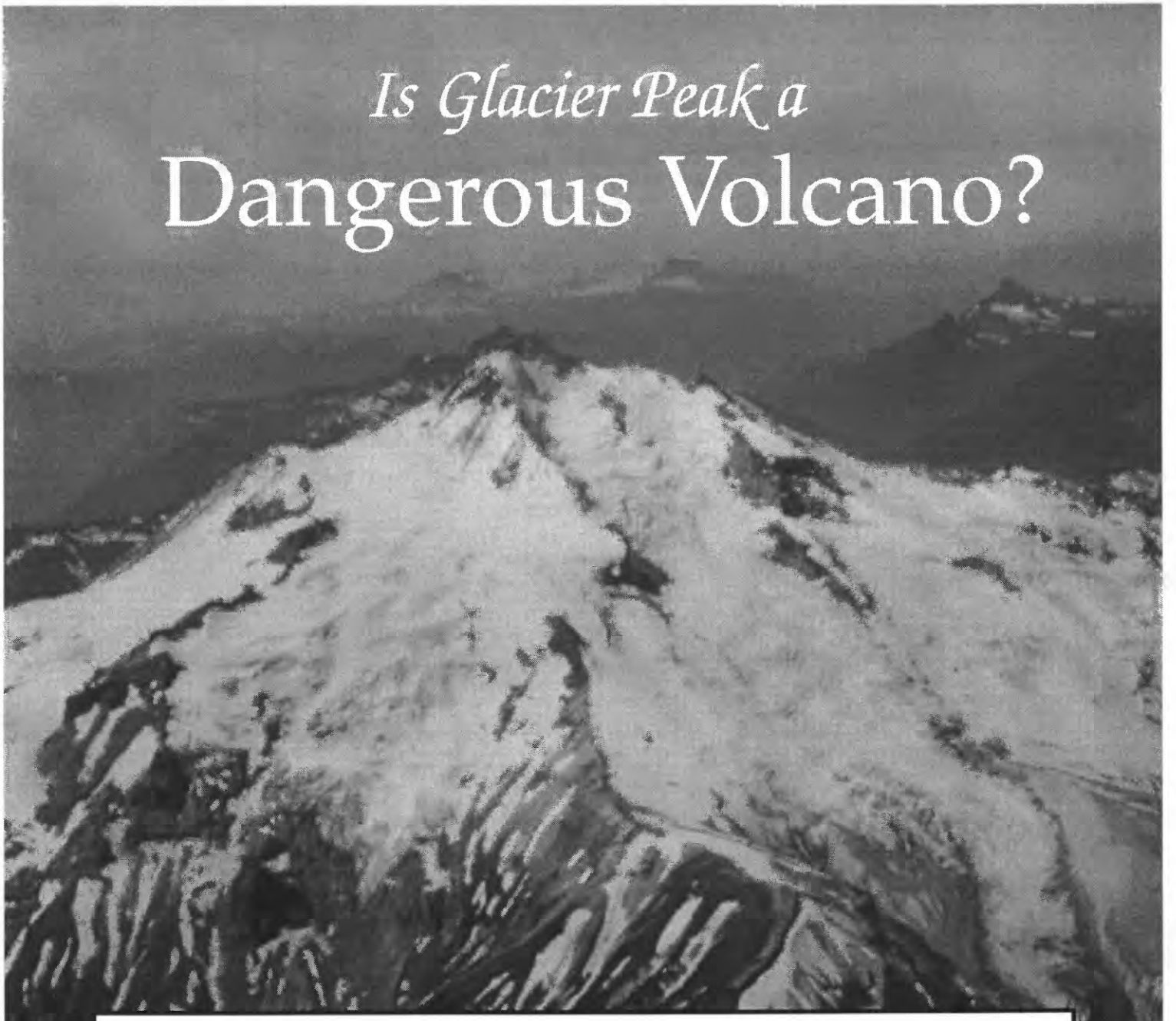


# *Is Glacier Peak a* Dangerous Volcano?

**Glacier Peak** is not prominently visible from any major metropolitan centers, and so its attractions, as well as its hazards, tend to be overlooked. Yet, Glacier Peak has produced larger and more explosive eruptions than any other Washington volcano except Mount St. Helens. In the past 14,000 years, Glacier Peak has erupted at least a dozen times, most recently around the eighteenth century.

