Volcanoes

Mount St Helen's

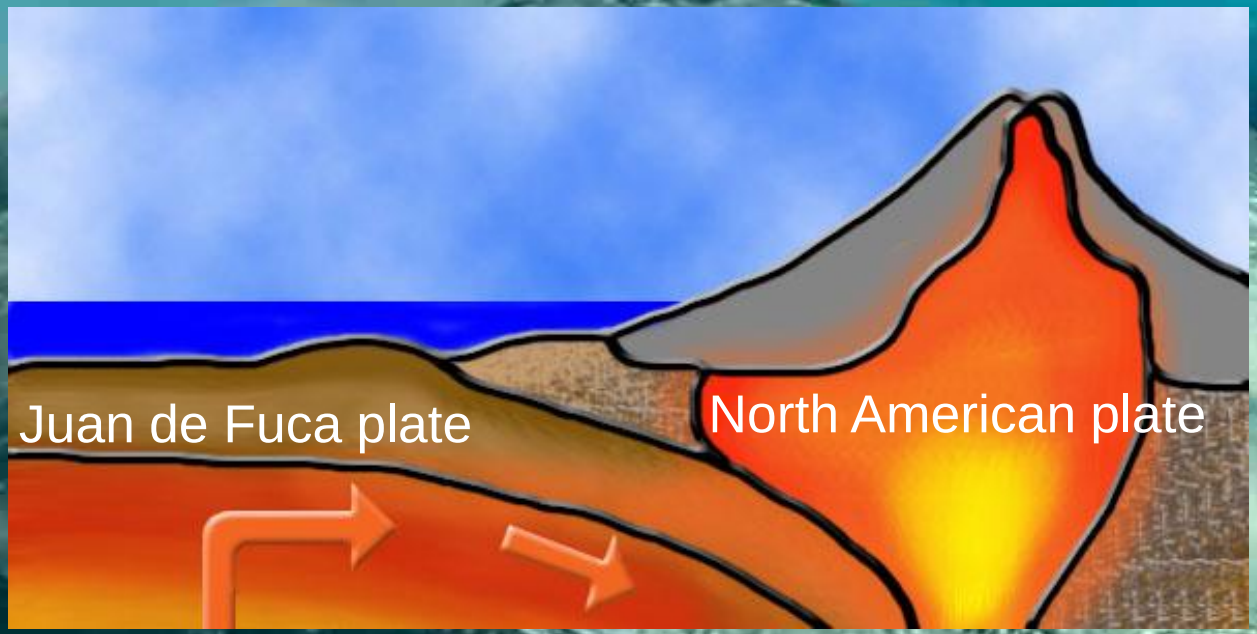
- Location: southwest Oregon 50 miles away from Portland
- Type: Composite
- Last known activity: 1857 until…

Mt St Helens eruption (May 1980)

Mt St Helens is located on the '**Ring of Fire**'.

Mt St Helens – causes of the eruption

Mt St Helens is located on a **destructive** plate boundary where a continental plate (North American) meets an oceanic plate (Juan de Fuca)



Before the Eruption

The Eruption…
Kind of

Earthquake!

- Beginning as early as March 16, there were many smaller earthquakes in the region. On March 20, 1980 at 3:47 pm, a magnitude 4.2 earthquake hit the area.
- The number of earthquakes recorded daily reached peak levels in the next 2 days, during which 174 shocks with magnitudes greater than 2.6 were recorded.
- Aerial observations of Mount St. Helens during the week of seismic buildup revealed small earthquake-induced avalanches of snow and ice, but no sign of an eruption

Crater!

- With a thunderous explosion, or possibly two nearly simultaneous ones, widely heard in the region at about 12:36 pm on March 27, Mount St. Helens began to spew ash and steam.
- The crown of the ash column rose to about 6,000 feet above the volcano.
- The initial explosions formed a 250-foot-wide crater within the larger, preexisting snow- and ice-filled summit crater, and new fractures broke across the summit area.

