CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
3550 N. Central Ave, 2nd floor
Phoenix, AZ, 85012
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov

The following file is part of the Edwin Noel Pennebaker Mining Collection

ACCESS STATEMENT

These digitized collections are accessible for purposes of education and research. We have indicated what we know about copyright and rights of privacy, publicity, or trademark. Due to the nature of archival collections, we are not always able to identify this information. We are eager to hear from any rights owners, so that we may obtain accurate information. Upon request, we will remove material from public view while we address a rights issue.

CONSTRAINTS STATEMENT

The Arizona Geological Survey does not claim to control all rights for all materials in its collection. These rights include, but are not limited to: copyright, privacy rights, and cultural protection rights. The User hereby assumes all responsibility for obtaining any rights to use the material in excess of "fair use."

The Survey makes no intellectual property claims to the products created by individual authors in the manuscript collections, except when the author deeded those rights to the Survey or when those authors were employed by the State of Arizona and created intellectual products as a function of their official duties. The Survey does maintain property rights to the physical and digital representations of the works.

QUALITY STATEMENT

The Arizona Geological Survey is not responsible for the accuracy of the records, information, or opinions that may be contained in the files. The Survey collects, catalogs, and archives data on mineral properties regardless of its views of the veracity or accuracy of those data.

Return to

E. N. Cunningham

Scottsdale,

Arizona

BONANZA MINING PROPERTIES

NEAR WENDEN, ARIZONA

****

E. N. Pennebaker
December 1952

THE BONANZA MINING PROPERTIES

NEAR WENDEN, ARIZONA

SUMMARY

An examination of the Bonanza Mining Company project brings up two questions: (1) From the evidence at hand, what sort of copper-gold deposits can we reasonably expect to be developed on this property, and (2) can such deposits be mined at a profit? As regards the first point, it is concluded that the valuable constituents of the ore, copper and gold, are mostly confined to narrow streaks generally from 2 to 6 inches wide. These streaks are discontinuous along their course and also down-dip as they incline to greater depths. It is pointed out that these characteristics are not likely to improve laterally nor at greater depth and that tonnage possibilities are small and in the form of widely scattered lenses. Although these erratic narrow zones in places carry copper and gold in attractive amounts, their mining necessitates the extraction of a 5-foot width of rock to win the narrow streak. The ore thus becomes diluted to such an extent that, in the writer's opinion, it cannot be mined and treated at a profit. Furthermore, the nature of the ore occurrence imposes high exploration and development costs.

Therefore it is recommended that very serious consideration be given to the abandonment of this work as a company activity. First, however, it is proposed that the mine be properly sampled to obtain a basis of facts to reveal precisely the quality and quantity of ore-bearing material remaining exposed in the mine

workings. These are features that can be measured and need not remain a subject of speculation. With these facts at hand, the economic worth of such ores can be more properly assessed. It is the writer's present view that this material will be found to be uncommercial, but no sample maps are now available and this must be supported by impartial sampling. In the following report it is concluded that future discoveries of ore, both laterally and at greater depth, will be no better in grade and thickness than that already encountered in the mine workings. Consequently if this ore was not good enough to be mined and treated at a profit, as now appears to be the case, then the considerable expense of further exploration is not warranted.

INTRODUCTION

The property of the Bonanza Mining Company and the adjacent Bonanza Central ground were briefly examined on December 2 and 3, 1952. Most of one day was spent in observing surface exposures and about four hours were occupied underground in the mine. There were no plan maps nor any mine sample data furnished by the mining company. An associate of the writer made a short examination of this property in mid-1952 and carefully took 16 samples. The results of these have been available for confidential use and guidance.

The Bonanza properties are seven miles northwest of Wenden, Arizona, in the Ellsworth mining district, northwestern Yuma County, Arizona. They are located about in the center of the Harcuvar Mountains, a few miles southwest of Cunningham Pass. The area of interest is on the middle slope of the south face of the mountains where the mineralized zone is displayed throughout a

vertical range of about 250 feet uphill from the shaft and for about 250 feet downhill. The zone can be followed along a course of about 3 miles.

