unusual steam jets. At the beginning of June, 1886, a creek went dry on Lake Tarawera, then with a rushing sound the lake water came running up, overflowing the creek bed, and thereafter retiring twice after the fashion of unusual flood waves. No earthquake was noticed, but some fault block movement in Tarawera Mountain may have caused the retirement of the waters.

The district is thinly populated. Natives on Lake Tarawera did not survive to relate what happened. The nearest observers were at the Wairoa, eight miles west of Tarawera. The previous year had been very dry. After a fine evening June 9, 1886, earthquakes occurred at 12:30 a. m. June 10 and increased in violence for an hour. The northern part of Tarawera Mountain split open and a column of black ash-laden steam arose. This spread to other parts of the plateau summit of the mountain. At 2:10 a. m. there was a violent earthquake, followed by a loud and prolonged roar. A black cloud ascended and spread outwards. Red-hot fragments were seen darting from the cloud. Lightning began to appear, there was rumbling, a red glow lit the scene and as fresh outbursts occurred the clouds were lit up with stronger glow. Fire-balls fell about the summit.

The fissure probably split its way southwest through Lake Rotomahana soon after 3 a. m., for about that time earthquakes were especially severe, the heaviest one happening at 3:20 a. m. Engulfment on a big scale probably occurred at this time. This continued southwest from Rotomahana to other craters. By 3:30 a. m. the whole line was in violent eruption for a distance of nine miles from beyond Tarawera on the northeast to Lake Okaro on the southwest. Glow was seen only at the Tarawera end. The clouds spread out, stones and sand began to fall at Wairoa about 3 a. m, then at Rotorua about 4 a. m., and a fierce southwest gale at this time drove the ash-laden cloud away from Rotorua in the direction of the Bay of Plenty. It dropped its ash over all the country between Rotorua and the sea. The chief violence of the eruption was over before 6 a. m. At Rotorua darkness lasted until after 9 a. m. At Wairoa ash fell until 9 a. m., and about Lake Tarawera many people were killed. In the direction to which the ash cloud was blown, at Opotiki, 47 miles away, it was pitch dark until 10:20 a m., when the fall of dust became lighter, and daylight gradually appeared. Detonations were heard even as far away as Hokianga (253 miles) and Auckland (133 miles).

Along the line of the great fissure a series of steam-blast craters was formed. The greatest was the Rotomahana Lake crater, with a hot lake left at the south and another at the north. A great chasm was left in the southern face of Tarawera Mountain, shown in the photograph on Page One, with the Rotomahana lake refilled. There were lines of pits at the north and at the south. The Pink and White Terraces were blown out, with fragments left in the debris. Bold Pinnacle Rocks of rhyolite stand near where the White Terrace geyser was. The southern portion of Rotomahana Crater is bounded by high cliffs of horizontal strata. Tarawera chasm in the hillside is a gash a mile and a quarter long. The bottom is marked by crater-like hollows. The largest hollow has a thousand-foot wall at its back Large trees were blown off the mountain and their stubs were found near Rotomahana. Molten augite andesite was believed to rise in the fissure during the glowing stages of the eruption, and was ejected explosively as scoriae, sand, and dust. There were also bombs one to eight inches in diameter, with cracked surfaces. The rock is black and approaches basalt, with sp. gr. 2.93. Olivine occurs sparingly. The only ryholite ejected was fragmental from old country rock.

At the south end of the Rotomahana Crater there developed in later years the famous destructive mud geyser Waimangu, irregular in its outbursts and at times behaving like a steam-blast volcanic eruption. On several occasions it caused loss of life. (From A. P. W Thomas, Eruption of Tarawera. N. Z. Gov't Report, 1888.) T.A.J.

TILTING OF THE GROUND FOR JULY

The following figures show the net amount of tilt by weeks at the Observatory on the northeast rim of Kilauea Crater, and its direction, computed from the daily sesimograms by platting a curve smoothed by overlapping seven-day averages. This is the departure of the plumbline in the direction given.

June 29-July 5	0.9 second W.
July 6-12	0.4 second NW.
July 13-19	0.7 seconfl NNE.
July 20-26	0.4 second NNE.
July 27-August 2	0.8 second WNW.

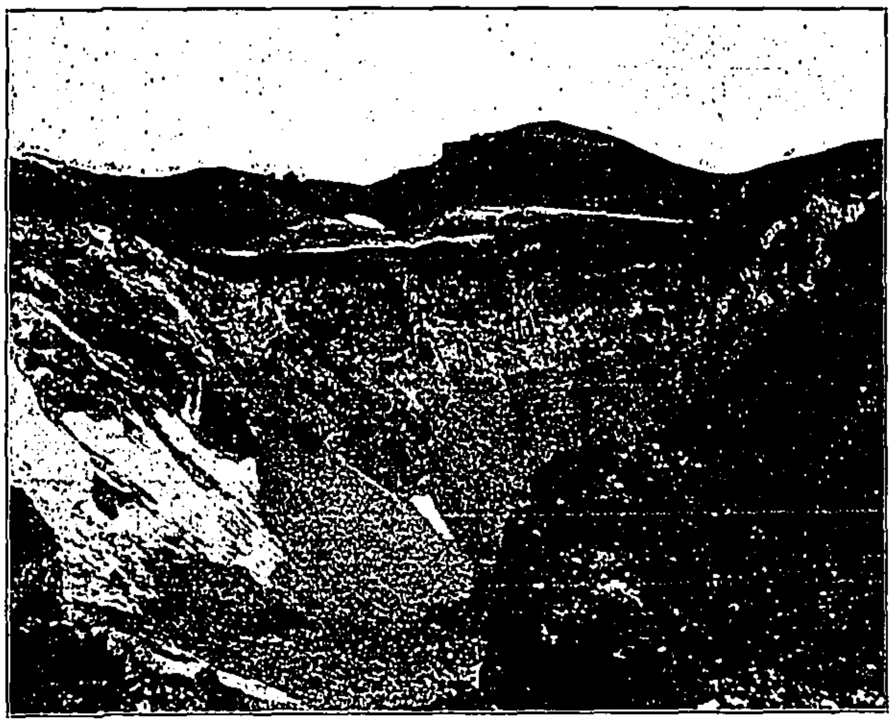
KILAUEA REPORT No. 1020
WEEK ENDING AUGUST 9, 1931

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge

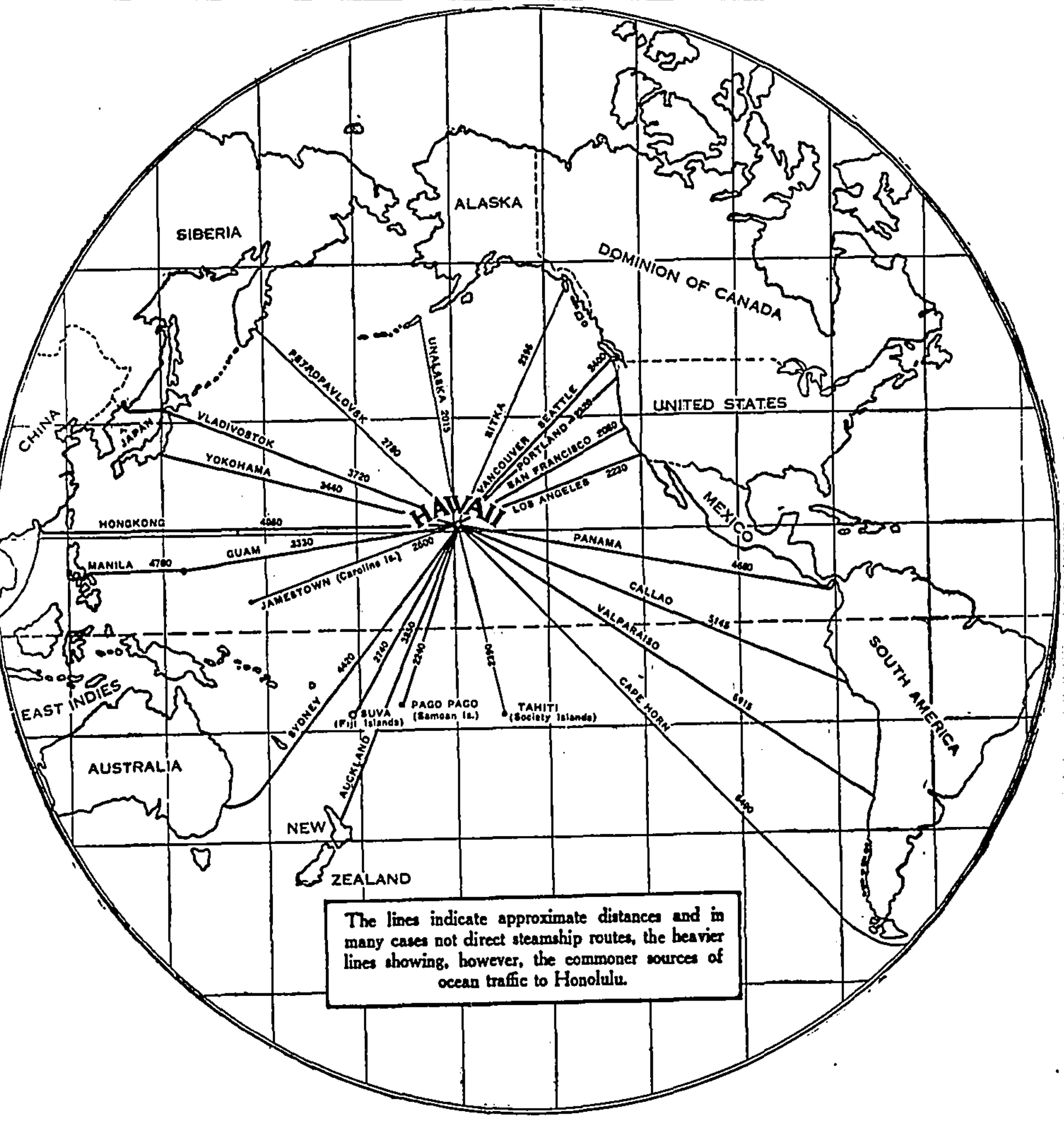
The week at Kilauea passed without changes in volcanic conditions. On August 3 no fume was visible on the Halemaumau bottom. Steam showed at the southeast rock slope but not at the south talus. A strip of sulphur at the lower edge of the south talus appears to be spreading in the direction of the 1931 cone. Rim cracks were measured and showed no changes. On August 4 fume reappeared at the sulphur spot north of the 1931 cone. The pit seismograph had registered two small tremors with slight tilt toward the pit. On August 8 steam and fume were absent from the interior of the pit. A few rocks were heard falling on the north talus at 9:30 a. m. The pit seismograph recorded a few slow-period tremors.

There was a very considerable increase in the number of seismic disturbances recorded by the instruments at the Observatory, including 39 tremors and 6 seisms. One of the latter at 1:43 a. m. August 3 showed distance to origin 23 miles; another at 4:22 p. m. on the 8th showed distance 14 miles and was felt locally. In addition there was a teleseism at 3:54 p. m. August 6 feebly recorded.

The average of accumulated tilt was slight NE. Microseismic motion was slight.



Crater of Fujiyama, August 1917, showing a typical engulfment crater with dikes in its walls, with a section of a lava fill, and inner debris slopes of last engulfment. This is not especially different from Tarawera Chasm, though nothing is reported about engulfment during the Tarawera eruption. Fujiyama Crater is central, whereas the New Zealand craters of 1886 are numerous and in a line. It is probable enormous engulfment occurred at Rotomahana, when the lake and the geyser terraces fell into a void. Photo Baker.



The lines indicate approximate distances and in many cases not direct steamship routes, the heavier lines showing, however, the commoner sources of ocean traffic to Honolulu.

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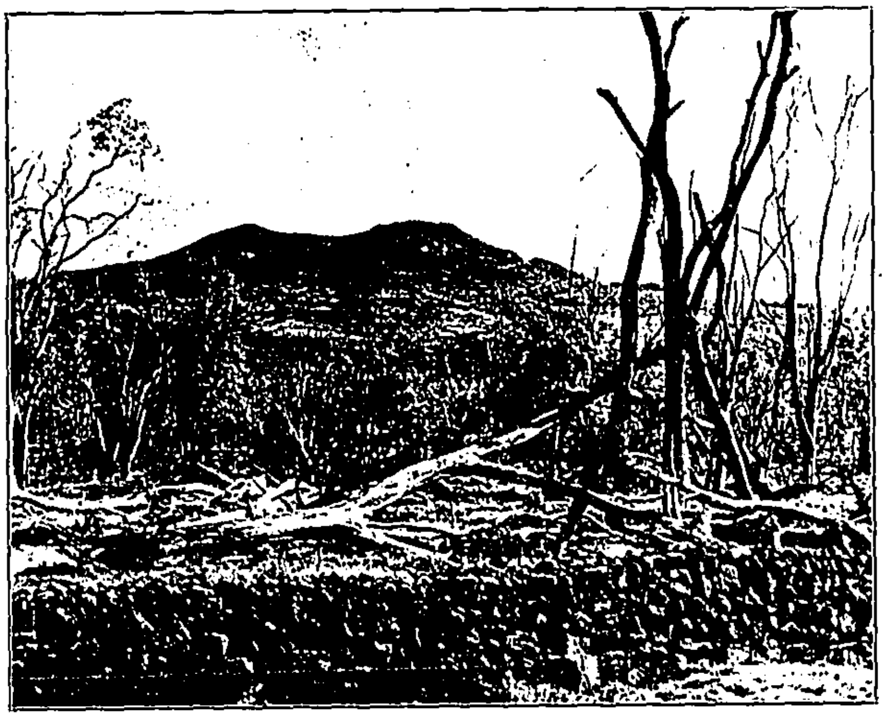


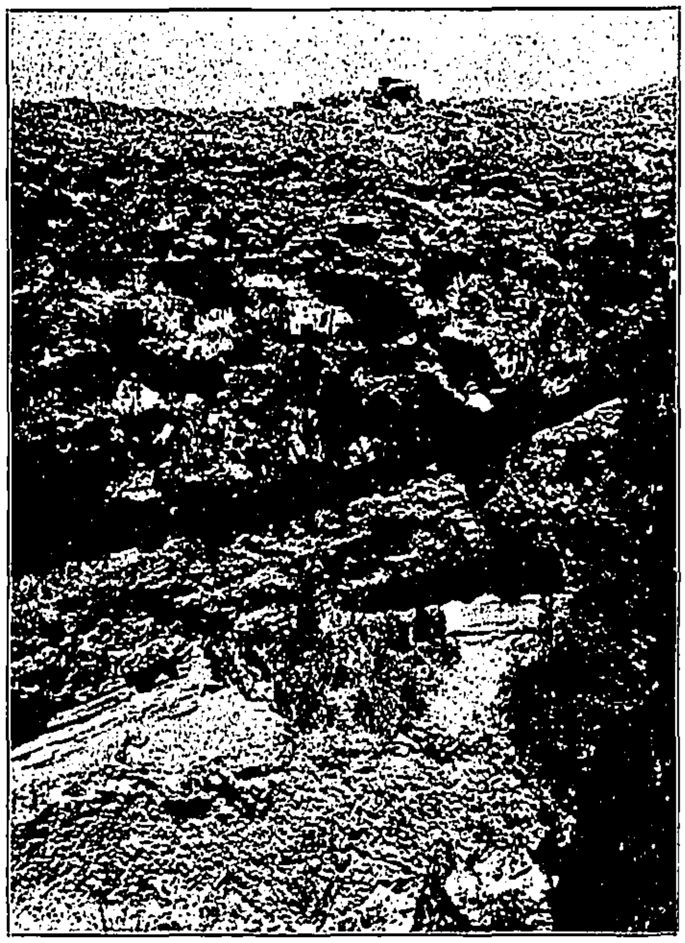
Hualalai as seen from the southeast. The two prominent points are large cones of cinder and slag. The largest summit pit crater is not visible but is located just over the skyline formed by the saddle between the two cones. Photo O. H. Emerson.

HUALALAI

Hualalai Volcano lies entirely within the bounds of the North Kona District of the Island of Hawaii. It has the shape of an elongated dome with the longer dimension of the dome lying almost on a line drawn due northwest from the summit crater of Mauna Loa. The belt road around Hawaii follows the slopes of Hualalai for a distance of more than 30 miles between Kealakekua and Waimea, half encircling the volcano. The broad fan-shaped plain which culminates in Keahole Point, the westermost point of the Island of Hawaii, is formed of pahoehoe flows from this volcano.

The summit peak of Hualalai has an elevation of 8,251 feet above sea level, more than twice the elevation of Kilauea Crater, but lacking more than 5,000 feet of attaining the extreme altitudes of Mauna Kea and Mauna Loa. Because of its moderate height, the mountain is covered with vegetation almost to its very summit. There is a remarkable contrast in type of vegetation on the two opposite slopes of the mountain due to different conditions of rainfall. The northeast slopes, the trade wind side, are reached by trade winds only after they have crossed the broad plains of Waimea and have lost most of their moisture. As a consequence, the entire northern slope of Hualalai has a relatively small rainfall, probably nowhere exceeding 40 or 50 inches of rain a year. The vegetation of this slope accordingly is made up of the kinds of plants which exist on a small amount of moisture, but it is sufficiently luxuriant to provide pasture for cattle so that most of the northern slopes are utilized as range land by the Huehue and Puuwaawaa ranches.

Conditions on the southwest or leeward slopes are very different. The area is sheltered from the trade winds by the mass of the mountain, so that a true land and sea breeze is characteristic. During the night, the slopes of the mountain cool off more rapidly than does the ocean which causes a breeze to blow from the colder mountain slope toward the warmer ocean. Then as the sun warms the mountain slope more rapidly during the morning hours than it does the surface of the ocean, the wind reverses and blows



A small pit crater near the summit of the mountain. In the wall is exposed an old lava flow (at bottom of picture) covered with several feet of bedded cinders from a nearby cone, and over all two or three flows of recent lava which have been poured out since the cinder cone activity. Photo O. H. Emerson.

from the sea onto the land. This day breeze is laden with moisture from the ocean, and as it cools on its way up the mountain side, it drops its excess moisture in almost the same general area every day. As a consequence of this combination of conditions, the rainfall gradually increases from sea level up the slope of the mountain till it reaches a maximum (over 100 inches a year) at an elevation between 2,500 and 3,000 feet, then decreases gradually from this rain belt to the top of the mountain. Thus the vegetation of the southern slope of Hualalai changes with this distribution of rainfall from the semiarid plants at sea level, through fern jungles in the rain belt, then back to the forests and grasses of the dry lands on the higher slopes. The belt road passes through a region of moderately heavy rain and the lands accessible from the road are used for coffee and other planted crops. The lower and upper dryer slopes are used almost entirely as grazing lands by the ranches of the area, but the narrow belt of highest rainfall is too wet and swampy for human use, so in the main is left as native fern jungle.

Hualalai is by far the most "climbable" of all the volcanoes of Hawaii. The ascent to its summit and side trips over its slopes are pleasure jaunts compared to the gruelling climbs to the summits of Mauna Loa or Mauna Kea or to the arduous wanderings through the jungles on Kilauea. It also is an extremely interesting volcano from the standpoint of the geologist or volcanologist.

The first mystery of Hualalai is the question of its relation to Puu Anahula and Puuwaawaa. These two areas are located on the northeast slopes of the mountain and are kipukas, or islands, left in the younger floods of lava from the top of the volcano. From their position so near to Hualalai, they would seem to be a part of that volcano, yet the lava of which they are formed is very different from all the other lavas of Hualalai, but very similar to some of the lavas of the Kohala volcanoes. So far the question has not been answered whether Puu Anahula and Puuwaawaa belong to a very old stage of the activity of Hualalai or whether they really are parts of the Kohala mountains.

Leaving this question open, it is known that the volcano as we see it began its activity by pouring floods of aa and pahoehoe lava out of a number of vents arranged along a fissure line or zone of cracks which is almost straight in a northwest-southeast direction. As more and more of these flows were poured out they built an elongated dome. Activity was more pronounced at one particular part of the fissure line so that the dome of flows was built up to a greater elevation at this spot. There may possibly have been a summit crater similar to Mokuaweoweo on the top of this Hualalai dome. Certainly the structure of the Hualalai dome, elongated along a line of cracks, is very similar to the structure of Mauna Loa as it exists today.

Gradually the eruptions from the Hualalai dome began to change from quiet outpourings of lava flows to eruptions which were more violently explosive and which broke up the molten lava into small particles of cinder and ash. These cinder eruptions broke out in many places along the main rift line and built up huge conical piles of cinders and ash, as well as poured out smaller flows of aa lava. *Many of these cinder piles can be seen on the lower slopes* of the mountain below the Huehue Ranch, and the two most prominent ones form the two highest points of the mountain.

After these explosive eruptions, for some reason the activity changed back again to the more quite type, and the later flows have been poured out with less explosive activity at the source vent. Accompanying this change in type of activity, the main activity seems to have shifted from the center of the volcano out along the rift line in both directions from the center. There has been a moderate amount of the later activity at the top of the dome, enough to pour out a few small flows and to build several large pit craters at the top, but by far most of the later flows have been poured out from points on the rift line down both slopes from the center. Most of the pit craters and slag cones which show up so well along the rift line on the relief map which was made by Dr. Pope have been formed during these later eruptions.

This type of activity has continued into historic time. There have been apparently several flows from Hualalai since the occupation of the island by the Hawaiians according to accounts given by natives to Ellis in 1823. He says: ". . . . the traditional accounts given by the natives of the eruptions, which, from craters on its (Hualalai) summit, had in different ages deluged the low land along the coast; . . . ." (Ellis, p. 53). The only activity which has occurred since the arrival on the island of English settlers took place in 1800-01. On Dr. Pope's relief map two recent flows are shown on the north slope of the mountain. The western and shorter one of these is marked as the flow of 1801, and the other as the flows of Kaupulehu. There has been a considerable discussion as to whether or not both of these flows are of the same date, i.e. 1801. In a personal communication Dr. Pope states that he is convinced that the Kaupulehu flow belongs to the 1801 eruption.

Ellis' description of a visit to the source crater of the 1801 activity certainly seems to indicate that the Kaupulehu flow is the one in question. Parts of his description follow:

"Having traveled about 12 miles in a northeasterly direction, they arrived at the last house on the western side of the mountain." (Probably Huehue Ranch) ". . . . Leaving the path, the party began to ascend in a southeast direction and traveled about six miles."

At this spot the party spent the night. The location of their camp probably was on the northwest ridge of Hualalai, a few miles above the present belt road.

"Having united in their morning sacrifice of thanksgiving to God, and taken a light breakfast, they resumed their laborious journey. The road, lying through thick underwood and fern, was wet and fatiguing for about two miles, when they arrived at an ancient stream of lava, about twenty rods wide, running in a direction nearly west. Ascending the hardened surface of this stream of lava, over deep chasms, or large volcanic stones imbedded in it, for a distance of three or four miles, they reached the top of one of the ridges on the western side of the mountain.

"Between nine and ten in the forenoon they arrived at a large extinguished crater, about a mile in circumference, and apparently 400 feet deep, probably the same that was visited by some of Vancouver's people in 1792. The sides sloped regularly, and at the bottom was a small mound, with an aperture in its centre. By the side of this large crater, divided from it by a narrow ridge of volcanic rocks, was another fifty-six feet in circumference, from which volumes of sulphureous smoke and vapour continually ascended. No bottom could be seen; and on throwing stones into it, they were heard to strike against its sides for eight seconds, but not to reach the bottom. There were two other apertures near this, nine feet in diameter, and apparently about 200 feet deep.

"As the party walked along the giddy verge of the large crater, they could distinguish the course of two principal streams, that had issued from it in the great eruption, about the year 1800. One had taken a direction nearly northeast; the other had flowed to the northwest, in broad irresistible torrents, for a distance of twelve or fifteen miles to the sea, where driving back the waters, it had extended the boundaries of the island. They attempted to descend this crater, but the steepness of its sides prevented their examining it so fully as they desired."

H.A.P.

KILAUEA REPORT No. 1021

WEEK ENDING AUGUST 16, 1931

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge

There is nothing new to report. Steam and fume were detected occasionally at vents within Halemaumau, usually very thin as dry weather has prevailed. On August 13 about 9 a. m. there was a large avalanche from the middle of the northwest wall, causing much dust. Another avalanche dust cloud was observed from Uwekahuna about 9:20 a. m. August 15.

The seismographs at the Observatory recorded 23 volcanic tremors, six very feeble local seisms and one teleseism. Three seisms gave indicated distances as follows: August 12 6:11 a. m., 4 miles; August 13 6:20 a. m., 11 miles, and 7:03 a. m., 5 miles. None was reported felt. The teleseism registered at 11:04 a. m. August 10 without distance phases.

Tilt for the week was slight NNE. Microseismic motion was slight.

Model of Hualalai, 1930, by Willis T. Pope. Shows recent flows and the northwest-southeast summit rift well marked by cinder cones and pit craters. Distance from Kailua Bay to Keauhou Bay (southwest corner) is about six miles

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The Board of Directors includes Frank C. Atherton and Walter F. Dillingham, Vice-Presidents; L. Tenney Peck, Treasurer; Wade Warren Thayer, Arthur L. Dean, and Richard A. Cooke.

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The Volcano Letter

Two dollars per year | Ten cents per copy

No. 348—Weekly | Hawaiian Volcano Observatory, National Park, Hawaii | August 27. 1931

A typical pahoehoe surface on a lava flow. The skin of vesicular glass which forms rapidly is often wrinkled and contorted into curious shapes. Flow from southwest flank of Kilauea December 1919. Photo Finch.

VOLCANIC PRODUCTS

The statement is often made that the islands of the Hawaiian group have been formed by volcanic action. In other words, the islands are built of materials which have been thrown out from a number of separate volcanoes. It may be of interest to consider in some detail what these volcanic products are of which the Hawaiian Islands are made.

Geologists who have studied the question are rather well agreed that the basin of the Pacific Ocean is made up largely of a kind of rock known as basalt. One of the facts on which this statement is based is that most of the material thrown out of the numerous volcanoes in the Pacific Ocean basin is basalt of nearly uniform composition. This is certainly true in the Hawaiian Islands. All of the volcanoes in the Hawaiian group have drawn the materials for their eruptions from a common, deep-lying supply of basalt. Geologists do not agree as to the exact physical condition in which the basalt exists under the ocean. However, for the study of volcanic products it is unnecessary to determine this original condition. We are interested in the basalt only after it begins to be erupted from one of the volcanoes.

Under appropriate conditions of heat and pressure, part of the deep supply of basalt under a volcano becomes liquid, and then is capable of being erupted from the volcanic vent at the surface of the earth. When it is in this liquid condition it is called "magma." Magma may be defined simply as liquid rock. In more detail it may be defined as a solution of a number of chemical elements in different chemical combinations just as sea water is a solution of many chemical elements, the most important of which are sodium chloride (common salt) and pure water. Chemists express the amounts of the different elements in a rock in terms of their weight when combined with oxygen. A typical basaltic magma would be made up of the following principle elements in the given proportions:

Oxide of silicon	50%
Oxide of aluminum	14%
Oxide of iron	10%
Oxide of magnesium	8%
Oxide of calcium	10%
Oxide of sodium	3%
Oxide of potassium	1%
Other substances	4%

In addition to the main elements, the magma contains very small amounts of many substances such as water, manganese, titanium, phosphorus, sulphur, nickel, chromium, copper, chlorine, carbon, and molybdenum. Thus we see that a magma is a very complex liquid made up of a large number of elements in solution.

The magma can exist as a liquid only at very high temperatures. Dr. Jaggar made a number of measurements of the temperatures in different parts of the magma lake ranging from about 750 degrees Centigrade to 1,500 degrees Centigrade. Iron in a blast furnace would be white hot at the higher of these temperatures.

When the magma begins to rise in the throat of the volcano, some of its elements begin to combine to form gas such as water vapor, sulphur dioxide, and carbon

The lava flow from Mauna Loa in 1926 as it crossed the road like a moving cinder pile. The clinkery, broken surface of the aa flow is radically different from the smooth, glassy surface of the pahoehoe flow, yet the lava forming the two different flows may be of exactly the same composition. Photo Boles.

dioxide. The gas comes out of the magma solution, begins to expand and form bubbles, and cause the whole mass of the magma to swell and froth like soda water in a bottle after the cap is removed. The expanding gas makes pressure within the liquid magma which helps force it to the opening in the crater of the volcano and makes the magma erupt. If the gas pressure is relatively low and the opening to the volcanic vent is fairly open, the escaping gas makes fountains of liquid lava at the vent such as are seen in Halemaumau or at the heads of the Mauna Loa flows. However, if the gas pressure is great and the escape of gas is partly obstructed, the lava may be thrown out of the vent with great violence. These stronger gas explosions break the lava up into drops and fragments of different sizes so that, instead of a lava flow, an eruption of volcanic ash and cinders will result. Such activity has formed the large cinder cones on Mauna Kea and such craters as Diamond Head on Oahu.

Going back to the magma, as the gas begins to bubble out and the lava rises in the volcano, its temperature is lowered by radiation of heat to the rocks forming the throat of the volcano and to the open air. As the temperature drops, some of the constituents of the magma combine and crystallize from the solutions as minerals which can become solids at high temperatures. Olivine (Hawaiian diamond) is one of these minerals which begins to form crystals while most of the magma is still liquid. Some of the liquid lava dipped from Halemaumau had large crystals of olivine floating in it. Since the olivine crystals begin to grow before the lava is erupted, many of them attain a large size and are conspicuous in some flows as large greenish crystals known as phenocrysts Olivine is made up of magnesium, iron, and silica and is called a magnesium-iron silicate.

