Pahu Manamana o ʻUmi

Dr. Pualani Kanahele Kanakaʻole
Dr. Huihui Kanahele-Mossman
Kuʻulei Higashi Kanahele, PhD Candidate
Pualani Lincoln Maielua, M.A.
Kalāhoʻohie Mossman, M.A.
Kalei Nuʻuhiwa, PhD Candidate

Prepared for
Hawaiʻi Volcanoes National Park
PO Box 52
Hawaii National Park, HI 96718

Contract/Task Order Number: P16PX02852

Edith Kanakaʻole Foundation
1500 Kalanianaole Ave.
Hilo, HI 96720

September 30, 2018

Executive Summary of Pahu Manamana o ‘Umi

by Dr. Pualani Kanaka‘ole Kanahele

Papakū Makawalu is the process used to interpret the site referred to as “Pahu Manamana o ‘Umi” (PMU) or the “Star Instruments of ‘Umi” as requested by the Hawai‘i Volcanoes National Park personnel. It is in the ahupua‘a (land section) of Kahuku, Ka‘ū, Hawai‘i within the boundary of Hawai‘i Volcanoes National Park. It is located on Mauna Loa at approximately 7,752 feet above sea level.

Papakū Makawalu is the Native Hawaiian comprehensive study of the Hawaiian universe. The Native Hawaiian divided his/her universe into three primary areas of concern. This document will be executed in the order as identified in this paragraph. 1) **Papahānaumoku** (PHM) erudition includes all entities that go through a generative cycle and are separated upon birth from its originator. Examples of this process are man, birds, fish, coral, shell fish, bees, trees, and the list is long. PHM’s focus in this document is to recognize the holistic presence of the Native Hawaiian mind or the ruling chief ‘Umialīloa, who initiated this site. 2) **Papahulihonua** (PHH) possesses deep knowledge and understanding of all the natural elements of the earth such as fresh and salt water, volcanism, land, petrology, soil make up, ocean and ocean currents. PHH represents the selected site, the active volcano, and the materials needed for site construction. 3) **Papahulilani** (PHL) intellect includes all natural celestial and atmospheric activities. PHL’s calculated outcome of the site was the product of the Native mind and site construction.

The site on Mauna Loa is a pahu manamana site. Pahu manamana is a site of star alignments. It is considered unique in that there are few on the main islands. Pahu manamana are usually on high volcanic islands. This pahu manamana has its back towards north- northwest direction and its front faces the south-southwest direction.

Other cultural sites are included in the “Nomenclature” section in the “Introduction”.

The pahu manamana and other sites were deconstructed through the lens of Papakū Makawalu. The lens of Papakū Makawalu has to be dissected carefully because PHM, PHH, and PHLwill be concerned with the same entities. For example, where PHH will focus on the Wao and rainforest as land sections, PHM uses the Wao and rainforest as a land section occupied by vegetation. Know that there will be similarities and crossovers.

Papahānaumoku team (PHMt) is inclusive with the findings and theories of PHL and PHH. These theories or ideology begins with the Native Hawaiian mind, which is PHM. PHM focused on ‘Umialīloa and his relationship to people whether they were of common descent, warriors, kahuna intelligencia or of ali‘i lineage. The chant “‘O Kū, Uli, e Kama, Lele Wale” describes ‘Umi’s challenges. The chant introduces ceremonies of ali‘i assigned to the sacredness and prohibitions of his/her status. What follows as part of this elevated ceremony is that the sacred one becomes involved in a ‘Aha ceremony as a means to connect and or tie all elements together which is the reason for the pahu manamana.

The supposition for PHM when interpreting ancestral data, consequently means, understanding all components of life in the physical, mental and spiritually state of being.

PHMt introduces a look at the possible carving of the manamana features of PMU. Mapping is included by the PHMt, it provides an understanding of things and places involved in this study that were not seen. However, the knowledge that these unseen places and things were a reality in trusting your mental and spiritual state of being.

Papahulihonua (PHH) relates the horizontal land sections with the placement of PMU site in the Wao kuahea. Wao is the montane ecosystem of the mountain. Wao is the natural horizontal land sections and kuahea is an ecosystem within the Wao. The kuahea is described as being below the top of the mountain and has very few vegetation. The Wao system involves a relationship with the atmosphere above and the earth under it.

PHH presents two strong hypotheses concerning the placement of PMU at the long lava tube that runs northeast from the site. The stars from the pahu manamana sets in a north-northwest position which relates to the placement of islands in the Hawaiian Archipelago. The first hypothesis is: ʻUmi, according to PHH, is knowingly tying himself to significant wahi pana throughout the archipelago. The second hypothesis is: ʻUmi again aligns himself with the southeast migration of Pele indicating his interest in magma movement from the north-northwest to the southeast.

PHH has an interesting list of pōhaku. The length of the list proves that the Hawaiian was still stone age mentality, but they used the contents their land offered. They utilize pōhaku as war implements, fishing tools, farming tools, dancing implements, carving tools and for ceremony.

Papahulilani team (PHLt) noticed immediately that these sites were strictly stellar and could only be studied in the evenings. On the evening of the summer solstice, 2017, they tracked the stars and noted that the north stars and constellations were setting on the pahu manamana. Therefore, they took copious notes on both summer and winter solstices, 2017, on alignments of star settings, star risings and stars and planets maintaining a pathway. The important information was marking which manamana aligned with which moving stars. The PHLt than set out to connect the manamana and stars to land sites.

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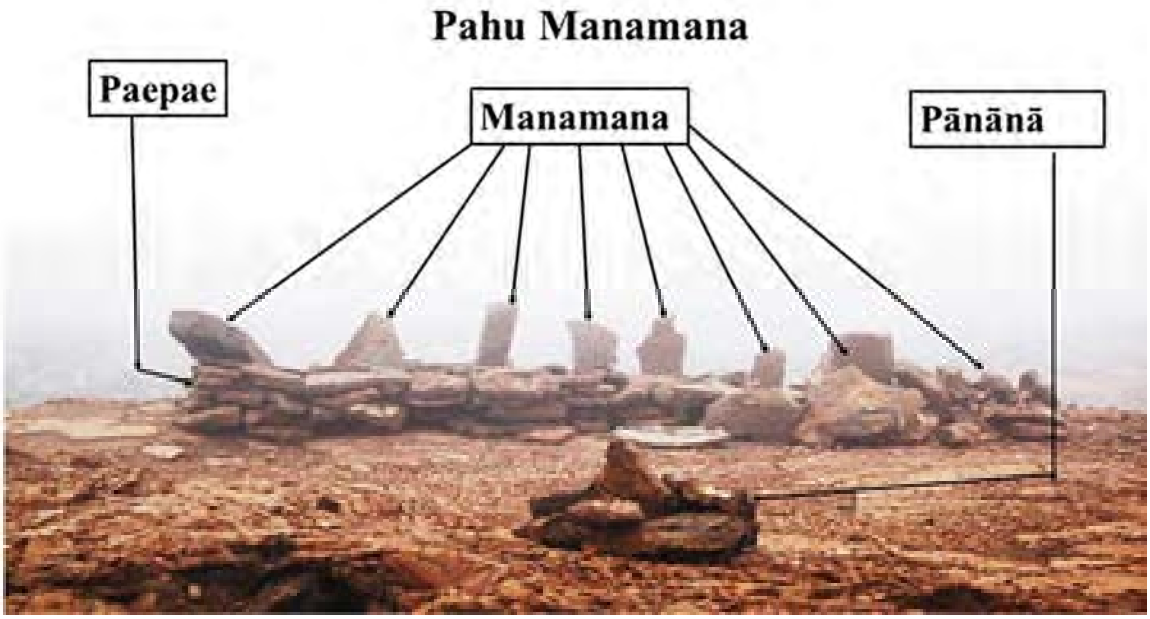

Figure 1: Pahu manamana are made up of manamana (uprights) atop a paepae (platform) and a pānānā (compass for manamana) which is found in foreground facing the pahu manamana. Pahu manamana is an instrument which is a junction that intersects stars with earth locations and/or other cosmic intersections.

Pahu Manamana, a Primal Instrument

Pahu Manamana is the instrument in figure 1. It has three parts; 1) pānānā, 2) paepae, and 3) manamana. The three parts together is a “pahu manamana”. The pahu manamana is an instrument set to locate land while intercepting stars. The interception of stars was used for ceremonial purposes. The pānānā is a compass which has three purposes, as we know; 1) it aligns with each manamana, 2) it aligns with a star or stars, and 3) finally it aligns with an unseen island. “Manamana” are literally toes, fingers, and extensions, therefore these upright rocks are extensions of the site. Pahu manamana is a star instrument.

Pahu manamana is a prime example of the Native Hawaiian mind in eclectic mode for survival and how to live fully in his or her space.

‘Umialīloa

This pahu manamana site is credited to ‘Umialīloa or ‘Umi. All other sites of this caliber are also ‘Umi oriented.

‘Umialīloa was an ali‘i or person of chiefly rank. His existence is dated approximately between 1550–1650 AD. He was raised in Hāmākua by his mother without the benefit of chiefly status. Eventually he moved to Waipi‘o where he inherited the ali‘i rank of his father Līloa who possessed the highest possible status of chiefs on Hawai‘i Island. On contact with Līloa ‘Umi is afforded the “‘Oki Ka Piko” ceremony, a distinction which offered him the privilege of inherited ali‘i rank and other rights and privilege of this position.

Upon the death of Līloa, Hākau the elder step-brother of ‘Umi attained the privilege of ruler as assigned by Līloa and ‘Umi was granted the care of the gods, religious relics and associated personnel. This was a position for growth of intelligence and spiritual mana. ‘Umi was the immediate manager of the ceremonial well-being of all the gods and therefore the space. Upon the death of Hākau, ‘Umi stepped into the position of ruler of Hawai‘i Island.

‘Umi gathered his comrades of wisdom and knowledge to extend the boundaries of the natural world, people such as: Kuhikuhipu‘uone, structural engineers who knew the lay of the land and built heiau; Kilokilo, one who studied the star movement, prognosticated accordingly, knew the movement of the moon, sun and weather; Kālai Wa‘a, canoe carver whose knowledge extended to the forest and the ocean; and Kāula, who read omens in the sky, earth and people.

With this group of intelligencia ‘Umi is credited for all the stellar and solar instruments on the island of Hawai‘i as well as others on Kaua‘i and Maui. The stellar and solar sites of Hawai‘i Island include: 1) Ahu a ‘Umi, which sits in the middle of the saddle of the mountains, 2) Pōhaku Hanalei in the northeast corner of Mauna Loa, marks the junction through the middle of Hawai‘i Island from Kumukahi Point to Pu‘u Ohau in Kona, 3) Pu‘u Kūki‘i stands in alignment with Kumukahi. (Kūki‘i has a few manamana aligned with the equinox). 4) Kumukahi, Pu‘u Kūki‘i, Pōhaku Hanalei and Pu‘u Ohau are solar equinox sites, and 5) Ke‘eke‘e is the bay at Pu‘u Ohau. Ke‘eke‘e means “dome of the sky” it is an epithet to the sun at its setting and an important clue to the four solar sites mentioned.

‘Umi sought the ‘Aha, endowment bestowed ceremoniously and was meant only for ali‘i, to validate his connection to his genealogy, to pu‘uhonua ‘ele‘ele and to a star. ‘Aha is literally a cord that binds. It is a metaphor of binding someone to his or her responsibility. The Milky Way is known as Ka ‘Aha, it is the cord that binds the sky from the north to the south.

‘Umi became a chief of great reputation and an outstanding warrior who with-stood the rigors of competitive warrior chiefs. He had to be able to calculate time and space as well as out think his opponents, family and friends. Spiritually he must be prepared to reach out into the natural elements and understand their responses. The Hawaiian mind of a chief was an instrument that functioned with total control. Intelligence was expected of a chief as a component of his status.

Volcanic Islands, The Hawaiian Archipelago

High volcanic islands are a necessary setting for pahu manamana.

“Aloha Ko Kāua Hoa O Ke Ala Kai” is a short chant which reveals the volcanic islands of the Northwestern Hawaiian archipelago, islands whose growth were interrupted by emptied magma

tubes. The islands are Laupala (Gardner Pinnacle), Nihoa, Moku Manamana (Necker) and Hanakaʻieʻie (Kamokuokamohoaliʻi or La Perouse Pinnacle). Hanakaʻieʻie, according to the chant is the island of Kamohoaliʻi. If this is so then this is the parallel of Kapalikapu o Kamohoaliʻi at Kīlauea. There are other Kapalikapu o Kamohoaliʻi, such as found on Kauaʻi and Kahoʻolawe. The concept of Kapalikapu o Kamohoaliʻi is that it is the initial source of island development therefore on each of these islands it stands as the summit of a volcano caldera.

Despite the immature nature, the islands mentioned above were given an identity which solidified their position in the Hawaiian volcanic chain of islands. The islands were understood to have connective links to each other.

There are three chants from Papahulihonua (volcanic earth chants) which lay out the islands of volcanic origin and the above chant which leads the pele (magma) movement under the ocean from northwest to southeast. The origination of Pelehonuamea islands as we know it, begins with Hanakaʻieʻie.

"Kū Mākou E Hele Me Kuʻu Mau Pōkiʻi Aloha" names the islands from the northwest beginning with the islands of Nihoa, Lehua, Niʻihau, Kauaʻi and Oʻahu. The chant finale ends while moving southeast, always on the path of the rising sun until Makahanaloa in Hilo. The long back of Puna, seen in the distance, is described as the ultimate destination.

Another chant, "Aloha ʻO Maui, Aloha Ē", bids farewell to the islands of Maui, Molokaʻi, Lānaʻi and Kahoʻolawe stating that Hawaiʻi is the island they, Pele and Hiʻiaka mā, will settle on forever. These three chants are inclusive of all volcanically built islands and their placement in relationship to each other.

The farewell chant is an indication that the composers were aware that eruptive cycles of islands prior to Hawaiʻi Island had ceased. Hawaiʻi was now the hot spot and the rest of the volcanic islands were now in erosional mode.

Background on Stellar and Solar Instruments

In a large ocean it was important to find other means of locating islands beside sight, currents and memorization of old chants. Ocean navigation was a lifestyle with the oceanic people of Hawaiʻi, therefore they also used stars as another means of pinpointing islands or other locations. This process detects designated stars, stars as described in "O Kāne ʻo Kūkapao".

This basic chant classified stars in particular groups. These were known as: 1) aligned stars, 2) fixed stars, 3) constellations, 4) meteors, 5) red stars, and 6) big and small stars. According to this chant, all stars were affixed and floating in space as were the moon, sun and earth. Each pahu manamana is quantified for a specific group of stars localizing on a definite point of interest.

Pahu manamana is our topic of interest for the Hawaiʻi Volcanoes National Park and the chief ʻUmialīloa is given credit for many of the manamana sites on the island of Hawaiʻi. This short introduction of manamana will include pahu manamana and other Papahulilani (atmospheric)

instruments here in the Hawaiian Islands and elsewhere in the Pacific. This section provides a linear legacy of solar and stellar instruments. Usually sun instruments are at sea level, pahu manamana and other stellar instruments are higher.

Moku Manamana (Necker) was mentioned earlier, the name of the island describes its use. When it was used, is unknown. The island is overburdened with both solar and stellar instruments which means that the island was used constantly only for this purpose, for a long period of time, by many people. Moku Manamana is probably the oldest island which utilized the manamana concept to the extreme in the Northern Hemisphere.

Figure 2: Moku Manamana Island lays from east to west. The high points from east to west are Hā‘ena, Hā‘ena Kū, Hā‘ena Ala, Hā‘ena Mau Hoa Lala, Hā‘ena Moe and Hā‘ena A‘e.

There are over 35 pahu manamana and a number of singular manamana on the island. Figure 2 lists the Hā‘ena nomenclature which hints to the path of the rising and setting sun on the summer solstice. Each of the high points of the island utilizes Hā‘ena which describes the breath of the sun at sunrise and sunset. Moku Manamana sits on Ke Alanui Polohiwa a Kāne or the Tropic of Cancer. This is the northern corridor of the sun and the alignment for the rising of the Makali‘i (Pleiades). In the chant “‘O Kāne, ‘o Kūkapao,” Makali‘i belongs to star group #1, it is in alignment with Ke Alanui Polohiwa a Kāne, the Hawaiian Islands and the summer solstice sun.

Figure 3: This seems to be the biggest pahu manamana on Moku Manamana, it faces direct east. Its shoulders are north and south. Its back is to the west.

Figure 4: Well-developed, very sophisticated instruments of pahu manamana are found on Moku Manamana. Some instruments have paepae on all sides, with one manamana on the side wall, including a pānānā in the east, facing the pahu manamana.

Figure 5: Pahu manamana on Mauna Kea, faces direct east.

Figures 3 and 4 on Moku Manamana are are well developed in a rectangle, enclosed paepae with the manamana facing east and its back to the west. These pahu manamana also have a manamana on the side paepae. Figure 5, Mauna Kea pahu manamana like Mauna Loa's are not as sophisticated or well developed as any on Moku Manamana.

Figure 6: This is a sun instrument from the island of Mau Piti. It has a sun bow on the middle manamana.

Figure 7: These manamana are also from the island of Mau Piti. They are not on a paepae but are on pā (stone pavement).

Manamana on Tahiti, Raiatea, Borabora and Mau Piti are noted sun instruments. They are all at sea level. They are also found on other islands throughout the Pacific but these are the islands where they are prominent and have been observed. Figures 6 and 7 are sunset manamana on Mau Piti. Figure 8 is the sunset instrument in Tainui on Raiatea. These have the luahoano or sun bow feature on the middle stone. The manamana measures the corridor of the sun from solstice to solstice from one end of the manamana to the other.

Figure 8: These very large, very old stones, are sun-related. The middle pōhaku along with Mau Piti has a luahoana or sun bow. The manamana measures the corridor of the sun from solstice to solstice from one end of the manamana to the other.

Figure 9: Hāpaialiʻi Heiau in the foreground and Keʻekū Luakini Heiau in the background. Kahaluʻu, Kona, Hawaiʻi.

Hāpaialiʻi seen in the foreground of figure 9, is a sun instrument. The west edge faces ma kai, north and south corners of the west edge are where the solstice suns will set. It does have a pānānā within the walled area towards the east. Keʻekū Heiau in the background is a luakini dedicated by Lonoikamakahiki, the grandson of ʻUmi. Both of these structures were the worshipping place of Lonoikamakahiki. ʻUmi and Līloa utilized these structures.
These two structures were highly damaged from natural causes and were almost unrecognizable. Kamehameha Investment Corporation initiated the structual restoration in 2006 at Kahaluʻu, Kona.

Figure 10: Ahu a ʻUmi is the most talked about structure in the mountains because of its size and location. It is closest to Hualālai Mountain in the saddle of Mauna Loa and Mauna Kea.

Ahu a ʻUmi (figure 10) was well built and lasted for centuries. The genius of this structure building, including the two at the kahakai of Kahaluʻu is credited to the Kuhikuhipuʻuone of ʻUmi. Ahu a ʻUmi is built more like a heiau instead of a pahu manamana/ahu site for star and sun movements.

Methodology

The methodology is Papakū Makawalu or a foundational method utilizing the three divisions of the Hawaiian universe which are Papahānaumoku, Papahulihonua and Papahulilani:

- **Papahānaumoku** includes all entities produced through procreation and generative process. These are some of the entities: humans, animals, mammals, fish, gastropods, reptiles (limbless or otherwise), all young blooded vertebrates with feather and wings, plants, polyps; the list is very long.

- **Papahulihonua** is inclusive of the rotating earth, strata of land, soil, mud, rocks, volcanism, lightning, thunders, ocean, currents, fresh water, rivers, acquifers, etc.

- **Papahulilani** includes everything in the revolving cosmos. This is inclusive of the sun, moon, planets, stars, meteors, clouds, rain, mist, rainbows, lightning, thunder, wind and all else in the space above the trees.

Hawaiian antiquity and ethnic perspectives on ideology begins with the Native Hawaiian mind.

Papakū Makawalu processes, analyzes and deconstructs cultural nuances, translations, chants, epistemology and other literature and then reconstructs the information to glean insight into the metaphorical nuances. The study will focus on the instrument and mapping will be done in relation to the instrument. This is an extention of Papahānaumoku.

The fact that the pahu manamana is earth bound, it is of the earth, is related to the movement of volcanic islands, utilizes pōhaku, measures and aligns with other islands establishes its connection to Papahulihonua.

The pahu manamana is a star pointer, identifying and locating stars in connection to places gives the instrument a stellar relationship. The position and building of the pahu manamana and its hypothesis will provide the reasoning for its location. Why and how it was constructed and what its relationship to the immediate environment as well as the greater Hawaiian universe is a Papahulilani ingenuity.

The pahu manamana site will be presented according to the papa grouping listed above. Each papa will show and explain their findings and the eventual theory and concepts for the instrument in the Kahuku site.

Informative Methods for Pahu Manamana

The first concern was to acquire as much information as possible for the pahu manamana. An immediate worry is that there is no literature on manamana, however the primal features is still present today. Therefore developing a vocabulary for the study of manamana sites is necessary. We initiated the interest when visiting Moku Manamana. There are three references that mentions Moku Manamana. The chant in the introduction, for one, uses this name. In 1973 Dr. Kanahele gathered as much information as possible concerning volcanic activites and

Pelehonuamea. The book “Hawaiian Legends of the Volcano” by William D. Westervelt, in one sentence mentions that Kamohoali‘i asks Pele where she was going and she replied that she was going to Bolabola; to Kū‘aihelani; to Kānehunamoku; then on to Moku Manamana, after which she was going to see the ali‘i wahine, Kaoahi, on Ni‘ihau.

From 1973 to 2005 Moku Manamana was never mentioned until an invitation arrived to sail to the island to reinter iwi (bones). A curious island with all the fingers pointing to the sky, what was this about? The morning after arrival, while anchored on the south side of the island, watching the sun rise from the northeast, exactly over a large manamana prompted the purpose for the island’s multiple manamana. Moku Manamana, island of extented fingers to sun and stars. Figure 11 is the sunrise on the summer solstice on Moku Manamana. Sun rising and setting, star rising and setting have been chronicled by practitioners on this island from time immemorial.

Figure 11: Sunrise on Moku Manamana on the summer solstice.

Manamana on Moku Manamana are all about celestial bodies. This was indeed the informative method of island produce. Manamana sites tell their own story.

The group has since made five trips back. Each trip we learn a few more things about manamana. We are fortunate to have this opportunity to study this site on Mauna Loa, a place closer to home, a familiar environment with mountains and pu‘u.

Nomenclature

Figure 12: Pahu Manamana o ‘Umi overview.

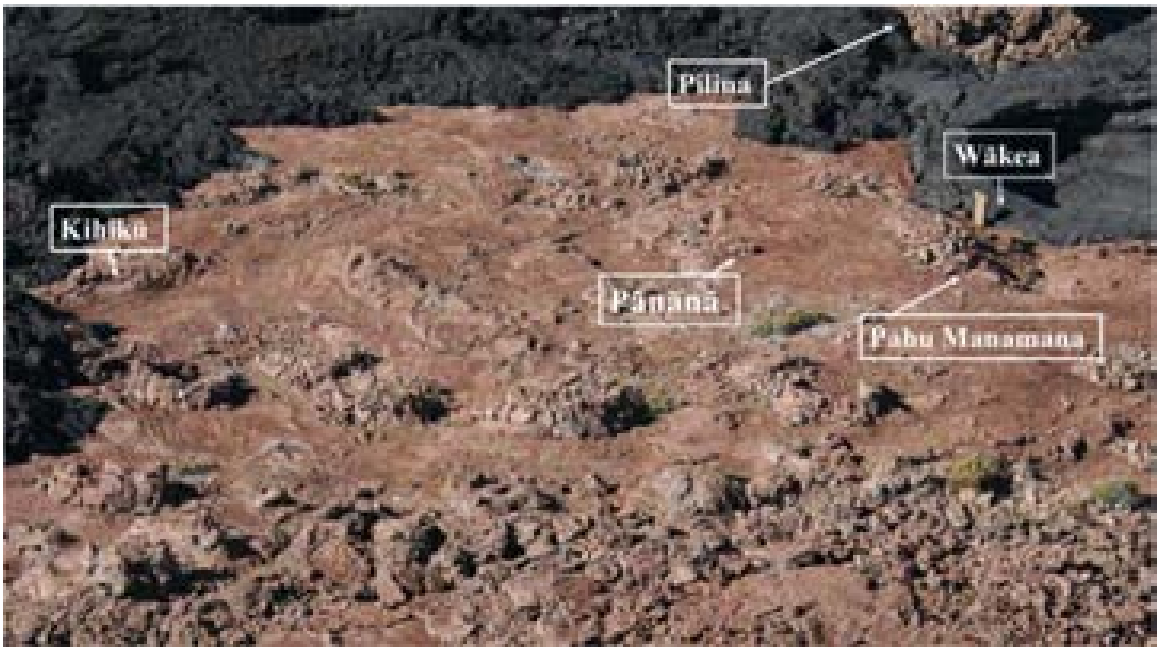

Figure 13: Pahu Manamana o ‘Umi site.

All cultural features on the pahu manamana site have been named according to their function. Figure 12 points out the features on Pahu Manamana o ʻUmi as they relate to the whole site and to each other. Figure 13 illustrates the realistic positions of the features and nomenclature assigned to each.

- **Pahu Manamana**: has already been explained in the first paragraph of the Introduction.
- **Pānānā**: has also been clarified.
- **Wākea**: is the single manamana which fell and was set upright again in the collapsed tube. Wākea is the name for Orion and is the constellation that is the equator of the sky. Wākea was a chief who was deified and rules forever at the equator on the equinox. The manamana Wākea is in alignment with the constellation Wākea as it passes over head each night.
- **Pilina**: there are three ahu up on the old lava flow with the new lava surrounding it. Pilina is translated as always on track or sticking together. This track was observed and proved to be the ecliptic of the planets. This cycle is constant therefore, the idea of "pili" is to adhere, to stick to or abide by, in this case to abide by the law of the sun. The addition of "-na" on the end of pilina translates as always or constantly.
- **Kihikū**: is an outcrop of manamana attached to the new lava flow positioned from east to west. There are two manamana standing however according to the stacks of rock located westward there should have been five. Because the lava flow seems to have cut off a continuum of manamana eastward it is difficult to make an educated guess on the possible amount there were initially. However, there are two standing and three more rock piles therefore five possible manamana. This is not a pahu manamana which has one purpose. Each manamana on Kihikū are accounted for individually. Pahu manamana stand shoulder to shoulder, Kihikū stands front to back. Kihikū aligns with the rising of stars and planets in the eastern horizon.
- **Pahu Manamana o ʻUmi:** Because ʻUmi is credited for the stellar and solar instruments of this island, this site should be endowed accordingly therefore, PMU as a nomenclature for the entire site is fitting.
- **Makahuina:** a natural outcrop of rocks north-northeast of PMU. It seems to be central to the entire site. Makahuina means "central point" which is what it represents.
- **Pāpaʻi:** C-Shelters.

Kihikū means the upright acts individually unlike the pahu manamana where each pōhaku correlates with the next to solve a puzzle. Kihikū and Wākea marks an alignment of stars and planets as they move in their place in the sky. Like Kūmau (North Star) and Newe (Southern Cross) which keeps the sky in alignment for those observing, the purpose of Kihikū, Wākea and Pilina are to keep the sky in alignment with the earth location of PMU.

The Team

Dr. Pualani Kanahele Kanakaʻole is the principle writer for this project. Dr. Kanahele is a Hawaiian Culture expert who is retired from the University and Community College of Hawaiʻi. Dr. Pualani will analyze the possibilities of what is actually on site, what is there that we do not

see, what should be there that is not there at this time and how to broaden the horizon by including as much Hawaiian literature as possible that may be related to the work.

Papahulilani is lead by Kalei Nu‘uhiwa and Pualani Lincoln-Maielua. Kalei is a doctoral candidate at Waikato University in New Zealand and has been studying and teaching Papahulilani for 16 years.

Pualani LM has a Masters degree and is a lecturer with Hawai‘i Community College in Kona. She is also a navigator with Makali‘i, a double-hull canoe, and crew member with the return voyage of the Hōkūle‘a on its last leg from Tahiti to Hawai‘i. She has engaged in navigation for twelve years.

Papahulihonua is lead by Ku‘ulei Higashi Kanahele, a doctoral candidate at the University of Hawai‘i Hilo in Hawaiian Language. Ku‘ulei is a Hawaiian Language Instructor on tenure track. She is well versed in all Hawaiian literature from the mythology of Pele and Hi‘iaka which she translated from Hawaiian to English when she was nineteen years old. She has researched, collected and translated hundreds of chants that deal with the earth, fresh water, ocean water and the cycles of water from the earth to the atmosphere. She has been involved with developing Papahulihonua for the last twelve years. She is indeed a Papahulihonua.

Dr. Huihui Kanahele-Mossman is the lead with Papahānaumoku. Dr. Huihui Kanahele-Mossman was with the University of Hawai‘i as the Acting Director of Kīpuka Native Hawaiian program and has now been hired by Kohala Center as the Director of Education and Place. Dr. Huihui has been teaching Papahānaumoku for the last 10 years and she is also the Kumu Hula for Hālau o Kekuhi.

Mr. Kalāho‘ohie Mossman is the Executive Officer (EO) of the Edith Kanaka‘ole Foundation (EKF). He has earned a Master’s Degree in Heritage Management from the University of Hawai‘i at Hilo. As the EO of EKF, Kalā Mossman heads the revitalization of cultural places. Haleolono, a fishpond in Keaukaha, is one of his projects. The Hula Heiau of ‘Īmakakāloa in Ka‘ū is a project that he and Dr. Huihui are revitalizing to be used by Hālau today. The taro ponds at Hi‘ilawe in Waipi‘o Valley is another project of Kalā Mossman. Kalā carves in both wood and stone. He is also engaged in navigational training with the Makali‘i.

Ku i ke Kaʻai

Pahu Manamana o ʻUmi

Papahānaumoku

By Huihui Kanahele-Mossman Ph.D.
Papahānaumoku

Kalāhoʻohie Mossman M.A.
Carving and Mapping

Kialoa Mossman B.A.
Mapping

Introduction

This is the study, observation and analysis of all things that are born is Papahānaumoku (PHM). The area of study is identified by the word PHM:

- Papa – A sect, order, race, division, or foundation
- Hānau – to give birth, lay an egg as examples
- Moku- cut, severed, amputated, broken in two, district, island, forest grove, and the separation of child from mother as cutting the umbilical cord or separation of egg from the bird are examples

If defined by a literal English translation PHM is a sect or order of people, or a class of organization who studied or looked at items that were separated from their orginator and became their own independent fragment, or island. Examples of these subjects of study are humans, birds, grass, wasps, whales, shell fish, trees, and coral polyp, to name a few.

The study of the pahu manamana on Mauna Loa essentially belongs to PHM. Its shape and construction are affected by mankind directly. The need for such a structure derive from man's psyche and the justification for supporting structures exists firmly in the realm of PHM. The pahu manamana is a PHM structure. It is erected with PHH material and it will manifest the consciousness of PHL phenomena. All of this through the mind of the Native Hawaiian.

This report is a compilation of three reports that all reside in the space of PHM. The first component is an overall study of all aspects of PHM utilizing information from the PHL, PHH and the PHM reports to provide a comprehensive understanding of the PHM view. The second is a study of the stone carving of the Pahu Manamana o ʻUmi which illustrates the amount of labor and time required to build the pahu manamana as well as the pāpaʻi. The third is a mapping report of the site providing the context for our positional understanding of the area.

PHM inquiry will first discuss the plant life found in and around this environment. Next, all fauna will be listed as observed in the surrounding lava field of this site. Lastly, due to the length and depth of the topic, all human affected structures, artifacts and possibilities will be discussed. This section will be deliberated for justification of juxtaposition, location, utility, and sheer number of structures located around the main structure.

The carving study and trials provide information regarding the work involved with PMU site construction. Fifty-two pāpaʻi were counted at the surface surrounding "'Umi's cavern". This number would have been much greater prior to the lava flow in 1950 which likely covered several pāpaʻi. The process undertaken in this study involved studying and constructing pāpaʻi as well as constructing the pahu manamana consisting of seven to eight uprights on a paepae.

Mapping helps to draw a holistic picture of the site and how it is interlinked to the environment around it. Existing maps provided from the Hawaiʻi Volcanoes National Park and other sources have helped to better understand the use of this site built by the kanaka maoli (native Hawaiian). The maps also help tell their story through visual media. In this report, various maps will be

examined, and others created to tell the story of this pahu manamana on the slopes of Mauna Loa where the environment is harsh and the resources few.

Papahānaumoku

Flora and Fauna

At approximately 7,752 ft. elevation on the southwest flank of Mauna Loa, the vegetation reflects the environment's water accessibility. The site is located above Mauna Loa's rain and cloud forests and sits in a region known as the kuahea, a region below the mountaintop where small shrubs, such as kalamoho (Pellaea ternifolia) and ʻōhelo (Vaccinium reticulatum) (figure 14), grow. Also observed in that immediate area were pūkiawe (Styphelia tameiameiae) (figure 15) and ʻaʻaliʻi (Dodonaea viscosa) (figure 16). In the Hawaiian worldview, the mountains were divided into eight horizontal wao, or regions (from top to bottom, and in order of sacredness):

- piko (summit)
- kuamauna (mountaintop below summit)
- kuahea (area below kua mauna where vegetation is stunted)
- wao nahele (upper cloud forest)
- wao lipo (lower cloud forest)
- waoʻeiwa (upper rainforest)
- maʻukele (rainforest w/ koa & ʻōhiʻa canopy)
- wao akua (lower rainforest)

These montane wao are ma uka of the wao kanaka, where men lived and worked. Traditionally, the wao akua (and above) are pristine zones inhabited by the akua (elements) where elemental processes occur to ensure the health of the land. Typically, access to the montane wao were reserved for ritual and ceremonial purposes and strict protocol was followed to ensure the safety of kanaka and preservation of the wao.

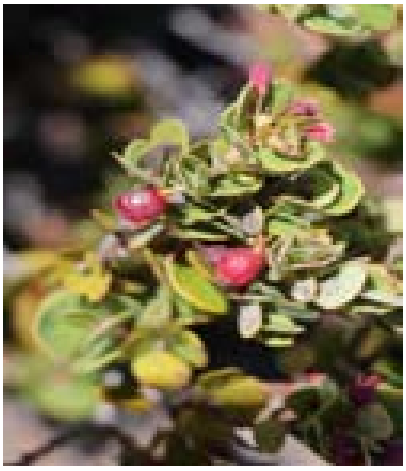

Figure 14: ʻŌhelo (Vaccinium reticulatum).

Figure 15: Pūkiawe (Styphelia tameiameiae).

Figure 16: ‘A‘ali‘i (Dodonaea viscosa).

The following animal, insect life (figures 17-20) was observed on the scheduled visits to the site.

Figure 17: *Kao kuahiwi (mountain goat).

Figure 18: ‘Ua‘u (Hawaiian Petrel).

*The mountain goat was not directly observed however evidence of their visitations such as goat excrement were seen.

Figure 19: Pulelehua (Vanessa tameiameiae).

Figure 20: Yellow jacket (?).

Ke Kanaka

‘Umialīloa was the chief of Hawai‘i Island approximately between 1550-1650 AD. He and his experts were noted to have built this site, PMU. This is not the only structure of this chief’s making however, it is the only structure on the slopes of the most southern and largest mountain range in the archipelago. ‘Umi and his experts were noted for constructing other structures of this type in different ahupua‘a of this island, most famous and immense of these structures is Ahu a ‘Umi at an elevation of 5200’ level on the saddle between Mauna Loa and Hualālai.
Is this PMU structure connected to Ahu a ‘Umi? Is it connected to any of the other manamana structure? If this feature anchors stars, which ones and what is the significance? Why was this location chosen? What is the purpose of this structure? These questions and more are the pivotal points in this research. PHM will provide information that will build a framework of inquiry aimed at answering these questions.

Pāpa‘i

Following the death of ‘Umi’s older brother Hākau, ‘Umi ascended to the highest rank as ali‘i nui, (ruling chief of Hawai‘i) and Pi‘ikeapi‘ilani, the highest-ranking female of the Maui royal lineage was chosen as ‘Umi’s mate. ‘Umi lived together with chiefs and commoners alike and selected three sets of forty people (120 people) for his court. Among these three sets of forty people were kahuna (experts in a profession), Kākā‘ōlelo (orators), Kuhikuhipu‘uone (architects), Kilokilo (stargazers), and Kūkini (runners). It was said that these 120 people had no other job except to sit and be ready for whenever ‘Umi needed to consult with them and/or send them (the Kūkini) to far places quickly. This background of ‘Umi’s explains his accessibility to a large number of people that make up his traveling entourage.

‘Umi’s association with common people were his best friends which he grew up with. He took them to court during his reacquaintance with Līloa. They became his lifetime warriors and friends. They were ‘Oma‘okamao and Pi‘imaiwa‘a. At ‘Umi’s death they buried him.
There are approximately 52 pāpa‘i. The map provides a general idea of the number of individuals who occupied the site. Each shelter could accommodate 1 to 3 persons and therefore the number of shelters would correlate with the number of individuals that occupied the site.

While some shelters would fit two to three individuals we will work with the minimum number of human visitors being 52 individuals even though it has been estimated that up to 300 individuals may have occupied the area. Fifty-two pāpa‘i were counted; 13 near the pahu manamana itself and 39 north of the pahu manamana as seen in figure 21. Figures 22 and 23 are examples of the different kinds of pāpa‘i constructed. Figure 22 displays a double jointed pāpa‘i which probably accommodated four people while figure 23 is a singular structure accommodated two people.

In her book “Hawaiian Mythology”, Martha Beckwith noted that 75 shelters were built:

> On the slope of the mountain ... before the lava flows of 1887 and 1907 covered them, the stone structures of ‘Umi’s camp. Seventy-five huts were counted, all facing away from the wind and built of three slabs of pahoehoe lava rock, two set together at an angle and a third forming the back, each hut large enough to hold two men. Larger huts, perhaps designed for chiefs, were supported by slabs within and built up outside with stone walls shaped into a dome.

The source of the rock used was studied and was determined to be of local origin. Possible sources included “‘Umi’s cavern” as well as from blistered pāhoehoe material and rock outcroppings at the surface. Simulation of the construction of the manamana and shelters were completed to determine the number of man hours required for the task.

Figure 22: Double pāpa‘i.

Figure 23: One large pāpa‘i.

The following statement in Ruling Chiefs of Hawai‘i by Samuel Kamakau hints to the size of ‘Umi‘s well known entourage. If this traveling configuration was a habit of the Chief then it would be to reason that the number of shelters, as well as the variety in sizes were needed in PMU observation and alignment missions.

> ‘Ī mai la ua mau wahi ‘elemākule nei iā ia, " ‘O nā kanaka no ou o Hāmākua nei, e lawe mai ana i ai nāu." (The old men stated, “Your people is of Hāmākua that you will be taking.”) Me kona mau kanaka ho‘okahi lau wa‘a, (“With their canoes 400 in number.”).

Pahu Manamana o ‘Umi

The pahu manamana currently consists of seven to eight manamana or uprights set on a three to five-foot-wide paepae, two feet high and nineteen feet long. The stones used for the platform are flat pōhaku generally mined from pāhoehoe blisters or from the nearby cavern. Large quantities of this material can be found in the collapsed portions of the cavern allowing the craftsmen to select and gather from the existing supplies. The rock was broken into a size one to two men could manage prior to moving them to the manamana site or constructing the paepae. According to the carving section of PHM, the manamana were clearly the largest of the rocks utilized with the largest weighing approximately 250 lbs. The pahu manamana as seen in figure 24 is comprised of eight pōhaku manamana firmly standing upon a paepae or short stacked wall. Eight is a common number for navigating and site placement in stories. Each pōhaku manamana has a very unique and distinct shape as well as a variety of heights and widths. The two pōhaku manamana in the center of the pahu manamana are set closer to each other than the outer pōhaku manamana.

Figure 24: Pahu Manamana illustrating proximity to one another.

Star Alignments

The manamana aligns to the most dominant Northern Pointers in our sky. Northern Pointers are essential combinations of stars and constellations that align directly with Kūmau (Polaris) or the

North Star. These stars are crucial in identifying Kūmau's location in the sky when cloud coverage, weather, or latitude prevents visibility of the polar star. The most relied upon and accurate Northern Pointers set upon these manamana or within this pahu manamana. The accuracy of sky position of stars was essential for the reflection on 'Umi's position as ruling chief.

Each pōhaku manamana located on the pahu manamana has been numbered from #1 to #8, south to north, for simple referencing purposes.

For the Kihikū**,** observations were easily made for the risings and settings of the entire sky. Visibility throughout the night of the Orion arm - MilkyWay and the Sagittarius arm - MilkyWay were clear. The wao kuahea location allows the viewing of the Milky Way. The Milky Way is the entire night sky.

Position and Alignments With Islands and Other Significant Geographical Features

Besides the mapping of the site and as part of the progression the PHMt extended the reach of the pānānā to the manamana and further out beyond the island of Hawai'i towards the north, northwest as suggested by the pahu manamana and this was the result. This was probably the intent of the original kanaka of this site. Figures 25 and 26 explain the mapping progression.

Manamana #1 appears to have fallen and has been re-erected recently, although it currently is at 292˙ magnetic, we believe that it originally was at 300˙ and aligned with the island of Papa'āpoho (Lisianski Island). Manamana #2 aligns with Kānemiloha'i (French Frigate Shoals), Kauo (Laysan) and Pihemanu. Manamana #3 aligns with Moku Manamana (Necker) and Ka'ula and manamana, #4 aligns with Nihoa and Ni'ihau. Manamana #5 aligns with Kaua'i and Manamana #6 aligns with Kaua'i and O'ahu. Manamana #7 aligns with O'ahu and manamana #8 with Moloka'i, Lāna'i and Kaho'olawe.

It is unclear what manamana #9 aligned with since it no longer sits in its original location, but it is possible that it is a west directional alignment allowing the observer to set the main cardinal points or it is possible that it aligned with Kalama (Johnston Atoll). The Papahulilani team (PHLt) found that the setting stars Konamaukuku aligned with manamana #4, Mirfak with #5 and Hikukahi #8.

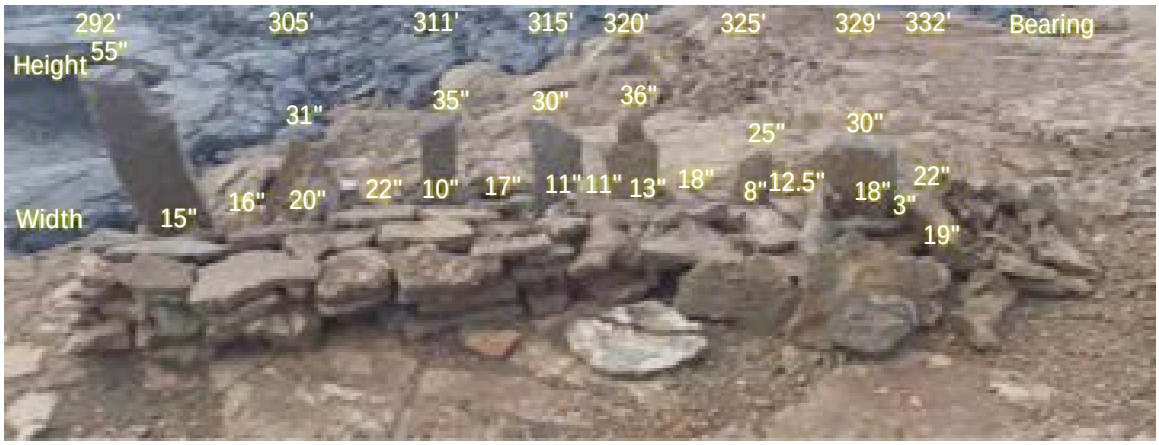

Figure 25: Photo used to run star setting simulations to the northwest. Shows manamana height with width at the base, width of space between manamana as well as compass bearing from pānānā.

Figure 26: Manamana and bearings from pānānā with corresponding island alignment.

Utilizing nautical chart 19007, these bearing were plotted from the GPS point of the pānānā on Mauna Loa. The results were that the manamana aligned with islands in the Hawaiian archipelago as illustrated by figure 26.

For the PHMt a visual of the greater area provides necessary perspective of the site and a topographical map, figure 27, construes the slope of the movement of the mountain in understanding the geographical structure of the area.

The following map (figure 28) is a plan view map of the PMU showing the relationship of the pānānā with the manamana. It seems probable that the manamana were spaced 5° apart similarly to those on Moku Manamana which would result in manamana at every 5° from 300° to 335°. The nautical chart revealed a new understanding of these sites.

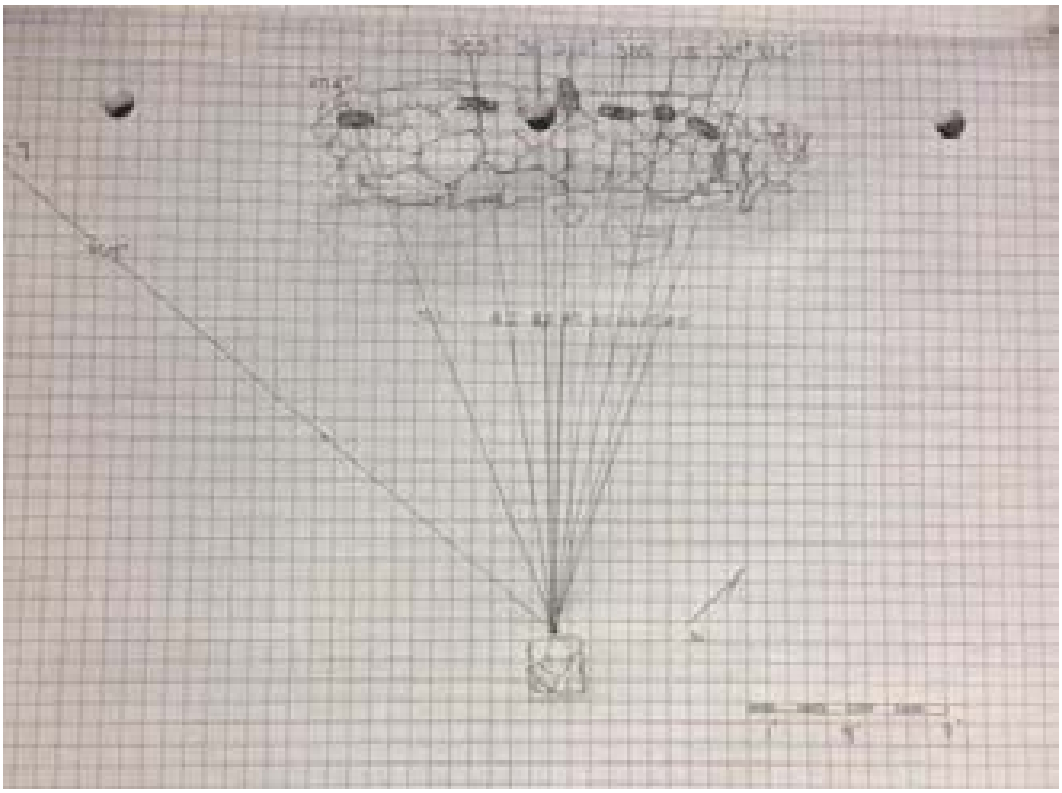

Figure 28: Maps – Situated positioning – Archipelago line of sight

All of this concentrated effort would not be a reality without intention. For modern-day existence, the true intention of the kūpuna (ancestors) in building these structures were for progeny to theorize and evaluate. With the information presented in this report one now has more evidence toward a positive outcome. Presently maps provide a possibility of understanding the purpose of these structures. A logical conclusion based upon these understandings of other like structures across the island could lead to exciting revelations.

In light of the background information provided in this report, the PHLt and the mapping team have extended their lines of alignment in figure 29 to encompass the entire archipelago, the first step in experimenting on theories after careful observation of their data. In the image below the lines extending from the site to the closest 8 islands are perhaps more likely wahi pana and kūpuna designed sites.

Figure 30 provides a closer look at the manamana extension from figure 29. The purple line of figure 30 moves through Kahoʻolawe and Molokaʻi. Kahoʻolawe perspective: the line touches Lae Kuikui, the northwest point of the island; also touches on Kapalikapuokamohoaliʻi, a crater in the ocean off of the cliff with the same name; also touches on Halona, the southeast point of the island. Molokaʻi perspective: the line crosses to Kaleamau, the crater at Kalaupapa. Therefore, this provides substantial locations from the extended manamana.

