DEPOSITIONAL ENVIRONMENTS OF TRACE ELEMENTS IN SOILS OVER AN ACTIVE HYDROTHERMAL SYSTEM, ROOSEVELT HOT SPRINGS, UTAH

CAPUANO, REGINA M., Univ. Utah Res. Inst., Salt Lake City, UT 84108

Roosevelt Hot Springs is a high-temperature (280°C) geothermal system. Over 600 soil samples were collected on a spacing that ranged from 30 to 300m and covered 6 sq km of the thermal field. These samples were analyzed for 36 elements and the results were compared with He and Rn soil-gas surveys (Hinkle, 1980; Nielson, 1978) covering the same area. Four suites of elements provide important information on the shallow hydrology. These suites include: 1) Hg and As enrichments; 2) Hg, Rn and He enrichments; 3) Mn, Cu and Zn depletions; and 4) Mn enrichments. Hg and As soil anomalies are associated with hot spring deposits formed by upwelling thermal water. Hg, Rn and He enrichments form broader anomalies that include the areas of anomalous Hg and As and reflect vapor transport and dispersion by ground-water movement. The highest element concentrations observed in both suites 1 and 2 occur along permeable faults. Depletions of Mn, Cu and Zn in soils are found in areas where acid-sulfate water has leached these metals. This acid-sulfate water is produced in the oxidized near-surface environment over the geothermal reservoir through the condensation of H_2S-rich vapors derived from the reservoir water. Mn enrichments occur as local oxide deposits and are a consequence of the leaching of Mn from alluvium by the acid-sulfate water which is later incorporated into the ground-water flow system. Reaction with the arkosic alluvium neutralizes and reduces this water allowing continued transport of the high Mn concentrations. Precipitation of Mn oxide phases results from oxidation of this water emerging as a cold spring. Trace element studies of soils over geothermal systems can be used to differentiate the various depositional environments leading to a better understanding of near-surface hydrologic regimes. This will ultimately aid in the interpretation of the deep reservoir system.