



SHATTUCK DENN MINING CORPORATION

PROPERTY OF
MESA STATE COLLEGE LIBRARY
GRAND JUNCTION, COLO. 81501

REPORT ON THE NAVAJO PROPERTY

WHITE MESA MINING DISTRICT

COCONINO COUNTY, ARIZONA

By

J. A. Wilcox

Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed in this report, or represents that its use would not infringe privately owned rights. Reference therein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Report Submitted to the
Manhattan District Engineers

REPRODUCED FROM BEST AVAILABLE COPY

February 2, 1943

Bisbee, Arizona

REPORT ON THE NAVAJO PROPERTY

WHITE MESA MINING DISTRICT

COCONINO COUNTY, ARIZONA

by

J. A. Wilcox

The diamond drilling campaign in the White Mesa Mining District of the Navajo Indian Reservation consisted of 49 holes with a total footage of 4,570 feet. Holes were drilled from 50 to 160 feet in depth and averaged 94 feet in depth. The general plan was to drill at 400 foot intervals and then drill some of the better looking areas at closer intervals to determine the size and gradation of the apparently more enriched zones. This campaign of drilling produced reliable information from which I have determined the probable grade and tonnage of copper bearing sandstones in the areas drilled, and has brought to light the scheme of mineral deposition peculiar to this district. The program was one of reconnaissance in nature, in that it was expected only to determine whether the area merited a broader development campaign covering larger areas, and warranted further scientific study of the metallurgical and physical conditions under which the copper deposits could be mined and treated.

The mineralized area is about six miles long and two miles wide, and from very obvious surface showings, about 20% of the 12 square miles is mineralized to a sufficient degree to make it, from casual observation, comparable to the area drilled. The reasons for selecting certain areas to drill were numerous. First, the area around the Old Fort or Trading Post was an area where the most extensive early mining was done and many old cuts and shafts exposed the ore, giving it a better first-glance appearance. Secondly, it was an area where patented and unpatented claims were more closely grouped; and finally, access roads were superior to those in the remaining area. By reason of the old workings, extensive sampling was easily accomplished and the large area near the Old Fort seemed to be one of large area with a more even grade. The area on the Dutchman had the appearance of being higher in grade and less extensive in area. By drilling these two areas, we attacked the proposition from the standpoint of both grade and tonnage.

* The accompanying maps, Exhibits A, showing the entire area, Exhibit B, showing the Old Fort Area, and Exhibit C, showing the Dutchman Claim will aid in visualizing the conditions pursuant to the district and the program. Old surface workings are shown on exhibits B and C, upon which the locations of the drill holes are superimposed. The actual areas drilled consist of 100 acres on the Old Fort area and 5 acres on the Dutchman Claim. A geological report on the District and the White Mesa Mining District in particular, by Thomas W. Mitcham also accompanies this report. The drilling log and assay results of each hole will be found in the accompanying folder.

The preliminary surface sampling, assaying and mapping program was followed by the drilling campaign which, as stated before, embraced, first, the block-system at 400 foot intervals followed by close drilling of several higher grade sections. Drilling was done in two separate areas. Holes from 1 to 44 inclusive were drilled in the Old Fort Area (Exhibit B) and holes 45 to 50 inclusive were drilled on the Dutchman Claim (Exhibit C).

*All material mentioned in this paragraph was not with the report in August 1982.

DRILLING METHODS

Drilling was all done with a diamond drill, using preheated compressed air instead of water as a means of raising the cuttings. This was done because the sandstones were so absorbent of water that sludges could not be returned; because an appreciable portion of the copper is water soluble and because water tended to break down the sandstone, eliminating core recovery. Holes were started by digging a pit 5 feet deep in which a pipe collar was set. (Note first five feet of samples are pit samples.) Drilling was started with a Standard "R" bit and the size reduced as casing became necessary. Cuttings were brought to the surface by air, preheated to dry them, and then carried to a manifold where canvass bags collected the cut material. Experience soon taught us that the copper, mostly in the form of malachite and silicate, was very finely ground and very light. Great care had to be exercised in gathering, handling and assaying the cuttings to prevent undue air-borne loss of copper by drafts. The sacked cuttings were sent to the Assay office in Bisbee. The cores were sent to Bisbee where they were quartered by the engineers and one-fourth made into a leaching sample and one-fourth into an assay sample. The remaining half was stored in case further study was warranted. Core recovery was not entirely satisfactory, but sufficient cores were recovered to make a fair check on the cuttings. We found that the larger the hole drilled the larger the percentage of core recovered, and the higher the copper content the higher the percentage of core recovery.

