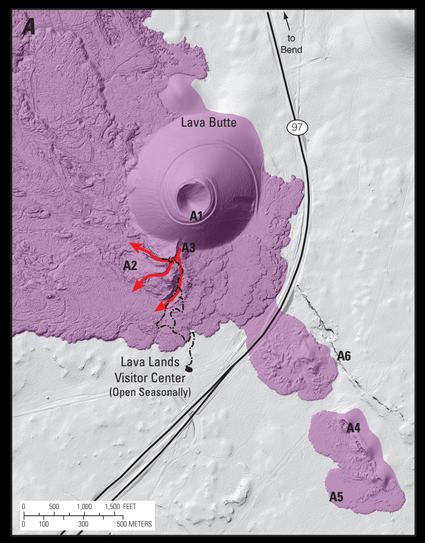
U.S. Department of the Interior
U.S. Geological Survey

Scientific Investigations Map 3329

Most of Newberry Volcano's youngest lava flows are found within the Newberry National Volcanic Monument in central Oregon. Established November 5, 1990, the monument is managed by the U.S. Forest Service as part of the Deschutes National Forest. Since 2011, a series of aerial surveys over the monument collected elevation data using lidar (light detection and ranging) technology, which uses lasers to directly measure the ground surface. These data record previously unseen detail in the volcano's numerous lava flows and vents. On average, a laser return was collected from the ground's surface every 2.17 feet (ft) with ±1.3 inches vertical precision.

The central caldera is visible in the lower right corner of the center map, outlined by the black dashed line. The caldera collapsed about 75,000 years ago when massive explosions sent volcanic ash as far as the San Francisco Bay area and created a 3,000-ft-deep hole in the center of the volcano. The caldera is now partly refilled by Paulina and East Lakes, and the byproducts from younger eruptions, including Newberry Volcano's youngest rhyolitic lavas, shown in red and orange. The majority of Newberry Volcano's many lava flows and cinder cones are blanketed by as much as 5 feet of volcanic ash from the catastrophic eruption of Mount Mazama that created Crater Lake caldera approximately 7,700 years ago. This ash supports abundant tree growth and obscures the youthful appearance of Newberry Volcano. Only the youngest volcanic vents and lava flows are well exposed and unmantled by volcanic ash. More than one hundred of these young volcanic vents and lava flows erupted 7,000 years ago during Newberry Volcano's northwest rift zone eruption.



A. Map showing Lava Butte, the northernmost and largest among the vents of Newberry Volcano's northwest rift zone eruption. The lidar image shows the 500-ft-high cinder cone (A1), its 200-ft-deep central crater, and multiple flow lobes (A2) emerging from a boca (Spanish for mouth) (A3), at the base of the cone. Red arrows mark flow paths of lava that was erupted from the boca. Also nearby are several fissure vents (A4), small lava flows (A5), and a set of parallel extensional cracks that project to the southeast along the northwest rift zone (A6). A paved trail (black dash-dot line) from the Lava Lands Visitor Center, located adjacent to Highway 97, extends north into the boca. A paved road (open seasonally) to the top of the cinder cone provides an expansive view to the southeast, encompassing the cinder-cone-dotted northwest flank of Newberry Volcano, and a view of the Cascade Range to the west, including the Three Sisters and Mount Bachelor.

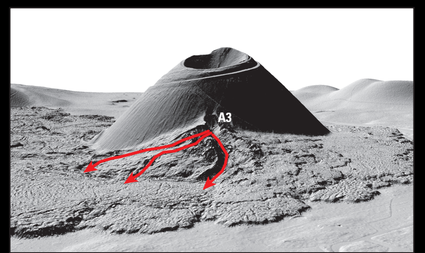
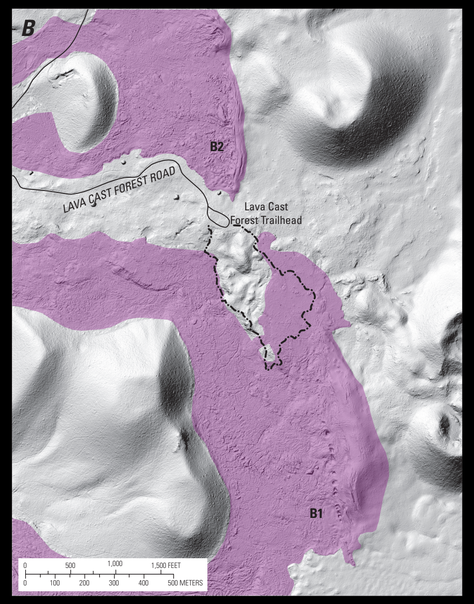


Image showing oblique view (as if flying north) of Lava Butte using lidar data. Explosive eruptions built the cinder cone to its full height before lava broke through the side of the cone at a boca (A3), producing multiple layered terrace-like lobes of lava.



