

Structural Setting of the Emerson Pass Geothermal Anomaly, Pyramid Lake Paiute Reservation, Western Nevada

Ryan B Anderson, James E Faulds

Nevada Bureau of Mines and Geology, Reno, NV, USA

The Pyramid Lake area is favorable for geothermal development due to the tectonic setting of the region. The Walker Lane belt, a dextral shear zone that accommodates ~20% relative motion between the Pacific and North American plates, terminates northwestward in northeast California. NW-directed dextral shear is transferred to WNW extension accommodated by N-to -NNE striking normal faults of the Basin and Range. As a consequence, enhanced dilation occurs on favorably oriented faults generating high geothermal potential in the northwestern Great Basin. The NW-striking right-lateral Pyramid Lake fault, a major structure of the northern Walker Lane, terminates at the southern end of Pyramid Lake and transfers strain to the NNE-striking down to the west Lake Range fault, resulting in high geothermal potential. Known geothermal systems in the area have not been developed due to cultural considerations of the Pyramid Lake Paiute Tribe. Therefore, exploration has been focused on discovering blind geothermal systems elsewhere on the reservation by identifying structurally favorable settings and indicators of past geothermal activity. One promising area is the northeast end of Pyramid Lake, where a broad left step between the west-dipping range-bounding faults of the Lake and Fox Ranges has led to the formation of a broad, faulted relay ramp. Furthermore, tufa mounds, mineralized veins, and altered Miocene rocks occur proximal to a thermal anomaly discovered by a 2-m shallow temperature survey at the north end of the step-over in Emerson Pass. Detailed geologic mapping has revealed a system of mainly NNE-striking down to the west normal faults. However, there are three notable exceptions to this generality, including 1) a prominent NW-striking apparent right-lateral fault, 2) a NW-striking down to the south fault which juxtaposes the base of the mid-Miocene Pyramid sequence against younger late Tertiary sedimentary rocks, and 3) a NNE-striking down to the east normal fault, which accommodates motion such that the Mesozoic Nightingale sequence is juxtaposed with late Tertiary sedimentary rocks. The NW dextral fault, the NNE-down to east fault, and several NNE-down to the west faults intersect roughly at the thermal anomaly in Emerson Pass. This suggests that fault intersections locally control upwelling of geothermal fluids within the step-over. Based on this assumption, it is proposed that the area near Buckbrush Springs be investigated further for geothermal potential. At this location, a NNE-down to the west normal fault, with >1 km of offset, intersects a NW-striking down to the south fault at a small left step in the NNE fault. Further studies will include collection of available kinematic indicators near the shallow thermal anomaly in Emerson Pass, geothermometry on Buckbrush Spring, and possibly drilling of temperature gradient wells in Emerson Pass and at Buckbrush Spring.