ASSAYING & HANDLING OF SAMPLES

Samples were all cut in a closed room to avoid loss of values by dusting. Pulps were all run by the iodide method. All results shown on the assay sheets are those obtained by this method. As soon as it became apparent that material losses could be sustained by dusting, a study was made to determine what these losses might amount to. Visual experiments were made by pouring crushed ore onto a large white paper from a height of three feet, allowing a draft to pass through the falling material. We discovered a distinct separation of the copper from the round sand particles. The sand making a steep descent, while the copper was carried some distance by the air currents. Some microscopic examination showed fine particles of malachite traveling relatively long distances from the pouring point. After being satisfied that this separation occurred, lumps of ore were broken in a mortar and the crushed material divided, one-half being leached in a sulphuric acid solution and the remaining half being cut successively and a sample taken after each cut. After considerable amount of work along this line, it was found that in each handling of dry pulverized ore, approximately 5% of the metal content was lost by dusting. The average sample was handled about five times, therefore, to all results reported by our assay department, 25% may be added. Although the above phenomena is very unusual, we are quite positive that our findings can be confirmed.

METALLURGY

Only preliminary metallurgical work has been done on the ore. However, numerous tests have been made by leaching. These tests have proven the amenability of the ore to leaching with sulphuric acid. The following tests are representative:

	<u>Heads</u>	<u>Tails</u>	<u>Recovery</u>
Test No. 1	1.19% Cu.	0.116% Cu.	91%
Test No. 2	11.34% Cu.	0.19% Cu.	98.4%
Test No. 101	0.84% Cu.	0.07% Cu.	91.6%

METALLURGY (Continued)

Silver in small amounts and gold in traces was found. The Silver content in the ore seems to bear a direct relation to the copper content. Ore of 3/4% would average about .17 ounces. The Silver is not recoverable by leaching.

ORE RESERVES

In estimating the tonnage of ore available in the area drilled, it was assumed that all minerals containing values of .3% copper or over, which were near the surface or where these values extended downward continuously, would be considered ore. Any departure from this minimum would materially change the tonnage. It is to be noted that every sample taken contains some copper, and that only in a few instances do sharp changes in grade occur, the rule being gradual gradation up or down of the copper content.

By plotting the worthwhile areas according to the above procedure, it was found that four areas of mineralization existed, three being in the Old Fort area and one on the Dutchman Claim. A fifth area, which was drilled to some extent by other parties and on which very favorable surface showings exist, lies on the North End of the Nannie E and California Claims. Undoubtedly this area will prove to be of an equal grade to the others, but since the size of the block is not known it was not included in tonnage estimates.

Drilling revealed that with the exception of the first four feet, nearly all the ore was relatively close to the surface. Although there were some exceptions, ore seldom went below 60 feet. Below this values below .25% were the rule, and the sandstone became more granular and was poorly cemented. In many holes at a depth of from 85 to 100 feet, dry, round, uncemented sand, all particles of which were nearly the same size, was encountered.

The favorable areas shown on Exhibits A and B cover an area of 1,000,000 square feet and 104,000 square feet and the depth of ore was 43 feet on the first area and 22 feet on the second area. This will account for 3,055,860 tons and 152,533 tons respectively. The areas shown on Exhibit A had an average grade of .75% and the area on Exhibit B averaged 1.94%.

CONCLUSION

It is concluded from the information gained by drilling, from exploratory work by adjoining operators, and from observing the portions of the district on which cuts and pits from early workings remain, that portions of the twelve square miles above mentioned which we did not drill are likewise of value. The entire area is structurally the same and mineral deposition was contingent on the same conditions. For three reasons, I believe that exploratory work on other areas will reveal similar conditions to those in the drilled area. There seems to be no pattern of enrichment, the ore bodies being more like large kidneys in a vast area. Although we failed in determining any direct relationship between these areas, it is quite probable that channels of enrichment connect them in many instances. The consistent occurrence of good ore on the surface, even in areas that proved lean when drilled, insures many small ore bodies in the areas not now classified as mineable. By this reasoning, it is reasonable to