No magma. Yet…

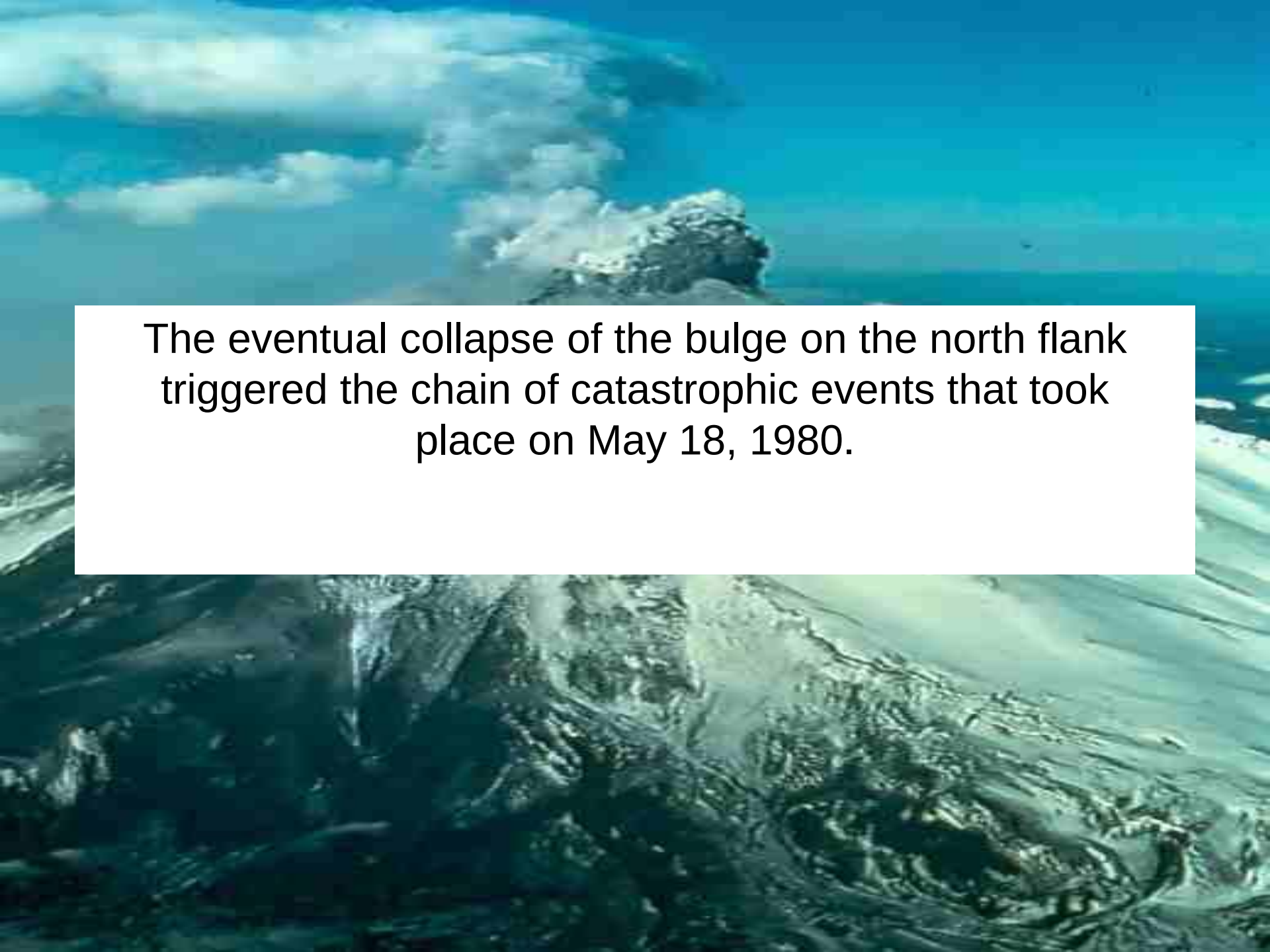
- The ash blown out between March 27 and May 18 was derived entirely from the 350-year-old summit dome, shattered and pulverized by steam-blast processes driven by the explosively expanding, high-temperature steam and other gases.
- No magma was seen during the initial eruptions.