B. Map showing Newberry Volcano's northwest rift zone eruption that was caused when the ground surface was stretched and broken, allowing magma to rise and erupt. The eruption 7,000 years ago opened multiple fissures, producing volcanic vents for 20 miles, mainly to the northwest of the caldera. Halfway up the volcano's flank, multiple vents (B1) opened close to where the Lava Cast Forest Trailhead is today. The lava from these vents engulfed a stand of trees, chilled and solidified against them, and then burned away the wood leaving behind tree molds. Many of these molds can be seen along a paved trail (black dash-dot line) at Lava Cast Forest. Further north, another vent erupted lava along a crack or fissure (B2).

Photograph showing fissure eruption at Mauna Loa, Hawaii during its 1984 eruption (photo by J. Griggs, U.S. Geological Survey). Fissure eruptions at Newberry Volcano may have occurred in a similar way. Note person in the lower left-hand corner of the photograph.

Photograph showing tree molds scattered along the Lava Cast Forest trail. The molds were left behind when trees were engulfed by less viscous lava that erupted from a nearby vent.

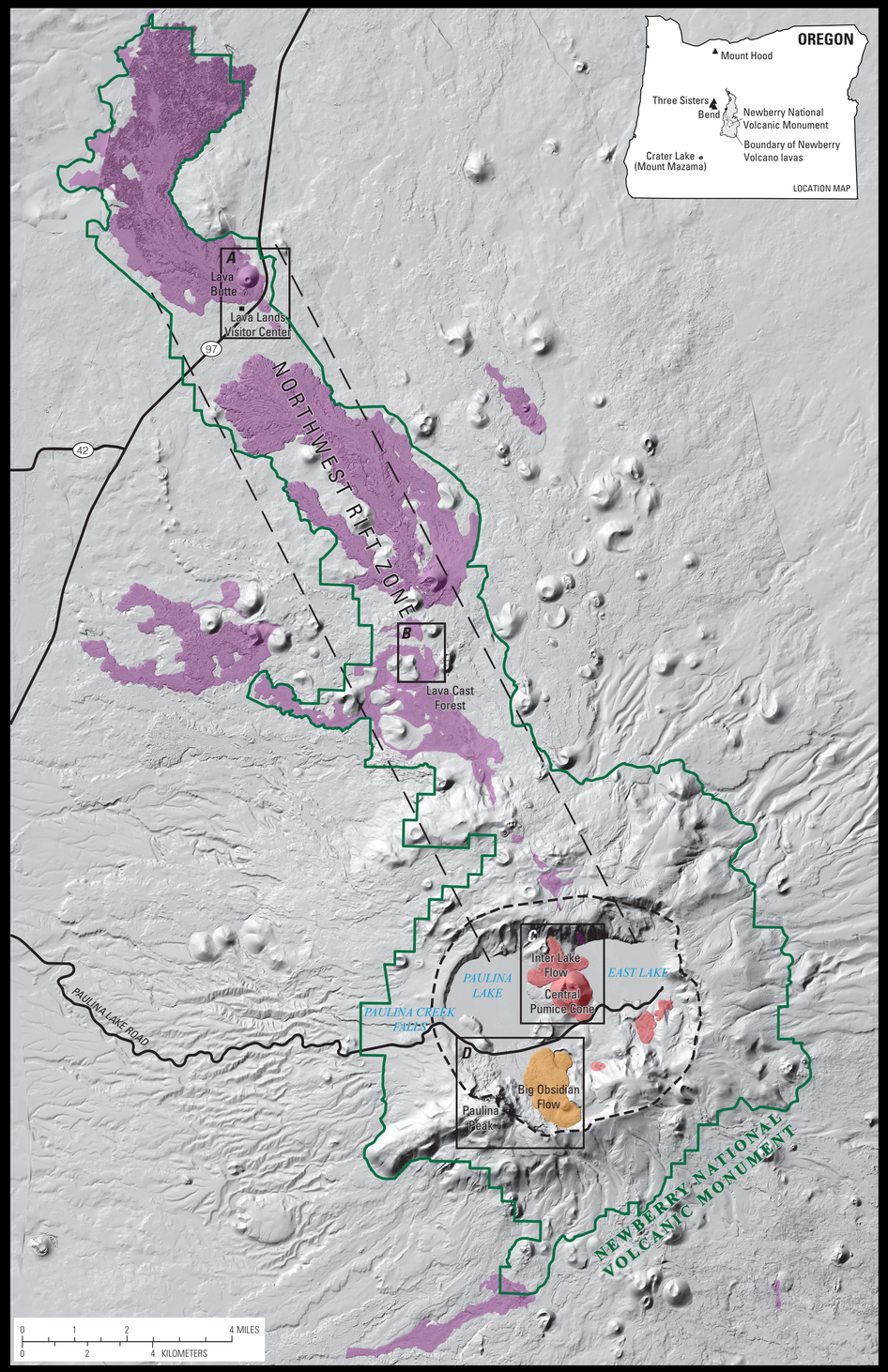
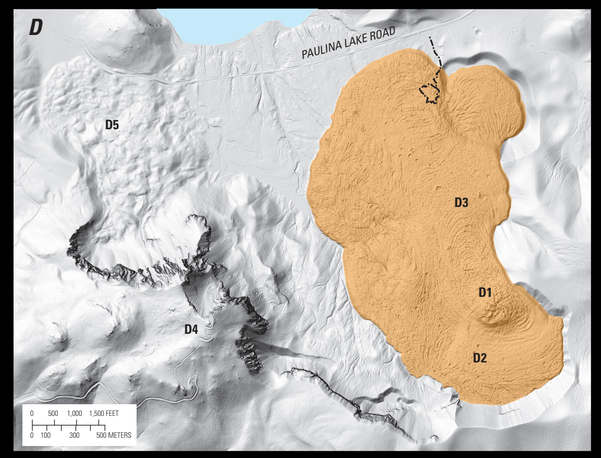