CONCLUSION (Continued)

expect a material increase in the reserve tonnages reported above. Likewise, as borne out by the results obtained on the Dutchman Claim, which is over a mile from the main mesa, ore zones of value undoubtedly occur over the entire district. It now appears that a very large tonnage, probably ten or fifteen times that recorded by this exploration campaign, with an average grade of $3/4$ of one per cent copper, or around 450,000,000 pounds of recoverable copper lies within the twelve square miles. It is without a doubt one of the large potential copper bearing areas and is well worth the cost of further detailed exploration and metallurgical study. The cost of such a program will be large and should be attempted only after a review of the work all ready done by persons experienced in this type of operation.

Submitted by:

J. A. Wilcox

February 2, 1943

SHATTUCK DENN MINING CORPORATION

ASSAY REPORT

NAVAJO PROPERTY

May 18

19 42

SAMPLER	LEVEL	DATE SAMPLED	PLACE	oz. AU.	oz. AG.	% CU.	% PB.	% ZN.
Little Dick Claim			N.E. End	.001	0.24	0.86		
			North end cut, West wall	.001	0.15	0.81		
			South end cut	.001	0.18	0.40		
			Number 2	.001	0.17	0.75		
			Number 3	.001	0.20	1.56		
			Number 4 Face cut at tunnel portal.	.001	0.18	0.80		
			Number 4 0' - 35'	.001	0.14	0.59		
			Number 4 At 73'	.001	0.12	0.32		
			Number 5 S.W. End	.001	0.14	0.59		
			Number 6 South side	.001	0.22	1.18		
			Number 9	.001	0.22	0.64		
			Number 8	.001	0.16	1.34		
			Tunnel in cut into W. wall. Face sample in 13'	.001	0.22	0.36		
			Tunnel in West wall of cut. 0' - 25'	.002	0.52	1.67		
			South end plus 25'. West wall.	.001	0.14	0.59		
			Tunnel in West wall of cut. 25' - 37'	.001	0.21	0.37		
			South end cut plus 50' West wall.	.001	0.14	1.23		
			South end cut plus 75' West wall.	.001	0.16	1.13		
			South end cut plus 105' West wall.	.002	0.54	1.24		
			South end cut plus 150' West Wall	.001	0.34	1.50		
			South end cut plus 125' West wall.	.002	0.58	1.18		
			South end cut plus 175' West wall.	.001	0.41	1.89		
			South end cut plus 200' West wall.	.005	0.66	2.31		
			South end cut plus 225' West wall.	.001	0.33	1.56		
			South end cut plus 250' West wall.	.001	0.20	1.96		
			Lot Number 2. Number 1 muck pile	.001	0.23	0.53		
			Lot Number 2. Number 2	.001	0.20	0.64		
			Lot Number 2. Number 3	.001	0.27	0.32		
			Lot Number 2. Number 4	.001	0.16	0.75		
			Lot Number 2. Number 5	.001	0.24	1.34		

J. B. Campbell

ASSAYER

SHATTUCK DENN MINING CORPORATION

ASSAY REPORT

NAVAJO PROPERTY

May 18,

19 42

SAMPLE	LEVEL	DATE SAMPLED	PLACE	OS. AV.	OS. AG.	% CU.	% PB.	% ZN.
Grand Pacific			Number 3. East wall.	.001	0.24	0.86		
			Number 4.	.001	0.14	1.13		
			Number 5. North wall.	.001	0.16	0.64		
			Number 6. Shaft 0' - 29'	.001	0.24	1.29		
			Number 6. Tunnel out of shaft. to East 34'	.001	0.46	1.18		
			Number 7.	.001	0.14	1.02		
			Number 9. West wall.	.001	0.13	0.96		
			Number 11. 0' - 15'	.001	0.21	0.75		
			Number 12. 0' - 13'	.001	0.22	0.75		
			Number 13. 0' - 9 $\frac{1}{2}$ '	.001	0.10	0.25		
			Number 13. 9 $\frac{1}{2}$ ' - 19'	.001	0.30	0.42		
			Number 16. West End cut	.001	0.24	0.64		
California			Number 1. 30' cut through beds	.001	0.19	0.75		
			Number 2. West wall.	.001	0.26	0.75		
			Number 3. 0' - 22'	.001	0.14	0.48		
			Number 3. 22' - 48'	.001	0.08	0.75		
			Number 4. Cut through L.G. Cu. beds on cliff edge.	.001	0.09	0.42		
			Number 5. H.G. Bed. Outcropping	.001	0.12	0.96		
			Number 6. North wall cut.	.001	0.14	0.96		
			Number 7. H.G. Vein of Cu. on South side.	.001	0.12	2.75		
			Number 8.	.001	0.10	1.22		
			Number 8. Sample 80' across beds.	.001	0.14	0.36		
			Number 9.	.001	0.12	0.48		
			Number 11. South wall cut.	.001	0.08	0.63		
			Number 10.	.001	0.08	0.59		
			Number 12.	.001	0.18	1.13		
			Number 13. West wall.	.001	0.26	1.07		
			Number 16.	.001	0.08	0.25		
			Number 17.	.001	0.12	0.69		
			Number 19.	.001	0.12	0.48		