Due to the fact that the pānānā is located on the east side of the structure the Kilolani, Kilohōkū will be observing the western sky. More than likely, the stars, according to PHLt, setting on the

structure are northern rising. Our southern placement in the archipelago, and the very southern placement of this PMU also infers that the observation and data recordation is meant for everything that is northwest of Hawaii Island, thus making this extension of compass points theory a logical one.

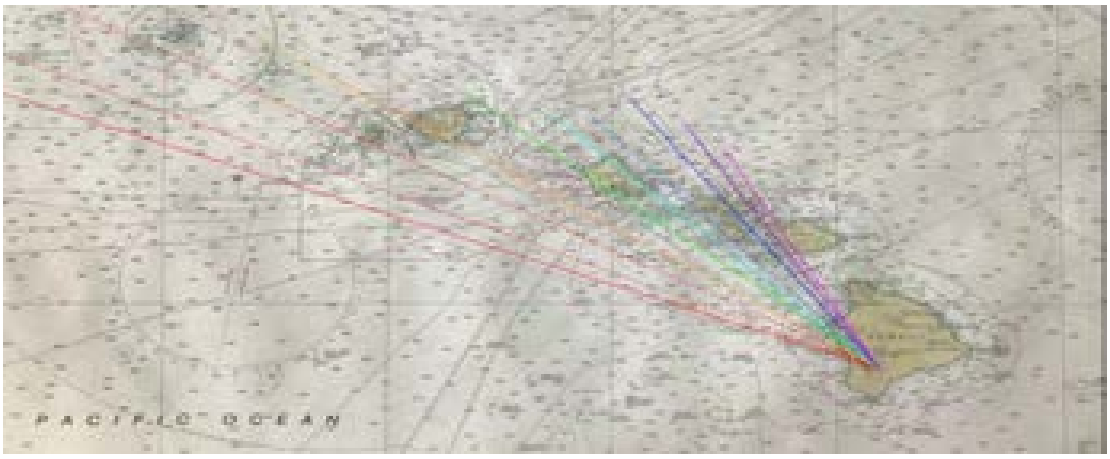

Figure 29: Extension of compass points taken from pānānā to individual manamana.

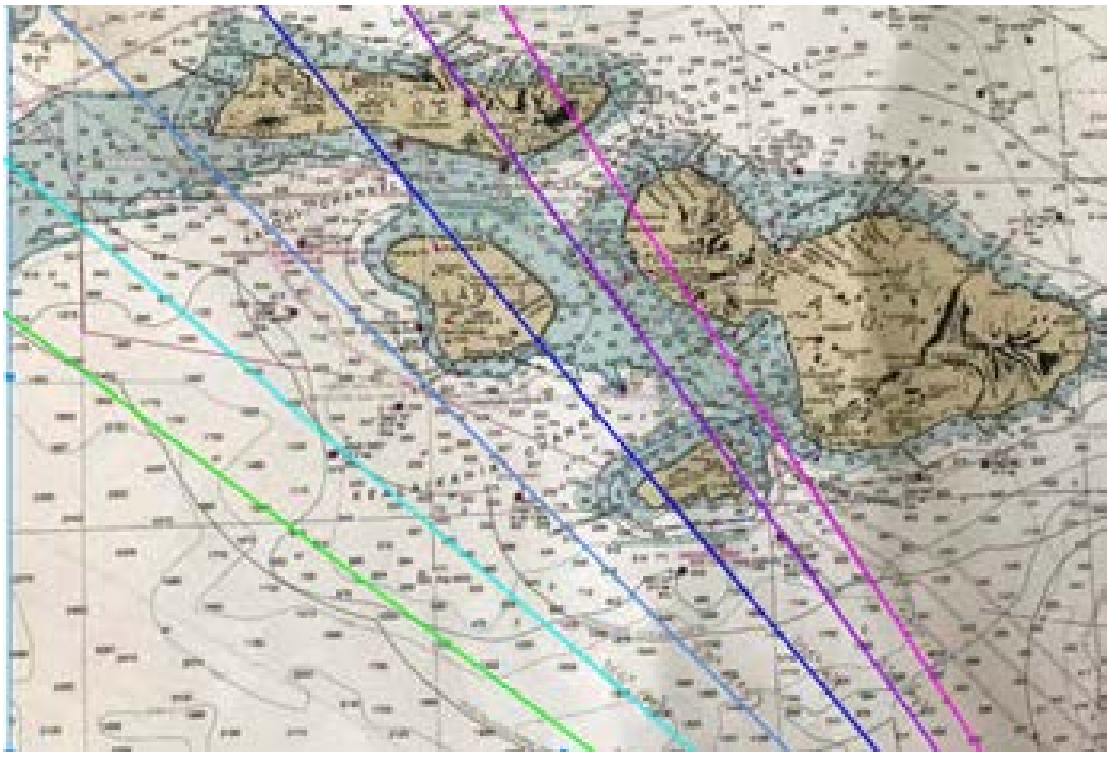

Figure 30: Extension of compass points taken from pānānā to individual manamana.

Outcomes and Results

This report combines the data, research and conclusions of all of the three Papakū Makawalu teams and the mapping team as this one man made structure is an acculturation of the natural

world, or a tool to organize and predict natural phenomenon for the purpose of social and intellectual progress. Therefore, the other two papa are incorporated in this report and tells the story of ‘Umi’s method of political advancement.

There are several theories for the purpose of this man-made structure, the location, and the other structures that surround the PMU. These theories also consider PMU’s connection to the chief and its utility in ‘Umi’s reign and perhaps beyond. This mele gives vocabulary and direction to several conclusions that can be made.

E Kū, Uli, e Kama, lele wale	To Kū, Uli, and Kama, lele
O Kalani ke ‘lii ka‘ahea o Ka‘iwa or Kūka‘iwa	The alii in the time of Ka‘iwa
Iwikauikaua haulili mai lalo	Rising of Iwikauikaua
Mai kumu kahiki ka honua ua kele	From Kahiki
Ua nao ua pēlā i ke kapu ali‘i	Ridge up at bind the kapu ali‘i
I ka pēlā ali‘i kapu o Kukonala‘a	The gathering up of the kapu of Kukonala‘a (Pegasus)
Ua kau ke kapu i Makali‘i	The kapu is put upon Makali‘i
Akahi a aha; lele wale	The first ‘aha, lele wale
Lele mai ke kapu o ka moku	Bring upward the kapu of the island (separation)
Lālani ke kapu o ka moku	Align the kapu of the island
Kui mai ke kapu o ka moku	Connect the kapu of the island
Pi‘i mai ke kapu o ka moku	Climb the kapu of the moku
Ili aku, kau aku ke kapu o ka moku	Revealed, the moku kapu is placed
Na Pili e noho ia kapu	Pili brought forth this kapu
Ka moku i Hawai‘ikuauli	Hawai‘ikuauli
Alua a ‘aha, lele wale	The 2nd ‘aha lele
Lele aku ke kapu iā Wākea	The kapu is sent up to Wākea
Ua kapu ka moku iā Līloa	The moku forbade Līloa
Ua kapu kawao i Tahiti	The dwelling of Tahiti is forbidden
Līloa o ‘Umi ke kapu i nahae	‘Umi broke the kapu
Nahae nā mana o ke kapu	Broke the essence of the kapu
O Iwiaulana Iwikauikaua	Iwiaulana, Iwikauikaua
Lola kamahele kikiwi	Reaches and bends far reaching
I pipi‘o i ke kapu o Iwikauikaua	That arches the kapu of Iwikauikaua
Na ka iwi a pani ke kapu o ka moku	The iwi will close the kapu of the moku

Iwikauikaua ke kalohe	Iwikauikaua the mischievous one
Ka hoʻolololohe wai i haunaka	Attentive to the water that shakes the earth

Theory one: As the ruling chief, ʻUmi can dictate the establishment and implementation of several very crucial points of society, and one of those points is the calendar. As a warrior chief who has studied, warfare, farmed, fished and surfed this land while in exile during his brother's reign ʻUmi was an expert at landscape observation thereby capable of making fair decisions for these practices. The conclusion is based on the fact that the timing for a ceremony and war could only be approved of if they were initiated at the right time of the year. Therefore, the first theory is the setting of the calendar. If a ruling body can determine the calendar system, then they can control the movement and organization of society.

According to PHLt (translated "E Kū, Uli, E Kama lele wale") the honored chief is proclaimed by Kaʻiwa at the rising of Iwikauikaua (Cassiopeia).

In December of 2017, the PHLt recorded that Iwikauikaua is very visible and brilliant constellation hovering above the center of the pahu manamana at midnight. The constellation set on #4 and #5 manamana. Iwikauikaua is a dominant and accurate northern pointer.

The chant also mentioned Kukonalaʻa (Pegasus) in the fifth line. According to PHLt the southern stars in Kukonalaʻa and Humu or Delphinus set directly on Pilina. Iwikauikaua is visible above the horizon (haulili mai lalo). As the constellation Kukonalaʻa begins its decent, from the pānānā, one can observe its placement on the outcropping on the Pilina.

In the last verse of this mele, ʻUmi breaks the kapu, or rather takes the mana off of the kapu that was established then resets Iwikauikaua star frame. The line states "Lele aku ke kapu o Wākea, ke kapu ka moku o Līloa, ke kapu ka wao i Tahiti, Līloa o ʻUmi ke kapu i nahae, Nahae ka mana o ke kapu, o Iwiaulana, Iwikauikaua, lola kamahele kikiwi." (Wākea's kapu is released, the Kapu of Līloa's portion, the kapu of Tahiti's realm, ʻUmi severs the mana from the kapu, the time that was passed down is re-established with Iwikauikaua. The kapu that was a part of Wākea has ended. ʻUmi and Līloa will change the order of time.) The evidence laid out in the mele is sequenced in a manner that first sets up the kapu of the calendar and then internally breaks the mandate of the systemtic calendar.

Theory two: In the mele "Kihanuilūlūmoku", likewise evident in the aforementioned mele "E Kū, Uli, E Kama Lele Wale", the structure is sequenced by generations.

Epoch 1 is from ʻOpuʻukahonua to Kukonalaʻa
Epoch 2 is from Pili to Kahiko
Epoch 3 is from Wākea to Waiā
Epoch 4 is from Waiā to Līloa
Epoch 5 is from Līloa to Kamehameha
In the mele "Kihanuilūlūmoku", the style of sequencing is written as a genealogy. The first name mentioned in the genealogy would be Kihanuilūlūmoku and the last was Kalaniahiʻenaʻena. Beyond the surface structure of the mele the repetitiveness of the word ʻAha (connection to) delineates the aliʻi family that belongs to the land. The PHH report states

“Modern lava flows split ma uka of the pahu manamana site, creating a kīpuka and preserving most of the site (see figures below)” leads one to conclude that the insightful kuhikuhipu‘uone of the Pahu Manamana o ‘Umi were very thoughtful of their placement, constructing them in areas that will remain unchanged for a very long time. This fact is crucial in securing a generational ‘Aha of one’s lineage to a site.

Further evidence to the supposition of this genealogical theory lies in the reports published by Kalā and Kialoa Mossman, and the PHLt of Kalei Nu‘uhiwa and Pualani Lincoln Maielua. Both reports agree to the intentional placement of Pahu Manamana o ‘Umi. The evidentiary measurements of the individual manamana in Mossman’s report states that the separation of the stones were precisely five degrees apart. The PHLt records the accurate placement of the pānānā as a point of observation of all the main structures and the natural outcroppings of the surrounding landscape. Precision is witnessed by both the PHMt and the PHLt.

These observations affirm the genealogical ‘Aha theory. The lines drawn by both teams on the maps are in fact ‘Aha. These ‘Aha exist due to the precise placement of the pahu manamana. The lines as theorized by the two reports were accurately extended out to encompass the Hawaiian Archipelago. This one pahu manamana site secures the evidence of mokupuni, wahi pana and genealogical existences throughout the Hawaiian Archipelago.

Stone Carving and Construction of Pahu Manamana o ʻUmi

Figure 31: View of the pahu manamana from pānānā.

Methodology

The number of pāpaʻi were utilized to formulate the minimum number of individuals who may have been at the site during the time of its construction and/or occupation. While it is believed that the number could be much greater, the physical evidence allows only to count that which has survived historic lava events. Based on maps generated by Hawaiʻi Volcanoes National Park and archaeological surveys of the area, we believe that there are 52 pāpaʻi still existing. While some pāpaʻi would fit two to three individuals we will work with the minimum number of human visitors being 52 individuals even though it has been estimated that up to 300 individuals were present on site.

The source of the rock was studied and was determined to be of local origin. Possible sources included "ʻUmi's cavern" as well as from blistered pāhoehoe material and rock outcroppings at the surface. Simulation of the construction of the pahu manamana and pāpaʻi were completed to determine the number of man hours required for the task. Simulation was done off site in the Kaʻū district in the ahupuaʻa of Kaʻalāiki and Waiʻōhinu. The construction method used was that of uhauhumu pōhaku or dry stack construction and upright shaping was done by kuʻi pōhaku, percussion chipping of the stone and hamo, stone rubbing.

Findings

The pahu manamana currently consists of seven to nine manamana set on a three to five-foot-wide paepae or platform two feet high and 19 feet long (figure 31). The stones used for the platform are flat pōhaku generally mined from pāhoehoe blisters or from the nearby cavern. Large quantities of this material can be found in the collapsed portions of the cavern allowing the craftsmen to select and gather from the existing supplies. The rock was broken into a size one to two men could manage prior to moving them to the manamana site or constructing the platform. The manamana were clearly the largest of the rock utilized on the paepae with the largest weighing approximately 250 lbs.

Figure 32:Top surface of manamana #9, Wākea, showing slightly smoothed area at corner.

Figure 33: Mined blister site converted into pāpa‘i.

The manamana are irregular in shape but are naturally flat on both the interior and posterior sides. While most of the manamana do not appear to have been shaped there appears to be some evidence that the sides and tops of a few uprights may have been shaped to a flat surface rather than just gathered and put in place. In figure 32, the stone carver demonstrates the hamo technique of smoothing pāhoehoe slabs with harder basalt or ‘alā stone. This manamana shows definite wear to the top surface. No actual rubbing was initiated by the carver.

Figure 33 shows a mined pāhoehoe blister site that doubles as a pāpa‘i. This site is less than 100 feet from the PMU site and may have been a source for manamana stone. Figure 34a is a close-up of the top of one manamana showing a cut notch and slight smoothing of the surface. Figure 34b shows three pecked cirucular indentions in the posterior face of the manamana refered to as Wākea. While the physical evidence suggests that the PMU was built rather quickly, it does appear additional time was spent shaping some of the manamana.

Figure 34 a & b: Manamana #9, Wākea showing worked surface and three pecked holes on posterior.

Tools

Cutting and shaping the manamana would have been the most time-consuming effort of the pahu manamana construction. Care would have been taken to mine the stone utilizing the existing linear cracks in the pāhoehoe resulting in slabs with relatively straight edges. Based on my experience working with stone, it takes anywhere from one to four hours to shape a manamana by chipping of pieces of the slab and smoothing it with other rocks. The rocks on site could have been used as shaping tools, or denser rocks could have been brought for the task.

Figure 35: Examples of tools used for shaping manamana.

One such stone was noted at the site, a dense basalt stone of the ʻalā type the size of a golf ball with some wear to one side. This stone would have been used as a hamo stone or rubbing stone used to smooth the edge of the manamana. No hammer stones were observed at the site suggesting that local material was used for this task or they were taken with them when they left. figure 35 shows samples of stones used for stone carving. These stones were not recovered from the site. Positioning the manamana in the appropriate location on the paepae would have also required some time to assure proper alignment. This task would have been completed by the Kuhikuhipuʻuone and the Kilohōkū. These individuals were very skilled in their practice and knowledgeable of their surrounding environment. Their role would be key in not only the positioning of the manamana but also the orientation of the paepae and building the structure. Great care would have been taken to assure proper alignments were achieved establishing the connections and outcomes the chief aspired to achieve.

Stacking Platforms and Setting Manamana

The stacking of the platform and setting of the manamana were done in a simple slab on slab technique and would have not taken long to construct. It's estimated that the pahu manamana was constructed of 150 slabs stacked upon each other. Little effort was made to interlock the rocks and create smooth faced surfaces suggesting the manamana was made in haste. Based on efforts made to simulate the construction of the structure, moving at a slow pace and working alone, it took 6.5 man-hours to complete the structure. Most of the time was spent hauling material from the supply caches to the site 72 feet away. If there were 52 individuals on site a human chain could pass the needed material much more efficiently. I estimate that a crew of 52 would have the pahu manamana completed in less than one hour with additional time allocated for mining of material and shaping of manamana, an estimate of three to four hours would be adequate.

Figure 36: Mine site 72 feet from the shrine.

Pāpa‘i

The pāpa‘i and shelters were very diverse, some were much more elaborate than others indicating that they took longer to construct (figures 37 and 38). The time it took to build a one- to two-person enclosure of stacked stone depended on the complexity of the structure but would generally take one to three hours to build with the needed rock supply in the immediate area. These are very simple structures meant to protect one from the cold. If mining was required, an additional one to three man hours would have been needed. Figure 36 shows a typical mining site.

Figure 37: Multiple pāpa‘i.

Figure 38: Simple pāpa‘i.

Mapping Pahu Manamana o ‘Umi

Methodology

Due to limited time on the mountain and a large amount of data collection required during each visit, mapping included National Park Service maps, archaeology maps as well as GIS maps generated using GPS coordinate data collected on site. A general tape and compass map was also generated of the pahu manamana site with supporting photos and GPS coordinates. The primary goal of the maps and photos created for this project are to create a working copy of the site so that we can simulate star alignments off site. Each map generated has been included in this report with brief explanations of how they are used and what they mean. GPS data collected by the EKF team were collected utilizing a Garmin Terex 20x device and compass bearings using a Cammenga model 27 military compass. The majority of the data was collected on December, 2016, July, 2018 and September, 2018.

Map Descriptions and Findings

After compiling and constructing the maps in this report, a clearer understanding of the area is revealed. This point is taken on what is referred to as manamana #1. There are seven to eight manamana on the paepae or platform making up the pahu manamana with a ninth manamana to the southwest. We begin with an aerial map of the project area provided by Hawai‘i Volcanoes National Park.

Figure 39: Project area map provided by Hawai‘i Volcanoes National Park. Map provided by Google Earth.

Figure 39 shows multiple skylights of "'Umi's Cavern" and multiple pāpa'i with the pahu manamana located at the western edge of the old flow. The pahu manamana is the linear feature just southeast of the circular depression in the new flow. Many of the pāpa'i associated with the pahu manamana site can be seen in this Google Earth map. 52 pāpa'i were counted with more believed to have been covered in recent lava flows. Clearly this flow has changed the landscape of the area since the time of 'Umi. Utilizing GPS coordinates and GIS technology, we can still get an idea of what the view plane may have been like. Core samples of the flow to the northwest of the site could determine exactly what the geological landscape looked like prior to more recent lava flows; however, this was not part of this study.

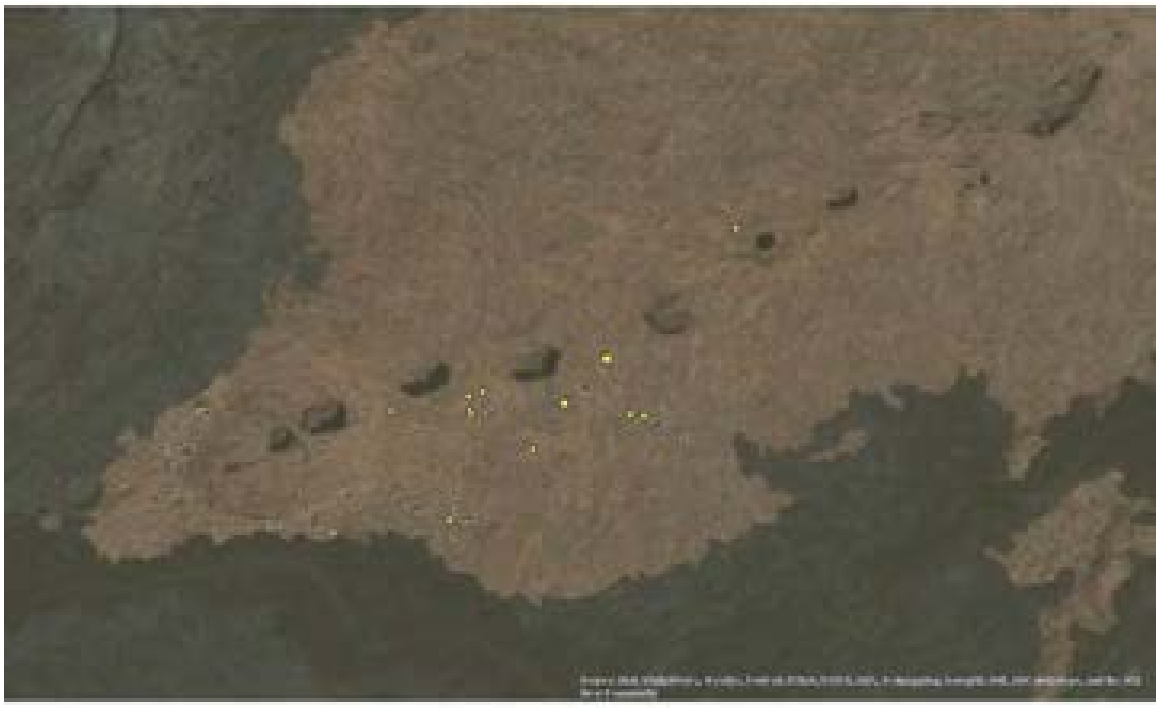

Figure 40: Map of GPS coordinates of archaeological sites and features generated by Hawai'i Volcanoes National Park.

Figure 40 provides a general idea of the number of individuals who occupied the site. The shelters could accommadate one to three persons and therefore the number of shelters would correlate with the number of individuals that occupied the site.

A series of photos and measurements were taken on the pahu manamana site to help better understand its use. An aeirial photo shows the location of the pahu manaana as well as the landscape to the northwest which appears to be the general orienation of the site (figures 41 and 42). An Osmo rotating camera was set up at the pānānā GPS coordinate along the front (NW) edge. The camera was set up at the height of three feet simulating a six foot individual in a sitting position. Bearings utilizing a Cammenga model 27 military compass were taken from the pānānā to each manamana along with height of manamana from the ground (figures 43-48). A measurement was also taken on the possible original location of manamana #9 or Wākea, presently located in a depression just southwest of the pahu manamana (figures 47 and 48).

While this manamana currently stands erect it is possible that it had fallen from its original location and re-erected where it fell at a historic date after 1950. This obervation is based on the physical evidence at the base of the manamana.

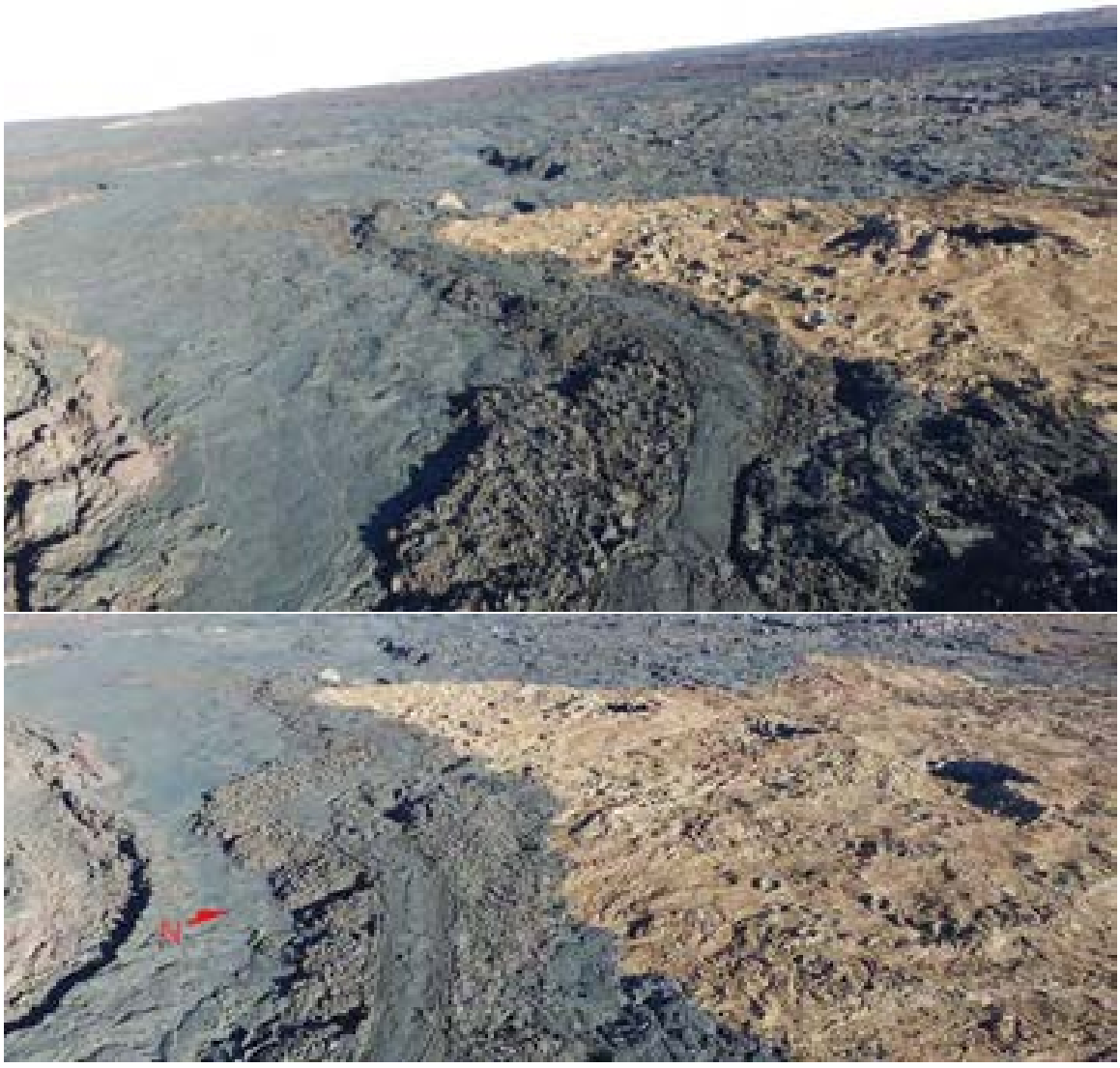

Figure 41: In these photos, the project area is viewed from more of a southeastern perspective looking northwest. These photos provide a perspective of the landscape to the northwest which appears to be the orientation of the pahu manamana.

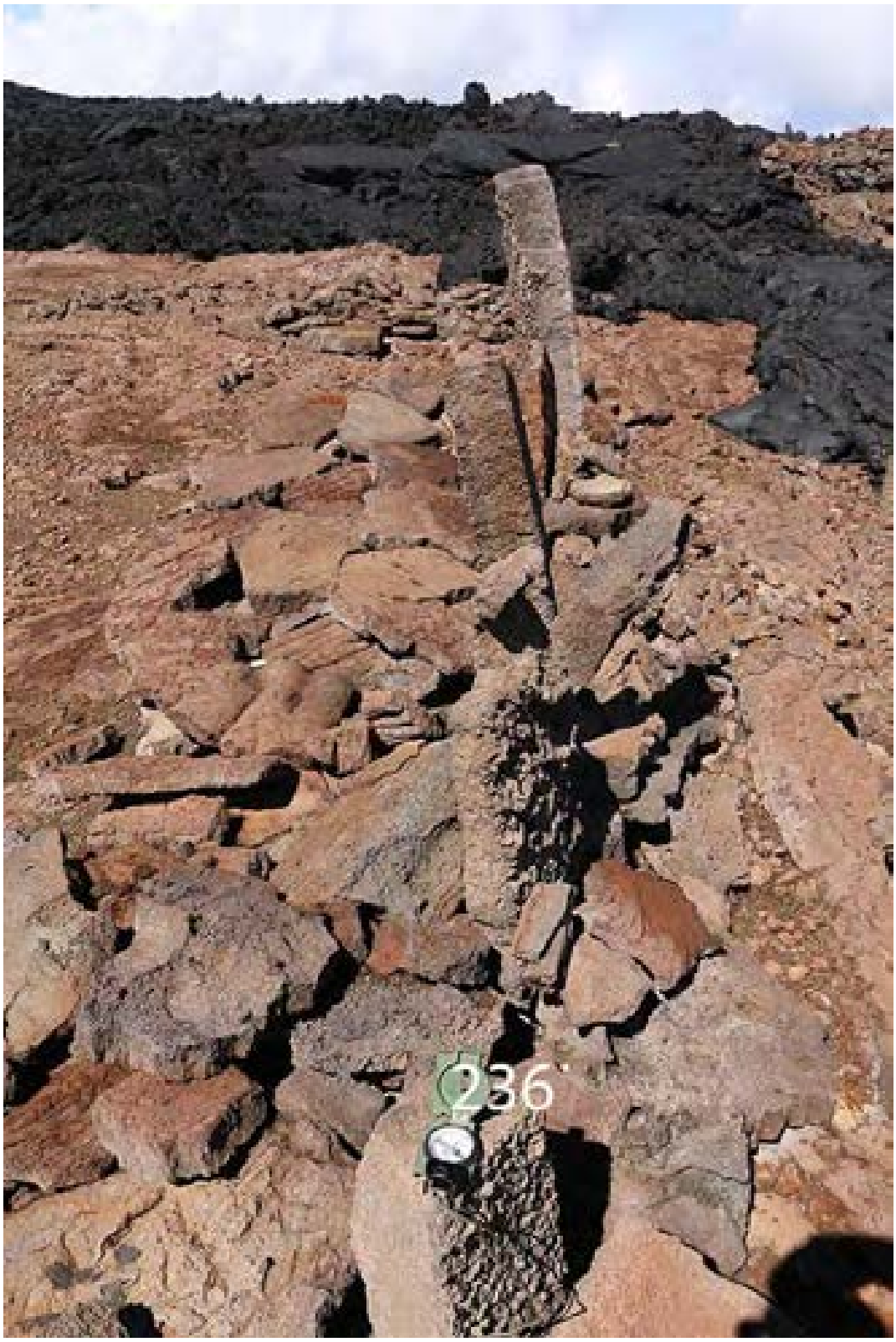

Figure 42: Pahu manamana showing alignment of manamana and bearing.

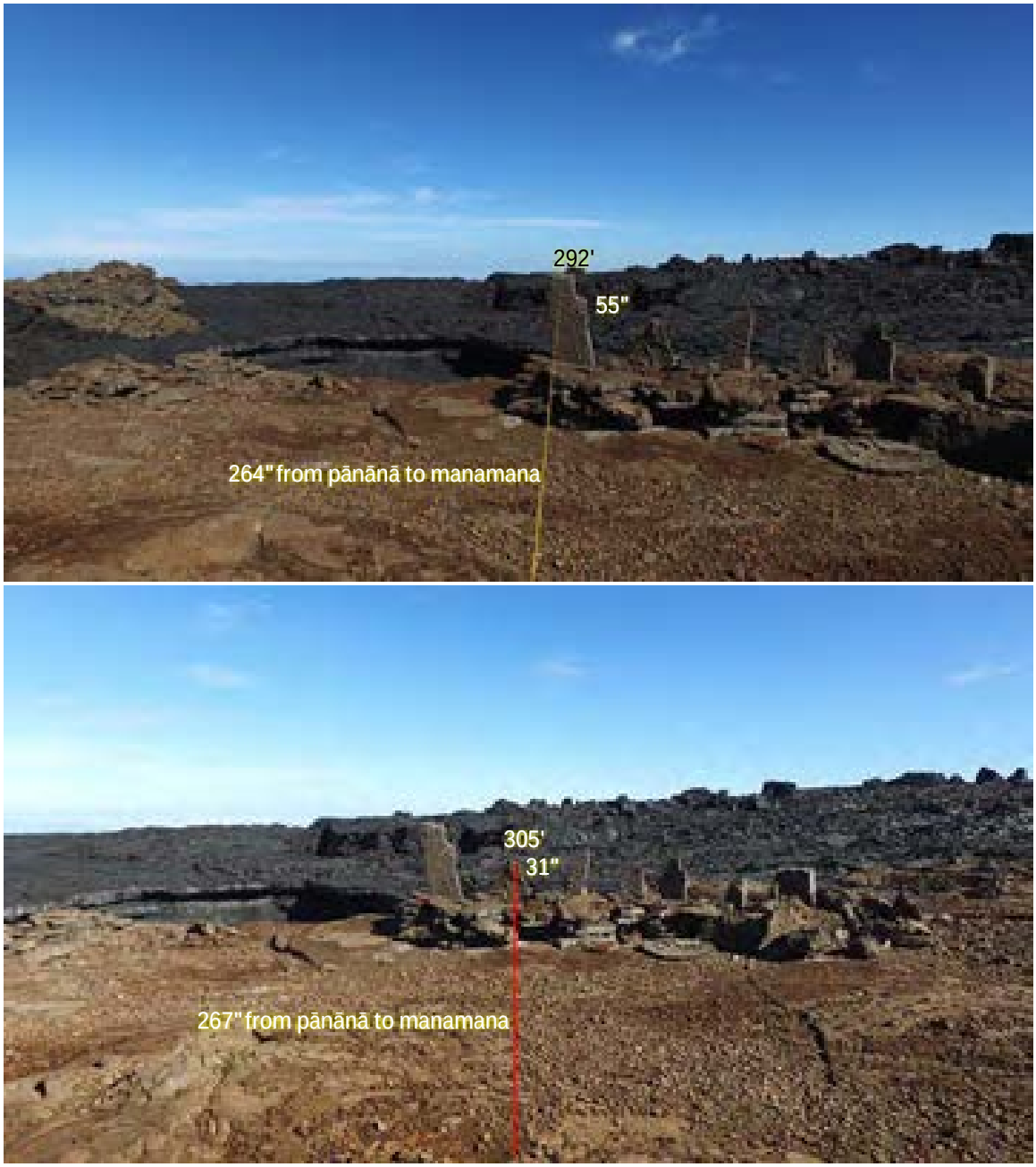

Figure 43: Manamana #1 and #2 showing height and bearing from pānānā.

Figure 44: Manamana #3 and #4.

Figure 45: Manamana #5 and #6.

Figure 46: Manamana #7 and #8.

Figure 47: Possible original location of manamana #9, Wākea. The tripod simulates height of manamana.

Figure 48: Photo of existing manamana #9, Wākea and relationship to #1, pānānā and original location.

GPS points of all major components of the site were collected including, each individual manamana, pāpa‘i and other sites and features of interest. The points were plotted using Arch GIS programing to create a series of maps illustrating the location of the points collected. The GPS data has a 3 meter range of error, however it provides an exellent baseline location of points collected in relationship to the lay of the land. This data can then be analylized and compared to other existing sites and land features first on the island of Hawai‘i and then to other islands, cardinal points determined by the stars and planets. Figures 49 thru 53 illustrate the location of the data points on the island of Hawai‘i and the topography of the surrounding area. The sequence of maps begin with the entire island and gradually zoom-in to the site.

During the analysis of the GPS data it was determined that one could draw a line from the northern most point of the island to the southern most point and our data points would lie on that line (figure 54). The meaning of this is unknown. Perhaps it is intentional and this location aided in helping ‘Umi to esablish his ‘aha by connecting to these to prominant points. ‘Umi was attributed to the building of many similar sites, but none were more prominant than Ahu a ‘Umi located in the Kona district surrounded by Hualali, Maunaloa and Maunakea. This site resembles a heiau site rather than a pahu manamana, however it is made up of one central structure with several ahu surrounding it. These ahu seemed to align with the surrounding mountaintops as well as the cardinal points and Waipi‘o valley, ‘Umi‘s home. The idea of creating these connections to prominant land features as well as the stars which gives us our directions seems to be important to ‘Umi and his kāhuna in contructing these sites. It is also interesting that Ahu a ‘Umi also lies on the same line drawn from the northern point to the southern point of the island of Hawai‘i (figures 54 and 55).

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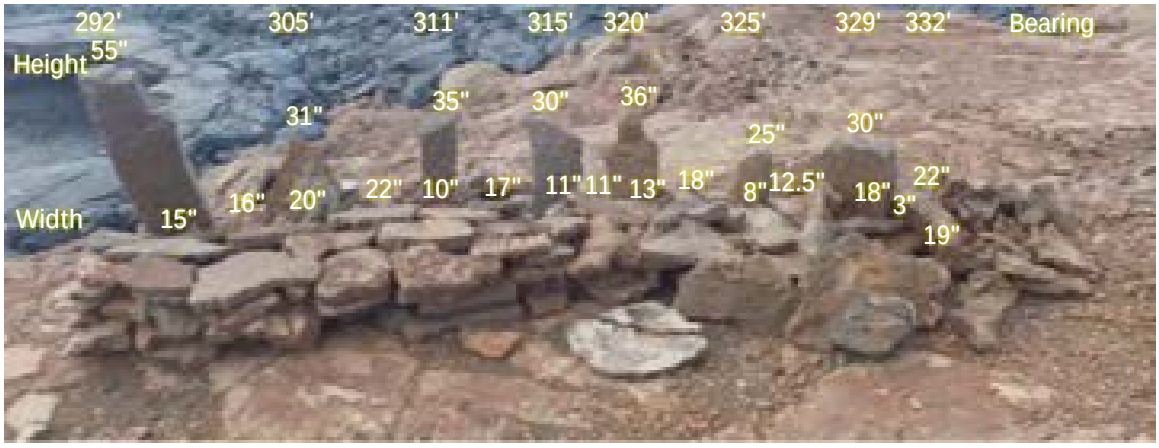

Figure 56: Photo used to run star setting simulations to the northwest. Shows manamana height and width at the base and width of space between manamana as well as compass bearing from pānānā.

Figure 57: Photo of manamana and bearings from pānānā with corresponding island alignment.

Further analysis utilizing nautical chart 19007 were conducted and bearings were plotted from the GPS point of the pānānā on Mauna Loa. The results were that the manamana aligned with islands in the Hawaiian Archipelago as illustrated in figures 56 thru 60. The PHLt has observed star setting on the manamana and they have found interesting alignments as well and continue to run simulations of different time periods throughout the year. The following map is a plan view map of the pahu manamana showing the relationship of the pānānā with the manamana. It seems probable that the manamana were spaced 5˙ apart similarly to those on Moku Manamana which would result in manamana at every 5˙ from 300˙ to 335˙. The nautical chart provided a new understanding of these sites. It is interesting that ‘Umi would honor these connections.

Results

Manamana #1 appears to have fallen and has been re-erected in recent times based on historic photo documentation, although it currently is at 292˙ magnetic, we believe that it originally was at 300˙ and aligned with the island of Papa’āpoho (Lisianski Island). Manamana #2 aligns with Kānemiloha‘i (French Frigate Shoals), Kauō (Laysan), Kamokuokamohoali’i (La Perouse Pinnacle), Ko‘anāko‘a (Maro reef) and Pihemanu (Midway). Manamana #3 aligns with Moku Manamana (Necker) and Ka‘ula. Manamana #4 aligns with Nihoa and Ni‘ihau. Manamana #5 aligns with Kaua‘i. Manamana #6 aligns with Kaua‘i and O‘ahu. Manamana #7 aligns with O‘ahu. Manamana #8 with Moloka‘i, Lāna‘i and Kaho‘olawe. It is unclear what Manamana #9, Wākea aligned with since it no longer sits in its original location, but it is possible that it is a west directional alignment allowing the observer to set the main cardinal points or it may be possible that it aligned with Kalama (Johnston Atoll).

The last visit to the site revealed a possible 10th manamana next to manamana 8 which would align with Maui, Kaho‘olawe and Moloka‘i. It is a small manamana which had fallen over set at bearing 340° and it is included in figure 60. The PHLt found that the setting stars Konamaukuku and Mirfak aligned with this manamana. The alignments give us clues as to the connections they were making. Kilohōkū, those who studied the stars, would understand which stars align with each island allowing for successful interisland travel. The maps help to understand the alignments as well as aid in continued study of the site, its use, and the people who occupied it.

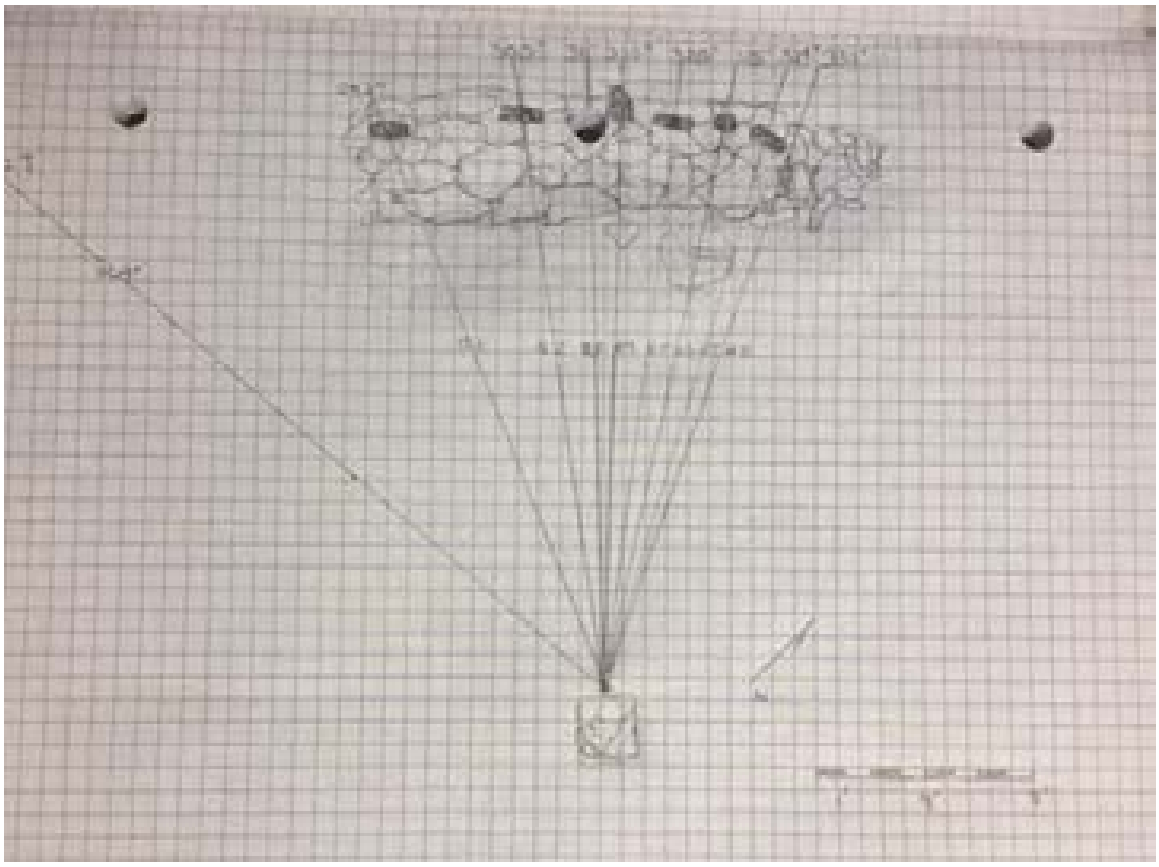

Figure 58: Plan view map of pahu manamana in relation to the pānānā and manamana #9.

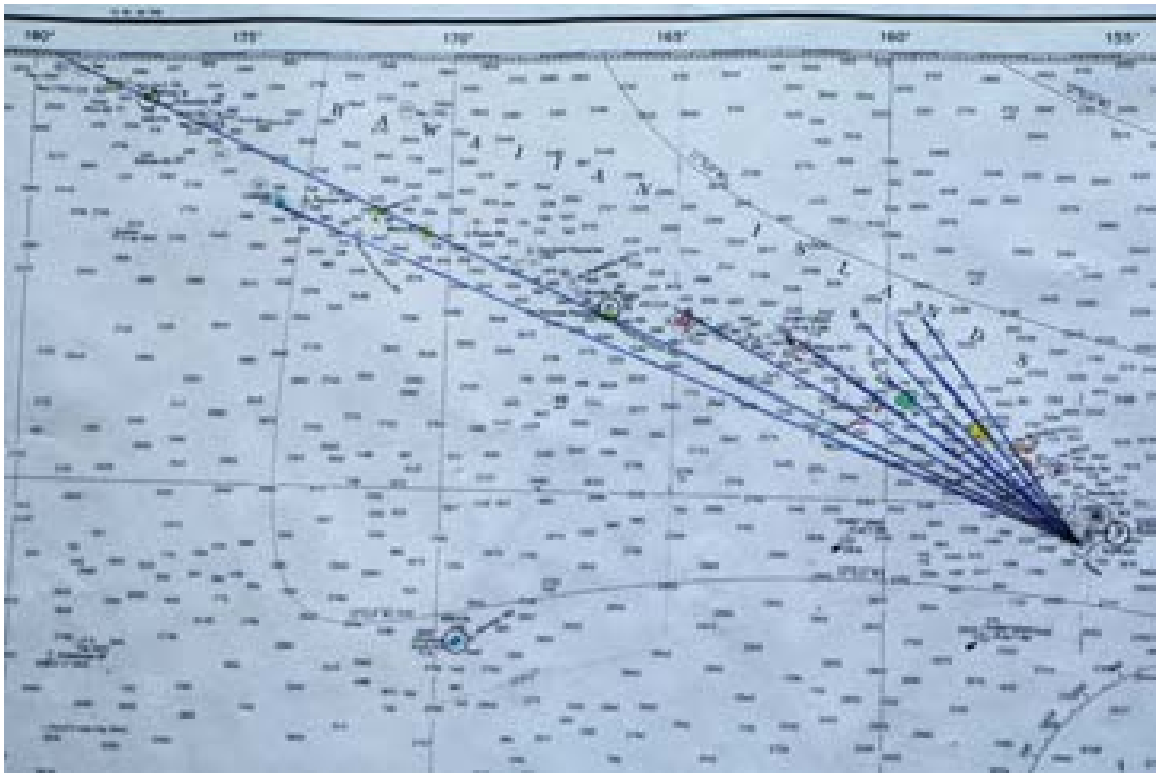

Figure 59: Map of the pae‘āina (archipelago) and its relation to the site.

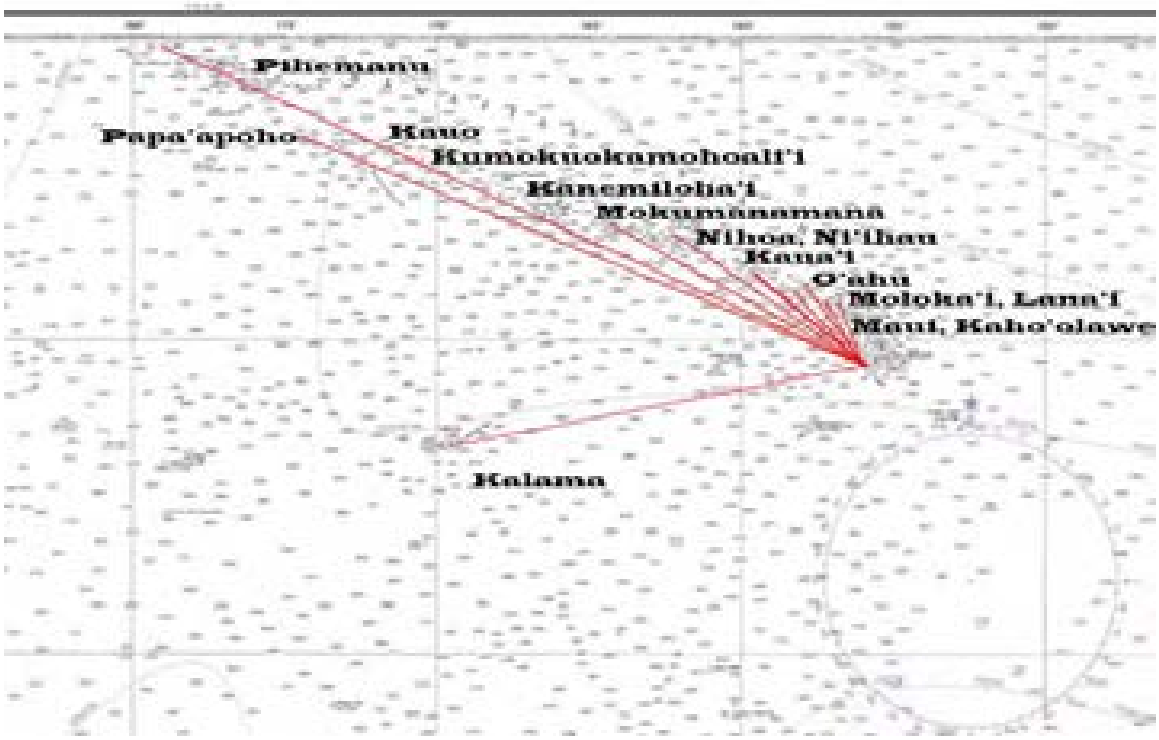

Figure 60: Nautical chart of alignments from PMU to outer islands including Wākea and newly discovered manamana 10 aligning with Maui, Kaho‘olawe and Moloka‘i.

