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DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA
OWNERS MINE REPORT

Date 10/21/40

1. Mine Total Wreck
2. Mining District & County Empire Pima County
3. Former name None
4. Location 9 mi. S. from Pantano
5. Owner "Vail Estate"
6. Address (Owner)
7. ~~Operator~~ Lessee: Jesus Estrado Torres
8. Address ~~(Operator)~~ Pantano, Arizona Box 227- E. 29th St., Tucson
9. President
10. Gen. Mgr.
11. Mine Supt.
12. Mill Supt.
13. Principal Metals Molybdenum, lead, Ag.
14. Men Employed
15. Production Rate Not istablished
16. Mill: Type & Cap.
17. Power: Amt. & Type
18. Operations: Present Road repairs, development
19. Operations Planned Depend on market and finances
20. Number Claims, Title, etc. 4 unpatented lode claims
21. Description: Topography & Geograph

TOTAL WRECK MINE

Mo

Pima 10 - 6 S 3, T 18 S, R 17 E

~~Vail Estate, Pantano~~ '40

J. E. Torres, Box 227, East 29th St., Tucson

22. Mine Workings: Amt. & Condition
1 incline shaft 800 ft.,1000 ft. of drifts on 4 levels.
1 vertical shaft 60 ft., 1 crosscut 40' - 80', 1 tunnel 400 ft., Winze 40'.
1 tunnel 600 ft. Winzes and lower drifts.

(over)

23. Geology & Mineralization

24. Ore: Positive & Probable, Ore Dumps, Tailings

Pockets average 6-8% MoO_3. 1000 tons in sight
Further development promises many thousand of tons.

24-A Vein Width, Length, Value, etc.

25. Mine, Mill Equipment & Flow Sheet None

26. Road Conditions, Route Fair condition, 2 men workings 2 weeks will put in good condition

27. Water Supply Nearest water 1/4 mile for camp use, for milling operation 3 miles.
Road is old and must be repaired

28. Brief History

29. Special Problems, Reports Filed

David H. Howell, 4550 Lue Drive, Claremont, Calif.

30. Remarks For operation of 10 tons per day — 4 men.

31. If property for sale: Price, terms and address to negotiate. Will take partner on 50-50 of profits on small operation. Will give fair deal on larger operation.

32. Signed Jesus Estrado Torres

33. Use additional sheets if necessary.

TOTAL WRECK MINE.

Location.—The Total Wreck mine is 7 miles south of Pantano, the nearest station on the Southern Pacific Railroad, to which there is a good wagon road. It is on Cienega Creek at the east base of the Empire Mountains, in the northeast end of a long ridge, at an elevation of about 4,600 feet (Pls. I, II, and III, in pocket).

History and production.—The mine was discovered in 1879 by John Dilden, a cowboy, and later was relocated and passed into the

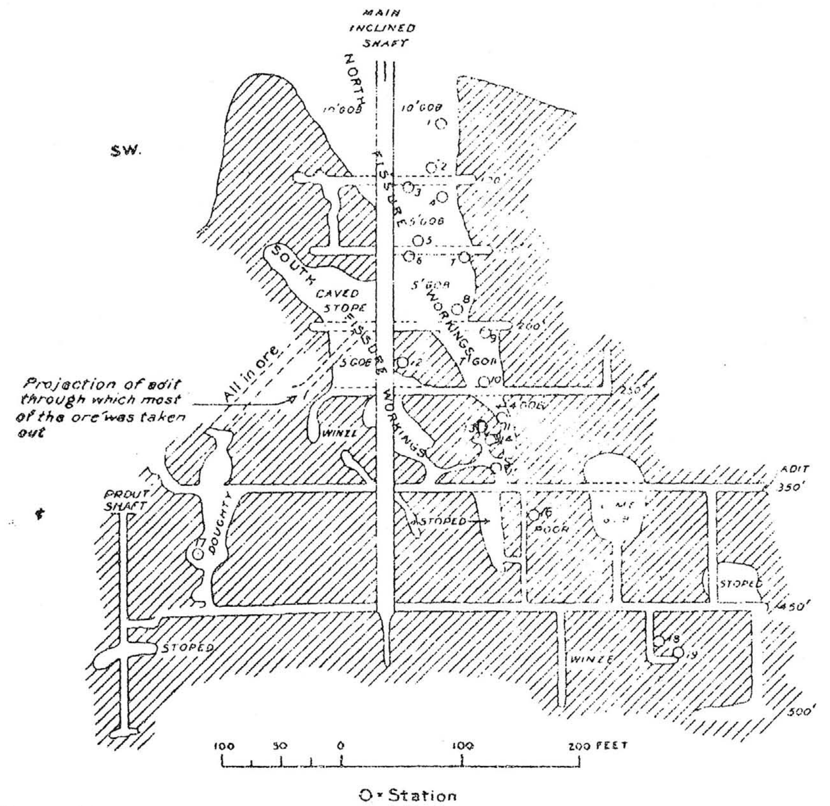


FIGURE 15.—Diagrammatic longitudinal section of Total Wreck mine on dip of main vein.

hands of the Empire Mining & Development Co., which installed a 70-ton milling plant and beginning in 1881 operated the mine and mill for a year and a half on rich surface ore. In 1882 the manager reported 50,000 tons of ore in sight,[1] but after the production of 7,500 tons of ore the mine and plant were closed. Soon afterward the mine was sold for taxes and purchased by Vail & Gates, of Tucson, who still own it. It was idle until 1907, but was then

[1] Blake, W. P., Mining in Arizona: Report of the Governor of Arizona for 1899, p. 113.

worked by C. T. Roberts, who found several thousand tons of low-grade ore remaining in old workings, discovered some new bodies, and shipped considerable ore until March, 1908. In March, 1909, the property was bonded to E. P. Drew, of Tucson, and work was resumed on a small scale. Some ore, in part high-grade lead-silver ore, was produced, but early in 1911 it was reported that the work had been discontinued. The production, which so far as learned seems

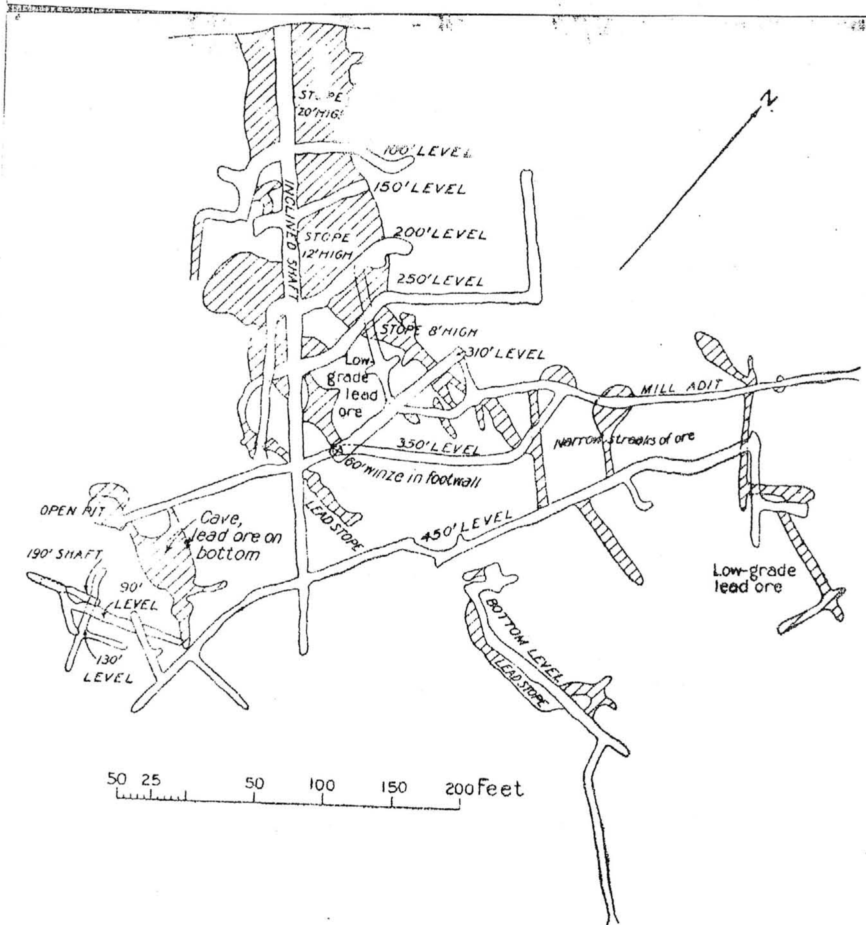


FIGURE 16.—Plan of underground workings, Total Wreck mine.

to be more than 10,000 tons, was mostly made prior to 1902, especially in 1881 and 1882, when the mill was in operation, and a five months' run is said to have produced over $450,000, or about 7,500 tons.[1]

Developments and equipment.—The mine is well developed to a depth of about 500 feet by shafts, tunnels, drifts, inclines, winzes,

[1] Hamilton, Patrick, The resources of Arizona, 2d ed., p. 131, San Francisco, 1883.

and stopes aggregating about 5,000 feet of work. (See figs. 15 and 16.) Some of the principal openings are shaft No. 4, which is 460 feet deep and is inclined 35° S., following the footwall of the principal vein; a main working tunnel tapping the shaft at a depth of 200 feet; and a 250-foot tunnel intersecting the vein on the 200-foot level. The deepest vertical shafts are the Front and Roberts shafts, respectively 185 and 200 feet deep, on the lower slope of the hill. The levels in general lie about 50 feet apart vertically. They run northeast and contain several hundred feet of drifts in both directions. Tunnel No. 1 is 600 feet long and has an upraise to the surface at the breast, a drift to the stope on the southeast, and a 50-foot winze containing a drift to the north and to the east. Shaft No. 2 is 175 feet deep and has a drift to the south on the 80-foot level and drifts to the north and south from the bottom. Tunnel No. 3 is 250 feet long, runs northwest to the breast 80 feet below the surface, and contains stoping to the northwest along vein No. 2. The main crosscut, in the bottom of the mine, runs north and is 800 feet long.

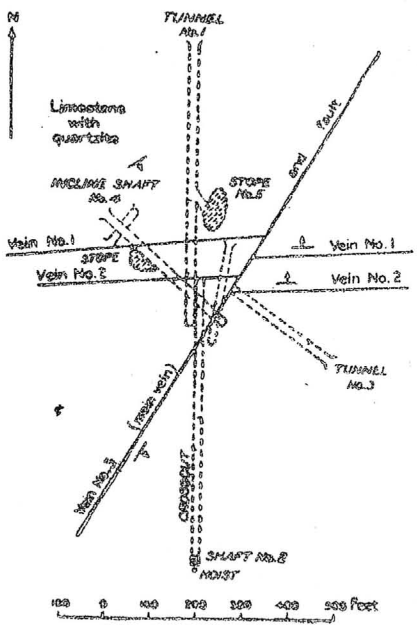


FIGURE 17.—Diagrammatic plan of veins of Total Wreck mine.

The property comprises a group of seven claims, some of which are patented. The principal equipments are a 20-stamp 70-ton mill and a 300-horsepower engine. The machinery and plant are well preserved. The camp and mill were supplied with water pumped from a spring 4 miles to the south.

Geology.—The mine is in the dark-bluish medium to heavy bedded Carboniferous limestone, which is interstratified with heavy to thin beds of light-gray quartzite. The rocks in general dip about 35° SSE., which is approximately the inclination of the east and south slopes of the hill in which the mine is located (Pl. XIV, *B*). They are shown in a much better preserved state in the mill tunnel than in any other part of the mine. They are much faulted, for the most part horizontally, and somewhat folded and contain one or more systems of fissures, of which the principal ones dip steeply to the north. These rocks are intruded by small dikes and stringers of diorite. The limestone is apparently the same as that at the Blue Jay mine and in the dark ridge east of the Copper World mine. It is in general only slightly crystalline and contains some fossil remains, of which a fragment collected as stated on page 50 has been identified as a bryozoan and probably Tabulipora, from the Pennsylvanian.

The mine is dry, and no water has ever been encountered in it.

Deposits.—The deposits occur principally in three so-called veins and replacement ore beds, which are irregular zones, as represented in figure 17. They are mostly in or associated with fissures, especially fissures of the east-west system, of which the two most important are represented in figure 15. The fissures are about 90 feet apart. They have a steep northerly dip, and the ore bodies occur on their northerly or hanging-wall side, mostly in the limestone and usually above beds of quartzite. Some of the deposits extend from the fissures along the bedding planes of the limestone as blanket veins or ore beds. Examples illustrating the relations of the ore bodies to the fissures and the quartzite and limestone bedding planes are shown in figure 18, in which *a* shows also the leached zone in the fissure extending to a depth of about 250 feet, and *b* shows faulting denoted by change in dip and offset of the quartzite beds along the fissure.

The fissure or vein portion of the beds is more or less uniformly about 6 or 8 feet wide, but the width of the zone, comprising the fissure vein and the replacement ore body in the adjoining limestone, is many times greater, being in places nearly 100 feet, as shown in figure 18, *a*. The deposits extend from the surface to the bottom of the mine, where their lower limits have not yet been reached. Though some good-looking ore bodies occur in the deeper part of the mine, practically all the ore which was profitably worked was found between the surface and the 350-foot level.

The ore is an argentiferous lead ore which carries also a little copper in the deep part of the mine. It is contained in a mineralized, altered, more or less crushed limestone gangue with calcite and infiltrated quartz in porous or honeycombed masses of various forms. It is stained reddish brown, yellowish, greenish, or blackish by oxides of iron and manganese and carbonates of lead and copper. With it in places, as shown on the 450-foot level, are associated 40 or 50 feet of breccia and some light-colored argillaceous gougelike material, locally called Chinese talc, which is probably kaolin.

