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ITEM 16

MELLAN MOUNTAIN DISTRICT Nye Co

The Mellan mining district is located in the immediate vicinity of Mellan Mountain, an area of two joined hills near the old townsite of Mellan in southern Cactus Flat that is isolated from nearby mountains. The entire area of bedrock outcrop is slightly less than 1 km^2 entirely within section 3 (protracted), T3S, R48E. Mellan Mountain is at the northern end of a ridge of low hills that join with the Cactus range south of Cactus Flat. Workings in the district, mainly underground, consist of an inclined shaft (the Mellan Incline) reported to have over 800 ft of total workings, a vertical shaft on the Golden Leo claim) reported as having about 700 ft of total workings, and two adits (the Daniels Lease and the townsite) each having about 200 ft total workings (Kral, 1951; unpublished data at the Nevada Bureau of Mines and Geology???). Additionally, there are a number of short adits and a short inclined shaft, all generally less than 60 ft each, throughout the district. Total workings are thus more than 2,000 ft.

The district was reportedly discovered by Jess and Hazel Mellan in 1930. No claims were patented in the district??, and unpatented claims staked in the 1930s cover most of Mellan Mountain (Turner, 1934). Claim names from that time include: Golden Leo, Charlotte, Vista, Forked Willow, Jackson, Colorado, and Viola (Turner, 1934). Mellan Gold Mines, Inc. and at least two other groups held claims in the district during that time, and three sets of leasers were reported to be working in 1933 (Goldfield News and Weekly Tribune, Aug. 25, 1933). Production has been estimated at about $1,000, prior to World War II (Kral, 1951, p. 131). Records of the U.S. Bureau of Mines indicate that 33 tons of ore yielding 11 ounces of gold and 50 ounces of silver were mined in 1936 and 1937. Apparently the major development effort was in the mid-1930s. Newspaper accounts report that some vein material from the district could be crushed and panned to obtain up to $100 per ton (gold was valued at $20.67 per oz at that time, so this is about 4.8 oz); select samples were said to carry up to $500 per ton (about 24 oz) (Goldfield News and Weekly Tribune, Aug. 25, 1933). Unpublished data at NBMG indicates that sacked ore from this period had a grade of 0.33 oz per ton gold and 2(?) oz per ton silver, in general agreement with the U.S. Bureau of Mines grades. Also, it is reported that some ore was sent to the McGill (Nevada) smelter that graded 1 oz per ton gold. There is no record of operations in the district after World War II.

Mellan Mountain is underlain by rhyolitic ash-flow tuffs and local intercalated tuffaceous and volcaniclastic sedimentary rocks. The informal names used for these geologic units, the tuff of White Blotch Spring, and tuff of Wilsons Camp, are reported in Ekren and others (1971).

The older of the two ash-flow tuffs, described as the tuff of White Blotch Spring by Ekren and others, is a light pinkish gray moderately welded ash flow tuff with moderately compacted light gray pumice (commonly 1 by 3 cm), sparse volcanic lithic fragments less than 1 cm in diameter, and phenocrysts of reddish vermicular quartz, plagioclase, sanidine, and biotite. K-Ar ages of this tuff (Ekren and others, 1971) are 22.4 to 25 Ma (new constants).

A nonwelded rhyolitic ash-flow tuff and intercalated volcaniclastic sedimentary rocks is exposed over most of Mellan Mountain. This rock has been referred to the tuff of Wilsons Camp by Ekren and others (1971). The ash-flow tuff and sedimentary rocks are silicified in all outcrops; in the tuff, this alteration has resulted in removal of some of the nonwelded pumice from the rock and deposition of drusy quartz in the resulting cavities. The rock is light brown to locally dark reddish brown weathering, light yellowish gray rock with uncollapsed pumice and lithic fragments that are commonly in the 0.5-2 cm range and can be up to several centimeters in diameter (rarely 20 cm for pumice). The lithic fragments are commonly silicic volcanic rocks, but at least one fragment of foliated metamorphic rock was noted; this rock type was most likely derived from the Trappaman Hills area about 20 km to the southwest. Phenocrysts consist of vermicular quartz, sanidine, plagioclase, and biotite.

