from NBMG OFR 83-9
See also 83-10 for geochemical results.

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Item 13

CORTEZ DISTRICT

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The Cortez mining district is located in the southern Cortez Mountains about 30 miles south of Beowawe. The district contains 4 main areas of mineralization which surround Mt. Tenabo, the highest peak in the range. These areas are the old Cortez silver mines on the steep west flank of Tenabo, the Cortez gold mine on the northwest flank, the Mill Canyon area which lies along the northeast flank and the new Horse Canyon property located east of the peak. The district is bissected by the Lander-Eureka county line with mines occurring in both counties.

The geology and mineralization at Cortez has been studied in detail by numerous authors (see Selected References). Some interesting facts on the early history of the district are reported by Vanderburg (1938) and Emmons (1910). The geology of the Cortez 15' quadrangle was mapped by Gilluly and Masursky (1965) and the text includes a discussion on the ore deposits written prior to the development of the Cortez Gold mine. The USGS studies which led to the discovery of the large tonnage, low-grade gold ore body on the northwest flank of Mt. Tenabo are contained in Erickson and Marranzino (1961) and Erickson, et al (1961, 1964 and 1966). Numerous studies of the gold ore body and surrounding areas ensued, including a geochemical investigation of the Mill Canyon area (Elliot and Wells, 1968).

The extensive underground workings of the Cortez Silver mines are entered through the Garrison and Arctic Tunnels on the west side of Mt. Tenabo. The mines were worked fairly continuously since their discovery in the early 1860's through January 1930, when the "low price of silver and depletion of ore reserves" forced the mill to shut down (Vanderburg, 1938). Nevertheless, from 1862 through 1958, 14 million dollars worth of gold, silver, copper, lead and zinc were produced from the district (Stager, 1977). A small amount of the total production includes ore derived from the mines in Mill Canyon also.

The ownership of the Cortez Silver mines changed hands several times after the main production and during this period the mines were reopened, reworked and redrilled. When the USGS discovered geochemical indications favorable for gold mineralization, Placer Amax Inc. auspiciously held the controlling claims in the district. In joint venture with three other companies, Amax drilled the area during 1965-1968 and successfully outlined a large disseminated gold ore body in section 13, T27N, R47E with inferred reserves of 3.4 million tons of ore containing 0.29 oz Au/ton. The Cortez Gold mine was soon developed and between 1968 and 1982, 3,562,100 tons of ore averaging 0.279 oz Au/ton were mined (Bonham, 1982), resulting in a production of almost 1 million ounces of gold. Currently, the main deposit is mined out, but leaching of stockpile ore continues. At the time of our examination of the district, the millsite was predominately being used to process ore from the Gold Acres deposit, located in the Shoshone Range about 8 miles northwest of Cortez.

In addition to the gold production, a small production of turquoise is recorded for deposits located south west of Cortez Canyon (Vanderberg, 1938). Also, some antimony was produced as a by product of smelting the early silver ores (Lawrence, 1963). In 1941, a mercury deposit, named the Rossi mine, was discovered and explored on the east slope of the range, but was probably never productive (Bailey and Phoenix, 1944). The mercury occurs as cinnabar in bleached and silicified calcareous shales of the Vinini (?) Formation. Autunite (?) was uncovered by bulldozers during the development of the gold deposit, but the exact location of the occurrence is unknown (Garside, 1973).

The geology of the Cortez area, as mapped by Gilluly and Masursky (1965), consists of thrusted Paleozoic sediments which are intruded along the north flank of Tenabo by a Cretaceous intrusive stock and associated dikes and veins. The general geology of the area is well described by Elliot and Wells (1968, p.3) as follows:

"The Paleozoic sedimentary rocks comprise two distinct facies which are approximately equivalent in age; these facies are separated by the Roberts Mountains thrust fault. One facies includes formations that range in age from Cambrian to Devonian and consist predominantly of carbonate rocks with minor quartzite. The second facies includes formations that range in age from Ordovician to Silurian and consist predominantly of siliceous rocks. In adjacent areas, Devonian rocks of the siliceous facies are also represented. The carbonate facies is considered to be autochthonous and the siliceous facies allochthonous. The siliceous facies has been transported into juxtaposition with the carbonate facies from the west along the Roberts Mountains thrust (Gilluly and Masursky, 1965, p. 10). The rock unit mapped as Paleozoic undifferentiated occupies the thrust zone and is not directly assignable to either the carbonate or the siliceous facies.