The ore is practically all oxidized, scarcely more than a trace of sulphide having yet been found even in the deepest part of the mine. The principal ore minerals are silver chloride (cerargyrite or horn silver), lead carbonate (cerusite), wulfenite (lead molybdate), mala-

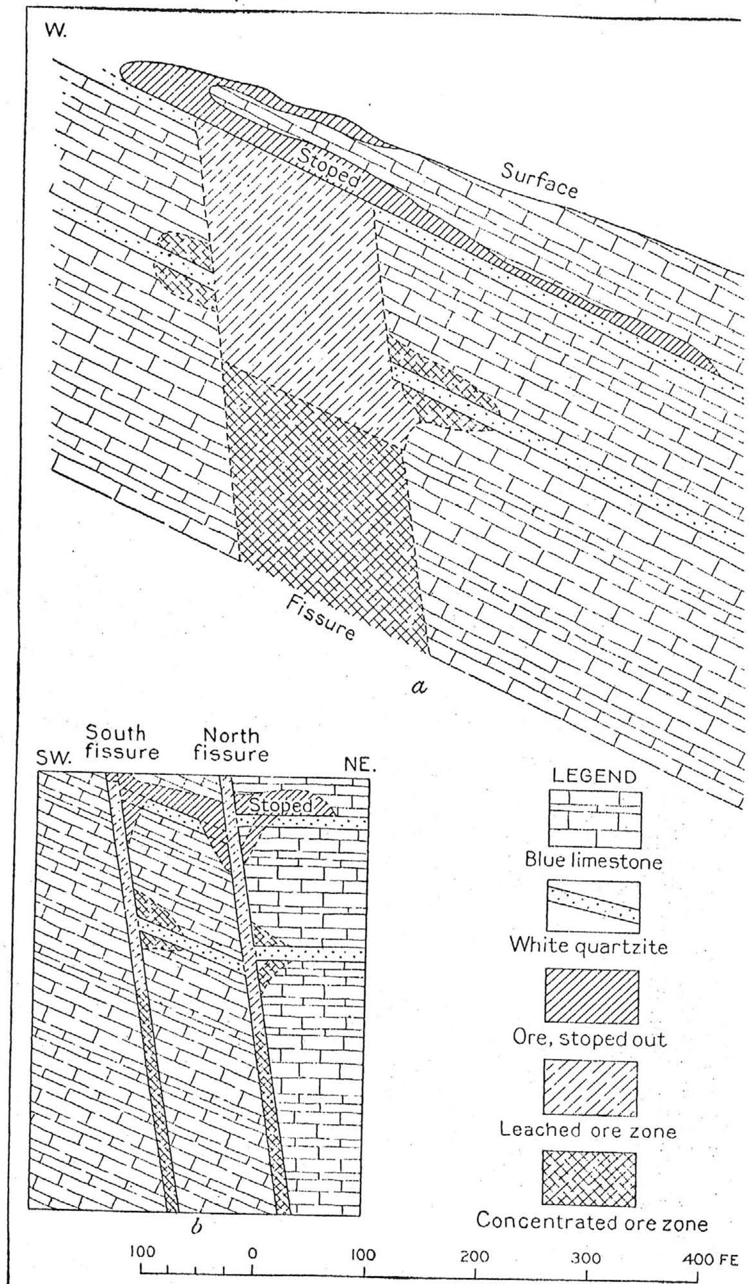


FIGURE 18.—Sections of fissures and ore bodies in Total Wreck mine. *a*, C tion near surface; *b*, cross section on 350-foot level.

...lite, azurite, chrysocolla, and a little chalcopyrite, and perhaps lead oxides. The associated minerals are hematite, limonite, vanadinite, jarosite, siderite, and manganese oxides.

In the surface ore, much of which is very rich, the principal mineral was cerargyrite. In the lower part of the mine, however, silver is only sparingly present or absent, and copper, principally in the form of carbonates, occurs in its place. The principal vein is said to be 5 feet wide, to contain considerable lead molybdate, and to average 4 per cent copper, 12 per cent lead, and 12 ounces in silver to the ton.

The early ore is said to have averaged in mill tests about $60 to the ton. During the operation of the mill in the early eighties it was worked to 84 per cent, and the tailings were concentrated and saved. The cost of mining and milling was reported to be about $8 a ton.

The deposits seem to owe their origin to circulating thermal solutions that accompanied or followed the intrusion of the underlying granite. Subsequently, so far as the workings now extend, the deposits have become concentrated by percolation of meteoric waters in the oxidized zone. In the processes of formation and concentration of the ore the underlying quartzite beds which separate the limestones into a series of subdivisions were important physical agents in aiding mineral precipitation by arresting the downward progress of the solutions.

The mine seems to contain considerable good ore, but most of it is probably of low grade. As some leads seem to have been lost on the lower levels, the deeper part of the mine should receive detailed examination before operations are resumed on any large scale.

COPPER CAMP.

GENERAL FEATURES.

The Copper camp is located 3 miles southwest of the Total Wreck mine near the center of the Empire Mountains, in a north-south belt about a mile wide and 3 miles long, mostly in the west side of an irregular open valley or embayment that extends northward into the heart of the range and is known as the Basin. The principal settlement is near the Hilton ranch, in the northern part of the belt at an elevation of about 5,000 feet. It is reached by a wagon road of easy grade leaving the Pantano road about a mile north of the Total Wreck mine. The deposits are in the same limestone belt as those of the Total Wreck mine and extend from the granite contact on the north through the foothills and into the lowland on the south. The rocks are principally the dark limestone with interbedded quartzites, about the same as at the Total Wreck mine. They dip in general about 45° SSE. or S. They are faulted, folded, and

M E M O R A N D U M

TO: Jack Pierce

FROM: George Potter

SUBJECT: Total Wreck Mine, Job No. 905

DATE: April 26, 1977

Preliminary metallurgical tests were completed on a composite sample of dump ore from the Total Wreck Mine, Job No. 905. The ore assayed, in percent, 2.5 Pb, 2.5 Zn, 0.31 Cu, 0.042 Mo and, in ounces per ton, 0.004 Au and 3.75 Ag. Mineralogically, the major gangue mineral is limestone (calcite). Quartz is present as quartzite or hydrothermal veins. Cerussite, some smithsonite, malachite, aurichalcite, mimetite, mottramite, and a few small grains of galena occur in the ore. Hydrous iron oxide occurs in the ore. Pyrite is rare. There is jarosite in the material, and silver, in part, probably is a constituent of the jarosite.

In summary, gravity concentration or froth flotation failed to provide satisfactory silver recoveries from the ore, because less than one-half of the silver was so recovered although lead recoveries of 70 to 80 percent were obtained. An assay of a gravity concentrate for zinc indicated that zinc tended to concentrate with the lead. By fine grinding (100-mesh) and cyanidation for 72 hours, about 62 percent of the silver was extracted. A brief resume of the tests follows.

I. Sink-Float

A sample of the plus 1/2-inch size ore was screened, and the screened sizes were treated separately by sink-float in a heavy liquid at 2.70 specific gravity. Overall, the combined sink (concentrate) product represented 30 percent of the weight of the ore, assayed 5.7 percent Pb and 4.7 ounces per ton Ag, and contained 81 percent of the total lead and 45 percent of the total silver in the ore. One of the richest sink products, the minus 1/2-inch plus 1/4-inch, assayed 12 percent Pb, 9 ounces per ton Ag, and 14 percent Zn, thus indicating that the zinc tends to concentrate with the lead in the sink product and doubtless carries any associated silver with it.

II. Froth Flotation

A sample of the ore was ground to 17 percent plus 65-mesh and processed by sulfidization and froth flotation. About 70 percent of the lead, but only 25 percent of the silver, was recovered. The flotation concentrate assayed 38 percent Pb and 18.6 ounces per ton Ag.

MEMO TO: Jack Pierce (Cont'd)

FROM: George Potter

SUBJECT: Total Wreck Mine, Job No. 905

DATE: April 26, 1977

III. Cyanidation

Ore ground to 100-mesh was cyanided for 72 hours. About 62 percent of the silver was extracted. Reagent consumption was 5.4 pounds of NaCN and 7 pounds of lime per ton of ore.

Conclusions

Although moderate recoveries of lead can be made by gravity concentration or flotation, fine grinding and leaching will probably be required to obtain even moderate silver recoveries. Indicated cyanide and lime consumptions are relatively high. To justify the expensive plant implied, large reserves of similar grade ore, or higher grade ore in lesser amounts, would be a requisite. A limited amount of dump ore alone would probably not justify an elaborate plant. Some zinc by-product might be possible. Copper and molybdenum were not studied in this preliminary evaluation.

Recommendations

Inasmuch as the tonnage of these refractory dump ores probably would not alone justify a treatment plant, future studies should be guided by the amount and type of underground ores available. If sufficient underground reserves are estimated, then the following tests will be helpful.

1. Attempts to make saleable lead, silver and zinc products by gravity.

2. Froth flotation to recover additional lead and silver (also possibly zinc).

3. Cyanidation of the tailings.

4. Examination for a possible wulfenite by-product.

Through special arrangements owing to the Company's interest in the project a saving of one-third to one-half may be effected in the above suggested test program, estimated at 160 to 200 hours, resulting in a cost on the order of $4,000 to $5,000.

George Potter

GP:kw
cc: Joe Keane

Tucson, Arizona
April 7, 1977

To: Dr. Roshan B. Bhappu
Vice President
Research and Development
Mountain States Mineral Enterprises
Tucson, Az. 85731

From: L. Dudas
Mineralogist
Research and Development
Mountain States Mineral Enterprises
Tucson, Az. 85731

MINERALOGICAL REPORT

Subject: Mineralogical Examination of Hand Samples and a Composite Ground to Minus 10 Mesh and Split on 48 Mesh Screen from the Dumps of the Total Wreck Mine, Empire Mountains, Pima Co., Arizona. Project No. 905.

Purpose: To determine the mineral composition of the samples in particular respect to their silver, lead and zinc mineralization.

Samples: Four hand samples were chosen for mineralogical work from the bulk material collected (for sampling purposes) from the trenches cutting the existing dumps. The bulk sample was crushed to minus 10 mesh, mixed and composited. A 1000 grams sample was cut out from the composite for mineralogical examination. This (1000 g) composite was split on a 48 mesh screen.

One thin section was made of each of the hand samples and two of each of the screen fractions. Then two polished sections were made from the hand samples and also two from each of the screen fractions of the composites.

The thin and polished sections were observed under transmitted and reflected light, polarizing microscope respectively. The results follow.

M I N E R A L O G Y .

TRANSPARENT MINERALS predominate in the hand samples and the screen fractions of the composites.

Calcite is the major transparent mineral in the composite, which should be representative of the total amount of the received sample. The amount of the calcite is greatly variable in the hand samples (from trace to 90 volume percent) due to the nature of selection, which was aimed to choose conspicuous minerals rather than random distribution. According to the microscopic observation the calcite seems to occur in two distinct forms: (1) very fine grained (sedimentary rock component) and (2) medium to coarse grained vein fillings (hydrothermal calcite). In the coarse screen fraction (plus 48 mesh) most of the calcite is locked, only 32 percent of the total calcite is free; in the fine fraction (minus 48 mesh) of the composite, however, the major portion (66 percent) of the calcite is free.

Generally the calcite is associated with quartz (this association is present in both, the sedimentary rock and in the hydrothermal vein), chlorite, serpentine, cerussite, hemimorphite, smithsonite, willemite, hydrous iron oxides, pyrite, chalcopyrite etc. Among these minerals hydrous iron oxides are the major locking components of the calcite. Most of the calcite is impregnated and in lesser degree is locked with (discrete) hydrous iron oxides.

The grain size of the calcite varies between 10 and 1000 microns.

Quartz is the second most frequent transparent mineral in the observed samples. It is more frequently present in the hand samples (even if not in high amounts) than the calcite. The amount of quartz almost equals that of the calcite in the coarse (plus 48 mesh) and it is almost half of that in the fine screen fraction (minus 48 mesh) of the composite. Most of the quartz (75 percent of the total amount) is locked in the coarse (plus 48 mesh) and most of it free in the fine (minus 48 mesh) screen fraction (70 percent of the total quartz) of the composite. Hydrous iron oxides are the dominant locking components with quartz. The hydrous iron oxides usually form fine scales or thin coating on the surface of fractures and cracks of the quartz grains. Besides hydrous iron oxide, the quartz is locked with calcite, chlorite, serpentine, hemimorphite, and malachite in this order of frequencies.

The quartz, similarly to calcite occurs in two distinctily different forms, as: (1) fine grained (sedimentary, metamorphic) quartzite, and (2) small to medium grained vein filling (hydrothermal) mineral.

The grain size of the quartz ranges from 8 to 500 microns.

Chlorite, Serpentine, and other micas are third in the sequence of frequencies among the transparent minerals. They occur in fine flakes or matted aggregates. It seems that the serpentine is the dominant mica type mineral (layer silicate) in the samples (hand and composite) followed by chlorite, sericite and a few biotite. Some of the micas are impregnated with hydrous iron oxides. Most of the mica type minerals are free even in the coarse (plus 48 mesh) screen fraction of the composite and only a small amount is locked with calcite, quartz and with the above mentioned hydrous iron oxides.

The grain size of the micas varies between less than one micron and 40 microns for the individual flakes. The aggregate size may reach 1500 microns

(in the coarse plus 48 mesh screen fraction of the composite)

Willemite ($ZnSiO_4$) and Hemimorphite ($Zn_4(OH)_2Si_2O_7.H_2O$) are minor mineral components in the samples but they represent the major (economically valuable) zinc minerals. Both minerals occur in aggregates of prismatic crystals. The fan shaped arrangement of these prisms are more conspicuous in the hemimorphite aggregates. The hemimorphite shows lower refractive index than the willemite, which is a main criterion (besides other optic properties) in differenciating between the two minerals. Both, the willemite and the hemimorphite usually line cavities and vugs in the vein and are associated with quartz and in lesser degree with smithsonite, calcite, cerussite etc. transparent minerals. Generally hydrous iron oxides coat the surfaces of both minerals.

