REGIONAL DIRECTOR

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

224 NEW CUSTOMHOUSE
DENVER 2, COLORADO

August 31, 1951

Air Mail

Memorandum

To: Executive Secretary, Defense Minerals Administration

From: DMA Field Team, Region IV

Subject: Final Report, DMA Docket 1109, San Miguel Copper Project, Nacimiento Mining District, Sandoval County, New Mexico

Enclosed herewith is original and two copies of the report as indicated above.

We concur with the conclusions and recommendations of the examining team.

J. H. East, Jr.

A. H. Koschmann

Enclosures

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

Mining Division
Region IV

224 NEW CUSTOMHOUSE
DENVER 2, COLORADO

August 29, 1951

Memorandum

To: DMA Field Team, Region IV

From: Chief, Mining Division, Region IV

Subject: Final Report, DMA Docket 1109, San Miguel Copper Project, Nacimiento Mining District, Sandoval County, New Mexico

Enclosed are original and seven copies of the above report. We agree with the examining team that the application be denied.

W. H. King

W. H. King, for
P. T. Allsman

Enclosures

Mining Division
Date Rec'd.

AUG 22 1951

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

BUREAU OF MINES
Denver, Colorado

Arizona-New Mexico Branch
[redacted]
Box 4097
UNIVERSITY STATION

MINING DIVISION
REGION IV

TUCSON, ARIZONA

Memorandum

August 20, 1951

To : Paul T. Allsman, Denver, Colorado

From : Chief, Arizona-New Mexico Br., Mining Div., Region IV

Subject: Final Report, DMA Docket 1109, San Miguel Copper Project, Nacimiento Mining District, Sandoval County, N. Mex.

Enclosed are original and 7 copies of the section on Summary, Conclusions and Recommendations by J. B. Clemmer and B. C. Brown of the Bureau of Mines, and the Metallurgical Section by J. B. Clemmer. The section on Engineering by B. C. Brown was mailed to you on August 9.

I believe Mr. Zimmerly asked that this report be sent directly to Mr. East, but Mr. Clemmer has requested that I mail it to Denver, hence it is being sent to you.

I believe Messrs. Clemmer and Brown have written a very good report and heartily approve it.

The brochure is attached; also lease agreements that were wanted by DMA Washington.

Walter R. Storms

Walter R. Storms

CC P.T. Allsman (7)
C.A. Anderson
DMA 1109
DF

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

Arizona-New Mexico Branch Mining Division
[redacted]
Box 4097
UNIVERSITY STATION

Date Rec'd.
AUG 13 1951
BUREAU OF MINES
Denver, Colorado

MINING DIVISION
REGION IV

TUCSON, ARIZONA

August 8,1951

Memorandum

To : Paul T. Allsman, Denver, Colorado

From : Chief, Arizona-New Mexico Br., Mining Div., Region IV

Subject : Engineering Report, DMA Docket 1109, San Miguel Copper Project, Nacimiento Mining District, Sandoval County, N. Mex.

As requested by Mr. East in his telephone conversation to Mr. J. B. Clemmer this morning, we are enclosing original and 7 copies of the Engineering Report by Brinton C. Brown of the Bureau of Mines. No geological report has been made by the Geological Survey as Brown visited the property alone. However, a Metallurgical Report will be submitted by Mr. Clemmer within a few days.

This report has my approval.

Walter R. Storms

Walter R. Storms

CC P. T. Allsman (7)
C. A. Anderson
DMA-1109
DF

UNITED STATES
DEPARTMENT OF THE INTERIOR
OSCAR L. CHAPMAN, SECRETARY

DEFENSE MINERALS ADMINISTRATION

REPORT OF EXAMINATION BY FIELD TEAM
REGION IV

DMA-1109, San Miguel Copper Project

Nacimiento Mining District, Sandoval County, N. Mex.

J. B. Clemmer, Metallurgist,
U. S. Bureau of Mines

B. C. Brown, Mining Engineer,
U. S. Bureau of Mines

August 1951

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

By J. B. Clemmer[1] and B. C. Brown[2]

The copper Commodity Committee of the Defense Minerals Administration requested that the Field Team, Region IV, make an examination of the San Miguel mine, Sandoval County, N. Mex., with particular reference to the following:

1. Tonnage and grade of copper ore remaining in the dumps.

2. Possibility of obtaining ore from existing workings that were caved in 1945, if now accessible.

3. Feasibility of applicant's process of manufacturing sulphuric acid and his estimate of costs.

4. Feasibility of the proposed leaching process, considering the Bureaus' findings in 1945.

The San Miguel is a 70 year old mine with a reported production of 4,200,000 pounds of copper. High-grade chalcocite occurring as fossil remains of trees was mined in early operations. The mine has been idle since 1900 except for a few years operation prior to 1921 when it was shut down as a result of the low price of copper.

Lessees of the property have applied for a $36,500 loan for the purpose of "installing a copper leaching plant on the copper mining lease to recover metallic copper in place on dump". In 1945 a similar proposal was made and the Bureau of Mines found that the cost of leaching operation exceeded the possible returns from the sale of the copper.

1/ Metallurgist, Southwest Experiment Station, U.S. Bureau of Mines.
2/ Mining Engineer, Arizona-New Mexico Br., Mining Div., Region IV, U.S. Bureau of Mines.

On July 12 and 13, 1951, B. C. Brown visited the property, measured and sampled the dumps and discussed the proposal with John C. Merrison and J. B. McCoy, lessees. In addition to a 200-ton per day leaching operation they intended to install a sulphuric acid plant at Sulphur Springs, N. Mex. and manufacture acid for the operation. Concurrent with the leaching of the dumps it was proposed to open the mine and remove any ore in sight. Funds for mining would be available only if a profit was made of the dump leaching operation. After the dump material had been exhausted the applicants expected to continue mining and leaching operations indefinitely.

As the mine is inaccessible with no ore blocked out there is no evidence to substantiate the statement that production of 200 tons per day could be made from the mine. Indications should not encourage belief that any sustained mining operation could be maintained. However, in view of the fact that the mine was shut down in 1921 as a result of the low price of copper it is probable that the mine was not worked out. The mine should be opened and the workings examined to determine whether any mineable ore reserves remain.

For the purpose of granting a loan, only the dump material can be considered. Tonnage measured in the dumps is 22,200 tons with an average grade of 1.59 percent copper. Much of the mineral is in sulphide form not amenable to leaching. The grade of sulphuric acid soluble copper is 0.74 percent. At the rate of 200 tons per day the dumps would be exhausted in 111 days.

It is believed that the applicants have greatly underestimated the capital requirements. However, based on their figures the cost of producing copper from the dumps would exceed the returns from the

sale of copper by more than $3 per ton.

Although the mixed oxide-sulfide dump ore can be processed by flotation and sulfuric acid leaching to recover about 94 percent of the copper, the process is too involved and expensive to apply to the 22,000 tons of dump ore.

The plan as proposed by Messrs. Morrison and McCoy for recovering cement copper from sulfureus acid leaching of San Miguel dump ore is not metallurgically feasible. The loan should be denied.

SAN MIGUEL COPPER PROJECT
NACIMIENTO MINING DISTRICT, SANDOVAL COUNTY, N. MEX.
DMA-1109

Metallurgical

Metallurgical Report

By J. B. Clemmer
Metallurgist
U.S. Bureau of Mines

SAN MIGUEL COPPER PROJECT
NACIMIENTO MINING DISTRICT, SANDOVAL COUNTY, N. MEX.
DMA-1109

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INTRODUCTION

This report discusses the metallurgical and economic aspects of a plan proposed by John C. Morrison and J. B. McCoy of Albuquerque, N. Mex., for recovering cement copper from acid leaching of dump ore at the San Miguel Mine, Sandoval County, N. Mex. Messrs. Morrison and McCoy, sub-lessee of the property, applied for a production loan of $36,500 for purchase of equipment and construction of an acid making and leaching plant. A field examination was requested to determine the tonnage and grade of ore remaining in the dumps and the feasibility of the proposal.

Mr. B. C. Brown, Mining engineer of the Bureau of Mines, visited the property in company with Messrs. Morrison and McCoy to obtain additional information on the proposal and to measure and sample the mine dumps. As the proposal includes construction of a plant at Sulfur Springs, N. Mex., to make acid from low-grade sulfur rock, Mr. Brown also visited the sulfur deposit and obtained samples for analyses.

