

3-Dimensional Geologic Modeling Applied to the Structural Characterization of Geothermal Systems: Astor Pass, Nevada, USA

Drew L. Siler
James E. Faulds
Brett Mayhew

Nevada Bureau of Mines and Geology, University of Nevada, Reno, Nevada 89557 USA

Geothermal systems in the Great Basin, USA, are controlled by a variety of fault intersection and fault interaction areas. Understanding the specific geometry of the structures most conducive to broad-scale geothermal circulation is crucial to both the mitigation of the costs of geothermal exploration (especially drilling) and to the identification of geothermal systems that have no surface expression (blind systems). 3-dimensional geologic modeling is a tool that can elucidate the specific stratigraphic intervals and structural geometries that host geothermal reservoirs. Astor Pass, NV USA lies just beyond the northern extent of the dextral Pyramid Lake fault zone near the boundary between two distinct structural domains, the Walker Lane and the Basin and Range, and exhibits characteristics of each setting. Both northwest-striking, left-stepping dextral faults of the Walker Lane and kinematically linked northerly striking normal faults associated with the Basin and Range are present. Previous studies at Astor Pass identified a blind geothermal system controlled by the intersection of west-northwest and north-northwest striking dextral-normal faults. Wells drilled into the southwestern quadrant of the fault intersection yielded 94°C fluids, with geothermometers suggesting a maximum reservoir temperature of 130°C. A 3-dimensional model was constructed based on detailed geologic maps and cross-sections, 2-dimensional seismic data, and petrologic analysis of the cuttings from three wells in order to further constrain the structural setting. The model reveals the specific geometry of the fault interaction area at a level of detail beyond what geologic maps and cross-sections can provide.