The grain size of the willemite. and hemimorphite ranges from 20 to 300 microns for the individual prisms. The size of the aggregates may reach 1500 microns.

Smithsonite is a minor mineral in the composite, but in some hand samples it is one of the dominant minerals. It occurs as medium to coarse sized grains and grain aggregates filling fractures and cavities. The smithsonite regularly is associated with calcite, malachite, cerrusite and other transparent minerals in this order of frequencies. Very often the smithsonite is coated with hydrous iron oxides along its rhombohedral cleavage planes.

The grain size of the smithsonite varies between 40 and 400 microns.

Mottramite ($PbCuOHVO_4$) is a minor to trace mineral in the samples. It occurs in small crystals, lining cavities and vugs. The mottramite is associated with calcite, smithsonite, quartz, willemite etc. transparent minerals. Occasionally it is coated with hydrous iron oxides. The grain size of the mottramite ranges from five to 80 microns.

Cerussite is a minor component but it is the dominant lead mineral in the samples. Its amount is relatively low in the screen fractions of the composite, but it is moderately high in a few hand samples. The cerussite is associated with calcite, smithsonite, malachite, quartz, mimetite etc. transparent minerals. In many instances the cerussite is also coated with hydrous iron oxides.

The grain size of the cerussite varies between 20 and 400 microns.

Mimetite ($Pb_5ClAs_3O_{12}$) is a very minor constituent in the composite. It was not detected in the hand samples but this does not exclude its presence in the deposit. The mimetite usually is associated with cerussite, calcite, smithsonite, quartz etc. transparent minerals in the samples. It may also grade into pyromorphite ($Pb_5ClP_3O_{12}$) which was not seen but it can occur in the deposit along with wulfenite ($PbMoO_4$) which was not detected either. They all belong to the same mode of formation. The grain size of the mimetite ranges from five to 100 microns.

Malachite, Chrysocolla, Aurichalcite are minor components but major copper minerals in the samples. Their amount is low in the composite but in some of the hand samples they might be the dominant minerals. Generally these copper minerals are intergrown with calcite, smithsonite, cerussite etc. transparent minerals. The malachite and aurichalcite occur as long needles, while the chysocolla forms fine crystal aggregates. Some of these copper minerals are impregnated with hydrous iron oxides.

The grain size of these copper minerals vary between four and 400 microns.

Jarosite ($KFe_3(OH)_6(SO_4)_2$) is a minor but frequent constituent in the samples. The composition of the jarosite varies between wide ranges. It may contain valuable elements, such as silver (argento-jarosite) or lead (plumbo-jarosite) etc. Generally it is associated with hydrous iron oxides and most of the transparent minerals particularly calcite, smithsonite, cerussite, quartz, willemite etc. The optic character of the jarosite noticably changes with its composition and all type of transition is possible. This makes its identification difficult, particularly in association with hydrous iron oxides.

The grain size of the jarosite ranges from three to 200 microns.

OPAQUE MINERALS are present in noticably lesser amount than the transparent minerals.

Hydrous Iron and Manganese Oxides predominate among the opaque minerals. They occur in two distinct types: (1) discrete, solid grains with smooth or porous surface, and (2) diffuse impregnation in foreign host minerals.

Goethite, Limonite group, todorokite, nsutite etc. belong to the first group. They appear in well delineated solid grains, disseminated among the transparent minerals. A large portion of the hydrous iron oxides seem to be alteration products of preexistent pyrite. The smaller portion of the hydrous iron oxides apparently are derived from magnetite-hematite and iron containing silicates. This latter mode of formation is applicable to the hydrous manganese oxides (todorokite, nsutite).

The second type of occurrence of the hydrous iron and manganese oxides are very wide spread in the samples. The circulating surface water carries ample amount of iron and manganese. This water soaks (impregnates) the surrounding soft minerals or seeps through cracks and fractures and when the physical-chemical conditions are favorable it precipitates fine flakes of iron and manganese compounds. These give a yellow-brown-black color to the host minerals or they coat them with a very thin film of the above dark color. Naturally the circulating water helps to decompose minerals which may carry other elements, such as copper, lead, zinc, silver etc., besides iron and manganese.

These elements may co-precipitate with the hydrous iron and manganese oxides, thus the yellow brown impregnation (fine iron flakes) and also the discrete minerals, goethite, limonite group etc. may carry silver, copper, lead etc. as solid solution.

The grain size of the discrete hydrous iron manganese oxides varies between four and 600 microns. The size determination of the iron-manganese impregnation is almost impossible due to their diffuse nature.

Sulfide minerals are present in the samples but only in trace amounts.

Pyrite is the dominant trace sulfide in the samples. It is present in both, the hand samples and the screen fractions of the composite. The pyrite usually occurs in small idiomorphic crystals disseminated in the transparent matrix.

The grain size of the pyrite ranges from four to 100 microns.

Chalcopyrite is the second most abundant trace mineral among the opaques in the samples. It occurs as small, irregularly shaped grains dispersed in the transparent matrix.

The grain size of the chalcopyrite varies between two and 60 microns.

Chalcocite and Covellite are also present as sub-trace minerals in the observed samples. Their grain sizes range from two to 40 microns.

Sphalerite and Galena were also seen in the minus 48 mesh fraction of the composite. They are present in a few free grains.

Their grain sizes vary between eight and 80 microns.

Rutile is a frequent minor oxide mineral in the samples. It occurs in small, disseminated grains or grain aggregates usually associated with quartz and mica. The rutile grains show light yellow internal reflection a sign of low iron content.

The grain size of the rutile ranges from five to 60 microns. The aggregate size may reach 120 microns.

Plattnerite (PbO_2) was discovered in the first hand sample. It occurs in medium size, strongly anisotropic grains. Since the deposit carries a number of oxide-type lead minerals the presence of the plattnerite is not surprising.

The grain size of the plattnerite varies between four and 100 microns.

No silver mineral was seen in the observed sample, which does not mean that they are not present.

DISCUSSION.

1. The received samples are typical of the oxidation zone of a lead-zinc replacement deposit. The microscopic examination of the screen fractions of the composite indicates, that more than half of the material is waste gangue and only less than a third of the total amount of the minerals belong to the economically valuable group.

2. It seems that the zinc minerals dominate among the economically valuable components. Willemite and hemimorphite (both silicates of zinc) are the major zinc carriers in the samples followed by smithsonite, aurichalcite, mottramite and sub-trace sphalerite. The presence of the sphalerite has a genetical significance which points toward the original source of the zinc in this deposit.

3. Lead minerals are second in sequence. Cerussite is the dominant lead mineral, followed by mimetite (perhaps pyromorphite and wulfenite), plattnerite and galena. Most of these minerals are oxidation products of a hypogene sulfide which in this case, obviously is the galena. Unfortunately only a few grains of galena are present in the composite (which are free of any inclusions). Thus it can not be stated that the galena is a silver carrier.

4. Copper minerals are minor but fairly frequent components in the composite. Malachite seems to be the major copper mineral with some chrysocolla, aurichalcite (which also contains Zn) and chalcopyrite. Again, the occurrence of the chalcopyrite shows the hypogene source of copper in the deposit.

5. Since no discrete silver mineral was found in the samples but the assay shows almost four ounce of Ag, it can be postulated that the silver is present as a solid solution in some of the oxide minerals. The most likely hosts for the silver are the hydrous iron and manganese oxides. The silver has some affinity, particularly to the manganese oxides. The observed samples and composite represent the oxidation zone of the deposit, thus it is possible that the circulating surface water, which is partially responsible for the decomposition of the original sulfides, carried some silver also. This silver could, perhaps, coprecipitate with the hydrous iron and manganese oxides, which,on the other hand, are coating or impregnating the transparent host minerals, among them the zinc, lead, copper silicates, carbonates, vanadates etc.

Thus the recovery of the valuable elements (Ag, Zn, Pb, Cu) is impaired by the hydrous iron oxides, in any applicable metallurgical process.

6. It can be assumed that in the depth the original sulfide veins or veinlets (containing sphalerite, galena, chalcopyrite, tetrahedrite etc.) still exist which might represent a recoverable ore. This naturally can be ascertained and evaluated only by diamond drilling.

This assumption is based on the persistent presence of sulfide in the sample and the hydrous iron oxide pseudomorphs after pyrite, which indicate that there was a preexistent sulfide mineralization (vein forming and disseminated) in the deposit.

Tables of volumetric percent distribution of transparent and opaque minerals in the observed samples, are appended.

László Dudás

TABLE I.

Volumetric Percent Distribution of the Transparent Mineral Components in Hand Samples and Composites from the Dumps of the Total Wreck Mine, Pima Co., Arizona.

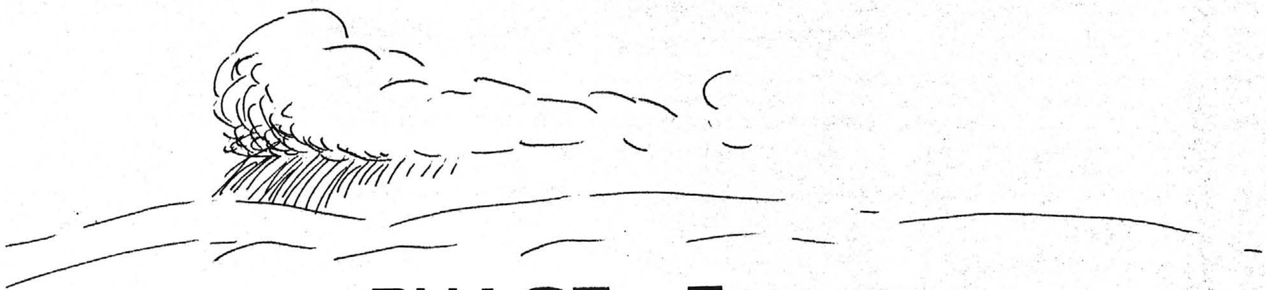
Names of Minerals	Hand Samples 1	2	3	4	Composite +48M	-48M
Calcite free	89		5	15	8	20
" locked w. quartz					3	tr
" " " chlorite, serpentine					1	2
" " " cerussite						tr
" " " hemimorphite					1	tr
" " " smithsonite					2	tr
" " " hydrous Fe oxides					10	8
Quartz free	1	5	30	75	6	12
" locked w. calcite					4	tr
" " " chlorite, serpentine					2	tr
" " " cerussite						
" " " smithsonite						
" " " hemimorphite					2	tr
" " " malachite etc.					1	
" " " hydrous Fe oxides					9	5
Chlorite-Serpentine free		25		10	5	4
" locked w. calcite					tr	
" " " quartz					1	
" " " cerussite						
" " " smithsonite						
" " " malachite						
" " " hemimorphite						
" " " hydrous Fe oxides					3	2
Cerussite free		20				5
" locked w. calcite			10		tr	
" " " quartz					tr	
" " " smithsonite						
" " " malachite						
" " " hydrous Fe oxides					tr	3
Smithsonite		15	30		2	
Hemimorphite					2	4
Willemite					5	6
Malachite, Chrysocolla, Aurichalcite		20			1	2
Mottramite					tr	1
Mimetite					1	1
Jarosite					3	4
Hydrous Iron Oxides impregnation						
" " " " calcite	10	15	25		12	12
" " " " quartz					7	4
" " " " malachite					6	3
" " " " cerussite					tr	1
Total	100	100	100	100	100	100

TABLE II.

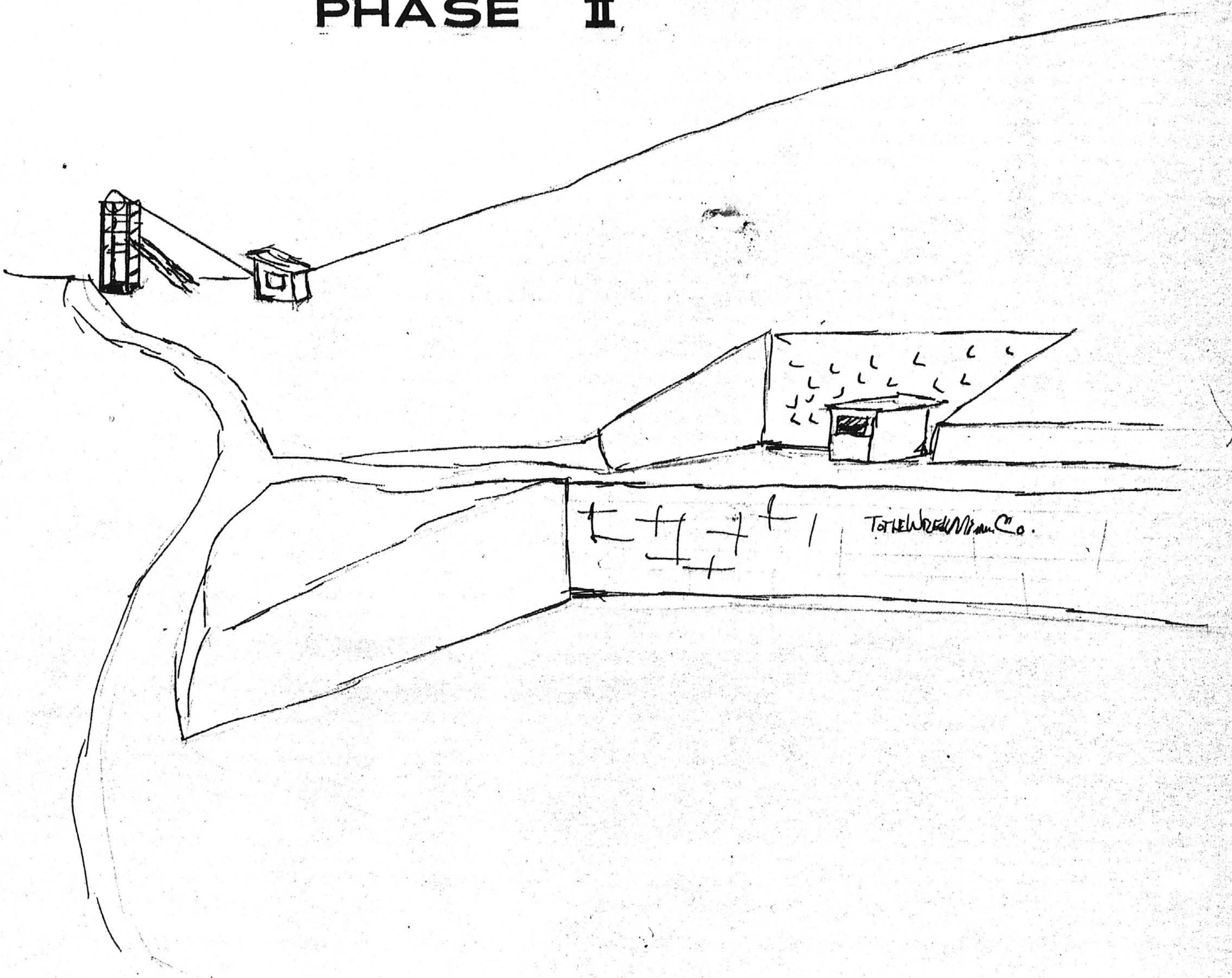
Volumetric Percent Distribution of Opaque Minerals in Hand Samples and Composite from the Dumps of the Total Wreck Mine, Pima Co., Arizona