Mr. Brown's engineering report, in summary, indicates that the San Miguel mine dumps contain some 22,000 tons of mixed oxide-sulfide ore assaying 1.59 percent copper. As the portals of the mine are caved, no examination could be made of the underground workings. While it seems probable that the mine was not worked out, no exploratory drilling has been done and it was impossible to estimate the reserves of mine ore. For the purpose of granting a loan, the only assured ore is the 22,000 tons in the dumps. As no exploratory work has been done

on the sulfur deposit at Sulfur Springs, its size could not be estimated.

Because of the small tonnage of assured ore and the uncertainity of a source of sulfur, the applicants' proposal does not appear attractive. Metallurgical testing of a composite of the dump ore seem unwarranted, however, to determine the feasibility of the proposal. Other methods for recovering the copper also were investigated to obtain preliminary data which could be used in reaching a decision as to whether or not further exploration of the mine would be justified.

PRODUCTION PLAN

The plan proposed by Messrs. Morrison and McCoy involves leaching 200 tons of dump ore per day with acid made from low-grade sulfur rock and to recover the leached copper by cementation on tin cans. Although details of the plan were discussed in Mr. Brown's engineering report, a few remarks regarding acid making may help to clarify the proposal.

While sulfuric acid can be made from sulfur dioxide by catalytic oxidation methods [1/], the applicants apparently intend to make acid by the more simple method of absorbing sulfur dioxide in water. This

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1/ Oldrigh, G. L., Keyes, H. E., and Wartman, F. S. : Precution of Ferric Sulfate and Sulfuric Acid fromRoaster Gas. A.I.M.E. Trans., Vol. 73, 1926.
Ralston, O. C. and Maier, C. G.: The Ferric Sulfate - Sulfuric Acid Process. U.S. Bur. of Mines, Bull. 260, 1927.
Keys, H. E. and Travaini, B.: The Autoxidation Process. Water Works and Sewage, August 1945.
Rampacek, Carl and Clemmer, J. B.: Sulfuric Acid from Sulfur Dioxide by Catalytic Oxidation in Mechanical Cells. A.I.M.E., San Francisco Meeting, Feb. 1949.

procedure would yield sulfurous rather than sulfuric acid. As sulfurous acid is a weakly ionized acid, it is not well suited for leaching copper ores. Later tests will show that dissolution of the oxides is slower and less complete than with sulfuric acids, and a large excess must be used to dissolve and keep the copper in solution. The acid is unstable and must be kept and transported in tightly closed containers. The idea of making sulfurous acid at Sulfur Springs and transporting it some 60 miles to a leaching plant at La Ventana would not be practical.

An alternative is to make sulfuric acid at La Ventana by catalytic oxidations method. Additional ore and sulfur would have to be developed, however, before this would be feasible. An 8-ton per day acid plant required for the 200-ton per day leaching operation would cost about $150,400, or more than the entire loan requested in the application.

METALLURGICAL TESTING OF ORE

Mineralogy

A composite of the dump ore was prepared for metallurgical testing by combining all of the assay sample rejects without regards their respective weights. The composite was somewhat higher grade than a weighted average of the dumps and it assayed 1.95 percent total copper, 0.55 percent sulfide copper and 1.40 percent oxide copper.

A petrographic examination showed that the ore is an arkosic sandstone in which the cementing material is calcite, chalcocite, malachite, azurite, hematite, and sporadic grains of metallic copper, covellite,

chrysocolla and carbonaceous material. The sample also contains feldspar and clay minerals from weathering of the feldspar. The examination indicates that grinding the ore to pass 100 mesh would liberate the chalcocite and a large proportion of the copper carbonates.

Leaching Tests

A number of bottle leaching tests were made on the dump ore to determine the copper extraction and the acid consumed per pound of copper extracted. The ore was stage-crushed in rolls to pass 20 mesh and leached with concentrated sulfurous acid. Comparative tests also were made using sulfuric acid of similar strength as the lixiviant. The results of the tests are summarized in table 1. Included also are data obtained for leaching a tailing from the ore after selective flotation of the chalcocite and calcite. The preparation of the product will be described later.

These tests clearly demonstrate that sulfurous acid is not effective for leaching the ore or tailing at atmospheric pressure. As the acid is unstable, evolution of sulfur dioxide accounts in part for the high acid consumption; aeration during leaching increases the consumption. To be effective, leaching, and thickening and filtration of the leach residues would have to be done under pressure. Even then copper sulfite would undoubtedly precipitate unless a large excess of acid was used. In the tests on the ore, calcium sulfite separated in the pulp and filtration of the residue was so slow that washing by decantation was necessary. Little if any chalcocite was dissolved by the sulfurous acid. Leaching with sulfurous acid does not apply to the San Miguel ores.

Table 1 Summary of leaching tests on ore and flotation tailing

Leach Feed	Time	Acid	Strength Gm/L.	Acid, pounds per ton Added	Acid, pounds per ton Consumed	Leach Residue %Wt.	Leach Residue %Cu.	Copper Extraction Percent	Pounds Acid Consumed per pound of Cu.
				Assay, percent					
			Leach Feed	Cu., total	Cu., sulfide	Cu., oxide			
Ore	1 Hr.	H_2SO_3	56.4	90.0	64.0	94.0	1.62	21.9	7.5
Ore	1½ Hr.	H_2SO_3	56.4	180.2	128.0	95.2	1.51	25.3	12.5
Ore	1½ Hr.	H_2SO_3	56.4	90.0	79.4	97.2	1.79	10.8	18.9 *
Ore	1 Hr.	H_2SO_4	52.2	125.2	81.4	96.2	0.59	70.9	2.9
Ore	1 Hr.	H_2SO_4	52.2	88.8	79.4	96.5	0.59	70.8	2.9
Tailing	1 Hr.	H_2SO_3	54.5	76.2	48.6	96.9	0.68	49.3	3.8 **
Tailing	1 Hr.	H_2SO_4	52.2	104.2	63.2	96.0	0.07	95.4	2.6
Tailing	1 Hr.	H_2SO_4	52.2	73.8	61.0	96.0	0.10	92.6	2.5

* Pulp aerated during leaching; gypsum separates from pregnant liquor
** Copper sulfite separates from pregnant liquor

Sulfuric acid leaching of the ore and tailing give an excellent extraction of the acid-soluble copper. The copper content of the leach residues agrees well with the copper sulfide assay of the feeds. Selective flotation of sulfides and calcite from the ore, followed by leaching and cementation of copper from the tailing would be an ideal flowsheet if enough ore could be developed to justify such a plant. Leach-precipitation-flotation also might be appreciable to low-line ores but this process is still in an experimental stage of development.

Flotation

A number of cursory flotation tests were made on the ore to determine the grade and recovery of concentrates from selective and bulk flotation of the copper sulfides and oxides.

The results of an average test made on the ore ground to pass 100 mesh in an iron rod mill are given in Table 2. The chalcocite was floated with American Cyanamid Aerofloat 238 followed by flotation of the malachite and azurite with American Cyanamid reagent 424.

Table 2 - Selective flotation of sulfides and oxides.

Product	Wt. percent	Assay, percent Cu. Sulfide	Oxide	Total	Distribution, percent Cu Sulfide	Oxide	Total
Sulfide R. Conc.	2.1	23.24	8.49	31.73	86.5	13.4	35.1
Oxide R. Conc.	2.3	1.23	29.93	31.16	5.0	51.6	37.7
Tailing	95.6	0.05	0.49	0.54	8.5	35.0	27.2
Composite	100.0	0.56	1.33	1.89	100.0	100.0	100.0

Reagent	Rod mill	Pounds per ton of feed Sulfide Cond.	Sulfide Rougher	Oxide Cond.	Oxide Rougher
Hydrated lime	2.0	-	-	-	-
Am. Cy. 238		0.05			
Am. Cy. 425				4.0	-
Frother 70			0.02		0.02
Time, min.	10	2.5	5	2.5	7.5
pH	10.3	10.0	9.95	10.0	9.75

Flotation of the chalcocite was good, but only part of the oxide copper was recovered. No method as yet has been devised for good flotation of oxidized copper minerals.

In another test, the chalcocite, azurite, and malachite were floated in a bulk concentrate using reagent 425 as the collector. The results were almost identical to those of selective flotation and are recorded in table 3. The rougher concentrate was of acceptable grade without cleaning and contained 73.4 percent of the total copper.

Table 3 - Bulk flotation of sulfides and oxides.