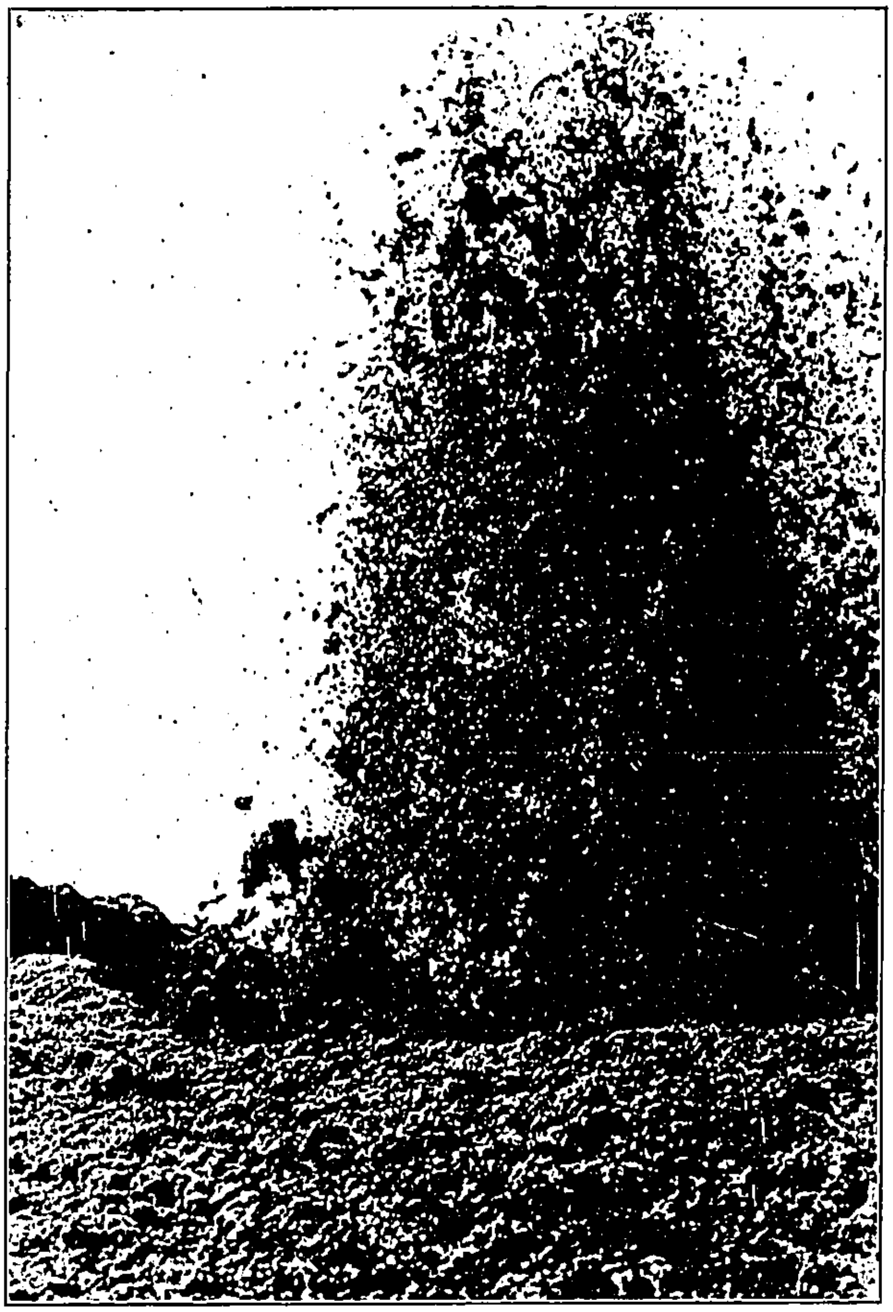
Other minerals begin to precipitate from the magma when the temperature drops still lower. The two other important minerals which form from basaltic magma are pyroxene and calcium feldspar. Proxene is made up of calcium, magnesium, iron, and silica. Calcium feldspar is made of calcium, aluminum, silica, some sodium, and a little potassium. Proxene and calcium feldspar are the most abundant minerals in basalt, olivine is third in abundance, and the only other common mineral of much importance is magnetic iron ore which is present up to 5 or 6 per cent in some basalts. Though olivine is the most common phenocryst in the Hawaiian basalts, occasionally pyroxene and calcium feldspar are found as black and white phenocrysts, respectively.

If magma cools fairly slowly, there will be time enough for all of its constitutents to combine in crystals of the above mentioned minerals. However, if the liquid magma is cooled very rapidly it may freeze to a solid form without giving the elements time to form crystals. This rapidly frozen magma is a volcanic glass which is called basaltic obsidian.

If the magma is thrown out in explosive eruptions, such as have occurred on Mauna Kea, the small drops of magma which are suddenly blown out into the air cool very rapidly and form small particles of basaltic obsidian. Many of these particles are full of gas bubbles and so form a sort of glass sponge which is called pumice. The larger fragments or blebs of magma may be big enough to cool more slowly and so have time to crystallize to some extent. Many of them are full of bubble holes also and so form slag-like pieces which are called cinders. An explosive eruption thus produces fine grains of glassy ash or pumice and coarser fragments of partly crystalline cinders.

A small part of the magma which comes out in a quiet eruption is blown into the air by the fountains at the source vent. This part freezes rapidly and forms a little pumice and Pele's hair which is basaltic glass drawn out into fine threads. However, most of the magma from quiet eruptions pours out as lava flows. These are of two types, aa and pahoehoe, which are distinguished by the character of the surface of the lava flow and not by any difference of composition of the lava.

If the magma which flows out is so hot that it contains very few crystals, the surface of the flow rapidly freezes and forms a thin skin of basaltic glass on top of the flow. This skin acts as an insulator and permits the rest of the lava in the flow to retain its heat and so to cool slowly enough for complete crystallization. A flow



Fountaining lava at the source of the 1919 flow from Mauna Loa. The force of the rising gas throws the lava into the air and blows it full of bubble holes. Pumice and Pele's hair are formed by this sort of fountain. If the explosive force becomes much greater, all of the rising lava may be blown into the air to form cinder and ash cones. Photo Jaggar.

which has formed such a glassy skin on its surface is called a pahoehoe flow.

In contrast, if the magma has been cooled enough before exposure to the air so that it is full of tiny crystals, as soon as it is exposed to the air all of the magma crystallizes rapidly. Thus, instead of forming a glassy skin on its surface, the flow forms a top layer of crystalline clinkers. This clinkery surface also is an insulator so that the inner part of the flow loses its heat slowly and has time to crystallize completely. A lava flow with a clinkery surface is called an aa flow.

Aa and pahoehoe flows make up most of the rock of the Hawaiian Islands. Cinders and ash are present in appreciable quantity on the islands of Maui and Hawaii, and are fairly conspicuous as building material in the make up of Oahu. For example, Punch Bowl and Diamond Head on Oahu are craters made up largely of ash and cinders.

H.A.P.

KILAUEA REPORT No. 1022

WEEK ENDING AUGUST 23, 1931

Section of Volcanology, U. S. Geological Survey

T. A. Jaggar, Volcanologist in Charge

There are no visible changes in volcanic conditions at Kilauea. Halemaumau remains quiet and with the usual vapor activity. The records of the seismograph nearby indicate quiet conditions.

There were 21 short tremors registered by the instruments at the Observatory, one two-minute tremor, and one eight-minute tremor; and three very feeble local seisms. One of the seisms, occurring August 21 at 12:09 a. m., and having close epicentral distance, was felt locally; another at 11:05 p. m. August 22 showed distance to origin 32 miles.

The average tilt for the week was very slight NE, with a decided trend to N toward the end of this period. Microseismic motion was slight.

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August 3, 1931

The Director,
National Park Service,
Washington, D. C.

Dear Mr. Director:

Following is a report of activities and operations in Hawaii National Park for the month of July, 1931.

000 GENERAL

July was a delightful month in the park, the weather being fine and cool. Some rain fell on twenty nine days of the thirty one, mostly in the late afternoon or during the night. There was a severe tropical storm on the twenty first and twenty second, and 6.75 inches of rain fell, accompanied by a heavy wind. Most of the rain fell within a period of approximately six hours. Considerable damage was done by floods, washouts, blown down trees, wrecked buildings and minor structures, and tangled telephone lines, not only in the park but on the island generally.

100 ADMINISTRATION

110 Status of work
The office work was heavy during the month because of the closing of the accounts and reports for the old fiscal year and the beginning of operations under the new fiscal year. However, the work was kept up to date and is in good shape.

120 Park inspections by
121 The Superintendent
In addition to daily inspections of activities at headquarters, the superintendent made a trip to Hilina Pali on July 2 by automobile, then on horseback for six and a half miles over the new trail being constructed from the Hilina Pali toward Mauna Iki. Hevisited the battleship Oklahoma in Hilo harbor on July 8, with Park Naturalist Doerr, as a guest of the officers and men, where Mr. Doerr showed the reel on volcanoes and gave the lecture explaining the geology of the park.

A trip was made to Hilo July 3 to meet Governor Judd, who was to have been there over the fourth, but he was detained at the last moment and was unable to come. Hilo staged a very interesting Fourth of July program with a large parade, in which several bands participated. In the forenoon boat races were the principal attraction and in the afternoon a baseball game, with fireworks in the evening.

Other trips were made to Hilo once or twice a week on park business in connection with purchasing, repairs or equipment, filing radio messages, executing oaths of disinterestedness to contracts, etc.

130 Finance and Accounts

Following is a list of the funds appropriated for work in Hawaii National Park with the unexpended balances shown as of the close of July 31, 1931.

Symbol	Name	Allotted	Expended	Balance
41/2415	Hawaii National Park 1931-'32:	52,130.00	5,639.37	46,490.63
41/2406	Forest Protection and Fire Prevent:	100.00	8.21	91.79
40/1415	Hawaii National Park 1930-'31:	34,625.00	34,621.38	3.62
40/1406	Forest Protection & Fire Prev.	990.00	945.00	45.00
40/1456	Emerg. Reconst. & Fighting Forest Fires in Nat'l Parks, 1930-'31:	17.25	17.25	0.00
4X436	Roads & Trails, National Parks, no year:	382,386.00	21,682.17	360,703.83

The report of expenditures for the quarter ending June 30, was forwarded shortly after the first of the month. The report of discounts taken amounting to $29.38 was sent in. Recommendation for revising the outline of work for the 1931 fiscal year was sent in on July 17, and Form 10-210 with Column C filled in showing the actual expenditures for the past year was forwarded the same date, to be attached to the estimates for 1933.

150 Equipment and supplies

The principal items of supplies purchased during the month were the lumber, cement, roofing, and plumbing, and electrical supplies and fixtures for ranger cottage No. 411, on which construction was started.

170 Plans, maps and surveys

The plans for the U. S. commissioner's residence and for the new administration building were returned to the landscape division at San Francisco for further study, with suggestions from the superintendent.

180 Circulars, placards, publicity bulletins, etc.

Attached to the report is a copy of June Nature Notes, issued by the educational division. This is the initial issue of this publication and it has created much interest and favorable comment throughout the islands. Many requests to be placed on the mailing list have been received. Two hundred and fifty copies were mimeographed but approximately one hundred more will be required.

An article by M. Earle Adams, publisher of the Healdsburg Tribune entitled "Vacationing in the Hawaiian Islands" is such an interesting description of his recent trip as a member of the California Press Association, that it has been attached to this report as a worth while publicity bulletin.

Another article of interest appeared in the Pearl Harbor Weekly, written by Pharmacist Mate E. R. Nichols, entitled "Boys Visit Rest Camp" and describes the activities of the group of boys who visited the park in June and also the points of interest in the park that they visited under the guidance of the park naturalist.

There is also a set of eight pictures showing the group attending the University of Hawaii summer school here, and the damage to trail shelters and roads caused by the tropical storm of July 21. An allotment of $200 to repair this damage was requested from the fire, flood and storm appropriation.

Attached are copies of the weekly issues of the Volcano Letter.

200 MAINTENANCE, IMPROVEMENTS AND NEW CONSTRUCTION

210 Maintenance

The usual maintenance and repair of roads, trails, buildings, water and telephone lines, policing and sanitation, etc. was carried on during the month.

Haleakala section:

The Haleakala trail leading from Olinda to the rest house was repaired during the month; also the trail from the rest house to the White Hills section, the Sliding Sands trail to the bottom of the crater and across the floor to the Halemau trail, the latter also being repaired from the floor to the edge of the crater. These trails had suffered quite severely in many places from washouts due to heavy rains and the lack of proper drainage. The character of the country was such, however, that where the trail was washed out it was only necessary to make a new one a few feet to one side of the washed out place, and in many places there are four or five lines of ditches where the trails has been moved from time to time. In addition, the trails were literally covered with loose rocks that had been worked out of the soil and had rolled in from the sides until traveling over them was difficult and tiresome to horses and riders. This main system of trails was all repaired during the month and put in good shape.

220 Improvements

Experiments are being made to determine whether it is practicable to light the Thurston Lava Tube with small automobile headlights placed on small wires, which would be concealed, and supplied with electricity from a storage battery. It is proposed to use material that we have on hand if the experiment proves successful.

230 New construction

Mr. Henry P. Benson, president of the Hawaii Contracting Company, the parent organization of the Bitulithic Paving and Concrete Company, who have the contract for road improvement at Kilauea headquarters, called on July 11 to assure us that this road work would be speeded up immediately and carried forward with dispatch. He explained that they had been handicapped by the illness of their superintendent, and the finishing up of a job on Maui had taken a little longer than they anticipated. He promised to have the power shovel, trucks and other machinery sent over the following week and construction started on their camp buildings. Mr. Benson's promises were carried out and the company has actually gotten started and has made some progress. By the end of the month the buildings for their camp were about 75 per cent completed and the power shovel had been at work for about ten days excavating embankments and making fills. It appears now that the work will go forward as promised.

On July 17, Ranger J. H. Christ and Trail Boss Albert L. McKenzie were sent over to the Haleakala section to inspect the maintenance work started in June, the spraying of Silver Swords, and to construct a new trail from the Halemau trail at the edge of the crater to the rest house, so that a round trip route from the rest house down to the crater and back could be easily made in one day. This trail is a little over three miles in length, and was completed by the end of July, and built on the regular National Park Service standards.

On July 14, the Park Service crew was put to work digging new drainage ditches along the round-the-island road below the Kilauea Military Camp. This was a force account job and carried on with roads and trails, post construction funds. The Bitulithic Paving and Concrete Company had completed the rebuilding of shoulders, as required in their contract, so far as the same were necessary. It appeared that in some places the digging of drainage ditches was of more importance than the rebuilding of the shoulders, and as drainage ditches were not provided for in the contract, this work was done by force account. Approximately 800 linear feet of work originally called for in the contract was eliminated and made unnecessary by the construction of these drainage ditches and the saving made will be used to patch up holes, worn places, and places where the road has raveled between Stations 823 and Stations 341. The total amount of repair needed amounts of 3,820 square yards. Engineer E. S. Wheeler of the Honolulu office of the Bureau of Public Roads was here on July 22. He went over this section, approving the work and plans adopted, and arranged with the Bitulithic Paving and Concrete Company to submit a unit price for this patching work, for which they will be given an extra work order. They will have the material, tools and equipment, including a road roller with which to do this work, and as the park has nothing of this kind, they are in a much better position to handle the work for us. With this improvement, when the contract work is finished, the main roads at Kilauea headquarters will all be in first class condition.

While Mr. Wheeler was here, the following matters were discussed:

1. Plans for the proposed extension of the Chain-of-Craters road from Makaopuhi crater to the Park boundary toward Kalapana. The Bureau of Public Roads had been previously advised that a tentative allotment of $25,000 had been set up for this road, approximately one mile in length. The County of Hawaii was authorized by the last Territorial Legislature to sell $30,000 worth of bonds for the Kalapana-Hawaii National Park road. The distance is

fifteen miles, so that it will not be possible for the county to construct a road with this small amount, but it may be used for securing surveys and plans and used as the beginning of a project.

In view of the inability of the county to connect with our road at the park boundary, I recommended to Mr. Wheeler that the $25,000 be used for the improvement of the road from the Kilauea Military Camp to the Uwekahuna Observatory. This road should be entirely rebuilt and brought up to standard as to grades and alignment, and paved. This suggestion met with the approval of Mr. Wheeler.

2. The Kau road improvement, particularly the plan of eliminating unnecessary shoulder work and using the savings thus made to repair the paved section beyond the section included in the contract. The drainage ditches being dug by the Park Service were approved.

3. Many sections of this road have shoulders that are higher than the pavement so that water can not run off the road surface. It was agreed that the Park Service would put a grader on these shoulders and cut them down, after which they would be rolled by the contractor.

4. The new quarry requested by the contracting company was discussed and the action of the superintendent, turning down the request, was approved.

5. It was learned that no provision had been made in the plans for widening the road from headquarters to Halemaumau pit on the curves. As this was felt to be necessary, because of the many curves, in order to provide a greater element of safety for passing cars, it means there will be a greater quantity of excavation and more pavement required, which will require some additional funds over and above the amount set up to cover the quantities listed in the contract.

6. In discussing the plans for the park road at Haleakala connecting with the territorial road at the park boundary and continuing to the edge of the crater, it was learned that this road was to be 16 feet wide, with a paved portion 8 feet wide, with paved turnouts where necessary. The road, in its final location, touches the edge of Haleakala crater three times, where interesting views of the crater may be obtained. At one point, the road actually goes inside the crater on a switchback turn. I learned further that the terminus of the road is at the present rest house. I understood from Landscape Architect Vint that it was proposed to have this road terminate at White Hills, approximately two and a half miles farther, where there is space for parking automobiles, building a new rest house, stables for horses, etc. and where views of the crater can be assured to visitors most of the time. The view from the present rest house into the crater is often obscured by clouds when the upper end of the crater is clear, and from the White Hills section a wonderful view is obtained. Engineer Wheeler had never heard of this plan and stated that he would take the matter up immediately on his return to his office. I have recently been advised that his San Francisco office directed him to secure an order from the superintendent if this additional mileage was desired, and that $1,000 additional would have to be allotted for the necessary surveys and plans.

A radio was immediately sent to Landscape Architect Vint, explaining the situation, and if he approved the plan for extending the road to secure for me, from Washington, the necessary authority for issuing the order requested.

It was also learned from Engineer Wheeler that the $184,000 set up to begin construction of the Haleakala road would not begin to complete it, so that additional funds would have to be provided.

7. I also discussed with Engineer Wheeler the proposal for building either a road or a trail to the top of Mauna Loa, and the comparative costs of a trail and a road and various standards of both were estimated. No conclusion was reached in the matter, the superintendent merely endeavoring to secure all of the information possible on the subject.

8. The completion of the main road system at Kilauea headquarters by improvement of the road from the Kilauea Military Camp to the Uwekahuna Observatory and thence to the Halemaumau firepit, along the south side of Kilauea crater, making a circular loop road, was discussed and the superintendent's ideas and suggestions met with Mr. Wheeler's approval. This four miles of road, which is now a secondary road, should be brought up to the same standards as our other roads.

Work was started on Job 411, ranger cottage, early in the month, and the house was about 90 per cent completed on July 31.

The new trail from Hilina Pali toward Mauna Iki, terminating at the Uwekahuna Observatory, was completed during the month, the total distance being approximately 18 miles.

240 Improvement of approaches to the Park

Paving of the Haleakala road has been completed almost to the boundaries of the Wadsworth property on the upper homestead road in the Kula section, and rough grading work has progressed to Puu Niau Niau, the cinder cone that marks the boundaries of the National Park. From Wailuku to the end of the pavement and back has been found to be just an easy drive of one and a half hours. The Pukalani road has just recently been repaired and regraded to the end of the old pavement at the Makawao crossroads. The lower road is bordered by pineapple fields and sugar cane, and the upper section winds through dense growths of eucalyptus and rolling pasture land. When the road is completed to the summit of Haleakala it is estimated that it will take approximately two hours to drive from Wailuku.

On July 4 Joaquin R. Souza, employed by E. C. Mellor as a tractor operator, on a wager, drove a tractor over the trail from the end of the territorial road up to the rest house. It took two and one half hours to make the drive.

On July 10 the supervisors of Hawaii held a conference with Governor Judd on a suggested revision of the 7 per cent road system around the island.

The supervisors on July 9 also authorized Governor Judd to secure the approval of the President of the United States to issue $400,000 in bonds, authorized by the last legislature. These bonds cover the following projects.

Construction of asphalt, macadam road

Opihali toward Hookena, $50,000
Hualue toward Puuwaawaa, $90,000
Kawaihaeuka toward Waimea, $100,000
Kalapana toward Hawaii National Park, $30,000
Bridges, $55,000.

Governor Judd has asked for further information as to when they plan to start work on these projects and other data before submitting the request to the President for approval.

The four Kona road jobs now under contract are progressing favorably, according to K. L. Wung, County Engineer, and will, in all probability, be finished within the time limits. The Ames-Will contract will be finished about August 15, the Medeiros contract August 31, while the Wheeler-Williams contract should be finished October 6.

250 Landscape work
During the month the park rangers continued with the eradication of nasturtium plants growing along the roads, and in the road construction interesting native plants of various kinds have been transplanted to the quarters of the park staff and also to the grounds of the Volcano House. The entrance road to the Volcano House was overgrown with trees and shrubs so that the view was obstructed to the extent that the road was dangerous, and one or two accidents have occured by automobiles colliding. At the suggestion of the park superintendent, all of this young growth was pulled out. Practically all of the species were exotic plants and trees. As soon as the grass grows again the entrance will be more attractive and the road is now considerably safer.

300 ACTIVITIES OF OTHER AGENCIES SERVING THE PARK

310. Public service contractors
The Volcano House had 1,068 guests during the month, the Kilauea Military Camp 412, and the Kilauea Summer camp 146. On account of a shortage in the water supply at the Kilauea Military Camp it was necessary to cancel a number of reservations that they had received and to curtail the number of enlisted men being sent over from Honolulu and Schofield Barracks.

The Inter-Island Airways put a new Sikorsky amphibian plane into service on July 23. It was christened "Molokai". The cost of this new ship was approximately $60,000. This additional ship should prove popular with airplane passengers visiting the park.

On July 18 the new Matson liner "Mariposa" was launched at the Fore River ship yard, Massachusetts. This liner is to ply between the west coast and other Pacific ports. It is 631 feet long, draws 27 feet, has a displacement of 25,000 tons, accommodates 750 passengers and carries a crew of 390.

The Inter-Island Steam Navigation Company has been advertising the islands through the broadcasting station KGU of Honolulu, with a fifteen minute program twice weekly, entitled "Roaming around Hawaii". The Hawaii National Park was featured for several evenings. Mr. Clarke Irvine, lecturer, writer, and newspaperman of note, who was in charge of the program, made a visit to the Park on July 16 to become familiar with the new roads and trails, and interesting features of the park, as well as to learn about the service being rendered to visitors by the park operator and the Government.

On July 4, as well as once or twice later in the month, the Inter-Island Steam Navigation Company announced a special round-trip rate from Honolulu to Hilo, with a slight reduction from the regular one-way fares, and some little business was stimulated thereby.

530 Cooperating non-governmental agencies
In the election of new officers of the Honolulu Ad Club, which sponsors the Hui o Pele association, Mr. L. W. deVis-Norton was elected chairman of the Hui o Pele committee, Henry Brodhoff secretary, and the superintendent of the park the third member of the committee. The Hui o Pele certificates of membership are being taken by quite a number of visitors, 198 memberships having been sold during July.

The Hawaii Tourist Bureau has recently moved to new headquarters in the Dillingham Building in Honolulu, and has asked for a Hawaii National Park exhibit of bizarre lava shapes, rainbow lava, Pele's hair, olivines, etc., and a specimen of the Silver Sword fern, all of which are being secured in the development of our museum here, and a part of which will be loaned to the Tourist Bureau. The Tourist Bureau is soon to make its annual visit to all of the islands to gather material for publicity, talk over plans, etc. with those interested in tourist travel. They are planning to place markers at the various points of interest on the island.

Following my visit to the Haleakala section of the park in June, and contacts made with the Chamber of Commerce of Maui, a special committee was formed to take charge of affairs pertaining to the Haleakala section of Hawaii National Park, and Ed J. Walsh was appointed the first chairman. Mr. Walsh is the owner and manager of the Grand Hotel at Wailuku, and was a member of the Superintendent's inspection party in June. He is of course keenly interested in the development of a large tourist business there.

540 State, county, or municipal legislation affecting the park
The item of $10,000 before the territorial legislature for cooperating with the U. S. Geological Survey in its work in the park and on the various islands failed of passage.

400 FLORA, FAUNA AND NATURAL PHENOMENA

410 Educational activities

Theodore C. Zschokke, extension forester of the University of Hawaii, arrived in the park July 1 to prepare for the opening of the summer course in nature study conducted by the University of Hawaii and the educational department of Hawaii National Park. Headquarters for the school were established at the Kilauea Summer Camp. Fifteen registered for the class but due to illness and unavoidable circumstances, there were a number of cancellations. There were ten students who completed the course, with a teaching staff of three - Professor Zschokke, the Park Naturalist, and Ranger Brumaghim. Those who took the course were all teachers in the territorial schools or university students. Attached to the report is a picture of the group and full details of their activities are contained in the park naturalist's report for July. Duplicates of all of the botanical specimens collected were made for the park museum. At the close of the school a luau (feast) was held by the class at the big steam cracks along the Chain-of-Craters road, to which a number of guests were invited, including the superintendent and his wife. Most of the food had been cooked in the steam cracks and the meats, sweet potatoes, etc. were deliciously fine and tender. Professor Zschokke and one of the members of the class, with a guide, made a trip to the top of Mauna Loa.

The first issue of the Hawaii Nature Notes, which was for the month of June, was sent out on July 17. It created much interest and a large mailing list of interested persons and organizations was immediately established.

Ranger Service: Nominations to fill the four permanent ranger positions established as of July 1, were forwarded to Washington during the month. The selections were made from a Civil Service certificate of eligibles from the mainland who had expressed a willingness to accept appointment in Hawaii National Park and report for duty at their own expense. However, the entrance salary for permanent rangers was increased from $1860 per annum to $1980 per annum. Selection was made strictly in accordance with the standing of eligibles on the Civil Service list, and included the following: Donald H. Eaton of Fresno, California, who has spent seventeen summers in the Rocky Mountain National Park; Joseph B. Fordyce of Sequoia National Park, who is spending his second summer as seasonal ranger there; Vernon Lowery of Yosemite National Park, who has had three years service as seasonal ranger; and Theodore W. Barnett, of Yosemite National Park, who has had three seasons as park ranger. The first two men are married, the latter two unmarried, and it is expected they will report for duty some time in September.

All three of the seasonal ranger positions were filled, for the first time, this season. Appointment of Gilbert W. Lee and William J. Elderts, Jr. was made under field agreement during July.

440 Insect control

Ranger Christ reports that the spraying of the Silver Sword ferns in the Haleakala section, with an insecticide, seems to be producing satisfactory results, judging from the large number of insects that have been killed. About one hundred of the plants were sprayed and they do not appear to have been injured in any way by the spray. In order to get at the root borers, however, it was suggested that oleander leaves might prove poisonous to them and experiments along this line have been carried on. The oleander leaves are placed on the ground close to the stalk of the plant and already a number of worms have been poisoned by them but whether these worms are the ones that have been doing the damage to the plant remains to be seen. The seeding plants have been further protected from attack by insects by being covered with cheesecloth from top to bottom. This cheesecloth is fastened around lath. One of the interesting discoveries of the month was an area outside of the park containing about 125 of the Silver Sword ferns growing in good condition. If the seed can be gathered from the protected plants this year, it is proposed to re-seed the best areas next fall in the hope that new plants can be started. This work was carried on during July and will be continued through August and perhaps September. Special funds from the appropriation for insect control have been requested by radio for this work.

460 Birds

Twenty cock pheasants, eight hens, and sixteen chicks were seen by Ranger Williams during the month.

480 Natural phenomena

Dr. T. A. Jaggar, in addressing the Pan-Pacific Union at its weekly luncheon on July 13, assured his hearers that lava should return to Halemaumau pit this fall. His prediction was based on previous activity records of that volcano. He also said that Mauna Loa should be active soon, and based this prediction on the records of the past, which show that this volcano shows signs of life at intervals of five years.

The weekly reports of the condition of Kilauea volcano are contained in the issues of the Volcano Letter, attached to this report. Early in the month the pit was dry and quiet, while the following week interesting changes in the way of the appearance of blue fume and steam in two places on the pit floor occurred. Great steam clouds covered the pit following the heavy rain on July 21. The seismographs registered seventy tremors during the month, and one perceptible shock was felt locally at 2:43 P.M. July 30. Small slides occurred on July 10, 16 and 17. The tilt during the first part of the month was NNW, W, and NW, changing to NE the latter part of the month due to the weight of water from heavy rains on the pit floor.

500 USE OF PARK FACILITIES BY THE PUBLIC

510 Increase or decrease in travel

There was a total of 10,207 visitors during July, compared with 9,809 for the same month last year, an increase of 389 persons, or 4.1 per cent.