Names of Minerals	Hand Samples 1	2	Composites +48	-48
Transparent gangue	74	78	12	5
" impregn. w. hydrous Fe oxid.			35	40
" locked w. hydrous Fe oxides			20	8
" " " pyrite			1	2
" " " chalcopyrite			tr	tr
" " " galena			tr	tr
" " " sphalerite			1	
" " " hydrous Mn oxides			6	3
" " " rutile			3	1
Hydrous Iron oxides (goethite etc.)	15	10	10	20
" locked w. transparent gangue			3	6
Hydrous manganese oxides	5	8	5	8
" locked w. transparent gangue			2	3
Pyrite	tr	tr	tr	1
Chalcopyrite	tr		tr	tr
Chalcocite -Covellite				tr
Galena				tr
Sphalerite				tr
Plattnerite	3			tr
Rutile	3	4	2	3
Total	100	100	100	100

Total Wreck
D. Wilkins
ca 1970



PHASE II



Ore Bodies

Ore body #1 (drawing A-1000) averages (from seven samples taken on three sides of the block) 5.8% lead, 8.5 oz. per ton silver, .025 oz. per ton gold and 1.11% copper. This gives approximately 7% metals per ton, most of which is lead. Of a 1000 ton block of material that gives something on the order of 70 tons of metals, 60 tons of which are lead valued at slightly more than $12,000 net value. It also gives about 8500 oz. of silver which at $1.50 per ounce, net value yields some $12,750, about 10 tons of copper which at 25¢ a pound net valued at $5000, probably most of which is non-recoverable as with some 25-30 ounces of gold. Nevertheless, in this small block alone there at least appears to be some $25 to $30,000 net value in metals. Similar situations occur along vein #2 in the Vail Tunnel and should more than likely occur in vein #1 which is yet to be seen.

Possible Methods To Use

In area A, the ore lies in a bed 5 feet thick, dipping to the southeast about 35°, the ore being similar to the jelly in a sandwich. The most likely method to remove this material is room and pillar, robbing pillars and retreating. This is accomplished by driving a horizontal drift through the bed (500 foot level main crosscut) then following the bed upwards with a 4' x 5' raise on about 15' centers such as looking in doors down a hall. After a series of raises have been driven then connecting them parallel to the haulage drift at either regular or irregular intervals, and leaving pillars to protect the haulage drift. When the limits of the ore body have been reached, starting from the farthest corner from any access raise or drift, shooting out the pillars, letting the back cave, and retreating. 90% extraction can be realized. On vein #1 or vein #2 (drawing A-1001) there is a strong hanging wall and a strong foot wall. We can use a shrink stope or cut and fill method with the holtage drift either driven in the vein or in the foot wall, this being decided by the grade of ore and the quantity.

Types of Exploration Available

Exploration methods applicable to this situation are drilling, core drilling, pneumatic long hole drilling, rotary drilling, drifting, and shaft sinking. Core drilling, as I've previously said, is very expensive if done by contractor and equipment is expensive if done by Total Wreck Mining Company. There are two types of core drilling that we can use--surface and underground coring. Surface core drilling would probably be a fairly inexpensive unit. Underground core drilling, on the other hand, when coupled with pneumatically run drilling equipment, pumps, etc., to the extent of a 600 CFM, and the added cost of a large compressor would appear to be prohibitive. So far we have seen that there is a large quantity of mineralized material and that the hill probably will not show any large high grade bodies. Therefore, I believe we can get satisfactory results using a large bore drifter (instead of a core drill) which can be used on the surface and underground. Also with a pneumatic drill we will have less cost in drill sites, more ease in set-up and handling, quicker results by a factor of at least five, and in case of an accident such as sticking a string of tools, will be less of a lose. Also there are less maintenance worries.

Shaft sinking, a very expensive operation, appears to be too expensive for this type of exploration. On the other hand, drifting would be a method to be used only in certain instances, but would have irrefutable results. Although it is expensive, I believe after a crew is trained which would require only a short time, it would be less expensive than core drilling.

Therefore drilling and drifting appear to be the only feasible methods for exploration.

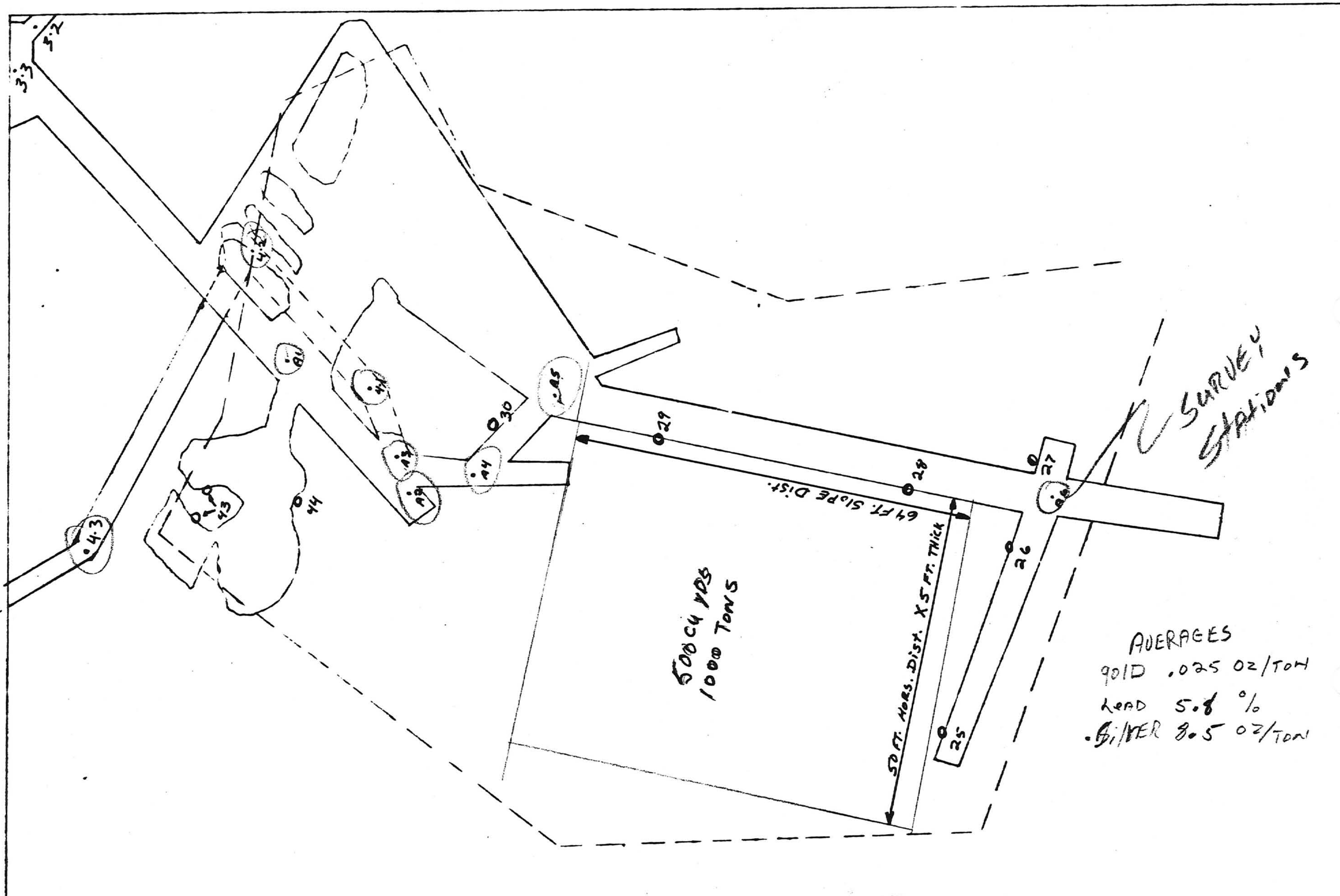
Proposed Exploration Work

Raises: Raise station #1 at the top of the east access raise follows a fracture driving back parallel with veins 1 and 2. Mineralization is very light but deposits seem to enlarge with depth. Long hole drilling is indicated. Station 3-6 exploration raise, a vertical exploration raise at station 3-6, or an inclined raise collared somewhere between 3-6 and 3-7 in the mineralized planes shown in figure one page 11 of the August report should be approximately 40' in depth ending in the shape of a T, with the drift running N 45° E and S 45° W from the end of it for approximately 20 feet in either direction. Material collected from this raise will be tested for possible milling ore. Raise station #8, some 20 feet south of survey station 4-8, is apparently some 10 to 15' below the bedding plane. Ore bedding planes show mineralization in Figure 1 of the August report only at a lower elevation. I believe it would be advantageous to drive a 20' vertical 4 x 4 raise, thus crossing into the mineralized planes and proving whether or not mineralization exists. Raise station #9, some 40' farther south in the drift shows a small seam of lead ore with 5% copper in a lightly mineralized bedding plane. It appears to me that long-hole drilling would prove to be the best form of exploration on such a small scale.

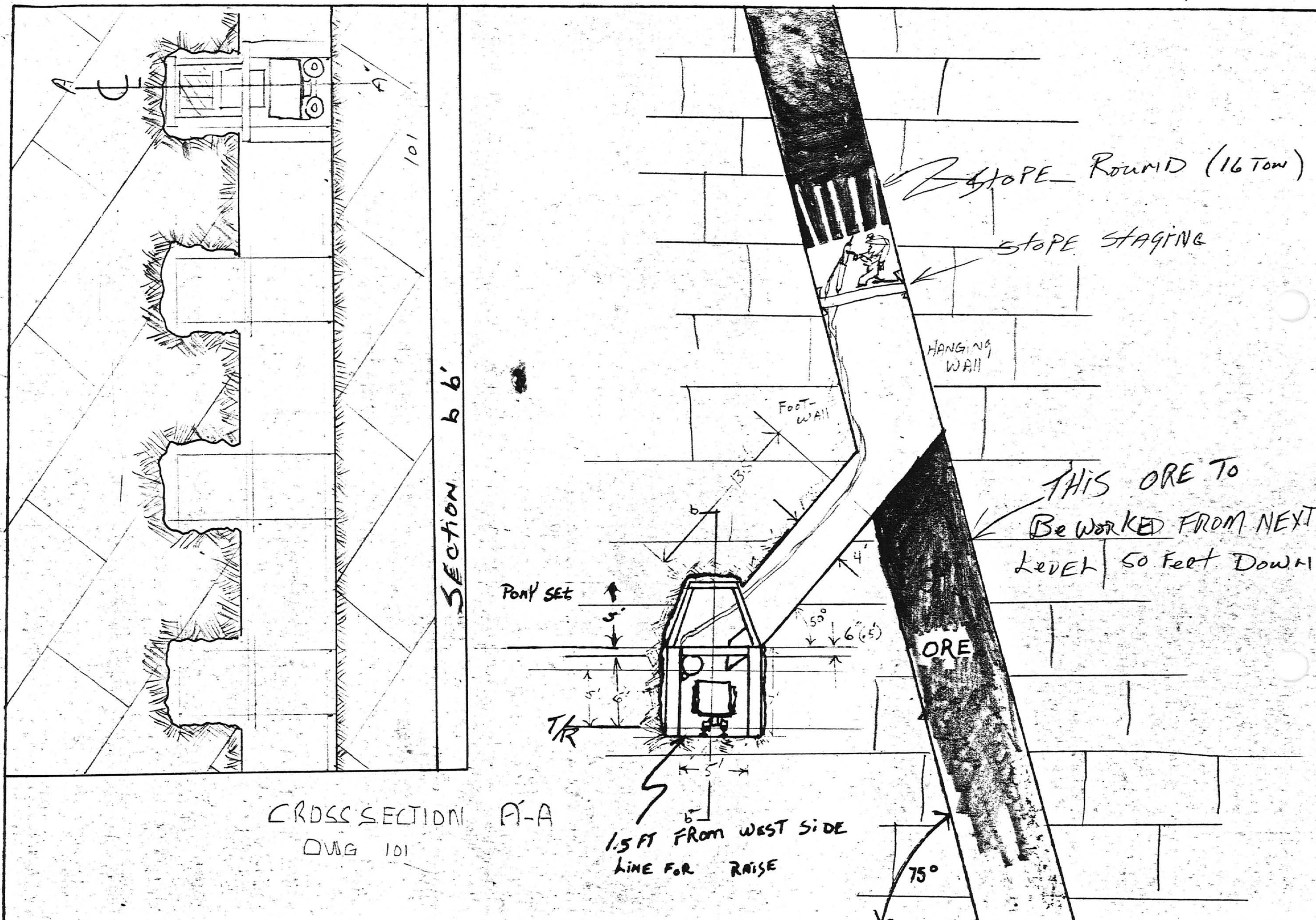
500' level main crosscut (MC), a drift collared at station V-2, running northeasterly to station A-6 is approximately 200' in length. Its dimensions are 7' x 7'. The purpose for which is to explore, give access to lower area A and to ventilate area A. Approximately 90' northwest of the collar, the new drift should intersect the #1 vein. Mineralization should be 4 to 8 feet in width running from near the surface to depths unknown. The #1 vein haulage drift (500' level) would probably be driven only after proving the existance of ore along vein #1 (a cross section of which is included in drawing A-1001), and after all other exploration work is finished.

