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James Doyle Sell Mining Collection

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928

# PHELPS DODGE CORPORATION

WESTERN EXPLORATION OFFICE

DRAWER 1217

DOUGLAS, ARIZONA 85607

TEL. 602-364-8414

August 6, 1971

Mr. James D. Sell  
American Smelting & Refining Co.  
1150 N. 7th Avenue  
Tucson, Arizona

Re: Exchange of Information  
Copper Springs Creek, Gila County, AZ  
and  
Spike E. Hills, Cochise County, AZ

Dear Mr. Sell:

I am very sorry to have been delayed so long in getting back to you on this matter. Unfortunately, I will not be able to get to it for sometime and suggest you call George Rogers at this office. We can exchange all of our data on the Spike E. Hills area, on the basis that such data will not subsequently be passed on to someone else.

Very truly yours,

*W. J. Walker*

W. J. Walker  
Senior Staff Geologist

WJW:c

12-13-82

J.D.S.

MCO BLOCKCAVE LEACH

I talked with Ray  
Sosh of MCO. They  
presently have a pump  
problem and the water is  
too deep to wade in.  
He said by Friday the  
water may be pumped down  
so we could walk through  
from one shaft to another.  
He said to check with him  
on Wednesday. We should  
bring hip boots, etc.  
Ray mentioned that Newmont's  
executives ~~are~~ will be given  
a big tour on Thursday.

H.G.K.

Postponed til '83

AMERICAN SMELTING AND REFINING COMPANY  
Tucson Arizona

April 3, 1970

FILE MEMORANDUM

PINTO VALLEY PROSPECT  
CASTLE DOME MINE AREA  
GILA COUNTY, ARIZONA

Miami Copper Company has recently announced a "new" discovery of over 300 million tons of possibly 0.45% copper, as chalcopryite, located under and around the old Castle Dome Mine area.

Attached Figure 1 shows the approximate pit limits to the area now known as the PINTO VALLEY prospect. Also shown are the three Laramide intrusive units in the area.

The mineralized area is in a horst block bounded on the west by the Gold Gulch fault zone and on the east by the Jewell Hill system and appears to be restricted to the extent of the Lost Gulch quartz monzonite distribution (which plunges under the Jewell Hill area).

Verbal communication with the Miami geology department revealed that one drill hole, near the west limiting Gold Gulch fault, stayed in ore-grade material down to a depth of 3800 feet where the hole was terminated.



James D. Sell 

JDS/kvs  
Attachment

Route file copy WESaegart

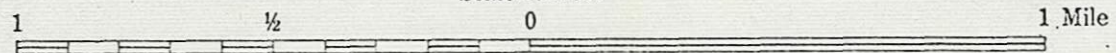


- Schultze granite
- Lost Gulch quartz monzonite
- Granodiorite in Gold Gulch

Approx. Pit Limit

From USGS PP 342

Scale 1:24 000



Contour interval 25 feet

Datum is mean sea level



~~Florida~~  
Miami District

Arizona Republic, Phoenix  
Saturday, April 29, 1972, p.23

MIAMI — The Occidental Minerals Corp. plans to negotiate to extend option agreements here that will expire starting in June, company officials said.

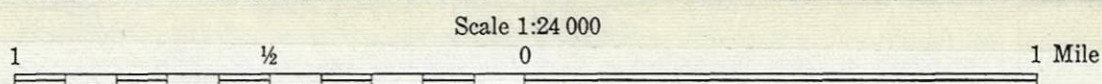
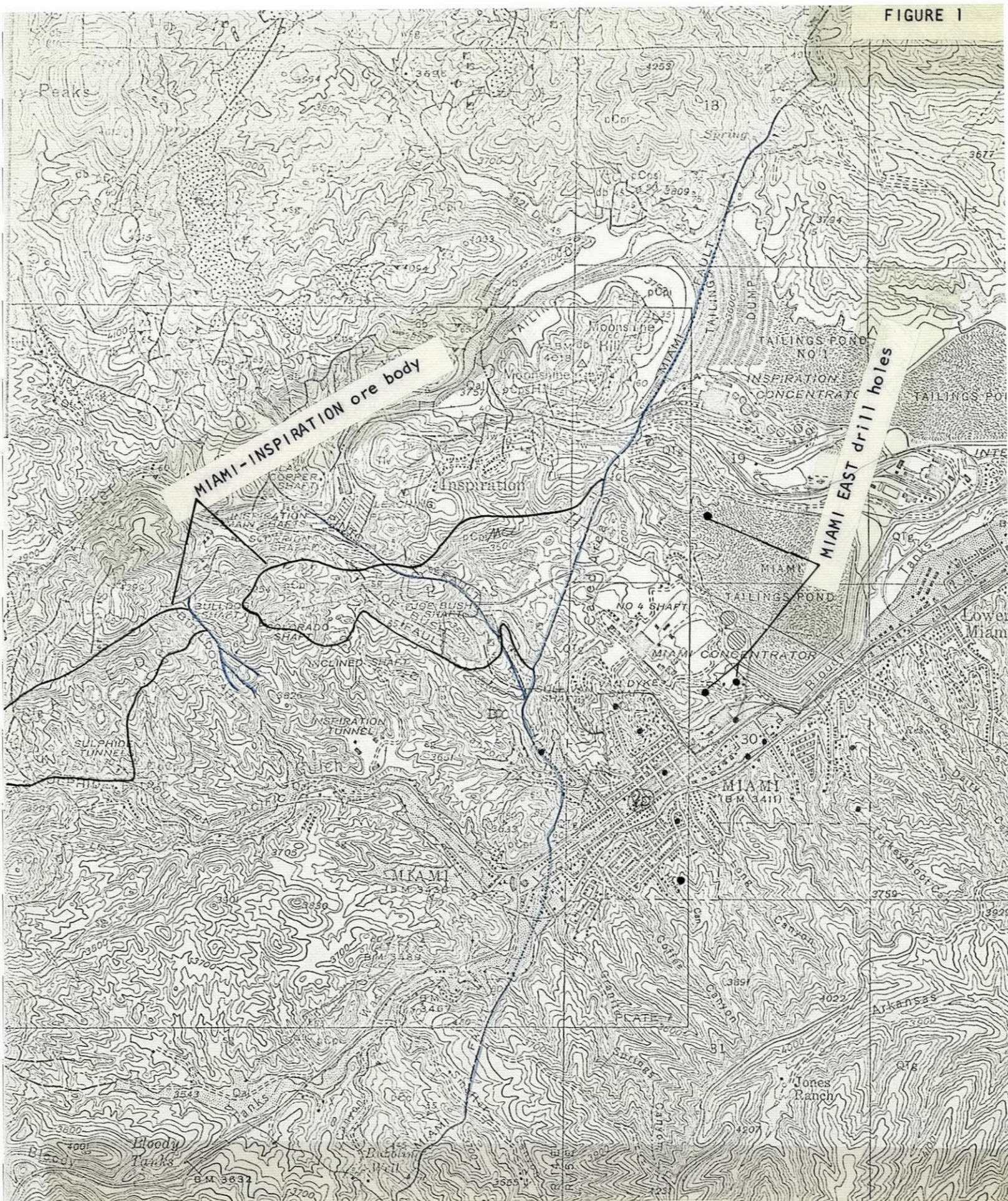
The mining company had signed the three-year options — dating back to 1969 — to make geological and engineering studies. A 1970 stockholders report indicated the company had found some copper ore on the optioned property.

The same report indicated the company had 7,000 acres in claims or under lease in this area at that time.

Rather than buying the land outright, the company now wants to work out six-year options on the claims in order to do more exploration, company officials said.



FIGURE 1



Contour interval 25 feet  
Datum is mean sea level



URANIUM AT COPPER CITIES AND OTHER PORPHYRY  
COPPER DEPOSITS, MIAMI DISTRICT, ARIZONA

By  
Arthur Rood Still

PhD Dissertation, Harvard University, 1962

Abstract

There are two varieties of porphyry copper deposits in the Miami district: those in both schist and granite (Miami-Inspiration and Live Oak orebodies) and those in quartz monzonite and related intrusive rocks (Copper Cities and Castle Dome). Deposits of the first variety contain appreciably less uranium and phosphorus compared to deposits of the second variety.

In the primary zone at Copper Cities the uranium occurs as a substitution for thorium in the mineral thorite (variety uranothorite). In the supergene zone most of the uranium is in the thorium mineral thorogummite formed by the alteration of thorite. In the capping of the deposit, in the mixed zone between the capping and the supergene zone, and in the upper portion of the supergene zone most of the uranium has been liberated from the thorogummite and occurs in metatorbernite and in the mineral plumbogummite where it is presumed to substitute for lead.

A less detailed study of Castle Dome indicates that this deposit contained more thorite but with less substitution of uranium compared to Copper Cities. Here also the uranium in the capping and the upper part of the supergene zone occurs in metatorbernite and plumbogummite.

The Thornton (part of the Miami-Inspiration orebody) and Live Oak pits are less radioactive than the Copper Cities and Castle Dome pits. Very minor amounts of metatorbernite were found at two sites in the Live Oak pit.

There is no supergene enrichment of uranium at Copper Cities but there has been leaching of radioactive disintegration products from the capping with a subsequent re-deposition of these products in the upper part of the supergene zone, presumably as radiocolloids in the mineral plumbogummite.

The gross distribution of uranium does parallel the distribution of hypogene copper; both show a vertical hypogene zoning and both are slightly concentrated along a granite porphyry-quartz monzonite contact. No relationship was recognized between the distribution of uranium and molybdenum.

The Copper Cities deposit contains an average of 11 times, and up to a maximum of 38 times (on 45 ft. bench composite samples), the quantity of uranium that usually occurs in normal igneous rocks of this general composition. Airborne and groundborne radiometric surveys and chemical analyses of local host rock types have revealed that while these rocks apparently contain up to 3 times as much uranium as normal igneous rocks of this composition range, they contain abnormally large amounts of radioactivity and/or uranium only within the areas of porphyry copper type mineralization at Copper Cities and Castle Dome. The parallel relationship between the distribution of copper and uranium at Copper Cities, i.e., vertical hypogene zoning and concentration along the Lost Gulch quartz monzonite-granite porphyry contact, strongly suggests that both elements were not only introduced into the rock after its emplacement but also that both used essentially the same avenues of ingress (zones of fracturing, faulting, etc.)

The copper mineralization of the district has been attributed to the same source as the granite porphyry, which is the youngest intrusive of the local Mesozoic complex. Because relatively less uranium occurs in the Miami-Inspiration type deposits where there is abundant granite porphyry, the thorium-uranium and the copper mineralization may have different sources. Quartz monzonite and Mesozoic diabase are abundant at both Copper Cities and Castle Dome but are not present in the Miami-Inspiration area. Some relationship may well exist between the uranothorite mineralization and the Mesozoic diabase.

This study indicates that the uranium and thorium in the Copper Cities deposit may have a by-product potential. Restricted areas of intense uranium mineralization in the Dripping Spring quartzite of the region may indicate porphyry copper type mineralization in the underlying rocks because of their similar mineralogy.

AMERICAN SMELTING AND REFINING COMPANY  
Tucson Arizona

April 7, 1970

FILE MEMORANDUM

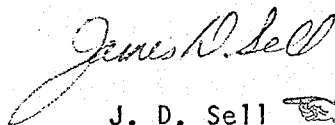

Miami East  
Miami Copper Company  
Gila County, Arizona

Miami recently announced the rediscovery of a deep-lying faulted segment of the Miami-Inspiration ore body on the east (down-dropped) side of the Miami fault.

The report listed six holes drilled in 1969 which encountered copper mineralization ranging in depths from 2460 to 3300 feet. The average thickness of the mineralization was reported at 465 feet containing 1.51% copper. Verbal communications with Miami suggested that a total of 15 holes have now been drilled.

Attached Figure 1 shows the location of the Miami-Inspiration (West) ore body, the Miami fault, and three of the Miami East holes. Inspiration has also been busy drilling their claims over the deep area. Occidental has secured options in the Miami townsite and are reported to have a number of holes drilled. The present location of the Occidental rig is the lower drill site at Hicks Canyon.

Miami drills on a 200-foot rectangular grid, but as pointed out at Copper Cities, they usually do not use each point during the early reconnaissance program. Miami will deepen the shaft at the old concentrator, drift through the fault, and establish stations for fan-drilling the deposit to determine its extent and grade.

  
J. D. Sell 

JDS/kvs

Attachment

Route file copy WESAegart





Scale 1:24 000

1 1/2 0 1 Mile

Contour interval 25 feet  
Datum is mean sea level



AMERICAN SMELTING AND REFINING COMPANY  
Tucson Arizona

April 3, 1970

FILE MEMORANDUM

Copper Cities and Diamond H Pits  
Miami Copper Company  
Gila County, Arizona

Miami Copper Company recently announced a combined reserves of the Copper Cities and Diamond H open pits at approximately 31 million tons of 0.55% copper. \*

Recent communications with them, coupled with a half-day tour of the pits, suggested that the new Diamond H pit contains 12 million tons of reserves coupled with 6 million tons of leach ore and 7 million tons of waste. The pit is in the final stages of stripping (by contract) and production will commence this summer.

Figure 1 shows the location of the Copper Cities pit area on the northeast side and the Diamond H pit area on the southwest side of a large alteration area. Some eight drill holes have been drilled in the intervening area and commercial ore intercepts were found. However, most of the values were in the 0.30-0.35% copper range.

Copper Cities is located in a horst block bounded by the Coronado fault zone on the west and the Drummond fault on the east. The major Sleeping Beauty fault zone, trending northeast, appears to be the limiting factor to alteration-mineralization as now known for the entire Copper Cities-Diamond H zone.

At Copper Cities there is a strong control on primary ore grade around the Schultze granite apex which is present. The higher values are in the monzonite porphyry adjacent to the granite.

\* AISC May 8, 1970.

... .. Copper Cities Reserves = 43 million tons  
" " " " Reserves = 18 million tons

... .. DH Reserves = 13 million tons

Aa-7.13.13D

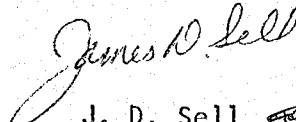



File Memorandum  
Page 2  
April 3, 1970

Copper Cities and Diamond H Pits  
Miami Copper Company  
Gila County, Arizona

Ore is known to extend under the moderately east-dipping Drummond fault but the mineralized grade apparently drops across the fault in the hanging wall side. However, to the southwest across the Coronado fault (steep-dipping), there is very little change of grade in the primary zone. The supergene sulfide blanket is apparently quite thin southwest of the Coronado and will not support stripping costs at the present time.

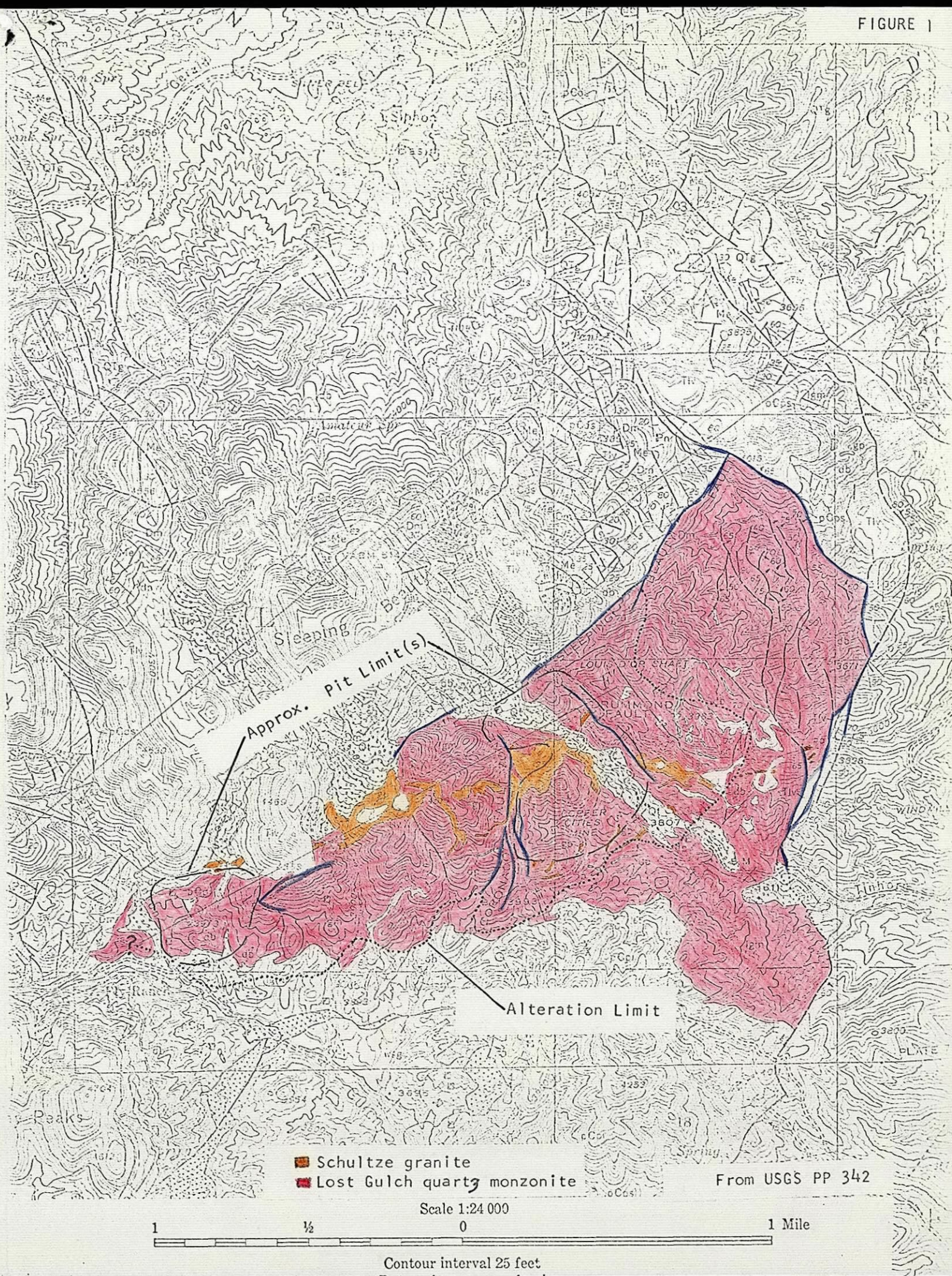
The AIME open-pit section meeting is scheduled for Friday, May 8, with Miami Copper as the host.

  
J. D. Sell 

JDS/kvs

Route file copy WESaegart





Schultze granite  
 Lost Gulch quartz monzonite

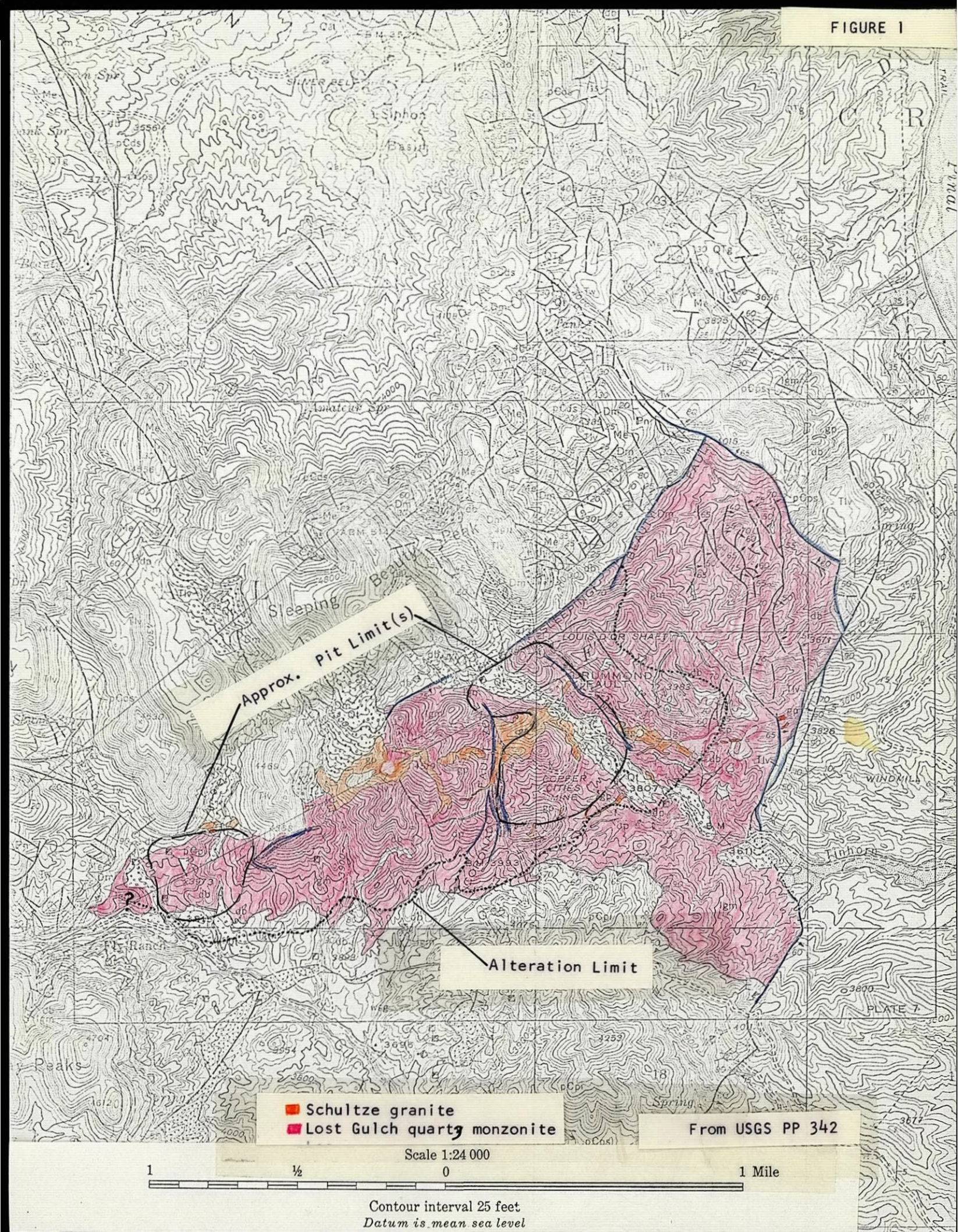
From USGS PP 342

Scale 1:24 000

1  $\frac{1}{2}$  0 1 Mile

Contour interval 25 feet









AMERICAN SMELTING AND REFINING COMPANY  
SOUTHWESTERN EXPLORATION DIVISION  
P. O. BOX 5747, TUCSON, ARIZONA 85703

W. E. SAEGART  
SUPERVISOR

W. L. KURTZ  
ASSISTANT SUPERVISOR

April 6, 1970

1150 NORTH 7TH AVENUE  
TELEPHONE 602-792-3010

Mr. W. W. Simmons  
Chief Geologist  
Miami Copper Company  
P. O. Box 100  
Miami, Arizona 85539

Dear Woody:

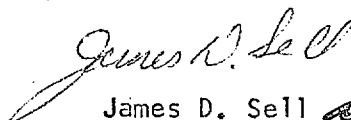

I wish to thank you for arranging the short tour of the Copper Cities pit last week.

As reported verbally to you, I am in the process of compiling what information I can on the drilling which has been accomplished on the Dacite Plateau between Miami and Superior.

I would be most appreciative of any information on the drilling that Miami would release at this time.

Hope to see you and Joe down at the mining geology session in Cananea later this month.

Sincerely,

  
James D. Sell 

JDS/kvs

cc: WESaegart

AMERICAN SMELTING AND REFINING COMPANY  
Tucson Arizona

November 3, 1971

FILE MEMORANDUM

From: R. B. Cummings

AIMCO Drill Holes  
Miami District

On June 29, Messrs. Sell, Balla, and myself obtained information on four old churn drill holes in the Miami District. This information was given by Dr. Nels Peterson (author of USGS Prof. Paper 342 on the Globe-Miami District).