It will be interesting to note that Ranger Christ reported a total of 304 visitors registered in the visitors' register at the rest House at Haleakala during the month of July, and it was observed that not all of the visitors who came to that section registered at the rest house. This shows an interesting and worth while travel to that part of the park, during the summer at least, and the need of having a ranger stationed there at all times.

520 General weather conditions
Weather during July was ideal, especially compared with that on the mainland, where many states suffered from record breaking heat waves and drought, and where there was any relief it was followed by terrific storms of hail, rain and lightning. There were 9.85 inches of rain during the month, compared with 4.14 inches for July of last year. The minimum temperature for the month was 49° on the first, and the maximum 76° on the thirty-first. The mean maximum was 70.6° and the mean minimum 55.8°. Light, cooling winds prevailed throughout the month and nearly every day was partly cloudy and partly clear. The total rainfall to date for this year is 29.90 inches, as compared with 47.04 inches last year. The humidity ranged from a minimum of 74 to a maximum of 94. The heavy rainfall on July 21 filled all the water tanks to capacity and the water shortage, which had been rather acute in some places, was ended. Weather report form is attached.

540 Visitors
John S. Ross, grand master of the California Masonic order, accompanied by Mrs. Ross and their two sons and two daughters, visited Hawaii National Park on July 7. They were entertained by the superintendent and his wife and were personally conducted to all the points of interest. They departed in the afternoon of July 8.

On July 4 W. Robert Moore, expert natural color photographer and member of the editorial staff of the National Geographic Magazine, arrived in the park to take pictures for a sixteen page color section to be published in the National Geographic Magazine early next year. He was personally conducted by the superintendent on that day to points of interest, particularly where color photographs could be secured but cloudy weather prevented him from taking pictures on the first day. The following morning, however, he visited the special points selected, under the guidance of the park naturalist. He visited the island of Maui and the Haleakala section of the park. On arriving at the edge of the crater, the entire pit was blotted out by dense clouds. Little by little, however, the cloud rack disappeared and at the end of two hours the view of the crater pit and Mauna Loa and Mauna Kea on the island of Hawaii, beyond, were as perfect as they could possibly be. Mr. Moore expressed enthusiasm over the wealth of color subjects here.

On July 18 and 19 a group of 80 students and faculty members from the University of Oregon who have been attending the University of Hawaii summer session, visited the park in a group. They were given special attention by the park naturalist.

At the completion of a visit to this island, Professor A. C. Alvarez, of the University of California, with Mrs. Alvarez and Miss Neal, visited the Haleakala section of the park. Ranger Christ was on duty there at the time, and special courtesies were extended to this party, who enjoyed a very fine trip to the crater, going down across the floor and back.

Col. P. M. Smoot, Adjutant General of Hawaii, was a visitor to the Park on July 28, and called at the superintendent's office.

Henry J. Lyman, tax collector of the County of Hawaii, visited the park on July 16.

A. E. Hudson, archeologist of the Bishop Museum, came to the park on July 30.

The Venerable Archdeacon James Walker was a park visitor during July.

On July 22 Mr. and Mrs. Irvin Stewart of Fresno, California, cousins of Mrs. Horace M. Albright, arrived at the park bearing a letter of introduction. It was a real pleasure to meet those people and they were entertained by the superintendent and his wife.

Mrs. E. J. Walsh, wife of the manager of the Grand hotel at Maui, made a special trip to the island of Hawaii and Hawaii National Park to study hotel service and the handling of tourist travel and was given personal attention while here.

The Bluebird Club of Hilo, of about twenty Japanese girls, camped in the public camp ground for several nights.

Mrs. Elsie T. George of Fresno, California, was a visitor at the Kilauea Military Camp, with other Army friends, and at a gathering to which the superintendent and his wife had been invited, Mrs. George was met and it was learned that she was a close friend of Mrs. Forrest S. Townsley, of Yosemite.

One of the outstanding events of the month which attracted world-wide attention to the Hawaiian islands, was the trip of the Shell Oil Company's ship of joy. This was the liner "Malolo" of the Matson Navigation Company, from San Francisco to Honolulu and return, with the world famous Hugh Barrett Dobbs, known far and wide as Captain Dobbsie, in charge of radio entertainment, which was unique and history making in many aspects. The entertainment programs on the ship of joy as well as while the entertainers were in Honolulu, were picked up by the Radio Corporation of America and rebroadcasted through mainland stations of the National Broadcasting Company. The Hawaiian islands were served by the broadcasting station KGU of the Honolulu Advertiser.

600 PROTECTION

610 Police protection

Complaint was made by Mr. and Mrs. Mitchell, on July 12 that a man had been heard prowling around their home during the night. A few days later the Sisson family made a similar complaint. On July 13 Mrs. Armitage reported hearing a man walking around her house about 1 A.M. and when she flashed a light on him through the window he turned and quickly left. The general opinion of these complaints was that they thought these prowlers were soldiers, although there was nothing to indicate such to be the case. However, there is a great timidity among the families here when there are no male members staying with them, and there is a considerable fear of the soldiers brought about, of course, by some of the actions of a few soldiers who have been guilty of various crimes. The matter was discussed with Captain N. A. Hedden and he issued an order putting the residential section of the park as an out of bounds area for all enlisted men. There has been no further complaint of this nature but there has been considerable petty theivery and housebreaking carried on during the month. On July 19, Dr. H. A. Powers reported that on that date, between 1 and 7 P.M. three watches had been stolen from his quarters which, however, had not been locked. Mrs. W. H. Beers reported that on July 23 a window had been broken on the second bedroom of her house, the latch lifted, and the house entered. Bureau drawers had been opened, window shades raised, and articles moved about.

The above cases were all within the park boundaries. In addition, quite a number of thefts and reports of housebreaking were reported by persons living in the summer cottage area adjacent to the park. The house occupied by Mrs. J. M. Gandy, wife of the manager of the Volcano House, was entered and a large flashlight and writing paper and envelopes taken and a bottle of ginger ale used. The back of a locked wardrobe was pried off with a poker, the thief evidently looking for articles of value. Another house was broken into and quite a supply of canned goods was stolen. The Hilo Detective Bureau and Sheriff's office was called on the case and investigation has been conducted jointly by that bureau and the rangers of the park but no evidence has been obtained as yet to indicate the party or parties guilty of this burglary.

On July 3 a group of visitors was arrested by Ranger Brumaghim at the Lava Tube for being under the influence of liquor, and a quart of liquor was destroyed. The driver of the car, which was a taxicab, was sober, so he was ordered to leave the park with his passengers and warned not to bring liquor or intoxicated persons into the park in future.

620 Fire protection

A small fire broke out along the Halemau trail in the Haleakala section of the park during July and was extinguished by Ranger Christ and Trail Boss MacKenzie. Evidently it had been caused by a carelessly thrown cigarette. Damage was nominal.

630 Accidents

Joseph Zembik, who was working on one of the trail shelters along the seacoast on the southern boundary of the park, received a badly contused shoulder when the structure on which he was working was overturned by heavy wind and rolled for a distance of nearly two hundred feet.

On July 5, a Dodge sedan with license number 22368 owned by Chun Hoon of Hilo, ran off the road between the Hilo entrance ranger station and the park headquarters. The automobile had struck a tree on the right side of the road, partly knocking it down. The right front wheel, right axle, right front fender and running board were broken but the occupants were not injured. They claimed to have been forced off the road by a passing car.

On July 17 Pedro Apilada, of Pahala, a Filipino, crashed head on into a Government Ford, 1½ ton capacity, truck, about three miles beyond the Volcano House on the Kau road. Bernard Waltjen was driving the Government truck. He was turning around at the time and had pulled off the road to his left and backed in on to the main road again, facing the opposite direction. He was about in the middle of the road, but the Filipino was to blame because the place where the accident occurred was on a straight stretch of road where the roadway as well as the sides of the road where the turn was made could be seen for a half mile in either direction. The Filipino was driving a Studebaker car, which was put out of commission. The front bumper was broken, the radiator smashed in so that all the water ran out, and the steering wheel was broken and the windshield cracked. However, there were no personal injuries. He was given assistance in getting help from his home at Pahala to tow his car in.

900 MISCELLANEOUS

Mrs. Mary Elizabeth Johnson Shipman died at her home in Hilo on July 13. She was born in Kona June 1, 1851, and was a member of the well known Shipman family.

In line with the proposal to abandon various Army camps that are no longer necessary, as a measure of economy, it was rumored that among the camps to be abandoned was the Kilauea Military Camp in the Park, but this has been officially denied by the Hawaiian Department of the U. S. Army.

The personnel of this park were all very sorry to hear of the illness of Director Albright and his operation for appendicitis at Fairbanks, Alaska on July 29. I am sure the thousands of friends that Mr. Albright has were distressed and alarmed on hearing of his operation and it was gratifying to receive later assurances that his condition was satisfactory and his recovery would probably be uneventful. The sympathy of a host of friends, both official and personal, goes out to Mr. Albright and to his family, and all hope for a speedy and complete recovery.

Very respectfully,

E P Leavitt

E. P. Leavitt,
Superintendent

Form No. 1009—Met'l.

U. S. Department of Agriculture, Weather Bureau.

COOPERATIVE OBSERVERS' METEOROLOGICAL RECORD:

Month of [illegible], 192 ; *Station,* Volcano Observatory; *County,* [illegible]

Hour of Observation, ________

State, Hawaii; *Latitude,* ________; *Longitude,* ________; *Time used on this form,* ________

DATE.	TEMPERATURE. Maximum.	Minimum.	Range.	*Set Max.	PRECIPITATION. Time of Beginning.	Time of Ending.	†Amount.	~~Snowfall, in inches.~~ Humid.	Wind ~~Depth of snow on ground at time of observation.~~	Prevailing Wind Direction.	Character of Day, Sunrise to Sunset.	‡Miscellaneous Phenomena.
	1	2	3	4	5	6	7	8	9	10	11	
1	69	49	20	61			16	91	Mod.	N.E.	P.C.	
2	72	59	13	65			03	80	Lt.	"	"	
3	72	52	20	65			04	84	Mod.	"	"	
4	73	56	17	58			05	84	"	"	Clear	
5	71	55	16	68			02	85	"	"	P.C.	
6	70	58	12	62			42	89	"	"	"	
7	70	65	05	61			08	88	"	"	"	
8	72	56	16	62			04	91	"	"	"	
9	69	51	18	61			05	91	Str.	"	"	
10	64	54	10	59			03	94	"	"	"	
11	69	56	13	60			34	89	"	"	"	
12	71	55	16	64			08	83	Mod.	"	"	
13	72	55	17	63			13	89	Lt.	"	Clear	
14	69	58	11	68			10	74	"	S.E.	P.C.	
15	72	56	16	66			25	85	"	N.E.	"	
16	72	55	17	67			05	80	Mod.	"	Clear	
17	71	59	12	63			04	84	Str.	"	P.C.	
18	72	59	16	66			02	90	"	"	Clear	
19	73	58	15	67			06	80	Mod.	"	"	
20	68	55	13	68			02	81	"	"	Cloudy	
21	66	59	07	64			59	89	Str.	"	"	
22	69	56	13	63			6.75	90	Mod.	"	"	
23	69	57	12	64			29	95	"	"	P.C.	
24	71	53	18	62			03	89	"	"	"	
25	67	56	11	60			03	89	"	"	"	
26	70	54	16	61			10	75	"	"	Clear	
27	71	54	17	63			02	83	"	"	P.C.	
28	72	55	17	63			01	89	"	"	"	
29	71	54	17	61			T	80	"	"	"	
30	73	56	17	64			04	79	"	"	"	
31	76	55	21	66			T	75	"	"	Clear	
SUM	2189	1730	459	1965			9.85	26.45				
MEAN	70.6	55.8	14.48	63.4			3.18	85				

*Reading of maximum thermometer immediately after setting.
†Including rain, hail, sleet, and melted snow.
‡Thunderstorms, halos, auroras, etc.

(IN TRIPLICATE.) See cover for instructions.

USGS Volcano Observatory, *Cooperative Observer.*

8—253

Post-Office Address, Natl. Park, T.H.

MONTHLY SUMMARY.

TEMPERATURE.

Mean maximum, 70.6

Mean minimum, 55.8

Mean, 63.2

Maximum, 76; date, 31

Minimum, 51; date, 9

Greatest daily range, 21

PRECIPITATION.

Total, 9.85 inches.

Greatest in 24 hours, 6.75; date, 22

SNOW.

Total snowfall, ______ inches; on ground 15th, ______ inches;

at end of month, ______ inches.

NUMBER OF DAYS—

With .01 inch or more precipitation, 29

Clear, 5; partly cloudy, 23; cloudy, 3

DATES OF—

Killing frost,

Thunderstorms,

Hail: Light, ; Moderate, ; Heavy,

Sleet,

Auroras,

REMARKS:

10-157
(July, 1929)

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

TRAVEL REPORT

Hawaii National Park for the month of July, 1931

	This Month	This Travel Year To Date	This Month Last Year	Last Travel Year To Date	Increase for Travel Year: Number	Increase for Travel Year: Percent
PRIVATE TRANSPORTATION:						
Cars first entry, ...						
Cars reentry, ...						
Motorcycles, ...						
Total motor vehicles, ...						
Persons entering via motor vehicles, ...	8,789	98,837	8,250	59,593	39,244	39.3
Persons entering via other private transportation, ...	448	3,253	427	2,585	668	20.5
Total persons entering via private transportation, ...	9,233	102,090	8,677	62,178	30,912	39.9
OTHER TRANSPORTATION:						
Persons entering via Hotel stages, .	832	6,858	1,132	8,856	-2,000	21.9
Persons entering via Summer Camp ~~trains~~ .	142	158			158	
Persons entering otherwise, . .						
Total other transportation, . .	974	7,016	1,132	8,856	-1,840	25.2
GRAND TOTAL ALL VISITORS, ...	10,207	109,106	9,809	71,034	37,072	33.9

	This Year	Last Year	Increase: Number	Increase: Percent
Automobiles in public camps during month, ...	4	0	4	400
Campers in public camps during month, ...	19	0	19	1900

10-158

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF AUTHORIZED PROJECTS

Hawaii National Park for the Month of July, 1931

Description of Projects	Percent Constructed To Date	Percent Constructed This Month	Percent Constructed Last Month	Probable Date of Completion
411 Employees Quarters --------	80 (90)	80 (10)	0 (80)	August 31, 1931
412 Employees Quarters --------	02 (30)	02 (75)	0 (0.2)	
502 Hilina Pali - Mauna Iki Extension - - - - - - - - -	90 (95)	60 (5)	30 (90)	August 15, 1931
502.5 Halemau, Rest House trail Extension - - - - - - - - -	50	50	0	August 31, 1931
502 Kipuka Bihopa Trail, Improvement and extension-	100	0	20	
502 Extension of Auto Trail Uwekahuna to Halemaumau	100	0	5	
Road Survey, B.P.R.Construction	5	0	3	

10-161

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

REPORT OF SALES OF PUBLICATIONS

JULY, 1931

	Number	Value
GOVERNMENT PUBLICATIONS:		
On hand beginning of month,	304	52.00
Received during month,	0	0
Total,	304	52.00
Sold during month,	5	5.00
On hand at close of month,	299	47.00

	Number	Value
NON-GOVERNMENT PUBLICATIONS:		
On hand beginning of month,		
Received during month,		
Total,		
Sold during month,		
On hand at close of month,		

Cash on hand beginning of month,	30.75
Sales during month,	5.00
Total,	35.75
Remitted during month,	0.00
Balance,	35.75

10-160

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

REPORT OF PARK REVENUES

Hawaii National Park for the Month of July, 1931

	This Year	Last Year
Park revenue on hand beginning of month,	0.00	0.00
Received,	50.00	50.00
Total,	50.00	50.00
Remitted,	50.00	50.00
On hand close of month,	0.00	0.00

Park revenues received this year to date,	50.00
Park revenues received last year to date,	50.00
Increase,	0
Per cent of increase,	0

10-215
(July, 1928)

UNITED STATES
DEPARTMENT OF THE INTERIOR
National Park Service

45334

HAWAII National Park

REPORT OF NON-APPOINTED PERSONNEL
(TEMPORARY)

Changes outside the District of Columbia for the month of July 1931

	Total at beginning of month	Additions	Separations	Net Gain or loss (a)	Total at ending of month
Permanent	8	3	1	2	10
Temporary	21	9	7	2	23
Total	29	12	8	4	33

(a) If loss, indicate by minus sign.

10-159
(May, 1931)

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

STATUS OF PERSONNEL

HAWAII National Park for the Month of JULY, 1931

	This Month		This Month Last Year	
	Appointed	Non-Appointed	Appointed	Non-Appointed
Number of employees beginning of month	8	21	6	12
Number of additions	3	9	0	16
Total	11	30	6	28
Number of separations	1	7	0	2
Number of employees close of month	10	23	6	26
Number of promotions during month	0	0	2	0
Aggregate amount of annual leave taken	0	0	0	0
Aggregate amount of sick leave taken	0	0	0	0
Aggregate amount of leave without pay	0	0	7	0

HALEAKALA AT SUNSET

By
L. W. deVis-Norton

Full many a sunset have I seen; o'er many a widespread land:
O'er mountains, o'er the desert, o'er India's coral strand:
O'er the bleak and sterile Northland, beneath the chill Pole-star:
But they all give place to Maui -- to Haleakala.

The might, dormant crater, that rears it's jagged crest
Ten thousand feet above the sea and Nature's fertile breast;
Around an awful chasm, -a devastated cone
Where man is but an atom - and terribly alone.

Upon that fearsome peak I stook and, as the clouds steep piled
Enwrapped the lower levels and hid fair "Idlewilde",
The golden orb of day sank down, and all that fleecy fold
Was turned, as in an instant, to wondrous, molten gold.

It was as though the Last Man, neglected by God's ire
Saw the dear world he loved so well, destroyed by living fire:
Leaving him, reft of all his kin, a ling'ring death to seek;
His plans - his visions - all in vain: waiting for God to speak.

By slow degrees the golden sheen to other colors changed.
My eyes o'er vast horizons of purple shadows ranged:
The clouds began to drift away, fast-fading was the light
As from the ocean - far below- rose up the shades of night.

The huge abyss beneath me - the crater's farthest rim,
A burned-out world, stupendous, mysterious and dim,
Was swallowed by the darkness: the whole world sank to rest,
Leaving me - awed and silent - upon the Mountain's crest.

And then there rushed upon me a sudden, awful fear
That never more should I behold the land to me so dear.
I felt as though the world were dead. Then, o'er the mountain bare
I saw the twinkly, friendly stars - and knew that God was there.

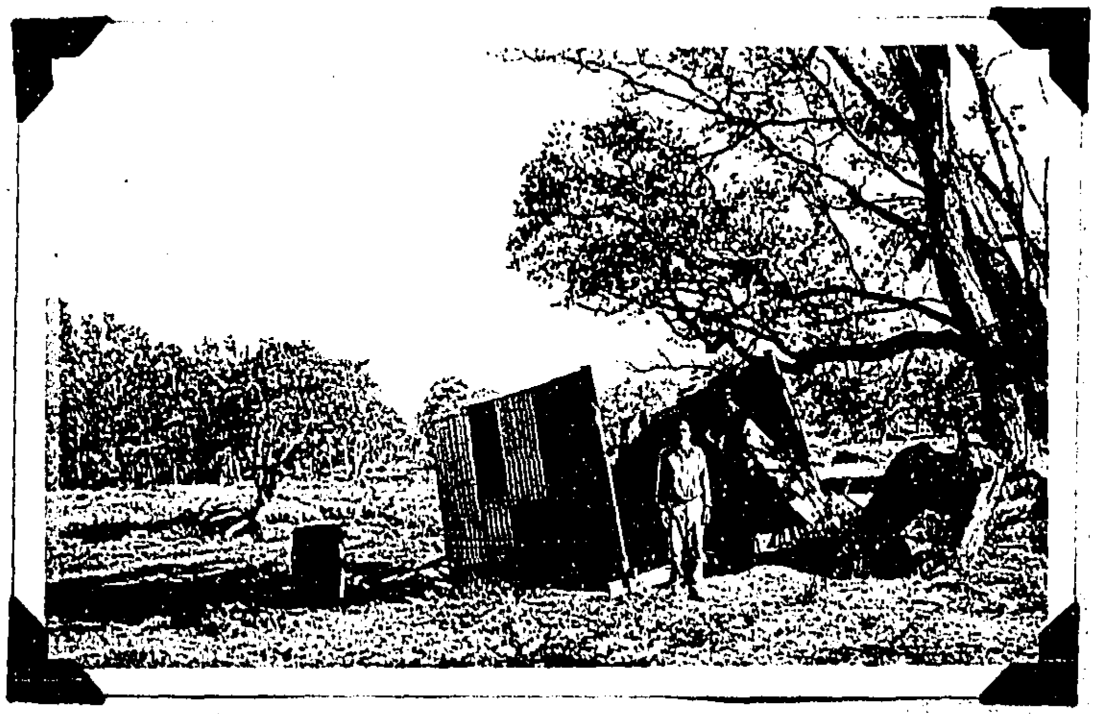
6/19/31

Nature Study Group from University of Hawaii, spending July 1931 in Hawaii National Park. Left to right, top row: L. Werth, teacher in Honolulu; E. K. Lindsey, teacher in Kohala; J. E. Doerr, Park Naturalist; Miss E. van Loben Sels, Stanford University.

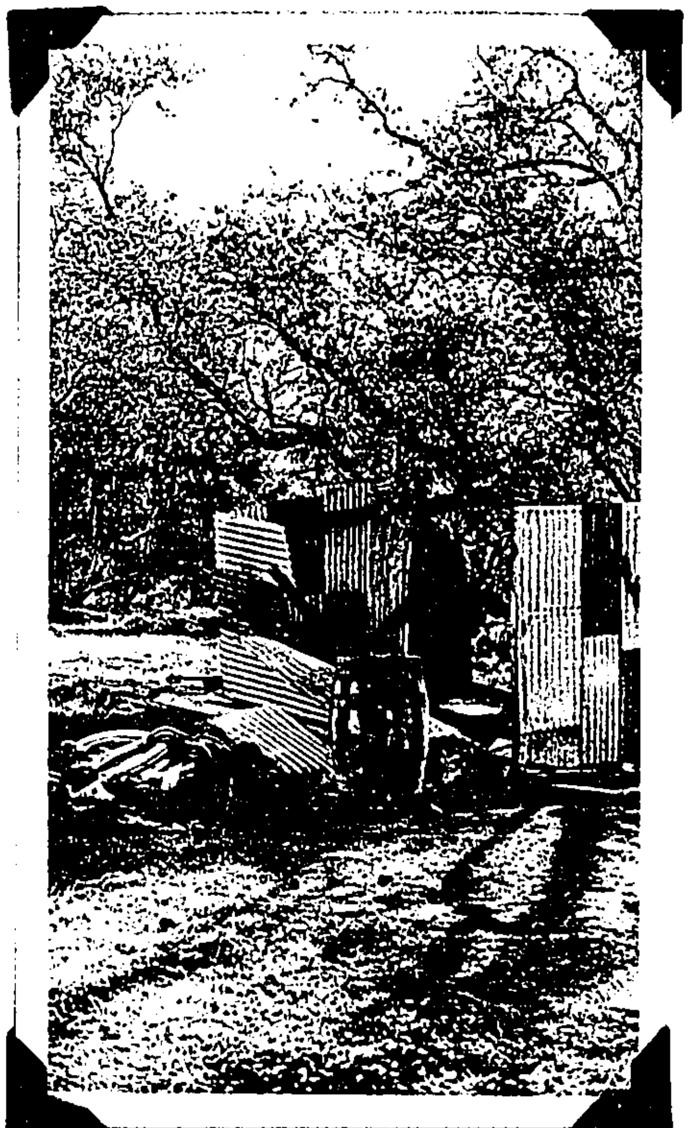
Second row: E. Brumaghim, Park Ranger; Miss N.Y. Chong, University of Hawaii student; Mrs. S. L. Kong, teacher in Hilo; Mrs. T.L. Chong, teacher in Hilo.

Front row: Miss E. Rickard, University of Hawaii student; Mrs. M. F. Brown, teacher in Hilo; Theo C. Zschokke, Extension Forester; Mrs. E.E.E.K. Luke, teacher in Kohala; W.F. Short, teacher in Kohala.

Picture by H. Werth.



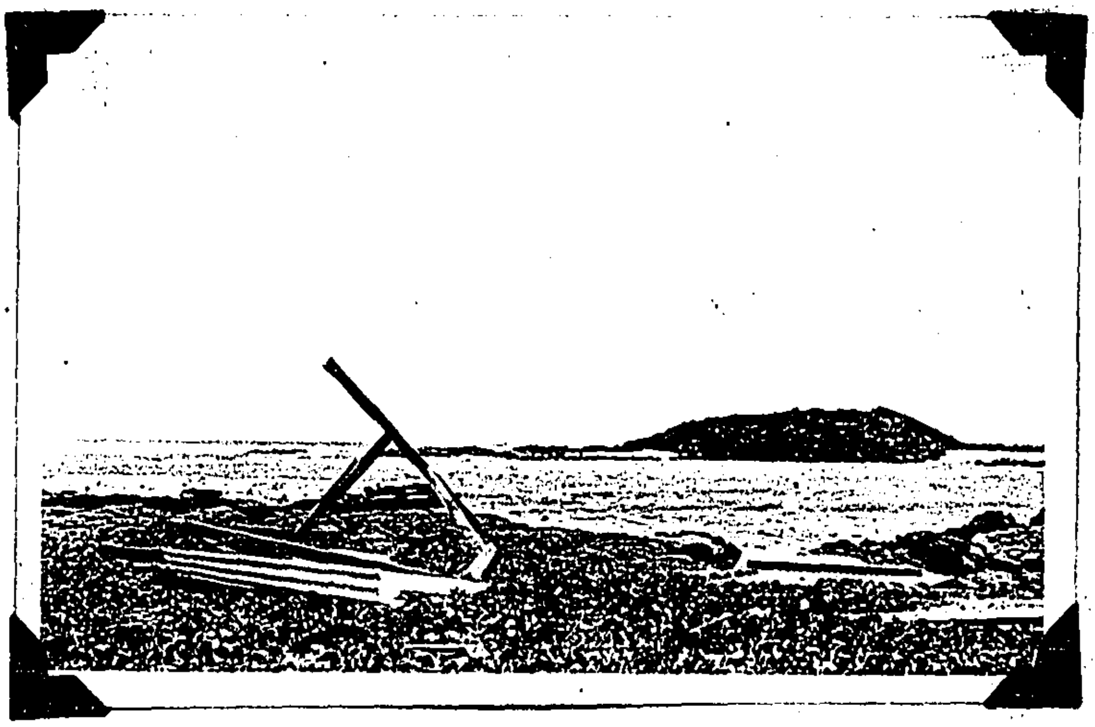
Picture No. 1. This picture shows the trail shelter At Kipuka Nene, turned completely over by the windstorm of July 21. It was caught by the tree and prevented from being carried farther away. Picture taken July 23, 1931, 9:30 AM, by Ranger Brumaghin.



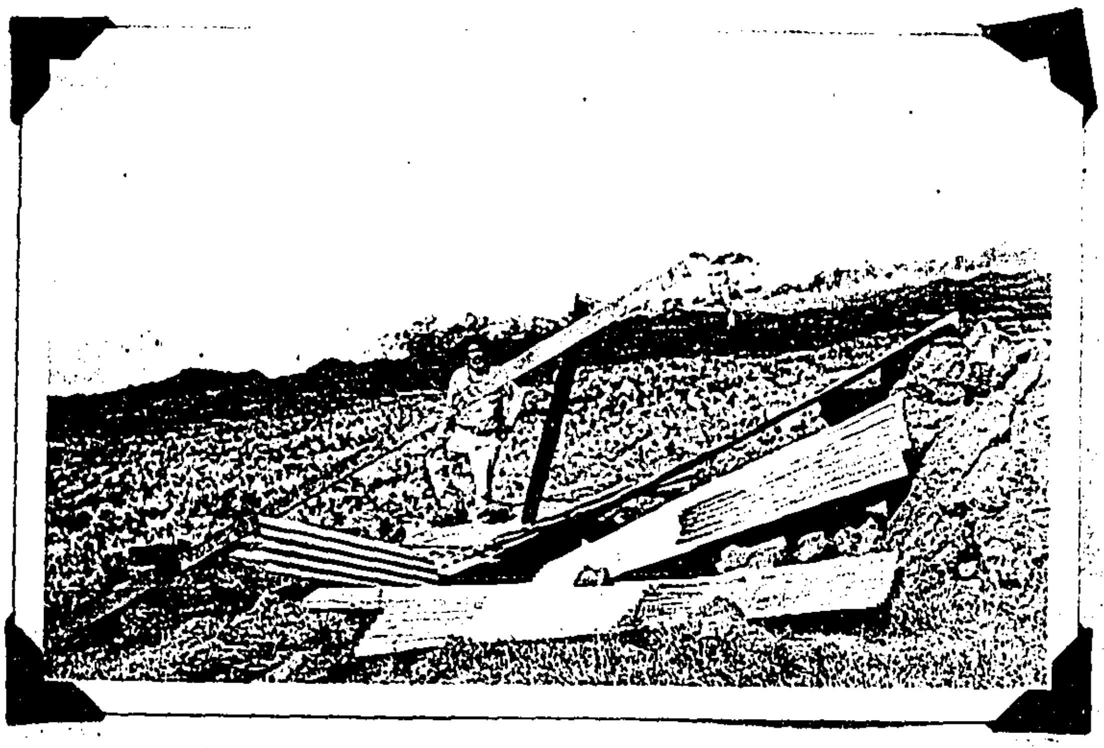
Picture No. 2. Another view of the trail shelter at Kipuka Nene, showing the damage done by the windstorm. The back of the shelter was all torn off and the framework twisted and broken. Picture taken July 23, 1931, 8:50 A.M. by Ranger Brumaghim.

