File No. 34704

NOTICE

TO WHOM IT MAY CONCERN

The following:

GEOLOGICAL REPORT
on the
CORTEZ METALS CO. PROPERTY
CORTEZ, NEVADA

is submitted in compliance with Public Law 85-876, 85th Congress, S. 2039, September 2, 1958.

Introduction

The geological survey which is the basis for this report included a reconnaissance study of the surface during which traverses were made around the periphery and at intervals, across each of the patented and unpatented claims; more detailed geological mapping was done in the underground workings and in the mineralized areas on the surface - as noted elsewhere in this report.

The survey was made at an approximate cost of $3,000.00. This figure includes the cost of labor involved in reopening the underground workings.

The work was done by the author, assisted in the early stages of the survey by Harold F. Bray and David F. Vance of Beowawe, Nevada. The author, A. G. Horton, whose permanent address is in care of Placer Development Limited, 700 Burrard Building, Vancouver 5, British Columbia, Canada, is a graduate geologist with a Bathelor of Arts degree from the University of Saskatchewan. The author offers the following professional background:

1948-1949 Part time instructor, Geoligical Sciences, University of Saskatchewan.

Geological Assistant and Junior Geologist, Department of Natural Resources, Saskatchewan.

1950-1951 Geologist, Department of Natural Resources, Province of Saskatchewan.

1952-Present Geologist, Placer Development Limited and affiliated companies, including Canadian Exploration Limited, Evan Jones Coal Company and American Exploration and Mining Company

The author has drawn freely from the considerable literature on the Cortez area and is indebted to George W. Hezzlewood, William H. Emmons, Francis Church Lincoln, C. A. Nelson, Jim Gilluly, Harold Masursky, M. M. Harcourt, L. F. Paddison, J. O. Greenan and John A. Burgess for their reports and comments. A complete bibliography is attached.

Location and Access.

The mines of the Cortez district are situated on the southwest slope of Mt. Tenabo of the Cortez Range, on the Eureka-Lander county line in north-central Nevada. The old camp of Cortez is 36 miles south of Beowawe, the nearest station on the Southern Pacific and Western Pacific Railroads. Mt. Tenabo, which is the highest summit of the south end of the Cortez Range, has an elevation of 9,240 feet; Cortez is about 6,280 feet above sea level.

The property is roughly 40 road miles south of Beowawe and 60 raod miles north of Austin. With the exception of some short jeep trails to the upper workings, all roads in the district are graded and suitable for automobile traffic. Although up to 18 inches of snow accumulates at the higher elevations, the winter weather is not severe and should interfere but little with road travel or mining operations.

Water for the town, mining, and milling operations was obtained in the past from shallow (100'-200') wells in the Grass Valley flats a mile or two southwest of Cortez and pumped to storage tanks above the workings. Later a seven-mile pipeline was laid to take water from Wenban Spring- west of Grass Valley in the Toiyabe RAnge.

HISTORY

The Cortez district was discovered in about the year 1860 when prospectors working north from the new camp of Austin found Indians gathering galena float in the canyons south of Mt. Tenabo. The earliest discovery was the St. Louis lode near the north end of the present Cortez Metals property.

Manyu claims were located in 1863 and by 1869 Simeon Wenban, one of the earliest locators, had acquired by location and purchase all of the important claims in the Cortez district. Wenban formed a partnership with George Hearst in 1864 and the rich ores shipped to Austin and Mill Canyon in the early years of the Cortez camp helped to found the Hearst fortune.

An 8 stamp mill was erected in Mill Canyon (4 miles north of Cortez) in 1864 and was later enlarged to 16 stamps and 4 roasting furnaces. The mill was purchased by Wenban in 1869 and operated until 1886 when a new mill was completed at Cortez. This was a chlordizing roast-leach plabt and an 85-90% Ag. extraction is reported.

Wenban operated under the name Tenabo Mill and Mines Co. until 1889 when he sold out to an English company (Bewick-Moering Syndicate?) who operated up to 1891 under the name of Cortez Mines Ltd. All properties were turned back to Wenban in 1892 and he continued to operate successfully until his death in 1895. His heirs continued mining and milling, but at a reduced rate to 1903.

