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late 1970s Exxon Minerals Co. drilled out a resource of greater than 20 million tons of 0.03 percent U_3O_8, and local areas of higher grade mineralization were encountered (Cuffney and others, 1988).

A red, flaggy siltstone has been quarried from one property in the district. It was used in the construction of ranch buildings in northern Nevada in the mid-1800s, and some stone was shipped to outlets in Nevada and adjacent states in the 1950s and 1960s (Cathrall and others, 1978).

Deposits which contain at least some mercury have been prospected in at least 4 localities in the district (E.H. Bailey and R.B. Jones, written communication, ca. 1983). The mineralization is usually reported to be from faulted or brecciated areas in a variety of Tertiary volcanic rocks ranging in composition from basalt to rhyolite. Silicification is the most common hydrothermal alteration reported, but argillic alteration is also associated (E.H. Bailey and R.B. Jones, written communication, 1991; Cathrall and others, 1978).

Precious opal has been produced from several mines in the district, and probably prospected for at many more areas. According to Tuchek and others (1984), the precious opal is associated with a bentonitic ash in lacustrine units of the Virgin Valley Formation. Partially petrified wood and voids where wood has rotted shortly after deposition are the sites of precious opal deposition. The precious opal is usually found as casts of limbs, twigs, cones, or small logs. The mines are all located within a few kilometers east and northeast of the Virgin Valley Ranch.

The Raven manganese prospects are located on the west flank of Rock Springs Table. At the prospects, manganese oxide minerals (cryptomelane) occur in 17 individual beds that average 15 cm in thickness. The manganese-rich beds are in a unit of tuffaceous and volcaniclastic sedimentary rocks which is interbedded with rhyolite and andesite flows (Tuchek and others, 1984; H.K. Stager, written commun., 1959). The source of the manganese is not known. The mineralization may be syngenetic, related to hot spring fluid inflow during deposition of the sediments.

Leadville District

The Leadville mining district is located on the southeast flank of Hog Ranch Mountain at the northernmost end of the Granite Range, about 60 km north of Gerlach, Nevada. Lead-zinc-copper-silver quartz veins in Oligocene andesite and dacite were discovered and worked in the early 1900s (Bonham and Papke, 1969). This portion of the district is included in the Winnemucca BLM District (see Bonham and others, 1985). The geology and ore deposits are well described in Bonham and Papke (1969) and Bonham and others (1985). The age of this base-metal mineralization is believed to be older than the overlying unaltered middle Miocene rhyolites (Cañon Rhyolite of Bonham and Papke, 1969), and thus older than the mineralization at the Hog Ranch Mine described below.

Gold mineralization was discovered in the early 1980s about 6 km to the northwest in rhyolitic rocks of the Cañon Rhyolite. The area was first prospected for uranium, based on an airborne radioactive anomaly (Steve Bussey, oral commun., 1991). At present there are six ore bodies at the Hog Ranch Mine, along a northeast-trending zone about 4 km long. The rhyolitic host rocks are weakly peralkaline, and commonly possess well developed flow foliation. Some, and perhaps most of these rocks are air fall (agglutinate) or ash-flow tuffs that have undergone secondary flowage after deposition (Harvey and others, 1986; Bussey and others, 1991). The flow-foliated rocks interfinger with welded ash flows, and other surge or air-fall pyroclastic rocks. The mineral deposits appear to lie along the southeast margin of a donut-shaped area of rhyolite exposures that have been interpreted to be an incipient ring structure of a "failed" caldera system (Harvey and others, 1986). This feature lies just to the northwest of a major lineament extending southward from the vicinity of Denio, Nevada to the northern Granite Range.

Mineralization at the Hog Ranch Mine consists of fine-grained gold with marcasite and pyrite, and locally, stibnite, cinnabar, and realgar in silicified and argillized rhyolitic rocks. At depth, the argillic (kaolinitic) zone is underlain by a zone of quartz-adularia alteration (Harvey and others, 1986). Resistant ledges of chalcedony and zones containing hypogene alunite and native sulfur occur within the zone of kaolinitic alteration. This zone of advanced argillic alteration formed above shallow zones of boiling related to a low-sulfur adularia-sericite type of mineralizing system. In the outer parts of the district, rocks are opalized. Harvey and others (1986) believe the mineralization to be quite shallow. It probably took place within a few tens of meters of the surface and during the time of deposition of the epiclastic sedimentary rocks which overlie the rhyolites. The present exposure surfaces on some rhyolite flows may be essentially at the level of the middle Miocene, because rock exposures of flow-foliated rhyolite and tuffs contain hundreds of pits from 10 m up to 100 m in diameter that are believed to result from very near surface hydrothermal phreatic explosive processes (H.F. Bonham, Jr., oral commun., 1991). Some pits reportedly exhibit cross-cutting relationships (H.F. Bonham, Jr., oral commun., 1991) and laminated breccia and fine rock flour (S.D. Bussey, oral commun., 1991) suggestive of an origin due to hydrothermal explosions which vented to the surface. It is possible , however, that these have been exhumed by erosion of an overlying unit. In some areas, these pits may result from collapse in slightly consolidated tuffs due to hydrothermal(?)

fluid action from below (S.D. Bussey, oral commun., 1991). A mineralized hot spring sinter (the Jabo property) is known from an area 5 km to the west of the mine. The sinter is anomalous in gold, arsenic, antimony , and mercury (Churchill,1988; Peters and others, 1987).

Soil and stream sediment samples from the area of the Hog Ranch deposits are anomalous in gold, silver, arsenic, antimony, and molybdenum (Bussey and others, 1991; Bonham and others, 1985, sample 2410).

The Hog Ranch Mine was originally explored for uranium, and several other minor occurrences have been reported in the vicinity (Garside, 1973; Castor and others, 1982). At many of these prospects, the uranium is associated with logs, wood fragments, or other organic-rich trash in the tuffaceous sedimentary units.

An area approximately 25-40 km north of the Hog Ranch Mine has been extensively prospected for gold mineralization in the past several years (Washoe County mining claim records). The exploration efforts are based at least in part on the presence of anomalous gold, silver, and mercury (as cinnabar at the GRE claims) in rock samples from several areas, especially in the vicinity of Grassy Canyon and upper High Rock Canyon (Scott, 1987).

GEOTHERMAL RESOURCES

A number of low-temperature (less than 100°F) thermal springs are found in the Nevada portion of the Susanville BLM District (Garside and Schilling, 1979). In general, spring water surface temperatures and reservoir temperatures estimated from chemical geothermometers are relatively low (e.g. Cathrall and others, 1984). Although waters of mixed thermal and non-thermal sources could have lower estimated reservoir temperatures than would be found with depth, drilling would be required to confirm an such speculations. The geothermal areas are unlikely to have subsurface temperatures suitable for the generation of electric power, and they are relatively remote from urban areas where process heat for aquiculture and similar uses might be required. Thus, the potential for utilization of geothermal resources in the area in not high.

PETROLEUM AND COAL RESOURCES

The volcanic province in northwestern Nevada has generally been considered to have a very low petroleum potential (Garside and others, 1988, Figure 3). This results from several factors, including: 1) the probability of Tertiary intrusive rocks at