# Older hydrothermal alteration in the Yellowstone Caldera, Wyoming

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Hydrothermal alteration about 350 meters thick is exposed in the Grand Canyon of the Yellowstone River, Yellowstone Park. The protolith is the post-Yellowstone caldera 480 ka rhyolitic Tuff of Sulfur Creek. Alteration is variable and includes advanced argillic zones of kaolinite+opal; kaolinite+alunite with local dickite and abundant opal and/or quartz; silicified zones of illite ± smectite; and weakly silicified zones with illite. Fine-grained disseminated pyrite is ubiquitous. Economic-grade Au-Ag mineralization is not present. Distribution of clay minerals may indicate a vertical temperature gradient related to depth below the paleosurface. Kaolinite and opal occur along and just below the canyon rim. Montmorillonite (smectite) is the dominant clay mineral at intermediate depths. Illite is the most common clay in the deepest exposures, and at intermediate depths along a strongly silicified ridge that contains vuggy silicification and hydrothermal breccias. This ridge is a local center of higher temperature fluid upwelling. One alunite yielded an age of ~150 ka. Alignment of geothermal features parallel to the caldera wall suggests deep structural control on hydrothermal fluid flow, most likely along the buried caldera ring fault. A broad alignment of hydrothermal features suggests that similar deeper concealed structures may control hydrothermal flow across the northern part of the caldera.

# The Hawaiian PLUME experiment and its initial data assessment

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Hawaii has long been viewed as the textbook example for a plume-fed hotspot. Yet, the plume model has been contested because the collected seismic data to support or disprove it have so far been inconclusive. Compelling constraints on even the most basic features such as the plume conduit and its head have been elusive. One major problem that seismology has faced has been its complete reliance on land-based stations.

During the Jan. 2005 – May 2007 Hawaiian PLUME experiment we occupied nearly 70 sites with broad-band ocean bottom seismometers (OBSs). We collected continuous time series at a 1000 km-wide array that was augmented by 10 dedicated sites on the Hawaiian islands. The seismic data will facilitate the construction of body wave tomographic images of never-before obtained coverage and a depth-extent that reaches well into the lower mantle. The data will also be used to constrain the topography of mantle discontinuities through receiver functions and anisotropy through shear-wave splitting.

Here, we concentrate on the analysis of surface waves for which the used sensors provide ideal conditions for excellent depth resolution. For the first deployment phase, a 35-OBS array in Jan. 05 – Jan. 06, we analyzed data from upward of 95 suitable earthquakes and obtained internally consistent dispersion data. These allow us to image the lithosphere and upper asthenosphere. We find significant heterogeneity across the array. Higher phase velocities to the southeast of the island of Hawaii resemble those of 90 Myr old Pacific lithosphere. The lowest phase velocities are found to the west and northwest of the island of Hawaii. Our initial assessment is consistent the findings from the 1997/98 PELENET and SWELL pilot experiments that imaged a pronounced anomaly downstream from the island of Hawaii signifying profound changes to the 90 Myr old lithosphere, and possibly the underlying asthenosphere as well.