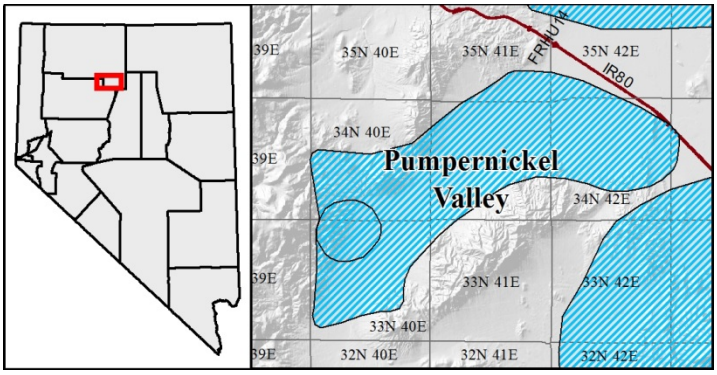
Site Description

Pumpernickel Valley
(updated 2014)



Geologic setting:

The Golconda thrust brought the Pumpernickel and Havallah Formations over the Antler Peak, Battle, and Valmy Formations (Bonham et al., 1985) in Permian-Triassic times. The Pumpernickel Formation, which consists of argillite, chert, and greenstone, underlies the Black Diablo mining district in southwestern Pumpernickel Valley. The Black Diablo Mine contains abundant manganese, the depositional product of submarine hot springs (Johnson, 1977). This mine is located along the Sonoma Range-front 1 km NW of Manganese Spring, and 12 km SW of Hot Springs Ranch.

The Havallah Formation, comprised of Pennsylvanian and Permian marine sediments, also contains hot spring-associated manganese at Buffalo Mountain (eastern Pumpernickel Valley) (Snyder, 1978). Buffalo Mountain contains Cretaceous granodiorite through its southwestern half, underlain by the Havallah sequence (Willden, 1964). Northeast of Buffalo Mountain, Lone Tree Hill has been mined for manganese and gold along high-angle faults in Ordovician Valmy quartzite (Bonham et al., 1985).

A second mining district in the Sonoma Range, the Gold Run district, is 10 km northeast of the Black Diablo Mine. The district extends from Gregg Canyon south of Hot Springs Ranch to Edna Mountain ~10 km north. Re-mineralization occurred in the marine Havallah and Preble Formations, adjacent to Mesozoic granitic intrusives. Sulfide ores (copper-zinc-lead-silver, predominantly) formed as metasomatic replacements of Preble limestone (Bonham et al., 1985).

Geothermal features:

Brooks Spring, Sulphur Spring: Flynn et al. (1982) reported minimal tufa at Sulphur Spring (SE¼ NW¼ S 34, T35N, R41E), which issues at 18°C from a prominent northeast-striking fault scarp. However, botryoidal and globular travertine was found along a fault zone in Paleozoic Pumpernickel formation about 1.6 km NE of the spring (Flynn et al., 1982). This travertine is probably the sinter area referred to by Trexler et al. (1982, p. 31). Kerr (1940, p. 1396) also described extensive tufa deposits in the vicinity of Sulphur Spring.

The Kemp anomaly, a geothermal area with no surface manifestations, was uncovered by two-meter temperature survey (Flynn et al., 1982; Trexler et al., 1982). The anomaly is ~1.4 km east of Sulphur Spring, and so-named for the Kemp triangulation station in NW¼ SE¼ Sec. 34, T35N, R41E (Brooks Spring 7.5-minute Quadrangle). Subsequent gradient drilling encountered 68-70°C fluids in gravel and sand at 60-90 m depth. Gravity data suggest the hot water originates along a concealed fault ~1.2 km east of the Edna Mountain range-front fault (Flynn et al., 1982).

Lone Tree Mine: Hot water (about 37°C) was reported in wells at the Lone Tree Mine in Sec. 11, T34N, R42E (Doug McGibbon, oral commun., 1995).

