

# **Mercury Vapor and Soil pH Surveys: Mineral Exploration Techniques for Geothermal Systems**

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## **ABSTRACT**

Mercury vapor and soil pH are two geochemical techniques used for mineral exploration in areas without outcrop. These techniques were tested in an orientation survey of a hidden, low enthalpy geothermal system near Paisley, Oregon. This geothermal system developed near the margin of a continental rift basin. Remnants of sublacustrine silicification indicate that the geothermal system vented to the surface when the area was submerged by ancestral Lake Chewaucan. Mercury vapor was measured at 274 sites, using a passive integrating collector. Hg values range from 0-35.6 nanograms. Soil samples for pH analysis were collected at 228 of the Hg stations. Two pH measurements, initial and acidified, were used to calculate a buffering capacity for the soil.

Anomalous Hg values were found in the following: areas with steeply dipping faults; across a broad zone on the basin side of the range-front fault near the main geothermal production wells; and roughly coincident to the boundary between areas of high and low soil buffering capacity. Buffering capacity was reduced across the hanging wall of known faults, returning to median values with distance from the fault. Hg values and soil buffering capacity are both elevated near seasonal spring mounds or seeps with efflorescence. The highest soil buffering capacity and the near-highest mercury vapor flux are associated with warm, dry, sub-circular areas of barren soils, permeated by small carbonate veinlets. These anomalous Hg and soil pH values are geochemical indicators of blind structural zones with increased vertical permeability and active gas flow. In this orientation survey, mercury vapor and the soil pH data produced repeatable and interpretable patterns, locating structures and alteration associated with the subsurface geothermal system. These mineral exploration techniques are especially robust in concert, creating indicators for drill targeting in blind geothermal systems.