Little additional work was done at Cortez, with the exception of some small leasing ventures, until 1920 when the property was purchased by the Consolidated Cortez Silver Mines Co. This company began developing the property immediately and in 1923 constructed a 125-ton concentrator and cyanide mill. The plant was changed to a 150-ton flotation mill in 1927.

Production

Emmons in his U.S.G.S. report of 1910 (see bibliography) states, "From the best sources of information that are available the production of Cortez and Mill Canyon since discovery is estimated at $10,000,000.00, the larger part of which was taken from the Garrison Mine." Production records of the Consolidated Cortez Co. show that the net value of the ore produced during the period 1919-1929 was $2,036,892.00. Government reports on Nevada's metal production (see bibliography) show that an additional $1,000,000.00 worth of metal was produced at Cortez between 1911-1918 and 1933-1939. Using Emmons' original figure, therefore, the total production from Cortez is estimated to be $13,000,000.00.

John A. Burgess in his report to the Cortez Company in 1922 states, "From the incomplete records it is certain that the property (Cortez) has produced not less than $15,000,000.00 in silver ores."

Available records show a production in excess of $7,500,000.00 - but as mentioned by Burgess- the records are far from complete.

Based on the production data and reports seen to date the total past production is believed to have had a gross value in the order of $15,000,000.00. This is again substantiated by a recent estimate by the author of 500,000 tons of mill tails - which assuming an average original ore grade of $20.00 per ton would total $10,000,000.00. It is assumed that approximately one-third of the ore produced (or $5,000,000.00) was hauled to Mill Canyon or Austin for treatment or shipped direct to the smelters in the Salt Lake Valley.

Geology/

The Southern part of the Cortez Mountain Range is composed of a series of Paleozoic sediments which strke generally north-south and dip gently to the east at an average angle of 23°. At the northern limit of the main silver producing area, the sediments are in intrusive contact with a stock of Mesozoic quartz monzonite.

There has been some difference of opinion in past years concerning the age relationship of the various formations in the Cortez district. Much of the stratigraphic interpretation was originally projected from the Eureka area (which Cortez resembles in many respects) by Emmons; but more recent work by Nolan, Nelson, Burgess, Harcourt and Paddison (see bibliography) suggests some changes.

West of the Cortez Range, Grass Valley is covered by a thick mantle of Quaternary alluvium and west of this again is a thick series of Tertiary volcanics, suggesting the presence of a major north-south fault along the western base of the Cortez Range with the western block down-thrown in relation to the ore-bearing Paleozoic series at Cortez.

Several faults have been recognized at Cortez but none of them have been considered of any great importance in relation to the ore bodies. The most prominent of these trends east-west and forms a prominent cleft in Cortez ridge south of the St. Louis workings. North of the fault surface exposures indicate that at least 300 feet of Hamburg dolomite underlies the lowest workings at Cortez.

The sedimentary series is intruded by a series of eight "porphyry dikes" (numbered from 1-8) which strike 100° and dip steeply to the north. Most of the ore mined at Cortez was taken from structures associated with No. 1 Porphyry Dike. Very little work has been done on the others. The ore is not commonly found in the porphyry but rather in or adjoining the porphyry fissure where it has not been filled by the intrusive material. The porphyritic material is too highly altered for accurate identification but it seems likely that the rock was originally quite basic - possibly an andesite.

Small dikes seen elsewhere on the property suggest multiple intrusives with both rhyolite and andesite occupying the fissures. These trend roughly north-south and do not appear to exercise any control on ore deposition.

Recent geological mapping by C. A. Nelson of the University of California suggests the following stratigraphis sequence at Cortez (from youngest to olders):

White Pine Formation, Mississippian, 100'-6500', exposed on the eastern slope of the range, shale with some chert, limestone, and sandstone.

Cortez Formation, Carboniferous, 3000'-6000', cherts with some shale.

Bald Mountain Formation, Carboniferous, 6500'-10,000', chert, shale, quartzite, and siltstone.

Shoshone Formation, (possibly Nevada Formation), Devonian, 1000'-1500', limestone with dolomite lenses.

Nevada Formation, Devonian, 1000'-4000', limestone.

Lone Mountain Formation, Upper Silurian, 2050'-3000', dolomite.

Roberts Mountain Formation, Lower Silurian, 1000'-1200', limestone with minor dolomite.

