Lava Beds

National Park Service
U.S. Department of the Interior

Lava Beds National Monument

The Geology of Lava Beds

Medicine Lake Volcano

Lava Beds National Monument is located on the north flank of the Medicine Lake volcano, a large shield volcano. Medicine Lake is part of the old caldera of this volcano. This entire area has a variety of volcanic rocks such as basalt, andesite, dacite and rhyolite. Medicine Lake is the largest volcano in the Cascade Range, and is approximately 150 miles (241 km) around the base and 7900 ft (2408 km) in height. Lava Beds covers only about 10 percent of the Medicine Lake volcano. It has been erupting periodically for half a million years, and is believed to have many small magma chambers rather then one large chamber. Please remember that rock collecting is not permitted.

Rock Composition

The name given to each type of volcanic rock is determined by the amount of silica present. Basalt has the least silica at around 47 percent, and rhyolite has the most, reaching 77 percent. Dacite and andesite have contents between those of basalt and rhyolite. The physical properties of the rocks change with the percent of silica.

Dacite and rhyolite have a high content of silica, which makes magma slightly cooler and more viscous (sticky). This results in eruptions that tend to be explosive and slow moving, forming thick flows. One form of rhyolite is obsidian, a volcanic glass used by Native Americans to make arrowheads and other tools.

Basalt has a low silica content which results in a hotter and more fluid magma. Basaltic lava flows rapidly over the ground or through lava tubes.

Location of Rock Types

Basalt
Approximately 90 percent of the rocks at Lava Beds National Monument are composed of basalt. The remainder are primarily andesite. This distribution is true of all of the lower slopes of the Medicine Lake volcano. Rhyolite and dacite can be found high on the volcano in the Modoc National Forest.

Aa and *pahoehoe* are two Hawaiian terms used to describe the texture of basaltic lava. Aa is very rough and jagged. The Devils Homestead lava flow is one example of aa. Pahoehoe has the consistency of pudding—smooth and ropy. Pahoehoe flows often create lava tube caves.

Obsidian
The nearest location of an obsidian flow is Glass Mountain. The drive from Lava Beds is approximately 30 miles (48 km). Ask at the visitor center for directions. Collecting is not permitted.

Pumice
Pumice may be found in many areas, including nearly all unpaved trails within the monument. Glass Mountain is the source of all the pumice in the area. It was carried here by the wind at the time of Glass Mountain's most recent eruption nearly 900 years ago.

Tuff
This material forms when lava flows into water, such as ancient Tule Lake, which formed what is now Petroglyph Point. Tuff is soft in comparison to other volcanic rocks and this is the reason Native Americans were able to carve into the side of this cliff. Tuff may also be found at Juniper Butte. Try to figure out how tuff could have formed in areas where there is no water (or ask a ranger).

Why It Doesn't Look Like a Volcano

Shield volcanoes have a very low profile due to the way they erupt. The Medicine Lake volcano may have nearly 200 vents (places where the lava flows out to the surface). The amount of gas present in the magma and the pressure upon it contribute to the way a volcano erupts. Shield volcanoes tend to have gentle eruptions and lava that flows easily over large areas. The largest shield volcano in the world is the island of Hawaii, the majority of which is under water.

Composite or strato volcanoes are what many people think of when they hear the term 'volcano'. Mount Shasta is this kind of volcano and may be seen in the distance from the northern portions of the monument and from the top of Schonchin Butte. These volcanoes result from thicker lava that piles up on top of itself. These eruptions are often violent, and often alternate between eruptions of lava and eruptions of ash.

Relative Ages of Lava Beds Features

Many features in the monument formed before the eruption of basalt from Mammoth Crater that made most of the lava tube caves about 30,000 years ago. These include Schonchin Butte and the Schonchin Flow, Eagle Nest 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 continue. Gillem Bluff, also called Sheepy Ridge, exposes lava flows about one million years old, the oldest in the monument.