The holes in question were drilled by AIMCO Mining Corp. This corporation was formed by Anaconda Copper Co., Inspiration Consolidated Copper Co., and Miami Copper Co. The corporation was formed in 1947 and dissolved in 1949, after the holes had been drilled.


The holes in question are south and southeast of the Town of Miami. Approximate locations are shown on Attachment #1. All holes are churn drill holes and all were collared in Gila conglomerate. Three of the holes reached pre-mineral rock; schist in all cases. The total depth of the holes and corresponding depth to bedrock are shown below:

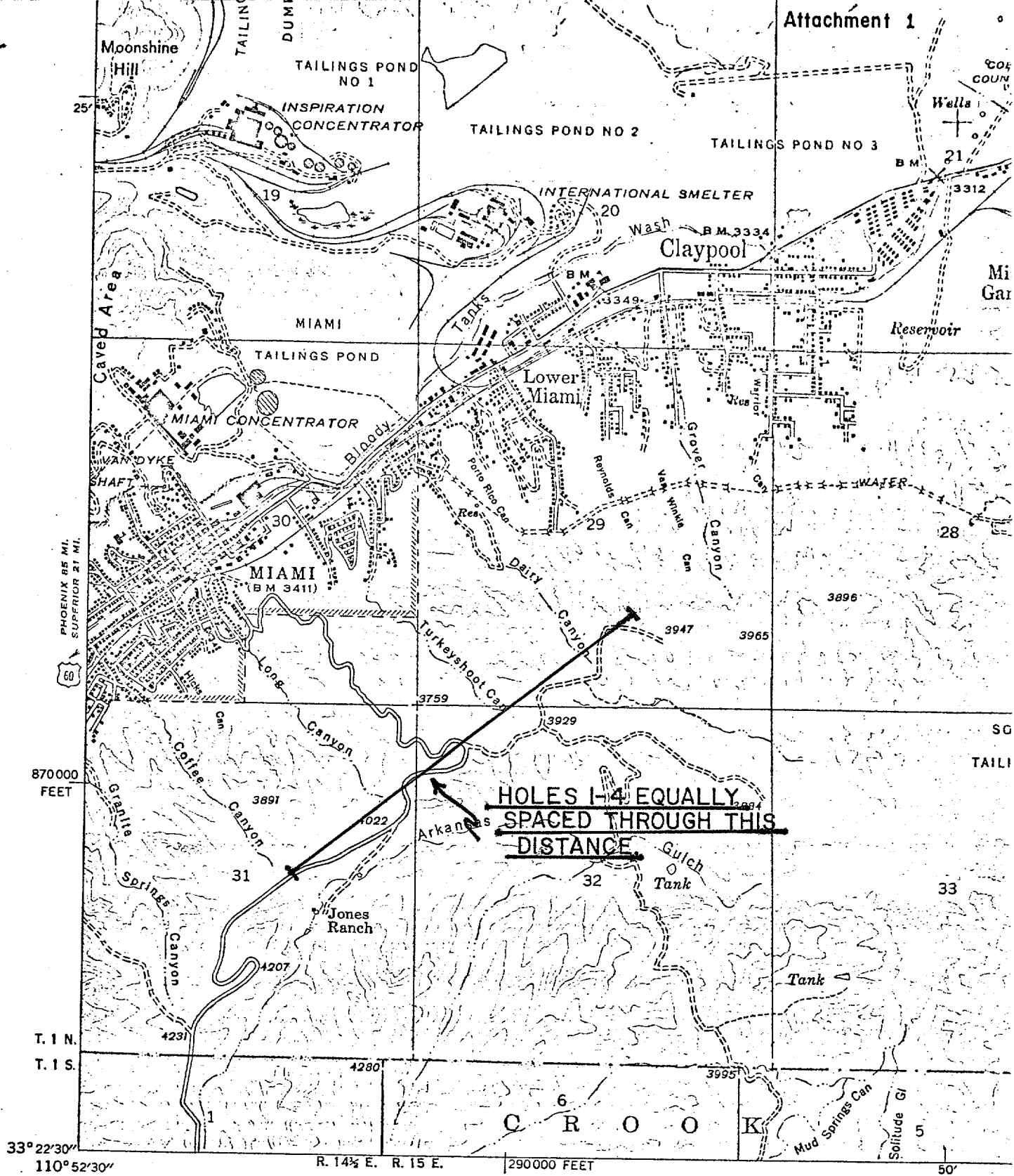
<u>Hole</u>	<u>Depth to Schist</u>	<u>Total Depth</u>
1	2290'	2900' approx.
2	2690'	2900' approx.
3	3425'	+ 4000'
4	not reached	4031'

The geologic logs showed that the schist was generally fresh and unmineralized although very minor amounts of oxidized copper minerals and FeOx after pyrite were noted.

*R. B. Cummings*  
R. B. Cummings

RBC:lad  
Attach.

cc: WLKurtz  
JDSell   
JCBalla



(Globe)  
1:62,500

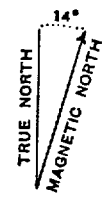
Mapped by the Geological Survey  
1945

Gray tint indicates area in which  
only landmark buildings are shown

ROAD CLASSIFICATION  
1947

Dependable hard surface	Dry weather roads	U. S. Route 18
heavy duty road	Loose surface graded	
Secondary hard surface	Unsurfaced, graded	
all weather road	Dirt road	State Route 76

More than two lanes indicated along road with tick at point of change



TO ACCOMPANY *Memo*  
DATED \_\_\_\_\_  
BY *R.B. Cummings*

APPROXIMATE MEAN  
DECLINATION, 1945

# AIMCO DRILL HOLES MIAMI DISTRICT

R.B. Cummings

Nov. 1971

◆ ◆ ◆ GEOLOGY OF THE COPPER  
CITIES MINE

BY W. W. SIMMONS AND J. E. FOWELLS

INTRODUCTION

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]





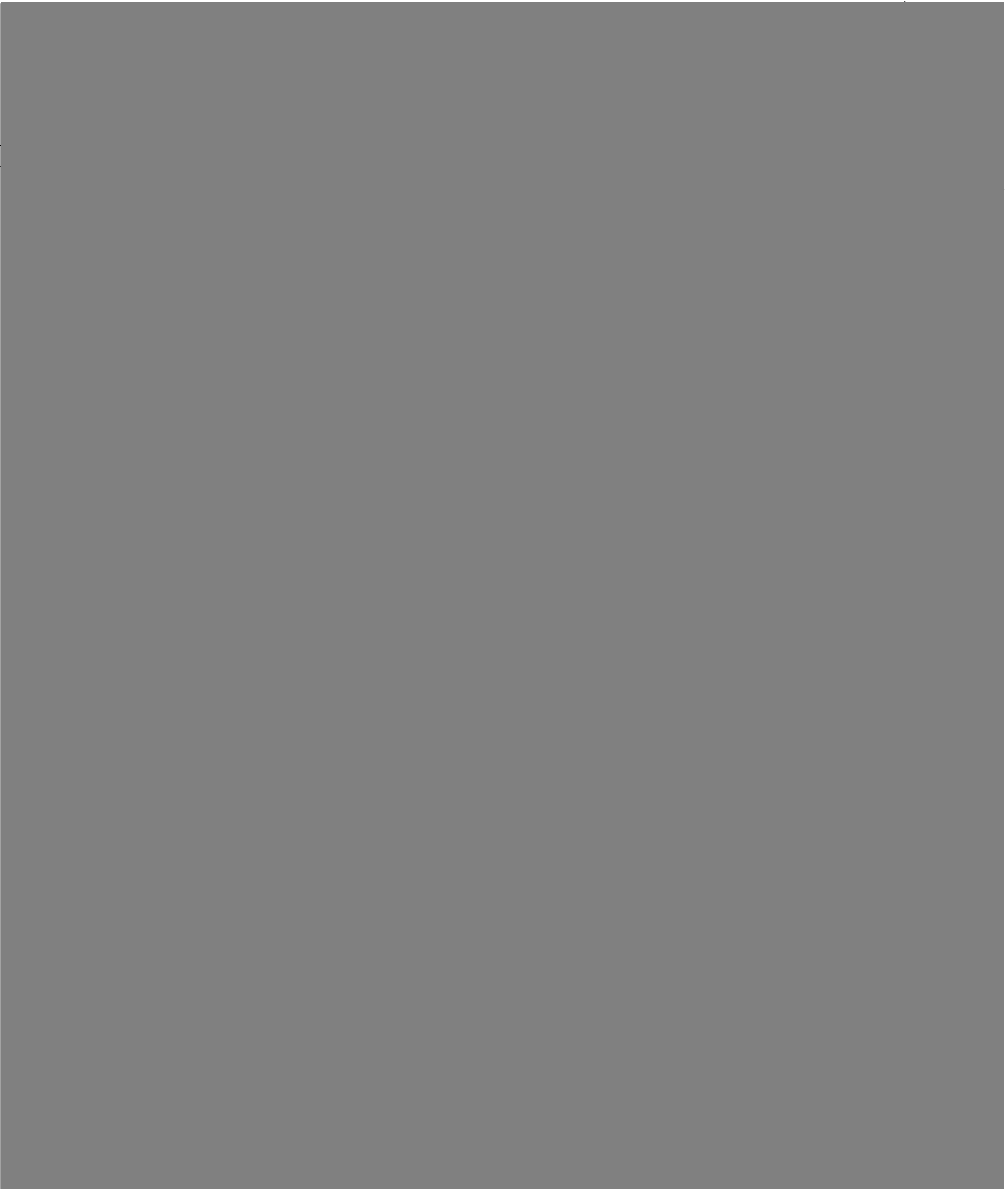


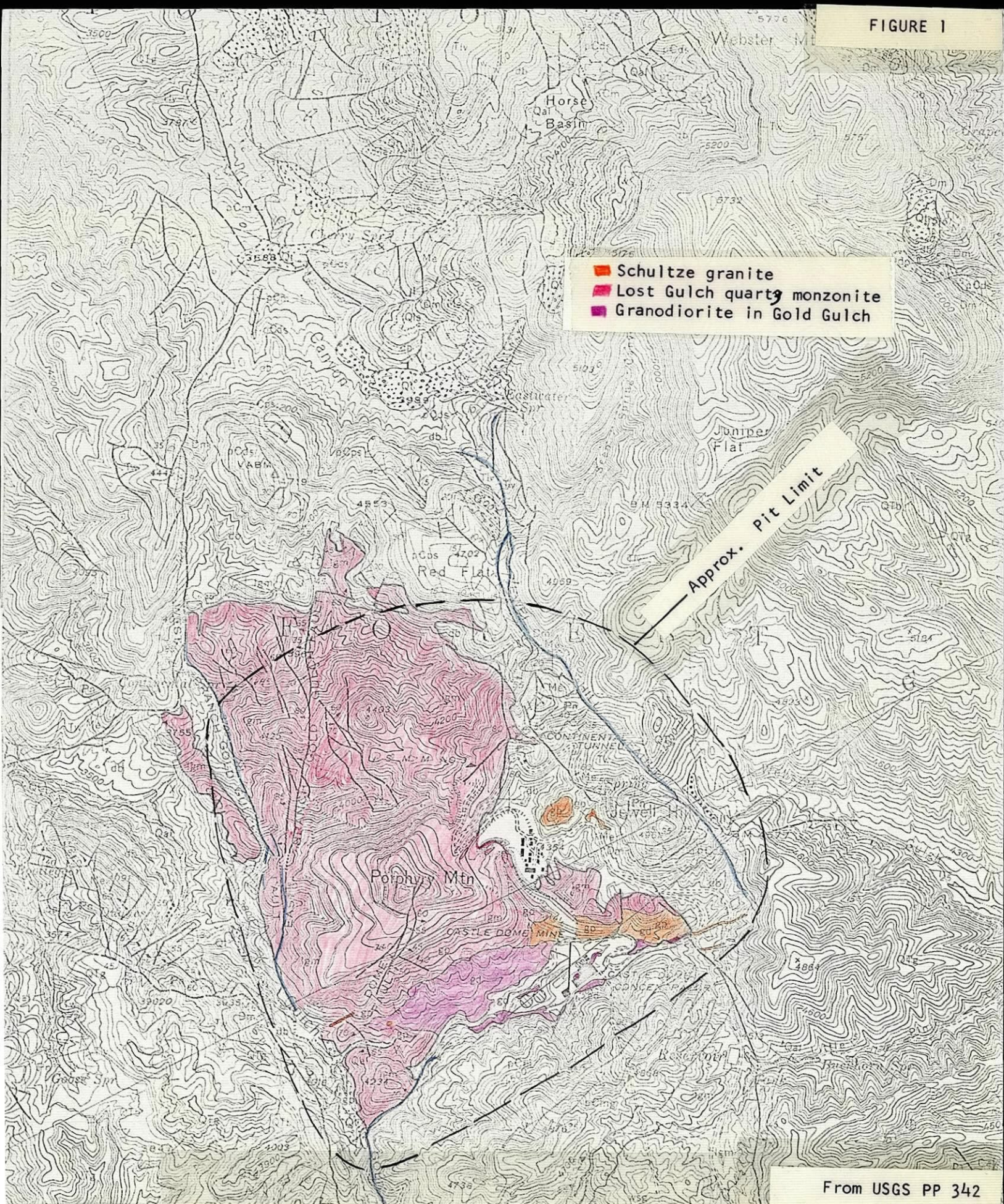








FIGURE 1



Scale 1:24 000

1  $\frac{1}{2}$  0 1 Mile

Contour interval 25 feet  
Datum is mean sea level



the volcanics and

ata defined very well  
a sulfide mineraliza-

gments

s described in this  
by Kennco Explora-  
ed, a subsidiary of  
poration on a prop-  
by Western Beaver  
and Farwest Mining  
wish to express their  
companies for grant-  
sh this paper.

ence

A method for determin-  
soils and alluvium, in-  
as a solvent for dithi-  
Imp. Coll. Sci. Tech.  
osp. Research Centre,  
15p.

## INDUCED-POLARIZATION AND RESISTIVITY RESULTS FROM THE CACTUS DEPOSIT, MIAMI, ARIZONA†

PHILIP G. HALLOF\*

The primary reason for the development of the induced-polarization method was the detection of disseminated mineralization that could not be detected by other geophysical methods. The Cactus deposit near Miami, Arizona is a "porphyry copper" type deposit of disseminated mineralization. It is too small in tonnage to be ore today; but because it is small, and at depth, it is a good test for the IP method.

### Introduction

The use of the induced-polarization method in mining exploration has increased progressively during the last few years. The method was originally developed to aid in the search for disseminated "porphyry-copper" type mineralization. The method has found wide use in exploration for all types of mineral deposits, but its greatest potential is still probably in the search for disseminated mineralization.

The results described here were measured in the vicinity of the Cactus Deposit just west of Miami-Globe Arizona (See Figure 1). The variable frequency induced-polarization method was used, with dc and 5.0 cps for the frequencies of the applied current. The parameters used in the interpretation are the apparent resistivity ( $\rho_a/2\pi$ ) and the apparent metal factor  $(MF)_a$  which is equal to  $2\pi \times 10^5 \times (\sigma_{ac} - \sigma_{dc})$ .

The mineralization in the Cactus deposit is typical of the porphyry copper ore bodies. However, the deposit is of too small a tonnage and/or low grade to be economically mined. Because it is small, and at depth, its detection by induced-polarization measurements is a definite indication of the usefulness of the method in the search for similar deposits.

### Geology of the Cactus Deposit

The Cactus deposit was located by Miami Copper Co. just west of Globe, Arizona (Figure 1). The Cactus body lies just south

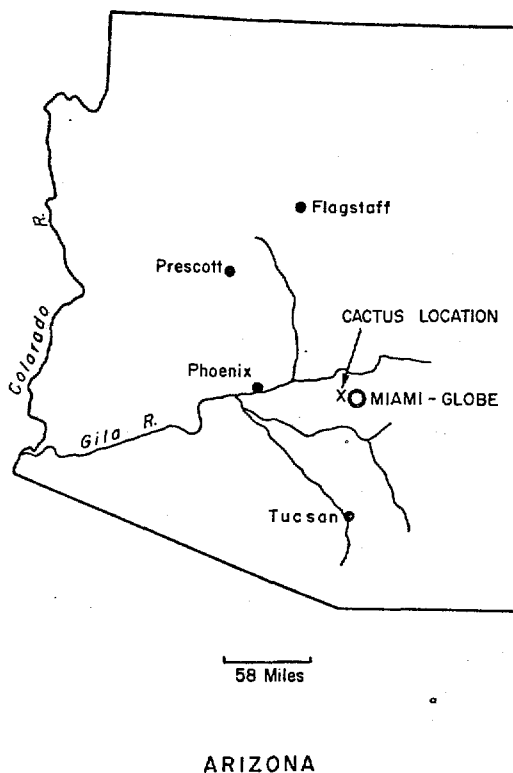


FIG. 1. Location map for the Cactus deposit.

of the much larger Castle Dome deposit which has already been completely mined out. The mineralized zone contains 3-5-percent sulfide and is found in the altered and fractured portion of the Pinal Schist just above a large thrust fault (Figure 2). The

† Presented at the 31st Annual SEG Meeting at Denver, Colorado, November 8, 1961.

\* McPhar Geophysics Limited, Don Mills, Ontario, Canada.

## CACTUS ORE BODY

Section 'X'-'X' Looking N-W

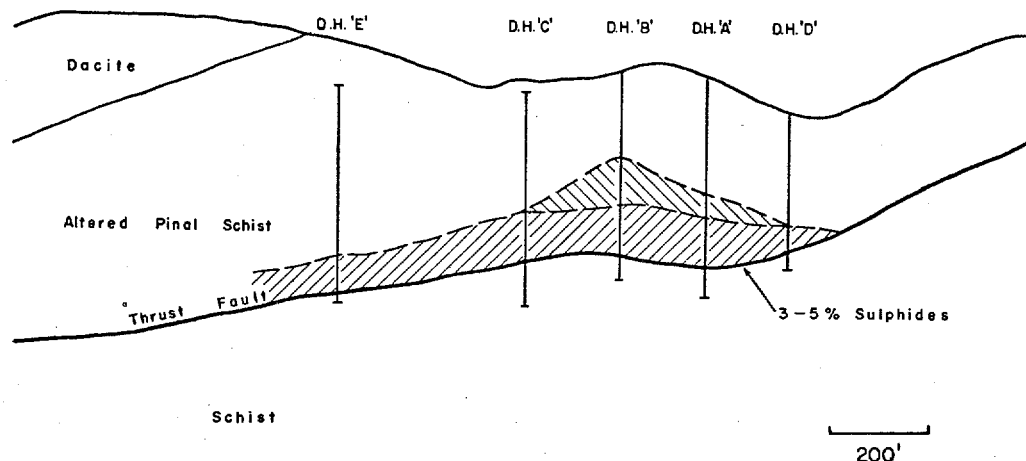


FIG. 2. Geology of the Cactus ore body.

flat-lying mineralized "blanket" is roughly 1,000 ft in diameter, 200-400 ft deep, and 100-150 ft thick.

With present prices and mining costs, the deposit is not mineable but it is a small deposit of porphyry copper type mineralization and is of interest. Because of its depth and size, it is the smallest target that would be sought in porphyry copper exploration. Therefore, the results of the IP survey over the Cactus deposit can be used to evaluate other anomalies from unknown sources.

#### Method of Measurement and Plotting of Results

The method used in making the variable-frequency IP measurements and the plotting of results is described briefly in the literature (Hallof, 1957, Marshall and Madden, 1959). A more complete description was given in an unpublished paper presented by the author at the SEG meeting in Los Angeles in November, 1959.

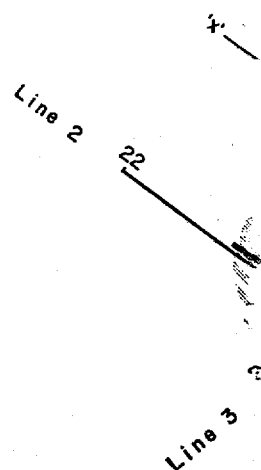
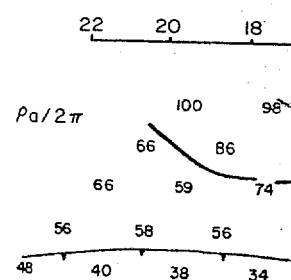
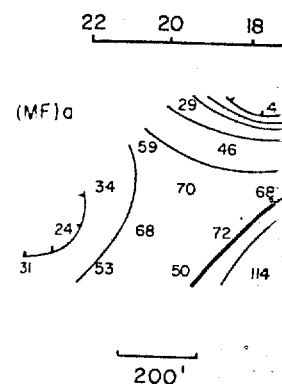
The measured IP values and the apparent resistivities are plotted in a two dimensional array using the separation between sender and receiver electrodes as the abscissa, and

the center point of the sender and receiver electrodes as the ordinate. The resulting pattern, when contoured, shows something like a cross section of the measured electrical parameters. Since the true values of resistivities in the ground, as well as the geometry, control the depth to which each value is influenced, the contour pattern is not a true cross section; however, it has some of the properties of a cross section, since the values measured for larger separations between current and potential electrodes are plotted below those measured for shorter separations.

The IP parameter shown on the data plots is the apparent metal factor, which is measured as  $(\sigma_{ac} - \sigma_{dc})_a \times 2\pi \times 10^5$  and has the units of mho/ft. The advantages of this parameter in interpreting induced-polarization results has been described previously (Hallof, 1957, Marshall and Madden, 1959). The values of the apparent resistivities measured are shown on the lower part of the data plot.

#### Discussion of Results

The induced-polarization and resistivity results shown on Figure 3 were measured on a



## CACTUS ORE BODY

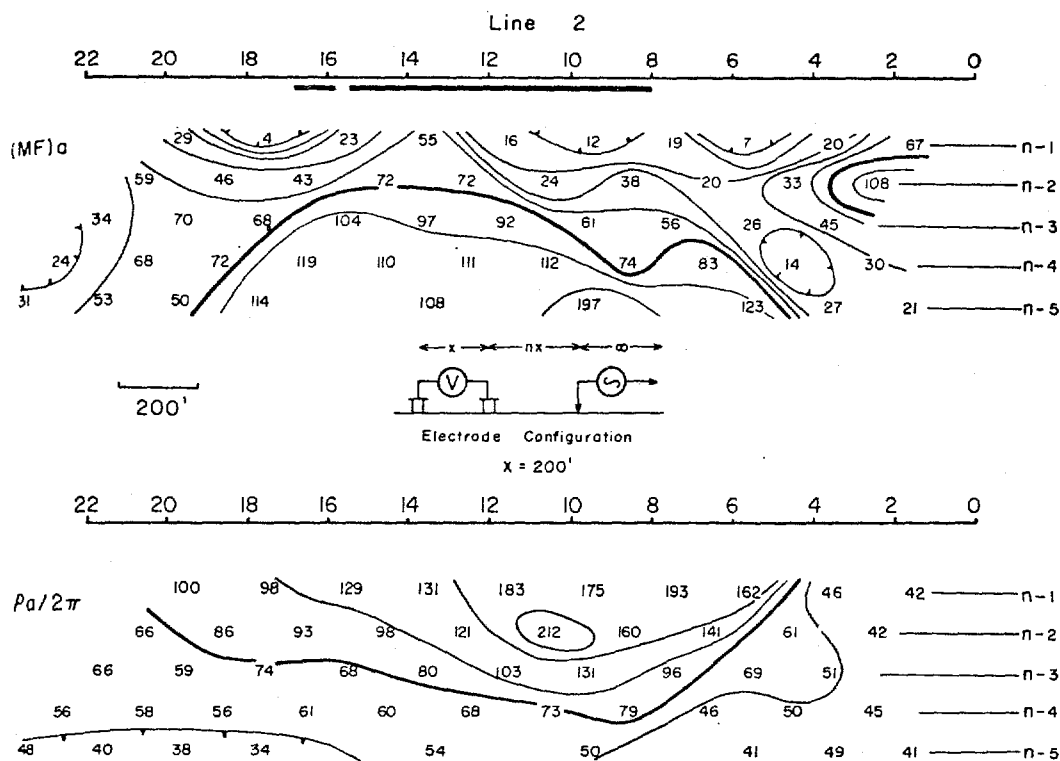


FIG. 3. Induced-polarization and resistivity results.