Activity Within

- Intense earthquake activity persisted at the volcano during and between visible eruptive activity.
- As early as March 31, seismographs also began recording occasional spasms of volcanic tremor, a type of continuous, rhythmic ground shaking different from the discrete sharp jolts characteristic of earthquakes.
- The combination of sustained strong earthquake activity and harmonic tremor suggested magma and associated gases were on the move within the volcano.

More Earthquakes!

- Small steam-blast eruptions resumed on May 7, continued intermittently for the next several days, and ceased again by May 16.
- The forceful intrusion of magma into the volcano continued, as was shown by intense seismic activity and visible swelling and cracking of the volcano.
- Through mid-May about 10,000 earthquakes were recorded. The earthquake activity was concentrated in a small zone less than 1.6 miles directly beneath the bulge on the north flank of Mount St. Helens.



The eventual collapse of the bulge on the north flank triggered the chain of catastrophic events that took place on May 18, 1980.

The Eruption

One Last Earthquake

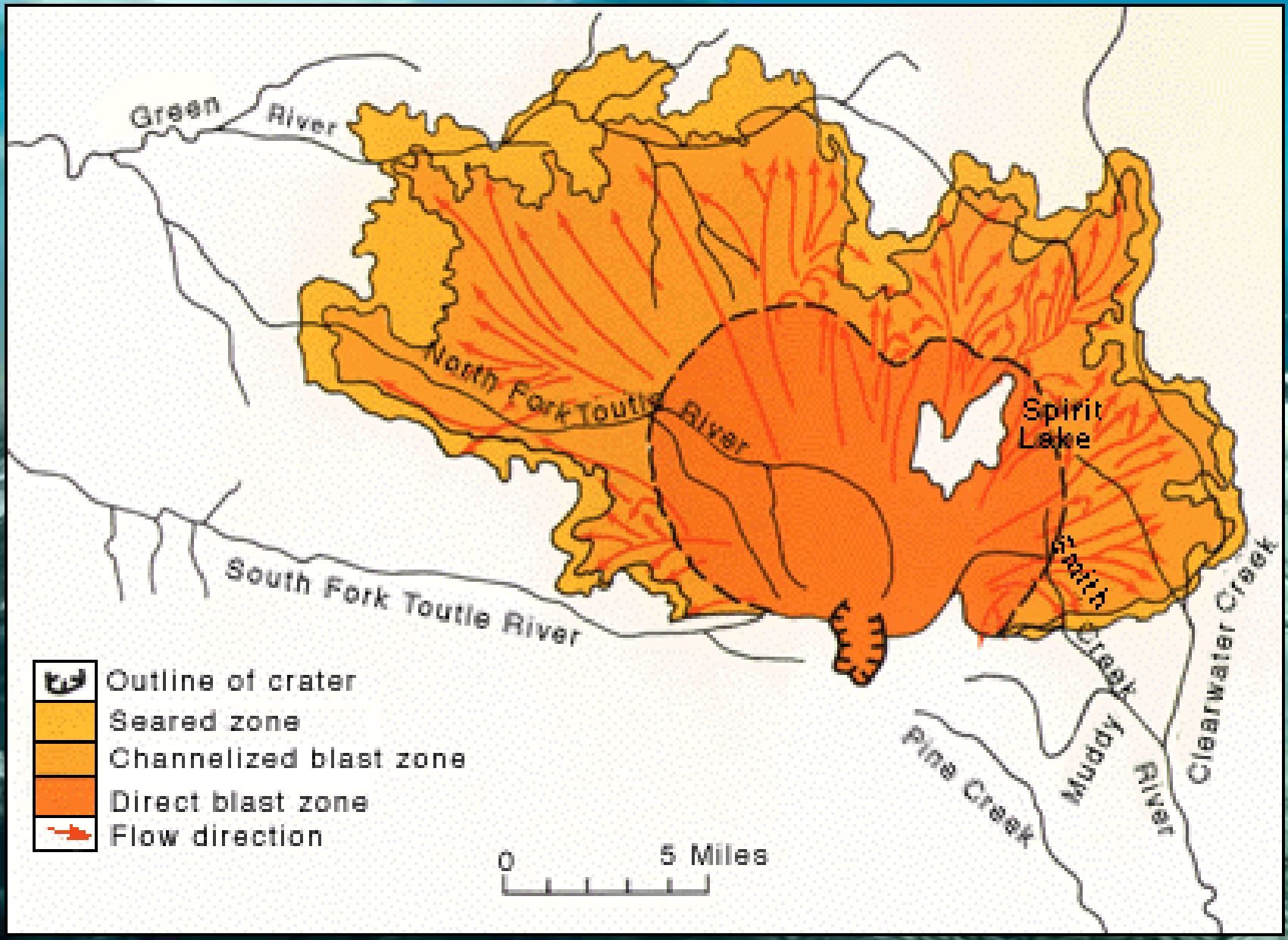
- About 20 seconds after 8:32 am, apparently in response to a magnitude 5.1 earthquake about 1 mile beneath the volcano, the bulged, unstable north flank of Mount St. Helens suddenly began to collapse, triggering a rapid and tragic train of events that resulted in widespread devastation and the loss of 57 people.

