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Item 3

Investigation of Manhattan-Belmont Pluton,
Nye County, Nevada

Introduction: Investigation of the mineral potential of the area of the Manhattan-Belmont pluton was undertaken as part of the work to be performed under Contract Number DE-A508-79NV10058, Department of Energy, titled "Potential Mineral Occurrences on Nevada Lands Being Investigated for Possible Use in Nuclear Waste Storage". Work consisted of a review of geologic literature pertaining to the area, compilation of information concerning individual mineral occurrences onto standard Nevada CRIB forms, and investigation of land status and mineral claim activity. No field examinations were conducted as part of the investigation of the area.

Location: The Manhattan-Belmont pluton crops out along the southern flank of the Toquima Range, on the north side of Ralston Valley in west central Nye County. The mining camp of Manhattan is about 6 miles north of the study area, and the old town of Belmont is some 8 miles to the northeast. All of the area should be considered to be within the Manhattan Mining district, although the Belmont district could include the eastern portion. Most of the area investigated is within the boundaries of the Baxter Springs 1:62,500 scale and Big Ten Peak West 1:24,000 scale U.S.G.S. topographic quadrangle maps, but part of the area extends north into the Manhattan and Belmont West 1:24,000 quadrangle maps.

Mining History and Production: The area considered in the study is flanked by two important mining districts, Manhattan and Belmont. Four smaller centers of activity, Monarch, Spanish Springs, Baxter Spring, and Willow Springs also are located within the area. Mining activity near Belmont is documented as beginning in the Fall of 1865. Discoveries at Manhattan also date from that time, but the main period of activity at Manhattan was between 1907 and 1947. Production of Belmont was silver while Manhattan produced mainly gold. At the present time,

Manhattan is experiencing a revival of activity, and gold mining operations there are again underway.

There is no record of production from the smaller camps mentioned. Spanish Springs apparently served as the base of operations for a Spanish prospecting group in the 1880's, and thereby received its name. Monarch Camp was the focus of a land sales-mine promotion scheme in 1906, but never really boomed. Gold was discovered near Baxter Spring in 1906, but activity lasted only a few months. Early production at Willow Spring is inferred to have been gold and silver, but there are no production records to document this.

Land Status: Most of the land in Ralston Valley, south of the Toquima Range, is public land administered by the Bureau of Land Management. The public land in the Toquima Range around Manhattan and Belmont and in the Monitor Range east of Ralston Valley is within the Toiyabe National Forest.

Around both Manhattan and Belmont, there are large blocks of patented mining claims. Currently, mineral exploration activity is at a very high level in this area, and most of the public land surrounding Manhattan and Belmont is blanketed with new mining claims.

Outlines of some of these claim blocks, those covering the actual outcrop of the Manhattan Pluton and adjacent Ralston Valley, are shown on the map accompanying this report. Claim blocks north of the north boundary of the Manhattan stock, and claims in northern Ralston Valley, north of Monarch, have not been shown.

General Geology: The Belmont pluton is in contact with Paleozoic rocks in the southern part of the Toquima Range. The paleozoic rocks, consisting of Cambrian and Ordovician quartzite, siltstone, mudstone, shale, and carbonate strata, are closely folded along west-northwest-striking axes and are commonly overturned northward (Ferguson, 1924, p. 55). Present data indicate a Laramide age for the pluton, which tends to conform in shape to the fold trend. This conformity and the tendency toward gross concordance of the pluton margins with stratification

suggest that emplacement of the pluton was controlled by preexisting folds, with doming accompanying emplacement (Kleinhampl, p. 804).

Near Willow Spring, and also near Mammoth Ranch, a greenstone-serpentinite assemblage overlies or intertongues with the Cambrian and Ordovician strata. One constituent of the assemblage, pyroxene porphyry, commonly autobrecciated, crops out only southwest of Manhattan in the Willow Spring to Baxter Spring area. The nickel occurrences at Willow Spring and Mammoth Ranch are associated with this greenstone.

To the east of Ralston Valley, volcanic rocks associated with the Big Ten Peak Caldera crop out. These rocks are mapped as silicic ash flow tuffs, rhyolitic flows and shallow intrusives. The caldera margin may follow the edge of Ralston Valley (Stewart and Carlson, 1976).

Specific Areas of Mineralization:

Baxter Spring: Prospecting for gold apparently began near Baxter Spring in 1905-1906. A small settlement sprang up at Baxter Spring following discoveries made there. This early activity was short lived, however, and no production is recorded from the area.

Gold values occur with quartz in shear zones cutting Cambrian and Ordovician strata. The shear zones are discolored by the presence of iron oxide, and trace values of arsenic and mercury are present. The present high gold price has caused renewed interest in Baxter Spring, and the entire area is under claim by Felmont Oil Company. There is potential here for the occurrence of a large low-grade gold deposit, and that is no doubt Felmonts object in acquiring land at Baxter Spring.

