## The 1980 Eruption of Mount St. Helens

Probably the most studied and photographed composite (explosive) volcano on Earth is Mount St. Helens, located 70 km (45 mi) northeast of Portland, Oregon, and 130 km (80 mi) south of the Tacoma-Seattle area of Washington. Mount St. Helens is the youngest and most active of the Cascade Range of volcanoes, which form a line from Mount Lassen in California to Mount Meager in British Columbia (Figure 9.1.1a). The Cascade Range is the product of the Juan de Fuca seafloor spreading center off the coast of northern California, Oregon, Washington, and British Columbia and the plate subduction that occurs offshore, as identified in the upper right of Figure 9.12.

The mountain had been quiet since 1857. New activity began in March 1980, with a sharp earthquake registering a magnitude 4.1. The first eruptive outburst occurred one week later, beginning with a 4.5 quake and continuing with a thick black plume of ash and the development of a small summit crater. Ten days later, the first volcanic earthquake, a *harmonic tremor*, registered on the many instruments that had been hurriedly placed around the volcano. Harmonic tremors are slow, steady vibrations, unlike the sharp releases of energy associated with earthquakes and faulting. Harmonic tremors told scientists that magma was on the move within the mountain.

Also developing was a massive bulge on the north side of the mountain. This bulge indicated the direction of the magma flow within the volcano. A bulge represents the greatest risk from a composite volcano, for it could signal a potential lateral burst through the bulge and across the landscape.

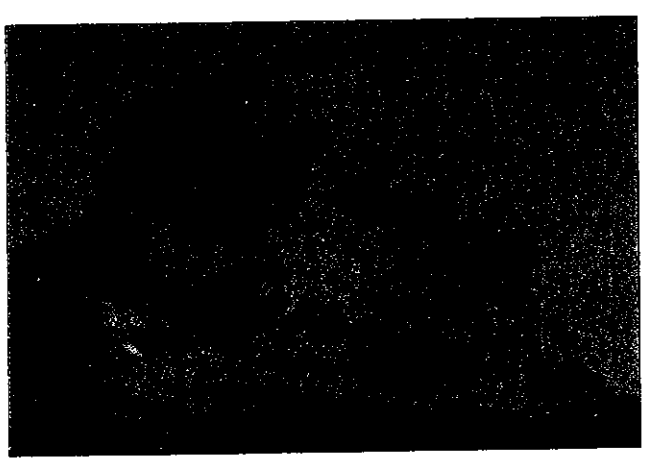
Early on Sunday, May 18, the area north of the mountain was rocked by a magnitude 5.0 quake, the strongest to date. The mountain, with its distended 245-m (800-ft) bulge, was shaken, but nothing else happened. Then a second quake (5.1) hit at 8:32 A.M., loosening the bulge and launching the eruption. David Johnston, a volcanologist with the U.S. Geological Survey, was only 8 km (5 mi) from the mountain, servicing instruments, when he saw the eruption begin. He reportedly radioed headquarters in Vancouver, Washington, saying, "Vancouver, Vancouver, this is it!" He perished in the eruption. For a continuously updated live picture of Mount St. Helens from Johnston's approximate observation point, go to **http://vulcan.wr.usgs.gov/Volcanoes/MSH/VolcanoCam/framework.html**. The camera is mounted below the roof line at the Johnston Ridge Observatory 8 km (5 mi) from the mountain (Figure 9.1.1b). The observatory is open to the public and is named for this brave scientist.

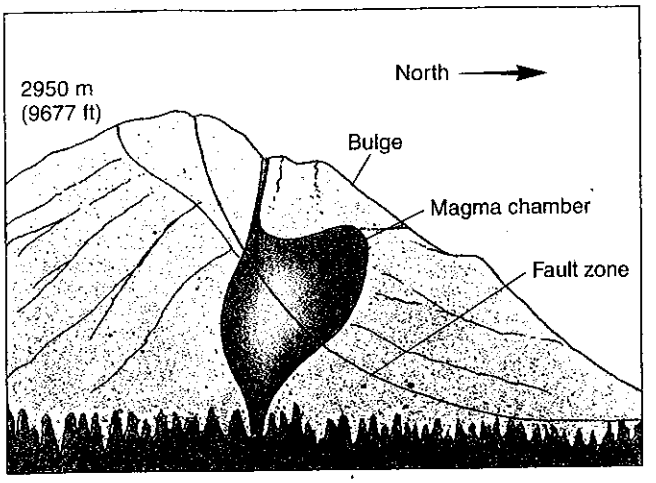
As the contents of the mountain exploded, a surge of hot gas (about 300°C, or 570°F), a *nuée ardente* (rapidly moving, very hot, steam-filled, explosive ash, pyroclastics, and incandescent gases) moved northward, hugging the ground and traveling at speeds up to 400 kmph (250 mph) for a distance of 28 km (17 mi).