Papahānaumoku Team Summary

This PHM report is a compilation of the mapping, PHH, and PHL documents. This narrative acknowledges excerpts of ʻUmi's history as it pertains to the building of this pahu manamana site. The PHM condition of the plant life and animal life of the surrounding area is also addressed. According to PHH, the elevation and landscape dictates the plant and animal life.

The carving skill and intelligence of the kanaka maoli kahiko (Native Hawaiʻi of old) were incredible. While the exact reason for the placement of the pahu manamana is not clearly known, the continued study of the site and others like it on Moku Manamana, Mauna Kea and Haleakalā will reveal more possibilities. Based on the physical evidence it does not seem that this site was occupied for an extended period but may have been visited during times designated as important to the kāhuna and aliʻi. With the manpower, available, the site could have been constructed in a single day and properly aligned during the following evenings. Temperatures during the evening are very cold, limiting the time spent at the site for ceremony. The fact that the kanaka would endure this harsh environment is a testament to their strength, stamina and spiritual beliefs.

Mapping in conjunction with PHL conveys the impressive placement and architecture of this site. Lastly, in the tradition of the intellect of PHM, this narrative intercalates theory of justification of this PMU. The first theory finds basis in the mele "E Kū, Uli, E Kama Lele Wale" supported by evidence presented in PHL. The theory states that the purpose of this structure is to establish a system of time and seasons. The second theory infuses research from all three teams through the lens of mele including the Kihanuilūlūmoku input. The theory is based on genealogical security of aliʻi lines. The ʻAha confirmed in the mele are physically represented in the alignment of the manamana to the setting stars and the encompassing alignment of the wahi pana and islands in the entire pae ʻāina (archipelago).

PHMt supports, agrees and concludes with the last lines of each pauku in Kihanuilūlūmoku.

E kū ai i ka nuʻupaʻa, i ka pokipaʻa,
Paʻa ai o ʻUmi a kū i ke kaʻai!

It elevates, it unifies,
Solidified by ʻUmi and anchored by the bones of our kūpuna!

Pōhaku ʻAumakua

Pahu Manamana o ʻUmi

Papahulihonua

By Kuʻulei Higashi Kanahele, PhD Candidate

Introduction

PHH is a study of the island earth we live on. In modern terminology, PHH experts are knowledgeable in such fields as volcanology, geology, hydrology, petrology, and oceanography, to name a few. Exploring PHH may give modern kanaka an insight as to why ʻUmi chose to build the pahu manamana in such an isolated location.

Wao

The pahu manamana site is located in the ahupuaʻa of Kahuku, 7,752 feet above sea level on Mauna Loa (13,679 ft elevation).

The site is located above Mauna Loa's rainforests and cloud forests and sits in a region known as the kuahea, a region below the mountaintop where small shrubs, such as kalamoho (*Pellaea ternifolia)* and ʻōhelo *(Vaccinium reticulatum),* grow. In the Hawaiian worldview, the mountains were divided into eight horizontal wao, or regions (from top to bottom, and in order of sacredness):

- piko (summit)
- kuamauna (mountaintop below summit)
- kuahea (area below kuamauna where vegetation is stunted)
- wao nahele (upper cloud forest)
- wao lipo (lower cloud forest)
- waoʻeiwa (upper rainforest)
- wao maʻukele (rainforest w/ koa & ʻōhiʻa canopy)
- wao akua (lower rainforest)

These montane wao are ma uka of the wao kanaka, where men lived and worked. Traditionally, the wao akua (and above) are pristine zones inhabited by the akua (elements, such as clouds, mist, and snow) where elemental processes occur to ensure the health of the land. Typically, access to the montane wao were reserved for ritual and ceremonial purposes and strict protocol was followed to ensure the safety of kanaka and preservation of the wao.

Pele

Pelehonuamea is the nomenclature of the elemental "god" of eruptions. She is mentioned in the following paragraphs, pele means "magma or lava" as is also used in the accounts below. Just know that there are two uses for the word. Pelehonuamea means "red earthy substance".

Scientists estimate that Mauna Loa has been erupting for 700,000 years and emerged from sea level approximately 400,000 years ago. The oldest known dated rocks are estimated to be 200,000 years old. Mauna Loa is an active volcano, erupting at least 33 times in the Western historical record. Mauna Loa has two prominent rift zones; the rift zone that is important to this study is the southwest rift zone, a historically active zone where the pahu manamana is located.

The pahu manamana site is attributed to ʻUmi (Baker, 1917, p.85):

> A most interesting discovery ... was made by Professor Jaggar on visiting the source of the 1919 lava flow. There it was, high up, perhaps at an elevation of 8,000 ft, easy to follow, and seeming to bend around toward Kapapala, Kau, while still high in elevation. Near the source of the flow were many small horse-shoe shaped stone shelters at different parts of the trail, and one large stone platform with long stones erected at the back, and further along a smaller stone platform. It has been learned from the Hawaiians that these platforms were for the priests, and the upright stones were offerings erected whenever there was a flow in this especially Pele-ridden section of Mauna Loa, to avert disaster. The shelters were against the prevailing wind, and would hold from one to several men, sheltering quite a company in all. Umi was certainly a remarkable builder and strenuous climber.

A note regarding this account: Aside from the pahu manamana, the other notable man-made structure of the area are the dozens of pāpaʻi still in existence, built from local rock material and oriented to block the prevailing tradewinds. Pāpaʻi is the general word for crabs, an interesting name as the shelters resemble a crab's claw. Further analysis of the word "pāpaʻi" reveals that "pā" is the word for "fence, wall, corral, pen, enclosure" and "paʻi" is a "heap"; "heaped up corral" is the perfect desription of these shelters. In most instances, poles supporting the walls and roof were anchored into the stone walls.

While on-site, 52 pāpaʻi were counted, 13 near the pahu manamana itself and 49 north of the pahu manamana. In the book "Hawaiian Mythology", Martha Beckwith (1970) notes that at one time there were 75 pāpaʻi:

> On the slope of the mountain ... before the lava flows of 1887 and 1907 covered them, the stone structures of Umi's camp. Seventy-five huts were counted, all facing away from the wind and built of three slabs of pahoehoe lava rock, two set together at an angle and a third forming the back, each hut large enough to hold two men. Larger huts, perhaps designed for chiefs, were supported by slabs within and built up outside with stone walls shaped into a dome.

Papakū Makawalu researchers did note a few pāpaʻi partially buried by an ʻaʻā flow (see figure 61), which accounts for the discrepancy in numbers. Using Beckwith's count, and based on the size of the pāpaʻi, 300 people could be sheltered on site (not counting persons that could shelter

in caves and lava tubes), a number that suggests a large royal entourage, instead of a few priests erecting manamana.

Figure 61: Pāpa‘i possibly buried by an ‘a‘ā flow.

As noted earlier in this report, since this site was constructed in the 16th century, eruptions have partially covered the area. Modern lava flows seem to split the pahu manamana site, creating a kīpuka and preserving most of the site as we know it today (see figures 62 & 63).

Figure 62: Aerial view of the whole Pahu Manamana o ‘Umi site with old and new lava flows.

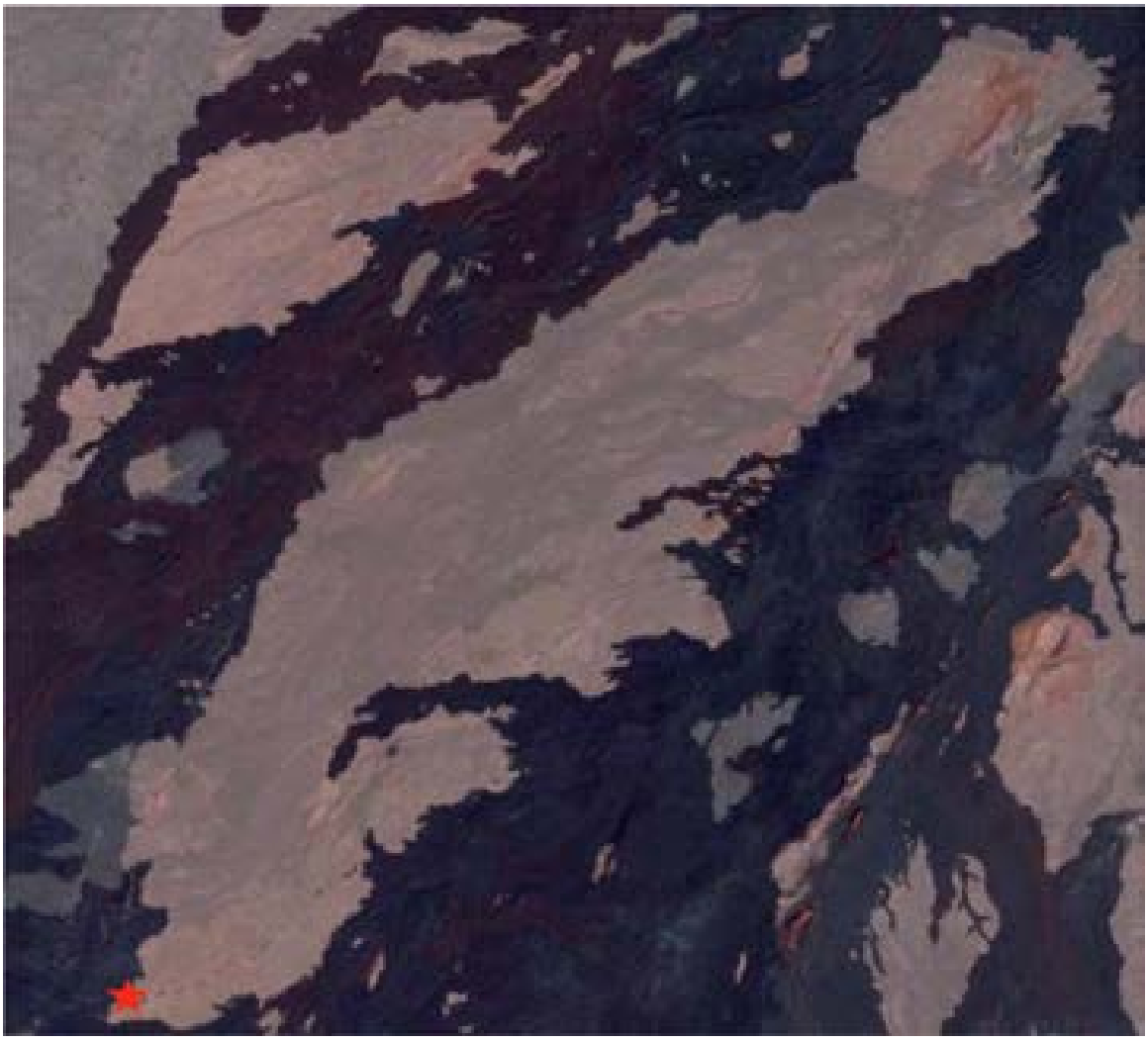

Figure 63: A grand view of the Pahu Manamana o ‘Umi site on the slope of Mauna Loa with lava tube skylights.

As you can see in the lower left hand corner of figure 63, the pahu manamana align with a row of lava tube skylights. Based on visual clues, the pahu manamana is built on a prehistoric eruption, the lava tube system present in ‘Umi’s time suggests that the pahu manamana was specifically built on this alignment.

One hypothesis is that while ‘Umi built the pahu manamana to trace stellar alignments, the placement of the pahu manamana on a volcanically active mountain, and along its lava tube system, suggests that ‘Umi also wanted to align himself with the migration of the pele (magma/lava). Another hypothesis is that ‘Umi erected the pahu manamana, in accordance to the setting of the stars, to mark the northwestern islands, tying himself to significant wahi pana across the archipelago.

Measurements made by the PHM mapping team reveal (page 25; figure 26):

Manamana #1 aligned with the island of Papaʻāpoho (Lianski Island). Manamana #2 aligns with Kānemilohaʻi (French Frigate Shoals), Kauo (Laysan) and Pihemanu. Manamana #3 aligns with Moku Manamana (Necker) and Kaʻula. Manamana #4 aligns with Oʻahu. Manamana #8 with Molokaʻi, Lānaʻi, and Kahoʻolawe.

The chant "He Lua I Ka Hikina" shows that our ancestors understood the easterly migratory nature of the pele from the northwest to the southeast:

He lua i ka **hikina**	A crater or hot spot in the **east**
Ua ena e Pele	The lava is red-hot
Ke haoloolo e la ke ao	Light floods forth
Ke lele la i luna i lalo	Sailing through the air
Kawewe ka oo i lalo i akea	Earth's strata are exposed
A ninau o Wakea o wai nei akua e eli nei	Wakea asks, who is exposing the strata
O wau no o Pele	It is I, Pele
Nana i eli aku i ka lua i **Niihau** aa	Opening the fiery crater at **Niihau**
He lua i **Niihau**	... **Niihau**
Ua ena e Pele	
Ke haoloolo e la ke ao	
Ke lele la i luna i lalo	
Kawewe ka oo i lalo i akea	
A ninau o Wakea o wai nei akua e eli nei	
O wau no o Pele	
Nana i eli aku i ka lua i **Kauai** aa	... **Kauai**
He lua i **Kauai**	... **Kauai**
Ua ena e Pele	
Ke haoloolo e la ke ao	
Ke lele la i luna i lalo	
Kawewe ka oo i lalo i akea	
A ninau o Wakea o wai nei akua e eli nei	
O wau no o Pele	
Nana i eli aku i ka lua i **Oahu** aa	... **Oahu**
He lua i **Oahu**	... **Oahu**
Ua ena e Pele	
Ke haoloolo e la ke ao	
Ke lele la i luna i lalo	
Kawewe ka oo i lalo i akea	
A ninau o Wakea o wai nei akua e eli nei	
O wau no o Pele	
Nana i eli aku i ka lua i **Molokai** aa	... **Molokai**
He lua i **Molokai**	... **Molokai**

Ua ena e Pele	
Ke haoloolo e la ke ao	
Ke lele la i luna i lalo	
Kawewe ka oo i lalo i akea	
A ninau o Wakea o wai nei akua e eli nei	
O wau no o Pele	
Nana i eli aku i ka lua i **Lanai** aa	... **Lanai**
He lua i **Lanai**	... **Lanai**
Ua ena e Pele	
Ke haoloolo e la ke ao	
Ke lele la i luna i lalo	
Kawewe ka oo i lalo i akea	
A ninau o Wakea o wai nei akua e eli nei	
O wau no o Pele	
Nana i eli aku i ka lua i **Maui** aa	... **Maui**
He lua i **Maui**	... **Maui**
Ua ena e Pele	
Ke haoloolo e la ke ao	
Ke lele la i luna i lalo	
Kawewe ka oo i lalo i akea	
A ninau o Wakea o wai nei akua e eli nei	
O wau no o Pele	
Nana i eli aku i ka lua i **Huehue** aa	... **Huehue [Hualalai]**
He lua i **Huehue**	... **Huehue**
Ua ena e Pele	
Ke haoloolo e la ke ao	
Ke lele la i luna i lalo	
Kawewe ka oo i lalo i akea	
Elieli kau mai	Profundity manifests

Understanding the nature of akua (elemental entity) showed the strength of one's relationship to the akua and assured one's status as aliʻi. Several generations after ʻUmi, history reveals the peril of not being in sync with the akua. In 1790 the aliʻi Keōua was engaged in a battle with Kamehameha and led his army across Kīlauea. Keōua's army was decimated when an immense volume of sand and cinder blanketed the area. Society took this as a sign that Pele favored Kamehameha and his right to rule.

The pahu manamana, an instrument used to track the stars, was erected on an isolated area in the kuahea, on an active volcano, to mark the location of islands significant to ʻUmi, and to track the movement and activity of Pele. "He Lua I Ka Hikina" is an important chant because this is also one of the few chants that reveal Pele's relationshop to Wākea. Wākea as the constellation Orion is the equinox. The earth equinox for the island of Hawaiʻi is Mauna Loa from Kumukahi to

Pōhaku Hanalei to Puʻu Ohau, a volcanic landscape. Wākea, the expanse of the sky, is reflected here in the expanse of the earth's strata. ʻUmi was ensuring his right to rule by purposely gathering about him the akua needed for success as an aliʻi (It would be interesting to find the equinox for each of the island in "He Lua I Ka Hikina").

Pōhaku

Petrology is the branch of geology that studies rocks and the conditions under which they form. The Hawaiian language has nomenclature for the following rocks:

- Basalt, a common volcanic rock, high in iron, formed by the rapid cooling of lava exposed at or very near to the surface of the Earth.
    - Vesicular basalt, basalt that contains many small holes (vesicles). A vesicle is a small cavity in volcanic rock formed by the expansion of a gas bubble trapped inside the lava.
- Jasper, dense and opaque varieties of microcrystalline quartz, typically found in veins and cracks in volcanic rocks. Jasper has a very strong magnetic susceptibility due to high concentrations of iron.
- Limestone, sedimentary rock composed mainly of skeletal fragments of marine organisms, such as coral, forams, and molluscs.
- Sandstone, sedimentary rock composed mainly of sand-size mineral particles or rock fragments.
- Tephra, rock fragments and particles ejected by a volcano.
    - Cinder, volcanic rock similar in appearance to pumice, but with a higher percentage of iron and other heavy elements. Cinder will sink readily, whereas pumice floats.
    - Pumice, volcanic rock with a high content of silica, making it light in weight, and numerous air pocket, which make it even lighter. This lack of density gives pumice the ability to float on water.

PHH petrology experts have 120 names for pōhaku:

Rock	Pukuʻi Definition	Other
1. ʻaʻā	ʻAʻā lava; stony, abounding with ʻaʻa lava.	
2. ʻaʻā puʻupuʻu	Sharp or water-worn, coarse gravel or rock.	
3. ʻākeke	Cinder.	
4. ʻalā	Dense waterworn volcanic stone, as used for poi pounders, adzes, hula stones; hard lava, basalt.	
5. ʻalaʻalā	Small ʻalā stones.	
6. (ʻalā) haumekū ʻolokele	A kind of stone used for adzes.	
7. (ʻalā) lelekepue	Hard volcanic rock, as used for adzes.	
8. ʻalā māhinu	(See ʻalā above). Māhinu = smooth and polished.	

9. (ʻalā) makahinu	Kind of hard stone.	
10. ʻalā mea	Hard volcanic stone, used for adzes. Mea = reddish-brown.	
11. ʻalā mole	Species of stone. Mole = Smooth, round, bald.	
12. (ʻalā) pia maka hinu	A type of stone used for adzes.	
13. ʻalā poʻo malu	Name of a dark basalt. Also kaiʻanuʻu.	
14. ʻana	Pumice, used as a rubber.	
15. ʻana ōlaʻi	White pumice with fine pores.	
16. Au	Pumice.	
17. ʻawaliʻi	Name of a hard stone out of which koʻI were made.	
18. Ehuehu	A kind of rock, used for adzes.	
19. Elehu	Slate or ash-colored pumice. *Rare*.	
20. ʻelekū	Course vesicular basalt. Stone polisher made of this rock.	"In fine work the usual succession was fine coral, or *puna, pohaku eleku,* a rather soft, brittle stone, rough pumice or *ana oahi* (baked pumice), *olai, oio,* and *lau ulu* or dried leaves of the breadfruit tree" (Brigham, 1902).
21. ʻeleʻū	A hard stone, sometimes used as a fish god.	
22. haʻialiʻi	Name of a hard rock used for making adzes.	
23. Haku	Stone. Haku kā koʻi, stone for chipping.	
24. Hāpou	Same as ōlaʻI, pumice.	
25. Hau	A soft porous stone, as used for polishing calabashes. Rare.	
26. Haumekū	A kind of stone used for adzes. Rare.	
27. Hauone	Soft limestone.	
28. Hiena	Kind of soft porous stone used to smooth and polish utensils; it is harder than the ʻana stone, which is used on wood.	
29. hoʻokele	Kind of stone found at craters, as Kīlauea, and used for adzes.	
30. huiʻapa	A kind of stone, as used for making maika stones.	
31. Huipa	Kind of hard, black stone used for maika stones.	

32. huleʻia	A kind of soft pumice stone. Also ʻana, ōlaʻi.	
33. humuʻula	Red jasper stone, as used for adzes.	
34. ihuokapuaʻa	Type of coarse-grained stone. See kaihuokapuaʻa.	
35. ikimakua	A kind of stone, as used for making maika stones.	
36. ʻili	Pebble (less used than ʻiliʻili); kōnane pebble.	
37. ʻiliʻili	Pebble, small stone, as used in dances or kōnane.	
38. ʻiliʻiliʻeleʻele	Black kōnane pebble.	
39. ʻiliʻili hānau	The birth pebbles of Kōloa (a small section of the beach at Punaluʻu, Kaʻū), which were believed to reproduce themselves, the smooth nonporous ones being male, the porous ones female. These stones were best liked for the pebble hula.	
40. ʻiliʻili kea	White kōnane pebble.	
41. ʻili kea	White kōnane pebble.	
42. ʻiliʻili makaliʻi	Gravel, small stones.	
43. ʻina	Kind of stone, used to make octopus sinkers.	
44. kāʻauʻaupuʻu	Hard, mottled stone, as used for ʻulu maika stones. Rare.	
45. Kahakaha	Small stone larger than a pebble. Rare.	
46. Kahaloa	A stone brought before a priest in sorcery prayers.	
47. kaialiʻi	Hard type of rock, used for adzes.	
48. kaiʻanuʻu	Same as ʻalā poʻo malu, a basalt.	
49. kaihuokapuaʻa	A type of stone (no data). Lit., the snout of the pig. See ihuokapuaʻa.	
50. kalamaʻula	Same as humuʻula, a stone.	
51. kalaniāʻula	Same as humuʻula, a stone.	
52. Kalapaiki	Kind of stone used for octopus lures.	
53. Kanawao	Hard, striped pebble, found in streams and used in slingshots and as sinkers.	
54. kauaʻula	Kind of soft, reddish porous stone used for polishing and smoothing and as a sinker for octopus lure.	
55. Kauila	Hard, reddish rock resembling ʻalā.	
56. kaʻulaiki	Type of pink, smooth, somewhat porous stone.	

57. kāwaʻewaʻe	Kind of stone or coral, as used in polishing canoes, or in rubbing off pig bristles.	
58. kāwaʻupuʻu	Type of stone from which sinkers for octopus fishing were made.	
59. keʻe	A stone used for adzes.	
60. Kei	A hard rock from which adzes were made.	
61. Kepue	A kind of hard stone from which adzes were made. Also humuʻula.	
62. Kohenalo	Corrugated stone used for smoothing wood or stone; to file or rasp with this stone.	
63. kuanuʻu	Kauaʻi name for māono, a basalt.	
64. kumumaʻo	Any type of green Hawaiian stone, as used for maika stones.	
65. Kumuone	Sandstone, used for maika stones. Lit., sand base.	
66. Kūpaoa	Stone from which octopus fishing sinkers were made.	
67. Laekoloa	Type of hard, red stone, as used for adzes. Also humuʻula.	
68. Laukea	Hard gray stone, used for adzes.	
69. lei ole	Same as ʻana, pumice stone used for medicine and for polishing.	
70. Lelekepue	Hard volcanic rock, as used for adzes.	
71. lūʻau	Kind of soft porous stone, as used in the ground oven. Rare.	
72. Luehu	Kind of soft porous stone that breaks easily.	
73. Maheu	Kind of porous stone, used to rub, scour, polish, and as an octopus lure.	
74. Māhikihiki	Stone, as used for adze. Also called makaiʻa.	
75. Maika	The stone used in the game.	
76. māʻili	Pebble or stone, as used for making sinkers for squid fishing.	
77. makaʻāwela	Kind of soft, porous stone.	
78. makaiʻa	A kind of stone, used for adzes and poi pounders. Also māhikihiki.	
79. Makawela	Type of stone from which weights for cowry octopus lures were made.	
80. Makawī	See pahapaha.	
81. Makiki	Type of stone used as weights for octopus lures and for adzes.	
82. Māono	A gray basalt, used for pounders. Rare. Also kuanuʻu.	
83. Mauna	Kind of hard stone from which adzes were made.	

84. Naninui	Soft stone used in making lūheʻe, squid-fishing sinkers.	
85. Nohu	Soft, porous stone, used in scouring.	
86. Nohunohu	Same as nohu.	
87. Noninui	Soft, pinkish porous stone, as used in polishing.	
88. ʻōahi	Rough stone or pumice, as used for polishing surfboards or bowls, or for scraping bristles of a pig.	
89. ʻoai, ʻowai	Porous stone, as used for polishing canoe and calabashes.	
90. ʻōʻio	Stone used for polishing and as octopus lure.	
91. ōlaʻi	Light porous stone or pumice, as used for polishing canoes or for scraping off hair of pig or dog to be roasted.	"In fine work the usual succession was fine coral, or *puna, pohaku eleku,* a rather soft, brittle stone, rough pumice or *ana oahi* (baked pumice), *olai, oio,* and *lau ulu* or dried leaves of the breadfruit tree" (Brigham, 1902).
92. one ʻā	Black sand or gravel made of ʻaʻā lava; volcanic cinder.	
93. paʻakea	Limestone, coral beds, as found on the leeward sides of the islands. *Lit.*, white hardness.	
94. paʻalā	Smooth, water-worn ʻalā rock.	
95. Pahapaha	Oʻahu name for a kind of stone used for poi pounders. Called makawī on Kauaʻi.	
96. Pāhoa	Sharp stone, especially used for a weapon.	
97. Pāhoehoe	Smooth, unbroken type of lava, contrasting with ʻaʻā; to turn into pāhoehoe lava.	
98. Pākā	Sinker on a fish line for deep-sea fishing.	
99. Pākea	Type of stone (no data). Rare.	
100. palaʻā	Type of stone, used for sinkers for octopus fishing.	
101. Papa	Stone used as sinker for lūheʻe, octopus lure.	
102. pāpaʻakea	Same as panaceas, limestone.	
103. peʻahi	A dark-colored stone with grain said to suggest the fingers of a hand. Rare.	
104. Pia	A kind of stone, as used for adzes.	
105. Pīwai	A type of hard rock used for adzes.	
106. Pōhāhā	Volcanic ejecta of any kind.	

107. pōhā kea	White stone, as limestone.	
108. pōhākialoa	Stone used as a landmark, as of a land boundary, or for locating a fishing ground; stone with a knob at the top, used as a weight for deep-sea fishing.	
109. pōhākioloa	Var. of pōhākialoa.	
110. Pōhaku	Rock, stone, mineral.	
111. pōhaku lūʻau	Fine-grained dark ʻalā stone, as used for adzes; water-worn basalt. Lit., cooked-taro green rock, so called perhaps because of the dark color.	
112. pōhaku paʻa	Basalt; general name for hard rocks, such as were used for adzes.	
113. Pōhuehue	A kind of stone used for polishing canoes.	
114. Polipoli	A soft, porous stone as used for polishing or for octopus lure sinkers.	
115. puʻupā	A stone used for maika stones. Rare.	
116. Uliuli	A kind of rock from which adzes were made.	
117. ʻulu	Round, smooth stone as used in ʻulu maika game. Name for kōnane stone.	
118. Unu	Small stone, pebble, stone chip.	
119. waianuʻukole	Name of a soft porous stone, as used in medicine or for octopus sinkers. Rare.	
120. Waiehu	Formerly a rough stone used to grind and polish.	
121. Waimano	Stone from which octopus sinkers were made.	

A quick study of this list shows some rocks are given different nomenclature, depending on dialectic differences and its origins. For example, the rock used for poi pounders, māono (#82), is called kuanuʻu (#63) on Kauaʻi. A rock may also be known by several similar-sounding nomenclatures, such as the adze known as ʻalā lelekepue (#7), lelekepue (#70) or kepue (#61), which is also known by the name humuʻula (#33), kalamaʻula (#50), kalaniāʻula (#51), or laekoloa (#67).

The pahu manamana site is composed of porous ʻaʻā, pāhoehoe, and cinder. A single round basalt rock was seen near the lava tube's skylights. Based on observations, the pāpaʻi were built using thin slabs of local rock. In contrast, architects chose thicker slabs for the manamana.

Stone selection would have been critical when forming the pahu manamana – especially the paepae and individual manamana – each stone used was selected with intent. To compare manamana shape of this pahu manamana site with other manamana, the following photo is of an engraving by John Webber, an English artist accompanying Captain Cook when he landed in Hawaiʻi in 1778. Webber's engraving shows five stone manamana on a Kauaʻi heiau with kapa

tied to holes bored into the sides (manamana were dressed with kapa for ceremony). Although the manamana in this engraving are flat-topped, samples of manamana in museums show the notched figure seen at the pahu manamana site today and suggests that the notched form has been carved.

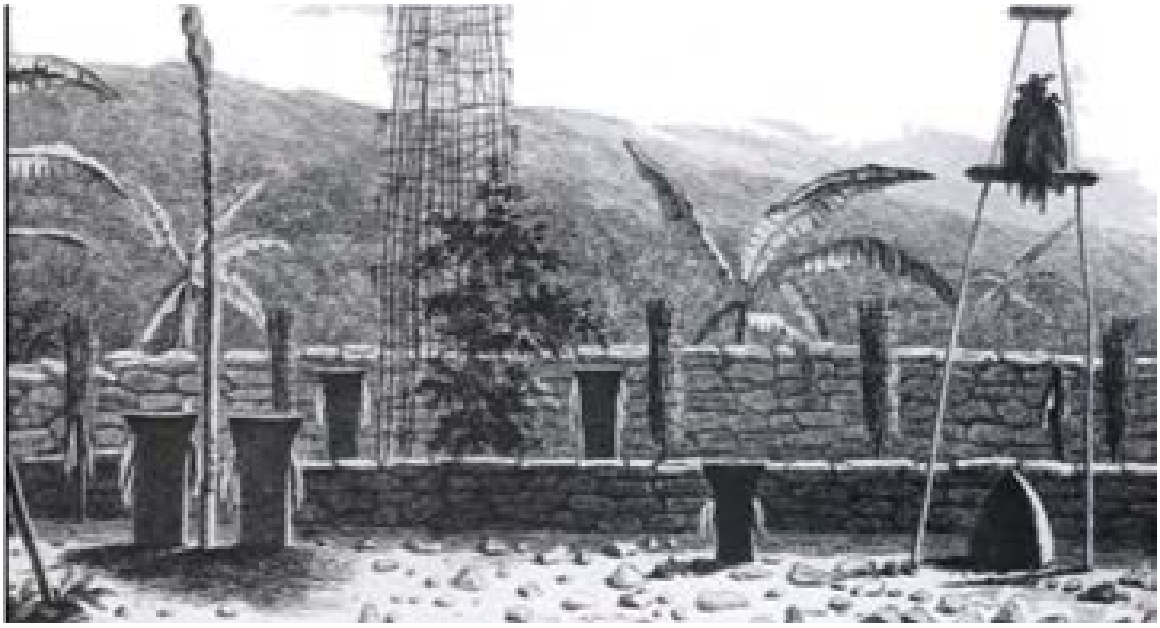

Figure 64: Kauaʻi Heiau with dressed manamana captured by artist John Webber.

The practice of dressing "uprights" continues today with the dressing of this wooden image used on a hula altar:

Figure 65: Kuahu for Laka, the Laka is dressed with kapa and vegetation.

Another aspect of the pahu manamana site that is interesting is that while on-site researchers noted that their compasses were not working properly when aligning with celestial markers. Paul Baldwin (2018) reported the following on magnetism on Hawaiʻi's volcanoes:

> Kilauea, Hawaii's erupting volcano, has a magnetic field which flows in the OPPOSITE direction to the rest of the planet, scientists have discovered.
>
> The bizarre finding, which sends compasses into an uncontrollable spin, had scientists baffled ... But now the reason for the magnetic volte-face has been explained – and it's even more mind-blowing.
>
> According to geologists the molten rock below [Kilauea] caldera contain vasts amount of iron and is effectively a sea of floating magnets.
>
> About 780,000 years ago the rock cooled and simultaneously the Earth's magnetic field inexplicably FLIPPED – the South Pole became the North and the North Pole became the South.
>
> But the sea of iron magnets below [Kilauea] were now cooled and trapped in the now solid rock – with their poles facing the opposite way to everything elese on the planet ... Brad Singer, a geology professor at the University of Wisconson – Madison, who investigates lava flow magnetic fields, said: "When the lava flows erupt and cool in the Earth's magnetic field, they acquire a memory of the magntic field at that time.

Baldwin's report supports the idea of a magnetic anomoly at the pahu manamana site, causing compasses to malfunction.

Of the rocks listed in the table above, the humuʻula rock (also known as ʻalā lelekepue, kalamaʻula, kalaniāʻula, kepue, laekoloa, and lelekepue) is likely to have magnetic properties. Humuʻula (literally, red binding) is a red jasper stone. The root word "humu" means "to bind together" which gives an insight to the magentic property of this stone and jasper is known to show strong magnetic susceptibility due to high concentrations of iron. It is very likely that the humuʻula stone is found in Kahuku because "humuʻula" is also the name of a boundary point separating the ahupuaʻa of Kahuku and Kaʻapuna. The humuʻula stone may be named for the place it was found - or vice versa, the name of the area could be named after the stone. It is also interesting to note that two stone ahu, named Nāhuaʻumi (literally, mounds of ʻUmi), are located on this Kahuku/Kaʻapuna boundary further cementing ʻUmi's presence in the area.

Wai

There is no surface water present at the pahu manamana site. A question was asked as to how the area could support the substantial amount of people that the pāpaʻi were able to house. Aside from transporting water to the site in huewai (calabashes specifically used for containing water), another solution was presented during the 2016 winter solstice access. At 8:30 am, water was heard dripping/flowing in the lava tube system (seen from skylights) due to condensation of the chilly mountain air as the sun rose (sunrise that day was 6:50 am). Observation showed that the

walls of the lava tube system were damp and water could be seen, and heard, dripping steadily. Hue wai could be placed to collect the dripping water to help replenish water that was brought to the site.

The following waterholes, located in Kahuku, could also have supplied water to the campsite (keeping in mind that ʻUmi retained runners for this purpose, see "kūkini" in PHM notes below):

- Kawaihou, elevation 2,240 ft.
- Waiahuli, elevation 2,430 ft.
- "One Hundred Acre", elevation 5,630 ft.
- Polewai, elevation 6,400 ft.z

The kūkini were noted in history for their speed and efficiency. There are many stories that report a kūkini was able to satisfy fish cravings of a chief by running to another district, even across the island, to get the specific fish desired, and return with the fish still alive and twitching in his hands. Fetching water from Kahuku waterholes, or even waterholes on the shoreline, would have been an easy task for kūkini.

Papahānaumoku Notes

It was written that at the time ʻUmi's older brother Hakau died, ʻUmi ascended to the highest rank as ruling chief, and married Piʻikeapiʻilani, the highest ranking female of the Maui royal lineage. ʻUmi lived together with chiefs and commoners alike and selected 3 sets of forty people (120 people) for his court. Among these 3 sets of forty people were kahuna (experts in a profession), kākāʻōlelo (orators), kuhikuhipuʻuone (architects), kilokilo (stargazers), and kūkini (runners). It was said that these 120 people had no other job except to sit and be ready for whenever ʻUmi needed to consult with them and/or send them (the kūkini) to far places quickly. These are the reasons ʻUmi retained these people. The amount of pāpaʻi located at the pahu manamana site certainly indicate that 120 people could easily be housed there.

The nomenclatures "ʻUmi Caverns" and "Puʻu ʻo ʻUmi" indicate that this site was initially constructed in the time of ʻUmi in the sixteenth century. Samuel Kamakau (1992) writes that in the eighteenth century, Keōua Kūahuʻula, son of Kalaniʻōpuʻu, who was the ruling chief at the time of contact by Captain Cook, also lived in the area:

> As soon as [Puukohola] heiau was completed, just before it was declared free, Kamehameha's two counselors, Keaweaheulu and Kamanawa, were sent to fetch Keoua, ruling chief of the eastern end of the island of Hawaii … Keoua was living in Kaʻu *mauka* in Kahuku with his chiefs and the warriors of his guard. Keaweaheulu and his companion landed at Kailikii [in Pakininui] and began the ascent of Kahehawahawa along the plains of Keekeekai. Close to the extreme edge of the tabu enclosure of Keoua's place the two got down and rolled in the dirt and began to weave their nets of speech. Keoua's people nodded at each other, and Kaieiea said to Keoua, "It will be a good thing to kill these counselors of Kamehameha." Keoua answered, "They must not be killed for they are younger brothers of my

> father." Kaieiea went on, "If these are killed he will have but two counselors left, and the government will become yours." "I cannot kill my uncles." The two messengers rolled along in the dirt until they came to the place where Keoua was sitting, when they grasped his feet and wept. When the weeping was over Keoua asked, "What is your errand?" Keaweaheulu answered, "We have come to fetch you, the son of our lord's older brother, and to take you with us to Kona to meet your younger cousin, and you two to be our chiefs and we to be your uncles. So then let war cease between you." "I consent to go with you to Kona," answered Keoua.

Keōua, ruling chief of East Hawai'i, may have chosen to live in Kahuku because of the pahu manamana site. He could have lived in a friendler environment, but chose Kahuku because of the significance of the pahu manamana to prepare against his upcoming skirmish with Kamahemeha at Pu'ukoholā Heiau.

Results

Why did 'Umi choose to build the pahu manamana in the kuahea of Kahuku, 7,752 feet above sea level, away from the physical comforts of lower elevations?

Two important landmarks are located in Kahuku, Kalae and Pōhaku Hanalei. The pahu manamana sits ma uka of Kalae, a cultually important landmark in the sacred geography of Hawai'i that marks the southern tip of the island (the other cardinal landmarks are 'Ūpolu in the north, Kumukahi in the east, and Pu'u Ohau in the west). Visible, also, from the pahu manamana is Pōhaku Hanalei on the summit of Mauna Loa. Natural landmarks, along with man-made structures oriented to cardinal points, was used to track celestial objects to mark the different seasons of the year.

'Umi chose this area because of its position on the island in the kuahea. Not only is the kuahea above the cloud line (an important aspect for the PHL perspective of observing celestial activity), but the site places 'Umi in an area reserved for the akua.

Finally, as stated in the Pele section, the pahu manamana, an instrument used to track the stars, could have been erected on an isolated area in the kuahea, on an active volcano, to mark the location of islands significant to 'Umi, and to track the movement and activity of Pele and Wākea. 'Umi was ensuring his right to rule by purposely gathering about him the akua needed for success as an ali'i.

Kauila o ‘Umi

Pahu Manamana o ‘Umi

Papahulilani

By Kalei Nu‘uhiwa, PhD Candidate &
Pualani Lincoln Maielua, M.A.

Introduction

This report focuses on the PHL research, which is the atmospheric and celestial studies. PHL is a classification of Hawaiian experts who devoted their lives to the study and elevation of knowledge associated with the cycles and celestial activities of the sun, moon, stars, planets, comets, and asteroids. The natural cycles and activities pertaining to weather phenomena such as clouds, wind, rain, and snow were also part of the study. The final aspect that was studied by the PHL experts was time, due to the understanding of the natural progressions of the timely celestial entities.

On the initial crepuscular study of PMU, there were no significant alignments or connections from any of the cultural features to the sun's solstices and equinoxes. The decision was made on this first trip that this pahu manamana was meant for night observations, therefore the obvious choice to visit the site were during the winter and summer solstices. The evening field studies were to investigate and view possible star alignments with the pahu manamana and other individual manamana on site.

Two overnight camping at the site occurred which has led to the most astute realizations. The compasses were not reliable on our initial visits. However, the unreliability of the compasses forced the team to use the stars. The stars immediately set the team onto location and alignment to the cardinal points.

The chants utilized provided insight into star alignments were:

- Kumulipo, focusing on Wā 14, Wā 15 & Wā 16
- Hānau Ke Aliʻi – Koʻihonua o Kauikeaouli
- Kumuhonua Koʻihonua - ʻAha Lanalana o ke Aliʻi
- Kihanuilūlūmoku - ʻAha Lanalana
- Hānau ka Malama
- ʻO Kāne ʻO Kūkapao

Stories utilized to inform our observations were:

- ʻUmialīloa, Kamakau & Fornander versions
- Kamiki & Makaʻiole
- Kamakau's publications of Moʻolelo Kahiko, genealogies and stories
- Ke Kau a Hiʻiaka

Chants inform our research and stories inform the thought process of the storyteller.

Methodology & Site Details

Figure 66: Manamana placement, this is the front face of the manamana, it measures stars setting in the north, northwest. Night vision of pahu manamana.

The PHLt chose to report on the observations made specifically during the Winter solstice visit of 2017 because both PHLt members were present and conducted observations. Figure 66 provides an example of the manamana with the north-northwest night sky at its back.

The team chose four significant site to make observations and alignments as shown in figures 67 and 68:

- Pahu Manamana o ‘Umi (Main site)
- Kihikū (5 ahu)
- Pilina (3 ahu on Bedrock)
- Wākea (Single Manamana)

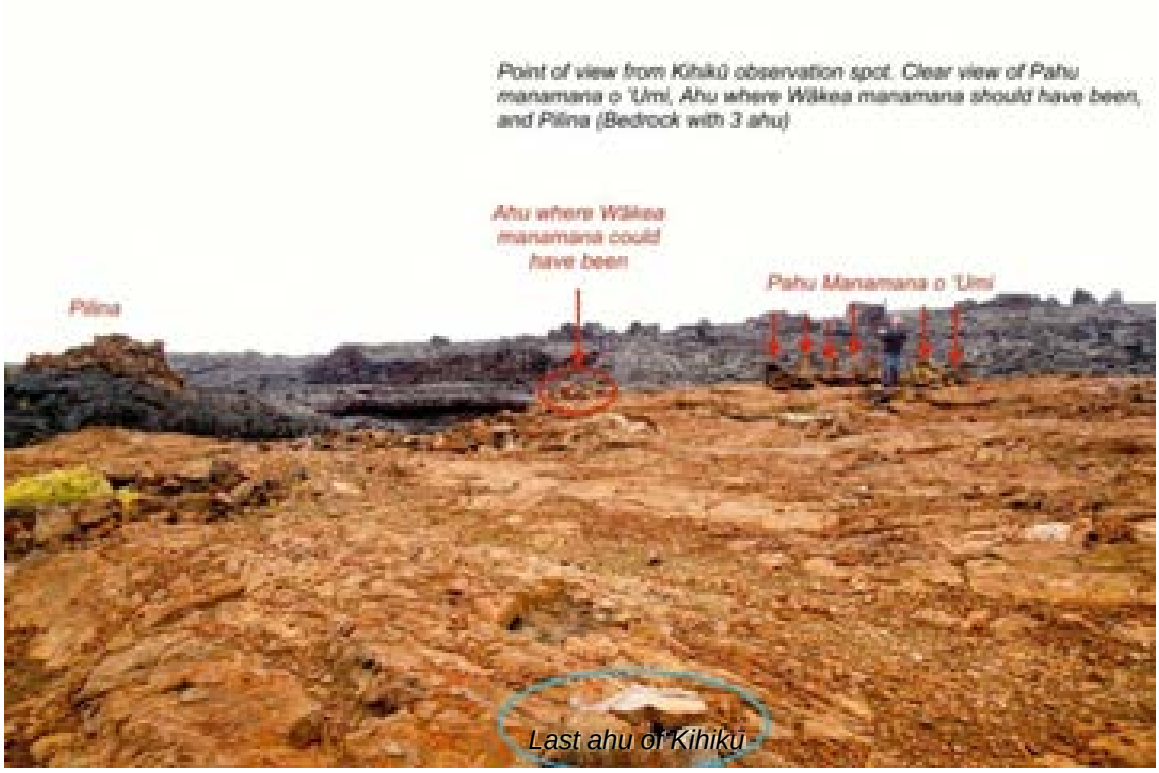

Figure 67: View from Kihikū towards the west, points of observation.

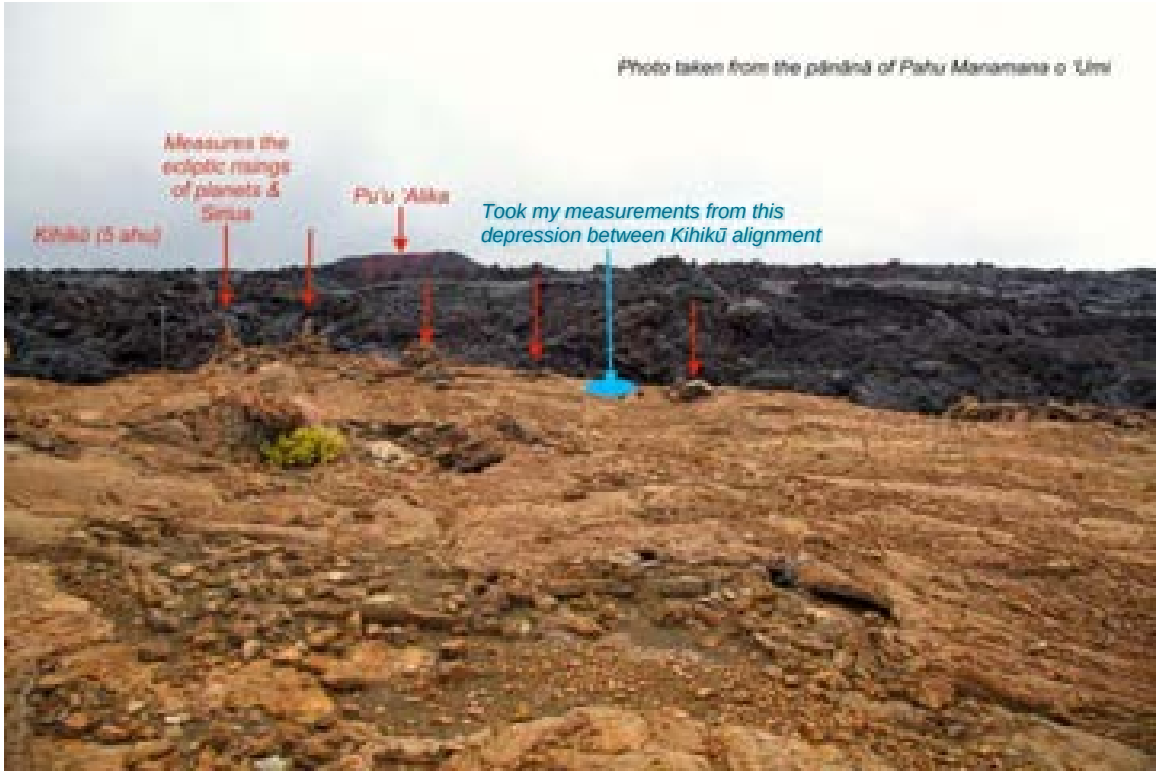

Figure 68: View from pahu manamana to Kihikū which is towards the southeast direction, point of observation.

Kauila Methodology

Kauila is the name of a nocturnal ceremony tracking time of stars based upon their movement and transition in the sky (Malo, 1898); (Johnson, 1985); (Kelou Kamakau qtd. in Fornander, 1919). This system was used by kāhuna to assure that certain rituals and ceremonial activities occurred at the proper time over the course of an entire evening. Kauila was used during certain Makahiki rituals and ‘Aha Lanalana ceremonies. Figure 69 displays the image of Kauila and the star positions important to the ceremony. The following are Kauila designations of stars in positioned at sunset:

- **Kihi,** stars position on the western horizon
- **Pili,** stars positioned 20 degrees above the western horizon
- **Kau,** stars at the zenith
- **Pili Puka**, stars in positioned 20 degrees above the eastern horizon
- **Kihi Puka**, stars positioned on the eastern horizon at sunset.

The PHLt structured the observations to follow Kauila position referenced throughout the evening. Observations were made at each of Kauila position as noted below throughout the night. The origin of Kauila was that it was pertinent to the consecration of a heiau and building of the hale kapu, sacred structures, on the heiau throughout a single night. Kauila time was significant to the commencement and completion of rituals based on the movement of stars and planets as they traveled through the night sky. Kauila was a process used by one of Kamehameha’s kahuna, Kelou Kamakau, as he watched the rise of stars and planets while conducting a ceremony. One of the reasons for watching stars and planets has to do with ceremony.