Picture No. 5. Site of the trail shelter under construction at Halape. This trail shelter was picked up by the wind and carried about 250 feet. Joseph Zambik, who was working on the shelter at the time, was carried and dragged to the water's edge and received a severe contusion of the left shoulder and body bruises. Picture taken July 23, 1931, 2:37 P.M., by Ranger Brumaghim.

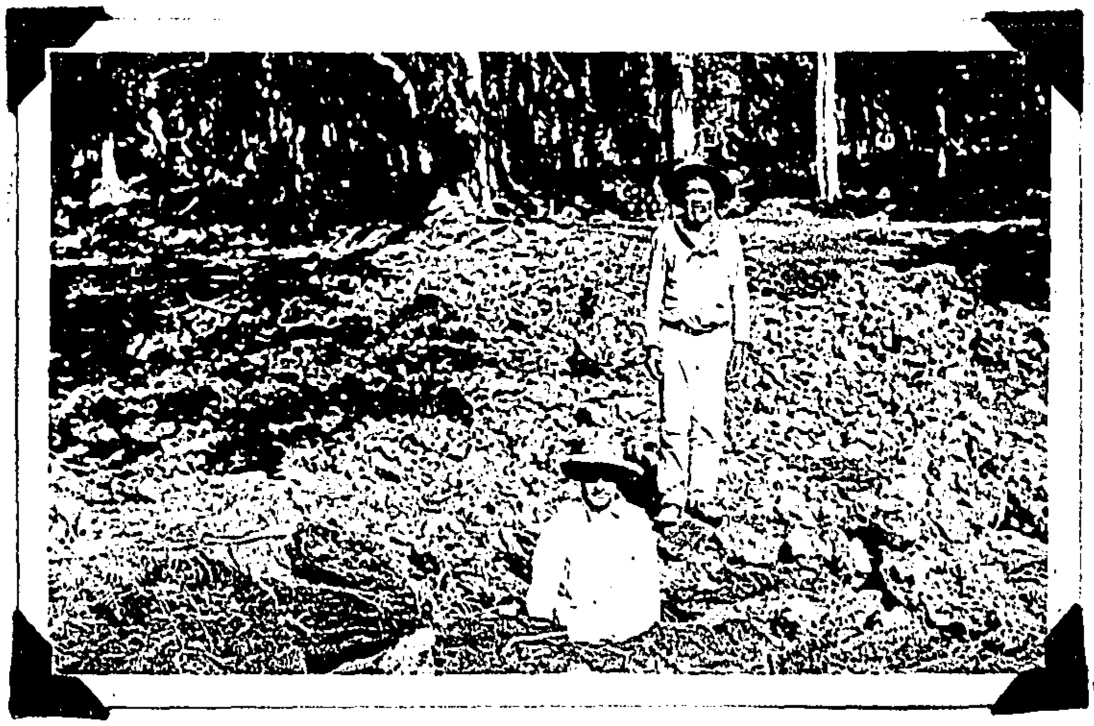
Picture No. 4. Part of the shelter at Halape, scattered by the wind storm over a distance of 150 feet. The shelter had been erected in the foreground of the picture. Picture taken July 23, 1931, at 2 P.M., by Ranger Brumaghim.



Picture No. 5. Part of the ruined trail shelter at Halape from under which Laborer Joseph Zambik was pulled when it was picked up and carried and rolled more than 150 feet by heavy wind storm. Picture taken July 25, 1931, 2:30 P.M., by Ranger Brumaghim.



Picture No. 6. What was left of the out-door kitchen adjacent to the trail shelter at Hilina Pali after the wind storm of July 21. Some of the material was carried over the cliff and lost. Picture taken July 23, 1931, 10 A.M., by Ranger Brumaghim.

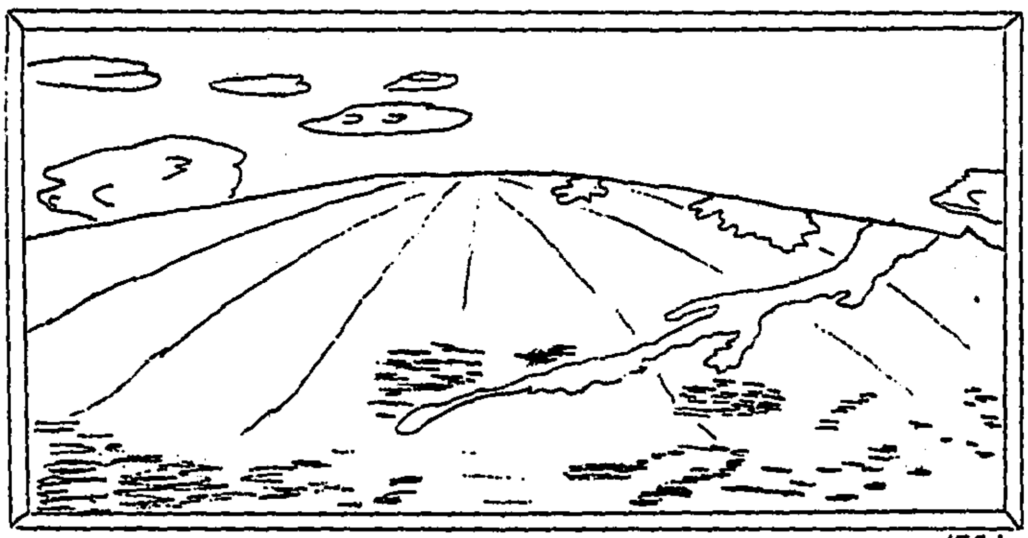


Picture No. 7. Washout on the road to Hilina Pali, 2½ feet deep, which had to be repaired by Ranger Brumaghim before he could get through with his car to the relief of laborers stranded by the storm.

The old Hawaiian in the background nearly lost his life and some of his animals in crossing a stream to get back to camp during the period of heavy rainfall. Picture taken July 23, 1931, 9:45 A.M., by Ranger Brumaghim.

NATURE NOTES

HAWAII NATIONAL PARK



Mauna Loa from Uwekahuna

JUNE 1931

Vol. I. No. 1.

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

HAWAII NATIONAL PARK
NATURE NOTES

Volume I June 1931 Number 1

Nature Notes from Hawaii National Park is a monthly pamphlet edited by the Park Naturalist and distributed to those interested in the natural history of the Park. Free copies can be obtained through the office of the Park Superintendent, Hawaii National Park, Hawaii. Anyone desiring to use articles appearing in Nature Notes may do so. Please give full credit to the pamphlet and author.

E. P. Leavitt, Superintendent John E. Doerr, Jr., Park Naturalist

TABLE OF CONTENTS

Aloha

This being the first edition of Hawaii National Park's Nature Notes, it is a pleasure to greet you in a truly Hawaiian manner-

Aloha-the happiest word in the Hawaiian Language-conveys to you our greetings with kind wishes--it bids you welcome and expresses our hope that you will find us creating and stimulating a desire to experience the things that only Nature and Hawaii can give you-

FOREWARD

HAWAII NATURE NOTES

The Hawaii Nature Notes, the official publication of the Educational Department of the Hawaii National Park, makes its initial appearance with this issue. It will appear each month hereafter. Its purpose is to supply authoritative information on the natural history and scientific features of the Park. The articles are not copyrighted and it is intended that they will be freely used by the press, schools, nature study clubs, and all interested in the out-of-doors.

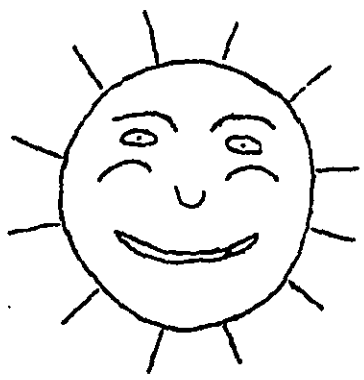
The plans for the educational activities of the park began to take definite shape on May 23 last, with the appointment of Mr. John E. Doerr, Jr., of Fargo, North Dakota, as Park Naturalist. Mr. Doerr, as head of the Educational Department of the park, is especially well qualified for his new duties. He graduated from the University of Wisconsin in 1924 with the degree of Bachelor of Arts, majoring in geology, and received his Master's degree from the same institution in 1926. During the summers 1921 - 1930 he was field geologist for the Wisconsin Geological and Natural History Survey. For four years prior to taking up his new duties with the National Park Service, Mr. Doerr was head of the Department of Geology in the North Dakota Agricultural College at Fargo. His experience in teaching not only in the class room, but also in the field as the leader of groups and organizations engaged in geological field work and study of natural history, particularly fits him for his new position as Park Naturalist.

Hawaii National Park was created to conserve the most representative area of volcanic interest in the United States. Its craters, active, dormant, and extinct, are among the most important in the entire world, and are probably the only volcanoes which can be visited with reasonable safet y. The park is also noted for its luxuriant tropical vegetation, which forms a striking contrast to the volcanic craters and barren lava flows.

This publication is issued not only to provide authentic information, but to stimulate interest in the park and its features, as well as to help the visitor understand and enjoy more thoroughly his trip to this region.

by E. P. Leavitt
Superintendent, Hawaii National Park

BOY'S WEEK



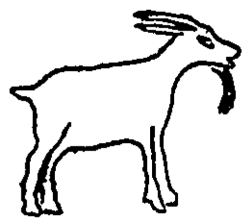
During the week June 16 - 23 the U.S. Navy Recreation Camp, in Hawaii National Park, had as their guests thirty-five boys from Pearl Harbor, Hawaii and vicinity. The boys were accompanied by Commander W.N. Thomas, Chaplain Corp, U.S.N.; Chaplain F.C. Rideout, U.S.A.; A.O. Amundson, Sec. Army and Navy Y.M.C.A.; E.R. Nichols and K.C. Mikkelson, U.S.N.; and W. Rundel, U.S.M.C.

The park staff had the pleasure of helping to make the week's outing enjoyable by arranging special talks on natural history, and conducting trips to the Chain-of-Craters, Bird Park, Maunaiki Crater, and Halemaumau. Trips were also made to the black sands at Kalapana and Brown's Ranch.

The boys showed a keen interest in the natural phenomena and an excellent spirit in all their activities. Many a laugh was had over sun-burned noses, blistered heels, arranged volcanic eruptions which dropped rocks on the metal roof of the barracks, the photographic attempts of some of the group, the evening campfire's "Wangdoodle" which reported each day's amusing events, as well as over the numerous things that can only be said and done by thirty-five boys.

Hawaii National Park is proud to have had this group in the park and extends to them a hearty invitation to return. We hope that others will follow your lead and avail themselves of the opportunity to enjoy the wonders of Hawaii National Park.

by the Park Naturalist



WILD GOATS

Among our childish beliefs there was one to which we clung tenaciously until quite recently. It was our firm conviction that wild goats could climb anything. The highest, most inaccessible peaks of the Swiss Alps have frequently been depicted as a favorite playground of goats. We shall concede that goats gambol from peak to peak in the mountains but in Hawaii National Park's volcanic craters, nature has built a barrier which restricts the gambols of the most courageous goats.

On the Chain-of-Craters road in the park there is one very interesting crater called "Alealea" which means "Bright". This crater is about 450 feet deep, 1800 feet long and 1450 feet wide; for the first 100 feet its sides are almost straight down.

About twelve years ago a few wild goats were happily domiciled - to all appearances - within the crater. These goats have since shown a regrettable lack of ambition to climb out into the wide, wide world. No Billy among them seems to have enough get up to come out, no Nanny, no Kid. It may be that what they see of the outside world peering down at them from the rim above leaves them with a feeling of contentment with their lowly lot. Perhaps a few whiffs of burning gasoline drifting down to their sequestered nooks makes for discouragement of their own comparatively puny efforts, who can tell.

They seem to thrive on the ample vegetation which grows on the benches and lower slopes within the crater. Frequent rains supply enough moisture for their modest needs. Unlike their relatives in other parts of the park, they are safe from attacks by dogs. Their only fear is the yells of wild taxi drivers who disturb their serene tranquillity to make them more easily discernible to the tourists.

Perhaps they could get out if they wanted to gambol from crater to crater.

by Ranger K. Williams

JUNE'S EVENING SKIES

One of the many things the traveler from the north anticipates seeing during his Hawaiian tours is the Southern Cross, the most celebrated of southern constellations.

Low in the sky during the early evening hours, Crux, as the cross is known to the astronomers, can be seen distinctly. Alpha and Beta Centauri, of the constellation Centaurus, the two brightest stars in the southern sky, are the pointers to the cross.

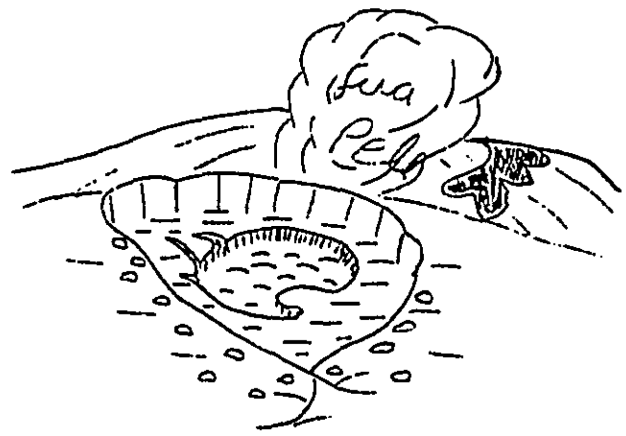
Standing on the north rim of Kilauea's crater, in front of the Volcano House, many visitors to the park experience seeing for the first time the Southern Cross. What thoughts does the first view of the cross create? Perhaps it brings to mind Mark Twain's impressions on seeing the cross for the first time as recorded in "Following the Equator"; perhaps to some it means direction, to others it may be a symbol of southern latitudes, of the romance of the South Seas. Looking through the telescope the visitor sees Alpha Crucis at the foot of the cross, the brightest star in the consellation, as a double star; Gamma Crucis, an orange-colored star, is at the top of the cross. Beta Crucis is at the eastern end of the short arm, Delta Crucis at the western end. The visitor from the north looks to the northern sky and finds the familiar constellation the Big Dipper and perhaps realizes that for the first time he is in a latitude where both of the guiding constellations can be observed.

During the late twilight of June's evenings, Jupiter hangs in the western sky above the top of Mauna Loa's thirteen thousand feet. The telescope brings out four of Jupiter's satellites. Above Jupiter is Mars, casting its red reflected light. The later evening hours brings Saturn with its rings into the low eastern sky.

As one stands on the slopes of active volcano Kilauea and looks up at the myriads of twinkling stars and the steady glow of the light reflected from the planets, one wonders if there is any relationship between the volcanic craters on the earth and the heavenly bodies. Directing the telescope on the Moon, many visitors express surprise at seeing the Moon's surface pitted with what may be volcanic craters.

Perhaps - who knows - maybe the Moon too has its volcanic craters.

by the
Park Naturalist



MYTHOLOGY OF THE VOLCANOES

According to the traditions preserved in chants (Mele) Kilauea has been burning since the island of Hawaii emerged from night. It was not until after the Kaiakahinalii or flood of the Sandwich Islands that the region of the volcanoes was inhabited. Shorty after the deluge, the Volcano Family came from Tahiti, (Kahiki as it is known to the Hawaiians) an island far to the south.

This family of five brothers and nine sisters found Kilauea Volcano to their liking and since have used it as their principal home. It is thought that they also have many other dwellings in different parts of the island, some in other craters, and not a few on the tops of snow covered mountains.

The names of the five brothers indicate their particular interests in life.

Kamohoalii, the king of vapor or steam, frequented Uwekahuna Bluff. To-day his image may be seen on this b· luff, or pali, overlooking the Crater of Kilauea. Uwekahuna is known to some as Pali Kapu a Kamohoalii, the forbidden cliff of the king of vapor.

Kapohaikahiola, the vulgar one, is known as a deformed hunchback. Keuaakepo, is the rain of night; Kanehekili, also a hunchback, is the God of thunder; and Keoahikamakana, the fifth brother, is the fire-thirsting child of war.

The names of the nine sisters also indicate their particular activities.

Pele, "Madam Pele", as she is frequently called to-day, is the fire Goddess of Volcanoes. She is the most celebrated member of the Volcano Family. Halemaumau, meaning "The House of Ferns", is her dwelling place although she is often encountered in other parts of the island.

Makolewawahiwaa is the fire-eyed canoe breaker; Hiiakawawahilani is the heavenly cloud holder; Hiiakakaalawamaka is the quick-glancing cloud holder. Hiiakahoikepoli O Pele is the cloud holder kissing the bosom of Pele. Her home is among the Chain of Craters. Hiiakakapuenaena is the cloud lifter of red hot mountains; Hiiakakalei Ia is the wreath-encircled cloud holder; and Hiiakaopio, the youngest of the nine sisters, is the young cloud holder.

As you may judge from the meanings of their names, this large family is not a particularly peaceful one. They wander about in a state of unrest. Sometimes their arrival in a district is foretold by priests, or is announced by tremblings of the earth. At times their presence is made known by an illuminating fire in their crater homes, or by flashes of lightening and roaring thunder.

The whole island pays tribute to the Volcano Family, supports their heiau (temples) and kahu (honored servants). Whenever the chief and people fail to make proper offerings, incure their wrath by insult, or break the kapu (sacred restrictions) of the family domain, Kilauea fills with molten lava. At times this molten wrath takes subterranean passages leading from Kilauea to the more distant crater dwellings, there to engulf the offending parties with all the horrors of smoke clouds, thunder, lightening, and molten lava.

(To be continued in the July Nature Notes)

by Ranger E. Brumaghim
and the Park Naturalist

BLACKBERRIES

One of the many surprises that greets the guests along the roads and trails are the blackberry bushes loaded with large, shiny, black berries. They are so tempting that even the least courageous will risk a scratch or two and perhaps stained lips to partake of a few of these delicious gifts of nature. Even the rangers and naturalist have been found making a study of the cool, sweet taste of these palatable berries.

The common blackberry was introduced into the Hawaiian Islands from North America in 1394. In places in the Kilauea section of the park the blackberry is becoming so wide spread as to be considered a pest.

by the Park Naturalist

Pau

Vacationing In The Hawaiian Islands

By M. EARLE ADAMS
Publisher of
Healdsburg Tribune

After such a send off as we got from home folks at the depot Tuesday, April 21, it would seem as if anything else that happened would be tame. It is a good thing our three pretty-well grown up daughters were at the depot to see us go, otherwise the rice shower and our gray hair might have been embarrassing. As it was, every time we'd pick up passengers en route to the city, they'd see the rice, follow its trail as far as our seats, and then slyly nudge their associates and laugh sardonically. Two old folks in their dotage, is what they probably thought, but we had the last laugh, of course. Both of us shed rice all over San Francisco, even up to our hotel room. I was combing the stuff out of my hair hours later.

Well, we're off. We sailed out of the Gate at noon Wednesday and it was comparatively calm, so we had a nice lunch, watched the Farallones slip by, and the increasing wind began kicking up a sea. I walked around alone until I began finding my footsteps leading me in four ways at once, so went to the card room and joined a couple of other guys in "a little game." It became rougher, and one of the other fellows, reaching for his own chips, found mine instead. After that happened a few times, I gave him the rest of them. Yes, I had three "bullets," but he had a "full house."

So I started hunting for the wife. She wasn't in her deck chair where she was headed for when I last saw her, so I started for the state room. It seems that it's an old Spanish custom to send flowers to a couple when they're sailing on a voyage. An organization I belong to did that when a couple of doctors took boats somewhere. But if a guy is going to get sick he doesn't need flowers—something else is better. Anyhow, this organization of mine didn't send us flowers, so I didn't get sick. But the wife, to return to the subject of our discourse. Somebody in San Francisco did send her flowers. When I got to the state room there was a box of roses and my wife, both stretched out. She had lost her fine lunch, chicken and everything, and had given up in dispair.

So passed the afternoon. I tried to write a letter, but when I began dotting an "i" and found I'd done it on the lamp shade which had moved into position with the boat action, I quit in disgust. Went down to supper or dinner, and the dining room was about deserted. My wife wasn't alone, evidently. At our table Mr. and Mrs. Clyde Edmondson were our pals. I was alone. Soon Clyde came in. The missus hadn't eaten any lunch, but he said she lost it anyhow. At Friend Richardson's table not a soul showed up. We had a fine meal. You had to watch out, however, or the vase of flowers in the center of the table would skid into your lap. Clyde would frown, look kinda funny, but stuck by me.

Had a movie show under canvas on top deck last night. Arranged the steamer chairs to make seats. Showed a picture of somebody getting sick on a merry-go-round. Nice, pleasant picture for the 25 or 30 folks who remained "in the ring" at that hour. It was a little rougher. Fellow in the end chair next to me fell over, chair and all, when a wave struck. So did another guy at the same time. Went to bed about 10 o'clock. Couldn't sleep much because I had a hard time keeping the bed under me. The trunk fell over against the door a few times and leaned at a 45 degree angle. But I didn't bother it, because the next wave would knock it upright again. The cabin boys this morning told me they were up all night feeding "sailors" orange juice.

Thursday Morning

They pulled a dirty trick on me this morning. I got up and hunted up my watch, saw it was my usual *rising time.* So I got all dressed, having a heck of a time because the state room was trying to jump over the rail with me, and wandered about. Came across the ship clock and it said 6:15 a. m. My watch said 7 o'clock. And then I found out they'd changed the time on me. So I came into the writing room and began this thing. And I gotta smoke my pipe on an empty stomach in a rough sea for another hour yet. But I'll fool 'em, doggone it. They can't make any money out of my meals, no sir, not even if I have to eat twice as much to make up for my wife falling down on the job. It isn't fair for me to pick on her that way. She's doing the best she can. Maybe she'll be up and around a little later. There's one thing sure, she can't quit on me —she can't change her mind about going.

The ship purser tells me we don't stop at any mail boxes en route and letters go all the way to Honolulu with us and lay around there a couple of days until May first before starting back. That's rotten mail service, you betcha. We'll have to see if we can't get Grid Clement's route changed to take care of this territory. Wouldn't he be a picture for sore eyes, in a boat that plays tennis with a guy trying to walk along the deck? Well, anyway, I'll keep on writing for a spell, being's how nearly all my pals have run out on me and we still are five days out of Honolulu. Gotta go now and see what's happened to the wife—if anything.

Lots of "Eats" Aboard

Saturday morning and all is well. The sea has calmed down a lot and the sick are again filling the dining room. Speaking of dining rooms, I've gained six pounds in the less than three days on this ship. I never saw so many eats in my life. You have breakfast about 8 o'clock, along about 10:30 they hunt you up with hot broth, while in the men's lounge they serve hot roast beef sandwiches. Lunch at 12:30, and the menu makes most banquets I ever attended look mighty sick. In the afternoon about 3:30 more broth and sandwiches. Along about 6 o'clock they come to your stateroom with a tray called a "canope," containing caviar and other sandwiches to serve as appetizers. Dinner is served at 6:30—and it can't be more than a step ahead of lunch. Then along about 9:30 or 10 o'clock they come around again with cold meat sandwiches and what have you, and I'm told if you are still up at midnight they try to persuade you it's time to eat again. The cooking and service are very excellent on this ship. In fact, when you turn anything down in the "eats" line you have to have a lot of courage. I never had courage enough to turn down good eats.

My wife borrowed four bits from me to bet on a "deck horse race" where you picked the horse that comes in last. She won $2.25. Said she could pick a loser better. I don't know what she meant by that, but let it pass. She played in a bridge tournament yesterday afternoon and dragged down high score. I'm mixed up in a shuffle board tournament.

We haven't seen anything alive off the boat except some birds called "gunne," a species of albatross, which follow the ship looking for grub. We are 1000 miles from nearest land. The birds don't seem to worry, however, about that. They live several hundred miles west of the Hawaiian Islands, I understand. I guess the birds are fed well at that. It seems as if food is more common than dust at home.

And now it is Sunday morning and raining. I can't conceive of a more unnecessary performance than to have it rain at sea, a thousand miles from nowhere and no place for the rain to go. The sea is all right as a place for rain to originate from. Luther Burbank, Thomas Edison or some other wise guy ought to have made it possible for rain to be conserved out here and transported to the places where the camel plies his weary way.

Had a "hard times" dinner at 6:30 last night, at which we were supposed to wear the toughest outfits we could. I left my regular clothes at home, otherwise I would have won a prize. It's a hard job making a hard times outfit out of the pride of one's wardrobe and rather droll in principle as well. It has about the same result in a measure as if a preacher's society was forced to go slumming.

Sunday was a day of rest. Church services were held in the main lounge at 11 a. m. with the captain in charge. Walter Murphy insisted somebody else was captain, so I bet him a dime on it. He lost. I haven't seen the dime. Former Governor Richardson was called upon to talk as the speaker of the occasion and he gave us an interesting discourse on his ramblings through Palestine. Incidentally he brought out the fact that the captain, now in charge of this fine ship, was once a newsboy on the former governor's newspaper.

It rained off and on during the day and in the evening a wind came up, kicking up a sea which makes our progress this Monday morning one of ups and downs. We are driving into the waves and wind.

Have seen a lot of "flying fish." They are about 6 inches to a foot long, with transparent wings. As the ship plows into a wave they scatter, jumping out of the water, and with wings outspread, sail away until they lose momentum, lighting on their tail alone, which twists like a propeller and boosts them off for another sail. Going with the wind they sail for 300 feet, more or less, before losing momentum.

Charles Dunbar, city manager of Santa Rosa, has the next stateroom to us. The first three days, when it was very rough, he was feeling fine, but Sunday when it calmed down for several hours, he couldn't stand it and got sick; had to have the doctor and everything. Today it is rough again, so he's up and around. I just saw him making for the barber shop, so he's O. K. again. I said it is rough, and that is a mild term. The wind, head-on, blows [illegible] twenty-foot waves, while the prow of the ship bobs way up so that part of the keel is exposed, slaps down onto the sea with a "boom" and digs her nose into the next wave, throwing "green water" over the forward deck and smashing heavy spray up against the plate glass windows on B deck, as well as drenching the navigator on the bridge above, 50 or more feet above the water line. I watched it, along with 15 or 20 other hardy souls, for a couple of hours. The ship's doctor, they say, is sick.

We Arrive In Honolulu

This being the last night en route, the captain's dinner was the occasion. It was a formal affair, but was disappointing because the rough weather prevented most of the folks from leaving their beds. About 35 were at dinner, and many left before finishing. One poor lady, a Sonoma county woman by the way, who so far has "made" every meal, got only beyond the dining room door, headed outward, before she had to "give up the ship."

Tuesday morning and all is well. The sea calmed down sometime during the night. I was asleep and didn't find it out until I woke up at daylight. Got out and watched the sun hit the cliffs of Oahu and Molokai, the two islands each side of the channel many miles apart. We reached port on time at 8 o'clock and were warmly greeted at quarantine by newspapermen, chamber of commerce representatives and photographers. Leis of live flowers were presented us. At the dock the wife and I were met by Mrs. John Fisher, her sister Chrystal, Postal inspector L. E. Miller, his daughter, and two boys. They each presented leis, so that the wife and I had seven each around our necks when we reached this beautiful hotel, the Royal Hawaiian.

The newspapers of Honolulu, telling of our trip, quote the captain as stating on arrival that we had run into a sou'wester and had an exceptionally rough voyage. So even the ship's crew realized we had been somewhere and seen something. The first thing of importance we saw as we entered the harbor was the new cruiser Chicago, which was at Mare Island the Sunday

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Sunday was a day of rest. Church services were held in the main lounge at 11 a. m. with the captain in charge. Walter Murphy insisted somebody else was captain, so I bet him a dime on it. He lost. I haven't seen the dime. Former Governor Richardson was called upon to talk as the speaker of the occasion and he gave us an interesting discourse on his ramblings through Palestine. Incidentally he brought out the fact that the captain, now in charge of this fine ship, was once a newsboy on the former governor's newspaper.

It rained off and on during the day and in the evening a wind came up, kicking up a sea which makes our progress this Monday morning one of ups and downs. We are driving into the waves and wind.

Have seen a lot of "flying fish." They are about 6 inches to a foot long, with transparent wings. As the ship plows into a wave they scatter, jumping out of the water, and with wings outspread, sail away until they lose momentum, lighting on their tail alone, which twists like a propeller and boosts them off for another sail. Going with the wind they sail for 300 feet, more or less, before losing momentum.

Charles Dunbar, city manager of Santa Rosa, has the next stateroom to us. The first three days, when it was very rough, he was feeling fine, but Sunday when it calmed down for several hours, he couldn't stand it and got sick; had to have the doctor and everything. Today it is rough again, so he's up and around. I just saw him making for the barber shop, so he's O. K. again. I said it is rough, and that is a mild term. The wind, head-on, blows the whitecaps off twenty-foot waves, while the prow of the ship bobs way up so that part of the keel is exposed, slaps down onto the sea with a "boom" and digs her nose into the next wave, throwing "green water" over the forward deck and smashing heavy spray up against the plate glass windows on B deck, as well as drenching the navigator on the bridge above, 50 or more feet above the water line. I watched it, along with 15 or 20 other hardy souls, for a couple of hours. The ship's doctor, they say, is sick.