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Hot Springs Ranch (Map): Hot springs at Hot Springs Ranch (Secs. 4,5, T33N, R40E) have reported temperatures as high as 85°C (Mariner et al., 1974), and UNR-measured temperatures up to 87°C (September 2002). There are numerous springs and seeps, some discharging gas, along a N20°E fault that forms the boundary of the Sonoma Range. Spring deposits are predominantly travertine with a trace of siliceous sinter. Most springs are low flow, but the combined discharge likely exceeds 400 L/min. The "best" estimates of the thermal-aquifer temperature are 194-196°C (Mariner and others, 1974), whereas the Na-K-Ca estimate based on 2002 samples is slightly lower at 175 to 192°C. Wollenberg (1974b) reported that slightly anomalous radioactivity (up to 22.5 µR/hr) is present at the springs.

In 1974 Magma Power Co. drilled a geothermal well at Hot Springs Ranch to a total depth of 919.6 m. The well, also called Pumpernickel Valley Well, had a bottom-hole temperature of 135°C after 10 hours of circulation, with a gradient of 0.16 C/m over the last 91 m (Skip Matlick, personal comm.). In September 2002, UNR samplers found 95°C water leaking from the casing and depositing travertine over the well head. Magma conducted geophysical surveys and temperature-gradient drilling in late 2005 and early 2006.

Tipton Ranch: A warm spring issues from bedrock near SW Buffalo Mountain (SE¼ SE¼ SW¼ Sec. 22, T33N, R40E). Temperatures vary from 27°C (Trexler et al., 1982) to 28°C (Flynn et al., 1982), depending on the report.

Leasing information:

As of 2006, Nevada Geothermal Power Inc. (now Alternative Earth Resources Inc.) and ORMAT Technologies, Inc. entered into an agreement to construct a binary geothermal power plant at NGP's Pumpernickel Valley project area. Part of this agreement included acquiring a 933.5-acre lease from ORMAT to consolidate NGP's land holdings. NGP also acquired an additional 1,920-acre lease from the BLM. Development work included drilling up to three 820-foot gradient wells to better define the resource, and then drill a deep production test well (Bulletin Geothermal Resources Council, July/October 2006). The wells have a maximum measured temperature of 135°C, and geothermometer estimates of 150°C to 218°C. Gravity, seismic, and thermal gradient surveys have led NGP to conclude a 15-33MW estimate of the property. In 2013, NGP was reorganized and renamed Alternative Earth Resources, and Alternative Earth Resources retained the geothermal leaseholds at Pumpernickel. As of February 2014, Pumpernickel was considered an advanced state project ready for commercial development. Updated geothermometry indicate reservoir temperature estimates of 170°C to 200°C and a license from the State of Nevada was obtained permitting water cooling of a binary geothermal power plant. Alternative Earth has signed a Large Generator Interconnection Agreement with NV Energy (Alternative Energy Resources, 2014).

Edna Mountain: The 12mi^2 Edna Mountain property, northeast of NGP's Pumpernickel Valley property, is a blind target without associated hot springs. A hot well on the property has geothermometer values suggesting a 200°C resource.

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Bibliography:

Alternative Energy Resources, Inc., 2014, Pumpernickel, Nevada, <www.alternative-earth.com/s/PumpernickelValley.asp> Accessed 7 February 2014.

Bonham, H.F., Jr., Garside, L.J., Jones, R.B., Papke, K.G., Quade, J., and Tingley, J.V., 1985, A mineral inventory of the Paradise-Denio and Sonoma-Gerlach Resource Areas, Winnemucca District, Nevada, Nevada Bureau of Mines and Geology Open File Report 85-3, 473 p.

Johnson, M.G., 1977, Geology and Mineral Deposits of Pershing County, Nevada, Nevada Bureau of Mines and Geology Bulletin 89.

Snyder, W.S., 1978, Manganese deposited by submarine hot springs in chert-greenstone complexes, western United States, Geology, v. 6, p. 741-744.

Willden, R., 1964, Geology and mineral deposits of Humboldt County, Nevada, Nevada Bureau of Mines and Geology Bulletin 59, 154 p.