MANHATTAN DISTRICT

LOCATION

Manhattan is in the southern part of the Toquima Range, about 45 miles north of Tonopah. The main Manhattan district lies along Manhattan Gulch, a northwest-trending drainage on the west side of the range. Numerous other small mining areas located in the southern Toquima Range south of the Belmont and Round Mountain districts are included in the Manhattan district. The Manhattan lode and placer mines are located in Township 8 North, Ranges 43 and 44 East. Other mines in the district are located near Pipe Spring in Township 8 North, Ranges 44 and 45 East, at Spanish Spring in the central part of Township 7 North, Range 44 East, near Willow Spring along the western side and near Baxter Spring on the eastern side of Township 7 North, Range 43 East.

HISTORY

Silver ore was discovered in the Manhattan district in 1866 and the district was organized the following year (Thompson and West, 1881). The Thompson and West account of the district related that the principal mines were the Mohawk and the Black Hawk and described the deposits as veins containing copper but no trace of gold which occurred between limestone and porphyry. Raymond (1868) described the ores as "antimonial sulphurets... with their decompositions such as chloride of silver, etc." A few shipments of silver ore were made to the mill at Belmont, but the district was abandoned in 1869 (Paher, 1970). The location of the early silver discoveries is not exactly known, Ferguson (1921) mentions old silver mines worked in 1866 located about 4 miles south of the town of Manhattan, and these may be the original silver workings. Their location would be either near Pipe Spring or Spanish Spring in the southeastern part of the present Manhattan district.

The district was inactive until 1905 when, on April 1, ore rich in free gold was discovered only about 100 feet from the stage road from Belmont to Cloverdale (Ferguson, 1924). The district boomed in early 1906 but enjoyed a fairly short life; the San Francisco earthquake and fire of April 1906 triggered a financial panic which dampened activity at Manhattan as well as many other mining camps in Nevada. Some activity resumed in the fall of 1906 and the summer of 1907 (Paher, 1970) but the district did not fully recover until 1909 when mining of placer gold deposits began in Manhattan Gulch below the town. A rich strike at the White Caps gold mine in 1912 brought additional life to the camp, and activity continued at a fairly constant level until the mid- 1920's when operations subsided (Paher, 1970). Lode gold production continued at variable levels until 1940 when operations ceased during the war. Minor lode production is recorded between 1944 and 1950 (Kleinhampl and Ziony, 1984). Placer gold production was more or less continuous in the district from 1906 until 1950 and a large gold dredge operated at Manhattan between 1938 and 1946. Total production from Manhattan, 1906 to 1967, has been about $11 million (Kleinhampl and Ziony, 1984). In the mid-1970's, Summa Corporation obtained control of the major mining properties at Manhattan and began exploration. Summa reportedly produced nearly $500,000 in gold from its properties before selling them to Houston Oil and Minerals in 1977. Tenneco Minerals purchased Houston's Manhattan properties in 1983 and are currently producing gold at an announced production rate of 27,000 ounces

per year from an open-pit mine. Published reserves at this mine are 5 million tons of 0.036 oz gold per ton (Bonham, 1985).

GEOLOGIC SETTING

The southern Toquima Range consists of Paleozoic sedimentary and metamorphic rocks intruded by a large Cretaceous granite pluton and intruded or overlain by Tertiary hypabyssal and volcanic rocks (Shawe and others, 1986). The Palozoic rocks are marine sedimentary rocks: quartzite, silty argillite, silty argillite, and limestone of Cambrian age; and argillite, lime argillite, limestone, dolomite, chert, and quartzite of Ordovician age (Ferguson, 1924). A small patch of serpentinite of the Permian Pablo Formation crops out southwest of Manhattan in the Willow Spring area. Cretaceous granite crops out south of Pipe Spring and extends along the southeast margin of the district to the area southwest of Spanish Spring. Locally, Paleozoic argillite has been metamorphosed to phyllite; near granite contacts, it consists of knotted schist and muscovite-biotite schist. In places near the granite contact, limestone has been metamorphosed to skarn. South of Manhattan, epidote, diopside, and garnet are common in the metamorphosed limestone; potassium feldspar locally floods these rocks or forms thin veins that cut the limestone, and sulfides are present in places (Shawe and others, 1986). Tertiary volcanic rocks cover a large area of the district north of Manhattan Gulch. These rocks are largely silicic ash-flow tuffs originating from and now filling the Manhattan caldera. The caldera is centered around Bald Mountain and Diamond King Hill, north of Manhattan; the southern caldera margin passes roughly in a west-northwest direction along East Manhattan Wash and Manhattan Gulch (Shawe, 1981).