Sedimentary beds of volcaniclastic sandstone, conglomerate, and tuffaceous siltstone were noted intercalated in the tuff of Wilsons Camp at a number of localities. These sedimentary rocks are thick enough and well enough exposed to be mapped only in the northwest Mellan Mountain area (fig. xx); however, thinner units are exposed, especially in adits and pits, throughout the district. The sedimentary rocks are also silicified, and locally iron-stained. The conglomerate units contain pebbles of volcanic rocks, commonly of felsic composition, but a few basalt(?) pebbles were noted. The pebbles in conglomerate and conglomeratic sandstone are commonly 1 cm or less in diameter. Finely laminated silicified sedimentary rocks represent bedded and reworked ash.

The tuff of Wilsons Camp is interpreted to be faulted against the presumably older tuff of White Blotch Spring along a north northwest striking normal fault. It may overlie it directly in an area southwest of the Mellan Incline, but exposures are poor in that area. Regionally, the Wilsons Camp rests on the White Blotch Spring (Ekren and others, 1971, p. 39). Other north northwest-striking faults are observed in the area southeast of Mellan Mountain (Ekren and others, 1971, Plate 1), and the region is likely one of considerable extension and low-angle normal faulting. Although no low-angle faults were noted in the Mellan Mountain district, local steep dips in sandstone units of the tuff of Wilsons Camp are suggestive of considerable rotation and thus extension.

Mineral deposits at Mellan Mountain consist of chalcedonic quartz veins and silicified breccia zones in silicified tuff of Wilsons Camp carrying values in gold and silver. For the higher grade samples, the Ag/Au ratio is about 5:1 to 10:1, while the lower grade samples (0.0X oz per ton gold) have ratios of 15:1 to 50:1. The main underground workings were not easily accessible, as they are vertical or steeply inclined. However, based on examination of all the surface workings and unpublished information (Turner, 1934; NBMG files???-USS&R Co.), it appears that the predominate strike of the major veins is N30°W; the veins dip 55°-75°NE. The Mellan Incline (names are from Turner, 1934), located on the west flank of the eastern hill of Mellan Mountain, was sunk to explore a quartz vein along a N30°W, 55°NE normal fault zone which separates the hanging wall tuff of Wilsons Camp from the footwall tuff of White Blotch Spring (fig. xx). The vein is found for nearly 300 ft along the surface trace of this fault, and is over 3 ft wide at the surface. Shallow workings explore the fault further to the northwest, but vein material was not noted (e.g., fig. xx, Mellan townsite adit). Underground in the Mellan Incline, good values in gold are found in veins and veinlets across a mineralized zone that varies from 10 to 50 ft. However, enough uncertainty exists in the unpublished data (NBMG files??) on channel and chip samples from underground at the Mellan Incline that only rather general estimates of grade can be made. One report of grades across the mineralized zone (Miles P. Romney, Field Engineer for U.S. Smelting, Mining, and Refining Exploration Co.) indicates 0.03 opt Au over 46 ft on the 165-ft level, 0.0075 opt Au over 12 ft on the 280-ft level, and 0.025 opt over 10 ft on the 343-ft level. Dollar values reported for underground samples collected by Professor C. L. Chapman (Arizona University), if interpreted as all gold, indicate from trace to 0.1 to 0.34 opt over 5-10 ft widths. Although Chapman cut some 4.5-6 ft samples with grades up to about 0.6 opt Au, values across these widths on the 343-ft level appear to average only about 0.05 opt Au equivalent. Higher values than those described above are reported by J. C. Robinson (unpublished maps, NBMG) for a number of areas in the Mellan Incline workings. A narrow vein of similar strike to the Mellan Incline vein (and having a 70°NE dip) was noted in a short adit in the hanging wall near the Mellan Incline collar. If a block of mineralized rock 300 feet long, 400 feet down the dip of the vein, and 20 feet thick is assumed to have an average grade of 0.025 opt Au and the specific gravity of quartz (or 75% of quartz for a lower estimate), this yields 150,000 to nearly 200,000 tons of material containing about 3,700 to nearly 5,000 ounces Au. Grades in this range are not economically mineable underground today, but even if higher grade zones were selectively mined they would likely total, based on the above calculations, a few thousand ounces.