Hansen Creek Formation, Upper Ordocivian, 250'-300', thick limestone member separated by thin dolomite bands.

(Note: Emmons, Burgess and others considered the above series as a single formation which they called Lone Mountain).

Eureka Formation, Upper-Middle Ordovician, 200'-300' quartzite. This is the white, resistant formation which forms near vertical cliffs for a distance of over two miles along the west side of the Cortez Range in the immediate vicinity of the Cortez property.

Hamburg (?) Formation, Cambrian, 2000'-, dolomite, fine grained, mottled, grey, weathers to dull grey, subrounded blocks forming rather steep talus slopes. Discordant and concordant dolomite and calcite veins are numerous.

This is the oldest stratigraphic unit exposed at Cortez and was called the Pogonip Formation by earlier authors. This has been the main ore producing unit in the Cortez district where it forms the western slopes of the range. The total thickness of the formation is not known; the lowest workings at Cortez are still within it.

Comparing the stratigraphic section at Cortez with the better-known Eureka area it appears that the Pogonip limestone which underlies the Eureka quartzite at Eureka is missing at Cortez and the quartzite is in unconformable contact with the Hamburg. The dip of the two formations is the same, however. The Prospect Mountain limestone which was the main ore-producing formation at Eureka probably underlies the Hamburg limestone and an unknown (360' at Eureka) thickness of Secret Canyon shale.

Mineralization and Ore Bodies.

Slight contact metamorphic mineralization has occurred north of the Cortez properties where the Paleozoic sediments are intruded by a stock of quartz monzonite several square miles in extent. It is possible that the mineralizing solutions which are responsible for the silver ores of Cortez originated in this large intrusive mass which may underlie the entire district at some considerable depth. Near the contact the Hamburg dolomite has been altered to a marble and several of the typical contact minerals have been identified, including tremolite, foresterite, and wollastonite. There does not appear to be a recognizable tactite zone, however, and no ore minerals have been reported near the contact. Another hypothesis recently advanced to account for the origin of the Cortez ore relates the mineral bearing solutions to the series of Tertiary volcanic rocks lying on the other side of the range, to the south-east of Cortez.

Most of the Metal mineralization of the district is believed to be related to the series of eight steeply dipping "porphyry dikes" which trend generally east-west and cut the Paleozoic sedimentary series. Although all of these have been intersected in some of the underground workings, only one of them - the No. 1 dike fissure - has been thoroughly prospected and certainly more than 90% of the Cortez ore came from ore bodies closely associated with this structure.

The known Cortez ore bodies occur chiefly in the Hamburg limestone but also in the overlying Eureka quartzite and to a lesser extent in the still younger limestones near the upper Eureka contact. The occurrences include bedding and contact replacements, steeply dipping, irregular fissure zones roughly parallel to the dikes, and irregular "pipe" and ribbons.

No. 1 "dike fissure" was so designated because it is primarily a fissure vein only partly filled with a highly altered igneous rock. The remainder of the fissure filling is brecciated limestone and calcite. In places much of this material has been replaced by quartz carrying silver, galena, pyrite, argentiferous tetrahedrite, sphalerite, and chalcopyrite.

The following statement regarding ore deposition is taken from a report (see bibliography) by J. O. Greenan, general superintendent of the Cortez operation:

"Filed relations indicate that the dikes were injected from below, following but not completely filling zones of weakness in the three formations. Ascending solutions replaced large portions of the resulting mass along the dike fissure (or fissures) with silver-bearing quartz. They spread out along both upper and lower quartzite contacts, forming umbrella-like masses of ore radiating from the dike fissure. They also followed fractures and cavities in the limestones and to a lesser extent in the quartzite, forming tabular veins as well as highly irregular but rich ore bodies, extending several hundred feet into the footwall of the dike fissure. Local evidences of secondary enrichment can be found but the ore is unquestionably primary."

Ore in the upper workings apparently contained a considerable amount of galena but the lower ore bodies developed by the Arctic tunnel showed little lead but an increase in sphalerite and tetrahedrite. The fissures are quite open; the mine is exceptionally dry and thereis some evidence of oxidation even on the bottom level.