Product	Wt. percent	Assay, percent Cu			Distribution, percent Cu		
		Sulfide	Oxide	Total	Sulfide	Oxide	Total
Rougher Conc.	4.5	12.87	19.39	32.26	92.4	64.6	73.4
Tailing	95.5	0.05	0.60	0.55	7.6	35.4	26.6
Composite	100.0	0.63	1.35	1.98	100.0	100.0	100.0

Reagent	Pounds per ton of feed		
	Rod mill	Conditioner	Rougher
Hydrated lime	2.0	-	-
Am. Cy. 425		4.0	
Frother 70			0.02
Time, Min.	10	5	7.5
pH	10.4	10.5	10.3

Although the flotation tests were of a preliminary nature, the results are indicative of what can be expected by fine grinding and flotation of the dump ore. The copper recovery by flotation or sulfuric acid leaching are about the same; in leaching, the sulfides are lost, and in flotation the chrysocolla and part of the azurite and malachite are lost. Flotation of the sulfides and acid leaching of the tailings to recover the oxides would be necessary for a high copper recovery. Flotation of the calcite also would be necessary on high-lime ores to minimize acid consumption. Although the sample of dump ore only contained about 2 percent calcite, a selective flotation test was made to recover the chalcocite, reject the calcite, and prepare a tailing for leaching. The results of such a test are recorded in table 4. The chalcocite rougher concentrate was of acceptable grade. The calcite reject after cleaning still contained about 0.6 percent copper. The calcite middling and flotation tailing were combined with similar

products from other tests to obtain enough material for leaching experiments. The leaching data are included in table 1. The calculated distribution of copper in the flotation and leach products based upon these data is as follows:

Copper in sulfide concentrate	41.9	percent
Copper in leach liquor	53.0	
Total	94.9	
Copper lost in calcite reject	2.5	
" " " leach residue	2.6	
	100.0	

Table 4 - Selective flotation of sulfides and calcite.

Product	Wt.	Assay, percent Cu			Distribution, percent Cu		
	Percent	Sulfide	Oxide	Total	Sulfide	Oxide	Total
Sul. R. Conc.	2.7	20.98	9.09	30.07	90.6	18.7	41.9
Calcite reject	8.1	0.11	0.50	0.61	1.4	3.1	2.5
" middling	11.0	0.10	2.45	2.55	1.8	20.5	14.5
Tailing	78.2	0.05	0.97	1.02	6.2	57.7	41.1
Composite	100.0	0.63	1.31	1.94	100.0	100.0	100.0

		Pounds per ton				
		Sulfide		Calcite		
Reagent	Rod mill	Cond.	Rougher	Cond.	Rougher	Cleaner
Caustic soda	2.0					
Sodium silicate		0.50		0.50		0.50
Ethyl Xanthate		.05				
Frother 70			0.02		0.02	.01
Oleic acid				0.24		
Time	10	2.5	5	2.5	5	5
pH	10.6	10.4	10.2	10.0	9.7	10.0

SUMMARY AND CONCLUSIONS

Metallurgical tests have demonstrated that the San Miguel mixed oxide-sulfide copper ore is not amenable to leaching with sulfurous acid. The oxide copper minerals are attacked slowly and the sulfides hardly at all. As the acid is unstable and obnoxious to use, leaching, thickening and filtration or washing of the residues would have to be done in a closed system under pressure. Even then, the copper recovery would be low; the chalcocite and precipitated copper sulfide would report in the leach residue. The plan proposed by Messrs. Morrison and McCoy to make sulfurous acid and leach the dump ore in place is unfeasible.

Complementary tests have demonstrated that bulk flotation of the copper minerals or sulfuric acid leaching of the ore will recover a little over 70 percent of the copper. In leaching, the sulfides are lost, and in flotation the chrysocolla and part of the copper carbonates are lost. Flotation of the sulfides followed by sulfuric acid leaching of the tailing to extract the oxide copper for cementation would recover about 95 percent of the total copper. Such a flow sheet would be ideal if enough mine ore could be developed to justify the expensive plant that would be required. Should later exploration of the mine develop a substantial tonnage of copper ore, more extensive testing of representative samples would be warranted to determine the best combination of methods for economic processing of the ore.

RECOMMENDATIONS

Although the mixed oxide-sulfide dump ore can be processed by flotation and sulfuric acid leaching to recover about 94 percent of the copper, the process is too involved and expensive to apply to the 22,000 tons of dump ore.

The plan as proposed by Messrs. Morrison and McCoy for recovering cement copper from sulfurous acid leaching of San Miguel dump ore is not metallurgically feasible. The lease should be denied.

SAN MIGUEL COPPER PROJECT
NACIMIENTO MINING DISTRICT, SANDOVAL COUNTY, N. MEX.
DMA-1109

Engineering Report

By B. C. Brown
Mining Engineer
U. S. Bureau of Mines

August 1951

Engineering

SAN MIGUEL COPPER PROJECT
NACIMIENTO MINING DISTRICT, SANDOVAL COUNTY, N. MEX.
DMA-1109

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INTRODUCTION

The Defense Minerals Administration Field Team, Region IV, requested that an examination be made of the San Miguel mine, Sandoval County, N. Mex. Lessees of the property applied for a $36,500 loan for the purpose of "installing a copper leaching plant on the copper mining lease to recover metallic copper in place on dump". The mine was visited on July 12 and 13, 1951 by the writer who measured and sampled the dumps and obtained additional information on the leaching proposal. He was accompanied by John C. Morrison and J. B. McCoy of Albuquerque, N. Mex., lessees of the property and applicants for the production loan.

This property was examined by engineers of the Bureau of Mines in 1945. At that time J. G. Cleary, who held a lease on the San Miguel, applied for a loan of $15,000 to "purchase and install equipment in order to leach the old mine dumps and obtain the contained copper". According to a report[1/] "the cost of this leaching operation seems to be higher than the possible returns from the sale of the resultant copper". Results of metallurgical tests were summarized in a report[2/] as follows: "The oxidized copper in ore from dumps of the San Miguel mine was not recovered by weak sulfuric acid leaching of the minus ½-inch ore. Fine grinding for a long period is necessary to recover the copper with dilute acid solution. A grind leach of the minus ½-inch, composite of the ore recovered 86.6 percent of the copper". The Bureau of Mines recommended that the loan be rejected.

1/ Storms, W. R., Russell, P. L., Preliminary War Minerals Report, Bur. of Mines, 1945.

2/ Weak Sulphur Acid Leaching of Oxidized Copper Ore from San Miguel Mine, Sandoval County, N. Mex., R.M.T. 264, Rolla Div., Metallurgical Branch, Bur. of Mines, June 1945.

In connection with the present leaching proposal the applicants consider installing a sulphuric acid making plant at Sulphur Springs, N. Mex. to supply acid for the leaching operation. The sulphur property was visited on July 14, 1951. A sample was taken from an exposed bed containing low-grade sulphur.

ACKNOWLEDGMENTS

Information contained in a Bureau of Mines report[3] and in a U. S. Geological Survey report[4] has been freely used. John C. Morrison and J. B. McCoy were very co-operative in providing available information.

LOCATION AND ACCESSIBILITY

The San Miguel mine is located in the Nacimiento Mining District at the southwest tip of the Santa Fe National Forest in Sandoval County, N. Mex. (figure 1). It is in sec. 24, T. 19 N., R. 1 W., N.M.P.M., about 70 miles north and west of Albuquerque. State Highway 44, connecting Bernalillo and Cuba, is the nearest paved highway.

The mine is accessible by a dirt road intersecting Highway 44 at a point about 2½ miles north of La Ventana. This is a bulldozed road for a distance of 6.6 miles east of the highway. The last mile has an average grade of 20 percent with some grades as steep as 30 percent. La Ventana, 42 miles from Bernalillo on Highway 44, is the nearest Post Office. Nearest rail transportation is at Bernalillo, a Santa Fe Railroad station, a distance of 41 miles.

