



Capulin Volcano National Monument

Geology Merit Badge





Geology Merit Badge

What is Capulin Volcano National Monument?

Capulin Volcano lies within an 8,000 square mile volcanic field called the Raton-Clayton Volcanic Field. The earliest activity in this field began approximately 9 million years ago, in the vicinity of the present day town of Raton, NM. It is estimated that Capulin Volcano, one of the most recent volcanoes in the field, erupted 56,000 to 62,000 years ago. This eruption lasted between 5 to 15 years during which time the geological structure of this area was drastically altered.

How can you earn your Geology Merit Badge by using Capulin Volcano National Monument and this booklet?

1. Read the information and directions in this booklet as you walk the rim trail and work in the visitor center or another area designated by a Park Ranger.
2. Complete the booklet's activities. Activities 1, 2, and 3 will be done on the volcano while activities 4, 5, and 6 will be completed in the visitor's center.
3. When you are finished, give the booklet to your group leader. He or she will read what you have written to determine if you have earned your Geology Merit Badge.



Geology Merit Badge

1. What is geology?

Geology is the scientific study of the origin, history and structure of the Earth.

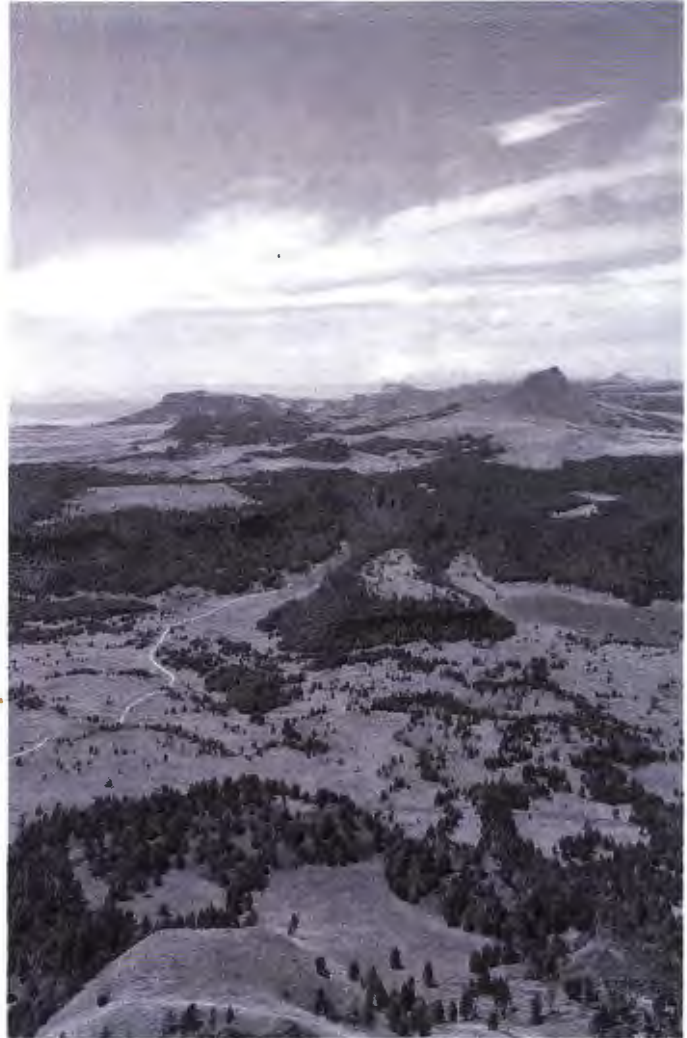
Geologists study both the materials which make up the earth as well as the processes acting upon them. One principle that a geologist uses to help better understand the Earth is called the principle of *uniformitarianism*. Uniformitarianism states that the processes which formed the Earth in the past are the same processes that are forming the Earth now and will form the Earth in the future, or simply stated "the present is the key to the past". For example, if a scientist was interested in learning how an old river formed he/she might study the development of a similar young river.

a. Travel up to the crater parking lot. Look out over the Raton-Clayton Volcanic Field and pay special attention to the various geological structures.

Now cross over to the other side of the parking lot and read the information about Paricutin Volcano.