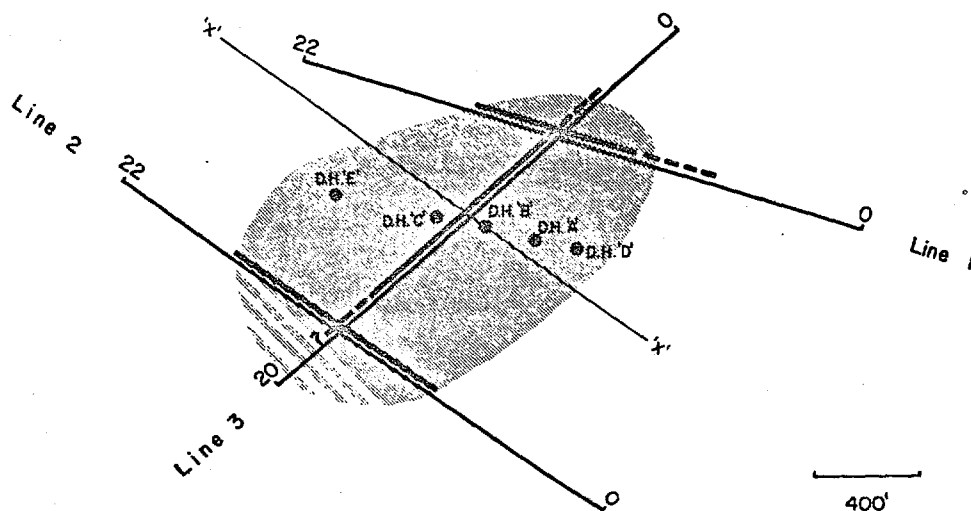


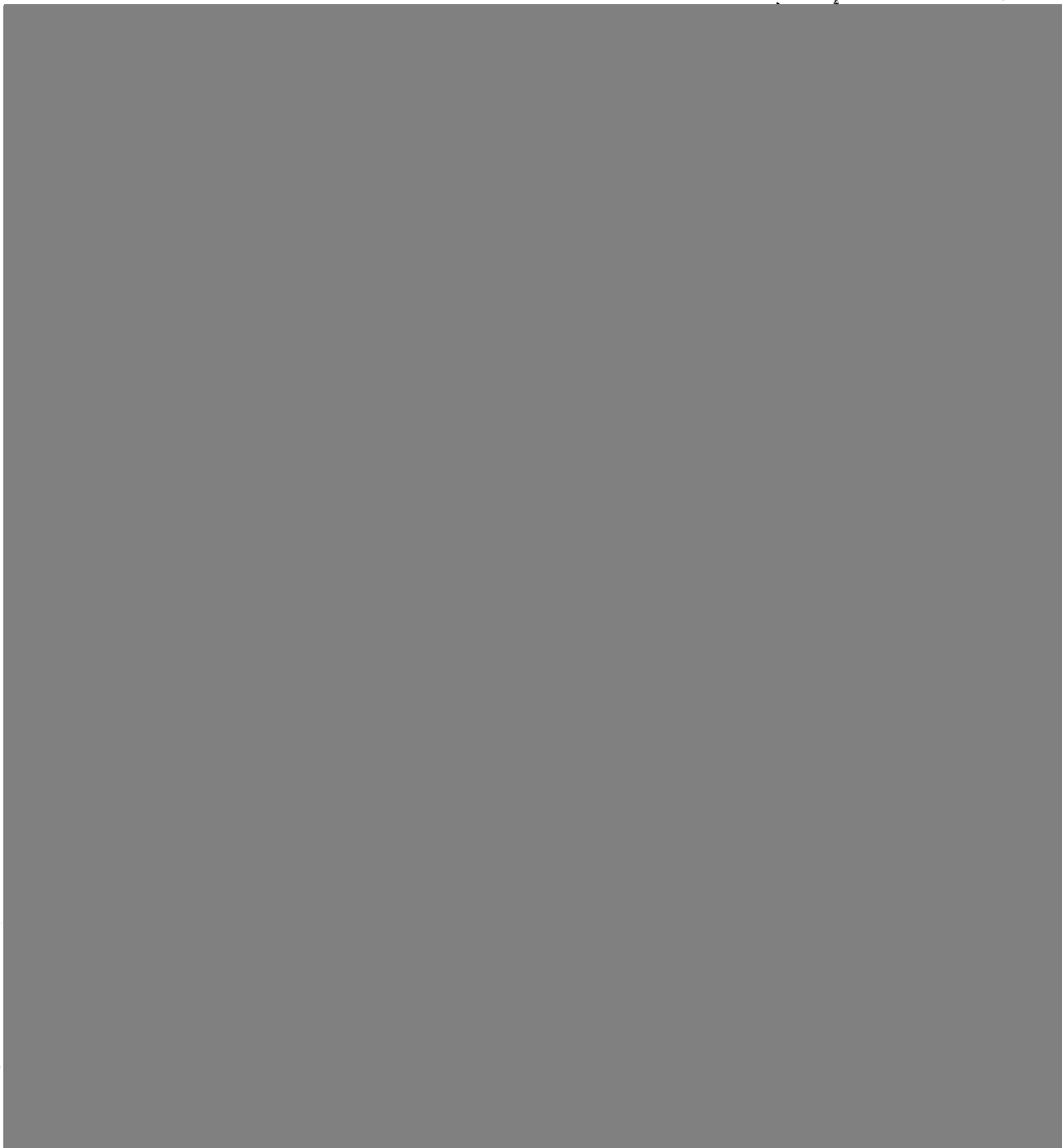
FIG. 4. Plan map of the Cactus ore body.

sender and receiver  
The resulting pat-  
terns something like  
measured electrical  
the values of resistiv-  
all as the geometry,  
which each value is  
pattern is not a true  
it has some of the  
ion, since the values  
relations between cur-  
rents are plotted be-  
shorter separations.  
own on the data plots  
factor, which is  
 $\pi \times 10^3$  and has the  
advantages of this  
induced-polariza-  
described previously  
and Madden, 1959)  
apparent resistivities  
the lower part of the

## Results

ion and resistivity  
were measured on a





Aug. Salinas Belt, Miami  
Thurs., May 4, 1972

Occidental affairs



AMERICAN SMELTING AND REFINING COMPANY  
Tucson Arizona

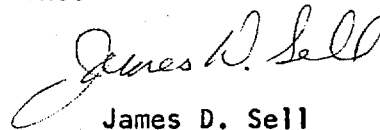
November 11, 1971

TO: W. L. Kurtz

FROM: J. D. Sell

Bluebird Mine  
Ranchers Exploration  
Gila County, Arizona

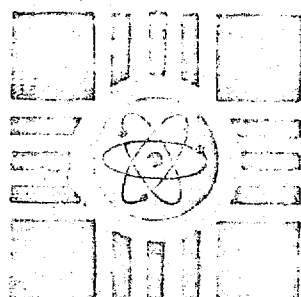
Attached are several pages from the 1971 Annual Report of Ranchers Exploration and Development Corporation. This is the first release on information concerning the newly developed 75 million tons of 0.52% copper reserves at their Bluebird Mine.

  
James D. Sell

JDS:lad  
Attachs.

cc: DCRees - w/attachs.

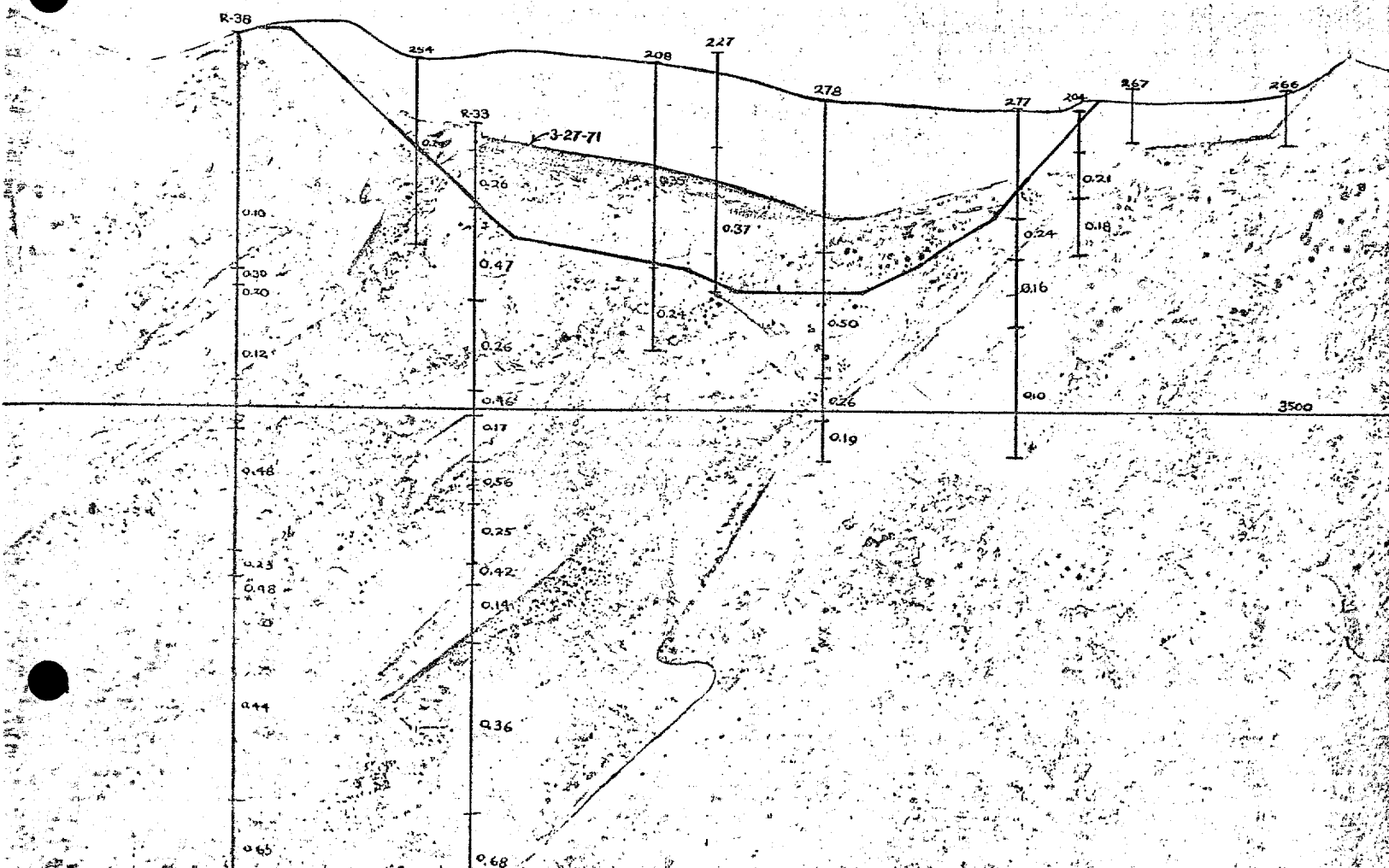
J. D. SELL

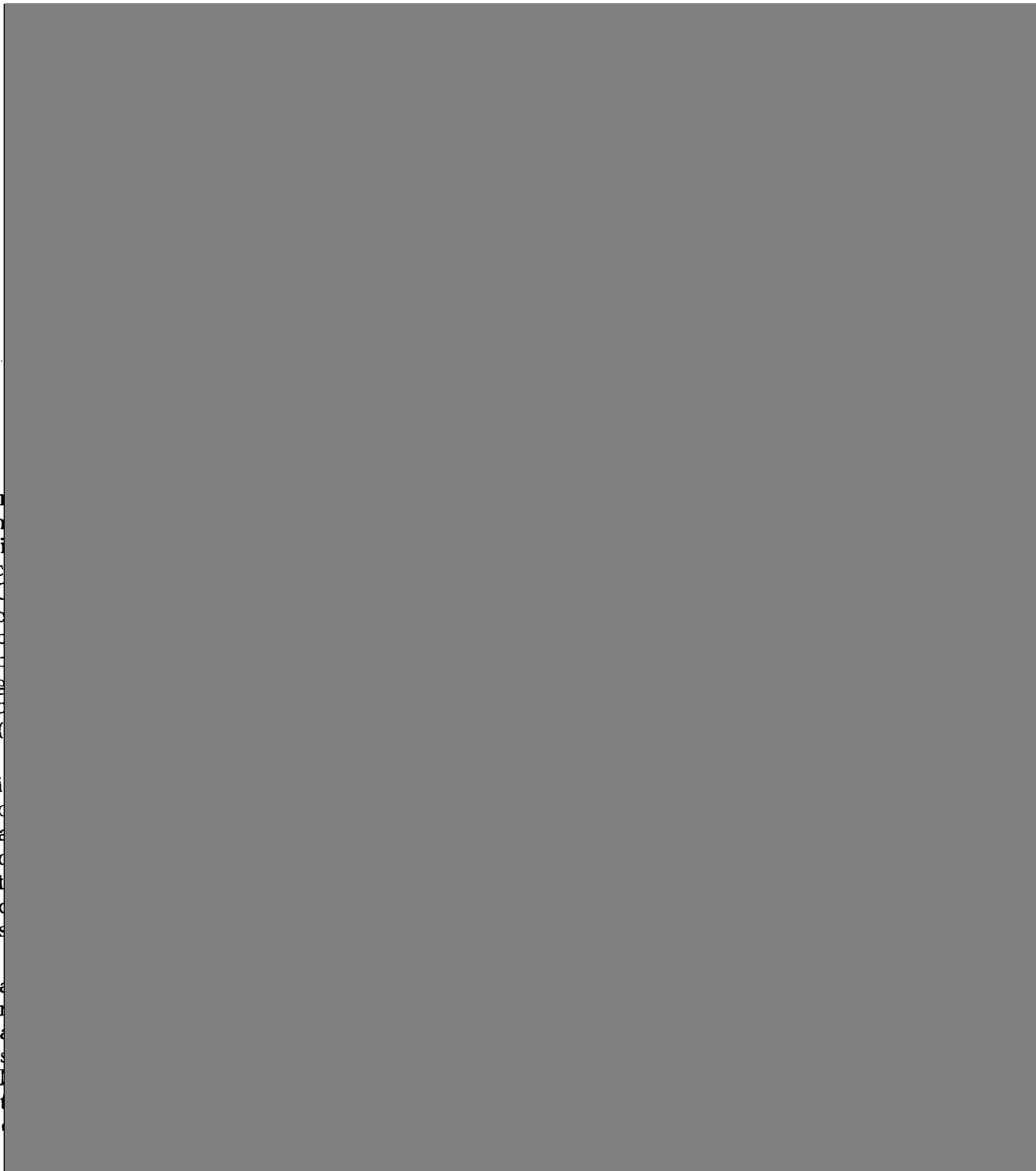


## 1971 ANNUAL REPORT

# RANCHERS

EXPLORATION AND DEVELOPMENT CORPORATION





THE 1971 ANNUAL REPORT / Design and Layout - Mary Garriott / Cover - Gene Garriott / Photography -  
Dick Kent / Typography - Reay's Typographic Service Company, Inc. / Printing - The McLeod Printing Company

# A Good Year for Copper

Record Production, New Reserves Highlight 1971;  
Company Exercises Option on Old Reliable Property

\*Record production and a major increase in reserves at the Bluebird Mine highlighted the Company's copper operations in 1971. The Company also elected to exercise its option on the Old Reliable copper property near San Manuel, Arizona, following extensive geologic and engineering evaluations.

Operations were quite successful at the Bluebird. Production reached a record 11,859,533 pounds of cathodes, an increase of 12 percent over the 10,556,855 pounds produced last year and well in excess of the production goal for the year of 11.5-million pounds. Sales, which included \$983,704 in revenue from sale of copper purchased for starter sheets, totaled \$7,654,851, compared to \$6,846,243 a year ago.

Profits from the operation were slightly lower than in 1970, despite satisfactory copper prices averaging about \$.57 per pound. Chief reasons for the decline in profitability were a significantly higher stripping rate (removal of overburden), greater acid consumption in the leaching heaps, and lower grade ore. About 2,871,000 tons of ore and 2,955,000 tons of overburden were moved during the year, compared to 2,340,000 tons of ore and 1,609,000 tons of overburden moved in 1970.

The stripping ratio is expected to remain about the same in the present year, but profits should improve somewhat because of higher production and a substantial decrease in the cost of acid. Acid prices are expected to decline to about \$18 per ton, compared to the \$31 per ton paid last year. The Company has sold about 55 percent of the Mine's projected output of 13-million pounds at prices averaging approximately \$.55 per pound.

The most significant development at the Bluebird during the year was the addition of substantial new ore reserves. Reserves on the property at the beginning of the year had been estimated at about 13-million tons of ore with an average grade of .50 percent copper. Drilling during the year increased indicated reserves to about 75-million tons of ore, with an average grade of .52 percent copper, and the property has good potential for additional ore reserves. While engineering studies have not been completed, it appears that the reserves can be mined with a stripping ratio of approximately 1½ tons of overburden to one ton of ore.

Further drilling must be conducted on the property to fully delineate the reserves. However, the Company has already begun preliminary planning to determine the optimum manner of expanding operations at the Mine. It now appears that it may be desirable to change the method of extracting the copper from the ore. The ore is currently placed in heaps, which are leached with acid and water to produce a copper-bearing solution which is converted into cathodes.

Heap leaching is a relatively inexpensive method of removing copper from the ore, but it results in recovery of less than half the copper. Vat leaching, agitation leaching, and other methods of ore treatment which could approximately double recovery of copper values are being investigated by the Company now that the Mine's reserves appear great enough to support the sizable capital costs of these leaching systems. Selection and installation of one of these systems would ultimately mean a major increase in copper production at the Mine.

(Continued)



Shipment of high grade sulphide copper ore from the Big Mike deposit at Winnemucca, Nevada, to foreign smelters was completed during the first quarter of the fiscal year. Another 2,000 tons of ore were shipped to domestic smelters in the second quarter, bringing foreign and domestic shipments from the deposit to a total of 94,000 tons in 1970 and 1971. Shipments during fiscal year 1971 contained 11,403,732 pounds of copper, which were sold for \$7,200,739. Cerro Corporation's 20% net profits interest in the project amounted to \$416,321, thus reducing net revenue to \$6,784,418.

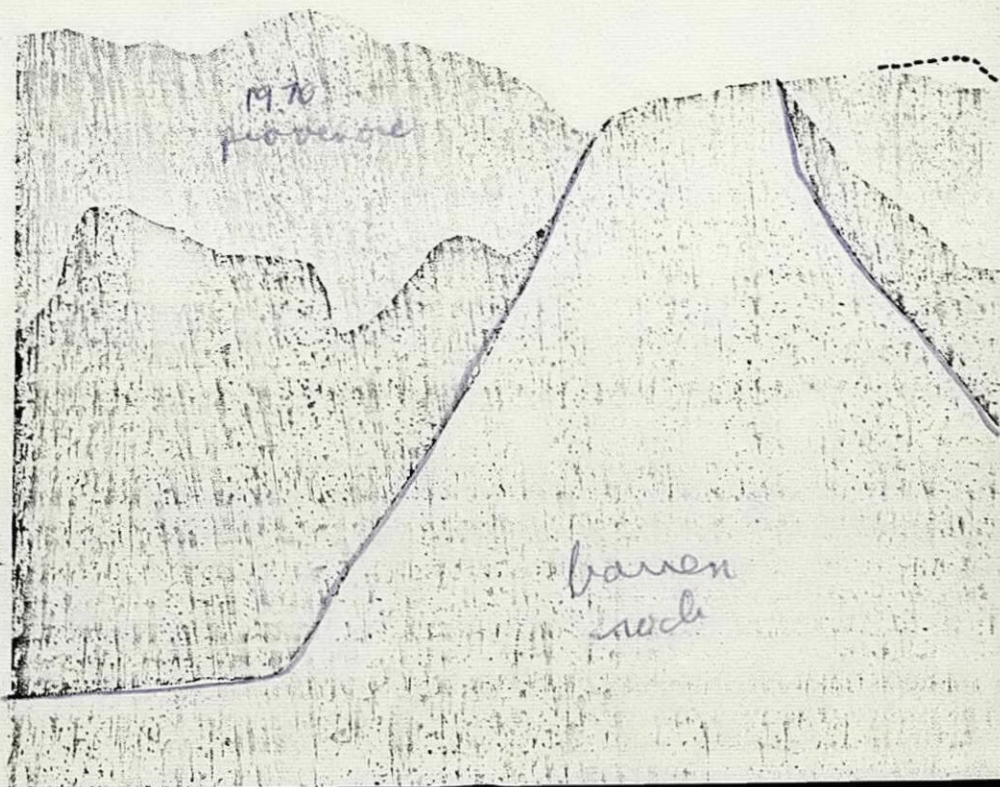
About 300,000 tons of oxide-sulphide ore, containing approximately two percent copper, are still in stockpile at the Mine, and will be leached and treated in a precipitation plant to produce cement copper. Production is tentatively scheduled to begin in November, but may be delayed if the price of copper declines. Full production from November through June would result in output of about 1.6-million pounds of copper. Production would continue during fiscal years 1973 and 1974, and perhaps longer if the price of copper permits treatment of 400,000 tons of ore remaining in place in the Big Mike ore deposit.

The price of copper will also determine when the recently-acquired Old Reliable deposit is brought into production. Drilling on the deposit, acquired from Occidental Minerals Corporation, has confirmed that it contains approximately 4-million tons of ore with a copper content of .74 percent. The deposit occurs in a pipe-like structure which the Company believes could be fractured with explosives and leached by percolating solutions through the shattered ore to remove the copper. It is estimated that about 30-million pounds of copper could be recovered in this manner over a period of five years, making the property a low-cost, short-term producer of cement copper. Production would begin, at the earliest, some time in fiscal year 1973.