We Arrive In Honolulu

This being the last night en route, the captain's dinner was the occasion. It was a formal affair, but was disappointing because the rough weather prevented most of the folks from leaving their beds. About 35 were at dinner, and many left before finishing. One poor lady, a Sonoma county woman by the way, who so far has "made" every meal, got only beyond the dining room door, headed outward, before she had to "give up the ship."

Tuesday morning and all is well. The sea calmed down sometime during the night. I was asleep and didn't find it out until I woke up at daylight. Got out and watched the sun hit the cliffs of Oahu and Molokai, the two islands each side of the channel many miles apart. We reached port on time at 8 o'clock and were warmly greeted at quarantine by newspapermen, chamber of commerce representatives and photographers. Leis of live flowers were presented us. At the dock the wife and I were met by Mrs. John Fisher, her sister Chrystal, Postal inspector L. E. Miller, his daughter, and two boys. They each presented leis, so that the wife and I had seven each around our necks when we reached this beautiful hotel, the Royal Hawaiian.

The newspapers of Honolulu, telling of our trip, quote the captain as stating on arrival that we had run into a sou'wester and had an exceptionally rough voyage. So even the ship's crew realized we had been somewhere and seen something. The first thing of importance we saw as we entered the harbor was the new cruiser Chicago, which was at Mare Island the Sunday

This hotel is smack dab on the famous beach of Waikiki. It cost $4,000,000 to erect. I noticed the price of our rooms on the inside of the door. It said, "$14 per day, one person; $26 per day, two persons." I nearly had heart failure, but remembering I had paid for all this before leaving home, I decided not to walk out and leave them flat. A beautiful bouquet of—well, I just asked the wife and she couldn't tell me—were in the room, and a dish of fresh sliced pineapple, "Dole" fruit, on the dresser.

Mustn't forget to tell you about getting out of the car at the hotel. When I got out, the ground seemed to slip sideways and I leaned up against a pillar to take the roll, and then looked *foolish*. "Sea legs" they call it. Well, I staggered up the steps and around the lobby a bit before getting to the elevator after we had our pictures taken, neck deep in leis. Notice I say "I" staggered around. The wife didn't. She'd been flat on her back so much aboard ship she didn't have any such trouble only when she saw a garden hose operating on the lawn.

I went out with Miller shortly afterward, to the Honolulu golf club and played 18 holes of golf, beating him seven holes to five, while the wife and Mrs. Fisher went sightseeing. I didn't get back until four, waded into the baggage and found my bathing suit, and took a dip in the song-famous warm water of the ocean which so lately had been so cruel to our party. After dinner we enjoyed an outdoor concert of Hawaiian girls singing and dancing the famous hula, and here it is 11 p. g. and time to advertise Iversen's famous tires.

Visit to Pineapple Cannery

Wednesday, April 15th

We visited the Dole pineapple cannery this morning and, in parties of four, were escorted through the big institution from stem to stern. We saw all the processes of handling an output of a hundred thousand tons of fruit annually by 4500 employes in the cannery, as well as by an equal number employed on the plantations owned by the Dole interests. Not only are sliced pineapples put into cans and shipped to all parts of the world under numerous brands maintained by individual buyers, but citric acid and a stock feed are by-products that are of great value. It was explained to us that the development of these by-products has made possible the low prices for the fruit in cans.

On entering the institution, besides being greeted by a selected corps of executives who served as guides, we were handed paper cups and shown faucets where pure pineapple juice was on tap, ice cold, in limitless quantities. We then went into the department where millions of cans filled with fruit are awaiting shipment. The canning season lasts about three months, and a large floor space for storage must be provided. If they ever had an earthquake there they'd surely have a mess, because the cans are piled ten to fifteen feet high.

The plant covers 35 acres, all buildings three to five stories high, are steel and concrete. The fruit, from the time it arrives by rail and is fed head first into the paring and coring machines, is not touched by hand, all operations either being mechanical or performed by girls wearing rubber gloves.

I was not only interested in the method of handling the fruit and the mechanical processes involved, but in the treatment accorded the thousands of workers from a humane standpoint. Each worker has a locker, one floor being given over to women and the other to men. Concrete floors of these quarters are kept spotless. Modern plumbing is maintained, hot and cold showers are provided. A large restaurant serves meals from ten cents to fifty cents. For ten cents one can get a plate of meat stew, potatoes and all the rice one can eat. The class of ordinary workers, recruited from the lower types of Hawaiians, Filipinos and Japanese, is taught sanitation, diet and rudiments of finance. A kindergarten is provided for little tots whose mothers are working. This is in charge of a competent teacher, who watches the youngsters all day, sees that they are fed, learn to play and get their preliminary education. No limit is put on the number of children of kindergarten age who are brought to the cannery by their mother workers. Ample recreational grounds under supervision of a competent person are part of the equipment of this place.

As in the pork industry, which saves all of a hog but the squeal, so the pineapple industry uses all of the pineapple. After all the juice is extracted from the husk, or outside, it is treated, dried and combined with wheat, making a bran which makes a wonderful cattle feed. Seventy thousand sacks, 100 pounds each, of this bran is turned out annually.

In the afternoon the wife and I, guests of a friend, played the famous 18 hole golf course of Waialae, which is very sporty, having a full quota of ditches, roughs, water hazards and sand traps. I made it in 95, a course totaling 6468 yards, with a championship rating of par 72. It rained hard for about a half hour shortly after we started and we got soaked, but dried out completely before finishing the match. They call it "liquid sunshine" here. I'll say it is liquid all right enough, but the sunshine afterwards takes care of it except the discomfort of being out in the rain.

Tomorrow noon we board ship again for the island of Hawaii. The trip takes all night, landing at 8 a. m. We spend all of Friday, that night and half of Saturday on that, by far the largest of the islands. We board ship and return here during Sunday night, getting back to Honolulu Sunday morning. Then, the postmaster here, Miller and myself are going to make a fishing excursion on a power boat from another part of the island. What we will catch, if anything, I do not know, nor what to do with the fish after caught, I know less. But it will be another experience, I have no doubt.

Fine Ocean Trip To Hawaii

Thursday morning Mrs. John Fisher took us on a sightseeing trip to Palai, where you obtain a wonderful view of part of Oahu from a precipice about 1200 feet high, where the road goes through a pass. Ira Rosenberg told us the wind blows so strong there it blew the clothes right off a lady sightseer, but I was disappointed; it didn't blow at all. Mrs. Fisher said that sometimes the wind was so strong it blew the tops off touring cars. You see, she was more conservative in her claims. While we were there a whole gang of folks arrived in autos from the round-the-world German vessel Resolute, in port for two days.

We then went to the top of a small crater back of Honolulu called "The Punchbowl," from the summit of which we had a wonderful panorama of the entire city. Then back to the hotel to pick up our baggage and board the Maui for the island of Hawaii and its port, Hilo. Leaving at noon, we sailed slowly past the islands of Oahu, Molokai, Lanai, Kaloohawe, Maui and Hawaii, reaching Hilo next morning at 8 o'clock, where the crew was to load 3000 tons of sugar bound for "the states," while we enjoyed Friday, that night and Saturday on this, by far the largest island of the Hawaiians.

As we enjoyed "unusual" rough weather on our trip from San Francisco to Honolulu, so we were greeted by a glassy sea, an "unusual" smooth trip to Hilo. During daylight Thursday afternoon we sailed by the coast line of Oahu, seeing miles of sugar cane and pineapple plantations, and the island of Molokai with first, miles of plantations, and then some of the wildest and most rugged mountains rising precipitously out of the sea. We saw one of the most beautiful sunsets I ever witnessed, and we have some fine ones around Healdsburg. The supper gong rang, but we stayed on deck until the gold, silver, blues and greys faded, and only then realized we should eat.

Next morning I was up at four, watched the moon sink behind Hawaii and the first rosy tinge of daylight, and when the dawn broke, gazed on miles upon miles of sugar cane, with here and there a white sugar factory nestled amid its accompanying town of workers' houses. The land, rising from a precipice about a hundred feet high at the sea, where prehistoric lava flows had stopped on their path from the volcanoes, sloped gradually to the summit of high mountains, over 13,000 feet high, on the tops of which patches of snow could be seen. About ten miles inland the elevation changed the climatic condition so suger cane could not be grown profitably and forests took its place. A strip of that and then another elevation was reached beyond which little vegetation was found and the red volcanic soil was bared to the summits. A railroad wound along through the sugar cane, and where gorges made by streams were found, trestles carrying flumes were seen. We later found that these flumes were used to freight the sugar cane from plantations to sugar mills. No lack of water was found, because it rains nearly every day on the island, the seasonal total averaging 200 inches.

Beautiful waterfalls were seen at intervals where these streams, reaching the edge of the precipice, fell to the sea. If you can visualize the panorama which greeted us, you will realize faintly the beauty of which I feebly attempt to write.

We had been told that this inter-island trip we were taking was usually very rough, but as I said at the outset, we had an "unusual" trip and the boat rode on such an even keel we could not realize we were on the water except visually.

I see this account has already started out to fill a day's allotment of space in the paper and yet we have merely reached Hilo and said nothing, so far, of that community, of our trip to the volcanoes, nor of a railroad journey we took back up the coast over the ground we had seen from the ship. I am just wondering if the time I am spending writing this stuff on paper long hand is of interest to you folks back home. I hope it is. I hope I can tell it so you can see, in a measure, the wonderful things we have seen on this trip. If so, the effort is worth while. So, hoping it is, the next time I write will tell you about the trip to the volcano section of the island of Hawaii.

Hilo has Many Japanese

We reached Hilo Friday morning welcomed by the usual band, hosts of leis, and delegations of citizens. A string of fine automobiles, each in charge of a competent driver-guide, awaited us, starting off for the ride which was to take us to the edge of Kilauea crater at noon. We passed rapidly through the city of Hilo, a community of 17,000 people, mostly Japanese, I'm sorry to say. There are many schools here, and we were told ninety per cent of the students are Japanese. Most of the store keepers of the city are of this nationality. The Japanese, before being educated in American schools, are satisfied to perform the plantation work for which they are best adapted, but after a Japanese boy goes to school and grows to manhood he is not satisfied with such employment and wants a white collar job. As a result, these people take over business conduct of the smaller nature. This has gone on until the labor situation has reached the same point which called for Japanese immigration in the first place, lack of plantation workers. The educated Japanese boy will loaf around waiting for an easy job, while his parents, growing old in service, work to support him.

And so the Japanese are still a major problem of Hawaii, even though the islands have been barred to Oriental immigration since becoming property of the United States. This problem also explains one of the reasons why Governor Judd vetoed the legislative petition to congress asking for statehood for Hawaii. Many of the elective officers in the islands are now Japanese, including members of the legislature. But the governor of the islands, appointed by the president, is a white American. Thus is control maintained. If Hawaii became a state, these Japanese, born in Hawaii and therefore citizens, would take over control of the entire political machine and become the dominating, arrogant masters they potentially are now. Some white citizens of the Hawaiians hope the islands are never granted statehood until the Japanese are outnumbered, which will take a very long time.

The business section of Hilo, therefore, reflects the control of the yellow man. Its stores are small, shack-like in construction, and lacking in modern appearance. The Japanese owners do not participate in such things as chamber of commerce activities, luncheon clubs or civic welfare organizations and therefore cannot be counted on to help make the community in which they live, progress. I was talking with a Hilo newspaperman yesterday and he illustrated this lack of civic interest by stating that when an advertising man, newly employed and coming from "the states" for the first time, tries to interest these Japanese merchants in newspaper advertising, the reply is, "Oh, no, me no advertise. You see, this is Japanese store." And that reason explains fully the stone wall resistance this tide of Orientalism offers to the white man in Hawaii.

Well, well. Here is the end of another installment of a journey to Hawaii, and all I have done is to take ourselves from the ship, into cars and be whisked to the city limits. Have patience. We will soon reach the volcano.

The Volcanoes of Kilauea

We finally got outside the city limits of Hilo in the last letter to you and are now skimming along in fine Cadillac automobiles upon a wide concrete highway en route to Kilauea volcano in the Hawaiian national park. It was a steady, easy climb from sea level to 4000 feet elevation, in 25 or 30 miles and we passed through sugar cane fields to areas of tall fern trees and other tropical flora, then as we went higher, through areas where trees and shrubs looked more familiar, particularly eucalyptus and fir tree groves. Finally we came to areas covered with lava rock through which vegetation was sparse. We halted later on the rim of the great volcano crater where the Volcano House, our hotel for the night, was situated. The least said about this hotel the better. It has poor accommodations and food for a place which charges patrons $9 per day each. They say the hotel is losing money. I don't wonder at it because few who visit it want to stay there any longer than necessary. As it is owned by the steamship companies, who make money hauling folks to and from the scene, the hotel is part of the paying business. The park service should make the concessionaires give service. There is no hot water, the rooms are unheated, with poor beds; there are totally inadequate bath facilities and the food is poorly prepared and served.

The awesome scenes at the volcano and its associate vents, pits and other evidences of the forces of enraged nature, are well worth the discomforts man has provided visitors. We went from the hotel along the crater rim visiting the sulphur vents, steam fissures scattered all about, to the observatory and museum at the crater edge. There we heard a lecture, illustrated with slides and moving pictures, on the activities of the volcanoes or Hawaii, and afterwards viewed many interesting specimens of lava formation and other exhibits connected with volcanic life. Then we returned to the hotel for lunch.

In the afternoon we went by automobile down into the crater, nearly eight miles in circumference and 600 feet deep, containing an area of 2650 acres of solid lava molded into fantastic shapes. Near the center of the crater is the great pit which has recently been in eruption, called Halemaumau, pit of everlasting fire. This is a hole in the lava 3500 feet across and 1000 feet deep, with precipitous sides, at the bottom of which gas and steam vents tell of the pent up activity soon again to break forth. While we were there no molten lava was visible as the volcano is quiet. The scientists stationed there tell us, however, that the internal pressure is still the same as it was last fall when the volcano burst forth and that soon the molten lava, rocks and steam will gush out again.

It gives one a very creepy feeling to stand near the edge of this sheer precipice looking down, *down, down into that yawning* abyss of black lava, once melted and roaring like a thousand steam engines on a steep grade. Guides provide one with a golf club and brand new ball to swat into this "hole in one," which you can't miss unless you fail to hit the ball at all. Harry Lutgens, publisher of the San Rafael Independent, did this, making a terrific swing and hitting the dirt, "whango" about a foot behind the ball. A little woman of our party, Mrs. W. N. Burkhardt of the San Francisco Daily News, though no larger than a 12-year-old boy, made the best shot of the four or five driven. A ball, socked into space where it travels outward from 100 to 150 yards before starting its descending arc, falls and falls. You think many times it surely must strike bottom, but down it goes, down, down, down. It takes at least 30 seconds, maybe more, before it hits the hard lava on the floor of the volcano and is lost forever. I couldn't help but think of some of our eagle-eyed caddies at Healdsburg who love to look for lost balls, and what a paradise of brand new ones they would find in that crater could they get down to them.

Then we started out again in our autos, along a highway leading past eight other vents, which we inspected and 13 others at which we did not stop. These stretched for ten or twelve miles in a string, all of them being "blow holes" from the main crater of Kilauea volcano, connected by underground passages called tubes, which carried the molten lava and gasses beneath the surface until a weak point in the earth's structure would allow them to burst forth in eruption. These pits varied in diameter from a thousand feet to less than 25, and in depth from 900 feet to a couple of hundred feet. One of them, "The Devil's Throat," is not more than 25 feet in diameter, nearly circular and yet is over 300 feet deep, straight sides all the way.

Wild Goats Found In Abundance

There is no surface water in this section of course, no rains, no wells. What water finds its way beneath the surface is thrown back again through steam vents which are numerous, and around whose hot perimeter ferns and other flora grow seemingly careless of the heat, relishing the moisture given off, though it is hot. And yet wild goats abound in this country, getting their water by licking the dew from the herbage. Down in one of these extinct volcanoes one can see, if he is sharp-eyed or has field glasses, both black and white goats, living their lives in security, several hundred feet beneath the ground surface of the crater's edge. The park superintendent told me that a couple of weeks ago a force of rangers, aided by natives who wanted meat, rounded up and slaughtered some 2000 of these animals. It is necessary to kill them off occasionally or they would multiply so rapidly they would eat up all the vegetation. These goats originally only a half dozen or so, were brought in by early-day explorers. They got away and turned wild. Cats and dogs, cattle and horses, do the same, and become pests. The mongoose, a weasel-like animal, imported to rid the country of hordes of native rats, did the job so well it rendered practically extinct several species of ground-nesting native birds by invading the nests and eating the eggs and newly-hatched fledglings. Now the mongoose is a pest itself. Everything thrives, even the dreaded Mediterranean fruit fly which prevents the cultivation of citrus and thin-skinned fruits. Vast areas formerly devoted to pineapples are not planted today because nemetodes got into the roots and destroyed their value. Over here as well as elsewhere they have to spray and watch constantly to prevent crop destruction by pests.

We went down into one of the lava tubes which undermine the vicinity of Kilauea volcano, traversing a distance of some 400 feet through a bore carved by lava in the rock of that section. We could have continued on some 4000 feet or more, but as there was no other exit beyond the 400 foot station, returned to the surface, walked back to the cars, and went back to the Volcano House for supper. After eating we enjoyed a program of hula dancing and songs by native girls, and a very splendid moving picture exhibition showing the activities of Mauna Loa volcano, a peak 40 miles away and standing at an elevation of 13,675 feet, whose summit we could see had patches of snow upon it. I think these pictures are to be shown in the United States. If they are, they are worth seeing. The Hilo Rotary club put on this entertainment for us.

Saturday morning we were up early, had breakfast after a fashion and shortly after 7 o'clock started for Hilo, as the automobiles were needed to bring a new crop of tourists due to land at 8 o'clock from the liner Resolute, which had followed us. At Hilo we boarded a special train which took us along the coast, through sugar cane fields and past sugar factories, where sacks of raw sugar are prepared to be shipped to California to be refined and marketed. The ride took us to Paauilo, end of the line, and back to Hilo, where we had a good lunch at the Hilo hotel. In the afternoon most of the party went to the Yacht club, an organization without any yachts, but I looked up Postmaster Chilson and we took an automobile trip around the city.

I also visited the daily newspaper plant at Hilo and talked over conditions with the members of the staff. I found that the newspaper in this community does not pay to operate, although the job printing plant run in connection with it, doing printing for the sugar plantations and factories, supplies the profit necessary to continue the daily. I was told the paper didn't pay because advertising income was small, despite its 3000 circulation. It was explained by stating most of the merchants, operating little, ordinary shops, were run by Japanese, and therefore they didn't need advertising. The stores looked it. The Japanese may be an aggressive people, but if they alone were to be relied upon, progress would be stopped at Hilo surely. They apparently have no interest in the community in which they live.

We were back on the boat at 5 in the evening, spent the night in a pleasant and quiet return to Honolulu, which we reached at 8 o'clock Sunday morning.

The Two Chiefs Of Old Hawaii

Sunday morning we returned to Honolulu after a very calm trip from Hilo and, writing this, just one week later, Saturday night, I can safely say we've had a hectic happy time. If there is anything appreciable on or under the waters of Oahu that hasn't been invaded, it has just been because we lacked time, that's all. We've swam, we've walked, we've ridden in street cars and automobiles and Tuesday I spent most of the day in a submarine, diving and touring over and under the warm, deep blue waters that lay off Honolulu. We've played golf on three different golf courses, the last of which, played today, we had to have cards of entry from an active member *before being* privileged to dig a divot. We've interviewed the two remaining chieftians of the old royal clan group, been dined by the last royal princess, tried to ride a surf board without success, accumulated coats of tan, shopped for trinkets to take home, including grass hula skirts ordered by various folks, raided a cocoanut grove for nuts to lug back with us, eaten practically everything that anybody ever thought of eating here and we've snarled and gagged until black in the face trying to pronounce the Hawaiian names they have here, so the natives wouldn't die laughing at everything we said, like we were imitating Will Rogers and Marie Dressler.

After we got back Sunday we had a fishing date with the high sheriff and the postmaster. We all gathered at the former's home about 10 o'clock, but there was a high surf and it didn't look good for fishing. So we sat down in the house for awhile, to wait until after lunch before deciding about the fishing expedition. Well, sir, although I had my mind all set on fishing, after the high sheriff, John Lane, and the postmaster, Charles Chillingworth, got to telling stories of old Hawaii and the traditions and superstitions, beliefs and experiences of their people and themselves, I was glad the surf was running high to spoil fishing. John Lane is one, and Charles Chillingworth the other surviving chieftains of the old clan feudalism of Hawaii. The first is king, and the other advisor, of the Order of Kamehameha, ritualistic order of the old Hawaiians. There are about 17,000 members of this clan or lodge, or whatever it may be termed, left. Lane, a wonderfully built man of about 67 years, now high sheriff and prison warden, a former senator, says when he was a boy he was selected by leaders to be the story teller, or historian, of the nation. Having no written records, all folk lore and traditions had to be handed down by word of mouth. In every generation a youth was selected to be the vehicle for transmitting these things, and Lane, when he grew up, was to educate the other younger royal children along these lines. So John Lane told us many of the old Hawaiian stories of the ancient chieftains, their wars, their accomplishments. He told of the ancient religions, rites, superstitions. He told of the strict discipline under which the subjects were held, the punishments as well as the rewards meted out.

And Mr. Chillingworth, the postmaster, business man, former president of the senate for many terms and representative of the Hawaiian territory in Washington on the commission, sophisticated man of the world today, told of stories of the olden days, of his personal experiences in both young manhood and today. Here we were getting first hand, authentic information into the fast disappearing customs and habits of an ancient civilization this is now becoming obsolete and forgotten in the swirl of a modern civilization which overwhelms the simple modes of living, of justice and of equity that held sway for countless generations on these isolated islands in mid-Pacific. Some day I may tell you about the stories I heard. I couldn't take notes while these two were talking. I realized they were merely chatting and not being interviewed. Had I pulled out a pencil and paper, both undoubtedly would have changed the subject. I asked them if there were any books that gave these old stories, but they said no, that many books had been written of Hawaii, but by writers who either were strangers who came only for a few weeks to gather material here, or by those more anxious to create "best sellers" than historically correct documents. So when I got back to the hotel that night I jotted down notes for nearly two hours before they should leave my mind. Some day, perhaps, I'll spin a few yarns about these good folks of Hawaii.

Honolulu a Modern City

Monday morning my wife and I, together with Miss Bernice Downing of Santa Clara, the only other postmaster on the trip, went through the Honolulu post office located in a fine new federal building. This post office occupies a similar relationship to the nearly 100 offices in Hawaii as San Francisco's office occupies with reference to other California offices in that it is a central accounting office. As most of the population of the islands lives within the jurisdiction of the Honolulu office, it handles nearly all the mail for island destination. And being the main seaport, with large shipping business and therefore incoming and outgoing mail in big boats, a considerable force of clerks must be provided to handle the mail quickly.

Honolulu has a very cosmopolitan population, with the larger proportion, almost two to one, of Oriental origin. Of the 351,606 people on the island, 134,600 are Japanese, 64,048 Filipinos, 25,810 Chinese, 29,117 Portuguese, 20,720 Hawaiians, 25,984 Hawaiian mixed with white or oriental parents, and the balance divided among Americans, English, Porto Ricans, Spanish, Koreans and other nationalities. The postmaster is English-Hawaiian, the assistant is Portuguese, the superintendent of mails from the American mainland, while the clerks and carriers are Hawaiians, Portuguese, Japanese, Chinese and what have you. The post office has two general delivery and two box sections, the Orientals being segregated. Whenever mail is distributed, that written in Oriental language is separated from the rest and sent to the Oriental sections for handling. The post office lock boxes are not inside the office, but range along the side of an open portico. Mild weather makes this possible. The whole building is so open on all sides that the breeze blows freely through it and at the same time may be closed tightly in time of storm. The postal receipts at the Honolulu office are $540,000 annually, a steady growth from 1901, when they were less than $65,000. The receipts have doubled every ten years and are still mounting. All the mail carriers in the residence sections use motorcycles with side cars in their work. Money order business averages around $200,000 a month.

Honolulu, and by the way, it is pronounced Hone-o-lu-lu, the first syllable sounding like the word for a stone used in sharpening tools. Honolulu is suffering from growing pains just like her sister cities on the mainland. She has grafting policemen, gangs of hoodlums, traffic congestions, building difficulties, harbor congestion, legislative squabbles, prohibition laxity, gambling and red light difficulties and so forth. The police situation here is very deplorable, however, apparently the class of men on the force being of a menial type of polyglot native swinging some political influence with his crowd, so that he is recognized as having a "drag." He holds his job with lackadaisical indifference, liking to show his authority, and sometimes aiding gangs of hoodlums in their fights with citizens by arresting a poor, lone man who has been beset upon by ten or a dozen others.

There is a fine fire department in Honolulu. Surrounded by squalid shacks in some sections of town, a fine concrete building, through the doors of which the gleam of polished nickel or bronze of big, modern fire-fighting equipment may be seen, are frequently met with, indicating that in the not distant past a large amount of money, probably proceeds from a bond issue, have been spent on this department by the municipality.

At the middle of each important street intersection during the day, beneath a large umbrella, sits a big, fat traffic cop, manually operating a stop-go sign above the umbrella. I asked Betty Fisher one day why they didn't install automatic traffic control and cut out all these salaries. She replied that it couldn't be done with the folks making up Honolulu's population. It has been tried, but it took four policemen, one on each corner, to keep traffic moving while the automatic system was operating. So the city went back to the fat cop and his umbrella.

Under The Sea In a Submarine

Tuesday was a red letter day of my experience in that I spent the day at sea in a submarine. Very few people, outside the members of the crews of these engines of warfare are ever privileged to go to sea in a submarine, go through warfare practice, and have free run of the ship. Through the courtesy of the postmaster at Honolulu, C. F. Chillingworth, whose son is first lieutenant on the underseas boat, the superintendent of railway mail service, Mr. Grantham, of Honolulu, and myself went aboard the S-24 at 8 in the morning and we cast off from the ship's berth in Pearl Harbor. Standing in the open cockpit above the conning tower with the captain and helmsman, we saw the biggest dry dock of the navy, many other vessels and buildings which make up this famous naval base. We backed into the channel, using the sub's electric motors and then started winding out of the channel to sea with the diesel engines working. At the entrance to the blue Pacific we passed Fort Kamehameha and stood out to sea.

The day's work was to be approach maneuvers on a target ship. This vessel, one of the trawlers of the navy, steamed over a prescribed area, at various speeds and changing her course often, to fool the attacking submarine. Accompanying her, one on each side, were two other submarines acting as screens. Our submarine was supposed to sneak up on this target ship unnoticed and feint discharge of torpedoes so they would sink the target ship.

We submerged and traveled along with nothing but the periscope above water, the captain keeping his eye on the quarry as we crept up on her. Each of the 30 or 40 members of the crew was at his station, either beside a valve, gauge, throttle, dial or other device. In front of the captain stood the helmsman, watching the dial on a gyroscope compass, a small device in one hand which automatically worked the rudder. As the captain ordered, he would swing the rudder right or left. Beside the captain stood the first lieutenant, an elaborate computing scale device in his hands. Beside him, over a draughting board, was another officer with a chart before him. Nearby, before a device on a pedestal, with the positions of his sub and the target ship outlined on it, a clockwork clicking off the decreasing distance in yards between the two, another officer was engrossed in his particular duty. Occasionally the captain would shout "point." Each officer would repeat a compilation of his own work at that particular instant. A button was pressed, down into the hull sank the periscope and after traveling blind for a space the order "fire" would come and the lieutenant would seize four levers in rapid succession, working the torpedo tubes forward. The radio operator would telegraph the speed, course and instant of firing to the target ship on which the umpire, in possession of similar data as to the actions of his own ship, was located. If the movements of the ships would have called for a "hit" by the approaching submarine, it would be given a rating for the problem.

After firing the first salvo of fake torpedoes we dove deeper and the dial for depth read 100 feet. We passed beneath the target ship and came to the surface well on the other side of her. This dive took about 45 minutes. All of the time we were out, from 8 until 3 p. m., we had free run of the ship, wandered from prow to stern, up and down, watching anything we chose, and having a fine time. After we came to the surface we floated around for an hour or so while the S-27, the other submarine engaged in similar practice, did her stunt. As soon as we came up and the hatches were opened, we rushed back to the open cockpit for cool air. We noticed no lack of air while submerged, but as the waters around the islands are very warm, it was hot in the underseas ship. It would have been better had I not rushed into the cool air in my shirt sleeves, as I caught a cold doing so.

Three times we dove and fired at the target. At no occasion were we seen by the target ship and all three "attacks" were successful. The second time we went down, after the periscope sighting had been completed and this "eye" pulled down beneath the surface, the captain ordered the helm hard over and we made a complete circle, firing without another look as soon as the 360 degrees had been completed. On the third time down, Grantham and I remained in the conning tower as the dive was being made. We could see through the glass port holes and watch the nose of the sub disappear beneath the surface, the water rush up and over our heads, and then by looking up when we were 20 feet submerged, see the surface waves through the clear water look just the same from beneath as from above the surface. It was quite an interesting experience. On the surface the sub would roll like any other ship, but when submerged she was on steady keel. The only thing I regret was that I could not get any pictures of our trip, the navy prohibiting cameras in or near her yards or vessels.