The Bonanza Mining Company is reported to hold a group of 39 mining claims which forms the eastern half of the property, and the Bonanza Central Mining Company is said to control 57 claims which make up the western portion. These claims form a strip of ground for a strike length of about 3 miles and adequately cover the mineralized zone.

GENERAL GEOLOGY

In this area the south face of the Harcuvar Mountains is made up of granite gneiss. This is a granitic rock composed of feldspar, quartz and dark mica, these constituents being arranged in a manner that gives a layered structure to the rock mass. These layers strike west-northwest and dip to the south at moderate angles. Here and there thin-laminated bands rich in dark mica are found. Layers of coarse-grained pegmatite composed of large crystals of quartz and feldspar are also present, and irregular bodies of this rock are squirted into and across bands of gneiss.

Cutting through the above group of rocks and also striking west-northwest, but inclined to the north, are a series of steep sheets of a dark basic type termed diabase, a rock that is composed of small lathe-like crystals of feldspar minerals set in a dark matrix. These are the so-called diabase dikes associated with the copper-gold mineralization. The impression has grown that in the Bonanza properties there is a zone about 3 miles long and 1000 feet wide well-filled with these dikes and that they are generously

impregnated with copper and gold. Thus the view has arisen that there is a great reserve of commercial ore available on the property. Because of this, it will be worthwhile to observe the dike zone with considerable attention.

The diabase dikes follow a broad band of broken bedrock whose fracturing was caused by fault movement. This fractured zone is persistent, but individual members show only light breaking and somewhat erratic distribution. In the vicinity of the mine much of the dike zone is covered by coarse gravel streaming down from higher slopes on the north. Nevertheless, the dikes can be seen to be most abundant along the northerly side of the zone where a width of 100 to 200 feet contains four or more dikes which in the aggregate fill less than half of this restricted width. These dikes pinch out and reappear again along strike to give an arrangement called en echelon; the same may be expected down dip as the dikes incline into the earth, and such an example may be observed in the shaft. Along the southerly part of the dike zone, as noted on the surface, the dikes are more widely scattered and are more erratically distributed. Thus it is evident that only a fraction of the 1000-foot zone (if it is actually this wide) is filled by allegedly favorable diabase dikes. The number of dikes actually present is dubious because of the gravel cover that masks much of the zone, and the number may be expected to change as various dikes come in and disappear along its course. Across any one cross-section, from 8 to 19 dikes have been stated to be present.

The diabase dikes dip northerly across the layered gneiss at inclinations that vary between 45 degrees and almost vertical. Whether or not their dips cause the dikes to converge at depth is

problematical; quite likely they alternately steepen and flatten irregularly as they go downward.

The dike zone does appear to persist for a strike length of about 3 miles. To the northwest it may die out, although time did not permit a proper checking of this. To the southeast the zone disappears under valley soil.

In summary, the dike zone was found to be persistent, but it consists of members erratically arranged, and these are most abundant along the northerly (hanging wall) side of the zone.

MINERALIZATION AT THE SURFACE

In general the diabase dikes at the surface can be seen to be mostly barren of copper or to contain it in small amounts. Rocks with the chemical composition of diabase have the ability to precipitate copper at the surface where copper-bearing sulphide minerals have been oxidized by weathering. Thus the familiar green and blue copper minerals are fixed in the outcrop, and these in association with accompanying iron oxide advertise the extent and in some measure the richness of the mineralization prior to oxidation. In this respect, having diabase as the host rock permits a particularly helpful diagnosis.

Examination of the diabase dikes exposed throughout a topographic range of 500 feet displayed down the mountainside reveals that copper minerals are mostly restricted to very narrow widths (measured in inches rather than feet) along parts of the margins of some of the exposed dikes. Very little if any improvement in copper content can be discerned in descending the slope through this vertical range, and consequently in a shaft of similar depth we would have no reasonable expectation of general improvement.

The testimony from the surface makes it evident that copper ore to a depth of about 250 feet below the collar of the main shaft can be reasonably expected only in very limited tonnage from bodies of very narrow width and such will be found in erratic distribution. With this in mind let us examine the results of underground exploration and development to see if any radical improvement appears at still deeper horizons.