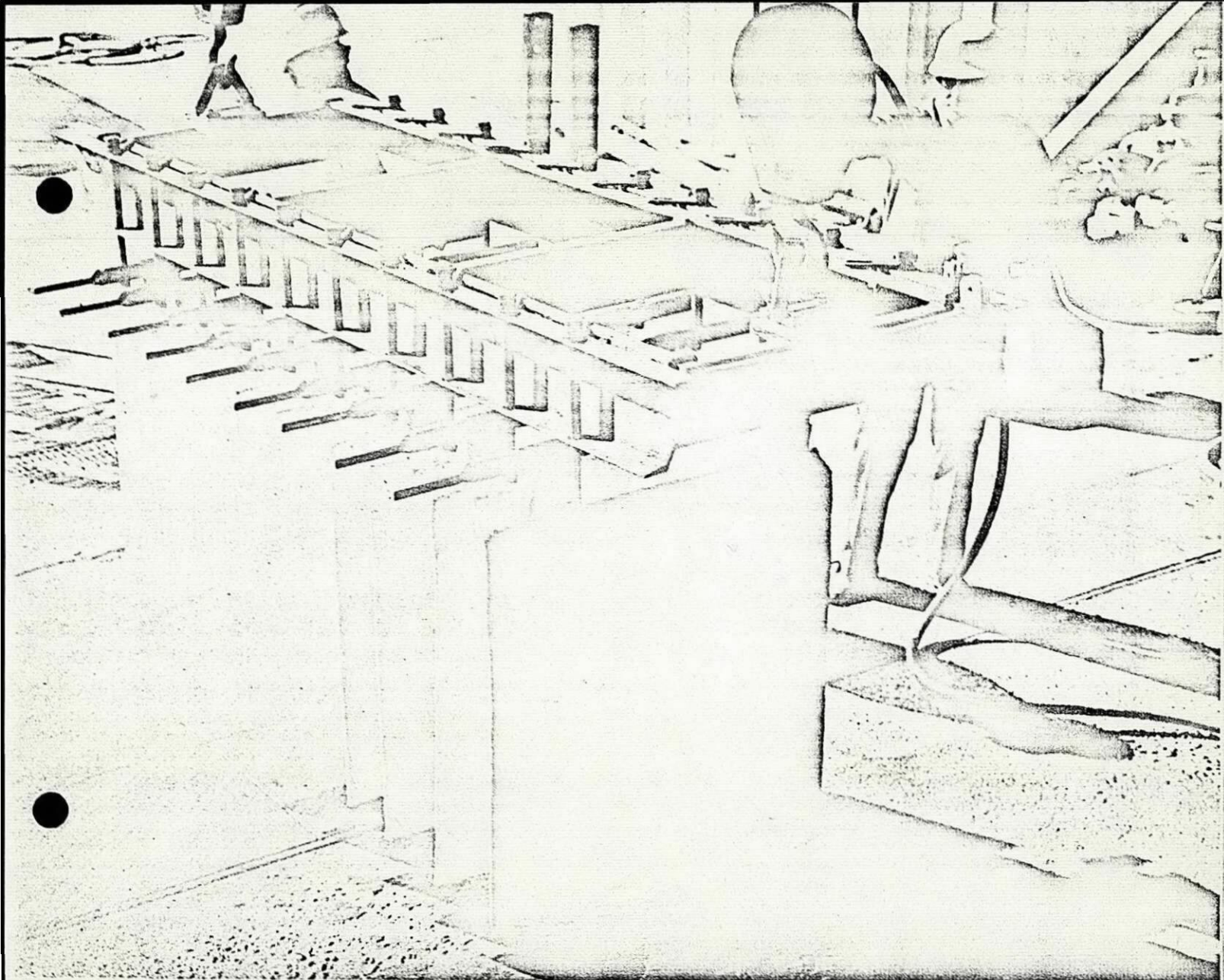
Occidental has retained a 20 percent net profits interest in the property, commencing after the Company has recovered its total investment in the property and in production facilities. Occidental will also receive a production payment of not more than \$200,000 and \$150,000 in cash, \$50,000 of which has already been paid.

Side View  
of Bluebird  
Ore Deposits  
(Looking East)

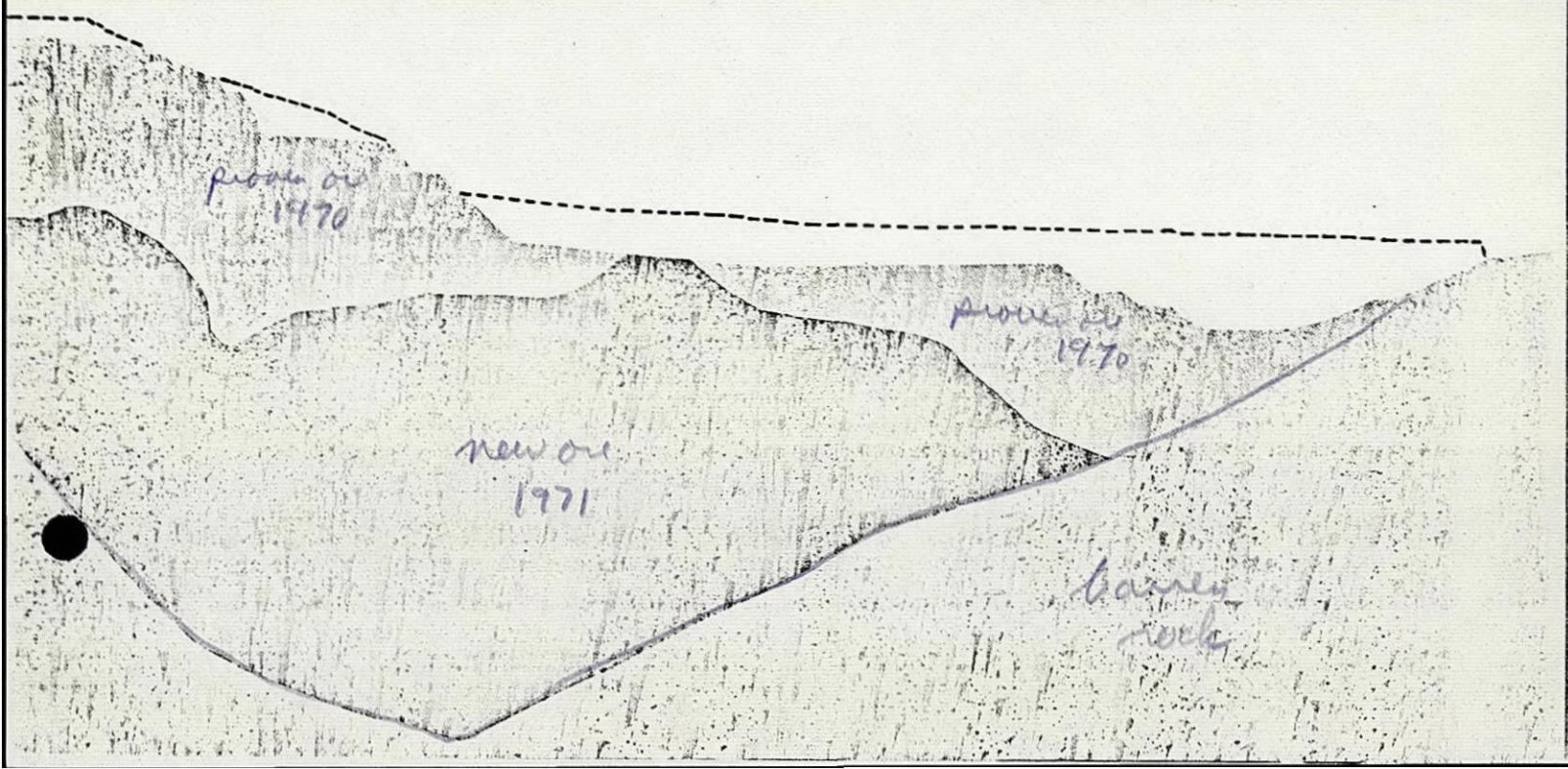
■ Proven Ore (1970)  
■ New Ore (1971)  
■ Barren Rock  
--- Surface of south  
ore body before min-  
ing commenced  
in 1964



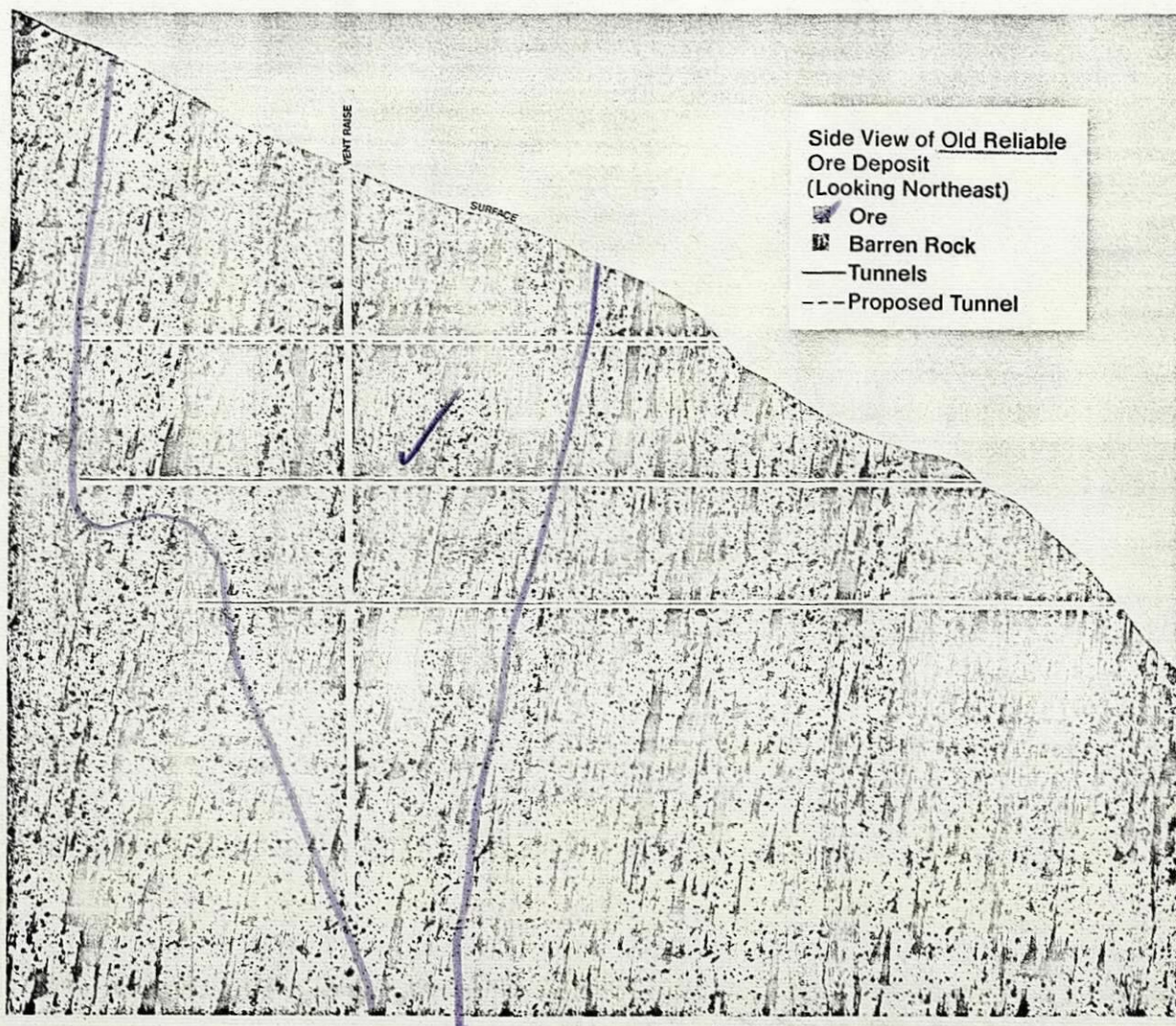
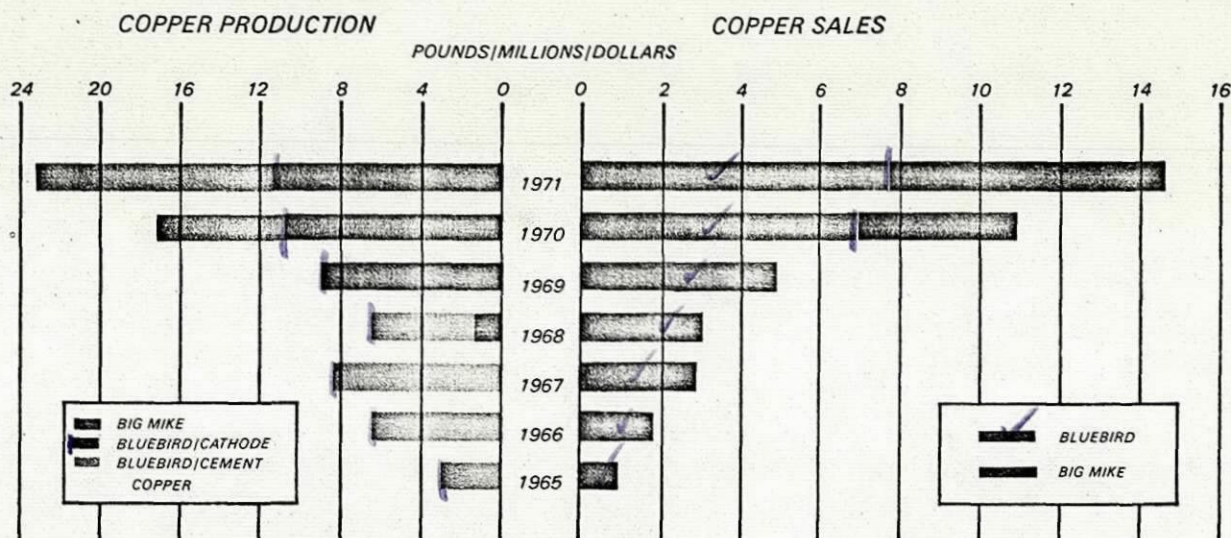




Washing electrolyte and acid from finished cathodes



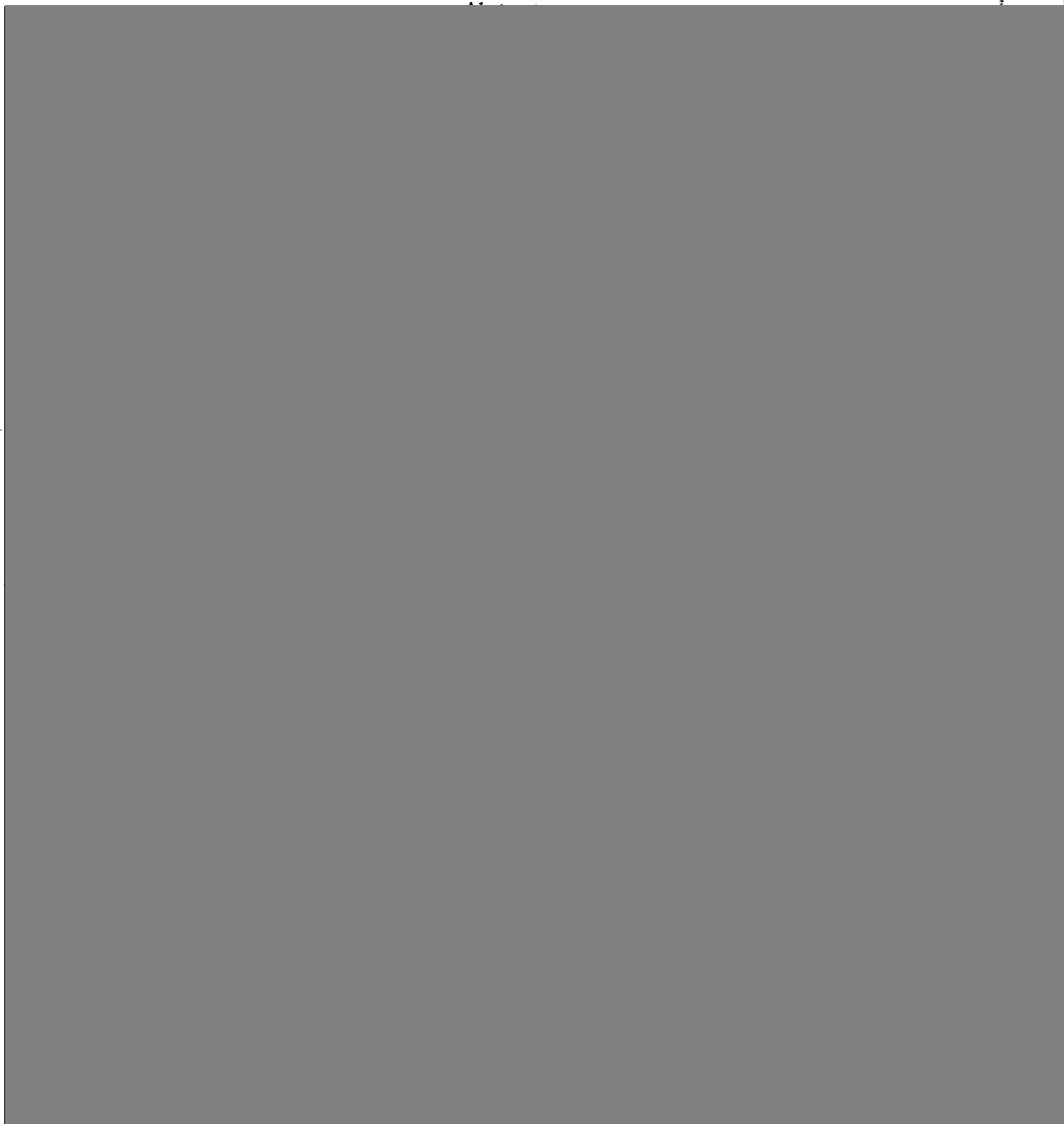




December 1971

## Nature and Origin of Black Chrysocolla at the Inspiration Mine, Arizona

ALLEN H. THROOP AND PETER R. BUSECK



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AMERICAN SMELTING AND REFINING COMPANY  
Tucson Arizona

February 23, 1972

TO: W. L. Kurtz

FROM: J. C. Balla

Age of Solitude Granite  
Globe-Miami District

I talked today with S. C. Creasy and Medora Krieger of the U.S.G.S. regarding isotopic ages of rocks in the Globe-Miami district. They mentioned that there is one rock, the Solitude granite, which has given highly unusual K-Ar ages. In the central part of the stock, the rock has an apparent isotopic age of around 8-900 m.y., while near the Schultze granite contact, the age is less, perhaps around 500 m.y. This younger age is probably due to a slight reheating, and subsequent loss of argon, by the intrusion of the Schultze.

Creasy feels that this rock may have had an unusual magmatic history, but does not know what it might be. Further isotopic work on this rock needs to be done before Creasy is willing to publish the dates.

It is interesting to note that in the Sacaton mountains, I have an isotopic date of 857 m.y. on the Sacaton microgranite, which, like the Solitude granite, is a medium-grained, equigranular, muscovite granite.

  
J. C. Balla

JCB:lad

cc: JDSell ✓  
RBCummings

AMERICAN SMELTING & REFINERY COMPANY  
Tucson Arizona

May 5, 1971

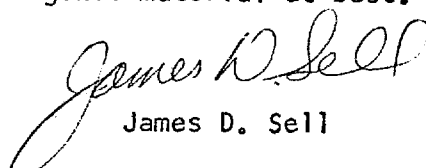
FILE MEMORANDUM:

Inspiration Drilling  
Faulted Segment of M-I  
Miami District  
Gila County, Arizona

Inspiration reported in their 1970 Annual Report (released April 1971) and reprinted in PAY DIRT (April 1971) the fact that they have drilled five holes in the area of the Smelter for checking the faulted portion of the Miami-Inspiration ore body on the east side of the Miami fault.

Inspiration reports five holes ranging in depth from 3300 to 5500 feet, with the fifth hole hitting ore at 4,800 feet with a 300-foot column averaging over 1% copper and underlain by more than 300 feet of lower-grade material. The other holes apparently intercepted only marginal material at best.

JDS:jmc

  
James D. Sell

AMERICAN SMELTING & REFINERY COMPANY  
Tucson Arizona

May 5, 1971

FILE MEMORANDUM:

Inspiration Deep Drilling  
Miami District  
Gila County, Arizona

Mr. R. P. Shannon has secured the following deep drilling depths, from our diamond drill crew, of holes recently completed by Inspiration in the Miami District.

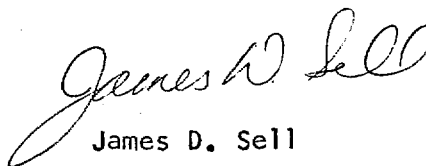
4300 feet at Bayless (Note: This may be Dave Johnson's 'water well'?)

5210 feet at Loading Dock

5400 feet at Inspiration tailings pond

5510 feet at Smelter parking lot

Further information may be possible. As reported in separate file memo, Inspiration reported five holes being drilled in Smelter area to check the offset portion of the Inspiration-Miami ore body.

  
James D. Sell

JDS:jmc



J. R. K.

JUL 14 1971

**PHELPS DODGE CORPORATION**

**WESTERN EXPLORATION OFFICE**

**DRAWER 1217**

**DOUGLAS, ARIZONA 85607**

TEL. 602-364-8414

July 9, 1971

Mr. John R. King  
ASARCO  
1150 North 7th Avenue  
Southwestern Exploration Division  
P. O. Box 5747  
Tucson, Arizona 85703

Re: Copper Springs Area  
Gila County, Arizona

Dear John:

Your letter of May 10 addressed to Jim Lukanuski has not been ignored, it has simply been part of a pile of unfinished matters accumulated on my desk since Jim left us at the end of May. As you probably know, he has gone to work for Scurry-Rainbow and is now located in Reno.

We would be glad to exchange our information for yours on the Spike-E Hills, if you are still interested. In addition to the drilling, we also did some geological mapping, geochemical sampling, and petrographic work.

Very truly yours,



W. J. Walker  
Senior Staff Geologist

WJW:c

*Jim Sell: you carry out exchange of data since Copper Springs  
is in "your area".*

*Kutz*

Aa - 3.20 A.O

Spoko - E Hills

9 Drill holes from 395 ft to 797 ft (total of 4990 ft).  
of drilling.

Drill map 1839 with hole, assays, IP interpolations.

General drill logs with assays.

X-section

Map { Gravity  
Profile { IP  
Aeromag.





AMERICAN SMELTING AND REFINING COMPANY  
SOUTHWESTERN EXPLORATION DIVISION  
P. O. BOX 5747, TUCSON, ARIZONA 85703

1150 NORTH 7TH AVENUE  
TELEPHONE 602-792-3010

October 20, 1971

Mr. James Anderson  
Manager, Exploration for U.S.  
Occidental Minerals Corporation  
6073 West 44th Avenue  
Denver, Colorado 80200

Occidental Minerals  
Miami Copper Deposit

Dear Mr. Anderson:

Please be advised that Asarco is definitely interested in participating in the continued exploration and development of your Miami Copper Deposit. If and when Occidental seeks a joint venture partner, I should like to review all your data. A positive recommendation on my part should elicit a quick decision from Asarco's New York office. Asarco funds on a project to project basis, so that work can start immediately after a decision is made.

Please plan to join me for dinner on your next trip to southern Arizona.

Very truly yours,

W. L. Kurtz  
Supervisor

WLK:lad

cc: JJC Collins

bc: JDSell

AMERICAN SMELTING AND REFINING COMPANY  
Tucson Arizona

October 20, 1971

TO: J. J. Collins  
New York Office

FROM: W. L. Kurtz

Occidental Minerals Corp.  
Tennessee Zinc

In a recent phone conversation with Mr. James Anderson, Manager of U.S. Exploration for Occidental Minerals Corp., 6073 West 44th Avenue, Denver, Colorado 80200, he stated that Occidental is not actively seeking a joint venture partner, at this time, for their Tennessee zinc deposit, but conceivably could be in the near future.

Occidental Minerals apparently has presented a proposal to Occidental Petroleum for the continued exploration of the Carthage zinc deposit. This exploration work will include shaft sinking, drifting, and underground drilling. Mr. Anderson seemed uncertain whether Occidental Petroleum would approve this exploration work.

As you recall, the press releases indicated a zinc content of 5-1/2%. This is a high purity zinc deposit without Pb-Fe contamination. Also, much of the ground held by Occidental has not been tested by drilling.

Should Asarco be interested in a possible joint venture, please write Mr. Anderson informing him of this interest, in the event Occidental decides to joint venture their zinc holdings.

