Mount St. Helens 1980 Eruption

Location: Mount St. Helens, Washington, a volcano in the Cascade Range in southwestern Washington State. Closest major city: Portland, OR – SSE 80 km. (50 mi.)

Date: October 14, 2004. This imagery was collected for the U.S.G.S. and NASA's Jet Propulsion Lab using a Cessna Caravan operated by Sky Research.

Image Source: ASA MODIS/ASTER Airborne Simulator 3m thermal, mid-infrared and visual composite draped over a 10-meter digital elevation model.

Inset Image: USGS Photograph, May 17, 1980

Early Signs of Activity

The first sign of activity at Mount St. Helens in the spring of 1980 was a series of small earthquakes that began on March 16. After hundreds of additional earthquakes, steam explosions on March 27 blasted a crater through the volcano's summit ice cap. Within a week the crater had grown to about 1,300 feet in diameter and two giant crack systems crossed the entire summit area. By May 17, more than 10,000 earthquakes had shaken the volcano and the north flank had grown outward at least 450 feet to form a noticeable bulge. Such dramatic deformation of the volcano was strong evidence that molten rock (magma) had risen high into the volcano's magma chamber.

Eruption

On May 18, 1980, within 15 to 20 seconds of a magnitude 5.1 earthquake at 8:32 am, the volcano's bulge and summit slid away in a huge landslide - the largest on Earth in recorded history. The landslide depressurized the volcano's magma system, triggering powerful explosions that ripped through the sliding debris. Rocks, ash, volcanic gas, and steam were blasted upward and outward to the north. This lateral blast of hot material accelerated to at least 300 miles per hour. The blast cloud traveled as far as 17 miles northward from the volcano and the landslide traveled about 14 miles west down the North Fork Toutle River.

The lateral blast produced a column of ash and gas (eruption column) that rose more than 15 miles into the atmosphere in only 15 minutes. Less than an hour later, a second eruption column formed as magma erupted explosively from the new crater. Just after noon, swift avalanches of hot ash, pumice, and gas (pyroclastic flows) poured out of the crater at 50 to 80 miles per hour and spread as far as 5 miles to the north. Over the course of the day, prevailing winds blew 520 million tons of ash eastward across the United States and caused complete darkness in Spokane, Washington, 250 miles from the volcano.

During the first few minutes of this eruption, parts of the blast cloud surged over the newly formed crater rim and down the west, south, and east sides of the volcano. The hot rocks and gas quickly melted some of the snow and the ice capping the volcano, creating surges of water that eroded and mixed with loose rock debris to form volcanic mudflows (lahars). Several lahars poured down the volcano into river valleys, ripping trees from their roots, and destroying roads and bridges. The largest and most destructive lahar was formed by water seeping from inside the huge landslide deposit through most of the day. This sustained flow of water eroded material from both the landslide deposit and channel of the North Fork Toutle River. The lahar increased in size as it traveled downstream, destroying bridges and homes and eventually flowing into the Cowlitz River. It reached its maximum size at about midnight in the Cowlitz River about 50 miles downstream from the volcano.

The post-eruption image shows the breach from the north and the channels where materials were removed in the blast flowed from the crater as a large landslide. The post-eruption image and the inset image provide a visual comparison of the impact of the explosion and landslide. The original mountain summit as seen in the inset was at 9,677 feet in elevation; but after the eruption, the height was 8,363 feet.

Dome Growth

Five smaller explosive episodes occurred between May 25 and October 16, 1980. Each produced eruption columns 8 to 9 miles above sea level and pyroclastic flows down the volcano's north flank. The episodes in June, August, and October also erupted lava in the crater to form a dome. Lava domes are mound- shaped features that form when stiff, viscous lava accumulates over and around a volcanic vent.

For the next six years, beginning with the October 16, 1980 eruption and ending on October 21, 1986, 17 eruptive episodes built a new lava dome that reached 876 feet above the crater floor. The larger explosions showered the crater with rocks and occasionally generated small lahars. In addition to the 17 dome-building episodes, hundreds of small explosions or bursts of gas and steam occurred, sending ash a few hundred feet to several miles above the volcano. The dome is visible in the center of the crater on the image.

Interpretive Learning…

1) Using a Physical Geography textbook, describe the differences between a composite volcano (such as those in the Cascades) and a shield volcano as found in Hawaii. Why and how do the respective hazards differ?
2) Consider what planning efforts people in the area are making to prepare for evacuation in the face of other Cascade hazardous volcanic events, possibly from Mt. Rainier, Mt. Baker, or Mt. Hood.
3) What impact might a large volcanic eruption, such as Mt. St. Helens, have on local economies, for example, agriculture, transportation, tourism, forestry, and others; and on global economies?
4) Speculate on the affect of major volcanic eruptions, such as Mt. St. Helens, on global climate.

