

Mount St. Helens Eruption: A Geophysical Investigation of the Spirit Lake Blockage

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Spirit Lake, on the northwestern flank of Mount St. Helens, was cut-off from the Toutle River drainage system during the May 18, 1980 eruption. The blockage formed by a debris landslide followed by pyroclastic flows and ash deposits eliminated Spirit Lake's only drainage outlet. Between 1984 and 1985 the U.S. Army Corps of Engineers (USACE) bored a drainage tunnel to link Spirit Lake to the South Fork of Coldwater Creek to alleviate the rising lake level (Grant et al., 2017). After 33 years of service the tunnel system needs repairs. Currently, a joint effort between the U.S. Forest Service (USFS), U.S. Geologic Survey (USGS), and the USACE has been commissioned to investigate the debris blockage of Spirit Lake to develop an updated geologic model. Colorado School of Mines (CSM) assisting in this effort by conducting geophysical surveys at sites identified by the USFS as areas of interest within the debris blockage. The first objective of the geophysical surveys is to identify the likely boundary between the pyroclastic and ash material deposited on top of the debris avalanche. Second objective is to explore the likely boundary delineating the debris avalanche and the pre-eruption surface. A third objective is determining the groundwater level. To meet the objectives CSM conducted ground penetrating radar (GPR) and active seismic surveys during August 2018 (Figure 1).

GPR lines were collected with a ruggedized 25MHz antenna at areas of interest indicated by the USFS. The seismic surveys consist of two north-south oriented lines. Figure 1 is an inversion of one seismic line. From the north end, at 1070 m and towards the surface is likely the pyroclastic/ash and material. The red/yellow boundary is likely the interface between the pre-eruption surface and the debris avalanche deposits. By March 2019 we will have a robust analysis of our data and how well we met the objectives outlined above.

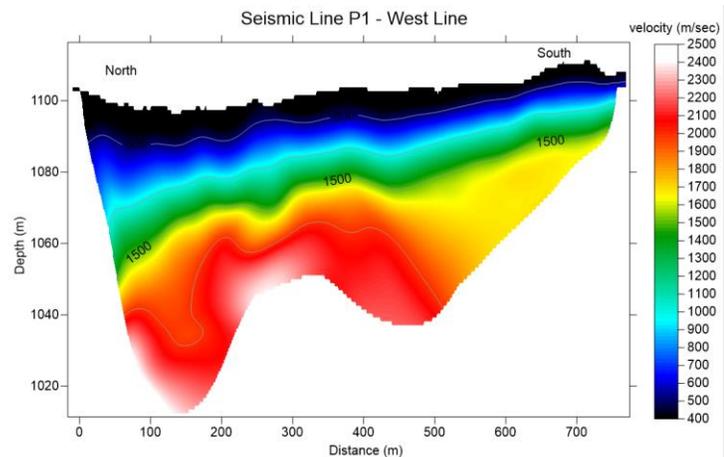


Figure 1: Reflection tomography of seismic data collected over pyroclastic and ash material atop the debris avalanche blocking Spirit Lake at Mount St. Helens.

REFERENCES

Grant, Gordon E.; Major, Jon J.; Lewis, Sarah L. 2017. The geologic, geomorphic, and hydrologic context underlying options for long-term management of the Spirit Lake outlet near Mount St. Helens, Washington. Gen. Tech. Rep. PNW-GTR-954. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 151 p.