  
W. L. Kurtz

WLK:lad  
Enc. June '71 Mining World p. 40

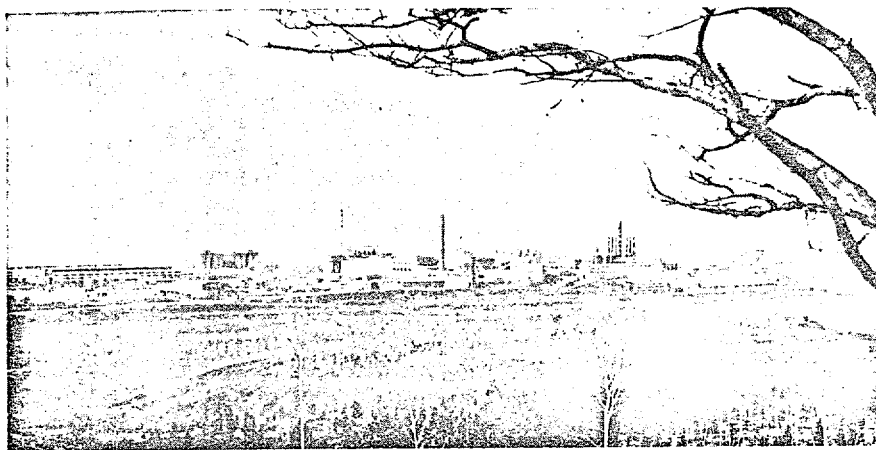
cc: JVDesvaux - w/enc.

bc: JDSell - w/enc. 

# WHAT'S GOING ON in world mining

Soviet Union . . .

## Alumina plant using nepheline as ore goes into production in Si



The world's first and only alumina plant which uses nepheline instead of bauxite as raw material is in operation in Siberia. The Achinsk Alumina Complex on the Chulim River in central Siberia is a key plant in the program to concentrate 65 percent of the Soviet Union's aluminum production in areas to the east of the Urals.

Nepheline for the Achinsk plant is mined in the Kuznetsk-Alatau mountains, about 330 kilometers (190 miles) distant. The nepheline contains only about half the alumina content of bauxite, but it is claimed that the new technology developed for the Achinsk plant makes its use economic. Byprod-

United States, Idaho . . .

## Bunker Hill mine releases data on ore reserves, production, and

Despite a sharp advance in prices for supplies, labor, freight, and other products the Bunker Hill mine of Gulf Resources and Chemical Corporation has been able to hold mining, milling, smelting, and refining costs to a minimum increase over the last six years. More importantly, the grade of the ore milled has been raised as has the tonnage mined and milled. Details are shown in accompanying tables.

All of Bunker Hill's ore, including the Star Unit, is mined underground, very deep underground, from relatively narrow veins and fracture zones. Mining has been mechanized using small load haul dump equipment and mobile rubber tired drill jumbos in many places in the Bunker Hill mine. Most stopes are filled.

In 1970 the company's smelter production was 123,106 tons of lead, 95,637 zinc, 18,437 tons of zinc in zinc oxide, 1,193,000 pounds of cadmium, 7,829,479 ounces of silver, and 23,182 tons of 100 percent  $P_2O_5$  content in fertilizer.

Production, Costs, and Grades of Ore Mined by Heda Mining Company at the Hecla-Bunker Hill Star Unit Area from 1963 through 1970\*

Year	Bunker Hill's Share in Tons	Percent Lead	Per Ton Percent Zinc	Ounces Silver	Average Cost per Ton <sup>1</sup>	Average Net Smelter Return per Ton
1963	177,459	4.95	10.26	2.04	\$16.61	\$19.52
1964	171,771	4.51	10.51	2.40	16.46	22.91
1965	168,137	4.68	10.23	2.80	17.16	25.48
1966	172,418	5.00	7.91	2.86	16.48	22.82
1967	159,615	5.08	8.83	2.64	17.69	22.61
1968	132,955	4.93	3.84	2.19	22.17	—
1969	110,135	5.25	8.32	2.40	22.35	—
1970	150,881	5.21	6.79	2.45	22.44	—

\* Bunker Hill has 70 percent share. 1. Total additional costs per ton were \$0.75 for 1966, \$0.51 for 1967, \$0.21 for 1968, \$0.18 for 1969, and \$0.26 for 1970. Such additional costs include those for depreciation, depletion and net profits taxes. 2. Reduced production for 1967 through April 1970 is attributable to curtailment of production operations due to construction of a new production shaft. Increased average mine and mill costs per ton for such periods are principally attributable to such reduced production. The mine has been operating at approximately 90 percent of capacity since April 1970.

Production, Costs, and Grades of Ore Mined by Bunker Hill Company at its Bunker Hill Mine

Year	Tons Crude Ore Mined	PER TON Percent Lead	Percent Zinc	Ounces Silver	Average Cost per Ton <sup>1</sup>	Average Net Smelter Return per Ton
1963	450,903	7.50	4.03	4.38	\$16.26	\$20.09
1964	454,326	6.53	3.83	3.78	18.01	21.08
1965	366,837	6.40	4.68	3.93	22.61	25.04
1966	383,630	5.66	5.47	3.04	20.05	23.31
1967	366,025	5.77	5.45	3.35	20.17	23.03
1968	387,941	5.78	6.07	3.42	19.18	—
1969	427,172	5.37	5.33	2.99	20.12	—
1970	425,954	6.03	4.89	3.86	22.91	—

1. Total additional costs per ton were \$0.44 for 1966, \$0.54 for 1967, \$0.61 for 1968, \$0.66 for 1969, and \$0.70 for 1970. Such additional costs include charges for depreciation, depletion, and local taxes.

United States, Tennessee . . .

## Occidental extends Carthage trend; drills deep zinc ore

Of the first 66 completed diamond drill holes on Occidental Petroleum Corporation's Carthage zinc claims 36 cut zinc mineralization. Eighteen cut thicknesses in excess of 10 feet and averaged 14.7 feet assaying 5.59 percent zinc. Another 18 holes cut lower grade zinc (sphalerite) mineralization. The mineralization was cut in gently dipping Knox dolomite between 1,200 and 1,400 feet in depth. All indications point to low cost mechanized room and pillar stopping. Occidental is continuing

to drill along a 15 mile strike on its 10,000 acre claim block.

The New Jersey Zinc Company was the discoverer of the Carthage Trend and announced such a discovery in January 1969 after prospecting beginning in 1964. Ore bodies were first discovered on the northeastern flank of the Nashville Dome. At the time of the discovery, New Jersey announced one ore body, between 13,000,000 and 50,000,000 tons assaying from 5.0 to 10.0 percent zinc. Zinc had also been found in

five other areas by drilling. New Jersey has finished sinking its Elmwood shaft.

After New Jersey Zinc announced discovery of the Carthage Trend there was an immediate claim staking and diamond drilling rush to the district. Cerro Corporation signed an exploration lease with Frontier Resources, Inc.; Five Resources, Inc.; and J. Fred Landers on a 15,000 acre block due north of New Jersey Zinc. North of Cerro the United States Borax and Chemical Corporation is evaluating its 15,000 acre block.



AMERICAN SMELTING AND REFINING COMPANY  
Tucson Arizona

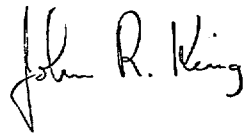
March 1, 1971

TO: W. E. Saegart

FROM: J. R. King

On February 23, I took Henry Kries, geologist for Occidental at Miami, out for dinner. No information was gathered from him concerning their drilling except that they are drilling an ore body and that to date 20 or 21 holes have been drilled.

Later in the evening, Henry casually asked if ASARCO would be interested in a joint venture in our exploration program for the Miami-Superior region. I indicated that I did not believe we would be interested and the subject was dropped..



John R. King

JRK:mw

cc: J. D. Sell ✓

AMERICAN SMELTING AND REFINING COMPANY  
Tucson Arizona

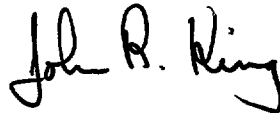
March 8, 1971

TO: J. D. Sell

FROM: J. R. King

Re: Copper Springs Prospect  
Gila County, Arizona

On Thursday evening, March 11, I meet Jim Lukanusk, exploration geologist for Phelps Dodge. He mentioned that several years ago, Phelps Dodge, in a joint venture with Kerr McGee(?), had drilled the Copper Springs area south of the Schultze Ranch and in their drilling program they had delineated a small(?) tonnage copper ore body. He indicated that Phelps Dodge might be willing to exchange with Asarco some of their information on this area in return for some Asarco data. Apparently Humble Oil presently has the property.



John R. King

JRK:mw

cc: W. E. Saegart

PLEASE REPLY

SOUTH BETH CO. USA.

20% COTTON FIBER

AMERICAN SMELTING AND REFINING COMPANY  
Tucson Arizona

April 9, 1971

TO: W. E. Saegart

FROM: J. C. Balla

Re: MIAMI EAST

I talked this afternoon with John Abel, Professor of Mining Engineering at the University of Arizona, and learned the following information, which may be of interest.

The Miami East orebody averages about 2% copper, with a 0.75% Cu cutoff. The shape of the orebody in vertical section, appears to be bounded by faults. In vertical section, the orebody has a shape as shown below. The central core is not barren, merely low grade.




The depth of the deposit is variable, but appears to be 2600 feet below the surface. Mineralization extends eastward to a depth of at least 4000 feet.

Miami has decided to mine the deposit by cut and fill methods, starting with several levels at the top of the orebody (in order to get the high grade first). Fill will be tailings.

Miami is not communicating with Occidental Petroleum and does not plan a joint venture operation with Occidental.

Dames and Moore is doing the rock mechanics study for Occidental, while Abel is for Miami.

  
John C. Balla

JCB:sh

cc: JDSell



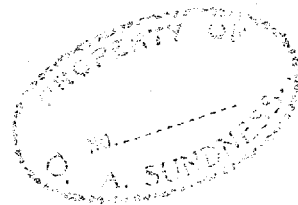
*From: Library Collection of RBCist  
12/31/70.*

# PRODUCTION POSSIBILITIES OF THE MARGINAL COPPER MINES IN ARIZONA

A Report to Mr. Leon Henderson, Director,  
Office of  
Price Administration and Civilian Supply.

Prepared by the  
ARIZONA DEPARTMENT OF MINERAL RESOURCES  
At the Request of the  
ARIZONA COPPER TARIFF BOARD

*Carlota Mine  
Incorporation Consol. Copper Co.  
Van Dyke Copper Company*



The copper shortage is not a question of reserves. Supplies in the ground are more than adequate for any demand that may be realized. The problem is to provide certain essentials including a satisfactory price and to assure a return of capital investment in order to encourage high-cost operations.

BOARD OF GOVERNORS:  
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DEPARTMENT OF MINERAL RESOURCES  
STATE OF ARIZONA  
518 TITLE AND TRUST BUILDING  
PHOENIX, ARIZONA



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W. J. GRAHAM, PHOENIX  
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AND SECRETARY TO THE  
BOARD OF GOVERNORS  
FIELD OFFICES AT  
GLOBE - KINGMAN  
PRESCOTT - TUCSON

August 1, 1941

Mr. Leon Henderson, Director  
Office of Price Administration and Civilian Supply  
Washington, D. C.

REPLY TO

Dear Mr. Henderson:

In response to a suggestion made some time ago, the Arizona Department of Mineral Resources, at the request of the Arizona Copper Tariff Board, has undertaken a survey of high-cost copper mines in Arizona to determine how much additional copper might be obtained from them under the right conditions. The conclusion is that they could produce millions of additional pounds of copper a year with an adequate price and assurance that the necessary capital investment involved will be returned.

The report does not survey in detail the possibilities held by the major producers, but it does point out that they likewise could increase their production and that, under the right conditions, all the copper that is needed for defense could be obtained. The large mines and the small mines are fundamentally the same -- the difference is only a matter of degree. In both cases it will take time and cost money to obtain the additional supplies that are called for.

This survey was compiled from questionnaires filled out by the individual producers and from other information available. There are many other potential copper producers on which the complete information needed was not quickly available and for that reason they were not included in this survey. Thus, there are possibilities beyond those mentioned.

While this report is limited to Arizona, a similar situation undoubtedly prevails in all other copper-producing states. Mines outside Arizona also could produce large quantities of copper for defense if given the proper conditions.

Because of physical limitations it was not possible to make a detailed engineering survey in the field of all the mines mentioned in this report. The report should therefore be considered as a preliminary study and be followed up by a detailed examination. It is recommended that engineers of the United States Bureau of Mines do this work.

There are great possibilities in Arizona and in the other copper producing states and it is urged that action be taken promptly to place the higher cost mines in operation. They can make a substantial and necessary contribution to the defense of the nation.

The copper is available and it can be mined and processed. There is no question about that and it is hoped that the problems that are keeping many mines idle and others producing on a curtailed basis can be solved promptly so that they can start operating as soon as possible.

Yours very truly,

*Charles F. Willis*

Chairman, Board of Governors  
Arizona Department of Mineral Resources.

While the mine is still pretty much in the prospect stage, reputable engineers have reported highly on it and stated that they believe sufficient ore could be made available to guarantee the payment of the initial development cost. The metal content of the ore that might be recovered is reported by the owner to run from 8 to 10 per cent in copper with small quantities of gold, silver, and tungsten (scheelite).

Approximately 1,500 feet of workings on the 16 claims have been extended in development operations. The property would be a tunnel operation and two tunnels, one 220 feet long and another 100 feet long, have been driven on the Bonanza. Work on the Azure consists of a 50-foot incline, a 50-foot winze, a 50-foot shaft on a fault, and 100 feet of drifts.

Calvillo reports that it would be possible to produce 1,000 tons of ore a month with a copper content of from 8 to 10 per cent if the mine were properly equipped indicating an output of as high as 1,920,000 pounds of copper a year. Equipment costing about \$25,000 would be required including a compressor, drills, cars, track, and a tramway or about  $1\frac{1}{2}$  miles of road.

A copper price of 14 cents a pound would be required to justify operations and assurance of the sale of full production over a period of at least a year and a half would be necessary. Production could be started in about six months after the preliminary financial and price matters are disposed of.

#### CARLOTA MINE

The Carlota mine is located in Pinto Valley in the Globe-Miami mining district, about 10 miles southwest of Miami, Arizona. A good road leads from the property to the International smelter at Miami and at the present time trucks haul seven tons of ore a trip.

The ore occurs as parallel fissures in andesite and the present workings are in the oxidized zone, the depth of which has not been determined. The possibility



finding a secondary enriched zone is reported to be very good; the values appear to increase with depth.

Continuous ore zones are found in the property ranging from a few feet to as high as 30 or 40 feet in width. The gangue rock is high in alumina, averaging around 16 per cent, of which the smelters do not like to take too large a quantity.

The Carlota is owned by John L. Alexander of Phoenix, Arizona, and is now held under lease and option to purchase by George T. Scholey, 802 Hoge Building, Seattle, Washington. Scholey is manager of Nielson and Company, Inc., an important copper producer in the Philippine Islands.

The development work that has been done to date consists of approximately 3,000 feet of drifts, raises, and crosscuts on three different levels covering a vertical distance of 200 feet. Ore reserves now aggregate 70,000 tons running from 3 to 5 per cent copper and intensive development work is blocking out additional supplies.

Copper is the only mineral of commercial importance in the deposit. The total copper production prior to 1940 was reported at 5,000 tons of 5 per cent copper ore and the bulk of this was taken out in 1929. The Arizona Bureau of Mines reported that 440,000 pounds of copper were produced by the mine in that year.

The mine has been producing steadily on a small scale ever since the present lease was negotiated a few months ago. In March, 1941, a production of 176 tons averaging 4.1 per cent copper was reported, in April output came to 713 tons of 5 per cent ore, and in May 826 tons were mined with a copper content of 5.2 per cent.

At the present time (June, 1941) the property is producing around 1,000 tons of 5 per cent ore per month which is shipped direct to the International smelter at Miami. It is impossible to ship a lower grade ore than 5 per cent and production cannot be stepped up materially because the smelter contract calls for the delivery of not more than 50 tons of ore daily.

The metallurgical problem appears to be the biggest obstacle that confronts the operation. The high alumina content does not make the ore desirable for direct

smelting and the high copper silicate content does not permit high recoveries in concentration. Metallurgical tests to work out a suitable method of concentration are now being run at the Arizona Bureau of Mines.

There is a large amount of ore with a copper content of between 3.5 and 5 per cent available in the mine and Scholey states that if a plant were available this could be mined, concentrated, and shipped. With the proper equipment and smelter contracts, production could be stepped up to 100 tons of 5 per cent copper ore a day which would yield 300,000 pounds of copper a month or approximately 3,600,000 pounds a year.

The cost of erecting the 100-ton concentrating plant which would be required to do this together with mine plant expansions necessary is estimated at \$60,000. A 14-cent price and assurance of the sale of full production over a two-year period would be required to permit operations and after providing for financing about four months would elapse before production on this basis could be reached.

#### CHRISTMAS MINE

The Christmas mine is located at Christmas, Arizona, in the Banner mining district of Gila County on a branch of the Southern Pacific Railroad. The mine is owned by the Christmas Copper Corporation with head offices at 29 West Street, Beverly Farms, Massachusetts. Frank P. Knight is president of the company with headquarters at the eastern office and Frank P. Knight, Jr., the general manager, is at Winkelman, Arizona.

The Christmas ore body was formed by the intrusion of a quartz-diorite-biotite plug into a thick series of carboniferous limestones, shales, sills, and volcanic rocks which normally dip about 12 degrees southeast. At or near the contact of the plug with the wall there are concentrations of silicates, oxides, and sulphides largely in sedimentary rock hosts and the deposit is classified as pyrometasomatic.

and there is an ample supply for milling underground in the mine. A 100-ton flotation mill is now in operation on the adjoining property.

Hartman reports that with a 100-ton flotation mill the mine ought to be able to produce 2,000,000 pounds of copper annually. This would require a two-mile road, however, and mining as well as milling equipment, the total cost of which is estimated at \$65,000. It would take about six months to get the property ready for production on this scale.

#### INSPIRATION CONSOLIDATED COPPER COMPANY

The Inspiration Consolidated Copper Company, located in the Globe-Miami district of Gila County, Arizona, is one of the foremost copper producers in the nation, but at the present time operations there are below equipped capacity. The company owns 195 patented and 9 unpatented mining claims.

Inspiration's copper production from 1915 through 1940 has approximated 1,671,500,000 pounds of copper worth about \$260,000,000. Production of the company since the mine reopened in 1935 after a shutdown during the depression is listed below:

Year	Copper Production (pounds)
1935	7,516,625
1936	59,876,118
1937	105,815,954
1938	34,084,191
1939	51,576,333
1940	76,119,435
Total.....	334,988,656

Inspiration is now producing copper at the rate of 8,000,000 pounds a month, but it probably will not be able to maintain operations at this level throughout the year.

According to a prospectus filed with the Securities and Exchange Commission by the Anaconda Copper Mining Company in 1935 preparatory to issuing \$55,000,000 worth



of  $4\frac{1}{2}$  per cent sinking fund debentures, the equipment of Inspiration's "mines and metallurgical plants have a capacity of reducing 130,000,000 pounds of copper per annum in the form of concentrates, cement copper, and electrolytic cathode copper from combined leaching and concentrating operations. The concentrates and cement copper are shipped to the International Smelting and Refining Company's plant at Miami, Arizona, for treatment on a toll basis, and the electrolytic cathode copper to that corporation's plant at Perth Amboy, New Jersey, for casting."

The prospectus also pointed out that during the years 1925 to 1929, inclusive, copper production from the Inspiration property averaged approximately 89,315,000 pounds per annum. At such rate of production, the prospectus (which was dated October 1, 1935) stated the productive life of the property would be approximately 16 years based upon the estimated recoverable copper contents of the ore reserves.

Ore reserves were estimated at that time to have been:

	<u>Tons</u>	<u>Per cent Copper</u>
Sulphide Ore .....	41,217,769	1.438
Mixed Oxide and Sulphide Ores....	<u>27,793,001</u>	<u>1.276</u>
Total.....	69,010,770	1.373

The great bulk of Inspiration's production at the present time is recovered by leaching. The concentrator of the company is working on a very limited scale, but under the right conditions, operations there could be stepped up materially and a substantial increase in copper production would result. The following comparison of production figures taken from the annual reports of the company in 1937 and 1940 indicates the possibilities:

<u>Method of Recovery</u>	<u>Production -- In Pounds of Copper</u>	
	<u>1937</u>	<u>1940</u>
Main Leaching Plant	67,253,725	70,368,524
Concentrator	34,937,424	1,426,074
Slimes Leaching Plant	<u>3,624,805</u>	<u>4,324,837</u>
Total	105,815,954	76,119,435

The Inspiration concentrator has not been operated at anything like its

capacity in recent years because the price of copper has been too low to justify it -- and at the present 12-cent price there is little likelihood that it will be started up. Furthermore, a substantial capital investment of from a quarter to a half million dollars would probably be required to rehabilitate the plant and place it in operation.

Price is not the only question involved in the operation of the Inspiration concentrator. The metallurgical problem presented by the mixed oxide and sulphide ores in the deposit is a serious one and one of the main reasons why the concentrator has been idle lately is that it is unable to obtain a high yield of copper from the ores.

However, if this plant were placed in operation, it might well add 30,000,000 pounds of copper yearly (and perhaps more) to the company's current production. To get this production and to amortize the capital investment necessary a copper price of 14 cents a pound over a period of five years would be required.

#### ~~KAY COPPER MINE~~

The Kay copper mine is located in the Tip Top mining district of Yavapai County, Arizona, 50 miles from Phoenix on the Black Canyon Highway. It can be reached by a 39-mile graded road from Marinette, Arizona, or by a 22-mile graded road from the Turkey Creek Station. Both Marinette and the Turkey Creek Station are on the Santa Fe Railroad.

There are 153 mining claims in the Kay property which cover an area of 2,592 acres. In addition there is a 590-acre millsite.

The Kay Copper Company was incorporated to operate the property in 1909. The mine was equipped and a considerable amount of development work together with some production was carried on by the company for the next 13 years.

In 1922, the company ran into financial difficulties and the Kay Copper Corporation was formed early in 1923 during a reorganization. Further complications

### VAN DYKE COPPER COMPANY

The property of the Van Dyke Copper Company is located at Miami, Arizona, and adjoins holdings of the Miami Copper Company and the Inspiration Consolidated Copper Company. It is well situated insofar as transportation and rail facilities are concerned.

The company was incorporated in 1916 and the property originally contained 1,700 acres but this may have been cut to 1,200 acres, of which 393 are patented, later. For many years development operations were carried on and in 1929 production was started with shipments going to the International smelter at Miami.

During that and the following two years, the company shipped ore containing 11,000,000 pounds of copper valued at \$1,200,000. This production came from ores from 5 to 10 per cent copper, but plans were made for the construction of a leaching plant for the treatment of ores containing less than 3 per cent copper. This proposed plant was never built and all production was brought to a halt in 1931 as a result of depressed prices.

The mine has not been worked since the 1931 shutdown and financial difficulties in the years following necessitated a reorganization. This was effected with the approval of both the creditors and stockholders.

The copper deposit of the Van Dyke company is in Pinal schist capped by a blanket of conglomerate. There are two leading types of ore in the property.

One is a highly brecciated ore of silicates and carbonates running from 5 to 15 per cent copper -- it is a broken schist highly impregnated with malachite and veined with azurite and chrysocolla. The other is a somewhat massive black ore veined with malachite and azurite and often seamed with streaks of chrysocolla. Chalcocite is reported to be present at lower levels.

A body of ore 250 feet north of the shaft on the 1,200-foot level of the mine has been developed for more than 500 feet. This ore averages about 6 per cent copper with a maximum width, so far developed, of 165 feet. It has been cut on the



1,300-foot level and according to responsible engineers there is a potential area for its continuation for a distance of 3,000 feet. This extension has not been touched except by drill but drilling indicates that the ore is the same as that developed on the 1,200 level.

The rest of the property which has been pretty well explored by drilling appears to contain a solid tonnage of copper ore running in grade from  $1\frac{1}{2}$  to  $1\frac{1}{2}$  per cent copper. The possibilities of the development of a tremendous ore body are great when it is considered that mineralization has been demonstrated to extend below the 2,000-foot level.

At the time of the shutdown, about 10 years ago, 200 tons of ore were being shipped to the International smelter daily and it is believed that steady shipments of 300 tons of ore a day could be maintained over a long period. There are probably 500,000 tons of ore reserves in the deposit as it is now developed and reliable engineers state that there is a big chance of developing three or four times that amount.

