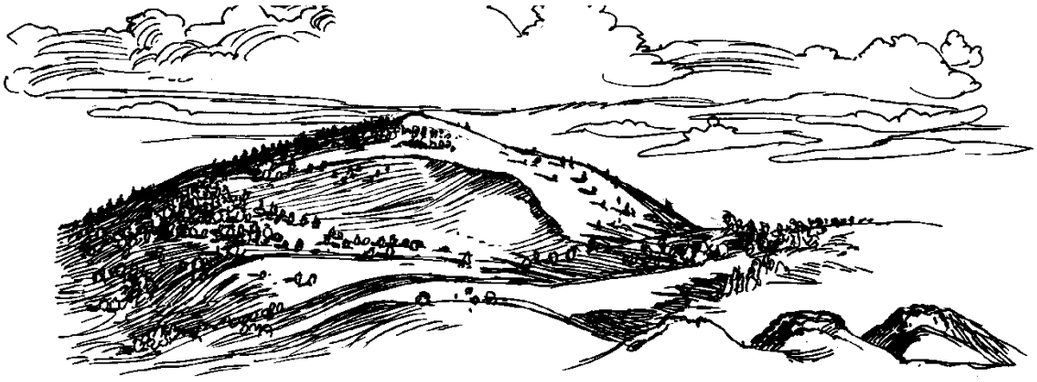
Craters of the Moon

National Park Service
Bureau of Land Management
U.S. Department of the Interior

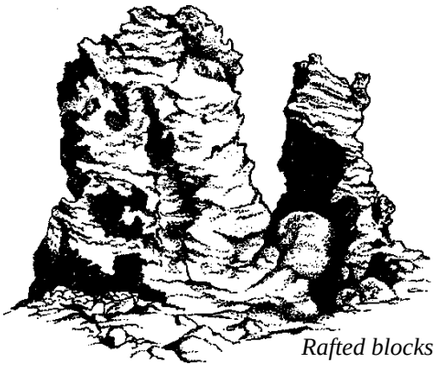
Craters of the Moon National
Monument and Preserve

Geology



What makes Craters of the Moon so special geologically?

Craters of the Moon is one of the most accessible and awe-inspiring places in the country to learn about volcanic geology. It is the largest and most complex post-Ice Age basaltic lava field in the continental United States. In the past 15,000 years eight major eruptive periods formed the Craters of the Moon Lava Field. During this time the Craters of the Moon Lava Field grew to cover 618 square miles. In contrast, most of the other lava fields on the Eastern Snake River Plain (including the Kings Bowl and Wapi Lava Fields) represent single eruptions. The Craters of the Moon Lava Field consists of up to 60 lava flows and 25 cones.



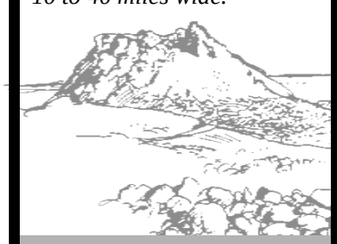
Rafted blocks

Where's the volcano?

The Great Rift is the deepest and longest volcanic fissure in the continental United States. It begins at the base of the Pioneer Mountains (north of the park's visitor center), extends for over 50 miles to the southeast, and has been measured to be more than 600 feet deep in places. The Craters of the Moon Lava Field formed from magma—molten rock below the earth's surface—pushed up along the Great Rift. The Craters of the Moon Lava Field is the northernmost of the three lava fields that, along with the Kings Bowl and Wapi lava fields, comprise Craters of the Moon National Monument & Preserve.

Timeline of Geologic Events

The Yellowstone Hotspot was beneath Craters of the Moon. This time was characterized by violent eruptions and formation of huge craters called calderas. Some calderas are 10 to 40 miles wide.

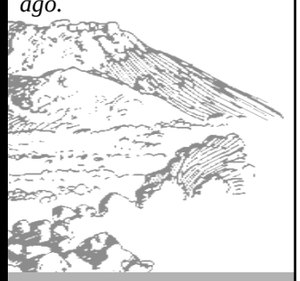


8 to 10 million years ago

Numerous basaltic eruptions produced a 4,000-foot-thick sequence of lava flows.