J. B. Campbell

ASSAYER

SHATTUCK DENN MINING CORPORATION

ASSAY REPORT

NAVAJO PROPERTY

May 18, 1942

SAMPLER	LEVEL	DATE SAMPLED	PLACE	OZ. AU.	OZ. AG.	% CU.	PP.	% Zn.
California			Number 5. L.G. Beds to S.E.	.001	0.12	0.59		
Hannie E.			Number 1. North face of outcrop.	.001	0.16	0.68		
			Number 3.	.001	0.16	0.32		
			Number 4.	.001	0.14	0.20		
			Number 5.	.001	0.14	0.37		
			Number 6.	.001	0.26	1.02		
			Number 7.	.001	0.24	0.64		
Copper World			15' Outcrop. Number 1. Bed outcropping N. of pile.	.001	0.30	0.60		
			North end of cut. East wall.	.002	0.68	0.64		
			North end cut plus 25'. East wall.	.002	0.47	0.96		
			North end cut plus 50'. East wall.	.002	0.50	0.16		
			North end cut plus 75'. East wall.	.002	0.64	1.07		
			North end cut plus 125'. East wall.	.001	0.36	0.50		
			North end cut plus 150'. East wall.	.001	0.36	0.57		
			North end cut plus 175'. East wall.	.002	0.54	0.10		
			North end cut plus 200'. East wall.	.001	0.13	0.44		
			North end cut plus 225'. East wall.	.001	0.18	0.46		
			North end cut plus 235'. Tunnel in East wall.	.001	0.16	0.64		
			North end cut plus 250'. East wall.	.001	0.33	1.07		
			North end cut plus 275'. East wall.	.001	0.44	0.34		
			North end cut plus 300'. East wall.	.002	0.12	0.31		
Ida M. Smyth			Number 1. Shaft. 16' - 24'	.001	0.12	0.37		
			Number 2.	.001	0.21	0.27		
			Number 3.	.001	0.14	0.37		
			Number 7. Center	.001	0.13	1.02		
			Number 7	.001	0.14	1.37		
Eli			Number 1.	.002	0.74	0.18		
			Number 2. Walls of cut.	.001	0.29	0.04		
			Number 2. South end of wall.	.001	0.22	0.91		
			Number 3. West wall.	.001	0.13	1.19		

I. B. CAMPBELL

ASSAYER

SHATTUCK DENN MINING CORPORATION

ASSAY REPORT

NAVAJO PROPERTY

May 18,

1943

SAMPLER	LEVEL	DATE SAMPLED	PLACE	OR AG.	OR AG.	% CU.	% FE.	% ZN.
Ore Type A.				.001	0.34	1.45		
Ore Type B.				.002	0.66	1.78		
Ore Type C.				.001	0.28	1.24		
Ore Type D.				.003	1.18	13.06		
Copper World.			North end cut plus 100'. East Wall	.001	0.34	0.54		
			South part of cut. 25' south of tunnel portal.	.001	0.30	0.91		
			7000 feet South. 35 degrees west of mineral mon-					
			ument. Iron Blowout.	.001	0.10	0.37		
Ida M. Smyth			Number 4. South side cut	.001	0.06	0.59		
Gopher			Number 1	.001	0.20	1.35		
			Quartz vein. Southwest Copper World.	.001	0.06	0.16		
			AVERAGE GRADE	.001	0.25	0.86		

J. B. Campbell

ASSAYER