3/ Previously mentioned in footnote 1.
4/ Lindgren, Graton, Gordon, U. S. Geol. Surv. Professional Paper 68, 1910, pp 141-148

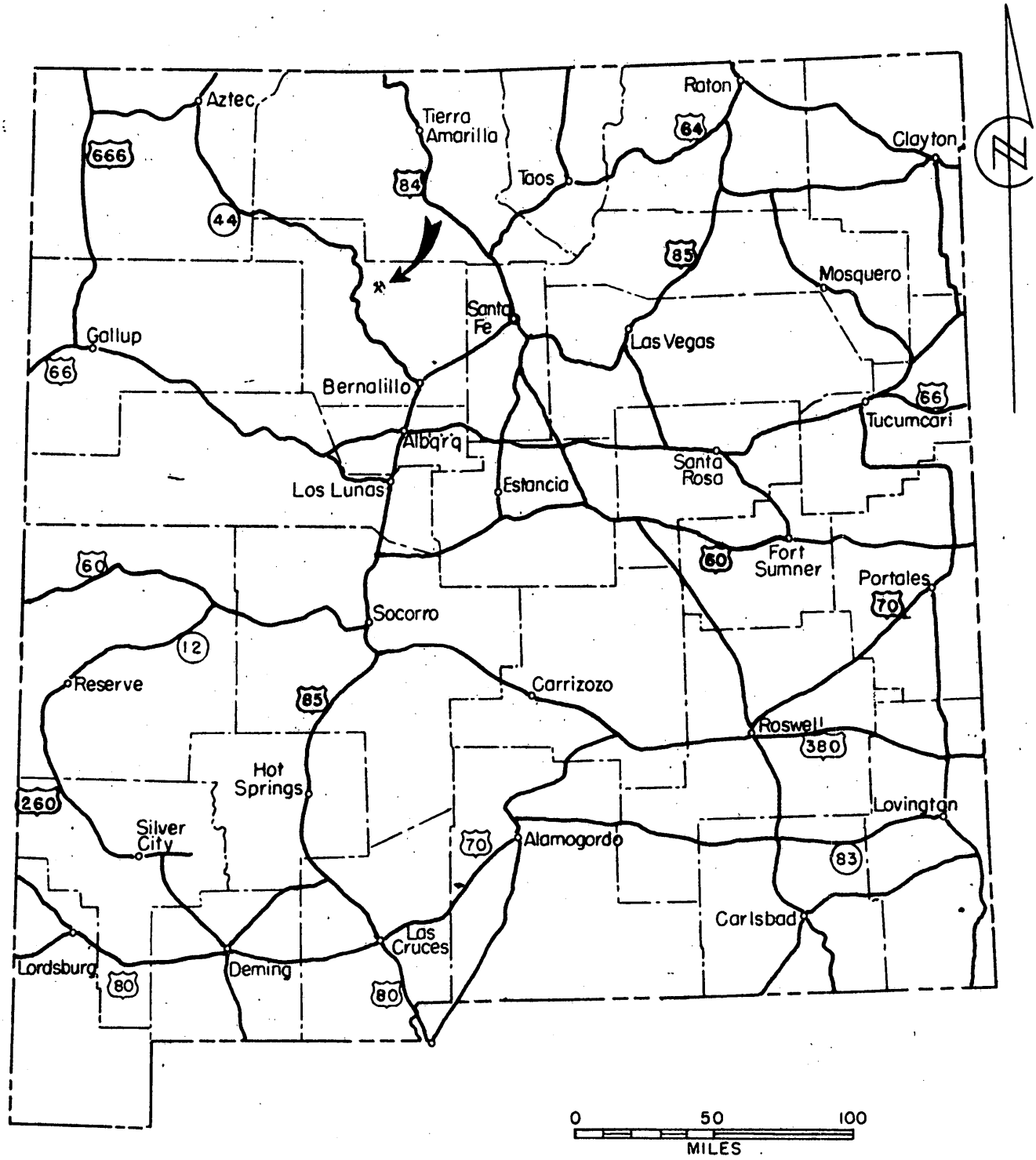

FIG. 1 - LOCATION MAP OF SAN MIGUEL MINE
SANDOVAL COUNTY, NEW MEXICO

DMA 1109 JULY 1951

PHYSICAL FEATURES AND CLIMATE

The mine area, situated on the western slope of the Nacimiento Range, is mountainous but not unusually rugged. The surface descends from elevations of 9,500 feet at the crest of the range to 7,000 feet at edge of the plateau on the west with a gradient of 500 feet to the mile.[5] The area is drained by the Arroyo de los Pinos which flows westward into the Rio Puerco.

At the San Miguel mine the altitude is 7,890 feet above sea level. The altitude of La Ventana is 6,500 feet.

The climate is typical of the northern New Mexico mountainous regions with cold winters accompanied by heavy snowfall, and mild, warm summers. Annual precipitation averages more than 16 inches. Temperatures range from 25° F. below zero to occasionally 100° F. during the summer.[6] Vegetation consists of scattered pines and a variety of brush. Timber is plentiful for mining purposes. No water is found near the mine. A spring, 2½ miles to the south, that was used during early operations, is nearly dry.

HISTORY AND PRODUCTION[7]

Copper deposits, originally discovered by Indians and Mexicans, first were reported in 1859 by J. S. Newberry, a geologist. The San Miguel deposit was discovered about 1880 and first was opened as

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5/ Previously mentioned, footnote 4
6/ Previously mentioned, footnote 1
7/ Previously mentioned, footnotes 1 and 4

a mine in 1884. Several drifts, 300 to 400 feet long and one about 800 feet long, were driven. The mine was closed in 1900 and no work was reported until 1918. At that time a Mr. Pope financed a corporation known as the San Miguel Mining Co. to operate the property. Underground workings were developed and a 150-ton gravity concentration plant was constructed. Operations ceased when the price of copper dropped in the early 1920's and no further underground work has been done.

It is said that about 4,200,000 pounds of copper were produced from the San Miguel mine, most of it before 1900. Some of the ore that was smelted ran 64 to 65 percent copper, much of it 48 to 50 percent, and very little of it less than 35 or 40 percent. It carried 2½ to 3 ounces of silver to the ton, but no gold. Ore was hauled 10 miles by wagon to a 30-ton smelter at Copper City. Metallic copper was hauled 60 miles by wagon to Bernalillo. A large tonnage of low-grade ore running 10 to 20 percent copper was reportedly left on the dump in 1900. Much of this high-grade ore since has been hand sorted and shipped to smelters.

A few cars of copper ore were shipped in 1919 and 1920 by the San Miguel Mining Co. In 1944, J. G. Cleary shipped one car of sorted ore reported to average 17 percent copper. Morrison and McCoy shipped a 9-ton truck load to the smelter at El Paso, Texas in December 1950. Assays of the applicant's samples ran 38.11 percent copper and 48.96 percent copper. The American Smelting and Refining Co. paid on the basis of the smelter's sample for 5.1 percent copper.

OWNERSHIP AND EXTENT

The property, consisting of three old patented lode claims known as the San Miguel group, is owned by Mrs. Mary E. Pope of Pittsburgh, Penn. and Clyde W. Pope, executor and residuary legatee of Mrs. M. W. Pope of Geneva, N. Y. This group of mining claims (figure 2) comprising the San Miguel, Copper Queen and Palmer, Mineral Survey 1894, and 12 unpatented lode claims, the San Miguel Nos. 1 to 12, inclusive, were leased in June 1949 to J. G. Cleary of La Ventana, N. Mex. for a period of 5 years. In November 1950, J. G. Cleary made a sub-lease of the property for a period of 3 years to J. C. Morrison and J. B. McCoy of Albuquerque, N. Mex., partners and applicants for a production loan. Cleary has an option to purchase the property for $50,000. Morrison and McCoy have an option in the sub-lease agreement to purchase all rights and interest from Cleary for $25,000.

Morrison, a lawyer by training, is a retired railroad brakeman. McCoy is an A. F. of L. minor official and conciliator for a Laborers and Hodcarriers Union in New Mexico. These men have no mining or milling experience.

DESCRIPTION OF DEPOSITS 3/

Sedimentary formations at the San Miguel mine strike approximately north and dip about 45 degrees to the west. The ore-bearing formation consists of medium to heavy bedded, white to reddish fine-grained

3/ Previously mentioned, footnote 4.