MINE DEVELOPMENT

The main shaft is on an incline that reaches to a depth of 640 feet. The angle of inclination of the shaft varies from 45 degrees to nearly vertical, which places its bottom at a vertical depth of approximately 550 feet below its collar. Thus the range in elevation, from the top of the ridge to the bottom of the shaft, throughout which the dikes and the veins are exposed is about 800 feet.

The shaft follows down the north side (hanging wall) of a diabase dike that displays narrow widths of erratic mineralization. Three levels have been driven from the shaft with workings that follow narrow vein structures.

On the 110 level there is about 180 feet of drive to the northwest and about 90 feet of drive to the southeast, along a vein zone that is associated with diabase only along part of its course. A cross-cut driven northerly into the hanging wall for about 90 feet reaches another diabase dike. The vein on this level is oxidized and narrow. It widens to about 8 inches near the end of the northwest drive where a very small body of ore was mined, presumably for its gold content.

The 520 level consists of a main drive along the diabase

dike, plus a footwall cross-cut to the south that reaches a second dike. Toward the northwest the main drive extends for about 240 feet from the shaft; toward the southeast for about 150 feet. The footwall cross-cut pierces a second dike lying about 100 feet to the south, but no driving has been done along it.

On 520 level near the shaft the diabase dike is about 15 feet wide. In the southeasterly face of the drive it has narrowed to a width of about 12 inches; in the northwesterly face it splits with a wedge of gneiss in between and its full width is not evident. Mineralization consists of a footwall streak on the south side of the dike. This pay streak as now displayed is from 1 to 6 inches wide and contains the copper-bearing mineral, chalcopyrite, enriched to some extent by the copper sulphide, chalcocite. The zone appears to extend with fair continuity for about 200 feet northwest of the shaft, beyond which the face shows some sulphides in the wedge of gneiss. Along the drive southeast of the shaft, no ore is evident for 40 feet; this is succeeded by a stoped zone for about 50 feet; beyond this the face of the drive appears to be very lean.

Ore extraction has been carried above 520 level for a vertical distance ranging from 10 to 70 feet. The back above these stopes can be observed in several places where it displays the pay streak varying from 1 to 6 inches in width.

The north (hanging wall) side of the dike on 520 level is not well exposed, but where seen it carried a very few inches of mineralization with some sulphides. Apparently it was not attractive enough for mining.

On 520 level the second, or footwall, dike is very poorly mineralized where exposed in the cross-cut, and averages only 0.15% copper.

The 620 level also consists of a main drive along the diabase dike and a footwall cross-cut to the south that again reaches the second dike.

On 620 level the diabase dike remains about 15 feet wide with generally narrow widths of mineralization on its hanging wall (north side). On this level toward the northwest the drive extends for about 112 feet from the shaft to the face where the main dike appears barren or of very low grade. Toward the southeast the main drive extends for about 100 feet beyond the shaft where in the face the diabase dike also is seen to be barren or very weakly mineralized. Along the drive an attempt was made to extract ore along 35 feet of the 200 feet driven. This stope was carried up only about 20 feet. A good view could not be obtained of its back, but the general conclusion is that mineralization exposed on 620 level is much weaker than it was on 520 level.

On 620 level the second dike on the south is very sparely mineralized and assayed only 0.03% copper.

In the bottom of the shaft about 20 feet below 620 level (the lower few feet of which are now covered by water) a full cut sample on the northwest wall is reported to contain 0.06 oz. gold, 0.03 oz. silver, and 0.88% copper with most of the values confined to a 6-inch streak on the hanging wall which assayed 0.19 oz. gold, 0.06 oz. silver, and 3.16% copper. The footwall assayed only 0.08% copper over a width of 2.8 feet in contrast to the footwall ore-bearing streak above 520 level.

In summary, the underground workings show about what was forecast from the surface examination. Most of the copper and gold is confined to streaks that are commonly 2 to 8 inches wide along

the margins of the dikes, as seen particularly on 110 level, 520 level, and the shaft bottom. No doubt there are in places thicker lenses of possibly richer ore, but it is believed that their tonnage contribution is subordinate and that as a general rule the payable sections are thin. These streaks are discontinuous along strike and down dip, so that the ore comes in and goes out erratically and may jump from one side of a dike to the other. The dikes are definitely not mineralized to constitute ore throughout their entire width but only in streaks within them and along parts of their edges. Thus in descending from the ridge crest down about 800 feet to the bottom of the shaft, the dikes display no consistent improvement in content of valuable metals nor in thickness as the additional depth of 300 feet is attained below the lower surface exposures. Although mineralization is stronger on 520 level than it is near the shaft collar, it weakens again on 620 level.

