

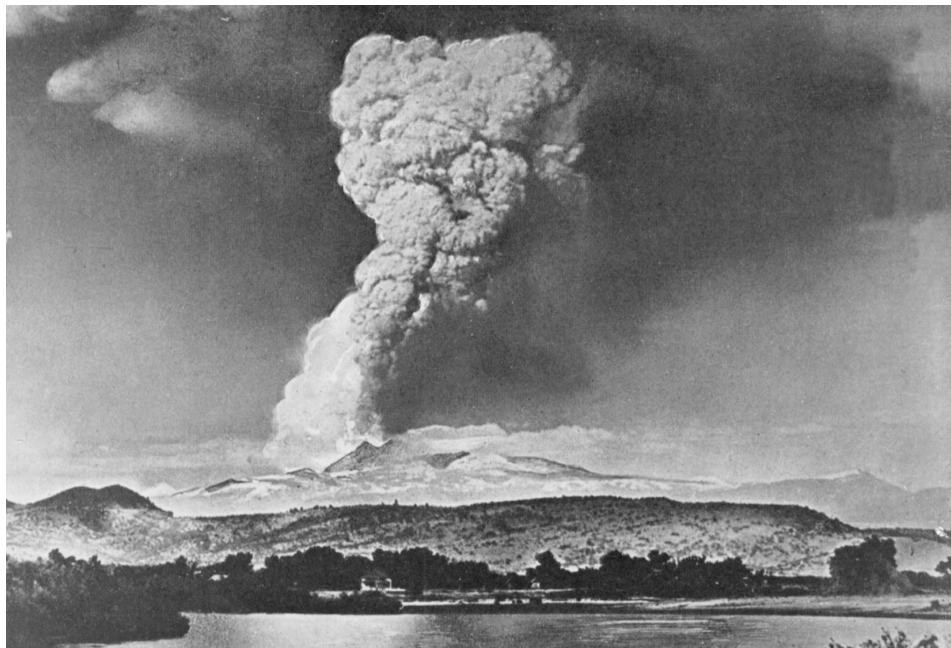
U.S. GEOLOGICAL SURVEY and the NATIONAL PARK SERVICE—OUR VOLCANIC PUBLIC LANDS

Eruptions of Lassen Peak, California, 1914–1917

On May 22, 1915, an explosive eruption at Lassen Peak, California, the southernmost active volcano in the Cascade Range, devastated nearby areas and rained volcanic ash as far away as 200 miles to the east. This explosion was the most powerful in a 1914–17 series of eruptions that were the last to occur in the Cascades before the 1980 eruption of Mount St. Helens, Washington. Recent work by scientists with the U.S. Geological Survey (USGS) in cooperation with the National Park Service is shedding new light on these eruptions.

Lassen Peak is the largest of a group of more than 30 volcanic domes erupted over the past 300,000 years in Lassen Volcanic National Park in northern California. These mound-shaped accumulations of volcanic rock, called lava domes, were created by eruptions of lava too viscous to flow readily away from its source. Eruptions about 27,000 years ago formed Lassen Peak, probably in only a few years. With a height of 2,000 feet and a volume of half a cubic mile, it is one of the largest lava domes on Earth.

When Lassen Peak formed, it looked much like the nearby 1,100-year-old Chaos Crags Domes, with steep sides covered with angular



The May 22, 1915, explosive eruption of Lassen Peak, California, blasted rock fragments and pumice high into the air and rained fine volcanic ash as far away as Winnemucca, Nevada, 200 miles to the east. In this photograph taken from near the town of Red Bluff, 40 miles west of the volcano, the huge column of volcanic ash and gas produced by the eruption rises to a height of more than 30,000 feet. (Photograph taken by R.E. Stinson; courtesy of the National Park Service.)

rock talus. However, from 25,000 to 18,000 years ago, during the last ice age, Lassen's shape was significantly altered by glacial erosion. For example, the bowl-shaped depression on the volcano's northeastern flank, called a cirque, was

eroded by a glacier that extended out 7 miles from the dome.

Initial Rumbblings (May 1914 to May 1915)

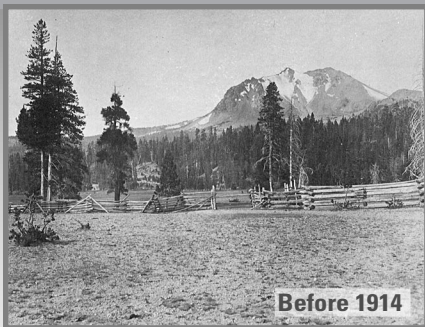
On May 30, 1914, Lassen Peak awoke from a 27,000-year-long slumber when it was shaken by a steam explosion. Such steam blasts occur when molten rock (magma) rises toward the surface of a volcano and heats shallow ground water. The hot water rises under pressure through cracks and, on nearing the surface, vaporizes and vents explosively.