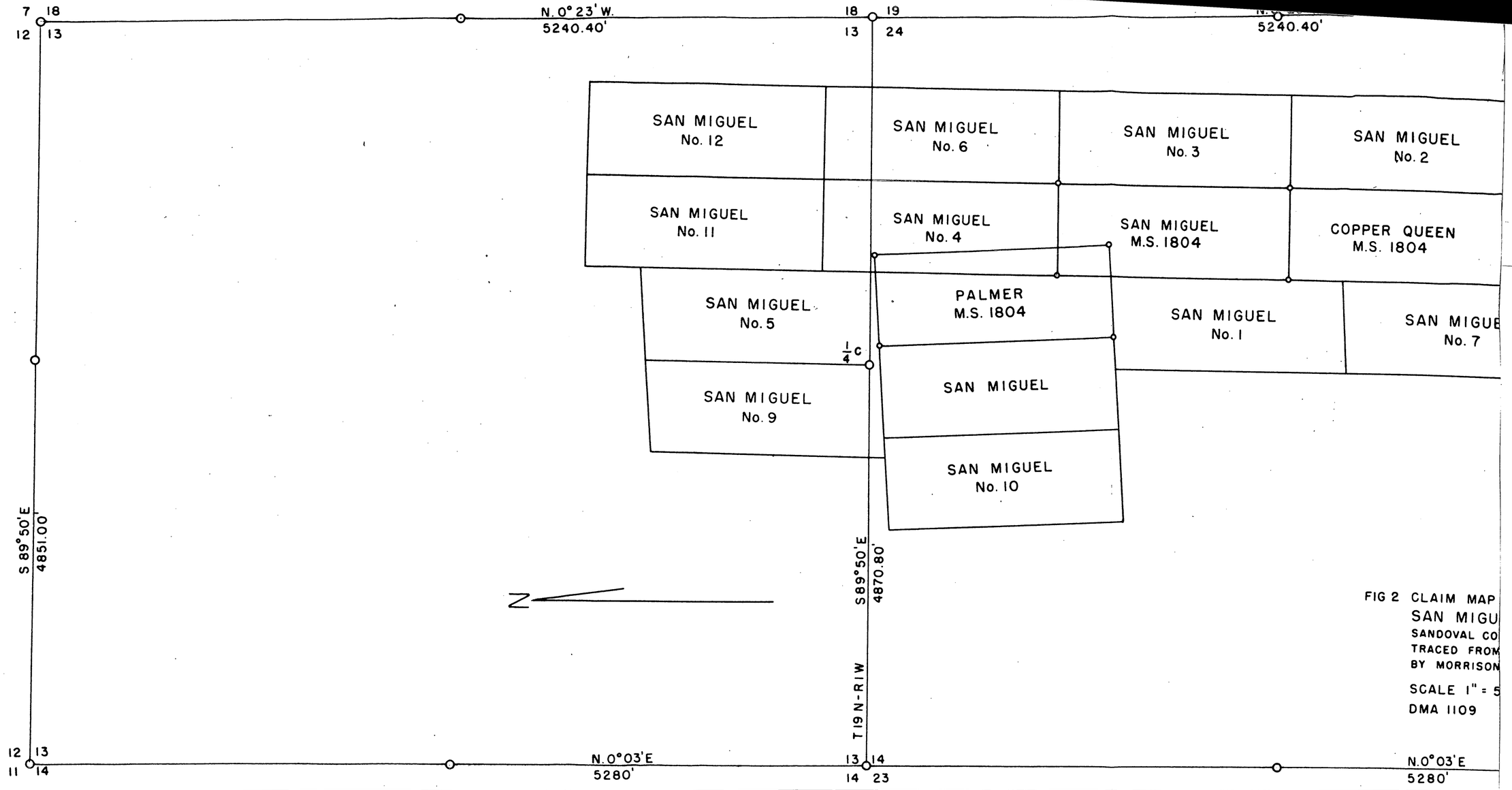

FIG 2 CLAIM MAP
SAN MIGU
SANDOVAL CO
TRACED FROM
BY MORRISON
SCALE 1" = 5
DMA 1109

sandstone known as the Dakota sandstone of Cretaceous age. These are underlain by several hundred feet of "Red Beds" which are separated from an axial core of pre-Cambrian granite by several hundred feet of carboniferous limestone, with some marls and sandstones.

The ore occurs mainly as chalcocite in fossil remains of wood or trees and in concretionary nodules of glance. Chrysocolla occurs as impregnations in the sandstone. Azurite and malachite are present where the deposits have been oxidized.

MINEABLE ORE RESERVES

The portals of the mine are caved and the underground workings are inaccessible. No exploration drilling has been done. No mine maps are available. No mine ore reserves can be estimated. However, in view of the fact that the mine was shut down as a result of the copper price dropping in 1921 it is probable that the mine was not completely worked out. The applicants are of the opinion "That they have 60 acres of copper-bearing mineral averaging 100 feet thick and about 4 of these acres have been mined".

A 10-ton excavation known as the "Uleary Cut" has exposed some chalcocite, azurite, and malachite in place. A grab sample taken at the cut assayed 1.77 percent copper. There are several outcrops of sandstone with oxidized copper exposed over a vertical distance of about 100 feet. It is proposed to open-cut mine this area. Open-cut mining is not warranted until the grade and size of the deposit and the amount of overburden have been determined.

Azurite, malachite, and some chalcocite are exposed on the old mine dumps. The dumps have been hand sorted many times since Lindgren reported 10 to 20 percent copper in 1910. The grade of four grab samples taken in 1945 by Bureau of Mines engineers from four different dumps averaged 0.83 percent copper.

The applicants estimated 50,000 tons of low-grade ore in the dumps. Ranjovsky[2] estimated 15,000 tons containing 1.5 percent copper. The dumps were measured and samples by the writer (Figure 3). Analysis of samples and tonnage calculated are as follows:

	Tonnage[1]	Grade,[2] percent copper	H_2SO_4 Sol. Cu., percent
No. 1 dump	1,[illegible]	1.37	0.85
No. 2 dump	3,[illegible]	1.44	1.42
No. 2 dump	4,[illegible]	1.15	0.57
No. 2 dump (south extension)	1,350	1.22	0.69
No. 2 dump (west extension)	3,[illegible]	1.10	0.50
No. 3 dump	2,[illegible]	1.87	0.71
No. 4 dump	3,[illegible]	1.70	0.51
No. 5 dump	[illegible]	[illegible]	1.14
Total	15,[illegible]	1.[illegible]%	0.74%

1/ Tonnage was calculated on the basis of 15 cubic feet to the ton of broken material allowing about 10 percent for contingency.

2/ In general samples consist of a combination of small amounts of material taken at 6-foot intervals on the center line of the dump and at 3-foot vertical intervals on the slope of the dump. The surface was removed to a depth of about 6 inches before samples taken. Samples averaged about 70 pounds.

1/ Ranjovsky, T. O., Report on San Miguel Mine, for the State Bureau of Mines and Mineral Resources, New Mexico.

