



Geologic Resources Inventory Fact Sheet

Fact Sheet Compiled in 2024

The *Geologic Resources Inventory* provides geologic map data, a written report, a map poster, and pertinent information to support resource management and science-informed decision making. Page numbers correspond to the GRI report.

Scan QR code for access to the full report, map poster, and GIS data



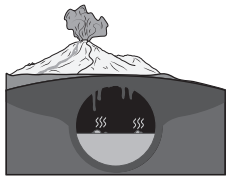
<https://irma.nps.gov/DataStore/SavedSearch/Profile/3003>

Geologic Features and Processes



Medicine Lake Volcano

Lava Beds National Monument is on the northern side of Medicine Lake volcano, which is estimated to be 600 km³ (150 mi³), making it the largest volcano by volume in the Cascade Range. Medicine Lake volcano is the primary source of “lava beds” at the monument. The monument represents 36 eruptions of Medicine Lake volcano. The oldest lava is from about 445,000 years ago, and the youngest is from about 1,120 years ago. *Pages 9–10.*



Lava Tubes

The rock unit known as the basalt of Mammoth Crater composes the most extensive lava flow at the monument. During the eruption, lava tubes served as conduits that distributed the basalt from south to north, flowing across more than 70% of the monument. Segments of the lava tubes were evacuated when the lava stopped flowing, leaving more than 700 caves. *Page 15.*



Paleontological Resources

The monument is one of five NPS areas known to contain tree molds—trace fossils that form when lava engulfs a forest or individual tree. Tree molds provided material (charcoal and charred wood) used to date some of the basalts in the monument. Caves have also yielded remains from the Pleistocene Epoch (2.6 million–11,700 years ago), including mastodon, camel, bear, jaguar, and bison. *Page 22.*

Geologic Issues

Cave Management

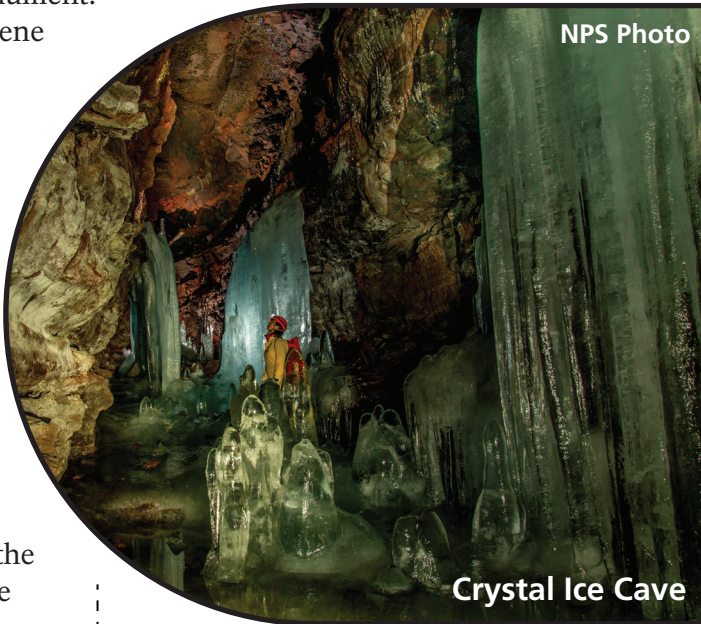
Caves at the monument are susceptible to threats such as modifications to passages, impacts on fragile cave features, impacts from surface development, white-nose syndrome in bats, and climate change, which may result in loss of cave ice. *Page 33.*

Recreational Impacts on Geologic Features

Damage as a result of recreational use from poor infrastructure or the lack of visitor management in sensitive areas is problematic because the monument’s distinctive geologic resources are unlikely to be replenished by natural processes in the near future. *Page 35.*

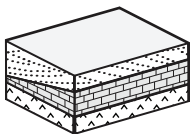
Wind Erosion at Petroglyph Point

Wind erosion (“sand blasting”) may be erasing petroglyphs (carved symbols) at Petroglyph Point. *Page 36.*



NPS Photo

Crystal Ice Cave



The geology in and around Lava Beds National Monument spans more than 2 million years.



Geologic Issues (cont.)

Abandoned Mineral Lands

The monument has 23 features at quarry sites where cinders and pumice were extracted in the past. The NPS is systematically reclaiming these sites. *Page 37.*

Rockfall and Roof Collapse

Freeze-thaw processes, storm events, and seismic activity induce roof collapse in caves and rockfall at cave entrances. Also, rockfall debris is commonly deposited on roads, requiring ongoing maintenance. *Page 37.*

Earthquakes

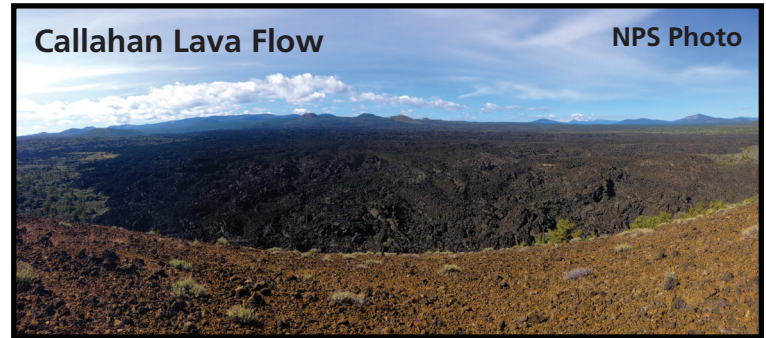
Since 1978, six significant earthquakes have been documented near Medicine Lake volcano. *Page 38.*

Volcano Hazards

Medicine Lake volcano will likely erupt again, although the probability is only a 1 in 3,600 chance in the next year. The most likely future eruption would be a small effusive eruption of basaltic lava. *Page 39.*

Geothermal Features and Development

Medicine Lake volcano hosts a large, active, high-temperature geothermal system fueled by a deeper zone of magma. In the early 2000s, development of geothermal resources was not economically viable, and the project remains “on hold.” *Page 41.*



Geologic History

A brief history of the geologic events that formed the present landscape.

Pre-Medicine Lake Volcano History (~2 million years ago)

Some rocks exposed in the monument, for example at Gillem Bluff, predate the existence of Medicine Lake volcano and were brought to the surface by faulting. *Page 43.*

Medicine Lake Volcano History

The Medicine Lake volcano built up in five major stages. *Pages 43–46.*

1. The volcano began erupting about 500,000 years ago in silicic (rich in silica) domes and flows.
2. About 180,000 years ago, the dacite tuff of Antelope Well erupted as an ash-flow tuff (a rapidly moving, chaotic mixture of pumice, ash, and gas).
3. 180,000–100,000 years ago, profuse volcanism occurred, and the Medicine Lake caldera formed.
4. 100,000–13,000 years ago, basaltic lava flows produced almost half of the volcano’s volume.
5. Since the retreat of Pleistocene glaciers about 13,000 years ago, Medicine Lake volcano has had at least 17 eruptions.



Glacial History

No glaciers occur on Medicine Lake volcano today, but during the Pleistocene Epoch, glaciers covered the caldera. *Page 46.*

Geology and Culture: Holocene Epoch (11,700 years ago–present)

Petroglyphs and pictographs (painted symbols) document the earliest human occupation of the area.

From 1872 to 1873, the lava beds were the site of the Modoc War, the only major Native American war fought in California and the only one in which a general was killed. Between 50 and 60 Modoc warriors fought about 1,000 U.S. troops at the height of the conflict. *Page 46.*