DIAMOND DRILLING

One exploratory drill hole is reported to be located east of the Bonanza shaft and was drilled in 1949. This was collared about in the center of the fractured zone and was drilled downward at an inclination of 65 degrees toward the footwall on the southwest. There is no log nor assay record of this hole. It was drilled 745 feet and it has been verbally reported that the last 32 feet weresoft and had to be pumped out with homogel. This mixture of homogel and rock supposedly ran around 3.5% copper. The manner of taking this sample and its reliability thus appear very dubious. The sample would have an implied true width of about 24 feet and come from an elevation approximately equivalent to that on the 620 level and may represent fractured and altered gneiss on the footwall

of the shear zone. It is said that some of the core from this hole is still at the drill site, but the mineralized sections have been taken away and all that remains is fresh, hard gneiss and occasional diabase dike material that contains some pyrite.

This hole is described differently in Rose's report. He locates it considerably to the west of the main shaft and lists 14 feet of 4% copper ore at a depth of approximately 360 feet. This is equivalent to an implied true width of 10.5 feet at a depth of about 300 feet below surface.

This conflicting information about the results of the hole is unfortunate. However, in the absence of a reliable log and a detailed description of how the sample was obtained, the writer does not believe that it over-rules the conclusions advanced farther along in this report.

FURTHER COMMENTS ON MINERALIZATION

In considering copper deposits, there are three types of mineralization to be distinguished. First is the primary mineralization effected by rising thermal solutions. This is the fundamental deposition of the valuable constituents, and it is commonly accompanied by chemical changes in the flanking host rock. Where such primary mineralization is exposed on or near the surface by erosion, these minerals, and particularly the primary copper-bearing sulphides, are oxidized and copper is taken into solution by rain water. Where the host rock is a basic type, such as diabase, much of the copper is precipitated nearby in the form of oxidized minerals with green and blue colors. Here also iron oxide is precipitated, and gold, if present, is freed and left behind with these minerals in the zone of oxidation. Some of the copper escapes

downward in solution, and at a variable depth, commonly near water level, this copper is re-precipitated as the copper sulphide, chalcocite, to form coatings on primary sulphides in a zone of "secondary sulphide enrichment."

In the Bonanza area the primary mineral containing copper is chalcopyrite. This is associated with pyrite (iron sulphide), siderite (iron carbonate) and quartz, with some barite (barium sulphate) and rhodochrosite (manganese carbonate) also reported. The ratio of gold to copper is somewhat variable but averages about 0.10 oz. gold to each 1% of copper. The wall rocks exhibit some hydrothermal alteration, but this is limited in amount and is best displayed as narrow zones of bleaching in the diabase adjacent to the veins plus probably a light development of chlorite throughout the dikes.

The veins have been oxidized to variable depths. Minor amounts of sulphides are reported at or very near the surface; on the other hand, oxidation is fairly strong to the 400-foot horizon and some persists along the permeable edges of the dikes to below 620 level. On surface most of the copper is oxidized and fixed in the outcrop as green and blue minerals.

Nevertheless, some copper has escaped downward and appears near 520 level as coatings of secondary chalcocite. Thus the ore is somewhat enriched near this horizon, and such enrichment may be expected to fade out at greater depth; however, it is to be emphasized that variation in the amount of copper in the diabase host is largely a matter of erratic primary deposition and that the factor of secondary enrichment is of subordinate importance.

PAST PRODUCTION

There are no records of production from the old workings on the west end of the property. This work is reported to have been done between 1910 and 1945, mostly by leasers. It has been roughly estimated that this amounted to some 2250 tons carrying about $100 per ton in gold with possibly 10 or 12% copper.

A formal record of production was not available for the more recent activity through the Bonanza shaft. Eight cars of "run of mine" material amounting to 348 tons are reported to have averaged 1.88% copper and 0.18 oz. gold; however, this ore is believed to have undergone some hand sorting after crushing.