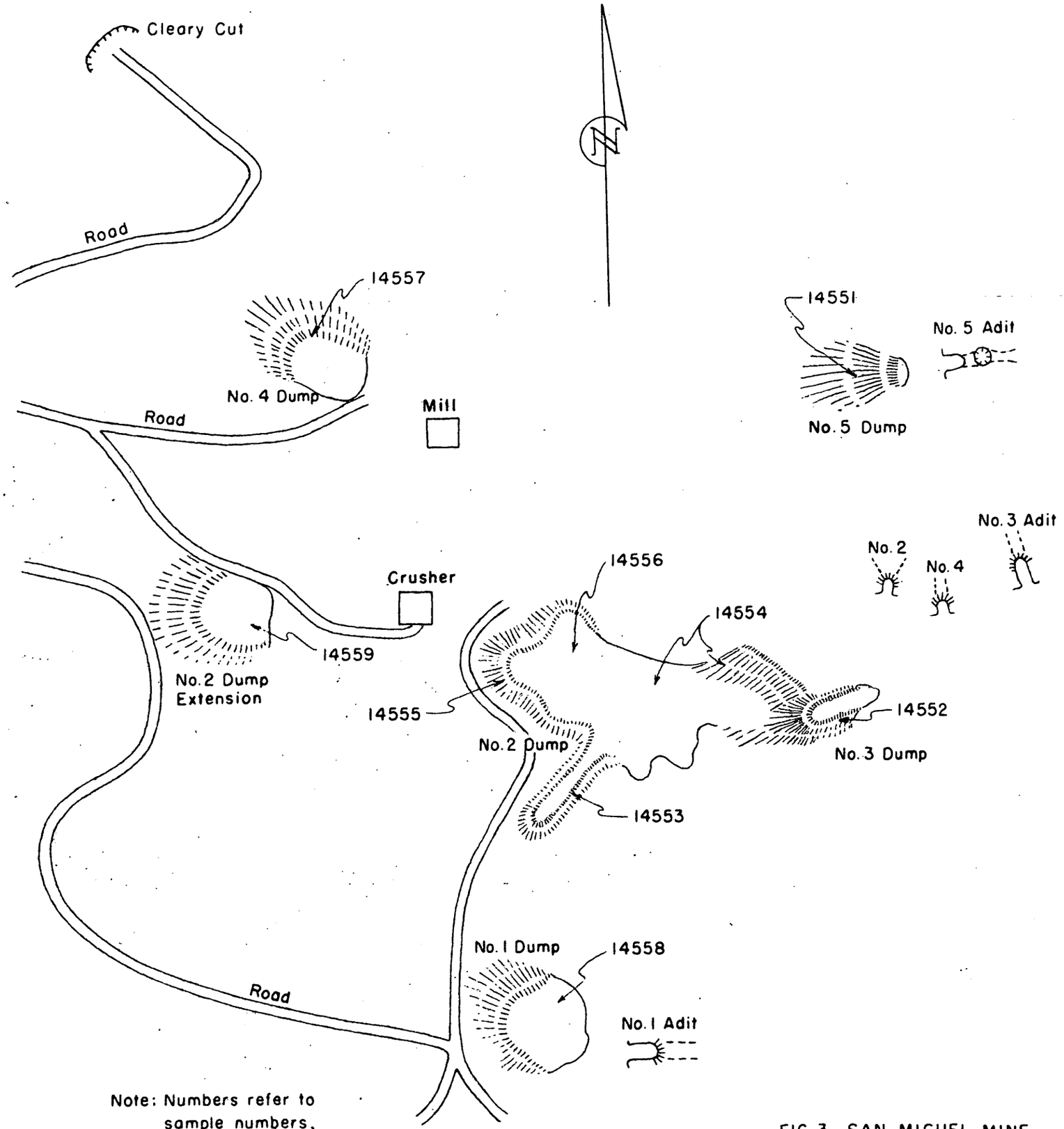

FIG. 3 SAN MIGUEL MINE
SANDOVAL COUNTY, NEW MEXICO
Rough Brunton Survey showing
location of dumps.
Scale 1" = 100'

DMA 1109 JULY 1951

Until the workings are accessible the only ore reserves that can be considered for the purpose of granting a loan are the 21,200 tons measured in the dumps. Much of the mineral occurs in sulphide form and is not amenable to acid leaching. Sulphuric acid soluble copper assayed 0.74 percent which will be the grade of the mill head. Huuh?

PRESENT STATUS

Exploration and Development

The mine has been idle for 30 years with the portals of all adits caved. Two men were attempting to open the entrances to three of the workings when the mine was visited. This operation, if continued, will require only a few weeks. Several small charges of dynamite were detonated at the Cleary Cut, breaking about a ton of rock and exposing some chalcocite, azurite and malachite.

Applicants are "waiting for a loan from the Government to install a leaching plant for treatment of the mine dumps. The profits they expect to realize from the leaching operation are intended to be used for the development of the mine".

Mining and Milling Equipment and Other Facilities

There is no equipment for mining or milling on the property. Milling equipment noted at the property during the Bureau's examination in 1945 has been removed. Old mill buildings are in a condition beyond repair. Pipe is being removed from the 2½-mile pipeline connecting the spring to the mill. One load of pipe was taken to Albuquerque.

The applicants state that they have possession of the equipment listed in table 1. According to their application they owe $5,000 on this equipment, which is located at Eland, N. Mex. They state that the equipment is nearly new, having been used at a gold property for a short period and has been idle since 1948. They have received a bid of $600 to move the equipment from Eland to the mine. Most of this equipment seems to have doubtful value. It is either not adaptable or inadequate for the proposed operation.

The applicants report that they have possession of 160 acres at La Ventana townsite, including a 14-room hotel and three other buildings. They owe $10,000 on the balance of the purchase price. This property is to be used for the proposed leaching plant. The hotel of rock and mud construction was boarded up and requires at least $2,000 worth of repairs to make it a suitable warehouse. The proprietor of La Ventana general store is not aware of the applicants' holdings in La Ventana and is sure that if they have any holdings they are confined to the hotel property.

It was asserted that they have a 40-acre sulphur deposit "tied up" at Sulphur Springs, N. Mex., about 68 miles by road from La Ventana via San Ysidro and Jemez Springs. During a visit on July 14, 1951 to Sulphur Springs the writer discovered the applicants did not have the sulphur holdings "tied up" and that they could not get a 60-day option to lease or buy the property at that time. The sulphur is to be used for making sulphuric acid for the leaching operation.

TABLE I. - List of equipment reported to be owned by applicants, located at Bland, N. Mex.

1	Pioneer Crusher - No. 816 - 9x16-C317
2	Ore cars Trux Mfg. Co.
34	Rails 22 ft. long 16 lbs.
1	Small Rail Bender
1	Steel water tank 8 x 20
1	Regrind crusher
3	Shafts 3 pulleys and boxing
8	Belts V-12 flat belts
1	Akin classifier, C. Iron Works
1	Hardinge Conical Mill 2/16 ball bearing
1	Acetyline torch 6 tanks, 3 empty and 3 full
1	Fairbanks Morse scale - platform
3	Fire extinguishers
1	Wheel barrow
3	Cell fletation plant complete
2	Sump boxes
3	Pump buckets
1	Work bench
1	Complete, wiring system - 6 reflectors
1	Boll carrier
75	Belts and Wedges (s)
700	ft. pipe, 2x1½
200	Ore sacks
1	Water tank steel
1	Automatic gas engine model R
1	Blacksmith furnace
1	Bake furnace
1	Die set
2	Saws
1	Assayer screen
22	Handles
	Misc. small tools and supplies
1	Complete set for Koehler 1½ KW plant
8	50-gallon barrels
1	TP water centrifugal pump complete. (Gas engine)
1	Koehler plant, small (at La Ventana)

PROJECT PROPOSALS

Exploration and Development

Originally the applicants proposed to build a 200-ton per day leaching plant at the mining property, install crushers below the dumps, build wooden chutes from the dumps to the crusher for gravity flow of the ore, and build an acid-making plant at Sulphur Springs, N. Mex., to supply sulphuric acid for the leaching operation. They are of the opinion that the Bureau of Mines will recommend in detail the procedure for leaching the ore; recommend in detail the size, type, and quantity of equipment required and suggest locations for each item; determine the cost of the equipment and the process; determine the number of men required for the operation; recommend equipment and process for making sulphuric acid; and recommend a metallurgist and technical personnel to conduct the operation.

A spring 2½ miles from the mine, the only source of water, is nearly dry. The applicants now propose to install a 200-ton per day leaching plant at La Ventana where they intend to develop a 400 g.p.m. well, hand-sort high-grade ore for direct smelting, crush ore at mine (if the Bureau recommends crushers there), and haul ore by trucks to La Ventana for leaching. Sulphur is to be mined at Sulphur Springs. The acid is to be made according to Bureau of Mines recommendations at Sulphur Springs and trucked to La Ventana. Tin cans for precipitation of leached copper are to be obtained from city dumps at Albuquerque and trucked to La Ventana. Silver is to be taken out of solution by electrodes placed in the leaching vats. As the applicants expect the

Bureau of Mines to determine their requirements, a break-down of costs is not available. They estimate that "the cost of removing the dumps, crushing, leaching, transportation and smelting charges will be about 25 percent of the value of the ore". (They estimate the value of the dump material at $300,000.)

The applicants further propose to use the profits derived from leaching the dumps to open the mine and remove any ore in sight. They consider using an open-cut mining method at the Clarey Cut if feasible. They would like for the Bureau of Mines to make recommendations for mining the old workings. Although the applicants have no definite plans for mining the old workings, they intend to remove ore from the mine concurrently with the dump leaching operation. They do not expect that operations will cease when the dump ore is exhausted.

New Equipment and Facilities

Equipment listed in table I was used at a gold property at Bland, N. Mex., until 1948. The applicants owe $5,000 on the balance of the purchase price and have a bid of $600 to move the equipment from Bland to the mine. Not all of this equipment is adaptable to their proposed leaching operation and some equipment may be inadequate. A considerable amount of additional equipment will be required. As the applicants are depending on the Bureau of Mines recommendations for equipment to be used for leaching the dumps, no breakdown of costs for new equipment was made. According to their application they estimate $11,000 for purchase of equipment.

Balance of the purchase price of La Ventana townsite is $10,000. They estimate that the 14-room hotel can be repaired for an additional $2,000. The building is to be used for a boarding house and office, or a warehouse, or a combination of both.

Transportation, Including Access Roads

A bulldozed road for a distance of 6.6 miles makes the mine accessible. However, the last mile has an average grade of about 30 percent with some grades as steep as 40 percent. The applicants state that about $900 was spent repairing this road in the fall of 1950. Additional work on the road will be required before operations can be started. Grades must be reduced, road width must be increased, and passing points made for trucks.