Eyewitness Account

"Within a matter of seconds, perhaps 15 seconds, the whole north side of the summit crater began to move instantaneously. . . . The nature of movement was eerie. . . . The entire mass began to ripple and churn up, without moving laterally. Then the entire north side of the summit began sliding to the north along a deep-seated slide plane. I was amazed and excited with the realization that we were watching this landslide of unbelievable proportions. . . . We took pictures of this slide sequence occurring, but before we could snap off more than a few pictures, a huge explosion blasted out of the detachment plane. We neither felt nor heard a thing, even though we were just east of the summit at this time."

Magma!

- The sudden release of pressure unleashed a tremendous, northward-directed lateral blast of rock, ash, and hot gases that devastated an area of about 230 square miles in a fan-shaped sector north of the volcano.
- To the south, the devastated area was much less, extending only a small distance downslope from the summit.
- Along with older volcanic debris, the blast also included the first magma material erupted by Mount St. Helens.


Green River
North Fork Toutle River
Spirit Lake
South Fork Toutle River
Pine Creek
Muddy River
Clearwater Creek
Outline of crater
Seared zone
Channelized blast zone
Direct blast zone
Flow direction
0
5 Miles

Some Data Points

- Although the lateral blast began some seconds later than the debris avalanche, the blast's velocity was much greater, so that it soon overtook the avalanche.
- Calculations have shown that the blast's initial velocity of about 220 miles an hour quickly increased to about 670 miles an hour.
- The lateral blast at the vent probably lasted no more than about 30 seconds, but the northward radiating and expanding blast cloud continued for about another minute, extending to areas more than 16 miles from the volcano