About 150 ft northeast of the Mellan Incline is the other major working of the district, the vertical shaft on the Golden Leo claim. There, Turner (1934) reports that three good veins were cut in drifts off the shaft. Only one vein is shown on Turner's map of the workings; it has an attitude of N35°W, 75°NE. Unpublished maps and other data by M. P. Romney indicate that this shaft was probably originally sunk to intersect the Mellan Incline vein, but was never extended that deep. His underground maps indicate that N45°W and N60°W as well as N55°E mineralized faults were encountered in the drifts off the shaft. A northwest striking crushed and iron-oxide stained zone about 40 ft wide had reported grades of 0.03 to 0.05 opt Au. Drifts from the bottom of the 100-ft shaft extend north and east-northeast, totaling almost 600 ft. At an adit (the Daniel's Lease) located about 550 ft east of the vertical shaft, a narrow (less than 10 cm), east-west, 90° vein was stoped along for a short distance (fig. xx). A chip sample of this vein and adjacent silicified wall rock taken during this study (no. 5322) contained only about 0.09 opt Au across 2 feet. Silver was about 1.5 opt in this sample.

The veins of the Mellan district are vitreous to milky, saccharoidal to chalcedonic, and are locally stained with limonite. No sulfide minerals were observed, and limonite pseudomoprhs after pyrite are rare; thus, oxidation is apparently complete to depths below those of mining (about 280 ft). Although Turner (1934) reports manganese oxides, they are rare in the veins examined during this study. Locally, the quartz vein material has parallel bladed texture (Morrison and others, 1991?) that probably indicates selective replacement of an early bladed carbonate mineral (calcite?) by quartz. No visible free gold was noted during this study, but Turner reports that gold can be panned from crushed ore. The quartz vein material is highly brecciated in some veins. Silicification in the wall rock is ubiquitous at Mellan Mountain in the porous unwelded tuff and sedimentary rocks of Wilson's Camp. The hills of the district, surrounded by an area of alluvium, result from the preservation of the more erosion-resistant silicified rocks. In thin section, altered pyroclastic rocks have overgrowths on quartz phenocrysts, patchy alteration (adularization?) of feldspars, and sparse clay alteration of groundmass. In a few areas along faults beyond the continuation of a vein, or adjacent to narrow veins, argillic alteration was noted. Illite and smectite were identified from two different samples from the district (L. Hsu, written commun., 1995).

In certain areas of the district, narrow (commonly 1-10 cm) veins of cream to light tan, locally banded, chalcedonic silica are very common in the tuff of Wilsons Camp. These concentrations of veins are generally somewhat separate from the major veins of the district. Some of these veins have curving fractures within them that are reminiscent of dehydration cracks observed in silica gel (amorphous silica). The texture indicates that the veins were originally opal and have recrystallized to chalcedony and finely saccharoidal quartz (see Fournier, 1985). One vein near the Mellan townsite has a corrugated or rippled (fluted) surface that is likely produced by deposition of silica gel during hydrothermal fluid streaming. Similar fluting textures have been observed at other hot-springs Au-Ag deposits (Tingley and Berger, 1985, p. 36; L. Garside, J. Tingley, and H. Bonham, unpublished data from the Hasbrouck Mountain area, Divide District, Nevada). Iron staining is not intense, indicating that pyrite was sparse to absent in these veins. They do not seem to have any particular orientation, and are more common in two areas in the district (fig. xx). The chalcedonic veins did not receive much attention during mining and exploration in the 1930s, probably because they were not found to contain appreciable Au and Ag values. A sample collected during this study (no. 1508) tends to confirm this speculation, having only very slightly anomalous values in Au and Ag (although Hg was anomalous).