Greenan used the following brief table to illustrate his application of the zonal deposition theory:

Metals Produced Per Ton of Ore

	Oz.	Per Cent				
	Silver	Lead	Zinc	Copper	Iron	Sulfur
*Ore from upper levels, 100 to 200 ft. depth	11.0	0.06	0.04	0.004	0.24	0.30
Ore from Arttic Level, 1000 to 1600 ft. depth	31.0	0.51	0.69	0.063	1.18	0.50
Ratio, Arctic level to upper levels	2.8/1	9/1	17/1	16/1	5/1	20/1

*Note - The ore produced from the upper levels by the Consolidated Cortez Co. was almost entirely stope fill-material left by Wenban and others as too low grade to handle. It is likely that the average grade of the ore was originally much higher - probably in the order of 30 oz. - or similar to that later produced from the lower levels.

The first major production from Cortez came from the irregular pipes and ribbons of high grade lead-silver ore near the surface (Garrison or Corkscrew areas) at the western end of the No. 1 Dike. These were replacement bodies in the Hamburg dolomite and although extremely irregular they were remarkably persistent. Like most of the ore bodies in the district they appear to rake somewhat with the bedding. Recementing of the dolomite or limestone leaves little evidence of the structures which localized these replacement bodies but Burgess reports "they are formed by replacement along definite planes, both limestone bedding planes and fault planes, usually of low dip, that cross the bedding." The Corkscrew, Chinese Bridge, China Basin, Hog Tail, and Caps Break ore bodies are of this type. Some of these have been mined for distances of up to 700 feet and over widths up to 100 feet and many shipments of ore from this area assayed 200 oz. Ag. per ton and more.

Little can be said regarding the possibility of developing more ore bodies of this type. The ones which have been mined were found by prospecting along narrow stringers of ore which led from one to another - from an outcrop near the top of the Garrison shaft - down, almost vertically for over 300 feet to the No. 1 Level-then eastward roughly parallel to the No. 1 Dike for a horizontal distance in excess of 800 feet. It appears possible, however, that geological mapping might develop a better understanding of the conditions necessary for the development of ore bodies of this kind and suggest methods of prospecting for additional pipes.

Some of the smaller "pipes" were examined by the author in the western, accessible parts of the No. 1 level and in the vicinity of the Garrison tunnel. These measured 50-100 feet in length and perhaps 10 feet by 20 feet in cross section. Although there appears to be an average rake parallel to the dip of the bedding (23° E.) no definite pattern was evident, all were fairly flat lying but the strike varied greatly. The pipes seen had been completely mined out but silicification of the dolomite in the walls was very apparent. Specimens taken from a stope wall "skim" show a slightly vuggy and highly fractured quartz gangue with numerous small splashes and stringers of black sulfides (tettahedrite?) and yellow and green silver-lead-copper staining.

At the eastern end of the Cortez property considerable ore was mined in the Fitzgerald Region from the Eureka Quartzite and from the overlying limestone within 100 feet of its contact with the quartzite. Much of this ore is of the replacement type and was formed from solutions migrating along the upper and lower contacts. During recent examinations by the author a fairly detailed surface study was made in the Fitzgerald region. The No. 1 "dike fissure" is well exposed in small surface workings but the main underground workings which connect with these were inaccessible. In the quartzite near its upper contact, although all ore has been removed from the workings, there remains some evidence of high grade silver mineralization on the walls of the stopes. Perhaps 50 feet further east the fissure contains only a 4-foot vein of white calcite with some silicification of the upper limestone. Note: Calcite veins are common throughout the entire property; they appear to be more recent than the intrusives and are probably unrelated to the ore. Very little prospecting appears to have been done east of the Fitzgerald shaft and certainly the surface to the east does not appear very encouraging - but it is possible that a northern split, which is evident in the extrmme eastern workings in the quartzite, may continue eastward or north-eastward through an overburden-covered area which does not appear to have been prospected at all.

Large fissure-type- ore bodies occur as replacements of the original fissure filling (porphryr dike or brecciated dolomite) or filling the series of fractures which trend roughly parallel to the dike. The latter structures are referred to as a "zone of sheeting" by Emmons, who states, "After the dike (No. 1 porphyry dike) solidified, it was sheeted and shattered, the fissures being in a broad way parallel to the intrusive but extending into the limestone wall rock also." Ore bodies of this type were responsible for the major portion of the Cortez production and the future of the district will probably depend on the discovery of similar bodies.