Ash

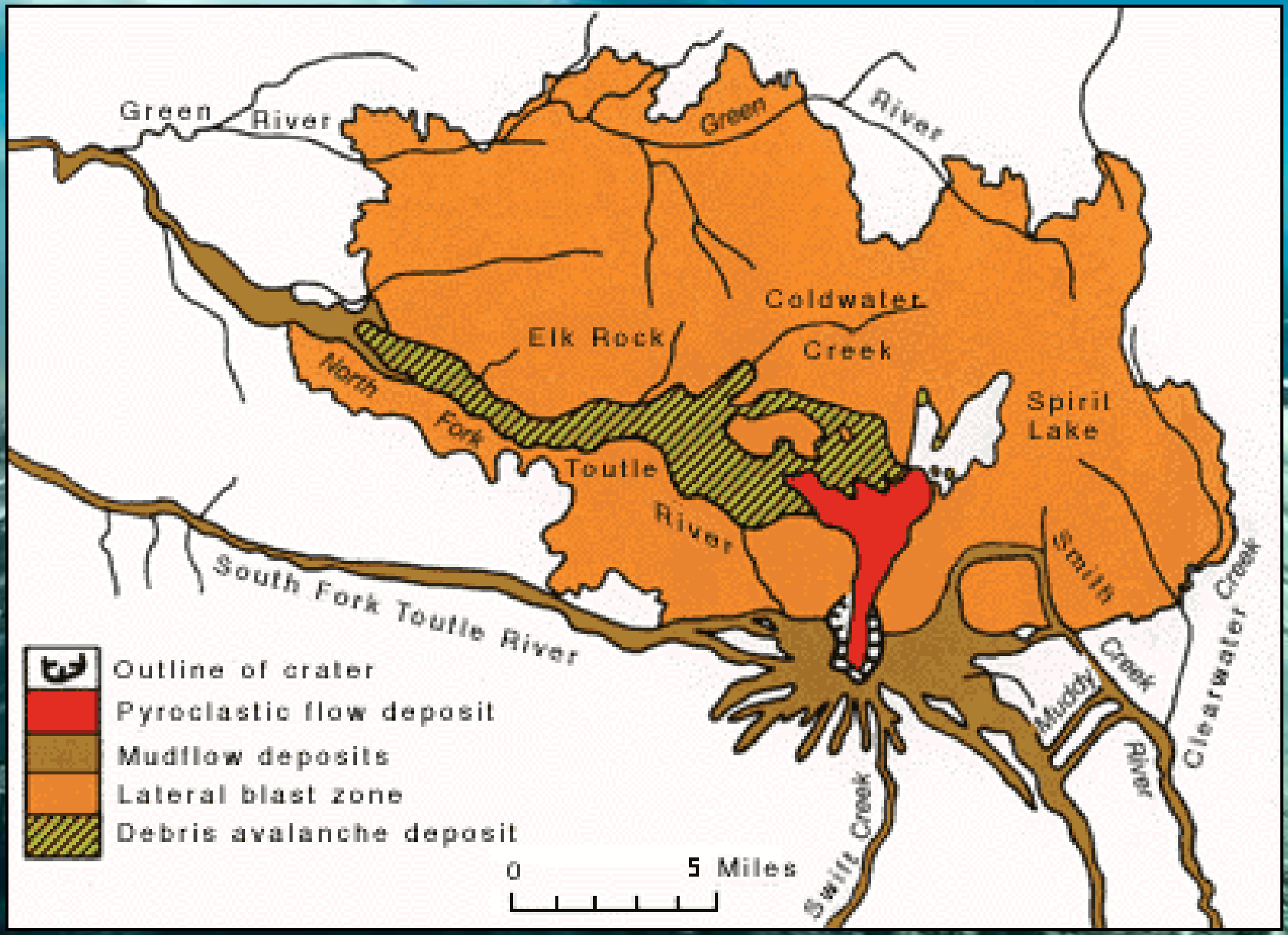
- Shortly after the blast shot out laterally, the vertically directed ash column rose to an altitude of about 16 miles in less than 15 minutes, and the vigorous emission of ash continued for the next 9 hours. The eruption column began to decline at about 5:30 p.m. and diminished to a very low level by early morning of May 19.
- Two days later, fine ash was detected by systems used to monitor air pollution in several cities of the northeastern United States. Some of the ash drifted around the globe within about 2 weeks.
- After circling many more times, most of the ash settled to the Earth's surface, but some of the smallest fragments and aerosols are likely to remain suspended in the upper atmosphere for years.

Pyroclastic Flow

- Pyroclastic flows were first directly observed shortly after noon, although they probably began to form a short time after the lateral blast. They continued to occur intermittently during the next 5 hours of strong eruptive activity.
- At least 17 separate pyroclastic flows occurred during the May 18 eruption, and their aggregate volume was about 0.05 cubic mile.
- When temperature measurements could safely be made in the pyroclastic flows 2 weeks after they were erupted, the deposits ranged in temperature from about 570 to 785 F.

Mud Flow

- The mudflows in the Toutle River drainage area ultimately dumped more than 65 million cubic yards of sediment.
- Mudflows also swept down the southeast flank of the volcano--along the Swift Creek, Pine Creek, and Muddy River drainages--and emptied nearly 18 million cubic yards of water, mud, and debris into the Swift Reservoir.


