Crater Lake

National Park Service
U.S. Department of the Interior

Crater Lake National Park

Geology

A Restless Landscape

The calm beauty of Crater Lake obscures the violent forces that formed it. Crater Lake lies inside the collapsed remnants of an ancient volcano known as Mount Mazama. Its greatest eruption, about 7,700 years ago, was the alrgest to occur in North American for more than half a million years. Though the mountain has now been dormant for five thousand years, geologists do expect it to reawaken someday.

Building the Cascade Range

Mount Mazama is part of a chain of volcanoes that extends along the crest of the Cascade Range from Lassen Peak in California to Mount Garibaldi in British Columbia. Two other Cascade peaks (Mount Rainier and Lassen) are also national parks.

These volcanoes are the visible evidence of what geologists call "plate tectonics." The earth's surface, seemingly solid, is actually broken up into many huge plates, all floating on top of the Earth's molton interior. As these plates slowly drift, the continents and adjacent sea floor either move apart or push into one another. Continental crust is thicker than oceanic crust and tends to be less yeilding.

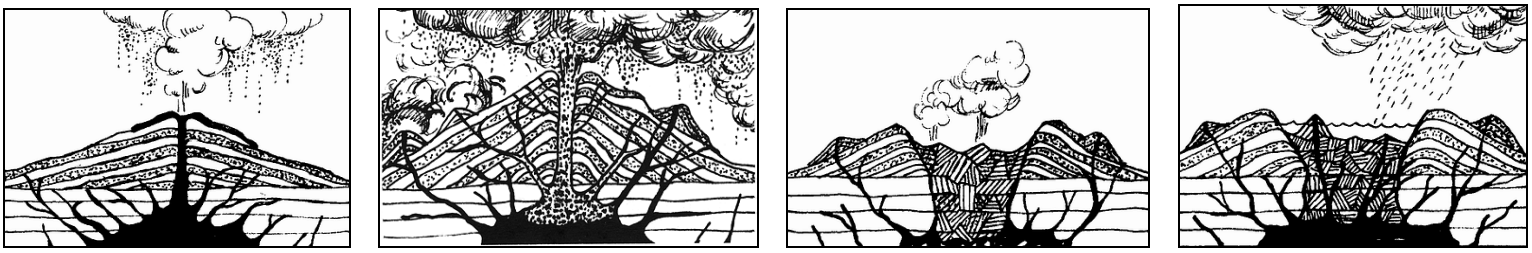
When a plate carrying oceanic crust pushed into what is now the northwestern United States, it was forced under the less-yielding continental plate. Tremendous pressures were exerted on the oceanic plate, causing it to deform and even melt. This melted rock is called magma. It is lighter and more fluid than the surrounding rock and tends to rise. Volcanic eruptions eventually bring the magma back onto the surface of the eaerth, where it is then called lava. This process, over a period of millions of yeaers, formed the Cascade Range. The High Cascade volcanoes we see today, including Mount Mazama, are the most recent results of this process.

A Cataclysmic Eruption

Mount Mazama began to grow half a million years ago. The oldest rocks visible today, 420,000 years old, form Mount Scott on the east side of Crater Lake. Over time, lava flowed from many volcanic vents, overlapping and building an irregularly-shaped mountina. By 8,000 years ago, Mount Mazama may have stood as much as 12,000 feet (3,660 meters) tall.

Mount Mazama's most violent eruption occurred about 7,700 years ago. A column of hot gas and volcanic rock was ejected high into the air. This magma fell to the earth as fragments of frothy white pumice and volcani ash. Layers of ash from this eruption may still be found in the soil as far away as Alberta, Canada, more than 1,000 miles away.

Explosions on the northeast side of the mountain produced fast-moving flows of hot ash. In all, 12 cubic miles (50 cuvic kilometers) of material poured out of the volcano, draining the magma chamber beneath it. As the underlying support for the mountain was lost, the walls of the volcano began to collapse inward. The top of a mountain that was built over hundreds of thousands of years probably "disappeard" in a few days.



Sequence of Events: Mount Mazama grew for almost half a million years. 7,700 years ago, it erupted violently, then collapsed into itself. Since then, rain and snow have filled Crater Lake. Other eruptions have created features including Wizard Island.

Recent Activity

After the collapse of Mount Mazama, minor eruptions continued inside the newly formed caldera (a word that comes from the Spanish word for "kettle" or "boiler" and is used by geologists to describe large basin-shaped volcanic depressions). These recent flows created Wizard Island, which projects 764 feet (233 meters) above the lake's surface, and Merriam Cone, which is submerged. About 5,000 years ago, a small eruption formed a lava dome, just east of Wizard Island, which is also under the surface of the water.

Over the course of several hundred years following the creation of the caldera, rain and snow filled the basin to a depth of 1,943 feet (592 meters). Today, Crater Lake is the nation's deepest lake.

What Will Happen Next?

"Crater Lake partially fills a 1,200 meter [4,000 foot]deep caldera, a depression formed by the collapse of ancestral Mount Mazama during the violent eruption of 50 cubic kilometers of magma, or molten rock, about 7,700 years ago… By comparison, Mount St. Helens in 1980 erupted about half a cubic kilometer of new magma. Geological history shows that catastrophic events of this kind can repeat. Are volcanic eruptions likely again at Crater Lake? One of the approaches U.S. Geological Survey scientists are using to answer this important question is to unravel the geologic history of the Crater Lake caldera floor."

-Dr. Hans Nelson and Dr. Charles R. Bacon, U.S. Geological Survey

The foremost threat from young calderas is that of renewed volcanic activity. Another eruption as big as the caldera-forming event, however, is unlikely. No volcanic activity has occurred at Mount Mazama in the last 5,000 years; studies of lake sediments show no evidence of magma movement beneath the earth's surface; and there have been no earthquakes of the kind associated with volcanic activity.

Calderas filled with water can also produce tremendous flooding if the caldera wall fails. Crater Lake show no signs of imminent crater-wall failure; the last major wall failure occurred more than 7,500 years ago, soon after the cataclysmic eruption of Mt. Mazama.

Scientists from the U.S. Geological Survey, the National Park Service, local universities, and other agencies continue to study Crater Lake and its geology. In addition, scientists from the USGS Cascade Volcano Observatory periodically make geodetic measurements and look for tilting or swelling of the caldera area that might forewarn of renewed volcanic activity.

For More Information About Volcanoes…

Crater Lake National Park
http://www.nps.gov/crla

Cascade Volcanoes Observatory
http://vulcan.wr.usgs.gov

Global Volcanism Program
http://www.volcano.si.edu/gvp

Volcano World
http://volcano.und.nodak.edu