

# USGS geologists map Lassen's volcanoes

**Tim Holt, Redding Record Searchlight, 8-27-11**

Dr. Patrick Muffler describes himself, at 74, as "an overgrown Boy Scout." He's a rock hound who loves trekking in and around the lava fields, the steaming fumaroles, the boiling mud pots of Lassen National Park. He's a longtime field geologist who specializes in geothermal and volcanic activity. Like others in that field he has his war stories, like the time at Yellowstone he broke through a thin crust of grass and dirt into boiling water. When he took off his sock and boot, a good deal of his skin came with it.

As a scientist with the U.S. Geological Survey, Muffler has spent more than three decades studying the volcanic features of Lassen National Park. Much of what he's learned has just been published in the form of two detailed maps and an accompanying 110-page pamphlet, cowritten with a USGS colleague, Dr. Michael Clynne. The maps show seven separate volcanic centers at Lassen and use color coding to show the types of rock produced by eruptions from each of those volcanic centers.

One thing geologists have learned, Muffler said, is that the oldest rocks in the park go back about 3.5 million years. This means Lassen is a relative youngster in geologic time, the "frosting on the geologic cake," as Muffler puts it. After all, the oldest rocks on Earth go back 4 billion years.

It may be a relative newcomer, geologically speaking, but the Lassen volcanic region has had a lot of activity. The USGS scientists found evidence of more than 300 volcanic eruptions in those 3.5 million years.

It took the two geologists and their colleagues at USGS 35 years to produce the Lassen maps. "We've been on top of every bloody peak out there," Muffler said. Age-dating techniques developed in the 1990s enabled the scientists to calculate more precisely how long ago eruptions occurred at various locations in the park.

They've also been able to trace the outlines of the mother of all Lassen volcanoes, the massive Brokeoff Volcano, which dominated the Lassen skyline some 600,000 years ago the same way Mt. Shasta does in its own region today. Over the years Brokeoff was worn down by water and glacial erosion.

The park's current star volcano, Lassen Peak, last erupted in 1915, drawing attention to the volcanic region and spurring its designation the following year as a national park.

Lassen National Park offers "the most spectacular array of thermal features in the Cascade Range," according to the pamphlet that accompanies the new maps. Those spectacular features include the fumaroles, bubbling mud pots, and a boiling lake, Boiling Spring Lake — all evidence of the intense thermal activity just under the surface. But don't hold your breath for the next big volcanic event, another eruption of Lassen Peak. It isn't expected for another 7,000 years. The sky will be darkened by eruptions of ash from one of the park's cinder cones about 1,500 years from now, according to geologists' estimates.

The shifting of two huge tectonic plates, one under the Pacific Ocean floor and another under the North American continent, caused the fissures that have allowed hot lava to erupt through the Earth's surface at Lassen. There are very few fossils found at Lassen, by the way. Most of those prehistoric creatures have been burned to a crisp, skeletons and all, by hot lava flows.

Muffler officially retired from his Geologic Survey post eight years ago, but he still shows up at his office in Menlo Park every day as a volunteer. He's determined, he says, to "die with my boots on."

Recently, he was getting ready to strap on those boots once again, for a field trip to help PG&E assess the seismic hazards at one of its dams along the Pit River.