After eruption at Mammoth Crater, another basaltic eruption formed The Castles, located on either side of the main road near Schonchin Butte. Magma erupted from numerous spatter vents and flowed north around Hardin Butte. Still younger are several Holocene flows (less than 10,000 years old). These include an eruption from Fleener Chimneys that formed Devils Homestead, a second at Black Crater, and a third that erupted just south of the monument boundary and flowed around Caldwell Butte to form Valentine Cave. Another eruption south of the boundary was from Cinder Butte, approximately 1100 years ago. This formed the blocky Callahan Flow, a portion of which covers the southwestern part of Lava Beds National Monument, and is the park's youngest flow.

The rocks of the Callahan and Schonchin Flows are more andesitic. The basaltic flows of The Castles and Mammoth Crater were more fluid and thus have a smoother surface. Soil forms more rapidly on these smooth flows and has allowed vegetation to take hold more easily than on the rough- surfaced andesitic flows.

Formations

Cinder Cones
Many cinder cones are visible from all parts of the monument. High pressures and concentrations of gas cause an eruption that blows lava into the air and falls as cinders when cooled. Schonchin Butte is the only one with a trail to the top. Please do not attempt to climb other cinder cones; they are easily eroded and scarred. Cinder Butte is the most recent cinder eruption here, about 1100 years ago.

Spatter Cones
Very thick, pasty blobs of lava are thrown up through the break in the Earth's crust. These are thicker than cinders and not thrown as high into the air, and often take the shape of whatever they coat. The Castles near Schonchin Butte and Black Crater are examples of spatter cones. A chimney may eventually be formed. Those found at Fleener Chimneys are 150 ft (46 m) deep.

Craters
Mammoth Crater was a lava lake that overflowed rather than erupted, and left behind an empty crater. The basaltic lava was transported to the northern and northeastern parts of the monument where Canby Cross, Captain Jacks Stronghold and Hospital Rock are located. Balcony, Boulevard and Skull Caves are part of the path this lava followed. The caves along Cave Loop Drive are lava tubes that transported the basalt of Mammoth Crater to the northeast.

Lava Tube Caves
A gentle slope and very fluid lava are required for the formation of lava tubes. The 2000° F (1093° C) lava flows downhill and immediately begins to cool and solidify upon contact with the ground and air. Lava touching the surface solidifies first, followed by the sides and eventually the top. When the flow stops, the insulated lava continues to flow until it either drains out or seals the end of the tube. The benches in Valentine Cave and many others show where a lava tube began to form, but the flow stopped, and lava drained away before the top was able to solidify.

Fault Scarp
A fault scarp is the result of currents of magma below the Earth's crust moving away from each other. This puts tension upon the overlying material, causing it to stretch and eventully sag and drop downward. Gillem Bluff is an example—some layers of basalt exposed here are believed to be over one million years old. The overlook just to the north of Schonchin Butte is a good place to view this fault scarp from a distance.

Lava Tube Features

Lavacicles
Icicle- like formations hang from cave ceilings. They are formed when molten lava splashes and drips from the ceiling, or the ceiling sags from having been reheated. Lavacicles vary in shape from thin and needle- like to thick nubs. Sometimes these are called shark's- tooth lava.

Dripstone
Molten lava slid down the sides of a lava tube, sometimes leaving ribs on the cave walls.

Rafted Block
A portion of ceiling falls into lava still as it flows inside a tube. The block becomes cemented in place when the flowing lava solidifies. A cupola is the hole in the ceiling from which the block fell.

Tributary
One lava tube flow into another, carrying lava toward the main tube.

Distributary
A lava tube branches off from another and carries lava away from the main tube.

Bench
A shelf of lava connects to the floor inside a lava tube. These form when a secondary flow of lava moves through the tube and drains out before its top surface cools. If the top surface of the secondary flow solidifies, it forms a tube- within- a- tube.

Pillar
Molten lava surrounds something in its path, such as a tree or a boulder. If the object is large enough, the lava flow encases the object and eventually connects the floor to the ceiling.

Pullout
Molten lava moving through the tube pulls off a piece of the wall. Examples may be seen in Mushpot Cave.