In general, the sedimentary units strike north and dip moderately east. The Roberts Mountains thrust has been warped into an antiform (Gilluly and Masursky, 1965, p. 89), and later erosion has formed the Cortez window in which the carbonate facies is exposed below the thrust. The lower plate rocks are cut by many faults, most of which are probably related to the period of thrusting. The upper plate is structurally more complex and is composed of many slices of western facies, all faulted together with little apparent system (Gilluly and Masursky, 1965, p . 93).

Rocks of Jurassic age are the quartz monzonite of the Mill Canyon stock and the satellite bodies of alaskite and intermediate dikes associated with the stock.

The Mill Canyon stock intrudes the lower plate rocks in the axis of the Cortez window and crosscuts the Roberts Mountains thrust to the east. The stock is composite and consists of two parts: (1) a discordant western part, roughly rectangular in outline, and (2) an eastern laccolithic or bysmalithic lobe (Gilluly and Masursky, 1965, p. 68). Several mineralized veins are near the junction of the two parts of the Mill Canyon stock."

Radiometric dating of biotite from the Mill Canyon stock yielded an age of 151 m.y. (Gilluly and Masursky, 1965). Two slightly younger ages of 124 and 147 m.y. were obtained from the same body a few years later by Armstrong (1963, unpub.) and published in Schilling (1965). Biotite and sanadine from a rhyolite porphyry dike adjacent to the ore zone yielded ages which date the mineralizing event at about 35 m.y.a. (Silberman, et al, 1976).

The Cortez Gold mine was visited only briefly during our reconnaissance of the district. For this reason, a description of the geology and mineralization of the deposit is taken from Roberts, et al (1971, p. 76):

"The host rocks of the Cotrez gold body are described by Gilluly and Masursky (1965), Elliott and Wells (1968), and Wells, Stoiser, and Elliott (1969) as altered calcareous silstone and limestone of the Roberts Mountains Formation and limestone of the Wenban Limestone. These rocks are cut by intrusive igneous rocks of Jurassic and early Tertiary age and overlain by Tertiary volcanic rocks. The ore may be genertically related to biotite-quartz porphyry dikes and sills of Oligocene age (34 m.y.) that cut the Roberts Mountains and Wenban Formations in the ore zone, or to younger igneous rocks in the area (Wells, Stoiser, and Elliott, 1969).

The zone of gold metallization is not controlled by any obvious structural feature, but it trends north-westward, parallel to the strike of the Roberts Mountains thrust at the mouth of Mill Canyon nearby. Wells, Stoiser, and Elliott (1960, Fig. 6) show the ore body in a tight, overturned fold in the Roberts Mountains Formation; the overlying Wenban Limestone was apparently not involved in this fold, indicating that the two units may be separated by a reverse fault. Roberts believes that the Roberts Mountains thrust plate probably covered the area at the time of metallization and may have exerted an important structural control on ore deposition. In addition, the Cortez district lies within the Battle Mountain-Eureka mineral belt that trends N35°-15°W in this area; this belt apparently lies along a deep-seated fracture zone which localized plutonic bodies in Mesozoic and Tertiary time and localized ore deposits during several metallogenic epoches (Roberts, 1966; Roberts et al., 1967).

Gold ores of the Cortez deposit are characterized by quartz, metallic gold, various iron oxides after pyrite, and small amounts of remnant carbonates and clays. Fine-grained gold is dispersed through the oxidized and hydrothermally altered carbonate rocks. Coarser grained metallic gold occurs in small quartz veins and is intergrown with partly oxidized hydrothermal pyrite scattered through the host rocks.

Radtke considers that most of the carbonaceous materials in the host rocks were destroyed either by a process of "weathering oxidation" or by thermal metamorphism induced by igneous intrusion prior to gold mineralization. Thus, the influence of organic carbon on the deposition of gold at Cortez was less than that at Carlin. Details of the genesis of the Cortez ores will be discussed in a paper by Radtke, Scheiner, and Christ (unpublished manuscript)."

The Mill Canyon area was visited and sampled during the course of this project. Many of the mines in the canyon are patented. The owner, Allen Russell, limits access to the mines by a locked gate at the entrance to the canyon. Prior permission is advised before entering the property.

"Deposits in the Mill Canyon area have been prospected and mined for the past 100 years. The estimated total production from the area is approximately $800,000. Most of the mining has been in gold and silver, the gold predominating in dollar value. The ore deposits are of three types: (1) fissure veins in quartz monzonite that contain silver, lead, zinc, and gold, (2) silver, lead, and zinc replacement deposits in limestone (Vanderburg, 1938, p. 27), and (3) gold deposits along fault zones in limestone. The most productive deposits have been near surface oxidized ore along faults in limestone near the quartz monzonite limestone contact." (taken from Elliott and Wells, 1968, p. 3)

Although many of the workings in Mill Canyon are caved, several adits are still open at their portals. Most of the adits explore north, northeast and northwest faults, fractures and fissure zones in bleached, recrystallized or silicated limestones and silty or carbonaceous sediments of the lower plate, Devonian Wenban Limestone. The structures are generally maked by the development of clay, calcite and abundant iron-oxides. The bedding of the host rocks near the minesites is generally highly contorted by folding and faulting.