Day 1	Lay rail Vail Tunnel, put in air and water
Day 2	Begin 500 foot level MXC
Day 30	Finish 500' MXC---at this point decision made whether to start mining, abandon or continue exploration
Day 31	Begin salvage air line and water
Day 33	Set up compressor at mill adit
Day 35	Begin raise at station 3-6
Day 36	Begin drilling raise station #1
Day 40	Begin drilling raise station #9
Day 48	Finish raise 3-6, finish raise #9
Day 50	Start raise station #8

QUANT.	DESCRIPTION	USED	NEW	RENT (MONTH)
1	Emco 12 B ROCKER SHOVEL	$1850.00		
2	THORE 35 LB. JACKLEG DRILLS	700.00		
2	30 FT 1 INCH AIR HOSE		$70.00	
5	1 TON 18" GAUGE ORE CARS	400.00		
	2½ TONS 8 LB RAIL & HARD WARE	250.00		
1	350 CFM COMPRESSOR	3500.00		
8	50' GARDEN HOSE		$58.64	
@25¢/FT	450' 2" VICDRALIC AIR PIPE & FITTINGS	112.50 113	300.00	
1	2½ hP GAS ENGINE	45.00	70.00	
1	DRUM TYPE COOLER (4000 CFM)	20.00		
1	4 INCH DRIFER ON FEED	1500.00		
10	10 FT. THREDED STEELS & SLEVES		500.00	
5	2½ in. CROSS BITS		250.00	
4	3-4 FT 7/8" STEELS (JACKLEG)		70.00	
4	6 FT 7/8" " "		100.00	
	MISC. FITTINGS WATER & AIR (JACKLEG)		50.00	
1	PU TRUCK	1600.00		
1	PU TRUCK	500.00		
10	55 GAL. BARRELS	35.00		
2	BARREL PUMPS	50.00		
	MISC. TOOLS, ROPE, CHAIN	200.00	200	
	TOTAL MACHINERY →	11742.00		
	FUEL & MAINT. FOR TRUCKS		150.00/mo	X 2 mos
	FUEL & MAINT FOR MACHINERY		200.00/mo	" "
	TIMBER, BOLTS, WIRE		200.00/mo	" "
30	POWDER - 40-60% AMOGEL 50 LBS		400.00	
30	500 FT ROLLS PRIMERCORD		400.00	
5	BOXES No. BLASTING CAPS		25.00	
5	PACKS FUSE		25.00	
	500 FT. 6 in. VENT. PIPE.		225.00	
	TOTAL SUPPLYS →		2175.00	
	LABOR			
	MINER No 1		450.00/mo	X 2 mos
	MUCKER		400.00/mo	X " "
(Full Time)	D. WILKINS [LIVING EXPENCE]		300.00/mo	X " "
	TOTAL LABOR →		2300.00	+ WORKMAN COMP
	ASSEYING & MILL TESTING		1500.00	
	GRAND TOTAL	$17,717.00 ←		

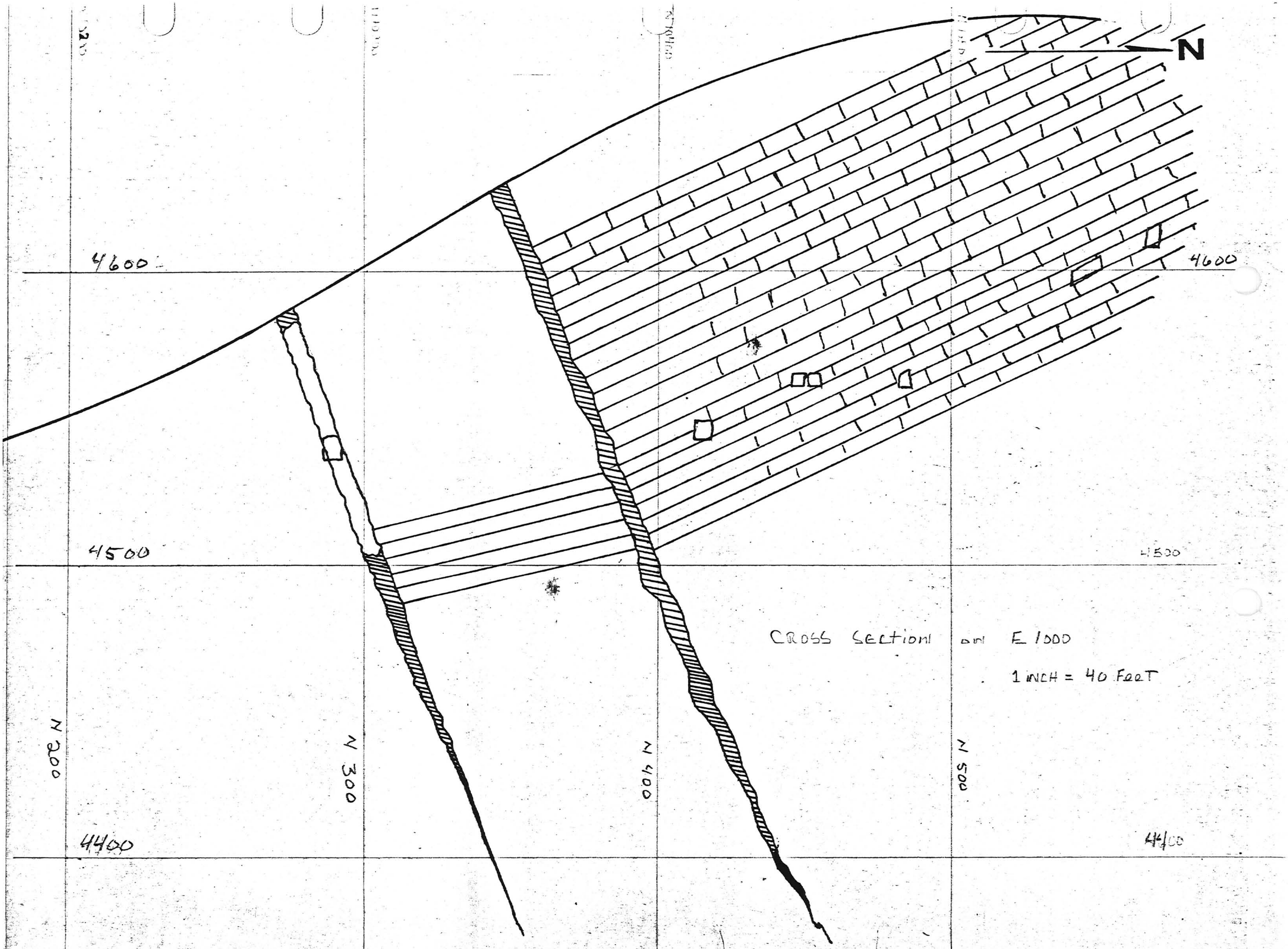


Scale 0 25 50	Description	No A-1007	By	Date



CROSS SECTION A-A
DWG 101

STANDARD PONY SET AND TRANSFER RAISE	PANEL DRIFT VEIN No 1(S) Looking North	JAN. 8 · 1970
		DRAWN by Wilkins


N
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1 INCH = 40 FeeT

THE TOTAL WRECK
ARIZONA'S FORGOTTEN "BONANZA" MINE

by

*GREGORY P. DOWELL**

[redacted]

* This article is drawn from a chapter in the author's master's thesis, "History of the Empire Ranch," completed at the University of Arizona in 1978.

Total Wreck Mine

Pima County, Arizona

<u>Location and Access:</u>

The Total Wreck Mine is located in Section 3, Township 18 South, Range 17 East, in Pima County, Arizona. It is at the approximate center of the USGS Empire Mountains Quadrangle. At the present time, the best access is by new dirt roads that are not shown on this 1958 map. This route is detailed at the end of this report for anyone wishing to find the property. The trip is slightly over an hour by car from Tucson.

<u>History and Ownership:</u>

The Total Wreck Mine workings are covered by one patented claim owned by Mr. J. V. Wilkinson of Temecula, Calif. This claim has been in his family since his grandfather originally started the mine. In November of 1976, the Solo 1 to 11 Group was staked by the writer adjoining and surrounding the patented claim to cover possible extensions of the ore zone. This was done in cooperation with Mr. Wilkinson. The required location drilling was completed in February of 1977, with the claims and the location work being recorded in Tucson and with the Bureau of Land Management.

Section 3, where the claims are located, is divided between private and State of Arizona ownership of the surface rights, with the mineral rights being retained by the Federal Government. As a result, it was open to location under the Federal Mining Laws at the time of staking.

The mine was discovered in 1880, and went into production with a 70 ton stamp mill in 1882. In the initial two years of operation, there is a recorded production of about 500,000 ounces of silver, from ores averaging over 60 ounces to the ton. After the initial operation, leasers at various times have produced an additional half million ounces of silver with some lead recovery. During World War 1 the mine was operated for about 18 months for its wulfenite content, occurring in the lower levels. This operation ceased when the market for wulfenite collapsed.

Investigation of Oxide Ores:

There are some headings in the mine workings that have fairly good oxide ore, averaging about 5% Zinc, 4% Lead and 5 or 6 ounces of silver. In addition to this, there are over 50,000 tons of dump ore averaging 2.5% lead, 2.5% zinc and 4 ounces of silver. Tests were made by Mountain States Engineers to see if recovery of these values was feasible.

Flotation, Gravity Concentration and Cyanidation tests were made, but recovery was not good, except for the gravity concentration of lead. However, only 45% of the silver was recovered with the lead.

A Mineralogical examination of the ore by Mountain States showed that the zinc was almost entirely in the form of the silicates willemite and hemimorphite, and that there were no visible silver minerals. The mineralogist postulated that the silver is present as a solid solution in some of the oxide minerals, probably in the hydrous iron oxides.

In the cyanidation test for recovery of silver, ore ground to 100 mesh was cyanided for 72 hours, with the extraction of about 62% of the silver. Reagent consumption was 5.4 pounds of NaCN and 7 pounds of lime per ton.

The conclusion drawn from these tests was that a simple method for the recovery of the silver was not practical, and the probable volume of material available would not warrant the cost of the plant that would be required to recover the lead, zinc and silver.

Traces of pyrite, chalcopyrite, galena and sphalerite were seen in the ore under the microscope, which suggests the original composition of the sulphide ore. The presumed downward extension of the ore zone below the water table into the primary sulphide zone is one of several targets for recoverable ores at the prospect.

General Geology:

The exposed country rock in the mine area is chiefly interbedded limestones and quartzites, with a thin series of red mudstones just above the mineralized horizon. These were thought to be of the Permian Concha by the USGS (1915), but there is some doubt about this. Perry believes that they are younger.

The main structural feature of the area is a low angle overthrust fault just east of the mine workings, dipping to the east. The hanging wall of this thrust is composed of interbedded quartzites, with limestone totally absent.

The fault can be traced by the 40 degree change in strike of the beds on the hanging and footwall sides. The footwall sediments generally strike N 60 E, while the hanging wall quatzites strike N 20 E. With the exception of small dikes, no igneous rocks are exposed in the mine area.

Structure and Ore Deposits:

The main ore deposit is a replacement of a limestone bed. In places, the ore horizon reached thirty feet or more in thickness, although the average was probably eight to ten feet. It strikes N 60 E and dips 35 degrees to the southeast. It has been followed from the outcrop for 500 feet down the dip, although the deepest workings are only 90 feet below the surface due to the favorable topography.

Two other mineralized horizons were encountered. A copper-bearing horizon about 30 feet above the main ore zone, and another about 50 feet below it. The latter is only exposed in the "Proust Shaft". Some mining was attempted here, but the bed was relatively narrow at this point. The copper horizon was not mined. It is exposed on the surface and the upper tunnel, and it is probably this same horizon exposed in the raise from the Vail Tunnel. As well as copper, it carries values in lead and silver.

Probably the most significant structural feature exposed in the mine workings is the Vail Vein-Fault in the Vail Adit. This fault was mined across a width of six to ten feet. It strikes N 70 W and dips about 70 degrees to the northeast. The trace of this fault and mineralization can be seen at one or two points on the surface and in the workings just above the Mill Adit Level, near the main incline. One other N 70 W fault is to be seen by the collar of the first winze on the Mill Adit Level. This fault is not mineralized at this point, but ore begins in the mineralized bed on the footwall side of the fault.

The best ore in the mine appears to have been controlled by the N 70 W faults. Mineralization was both up and down dip in the favorable horizons on either side of the main Vail Fault for a distance of several hundred feet, with the best widths being within 150 feet or so on either side of it. Mining on the Vail Fault itself was chiefly from the adit level to the surface, with down-dip exploration being limited to about 30 feet below the level.

A raise at the end of the adit exposes good mineralization, probably localized by the crossing of the Vail Fault with a strong N 65 E fault. However, the mineralized exposure at the head of the raise is approximately on the downward projection of the copper-bearing horizon exposed in the upper workings.

Near the southwest corner of Solo Nº 7 claim, a shaft and several open cuts expose a mineralized bed of limestone about six feet thick, similar in character to the main Total Wreck ore zone. However, little is known about this showing, as the trenches are badly sloughed and the shaft inaccessible. There is probably a major fault in the immediate area of these workings, as there is a notable change in strike and dip of the surrounding limestones just east of the prospect.