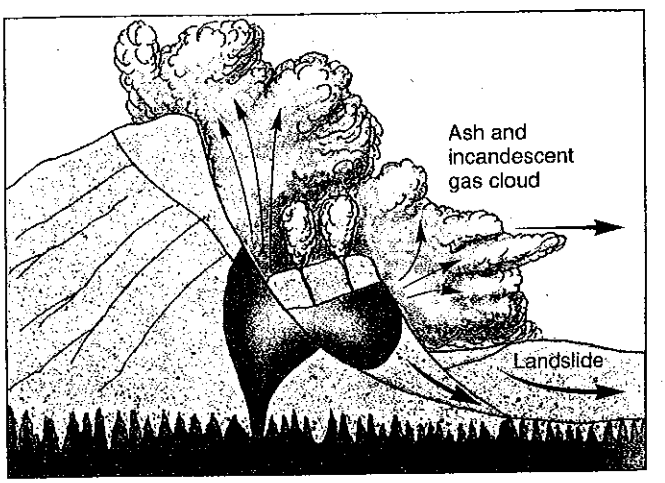
The slumping north face of the mountain produced the greatest landslide in recorded history; about 2.75 $km^3$ (0.67 $mi^3$) of rock, ice, and trapped air, all fluidized with steam, surged at speeds approaching 250 kmph (155 mph). Landslide materials traveled for 21 km (13 mi) into the valley, blanketing the forest, covering a lake, and filling rivers (Figure 9.1.1c). A series of photographs, taken at 10-second intervals from the east looking west, records this sequence (Figure 9.1.2). The eruption continued with intensity for 9 hours, first clearing out old rock from the throat of the volcano and then blasting new material.

Before the eruption, Mount St. Helens was 2950 m (9677 ft) tall; the eruption blew away 418 m (1370 ft). But today, Mount St. Helens is building a lava dome within its crater. As destructive as such eruptions are, they also are constructive, for this is the way in which a volcano eventually builds its height. The thick lava rapidly and repeatedly plugs and breaks in a series of lesser dome eruptions that may continue for several decades. The dome already is over 300 m (1000 ft) high; a new mountain is being born from the eruption of the old.

An ever-resilient ecology is recovering as plants and animals reclaim the devastated landscape. In Chapter 16, matching photographs from 1983 and 1999 document the slow successional recovery near the volcano (see Figure 16.19). More than 25 years have passed, yet strong interest in the area continues; scientists and millions of tourists visit the Mount St. Helens Volcanic National Monument every year. For more information, see the Cascades Volcano Observatory at **http://vulcan.wr.usgs.gov/** and specifically Mount St. Helens at **http://vulcan.wr.usgs.gov/Volcanoes/MSH/framework.html**.





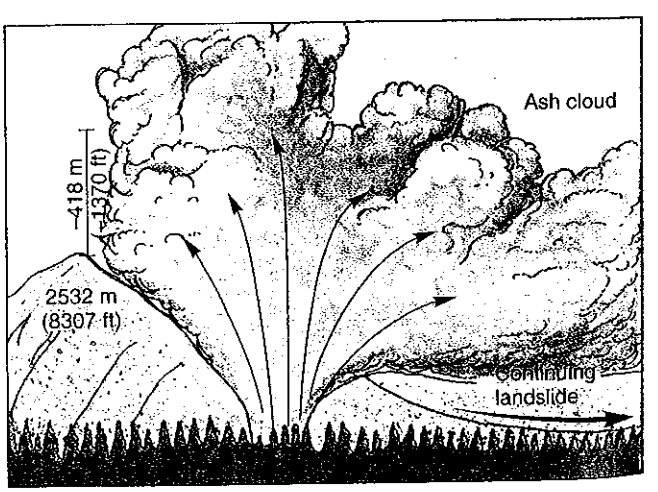




**FIGURE 9.1.2 The Mount St. Helens eruption sequence and corresponding schematics.** [Photo sequence by Keith Ronnholm. All rights reserved.]

NOTEBOOK Debris Avalanche and Eruption of Mt. St. Helens

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