About 2,000 tons of material from 520 and 620 levels is said to have been concentrated at Wenden. This concentrate is reported to have averaged about 6.0% copper and 0.54 oz. gold.

It thus appears that mine production was somewhat in excess of 2,000 tons but probably less than 3,000 tons. A rough calculation from the longitudinal sections in Rose's report indicates a maximum extraction of around 3,000 tons (or enough to supply a 100-ton mill for only one month).

GRADE OF CRUDE ORE

The material carrying copper and gold that was taken from underground consisted of a mixture of two kinds of material: (1) a thin quartz-carbonate vein carrying copper and gold, which is commonly about 6 inches thick, and (2) a low-grade or barren band of diabase dike that is 4.5 or 5.5 feet thick. The latter must be blasted out in order to give sufficient room to work in. The resulting mixture is either sent to the mill as it comes from the mine or richer pieces may be expensively retrieved by hand sorting.

Inasmuch as the mine has not been properly sampled and there are no formal production records giving the total tonnage and average grade of material extracted, it is at present very difficult to find out the amount of copper contained in the richer streak and in the mixture of material as mined.

The information in the following tabulation is from fragmentary records of shipments to smelters:

DATE	DRY TONS	PERCENT COPPER	OZ. GOLD	NET VALUE PER TON AT SMELTER	NET PROCEEDS (LESS FREIGHT ETC.)
5/5/51	43.46	2.38	0.26	$ 10.12	$ 317.44
5/31/51	43.41	1.66	0.19	5.77	124.95
6/30/51	45.46	1.63	0.12	2.87	0.02
8/17/51	35.28	2.04	0.26	9.91	249.50
3/10/52	31.03	3.82	0.33	17.67	440.14
TOTALS & AVERAGES	198.64	2.20	0.23		$ 1132.05

The character of these shipments is not stated, but it is suspected that it represents run-of-mine ore that has undergone some sorting. The last shipment might have been of concentrates. (Here we might note that this material yielded a net of only $5.70 per ton to pay for exploration, development, mining, sorting, and trucking to Wenden.)

Data on a shipment of concentrates was furnished the writer, as follows:

DATE	DRY TONS	PERCENT COPPER	OZ. GOLD	NET PROCEEDS
1/22/52	32.08	4.98	0.55	$ 701.92

(The above gives a net of $21.90 per ton of concentrates. Assuming a ratio of concentration of 3 to 1, this provides $7.30 to pay the costs of each ton of ore mined, trucked to Wenden, and treated, which likewise does not appear profitable.)

The previously mentioned 8 cars of ore (aggregating 348 tons) reportedly assaying 1.88% copper and 0.18 oz. gold was apparently run-of-mine ore somewhat improved by hand sorting. It may or may not have included some of the shipments listed in the foregoing table.

A sample of broken material in the 500 level stope assayed 0.77% copper and 0.03 oz. gold.

At the bottom of the shaft on the north side a 5.9-foot cut sample returned 0.88% copper and 0.03 oz. gold.

From this fragmentary information it appears that past mine production, after perhaps some sorting, ran about 2.0% copper and 0.2 oz. gold. After examination of the mine, the writer very seriously doubts that there remains any substantial amount of ore that will average this metal content over a stoping width of 5 feet.

This matter may be assessed in another way: If the 6-inch pay streak consisted of one-half by weight of the copper-iron sulphide mineral, chalcopyrite, this rich streak would contain 17% copper. If this was mined over a stoping width of 5 feet (thus necessitating the extraction of 4½ feet of barren diabase) the mixture would average 1.7% copper and have associated with it about 0.17 oz. gold per ton. Visual inspection of the mine workings reveals that there remains little or no material of this quality and that the general average over a 5-foot stoping width is leaner.