Heavy Cold Delays Trip Home

By Wednesday morning I had developed a severe cold and was continually sneezing. So I didn't feel much like doing anything and laid around, baking in the sun on the beach. Went down to the dock at noon and saw the steamer Maui, containing the *bunch we came over with*, sail out for California. In the afternoon I continued doing nothing, feeling thoroughly miserable. My wife this day, as formerly when I was programmed on separate business, went sight-seeing with either Mrs. Fisher or somebody else, either to see some particular view, visit a museum or window shop—or shop for curios in earnest.

On Friday we went on an auto tour of the island of Oahu, accompanied by Mrs. Fisher and her sister, Miss Fox. We visited many points of interest, including the native Hawaiian hut, with "David," the owner, showing us what implements his people used to use and the customs they observed. We saw the beautiful Mormon tabernacle, passed the youth's industrial home, several sugar factories, miles upon miles of sugar and pineapple plantations, went through several towns with their homes surrounded by beautiful flowers, their schools filled with smiling children—mostly Oriental, and glimpsed beautiful scenes of mountains, gorges, plains, beaches and beautiful blue ocean.

Sunday we visited the aquarium, paying 25c admission to see fewer fish than one can see in the Golden Gate park aquarium for nothing, and visited the wild animal zoo, which cannot compare with the San Francisco aggregation of wild life. One reason, perhaps, is that there are no natural wild animals on the Hawaiian islands, and the leopards, lions, monkeys, elephants and what have you, are a sorry lot of poor things not very well cared for by their keepers.

On Monday I had a most pleasant trip of 35 miles or so to Waianea on the eastern coast. My wife didn't go along because she had another engagement and as I had planned to go through a sugar mill, she wasn't particularly interested, having visited one with the press association the day I was out in a submarine. Arriving at Waianea, where my friend had business to attend to, I went to the sugar mill and introduced myself to the man in the office, Fred Bolte, the chemist. When I told him I was from Healdsburg, California, he asked if I knew the White family, who formerly lived in the islands. I, of course, was able to assure him I knew the White family, at least Mr. White, and he then informed me the family, particularly Mrs. White's parents, the Dowsetts, formerly owned the plantation and sugar mill I was then visiting. That was certainly a coincidence, because I had no idea I was coming to their former home. What I saw at the sugar mill will be left until the next installment.

What Happens at A Sugar Mill

The plantation at Waianae consists of 1400 acres of sugar cane and the balance of the plantation, totaling about 7500 in all, is devoted to a cattle ranch, on which approximately 1000 head are ranged. Of the sugar cane, 700 acres are harvested annually, as it takes two years for cut-over land to grow up again for market. Here a planting of cane may be harvested every two years for about ten years before being replowed and planted again. It takes quite a bit of equipment to operate a plantation of this size. Tractors, plows and the usual farm machinery, a railroad line for freighting the cane to the mill and other transportation about the plantation, the mill itself with its necessary machine, blacksmith, carpenter and other shops, a town of many houses for the workers and their families, school, clubhouse, church, stores and other buildings, a complete unit of life in a section where completeness is a necessity—such is the plantation which the Dowsett family (including Mrs. White) sold to the American Factors organization and moved to Healdsburg, to buy and improve one of our finest large tracts of land, the Hopkins estate.

The day I visited the mill it had just begun operations for the season at noon. Under the expert guidance of Mr. Bolte I was given a complete insight into the operations of the mill as each unit was put into use, and spent about two hours going over the equipment including the shops and refrigerating and ice-making plant. They even have a hydro-electric and an engine auxiliary plant for making their own current for use about the plantation and town. About forty men are employed at the mill, many of whom have been there for a long period of years. As I was introduced to each, from the engineer down to the blacksmith, they all wanted me to extend greetings to the former owners and expressed the wish they had not sold out and moved away.

The sugar cane, as cut in the field, arrives at the mill on narrow-gauge railroad cars, hauled by diminutive locomotives, one of which, in operation there for forty years, had just had a new boiler installed and converted into an oil burner. The cane is raked by a mechanical contrivance from the cars onto an endless belt which feeds it into a cutting machine where it is cut into shreds. This is fed between rollers after being sprinkled with hot water and the juice crushed out. After going through three double rollers under high pressure, the pulp is quite dry. At this mill this pulp is fed into the furnaces for fuel but at some places it is saved and pressed into cakes, sent to a special mill where cellose is extracted—the stuff which makes transparent cellophane and has many other uses. I understand even this plant will shortly be changed so as to save this material and use fuel oil for power—presuming the value of the cane for this by-product does not decrease to a point where it does not pay to save it.

After taking the juice, it is fed into sediment gathering tanks and the clear juice drawn off. The sediment, or thicker syrup, is also saved and goes to other settling tanks, where the thickest impurities sink to the bottom. The lighter stuff is drawn off and pumped into a filtering machine which consists of iron perforated plates, separated by burlap every couple of inches. The sediment that is "mud" stays in the fabric and the clearer liquid is drawn off and goes back into the syrup to make sugar. The mud goes out in cars and is used on land to enrich the soil. The final sediment, or molasses, from which all sugar crystals are finally extracted, goes into tank cars, so thick it hardly pours, and this is used for fertilizer. A portion is added to the irrigation water and thus returns to the land.

Meanwhile, the first grade syrup has gone into vacuum steam boilers, heated, thoroughly agitated by the boiling-hot steam that is confined in pipes, until sugar crystalizes, and then it goes to centrifugal precipitators, which whirls the crystals dry on drums. The remaining molasses is mixed with incoming sugar cane and goes through the same process over again until so little sugar remains it too goes into the tanks and back onto the land as fertilizer. As in the packing house, everything is saved and its last good extracted. The dried sugar, the brown sugar we find in markets, then is sacked, hauled to Honolulu, and shipped to California where it is refined at Crockett, in San Francisco, or at some other point having refineries. There is but one sugar refinery in the islands, I am told, and this is only large enough to refine the sugar needed to can pineapples at Honolulu.

Over the land of Hawaii, where they have about 200 inches of rain a year and it rains practically every day, there is so much available water that the sugar cane, cut on the plantations, is dumped into flumes, the water freighting the cane to the sugar mills and thus saving railroad hauling. On the island of Kauai, 100 miles northwest of Honolulu, the sugar cane, once planted, yields steadily without replanting, some plantations, I was told, having harvested from the same roots for more than 40 years. At one place on that island there falls 500 inches of rain a year, the world's record rainfall. And that is some rainfall, if you ask me—or if you don't.

War Game Is Serious Business

The average tourist, in his brief stay in the islands, does not get much of an idea of the military and naval mechanism which operates mainly from the base island of Oahu. True, one knows that Pearl Harbor is a naval base, having the largest American drydock. One sees seaplanes and big land bomber planes circling overhead and therefore realizes there must be adequate landing fields. One hears occasionally the concussion of heavy cannons engaged in target practice and knows there must be fortifications about. A few soldiers or sailors about town on leave of absence indicates there must be a few companies of infantry or ships in port. But other than this, our defense organization is unobtrusive and is passed unnoticed. But Uncle Sam is far from asleep. Heavy fortifications with modern disappearing cannons occupy strategic points to guard this basic outpost of American sovereignty. Pearl Harbor is a complete naval unit with drydocks, gigantic cranes, repair shops, ammunition dumps, seaplane hangars, oil reservoirs, radio communication systems capable of reaching all parts of the world, submarines, destroyers and other vessels for quick defense, manned by adequate and efficient corps of officers and men who are kept constantly busy engaged in war maneuvers so that they are always ready for call at any moment to spring into action. At the central point of the island of Oahu, 16 miles from the coast and hemmed in by a protective ridge of high mountains is Schofield barracks, with permanent quarters for an entire division, which calls for 35,000 men. Cavalry, artillery, infantry and aviation units are there, with full equipment ready for instant use. The men at these barracks engage in war maneuvers constantly. One day we passed two batteries of artillery, big guns and ammunition wagons, officers and men with all necessary equipment, hauled by caterpillar tractors, traveling from this point to a remote section of the coast line, where they were to engage in working out some defense problem assigned to them.

No, there is no monkey business to the Hawaiian islands in this war game. It is serious business and it is receiving close attention. One constantly sees war vessels steaming out to or in from sea. One sees boats dragging red target floats a half mile astern back and forth past the beach at Waikiki and hears sharp reports of guns, sees the spurts of water where the shells land near the targets. While I am writing this a fleet of submarines is engaged in a 10-day engagement off the coast of one of the nearby islands, one feature of which calls for submersion of the subs for three days without once coming to the surface. I had an invitation to accompany the S-24 on this trip, but of course I could not accept. Anyhow, having had a day of experience in a sub, I doubt if I would enjoy such an excursion, as there is nothing to do but watch valves and gadgets, and that gets tiresome. But the men whose job it is to operate these ships, are thoroughly conversant with their duties and would not be at a loss how to act if some nation decided to capture the islands from Uncle Sam.

A preponderance of foreign nationals in the islands makes it doubly imperative to provide adequate resident defense. By far the largest group of peoples on the islands is the Japanese who have nearly 200,000 people there of a total less than 400,000. American citizens from the mainland are greatly in the minority, most of them either being in the naval or military organizations, or occupying leadership posts in business. The governor of the territory is a mainland American, appointed by the president. The members of the senate and house, elected by the voters, are of various types, Hawaiians, Portuguese, Japanese or other groups, all Americans surely, but not Americans as we think of our countrymen. Most of the office holders, police and other officials are of this polyglot type. While the majority by far of island people pledge allegiance to the Stars and Stripes, it is entirely plausible to presume that the Mikado and other nation's leaders have representatives on the islands watching out for interests of their mother country. I am not at all sure in my mind that in case of a war between America and Japan, for instance, we could count on great loyalty from most of the citizens of Japanese extraction. I may be wrong, but I believe Uncle Sam is not absolutely indifferent to the possibilities thus offered.

I see that the notes I jotted down as to what we did for the last two days of our visit in Honolulu concern "mop up" experiences. For instance, on Monday night after visiting the Waianae sugar plantation, we stopped at Fort Kamahamaha at 5 o'clock to see "retreat," a sort of parade of soldiers before the commanding officer, Colonel Grant, and firing of the sunset gun, with its consequent lowering of the American flag. Sunset is fixed at 5 o'clock "by order of the commanding general," as it is put by a ranking officer on the islands, a bit of irony to explain the difference between the official action and actual sunset, which comes some two hours later at this season. On Tuesday we visited Schofield Barracks and drove around the spacious grounds, in and among the buildings which house the thousands of men. Colonel Tayman used to wipe the red dust of Schofield's parade grounds from his shoes when he was in active service. We played our fifth round of golf while in Honolulu that afternoon.

And on Wednesday morning, sailing day, we packed up, paid our bills and cared for baggage transportation. Then we spent the last couple of hours visiting and saying good byes to the fine folks who had devoted so much of their time to seeing that our visit was made pleasant. Promptly at noon the Manoa sailed from the island port.

The trip home was filled with good times. The boat, slower than the Maui, took seven days to come back. The passenger list was smaller because there are not many staterooms on the boat. We had about 75 on board, and all got acquainted. The crew was made up of fine officers who mixed with the passengers and seemed to enjoy making us feel welcome on their ship. We had good weather for the trip with the exception of the last two days approaching San Francisco when we ran into high winds with consequent waves and pitching. But the boat was very seaworthy and rode the waves, heavily laden as she was with a cargo of sugar, pineapple and bananas, very comfortably. We were held up several hours by high seas and arrived in San Francisco bay at 1:30 o'clock, May 20th, after one of the finest vacation trips one could expect. We met our little family of three children at the boat, took the first train back to Healdsburg, and were welcomed with cordial and sincere greetings by those we have learned to love—home folks. We were glad to go, glad we went, and glad to get home again. It was an experience we'll remember always with the most pleasant recollections. The Matson Navigation company, the Royal Hawaiian hotel management, the Waikiki Inn management, the wonderful friends in Honolulu, all extended themselves to give us, and all visitors who come to their little dominion in mid-Pacific, a wonderful time. We unhesitatingly recommend to our friends that they take the Hawaii trip. It is well worth while. And now, with the tale completed, Mrs. Adams and I bid you all "Aloha."

Pearl Harbor Weekly

The Voice of the Navy in Hawaii

PEARL HARBOR WEEKLY, JUNE 27, 1931

BOYS VISIT REST CAMP

By Ch. Ph. Mate E. R. Nichols, U. S. N.

By 8:30 o'clock Monday morning, June 15th, number 1010 Dock at the Navy Yard, Pearl Harbor, was teeming with activity. Big, expensive automobiles, government official and privately owned, were driving up at the rate of one a minute. These cars contained the sons of many prominent officials in civil, military and naval life who were to leave on the naval ships, U.S.S. SEAGULL and U. S. S. LARK, for a weeks outing at the Naval Recreation Camp at Kilauea, Hawaii.

Commander W. N. Thomas, Chaplain Corps, U.S.Navy was to head the "camping party," which consisted of 34 boys and 6 men. He was on hand and was busily greeting the boys and their parents as they arrived. Among the boys were Lawrence Judd, son of Governor Judd; Harry Stirling, son of Rear Admiral Yates Stirling, U.S.N., Commandant of the Fourteenth Naval District; Ernest Scott, son of Colonel E. D. Scott, U.S.A., Command Officer, 11th Field Artillery, Schofield Barracks; Nelson Miles, son of Colonel S. Miles, General Staff, Fort Shafter; Paul Speicher, son of Commander P. E. Speicher, U.S.N., Commanding Officer, U.S.S. Oglala; and Bob Munroe, son of Commander R Munroe, U.S.N. The other boys in the party were Bill Thomas, Jack Miller, Clinton Braine, Bob Kingsmill, Bill Dobie, Wally Dowd, Bob Holton, Harrison Holton, J. C. Adams, Jack Porter, Skippy McMorries, Jimmy Osborne, Harry Guilmette, Charles Hake, Robert Pace, Bill DeFries, Robert DeSomer, Miles DeSomer, Russell DeSomer, Elkin Franklin, Nathan Kingsbury, Buddy Manning, Jack Hayden, Jack Turner, Curtis Rideout, Tommy Torey, Sonny Murray, and Clyde Coggins. The other men in the party were Chaplain F. C. Rideout, U.S.A.; A. O Amundson, Executive Secretary, Army & Navy Y.M. C.A., Pearl Harbor; E. R. Nichols and K. C. Mikkelson, U.S.N., and Wright Rundell, U.S.M.C.

Nine thirty found our party complete—the boys had bid their parents goodbye. The sirens of the ships were sounded—lines were cast off and the ships moved slowly away from the dock and out toward the Pearl Harbor entrance while a crowd of excited boys stood on the decks and waved a fond Aloha to parents and friends standing on the pier.

All were happy and talking enthusiastically of the trip ahead of them and the things they wanted to do while at Kilauea, but shortly after rounding "Diamond Head" it began to get rough and almost instantly the pep began to leave the boys (and most of the men, too). They were soon feeding the fish and when dinner was announced there was a chorus of groans—some expressing themselves as not caring whether or not they ever ate again. However, there were a few who ate dinner and mustered strong for the other meals enroute. But on the whole the commissary officers of the ships made money on our party because the meals were paid for whether eaten or not, and it was plain to be seen after the first meal that only a few were going to be able to eat.

Fortunately the trip was only about 22 hours long, and there was much rejoicing when the ships got inside the breakwater at Hilo and into calm water again. Those who had been conspicuously absent began to put in an appearance on deck, and by the time the ships were tied up to the piers we were more than glad to throw our baggage out on the dock and disembark. The officer in charge of the Navy Recreation Camp had ample trucks, busses and cars on hand to meet us, and we were soon on our way to Kilauea.

Arrived in force about 10:30 a. m. and spent the balance of the forenoon in getting settled in the barracks and cottages. At noon a half starved crowd of boys and men were seated in the camp "mess hall" to a meal of good wholesome food that seemed to bring back all the lost strength and pep. After dinner the camp officials assigned a guide to take the boys on their first hike. The guide was instructed not to take them on a long hike—they were gone about two and a half hours and when they came back every boy had samples of lava and sulphur, the latter picked up along the steaming "sulphur banks."

Had our party consisted of the fathers of these boys we would not have received a more whole-hearted welcome. The camp officials were bending forth every effort to make us comfortable and happy. Hardly had we gotten our baggage unloaded when Mr. J. E. Doerr, Geologist of the Hawaiian National Park, arrived to consult Chaplain Thomas about our stay and to offer the services and facilities of their organization. This was a great break for us and opened up channels through which we were going to be able to see far more of the wonders of this National Park than most tourist are able to see by staying a much longer time here. Mr. Doerr returned in the afternoon and helped formulate our schedule of hikes and trips to points of interest. Later in the afternoon Chief Boadswain Mate Nimmo of the Camp took the men in his car for a twenty mile drive over some of the interesting roadways, stopping at the Volcano Observatory, the fire pit "Halemaumau," and many craters. Also stopped at the Headquarters of the Hawaiian National Park, where we registered and met Mr. E.P. Leavitt, the Superintendent of the Park, who renewed the offers previously made by Mr. Doerr.

Supper time soon rolled around, and by this time four group captains had been selected and the boys were divided into four groups. Mess call was sounded by the "camp bugler" and the boys fell in by groups and marched in to another meal of "camp chow," and how they did eat. Seasickness was about forgotten and the hike and mountain air had sharpened their appetites.

Indoor baseball and other games were participated in until dark; when the boys were assembled around the "camp fire" (a large fire place in the barracks) for a short song and devotional service. They had had a hard day so taps was sounded early. The barracks was soon quiet and the boys were journeying through dreamland. After they were asleep the men leaders had a conference and settled upon a "camp" routine.

The Navy trucks are out of commission, but adjoining the Navy Camp is the Army Camp, and it only took our Chaplains, Thomas and Rideout, a short time to make the acquaintance of the Army Officer in charge and make arrangements to get two trucks from the Army. Three cheers for the Army—we appreciate their kindness and cooperation.

Reveille was sounded at 6 o'clock the next morning and the boys rolled out with a willingness. At 6:10 assembly was sounded and muster was held outside the barracks. Formation for "setting up" exercises was formed and the boys were run through ten minutes of "Swedish" exercise, following which they were given a short run around the camp. They were dismissed for morning toilet and barracks duties. A good breakfast was had at 7:30. At 8:15 inspection and "sick call" were held—each boy standing at the foot of his bunk. Chaplain Rideout was the inspecting officer and declared the barracks and bunks were neat and orderly arranged. The boys were all feeling fine so the doctor had nothing to do except to redress a couple of boils, which were about pau.

Excitement ran high when it was announced that at 8:30 we would hike up to the Volcano Observatory for a free lecture and moving pictures of the previous activity of the volcano. Mr. Doerr, the geologist and lecturer, welcomed us, and after a short explaination of the causes and wherefors for the many different formations of the various specimens of lava on exhibition, he delved into a very interesting lecture, which was illustrated by slides and moving pictures, on volcanoes and volcanic eruptions. The seismograph there was a big drawing card, and fortunately they changed the roll while we were there. The one removed recorded a slight earthquake on the previous day. The explanation given, in removing and replacing the roll with a new one, and telling how the film on the old one would be developed in the same manner that photographs are developed, giving at last a seismogram which would tell the exact time and severity of the quake, was most interesting.

In the afternoon at 1:30 Mr. Doerr and Mr. Hanley, the Superintendent of the Park Road Construction, accompanied us by auto trucks over the "Chain of Craters" trail and through the famous "Thurston Lava Tube." On this trip we had the privilege of looking into many craters ranging from 350 to 950 feet deep, great holes containing many acres of floor space. The sights were marvelous and awe inspiring. The trip, with the aid of flashlights, through the lava tube, a distance of 1400 feet, will long be remembered.

On Thursday morning we left in busses for the famous "Black Sands" Beach, a distance (round trip) of over 100 miles. This was an all day trip and necessitated taking a lunch. Hot dogs were roasted over the fire and were enjoyed with ham sandwishes and red pop. On this trip we saw a good deal of the country side and life of the native populace.

Our evenings have been spent in popping pop corn, toasting marshmallows, playing indoor games, sing songs, and devotional periods. We still have many interesting places to visit during the few days we have left to stay here. All wish we were going to stay a month instead of a week.

After a rainy night Friday dawned a beautiful day, and immediately after inspection of quarters and sick call we manned the trucks and were off to a trip under the guidance of Ranger Bruminger and Mr. Doerr. After going about eight miles we parked the trucks off the road and started out on a two and a half miles hike out into the "Mauna Iki" section of Kau Desert. This trail proved to be a very rough one—over aa and pahoehoe lava. The aa lava is the very rough and jagged type—the pahoehoe is the smooth type. In this region are lava flows from both Kilauea and Mauna Loa. Signs are seen occasionally—these mark the various flows and give the dates. The last activity in this section was in 1920—the flow coming from Kilauea and the lava of the aa type. This lava is very dark and glistening on top, but when broken it reveals many brilliant colors. Mr. Doerr, the geologist, explained the reason for this, stating that many different mineral substances were to be found in the lava and that it cooled so rapidly that these and minute gas pockets gave it the beautiful colors and spongy, porous structure. Many phenomena are to be seen—in places the lava rises like giant waves on the ocean, in other places it is thrown up in large cones. Many of which are open at the top, and through these large openings or cracks hot air and steam is continually escaping. Some sticks of wood were put into one of the cracks and in a few minutes they were blazing. On this trip the boys gathered many samples of lava, including Madame Pele's Hair and Madame Pele's Tears. One of the most interesting things seen were foot prints of a woman and small children. These prints are supposed to have been made by the dependents of one of the Hawaiian king's armies who happened to be on the march in this region when an eruption occurred in 1790. The mother was supposed to have been overcome by gasses and fallen there—the foot prints of the children are supposed to have been made when she dropped them (two) as she fell. A rain that fell soon after hardened the volcanic ashes into a hard, cement like crust, thereby preserving the foot prints. By noon we were back in camp—wiser but somewhat footsore.

The afternoon was open—indoor baseball, volley ball and indoor games were participated in.

The steam baths have proven to be one of the most popular places around. Most of the boys and men taking a steam bath daily.

Our camp newspaper, "The Kilauea Whangdoodle" is read aloud every evening about 7:30 o'clock. The paper is edited by the four boy "group captains," and reveals keen observation, wit and humor on their part. No boy would miss the reading of the "Whangdoodle." Anyone or all are likely to be panned, and the jokes and wise-cracks bring forth much laughter and applause.

Saturday morning found us again on a hike under the guidance of Mr. Doerr. This time we were to take the "Sandalwood Trail" down to Kilauea crater, then 2.2 miles across the floor of crater to "Halemaumau," the giant fire pit of the volcano. We had been looking forward to this trip and enthusiasm was high. Many marvelous sights were seen, the most awe inspiring being "Halemaumau." Just imagine a hole 3500 feet long, 3000 feet wide and 1050 feet deep. One has to stand back from the edge five or six feet and even at that distance it makes many dizzy to look down into that great depth. There are many great cracks around the fire pit, some of which are several feet wide and extend down to great depths. During some future earthquake these sections will be jarred loose and millions of tons of earth and rocks will slide into the great hole, thereby increasing its width and length but decreasing its depth.

The afternoon was free and again "sports" claimed the attention of most of the boys, although many went to an adjoining ranch to see cattle branded.

Sunday found us thankful for the things we had seen and enjoyed during the week and all were willing to go to church. A "church party" was gotten up for the Catholic boys, and they were sent into Hilo to church, while the Protestant boys attended church at the "Army Camp," where services were conducted by Chaplain Rideout.

A good old fashioned, fried chicken dinner put us in the proper frame of mind and body to enjoy a twenty mile ride in trucks out to the "Kapapala Ranch." For this trip we are indebted to Mrs. Judd, the Governor's wife. She had written to Mrs. Sumner, the wife of the ranch owner, and told her that Lawrence was with us. Mrs. Sumner had visited our camp and very kindly extended an invitation for us to visit the ranch. This trip proved to be of great interest to the boys, many of whom had never visited a ranch before. An idea of some of the things we saw there can be had in a general way when you know that the ranch contains 70,000 acres, and has 3500 head of cattle, 250 horses and mules, many other animals typical of ranches and several Hawaiian cowboys. To top off their hospitality Mr. and Mrs. Sumner served refreshments to our entire party. We would be glad to visit them again.

Many have expressed regret today over having only one more day to stay in camp. We would like to stay much longer and are dreading our trip back by boat.

Monday, June 22, and our last day in camp. Part of our party started out for "Bird Park" on foot, the rest decided to go by automobile and truck. Mr. Bruminger, one of the rangers, who by the way, is Hawaiian born and quite familiar with Hawaiian history and mythology, acted as guide. The distance was only about two and a half miles, and the hikers soon joined those who had gone by cars. "Bird Park" is a most interesting place, especially to those who are interested in "native vegetation," for here the government is trying to preserve many trees and shrubs that are almost extinct. There was an abundance of "thimble berries" to be had, and it did not take the boys long to fill up on the big, luscious ones. Due to the noise made by the boys we were unable to see many of the different varieties of birds, but we were told that there were fifteen kinds of native birds there in addition to many kinds that had been imported to the Islands. The boys soon discovered a lava tube and were anxious to explore it, but, due to the small entrance and dangerous climb in getting down into it, only three of the largest boys were permitted to enter it, and they were only permitted to stay a short time. They reported a dark, dungeon like cave with a very irregular floor.

We were back in camp in time for dinner. The food has been excellent and our appetites have been better than excellent. The afternoon was free, the only requirement being that every boy was to take a bath in preparation for the trip back home in the morning. Recreational sports and the "Steam baths" were the chief attractions for the boys, while the men made a trip back to "Halemaumau" to make the 19th hole in one. Eight golf balls were driven off into space, but we were only able to follow one until it hit, the others being lost in the shadows. Chaplain Thomas was proclaimed "the champ"—he used a driver and made a beautiful drive that was conservatively estimated at two hundred yards, which, plus the three hundred and fifty yards drop, gave him a drive that totalled five hundred and fifty yards. Quite some drive.

Another interesting place which we visited earlier in our stay here, but which I forgot to mention, was "Fern Jungle." It is well named, because the ferns (there are three principle kinds; namely, Amaumau, Stag Horn and Tree) are so thick that very little light penetrates that part of the forrest. Some of the great "tree ferns" reach a height of thirty-five feet. The soft, downy substance known as PuLu, which grows on the frongs of the ferns was of great interest to the boys. The collection of this material we were told used to be quite an industry for the ancient Hawaiians—pillows and mattresses being stuffed with it.

For our last night in camp Mr. Gandy, the manager of the Volcano House, invited us to attend the moving picture show which is shown to tourist stopping there. We were there one hundred per cent strong—we had seen many wonderous sights and were anxious to see more, even if in the movies. There were two reels of the pictures, the first one being of the island of Hawaii alone, but the second one showed us the most scenic places on the other islands in the Hawaiian group. Since we had been so interested in volcanoes and craters we were particularly interested in the pictures of the great crater and cinder cones of "Haleakala."

Upon our return to camp, Chaplain Thomas called the crowd together and told the boys how proud he was of them and of their behavior. It had been a pleasure to be with them and he complimented them on being such good troopers. After a short devotional period taps were sounded, and the boys went to bed with the knowledge that reveille would go at five the next morning—our last reveille in camp.

When reveille was sounded all turned out and hastily packed their seabags. Breakfast was served at six o'clock and by six thirty the busses were filled with boys, the baggage was on the truck, and the procession, led by Chaplain Thomas and the officer in charge of the camp, Lieut. Bleisnr, U.S.M.C., in the latter's car, started for Hilo thirty miles away.

We reached the pier about 7:30 o'clock, and saw the U.S.S. Lark standing in. In a short time she was tied up, and in quick order all the baggage and passengers were gotten aboard. At 8:30 the lines were cast off and we were homeward bound. The sea was quite choppy, but the seas were off our "Starboard quarter" and aided rather than hindered our speed. Some of us were seasick, but only a few, and even the seasick ones were able to eat by supper time. Due to the decks being crowded it was decided to anchor for the night in Lahaina Roads. In reaching Lahaina we passed "Haleakala" close enough to see some of the great cinder cones we had seen in the movies the night before.

Anchored in twenty-one fathoms of water about 7:45 p. m., and soon after beds were made on the decks of the ship. Despite the hard decks all reported a good night's sleep. We were awakened at five a. m. by the hoisting of the anchor—we were on the last leg of our journey home.

It didn't take long to leave Maui in the distance, then Molokai, and there was considerable stretching of necks and straining of eyesight when someone shouted "Koko Head," but there it was,and in a few minutes "Diamond Head" was seen, too. They were good to us on the LARK, because while we were off "Diamond Head" dinner was "piped down," and we all sat down to another "fried chicken" dinner. It was good, too, seasickness was completely forgotten for we were again in calm water and all realized that we were speeding for Pearl Harbor and would soon be home. Docked at 1010 Dock about 1 p. m., and found the parents of many waiting to welcome their boys home. We were a dirty looking lot because all had soiled all their clothes, but we were well and healthy, and had a good tan. Our camping party ended by all posing for a picture, which was taken by a commercial photographer.

Chaplain Thomas had proved again that he is a great leader, he had so thoroughly organized our party and worked out such a well balanced schedule that it was impossible for our trip to be other than a successful, enjoyable one. The entire party loves him and would be glad to accompany him on more such trips.

The Volcano Letter

Two dollars per year | Ten cents per copy

No. 341—Weekly | Hawaiian Volcano Observatory, National Park, Hawaii | July 9, 1931

Experimental seismograph built of homemade materials at the Lassen Volcano Observatory by R. H. Finch, showing heavy mass, suspension and boom, the concrete pier and post, and the Howard clock.