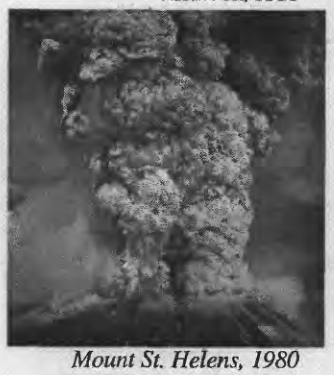
What were these eruptions like? Could similar ones affect us today?

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

Cascades Volcano Observatory

# Ash eruptions covered the landscape

Austin Post, USGS

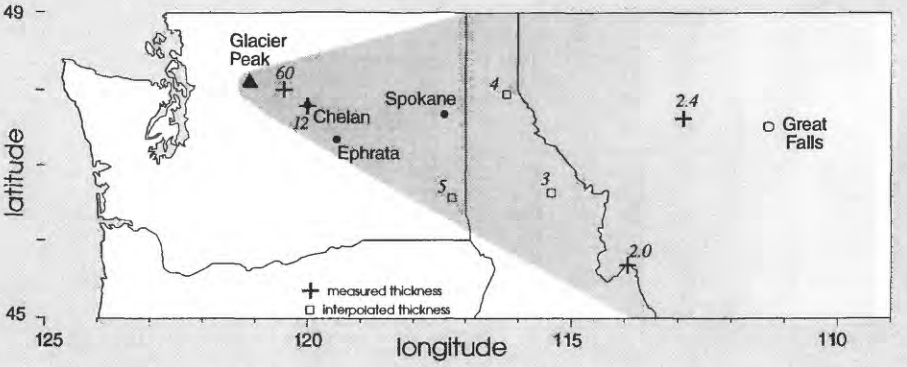


*Mount St. Helens, 1980*

Glacier Peak and Mount St. Helens are the only two volcanoes in Washington that have generated large, explosive ash eruptions. Their explosive history results from the type of magma they produce. Dacite, the magma of Mount St. Helens and Glacier Peak, is too viscous to flow easily out of the vent. It must be pressed out, like toothpaste. The pressure of millions of internal gas bubbles then break it apart into tiny fragments known as "ash".

About 13,100 years ago, a few millenia after continental glaciers had retreated from the Pacific Northwest, Glacier Peak began an eruptive sequence that produced nine ash eruptions in six hundred years. The largest expelled more than three times as much ash as the 1980 eruption of Mount St. Helens, and was the second largest in the Cascades in postglacial times.

Since 12,500 years ago, Glacier Peak has produced only a few ash eruptions, all of small volume.