Spanish Spring: Considerable prospecting for tungsten has been done in the intrusive outcrops near Spanish Springs. Huebnerite-bearing quartz veins, with associated tetrahedrite cut the granitic pluton. Very little tungsten was produced from the area, but some huebnerite was recovered from alluvium by dry wash methods in 1915 (Kleinhampl, p. 1122).

Willow Spring-Mammoth Ranch: These two areas are on opposing sides of the study area, Willow Spring is on the west, south of Manhattan, and Mammoth Ranch is on the east, near Belmont. They are described here together because of their geologic and mineralogic similarities. The description is abstracted directly from Kleinhampl's discussion of Nickel and Related Minerals, Mineral Resources of Northern Nye Co. (rough draft), U.S.G.S. 1980 (pp. 661-664).

Nickel minerals near Manhattan include garnierite and possibly minor niccolite in hydrothermally altered sedimentary strata. Here, and at Monarch Ranch, nickel, chromium, and cobalt were also found in serpentinite. The mineral forms of the elements have not been established at Monarch Ranch, where, in addition to the nickel, turquoise was mined along a fault and chrysotile was noted within fractures cutting the serpentinite.

The nickel and related minerals, chromium and cobalt, are nearly everywhere associated with serpentinitized ultramafics. The best deposits are believed to have formed during alteration of some of these rocks, which had high primary contents of the metals. Depth of formation of the deposits is not known, but since much of one associated rock (ultramafic rocks autobrecciated greenstone porphyry, pl. 1) is autobrecciated at the Manhattan locality (Willow Spring), depth of emplacement there may have been shallow.

The nickeliferous deposits near Manhattan are at least in part post-Early Triassic, because the Lower Triassic Candelaria Formation is mineralized. The nickeliferous rocks southwest of Manhattan in the vicinity of Willow Spring have been examined for their nickel potential by several parties, including the Standard Slag Company in 1961, by other private parties in 1970, and by F. G. Poole of the U.S. Geological Survey in 1970-71. G. B. Gaylord stated (written commun., Nov. 17, 1965) that the zone of mineralization extends along strike for 3.2 miles for an outcrop width of from 35 to 200 feet in sedimentary strata (Candelaria Formation) that strike N10°W. He further stated that in the best

area the material has an average grade of 0.35 percent Ni and a few hundredths of 1 percent cobalt. F. G. Poole later noted (written commun., Sept. 1970) that Ni ranges from 0.15 to 0.20 percent by weight in the serpentinite in the same area. Out of seven selected grab samples of serpentinitized rock from the Mammoth Ranch locality collected by the U.S. Geological Survey, the maximum nickel and related metal values were 3,000 ppm Ni; 3,000 Cr; 500 Co; and greater than 2 percent Cu. The Monarch Ranch locality came under Howard Hughes' ownership in 1964. It is known to have been drilled in 1960 (F. G. Poole, oral commun., March 1971). Magnetic and I-P surveys were made in 1965 by Pilot Exploration and were followed by limited physical exploration. No mining has been conducted since then, however. The serpentinitized body at the Monarch Ranch area appears to be in a small upfaulted block and is separated by alluvium from an outcrop of diabasic rock on the east. A 400-foot drill hole remained in serpentinite all the way, but another bottomed in Ordovician transitional rocks similar to those at Manhattan (F. G. Poole, oral commun., March 1971). Dolomitic masses faulted against the serpentinite may be Cambrian and are probably altered sedimentary beds and not carbonatized serpentinite.

Big Ten Peak Caldera Rim: Stewart and Carlson (1976) show that the margin of the Big Ten Peak caldera may lie along the eastern margin of Ralston Valley, east of the Manhattan pluton outcrop. There are several small prospects located in ash flow tuffs in the Monitor Range east of Ralston Valley, and the general area of the caldera margin presents a favorable exploration target.

Summary and Conclusions: The outcrop of the Manhattan pluton itself is not specifically a high priority mineral exploration area. Nearby districts, such as Manhattan and Belmont, however, have been active since the 1860's and are currently undergoing a mining revival. The northern contact zone of the pluton, extending from Baxter Spring on the west to Stewart Spring on the east, contains numerous prospects and old workings and several companies are active in this area at present. The tungsten-bearing veins near Spanish Springs may warrant

additional exploration, and there are possibilities for gold and tungsten placer deposits in Ralston Valley. The occurrence of nickel and associated metals at Willow Spring and Monarch Ranch may indicate potential for these elements to exist here.

The prospects associated with the margins of Big Ten Peak caldera on the east side of Ralston Valley may define an important prospecting target in that area. The bedrock configuration of Ralston Valley is not known, but it is possible that alluvial cover is not thick along the inferred caldera rim northwest of the outcrop areas in the nearby Monitor Range.

The Manhattan pluton study area lies in the heart of one of the most well mineralized areas of northern Nye County. Exploration and mining activities are now underway in several localities in and near the study area, and it is expected that this activity will continue, even increase, as metal prices continue to rise.

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