PHLt utilized the Kauila method to identify star positions at specific times during the night and noted their movement from sunset to sunrise.

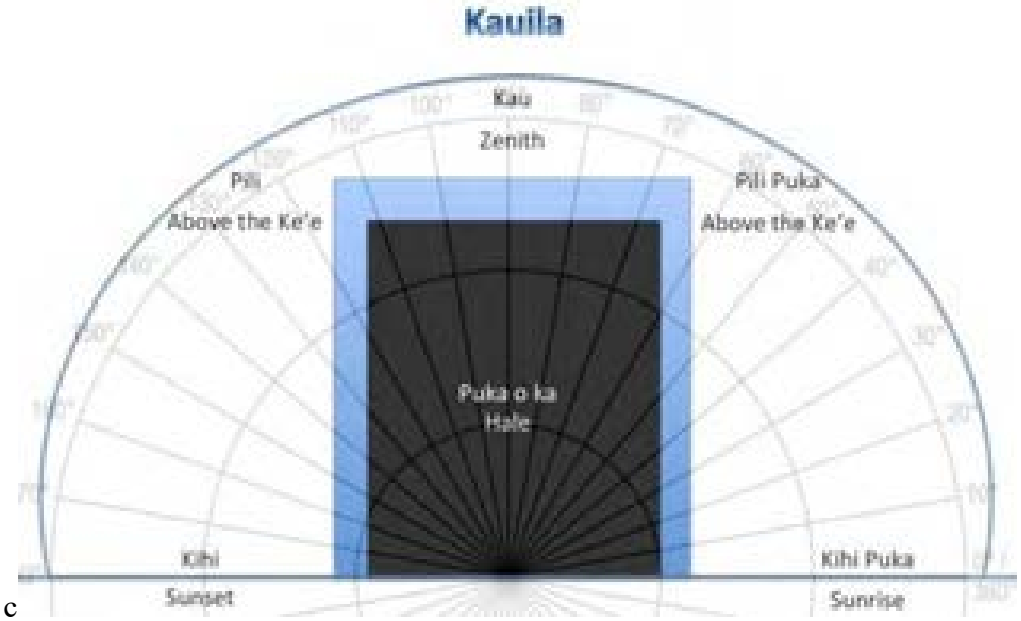

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Figure 69: Kauila methodology, nocturnal division of the sky.

Sun Alignment

As stated earlier the observation of Pahu Manamana o ‘Umi does not align with the sun.

Stars Alignment

The compasses and other devices used during the evening were inaccurate in providing true readings, however, the observation of the setting stars on the manamana delivered clarity. The setting stars were easily seen between the pahu manamana and Wākea. A realization that the pahu manamana was constructed so that the observer was oriented towards the north northwest, which means the focus of the setting stars in the northern hemisphere of the sky would align with the entire pahu manamana.

The PHLt recorded observations from two of the four sites.

PMU: The manamana aligned to the most dominant Northern Pointers in our sky which are the circumpolar stars such as Cassiopeia, Capella, Kochab, Pherkad, Merphak, Cepheus, Nāhiku (Ursa Major) and Draco. These stars and constellations all "point" directly to Kūmau (Polaris). The pointer stars are crucial in identifying Kūmau’s location in the sky when cloud coverage, weather, or latitude prevents visibility. The observations recorded many of the pointers set upon the main manamana of PMU as well as Pilina.

Figure 70: Each manamana were numbered reference.

According to figure 70, each manamana located on the pahu manamana has been numbered from #1 to #8, going from south to north, for simple referencing purposes.

These are the June setting of the constellations and stars in the evening according to Kauila:

- **Kihi**:
    - Eltanin and Rastaban of the constellation Draco set on #4 and #5. The significance of this constellation is that it is an accurate northern pointer.
    - Keoea (Vega) set on #2. Keoea is a significant star of the Northern sky as it is the brightest and first star to rise in the Navigator's Triangle a dominant constellation of the North as well as the summer night sky, thus it is also referred to as the Summer Triangle.
    - The extreme north upright or #8 is no longer standing or present, so it is unclear as to the placement of Kūmau as possibly the #8 manamana.
- **Pili**:
    - Konamaukuku (Deneb) of the constellation Cygnus and the base of the Navigator's Triangle set on #3. Konamaukuku along with Gienah is used as a Northern pointer.
    - Following Konamaukuku was a very distinct constellation Cepheus, another dominant constellation of the Northern sky and also used to find Kūmau. The 5 stars of Cepheus would have set between #5 and the possible #8 manamana.
- **Kau**:
    - Iwikau (Cassiopeia setting), a very visible and brilliant constellation hovered above the center of the pahu manamana at midnight. Though visibility was not as clear upon the time of its' setting, Iwikau most likely set upon #4 and #5. Cassiopeia is a dominant and extremely accurate northern pointer.
    - Mirach of Andromeda would also have set between #1 and #2.
- **Pili Puka**:
    - Perseus set upon #1, #2, #3, and #4.
- **Kihi Puka**:
    - Wainaku or Haumea of the constellation Auriga set upon #2.

Kihikū: The viewing from the pānānā of Kihikū was unobstructed. Observations from the pānānā to Pilina and from the pānānā to PMU were easily made. Alignments were then easily visible from the features on these sites up into the sky to identify a setting star, planet or constellation. Turning around in the same spot towards the lined manamana on Kihikū was easily made of the entire sky. From Kihikū the risings and settings of the stars in the entire sky were clear. Visible throughout the night were the Orion arm and the Sagittarius arm of the Milky Way. Clear sky throughout the night was very fortunate.

Noted star alignments in December:

- **Kihi**:
    - In the west, Humu (Delphinus) and the southern stars in Kahuelokū/Kukonalaʻa (Pegasus) called Algenib and Markab set directly on the 3 elevated ahu on the bedrock as depicted in the drawing. These constellations are "anchored" by the Milky Way. The setting Milky Way was anchored to Pilina. Keoea (Vega) set on the large manamana #1 of pahu manamana.

    - Exactly opposite in the east, Sirius was rising along the same line of Kihikū which leads me to believe that the 5 individual manamana or Kihikū is measuring the ecliptic plane.
- **Pili**:
    - The same stars noted at Kihi are lower, Iwikauikaua (Cassiopeia) is visible above the horizon and is affixed to the northern section of the Milky Way.
    - Makali‘i, Orion and the stars in Ke Kā o Makali‘i are rising in the east.
- **Kau**:
    - Kahuelokū and Kukonala‘a begins setting in the west. The two stars Algenib and Markab are setting on Pilina.
    - Makali‘i is at zenith. Ke Kā o Makali‘i has risen to the Pili puka position.
    - Nāhiku (Ursa Major), Holoholopi‘ina‘ao (Kochab in Ursa Minor) & Kūmau (Polaris) are visible in the north.
    - Iwikauikaua is setting but does not set below the horizon.
- **Pili Puka**:
    - The Milky Way is visible again and is located east of Kona (Canopus), which is also visible.
    - The False cross anchors the Milky Way to the south.
    - The stars in Ke Kā o Makali‘i are now setting and switch their names. Orion is now Wākea, Auriga is now Hale o Haumea, and Taurus is now Kaoahiapele.
    - Mars and Jupiter rise in the east.
    - Newe (the true Southern Cross) rises shortly after.
    - Shortly before the visible crepuscular light, Orion and Sirius are on their western descent.
- **Kihi Puka**:
    - Lehuakona (Antares) rises out of Pilina.
    - Realization occurred on the setting of Orion or Mintaka. Clearly, as seen in figure 71, the sites are specifically measuring the northern stars**.**

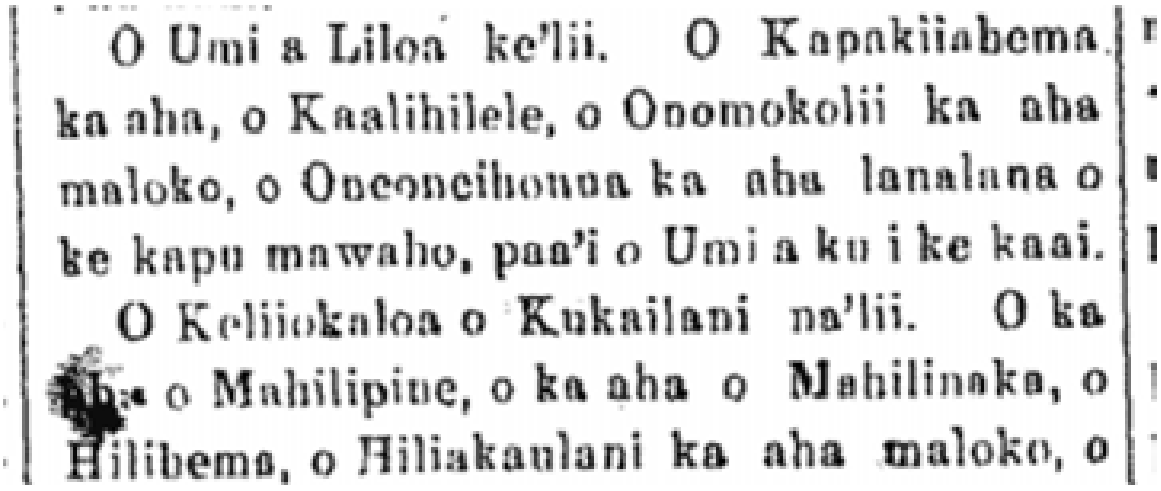
Figure 71: Northern stars setting as observed from the pānānā of Pahu Manamana o ‘Umi.

Haho

Haho, the Hallowed One is the first aliʻi, brought from Oʻahu to Hawaiʻi Island to create the ʻAha Lanalana ceremony for chiefs.

ʻUmi used Haho as his Puʻuhonua ʻEleʻele (his placement in the royal lineage) to anchor him in the ʻAha ceremony. As noted in PHM, the ʻAha ceremony connects the aliʻi to his puʻuhonua ʻeleʻele (earth place), his star (his infinity) and his progenitor and progeny. This covers the three division of the Hawaiian universe or the three Papa.

Ke Ao Okoa, November 4, 1869
Vol. 5, No. 29
na S.M. Kamakau



O Umi a Liloa ke'lii. O Kapakiiabema ka aha, o Kaalihilele, o Onomokolii ka aha maloko, o Oneonoihonua ka aha lanalana o ke kapu mawaho, paa'i o Umi a ku i ke kaai. O Keliiokaloa o Kukailani na'lii. O ka [illegible] o Mahilipine, o ka aha o Mahilinaka, o Hilibema, o Hiliakaulani ka aha maloko, o

Figure 72: Mele o Kihanuilūlūmoku.

Mele (chant) o Kihanuilūlūmoku

The above news article (figure 72) is the ʻUmialīloa section of the Mele Kihanuilūlūmoku. The following aliʻi (chiefs) were included in Kihanuilūlūmoku chant: Kihanuilūlūmoku; Līloa; ʻUmialīloa; Kanaloa-Kūkaʻilani; Makakaualiʻi; Iwikauikaua; Lono-o-Keākeālani; Keaweikekahialiʻiokamoku; Keʻeaumoku; Kalanikupuapaʻikalaninui; Kalaniahiʻenaʻena. In this chant these chiefs of high rank are all bound by the ʻAha to stars which are proof of their heritage and thus their infinity.

ʻO Lolohimehanai ke poʻo,	Loloimehanai is "the center." (var.sp) Betelgeuse or Sirius.
ʻO Kupuanuu, ʻo Kupualani,	Kupuanuʻu and Kupualani. (end stars of Makaliʻi)
Ma ka puʻuhonua ʻeleʻele,	On the sanctified heiau or sacred ground.
Kua ʻia ka puka hoaka,	A star crests through the crescent shaped hole
ʻOkiʻia moku ka mole ka paiʻaʻa,	The placenta is cut and severed.
Ia ʻuʻuina kani moʻo-hina,	This resounding gusts of the Milky Way *ʻuʻina = lei
Ka lani malu i Haʻupu,	The clarity of haʻupu. Haʻupu to recall.

This explanation of the chant produces the “Center of the depth where profound ideology emerge”; the center are the stars Betelgeuse and Sirius. This is where all of one’s inspiration materializes. The ‘Aha grants the chief his/her platform. Giving him/her the right to connect to a pu‘uhonua ‘ele‘ele. The function of ‘Aha is reestablishing personal rank. ‘Umi was not born with it. His relationship to the Lani Kapu (star), his pu‘uhonua, and his earth had to be established. Achieving the ‘Aha established ‘Umi's place to rule. The hoaka is ‘Umi's pu‘uhonua ‘ele‘ele. ‘Umi was connected through his father's genealogy. Genealogy is a ‘Aha. Genealogy sets the chief up, establishing who she/he is by virtue of lineage and then the characteristics will be realized. Ha‘upu is the height of attainment. The ko‘ihonua chant proves the method of a chief’s format to transcend from one status to a higher one.

The kahuna kilo hōkū or kahuna nui, because of his intelligence, experience, wisdom and connections, would have chosen the star that was significant to the chief and during the ceremony would bind the chief to his or her star to form a celestial ‘Aha.

Kumuhonua Chant

Kamakau publishes a version of the Kumuhonua a ko‘ihonua (genealogical chant) in the Hawaiian language newspaper. The chant describes a ‘Aha Lanalana ceremony through the construction of a canoe.

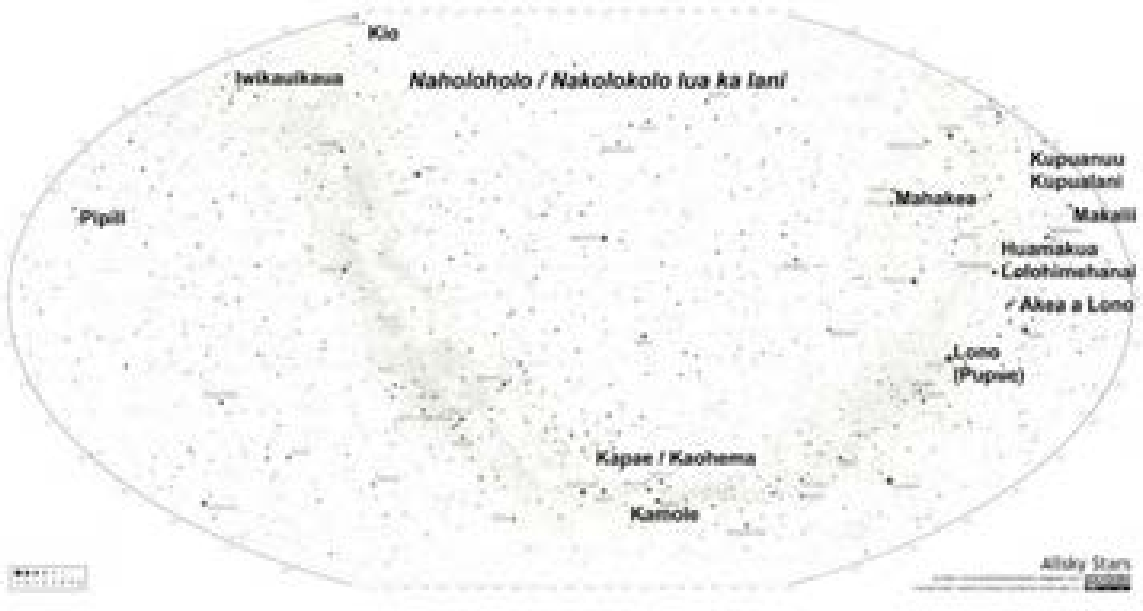


Figure 73: Star map.

The Kumuhonua chant makes references to the Milky Way and other significant celestial bodies (stars and planets). The stars and planets are "strung through" the Milky Way or hover along the edges of the Milky Way. The Milky Way is a celestial ‘Aha, a cord that connects all the significant stars to one another. Not all the traditional Hawaiian names for the stars are known at

this time. Many are identified and recognized through cross-referencing other chants and collected PHL resources. Included above is a star map (figure 73) identifying the stars mentioned in the Kumuhonua chant as translated by Kalei Nu‘uhiwa. The northern arm of the Milky Way sets directly upon the pahu manamana.

An Interesting Theory Using the Procession of Stars to Determine Age

One of the interesting discoveries is the alignment difference between the GPS readings and the star declination readings. The GPS alignments produce different land alignments from the star declination alignments, by as much as 6 degrees for some of the readings. Reading some of Frances Warther's unpublished and published materials produced a possible answer for the difference. Frances Warther was an engineer who had interest in archeoastronomy specifically with the islands of Kaua‘i and the Northwest Hawaiian Islands. He produced drawings and map illustrations based on information he garnered from two old time Kaua‘i fishermen who visited the Northwest Hawaiian Islands often. Warther found alignments between the construction of heiau sites in Hā‘ena and Waimea to important heiau on Ka‘ula, Lehua, Nihoa and Moku Manamana utilizing Pele and sun chants. Combined together, Warther began using the sun as a constant alignment throughout its annual trek to the solstice boundaries and equinox points. Warther hypothesized that a possible function of the manamana is to measure procession with the intention of recalculating calendars and construction of heiau. Stars move one degree ever 71.6 years.

When the PHLt compared the GPS and Declination readings there was an average difference of 5.6 degrees. 71.6 x 5.6 = 401+/-. The current year is 2018 and when subtracting 401 years the year 1617 A.D. appears. The year 1617 A.D. or close to it could possibly the construction date of PMU.

According to the genealogical calculations reported by Dr. Ross Cordy, we can date the site's construction or last recalibration right around ‘Umi’s time’. Dr. Ross Cordy determined ‘Umi’s birth around 1600-1620.

Results

From Kihikū, the pahu manamana and Pilina measures the western hemispheric stars, meaning that the setting of the stars and planets were pertinent to their observations and most likely also pertinent to ‘Aha rituals. From the pānānā at Kihikū, the most important stars were those that rose and set in the north. The boundary that marks the furthest southern edge of the observations was the ecliptic plane. The ecliptic plane is the apparent path of the Sun's motion on the celestial sphere as seen from Earth is called the ecliptic. The sun, moon and planets move on the plane.

The ruling stars that were used to keep track of time, political governance and religious ceremonies pertinent to an ali‘i nui and his/her kāhuna nui’s wellbeing and elevation are located within the northern and ecliptic boundaries. Therefore, the sites orientation face a northwestern alignment to connect to the ruling stars. In my opinion, the concept of acknowledging origins

and where ‘Umi’s ancestors had come from may be a reason that he sought out perfect alignments between a site and the northwest. One of ‘Umi’s ten-year challenges was to prove that he had a genealogical right to connect to Līloa thereby giving him the right to rule and to continue that right through his descendants. He needed to achieve a ‘Aha by establishing his own connection to those ruling stars and to a site that anchored those ruling stars to him and his kahuna.

The orientation of the pahu manamana to the north-northwest sky and its accurate alignment of manamana to the most dominant northern pointers and circumpolar stars is undeniably the main focus of this site. From an ocean migration and traditional navigation perspective, being able to identify and locate Kūmau (Polaris) is crucial in determining your latitude and positioning from the equator in the northern hemisphere. That said, the elevation of which this site was erected at does not replicate the true horizon therefore its use to determine latitude is deceiving as the horizon is several degrees below the pānānā. While this orientation and alignment of northern pointers is phenomenal, its application to navigation as we understand it today may be different which leads to the shape of the sky indicated by the movement of the stars and the particular section of the northern sky setting upon the pahu manamana. In observing these northern pointers and circumpolar stars transitioning throughout the evening the focus of their pivot and rotation is not just Kūmau but Mauna Loa as well. Perhaps the location of the mountain and its alignment north is a major component of this site. On another note, the alignment of northern pointers also brings our attention to the significance of the Milky Way and its northern anchors, such as ‘Iwakeli‘i (Cassiopeia). The Milky Way, also called Ka ‘Aha, houses the majority of the most relied upon and referenced stars in our sky. Similar sites of ‘Umi’s such as those on Moku Manamana also make connections to or alignments with the Milky Way.

PHL observed the star settings with some thought as to the extension of the alignments. The question of why, where and what was there within the setting stars. Synchronizing the compass direction from the pānānā to the manamana and out beyond Mauna Loa was not a simple task. The revelation beyond the stars transversely reached to the islands laying north/north/west in correlation from the stars to the pahu manamana to the pānānā. The following PowerPoint reveals their discovery.

Kalā Mossman initially utilized this technique while coordinating the mapping project.

Pahu Manamana Alignments with PowerPoint

The PHLt used the star declination to make alignments from the manamana on PMU and to expand the alignment out towards the northwestern to achieve the locations where the alignments will intersect. Using a slide rule, rhumb lines were established to find the intersections. The rhumb line was executed based on the manamana and stars. An initial bearing was achieved because in the field research the initial bearing is taken from the setting stars that are aligned with the manamana. The declination of the star is recorded and from there the team proceeded along the same bearing in a straight line. Each bearing was taken from the manamana, along the star or planet's declination, and moved along without changing the direction as measurement was relative to true north. The PHLt star bearing differs from the GPS bearing.

Steps Toward Maintaining Alignment

- each manamana was given a #number and color
- compass reading was verified and affirmed
- declination of star was decided
- star was recorded
- islands intercepted were documented
- location verified
- nearby stars were listed

Accounting of Slides

Slide 1. Title

Slide 2. Correlation of numbers with colors: #1, red and dash; #2, yellow; #3, green; #4, bright blue; #5, blue; #6, dark blue; #7, purple; #8, violet.

Slide 3. Chart listing: 1) matching color and manamana; 2) compass co-ordinate; 3) declination bearing; 4) stars involved; 5) mokupuni (island) alignment 6) wahi pana (sacred places) in this case craters; 7) nearby stars listed of identification.

Slide 4. Overview of alignment from pānānā to manamana to North, North/West.

Slide 5. A close view of the extension of pahu manamana to Moku Manamana.

Slide 6. #2, Nihoa and aligned with northeast height of the island.

Slide 7. Nihoa, the alignment touch the northeast tip of the island, this is the north and south view of the island, Nihoa is a crater.

Slide 8. #2, between Kauaʻi and Niʻihau; #3 clips Kauaʻi's north shore.

Slide 9. #2 channel of Kaʻulakahi is between Kauaʻi and Niʻihau; #3 Pākalā Point is close to Kīlauea crater; #4, Oʻahu this alignment includes Kūkaniloko Heiau in Wahiawa.

Slide 10. #4, Oʻahu; Leahi (Diamond Head), Aliʻapaʻakai, both craters.

Slide 11. #6, Molokaʻi; alignment Moʻomomi – a sandy beach on the northwest, Mauna Loa – old west side mountain, ʻUmipaʻa – an inland fishpond, probably an old crater. #7, Kalaemau – a crater at Kalaupapa, #8, Keanapuka - a cave in Halawa, Kalaekapu – a sacred point at Halawa. #6, Lānaʻi; Lānaʻihale – a crater, Puʻu Aliʻi – near the crater, Pōhakuloa point.

Slide 12. #7, Kahoʻolawe; Lae Kuikui – northwest point of island, Kapalikapuokamohoaliʻi – crater, Halona – northeast point of island. #8, Molokini. #8, Maui; Kaʻanapali, Ukumehame.

Slide 13. #8, Hawai‘i; Makalawe – seashore alkaline ponds, Pu‘u Ka‘ili, Kulua point – at Kiholo Bay.

Slide 14. #6, Hawai‘i, Kona; Kamakahonu, #5, Kahalu‘u – cluster of heiau. #4, Haleki‘i – land section, Kailua. #3, Kealakekua – heiau. #2, Ho‘okena.

Slide 15. Piko of Pahu Manamana o ‘Umi from pānānā to manamana to the North, North/West.

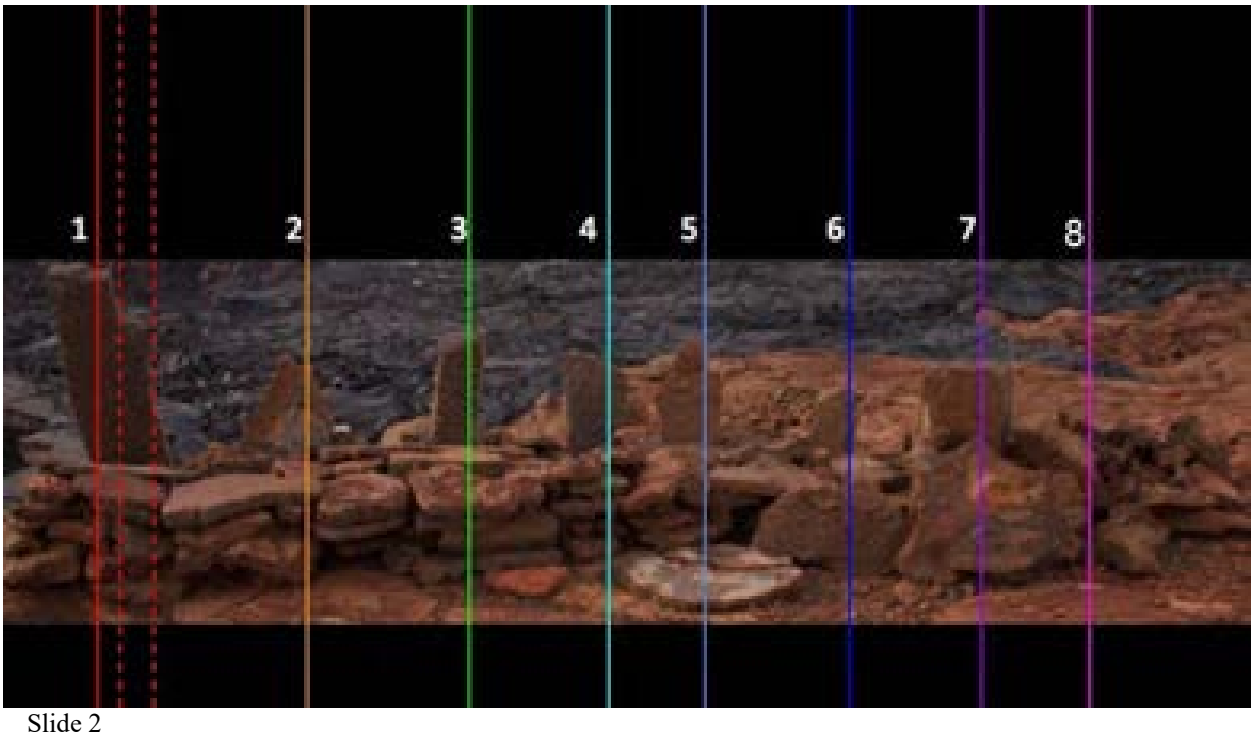
Pahu Manamana Alignments

Papahulilani

Kalei Nu'uhiwa & Pualani Lincoln Maielua

Hinaia'ele'ele 2018

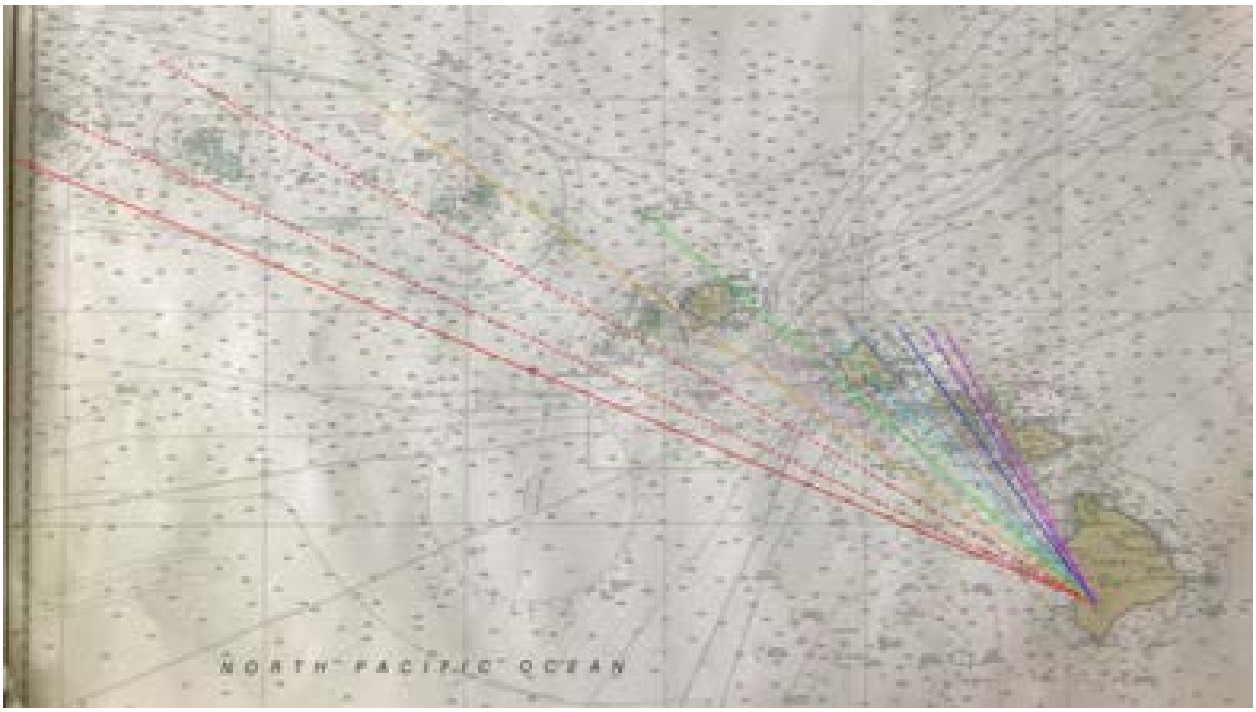
Slide 1



Slide 2

Mana Mana #	Compass	Declination	Stars	Mokupuni	Wahi	Nearby Stars
	292	22N				19N: Hokulea
	295			French Frigate Shoals		23: Hamai
	300			Manamana (N)	Manamana (N)	24N: Makali'i
#2	305	35N		Nihoa (N)	Kaulakahi, Nihoa (N)	
#3	311	41N		Kaulakahi Ch	Kilauea	39N: Kaoea
#4	315	45N	45N: Konamaukuku	Kaua'i	Leahi, Mokuleiau/Waialua	46N: Wainaku
#5	320	50N	50N: Mirfak	O'ahu	Makapu'u, Ulupa'u/Mōkapu, Kalaeuila	49N: Hikupau, 51N Elnath
#6	325	55N		Kaho'olawe, Lāna'i, Moloka'i		56N: Hikulima, Iwakeli'i (Schedar)
#7	329	59N		Kaho'olawe, Moloka'i		
	332	62N	62N: Hikukahi	Maui, Moloka'i		

Slide 3



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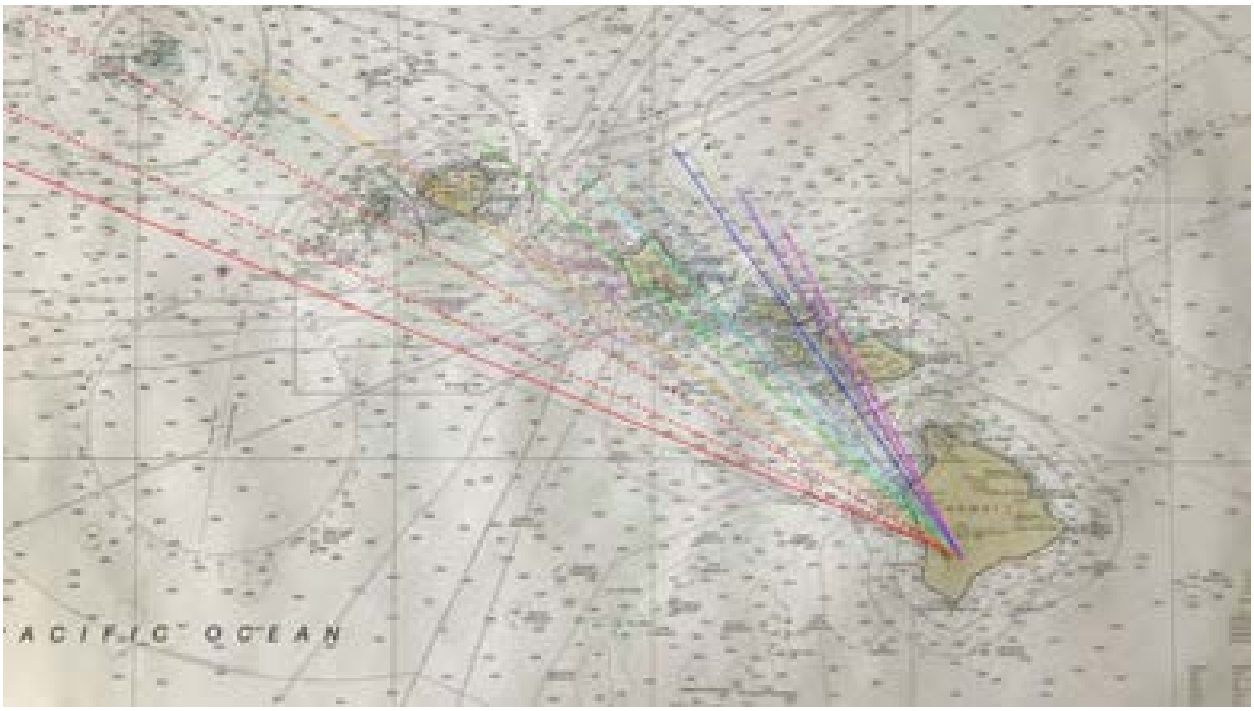

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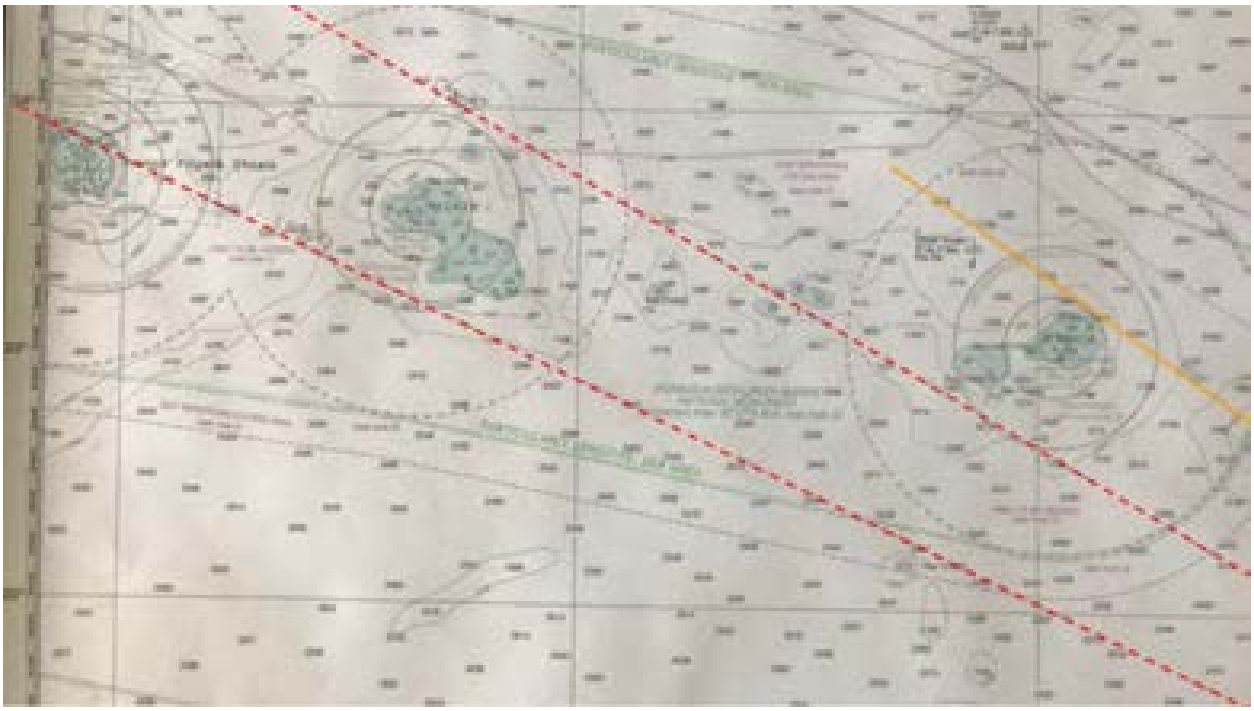

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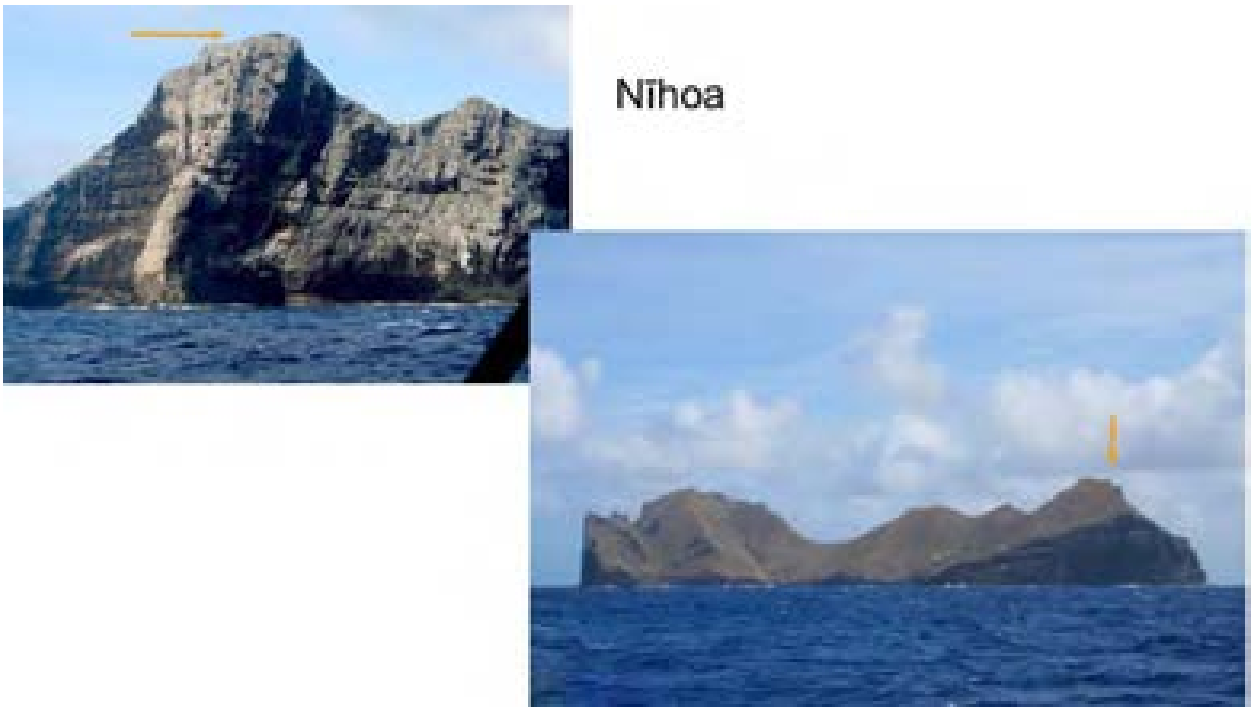

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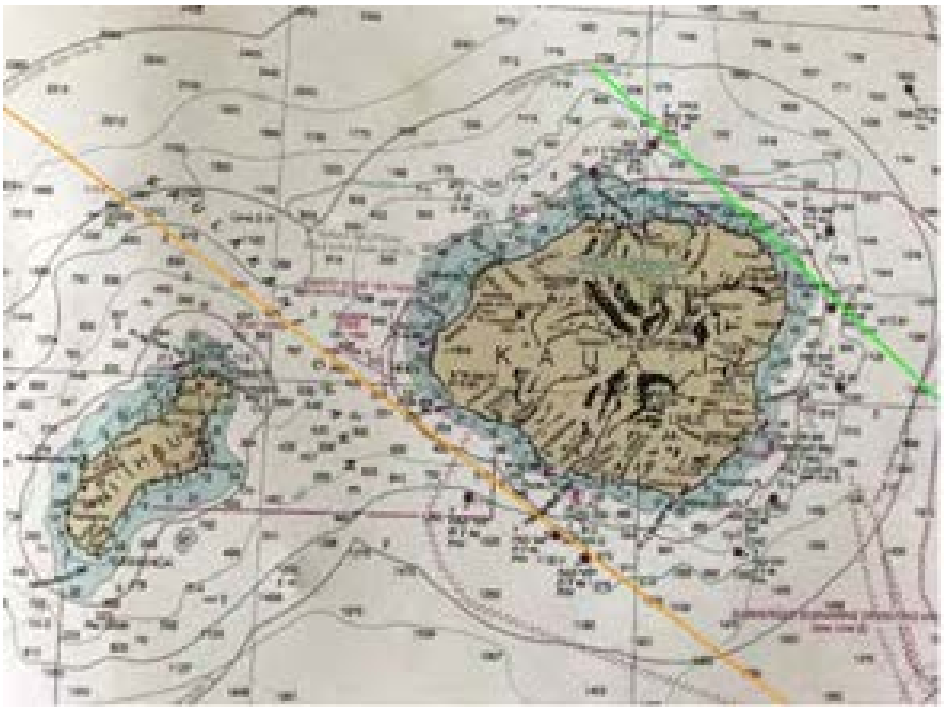

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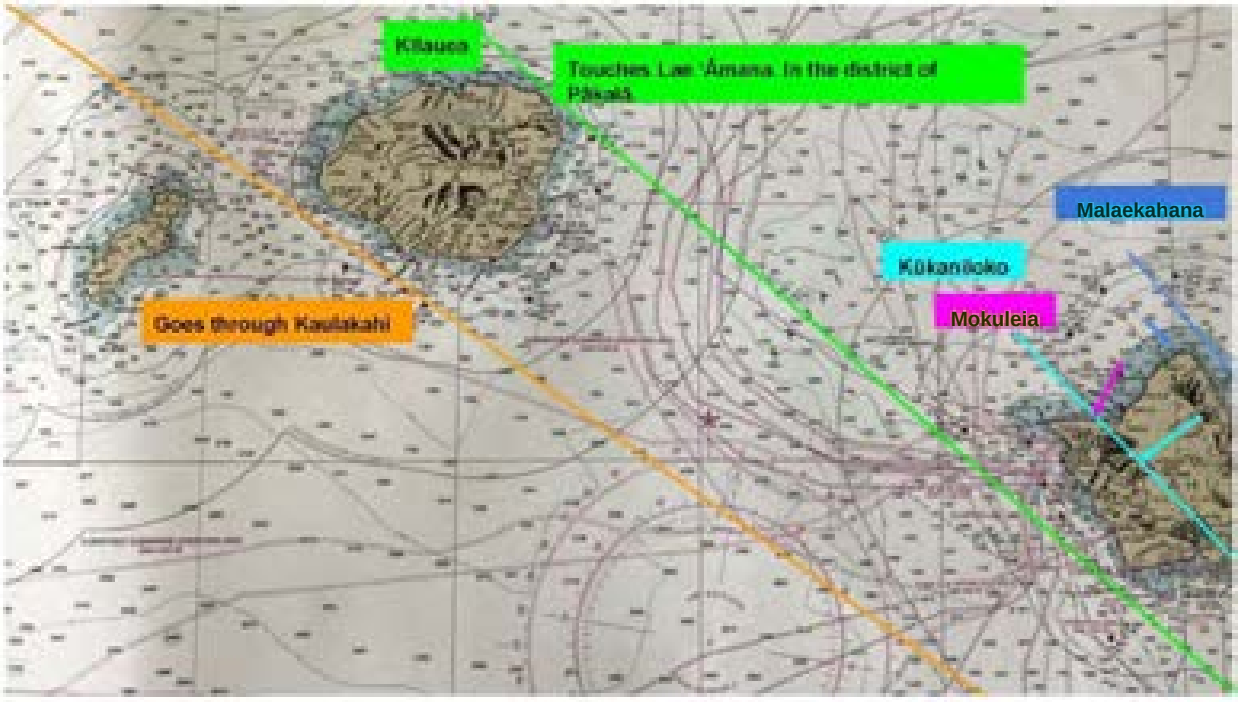

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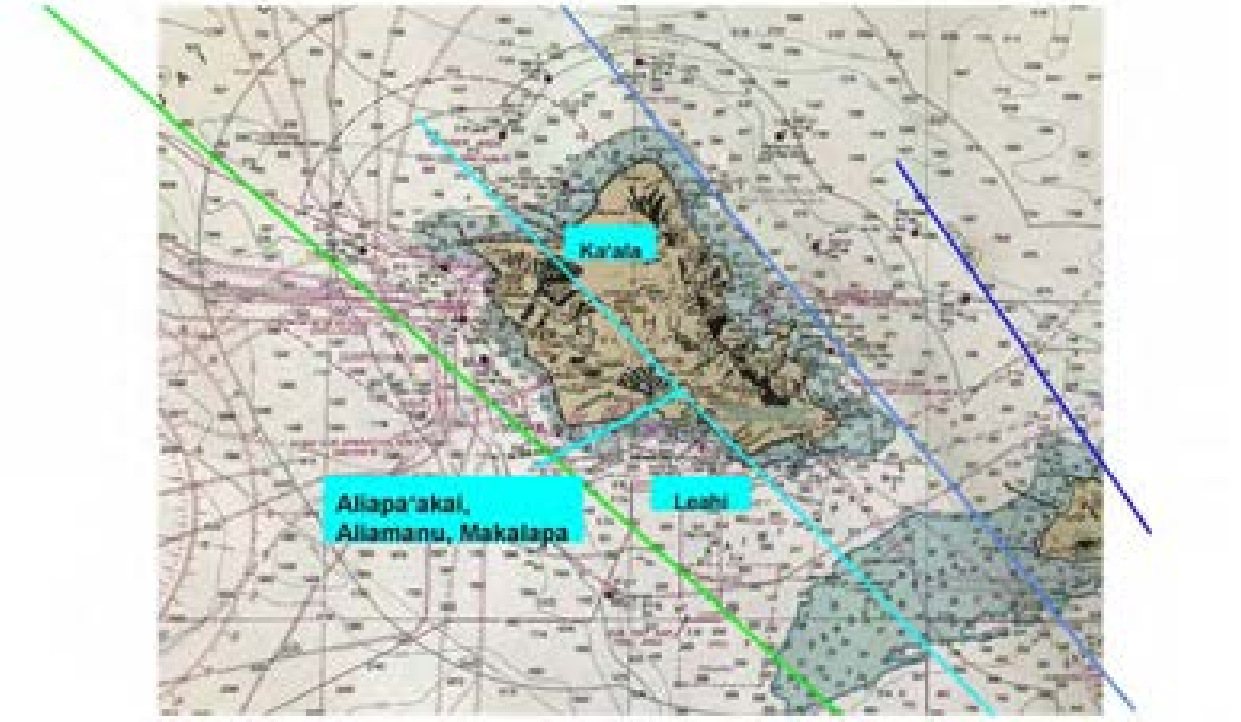

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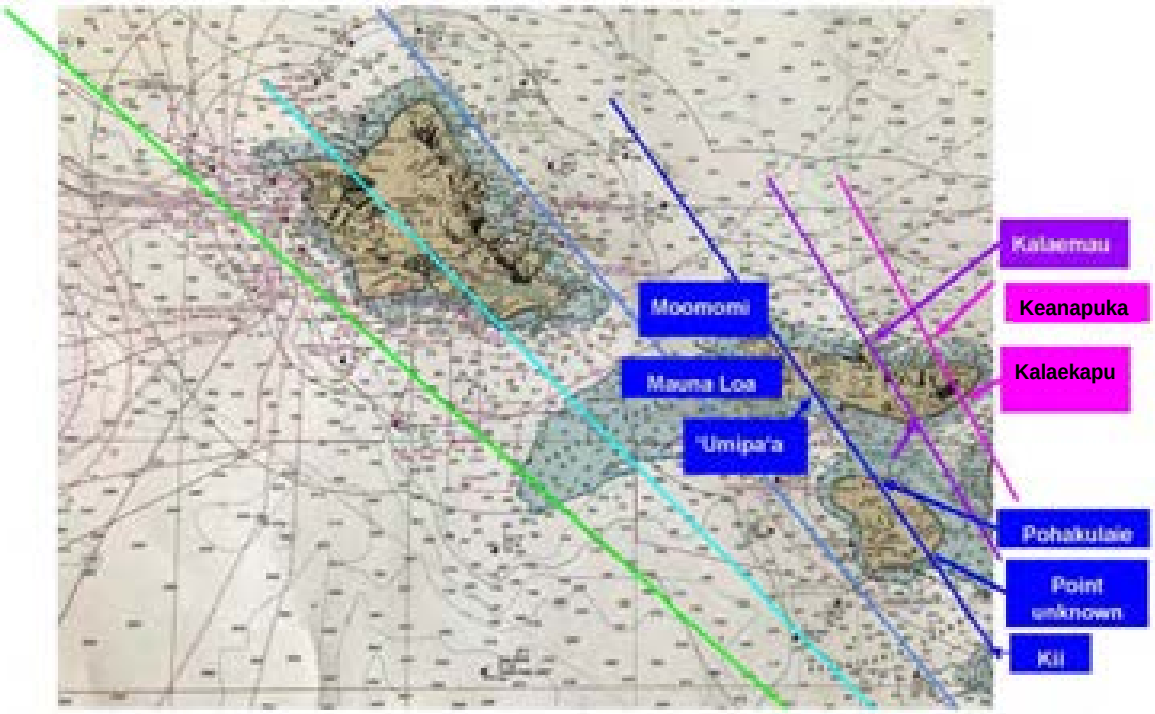