To place the mine in production would probably cost not more than \$250,000. This would include unwatering, putting the underground workings in shape for operations, provision of a surface plant commensurate with the operation, working capital, and a development fund for opening up the known ore body. With this expenditure, it should be possible to bring the Van Dyke into production at a rate of 300 tons of ore a day.

The production of the higher grade shipping ore at a rate of 300 tons a day should yield 10,800,000 pounds of copper a year, but capital would have to be provided and a higher price would be needed. It would take a price of 16 cents a pound and this would have to be guaranteed for a period of five years to permit recovery of the capital investment. A number of months would be required to make the necessary preparations for production.

AMERICAN SMELTING AND REFINING COMPANY  
Tucson Arizona

January 18, 1971

TO: W. E. Saegart

FROM: J. D. Sell and R. B. Crist

Re: Carlota Deposit  
Recent Drilling and Evaluation  
Gila County, Arizona

S. I. Bowditch, R. B. Crist, and J. D. Sell traveled to Phoenix on January 14, 1971, to talk with Home-Stake Production Company in regard to their Carlota deposit.

Home-Stake Production Company  
Financial Building  
3443 North Central Avenue, Phoenix  
Phone: 274-8049  
Mr. Dennis Pickens, Manager  
Mr. George Freeman, Exploration

Home-Stake secured the Carlota group through Mr. Sherwood Owens in July, 1968, and has drilled some twenty holes in the Kelly fault zone and in the Carlota breccia ore.

Mr. Pickens was unreceptive to giving us anything other than verbal information and a look at their plastic model of the drilling. The model portrayed two types of ore: 1) the steeply inclined Kelly fault zone and the related flat-lying blanket, and 2) the Carlota breccia ore similar to the outcropping breccia at the Cactus deposit.

The accompanying map of the area indicates the Carlota group (approximate outline since we have no claim map of the group) is bordered by Inspiration (Eder group) on the west and Miami (Cactus group) on the north and east.

Evaluation of N. P. Peterson's map suggests that the two northwesterly-trending faults--the Kelly fault on the southern edge and an unnamed structure on the north--are bounding faults in that they cut or limit the flat basement fault. The flat fault bottoms the Cactus-Carlota breccia ore. Mapping by Peterson places a similar "thrust" to the north and field work in this area by D. Friel has not, apparently, found any mineralization or features suggesting breccia ore in this Grizzly Bear block, except for a minor amount along a possible steep fault in the center of the block.

Information shown by Home-Stake suggests that to the west the flat fault has a sub-outcrop which is covered by dacite. This westerly trace of the flat fault will also limit, by termination, the Carlota breccia ore on the west. Similar copper ore of secondary origin, but higher grade, has been drilled out in the Kelly fault zone and this mineralization is shown to underlie the Carlota breccia ore as a flat blanket. It is reasonable to believe that the Kelly blanket is similar to the higher concentration of copper at the Eder area in that it represents precipitation in the reactive schist and other rocks in the footwall slate below the flat fault.

Tonnage-grade figures reported by Home-Stake are:

- 3.6 million tons of Kelly ore at 1.65% copper
- 5.0 million tons of Carlota ore at 1.03% copper
- 18.0 million tons of stripping (Dacite, leached(?) capping)

They believe straight leach will recover about 90% of the Kelly values and 40% of the Carlota values.

The known drilling patterns and property position suggests some 15 million tons of ore on the Carlota property. Some extension may be possible but limited. The lion's share of the Carlota breccia ore is controlled by Miami at the Cactus and adjacent area.

No sulfides were encountered in the Kelly or Carlota ores in the drilling but some pyrite was found in the schist, diabase, and basalt(?) in the lower portion of the holes below the Carlota breccia and Kelly blanket ore.

The Home-Stake holes in the last panel to the west showed no Carlota breccia ore but had very good Kelly ore as a flat-lying blanket and in the Kelly fault zone itself. No information was gained to interpret this flat blanket Kelly ore, and, although I believe it to be related to the same leach-precipitate sequence as in the Kelly fault ore, it is possible that these western holes penetrated into the edge of mineralization located in the lower plate of the original body.

George Freeman has stated that they will be drilling again soon, and at that time we will be permitted to view their previous core (stored in Miami) as well as securing additional information on the deposit. It will be essential to review the core information for better control on the geologic structure and ore control in the area.

Although Miami controls the larger part of the Carlota breccia ore, the Home-Stake area indicates a good investment return in the following analysis by R. B. Crist:



Carlota - Margin Evaluation

Estimate based on solvent extraction plant and electrowinning cathode circuit.

Reserves: 8,500,000 Tons of 1.0% Cu

Production: (Plant approx. 1000 gpm)

96,000,000 lbs. Cu. @ 60% Recovery

8,000,000 lbs. Cu. per year

11 tons per day

12 year life

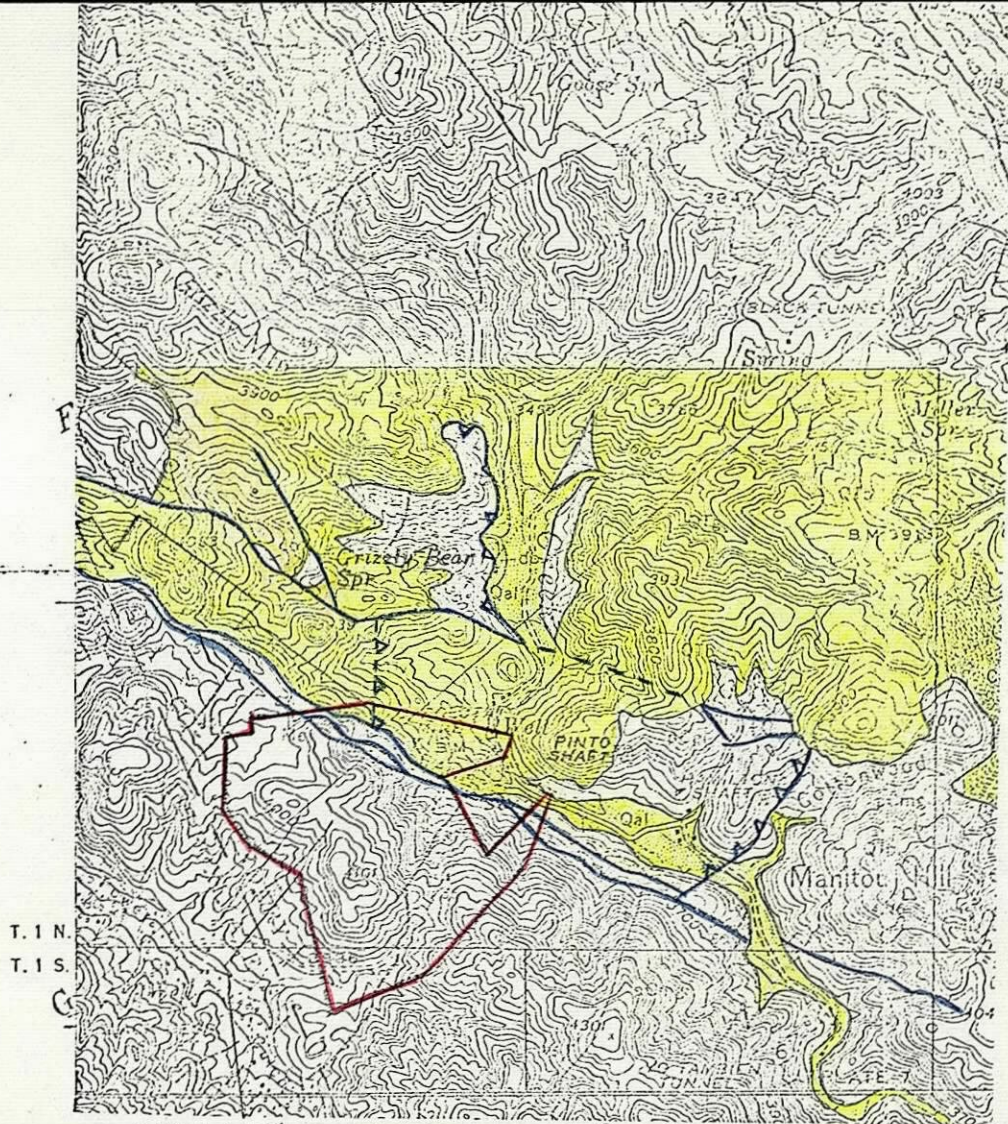
<u>Operating Costs*</u>	<u>\$/Yr.</u>	<u>Per Ton</u>	<u>Per lb.</u>
Mining: Ore 670,000 tons/yr.	167,500	\$ .25	.0209
Waste 1,200,000 tons/yr.	420,000	.63	.0525
Extraction: Leaching and Electrowinning	1,407,000	2.10	.1759
Royalty - 10% NR	197,200	.29	.0247
Administration	33,500	.05	.0042
Capital Costs - \$4,800,000	<u>400,000</u>	<u>.60</u>	<u>.0500</u>
Total Yearly Cost	\$2,625,200	\$3.92	.3282
Value @ .50 per lb.	4,000,000	6.00	.5000
Yearly Margin Before Taxes	1,374,800	2.08	.1718

\* From Lakeshore Leaching and Electrowinning Estimate  
0.9% oxide at 70% recovery and \$16.00/ton acid.  
Leaching and precipitation \$1.95 per ton.

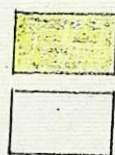
*James H. Sell*  
J. D. Sell

*R. B. Crist*  
R. B. Crist





CARLOTA-CACTUS AREA



Post-mineral cover

Pre-mineral units



Steep dipping fault



Flat-dipping fault.  
barbs on upper plate



Approximate Area  
claimed by Home-Stake





AMERICAN SMELTING AND REFINING COMPANY  
SOUTHWESTERN EXPLORATION DIVISION  
P. O. BOX 5747, TUCSON, ARIZONA 85703

1150 NORTH 7TH AVENUE  
TELEPHONE 602-792-3010

September 6, 1972

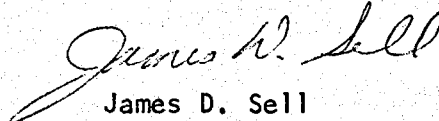
Mr. Robert P. Hughes  
Manager of Operations  
Cities Service Company  
Miami Copper Operations  
Box 100  
Miami, Arizona 85539

Dear Mr. Hughes:

Four of the personnel from this office are interested in a geological tour of your Copper Cities-Diamond H areas. The group includes W. L. Kurtz, J. A. Staargaard, A. J. Giesecke, and myself.

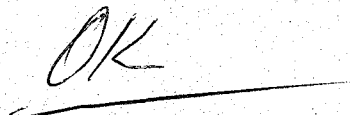
In a conversation with Mr. Joe Fowells, Resident Chief Geologist, it was suggested that Tuesday, September 12th, would be a convenient date. Please advise us if this will be agreeable.

Very truly yours,

  
James D. Sell

JDS:lad

cc: J.Fowells





AMERICAN SMELTING AND REFINING COMPANY  
SOUTHWESTERN EXPLORATION DIVISION  
P. O. BOX 5747, TUCSON, ARIZONA 85703

1150 NORTH 7TH AVENUE  
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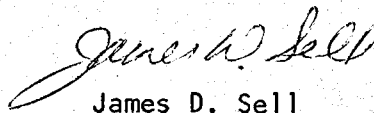
October 6, 1972

Mr. Robert P. Hughes  
Manager of Operations  
Cities Service Company  
Miami Copper Operations  
Box 100  
Miami, ARizona 85539

Dear Mr. Hughes:

The tour group from this office appreciates the excellent guidance and discussions held with Joe Fowells and Errol Anderson during the group's recent visit to your operations.

Sincerely,

  
James D. Sell

JDS:lad

cc: J.Fowells







18 mill. <sup>in</sup> strigous

3.6 M.I. Kelly ore card 1.45

Bd M.I. Calotte ore (brass) 1.03

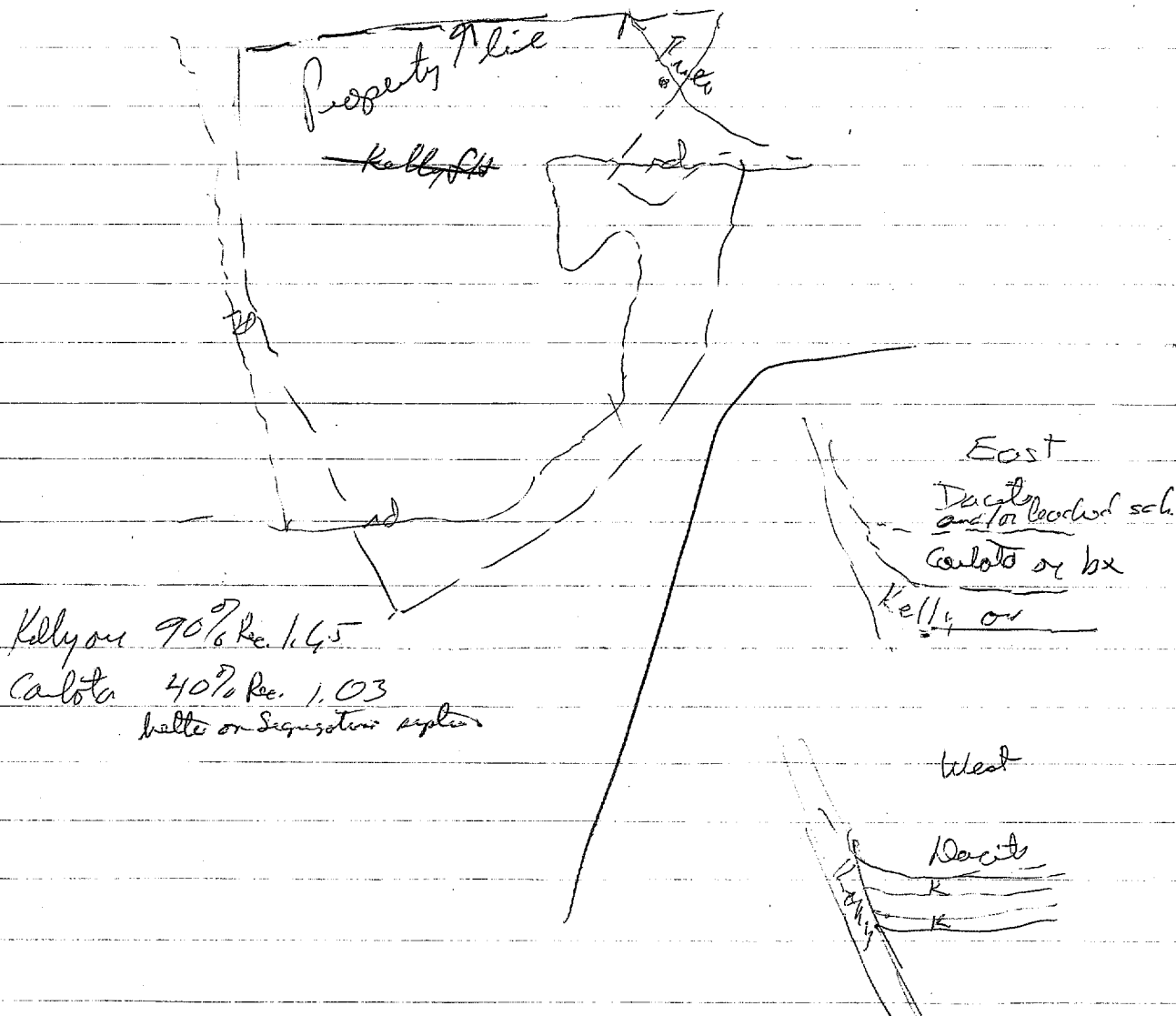
all probably in +1% column.

Some 20 hole in told you with  $\frac{1}{2}$  -  $\frac{1}{2}$  K & C  
Big Surveying & Eugene W Skelley  
Aerial Photo tops by Cooper

Main & North

Signature to west +  $\nabla$  ribbon Main & North

Apparently Td is 400-500 ft thick; no T<sub>2</sub>;



AMERICAN SMELTING AND REFINING COMPANY  
Tucson Arizona

January 19, 1973

TO: W. L. Kurtz

FROM: J. D. Sell

ICC's Montezuma Area  
(JDS's Needle Mtn. Segment Area)  
Miami District  
Gila County, Arizona

I chatted by telephone with Mr. Jack Eastlick, chief resident geologist of ICC, concerning the "graben" area presently being drilled by ICC. They call the area the Montezuma Project and it is apparently another segment of the Miami-Inspiration ore zone and lies west of the Barney fault. The last ICC annual report called it a significant discovery.

They have drilled it on 800-foot centers and are now filling in on 400-foot centers. A significant feature was that the early drill holes went into a deep (?) basin of Whitetail, while adjacent holes intercepted bedrock at substantially shallower depths. Eastlick says that mineralization decreases in intensity to the northwest in their present pattern.

Found during the drilling is the "Overthrust" fault which apparently bounds the north side of the "graben", with the mapped Williamson fault (ICC nomenclature) as the south boundary. The "Overthrust" fault has 500-600 feet of displacement and brings oxide mineralization over and into contact with Dacite and Whitetail conglomerate. Redistribution of the oxide has moved oxide mineralization into the porous parts of the adjacent Dacite and Whitetail. (The mineralization is apparently similar to that at the Black Copper workings north of the Thornton pit which is in Whitetail and the lower part of the Dacite.)

Shown on the attached sketch, taken from N. P. Peterson with some additions, the Gila conglomerate is downfaulted against Pinal Schist along the east-west trending Williamson fault. Eastlick feels that the "Overthrust" fault is similar to the Sulfide fault found in the Live Oak area. If the South-western fault (Olmstead, Porphyry Copper Volume) south of the Sulfide fault is the extension of the Williamson fault, as expressed by Eastlick, then the position of the "Overthrust" fault can be suggested based on the position of its counterpart, the Sulfide fault.

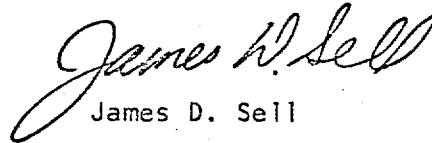
Eastlick also feels that the block under the Gila gravels is basically a southwestward tilted block complicated by the "Overthrust" fault. Since dacite (and Gila) are faulted into the block, the Williamson and "Overthrust" faults are in part post-dacite and post-Gila in age.



January 19, 1973

A sketch through cross-section A-A<sup>1</sup> is based on mapped and suggested information.

Eastlick has been drilling east of the Barney fault trace, starting in Gila gravels, going through the Barney fault which dips flatly to the east, and passing into the mineralized block.

  
James D. Sell

JDS:lb  
Attach.



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Tucson Arizona

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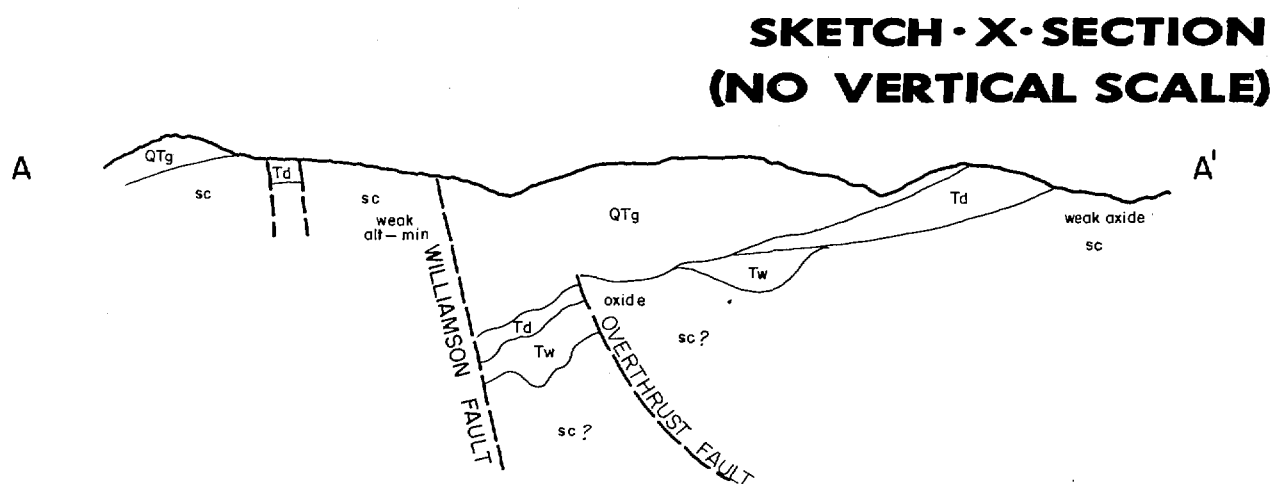
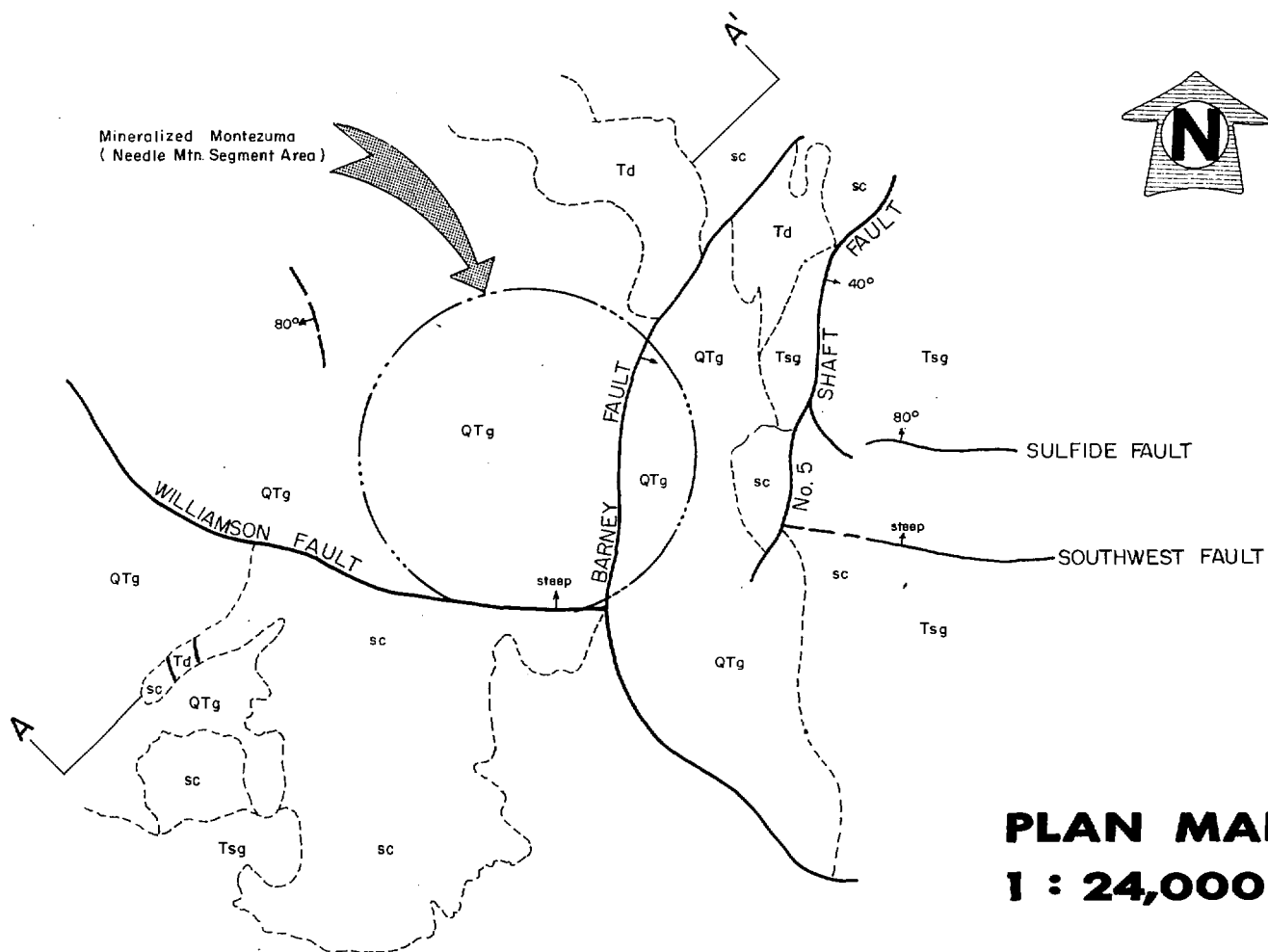
JDS:lb  
Attach.