The applicants estimate a cost of 60 cents per ton to load dump material and haul it by truck to La Ventana for leaching. They intend to haul more than 200 tons per day during good weather and stockpile it for operations during the winter. This cost estimate is low. It will cost at least 10 cents per ton mile or about $1.00 per ton to haul the ore to the plant.

No estimate was made on the cost of hauling acid from Sulphur Springs, a distance of 60 miles. The only cost of the scrap iron for precipitation of the leached copper is the cost of hailing the tin cans at the Albuquerque city dump and hauling it a distance of 75 miles. The hauling cost is estimated at 5-3/4 cents per ton mile. Trucking precipitates from La Ventana to the rail head at Bernalillo cost $4.12 per ton (about 8 cents per ton mile), according to applicants.

There is no reason to believe that the cost of hauling scrap iron will be less than hauling precipitates unless the same truck that hauls the scrap iron picks up a load of precipitates on the return trip.

According to Morrison rail charges from Reynalilla to the smelter at El Paso. Terms are $15.77 per ton.

Manpower

The applicants are of the opinion that it will be difficult to employ a metallurgist, and chemists. They expect the Bureau of Mines to recommend technical personnel for the project. No breakdown of jobs for the 20 men that are estimated as required in their application, could be obtained. They expect the Bureau of Mines to determine how many men will be required and what their jobs will be.

No shortage of unskilled labor exists. All the Spanish-American labor needed can be obtained from Cuba, a town about 13 miles from La Ventana, at 75 cents an hour. However, Morrison expressed his desire to pay $1.00 an hour and get a better class of labor. The "Padre" at Cuba, who knows the people well, has consented to select the men required. Housing will be no problem as the laborers have their homes at Cuba.

Power

The applicants have no estimate of the K.V.A. requirements of the operation. However, they contemplate installing a Diesel power plant of undetermined capacity costing approximately $2,000. As

listed in Table I, they have two small 1½-KW Kohler plants for lighting purposes. In the near future Rural Electrification Administration power lines are to pass through Sulphur Springs, the proposed site of the sulphuric acid plant.

Water

A spring, 3½ miles to the south of the mine, used during 1918 operations, is nearly dry. It is proposed to develop water at La Fontana by drilling an 8-inch well to a depth of about 300 feet. A driller has offered to drill the well at a cost of $2,300 and estimates a 400 g.p.m. capacity. An adequate supply of water is estimated at 100 to 200 gallons a minute.

Timber

According to Morrison, the timber on the property is available for mining and building purposes.

Acid Plant

The process originally considered for making acid was described by the applicants as the "Indian still process" where sulphur is heated with the SO_2 gas passing into agitated water. According to the Bureau's report, 10/ this would make sulphurous acid and not sulphuric acid. It was questionable whether or not sulphurous acid would leach the dump material.

The applicants now propose to make acid for the leaching operation at Sulphur Springs, N. Mex. They expect the Bureau of Mines to determine the plant requirements and costs, depending on the size

10/ Previously mentioned, footnote 1.

Rate of Production

The capacity of the plant is to be 200 tons per day. It is proposed to operate continuously 24 hours a day, 7 days a week. Concurrent with the leaching operation it is proposed to open the mine and mine ore in sight. When the dumps are exhausted the plant is to continue indefinitely on mined ore.

There is no evidence that a mining operation of 200 tons per day can be made. There is no ore blocked out to encourage belief that any sustained mining operation can be maintained.

For the purpose of granting a lease only the tonnage and grade of the mineral on the dumps can be considered. At the rate of 200 tons per day the dump material will be exhausted 111 days after the plant is put into operation.

Mining Methods and Costs

It is the applicants' belief that the mining method and costs should be determined by the Bureau of Mines. They favor an open-cut method, if feasible. Funds for financing mining operations are to come from the profits made by leaching the dumps. As the mine was not accessible, no mining method can be recommended at this time.

Open-cut mining is not warranted until the grade and size of the deposit and the amount of overburden have been determined. There are no indicated profits to be used to open the mine as proposed.

Milling Methods and Costs

Details of crushing and leaching have been left for the Bureau of Mines to determine. The only estimate made by the applicants is that the overall cost of milling, transporting, and smelting will be about 35 percent of the value of the dump material, which they value at $300,000.

Their tentative proposal in general is this: Install crusher and ore bins down slope from the dumps, build wooden chutes from dumps to crusher for gravity flow of rock, hand sort high-grade ore for direct shipment to smelter, crush ore in primary crusher, store crushed ore in bin, draw ore from bin into trucks, haul ore to La Ventana, dump into storage bin or stockpile, crush to recommended leaching size, convey material to leaching vats (about 100 feet long, 6 feet wide and 4 feet deep), obtain tin cans from Albuquerque city dumps for precipitation of leached copper, install electrodes for removal of silver from the solution, truck copper precipitates to Bernalillo and ship by rail to smelter at El Paso, sell silver on the open market, and dump tailings into the Rio Puerco. Acid for leaching is to be made at Sulphur Springs, N. Mex., and trucked to La Ventana.

The proposal to feed the primary crusher by gravity flow of the ore in wooden chutes is not feasible. The angle of repose of the rock in the dumps is greater than the grade from the dumps to any possible crusher site. Some loading or scraper device must be used.

and requirements of the leaching plant, also to be recommended by the Bureau of Mines. They have no idea how much it will cost to make the acid.

Sulphur was mined at Sulphur Springs many years ago. The extent of the deposit is not known and little evidence of the mine dump remains. A bed containing 15.33 percent sulphur was sampled by the writer. This bed, inclined at about 30 degrees, had about a 2-foot thickness exposed. Total thickness of the bed could not be determined. An outcrop of native sulphur by the hot springs and fumaroles was observed. The size of the sulphur deposit was not estimated but it is probably small.

Sulphuric acid is very difficult to obtain. According to the Bureau's findings in 1946, 4.44 pounds of acid are required for each pound of copper recovered. An acid plant of at least 7 tons per day capacity would be required. A 35-ton per day plant would cost $515,000. It is questionable whether a 7-ton per day plant could be built for $110,000. It is doubtful whether the size and grade of the sulphur deposit will justify this expenditure.

PRODUCTION PLAN

Time Schedule

No estimate of time for installing the plant has been made. The applicants are relying on the Bureau of Mines to determine the time schedule, along with its recommendations and specifications for the plant. They state that they are in a position to start work within two weeks after a lease has been granted.

There are several discrepancies to be noted. The applicants overestimated the value of ~~xxxxxxxxxx~~ the dump material about 4 times the actual value. The leaching proposal is essentially the same as proposed in 1945 with considerable added expense of buying the townsite of La Ventana, developing water, constructing a much larger plant, and moving the material for treatment. In 1945 the Bureau of Mines rejected a loan because the cost of producing copper was greater than the possible returns from the sale of that copper. A premium of $0.05 per pound of copper was included in these calculations.

Conditions now are about the same. The price of copper has increased; likewise, the cost of equipment, materials, and labor has increased. Based on a very conservative estimate of $1,000 per ton per day, the cost of building an adequate 200-ton per day mill would be about three times the value of the leaching material in the dumps. It is not feasible to recover silver as proposed. Much of the sulphide copper is not amenable to leaching.

Acid for leaching is exceedingly difficult to obtain. If procurable it will cost about $30 per ton delivered at La Ventana. More than 4 pounds of acid will be required for each pound of recoverable copper. The proposal to make sulphuric acid at Sulphur Springs is not feasible. The cost of an acid plant would many times exceed the value of the dump material. It is doubtful whether the sulphur deposit is large enough to warrant a plant. The cost of treating dump material will exceed the gross returns and the net loss would be high. There are no indicated profits to be used to open the mine as proposed.

In view of the infeasibility of leaching 22,200 tons of dump material, it seems that the application for a production loan should be withdrawn. However, there are sufficient indications to warrant opening the caved portals for examination of the workings to determine the feasibility of producing ore from the mine. Possibly enough ore can be found by an exploration program to justify installation of a flotation mill or a leaching plant.

Smelting Methods and Costs

Precipitates and hand-sorted high-grade ore will be trucked to Bernalillo, 51 miles from La Ventana. The Santa Fe Railroad transports the ore to the American Smelting & Refining Co. at El Paso, Texas, a distance of 289 miles. The applicants state the cost of trucking will be $4.12 per ton and the rail charges will be $15.77 per ton. They are of the opinion that smelting charges will be $4.50 per ton regardless of the grade of the precipitates and the grade of the hand-sorted high-grade ore.