ECONOMIC CONSIDERATIONS

A concentrating plant with a daily capacity of 100 tons will use up about 35,000 tons of ore per year. This physical

amount of ore requires a productive section of vein 700 feet long by 5 feet wide and reaching 100 feet from one level to the next one. When we observe that the best developed section of the mine (on 520 level) displays a strike length of only about 250 feet of ore (of dubious average grade), the bulk of ore and the footage of mine workings needed to feed the mill for 5 years become evident. Furthermore, the ore exposed on 520 level, such as it is, has only been proved to a maximum height of about 70 feet in the stope and at depth it weakens on 620 level. At the ends of both levels the exposed vein displays weak mineralization. Thus it is clear that the problem is not so much the determination of a suitable metallurgical method to treat the ore, but it is the finding of enough profitable ore to amortize a treatment plant that is the real difficulty. Consequently the problem of scanty ore reserves and unpromising exploration possibilities cannot be overcome by focussing attention on alternative methods of metallurgical procedure.

Referring back to a previous discussion of ore grade, if we grant that ore with a grade of 2.0% copper and 0.2 oz. gold is present, we derive the following:

1 ton of ore contains: 40 lbs. copper and 0.2 oz. gold.

Assuming 85% recovery in the metallurgical treatment, we obtain 34 lbs. copper and 0.17 oz. gold.

Value of ore at current metal prices:

34 lbs. copper @ 24½¢	-	$ 8.33	
0.17 oz. gold @ $35.00	-	5.95	
		$14.28	Gross value per ton of ore.

Assumed approximate costs per tons of ore:

Exploration and development	$ 1.50
Mining.....	5.00
Trucking to Wenden.....	1.00
Milling.....	4.00
Overhead.....	1.00
TOTAL.....	$ 12.50

In addition to this there will be substantial smelting costs on concentrates, the usual deductions at the smelter, interest charges, and taxes. Furthermore, both exploration and mining costs might exceed the figures listed above. Consequently ore of the grade here assumed is not likely to be profitable under present conditions. When we consider that it is doubtful whether worthwhile tonnages of even this grade of ore can be developed, the above rough analysis demonstrates the very speculative nature of the venture.

CONCLUSIONS

From the foregoing considerations of the Bonanza properties near Wenden, it is concluded that:

1 - Copper-gold ore occurs as thin discontinuous lenses. When diluted by mining, its grade is lowered to a point that is not likely to be profitable.

2 - Past exploration through the Bonanza shaft has not developed sufficient tonnage (and this of dubious quality) to supply a mill of 100 tons daily capacity over a period of 3½ months. Thus the problem of supplying sufficient profitable tonnage to amortize a mill over a 5-year life is evident.

3 - The erratic distribution of the mineralized lenses makes the search for them expensive and its outcome dubious.

4 - From the geological standpoint there might be three situations where a profitable improvement in the mineralization might be hoped for:

One of these is in other dikes of the zone. However, a number of these are sufficiently exposed to reveal that the mineralization of all is probably similar.

Secondly, at depth the dikes and veins cut different layers of gneiss, and it would be hoped that a more favorable wallrock might be associated with stronger mineralization at some unknown depth.

Thirdly, a bedding fault might exist parallel to the layers of gneiss at some unknown depth and have served as a barrier beneath which rich ore was abundantly deposited.

These are all remote geological possibilities, and in view of the information now available they are so speculative that the writer does not recommend the expensive campaign that would be needed to adequately test them.

Therefore, consideration of the geological environment of the ore lenses in conjunction with past mining experience makes it evident that we cannot reasonably expect conditions to materially improve laterally nor with added depth. Thus it is believed that the average character of the mineralization is now revealed. In view of this, it is also judged that the considerable expense of checking the alleged showings in the diamond drill hole is not warranted.

RECOMMENDATIONS

It is proposed that:

1 - Serious consideration be given to the abandonment of

this mining venture.

In order to aid in arriving at a final decision it is further proposed that:

2 - The mine be systematically and impartially sampled by an independent engineer. Samples should be taken (a) at 10-foot intervals along drives and stope backs, (b) across all stope and drive faces, (c) across dikes exposed in cross-cuts, (d) and wherever elsewhere deemed necessary. These samples should be properly segregated in order to determine the value of the narrow streaks and the character of the bordering material that must be broken during stoping. Maps and sections should be constructed and the sampling results properly plotted on them.

3 - An effort should be made to assemble data contributing to a full record of production in recent years.

E. N. Pennebaker

E. N. PENNEBAKER

Scottsdale, Arizona
December 15, 1952
Original and 3 copies submitted