Explore More…

A camera at the Johnston Ridge Observatory five miles away from Mt. St. Helen provides views year-round (except when snow-covered) at *http://www.fs.fed.us/gpnf/volcanocams/msh/*

Updates on activity at the crater and on dome growth are provided at:
http://vulcan.wr.usgs.gov/Volcanoes/MSH/Eruption04/framework.html;

Animated dome growth detail is available at:
http://vulcan.wr.usgs.gov/Volcanoes/MSH/Eruption04/LIDAR/framework.html

Visit USGS web sites and study the different volcanic hazards and view photographs.
http://vulcan.wr.usgs.gov/Volcanoes/MSH/ and *http://www.fs.fed.us/gpnf/mshnvm/*

Visit regional websites: *http://www.mtsthelens.com/mt-st-helens-links.html* or
http://www.mountsthelens.com/html/maps.html or *http://www.mshinstitute.org*

Sources:

U.S. Geological Survey Fact Sheet 036-00

U.S. Geological Survey: Mount St. Helens, Washington: Before, During, and After May 18, 1980 1980 - 2004
Available at: *http://vulcan.wr.usgs.gov/Volcanoes/MSH/Images/MSH80/framework.html*

Acknowledgements:

Content prepared and images selected by CNL World with contributions from Larry Handley (US Geological Survey Mid-Continent Geographic Science Center) and Nancy B. Hultquist, (Department of Geography, Central Washington University, Ellensburg, WA).

Image Processing by RoseAnne Dominguez, U.S. Santa Cruz, CA (enabled fusion of the airborne line scan imagery).

Image Courtesy of NASA's Jet Propulsion Lab

Summary of May 18, 1980 Eruption of Mount St. Helens

Volcano	
Elevation of summit	9,677 feet before; 8,363 feet after; 1,314 feet removed
Volume removed	0.67 cubic miles (3.7 billion cubic yards)
Crater dimensions	1.2 miles (east-west); 1.8 miles (north-south); 2,084 feet deep
Crater floor elevation	6,279 feet
Landslide	
Area and volume	23 square miles; 0.67 cubic miles (3.7 billion cubic yards)
Depth of deposit	Buried 14 miles of North Fork Toutle River Valley to an average depth of 150 feet (max. depth 600 feet)
Velocity	70 to 150 miles per hour
Lateral Blast	
Area covered	230 square miles; reached 17 miles northwest of the crater
Volume of deposit	0.046 cubic miles (250 million cubic yards)
Depth of deposit	From about 3 feet at volcano to less than 1 inch at blast edge
Velocity	At least 300 miles per hour
Temperature	As high as 660° F (350° C)
Energy released	24 megatons thermal energy (7 by blast, rest through release of heat)
Trees blown down	4 billion board feet of timber (enough to build about 300,000 two-bedroom homes)
Lahars	
Velocity	About 10 to 25 miles per hour (over 50 miles per hour on steep flanks of volcano)
Damaged	27 bridges, nearly 200 homes
Effects on Cowlitz River	Reduced carrying capacity at flood stage at Castle Rock from 76,000 cfs (cubic feet per second) to less than 15,000 cfs
Effects on Columbia River	Reduced channel depth from 40 to 14 feet; stranded 31 ships in upstream ports
Eruption Column and Cloud	
Height	Reached about 80,000 feet in less than 15 minutes
Downwind extent	Spread across US in 3 days; circled Earth in 15 days
Volume of ash	0.26 cubic miles (1.4 billion cubic yards)
Ash fall area	Detectable amounts of ash covered 22,000 square miles
Ash fall depth	10 inches at 10 miles downwind (ash and pumice); 1 inch at 60 miles downwind
Pyroclastic Flows	
Area covered	6 square miles; reached as far as 5 miles north of crater
Volume & depth	0.029 cubic miles (155 million cubic yards); multiple flows 3 to 30 feet thick; cumulative depth of deposits reached 120 feet in places
Velocity	Estimated at 50 to 80 miles per hour
Temperature	At least 1,300° F (700° C)
Fatalities	
Human	57
Wildlife	Countless non-burrowing wildlife in blast area, including about 7,000 big game animals; about 12 million salmon fingerlings in hatcheries