The quartz monzonite Mill Canyon stock outcrops in the central part of the canyon. Along the irregular southern margin of the body, the stock is intruded by a north-trending alaskite porphyry dike about 3/4 of a mile in exposed length. Some of the western workings in the canyon lie along the contact of the dike with limestones and quartz monzonite. South of these workings at the head of Mill Canyon, Homestake conducted exploratory drilling during 1980 and 1981 in altered Wenban Limestone. Drill holes are concentrated at higher levels where the limestones are cut by several high-angle faults.

By sampling the dumps in the area, we noted that quartz veins which cut intrusive rocks carry pyrite, galena and sphalerite. The ore derived from the limestone replacement deposits typically contains pyrite, galena, chalcopyrite, bornite and arsenopyrite. Argillized porphyry dikes occur locally and contain fine disseminated pyrite. In addition to these minerals, minor amounts of boulangerite ($Pb_5 Sb_4 S_{11}$), bournonite ($Pb Cu Sb S_3$), argentian tetrahedrite, pyrargyrite-proustite ($Ag_3 Sb S_3$-$Ag_3 As S_3$), gold, stibnite, argentite and stephanite ($Ag_5 Sb S_4$) are reported for the deposits (Elliott and Wells, 1968). Anomalous amounts of Au, Ag, Pb, Zn, Cu, As, Sb, Hg and Te and local concentrations of other elements were discovered by Elliott and Wells (1968) geochemical study of the area. Their informative article outlines the mode of occurrence of the gold and silver, geochemical indicators for mineralization and favorable areas for prospecting within Mill Canyon.

In the fall of 1982, Cortez Gold Mining Co. announced its plans to start production on its newly discovered gold ore body at Horse Canyon on the east side of Mt. Tenabo. Mining of the deposit is expected to begin in mid-1983, hopefully coinciding with the final mining of their Gold Acres property located on the other side of Crescent Valley. Ore reserves for the Horse Canyon deposit are estimated at 3.4 million short tons of 0.0555 oz. Au/ton. An annual recovery of 40,000 oz. Au/year is expected.

The Horse Canyon property was visited by NBMG geologists in July, 1982. At that time, the haul road which circumnavigates the south end of Mt. Tenabo was near completion. Drill roads lie along the southeast flank of Mt. Tenabo and extend for more than 1½ miles from the saddle between Mill and Horse Canyons to the southeast along the Horse Canyon drainage. The tight pattern near the saddle area suggests this may be the future site of the open pit mine.

Most of the southeastern drill roads are developed in controted, thin bedded black carbonaceous shales, cherty shales and fine-grained siltstones of the upper plate, Ordovician Vinini Formation. Intrusive and extrusive rhyolite underlie a prominent peak about 1 mile east of the drill roads. A K-Ar age determination on sanadine from the rhyolite yielded an age of 15.3 m.y. (Wells, et al,1971).

The most conspicuous geologic feature in the area is the presence of a bouldery, resistant rib of "jasperoid" breccia which trends northwest along (or above) most of the entire length of drill roads. The jasperoid rib lies along the approximate trace of the Roberts Mountain thrust (mapped by Gilluly and Masursky, 1965) which juxtaposes Wenban Limestones (to the west) and the Vinini Formation (to the east). Upon close examination, the jasperoid is highly silicified, has a jumbled, bouldery appearance, displays quartz-encrusted open-spaces between breccia fragments and fractures and is heavily iron-stained. Near sample locations 1518 and 1519, the open vugs and fractures in the jasperoid and silicified host rocks are coated by abundant euhedral red, jarosite crystals. White barite vein material is found throughout the area.

Drill cuttings sampled from the area consist mainly of siliceous and carbonaceous shales. One sample contained fine-grained, disseminated sulfides. All of the drill holes observed bottomed out in siliceous facies rocks. Bedded limestones of the Wenban Formation are exposed only in the drill roads located near the saddle between Mill and Horse Creek Canyons.

The Horse Canyon deposit is hosted by upper plate rocks which are mineralized adjacent to the Roberts Mountain thrust or possibly along a high-angle structure east of the thrust contact. Mercury is present locally (re: Rossi Mine) and the mineralization may be associated with the altered rhyolitic dikes of Miocene age which outcrop along the drill roads and on the east side of Horse Canyon.

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