There appears to be some difference of opinion in the literature as to whether or not the ore actually replaces the porphyry in the No. 1 dike fissure or whether it replaces only those sections of the fissure originally filled with a crushed dolomite - calcite mixture. In any case it is everywhere evident that the main ore bodies occur both as replacements along the dike fissure and along other fissures adjoining and related to that structure.

Greenan reports on the ore body in the cage shaft area as follows, "The largest stopes were between the 5th and 7th levels, 100-300 feet below surface. The largest of these was 630 feet long, 5 to 15 feet wide, with a maximum vertical extent of 220 feet along the vein." Greenan also wrote (in 1927) that the Consolidated Cortez Company had recently developed a new ore body in the Arctic tunnel (1000 level) which measured 200 feet along the dike and averaged 5.5 feet in width. Later a footwall split was discovered and the ultimate dimensions of this ore body were much greater. In a few months following the discovery of this ore Cortez produced 10,000 tons of 31 oz. Ag. ore, 7,500 tons of which came from development.

Some of the stopes in this area are accessible via the Arctic tunnel and were examined by the author. The shaft from the Arctic level to the 1100 and 1200 levels has been reopened and ladders installed. Geological and engineering plans of the levels in this area were made by Paddison, Burgess and Harcourt and are the best and most up-to-date data available on the Cortez mines.

On the main tunnel level no ore was found west of the Arctic crosscut. Some recent work done here on Burgess' recommendation developed a 2' zone of quartzose material with mineralization confined to a 2-inch veinlet containing some sulfides. East of the crosscut many of the stopes are accessible above and below the tunnel. Most stoping is over widths of 5-10 feet. The dip of the footwall split varies from over 60° (N) to as low as 30° in the first sub-level above the main level. The footwall split is quite regular but ore in the hanging wall split leads into numerous other fissures and pipes. In places the main fissures may contain only a few inches of ore at tunnel level but development winzes and shafts into the stoped areas show that these widen rapidly within a few feet into ore bodies several feet in width. Little ore remains in the stopes and it is usually impossible to see the back, but where seen the back or face exposes at most a few inches ofmineralization in a zone of silicified dolomite.

On the 1100 level the mode of occurrence of the ore is more simplified and the two near-parallel fissures are more prominent. On the level the two fissures are separated by 30 to 100 feet of slightly silicified dolomite. The footwall split is open throughout its 650 foot length but only 200 feet of the level is accessible on the hanging wall split; mine plans indicate that stoping extends for over 1000 feet. In the portions of the hanging wall split stopes which are open the vein strikes 110° and dips 70° to the north. Some stopes are up to 30 feet wide but the average stoping width would be more in the order of 15 feet. At the east face(and on the 1000 level) the only evidence of these ore bodies is a 2-inch stringer. The ore in the footwall split is narrower but was apparently higher grade (average about 30 oz. silver). The average stoping width here was about 8 feet.

The eastern limit of mining on the 1000 and 1100 foot levels appears to be the north-south trending Coleman fault. This structure is briefly mentioned in the early literature and seemed to have little if any effect on the continuity of the ore in the uppoer workings. Leasers who operated at Cortez in recent years are reported to have done some test drilling from the lower underground workings (including a flat hole drilled to the east through the Coleman fault on the 1100 level) but reports on the results of this work have not been found.

Study of the 1200 level was hampered by the fact that fill from the stoped area immediately above the level has broken through the cutes cutting off access to the productive eastern part of the workings. Paddison's map on this level indicates that the ore zone may have curved southward to the west of these chutes but, as no significant mineralization was intersected in the southern extension of the 12-2215 crosscut, it appears likely that the ore pinches out to the west. The only mineralization seen on this level was a little galena in a highly iron stained and oxydized fracture zone up to 2 feet wide which strikes 100° and dips about 80° to the north. This is exposed in the back throughout the length of the 12-2114 drift.

After reopening the #5 dike tunnel and the Polar tunnel it was possible to study all of the east-west trending dikes. Although these intrusives are remarkably similar in every other respect, no ore was found associated with any of them other than the #1 dike fissure.

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San Francisco, California

April 25, 1960

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Recorded at the request of American Exploration & Mining Co., May 2, A.D. 1960 At 06 minutes past 8 A. M.

Willis A. DePaoli- Recorder.