On the north side of the hill where the Total Wreck is located, interbedded limestones and quartzites are exposed, as shown on the geologic map. The overthrust fault passes near the foot of the hill. There are two limestone horizons exposed on the north side of the hill that look especially favorable as hosts to other possible mineralized beds. The higher bed has a considerable amount of silicification in the form of small quartz veinlets near its contact with the overlying quartzite. The other is a fifty foot thick limestone horizon, well iron-stained, exposed just above the road on the north side of the hill. At one point a prospect pit was sunk on this bed. These two beds are approximately 500 and 750 feet respectively down section from the Total Wreck Horizon.

About a mile east of the Total Wreck, in Sections 1 & 2, a series of shafts and trenches expose mineralized limestone beds very similar in appearance to the Total Wreck ore, except more siliceous. A grab sample of this material from the dumps ran 5 ounces of silver. It occurs in a similar series of interbedded limestone and quartzite as the Total Wreck.

West of the Total Wreck, several small orebodies were mined along the contacts of limestone and quartzite beds, similar geologically to the setting at the Total Wreck. Production figures for these properties are incomplete, but it is obvious from the dumps that the workings are not as extensive as the Total Wreck, so that it is presumed that production, as well, was considerably less.

Conclusions:

From the testing done by Mountain States Engineers, it appears that further work on the exposed oxide ores at the Total Wreck is not warranted. However, as mineralization continues to be strong in the lower workings, it is very likely that this mineralization will continue down dip below the water table, and a good zone of sulphide ore could be encountered.

Probably the best exploration target, however, will be drilling across the stratigraphic sequence, testing some of the lower limestone beds. About 800 feet of this sequence is exposed on the north side of the hill, at which point the unit is overlain by the quartzites on the hanging wall side of the overthrust fault. But, as the fault dips away from the mineralized area at a flat angle, it does not interrupt the sedimentary sequence at depth. By the same token, the overthrust fault would not cut off any extension of the Total Wreck zone which might exist to the east of the present exposures in the mine workings.

Respectfully Submitted,

Juan Muñoz

Juan Muñoz

Seattle, Wash.
August 31, 1977

RORIPAUGH
REPORT
1986

TOTAL WRECK EXTENSION SUBMITTAL

INTRODUCTION

The Total Wreck prospect is located in the Empire mining district, Pima County, Arizona, approximately thirty miles southeast of Tucson. Travel time is about one hour via I-10 and six miles of 4-wheel drive roads.

Silver mining at the Total Wreck mine commenced in 1881 and ended in 1911; however, the majority of the 500,000 ounces of silver production was from 1882 to 1884. After the initial operation, leasers at various times have produced and additional half million ounces of silver with some lead recovery. During World War I the mine was operated for about eightteen months for its wulfenite content. Mines in the Hilton, or Copper Camp, three miles to the southwest, were active up the middle Fifties where copper, lead, zinc, silver ores were mined from veins in a Laramide stock, skarn mineralization at the contact of the stock and Paleozoic sediments, fissures in quartzites and replacement deposits in the Paleozoic limestone, the latter being the most prolific.

The Total Wreck prospect includes two spacially separate silver-gold prospects: one prospect in Cretaceous Bisbee Formation adjoining the Total Wreck; and, the other is approximately one and a half miles to the east in silicified Permian limestone known as the East Zone.

This report summarizes the general geology of the Total Wreck mine area and describes the two prospect separately.

GEOLOGY

The Empire Mountains are composed of a number of thrust blocks which consists of Paleozoic sediments. The fault outcrops on the western flank of the range and dips to the east. East-west tear faults are fairly common.

The Total Wreck area is tectonically above the northeast trending thrust fault by some 1,000 - 2,000 feet, however, the writer feels that more are present in the overlying sequence of Paleozoic rocks. Immediately east of the Total Wreck mine a thin flat fault dips easterly and has been weakly silicified. This structure can be traced southerly along the eastern flank of the range and extends through our claim block. It can be seen in a number of prospect pits. The low angle faults in the area typically dip S.E. thirty to forty-five degrees.

Finnell's open file USGS map of the area shows a complete stratigraphic sequence in the Total Wreck area with the Rainvalley being partially covered by Cretaceous Glance conglomerate.

The majority of the production at the Total Wreck came from a N60°E 35° southeast replaced sheared limestone bed. The mine is a major fault intersection of two east-west high angle faults, a N70°W 70° northeast, and a N30°E 85° southeast. There has been some replacement of the limestone but the writer feels that structural preparation has played the dominant role in mineralization.

TOTAL WRECK EXTENSION

Introduction: This prospect consists of eleven unpatented mining claims that are contiguous and surround the Total Wreck patented claim. The former owner, Mr. J. V. Wilkinson, deeded the property to the University of Arizona in 1986. Jim Poulter and Ray Roripaugh located the Total Wreck Extension group in the Spring of 1986.

Section 3, where the claims are located, is divided between private and State of Arizona ownership of the surface rights, with the mineral rights being retained by the Federal Government. As a result, it was open to location under the Federal Mining Laws. Both of our anomalies are on State surface and we expect no conflict in that direction.

Approximately one hundred samples were taken and two anomalies were generated in the overlying Bisbee Formation. Currently the anomalies are approximately 500 feet by 500 feet and assay greater than 1/2 ounce Ag. per ton. The samples were fire assayed by Jacobs Assay in Tucson, Arizona, and A.A. was used to detect copper, lead, zinc and barium.

Barium seemed to correlate very well with silver values. The favorable stratigraphy would begin at the Glance Conglomerate some 200-500 feet below the outcrop. Both anomalies are on, or near, high angle east-west structures and are associated with weak drussy quartz veining.

In the early 1980's Day Mines drilled a few holes immediately southeast of the Total Wreck presumably exploring the down dip mineralized beds mined at the Total Wreck. Apparently the work was not encouraging, however, the holes are not located on geochemical anomalies.

ALTERATION AND MINERALIZATION

All the ores mined at the Total Wreck were oxidized, ~~The~~ with principal ore minerals ~~were~~ being ceragyrite, cerussite, wulfenite, malachite, azurite, and chrysocolla. A small jasperoid is developed at the surface and textures ~~show~~ suggest that at least some of the silica replaced the Rainvally limestone. Quartz veinlets exhibiting comb textures cut sediments and are particularly well developed in thin quartzite units in the mine area. The Glance Conglomerate is pervasively silicified in a small area near the eastern boundary of the patented claim. No calc-silicate minerals are present suggesting a low temperature and pressure realm. This is consistent with the manto-replacement deposits in Mexico where the upper massive sulfide manto chimney ores give way to skarn mineralization at depth.

The anomalies on the Total Wreck Extension show minor bleaching as well as weak silicification along drussy quartz fractures. Some of the silica may be chalcedonic. This type of silica was noted at the Total Wreck and also on the East Zone prospect.

Gold values of up to .13 ounces per ton are always associated with silicified rocks while the supergene silver minerals occur along bedding planes and fracture zones, particularly near quartzite beds.

Munoz states that "the main ore horizon in the Total Wreck reached thirty feet or more in thickness and averages about eight to ten feet. This bed was mined down dip from 500 feet although the deepest workings were only 90 feet below the surface due to favorable topography." Other units are mineralized; one about 30 feet above the main zone and another 50 feet below it. Thus, we have an interval of almost 100 feet which has been mineralized. Since the deposit is a dip-slope, it opens the door for some open pit production.

<u>TOTAL WRECK METALLURY - OXIDE ORES</u>

There are some heading in the mine workings that have oxide ore averaging about 5% zinc, 4% lead and 7 ounces of silver. In addition to this, there are over 50,000 tons of dump ore averaging 2.5% lead, 2.5% zinc, and 4 ounces of silver. (Mountain States, private report). Metallurgical tests by Mountain States Engineers using flotation, gravity and cyanidation were not good, except for the gravity concentration of lead. However, only 45% of the silver was recovered with the lead.

In the cyanidation test for recovery of silver, ore ground to one hundred mesh was cyanided for seventy-two hours with the extraction of about 62% of the silver. Reagent consumption was 5.4 pounds of NaCN and 7 pounds of lime per ton.

Mountain States concluded that no simple method for the recovery of the silver existed. However, the writer feels that their sample was not representative of the upper workings where most of the supergene silver is located.

Samples from surface exposures show a higher silver to copper ratio than most of the dump material which came from below the 200 foot level. For example, surface samples assayed:

Au. Oz./T	Ag. Oz./T	Cu. PPM	True Thickness	
0.005	4.15	565	5.0'	H.W. of replaced L.S. unit
Tr.	0.80	200	20.0'	F.W. of replaced L.S.
0.025	6.50	2600	7.0'	Vail Fault
0.005	79.60	3400	0.5'	Replaced L.S. bed
0.005	1.00	70	10.0'	Cretaceous Bisbee FM

And conversely, three high grade samples from the Milt adit dump assayed:

Au. Oz./T	Ag. Oz./T	Cu. %
0.006	3.34	9.78
Nil	0.40	29.35
0.012	12.33	10.75

Traces of pyrite, chalcopyrite, galena and sphalerite were seen in the ore under the microscope which suggests the original composition of the sulphide ore. The presumed downward extension of the ore zone below the water table into the primary sulphide zone is one of several targets for recoverable ores at the prospect.

EXPLORATION AND RECOMMENDATIONS

Structural interpretation of the faults show a northeast rake to the intersections, and on this projection approximately 1000 feet northeast of the Total Wreck workings, we have our best anomally still open to the northeast.

	Au. Oz./T	Ag. Oz./T	Cu. PPM	Pb. PPM	Zn. PPM
513	Tr.	0.40	92	72	310
514	Tr.	0.60	218	212	850
515	Tr.	0.15	86	68	340
516	Tr.	0.50	130	52	424
518	0.005	0.25	66	28	220
519	0.005	1.00	70	38	200
520	Tr.	0.70	306	588	1700
521	Tr.	0.75	86	24	230

Therefore, it seems as though the geochemical survey will work and it should be continued to follow up areas of interest. The anomalous areas should be drilled to at least the glance - Rainvalley contact estimated to be 200 to 500 feet. Deeper targets exist, however, they would be too deep to open pit. The low angle pre-ore faults may add to the interest.

EAST ZONE

The East Zone consists of three unpatented claims on land administered by the Bureau of Land Management. The Rainvalley is silicified over a 100 foot width, however, ore grade mineralization appears to be narrow. The mineralized zone is another slope dip to the southeast.

Our best gold sample came from a narrow six inch quartz-sulphide cast veinlet on bedding:

Au.Oz./T	Ag.Oz./T	Cu.PPM	Pb.PPM	Zn.PPM	Width	
0.13	19.20	54	2000	750	.5'	
Tr.	0.70	85	350	335	20.0'	Footwall
.005	0.50	35	341	474	4.0'	Hangingwall

A thousand foot adit was driven under the above mineralization and cut a twenty foot high angle fault zone with many solution cavities. The host rock is limestone, either the Rainvalley or Concha. Approximately two hundred foot down section is the Scherrer quartzite. Since the quartzite always shows some fracture controlled quartz veining, it may be a productive host. At the Total Wreck the ore was on both the hangingwall and footwall of the quartzite beds.

THE DEAL

Both Mr. Poulter and I would like to lease-option our claims. We are open to any reasonable deal; particularly, with a reputable outfit. Front money will depend on whether we get any work out of the deal. We have a couple thousand dollars in claim staking and assays and we would furnish all of our data to date. We do not represent the University of Arizona, however, they have leased properties before in favorable terms.

Mr. Jim Poulter may be contacted in Tucson, Arizona, at 602-296-6486 regarding any questions you may have.

Respectfully submitted,

RAY RORIPAUGH

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To: Sandy Wilkinson/Juan Muñoz Project 701 8-26-85
From: Jim Minno, Metallurgist
Subject: Continued sampling and metallurgical testing of the Total Wreck main dump.

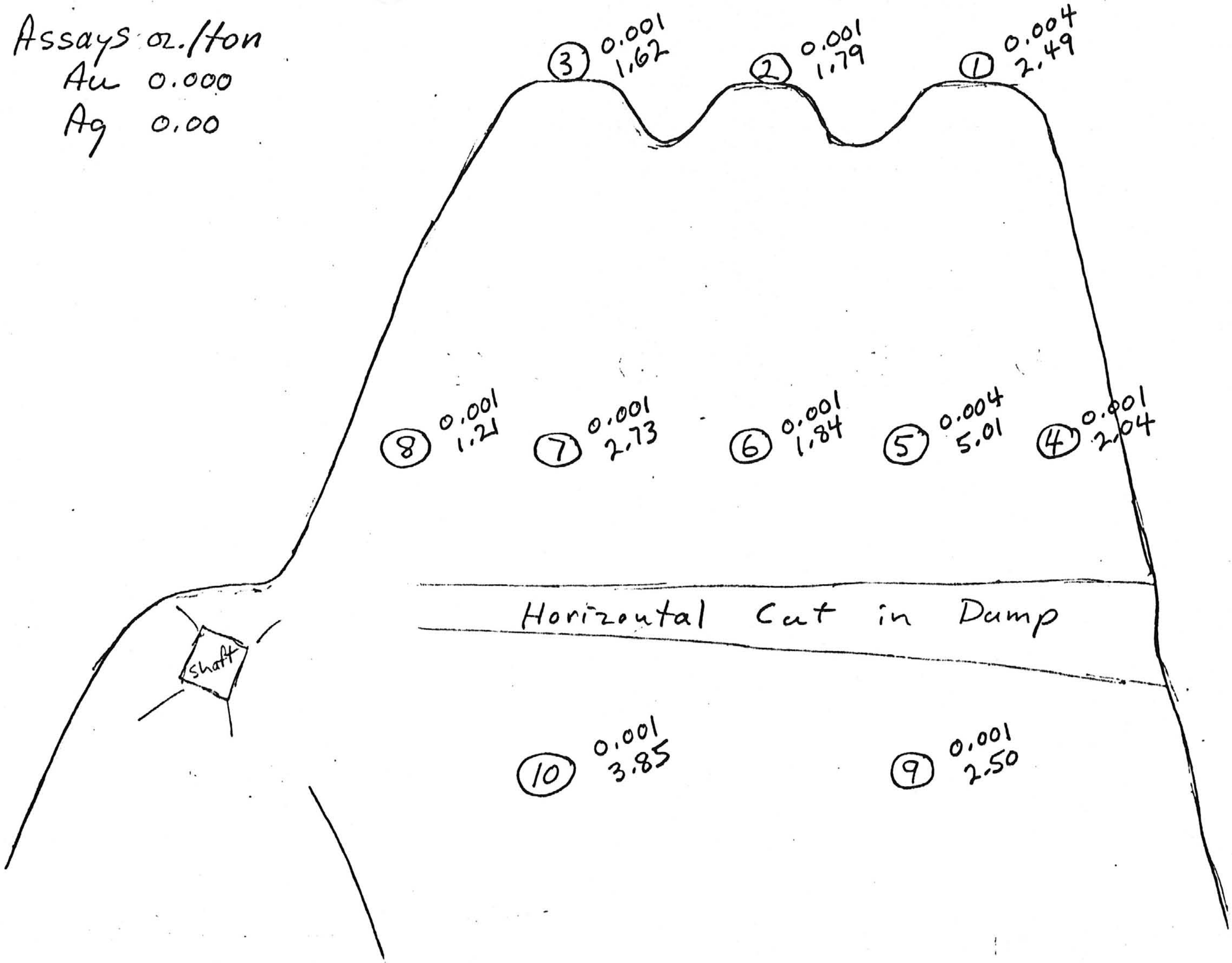
A sampling program of the Total Wreck main dump was undertaken in December, 1983. A total of ten (10) grab samples were taken from the top of the dump, accross the face of the dump approximately one third (1/3) of the way up from the bottom, and accross the face of the dump approximately two thirds (2/3) of the way up from the bottom. (See attached sketch).