6 million to 15,000 years ago

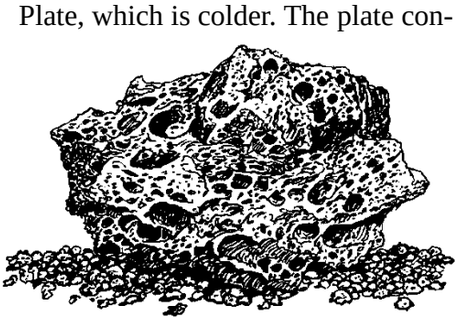
The Craters of the Moon Lava Field formed during eight major eruptive periods. The Wapi and Kings Bowl lava fields formed about 2,200 years ago.



15,000 to 2,000 years ago

The Yellowstone Hotspot

The Yellowstone Hotspot is a column of hot rock flowing up from the Earth's upper mantle. The hotspot has a plume shape, just like the wax in a "lava lamp." The column flows upward until it hits the overlying North American Plate, which is colder. The plate consists of the crust and the uppermost mantle. Periodically, blobs of iron-rich basaltic magma rise up into the crust from a depth of about 50 miles. In the crust, these molten blobs melt overlying rocks and form sponge-like magma chambers.



Cinder

About 100 times in the past 16.5 million years, catastrophic eruptions of huge volumes of granitic magma have taken place along the Eastern Snake River Plain. Although some of the mountain ranges that existed on the Eastern Snake River Plain before the hotspot may have been blown away by the eruptions, it is more likely that they were swallowed up as the floor of the caldera sank during the violent explosions.

The hotspot itself is stationary. Rather, the North American Plate is moving in a southwesterly direction over the hotspot, producing the progressively younger trend of eruptions to the northeast. Now situated beneath Yellowstone National Park, hotspot eruptions have left the wide, flat Snake River Plain in its path, much like the wake of a boat passing through calm water.

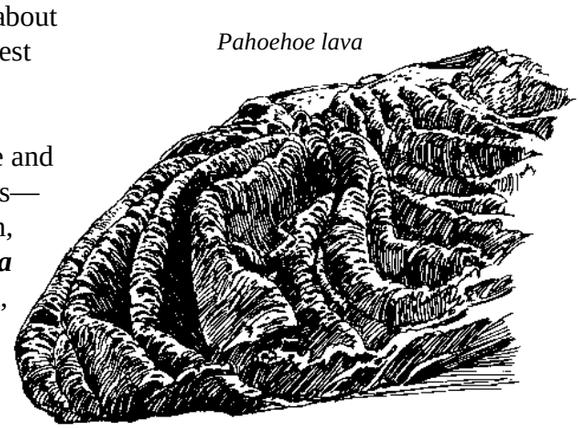
What kinds of lava are found at Craters of the Moon?

Molten rock on the Earth's surface is called lava. Of the 60 lava flows visible on the surface of the Craters of the Moon Lava Field today, 20 have been dated. The oldest is about 15,000 years old and the youngest about 2,000.

A'a lava

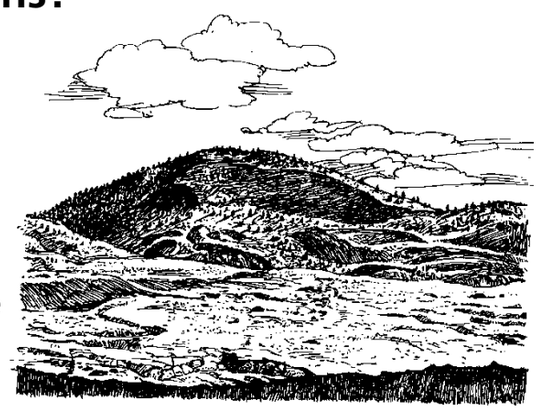
Some lava flows are very dense and have a surface of angular blocks—***block lava***. Others have a rough, jagged, or clinkery surface—***a'a*** lava. Still others have a smooth, ropy, or billowy surface—***pahoehoe*** lava.

