

Lava Beds

National Monument

National Park Service

The Geology of Lava Beds National Monument

Lava Beds National Monument is located on the north flank of a large shield volcano, Medicine Lake volcano. The volcano includes a variety of rock types known as basalt, andesite, dacite, and rhyolite. These volcanic rocks form a continuous series based on gradational increases in silica content (window glass is mostly silica). Basalt has as little as 47% silica, and rhyolite as much as 77%. As silica content changes, so do the physical properties of the volcanic rocks. Erupting high-silica lavas, such as those forming dacite and rhyolite, are occasionally explosive; they tend to be cooler and more viscous (sticky) than those forming basalt, and so move very slowly, creating thick flows. One form of rhyolite is obsidian, the volcanic glass that Indians commonly used to make arrowheads. When basaltic lava erupts, it is much hotter and more fluid than rhyolitic lava and can move quite rapidly over the ground surface or through lava tubes, typically forming relatively thin flows. For example, eruptions of basalt are common in Hawaii. Andesite has properties between basalt and rhyolite. About 90% of Lava Beds National Monument is covered by basaltic rocks; the remainder is mostly andesite. This distribution is true of all of the lower slopes of Medicine Lake volcano. Rhyolite and dacite can be found high on the volcano.

About two-thirds of the basalt exposed in Lava Beds National Monument erupted from Mammoth Crater and related vents, including Modoc Crater and Bearpaw Butte. The basaltic lava was transported out to the northern and northeastern parts of the monument where Canby's cross, captain Jack's Stronghold, and Hospital Rock are located, via lava tubes. Where empty, these tubes form caves, such as Balcony, Boulevard, Merrill, Skull, and Fern. The caves along Cave Loop Drive are located in lava tubes that transported basalt of Mammoth Crater to the east, to Craig Cave and beyond. This very large eruption produced at least one cubic mile of basaltic lava in less than a hundred years. The date of the eruption is unknown but almost certainly took place less than 100,000 years ago.

Many features in the monument formed before the eruption of the basalt of Mammoth Crater, including Schonchin Butte and the Schonchin flow, Eagle Nest Butte, Hippo Butte, Crescent Butte, the Three Sisters, and Juniper Butte. Also present was Gillem Bluff, which had already been broken by faulting into a high cliff, although some fault movement has taken place since and is likely to occur in the future. Much older lavas, about a million years old, are exposed in Gillem Bluff.

After the basalt of Mammoth Crater, another basaltic eruption occurred that formed The Castles, located on either side of the main road near Schonchin Butte. This basalt erupted from numerous spatter vents and flowed north around Hardin Butte. Still younger are several Holocene lava flows (that is, less than 10,000 years old, and younger than the latest glaciation that formed areas of ice on top of Medicine Lake volcano). These include basalt erupted from Fleener Chimneys that forms the Devils Homestead, basalt that erupted to form Black Craters, Ross Chimneys, and their associated flows, and basalt that erupted near Tickner and Bertha's Cupboard Caves just south of the monument boundary and flowed east around Caldwell Butte to form Valentine Cave. Slightly more andesitic lava erupted about 1100 years ago to form the blocky Callahan lava flow (sometimes known as the Black lava flow), a portion of which covers the southwestern part of Lava Beds National Monument; this flow erupted from Cinder Butte, located just outside the monument boundary. Cinder Butte forms a conspicuous landmark for park visitors, especially in winter when its treeless slopes are commonly covered with a dusting of snow. The Callahan flow is the youngest lava flow in the monument. Covering all the flows is a thin layer of white pumice fragments that formed as fallout from explosive eruptions about a thousand years ago when Glass Mountain and Little Glass Mountain erupted high on the slopes of Medicine Lake volcano.

Another flow that is andesitic in composition and blocky in appearance is the Schonchin flow. It appears much younger than the basalts of the Castles and Mammoth Crater that surround and overlie it. These latter flows were more fluid and thus have a smoother surface, on which soil formed more rapidly and vegetation took hold more easily than on the rough-surfaced Schonchin flow. Thus it is not always easy to decide which lava flow is younger unless the contact between them is carefully mapped. Commonly, the more blocky, viscous lava (typically higher in silica) erupted from cinder cones, whereas the more fluid lava erupted from small spatter vents (for example, Fleener Chimneys), although this is not always true.

Some lava in the monument interacted with water when it erupted. This is particularly apparent in the Petroglyphs section, where tuff rings formed when lava erupted in ancient Tule Lake. These rings of fragmental material that accumulated around the explosive vents were later partially eroded by the wind-driven waves of ancient Tule Lake, forming the wave-cut bench that is now the parking area for the Petroglyphs. Juniper Butte is another eroded tuff ring. The north edge of the basalt of Mammoth Crater flowed into ancient Tule Lake, forming the characteristic chilled blobs called pillow lava.

Lava Beds National Monument has features like those at Hawaii Volcanoes National Park and in Idaho at Craters of the Moon National Monument. All three areas are dominated by basaltic rock. However, Medicine Lake volcano also displays a much wider variety of volcanic phenomena, most notably the spectacular young rhyolite flows of Glass Mountain and Little Glass Mountain. These two flows have many similarities to the dome now growing in the crater of Mount St. Helens. Visitors to Lava Beds National Monument have the opportunity of viewing a wide range of interesting volcanic features in a relatively small area.