ORE DEPOSITS

The geology of the gold deposits of the Manhattan district has been very well described by Ferguson (1924); his work should be consulted for details of the deposits. The summary presented here has been taken largely from Shawe and others (1986).

The lode gold deposits of the Manhattan district are of a variety of types, although they occur together in a coherent belt, about 3000 feet wide, which follows the south margin of the Manhattan caldera for about 6 miles. The most productive deposits formed in shear zones in phyllitic argillite, silty argillite, and quartzite of the Gold Hill Formation. At deposits on Gold Hill, numerous thin veinlets of quartz, adularia, pyrite, and gold form a generally north-south trending stockworks zone. This is the area now being mined by Tenneco Minerals Co. At the White Caps Mine, on the east end of the district, gold ore occurred as replacement bodies in limestone of the Gold Hill Formation. Ore was mined along north-trending fault zones where gold occurred with pyrite, stibnite, realgar, orpiment and cinnabar in a ganque of calcite and quartz with minor fluorite. At the April Fool Mine, lying midway between the White Caps and Gold Hill deposits, gold mineralization took place in vuggy veins in a limestone layer in the Gold Hill Formation. The veins contain quartz, adularia, fluorite, minor pyrite, and free gold. At the Wall, or Summit, and Keystone mines near Summit Hill south of Manhattan, mineralized breccia on a fault contact between Gold Hill Formation and Ordovician limestone contains fluorite, finely crystalline quartz, free gold, and silver.

Away from the central Manhattan mines, mines and prospects can be found at North Manhattan, East Manhattan, near Pipe Springs, Spanish Spring, at Baxter Spring, and near Willow Spring. About 4 miles north of Manhattan, prospects at North Manhattan along Bald Mountain Gulch expose quartz veins which cut welded ash-flow tuff. The veins are vuggy and display iron-oxide staining. Mines at East Manhattan, along East Manhattan Wash, are near the contact of Tertiary rhyolitic ash-flow tuff and Ordovician limestone. Mine workings expose an east-west trending quartz vein; vein material is vuggy and iron-oxide stained. Workings seen near Pipe Springs did not display visible mineralization, although a strong northwest- trending vein is exposed there. At Spanish Springs, narrow huebnerite-bearing quartz veins cut Cretaceous granite. The veins range from a few inches up to 2 feet thick and follow a north-south strike. Tetrahedrite is reported to occur in these veins (Kleinhampl and Ziony, 1984), and either the Spanish Spring or Pipe Spring occurrences could be the site of the 1866 Manhattan silver discoveries. In the area of Baxter Spring, old workings expose silicified shear zones cutting thin-bedded shale and limestone. The shear structures roughly follow bedding and strike north-south. Drusy quartz stringers, stained with iron and manganese oxides, follow fractures in the zone. At the Willow Spring prospects, on the southern margin of the district, a zone of nickel mineralization in highly silicified serpentinite extends along the western face of the Toquima Range for about 3 miles. Garnierite and niccolite occur in the altered untramafic rock and several groups have explored the area for nickel. The best areas reportedly have grades of 0.35% nickel with traces of cobalt (Kleinhampl and Ziony, 1984).

GEOCHEMICAL RELATIONSHIPS

Ores from the central Manhattan district were found to be very high in gold, low in silver, and associated with high arsenic and antimony. Base metal values were very low and barium values were low. To the north, in North Manhattan, high gold and low silver values were obtained, but arsenic and antimony values were low, barium was moderate, and one sample was anomalous in molybdenum. Base metal values were also low. To the south, in the Keystone-Wall mine area, gold values were high, but silver values were also high, associated with very low arsenic, moderate antimony and lead, and low copper and zinc. Samples from Baxter Spring reported high gold and low silver associated with moderate arsenic values and low antimony values. Other base metal values at Baxter Spring were low. The nickel-rich deposits at Willow Spring were found to contain anomalous chrome as well as nickel.

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