By mid-May 1915, more than 180 steam explosions had blasted out a 1,000-foot-wide crater near the summit of Lassen Peak. Then the character of the eruption changed dramatically. On the evening of May 14, 1915, incandescent blocks of lava could be seen bouncing down the flanks of Lassen from as far away as the town of Manton, 20 miles to the west. By the next morning, a growing dome of dacite lava (lava containing 63 to 68% silica) had welled up into the volcano's crater and filled it.

Events of May 19–20, 1915

Late on the evening of May 19, a large steam explosion fragmented the dacite dome, creating a new crater at the summit of Lassen Peak. No new magma was ejected in this explosion, but glowing blocks of hot lava from the dome fell on the summit and snow-covered upper flanks of Lassen Peak.

DEVASTATION CAUSED BY THE MAY 1915 ERUPTIONS



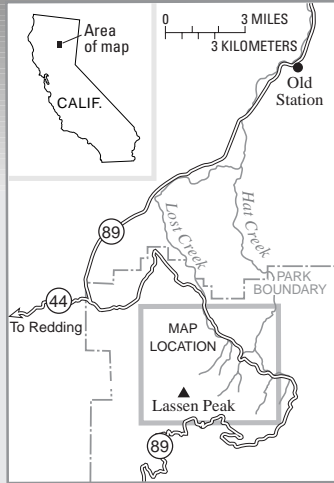
Before 1914



June 1915

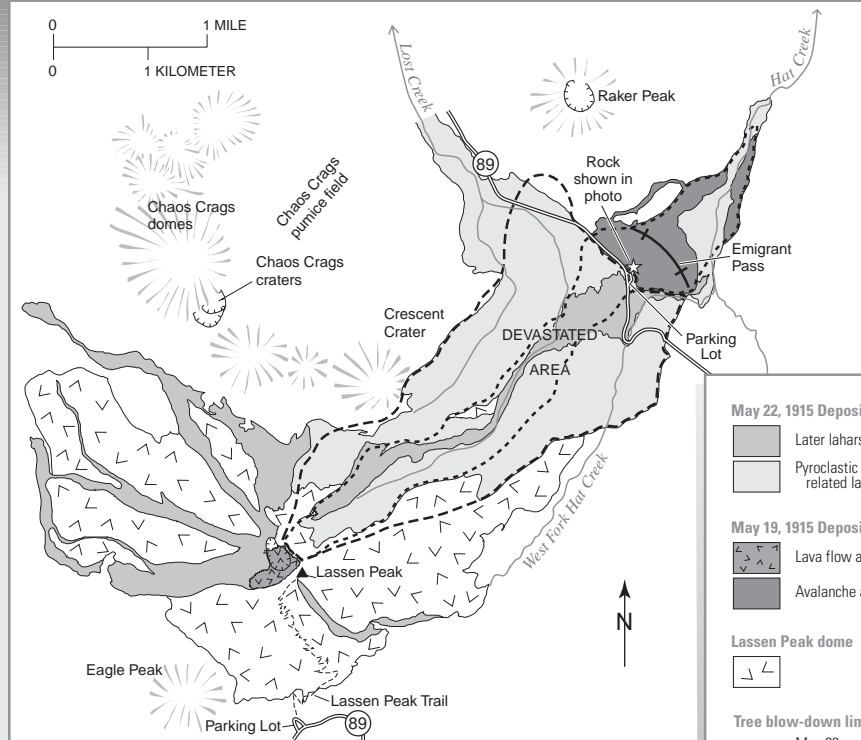
The 1914–17 series of explosive eruptions at Lassen Peak, California, were some of the first volcanic eruptions to be extensively photographed, largely by Benjamin Franklin Loomis, a local businessman and amateur photographer. As shown in the left photograph, the northeastern flank of Lassen Peak was covered by mature conifer forest before 1914. The photograph on the right, taken by Loomis in June 1915 from nearly the same location shows the devastation caused by the two most powerful eruptions in the series, those of May 19 and 22 of that year. The large rock in the foreground is a piece of the lava dome that filled Lassen's summit crater during the week before the May 19 eruption and was carried to its present location by the avalanche caused by this eruption. Today, this rock can be seen on the Devastated Area Interpretive Trail. The appearance of Lassen's northeastern flank was little changed for 50 years after the eruptions, while seedlings struggled to regain a foothold, but today young vigorously growing trees are obscuring the devastation and reclaiming the area as forest. (Photographs courtesy of the National Park Service.)