Each sample was assayed separately and a composite of all ten (10) samples was made. A portion of the composite was assayed, another portion was saved, and the remainder of the composite was dry screened at 1", 1/2", 1/4", 10 mesh, and plus and minus 20 mesh. Each screen fraction was assayed separately. (See attached sample preparation flowsheet). Each progressively finer screen fraction assayed higher in silver content than the previous fraction ranging from a low of 1.43 oz./ton Ag at plus one inch to a high of 4.99 oz./ton silver at minus 20 mesh. (See attached dry screen assay analysis and metallurgical balance).

Metallurgical testing was limited to the relatively high grade minus 20 mesh fraction only. Cyanidation yielded a poor recovery of 51.9% Ag with relatively high reagent consumptions of 7.0 lbs./ton CaO and 7.2 lbs./ton NaCN. Hot ammonium thio sulfate leaching with oxidant and catalist reagents yielded a slightly better recovery of 58.9% Ag. Reagent additions were high, but typically most can be recycled. Since the amount of available reagents remaining in solution at termination of leaching were not analized, actual reagent consumptions could not be determined. I believe that reagent cost for cyanidation and ammonium thiosulfate leaching would be similar. (See attached metallurgical data sheets).

With relatively low silver recovery and high reagent consumption, and at the present low price of silver, the project does not appear to be economically feasible.

Rough Sketch of Dump and Sample Locations



Sample No.	Assays oz/ton Au	Ag
1	0.004	2.49
2	0.001	1.79
3	0.001	1.62
4	0.001	2.04
5	0.004	5.01
6	0.001	1.84
7	0.001	2.73
8	0.001	1.21
9	0.001	2.50
10	0.001	3.85
Avg.	0.002	2.51

Note: Samples were run of dump and weighed approximately 60 pounds each.

Sample Preparation Flowsheet

Treat each approximately 60 pound sample separately as follows:

Air dry
↓
Mix + Split (Cone + Quarter)

- 1/4 ↓ Crush to ±10 mesh
  ↓
  Mix + Split (Riffle)
  - ±500 grams ↓ Assay Au, Ag
  - Reject ↓ Save
- 1/2 ↓ to composite No. 1-10
  ↓
  Mix + Split (Cone + Quarter)
  - 1/8 ↓ Assay Au, Ag
  - 7/8 ↓ Dry screen @ 1" × 1/2" × 1/4" × 10 mesh × ±20 mesh
    ↓
    Assay each screen fraction separately for Au, Ag
    ↓
    See attached Dry Screen Assay Analysis
- 1/4 ↓ Save

Dry Screen Assay Analysis and Metallurgical Balance (Composite 1-10)

Screen Size	Weight Pounds	% wt.	Assays oz./ton Au	Assays oz./ton Ag	Content oz/ton Au	Content oz/ton Ag	% Dist Au	% Dist Ag
+1"	65.0	23.09	0.001	1.43	0.0002	0.330	20.0	13.0
-1" + 1/2"	58.5	20.78	0.001	1.97	0.0002	0.409	20.0	16.1
-1/2" + 1/4"	42.0	14.92	0.001	2.10	0.0001	0.313	10.0	12.3
-1/4" + 10m	51.0	18.12	0.001	2.31	0.0002	0.419	20.0	16.5
-10m + 20m	18.0	6.39	0.001	3.67	0.0001	0.235	10.0	9.3
-20 mesh	47.0	16.70	0.001	4.99	0.0002	0.833	20.0	32.8
Calc. Head	281.5	100.00	0.001	2.54	0.0010	2.539	100.0	100.0
-1"	216.5	76.91	0.001	2.87	0.0008	2.209	80.0	87.0
-1/2"	158.0	56.13	0.001	3.21	0.0006	1.800	60.0	70.9
-1/4"	116.0	41.21	0.001	3.61	0.0005	1.487	50.0	58.6
-10 mesh	65.0	23.09	0.001	4.63	0.0003	1.068	30.0	42.1

Cyanidation Test Log

Project No. 701	Date 3-28-83 to 3-31-83	Sample ID Composite 1-10 Sample Weight 1000 gm	Test No. JM-4

CONDITIONS AND REAGENTS

POINT OF ADDITION	Conditions				Reagent Addition			Solution Strength		
	Time ~~Mins.~~ HOURS	Solids (%)	pH	Temp.		Lbs./Ton Ore		Lbs./Ton Soln.		
						CaO	NaCN	CaO	NaCN	
Condition	1/2	50	8.5							
"	2		11.3			5.0				
Cyanidation	0						15.0			
"	3		10.8					0.05	11.6	
"	24		10.4					Nil	9.3	
"	24+					1.0				
"	48		10.2					Nil	8.4	
"	48+					1.0				
"	72		10.5					Nil	7.8	
Reagent Consumption (Lbs./Ton)						7.0	7.2			

Remarks: Wash with 3 X 333 ml water washes.

METALLURGICAL RESULTS

PRODUCT	wt. or vol. / Weight (%)	Assays (Oz./Ton)		Contents (Oz./Ton)		Distribution (%)	
		Au	Ag	Au	Ag	Au	Ag
24 Hr. Preg. Soln.	10 ml / 1.04	0.003	3.30	0.0000	0.034	0.0	0.7
48 Hr. Preg. Soln.	10 ml / 1.04	0.003	3.30	0.0000	0.034	0.0	0.7
72 Hr. Preg. Soln.	10 ml / 1.04	0.003	3.30	0.0000	0.034	0.0	0.7
72 Hr. Preg. + Wash Soln.	1740 ml / 180.20	0.003	1.45	0.0054	2.613	40.3	49.8
Leached Residue	965.6 gm / 100.00	0.008	2.52	0.0080	2.520	59.7	48.1
Calc. Head	—	0.013	5.24	0.0134	5.235	100.0	100.0
Assay Head	—	0.001	4.99				
Combined Preg. + Wash Solns.	1770 ml / 183.32	0.003	1.48	0.0054	2.715	40.3	51.9

Remarks:

Screen Analysis Mesh	Residue (%)
-20	100.0

Ammonium Thiosulfate Leach
Test Log Sheet

Test Log

Project No. 701	Date 6-23-83	Sample ID Comp. 1-10 Sample Weight 500 grams	Test No. JM-5

CONDITIONS AND REAGENTS

POINT OF ADDITION	Conditions: Time Hours	Solids (%)	pH	C° Temp.	Reagent Addition (Approx. lbs./ton ore): 1	2	3	4	Solution Strength		
Agitation	0	25		52	2000.0	179.2	80.0	80.0			
"	2	25		54		314.8		120.0			
"	4	25		53		379.2					
Reagent Addition					2000.0	873.2	80.0	200.0			

Remarks: 3 X 300 ml water washes

Reagents: 1 64.3% $(NH_4)_2S_2O_3$
2 28.0% NH_4OH
3 $CuSO_4 \cdot 5H_2O$
4 $(NH_4)_2SO_3$

METALLURGICAL RESULTS

PRODUCT	Weight (%)	Assays oz./ton	Au	Ag	Contents oz./ton	Au	Ag	Distribution (%)	Au	Ag
Preg. Soln.	293.00		N.D.	0.86		0.0000	2.520		>0.0	51.2
Wash Soln.	182.00		N.D.	0.21		0.0000	0.382		>0.0	7.7
Leach Residue	100.00		0.001	2.02		0.0010	2.020		<100.0	41.1
Calc. Head	–		0.001	4.92		0.0010	4.922		100.0	100.0
Assay Head	–		0.001	4.99						
Combined Preg. + Wash Solns.	475.00		N.D.	0.61		0.0000	2.902		>0.0	58.9

Remarks:

Screen Analysis Residue

Mesh	(%)
-20	100.0

Analytical Results

Sample I.D.	Product	Assay oz./ton Au	Assay oz./ton Ag
1	Heads	0.004	2.49
2		0.001	1.79
3		0.001	1.62
4		0.001	2.04
5		0.004	5.01
6		0.001	1.84
7		0.001	2.73
8		0.001	1.21
9		0.001	2.50
10		0.001	3.85
Comp. 1-10		0.001	1.85
	+1"	0.001	1.43
	-1" + 1/2"	0.001	1.97
	-1/2" + 1/4"	0.001	2.10
	-1/4" + 10 mesh	0.001	2.31
	-10 mesh +20 mesh	0.001	3.67
	-20 mesh	0.001	4.99
Test JM-4	24 Hour Preg. Soln.	0.003	3.30
	48 Hour Preg. Soln.	0.003	3.30
	72 Hour Preg. Soln.	0.003	3.30
	72 Hour Preg. + Wash Soln.	0.003	1.45
	Leach Residue	0.008	2.52
Test JM-5	4 Hour Preg. Soln.	N.D.	0.86
	4 Hour Wash Soln.	N.D.	0.21
	Leach Residue	0.001	2.02

USGS BULLETIN 582

TOTAL WRECK MINE.

Location.—The Total Wreck mine is 7 miles south of Pantano, the nearest station on the Southern Pacific Railroad, to which there is a good wagon road. It is on Cienega Creek at the east base of the Empire Mountains, in the northeast end of a long ridge, at an elevation of about 4,600 feet (Pls. I, II, and III, in pocket).

History and production.—The mine was discovered in 1879 by John Dilden, a cowboy, and later was relocated and passed into the

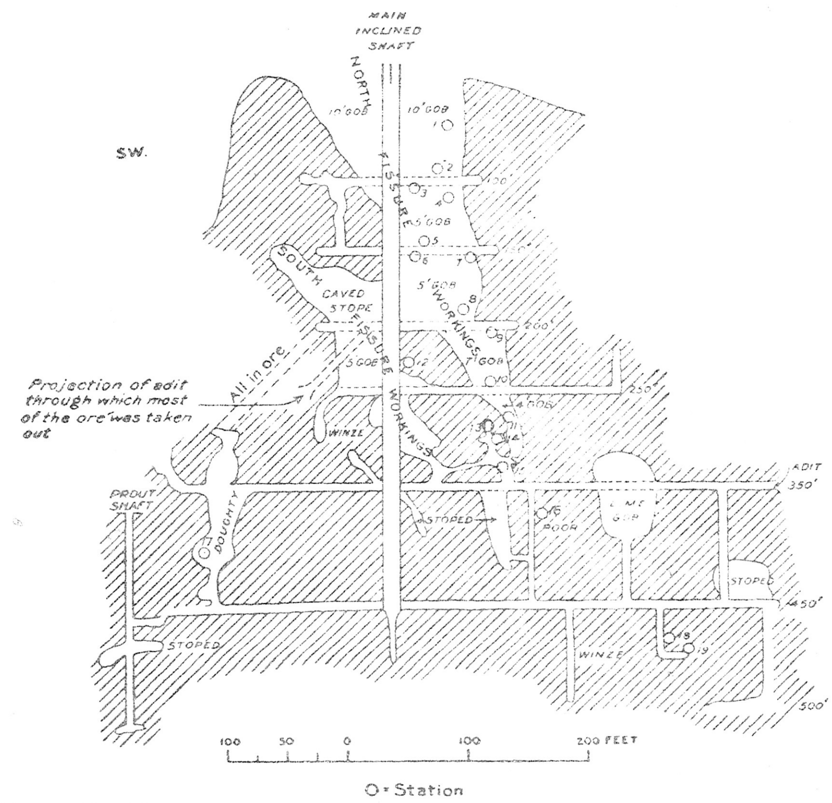


FIGURE 15.—Diagrammatic longitudinal section of Total Wreck mine on dip of main vein.

hands of the Empire Mining & Development Co., which installed a 70-ton milling plant and beginning in 1881 operated the mine and mill for a year and a half on rich surface ore. In 1882 the manager reported 50,000 tons of ore in sight,[1] but after the production of 7,500 tons of ore the mine and plant were closed. Soon afterward the mine was sold for taxes and purchased by Vail & Gates, of Tucson, who still own it. It was idle until 1907, but was then