Pahoehoe lava

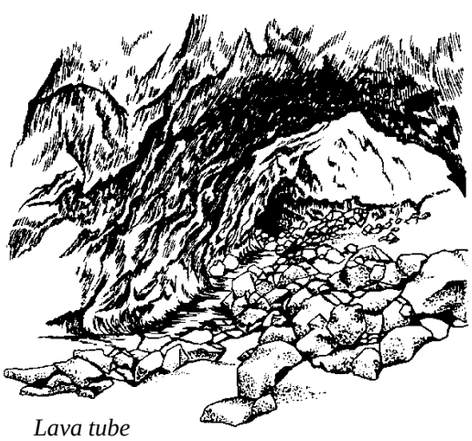


What kinds of features are built by eruptions?

When magma emerges at the Earth's surface along a segment of a rift, it often begins by producing a curtain of fire and a line of low eruptions. As portions of the segment become clogged the fountains jet higher. If magma emerges at the surface highly charged with gas it sprays high in the air, like taking the cap off a shaken bottle of soda pop. This lava foam cools and solidifies during flight, raining down to form cinders. When enough cinder piles up, a ***cinder cone*** is formed. If you look closely at cinders you will see that they are laced with gas holes and resemble a sponge or a piece of Swiss cheese. Cinders are very lightweight because of these gas holes. The fire fountains that produced many of the Craters of the Moon cinder cones were probably over 1,000 feet high. Big Cinder Butte, the tallest cinder cone at Craters of the Moon, is over 700 feet high.



Cinder cone



Lava tube

Lava tubes are hollow spaces beneath the surface of solidified lava flows. They are formed by the withdrawal of molten lava after the formation of the surface crusts. Indian Tunnel in the northern area of the park has a 40-foot-high ceiling and is 800 feet long. Bear Trap Cave, which lies between the Craters of the Moon and Kings Bowl Lava Fields, is about 15 miles long, but is not continuously passable.

Some vents along the rift eject very fluid particles (spatter) that accumulate to form steep-sided ***spatter cones***. Stop and visit the Spatter Cone exhibit along the loop drive.

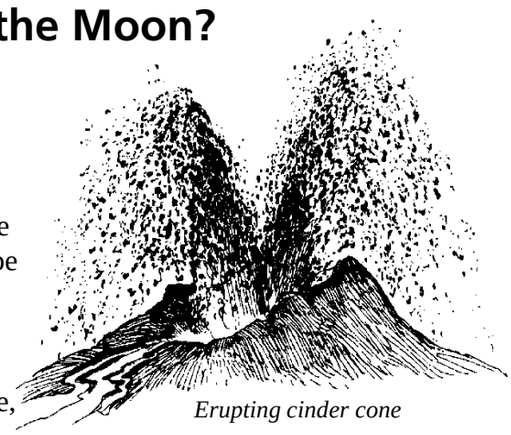
During some eruptions, pieces of crater walls are carried off like icebergs by lava flows. These wall portions are known as ***rafted blocks***. The monoliths on the North Crater Flow Trail across from the visitor center are excellent examples of these volcanic formations. Visit Devils Orchard to see more examples of rafted blocks.

How likely is another eruption at Craters of the Moon? What will this eruption be like?

The interval between eruptive periods in the Craters of the Moon Lava Field averages 2,000 years and it has been more than 2,000 years since the last eruption.

The area's geologic record suggests that future eruptions will begin along the central portion of the Great Rift in the Craters of the Moon Lava Field, but they may well travel to the northern part of the monument in the proximity of the loop drive. The nature of the area's volcanism suggests that slightly over one cubic mile of lava will be erupted during the next eruption period. Initial flows, based on past performance, will probably be relatively non-explosive and produce large-volume pahoehoe flows.

Eruptions from potential vents on the northern part of the Great Rift may be comparatively explosive, produce significant amounts of cinder, lava bombs, and spatter, destroy cinder cones by both explosion and collapse, and build new ones.



Erupting cinder cone

For further information, check out the following websites:

www.nps.gov/crmo/

http://vulcan.wr.usgs.gov/Volcanoes/Idaho/CratersMoon/framework.html

http://imnh.isu.edu/digitalatlas/geo/snkrvpln/snkrvpln.htm