

Rocky Mountain (56th Annual) and Cordilleran (100th Annual) Joint Meeting (May 3–5, 2004)

Paper No. 7-2

Presentation Time: 8:40 AM-9:00 AM

THE LOCHSA GEOTHERMAL SYSTEM, NORTHERN IDAHO; A MODEL FOR DEEP, FRACTURE-CONTROLLED, HYDROTHERMAL SYSTEMS WITH NON-VOLCANOGENIC HEAT SOURCES

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The Lochsa Geothermal System (LGS) is located near the NE edge of the Bitterroot lobe of the Idaho batholith in northern Idaho. Five thermal springs (Stanley, Weir Creek, Colgate Licks, Jerry Johnson and Lolo) discharge along a shear system with numerous transecting, vertically dipping shear zones, which control recharge, flowpath and discharge in the LGS and define the course of the Lochsa River. Geochemical analyses of these thermal waters have been coupled with previous petrologic and structural investigations (Kuhns, 1980) to develop a model for deep, fracture-controlled, non-volcanogenic, hydrothermal systems.

LGS waters have high pH (8.9-9.3), low Mg (13.9-121.6 ppb), high Na, low TDS and discharge temperatures from 44.0-48.2°C. Geochemical modeling using SOLVEQ (Reed, 1992) indicates equilibrium with granitic alteration assemblages of quartz, albite, microcline, clay minerals, serpentines and chlorites at four springs. Absence of clay minerals in inferred alteration assemblages at Weir Creek may reflect reaction with a different source rock. Partial re-equilibration at an intermediate depth/ temperature may occur at Colgate Licks. Rb/Sr ratios appear to differentiate between thermal waters equilibrated with Cretaceous or Tertiary rocks.

Stable isotope ratios ($\delta^{18}\text{O}$, -18.9 to -18.1; δD , -143 to -145 per mil) suggest meteoric recharge at high elevations and a mature, high W/R ratio system. Water flows to depths of 2.2-3.9 km reaching reservoir temperatures as high as 104 °C. Thermal water rapidly ascends to the surface along conduits formed where permeable shears and/or relatively impermeable dikes cross the major shear zone. Low Mg concentrations and δD values suggest that little mixing takes place between thermal and non-thermal waters. The LGS appears to be composed of several small convective cells, which flow primarily within structures that intersect the common shear zone, with limited hydraulic communication between them.

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Session No. 7

[New Horizons in Mineral Deposits: Ore Genesis to Mine Closure](#)

Boise Centre on the Grove: Willows

8:20 AM-12:00 PM, Monday, May 3, 2004

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