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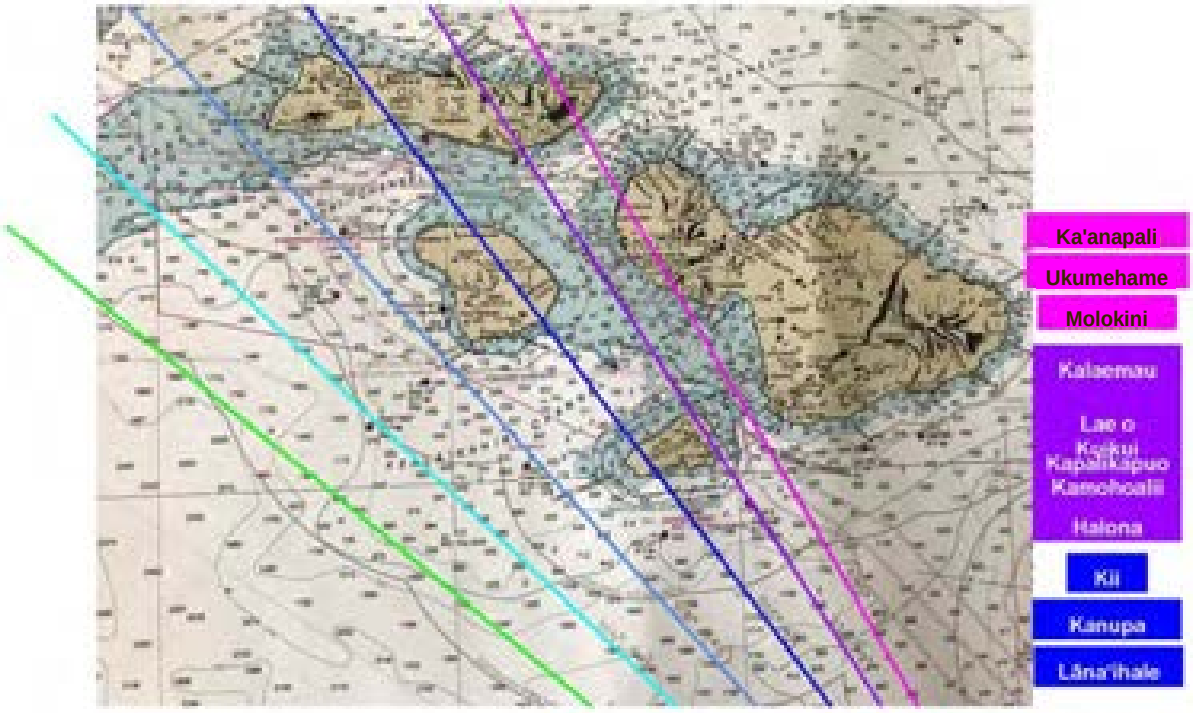

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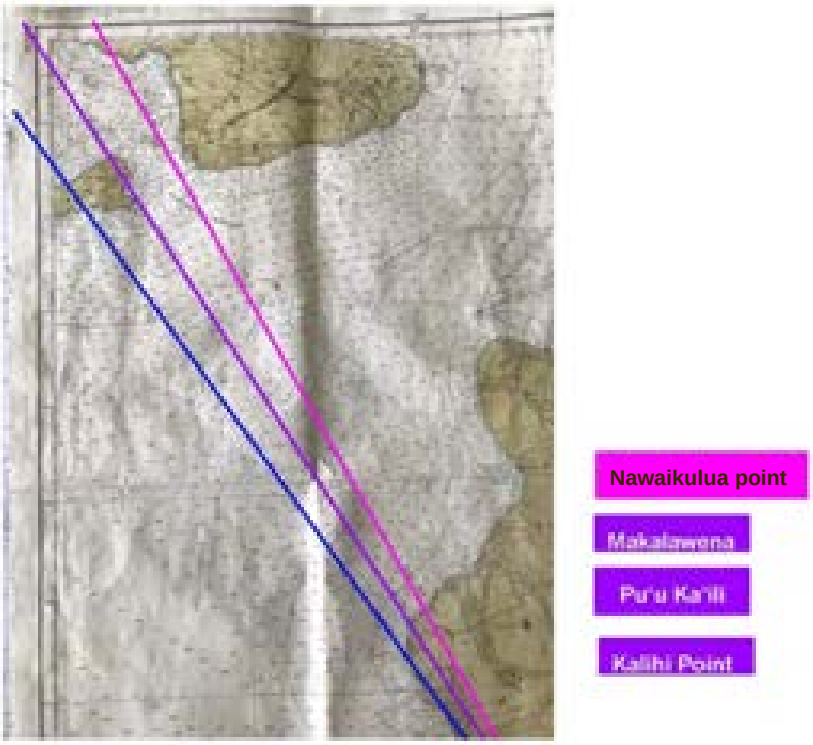

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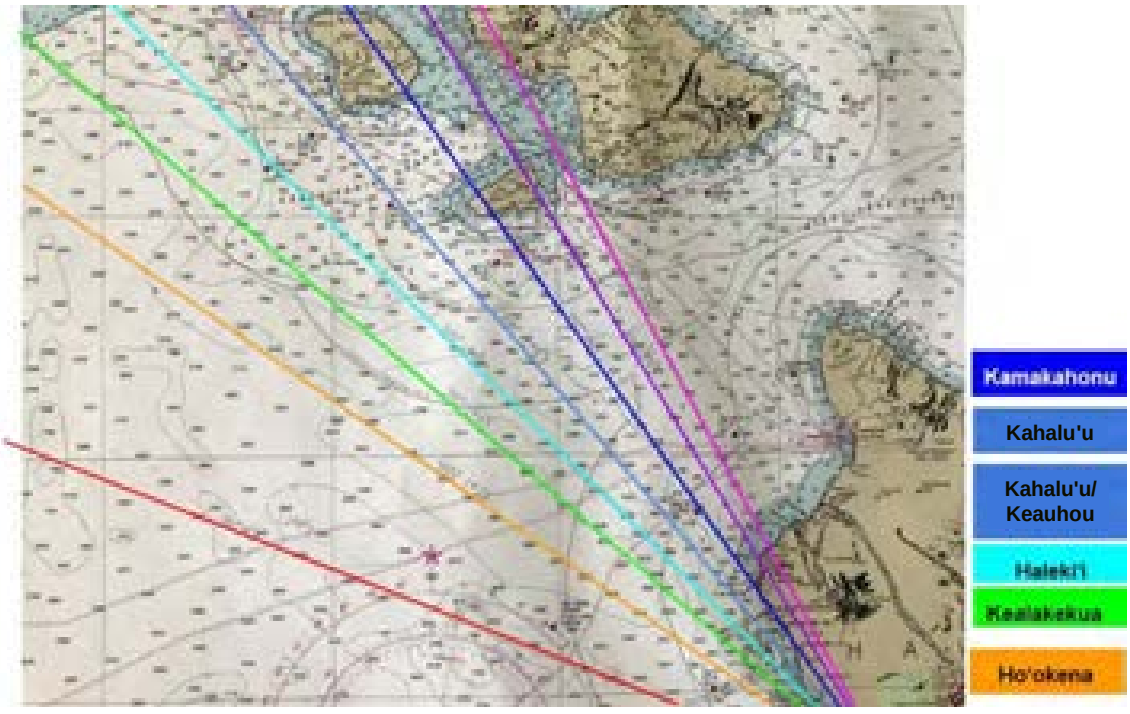

Slide 14

Results and Conclusion

Results

The Pahu Manamana o ‘Umi (PMU) produced very important information. The material PMU unlocked clarified and expanded the written history especially that of ‘Umi whether in narrative or chant forms. The PMU on the slope of Mauna Loa is indeed ‘Umi’s creation with the help of his kāhuna, warriors, very close friends and volume of followers.

Papahānaumoku Team (PHMt)

As was articulated earlier, PHMt laid the ground work for this report because this man-made structure requires progressive ingenuity through the philosophical lens of PHM.

Initially there is a thought to pursue an inclination, followed with talks, then, years of planning, followed by warfare to possess status, initiate training of people to construct the pahu manamana, finally choosing and trusting people to build it and acquiring the experts who possess generational knowledge of aligning manamana with stars and with islands. The islands will include craters, multiple heiau and other wahi pana (sacred places). PMU was produced through a basic collaboration of process and planning.

PMU was designed as a map for ‘Umi’s assurance that there were volcanic islands that laid a path to the physical, active volcano he stood on, Mauna Loa. This map, although not tangible, was a credit to ‘Umi’s mental and spiritual abilities to trust his kūpuna and kāhuna. This process produced the information for ‘Aha ceremony of connecting to pu‘uhonua and to stars, thus providing the acquisition of knowledge ‘Umi passed on to his progeny.

The maps of figures 54 and 55, were created by the GPS connecting ‘Upolu Point to Ahu a ‘Umi on to PMU and finally to Kalae (South Point), is a facsimile of the chant of PHH entitled “He lua i ka hikina” or “A hotspot in the east”. This chant follows the movement of lava from Ni‘ihau moving east eventually to Hualālai. Ahu a ‘Umi is between two active mountains of Hualālai and Mauna Loa. The hypothesis of figure 55 conjures ‘Umi’s intent to maintain an active association to Pelehonuamea for the continuation of magma’s activity. The alignment of PMU has touched upon other hotspots throughout the Hawaiian Archipelago therefore this is a continued configuration of one of the intents of PMU and ‘Umi.

PHMt produced a tangible form of ‘Umi’s map laying out the extensions from the manamana to the north, northwest islands, marking wahi pana, craters and high points. This map was created for today’s enthusiast of Hawaiian cultural pathways and knowledge. This map is a convincing opportunity that the Hawaiian archipelago movement was monitored.

Papahulihonua

PHH provided the confirm location on Mauna Loa while being aware of post volcanic islands. The kuahea of the wao was the chosen location for the site. The kuahea is part of the mountain slope and located above the rainforest. This allows PMU to have the viewing plane of 360 degrees a necessity for this instrument. The kuahea is also the zone of elemental forces or the gods.

Tracking active volcanoes as well as inactive volcanoes was a means of accounting for islands and their places as the hot spot moved east. Unlike the maps produced by PHLt and PHMt, PHH recalls information through chants such as, “He lua i ka hikina” or “A hot spot is in the east”. This chant informs that magma and lava continued to travel eastward.

The Kuhikuhipu‘uone kahuna possessed extraordinary knowledge of deep earth as well as surface stratification therefore his directions of where, with what and how to build was followed meticulously. A substantial list of pōhaku nomenclature from different islands and its uses are included in PHH report. Also included in this list of pōhaku are tools utilized for farming, fishing and warfare. Pōhaku were obviously used as building material for sacred places.

The task of supplying substantial amounts of rock or building material for pāpa‘i and considering the number of participants in this project, was a small task, because the kuahea possessed all the materials needed for building. However, the decision for the manamana materials and shaping them were daunting in the minds of the construction workers and the leaders. The shapes and forms of manamana seems to follow a systemic model as observed on Moku Manamana and Tahiti. Therefore, the forms and shapes appears to be prescribed.

PHH concludes with two thoughts: 1) because ‘Umi acquired so much volcanic information this was his way of aligning himself with Pelehonuamea, she being the elemental land maker; 2) the proof of the extended manamana to the north, northwest with the maps of PHMt and PHLt, it was conceived by PHH that this was a way for ‘Umi to tie himself to significant wahi pana across the archipelago. This point reiterates the ‘Aha connections to pu‘uhonua ‘ele‘ele, sacred land and stars.

Papahulilani Team (PHLt)

PMU was constructed with the expertise of Kilohōkū and Kilokilo. The two positions were the reason for the existence of PHL. The Kilohōkū was the astronomer, associated with the star as his title foretells. Hōkū is star. Kilo translates as star gazer, reader of omen and seer. Both Kilohōkū and Kilokilo were prognosticators. They directed the positioning of the manamana to suit the needs of ‘Umi. The position of the manamana today, as seen, was through the reckoning of these experts.

Both present day PHLt members were fully engaged in the task of recovering the information which sat silent on all the manamana for five centuries.

PHLt articulated a position for star placements in the sky. This arrangement followed the heiau practice known as Kauila. Kauila is an archaic formula which allows a basic format of star gazing for today without losing the sight of star positions. PMU has reactivated the Kauila justification of star setting.

PHLt recorded their finds of the 2017 winter solstice. The back of the pahu manamana is towards the north, northwest and all the northern constellations and stars were setting on the pahu manamana. It was exciting because the northern stars were rising from Mauna Loa or north, northeast and setting north, northwest. The lesson of this pahu manamana was that it only

focused on the north stars. The next step was to extend the pānānā position to each of the manamana and pushed out to the north, northwest. This was in search of islands as possible star anchors.

An intangible map resulted from the PHLt. This map was similar to the PHMt except there was a few degrees difference and this map involved stars aligned with land. PHLt learned that stars change their position every 71.6 years thus calculations followed in search of the year the PMU was built. Their math figures the year it was constructed was approximately 1617 A.D. give or take a few years.

This PMU provided the information that all pahu manamana were constructed to focus on one spatial section. The single manamana aligned at Kihikū noted the rising of important constellations such as Wākea (Orion) and planets while Pilina tracks the setting. Thus, focusing on the rising and setting of stars and planets while on ecliptic orbit. This was another lesson learned through the existence of PMU.

PMU is not concerned with the southern sky. This is a strong indication that they are tracking the movement of the Hawaiian archipelago.

Pahu Manamana o ‘Umi, New Information Gathered

1. Pahu Manamana o ‘Umi (PMU) is the nomenclature assigned to the ‘Umi site in Kahuku.
2. PMU has a pahu manamana which sits on a paepae with 7 manamana and possibly 8, the manamana stands side to side which dictates that it is an instrument with one purpose.
3. PMU has a singular manamana titled Wākea because it is aligned with Orion which is Wākea .
4. PMU has a structure of single manamana of two, possibly three more, this structure is titled Kihikū because each manamana functions individually and stand back to front.
5. Kihikū measures the rising equinox stars and constellations.
6. Three stacks of rocks of old lava surrounded by the new flow, titled Pilina.
7. Pilina measures the ecliptic and setting of the planets.
8. The pahu manamana has a pānānā to the southwest of it, this is the compass for each manamana on the pahu manamana and possibly for Wākea, Kihikū and Pilina.
9. Mauna Loa sits in a juxtaposition with the pahu manamana when considering the north stars.
10. Mauna Loa is the position of the rising north stars and the pahu manamana is their setting.
11. Mauna Loa is the active volcano and the pahu manamana represents the inactive volcanoes on which the setting stars align.

12. These constellations set on the pahu manamana: Cassiopeia, Capella, Kochab, Pherkad, Merphak, Cepheus, Ursa Major, Draco, Navigator Triangle, Cygnus, Andromeda, Perseus and Auriga.
13. According to the mapping process of PHMt these are the correlations of pānānā compass degrees to manamana # to north, northwest islands: #1, 292 degrees to Papaʻāpoho; #2, 305 degrees to Kānemilohaʻi, Kauo, and Pihemanu; #3, 311 degrees to Moku Manamana, and Kaʻula; #4, 315 degrees to Nihoa and Niʻihau; #5, 320 degrees to Kauaʻi; #6, 325 degrees to Kauaʻi and Oʻahu; #7, 329 degrees to Oʻahu; #8, 332 degrees to Molokaʻi, Lānaʻi and Kahoʻolawe.
14. According to the mapping process of PHLt, manamana #1 has three readings which will be listed as #1a, #1b and #1c all these are the correlations of pānānā compass degrees to manamana # to north, northwest islands, in alignment with the setting star (ss), a wahi pana (wp) and a near star (ns): #1a, 292 degrees, Hōkūleʻa (ns); #1b, 295 degrees to French Frigate Shoals, Hamal (ns); #1c, 300 degrees to Moku Manamana, Manamana (wp), Makaliʻi (ns); #2, 305 degrees to Nihoa, Kaʻulakahi and Nihoa (wp); #3, 311 degrees to Kaʻulakahi Channel, Keoea (ns); #4, 315 degrees to Kauaʻi, Konamaukuku (ss), Leahi, Mokuleiau and Waialua (wp), Wainaku (ns); #5, 320 degrees to Oʻahu, Mirfak (ss), Makapuʻu, Ulupaʻu, Mōkapu and Kalaeʻula (wp), Hikupau and Eltanin (ns); #6, 325 degrees to Kahoʻolawe, Lānaʻi and Molokaʻi, Moʻomomi Mauna Loa and Lānaʻihale (wp), Hikulima and Iwakeliʻi (ns); #7, 329 degrees to Kahoʻolawe and Molokaʻi, Kapalikapuokamohoaliʻi and Kalaemau (wp); #8, 332 degrees to Maui,Molokini and Molokaʻi.
15. The hypothesis of the selection of PMU site: 1) Kuahea is the land section chosen and is above the rainforest; 2) Kuahea provided the 360 degrees sight plane; 3) Kuahea is in the zone of elemental gods; 4) This site was on the west side of the Mauna Loa ridge, 5) the site was aligned with collapsed lava tubes, 6) There is a clear view of the top of Mauna Loa, 7) The site aligned with Ahu a ʻUmi which was probably the mountain home when ʻUmi needed to attend other mountain sites, 8) the PMU site was probably a satellite of Ahu a ʻUmi as were all other ʻUmi sites on the mountains.
16. PMU is an intangible map used to keep track of islands and position of stars.
17. PMU is strictly a stellar site.
18. According to Kalei Nuʻuhiwa and Francis Warther the PMU site can be dated, the first date calculated is 1617 give or take a few years.
19. Mapping was not an archaic practice, as we know it, until the movement from the manamana to the islands happened. This is archaic mapping through a very sophisticated and intelligent method. Pānānā, manamana, stars anchored to islands was the methodology used for generations and the information was passed on for generations.

Conclusion

The Papakū Makawalu methodology was used to reveal each element of PMU. The fact that there was no information associated with this site and absolutely nothing written on manamana was a difficult task.

PHMt were aware of four or five plants and even less fauna on site. Not worthy of a report. However, this site was a manmade site and that was worth writing about especially when the aliʻi involved was ʻUmialīloa whose history is substantial. This was an avenue which could be utilized. There are three other sites and a large amount of pāpaʻi all made and used by man. PHMt updated the information of PMU by mapping the site. Mapping as we know it is not an archaic practice, their mapping was temporary and intangible. Finding the correlation and relationship of the sites through mapping construes measurements therefore the eventual extension of these to the north, northwest, which was the focus of the primary instrument of the site, lead to one of the archaic mapping process that was unfamiliar to today's practice. With these elements PHMt marshalled a solid foundation.

PHH was established with the volcanic environment and the manmade site of stones. The manmade connection needed was the Kuhikuhipuʻuone, who was the architect and had great knowledge of the earth's makeup. It was the fortitude of the Kuhikuhipuʻuone to design the site and material used for construction. The "puʻuone" portion in the nomenclature above describes his role of sketching structures in the sand. I imagine the sand was also used to sketch maps, making the picture temporary. PHH was also impressed with the line of collapse lava tubes and perceived this as a connection to the building site and the association with land movement and Pelehonuamea.

PHLt was initially disappointed in the site. However, because manamana only functions with the night sky determined the need to return in the evening. Star movement, interception of stars and manamana was the arena for PHLt to begin the interpretation of Kilohōkū and relationship of sky to earth.

The site itself had the information needed for the report. We did use some chants and narratives to determine ʻUmi's lifestyle and objectives which were important to him and his environment as a ruler. The difficulty concerning ʻUmi was his need to update the old system. ʻUmi felt a need to change the kapu, ceremonies and protocol to fit his present time. The obsession with manamana, stellar and solar sites, placements of islands and volcanic movements were essential knowledge needed for preservation of not only his environment but his universe.

ʻUmi surrounded himself with intelligent people, good friends and stayed in touch with family.

The Papakū Makawalu team learned a lot from this report. There is more that can be learned and it will eventually manifest itself. Thank you for the exposure to Pahu Manamana o ʻUmi. It was an honor to unfold the past.

Glossary

Pūkuʻi-Elbert Hawaiian Dictionary

ahu. nvs. Heap, pile, collection, mound, mass; altar, shrine, cairn; a traplike stone enclosure made by fishermen for fish to enter; laid, as the earth oven.

ahupuaʻa. n. Land division usually extending from the uplands to the sea, so called because the boundary was marked by a heap (ahu) of stones surmounted by an image of a pig (puaʻa), or because a pig or other tribute was laid on the altar as tax to the chief. The landlord or owner of an ahupuaʻa might be a konohiki.

akua. vs. God, goddess, spirit.

aliʻi. nvs. Chief, chiefess, officer, ruler, monarch, peer, headman, noble, aristocrat, king, queen, commander; royal, regal, aristocratic, kingly; to rule or act as a chief, govern, reign; to become a chief.

aliʻi wahine. n. Chiefess, queen.

hamo. vt. Anointed, smeared; to anoint, stain, rub, as with oil; to besmear, plaster, stroke gently, pet, fondle, caress; to struggle, as a drowning man; to put on, as gloves; to spread, as butter; to plane smooth.

heiau. n. Pre-Christian place of worship, shrine; some heiau were elaborately constructed stone platforms, others simple earth terraces. Many are preserved today.

hue wai. n. Gourd water container, water bottle.

ʻaha. n. A prayer or service whose efficacy depended on recitation under taboo and without interruption. The priest was said to carry a cord (ʻaha).

ʻaʻā. nvs. ʻAʻā lava; stony, abounding with ʻaʻa lava.

ʻaʻaliʻi. n. Native hardwood shrubs or trees (Dodonaea, all species), 30 cm to 10 m high, more or less sticky at branch tips; leaves narrow, 2 to 10 cm long; flowers small; fruit a yellow, red, or brown papery capsule about 1 cm long and with two to four wings. Fruit clusters are made into leis with their own leaves or ferns and worn in the hair.

ʻalā. n. Dense waterworn volcanic stone, as used for poi pounders, adzes, hula stones; hard lava, basalt.

ʻōhelo. n. A small native shrub (Vaccinium reticulatum), in the cranberry family; it has many branches with many small, rounded, toothed leaves, and bears round, red or yellow berries, which are edible raw or cooked for sauce. Formerly sacred to Pele, to whom offerings were made by throwing fruiting branches into the fiery pit at Kī-lau-ea. Wind-dried leaves are still used for tea.

iwi. n. Bone; carcass (as of a chicken); core (as of a speech). The bones of the dead, considered the most cherished possession, were hidden, and hence there are many figurative expressions with iwi meaning life, old age.

kahakai. n. Beach, seashore, seacoast, seaside strand.

kahuna. nvi. Priest, sorcerer, magician, wizard, minister, expert in any profession (whether male or female); in the 1845 laws doctors, surgeons, and dentists were called kahuna.

kākāʻōlelo. nv. Orator, person skilled in use of language; counselor, adviser; storyteller; oratory; to orate. Lit., to fence [with] words.

kālai waʻa (kahuna kālai waʻa). Canoe builder.

kalamoho. n. Cliffbrake (Pellaea ternifolia), a short, slender fern, the fronds with short, paired, narrow divisions. It grows in dry, sunny places, as at Kī-lau-ea Volcano. Also kalamoho lau liʻi.

kanaka. nvs. Human being, man, person, individual, party, mankind, population; subject, as of a chief; laborer, servant, helper; attendant or retainer in a family (often a term of affection or pride); human sacrifice; physique; human, manly, pregnant, inhabited; Hawaiian; private individual or party, as distinguished from the government.

kapu. nvs. Taboo, prohibition; special privilege or exemption from ordinary taboo; sacredness; prohibited, forbidden; sacred, holy, consecrated; no trespassing, keep out.

kāula. n. Prophet, seer, magician.

kilo hōkū. nv. Astrologer, astronomer, astronomy; to observe and study the stars.

kilokilo (kahuna kilokilo). Priest or expert who observed the skies for omens.

kīpuka. n. Variation or change of form (puka, hole), as a calm place in a high sea, deep place in a shoal, opening in a forest, openings in cloud formations, and especially a clear place or oasis within a lava bed where there may be vegetation.

kuahea. nvt. Mountain area where trees are stunted as due to altitude.

kuamauna. n. Mountaintop.

Kuhikuhipuʻuone. Seer, soothsayer, necromancer, especially a class of priests who advised concerning building and locating of temples, homes, fish ponds, hence a professional architect. Lit., point out the sand dunes.

kuʻi pōhaku. vt. To pound, punch, strike, box, hit, hammer; to beat out, as metals; to churn, as butter; to boom or clap, as thunder; to smite, injure; to jar; to prod, as ʻopihi shells from rocks with a knife, formerly with sharp stones; to clash (as sound).

kūkini. nvi. Runner, swift messenger, as employed by old chiefs, with a premium on their speed; to run swiftly, as of a messenger; to race.

kupuna. n. Grandparent, ancestor, relative or close friend of the grandparent's generation, grandaunt, granduncle.

luahoana. n. Halo or rainbow around sun or moon. Lit., polished pit.

luakini. nvi. Temple, church, cathedral, tabernacle; large heiau where ruling chiefs prayed and human sacrifices were offered; to perform temple work.

maʻukele. n. Rain-forest area.

mana. nvs. Supernatural or divine power, mana, miraculous power; a powerful nation, authority; to give mana to, to make powerful; to have mana, power, authority; authorization, privilege; miraculous, divinely powerful, spiritual; possessed of mana, power.

manamana. appendages, claws, branches, rays, forks; to branch out.

mele. nvt. Song, anthem, or chant of any kind; poem, poetry; to sing, chant.

mokupuni. n. Island.

pae ʻāina. n. Group of islands, archipelago.

paepae. nvt. A support, prop, stool, pavement, house platform; plate of a house on which the rafters rest; block to keep an outrigger float off the ground; log or wooden horse that supports a seesaw; to support, hold up, sustain; rows.

pāhoehoe. nvt. Smooth, unbroken type of lava, contrasting with ʻaʻā; to turn into pāhoehoe lava.

pahu manamana. n. Intersection, crossroads. Lit., branching stake.

pānānā. nvi. Compass; pilot.

pāpaʻi. Small temporary hut or shelter.

paukū. nvs. Section, link, piece; stanza, verse, as in the Bible; canto; article, as of law; paragraph; to section off, cut in sections, slice in sections; to make a lei with sections of different colors, as feathers, or roses and begonias; land section smaller than a moʻo; a unit of measurement; a squad (military; see mokuna); jointed, linked. E paukū ana nō ka hala me ka lehua, pandanus and lehua sections being made into a lei.

pele. nvs. Lava flow, volcano, eruption; volcanic (named for the volcano goddess, Pele).

piko. Summit or top of a hill or mountain; crest; crown of the head; crown of the hat made on a frame (pāpale pahu); tip of the ear; end of a rope; border of a land; center, as of a fishpond wall or kōnane board; place where a stem is attached to the leaf, as of taro.

pili. n. Association, relationship, union, connection, meeting, joining, adhering, fitting.

pōhaku. nvs. Rock, stone, mineral, tablet.

puʻu. n. Any kind of a protuberance from a pimple (puʻu 2) to a hill: hill, peak, cone, hump, mound, bulge, heap, pile, portion, bulk, mass, quantity, clot, bunch, knob; heaped, piled, lumped, bulging; pregnant; to pucker. Fig., obstacle, burden, problem, discomfort, trouble, sorrow.

pūkiawe. Native shrubs and small trees (Styphelia [Cyathodes], all species and varieties), common near Kī-lau-ea Volcano, bearing narrow leaves 1.3 cm long, tiny whitish flowers, and many round red to white fruits .6 cm in diameter. The leaves were used medicinally for cold or headache.

uhauhumu. vt. To sew together, as sails; to lay together, as stones in a wall; to interlock. Rare.

wahi pana. n. Legendary place.

wao akua. n. A distant mountain region, believed inhabited only by spirits (akua); wilderness, desert.

wao kanaka. n. An inland region where people may live or occasionally frequent, usually considered below the wao akua.

wao lipo. n. Inland region said by Kamakau to be between the wao‘eiwa and the wao nahele. Lit., dark wao.

wao nahele. n. Inland forest region, jungle, desert.

wao. n. A general term for inland region usually forested but not precipitous and often uninhabited.

wao‘eiwa. n. An inland region.

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Appendices

Appendix A- Chants

Aloha Ko Kāua Hoa O Ke Ala Kai

Aloha ko kāua hoa o ke ala kai,
E hiki aku ai kāua i Lanikū, i Lanimoe,
I Laupala, i Nihoa, i ka Moku Manamana,
I Hanakaʻieʻie i ka moku o Kamohoaliʻi,
Ke ʻā wale maila nō ke ahi a ka Pele,
I loko o ʻai mūmū, o ʻai wawā,
I kaialalua, i kaiamikimiki, i kai hōʻae,
I luna o Manawaʻikiʻoʻo, a noho e ke hoa,
E ʻimi aʻe ana au i ko kāua hoa he wahine, o hele—ē.

> Regarding our companion of the ocean pathway
> We should arrive at the horizon
> At the isles of Laupala, Nihoa, Moku Manamana
> At Hanakaʻieʻie the island of Kamohoaliʻi
> Islands developed by the fire of Pele
> Space consumed softly, noisily
> The sea increases, an energetic sea, rising sea
> Upon the undeveloped island occupied by the companion
> I am going in search of our companion, a female, I go

Ka Hōkū o ka Pakipika, Maraki 20, 1862

Kū Mākou E Hele Me Kuʻu Mau Pōkiʻi Aloha

Kū mākou e hele me kuʻu mau pōkiʻi aloha
Ka ʻāina a mākou i ʻiki ʻole ai ma lalo aku nei
ʻAʻe mākou me kuʻu pōkiʼi, kau I ka waʻa
Noʻiau ka hoe a Kamohoaliʻi
ʻAʻeʻaʻe kau i ka nalu
He nalu haki kākala
He nalu e ʻimi ana i ka ʻāina ehiki aku ai
ʻO Nihoa ka ʻāina mākou i pae mua aku ai
Lele aʻe nei mākou, kau i uka o Nihoa
ʻO ka hana nō a koʻu pokiʻi, a Kāneʻapua
ʻO ka hoʻoili I ka ihu o ka waʻa a nou i ke kai
Waiho aʻe nei ʻo Kamohoaliʻi iā Kāneʻāpua i uka o Nihoa
Noʻiau ka hoe a Kamohoaliʻi
A pae i ka ʻāina i kapa ʻia ʻo Lehua
Huli iho nei ka waʻa a Kamohoaliʻi
E kiʻi ana i ko lākou pokiʻi, iā Kaneʻāpua i Nihoa
Pili aku nei ka waʻa o Kamohoaliʻi i uka nei o Nihoa
Kāhea aku nei i ko lākou pōkiʻi, iā Kāneʻāpua

E kau akum ma ko pola o ka waʻa
Huli iho nei ka ihu o ka waʻa o Kamohoaliʻi
He waʻa holo ana i Niʻihau
Kau aku nei ʻo Kamohoaliʻi i ka lāʻau, he pāoa
E ʻimi ana i ko lākou ʻāina e noho ai, ʻo Kauaʻi
ʻAʻole naʻe i loaʻa
Kau maila ʻo Kamohoaliʻi i ka lāʻau, he pāoa
Oʻahu ka ʻāina
Ia kā ʻana iho nei o lākou i Āliapa'akai
ʻAʻole naʻe he ʻāina
Ke kū nei mākou e ʻimi kahi e noho ai
Loaʻa ma Peleʻula
ʻO Kapōʻulakīnaʻu ka wahine
A loaʻa i ka lae kapu ʻo Makapuʻu
I laila pau ke kuleana
ʻImi iā Kānehoalani
A loaʻa i ka lae o Makahanaloa
He loa ka uka o Puna
ʻElua kāua i ke kapa hoʻokahi
ʻAkahi au a ʻike hāʻupu mau, walohia wale
E Kānehoalani ē
E Kānehoalani ē
Aloha kāua
Kau ka hōkū hoʻokahi, hele i ke ala loa
Aloha kama kuku kapa a ka wahine
He wahine lohiʻau, nānā i ka makani
He makani lohiʻau, hāʻupu mai ʻo loko ē!

We started our journey, my siblings and I
To a land below, we had not seen before
My siblings and I climbed upon a vessel
Kamohoaliʻi being the skilled navigator
Rising upon the wave
Riding the crest of a breaking wave
A wave in search of land to live upon
Nihoa was the land upon which we arrived first
We landed and went on shore
The task of my younger brother, Kāneʻāpua
Was to turn the bow of the canoe and push it out to sea
Kamohoaliʻi pushed off, leaving Kāneʻāpua on Nihoa
Kamohoaliʻi was indeed the skilled navigator
And we landed next on an island known as Lehua
Kamohoaliʻi turned the canoe about
To fetch our favorite Kāneʻāpua at Nihoa
The canoe of Kamohoaliʻi once again landed on Nihoa
They called out to their favorite one, Kāneʻāpua

To climbm onto the platform of the vessel
The canoe of Kamohoali‘i headed back out to sea
And sailed to Ni‘ihau
Kamohoali‘i consulted with Pāoa, the power staff
Searching for the land in which they could reside, perhaps Kaua‘i
However, this was not favorable
Again Kamohoali‘i consulted the land-searching rod, Pāoa
Perhaps O‘ahu was the land
Āliapa‘akai was evaluated and surveyed by them
This land was not suited for them
We started again in search for a suitable abode
Perhaps Pele‘ula was the place
The woman Kapō‘ulakīna‘u
Was found at the sacred cape of Makapu‘u
It was there where our task ended
We searched for Kānehoalani
And he was found at the cape of Makahanaloa
The uplands of Puna were far in the distance
At one time we shared one covering
I began to recall those memories and called out
Kānehoalani
Say, Kānehoalani
Greetings to us
Relying upon the one star, we traveled the long trail
Greetings to the child of the kapa-beating woman
An inactive woman, observing the wind
An inert wind, smoldering within!

Ka Honua Ola, Dr. Pualani Kanaka‘ole Kanahele, 2011, pages 40-43

Aloha ‘o Maui, Aloha Ē

Aloha ‘o Maui, aloha ē
Aloha ‘o Moloka‘i, aloha ē
Aloha ‘o Lāna‘i, aloha ē
Aloha ‘o Kaho‘olawe, aloha ē
Kū mākou e hele ē
‘O Hawai‘i kā ka ‘āina
A mākou e noho ai a mau loa aku
Ke ala ho‘i a mākou i hiki mai ai
He ala pāoa‘ole ko Kamohoali‘i
Ko Pele, ko Kānemiloha‘i, ko Kāne‘āpua,
Ko Hi‘iaka ka no‘iau ikapoliopele
I hiki mai ai.

Farewell Maui, farewell

Farewell Molokaʻi, farewell
Farewell Lānaʻi, farewell
Farewell Kahoʻolawe, farewell
We rise to travel
Hawaiʻi is indeed the land
Where we will reside forever
We followed the path until we arrived
A rodless path traveled by Kamohoaliʻi
Pele, Kānemilohaʻi, Kāneʻāpua,
Hiʻiaka, the gifted one, in the bosom of Pele
We have arrived.

Ka Honua Ola, Dr. Pualani Kanakaʻole Kanahele, 2011, pages 52-53

ʻO Kāne, ʻO Kū-ka-pao

ʻO Kāne, ʻo Kū-ka-pao	Kāne, Kū-ka-pao
Me Lononui noho i ka wai	With Lononui residing in the water
Loaʻa ka Lani, Honua	The sky and earth are gotten
Hoʻeu, kukupu, inana	Active, growing, alive
Ku i luna o ka moku. (hō)	Upon the land.
ʻO ka Moananui a Kāne	The great ocean of Kāne
ʻO ka Moana i kai oʻo	The ocean in the dotted seas
ʻO ka Moana i ka iʻa nui	The ocean with the large fish onus
I ka iʻa iki	The small fish
I ka manō, i ka niuhi	The shark, the niuhi
I ke koholā	The whales
I ka iʻa nui hihimanu a Kāne	The great fish hihimanu of Kāne.
ʻO nā lalani hōkū a Kāne	The stars alignment of Kāne
ʻO nā hōkū i ka nuʻu paʻa	The consistent stars of Kāne
ʻO nā hōkū i kākia ʻia	The stars that are affixed
I paʻa, i paʻa i ka ʻili lani a Kāne	Secure, fix into the atmosphere of Kāne.
ʻO nā hōkū i kahakahakea	The streaking stars (comets, meteors, etc)
ʻO nā hōkū kapu a Kāne	The stars reserved for Kāne
ʻO nā hōkū lewa a Kāne	The moving stars of Kāne
ʻO kini, o ka lau, o ka mano	Numerous amount of stars (meteorites)
ʻO ka hōkū.	The star
ʻO ka hōkū nui,	The big star
ʻO ka hōkū iki	The little star
ʻO nā hōkū ʻula a Kāne, He lewa.(ʻoi)	The red stars of Kāne, suspended.
ʻO ka mahina nui a Kāne	The critical moon of Kāne
ʻO ka lā nui a Kāne	The essential sun of Kāne
A hoʻolewa ʻia, a lewa	Was suspended until balanced
I hoʻolewa ʻia i ke lewa nui a Kāne	Stabilized in the great space of Kāne
ʻO ka honua nui a Kāne	The great earth of Kāne

‘O ka honua a Kapakapaua a Kāne	The land of Kapakapaua of Kāne
‘O ka honua a Kāne i ho‘olewa	The earth of Kāne that was balanced
Ō lewa ka hōkū, ō lewa ka malama	Stars are suspended, moon suspended
Ō lewa ka honua nui a Kāne.	The great earth of Kāne is suspended.

E Ku, E Uli, E Kama, Lele Wale

E Ku, e Uli, e Kama, lele wale	time of the year, a beginning of
O Kalani ke ‘lii kaahea o Kaiwa	Why Ku, Uli n Kama (who), time for growth
Iwikauikaua haulili mai lalo	Iwikau is the constellation(?00 is setting, haulili (?)
Mai kumu kahiki ka honua ua kele	
Ua nao ua pela i ke kapu alii	
I ka pela alii kapu o Kukonalaa	(is this a constellation?) is so this is the beginning of the makali‘i (Makahiki season)
Ua kau ke kapu i Makalii	
Akahi a aha; lele wale	

Ku, Uli, Kama, move (as stars in the sky)
Kalani is the languishing chief of Kaiwa
Iwikauikaua shivers below
The canoe sailed from Kahiki / The earth was lush from Kahiki
[nao?] and [pela?] of the royal kapu
The royal kapu of Kukonalaa
The kapu was placed on Makalii
First ‘aha, move (as stars in the sky)

Celestial names:
Iwikauikaua
Kaiwa – possibly Hokuiwa (constellation where Hokulea is found)
Makalii - Pleiades

Lele mai ke kapu o ka moku	Pili brings opelu and aku to hawai‘i
Lalani ke kapu o ka moku	Winter fishing
Kui mai ke kapu o ka moku	Pili is also the twin star Gemini that sits
Pii mai ke kapu o ka moku	Na Mahoe, Nanamua, Nanahope also known as Castor and Pollux (Beta Geminorum)
Ili aku, kau aku ke kapu o ka moku	
Na Pili e noho ia kapu	
Ka moku i Hawaiikuauli	
Alua a aha, lele wale	
Lele aku ke kapu ia Wakea	

The kapu of the island move (as stars in the sky)
The kapu of the island are ranked / lined
The kapu of the island are strung together / joined

The kapu of the island are elevated
Inherited, the kapu of the island are placed
Pili is the one who reigns over the kapu
The island known as Hawaiikuauli
Second ʻaha, move (as stars in the sky)
The kapu was moved (as stars in the sky) by Wākea

Celestial names: genre
Lalani – Kepelino calls it "ruling stars."
Wakea – piko o Wākea

Ua kapu ka moku ia Liloa
Ua kapu kawao i Tahiti
Liloa o Umi ke kapu i nahae
Nahae na mana o ke kapu
O Iwi au lana Iwikauikaua — Lana is a suffix
Lola kamahele kikiwi
I pipio i ke kapu o Iwikauikaua
Na ka iwi a pani ke kapu o ka moku
Iwikauikaua ke kalohe
Ka hoolololohe wai i haunaka — (cancerous)

The island is sacred because of Liloa
Coalesced in Tahiti
The kapu torn/branched out because of Liloa of Umi
The power/branches of the kapu were divided/branched out
Iwiaulana Iwikauikaua
The curved main branch drooping
Arching from the kapu of Iwikauikaua
The bones will substitute/fill the kapu of the island
Iwikauikaua the transgressor
Deafened by the water of Haunaka

O Kihanuilūlūmoku

O Kihanuilūlūmoku,
O Kuikē, Kanikē, Hoapipi,
O ʻUweke ka aha,
O Kapuahi ka aha maloko,
O Kailieʻe ka aha lanalana o ke kapu ma waho,
Ka aha o ke alii,
E kū ai i ka nuʻupaa, i ka poki paʻa.
Paʻa ai o Kiha, a kū i ke kaʻai, protraction

O Līloa,
O Kamakilaku ka aha,
O Waikaua ka aha hele honua,
Hele kaola moku maloko,
O ʻAhaʻula ka aha lanalana o ke kapu ma waho,
O ka aha o ke alii,
E kü ai i ka nuʻupaa, i ka pokipaʻa,
Paʻa ai o Līloa a kū i ke kaʻai,

O ʻUminui a Līloa,
O Kapakiiohema ka aha,
O Kalihilele o Nonomakolii ka aha ma loko,
O Neoneihonua ka aha lanalana o ke kapu ma waho,
Ka aha o ke alii,
E kū ai i ka nuʻupaʻa, i ka pokipaʻa,
Paʻa ai o ʻUmi, a kū i ke kaʻai,

O Kanaloa, o Kukailani,
Mahinipene ka aha, o Mahilinaka,
O hili hema hili akau ka aha maloko,
O Hoomau ka aha lanalana o ke kapu ma waho,
Ka aha o ke alii,
E ku ai i ka nuupaa, i ka pokipaa,
Paa ai o Kukailani a ku i ke ka ai.

O Makakaualii,
O homai ka aha ka moku pelelua,
O hiolo olowalu ka aha maloko,
O hauliaiawawau ka aha, Lanalana o kapu mawaho,
O ka aha o ke Alii,
E kuai i ka nuupaa, i ka pokipaa,
Paa ai o Makakaualii aku i ke kaai.

O Iwikauikaua, o kanihi ka aha,
O manawaikawae ka aha maloko,
O kapeke onaia ka aha,
Lanalana o ke kapu mawaho,
Ka aha o ke alii,
E ku ai i ku ai i ka nuupaa, i ka pokipaa,
Paa ai o Iwikauikaua a ku i ke kaai.

O Lono o Keakealani,
O kuipaa ka aha mai akea o Lono,
O iho mai ka aha mai ka lani,
O pipili omomoe kau auana,
O ka aha a Hoohokuhonua maloko,

O Kamakauwahine ka aha,
Lanalana o ke kapu mawaho,
Paa ai o Lono a ku i ke kaai.

O Keaweike, Aaliiomoku.
O Manawaipoo ka aha,
O Kahuluiauku ka holo ka aha maloko.
O ka olemaulewa i heeluukia,
O Luukia ka aha,
Lanalana o ke kapu mawaho,
Ka aha o ke alii,
E kuai i ka nuupaa, i ka pokipaa,
Paa ai o Keawe a ku i ke kaai.

O Kalanuiaeaumoku,
Ke kakamaka aha lani ahakea.
Ma ka aha heleholo,
Ka hele moo ka aha maloko,
Kamakini ka aha,
Lanalana o ke kapu mawaho,
Paai o Keeaumoku a ku ike kaai.

O Kalanikupuapaikalaninui,
O hoopii ka aha limalima,
O Kama o Ku, o Kama o Kiloia,
O Kamakiilohelohe ka aha,
O ke kuakini o ka lani,
O lumilani ka aha,
Lanalana o ke kapu maloko,
O kolii ka aha lanalana o ko kapu mawaho,
Ka aha o ke alii,
E ku ai i ka nuupaa, i ka pokipaa,
Paa ai o Kalani a ku i ke kaai,

O Kalaniahienaena,
O pue o hoouli moo,
O Poupou aua ka aha maloko,
O hulahula ka aha,
Lanalana o ke kapu mawaho,
O ka aha ia o ka moku e paa,
O Likelike ka aha alii aha kanaka,
Aha kau i ka moo o Haloa.