Verbal Comment by Eastlick (March 29, 1973)  
Westernmost holes of Montezuma area, some 2000 feet deep, with chalcocite blanket. Sometimes no Cu; but sometimes yes with maximum thickness of 400 ft of whitetail.

Verbal Comment by Eastlick (March 29, 1973).  
Most westerly holes have penetrated sufficient thickness of chalcocite to warrant block caving considerations.

Verbal (Eastlick April 30, 1973)  
Mineralization is 200-300 feet below dacite.  
Generally intercept "barren" porphyry sill, then into mineral below sill.

Eastlick March 29, 1973  
North Orchid needs more drilling to NW to check downstepped blocks  
One block has 12 million tons of ore under Gila. ? on UG mining  
South Orchid  
One ore tied up under highway right-of-way. East side of mineralization cut off by fault.



# GEOLOGIC SKETCH MAP OF MONTEZUMA WEST MIAMI DISTRICT GILA COUNTY, ARIZONA



AMERICAN SMELTING AND REFINING COMPANY  
SOUTHWESTERN EXPLORATION DIVISION  
P. O. BOX 5747, TUCSON, ARIZONA 85703

1150 NORTH 7TH AVENUE  
TELEPHONE 602-792-3010

October 3, 1973

Mr. James Anderson  
Occidental Minerals Corp.  
6073 W. 44th Avenue  
Wheatridge, Colorado 80033

Dear Jim:

This is to formally notify you that ASARCO is genuinely interested in studying all the data on your copper deposit at Miami, Arizona, in order to present a proposal to Occidental Minerals for ASARCO's participation in further exploration and development of the deposit.

ASARCO is vitally interested in oxide copper deposits from both the in-situ leaching possibilities and conventional mining possibilities.

I will be back in Tucson after October 22nd and hope we can get together immediately thereafter.

Very truly yours,

A handwritten signature in dark ink, appearing to read "W. L. Kurtz", written over a horizontal line.

W. L. Kurtz  
Manager of Exploration

WLK:lb

cc: RBCrist  
JDSell ✓

AMERICAN SMELTING AND REFINING COMPANY  
TUCSON ARIZONA

September 21, 1973

FILE MEMORANDUM

Occidental  
Miami East

I talked to Bob Kendricks, AMAX, and he confirmed that AMAX is terminating their agreement with Occidental. AMAX will be responsible for property payments to or thru November '73. Next week they are turning over all their data to Occidental.

Kendricks stated that he was instructed in April '73 to complete a "well test" for in-situ leaching with someone else's money. He could not arrange this and he has not been able to renegotiate terms with Occidental.

Previously Kendricks had stated that the oxide copper occurs on 2 sets of fractures and along the schistosity in the Pinal schist.

*W. L. Kurtz*  
W. L. Kurtz *WLB*

WLK:lb

cc: JHCourtright  
JDSell ✓



AMERICAN SMELTING AND REFINING COMPANY  
TUCSON ARIZONA

November 7, 1973

Mr. T. C. Osborne  
ASARCO  
New York Office

Occidental  
Miami East

The two enclosed File Memoranda outline the general parameters of Occidental's Miami East deposit and general terms under which they would like to negotiate. The deposit has been drilled on 400-foot centers, so the tonnage and grade are good figures.

If Asarco management is interested in the general parameters outlined, please inform me and I will arrange to review their detailed data. In any review, it would be most beneficial to have Mr. MacDonald participate since we are looking at underground development and mining or leaching.

WLK   
W. L. Kurtz

WLK:lb  
Encs.

cc: JHCourtright  
RBCrist  
JDSe11 ✓

AMERICAN SMELTING AND REFINING COMPANY  
TUCSON ARIZONA

September 21, 1973

CONFIDENTIAL

FILE MEMORANDUM

Occidental  
Miami East

The following information was obtained from Occidental Minerals:

Size -- +100 million tons	200 million (mostly within the 100-million ton area)
---------------------------	--

Grade -- 0.55% Cu                      0.4% Cu

Rock -- 10% porphyry; 90% schist

Mineralogy -- 75-80% oxide (2/3 malachite, azurite.  
1/3 chrysocolla - mainly in porphyry)  
20-25% chalcocite, little native copper, cuprite, etc.

Leaching -- Test on core recovered 72% of total copper.

Geometry -- Tilted blanket 100-600' thick,  
average about 300'; 1200 to 1600'  
beneath surface -- tilts SE.

Suggested Mining -- excavate 15 to 20% to allow caving (just to top of ore) then leaching in place.

Property -- 1) Van Dyke mineral ground --  
5% NSR until total price \$3 million paid.  
2) 20 acres city lots -- \$20,000 x 80  $\approx$  \$1,600,000  
3) Surface options 40-50 @ \$30,000  $\approx$  \$1,500,000

Purchased 1 sq. mile near Copper Hills for \$300 A;  
that could be subdivided.

AMAX is turning property back to Occidental on November 29, 1973.

W. L. Kurtz

WLK: 1b

AMERICAN SMELTING AND REFINING COMPANY  
TUCSON ARIZONA

November 7, 1973

FILE MEMORANDUM

Occidental  
Miami East

The following information was received by telephone today from  
Jim Anderson:

Terms Occidental would like for their Miami East deposit:

Down payment upon signing	\$1 million
1st year: land payments \$200,000; work \$1 million	\$1.2 million
Years 2-5, or however many it takes to determine mining feasibility of the deposit	
land payments plus work \$1.5 <i>million</i> .	\$1.7 each year

If deposit is held and not put into production,  
some holding costs plus land payments.

If deposit is put into production, a 20% carried  
interest to Occidental with option to buy  
additional 29%.

Provision for return of capital to ASARCO.

  
W. L. Kurtz

WLK:lb

AMERICAN SMELTING AND REFINING COMPANY  
TUCSON ARIZONA

September 24, 1974

FILE MEMORANDUM

Miami East  
AIME Talk  
Miami District  
Gila County, Arizona

Mr. John Brandon, Project Chief of the Miami East Project, gave a talk at the September 17th meeting at Kearny. Some of his comments:

5,000 tpd production anticipated.

35 to 50 years of operation. (Based on these figures, some 1,500,000 tons per year to be mined, with total reserves of between 52 and 75 million tons. Previously announced grade of over 1.2% copper.)

Rock temperatures of 110°-115°F.

400,000 cfm ventilation, refrigerated.

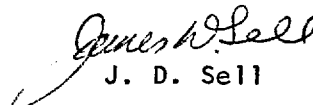
In the late 1920's, they had drifted into the general area from Number 5 Shaft toward the ICC Smelter and diamond drilled a number of holes. The results were not sufficient for the time and also the lack of secondary escape routes caused the closure of the operation.

In the late 1960's, a drilling program was initiated in the tailings areas and seventeen holes were drilled, only one of which failed to return an ore intercept.

They have deepened Number 5 Shaft and are driving haulage levels on the 2900 and 3300 levels. Two additional shafts are being sunk. Number 11, a 10-1/2' circular cement lined fresh air intake with manway, and Number 12, a 14' circular cement lined "bullet" exhaust shaft.

They will mine by horizontal cut-and-fill with alternate panels using cemented sand-fill, then mine the intervening panel. Essentially 100% extraction is planned. Jumbo drilling with load and carry machines to dump pockets. Rail haulage (3/4 mile) to Number 5 Shaft. All diesel equipment.

Number 5 Shaft holds the world record of 153 million tons hoisted from a single shaft -- which will soon be broken by the shafts at San Manuel.

  
J. D. Sell



AMERICAN SMELTING AND REFINING COMPANY  
TUCSON ARIZONA

September 24, 1974

FILE MEMORANDUM

Inspiration East  
Smelter Area  
Miami District  
Gila County, Arizona

At the AIME meeting of September 17 at Kearny, Mr. Jack Eastlick, Chief Resident Geologist, ICC, offered the following comments:

They believe they have the larger part of the presently-being-developed Miami East orebody. (Miami East announced at between 52 and 75 million tons.)

The last hole drilled in the smelter area drilled through 4000 feet of Gila Conglomerate, then 600 feet of Dacite before entering pre-mineral rock. The premineral intercept contained 300 feet of plus one percent copper and 300 feet of plus 0.7 percent copper with the last assay over 0.7 percent copper.

Bottom hole temperatures are between 150°-160° F.

  
J. D. Sell

JDS:lb

May 6, 1975

## Miami East

via JHC & W. Simmons

Shifting now into ore zone.

Ground is wet & heavy

Present plans to be cut-&-fill methods.

via cut-&-fill : 50 million ton @ 1.9% copper.

but if other plan such as :

via block caving :  $\pm$  120 million ton @ 1.25% copper.

Average thickness : 465 feet (4/7/70 file memo, JWC.)

mainly as secondary enriched ore.

T

~~CHL~~

RBC

7

The Northern Miner May 22, 1975 p. 23





Mon., Jan. 24, '77    The Arizona Republic



JDS - you follow up if interested  
with

WLR/JDS

AUG 31 1973

W.L.R.

MIAMI District  
F.L.A. County

AL SPRENGER (Oil & Gas Well Co. - Calif.)  
Del WEBB'S Townhouse  
Suite 1234  
PHX, AZ. 85013

PH: 264-0783

Spenger had forwarded some samples to  
ORE Purchasing from a prospect near Prescott.  
In talking to MARGE Hinton he asked  
if we would be interested in an option  
on his property in Miami.

IRENE GROUP of CLAIMS  
540 ACRES - unpatented

He is unable to come to terms with  
Occidental - I believe he confused  
ADARCO with AMAX.

He is willing to open his files -  
drill logs - samples - geological report.

CALL for App't. week of Sept. 10<sup>th</sup>  
At the above Address.

His TERMS sounded reasonable.

-RBC-

9/19/73

JDS

IF you think  
pertinent, pass  
on to WLE.

-RR-

# mericle oil company

suite 1234, del webb's townhouse 100 w. clarendon  
phoenix, arizona 85013 (602) 264-0783

September 18, 1973

Robert B. Crist  
American Smelting & Refining Company  
1150 North Seventh  
Tucson, AZ 85705

Dear Mr. Crist:

In response to your recent request for information, the following is submitted:

Mericle Oil has 540 acres in the Irene group near Miami, Arizona (see enclosed descriptive list, map, and other literature).

Access to the mine's network of tunnels is through a winze. The lowest drift is at the 800' level. According to the president of the company which opened up that level in the 1950's, there was a showing of 2% copper at that level. We will be happy to put you in touch with him to verify this information.

Yours,



Al Sprenger  
President

AS/ds



In Miami area

# THE ARIZONA REPUBLIC

Wednesday, May 19, 1971



Novella	No. 1	recorded in docket	80	page	358
"	" 8	" " "	82	"	178
Pontiac	" 2	" " "	76	"	45
"	" 3	" " "	76	"	46
"	" 4	" " "	76	"	47
"	" 5	" " "	76	"	48
Daysite	" 1	" " "	83	"	353
"	" 6	" " "	82	"	173
"	" 8	" " "	82	"	174
"	" 11	" " "	82	"	176
"	" 12	" " "	82	"	177
"	" 10	" " "	82	"	175
Patsy Ann	"	" " "	92	"	488
Sue Ann	"	" " "	92	"	489
Bobby Boy	"	" " "	92	"	490
Linda Sue	"	" " "	92	"	491
Novella	" 2	" " "	80	"	359
"	" 3	" " "	80	"	360
"	" 4	" " "	80	"	361
"	" 5	" " "	80	"	362
"	" 6	" " "	80	"	363
"	" 9	" " "	82	"	179
Globe	" 3	" " "	76	"	22
"	" 4	" " "	76	"	23
"	" 5	" " "	76	"	24
"	" 6	" " "	76	"	25
Mary Lee (Fraction)"	"	" " "	82	"	172

The above described claims are situated in Township 1 North, Range 15 East, are staked in a northeast-southwest alignment, and are more specifically located in the SW  $\frac{1}{4}$  and the Northeast Quarter with parts in the other two quarters of section 14, and the Northwest quarter of section 13, the extreme southeast quarter of section 11, and the Southwest quarter of section 12, with parts of the claims extending into the other three quarters.

## Production Due In New Copper Area

MIAMI (AP) — Cities Service Co. will begin producing ore from a high-grade copper body near here late next year, officials said.

The ore body, called Miami East, is 2,500 to 3,700 feet underground, a stockholders report said yesterday. Underground shafts, started in 1970, will be fully extended at the end of this year, with mining to follow.

Ore production is expected to reach 2,000 tons per day by 1976.

Cities Service said ore production and milling are set to start at its new Pinto Valley open-pit copper mine eight miles west of here by mid-1974.

Globe 7 1/2' Quad







**mericle oil company**

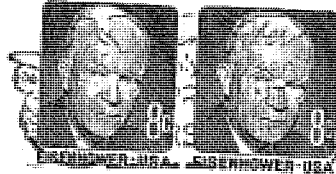
suite 1234, del webb's townhouse 100 w. clarendon  
phoenix, arizona 85013 (602) 264-0783

SEP 18 1973

FBI

Robert B. Crist  
American Smelting & Refining Company  
~~1150 North Seventh~~  
Tucson, AZ 85705

Box 5747





REALTY *EXECUTIVES* REALTORS

**M. W. (BUCK)  
LAMBERT**

**BUS: 264-7500  
RES: 266-2151**

**COMMERCIAL — INDUSTRIAL DIVISION**

4560 N. 19TH AVENUE

PHOENIX, ARIZONA 85015

---

JDS- interest 2

~~W L K~~



REALTOR®

COMMERCIAL INDUSTRIAL DIVISION

REALTY *EXECUTIVES* REALTORS

4560 North 19th Avenue, Suite 300 Phoenix, Arizona 85015  
Phone 602-264-7500

August 30, 1974

**RECEIVED**

**SEP 3 1974**

**EXPLORATION DEPT.**

**J. H. C.**

**SEP 3 1974**

Gentlemen:

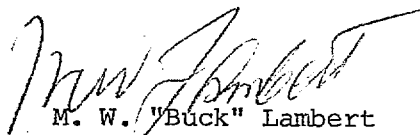
Attached please find a brief report on 40 contiguous unpatented mining claims located north of Globe Arizona.

The owner is looking for an exploratory drilling program. As past production and surface mineralization seem to justify more than just a cursory glance.

Terms and conditions are open and flexible, and additional details available upon request.

May I hear your interest.

Sincerely,

  
M. W. "Buck" Lambert

MWL/cu

The Apache Group of mining claims is the Globe-Miami mining district of Central Arizona. The Apache Group consists of 40 unpatented mining claims lying within sections 34 and 35, T .2N., contains the following claims:

Doty A Group	Claims
Doty B Group	Claims
Wonder	Claims
Time	Claims
Defiance	Claims

The Claims are accessible via 3/4 mile dirt road from Arizona Highway 88. The Radium railroad siding is about 500 feet south of the claims. Arizona Public Service has utility lines crossing the southern portion of the claims.

In 1930, 20 tons of vanadium concentrate were shipped from the Defiance Mine located on the Defiance Claim. The Defiance Mine was operated intermittently from 1936 to 1948. During this period 1,300 tons of lease ore was shipped to the A.S. & R. smelter in El Paso. The smelter paid for 424,637 pounds of lead, 3,755 ounces of silver, and 227 ounces of gold. Enclosed are several copies of the shipping reports.

Copper bearing veins of the Globe Hills area, about three miles to the southwest and in the same geologic environment, have produced nearly a billion pounds of copper and \$9 million in gold and silver. The economic history of the major producers i.e. the Old Dominion, United Globe, and the iron Cap show they also started as small silver producers in the late 1800's. The veins were formed by replacement of breccia and wall rock along faults and fiss-bodies of diabase intruded into them. Good ore bodies were also formed where diabase forms one wall of the fault and sedimentary formations are the other.

The rocks exposed on the Apache mining claims are Upper Precambrian Pioneer Formation sediments and Cretaceous diabase. Before the intrusion of the diabase, the region was intricately broken by faults. The diabase-magma forced its way into many of the faults to form dikes and between the strata of sedimentary rocks to form sills. The contact metamorphism of the intrusion made the rocks receptive hosts to hydrothermal solutions. Space for the invading magma was provided by the lifting and pushing apart of the faulted blocks. The diabase stills vary in thickness from 50 to 400 feet.



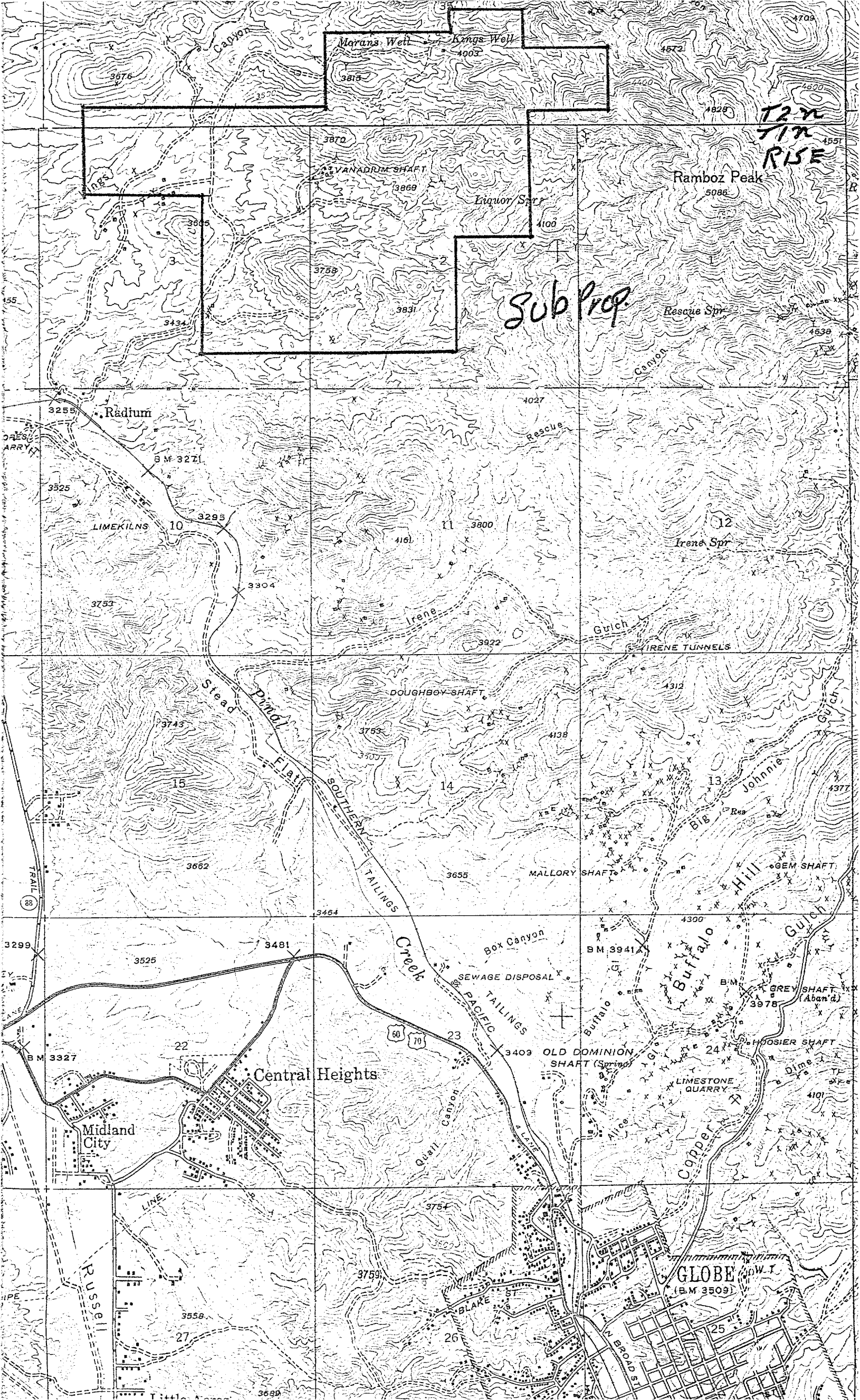
The Defiance vein strikes N. 35 E. and dips 80 SE. The outcrops of the vein fissure can be traced for 1,500 feet SW of the mine. It is marked by a darker color of the diabase caused by mineralization and chloritic alteration. A fissure that may be a continuation of the vein crops out nearly a mile to the northeast. The smelter shipping reports give an indication of the mineralization of the Defiance Vein as it was the vein being mined. Also recent assessment work has exposed another vein 200 feet west of the Defiance vein and parallel to it which is strongly mineralized with lead, silver, vanadinite, copper, and traces of gold. Vanadinite mineralization appears to be continuous between the two veins.

The mine workings of the Defiance vein comprise two shafts and about 1,400 feet of drifts, crosscuts, and raises. The No. 1 shaft, (blasted to discourage vanadinite mineral specimen collectors) is 150 feet deep with levels at 50 and 150 feet below the collar. The No. 2 shaft intersects the 150 foot level 160 feet to the southwest. The present water level in the mine is 14 inches above the sill of the 150 foot level. The drifts explore the vein for 550 feet. Most of the stopping is along the contact of the Pioneer Formation and the diabase.

Within the Apache Group of mining claims are two large blocks of precambrian sediments and numerous small blocks. There are also numerous shafts and adits which attempted to explore favorable geologic horizons in the 1930's. Grab samples from the dumps of these old workings show between .2% - .9% copper mineralization and values in manganese, lead, gold, silver. Surface samples taken of the diabase show consistent copper mineralization, but we assume you will want to cut and assay your own samples.

The deepest geologic information on this property is from the 150 foot level of the Defiance Mine. There has been no drilling on this group of claims. This property has the potential of being a major mineral producer and that potential should be explored by an adequate drilling program.

Additional information on this property from an impartial source may be obtained from Geological Survey Professional Paper 342, Geology and Ore Deposits of The Globe-Miami District, Arizona, 1962.



Mr. Pete Mosier, Jr.

Owner

est. G. W. H. H. H.