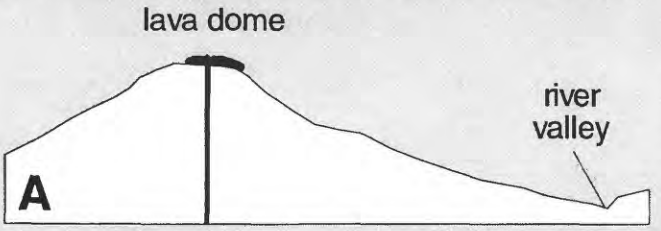


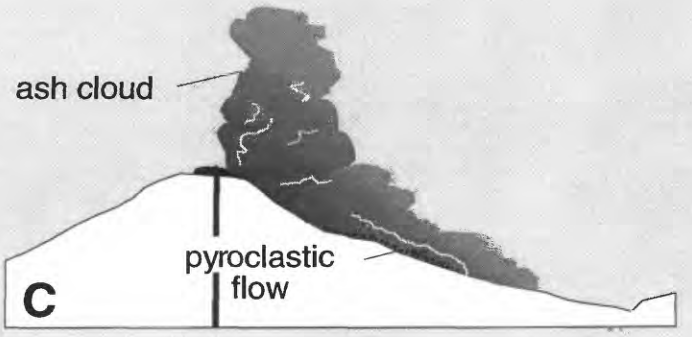

*Thickness of ash (inches) erupted from Glacier Peak's largest ash eruption*

# Domes collapsed onto the volcano's flanks

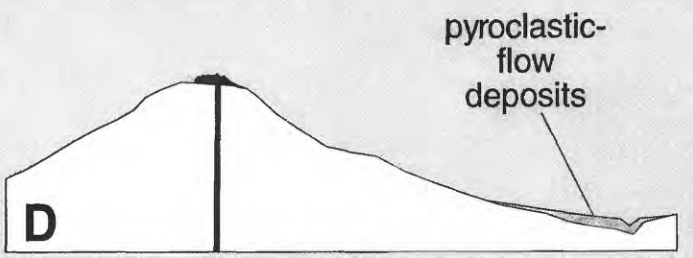
When gas bubbles are not abundant enough to break the magma into ash, it flows out of the vent and accumulates as thick, viscous "domes". Glacier Peak has produced lava domes during every major eruptive period in the volcano's history. Over years or decades, those domes repeatedly extended out to precarious positions on the volcano's steep flanks (A). Sections of the domes then broke away (B), and fragmented into hot, roiling clouds of ash and rock fragments (pyroclastic flows, C). Coarse debris cascaded down slopes at speeds up to several tens of miles per hour and accumulated in nearby river valleys. At the same time, clouds of hot ash rose thousands of feet in buoyant plumes.

Over decades or centuries, pyroclastic-flow deposits filled those river valleys to depths of several hundred feet (D). Some debris was hot enough (1500-2000° F) to fuse together. Most, however, consisted of loose pumice that choked the rivers and was quickly transported during storms.








