The youngest glacier on Earth

The 1980 Mt St Helens eruption destroyed a number of glaciers. Over the last 20 years a new glacier has formed in the crater. What can this tell us about volcanic and glacial processes?

The 1980 eruption

On 18 May 1980 Mt St Helens erupted with such violence that it dramatically reshaped the surrounding landscape. The eruption column reached 24,000 metres in less than 15 minutes and the ash cloud circled the Earth in 15 days. The eruption blast triggered the largest landslide on Earth in recorded history, removing 400 m from the top of the volcano as well as much of the northern flank. More than 2.5 km³ of debris were moved. Super-heated rocks and volcanic gases melted snow and glacier ice on the volcano, producing lahars that swept down the slopes of Mt St Helens, causing destruction and choking valleys with sediment.

The Mt St Helens glaciers

The pre-eruption volcano was flanked by 11 named glaciers and its crater was filled with ice and snow. Figure 1 shows how most of the glacier ice was on the north-facing slopes. When the northern flank exploded, several of the largest glaciers were completely destroyed. All the ice and snow in the crater was melted or blasted skywards, eliminating the main accumulation zones for several glaciers. This left large areas of wasting ice on the surviving upper flanks of the volcano. About 70% of the ice volume was removed during the eruption. Only the Toutle and Talus glaciers survived relatively unscathed. Blocks of glacier ice were carried downslope in mudflows. Some 2 months after the main eruption, large blocks of glacier ice remained buried within the debris flow sediments in the North Fork Toutle River.

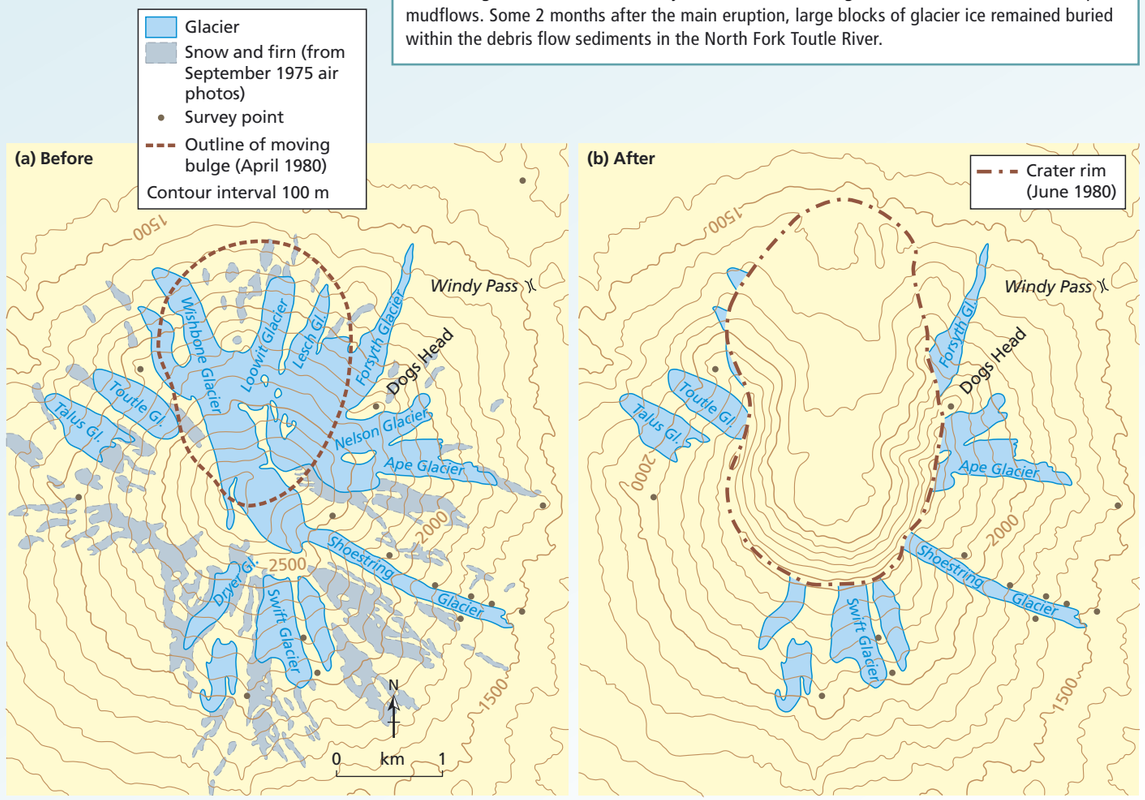

Figure 1 The glaciers on the flanks of the volcano before and after the 1980 eruption

An aerial view of the crater. The glacier tongues can be seen, descending either side of the degassing cone

Glacier mass balance

Glaciers form where there is a positive mass balance — the accumulation of snow and ice exceeds mass losses by ablation. This balance is controlled by two climate variables: precipitation falling as snow, and temperature. Both can be modified by aspect and local topography. In volcanic settings, other processes can also influence glacier mass balance. Heat from the volcano can increase rates of snow and glacier melt (ablation). Seismic activity can trigger snow avalanches from steep crater rims (accumulation).

References and further reading

Brugman, M. M. and Post, A. (1981) Effects of volcanism on the glaciers of Mount St Helens, US Geological Survey: **https://pubs.er.usgs.gov/publication/cir850D**

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Crater Glacier

The enlarged amphitheatre-like crater on Mt St Helens now contains the youngest glacier on Earth. This new glacier was first observed in 1996. Ten years later the name Crater Glacier was approved. This setting has provided a unique opportunity to observe the birth and growth of a mountain glacier.

Crater Glacier does not lie above the regional snowline but in almost permanent shadow beneath the steep slopes of the crater rim. Much of the glacier is covered by volcanic ash. The growth of a new volcanic cone from 2004 forced the young glacier to develop two tongues of ice. As the cone expanded it squeezed the glaciers against the crater walls and increased their flow velocities. The glaciers merged on the north side of the lava dome in 2008. The glacier has advanced at an average rate of about 10 cm per day since that time. All runoff from the glacier seeps into the porous crater floor.

Observing the processes

The post-eruption landscape is proving to be a fascinating context to explore interactions between volcanic processes, volcanic deposits and glacier behaviour. The intensive monitoring programme coordinated by the United States Geological Survey (USGS), allows us to observe these processes in unusual detail.

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