GENERALIZED MAP OF DEPOSITS FROM LASSEN PEAK'S MAY 1915 ERUPTIONS



The May 1915 eruptions of Lassen Peak destroyed a 3-square-mile area, now simply called the Devastated Area, on the flank of the volcano. On the evening of May 19, a large steam explosion fragmented the still hot lava dome that had filled Lassen's summit crater during the previous week, blasting out a new crater at the volcano's summit and creating an avalanche of hot lava blocks, volcanic debris, and snow. As the snow melted, a huge mudflow of volcanic materials, called a lahar, was generated. The lahar rushed 7 miles down Lost Creek, where it released huge volumes of water, flooding the lower Hat Creek Valley. The avalanche, lahars, and floods produced by this explosion uprooted and carried away 100-foot-tall trees with ease and destroyed six ranch houses.

During the night of May 19-20 new lava welled up into and filled the crater created by the steam explosion. On May 22 Lassen Peak exploded again in a powerful climactic eruption that blasted rock fragments and pumice high into the air, creating the larger and deeper of the two craters seen near the summit of the volcano today and generating a column of volcanic ash and gas. A high-speed avalanche of hot ash, pumice, rock fragments, and gas, called a pyroclastic flow, swept down the side of the volcano. Trees that were still standing after the May 19 eruption were blown down, with their trunks left lying on the ground pointing away from the volcano. The pyroclastic flow rapidly melted snow in its path, creating a lahar that followed the path of the lahar 2 days earlier and rushed down Lost Creek to Old Station, releasing water that again flooded lower Hat Creek Valley.



May 22, 1915 Deposits	
	Later lahars
	Pyroclastic flow and related lahar
May 19, 1915 Deposits	
	Lava flow and dome
	Avalanche and lahar
Lassen Peak dome	
	Lassen Peak dome
Tree blow-down limits	
	May 22
	May 19
	Lava dome
	Crater

These falling blocks launched a half-mile-wide avalanche of snow and volcanic rock that roared 4 miles down the volcano's steep northeast flank and over a low ridge at Emigrant Pass into Hat Creek.

As the hot lava blocks broke into smaller fragments, the snow melted, generating a mudflow of volcanic materials, called a lahar. The bulk of this lahar was deflected northwestward at Emigrant Pass and flowed 7 miles down Lost Creek. Even after coming to rest, both the avalanche and lahar released huge volumes of water, flooding the lower Hat Creek Valley during the early morning hours of May 20. The lahar and flood destroyed six mostly not-yet-occupied summer ranch houses. Fortunately, the few people in these houses escaped with only minor injuries.

Also during the night of May 19-20, dacite lava somewhat more fluid than that erupted on the night of May 14-15 welled up into and filled the new crater at Lassen's summit, spilled over low spots on its rim, and flowed 1,000 feet down the steep west and northeast flanks of the volcano.

Climactic Eruption of May 22, 1915

Late on the afternoon of May 22, after two quiet days, Lassen Peak exploded in a powerful eruption that blasted rock fragments and pumice high into the air, creating the larger and deeper of the two craters seen near the summit of the volcano today. A huge column of volcanic ash and gas rose more than

30,000 feet into the air and was visible from as far away as Eureka, 150 miles to the west.

Pumice falling onto the northeastern slope of Lassen Peak generated a high-speed avalanche of hot ash, pumice, rock fragments, and gas, called a pyroclastic flow, that swept down the side of the volcano, devastating a 3-square-mile area. The pyroclastic flow rapidly incorporated and melted snow in its path. The water from the melted snow transformed the flow into a highly fluid lahar that followed the path of the May 19-20 lahar and rushed nearly 10 miles down Lost Creek to Old Station. This new lahar released a large volume of water that flooded lower Hat Creek Valley a second time.

The powerful climactic eruption of May 22 also swept away the northeast lobe of the lava flow extruded 2 days earlier. The eruption produced smaller mudflows on all flanks of Lassen Peak, deposited a layer of volcanic ash and pumice traceable for 25 miles to the northeast, and rained fine ash at least as far away as Winnemucca, Nevada, 200 miles to the east.

Continuing Volcanic Activity and Future Eruptions

For several years after the May 22, 1915, eruption, spring snowmelt percolating down into Lassen Peak triggered steam explosions, indicating that rocks beneath the volcano's surface remained hot. Particularly vigorous steam explosions in May 1917 blasted out the second of the

two craters now seen near the volcano's summit. Steam vents could be found in the area of these craters into the 1950's but gradually waned and are difficult to locate today. Lassen Peak sleeps again, but active steam vents, hot springs, and bubbling pools of hot mud are still found elsewhere in Lassen Volcanic National Park. No one can say when, but it is almost certain that the Lassen area will experience volcanic eruptions again.

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See also *Living With Volcanic Risk in the Cascades* (USGS Fact Sheet 165-97), *What are Volcano Hazards?* (USGS Fact Sheet 002-97), and *Pictorial History of the Lassen Volcano* by Benjamin Franklin Loomis (1926, re-published by the Lassen Loomis Museum Association)