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GEOLOGY OF THE SIXTEEN-TO-ONE MINE

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Location

The Sixteen-to-One Mine is located in Cottonwood Canyon in the Red Mountain Mining District, approximately ten miles southwest of the town of Silver Peak in Esmeralda County, Nevada. The underground mine workings are between 6600 ft. and 7210 ft. above sea level.

District Geology

The rocks of the district are primarily Late Miocene extrusive volcanic tuffs and breccias, with individual units typically having a very limited lateral extent. The older volcanic units are generally andesitic in composition, while younger units are predominantly rhyolites and latites. Rhyolitic dikes and plugs can be found locally. Ages for the volcanic units range from 22.8 m.y. to 11.1 m.y.

The andesites exposed in the district are estimated to be more than 800 ft. thick, based upon underground mapping and drill hole data from the Sixteen-to-One Mine. They are the predominent host rock for the orebody presently being mined. The andesites can be divided into five units of alternating crystal tuffs, or tuffaceous sediments (which include tuffaceous breccia units).

The rhyolites exposed in the district include tuffs, flow breccias, and local intrusive dikes and plugs. The sequence is over 550 ft. thick in some areas, and typically forms the cliffs and jagged spires present in the upper portion of Cottonwood Canyon above the Sixteen-to-One Mine. Rhyolites form the host rocks for the orebody on portions of the uppermost levels of the mine.

Latites cap the ridge to the west of the Sixteen-to-One Mine in Cottonwood Canyon, and are more prevalent toward the west where they are part of the host rocks for the Mohawk Mine. The units consist of water-laid and air fall tuffs, intrusive dikes, and flows, in a sequence over 850 ft. thick.

The major structural system in the district consists of normal faulting which strikes generally northeast. These faults provided the open fissures for vein emplacement by hydrothermal fluids.

Sixteen-to-One Mine

Various companies have controlled the Sixteen-to-One property since its discovery in 1935. Sunshine's initial interest began in 1964, and continued until 1973, when a controlling interest was obtained from Mid-Continent Uranium Corporation. Sunshine then embarked upon further diamond drilling, sampling and geologic mapping through 1978. From 1979 into early 1980, metallurgical test work and detailed feasibility studies were performed. Following approval in June of 1980, underground development was started in the fall of 1980, and millsite construction began in early 1981. Full production was attained in June of 1982. Sunshine Mining Company is presently producing 700 tons per day of ore from reserves which average 6 ounces per ton Ag and .03 ounces per ton Au.

The Sixteen-to-One Vein is an epithermal fissure vein which strikes N. 40-70°E and dips from 65° to vertical to the southeast. The width of the vein ranges from 5 ft. on the surface to 50 ft. on the 7000 and 6890 levels, and averages 22 ft. for the entire orebody. The vein is widest in the central portion of the orebody, and tapers to an average of 8 ft. above, below, and to the southwest along strike. To the northeast, the vein narrows abruptly in the upper levels after the departure of a prominent footwall split called the Colorado Vein and finally horsetails into 1 in. wide stringers just 40 ft. beyond the northeast end of the orebody.

The dimensions of the ore chute presently being mined are roughly 1000 ft. along strike by 525 ft. vertically, although the lower limit of the chute is defined by the limitations of the mining method employed, rather than an ore tenor or mineralogical change.

The mineralogy of the Sixteen-to-One Vein is relatively simple. The dominant gangue minerals are quartz and calcite, with quartz comprising 60% and calcite 40% by volume. Minor amounts of barite and siderite have been noted in the upper levels. Rare

anhydrite has been noted in thin sections. Much of the calcite in the upper levels contains manganese, giving it a siderite-like appearance. Barite has been observed as white bladed crystals in local vugs. Smectite is common in bands on the lower levels. Adularia has been identified, but is rare.

The precious metal minerals are predominantly argentite (acanthite), with lesser amounts of the ruby silvers-proustite and pyrargyrite. The finegrained nature of the ruby silver occurrence has made both megascopic and microscopic differentiation difficult. Additional silver minerals which have been tentatively identified in polished section are polybasite, stephanite, tetrahedrite, and rare stromeyerite. Native silver occurs in minor amounts on the upper levels as wires and flakes in vugs and along fractures. Gold has been observed in section only once, as an 8 micron grain within a grain of acanthite. Silver values in the vein can range from nil to +100 ounces per ton, but overall average 6 to 7 ounces per ton for the deposit.

Base metals occur as sphalerite, galena, and chalcopyrite. The galena, which is not argentiferous, can locally be found in amounts exceeding 10% within individual vein sections on the lower levels. However, overall it averages less than 1%. Sphalerite occurs as the straw-colored, iron poor "honeyjack" variety. Like galena, it can approach 10% in individual bands on the lower levels, but averages less than 1%. The ratio of zinc to lead is approximately 2:1. Chalcopyrite is found locally only in fine grained disseminations in amounts less than 0.2%.

Other sulfides found in the vein include pyrite and marcasite. The pyrite content of the vein is very low (less than 0.3%). Marcasite is rare, and has been observed only in polished section.

Volcanic wallrock fragments or horses of waste between vein bands are common vein constituents on all levels.

Three major stages of vein emplacement can be recognized in the Sixteen-to-One Vein. Stage I is composed of fragments of barren cryptocrystalline quartz floating in Stage II and III material. The fragments are found primarily on the lower levels - occurrences above the 6770 level are rare. Stage II consists of predominantly quartz with precious and base metals and minor calcite. Stage III is comprised of mostly calcite with minor amounts of quartz and low grade (less than 2 oz./ton) precious metals. Well developed banding exists in Stage II and III in the upper levels of the mine, but diminishes with depth.

Precious and base metal content and the overall character of the mineralization vary with depth in the Sixteen-to-One system (Figure 1). On the upper levels (above 6770 level)

the metal contents average 9 oz/ton Ag, .02 oz/ton Au, and less than 1% Pb/Zn. Banding within the gangue minerals (particularly Stage III calcite) is much better developed on these levels. Manganese content of the vein is higher, and is reflected in the color of the calcite on the upper levels. By contrast, the lower levels (below 6770 level) show a decrease in silver values (5 oz/ton), an increase in gold (.05 oz/ton), and an increase in base metals (1-2% Pb/Zn). Within the calcite gangue, manganese contents are lower, and banding is much less well developed.

Wall rock alteration adjacent to the vein is not well developed. On the surface, a zone of footwall silicification extends at least 20 ft. from the vein. Preliminary petrographic work shows the hangingwall alteration to be weak argillic, although alteration from a dike adjacent to the vein hangingwall implies that the vein alteration is much more intense. At depth, only a 1 to 2 in. envelope of footwall silicification is present.

Fluid inclusion work performed to date indicates temperatures for vein emplacement ranging from 170° to 220° C, with the average near 208°C. Salinities of the inclusions ranged from 1.22 to 11.60 weight percent NaCl equivalent, and average between 10 and 11 percent.

Present production rates for the property are 775 tons of ore per day from the mine (5 days a week), with mill production at 675 tons per day (7 days a week). Exploration continues to extend reserves and the life of the property.

References

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