Why was it important for scientist to study the Paricutin Volcano?

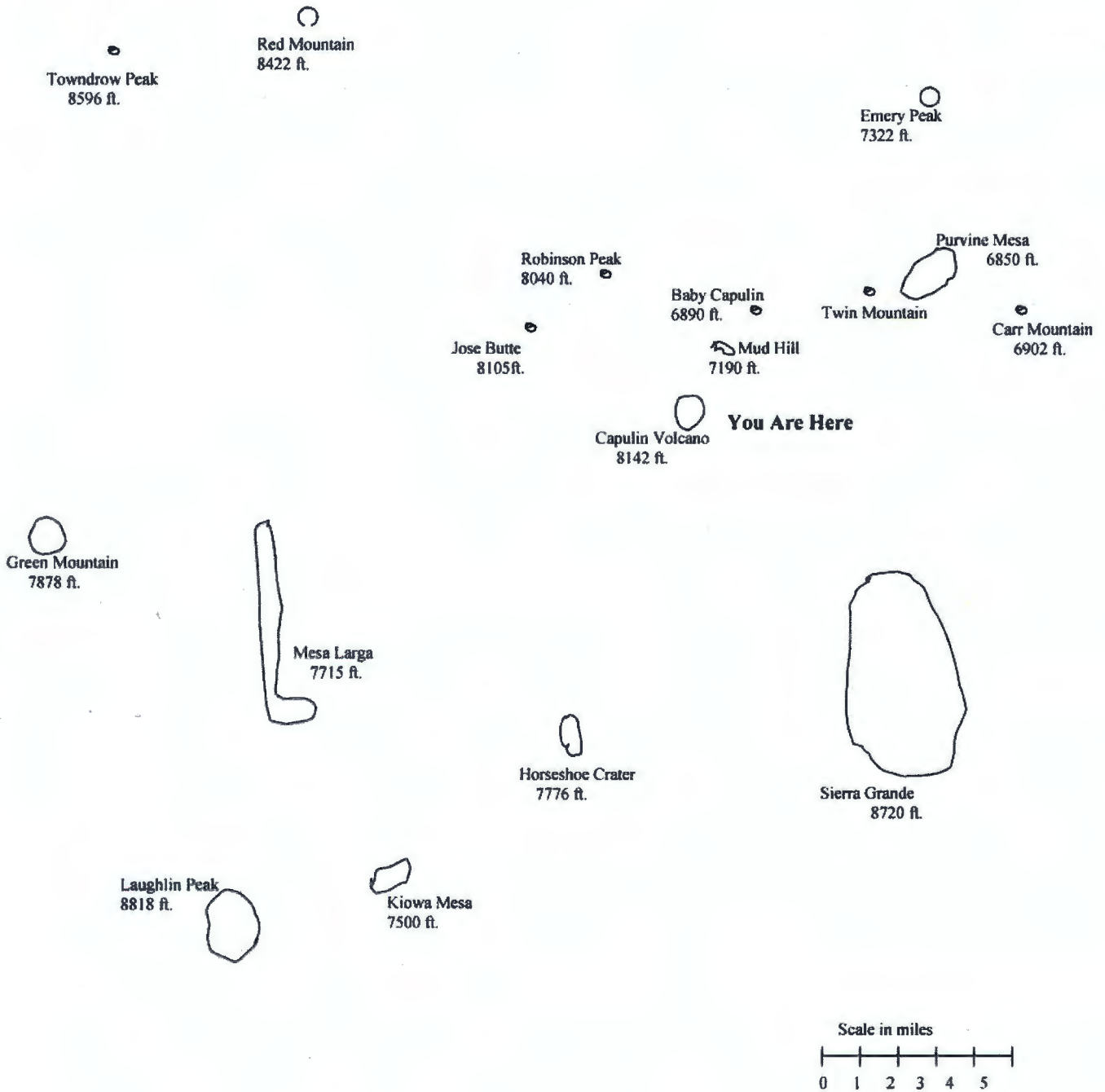
Write your answer in the space below.