*Stages in the collapse of a lava dome.*

# Lahars inundated stream valleys

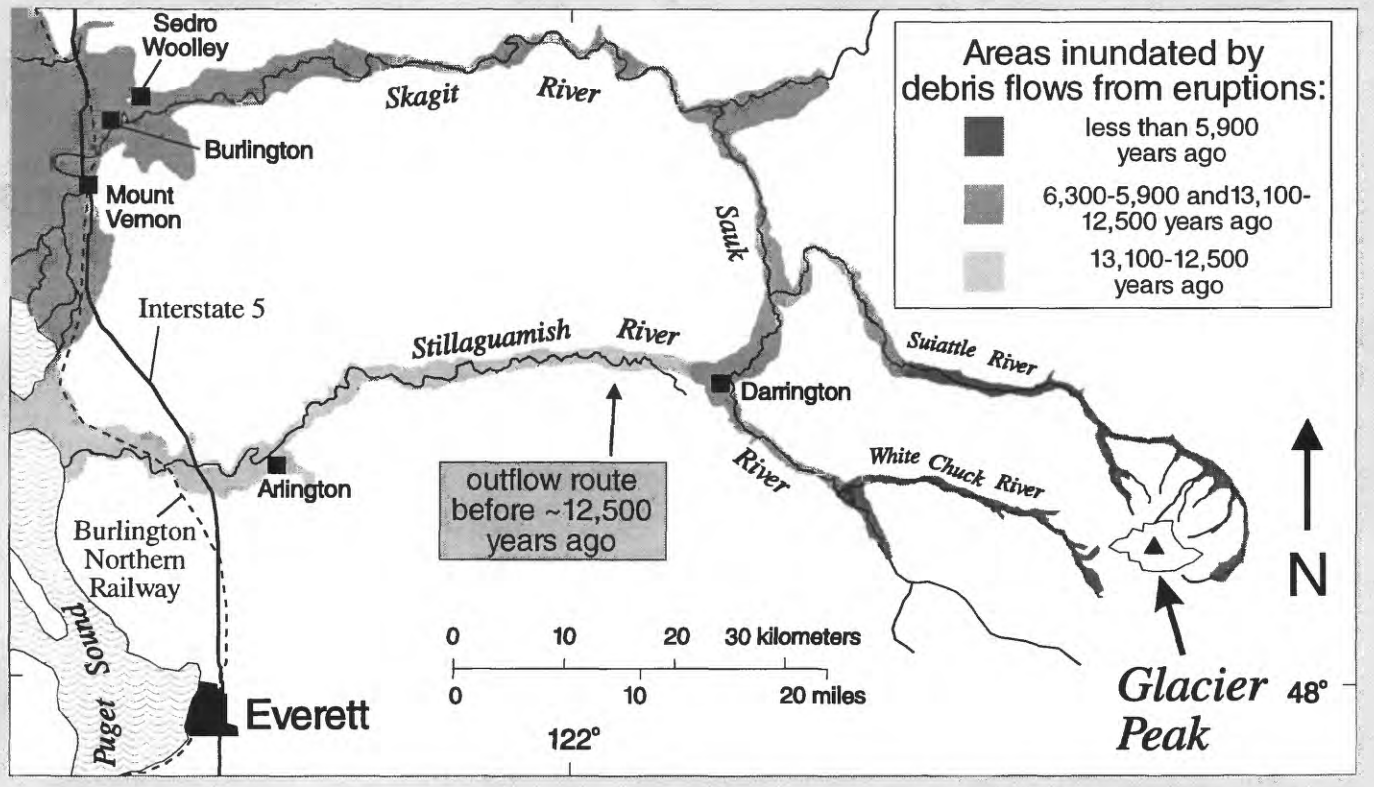
Lyn Topinka, USGS

Area inundated by a lahar from the 1980 eruption of Mount St. Helens. Note person (circled) for scale.

Perhaps the greatest impact of eruptions at Glacier Peak has been in the stream valleys. Ash and pyroclastic-flow debris that was not deposited directly into streams eventually slid, rolled, or was washed into them. That debris mixed with water to produce flowing jumbles of rock and mud known as "lahars or "debris flows".

Between 13,100 and 12,500 years ago, dozens or perhaps hundreds of lahars churned down the White Chuck, Suiattle, and Sauk rivers, completely inundating the valley floors. They then flowed down the Skagit and Stillaguamish Rivers as far as Puget Sound. When they stopped, the mud and debris solidified in place. At Arlington, more than 60 miles downstream from Glacier Peak, lahars from these eruptions deposited more than 7 feet of sediment.

Between 6,300 and 5,900 years ago, lahars extended at least to Minkler Lake, near Sedro Woolley in the Skagit River, and probably made it to the Skagit Delta. Smaller lahars have occurred during at least three episodes since 5,900 years ago. The largest of those made it only to the mouth of the White Chuck River.




Lahars are not just caused by volcanic eruptions. Volcanoes also produce huge landslides that can transform into lahars. At Mount St. Helens in 1980, a giant landslide decapitated the volcano and triggered the largest lahar of the eruption. At Mount Rainier, an even larger landslide about 5,700 years ago disaggregated into a lahar that filled in stream valleys as far as Puget Sound. Smaller landslides also produce lahars.

Landslide-caused lahars are typically made of clay and weathered lava from the volcano's edifice. In contrast, lahars caused by eruptions are made of fresh pumice and ash. At Glacier Peak, at least a few lahars of clay-rich material have covered the Sauk River Valley in the last 14,000 years. Two occurred shortly before each of Glacier Peak's two main eruptive episodes.