Taxes and Insurance

No figures are available for assessed valuation, tax rates, and insurance rates. The applicants state "that this cost will be small and when operations are started taxes will not be increased because the State of New Mexico is trying to encourage the development of its resources". These cost items should be determined, as a marginal operation could easily be turned into a submarginal one if these items are overlooked.

Royalty

Pursuant to the applicants' sub-lease agreement, copy attached, they must pay rental of "25 cents per ton for each and every ton of ore mined and removed" to J. G. Cleary, lessee, of the property. In addition, a royalty must be paid to Popes, owners of the property, according to the provisions of a lease to Cleary, copy attached, in the amount of 7½ percent of the gross proceeds, less the smelter treating charges, upon all ore netting less than $25 per ton, and 10 percent of the gross proceeds, less smelter treating charges, upon all ore netting in excess of $25 per ton.

Amortization of Capital

As stated in the application for a loan, the proposed method for repayment of the loan is to be made from "Returns from sale of copper in five annual payments, first payment to be made one year from date of loan". Inasmuch as the proposal for the loan is confined to the treatment of the dumps, only the tonnage and grade of the dumps can be considered for the amortization of the loan. Treating the 12,200 tons of dump material at the rate of 200 tons per day would exhaust the measured reserves in 111 days.

It was pointed out that amortization of capital is usually made on a "per ton" or "per pound of metal recovered" basis. The applicants wish to repay the loan as quickly as possible and are willing to follow any procedure that the Government recommends.

Reserves for amortization are taken as 22,200 tons of 0.74 percent recoverable copper. The loan amounts to $36,500. A certain rate of interest will be charged. Repayment of the loan on a "per ton" basis will amount to $1.64 per ton plus interest. (Interest at a low rate of 3 percent would amount to 5 cents per ton.)

SUMMARY: COST OF PROJECT

Capital Requirements

Applicants' Estimate

Land - La Ventana townsite - 160 acres	$10,000
Building construction on La Ventana	8,000
Purchase of equipment	11,000
Indebtedness	2,500
Working capital	5,000
	$36,500

Bureau of Mines' Estimate

Leaching plant, crushers, etc., 200 tons/day @ $1,000/ton/day	$200,000
Purchase of La Ventana townsite	10,000
Repair of mine road	5,000
Working capital	20,000
Total	$235,000
Acid plant - 7 tons/day (if sulphur deposit warrants)	$110,000
Total, including acid plant	$345,000

The above estimate of $1,000 per ton per day for purchasing of equipment, construction, and installation is very conservative. It also includes development of water, purchasing and installing power plant, and rehabilitating buildings at La Ventana.

An acid plant of 35-tons per day costs $515,000. It is questionable whether or not a 7-ton per day acid plant could be installed for $110,000. It is doubtful whether the size and grade of the sulphur deposit will justify this expenditure.

Operating Costs on Basis of Applicants' Capital Costs

	Per Ton	Total
Ore haul to La Ventana	$1.00	$22,200
Acid, - 4.44 lbs/lb. Cu @ 1.5¢/lb	0.99	21,882
Labor - 18 tons/man shift @ $10/man shift	1.00	22,200
Royalty to J. G. Cleary @ $0.25/ton	0.25	5,550
Amortization of loan, $36,000	1.64	36,000(1)
Misc. power, taxes, insurance, office, royalty to owners, etc.	1.00	22,200
	$5.88	$130,532
Cost of trucking precipitates to Bernalillo (81 miles), rail freight to El Paso, Texas (389 miles), smelter charge, moisture penalty, refining, and marketing charges are taken at 7.5¢/lb. of recoverable Cu @ 14.8¢/ton	0.11	2,442
	$6.99	$132,974

(1) Interest not included.

No safety factors or contingencies have been allowed in the above mentioned costs. The royalty to the owners would exceed $6,000.

Indicated Loss

Acid soluble copper @ 0.74 percent = 14.8 lbs. copper/ton.

22,200 tons in dumps @ 14.8 lbs. Cu/ton = 328,560 lbs. Cu total.

The price of copper is about 24.5 cents per pound.

328,560 pounds of copper (neglecting losses)

@ 24.5 cents per pound of copper is $80,497 gross returns

from sale of copper.

	Per Ton	TOTAL
Gross returns from sale of copper	$3.63	$80,497
Total costs (based on applicants' estimate)	6.99	155,174
Net loss	$3.36	$74,677

A substantial premium price of at least 30 cents per pound of recoverable copper would be required to profitably treat the dumps.

PROPOSED FINANCING

The applicants state that funds will be needed as soon as the application has been approved.

Effort was made to obtain a loan from the First National Bank in Albuquerque and the Bank of New Mexico in Albuquerque. These banks advise that they are not making this type of loan.

Collateral offered as security for repayment of the loan is the La Ventana townsite and lease covering copper in dump and to be mined, together with buildings and equipment. La Ventana townsite, including buildings (if owned by the applicants), has doubtful value to the Government. The condition of equipment at Niland was not observed. The Government does not seem to be interested in taking over leases on copper properties at this time. It is the opinion of the writer that collateral offered as security for repayment of the loan is inadequate.

As stated in the application the proposed schedule of repayment of the loan is "Returns from sale of copper in five annual payments, first payment to be made one year from date of loan".

The only reserves that can be considered for the purpose of granting a loan are the 22,200 tons measured in the dumps. At the proposed rate of production of 200 tons per day the dump material will be exhausted in 111 days. It will be noted that repayment of the loan does not start for one year.

This was called to the attention of the applicants. They wish to repay the loan as quickly as possible and are willing to repay on a "per ton" or "per pound of copper recovered" basis.

CONCLUSIONS

The San Miguel mine is a 70-year old mine with a reported production of 4,300,000 pounds of copper. It was mined in the early days for high-grade chalocsite found in fossil remains of trees. High-grade ore was mined again for 2 years until the price of copper dropped in 1921. Although the mine workings are inaccessible, it is reasonable to believe that the deposit is not completely mined out.

There are 22,200 tons of material in the old dumps with an average grade of 1.59 percent copper. Much of the mineral is in sulphide form not amenable to leaching. Acid soluble copper averaged 0.74 percent. Recovery would be less. The property was carefully studied during 1945 when a similar proposal was made. It was found that the cost of leaching would exceed the returns from the sale of copper. Now the price of copper has been increased; so have the costs of equipment, transportation and labor.

Sulphuric acid is very difficult to obtain. If procurable it would cost about $30 per ton delivered at La Ventana. According to the Bureau's findings in 1945, 4.44 pounds of acid were required for each pound of copper recovered. An acid plant having a minimum capacity of 7 tons per day would be required. The proposal to heat

sulphur and pass SO_2 gas into agitated water is not feasible. It is questionable whether or not a 7-ton per day acid plant can be built for as little as $110,000. It is doubtful whether the size and grade of the sulphur deposit at Sulphur Springs will justify this expenditure.

The leaching proposal is essentially the same as proposed in 1945 with the added expense of moving the material to La Ventana for treatment. It is believed that the applicants' estimate of capital expenditures was underestimated by a large amount. However, using the applicants' figures, a loss of more than $3 per ton is indicated. The cost of producing copper from the dumps still exceeds the possible returns from the sale of copper. If the shortage of copper becomes critical enough to warrant a substantial premium price of at least 30 cents per pound of recoverable copper, production of 150,000 pounds of copper can be expected from the dumps. Until such a time a loan should be denied.

In view of the indicated loss from the leaching operation there will be no profit to be used for opening the mine as proposed. To start mining the Cleary Cut by open-cut methods, as proposed by the applicants', is not warranted by present indications. The grade and size of the deposit and the amount of overburden should first be determined.

Morrison, a lawyer and retired railroad brakeman, and McGoy, a labor union official, have no mining or milling experience. They are not technically competent to supervise the proposed project. Competent technical supervision would be required for any efficient production.

If the applicants open the caved portals as they have planned, it seems that the property is worthy of further examination to determine reserves in the mine. Possibly enough ore can be found by an exploration program to justify installation of a flotation mill or leaching plant.

RECOMMENDATIONS

It is recommended that a loan be denied for the proposal to leach the dump material.

It is recommended that the caved portals be opened and that an examination of the underground workings be made to determine the feasibility of producing ore from the mine. Possibly enough ore can be found by an exploration program to justify installation of a flotation mill or leaching plant.

If an exploration loan or a production loan is granted it should be granted with provisions that the expenditures be made under direct management of an experienced operator.