The narrow chalcedonic veins described above were likely deposited at temperatures below 180°C as opal (see Fournier, 1985); they may not have been later heated above that. The character of these veins, combined with the chalcedonic to saccharoidal texture of the major veins, the sparsity of crustiform textures, occurrence of sparse illite and smectite as the argillic alteration minerals, and lack of noticeable crystalline adularia all suggest a shallow depth of deposition. Boiling of the hydrothermal fluids can be inferred, based on the presence of parallel bladed or lattice textures (White and Hedenquist, 1990). The silicification in the porous tuff is at least partly a result of redistribution of silica from pumice to the groundmass, and most likely represents a silica cap high in the hydrothermal system. All these features suggest that the Mellan district mineralization seen at the surface and in the shallow workings is in the upper part of a low-sulfidation (adularia-sericite) type hydrothermal system (e.g., White and Hedenquist, 1990; Heald and others, 1982). A continuum likely exists between low-sulfidation epithermal Au-Ag deposits and hot-spring Au-Ag deposits (Berger, 1985, 1986), which include mineralization formed at or within 100 m of the paleosurface (Bonham, 1985). The model that best describes the epithermal mineralization at the present level of exploration is that of the hot spring Au-Ag deposit (Berger, 1986). Mineralization formed at shallow depth, but no hot-spring sinter deposits were noted at the present level of exposure. Such mineralizing systems that have anomalous gold in the upper portions (the chalcedonic superzone of Morrison and others, 1991?) are reported by them to be more likely to overlie a well-mineralized crustiform-coliform superzone, which could lie below the depth of present exploration. The silicified hills that make up Mellan Mountain are likely preserved as erosional remnants because of this silicification; thus, although there may be an area of potential alteration and mineralization concealed by pediment deposits which surround Mellan Mountain, this area is likely to be small.

Further exploration in the distinct is warranted both at depth (for bonanza-type Au-Ag deposits) and in the silicified area in the vicinity of the veins (for bulk-mineable disseminated deposits of the Round Mountain type, e.g. Tingley and Berger, 1985).

Twenty-one rock geochemical samples were collected in the Mellan district, mainly from prospects and mines; they include select, grab and chip samples from surface and underground. Some select samples yield values comparable to those described in reports from the period of active mining, and some chip samples across several feet in veins or breccia zones which include vein material have Au values from 1 to 3 ppm, a range presently economic using bulk-mining methods. Select and chip rock samples that are not from or adjacent to veins have Au values below 0.1 ppm. Thus, no direct indication of disseminated, bulk-mineable material was found by sampling; however, its presence might be located by a more closely-spaced surface and underground sampling program and (or) by drilling.

In the samples collected during this study (refer to Table xx??), Au and Ag are anomalous, as is Sb; As is anomalous to strongly anomalous, and Hg is weakly to strongly anomalous. Additionally, W is commonly moderately anomalous and Bi should probably be considered weakly anomalous (> approx. 0.200 ppm). Base metals (Cu, Zn, Pb) are non-anomalous in essentially all samples, as are most other metals (Ni, Cr, V, Sn). Se, Te, and Tl are not anomalous, although Mo and U are. Ag/Au ratios for the higher-grade samples are in the range 16:1 to 25:1, generally comparable to ratios determined from ore samples reported in unpublished sources (see above).

The group of anomalous associated elements in ore and mineralized rock samples from the district is similar to that reported from hot-spring type Au-Ag deposits (Berger, 1986). The Ag/Au ratios from the Mellan district are also low (generally less than 50:1), another reported characteristic of hot-spring Au-Ag deposits. Although Berger (1986) reports that anomalous Tl should be expected in such hot-spring type deposits, it is not anomalous at the Mellan district; however, it is not certain that it is universally present in such deposits. Anomalous Mo, although not noted by Berger (1986) is reported from some hot-springs deposits, especially those hosted by or associated with silicic volcanic rocks (e.g., Hasbrouck Mountain, Nevada; Bonham and Garside, 1982, Appendix 1). U values from mineralized rock samples of the mining districts sampled during this study are commonly a few ppm (generally less than 10 ppm; see Table xx??). This range is similar to unmineralized rock samples from the area (Table xx??). Thus, the sporadic anomalous U values (ca. 20 and 30+ ppm) noted in Mellan district samples (and to a lesser extent at a few other districts) are most likely related to uranium redistribution and concentration during alteration of the wall rock or later supergene groundwater movement. ?? more on Au-U assoc.??

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