MAKING A SIMPLE SEISMOGRAPH

The seismograph in most common use is a horizontal pendulum. The photograph shown on Page One is the hanging part of such a pendulum which anyone with a little ingenuity might make for himself. The machine shown in our illustrations is in fact one constructed by Mr. R. H. Finch in two months in the autumn of 1926 for preliminary tests of earth motion at the Lassen Volcano Observatory in California. This instrument was made entirely out of materials and labor available in any country town. There is here shown a clock on the wall which is a good timepiece made by the Howard Company in Boston, Mass. This is fitted with electrical contacts closing the circuit of a four-cell dry battery for about two seconds every minute and about six seconds every hour. It is a weight-driven pendulum regulator with eight-day movement. The electrical contacts on the minute and hour are for marking the time continuously on the smoked paper which covers the drum of the seismograph, so that any hour or minute may be identified on the paper for discovering the time when an earthquake has marked the paper.

On the left is shown a concrete post in a basement room with an upright hollow or groove cast at the bottom where the post rises from a concrete table or pier. It is better to have the cylinder as shown hanging from an isolated post than to hang it from the wall. We have tried both plans for different instruments at the Hawaiian Volcano Observatory. As the hanging cylinder is very sensitive to the slightest tilt given to its supports, walls are not desirable. The upper part of the concrete wall of a cellar on the outside of the building is heated by the sun for some parts of each day. The heating expands the wall and it cools at night, thereby contracting. The seismograph is so sensitive, magnifying earth motion some two hundred times in case of a horizontal displacement, that the distortion of the wall under expansion and contraction will cause the writing pen to swing sidewise an inch or more in the course of a day. This causes the lines to interfere and interlace with each other. A certain amount of normal tilting of the ground is to be expected in the course of each day anywhere, and it is likely to be exceptionally big at an active volcano. Therefore we do not want any tilting due to solar heating of the house. What tilting we get, measured by the swinging apart or the close approach of the lines, should be indicative of what the actual ground is doing under the whole country, and therefore is measurable for the particular two directions in which a single horizontal pendulum swings.

The dimensions of the cellar shown in the picture are ten by ten feet, and the general plan of the instruments followed the lines of the Omori seismograph. The concrete post, ten by ten inches square, stands 27 inches high above the pier which is 18 inches high above the floor and two feet square. The cylinder consists of a cast-iron container holding nine circular lead discs, which make the whole weigh 225 pounds. The lead discs are each bored and threaded in the center to take a large screw-eye, so that the container can be handled by one man by lifting the discs out or putting them in separately.

An iron rod, bigger near the post, and smaller at its outer end, passes horizontally through the middle of the heavy mass or cylinder. This protrudes 52 inches from the center of the cylinder. The big end of the rod is bent and lies in the niche at the base of the post, supported by a short hinge of spring-steel wire. This wire hinge is terminated by metal balls in two slots cut with a hack-saw. One of these slots is in the flat iron strap shown pinned across the niche, the other in the bent end of the rod. The heavy cylinder is supported by a stirrup hanging from a piano wire which is made fast to a simple adjustable bolt in two angle irons pinned to the top of the concrete post. For these attachments to the post it is convenient to use expansion bolts, which are readily put in holes drilled in the concrete. The adjustments of the upper attachment of the piano wire permit of winding it up to lift the mass, and of moving it right and left to bring the outer end of the rod or boom to a medial position.

From all this there results a mass hung like a door with a boom protruding out from it, designed to record those oscillations or tilts of the earth at right angles to the plane of the suspension. The boom is braced by fine steel wires extending from its outer end to the cylinder. If the boom points to the east, the inertia of the mass registers the north-south earthquakes. Another similar pendulum is hung north-south to record the east-west earthquakes. Or better, for the same earthquake, two such pendulums register the north-south and the east-west components of the motion. Under each pendulum the system is damped, or prevented from free swaying on its own account, by sheet-aluminum vanes attached to the boom, protruding downward into a metal tank of automobile oil, so that with swinging of the pendulum, the vanes move edgeways in the oil. The little oil tanks, four or five inches square, not shown in the illustration, are supported by a removable stand in front of the pier.

The registering mechanism is shown in the figure on Page Three. The recording drum is built on a steel spindle threaded with ¼-inch worm at the end away from the drive-clock. This moves the drum lengthways in a sleeve at the driving end. The drive-clock is a Seth Thomas two-barrel power movement with rotation of spindle once in 30 minutes. The inner sleeve of the drum is set by a screw on the clockwork spindle. The worm end of the drum spindle rests on knife-edge wheels. Glassine paper is wrapped around the drum, pasted at the ends, smoked over a kerosene lamp, and the drum is set in place with the set-screw locking it to the clock. The writing lever-pen from the pendulum has a hinged stainless steel tip which rests on the smoke surface. The lever pens are made of aluminum. They are pivotted about a vertical axis near the end of the booms. The pen tips and the levers have pivots made of standard clock and watch balance staffs. Motion is transmitted from the boom to the lever by light metal T-bars, with the ends of the cross-bar in the boom and the lever respectively. The drum ends are made of ply-wood and the surface of pasteboard. The pen tips are magnetized, lifted to make a gap in the written line on the smoked paper every minute by an electro-magnet connected with the time-piece on the wall. The drum surface moves 30 mm. to the minute. The static magnification of the boom is five and of the writing lever forty, making the total 200. A marker pen attached to the plate supporting the drum and lever system, is made to write a line for a few minutes once a day on the side of the smoked paper, to be used as a datum line for measurement of wandering of the pendulums under tilting of the ground.

The free period of the pendulums is adjusted to seven seconds by moving the upper support of the piano wire in and out from the posts. The pen tips are laid back with a horseshoe magnet when the drum is changed. The change of paper is made once a day and the seismogram removed is passed through a bath of very dilute shellac and denatured alcohol, which fixes the smoke image of the line written by the pens. In the second photograph there is shown the second boom vanishing into the foreground, connected with the second pen by its T-bar impinging on an angle piece in the lever at right angles to the lever. In this way both pens, north-south and east-west, write during the day bands of lines side by side on the same paper. The paper is 12½ by 38 inches. Each line is interrupted by its minute and hour marks, the operator indicates the time of the starting mark by scratching it in the smoke, and simple counting of the succeeding hour marks on the smoke is all that is needed for timing an earthquake autograph that may appear. The light pasting of the ends of the paper on the drum is easily separated by a slender paper-cutter. The seismogram is dated and marked with its location before shellacking.

It will readily be seen from this account that any amateur with mechanical aptitude can build for himself a sensitive seismograph, and he can learn all about the technique of the science if he will consult the back files of the Bulletin of the Seismological Society of America, the headquarters of which are at Stanford University, California. T.A.J.

KILAUEA REPORT No. 1015

WEEK ENDING JULY 5, 1931

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge

Conditions remain unchanged at Halemaumau pit. The cauldron is quiet and dry. Strong northeast trade winds continue.

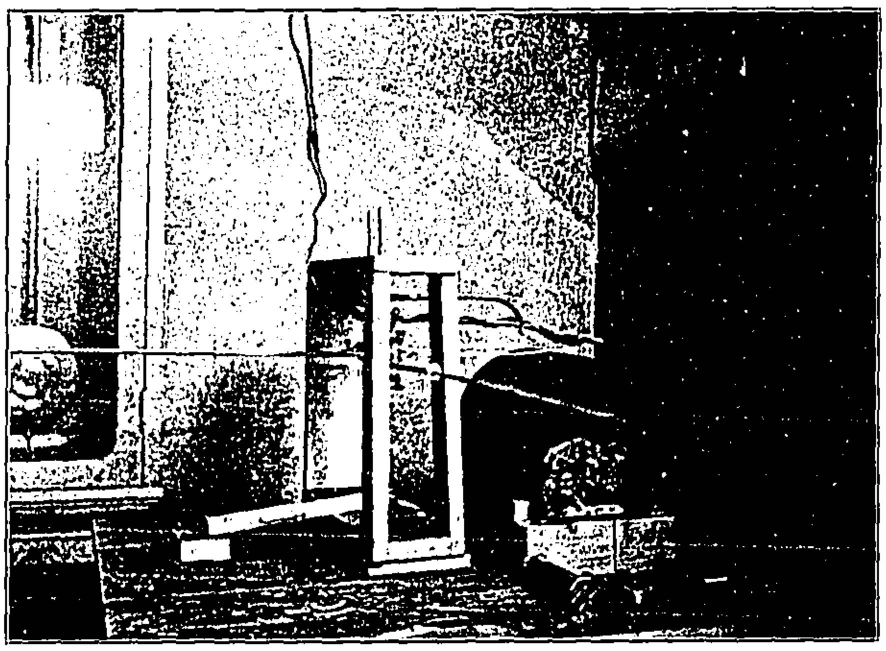
Seismic disturbances recorded during the week included 34 tremors and two very feeble local seisms. One of the latter at 12:08 a. m. July 4 indicated origin distance 23 miles from the Observatory.

Tilt for the week was slight NNW. Microseismic motion was slight.

TILTING OF THE GROUND FOR JUNE

The following figures show the net amount of tilt by weeks at the Observatory on the northeast rim of Kilauea Crater, and its direction, computed from the daily seismograms by platting a curve smoothed by overlapping progressive seven-day averages. This is the departure of the plumbline in the direction given.

June 1-7	0.1 second	W.
June 8-14	1.4 seconds	NE.
June 15-21	0.3 second	ENE.
June 22-28	1.4 seconds	NNW.



Recording end of homemade seismograph, showing booms of both north-south and east-west pendulums, pivot connections with writing levers, straight wound electric magnet for marking time, and the driving clock and drum, the latter with smoked paper.

Interior of seismograph cellar at St. Mary's School, Hilo, Hawaii, showing two-component seismograph hung on wall of chamber, with recording drum in middle of room.

THE VOLCANO LETTER

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HAWAIIAN VOLCANO OBSERVATORY
Founded 1911

This laboratory at Kilauea Volcano belongs to the Hawaiian Volcano Research Association and is leased and operated by the United States Geological Survey.

It maintains seismographs at three places near Kilauea Volcano, also at Hilo, and at Kealakekua in Kona District. It keeps a journal of Hawaiian volcanic activity and publishes occasional Bulletins.

Membership in the Hawaiian Volcano Research Association is limited to patrons of Pacific science who desire personally to aid in supporting the work.

The work of volcano research so supported is in collaboration with the work of the United States Geological Survey, but supplements it with buildings, research fellows, instrumental plants, explorations and special investigations for which there is no governmental provision. The Geological Survey maintains volcano stations in Alaska, California and Hawaii.

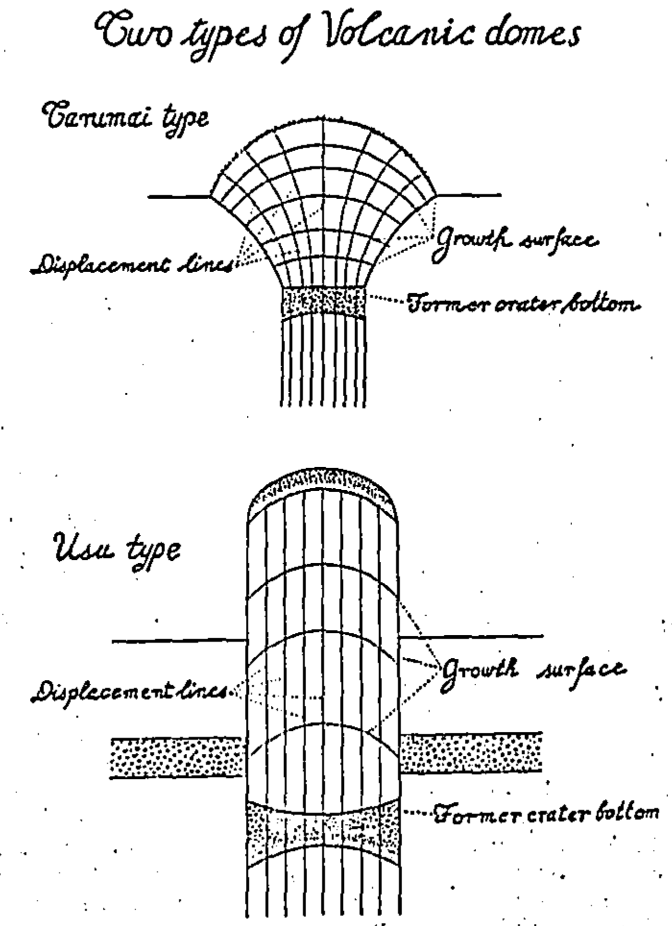
The Board of Directors includes Frank C. Atherton and Walter F. Dillingham, Vice-Presidents; L. Tenney Peck, Treasurer; Wade Warren Thayer, Arthur L. Dean, and Richard A. Cooke.

Persons desiring application blanks for membership ($5.00 or more) should address the Secretary, Hawaiian Volcano Research Association, 300 James Campbell Building, Honolulu, T. H.

The Volcano Letter

Two dollars per year | Ten cents per copy

No. 342—Weekly | Hawaiian Volcano Observatory, National Park, Hawaii | July 16, 1931



Sections by Tanakadate showing the two types of lava domes and their structual characters.

TWO KINDS OF LAVA DOMES

A clear analysis of the materials and the rising of stiff lava into two kinds of lava domes in Japan has been made by Tanakadate. (H. Tanakadate, Imperial University, Sandai, Japan. Proc. Fourth Pacific Science Congress Java 1929, pp. 695-703.)

The first is the Tarumai type, based on the Volcano Tarumaisan in the north island of Japan, which pushed up its crater floor into a dome in 1909. Before the eruption the crater was a funnel 600 meters across, gently sloping inward above and precipitous within. The funnel was 65 meters deep with a bottom 60 meters across, exhibiting active solfataras there and in the wall.

March 30 to April 12, 1909, there were big steam-blast eruptions, lava then filled the funnel, then the pudding rose into a dome reaching its maximum at the end of April, finishing its growth in mid-May, and remaining there ever since. Tanakadate expresses the mechanism by the upper diagram on Page One. By expressing the original crater bottom as a horizontal line in section, lava covered with gravel, the successive stages are shown by the growth surface lines, when the gravel must have been scattered on the increased area of the top of the dome. Such loose materials were found sparsely scattered on the slaggy surface of the dome when it was explored after it had cooled off between 1909 and 1917. Explosive eruptions in the latter year through fissures in the dome flung out fragmental materials on to the dome. At present detritus and lava blocks caught in the lava are found on the dome.

The displacement lines, radiating from the former

Lava dome of Tarumaisan in Hokkaido, two hours after an eruption of October 30, 1926, which fissured the dome of 1909. Photo K. Shibahara.

bottom of the crater upward, correspond to the successive positions in lateral displacement of equally spaced points on the crater floor at the beginning. Each imaginary vertical filament of lava in section rises and widens, the more in the center, the less where restrained by wall friction. The displacement lines are perpendicular to the growth surfaces.

The lava developed prismatic structure, mostly at right angles to the growth surface, with columns parallel to the displacement lines. In crater pits and fissures of the dome can be seen the chasms bounded by columnar joints, caused by contraction when the surface cooled, making upright parting planes.

In the large caldera of Usudake Volcano, near Tarumaisan but farther south (see map Page Four), is found the second type of lifted plug or dome, illustrated by the lower diagram on Page One. There are two domes on Usu (see map Page Three), and three crater lakes. Taking the bigger one called O-usu, it is 725 meters above sea, 350 meters high about its base, and is smoothly round like a cathedral. The top of it is not a round shell of rock, but is composed of gravel, sand, and clay 3 to 6 meters thick. The gravel contains fragments of quartzose rocks, crystalline schist, and several old volcanics; there are andesites with pyrite and hematite. The pebbles are reddened with oxidation, as though through the heating effect of the dome lava, and are sometimes bowlders a foot in diameter. They are smooth and scratched with parallel streaks like glacial erratics. The sands and clays are baked to natural brick.

The dome itself of rock is exposed on one side with the surface scratched, and a structure of parallel shells. Elsewhere fragments mask the rock. The sectors of the dome are cracked and faulted so that one sector may have been thrust up, another has lowered.

If the dome was regular on its rising, the volcano may have formed its caldera of subsidence in the course of a river, which deposited ordinary gravel, sand, and clay in the crater lake. The highly viscous lava rose and congealed under these deposits. The lava continued rising, lifting the plug, and heaving up the overlay of sediments. This made a structure with vertical side walls and dome-shaped top. The friction on the confining wall produced the streaks and striations. Just the same thing was shown by the Pelee spine. The lava and sediments agglutinated and formed a hard crust. The lava core pushing into the gravel layers produced the striations in the pebbles.

The parallel-shelled structure gives evidence that at first the growth surface was horizontal, later the viscous sides lagged and the center rose most, arching the top. Sinking of parts of the magma below, and renewed pressure, bring about the splitting into separate sectors or columns with differential lift at the top.

In the case of the Tarumai dome of the first type, the recession of magma caused a flattening of the top of the dome. (See Page Two).

The O-usu dome is much more siliceous than the Tarumai dome. The O-usu rock is a dacite with 68 percent of silica, that of Tarumai an augite andesite with 61 percent. The O-usu rock is fine grained, light gray, with few and small porphyritic crystals and a trachytic groundmass. The Tarumai rock is coarsely porphyritic with large anorthite feldspar prisms, and smaller augites. The lava shows fluidal streaks of red and gray.

The old outside lava wall of the caldera of Uusu is basic, and so was the new lava of the lower slopes of Usu, thrown up as bombs in the uplifting eruption of the outer flank in 1910. Both of these have only 51 percent of silica (see Volcano Letter No. 302).

Other volcanoes which have produced the low-dome type of eruption are Bogoslof, Katmai, and Galunggung. The spine or plug has been upraised in Pelee, Lamongan, and in the inner fin of McCulloch dome at Bogosloff in 1907.

T.A.J.

KILAUEA REPORT No. 1016

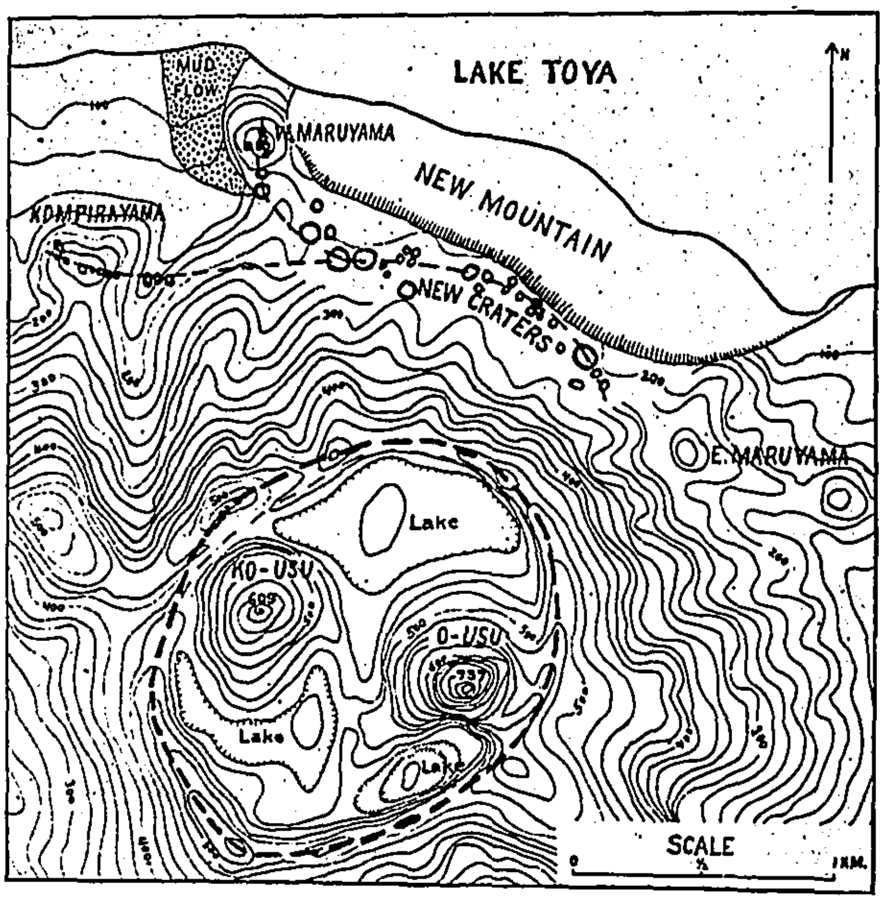
WEEK ENDING JULY 12, 1931

Section of Volcanology, U. S. Geological Survey

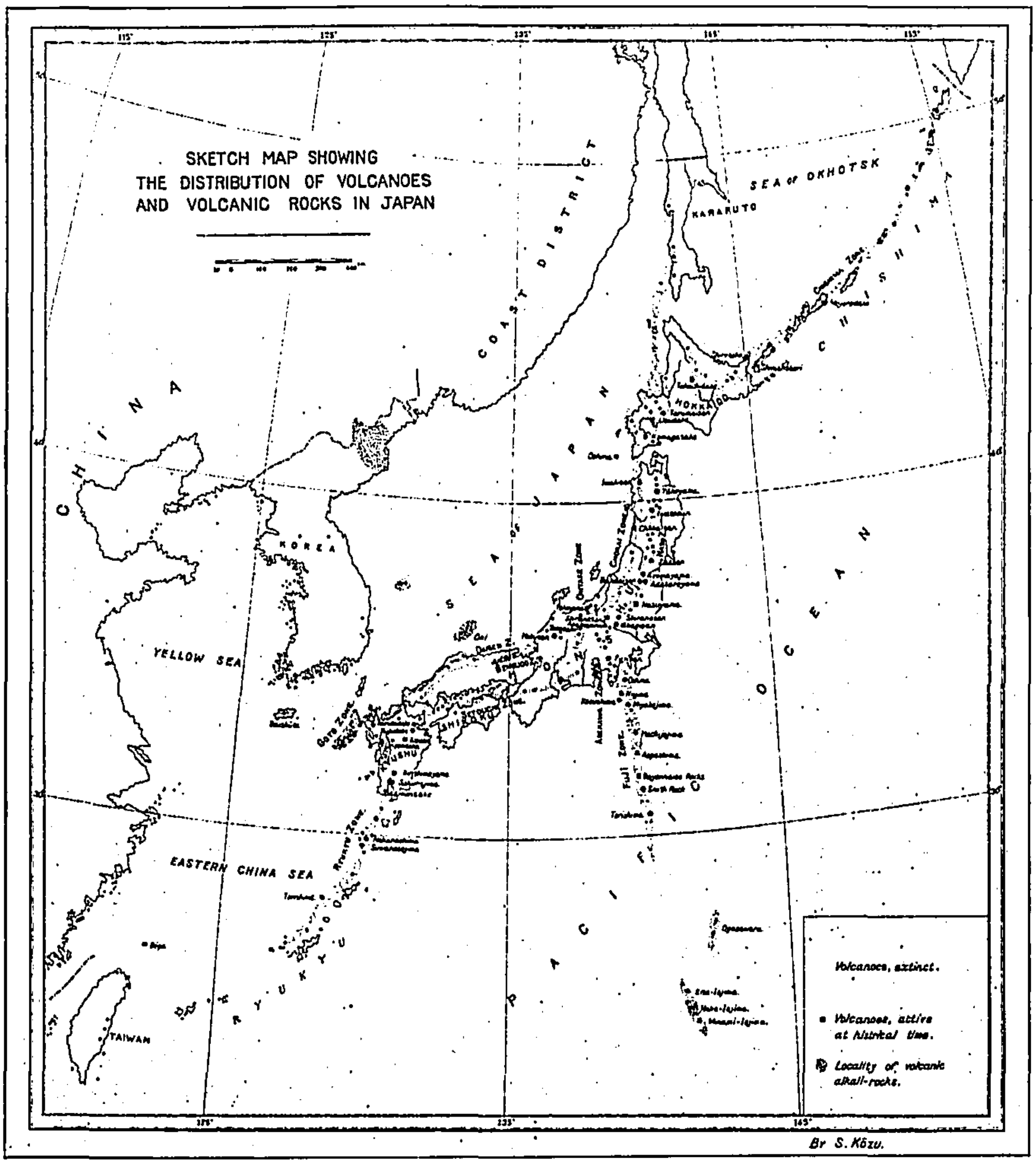
T. A. Jaggar, Volcanologist in Charge

Halemaumau has shown a few changes of interest. Blue fume has reappeared on the bottom in two new places, directly north of the 1930 cone in a sulphur area, the edge of which has caved in, and at the bright sulphur spot on the far northwest side. Dust from an avalanche was seen rising from the northeast rim of the pit at 4:30 p. m. July 10 in a compact cloud which gradually thinned. The seismograph on the crater floor recorded a few slow motion tremors without tilt.

The instruments at the Observatory registered 18 tremors and 5 very feeble local seisms during the week. Tilt was slight W. Microseismic motion was slight.



Map showing old caldera ring and domes of Usu, the active craters of 1910, and the uplifted "New Mountain" of 1910. After Daly.



Map of volcano belts in Japan by S. Kozu, showing extinct, active, and alkaline lavas.

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The Volcano Letter

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No. 343—Weekly Hawaiian Volcano Observatory, National Park, Hawaii July 23, 1931

Haleakala seen across Hawaii Channel from the summit of Hualalai. Photo Emerson.

HAWAIIAN VOLCANO LANDSCAPES

Professor Norman E. A. Hinds has produced an interesting paper on "The Relative Ages of the Hawaiian Landscapes" (Univ. of Cal. Publ. Bull. Dept. Geol. Vol. 20, No. 6, pp. 143-260, pls. 15-42, 13 text-figures; Berkeley 1931). He reviews the evidence for the supposition that Kauai is the oldest of the windward group of Hawaiian Islands, and points out that the extra heavy rainfall there, to speed up erosion, has not been sufficiently allowed for. Kauai may be younger than Oahu. He also accents downfaulting of island blocks along shore-lines which has robbed some islands of their mass. The text by Wentworth on quantitative estimates of marine and fluvial erosion in Hawaii (Jour. Geol. Vol. 35, 117-133, 1927) and Wentworth's Bishop Museum papers come in for criticism, and it is refreshing to note that both Hinds and Wentworth attempt to evaluate erosion on the basis of rainfall and drainage, and even to make some estimates of rate of removal of soil in carving landscapes. This is the beginning of a science of erosion.

Hinds writes: "According to Wentworth, the depths of material removed from the various mountains by streams stand in the following order: (1) East Oahu; (2) Kauai; (3) East Molokai; (4) West Maui; (5) Mauna Kea; (6) West Oahu; (7) East Maui; (8) Lanai; (9) Niihau; (10) Kahoolawe; (11) Kohala; (12) the rest of Hawaii. The estimates for East and West Oahu and Kauai apparently neglect extensive loss of bulk by downfaulting, hence the amounts of removal by rivers in these three cases are excessive. On East Molokai, Kohala, and Niihau, streams have eroded a residual of once larger domes since about half of these mountains has been carried below sea level by downfaulting. It is not improbable that faulting may have been partly responsible for the development of some of the great canyons on Kohala, East Molokai, Kauai, and Oahu."

Hinds uses the term "engulfment" for downfaulting, but this word "engulfment" is a volcanologic term for downbreak in volcanic craters or underground conduits, and is hardly identical with graben downfaulting.

"For Lanai, Wentworth has calculated the average rate of removal as one foot in 5,000 years, and from this he has estimated the approximate age of the landscape of that dome to be 125,000 years. Using the same rate of removal, he obtains figures of 225,000 years for Kohala and 2,090,000 years for Kauai." Hinds objects to applying a dry island rate to a wet island.

"According to wentworth, the relative amounts of

Panorama of Mauna Kea and Mauna Loa from a summit cone on Hualalai. The near foreground of Hualalai shows a slope of 35 foreground cones extend the Hualalai rift toward Mauna Loa. The left of this pict

material removed by wave action from the various islands stand in the following order: (1) Hawaii; (2) Kauai; (3) Molokai; (4) Niihau; (5) Maui and Kahoolawe; (6) Oahu; (7) Lanai." Hinds objects that the several domes on Hawaii are of different ages, and have been cliffed by the sea in different amounts. And that the formation of cliffs by faults has not been recognized. "The determination of relative amounts lost by downfaulting and by later marine erosion probably is impossible, though approximate values may later be obtained."

The point of this discussion is that the Hawaiian Islands form an excellent field for measures of erosion in time, if some one will only go at it experimentally by the observatory method.

Hinds arrives at the following conclusions:

The order of extinction of the younger Hawaiian mountains apparently has been: (a) Haleakala, (b) Mauna Kea, (c) Hualalai. Mauna Loa and Kilauea are still in process of construction, hence their landscapes will undergo certain changes before their major activity ends." (With Haleakala known to have made lava flow about the middle of the eighteenth century, and Hualalai in 1800-1801, one wonders why these two should be considered extinct.)