The Raton-Clayton Volcanic Field from the rim of Capulin Volcano

2. Where are these geologic features?

Now begin your hike on the rim trail starting on the steeper side. As you face the vent it will be to your left. Use the map below to help you identify landforms as you hike the trail. Find at least 5 structures and place a check mark on the map beside them.



3. What are natural resources?

Natural resources are materials or substances such as minerals, forests, water, and fertile land that occur in nature and can be used for economic gain. The area of Capulin Volcano and the state of New Mexico has an abundance of natural resources. Geologists are mainly concerned with the resources that are extracted or mined from the Earth.

a. As you continue to hike you will notice that Capulin Volcano is made up of extrusive igneous rocks ranging from bombs (volcanic rock larger than an adult hand) to cinders (volcanic rock smaller than an adult hand) with the majority of the cone being made up of the smaller cinders. Once you reach the area at the top you will see several benches and signs. Look to your right and find the town of Des Moines. Now look to your left and find the town of Folsom. Find the point approximately half way between the two and you will see the Twin Mountain Mining Company, which is an active scoria mine. You can also look directly down the volcano at the base and you will see the scars of an old scoria mine. Scoria is what we call the igneous rock you see along the trail that is either black or red in color and filled with holes. How do you think you could use scoria as a natural resource? Write your answer in the space below, then continue your hike to the end of the rim trail and return to the visitor's center to complete the rest of your activities.

b. Listed below are 3 resources found in New Mexico.

- **Scoria** is a light weight igneous rock. Its most common uses are fabric treatment, horticultural mixes, and landscaping. It is also used on roads for de-icing because it does not freeze into piles, providing for good traction. Since scoria is porous it can be used on baseball fields to allow water to drain and also keeps the field from packing down. Scoria is mined from cinder cone volcanoes. It can be pushed off the hill, sorted by size, and then sold. New Mexico is one of the largest producers of scoria.
- **Uranium** is a mineral most commonly found in the form of pitchblende or uraninite ore. An ore is a mineral or combination of minerals which contains metals that can be extracted and used commercially. The majority of the uranium extracted is used as fuel for nuclear power, while small amounts are used in the field of medicine. The leading technique for the detection of uranium is the use of a gamma-ray spectrometer. Because uranium is radioactive it can be detected and mapped from the air. Open pits, underground mines and in situ leaching are the most common ways to mine uranium. Grants Uranium District in NW New Mexico was the largest US uranium producer in the 20th century. Even though New Mexico has the 2nd largest concentration of known uranium deposits in the United States, there is no longer any active mining. Mining of uranium is only done if the concentrations are large enough to merit the cost of extraction.

In the 1940's and 1950's New Mexico uranium miners had a high incident of lung cancer due to the radon gas released by uranium. It was particularly high among the Navajo miners. Because of the health factors and the risk of contaminating ground water during uranium mining the Navajo tribe, which owns most of the land with known ore deposits, declared a moratorium, or halt, on uranium mining in 2005.

- **Coal** is a black or brownish-black sedimentary rock. Coal begins when layers of plant matter are deposited in bodies of water. The shallow seas of the Carboniferous period supplied such an environment. These immense peat bogs were then deeply covered with sedimentary material producing heat and pressure which, over millions of years, formed solid rock. Coal, a fossil fuel, is the largest energy source for generating electricity world wide. Coal is extracted from the ground from underground mining or open pits. The San Juan and Navajo mines are located near Farmington, New Mexico and supply coal to two major electric power plants. These power plants supply electricity to approximately 900,000 families and businesses in the southwestern region of the United States. The burning of coal to produce electricity is also a major contributor of pollution due to the carbon dioxide emissions into our atmosphere.

Which of the natural resources discussed above do you feel most greatly impacts your daily living? Why?

Which resources are used for energy?

Which resource do you feel is most harmful to the environment? Should that be a consideration when we mine and use resources? Explain.

4. How old are these rocks?

Scientists record the ages of rocks in two ways. Absolute dating is done by using radioactive decay and gives the age in actual years. Relative dating can be done by using the principle of superposition and is stated by identifying a rock as being older or younger than another rock. The principle of superposition states that in undisturbed layers of rock, the older rocks are at the bottom and the younger rocks on top.