Ka Hae Hawaii, 2 Mei 1860, aoao 22

Ke Kumu Honua

KE KUMU honua,	
Paa kumu honua lani kapu,	
O ke kumu alii kapu,	
O Lolohimehanai ke poo,	Loloimehana (var.sp) Noted as Betelguese or Sirius
O Kupuanuu, o Kupualani,	Kupuanu‘u and Kupualani. End stars of Makali‘i
Ma ka puuhonua eleele,	On the black flat hill,
Kua ia ka puka hoaka,	Milky Way/Antares (appeared) the crescent shaped hole
Okiia moku ka mole ka paiaa,	The placenta is cut and severed
Ia uuina kani moo-hina,	This resounding gusts of the Milky Way *‘u‘ina = lei
Ka lani malu i Ha-u=pu,	The clarity of Ha‘upu.
Mo ka lau lele ka eulu,	
Pipili ka lani oki ka honua,	Hamal & Sheratan in Aries. Equinox stars.
A nana i ka waa o ka moku,	
Ka honua ua apo kahi,	
O Pupue i ka hau no Ku,	Star associated with Kaulua (Sirius)
I ka hau e alii—la,	
He hau no Kanononui, Kanonoakea,	Possibly stars.
O Wakea, o Papa, o Hoohoku ka wahine,	Wākea = Orion. Papa
Hanau ke alii loaa ke kapuu,	
O Keakealani, o Lono,	
O ka hua a Lono i hanau,	Several Lono stars. Most refer to Sirius or Venus.
Opiopi ku ka lā-u-la,	
O kamumu i honua ka hua,	
O kawowo i ka lani,	
Ke ana a ke kahua,	
Hooika ia i maloeloe ka hua,	
O ka hua kapu ia i Akea,	
I Halekumulani o Kanaloa,	Revelation star, *Kanalu
O Leka, o Lalo, o Puukahonualani,	
O Kanekohaikolo, o Papa ke 'lii,	
Mai ka lewa o ka moku ka aina mai,	
Keehi mai e ku iluna, ku mai;	
Ulu mai, kupu mai,	
O Kalanikupuapaikalaninui,	
Ka ma-i-ka pehi kulana i pono,	
I oa i lele i ke kapu a pa i ka ai ki,	
O Nahienaena o ka lani,	
Ka ulumaika iki makua,	
Nana e kaa ke kahua loa pau,	
E hele ai ka ai a ka mahiki,	
O ka ai pau ole i ka na-i,	
O Naholoholo, o Nakolokolo lua ka lani,	
O oe ia e ka lau oeoe, laukapalili,	

O ka lau o ke kaa i Kiele i aala,	
E Kalani e, eia mai,—eia mai,	
Aala no mai ka lala a ke kumu,	
O Kio, o Kamole o ka wahine kapu,	Kiopa‘a-Polaris, Kamole -Alpha (Acrux)
I kapa hoi i ka mole, i ka mole,	
I ka mole o ke kamani alii—la,	
E ku i Hana keiki pono,	Unidentified star.
O Makakaualii o ke kapu ia,	Unidentified star. *Makemsom
E nonolo i ka lani,	
He lani mahakea, aole i pahulu,	Gemini. *Johnson
I ka hua ana a na lau alii i ke kanu,	
Kalani kanu kahi, o Iwikauikaua,	Cassiopeia
O Keaka, o na pue o ka Iku-a,	Keaka. Near Waia & Kekaihili. Ikuā - Principle star
I ku i ka makaili, hanini ka lani,	Makaili = Makali‘i? or ‘Ili‘ula = "Name of a star"
E hanini, e luai, e o-a,	Hanakaluai/Hanakalauai
E kakahe mai auanei,	
Ka omaka wai kapu o Lono,	
Ka wai huli a mahi o ke kahawai,	
E holo moku ai ku ka e-a,	
E u-u-ina ai ke aa laau,	
Ka mumu ai ka pohaku, ka pihe-a,	
E ku i ka loa a i ke kapu,	
O Keaweikekahialiiokamoku,	A southern star
Ka pua e ku haulani pa,	
Ka hiwa puni manea keakea,	
I puaki hia ka niho,	
I lou a halala i ke kapu,	
O Kalaninuikeeaumoku,	
Ka okupe olepe,	
Nana e wau pau ke kapu,	
O ka lani ka ia olelepa,	Milky Way marked on a lele/pā
Ka alapa pii moo ku,	
Ke kulepe iole ioiole kea,	Zenith star that climbs on ‘Upenamakali‘i
O Kalaninui-kuu-leho-ula,	
Akahi no a loaa ka olu,	
Palaha, paulua, maka ino,	
Ka okala aihee, ai moku o ku,	Jupiter
O Haholani, o Huamakua,	Hua = Antares
O Keapokuleiula, ka aha ,	Red lei White ridge post
O Kapae, o Kaohema,	Kapaemanu‘u = Paepae, Southern Cross
O lapuu, o miko, o kaiikapu,	
Kapioalii, o Kaailua ka aha ,	
O Kapokinanahua,	
O ka aha o ke alii e ku ai,	
I ka nuupaa, i ka poki paa,	
Paa ai o Haho, a ku i ke ka-ai,—	

O Palenanui a Haho kapu,	Solstice boundaries
O Makaipuleia ka aha alii,	*Is near the Makali‘i constellations
O Kokoni ka aha mai a Akea a Lono,	Orion or Sirius
O ka aha o ke alii,	
E ku ai i ka nuupaa, i ka poki paa,	
Paa ai o Palena, a ku i ke ka-ai,—	
O Hana, a Palena,	
Kakai ka pu Makahakoko,	*Is near the Makali‘i constellations
O Lanalana ka aha , Kaluanuuwaiku,	*Star in the Milky Way
Hiki e maliu ka lani, ka aha o ke alii,	
E ku ai i ka nuupaa, i ka poki paa,	
Paa ai o Hana, a ku i ke ka-ai,—	
O Lanakawai a Hana,	

Ka Hae Hawaii,11 Aperila 1860

Appendix B- Site Visit Report #1, December 21, 2016, by Kalei Nu‘uhiwa

Brief Manamana survey
Pu‘u Alika, Mauna Loa
12/21/2016

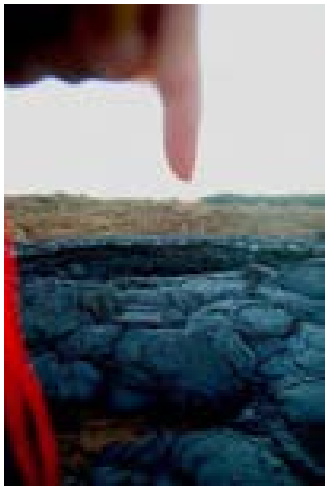
Field researchers:
Huihui Mossman Kanahele (HK)
Ku‘ulei Higashi Kanahele (KK) Kalei
Nu‘uhiwa (KN)

Departed hangar at 0605 hours
Arrived on site at 0650 hours

Sunrise just started peaking above the horizon when we landed. However, the site is surrounded by tall natural berms made by an old lava flow. The manamana are located in a "bowl" of lava where the horizon is barely visible. To the north of the site is a view of the southern flank of Mauna Loa. Pu‘u Pōhaku o Hanalei is clearly seen. Trails near the area are attributed to ‘Umialīloa. One trail passes alongside the paepae and various kuahu coming from ‘Umi’s old trail system that runs from Miloli‘i to Ka‘ū.

The manamana are located on a flat surrounded by older, tall rock outcroppings and the last flow of pāhoehoe lava berms. A lava tube skylight west of the manamana was filled in with pāhoehoe from the last flow. A single large manamana stands behind the paepae platform. Upon landing the team spread into three different points of view to observe the sunrise.

My observation is that there was no recognizable correlation between the single manamana situated behind the paepae and manamana with the sunrise or the site itself. In these photos below the first pictures shows KN’s finger pointing to the spot where the sun was rising. In the second photo, KN’s finger is pointing to the spot where the manamana are located. There was no visible pānānā west of the site where this photo was taken.



The sun in relation to the single manamana.

The location of the manamana on the site.

The condition of the site is still relatively intact. However, there are obvious signs of earthquake movement or volcanic activity that has violently shaken the stones. My observation is that the larger manamana behind the paepae may have fallen from a kuahu site next to the paepae. The remnants of a secondary kuahu exist and appear to have held a large manamana or stone that had been shaken off or fallen over. *See Single Manamana section.

Measuring with the compass from the single manamana 23.5 degrees north leads to no visual land feature or alignment with the manamana on the paepae. There may be a stellar connection. More research needs to occur to prove that there is an alignment to a star or constellation. Measuring the equinox location of the sun from the single manamana did not yield any insights to alignments as well. There is no visual feature alignment. Tentative conclusion for now is that the single manamana has no obvious alignments at this time.

From the Pānānā East of the Site

Moving up to the alo (face) of the manamana, my observation was that the Ala Polohiwa a Kanaloa sunrise lit the tops of each individual manamana one at a time starting with the first manamana on the north side and moving southerly as the sun rose higher.

There are a lot more features at this site then we originally observed. There are three pānānā locations, a three-tiered kuahu built upon a natural rock outcropping due south of the paepae, another kuahu southeast of the paepae where the single manamana may have originally been located and another kuahu due north of the site situated on a rock shelf.

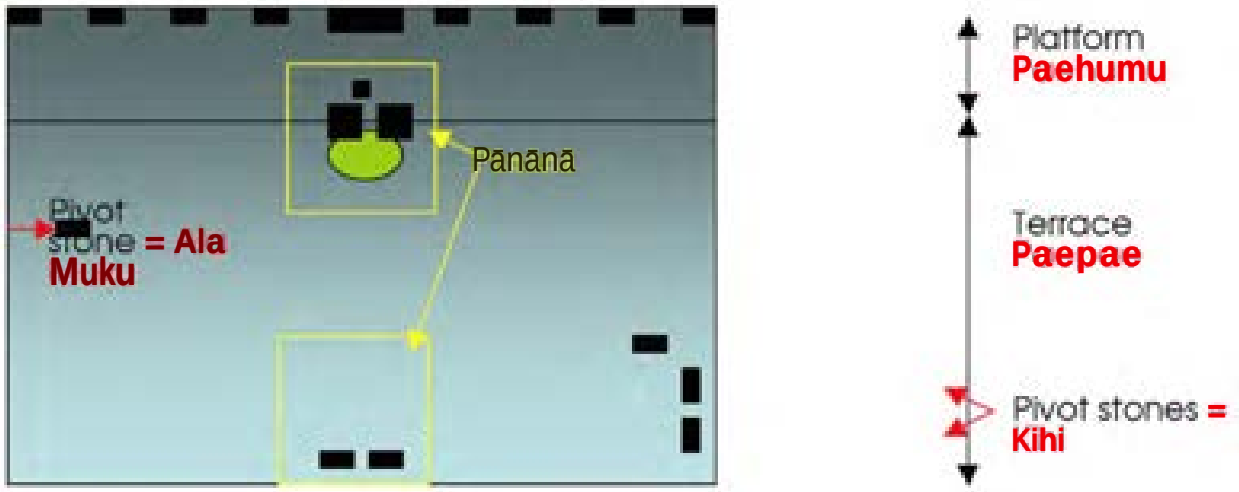
There are several C structures for shelter built with the same type of rock as the paepae, kuahu and manamana.

Nomenclature

During our surveys and studies of the sites at Moku Manamana a decision was made to name the parts of each site after traditional heiau terms. The same terms will be used for the sites at Pu‘u ‘Alikā, Mauna Loa.

All upright stones are called manamana. Observation points were called pānānā. Mounded up rock piles whether traditional or made previously are called kuahu.
Generally, each site has a centralized pānānā however any noticeable manamana by itself or off to the side of a paehumu was also utilized as a pānānā for consistent compass and observational readings. The following are the names being utilized for the parts of a site and the surrounding features:

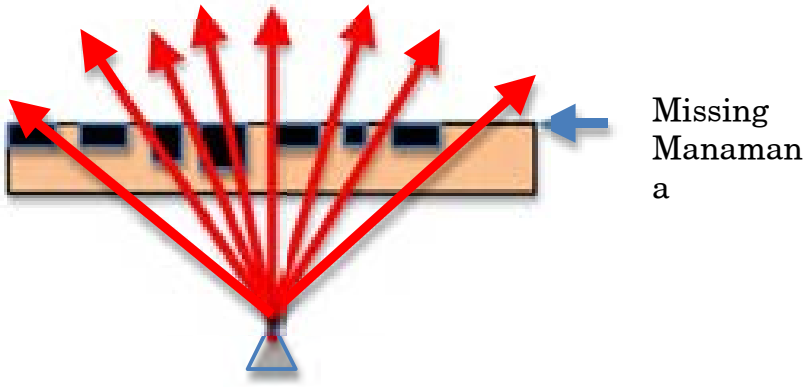
Paepae A flattened foundation that can be either raised or walled;
Paehumu Platform where manamana a situated;
Manamana Purposeful upright stone;
Ala Muku A single manamana placed on the edge of a paepae typically at or near the center of the site;
Kihi Circular manamana typically located in pairs and placed at the corner of a paepae;
Pānānā Observation point. There are two types. The first type of pānānā is generally two stones situated side by side and is often located at the center of the paepae. The second type of pānānā is any observation point located near or on a site; &
Kuahu Purposefully stacked mound of stone.



Top view of typical paepae found.

Pu‘u ‘Alikā

The site at Pu‘u ‘Alikā has a distinct paehumu where the uprights are situated and does not contain a paepae terrace. However, there are obvious pānānā stones situated in the center to measure or observe celestial activities.



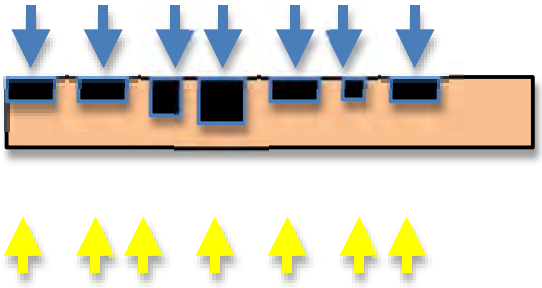
Pänänä & measurement method.

Systematic Reading

Figure 16 illustrates the location from which the main compass readings and observations are made from the central pānānā. Each field researcher followed the same procedures for observations, compass reading, site to site alignment, site to terrestrial feature and site to celestial activity. A pānānā acts like a compass. Although it was common for the manamana to be spaced 5º or 10 º apart from each other, the Pu‘u ‘Alikā site did not have similar or consistent space intervals. We observed that the site had been shaken violently from either earthquakes or volcanic eruptions. Several of the manamana have toppled forward or are leaning. Spaces between the manamana are not uniformed or consistent due to being displaced in the earthquakes.

Pānānā are designated areas or spots where systematic readings were taken during this field study. The first pānānā reading begins from the center of the paepae. With the compass, notation of each degree reading was taken for each manamana along the platform, followed by the pivot stones and then the corner stones. All possibilities and alignments were considered and recorded.

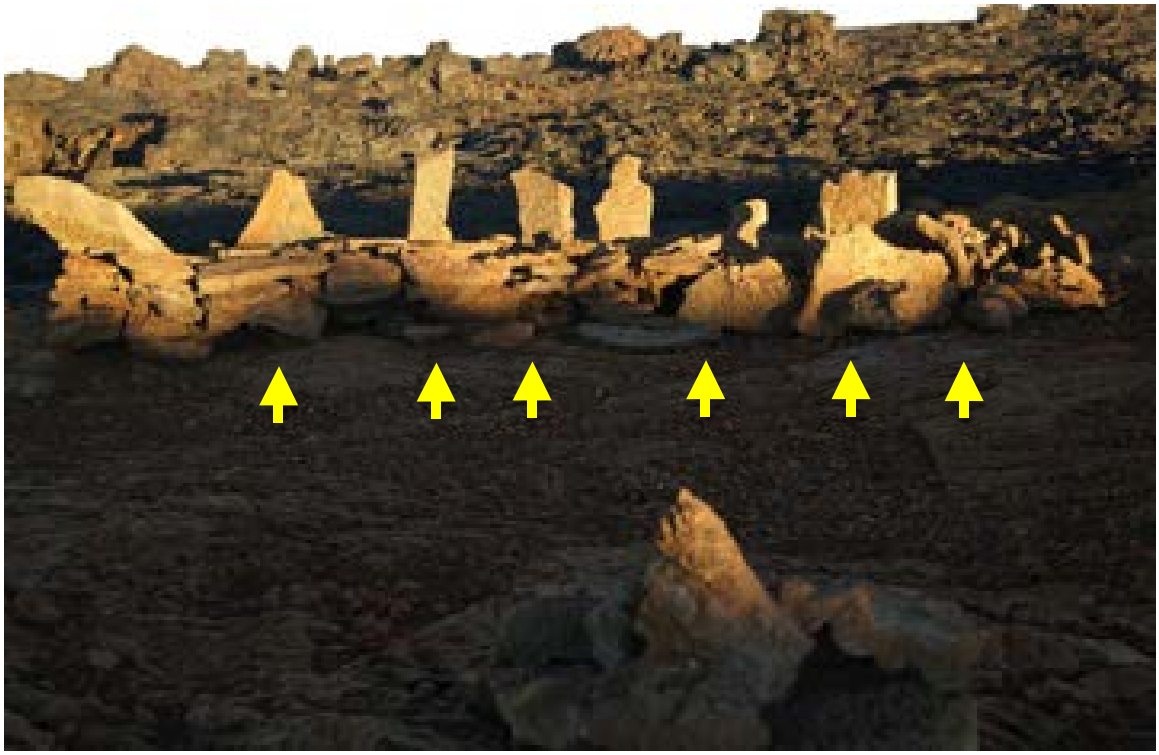
Front & Back of Manamana



The blue arrows indicate the kua or back of the manamana. The yellow arrows represent the alo or front of the manamana.

Manamana have two distinct sides to them, which we have named alo, the face or kua, the back. Understanding where the front and back of an upright is pertinent to knowing whether the site was built facing the east, west, north or south. Each rock has a front and a back. Generally, the front surface of all the manamana is aligned on a paehumu. The backs of the manamana generally run along the edge of the paehumu that either sit on an edge. Distance from pānānā stone to paehumu is 17 ft 6 ¼ in (5.34 m).

Illustrating the displacement of manamana. They are generally situated at the edge of the paepae.



The yellow arrows illustrate the alo of the manamana. Paepae is running on a north to south alignment. The alo faces east, the kua faces west.

Measurements

The paepae contains seven manamana with one possibly missing on the northern corner. The paepae is on a northeast-southwest corridor.

KK measured the manamana, paepae and distance from paepae to a few pänänä and kuahu. The following are the notes taken of the measurements of the uprights. KN recorded the measurements and converted the readings from American standard measurement to metric readings.

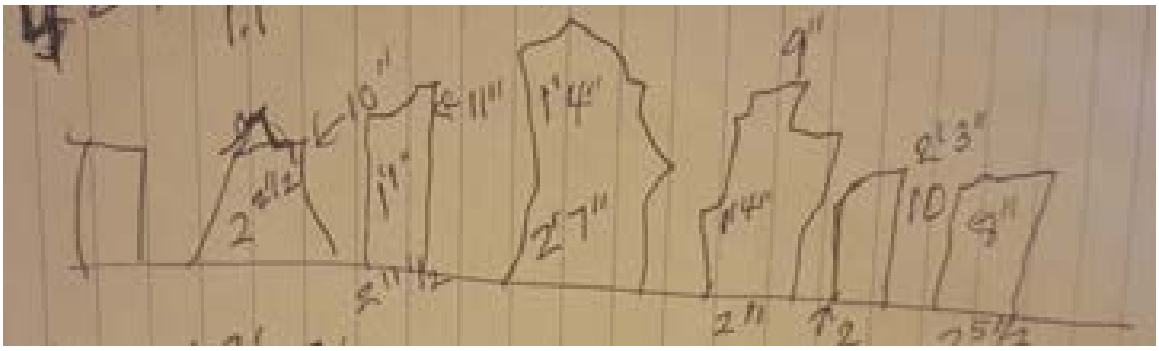
The length of the paepae is 19’ 4¼ ” (5.79m) and the width is 5’ 11¼ ” (1.52m). The height of the paepae is 1’ 3¼ ” (0.30m).

KK measured each upright. The following are the measurements for each manamana starting from the left of the figure 20 to the right.

H 3’ 11¼ ” (0.91m) x L 4’ 9 ¾ ” (1.22m) x W 1’ 6 ¼ ”(0.30m) H 1’ 11 ¾ ” (0.30m) x L 10” (.25m)
H 2’ 8 ¾ ” (0.61m) x L 10¼ ” (0.26m) x 8 ¼ ” (0.21m) H 2’ 4¼ ” (0.72m) x L 1’ 1¼ ” (0.34m)

H 2’ 8 ¾ ” (0.82m) x L 1’1¼ ” (0.34m) x Notched section: top L 6 ¼ ” (0.16m) H 1’ 9¼ ” (0.54m) x L 2’ ¼ ” (0.62m)
H 2’ 2 ¾ ” (0.68m) x L 5’ ¼ ” (1.60m)

Distance between each manamana was roughly 7 ¼” (0.18m).



Single Manamana

The single large manamana standing behind the paepae platform does not seem to correlate with any recognizable alignment between the single manamana situated behind the paepae or with the manamana along the paepae. It stands approximately 2 meters below the paepae and has no viewing of the sunrise.

This kuahu, which we are calling the secondary kuahu, is directly above the single manamana. The second photo below shows the view from the single manamana towards the paepae looking towards 23.5 degrees north of east. The view from the single manamana would have been of the first manamana on the
paepae had it not toppled forward. There would not have been any view of the sky or celestial movement. My hypothesis is that the single manamana had

This kuahu, which we are calling the secondary kuahu, is directly above the single manamana.

The view from the single manamana towards the paepae looking towards 23.5 degrees north to east.

fallen from its original position within the secondary kuahu and was later propped up in its current position. The following photo shows the Puʻu ʻAlikā pāhoehoe flow that stopped at the foot of the single manamana and surrounded by the fallen lava tephra. Other manamana at this site are supported by either a paepae or a kuahu.

The view from the single manamana would have been of the first manamana on the paepae had it not toppled forward. There would not have been any view of the sky or celestial movement. My hypothesis is that the single manamana had fallen from its original position within the secondary kuahu and was later propped up in its current position. Figure 23 shows the Puʻu ʻAlikā pāhoehoe flow that stopped at the foot of the single manamana and surrounded by the fallen lava tephra. Other manamana at this site are supported by either a paepae or a kuahu.

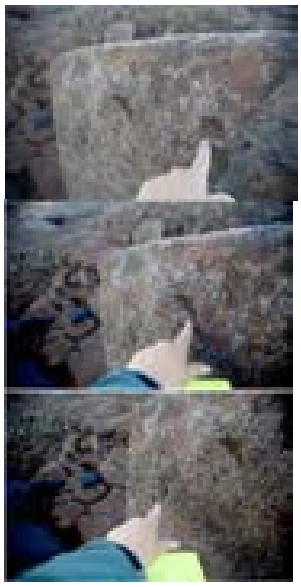
This single manamana does not have a paepae or kuahu, does not have a clear view of the north, east or southeast. The only clear view is towards the west and towards the lava tube that had been filled in with the same pāhoehoe lava seen at the foot of the manamana.

The secondary kuahu is located on the shelf where the paepae and manamana. It is southeast of the paepae and appears to have been disturbed. It is possible that the single manamana may have

been set within the kuahu. A missing section in the center of the kuahu matches the size of the base of the single manamana. The red circle in the picture below illustrates the slotted space in the secondary kuahu where the single manamana may have been originally situated. The yellow arrow is where the single manamana is located. The secondary kuahu is aligned with a three-tiered kuahu built up on a natural rock out cropping. The alignment from the secondary kuahu to the three- tiered kuahu is 240˚ on the compass. There is a star and a Hawaiian that sets between 230˚ and 242˚. Fomalhaut is the bright star. Mānaiakalani is the large constellation. If calculations are correct the star Lehuakona (Antares) sets directly upon the three-tiered kuahu. An overnight stay at the site would be required to confirm this hypothesis.

The red space is believed to be where the single manamana was originally located. The blue space is a natural rock outcropping, believed to be in alignment with the single manamana.

The single manamana has 3 pecked out circles on its surface. These pecks might be indicating the starts Fomalhaut, Lehuakona & Shaula. The location of the pecks and the built up three-tiered kuahu would align closely if the single manamana was situated within the secondary kuahu.



Displays hole made purposely, unsure of their purpose.

Single manamana.

H on the tallest point is 4’ ¾ ” (1.24m)
H on the lowest point is 3’6 ¾ ” (1.09m)
L 1’8 ¾ ” (0.53m) x W 1’ 6 ¼ ”(0.30m)

Other measurements taken:
From secondary kuahu to single manamana is 9’9 ¾ ” (2.98m). From the secondary kuahu to the paepae is 15’5 ¼ ” (4.71m).

We also discovered another pānānā which was directly behind the first pānānā. Its distance from the paepae is 17’6” (5.33m).

Two possible pānānā.

Natural outcropping, believed to be used for alignment.

Upon further research, another single manamana was located. Alignments could be made from this single manamana towards the secondary kuahu, towards the kuahu on the rock outcropping to the north and also Pōhaku o Hanalei. It may have been part of another kuahu but was covered up by the last pāhoehoe lava flow.

Photo on previous page shows the alignment from the new manamana towards the secondary kuahu and the three-tiered kuahu. Photo below is of another manamana and its alignment with the two pānānā and the paepae.

The compass reading from this manamana towards the paepae is 290º.

Appendix C- Site Visit Report #2, June 19-20, 2017, by Dr. Pualani Kanahele, Kuʻulei Kanahele, Kalei Nuʻuhiwa

A decision was made to provide a nomenclature for the site befitting the cultural description also identifying and honoring the individual credited for establishing this cultural feature.

Nomenclatures	Description
• Pahu Manamana o ʻUmi	ʻUmiʼs Star Intersection or ʻUmiʼs Star Crossroad
• Nā Manamana o Kahuku	Uprights belonging to Kahuku or Kahukuʼs uprights

As per the last report, several Hawaiian nomenclatures were introduced such as: paepae, ahu, paehumu, manamana, ala muku, kihi and pānānā. All of the names are in reference to the cultural feature at Pahu Manamana o ʻUmi and others of like determination and function throughout the islands. **Pahu manamana** is another nomenclature I wish to add to the list. Pahu manamana is translated and identified as "intersection or crossroad". Pahu manamana is a determination instead of a description therefore it gives immediate focus to its function. Pahu manamana is calculated to intersect stars.

Pahu manamana are sacred instruments because it interprets elemental language and the manamana are set up precisely for atmospheric navigation. I will refer to the pahu manamana sometimes as "instrument" or "feature".

The three traveling researchers were:
Dr. Huihui Kanahele-Mossman
Doctoral Candidate Kalei Ann Nuʻuhiwa
Doctoral Candidate Kuʻulei Higashi Kanahele.

With David Okita as the helicopter pilot, Kalei and Kuʻulei departed from the Hilo Helo-port at 9 am directly to Pahu Manamana o ʻUmi on Mauna Loa on June 19, 2017. Huihui departed from the Hawaiʻi Volcanoes National Park (HVNP) rain shed at 9:45 am on June 19, 2017 with the overnight gear.

Huihui taking GPS points from the newly discovered manamana. The compass reading from this manamana towards the three-tiered kuahu is 270º.

They returned in reverse with Huihui putting down at HVNP at 9 am June 20, 2017. Kalei and Kuʻulei landing at the Hilo Helo-port at 9:45 am.

Sighting star coordination and alignment was the initial function of the research team in relation to the pahu manamana. Their immediate plan upon landing was to set up a site of reference for the night sky. The pahu manamana front is south/southwest with a pānānā at its front. This

Kalei's position is at the pānānā.

allows the observer to face the pahu manamana observing the action of the north northwest, west and south sky in relation to the pahu manamana. Kalei set up her equipment at this location.

The above pānānā is directly in front and center of the pahu manamana. The afternoon of June 19th was very cloudy on the mountain with heavy mist and sprinkling of rain drops.

Three individual manamana facing west. Nomenclature for this feature is Ahu kua alo.

Huihui chose to set up her camera south of the feature observing the northern and eastern sky. This skyline includes Mauna Loa, Pōhaku Hanalei, Puʻu ʻAlikā and the sun rise in the northeast. Huihui was located at Ahu kua alo.

Ahu o luna.

Kuʻulei fixed her position at the Ahu o luna on the northern trail overlooking the pahu manamana espying the southern and eastern sky with a possible shot at the early morning stars and sunrise with Puʻu ʻAlikā, this is the Ahu o luna site.

Once their overnight gear and primary cameras were in place they focused on other cultural features attached to the area of the pahu manamana. The researchers were to list and photograph all manmade cultural sites and natural cultural resources associated with pahu manamana. This

information would fortify the research of the activities that existed during the time the feature was constructed. It would also bring awareness to the necessity of the immediate environment for use as a functional pahu manamana.

The research team, which also includes Dr. Pualani K. Kanahele, was responsible for acquiring knowledge of cultural connections and uses of the pahu manamana germane to atmospheric, land and ocean elements relative to ceremony. The pahu manamana is a sacred feature because it was a ceremonial instrument linking environmental elements and communicating in elemental language.

June 19 – 20, 2017 marks the summer solstice or Ke Alanui Polohiwa a Kāne. For the Hawaiian, it is the northern boundary of the sun's movement. The idea of the extra minutes to the length of the day was noted in the story of Pele and Hiʻiaka. When Hiʻiaka was sent to fetch Lohiʻau, the lover of Pele on Kauaʻi, she found him nearly dead and withered, and begged the sun for its energy, to imbue it into Lohiʻau and save him. This chant indicates that there was knowledge of the sun sitting longer in the sky at this particular time of year:

E ka lā, ē	Say, sun
E ka ʻōnohi a ka lani	You, fiery one who lights up the sky
Noʻu hoʻi kau wahi aloha	Grant me your kindness
E kau mālie ʻoe	Travel slowly (today)
I ko muli o hea	A request from your younger sibling

Knowledge of the perimeter of sun, moon and stars is important to an individual in knowing his/her place in the universe. ʻUmi was learned in this science by his many kahuna nui allowing him to set up pahu manamana or star crossroads to mark the perimeter of the atmospheric elementals.

ʻUmi took a large group of people with him to the locations when constructing pahu manamana, ala muku, paehumu, kuahu or ahu. ʻUmi's travel assembly would consist of many kahuna of diverse intellectual perceptions, warriors of diverse status, knowledgeable builders, personal attendants, experienced rock shapers, bird catchers, cooks, workers-consisting of men and women, and runners for messages and replenishing water, food and clothing.

In the research report entered below, the researchers counted 52 c-shelters, or pāpaʻi, which could probably sleep 2, 3, or 4 people each. The possibility of the capacity would be that this location could easily accommodate 200+ people. This does not include the caverns, which could also be used for shelters and sleeping.

ʻŌhelo

It is important to know that this environment is totally uncomfortable for human use. The researchers looked at other resources such as: stockpiling rock, vegetation (which was minimal; pūkiawe, ʻŌhelo, ʻaʻaliʻi, moho, māʻewaʻewa, kūpaoa), birds, and water during winter. All other necessities for the temporary stay on the mountain were brought it in.

ʻAʻaliʻi

Regarding Single-Filed, Back-Front Facing Manamana or Ahu Kua Alo

3 manamana facing west:

- 1st manamana touching 1957 lava flow. Base is 17” high, manamana 18” high.
- 2nd manamana 72” away at base, 119” away at tip. Base is 17” high, manamana 18” high.
- 3rd manamana 95” away at base. Base is 18” high, missing manamana.

- There was possibly a 4th manamana

Regarding Pahu Manamana

- Main paepae consists of 8 manamana (counting empty space on right).
- Large single pae (with missing manamana) Kaʻü-side.
- Pānānā Hilo-side of main paepae.
- Main paepae is 225" long, 21" high, 40" wide; 277°.
- 1 manamana = 59.5" high (from base), 16" wide, 7" thick
- 2 manamana (14" from 1st) = 22" high sloping to 19.5" high, 19.5" wide, 1" thick
- 3 manamana (20" from 2nd) = 33" high rising to 26" high, 9" wide, 6 ½" thick
- 4 manamana (17.5" from 3rd) = 27" high sloping to 26.5" high, 13" wide, 4 ½" thick
- 5 manamana (10.5" from 4th) = 17" high rising to 34" high sloping to 26" high, 14" w, 2" thick
- 6 manamana (21" from 5th) = 8" high rising to 24.5" high, 8" wide, 6" thick
- 7 manamana (12" from 6th) = 24" high, 16" wide, 6 ½ " thick
- 8 manamana missing

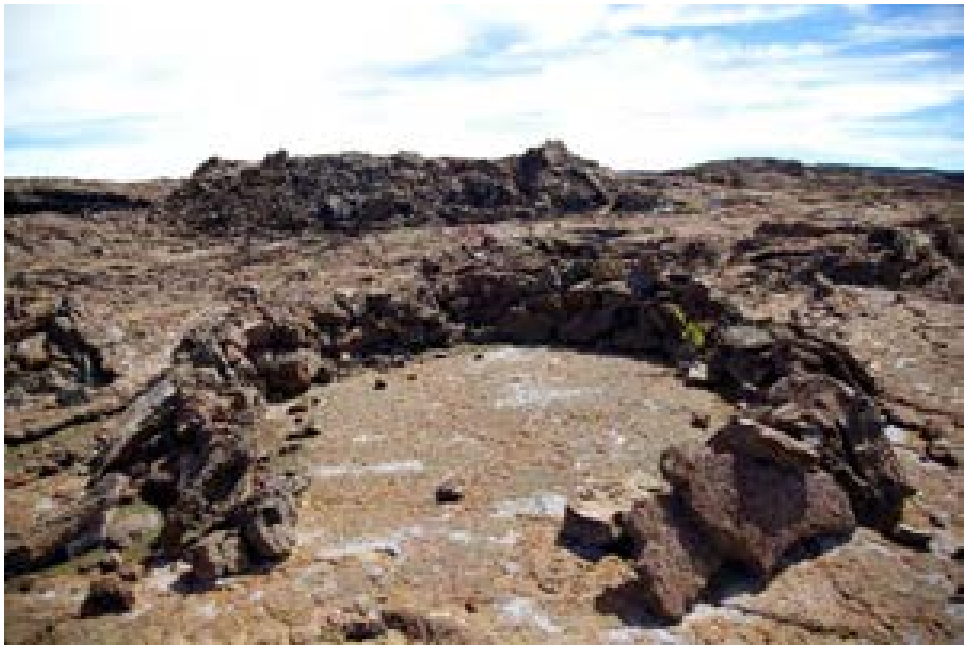
Distance from main paepae to large single pae is 187".
Pänänä is 205" from main paepae.
Base 7 ½ " high, 31" wide, 31" long.
Manamana 12.5" high, 280-290° (not facing main paepae).

Regarding C-shelters (Pāpaʻi)

Near manamana, 13 pāpaʻi counted.
At upper ahu, 16 pāpaʻi counted.
Above upper ahu, 23 pāpaʻi counted.
Total 52 pāpaʻi that could support 2-4 people each = approximately 208 people.
All pāpaʻi located Hilo-side of pahu manamana.

Example of a pāpa‘i.

Example of a pāpa‘i.



Example of a pāpa‘i.

Background: Finger pointing to an ahu located south of pahu manamana.
Foreground: Stockpile of rocks to be used.

Regarding Manamana Shape and Size

Manamana were carved into specific shapes as traditionally predetermined. We are unaware of this reason for the shapes; however, manamana elsewhere have some of the same shapes.

Rock files. These and other hard rocks where used to shape the manamana.

Example of distinct manamana shape.

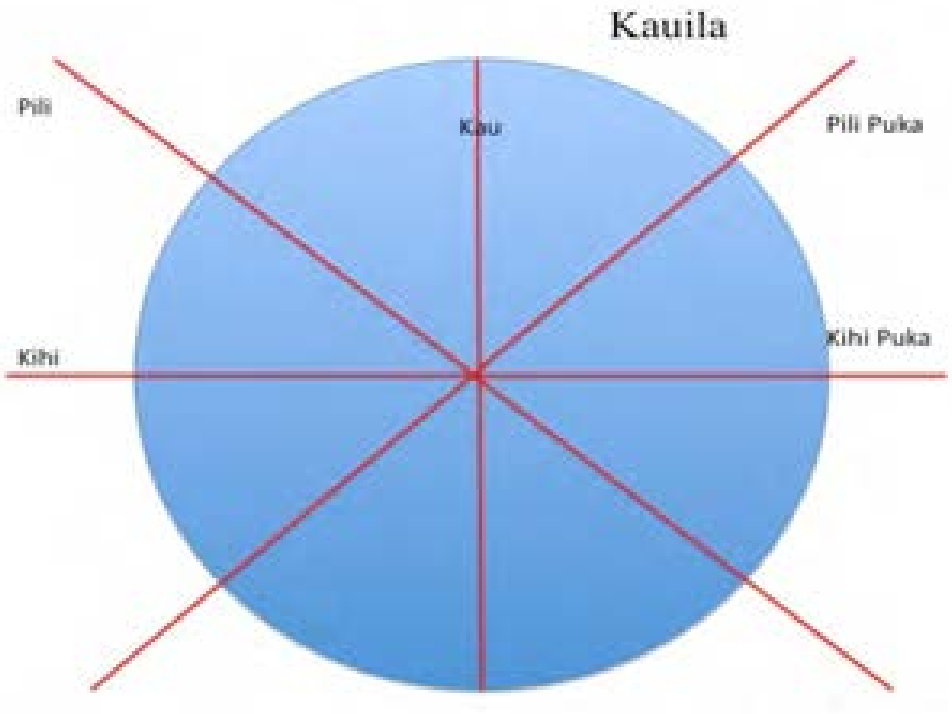
Example of distinct manamana shape.

Various manamana shapes.

A view of manamana thickness.

Another side view of the manamana and a look at the condition of the paepae.

Kauila, Hawaiian Methodology for the Division of the Night



Kauila divisions.

The researchers used the Kauila methodology of night study to note star placement. The method is to divide the night for viewing at different times, the three sites coordinate accordingly checking their part of the sky and recording it. The Kauila method is listed below.

- **Kihi** is 6 pm
- **Pili** is 9 pm
- **Kau** is 12 midnight
- **Pili Puka** is 3 am
- **Kihi Puka** is 6 am
- **Kau Puka** is noon (unrecorded in Hawaiian annuals)

Summary Report of Relevant Stars for June 19 – 20, 2017, Summer Solstice

Site 1 Monday June 19th

1:58 am moonrise Käloapau
5:21 am first light.
5:45 am sunrise
2:43 pm moonset
7:02 pm sunset, overcast, misty rain.
7:26 pm last light.
8:42 pm skies cleared, with light cloud coverage at southeastern/southern horizon.

Nāhiku high in sky, northwest
Hōkūleʻa overhead
Mānaiakalani visible on horizon slightly north of Puʻu ʻAlikā.
Mailemua, Mailehope and Newe (Southern Cross) visible on horizon slightly south of Puʻu ʻAlikā.

Tuesday June 20th
12:31 am Nāhiku setting to the west
3:17 am moonrise Kāne, glow seen in clouds from Mauna Loa
4:30 am approximate time of Mānaiakalani setting southwest (clouds obscured horizon); Makaliʻi rising northeast
4:45 am first light
5:45 am sunrise

Site 2 June 19th:

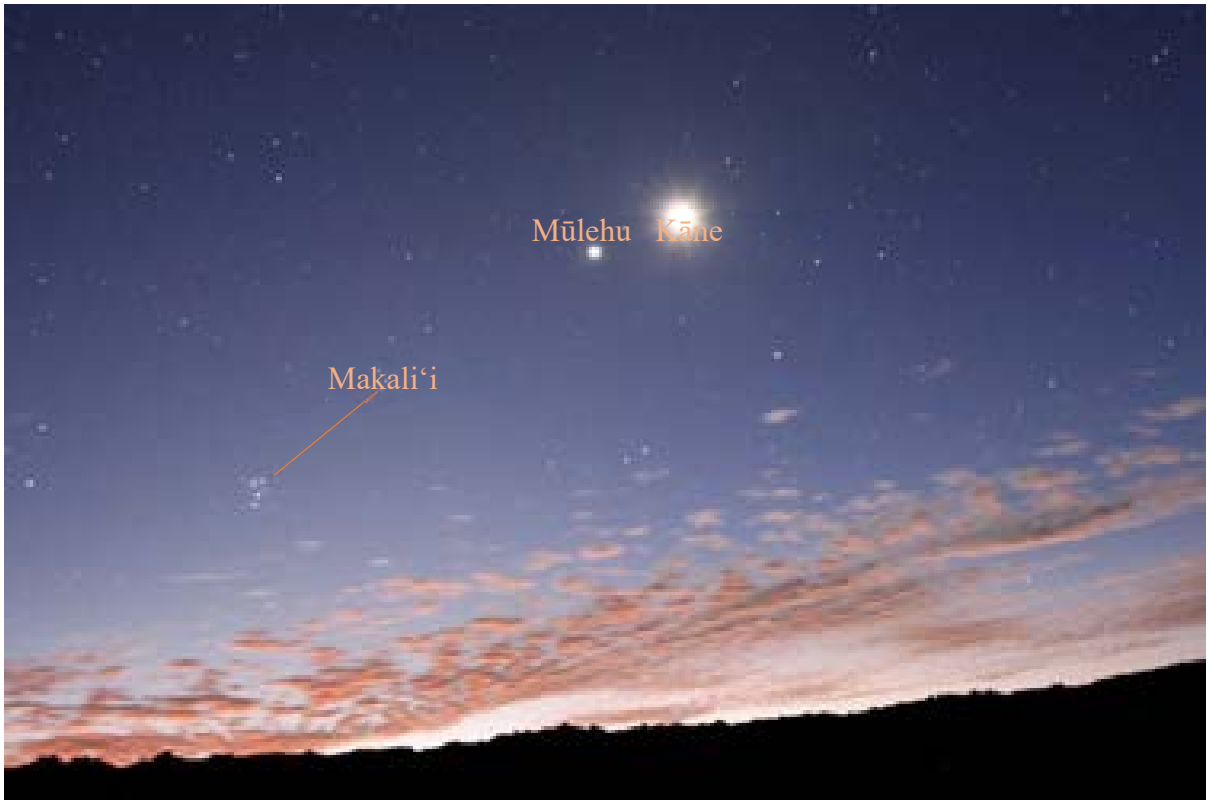
Kihi, no visibility due to the rain and clouds.
Pili, True north, Kūmau (Polaris),
Northeast, Konamaukūkū (Deneb) & Keʻoe (Vega) were visible,
East, Humu mä (Altair the main star & his sons Tarazed & Alshain)
Southeast, bottom hook of Mānaiakalani,
South, Kamailehope (Alpha Centauri) Kamailemua (Beta Centauri) and Newe (Southern Cross),
Southwest, nothing,
West, Hakamoa (Leo)
Northwest, Hikukahi & Hikulua of Nāhiku (Ursa Major) and Holopuni/Holopiʻinaʻau (the scoop of Ursa Minor).
Leleaka, Kāneikawaiola or Kaiʻanui (Milky Way) was sweeping from the north, northeast, east, southeast to the south with all the stars mentioned on the eastern hemisphere of the sky.

June 20
Kau, True north, Kūmau (Polaris),
Northeast, ʻIwakealiʻi/Iwikau (Cassiopeia) anchoring the Milky Way to the north,
East, Pegasus, not prevalent
Southeast, Kawahineamakaliʻi (Folmahaut),
South, nothing,
Southwest, nothing,
West, Hōkūleʻa (Acturus)
Northwest, Hikupau the last start of Nāhiku (Ursa Major) and Holopuni/Holopiʻinaʻau (the scoop of Ursa Minor).
Directly overhead were the stars mentioned during Pili that were intertwined with the Milky Way.

Pili Puka: True north was Kümau (Polaris),
Northeast was Makaliʻi, in the east was Venus & Pō Kāne,

Southeast, nothing,
South, nothing,
Southwest, Mānaiakalani was lying flat on our horizon, Mākulukulu (Saturn) was just above Lehuakona (Antares),
West, nothing,
Northwest, nothing visible except Holopuni/Holopiʻinaʻau (the scoop of Ursa Minor).

Kihi Puka: True north, Kūmau (Polaris),
Northeast, Wainaku/Hōkūlei (Capella) and the sun,
East, Kaʻoahiapele/Kapuahi (Alderbaran) photo vaguely visible
Northeast, nothing,
Southwest, nothing
West, Humu mā (Altair) and Holopuni/Holopiʻinaʻau (the scoop of Ursa Minor)
The MilkyWay was no longer visible from 4 am due to the sun.



Makaliʻi rising at sunrise.

June 20, Ke Alanui Polohiwa a Käne or the summer solstice, approximately 5 am, this photo was taken of Makaliʻi rising with the planet Mülehu, or Venus, and the Kāne moon. The sun will rise in the path of Makaliʻi. The importance of this revelation informs us that Makaliʻi rises on the border of Ke Alanui Polohiwa a Käne therefore it marks the northern corridor of the sky. The Hawaiians had three celestial divisions. The northern sky marked by the east west alignment of the Makaliʻi, the southern corridor marked by the east west alignment of Lehuakona in the

constellation Mänaiakalani (Scorpio), the middle corridor is the north south movement of the sun.

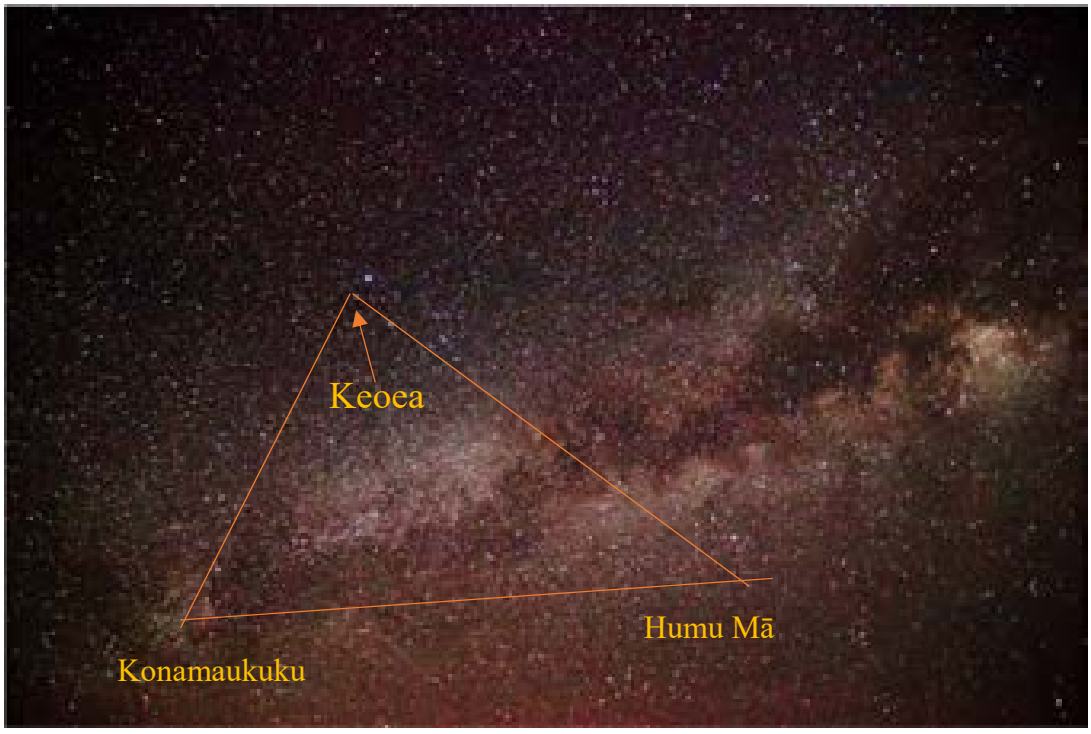
This is the same rock formation as noted in Figure 47 below Makali‘i. Now the sun is rising from the same location.

The sun is almost completely full.

Mānaiakalani has Lehuakona in its constellation which star marks the southern division of the sky.

Moon rising in the northeast.

Another view of Makali‘i rising with Mūlehu and Kāne.

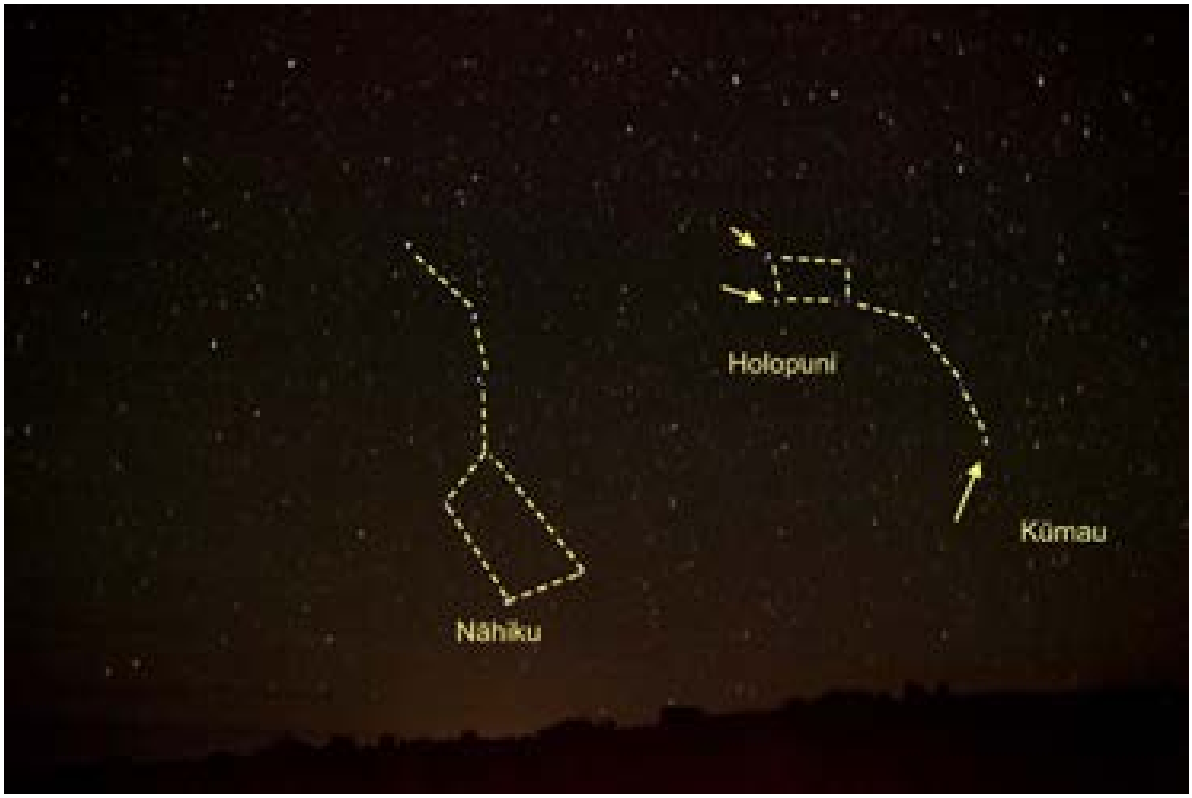


Milky Way with Mariner's Triangle, Keoea, Konamaukuku, and Humu mā.