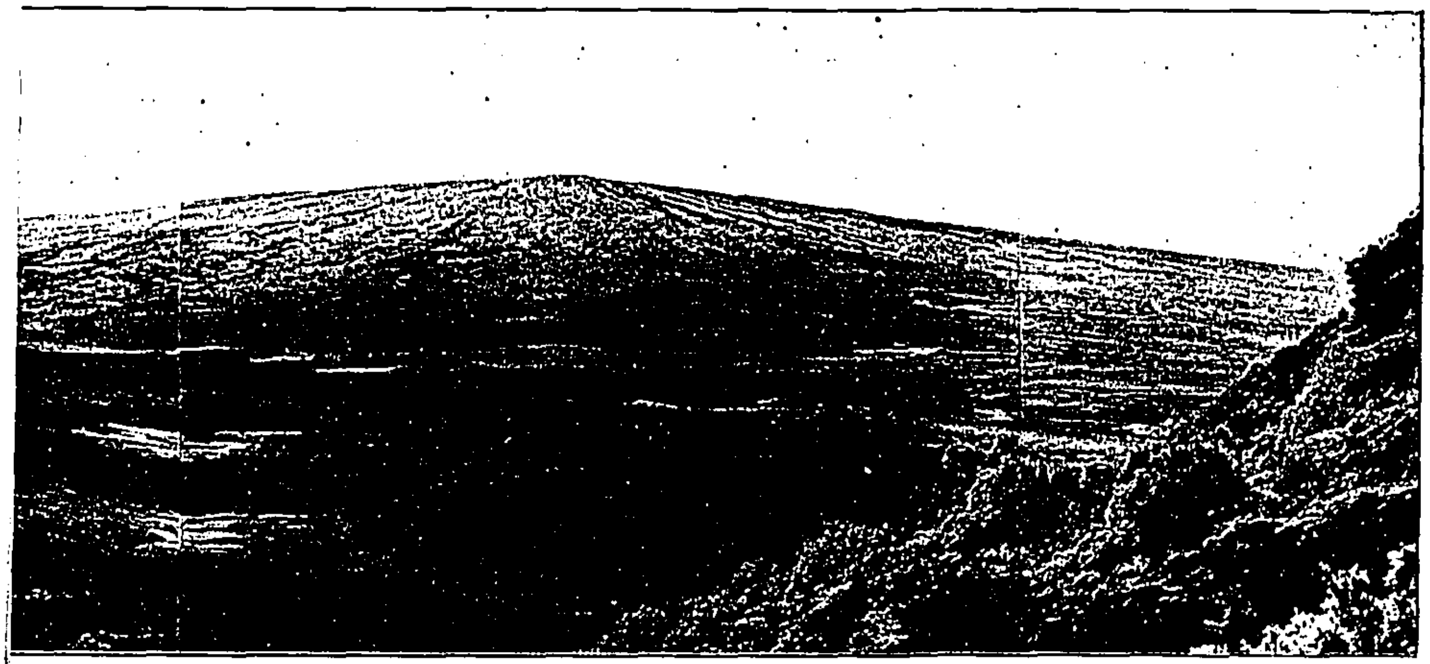
"The constructional surfaces of the old, high domes have been largely destroyed either by erosion alone or by erosion and downfaulting. On all the mountains either major or minor features of the relief have been formed by faulting, and in the ultimate destruction of the domes, faulting is one of the chief agents.

"West Oahu, West Molokai, and West Maui each became extinct before the eastern member of these doublet islands. The landscape of Kohala is the oldest on Hawaii."

Probably both of the Oahu domes are older than Kauai since the close of the last principal volcanism. The more rapid rate of fluvial erosion on Kauai, owing to the climate, does not establish the greater age of the landscape. The relatives ages of the landscapes of the high old domes appears to be: (1) West Oahu, (2) East Oahu, (3) Kauai, (4) East Molokai. West Maui and Kohala are younger, but their sequences is yet to be determined."

"Neglecting buried landscapes, the oldest landscape in the windward Hawaiian Islands is that of the Penguin Bank The final products of the destruction of lava domes are the volcanic stacks like Nihoa, roof islands, calcareous sand islands, and submarine banks without islands which make up the leeward group."

Hinds disagrees with Wentworth in the latter's belief that the Hawaiian Islands emerged in the late Tertiary. "The destruction of the leeward islands suggests that volcanism ceased there well back in the Tertiary, hence the mountains must have risen above the ocean long before, perhaps even in Mesozoic time. Buried erosion surfaces in the windward volcanoes prove that interruptions in the volcanic cycle took place and that there was deep erosion before the renewal of eruptions. The erosion of the present landscapes of the older domes probably began in late Tertiary or early Pleistocene times. The time required for the cutting of the great cliffs of Kauai very likely took at least two million years." T.A.J.



a Kea has slopes of 12° to 40°, and Mauna Loa on the right 3° to 8°. The long 1859 flow sweeps to the left from Mauna Loa. The na Kea) is incorrectly named "Hualalai" in pl. 16 of Hinds. Photo Emerson.

KILAUEA REPORT No. 1017

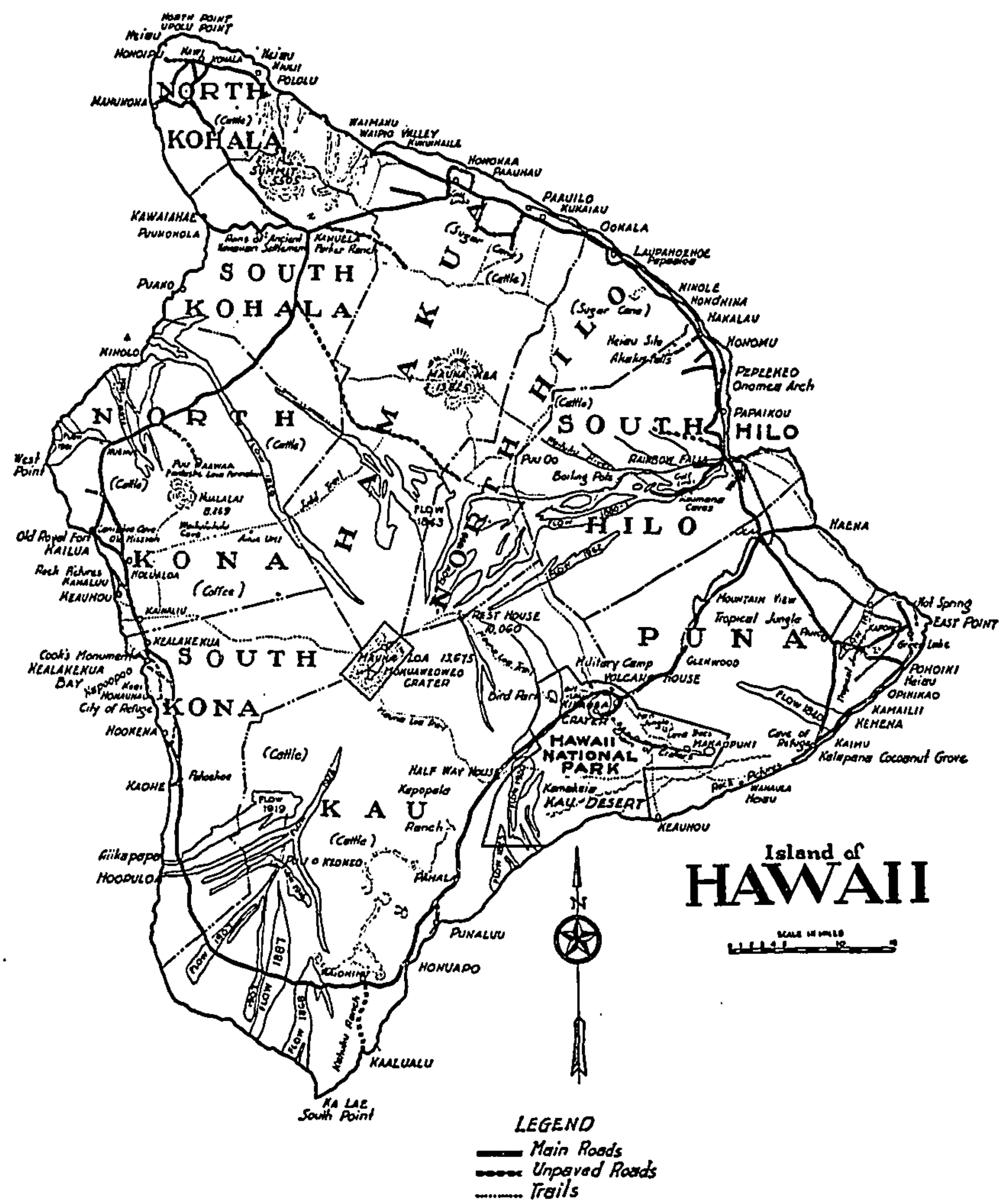
WEEK ENDING JULY 19, 1931

Section of Volcanology, U. S. Geological Survey

T. A. Jaggar, Volcanologist in Charge

Kilauea Volcano remains dormant. A few rocks were heard falling north at 11 a. m. July 16. On July 17 dust clouds from avalanches were seen at 5:30 and 9:40 a. m., and a scar showed on the northwest wall of Halemaumau. No fume or steam was reported visible during the week.

The instruments recorded 18 tremors and 3 very feeble local seisms. The average tilt movement for the week was slight northwest. Microseismic motion was slight.



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The Volcano Letter

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THE LANDSCAPE OF MAUNA LOA

Hinds speaks of Mauna Loa and Kilauea (Hawaiian Landscapes, Bull. Geol. Univ. of Cal. Vol. 20, No. 6, 1931) as being still under construction, with shallow weathering, and stream gulches only where eruptions have not recently taken place. "On certain parts of the rainy, windward side of the mountains, where flows have not been erupted for long periods of time, the lavas are decomposed enough to allow the growth of a heavy jungle forest in the soil cover. The more recent lavas are virtually untouched by ground water or atmospheirc solutions, and even in the rainest sections, have little or no vegetation on them."

This last statement is not correct for the 1881 flow at Hilo, where the rainfall is 200 inches, and good sized trees and bushes cover the flow.

"Where the climate is dry, weathering is much slower and there is little soil on any of the flows." This is particularly true of the Kau Desert on the southwest side of Kilauea, of Kahuku on the southwest side of Mauna Loa, and of the northwest flows of Hualalai. These places have rainfalls of 30 to 70 inches.

"Only a few permanent streams are present, and these have not cut deep valleys. Most of the constructional surface is unbroken. The eruption of new lava apparently is sufficiently frequent to cover most of the exposed surface before any considerable amount of weathering or erosion can take place.

"Short stretches of the coast are cliffed to heights of 50 or 60 feet, since flows apparently do not reach sea level often enough to prevent some inroads by wave abrasion. The occasional flows which pour into the ocean repair in part destruction thus caused. Low fault scarps are present, especially on the southeastern flanks of the domes, and part of the cliffed southeastern coast (of Hawaii Island) has been developed by faulting.

"Parasitic cinder cones in considerable numbers dot the flanks of the dome; part of these show rude linear arrangement as though erupted at various points along radial fissures.

"At the summits of both Mauna Loa and Kilauea are volcanic sinks, in which the principal eruptive center is located," Mokuaweoweo the Mauna Loa crater being 3½ by 1¾ miles in dimensions and 800 feet deep; Kilauea Crater 2 by 1¾ miles and 500 feet deep.

"The sinks are depressions resulting from the collapse of the crust in the vicinity of the principal eruptive center as liquid material has been emitted from below the surface. Small step-faulted blocks are present locally about the walls of the sinks." Near the middle is the conduit pit through which the lava rises and falls, in the case of Kilauea. Mokuaweoweo has cones and pits in the middle.

"As long as activity prevails at the central vents or eruptions take place from lateral fissures, the surface may be periodically renewed and the pre-existing topography blotted out. The final constructional outlines therefore are not complete.

"Kilauea is a small mountain far down on the southeast side of Mauna Loa at an elevation of about 4,000 feet. The relative ages of the two domes has been disputed. Jaggar formerly held that Kilauea is the older of the two, and that Mauna Loa has grown up in a great vale between Kilauea and Mauna Kea. Daly believes that Kilauea is fed by a laccolithic offshoot from the larger volcano, and now is independent of the main reservoir because of the sealing of the connecting channel. **It is now generally accepted that Kilauea is the younger mountain."**

"Field evidence supporting this view has been presented by Stone, who has recently described the general features and the geology of the volcano. Stone notes that Kilauea is an independent dome on the flank of Mauna Loa, but because of the very gentle slope of both Mauna Loa and Kilauea its domelike character is not apparent in some parts of the area. Important data are given by Stone proving *the superposition of the Kilauea volcanics* on older lavas from Mauna Loa and the association of the Kilauean series with faults which developed in the side of the greater mountain."

With reference to the general acceptance of the youth of Kilauea, the reviewer does not know what this statement is based on. Mr. Stearns in his "Geology of Kau" (Water-supply Paper U. S. Geological Survey) leaves the question open. In Kapapala and along the valley between Kilauea and Mauna Loa it is Mauna Loa flows which are overlapping the Kilauea slopes. The great sink of Kilauea is an old-age feature of a major dome. It was not the vale between Kilauea and Mauna Loa, but rather between Kilauea and Hualalai, that appears to have lain under the modern slagheap of Mauna Loa. Mauna Kea was the ancestral dome at the northeast which blocked any growth of Mauna Loa in that direction. Hence the pronounced development of a long lobe of Mauna Loa into the sea at the southwest. Both Kilauea and Mauna Loa have parallel lava rifts, starting at their craters, and trending respectively southwest and northeast.

The history, however, was not so simple. Both Kilauea and Mauna Loa appear to be over an older topography. Kilauea sink is in line with two other sunken amphitheatres southwest of it, Wood Valley and Mohokea, back of Kapapala and Hilea. These three sinks appear to lie along a common rift in the ancient land which the new dome volcanoes are burying. The live Mauna Loa of the present day has three centers of lava heaping, northeast, on top, and southwest. The accompanying panoramas show something of this vast bulky mass. T.A.J.

KILAUEA REPORT No. 1018

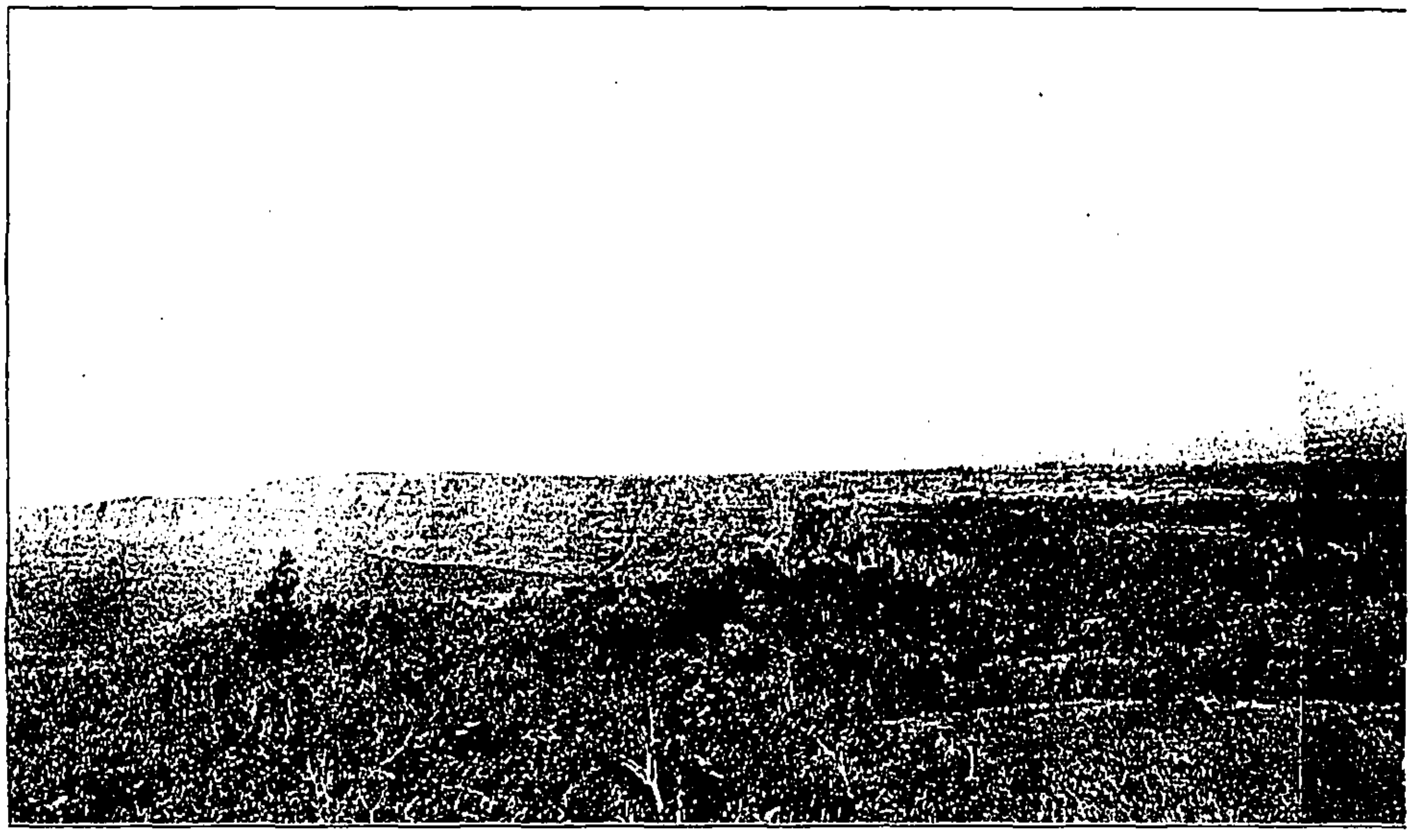
WEEK ENDING JULY 26, 1931

Section of Volcanology, U. S. Geological Survey
T. A. Jaggar, Volcanologist in Charge

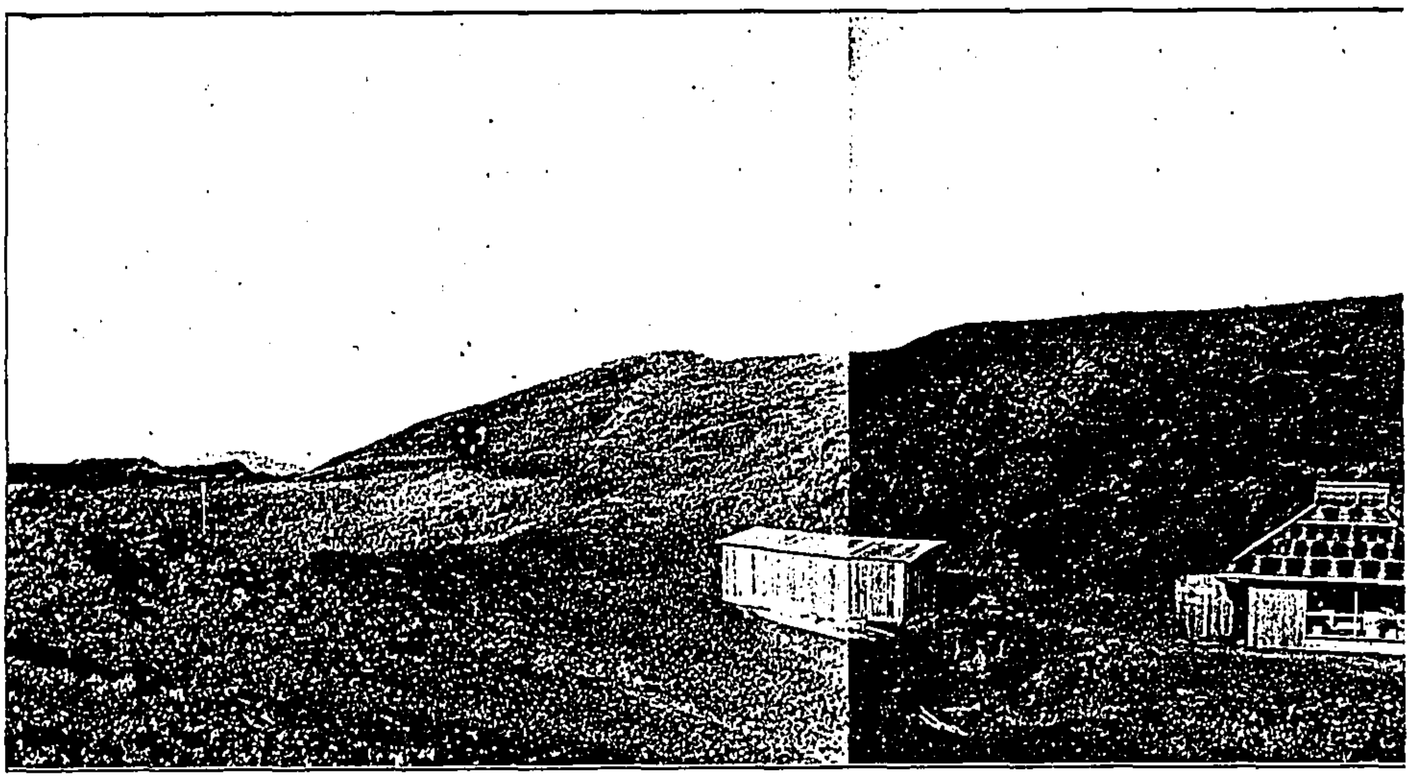
On Monday, July 20, the interior of Halemaumau was partly obscured from view by fog and light rain. Some steam was seen at the southeast rock slope. Heavy rains Tuesday caused great steam clouds to rise from the pit. All vents within the pit were steaming actively on July 22. Fuming was also strong at two places north of the 1930 cone. The pit seismograph showed heavy tilt due to the weight of rain water in the vicinity.

The seismographs at the Observatory registered three spells of strong continuous tremor on July 23: 6:43 to 7:05 a. m., 7:49 to 8:02 a. m., and 5:31 to 5:45 p. m. In addition there were 16 tremors and 2 seisms.

Average tilt for the week was slight NE. Microseismic motion was strongish on July 21 due to windstorm, and thereafter slight.

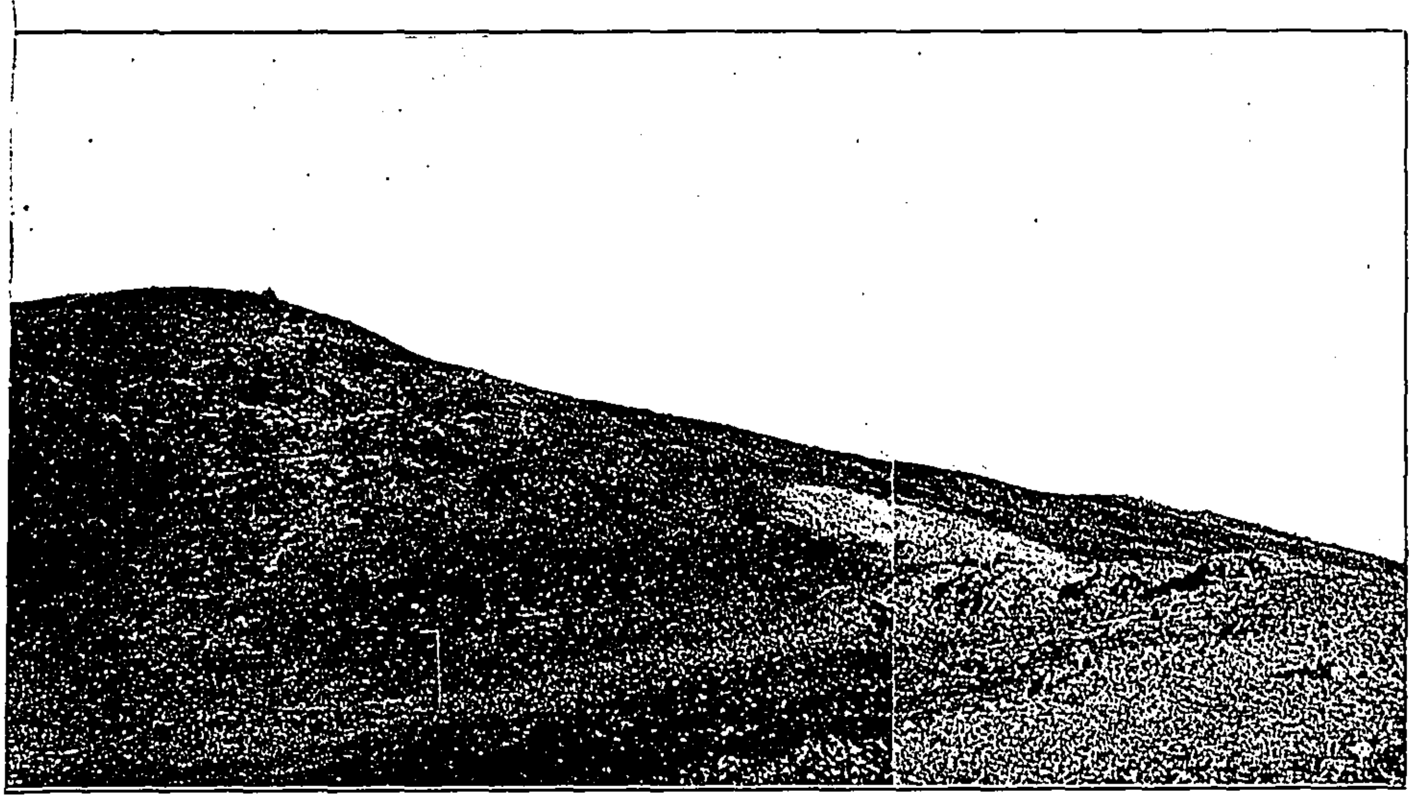


Panorama of Kilauea Crater, Mauna Loa, Mauna Kea, and Volcano House, looking west. Shows the three lobes of Mauna Loa and

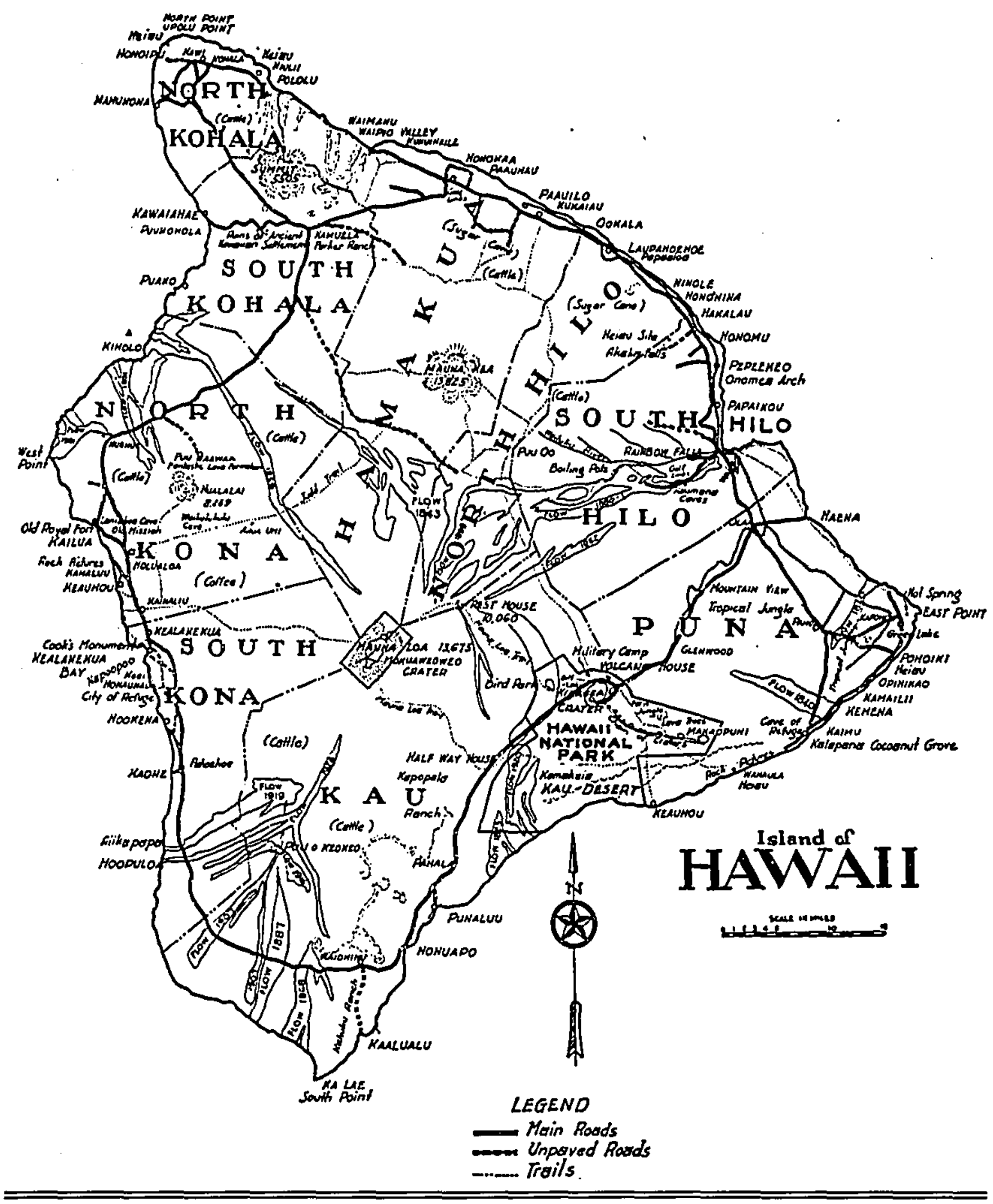


Puu Ulaula, or Red Hill, looking north, showing the rest house on the northeast rift of Mauna Loa. A characteristic old clinker-la

/ between Mauna Loa and the foreground ridge of Kilauea. Mauna Loa slope 6° on left, 4° on right. Photo Gartley about 1912.



at elevation 10,060 feet. Center of the northern lobe of Mauna Loa. Photo Wood in 1916. Slope 20° on left, 10° to 19° on right.



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