Look back at the geologic features you marked on your map in question #3. Fill in the table below with the feature you identified, then use the Capulin Volcano viewshed guide to determine the rock composition and its age.

Feature Name	Composition	Age

5. What types of jobs does a geologist do?

A geologist is a person who studies the origin, history and structure of the Earth. There are a wide variety of employment opportunities for geologists within the National Parks Service (NPS), with jobs ranging from a field paleontologist to a park guide. Listed below are 3 job descriptions for geologist in the NPS.

Paleontologists study petrified remains of plants and animals in geological structures. They use the information collected to trace evolution and development of past life and identify geology formations so a chronological time line can be made. They may recover and assemble fossils found at a dig site, note their position, and classify them.

Soil Scientists study the upper few meters of the Earth's crust. They evaluate it's physical, chemical and biological properties. A soil scientist might study the soil on which a NPS structure will be built or apply their knowledge to landscaping an area in the park. They might also gather and evaluate soil samples to help solve problems relating to the growth of plants in the park or help manage erosion of an area.

Park Guides and Interpretive Rangers may be geologists. They present programs to the public which explain the geology of a specific park and its surrounding area. These programs may be done in a visitor center or in the field. Our National Parks in New Mexico have a wide variety of geological formations, from the caves at Carlsbad Caverns to the volcano here at Capulin.

Which of the above jobs relating to geology most interests you? Why?

6. What is the difference between a rock and a mineral?

Minerals are homogeneous (the same throughout), inorganic (do not contain carbon), naturally occurring solids. They may be made up of one or more elements. A mineral also has a definite chemical composition and a crystalline structure. Minerals can be identified by using properties such as: hardness-will it scratch,

specific gravity-its density compared to water, streak-the color of streak left on a porcelain plate, cleavage-how it breaks, luster-how it reflects light, and color.

Rocks are made up of one or more minerals. Most of what we find at Capulin Volcano is rocks. The three classifications of rocks are sedimentary, igneous and metamorphic. Rocks are continuously changing from one form to another through what we call the rock cycle.

a. Using the rocks provided match each rock or mineral with its description.

- | | |
|--|--------------------|
| _____ extrusive igneous; shiny, black, glassy texture | A. Andesite |
| _____ sedimentary; chalky white on the outside, darker pieces of rock on the inside | B. Basalt |
| _____ extrusive igneous; light gray color, floats in water, vesicular texture | C. Bituminous Coal |
| _____ sedimentary; brownish tan in color, grains are sand size, coarse texture | D. Caliche |
| _____ intrusive igneous; mostly dark with some white, also small greenish-gray crystals, texture is granular | E. Gabbro |
| _____ extrusive igneous; blackish brown in color, has larger white/clear crystals and smaller black/green crystals | F. Gneiss |
| _____ extrusive igneous; very light tan color with small black crystals | G. Limestone |
| _____ metamorphic; pinkish red in color with gray striations | H. Obsidian |
| _____ extrusive igneous; color grayish black, contains small cavities, has fairly large green and white crystals | I. Olivine |
| _____ silicate mineral; olive green stubby crystals, medium heavy, vitreous luster, hardness 6.5-7 | J. Pumice |
| _____ sedimentary; light gray, fine grain size, texture is compact | K. Rhyolite |
| _____ sedimentary; black, layered, semi-glossy to dull | L. Sandstone |

b. Which one is not a rock but is a mineral? _____

What is its range on the hardness scale? _____

The softest rock on the hardness scale is talc. The hardest is diamond. The scale ranges from 1 to 10. Would you expect this mineral to scratch talc? _____

How about diamond? _____

Describe this minerals color. _____

Would the luster of this mineral be metallic or glassy? _____

c. Now that you have matched the above rocks place them into their appropriate class and use the rock cycle diagram to answer the questions:

Igneous rocks:

What type of processes would cause these igneous rocks to form?

Metamorphic rocks:

What type of processes would cause these metamorphic rocks to form?

Sedimentary rocks:

What type of processes would cause these sedimentary rocks to form?