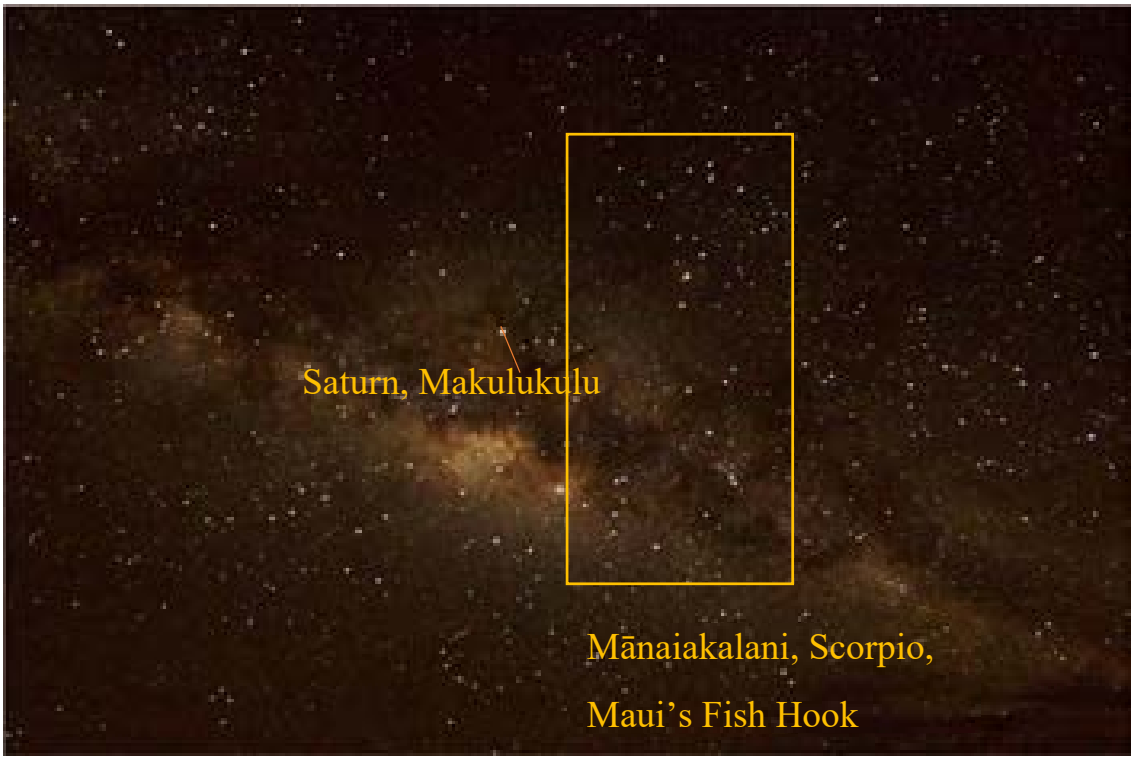
All of the stars of Makaliʻi.

Nāhiku, Big Dipper, Ursa Major setting on the pahu manamana.

Nāhiku setting on the pahu manamana. Kūmau is Hōkū Pa‘a or Polaris. Holopuni is Ursa Minor



Nāhiku, Holopuni, Kūmau.



Makulukulu, Mānaiakalani.

Milky Way, Mariner's Triangle and Ophiuchus.

‘Umialīloa

The final connection is ‘Umialïloa and his passion to connect the ‘aha of the land, to the ‘aha of the sky and the ‘aha of the ocean. The pathway of the pahu manamana is credited to ‘Umi and his ambition to connect to, undertake and understand all elements of his universe. It was a commendable journey and he accomplished a lot of his goals, if not all. It is said that this journey took ten years to complete.

‘Umi is responsible for Ahu a ‘Umi located in the saddle of Hualālai and Mauna Loa. He is also responsible for Pōhaku Hanalei. There are two Pōhaku Hanalei, one located on the northeast corner of Moku‘āweoweo and the other in the south of Moku‘āweoweo. I think maybe both Pōhaku Hanalei are in Hawai‘i Volcanoes National Park. ‘Umi is also credited for Kūki‘i at Kapoho near Kumukahi.

Pōhaku Hanalei, in the northeast, is in alignment with Kūki‘i and Pu‘u Ohau in Kona. This alignment is the sun’s middle corridor, Ka Piko o Wākea or the equinox. ‘Umi included a lot of the natural land features for this configuration of sun and land. I think ‘Umi believed that the making of land, which is the volcano, is influenced by the sun’s movement and the earth’s movement is influenced by the sun. With all this movement, fixed stars help us to find our place.

Appendix D- Site Visit Report #3, December 20-21, 2017, by Dr. Pualani Kanahele Kanakaʻole, Pualani Lincoln Maielua, Kalei Nuʻuhiwa

Pahu Manamana o ʻUmi was observed again on Ke Alanui Polohiwa a Kanaloa or the Winter Solstice, December 20 - 21, 2017. The researchers consist of:

1) Kalāhoʻohie Mossman, EO of Edith Kanakaʻole Foundation,
2) Kalei Nuʻuhiwa,
3) Pualani Lincoln Maielua,

Kalei and Pualani were flown to Pahu Manamana o ʻUmi on David Okita's helicopter leaving Hilo airport at 9:00 am on Dec. 20, 2017. The women arrived at the pahu manamana at 9:35 am. Kalā flew out from Volcano at approximately 10:00 am with overnight gear. He landed at the pahu manamana at 10:15 am.

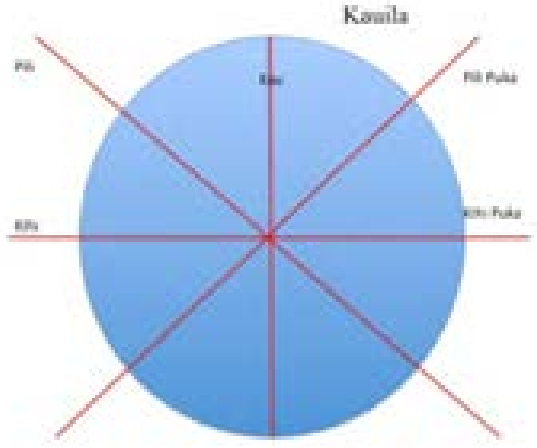
They returned in reverse with Kalā landing in Volcano at 7:00 am, Kalei and Pualani touching down in Hilo at about 8:00 am on Dec. 21, 2017.

Kauila

The researchers oriented themselves to an observation site that they felt might provide the most information throughout the night. The approach for observation was discussed, determined and agreed upon by the three researchers before leaving Hilo. The approach is known as Kauila.

Kalei is the leading Papahulilani authority in the islands and she and Pualani are both star experts. Pualani is also well trained in Hawaiian navigation and is very well acquainted with the celestial entities. Kalā is also training in Hawaiian navigation. Therefore, the three were necessary to pull as much out of the sky as possible.

The observational focus for Pahu Manamana o ʻUmi is that of stars intersecting in a particular part of the sky in relationship to the site. Therefore, the knowledge of these individuals is

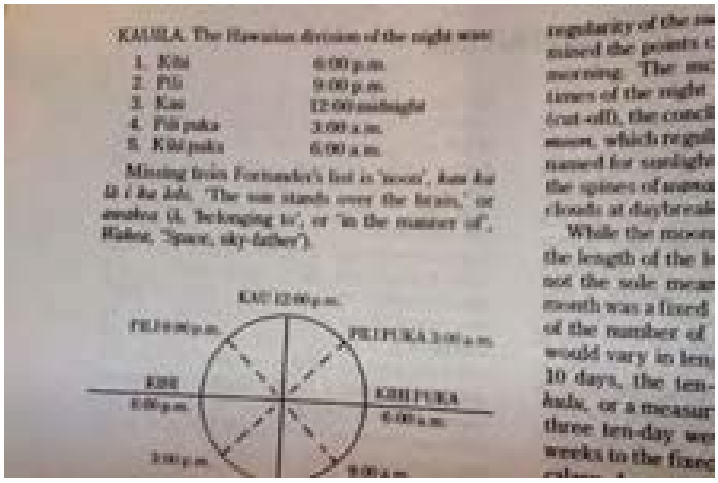


Kauila divisions.

valuable. Kauila is a familiar approach for them, it systematizes sky observation without the need to continually watch the dome from sunset to sunrise.

Kauila is an indigenous tracking of time based upon the movement and transition of the sky. This system of time was used to structure the observations throughout the evening. The following designations of time mark the movement and positioning of the stars and planets:

- Kihi, sunset or approximately 6 pm, setting in the west;
- Pili, 9 pm, 20 degrees above the west horizon;
- Kau, midnight or approximately 12 am, zenith (overhead);
- Pili Puka, 3 am, 20 degrees above the east horizon;
- Kihi Puka, sunrise or approximately 6 am rising in the east.



Another sample of the Kauila divisions.

Selecting Sites

Kalei selected the site with the 3 manamana maybe 5, which we named Ahu kua alo (back to front). This is the site of the standing manamana that were interrupted by Pele's new flow.

Kalei chose Ahu kua alo.

Pualani chose the pänänä and Pahu Manamana o ÿUmi.

Kalā's choice was the high central Ahu o luna.

Weather Occurrence

Camp site.

A camp site was selected beyond the cultural sites to negate the light from within. The weather at Pahu Manamana o 'Umi during the 24 hours seemed to hang between 30 – 40 degree

Fahrenheit, it was very, very cold. The tent was structured to protect against the rain, hail, frost and cold.

The team reported that it was 12:20 pm after building the camp site, settling their gear and choosing their observation sites when the storm was upon the site. The clouds in the western sky was socked in and they knew they wouldn't have a shot at the sun set. The wind was variable, switching from north/east to south/west then north to north/east then to south. The shift from the eastern sky to the south brought with it thunderheads. This storm wrapped itself around the site. Storm with lightning and thunder continued rumbling to the south of their location.

Thunderheads and heavy rain clouds arrived quickly before 1 pm, dropping sheets of rain and hail shortly thereafter. Frequent thunder and lightning continued with heavy rain, then hail, then rain and hailed again repeatedly. Rain and hail continued until 3:10 pm. The sky opened up for a short while, providing a glimpse of Mauna Loa's southwestern flank with more ice and snow.

Storm clouds building.

Heavy rain falling in sheets.

New ice packed on Mauna Loa.

Hail bouncing before splattering on the ground.

The team took photos of the variable cloud forms and color in the late afternoon and early evening until the fog rolled in and socked in the site into a reverent, still universe of Pahu Manamana o ʻUmi. It was ceremonial time and space. ʻAwa and chants were offered. The sky above was clear except for large orange thunderclouds.

Large orange thunderclouds.

After thunderstorm, heavy clouds came in.

As a result of the cold rain, hail, and cloud cover, the early morning ground was covered with light snow and frost.

Light snow and frost.

By 8 pm in the evening the dome had cleared and nothing, but stars were visible. The visibility remained until lift off returning to Hilo by 8:00 am. The researchers were relieved in witnessing this phenomenon that would allow them to get to work on aligning stars.

Kūlua, a waxing moon, rose at 9:30 am and set at 9 pm therefore it was high in the sky when visible in the evening. Kūlua is the fourth moon phase or the fourth night of the malama (month) Kāʻelo, the Hawaiian lunar month known for wet weather and saturated earth. The visibility of the moon was viewed in snippets between clouds and storm, from a few hours prior to sunset until it set at 252 degrees (WNW).

Kūlua in the month of Kāʻelo, 2017.

A close up of Kūlua.

Wai, Water

The rain provided an insight of how one gathers water in an obvious waterless land. The rain was substantial and lasted for at least 4 hours. Hawaiian texts talk about gathering water in dripping caves by leaving wooden, deep platters or trays with a clean kapa cloth in it and rinsing out the cloth every few hours and emptying the water into another container. The caves in the area sounded alive with flowing water, crickets and birds. Although no birds were observed at all, their chatter was obvious. The night was noisy with crickets, birds and other unrecognizable chatter.

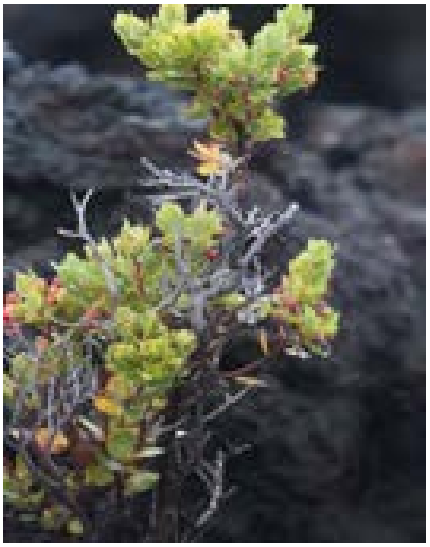
We refrained from entering the caves for safety sake. However, water was dripping from porous rocks and caught in all sizes of dips and bowls in rocks, it was very inspiring to see as much water possibilities at this time of the year, as opposed to the lack of it during the summer solstice.

Water deposits.

Vegetation

Despite the wet season the vegetation continues to be scarce and scrawny. At that elevation the hardy bush are sparse, no trees are available. Vegetation includes: ʻaʻaliʻi, ʻōhelo, pūkiawe and kūpaoa. Vegetation at that elevation were not dependable for daily use, therefore all vegetation for comfort, medication, firewood, etc. were brought in with the entourage. Below is the few vegetation at the pahu manamana site.

Kalamoho.



ʻŌhelo.

‘A‘ali‘i and pūkiawe.

Pūkiawe.

Star PowerPoint and Narrative on Ke Alanui Polohiwa a Kanaloa, Kāʻelo December 21 - 22, 2017, by Pualani Lincoln Maielua

KE AU O KANALOA: The time of our observation was during Ke Alanui Polohiwa a Kanaloa, the winter solstice, when the sun is at its most southern extreme boundary. This time also establishes the winter sky, star lines, and weather systems.

NĀ AO: Upon arrival to the site there was about 70% cloud coverage. Upper level winds were pushing majority of clouds in upper stratum while lower level clouds were more stagnant. One particular cloud structure in the south was fixed and growing rapidly upward. This cloud eventually became active with lightning and thunder at sunset.

KA WAI: The main source of water at this site is from clouds and fog. Water is housed and stored in the natural rock features, caves, taverns, crevices, and plant life and its understory. Shortly after we setup our basecamp the temperature dropped, and rain was preceded and followed hua hekili (hail). The hail size was no bigger than a BB gun pellet but did fall down heavily for a few minutes prior to rainfall and closed out the rain with another showering. Another source of water here is hau (snow) and hauʻoki (frost). Between the time periods of Kau and Kihi Puka the site was lightly dusted with both hau and hauʻoki. The temperature was low enough to maintain its solid structure until sunrise.

KA MAHINA: The Kūlua moon rose at 9:30 am and set at 9:00 pm. Külua is the fourth night of the malama Kāʻelo, the Hawaiian lunar month known for wet weather and saturated earth. Majority of our visibility of the moon was from a few hours prior to sunset until it set at 252 degrees (WNW).

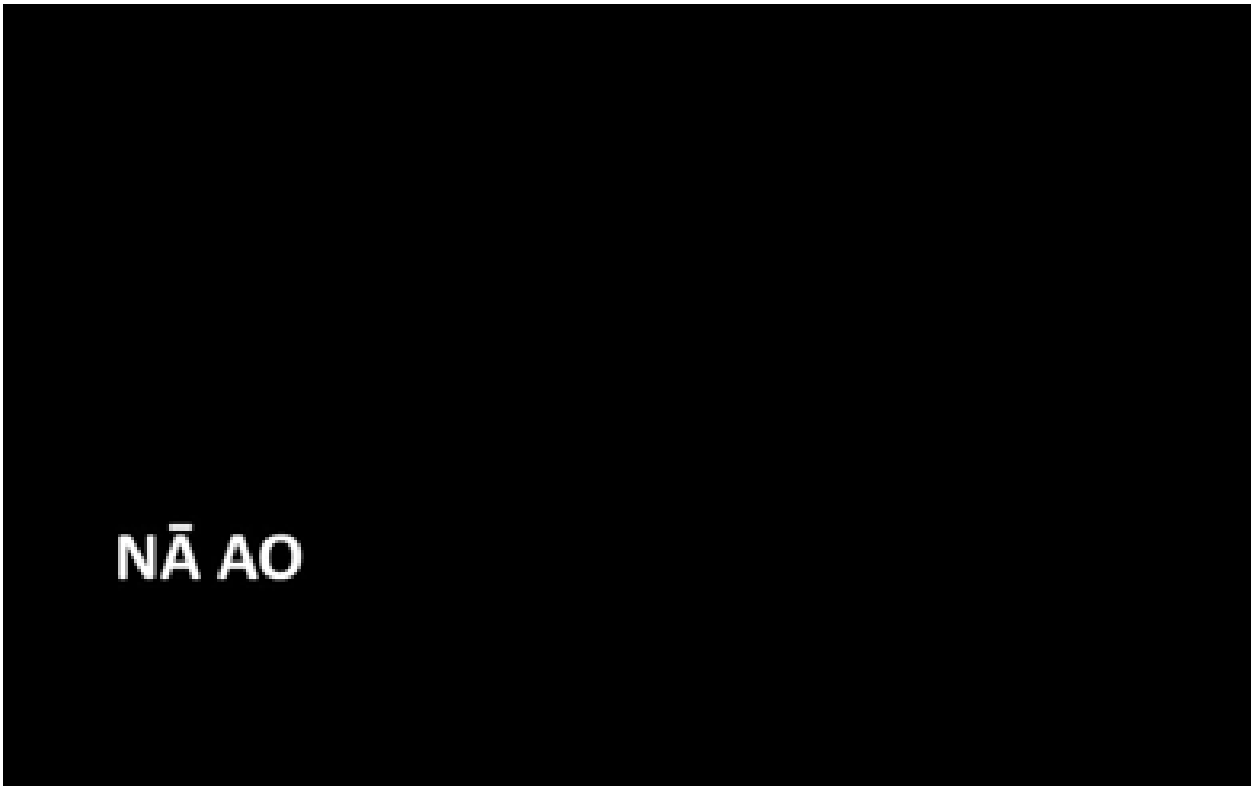
NĀ MANAMANA: The manamana are located on the paepae facing NNW. Seven of what appears to be eight manamana are firmly standing upon a short stacked paepae. Each manamana has a very unique and distinct shape as well as a variety of heights and widths. The two manamana in the center of the paepae are set closer to each other than the outer manamana. The center of the paepae proved to be a significant setting point for many of the stars observed that evening. Each manamana located on the paepae has been numbered from #1 to #7, south to north, for simple referencing purposes.

NĀ HŌKŪ: The Kauila is an indigenous tracking of time based upon the movement and transition of the sky. This system of time was used to structure our observations throughout the evening. The following designations of time mark the movement of the sky as well as positioning of celestial beings: Kihi, sunset or approximately 6 pm, setting in the west; Pili, 9 pm, 20 degrees above the horizon; Kau, midnight or approximately 12 am, zenith (overhead); Pili Puka, 3am, 20 degrees above the horizon; Kihi Puka, sunrise or approximately 6 am, rising in the east. The following observations were made facing the paepae and pōhaku manamana.

NĀ KUHIKUHI ʻĀKAU or NORTHERN POINTERS: Northern Pointers are essential combinations of stars and constellations that align directly with Kūmau (Polaris) or the North

Star. These star sets are crucial in identifying Kūmau's location in the sky when cloud coverage, weather, or latitude prevents visibility of the polar star. The most relied upon and accurate Northern Pointers set upon these uprights or within this paepae.


Pahu Manamana
Report
Mauna Loa, Hawai'i
Kā'elo 2017
Kealapolohiwaakanaloa
December 21 – 22


NĀ AO

KA WAI

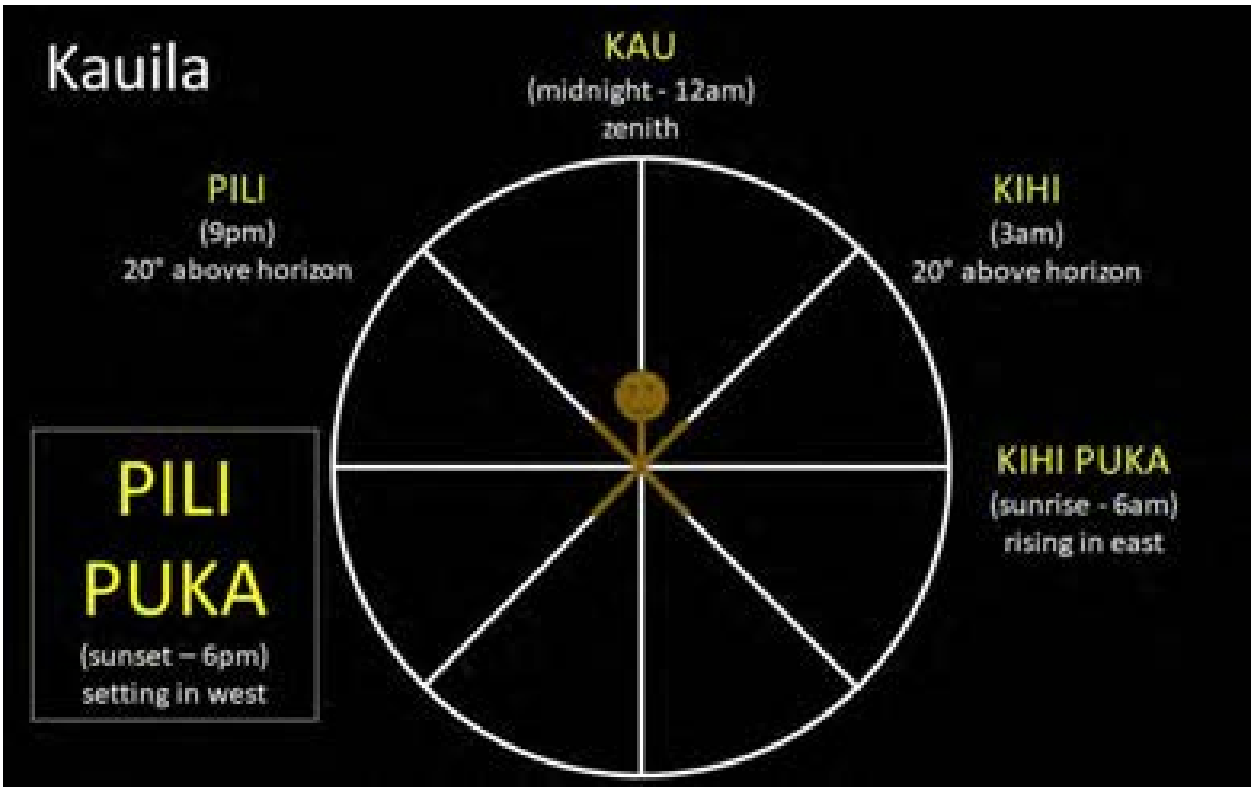
KA MAHINA


Kūlua, Kā'elo
December 21, 2017

NĀ MANAMANA

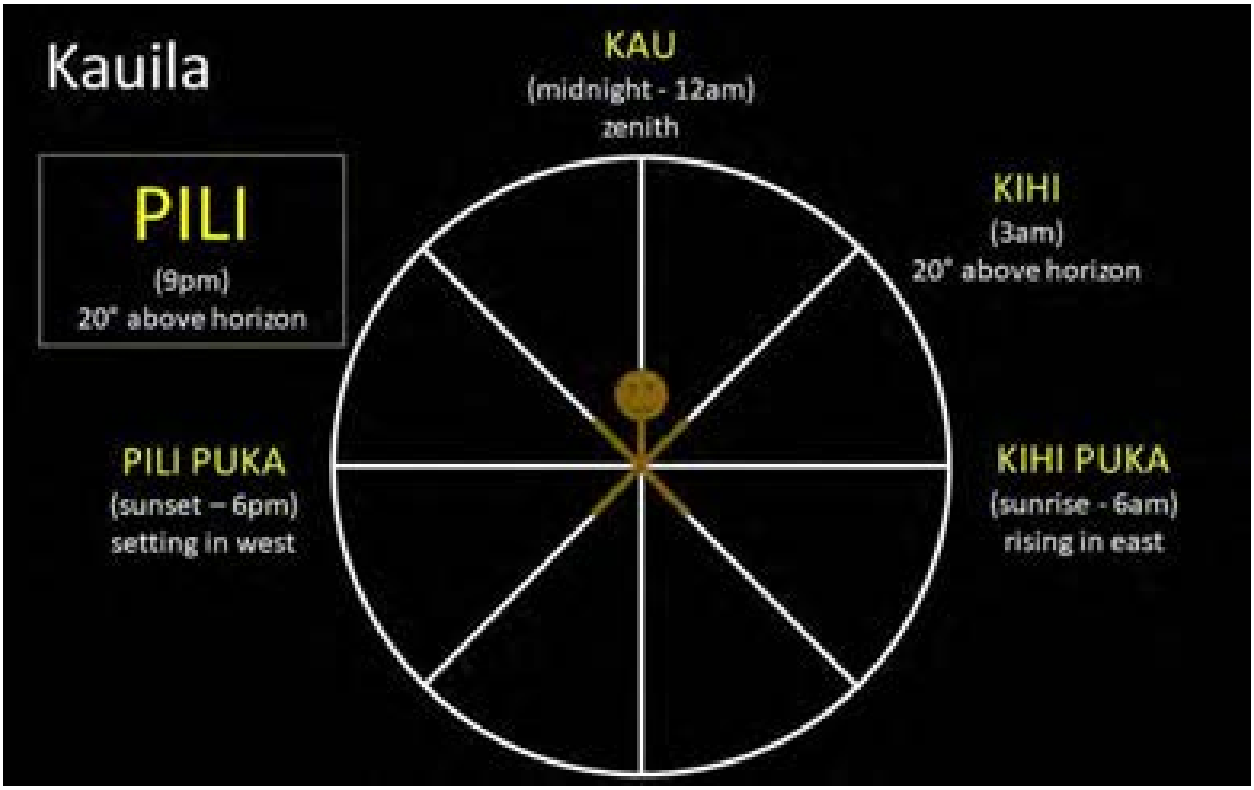

1
2
3
4
5
6
7

NĀ HŌKŪ

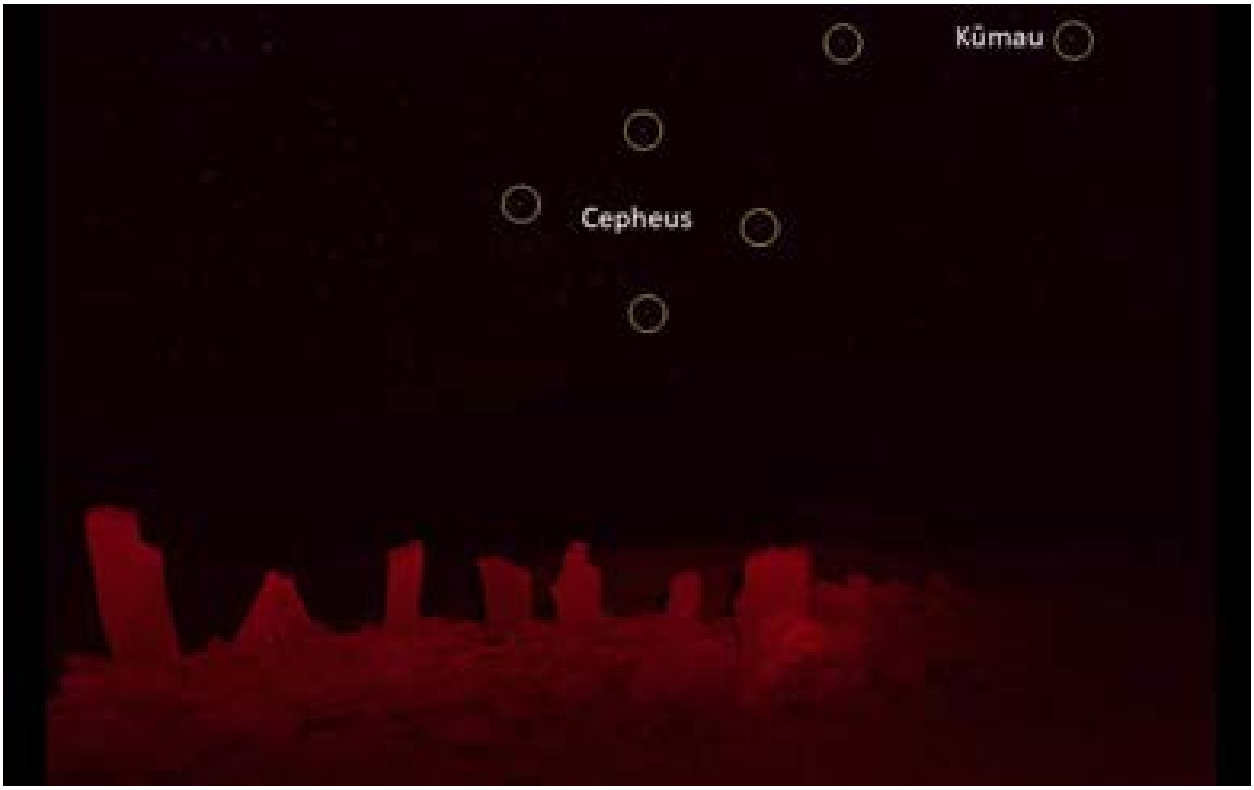

Kauila
KAU
(midnight - 12am)
zenith
PILI
(9pm)
20° above horizon
KIHI
(3am)
20° above horizon
PILI
PUKA
(sunset – 6pm)
setting in west
KIHI PUKA
(sunrise - 6am)
rising in east

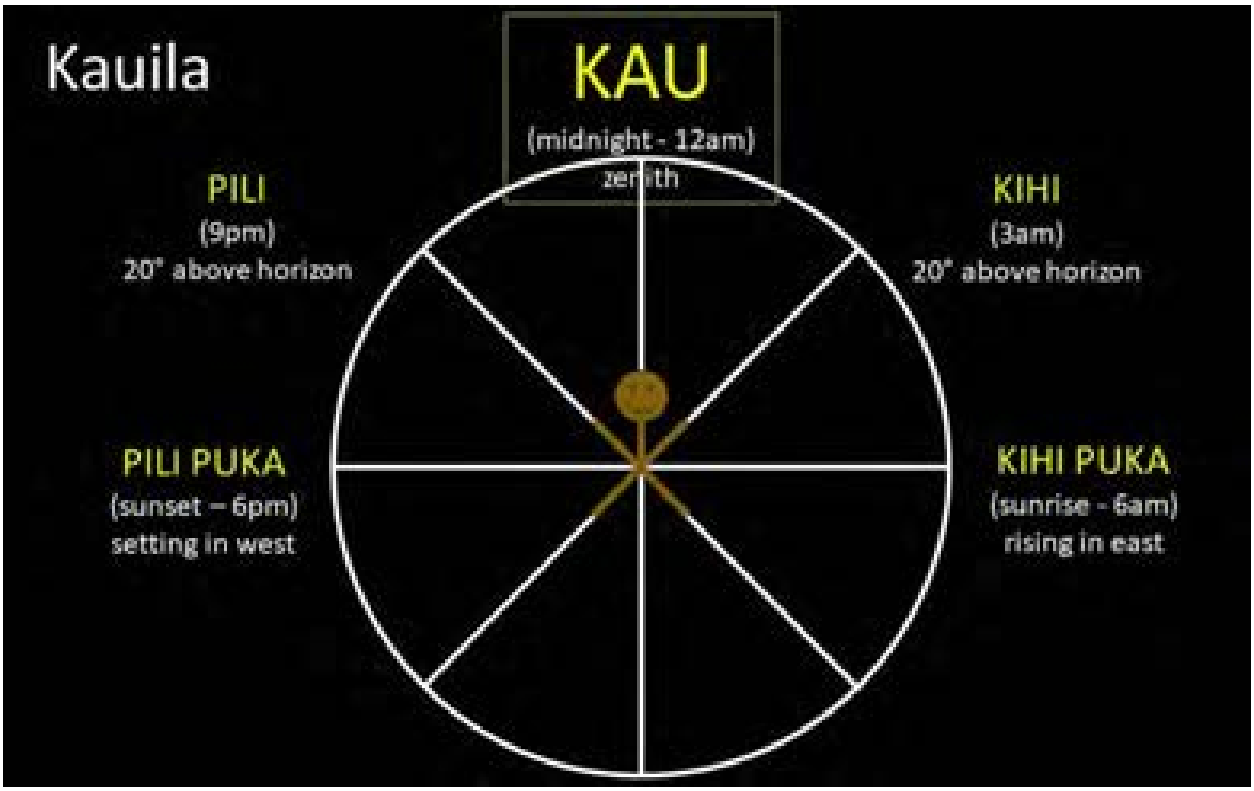

(constellation: Navigator's Triangle)
Keoea
Vega
Eltanin
(constellation: Draco)
Rastaban
Holoholopina'au
Pherkad
Kochab
(constellation: Ursa Minor)

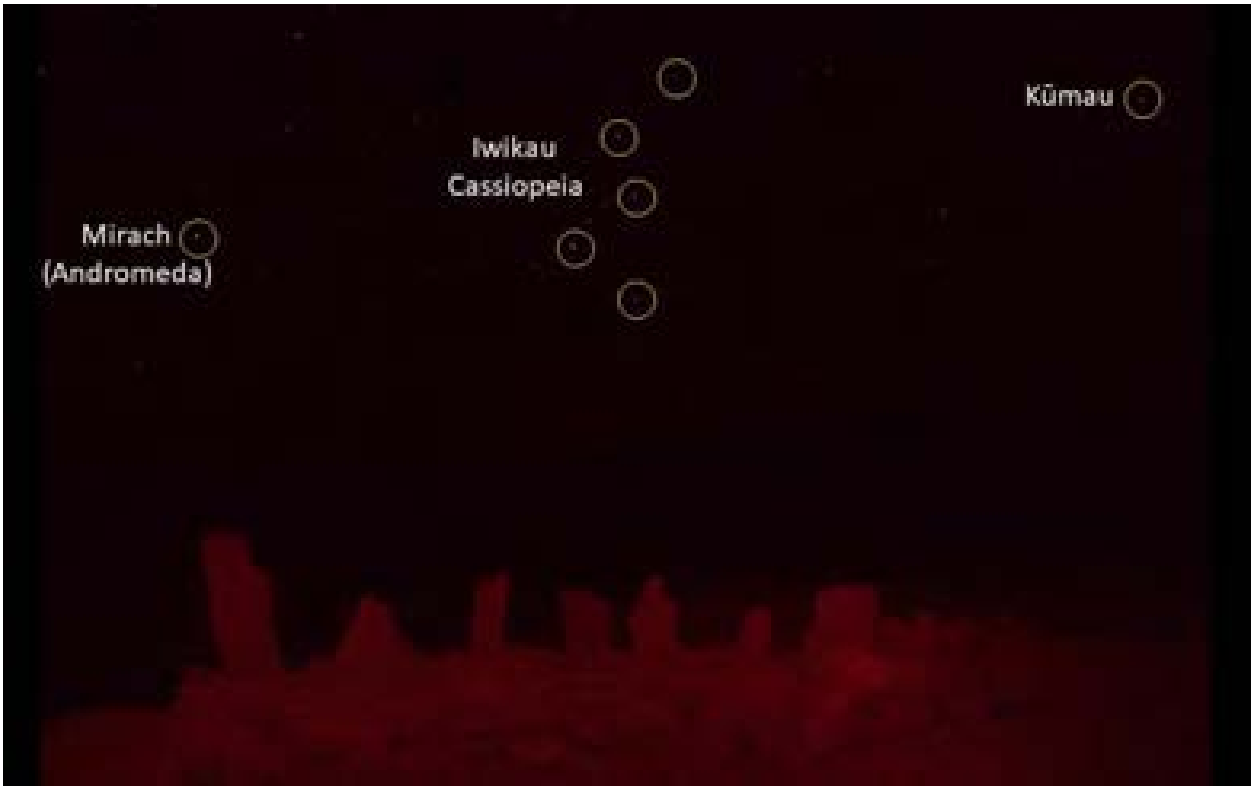

Konamaukuku
Deneb (Cygnus)
Kūmau
Kochab
Keoea
Vega

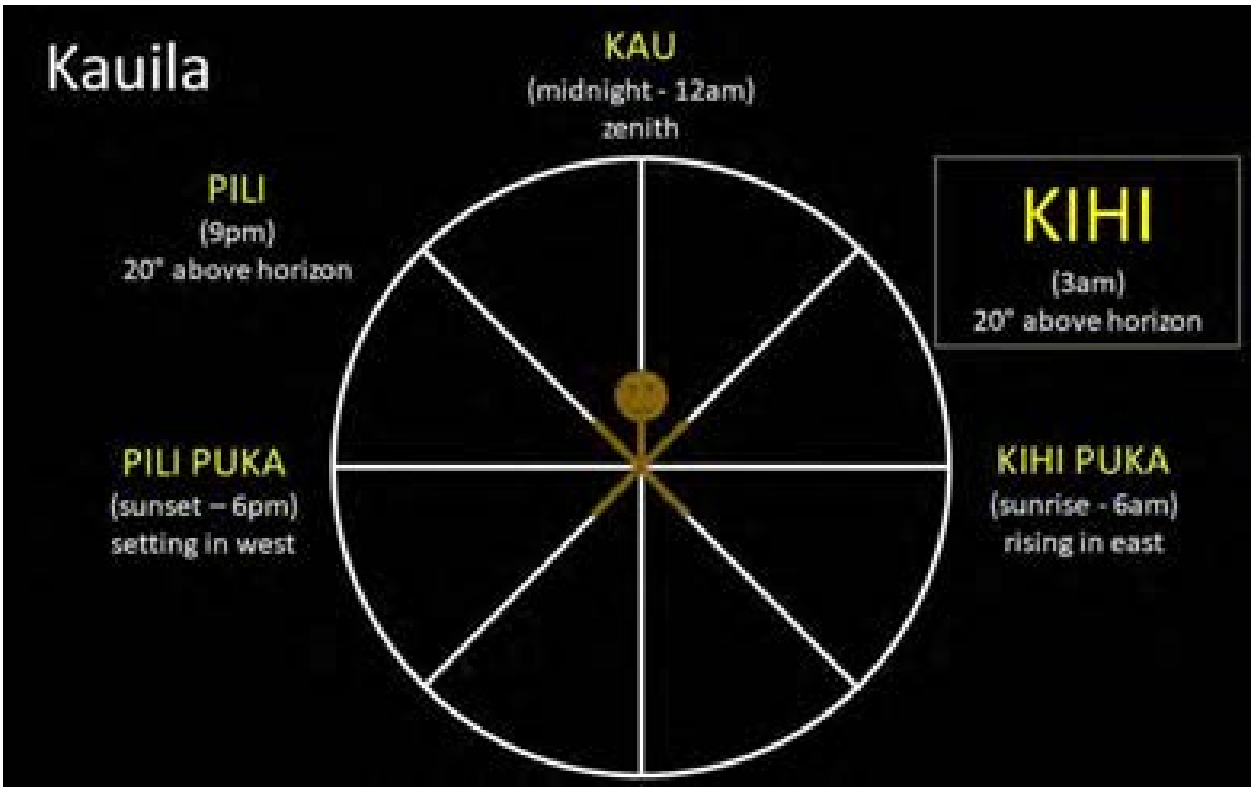

Kauila
KAU
(midnight - 12am)
zenith
PILI
(9pm)
20° above horizon
KIHI
(3am)
20° above horizon
PILI PUKA
(sunset – 6pm)
setting in west
KIHI PUKA
(sunrise - 6am)
rising in east


Kūmau
Konamaukuku
Deneb (Cygnus)


Kūmau
Cepheus


Kauila
KAU
(midnight - 12am)
zenith
PILI
(9pm)
20° above horizon
KIHI
(3am)
20° above horizon
PILI PUKA
(sunset – 6pm)
setting in west
KIHI PUKA
(sunrise - 6am)
rising in east

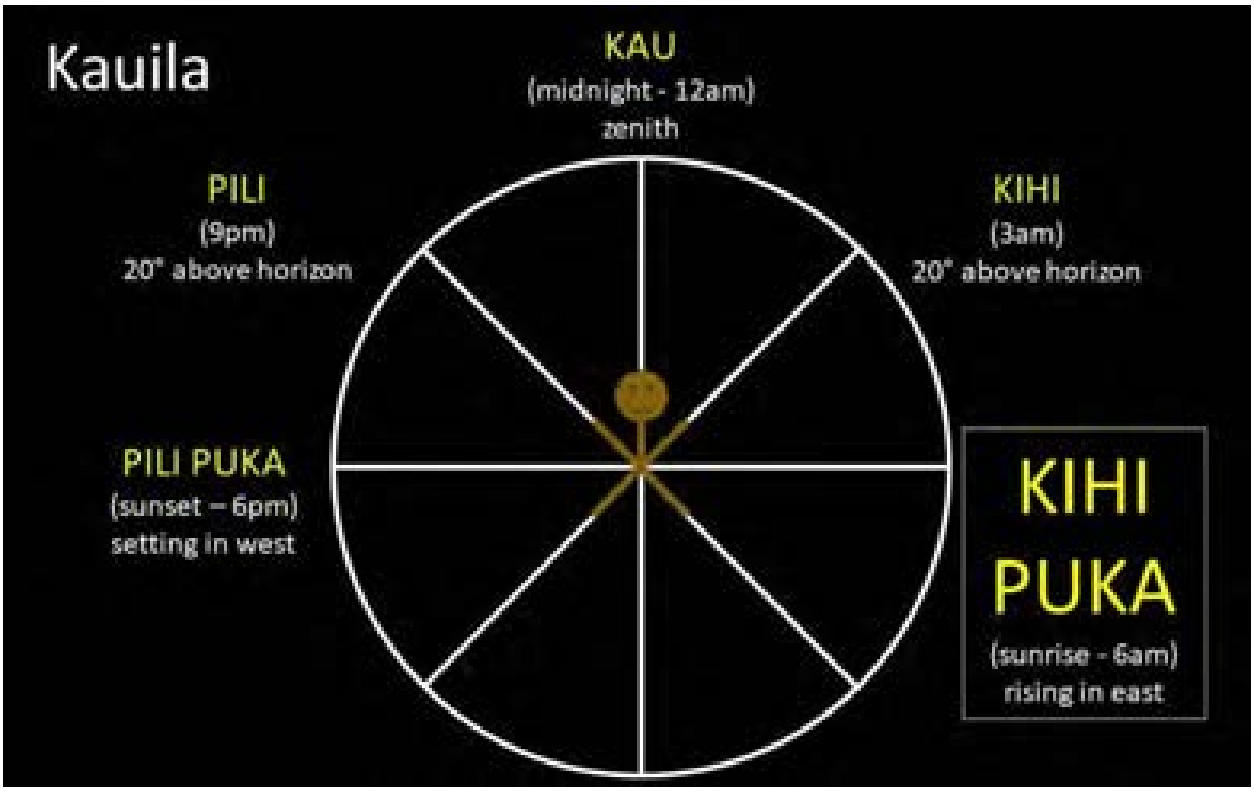

Kūmau
Iwikau
Cassiopeia
Mirach
(Andromeda)


Kauila
KAU
(midnight - 12am)
zenith
PILI
(9pm)
20° above horizon
KIHI
(3am)
20° above horizon
PILI PUKA
(sunset – 6pm)
setting in west
KIHI PUKA
(sunrise - 6am)
rising in east


Makali'i
Mirfak
(constellation: Perseus)
"fallen upright"

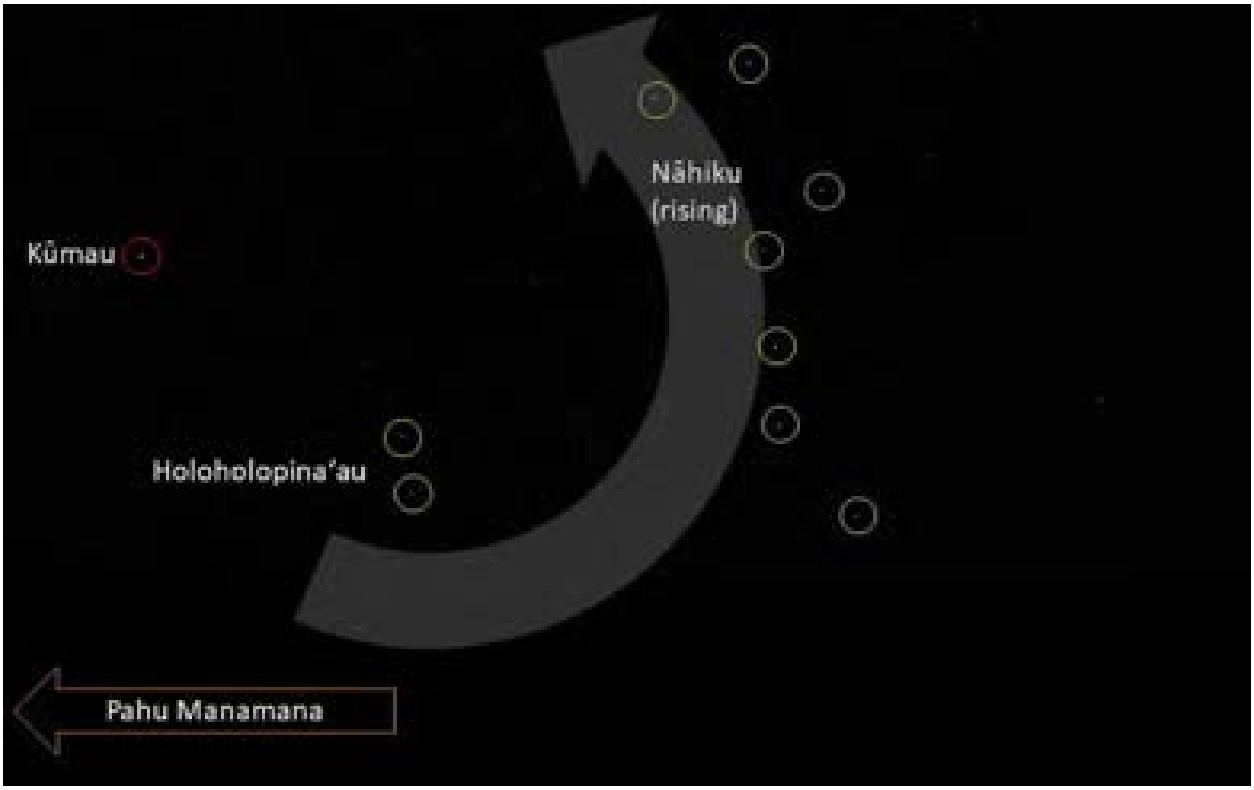

Makali'i
(constellation: Perseus)

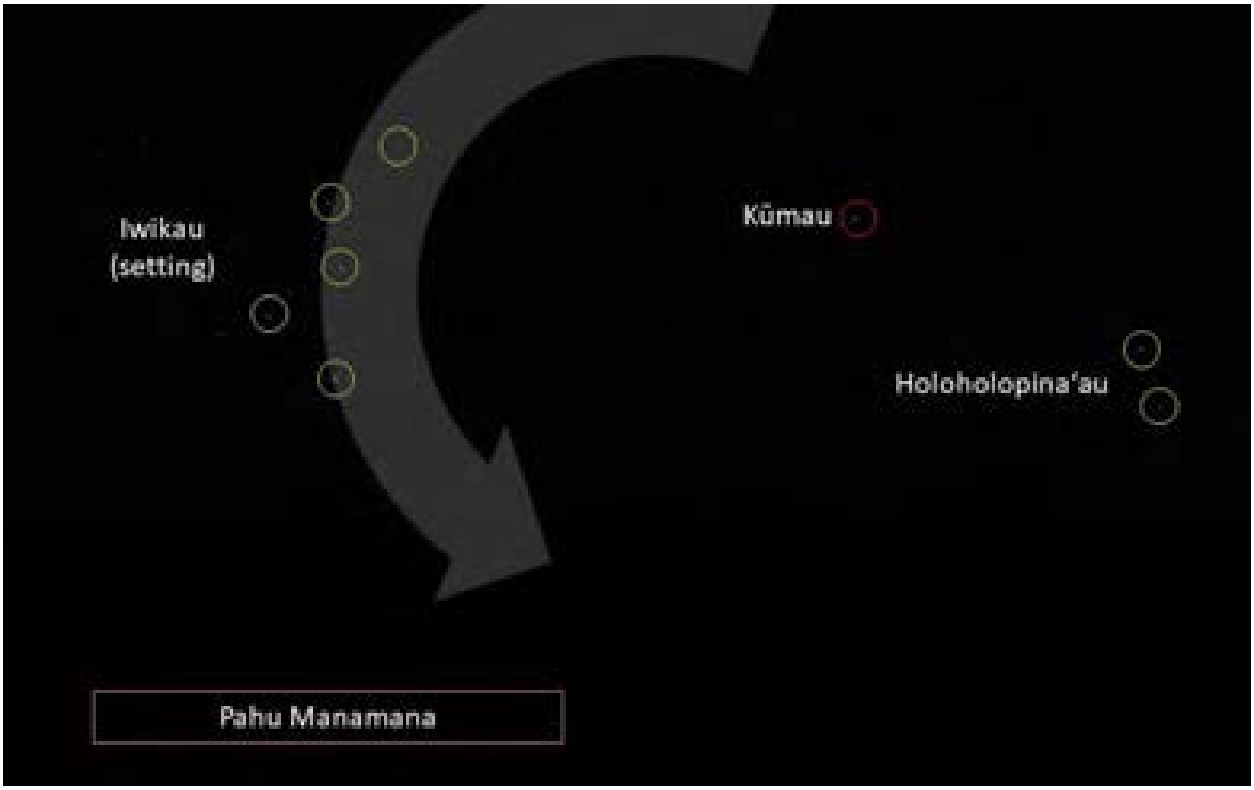

Wainaku/Haumea
Capella
(Auriga)
(constellation: Perseus)
Makali'i


Kauila
KAU
(midnight - 12am)
zenith
PILI
(9pm)
20° above horizon
KIHI
(3am)
20° above horizon
PILI PUKA
(sunset – 6pm)
setting in west
KIHI
PUKA
(sunrise - 6am)
rising in east

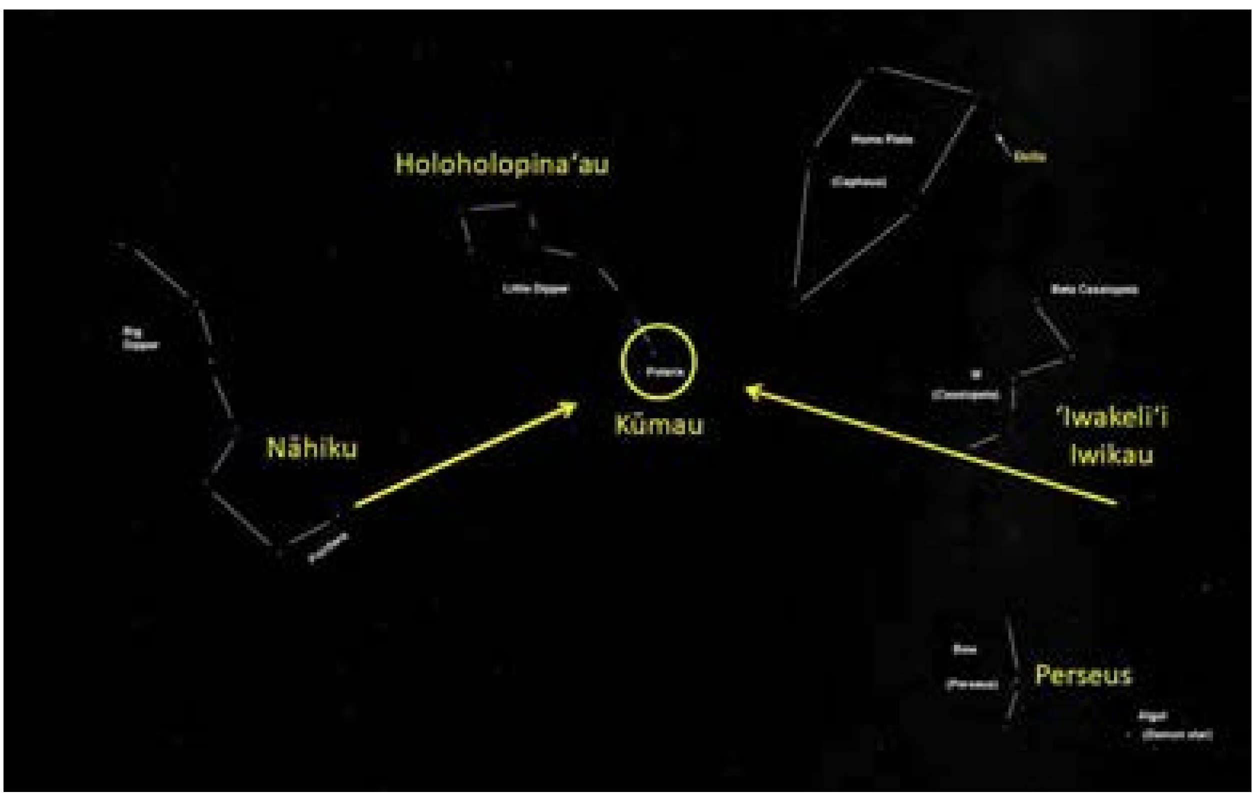

Wainaku/Haumea
Capella
(Auriga)

NĀ KUHIKUHI ʻĀKAU
NORTHERN POINTERS


Nāhiku
(rising)
Kūmau
Holoholopina'au
Pahu Manamana


Iwikau
(setting)
Kūmau
Holoholopina'au
Pahu Manamana


Kūmau
Polaris
Ursa Minor
Holoholopina'au
Nāhiku
Ursa Major


Holoholopina'au
Nāhiku
Kūmau
'Iwakeli'i
Iwikau
Perseus


Cepheus
Holoholopina'au
'Iwakeli'i
Iwikau
Kūmau
Perseus
Nāhiku
Wainaku/Haumea

KIHI: Some of the first stars visible just after sunset were Keoea (Vega), Kūmau (Polaris), Iwikauikaua (Cassiopeia), Humu mā (Altair), and Konamaukuku (Deneb). Also visible throughout most of the evening was Holoholopiʻinaʻao (Pherkad and Kochab). Holoholopiʻinaʻao is a circumpolar star in Hawaiʻi, therefore it doesn't "set" below the horizon, but travels around Kümau in a circle as the night transitions.