[1] Blake, W. P., Mining in Arizona: Report of the Governor of Arizona for 1899, p. 118.

worked by C. T. Roberts, who found several thousand tons of low-grade ore remaining in old workings, discovered some new bodies, and shipped considerable ore until March, 1908. In March, 1909, the property was bonded to E. P. Drew, of Tucson, and work was resumed on a small scale. Some ore, in part high-grade lead-silver ore, was produced, but early in 1911 it was reported that the work had been discontinued. The production, which so far as learned seems

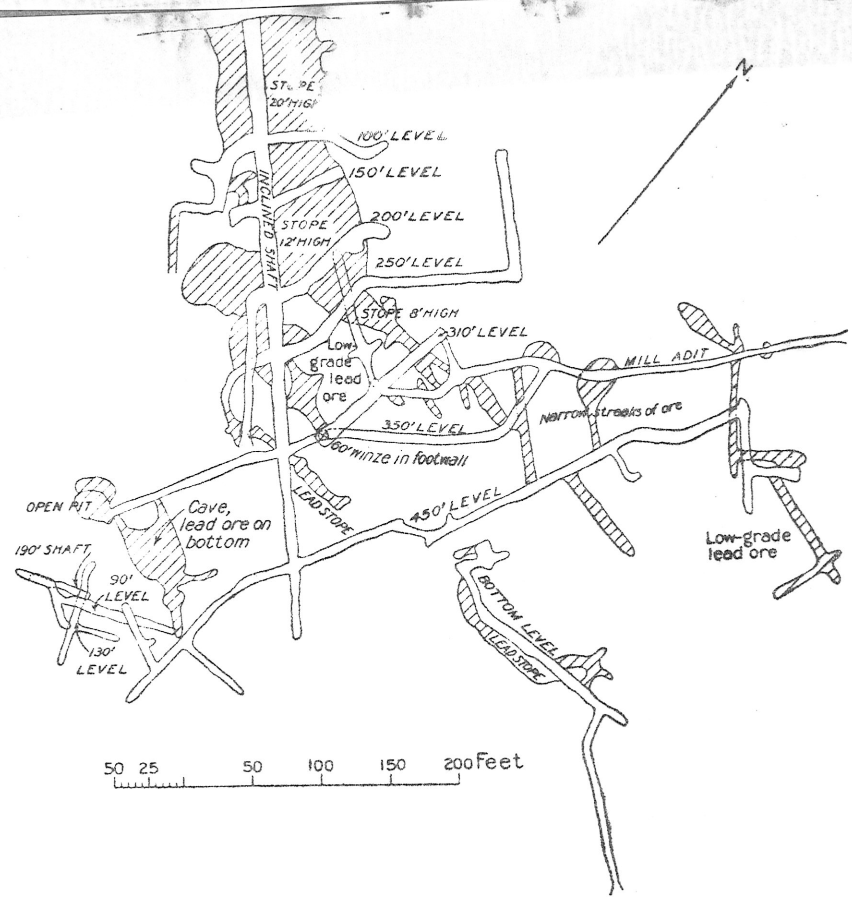


FIGURE 16.—Plan of underground workings, Total Wreck mine.

to be more than 10,000 tons, was mostly made prior to 1902, especially in 1881 and 1882, when the mill was in operation, and a five months' run is said to have produced over $450,000, or about 7,500 tons.[1]

Developments and equipment.—The mine is well developed to a depth of about 500 feet by shafts, tunnels, drifts, inclines, winzes,

[1] Hamilton, Patrick, The resources of Arizona, 2d ed., p. 131, San Francisco, 1883.

and stopes aggregating about 5,000 feet of work. (See figs. 15 and 16.) Some of the principal openings are shaft No. 4, which is 460 feet deep and is inclined 35° S., following the footwall of the principal vein; a main working tunnel tapping the shaft at a depth of 200 feet; and a 250-foot tunnel intersecting the vein on the 200-foot level. The deepest vertical shafts are the Front and Roberts shafts, respectively 185 and 200 feet deep, on the lower slope of the hill. The levels in general lie about 50 feet apart vertically. They run northeast and contain several hundred feet of drifts in both directions. Tunnel No. 1 is 600 feet long and has an upraise to the surface at the breast, a drift to the stope on the southeast, and a 50-foot winze containing a drift to the north and to the east. Shaft No. 2 is 175 feet deep and has a drift to the south on the 80-foot level and drifts to the north and south from the bottom. Tunnel No. 3 is 250 feet long, runs northwest to the breast 80 feet below the surface, and contains stoping to the northwest along vein No. 2. The main crosscut, in the bottom of the mine, runs north and is 800 feet long.

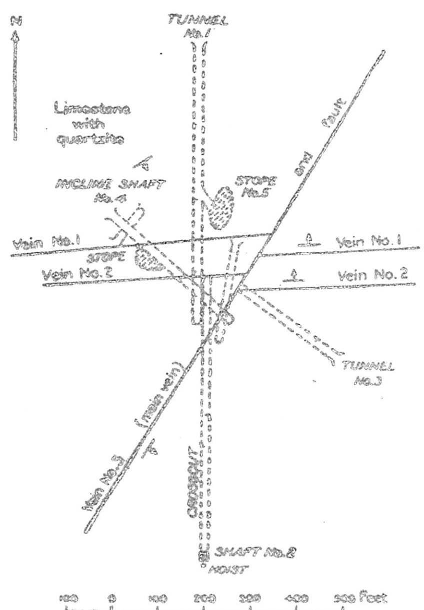


FIGURE 17.—Diagrammatic plan of veins of Total Wreck mine.

The property comprises a group of seven claims, some of which are patented. The principal equipments are a 20-stamp 70-ton mill and a 300-horsepower engine. The machinery and plant are well preserved. The camp and mill were supplied with water pumped from a spring 4 miles to the south.

Geology.—The mine is in the dark-bluish medium to heavy bedded Carboniferous limestone, which is interstratified with heavy to thin beds of light-gray quartzite. The rocks in general dip about 35° SSE., which is approximately the inclination of the east and south slopes of the hill in which the mine is located (Pl. XIV, *B*). They are shown in a much better preserved state in the mill tunnel than in any other part of the mine. They are much faulted, for the most part horizontally, and somewhat folded and contain one or more systems of fissures, of which the principal ones dip steeply to the north. These rocks are intruded by small dikes and stringers of diorite. The limestone is apparently the same as that at the Blue Jay mine and in the dark ridge east of the Copper World mine. It is in general only slightly crystalline and contains some fossil remains, of which a fragment collected as stated on page 50 has been identified as a bryozoan and probably Tabulipora, from the Pennsylvanian.

The mine is dry, and no water has ever been encountered in it.

Deposits.—The deposits occur principally in three so-called veins and replacement ore beds, which are irregular zones, as represented in figure 17. They are mostly in or associated with fissures, especially fissures of the east-west system, of which the two most important are represented in figure 15. The fissures are about 90 feet apart. They have a steep northerly dip, and the ore bodies occur on their northerly or hanging-wall side, mostly in the limestone and usually above beds of quartzite. Some of the deposits extend from the fissures along the bedding planes of the limestone as blanket veins or ore beds. Examples illustrating the relations of the ore bodies to the fissures and the quartzite and limestone bedding planes are shown in figure 18, in which *a* shows also the leached zone in the fissure extending to a depth of about 250 feet, and *b* shows faulting denoted by change in dip and offset of the quartzite beds along the fissure.

The fissure or vein portion of the beds is more or less uniformly about 6 or 8 feet wide, but the width of the zone, comprising the fissure vein and the replacement ore body in the adjoining limestone, is many times greater, being in places nearly 100 feet, as shown in figure 18, *a*. The deposits extend from the surface to the bottom of the mine, where their lower limits have not yet been reached. Though some good-looking ore bodies occur in the deeper part of the mine, practically all the ore which was profitably worked was found between the surface and the 350-foot level.

The ore is an argentiferous lead ore which carries also a little copper in the deep part of the mine. It is contained in a mineralized, altered, more or less crushed limestone gangue with calcite and infiltrated quartz in porous or honeycombed masses of various forms. It is stained reddish brown, yellowish, greenish, or blackish by oxides of iron and manganese and carbonates of lead and copper. With it in places, as shown on the 450-foot level, are associated 40 or 50 feet of breccia and some light-colored argillaceous gougelike material, locally called Chinese talc, which is probably kaolin.

The ore is practically all oxidized, scarcely more than a trace of sulphide having yet been found even in the deepest part of the mine. The principal ore minerals are silver chloride (cerargyrite or horn silver), lead carbonate (cerusite), wulfenite (lead molybdate), mala-

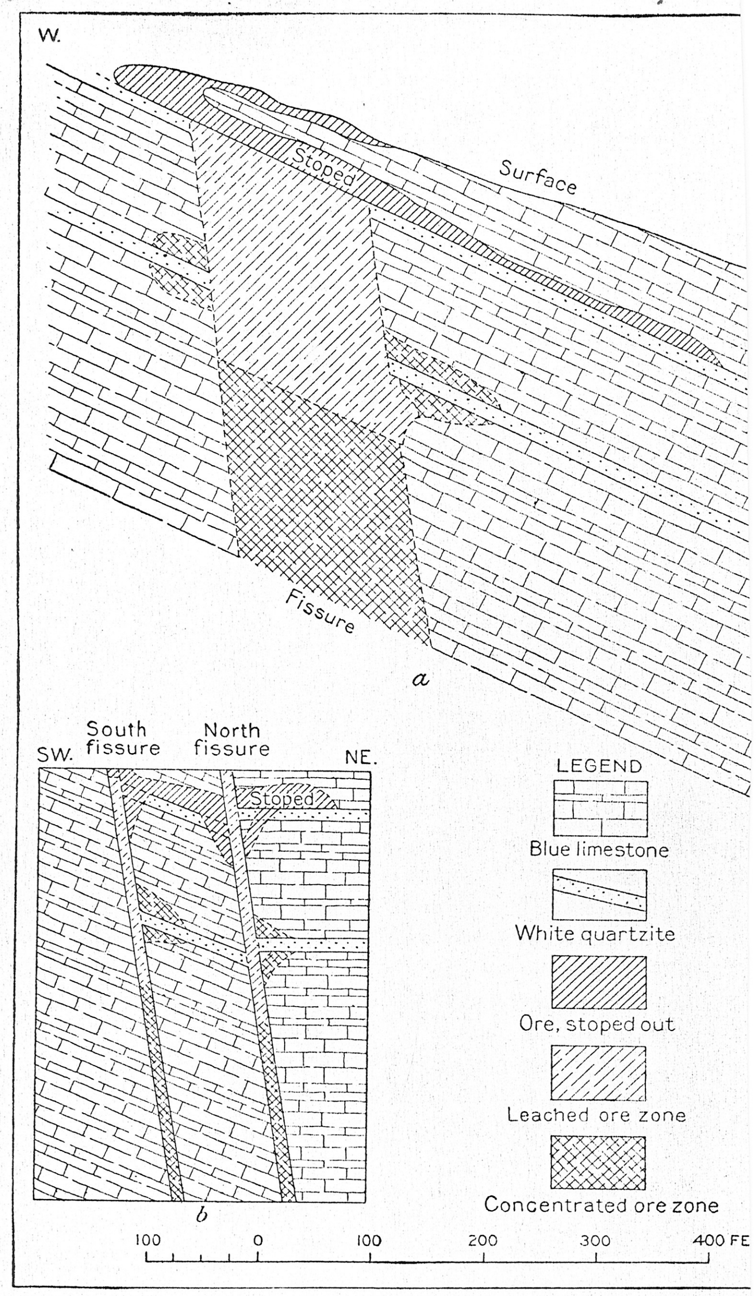


FIGURE 18.—Sections of fissures and ore bodies in Total Wreck mine. *a*, C tion near surface; *b*, cross section on 350-foot level.

…ite, azurite, chrysocolla, and a little chalcopyrite, and perhaps lead oxides. The associated minerals are hematite, limonite, vanadinite, jarosite, siderite, and manganese oxides.

In the surface ore, much of which is very rich, the principal mineral was cerargyrite. In the lower part of the mine, however, silver is only sparingly present or absent, and copper, principally in the form of carbonates, occurs in its place. The principal vein is said to be 5 feet wide, to contain considerable lead molybdate, and to average 4 per cent copper, 12 per cent lead, and 12 ounces in silver to the ton.

The early ore is said to have averaged in mill tests about $60 to the ton. During the operation of the mill in the early eighties it was worked to 84 per cent, and the tailings were concentrated and saved. The cost of mining and milling was reported to be about $8 a ton.

The deposits seem to owe their origin to circulating thermal solutions that accompanied or followed the intrusion of the underlying granite. Subsequently, so far as the workings now extend, the deposits have become concentrated by percolation of meteoric waters in the oxidized zone. In the processes of formation and concentration of the ore the underlying quartzite beds which separate the limestones into a series of subdivisions were important physical agents in aiding mineral precipitation by arresting the downward progress of the solutions.

The mine seems to contain considerable good ore, but most of it is probably of low grade. As some leads seem to have been lost on the lower levels, the deeper part of the mine should receive detailed examination before operations are resumed on any large scale.

COPPER CAMP.

GENERAL FEATURES.

The Copper camp is located 3 miles southwest of the Total Wreck mine near the center of the Empire Mountains, in a north-south belt about a mile wide and 3 miles long, mostly in the west side of an irregular open valley or embayment that extends northward into the heart of the range and is known as the Basin. The principal settlement is near the Hilton ranch, in the northern part of the belt at an elevation of about 5,000 feet. It is reached by a wagon road of easy grade leaving the Pantano road about a mile north of the Total Wreck mine. The deposits are in the same limestone belt as those of the Total Wreck mine and extend from the granite contact on the north through the foothills and into the lowland on the south. The rocks are principally the dark limestone with interbedded quartzites, about the same as at the Total Wreck mine. They dip in general about 45° SSE. or S. They are faulted, folded, and