# The Past, and The Future

## SUMMARY OF PAST ERUPTIONS

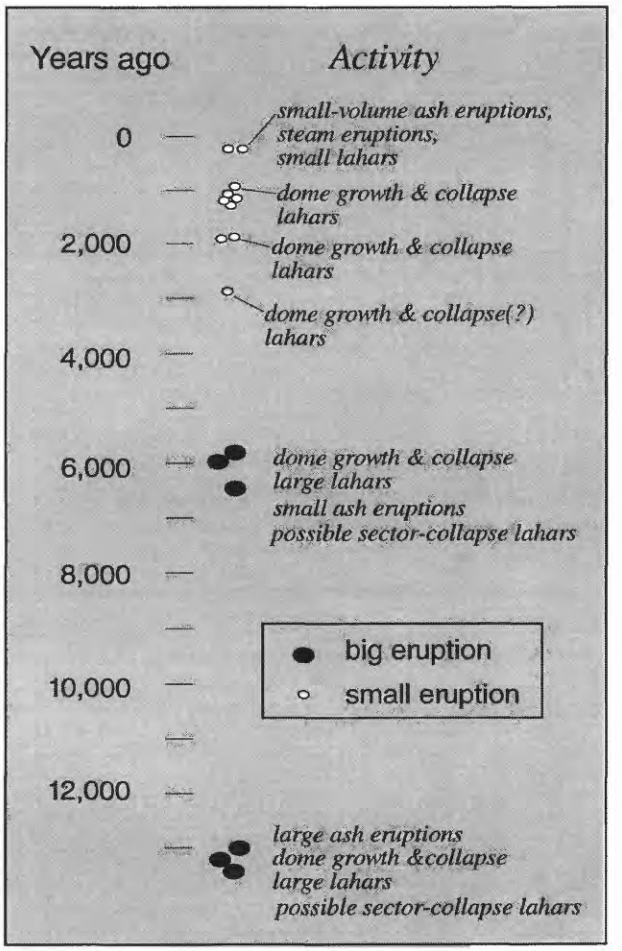
In the past fourteen thousand years, Glacier Peak has generated major eruptions during two episodes; one at 13,100-12,500 years ago, and the other at 6,300-5,900 years ago. At least seven smaller eruptions have occurred in the past 2,000 years.

The total number of eruptions produced by Glacier Peak in the last 14,000 years, both big and small, makes it one of the more active volcanoes in the Cascades. Yet Glacier Peak produces big eruptions relatively infrequently. The probability is therefore fairly low, perhaps one in a few hundred, that we will see a big eruption in our lifetimes.

## HAZARDS FROM FUTURE ERUPTIONS

If a large eruption were to occur, lahars would present the greatest danger. They could inundate river valleys as far downstream as Puget Sound. Voluminous pyroclastic-flow deposits in the headwater of streams around Glacier Peak may be redistributed by streamflow for years or decades, burying developed areas, periodically blocking transportation routes, reducing the capacity of river channels, and increasing heights of floods. The low-lying Skagit flood plain and river delta would be most impacted by large events. Smaller lahars would impact primarily upstream areas, including perhaps the town of Darrington.

Airborne ash would represent the second greatest hazard. Small ash eruptions or ash clouds from pyroclastic flows could disrupt local air traffic and deposit up to a half inch of ash in nearby towns of Chelan and Leavenworth. Ash from eruptions comparable to Glacier Peak's largest could collapse roofs in nearby communities, and stall transportation throughout much of the Pacific Northwest.




Landslides, pyroclastic flows, and lateral blasts (of the type that killed 57 people at Mount St. Helens in 1980) would impact mainly the wilderness area surrounding the mountain. However lahars generated by large landslides or pyroclastic flows could damage downstream communities well outside wilderness areas.

## PREPARING FOR THE NEXT ERUPTION

Although the probability of a large eruption occurring in our lifetimes is low, the consequences of such an eruption could be severe. With some low-cost, common sense measures, we can minimize the damage those events would cause. Those measures could include, for example, consideration of potential hazards when siting schools, hospitals, or other important structures in potentially impacted areas.

Earthquakes below Glacier Peak are currently monitored as part of a statewide network of seismic stations. If Glacier Peak were to reawaken, the U.S. Geological Survey would rapidly deploy additional instruments, and would work with federal, state, and local offiicials to evaluate developments and advise the public.

## FOR ADDITIONAL INFORMATION:

U.S. Geological Survey
David A. Johnston Cascades Volcano Observatory
5400 MacArthur Blvd.
Vancouver, WA 98661
(360) 696-7693
e-mail cvo@pwavan.wr.usgs.gov
WWW http://vulcan.wr.usgs.gov/

Further Reading

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*USGS Open-File 95-413*

*L.G. Mastin, R.B. Waitt*

cover photo by Donal Mullineaux, USGS