Green River
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Coldwater Creek
Elk Rock
North Fork
Toutle River
Spirit Lake
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Smith Creek
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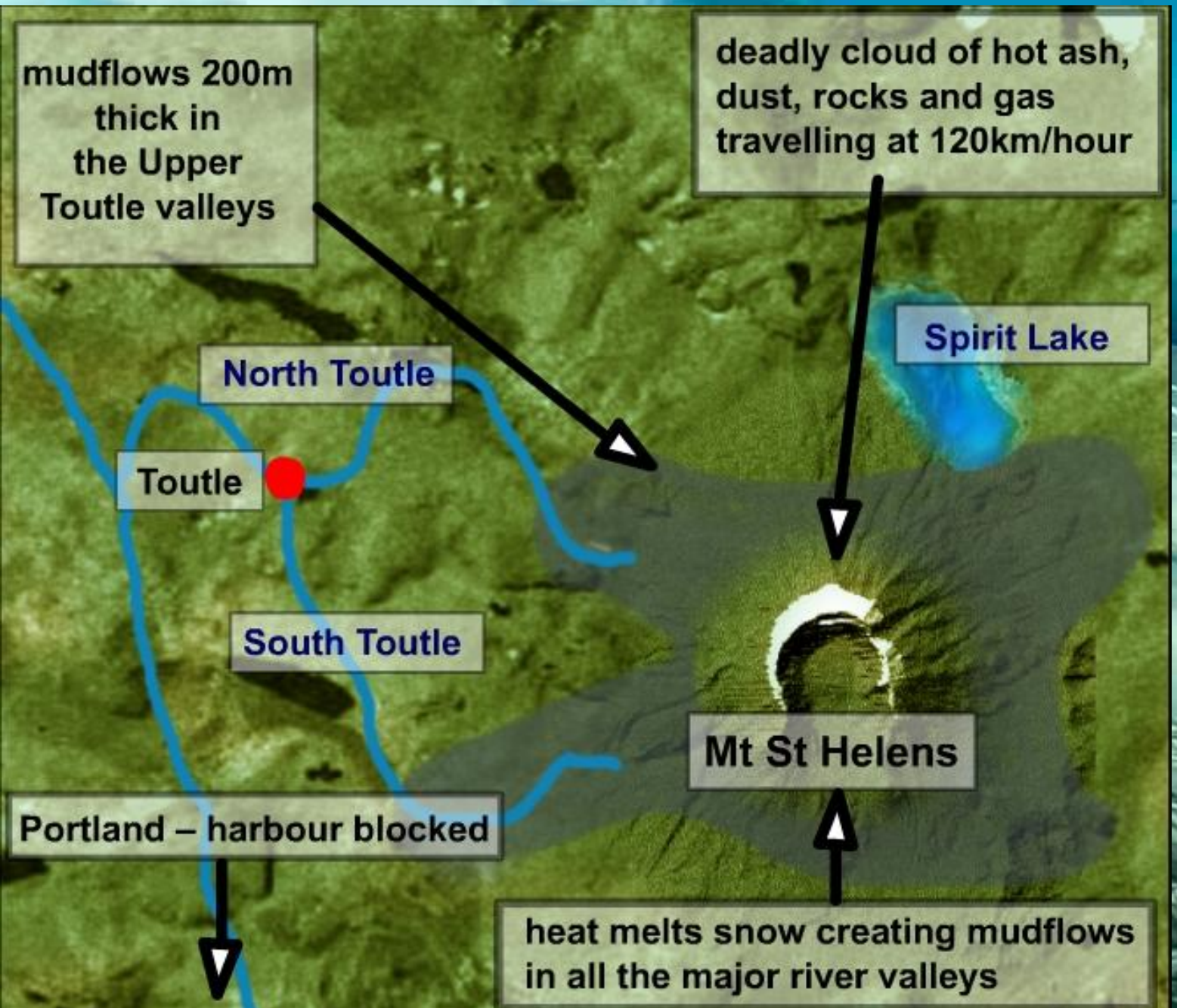
Clearwater Creek
Outline of crater
Pyroclastic flow deposit
Mudflow deposits
Lateral blast zone
Debris avalanche deposit
0
5 Miles

In Summary

- The 5.1-magnitude earthquake caused the gravitational collapse of Mount St. Helens' north flank
- which produced the debris avalanche
- and triggered the ensuing violent lateral and vertical eruptions
- which caused mud flows that destroyed everything in its path.

Mt St Helens – consequences of the eruption



Write down the causes and effects of the eruption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