As the darkness settled in the NW stars were became more brilliant and visible. Distinguishing the exact declination of the stars upon these manamana was a challenge as the high crested lava field behind the paepae prevented a clear visual. Studying the keʻe (angle of setting) throughout the evening allowed for a general estimate as to where these stars would set upon the manamana if a clear view was provided.

Eltanin and Rastaban of the constellation Draco set on #4 and #5. The significance of this constellation is that it is an accurate northern pointer.

Less than an hour following Kihi at approximately 7 pm Keoea set on #2. Keoea is a significant star of the northern sky as it is the brightest and first star to rise in the Navigator's Triangle a dominant constellation of the north as well as the summer night sky which is why it is also referred to as the Summer Triangle. By this time Kūmau was extremely visible and appeared to mark the northern edge of the paepae. The extreme north manamana is no longer standing or present, so it is unclear as to the placement of Kūmau upon the possible #8 manamana.

PILI: Konamaukuku of the constellation Cygnus and the base of the Navigator's Triangle set on #3. Konamaukuku along with Gienah is used as a northern pointer. Following Konamaukuku was a very distinct constellation Cepheus, another dominant constellation of the northern sky and also used to find Kūmau. The 5 stars of Cepheus would have set between #5 and the possible #8 manamana.

KAU: Iwikau (Cassiopeia setting) was a very visible and brilliant constellation hovering above the center of the paepae at midnight. Though visibility was not as clear upon the time of its' setting, Iwikau most likely set upon #4 and #5. Cassiopeia is a dominant and extremely accurate northern pointer.

Mirach of Andromeda would also have set between #1 and #2.

PILI PUKA: Mirfak and its' constellation Perseus hung just above the paepae at Kihi, directly to the west of this constellation was Makali‘i. I had to adjust my camera to capture Makali‘i. In my adjustment I noticed that a lower setup on my tripod would capture the larger NW sky. At this time, I relocated my camera directly behind the pānānā and lowered it. This allowed for full scope of Makali‘i setting.

At about 4:30 am Perseus set upon #1, #2, #3, #4.

Makali‘i did not set upon the paepae and was several feet to the left of the southern edge. Another visit in March would be helpful in determining the declination of Makali‘i at Pahu Manamana O ‘Umi.

KIHI PUKA: Wainaku or Haumea of the constellation Auriga set just as the sun was about to rise and brighten up the sky. Wainaku set upon #2. The significance of this constellation and star is that it is also used as a northern pointer.

Summary & Proposal For Future Observation

In summary the Pahu Manamana on Mauna Loa is most definitely in alignment with our dominant northern pointers. Being able to find Kūmau is to this day one of the most important skills in navigation whether by sea or land. Further study of this site will help to identify the exact declinations of these significant stars and their relation to Kūmau.

It is suggested that another research trip be executed in March during Ka Piko o Wäkea (the Spring Equinox) to further examine these findings as well as to determine the exact declination of Makali‘i and other significant stars of our Northern sky.

Narrative for Ke Alanui Polohiwa a Kanaloa, Dec 20 -21, 2017 by Kalei Nu‘uhiwa

Kalei's star determination is from Ahu kua alo.

PDF #1 begins with Kauila at 6 pm in the western sky.

Frame #1 the title

#2 6 pm, Mariner's Triangle sits in the clear western sky.

#3 8:30 – 9:30 pm, Mariner's Triangle lower in the western sky. Hawaiian nomenclature added: Humu mā, Konamaukuku, and Keoea setting on Mauna Loa's ridge.

Manamana #1 (according to Pua's ppt she identifies the manamana) marks Keoea setting.

#4

#5 Sirius is rising in the east marked by the Ahu kua alo manamana.

#6 Mariner's Triangle is setting between Ahu a luna and manamana #1

#7 Shows the stretch of the Lālani (MilkyWay) with Iwikau (Cassiopeia, a northern constellation)

#8 Makali‘i (Pleiades) is almost at zenith, Kaoahi (Taurus) is east of Makali‘i, Lono (Orion) is further east (is the sky equator), Sirius is rising in southeast. Hōkūlei is north of Makali‘i, Namahana is rising further north.

#9 Pegasus is setting in the north/west.

#10 12 am the star Markab in Pegasus is identified as Kahuelokū.

#11 Midnight Kahuelokū setting on Ahu a luna.

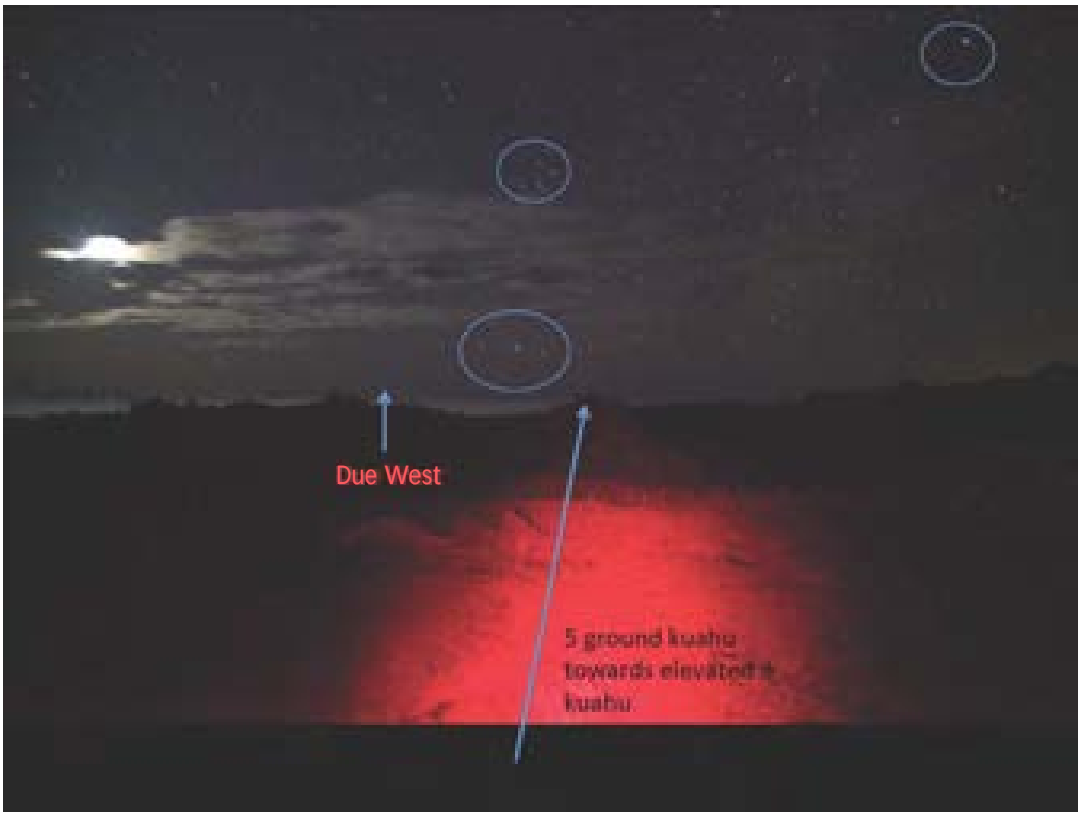
#12 Hōkūlei is zenith north sky, Nanamua, Nanahope north/east, Holoholopi‘ina‘ao (Ursa Minor) is north/west, Lono (Orion) is zenith.

#13 Kümau (Polaris) is true north, Holoholopi‘ina‘ao is setting to repeat the cycle and Nā Hiku (Ursa Major) is rising in the north/east.

From the 5 Ground Kuahu

Report by Kalei Nuuhiwa


Summer triangle
Delphinus
Konamaukuku
Milky Way
Humu mā
Kenea
Due West
Elevated 3 kuahu
Large manamana on paepae marks
Kenea setting
8:30 – 9:30pm

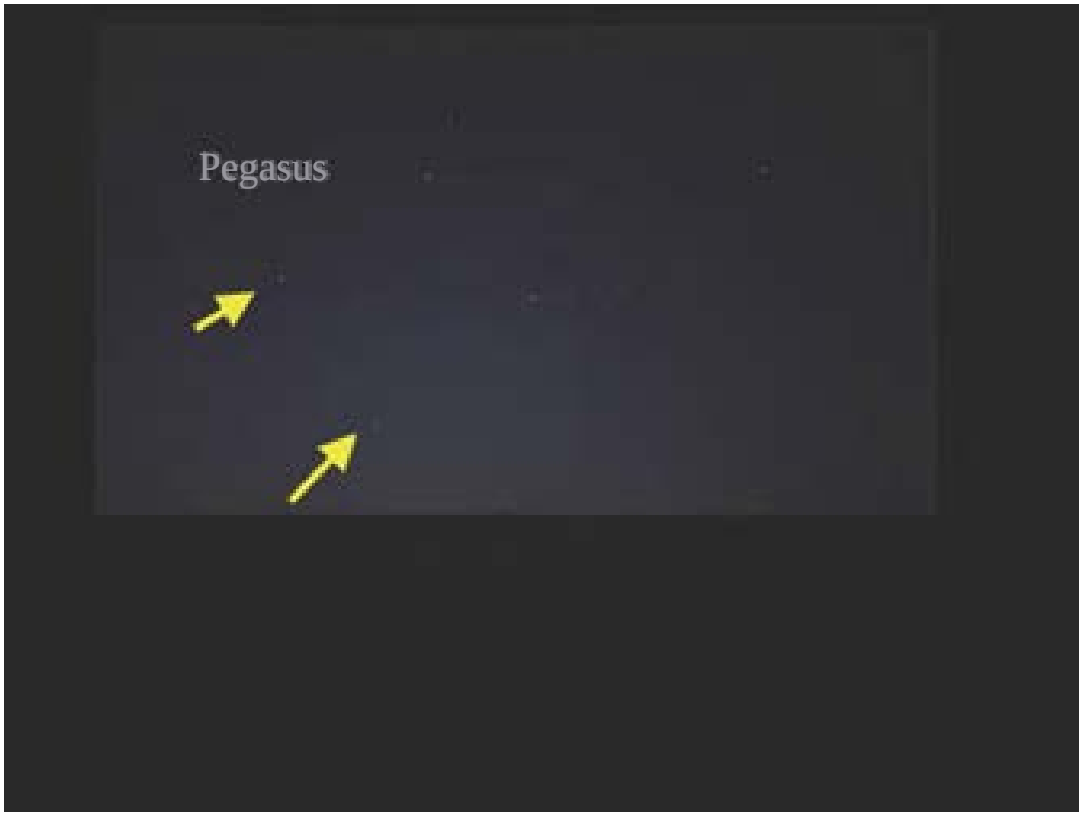

Due West
5 ground kuahu
towards elevated 3
kuahu


Sirius


8:30pm
Delphinius
Konamakuku
Humu mu
Elevated 3 knobs
Tall manamana on pacpac


Iwikau & Milky Way
Milky Way


Makali'i
Kapuahi/Kaoahiapele
Hōkūlei
Sirius
Nanamua


Pegasus


Algenib & Markab of Kahuelokū
(Pegasus)


Midnight
Algenib & Markab of Kahuelokū
(Pegasus)


Hokulei
Lono/Orion
Nanamua
Nanahope
Holoholopi'imaao

PDF #2 continues from Part 1

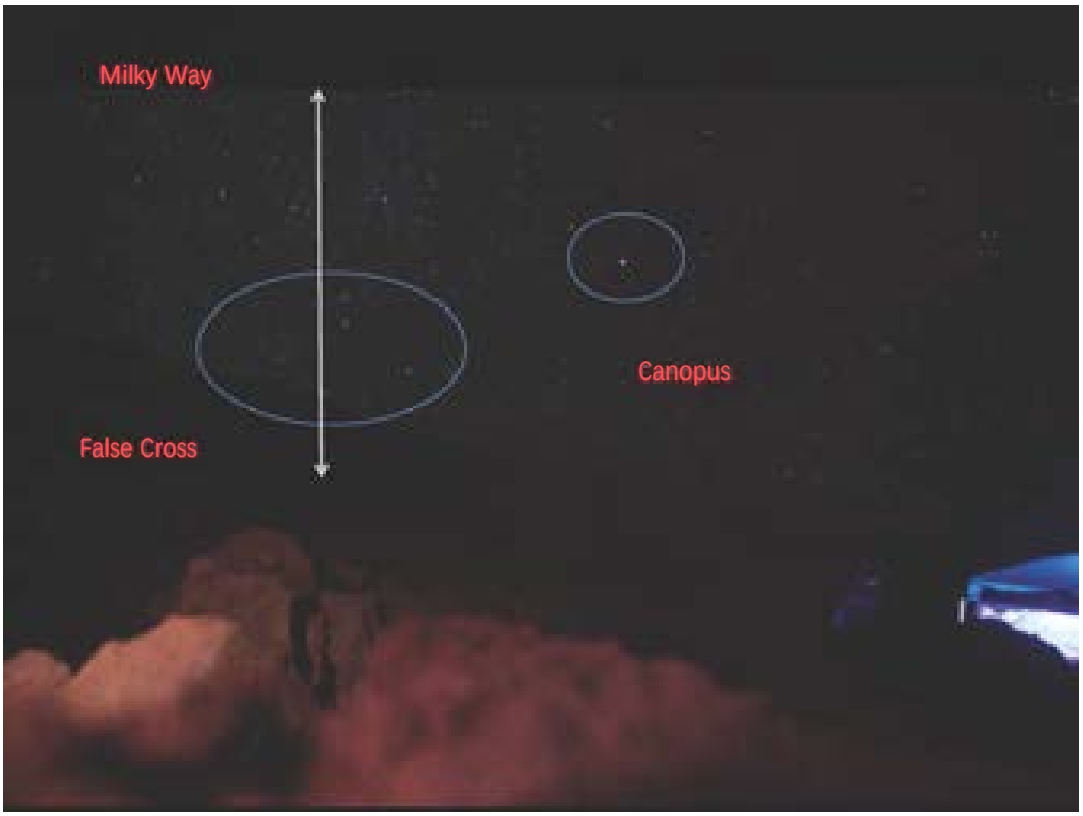
#1	Title page
#2	The focus of this frame is due south.
#3	Lālani (Milky Way) running due south, Canopus lays south/west.
#4	False Cross anchors Lālani in the South.
#5	Southern, Lālani seemed to be anchored to a manamana (?).
#6	West facing at 4-5 am, these great constellation that we saw east, then overhead are setting, they are Wākea is also known as Lono (Orion), Kaoahi (Taurus), Hale o Haumea and Sirius, 4-5 am.
#7	Mars and Jupiter are rising south/east just close to the Ahu kua alo.
#8	Newe (Southern Cross) anchors Lälani.
#9	Prominent constellations rise in the east at 4-5 am.
#10	North sky Kūmau, at 4-5 am.
#11, 12, 14	Setting of Sirius, is south of Lono (Mintaka, Orion) is the sky equator, Kaoahi (Betelguese, Taurus) is north of the equator and will set at Ahu O Luna.
#13	Lehuakona is rising at 6:00 am. Lehuakona is in the constellation of Mānaiakalani (Scorpio). An important factor of the rising of Lehuakona is that the sun on Ke Alanui Polohiwa a Kanaloa (Winter Solstice sun) will rise in its path. This is the southern border of the movement of the sun for Hawai‘i.

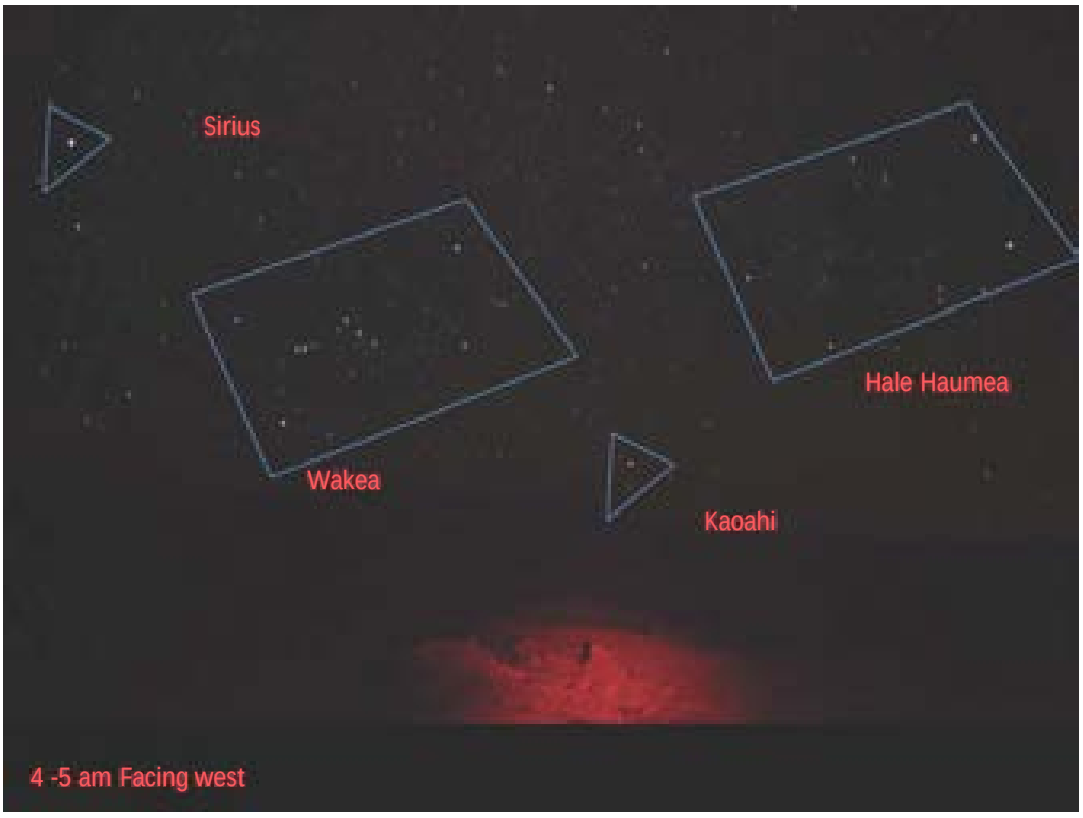

Part 2
Kalei Nu'uhiwa

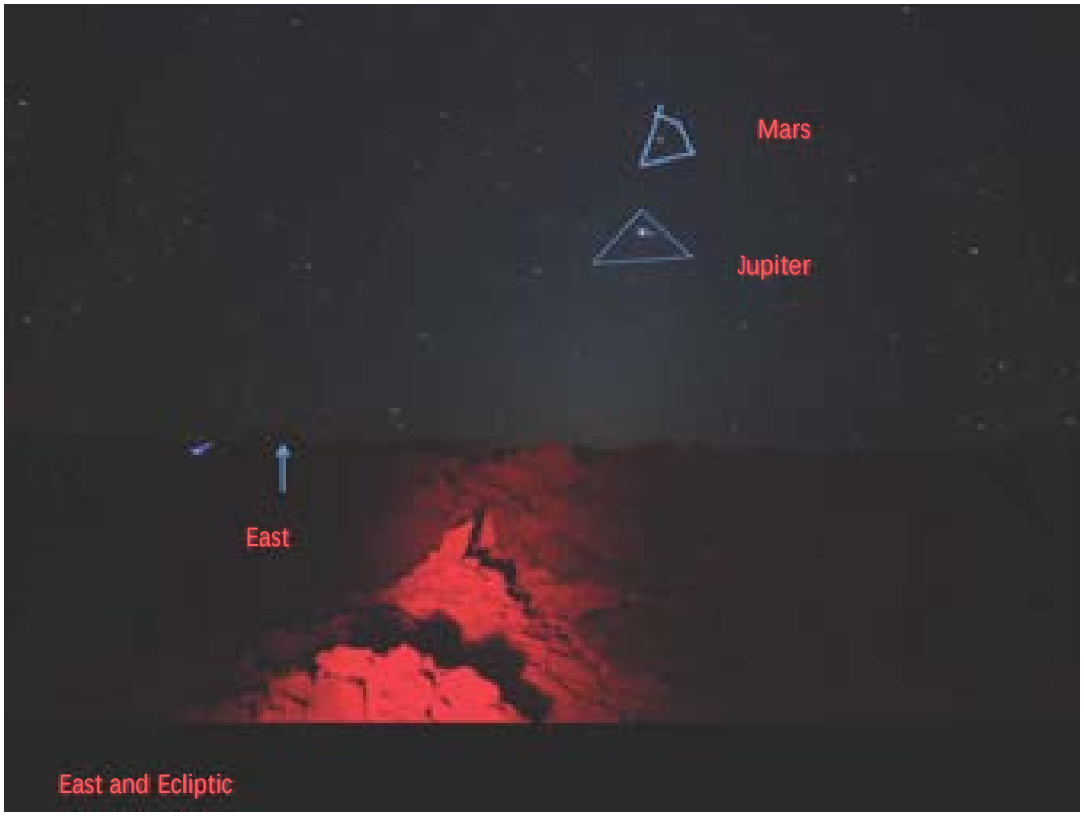

Zenith 2am


Canapus , Milky Way & due south
Milky Way
Canopus
South

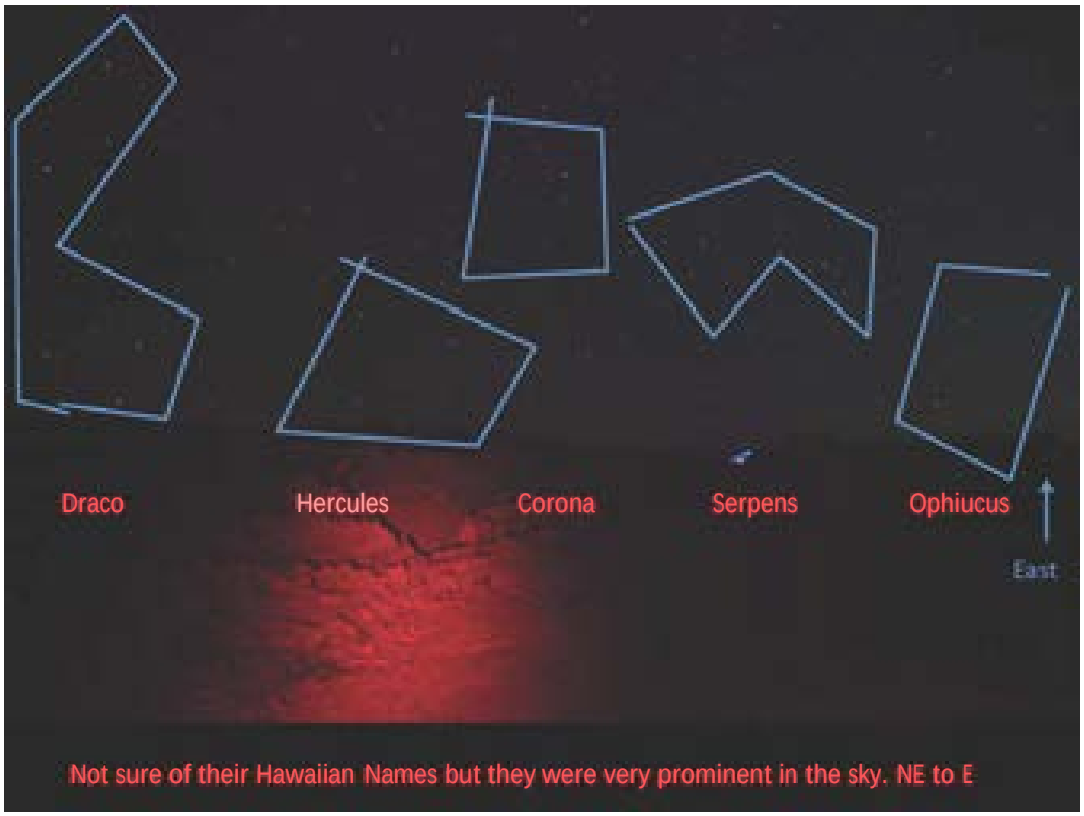

False southern cross anchoring the Milky Way
False Cross


Milky Way
Canopus
False Cross

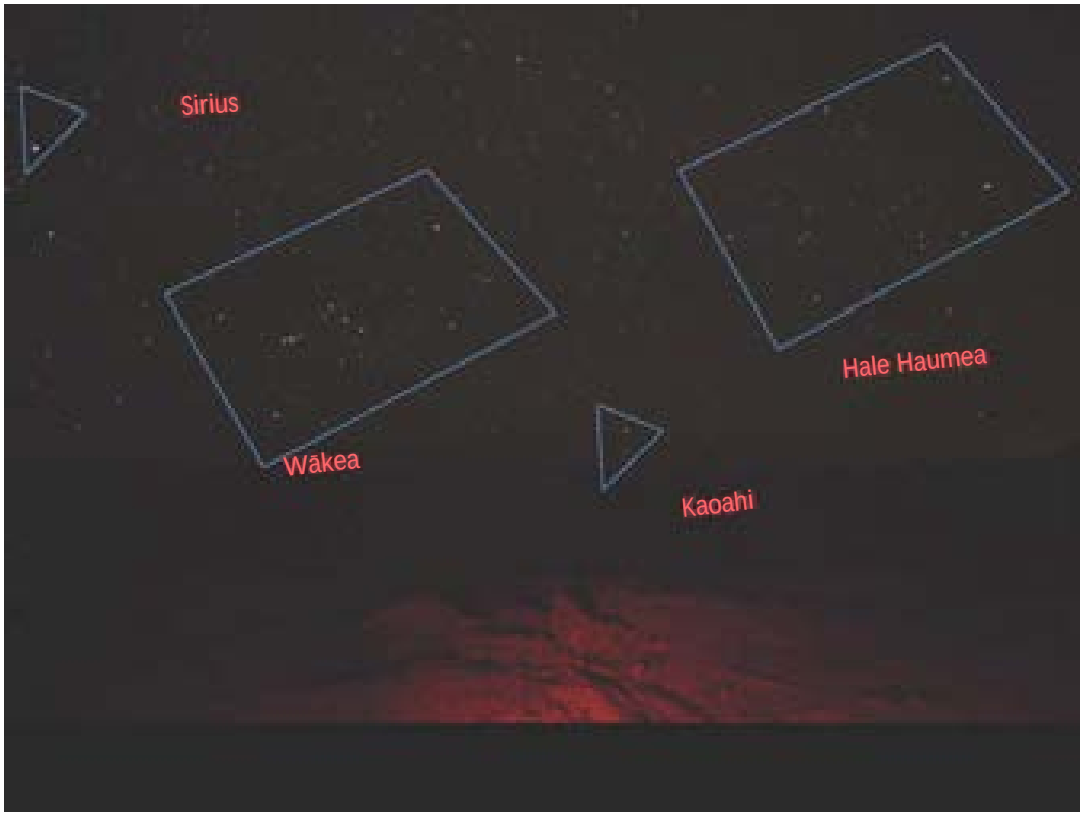

Sirius
Hale Haumea
Wakea
Kaoahi
4 -5 am Facing west


Mars
Jupiter
East
East and Ecliptic


Newe & Milky Way


Draco
Hercules
Corona
Serpens
Ophiucus
East
Not sure of their Hawaiian Names but they were very prominent in the sky. NE to E


Kumau


Sirius
Wākea
Hale Haumea
Kaoahi


Sirius
Kauluakoko


6 am, Lehuakona also rises out
our ecliptic kuahu


Sirius
Betelgeuse
Mintaka
Meissa
Elhath
Bellatrix
Elevated 3 kuahu

Summary

The focus for this pahu manamana are the rising and setting of stars. Specifically, for stars in the north sky. The other cultural feature that lends to this is the Ahu o luna which seem to mark the boundary between the east and northern stars. All stars to the north are considered northern stars. Kalei and Pua are the celestial experts and we acquired a lot of information on this trip because of their expertise.

The weather was not surprising but unusual for those involved. The weather provided several important benefits and experiences for the team. The chill factor was expected but not a reality until it was upon them. It started by 12 noon with clouds building very rapidly and moving on the location of pahu manamana. They witnessed lightning and thunder in the west beyond them, in the south, east below them and in the north/east as well. They endured heavy sheets of rain and rapid bouncing hail the size of bb pellet bullets. All of this lasted for 4 hours than the clouds fell as fog wrapped them in quiet serenity. It was freezing cold. They did have on 4 layers of clothing and socks.

The quiet provided a moment to contemplate ceremonial meditation. The advantage of the moment was consumed for the ʻaha (ceremony) and connections were made. The weather provided the physical manifestation of the hiʻuwai. Couldn't have asked for a better time or opportunity.

The waiting took another three hours then the sky opened up from 8:00 pm to morning after liftoff. Night was perfect for the work intended and they occupied the location each set up earlier. Kalā at Ahu o luna, which is more elevated than the other two. Pualani focused on pahu manamana and connecting the stars in the north with the manamana. Kalei positioned herself at the Ahu kua alo which faces east/south/east and west/south/west. (still determining) They maintained their position throughout the night.

The weather also allowed a look at a location without surface water and how the area acquires water. Hiʻiaka's conversation with an Oʻahu fisherman offered this saying about water: "He wai kēia o Kiʻowao. Ua hoʻokewai wale ka hau iā uka o ka ulu lāʻau a piha nā poʻowai. ʻO kēia a hele nei ka wai i ke kai." Kiʻowai is a rain of the upland, not necessarily heavy, a rain that wets rock, leaves, moss, stems and allow it to drip to the ground or towards the stem of a bush and flows down into the ground. Each drop adds to the poʻowai or the water catchments in the rock which in turn adds to the water lens which then flows into the ocean. So said Hiʻiaka. The drips of water witnessed by the team fortified this thought of Hiʻiaka and our natural water reservoir.

The experience of lightning and thunder below oneself brings consciousness of the elevation of this mountain. Being caught in the storm with the storm at your level, above and below, makes one aware of the lewa (horizontal space) one is occupying. Anytime the storm and clouds are below you, you are in the realm of the gods, gods are elementals and when you sit at the source of the storm you are at the seat of the elementals. It is a different world which man should not

occupy. This was yet another benefit of being there. This is a kānāwai (law of nature) for the top of the mountains, mountains the height and size of Mauna Kea and Mauna Loa.

From Kalei's view point Keoea set in the west between Ahu o luna and manamana #1 (we are utilizing the numbering of the manamana initiated in Pua's PowerPoint as a means of identity).

At about 6 pm the stars Eltanin and Rastaban of the constellation Draco set on manamana #4 and 5. Draco rose again at 6 am.

Pua observed that Keoea set on manamana #2. Keoea is from the constellation Mariners Triangle. Another star from this group, Konamaukuku, set on manamana #3. Later on that evening, 5 stars of the constellation Cepheus set on manamana #5 – 7 and a space beyond.

Iwikau (Cassiopeia) set on manamana #4 and 5. Andromeda set between manamana #1 and 2.

About 4:30 am Perseus set upon manamana #1, 2, 3 and 4. Makali'i being a border star set just south of the pahu manamana.

Wainaku, a star in the constellation of the Hale a Haumea, set on manamana #2.

Nā Hiku from the summer solstice indicated that it did set across the pahu manamana.

Pua shows that these stars are Kuhikuhi or pointers to the North Star Kūmau. It is important for sailors and others who use stars to have a working knowledge of these stars in order to fix their position. It is necessity to locate the North Star because Kūmau is stable, a constant, an anchor, a dependable instrument when there are no other indicators to pinpoint location. Knowledge of these north pointing stars should be second nature to seafarers or star seekers.

Pualani also specifies that according to her observation these north pointing stars seem to rise out from Mauna Loa and set on the pahu manamana. This is their cycle. From this location they rise out of the natural mountain and set in the manmade instrument. Brilliant, phenomenal, clever. Kūmau is indeed the center of a target.

Some of the pahu manamana on Moku Manamana was reviewed for comparison. The largest pahu manamana is on Hā'ena Moe and is the best example for comparison. The north shoulder of that pahu manamana is directly in alignment with Kūmau. It is structured like a compass with north – south, east – west directions.

Pahu manamana o 'Umi has its north shoulder at north/east alignment, Kūmau sits at its back in a north/west position. The pahu manamana faces south/south/west and its back is north/north/west. The initial pahu manamana on Moku Manamana faces directly east, indicating the formation of that island's location. We need to investigate other pahu manamana to be sure, however, because of its location on the kualono or ridge of Mauna Loa and the fact that it is facing south/west it may be an instrument set to indicate the direction of the movement of these islands. It seems that the erudite of the culture were adamant to sustain knowledge of island movement according the flow of Pelehonuamea using Kūmau as the anchor for this theory of island movement. This is within keeping two other laws of nature: the kai'okia kānāwai, a law of

boundaries of natural elements and the continuation of the ‘aha of volcanic eruptions or making of islands. Interesting!

The rising of the sun on Ke Alanui Polohiwa a Kanaloa, or the Winter Solstice on Dec. 21, 2017 followed the path of the star Lehuakona. This is the physical southern boundary of the Hawaiian sun.

Appendix E- Site Visit #4, July 4, 2018, by Kalā Mossman and Dr. Huihui Kanahele-Mossman

We arrived close at the site of ʻUmi Caverns at approximately 8:00 am.

Weather was fair, wind was light-heavy. Knowing that a cloud bank was going to be rolling in at about 10:30 am we started toward the pahu manamana with the gear.

Pāpaʻi, C-Shelters
One of the intentioned observations for that mission were the pāpaʻi. On the way to the pahu manamana which was about 200 yards away from the LZ. I contacted 3 c-shelters. I gathered the following information:

Magnetic properties through compass contact

--I collected data from three different rocks on three different pāpaʻi

--Each of the stones measured had no affect on the compass readings

--the pāpaʻi varied in size and shape. The commonality of all is the one opening to the south east of the shelter and the enclosed space surrounding the shelter. The "c" shape on all of the observed shelters were all intact.

Pictures for scale.

Objective #2 for this July 4 mission was to photograph and make notes on the individual manamana on the main pahu manamana.

The first was at the very south end of the pahu manamana. Due to the fact that there are no anomalies presenting in this close observation the sequence of shots started at the most southern end.

The close-up choices were in no particular order but I did find that running the photography from face to face did make sense in terms of series of the individual manamana. The following photos are examples of the actual number taken. All necessary photos will be posted on the final report.

The individual manamana.

The third objective was to record and photograph any other manamana besides the primary pahu manamana.

At the very south of the lava flow that housed the primary manamana, there are two other manamana that differ greatly from the main manamana. Approximately 40 feet away from the main pahu manamana there are two distinct manamana that are located alongside the newer lava flow, named Ahu kua alo in this report. The distinct difference is in the positioning and proximity to each other. As you can see in the photo the manamana are not adjacent to each other as the rocks on the main pahu manamana. The juxtaposition of these two manamana are face to face rather than side to side like the main pahu manamana. Besides the juxtaposition, the vicinity of each manamana is greater than that of the main pahu manamana. For instance, on the main pahu, the distance of the manamana from each other is no greater than 2'. These two manamana in the photos are approximately 10 feet apart. Also, there is a smaller pahu in the same line of these two manamana with no actual upright on it, 10 feet west of that pile of rocks in the same line is another pile manamana much like the former describe again with no upright.

Ahu kua alo.

Manamana from the outcropping directly west from these manamana.

When compass readings were taken from the top of the outcrop to the manamana it read due east 92 degrees. From the top of the outcrop the compass reading to the main pahu manamana was 135 degrees. There may have been a pānānā on the top of the outcrop as it would be an ideal sitting to observe rising stars however none was present at the time despite the flat 1' 6" flat area at the top. There were some worked stones at the bottom of the outcrop.
After climbing off of the outcrop the immediate photos intended for this mission were complete. The following are random Päpahanaumoku component photos:

'Ōhelo and wasp (?).

At approximately 10:30 am the cloud bank started to rise from the south being fed by clouds from the east moving fast due to the strong trade winds on that day.

Rising cloud bank.

At approximately 11:00 am the helicopter landed to retrieve our party. Leaving the site flying toward Hilo to the east, the cloud bank rapidly enclosed the area. We landed back in Hilo at approximately 11:30 am.

Lift off from Hilo airport bound for "'Umi's Cavern" on Mauna Loa. Planned 4 hour stay to collect data. We landed without incident and began data collection immediately. Objectives are to map the shrine site to replicate alignment testing off site, collect data regarding stone construction, take video and photographs of the area and to document any other significant findings observed.

GPS Readings

GPS readings of the pānānā, manamana #1, #7 and #9 were taken. A tripod was set up at the pānānā with an Osmo rotating camera set at 3' high to simulate an individiual 6' tall in a siting position. A line from the pānānā to each manamana was photographed and a measurement taken utilizing a Cammenga model 27 military compass. Additional measurements of site dimensions were also recorded. Additionally, a second tripod was set up in the location beleived to have been where manamana #9 was located. This manamana is believed to have fallen and was re-erected below at the edge of the modern flow. Future consultation with the Papahulilani team could give some insight into any possible star alignments with this and other manamana.

Photographs and Video

Photographs and video of C shape shelters, mine sites and the shrine were taken to better tell the story of this site. Close-up photos of the manamana using a macro lens were taken to determine possible cut and shape marks. While few appeared to show signs of shaping most did not show signs or were not conclusive.

Appendix F- Site Visit #5, September 19, 2018, by Dr. Huihui Kanahele-Mossman and Kalā Mossman

This report documents the day trip to "'Umi's Cavern" on September 19, 2018.

We lifted off from Hilo Hangar at 0600 bound for 'Umi's Cavern on the slopes of Maunaloa. Arrival time at the site was 0630. We anticipated a short stay on the ground resulting in the pilot, David Okita, to remain with the research team for the duration of the stay. This was ideal as it provided for a much safer stay on site and an immediate evacuation plan should it be needed. Research team consisted of Huihui Kanahele-Mossman and Kalā Mossman.

Weather was fair, wind was light from the southeast. Objectives for this trip were to secure additional raw video footage for the video presentation as well as to collect more GPS information and double check bearings of the manamana.

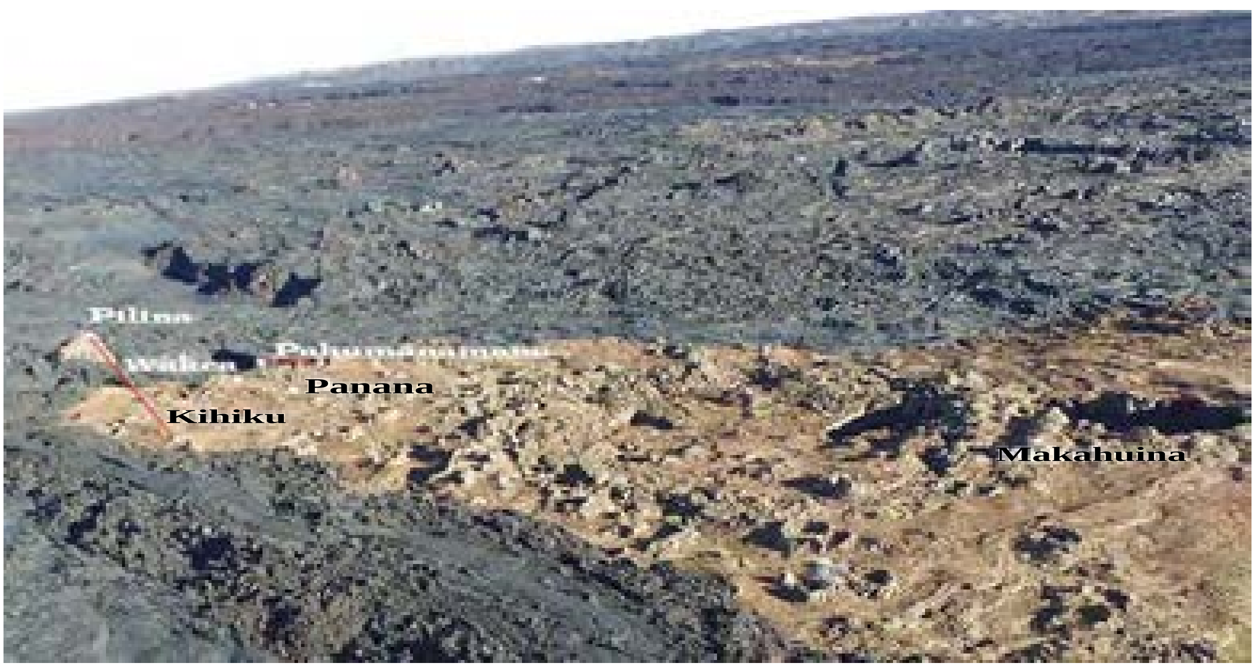
Objective #1 was to secure more footage to assist with the Hawai'i Volcanoes National Park request to make edits to the draft presentation video. Additional equipment to create smoother and better quality video was deployed and most the two hours spent on Maunaloa was utilized for this purpose.

Objective #2 for this mission was to photograph and make notes on the individual manamana on the main pahu manamana as well as GPS coordinates. After the access in July 2018, the team determined that the manamana corresponded to islands to the northwest. We thought it important to check these measurements a second time to confirm these findings. The results confirmed our initial discovery. We also inspected the manamana that is currently erected bellow the Pahu manamana o 'Umi site, this manamana is referred to as Wākea. It is the belief of the team that this manamana was probably set just to the east of its existing location where a small paepae is located. After further examination, the original location of Wākea is beleived to have been a Western alignment, which would have corresponded to the island of Kalama (Johnston Atoll). A comparison photo was also taken to see if there is any difference between now and the 1950 Jaggar photo. It appears that manamana number one may be slightly out of place which actually better aligns with the islands to the northwest.

Objective #3 was to collect GPS data and record and photograph any other manamana besides the primary Pahu manamana o ‘Umi. The coordinates for Kihikū, Makahuina, Pilina and Wākea were of interest. Locations of these sites can be viewed in the following two photos.

At the very south of the lava flow that housed Pahu manamana o ‘Umi, there are two other manamana that differ greatly and have been designated a part of the site called Kihikū. These manamana are approximately 40 feet away from the Pahu manamana o ‘Umi along the newer lava flow. The distinct difference is in the positioning and proximity to each other. The manamana are not adjacent to each other as the manamana on Pahu manamana o ‘Umi. The juxtaposition of these two manamana are face to face rather than side to side. Besides the juxtaposition, the vicinity of each manamana is greater than that of Pahu manamana o ‘Umi. For instance, with Pahu manamana o ‘Umi, the distance of the manamana from each other is no greater than 2’. The other two manamana are approximately 10 feet apart. Also, there is a smaller pahu in the same line of these two manamana with no actual upright on it, 10 feet west of that pile of rocks in the same line is another pile manamana much like the former describe again with no upright. All of these makeup the site referred to as Kihikū and appears to mark a straight line from Pilina, the large outcropping with stacked stones to the west to the manamana in the east. The Papahulilani team has determined that this is an alignment of the elliptical. Unfortunately, upon return from our flight it was determined that the GPS unit failed and these coordinates did not register correctly.


Pahu Manamana
Pilina
Makahuina
Pānānā
Wākea
Kihikū


Panana
Kihiku
Makahuina

Picture of the manamana of Kihikū from the outcropping (Pilina) directly west from these manamana.

At approximately 0830 the helicopter lifted off leaving the site flying toward Hilo to the East. Just after liftoff we discovered another Pahu manamana east of the current study area. It is believed that this site has not been recorded it is in a small kipuka and consists of a single manamana on a paepae. A photo of this discovery is shown below. It would be good to document this site as it shares many attributes of the site to the west and is most likely associated with it. We landed back in Hilo at approximately 0900.