Image from U.S. Geological Survey, National Elevation Dataset
Universal Transverse Mercator projection

C. Map showing the central rhyolite fissure (red) that erupted across the caldera about 7,500 years ago and includes craggy-surfaced lava flows and the nearly 700-ft-high Central Pumice Cone (C1). This prominent feature was built by the explosive interaction of rhyolitic magma and water. As the cone grew, water was forced away from the vent, allowing lava to ooze into the central crater. North of the cone, the Inter Lake Flow (C2) flowed south and then descended both sides of the central ridge into the basins occupied by the caldera lakes. The East Lake Fissure (C3), shown in purple, marks the extension of the northwest rift zone eruption into the caldera.



D. Map showing Newberry Volcano's youngest lava flow, the 1,300-yr-old Big Obsidian Flow (orange). This eruption began with explosions that sent volcanic ash east as far as Idaho. The lava dome (D1) above the main vent stands above the craggy surface of the obsidian flow. The lava flow's inhospitable surface is pockmarked by round gas-related cavities (D2), and wrinkled by lava flow pressure ridges (D3) showing flow direction to the north. A popular unpaved hiking trail (black dash-dot line) ascends by stairs to the upper surface of this spectacular rhyolite flow. Overlooking the Big Obsidian Flow is the nearly 8,000-ft-high Paulina Peak (D4), the highest point on the caldera rim. The peak is made of rhyolite that erupted about 80,000 years ago. The caldera collapse and subsequent glaciation beheaded the lava flow, and sections of these oversteepened cliffs collapsed to form the landslide (D5) that appears as the rumpled surface below the peak. An unpaved seasonal road ascends to the top of the peak that, on a clear day, offers one of the premier views in all of Oregon—the crest of the Cascade Range from Mount Shasta, CA to Mount Adams, WA.

ADDITIONAL READING

Donnelly-Nolan, J.M., Stovall, W.K., Ramsey, D.W., Ewert, J.W., and Jensen, R.A., 2011, Newberry Volcano—central Oregon's sleeping giant: U.S. Geological Survey Fact Sheet 2011–3145, 6 p., available at http://pubs.usgs.gov/fs/2011/3145/.

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