Delene Group

Barry DeRose

Land Open for

\$

option - work contract

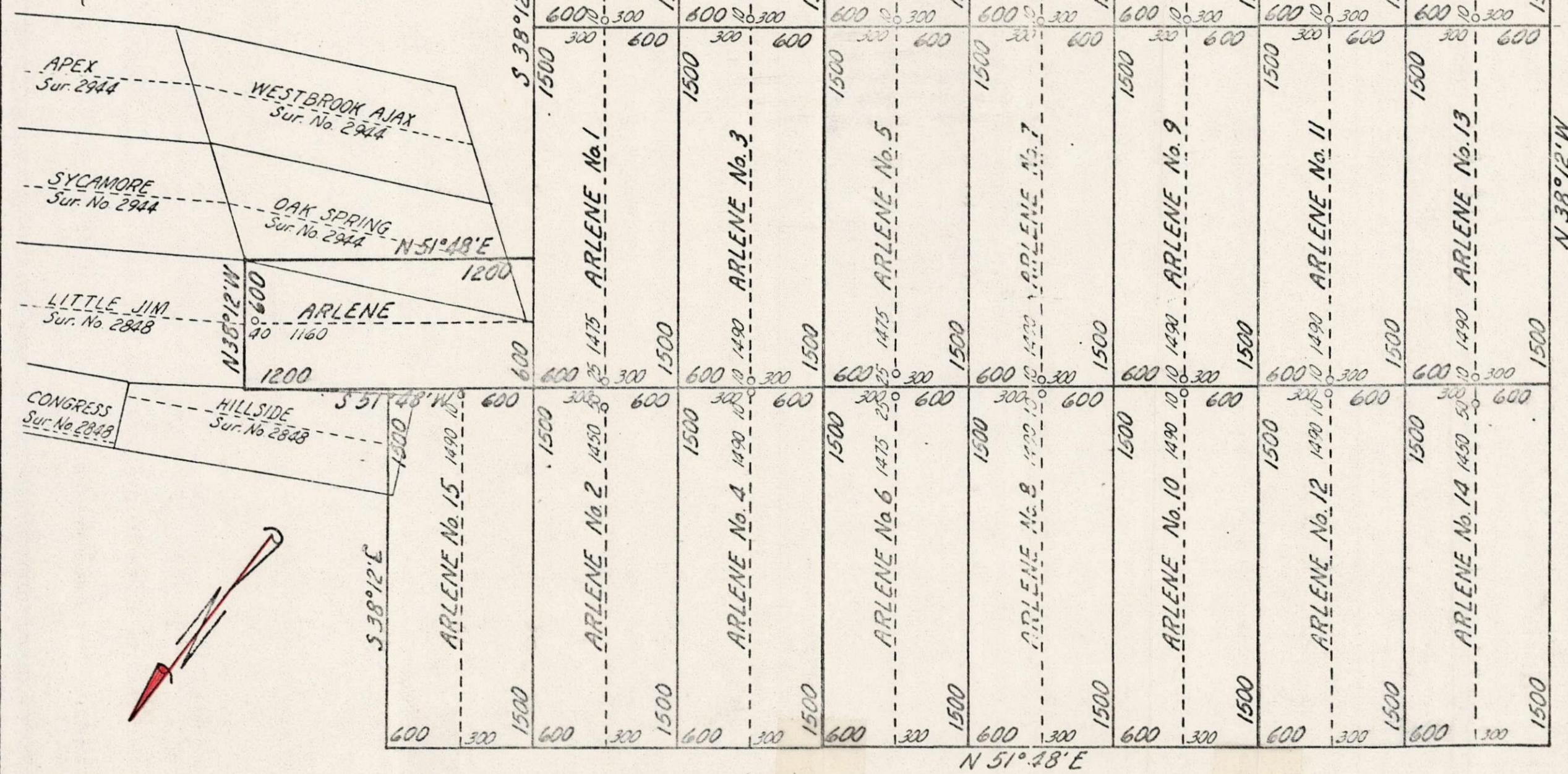
Annual Payments for 5 years

\$10,000/yr. +

end price of 300,000<sup>00</sup>



7/27/72  
 W.E.S.  
 Pete Hain asked me to put  
 you the I.C.C. surveys this  
 are you intended - please return  
 to Pete - J.S.



APEX  
 Sur. No. 2944  
 WESTBROOK AJAX  
 Sur. No. 2944  
 SYCAMORE  
 Sur. No. 2944  
 OAK SPRING  
 Sur. No. 2944  
 N 51° 48' E  
 1200  
 LITTLE JIM  
 Sur. No. 2848  
 ARLENE  
 40 1160  
 1200  
 N 38° 12' W  
 600  
 CONGRESS  
 Sur. No. 2848  
 HILLSIDE  
 Sur. No. 2848  
 1500  
 S 51° 48' W  
 600

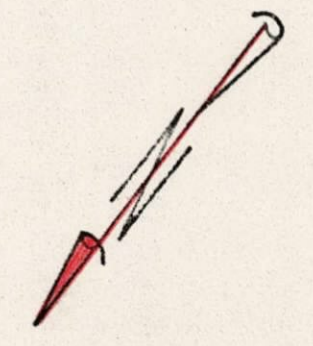


EXHIBIT "B"  
 PLAT  
 SHOWING THE LOCATION  
 OF THE

# ARLENE GROUP OF MINING CLAIMS

LOCATED IN  
 THE SUMMIT MINING DIST.  
 IN SEC'S 20, 21 & 29, T.1S., R.14E.  
 G.I.S.R.M., GILA CO., ARIZ.  
 ON NOV. 5 & 6, 1966 AND JAN. 7 & 8, 1967 BY  
 B.C. WADDELL

SCALE 1"=500' DATE JAN., 1967  
 SURVEY BY O.T. SMITH REG. LAND SUR.  
 DRAWN BY M.A. ERICKSON

*O.T. Smith*  
 1/28/67



May 30, 1978

FILE MEMO

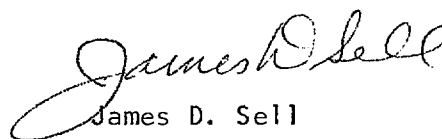
Odds and Ends  
Miami-Globe, Etc., District  
Gila County, Arizona

Blue Bird has mined 35 million tons of its 100 million tons of 0.5% copper oxide. They are presently on standby and not adding to the dumps but only leaching the present lifts. They produced 8,450,538 pounds of copper cathodes in the first half of their fiscal year.

Miami East is also on standby, but minor drifting and continued diamond drilling are taking place. They have found abundant  $\frac{1}{2}$ "-1" veins of K-spar throughout the Schultze granite and the adjacent Pinal Schist containing diabase dikes. They suggest this may be in the potassic core zone of the (a) system. They would not comment on what might be farther east and northeast, except that the ICC hole northeast of Miami East and east of the Cobre Valley Country Club intercepted, at 4,700 feet, very good leached capping and sulfides in porphyry (Schultze granite).

At the Monitor Mine, ICC is using a CP50 (Boyles) but are moving around more than they expected because the mineralization is dying out or terminating at around 1,600 feet of depth. I could not determine if this was a sharp structural feature or if it was oxide copper values which terminated in barren sulfides.

Sy Creasey, USGS, is studying the alteration-mineralization of the entire district and has full access to all of the workings available.

  
James D. Sell

JDS:jlh





Southwestern Exploration Division

May 23, 1978

TO: F. T. Graybeal

FROM: J. D. Sell

Pinto Valley Meeting & Tour  
AIME Open-Pit Session - Globe  
Gila County, Arizona

At the spring meeting of the Open-Pit Session of the Arizona AIME, five papers were given, part by video-replay, but no reprints were distributed.

- 1) Pinto Valley History and Geology, by Tom Dever,
- 2) Pre-Production and Plant Construction, by Don Skeels,
- 3) Truck Dispatching and the Modat System, by Mary White,
- 4) Pinto Valley Blasting, by Jerry Wills,
- 5) Pinto Valley Today, by Ken Bryne.

A tour of the facilities and pit followed in the afternoon.

Some tidbits from the papers and conversations with others;

Pinto Valley underlies the mined-out Castle Dome mine which operated from 1943 through 1953, with 41.4 million tons of ore mined, resulting in 514 million pounds of copper, 554,000 oz. silver, and 8,000 oz. gold.

Pinto Valley was explored by 158 drill holes aggregating 230,000 feet (1,400 foot average per hole). The ore reserve calculated was 350 million tons at 0.44% sulfide copper and 0.015% MoS<sub>2</sub>. The orebody is 6,200 feet long by 2,000 feet wide with the long axis trending N75°E. The ore thickness ranges from 300 to 1,200 feet and averages 800 feet thick and has a northerly dip of 15-20°. Overall stripping ratio of 1½ to 1. The first truck of ore delivered on July 11, 1974 to the mill rated at 40,000 tons per day. This tonnage has been generally exceeded with an average daily tonnage of 45-47 thousand tons.

They have not changed Nels Peterson's picture as far as the alteration and mineral trends are concerned. The best alteration (weak biotitization with silica overprint on argillic altered feldspars) is on the south, adjacent to the weakly altered granite porphyry (Laramide) which is in fault contact with Pinal Schist on the south. The majority of the ore is within Precambrian quartz monzonite (Ruin Granite) and the Precambrian diabase sill which caps much of the orebody. Alteration and mineralization grades outward to the north.

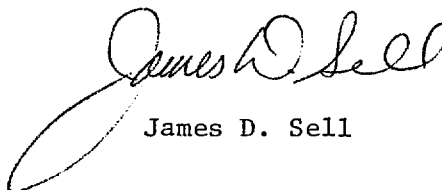
They mine by taking 5-45 foot benches back some 300 feet, all as a unit, then step down and take another group of five benches. The ultimate pit

May 23, 1978

will be some 800 feet below the lowest Castle Dome bench on the south side and when completed, will have a back wall of some 1,600 feet in height on the north side.

They blast by using a "cushioned blast". That is, only the first blast on the free face of the bench is open and then they drill out and blast the next group, so as to have the first broken muck as a cushion for the following blast. The powder consumption for the open blast is 0.9 factor and 1.3 factor for the cushion blast. In the open face blast they now use an expanding "V" shot and in reality, only the initial hole next to the face is open as they use delays and the point of the "V" progresses into the unshot bank, thus resulting in a modified cushion shot. They shot an 80-hole "V" cut in a drop cut (the second blast in the new drop cut), for us, which resulted in 280,000 tons of muck. They take video-tape replay of the shots so as to learn more about blasting mechanics and later replayed the shot frame by frame, to show the hole detonation pattern and muck distribution. No fly-rock was evident outside the drill hole pattern.

Joy Drilling has a rig coring within 300 feet of the drop cut blast and all they do is pull off bottoms with one stand. To date, the blasts have not injured the hole. A second rig was drilling some 300-400 feet west of the west dipping Gold Gulch fault and had passed through the fault and back into the weakly mineralized footwall of the orebody. Dever was disappointed as he wanted to go deeper on the west side in testing for down-dropped mineralization. He will step further away and "try again".



James D. Sell

JDS:jlh

January 22, 1980

MEMO TO: F. T. Graybeal

FROM: J. D. Sell

Miami East  
Cities Service Company  
Gila County, Arizona

On 1/15/80, I chatted with Ralph Molhollen, resident geologist, and Errol Anderson, mine superintendent of the Miami East Project, concerning some features sketched by Mr. J. H. Courtright from a meeting last December (see JHC file copy).

It was confirmed that the diabase mass is 60-350 feet thick and dips to the southeast, crosscutting schistosity of the Pinal Schist host. They would not speculate on the original dip of the diabase prior to down-faulting on the Miami fault.

Although the diabase has a faulted base, they believe it was intruded along an older fault as the diabase has chilled borders, and then reactivated during down-dropping of the basin side.

The diabase is host for a number of variable-sized quartz veins which also dip southeasterly at an angle greater than the dip of the diabase. No strike direction was given, but presumably they trend northeasterly. If the entire Schultz granite complex has been rotated counter-clockwise (looking northeasterly), then steeper veins would rotate to the flatter southeast dip.

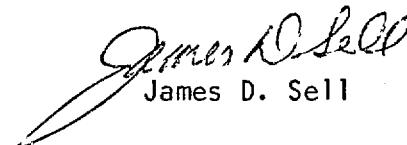
The quartz veins contain a zoned assemblage of hypogene chalcocite surrounded by bornite, followed by chalcopyrite, and pyrite in variable-sized pods. This same zoned assemblage was noted in the replacement deposits at Magma). A minor amount of secondary chalcocite enrichment is found at the oxidized interface.

Miami East presently has over 10,000 feet of underground development for extracting the seven million tons of plus 3% copper reserve in diabase. About 40 gpm of water is produced from this area at the present time.

Although the first attempt to find viable mineralization in this area was initiated in the late 1920's, and again in the 1950's, both these efforts were in low grade material. The late 1960's renewed interest and a number of holes were drilled prior to late 1969 when the go-ahead hole was cored.

Miami East has announced(?) 95 million tons of 1.95% copper with the bulk of this being in Pinal Schist which is not presently in their thoughts of mining because of very poor rock support.

JDS:jlh

  
James D. Sell

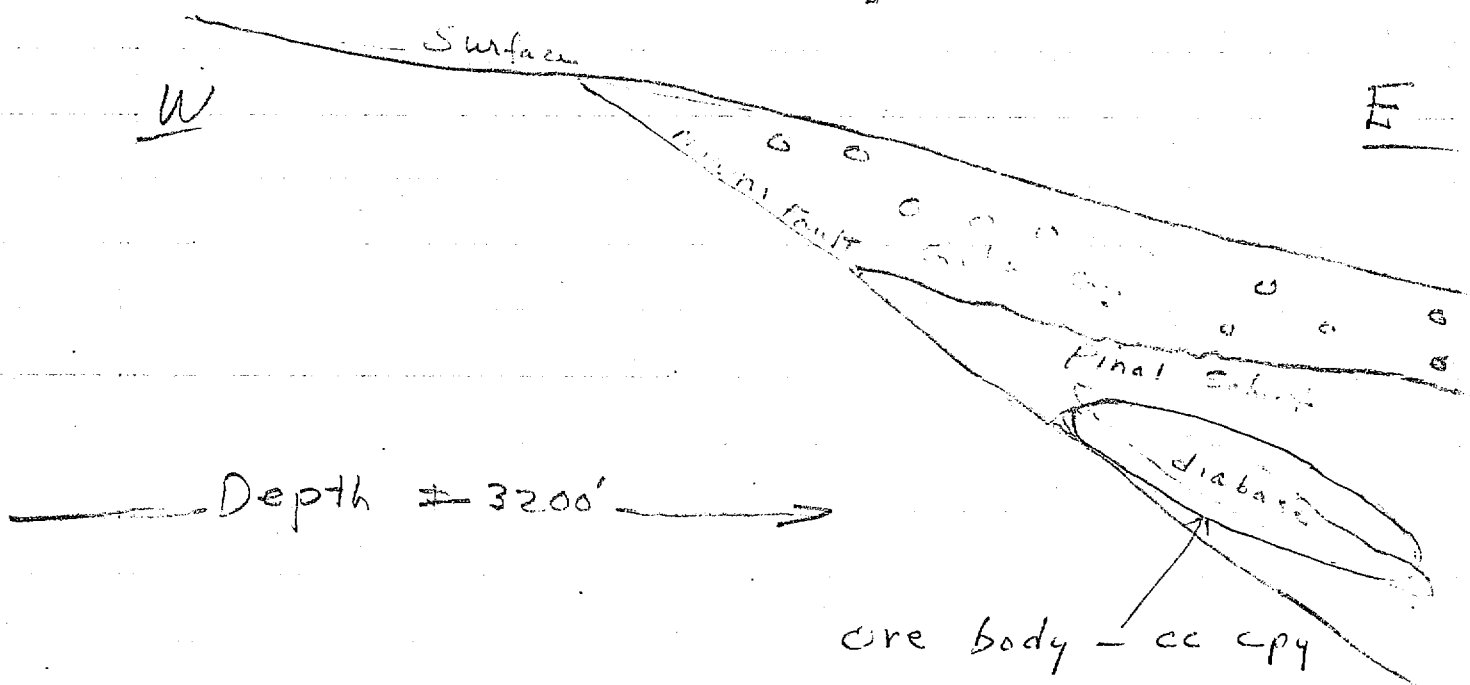
~~WKK~~, FIG, JDS → 8/9-9-79

Miami East

Gila County, Ariz.

Sketch section below picked up during recent SEG meeting in Tucson.

J.H.C.



P.S. Highest grade in diabase (2.0%?)

Tilting to East unexplained —

Reserve: (1977 data) 40 million at 1.9% Cu

Will be mined by sublevel stoping or  
some other selective method — not block caving

J.H.C.



January 21, 1980

MEMO TO: F. T. Graybeal

FROM: J. D. Sell

Black Pine Mine, Montana  
Inspiration Consolidated

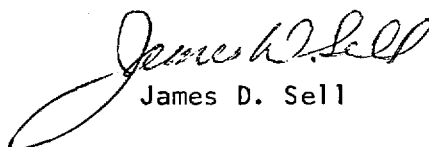
In chatting with Rene Von Boeck of Inspiration Consolidated Copper Company at the Pinal Mountain Section of AIME on 1/15/80, he mentioned that they have installed a laser beam-air jet separator at their Black Pine mine. The mine produces a high-grade silver-silica flux material for the Anaconda smelter.

The laser is calibrated to identify the black tetrahedrite ore from the white quartz gangue and activates air jets to puff off the tetrahedrite-bearing chucks of material.

Rene could not recall how fast the belt is presently moving, but they are producing 300 tpd ore and will boost this to 600 tpd with no change in the laser-jet system.

He also could not recall the upgrading factor, but stated that the million dollar expenditure was recouped in 9-10 months.

At present, they have only secured this high-grade silver-copper-silica flux material from development work and with the increased production from mining blocks, they will ship the excess material to their smelters at Flin Flon, Canada, and Inspiration, Arizona.

  
James D. Sell

JDS:jlh

Arizona Silver Belt, Globe, Arizona

# ASARCO

Explo

JDS, HGK, WLK  
files

May 22, 1981

Mr. R. L. Brown  
New York Office

Miami District  
Arizona

The attached sketch map prepared by Mr. Sell and Mr. Kreis portrays a rough outline of the copper deposits and their best estimate of the copper reserves in the Miami District. Also attached are pages 32 and 41 of Cities Service 1980 Annual Report.

Presently Cities Service's deposits, Ranchers' deposit, and the Van Dyke deposit are available for acquisition and we believe all should be considered by Asarco. Cities' properties appear to be the most attractive. The well-managed 40,000 tpd Pinto Valley operation, which came on stream in 1975 at an estimated capital cost of \$100 million, would provide a long-term copper reserve containing better than 8 pounds recovered copper per ton plus credits in moly, gold, and silver. Within the estimated 55 million tons of 1.95% copper in the Miami East deposit, Cities reportedly has developed a mineable six million ton block of 3.1% copper as chalcocite scheduled for production in mid-'82.

To acquire reserves in the U.S., perhaps consideration might be given to reducing our equity in Southern Peru Copper.

W. L. Kurtz  
W. L. Kurtz

WLK:lb  
Att.

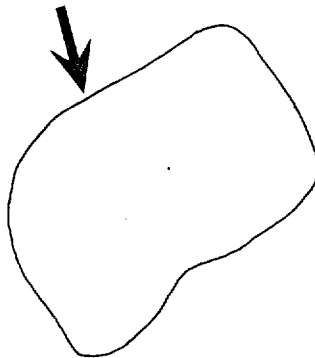
cc: WDPayne - w/att.  
Route file JDS/HGK - w/att.



1 MILE



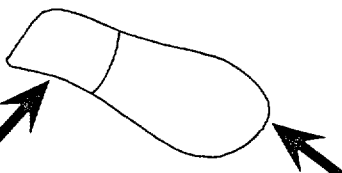
CITIES SERVICE  
PINTO VALLEY MINE  
OPEN PIT - SULFIDE  
413 M. TONS AT 0.41% Cu (1980)



ICCCo  
LIVE OAK-THORNTON-  
OPEN PIT MINES  
SULFIDE-OXIDE  
0.55-0.57 % Cu



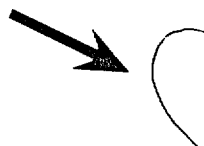
CACTUS-CARLOTA DEPOSIT  
UNDEVELOPED - OXIDE-SULFIDE  
28 M. TONS AT 0.8 % Cu



PRIVATE OWNER  
CARLOTA  
DEPOSIT

CITIES SERVICE  
CACTUS  
DEPOSIT

ICCCo  
ALL ICCCo MINES  
265 M. TONS AT 0.55% Cu (1980)



ICCCo  
OX HIDE MINE  
OPEN PIT MINES-OXIDE  
0.4% Cu





0.3% Cu BETWEEN PITS

DIAMOND H

CITIES &  
DIAMOND H-  
INACTIVE OPI  
MINED EST. 60-9'  
SULFIDE

RVICE  
BY MINE  
- SULFIDE  
0.41% Cu (1980)

CITIES SERVICE  
MIAMI MINE  
MINED OUT BY BLOCK CAVE 153 M. TONS  
LEACH RECOVERY TO DATE EST. 370 M. L

ICCCo  
LIVE OAK-THORNTON- RED HILL  
OPEN PIT MINES  
SULFIDE-OXIDE  
0.55-0.57 % Cu

ICCCo  
ALL ICCCo MINES  
265 M. TONS AT 0.55% Cu (1980)

RANCHERS  
BLUE BIRD MINE  
OPEN PIT - OXIDE  
65 M. TONS AT  $\pm$  0.50% Cu  
(1980)

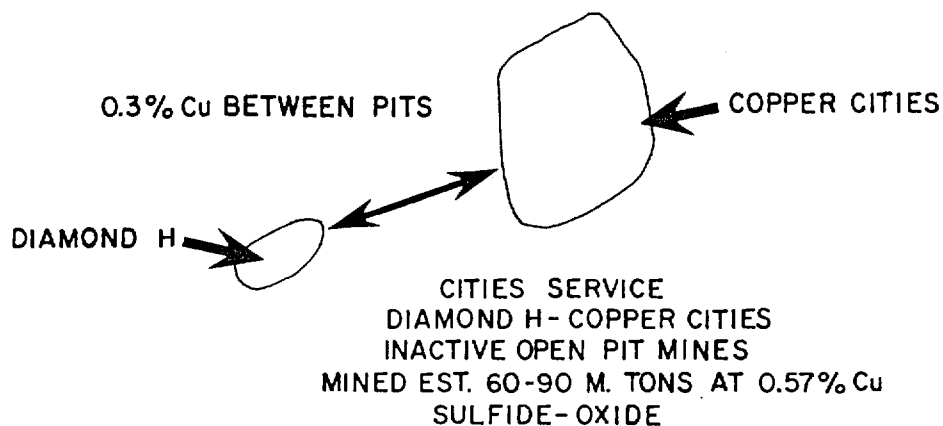
ICCCo  
OX HIDE MINE  
OPEN PIT MINES-OXIDE  
0.4% Cu

Highway 60-70

COPPER F

MIA

W.L.K.-H.G.K.-J.D.S.



ICCCo  
DEEP DISCOVERY  
UNDISCLOSED TONNAGE AT 1% Cu  
POTENTIALLY + 100 M. TONS

CITIES SERVICE  
MIAMI MINE  
MINED OUT BY BLOCK CAVE 153 M. TONS AT 0.82% Cu (SULFIDE)  
LEACH RECOVERY TO DATE EST. 370 M. LBS. Cu (OXIDE - SULFIDE)

CITIES SERVICE  
MIAMI EAST MINE  
ANNOUNCED 55 M. TONS AT  
1.95% Cu (1973). DEVELOPING  
CUT AND FILL OF 6 M. TONS AT  
3.1% Cu (SULFIDE)

TOWN OF  
MIAMI

RANCHERS  
BLUE BIRD MINE  
OPEN PIT - OXIDE  
65 M. TONS AT  $\pm 0.50\%$  Cu  
(1980)

VAN DYKE COPPER CO.  
VAN DYKE DEPOSIT  
PROPOSED INSITU - OXIDE  
100 M. TONS AT 0.5% Cu

Highway 60-70

# COPPER MINES & COPPER DEPOSITS OF THE MIAMI MINING DISTRICT

GILA COUNTY, ARIZONA

W.L.K.-H.G.K.-J.D.S.

MAY 22, 1981

**5. INFORMATION BY INDUSTRY SEGMENT AND GEOGRAPHIC AREA** — Financial information by industry segment and geographic area for the years 1980, 1979 and 1978 is summarized below (\$ millions).

	1980	1979	1978		1980	1979	1978
Sales to unaffiliated customers				Contribution to profit			
Energy Resources	1,340.3	1,117.0	803.9	United States	865.7	721.3	247.6
Refining, Marketing and Transportation	4,987.9	3,841.6	2,788.4	Canada	58.9	1.0	10.0
Natural Gas Transmission	668.7	514.0	421.3	Other International	24.6	20.7	43.1
Chemicals	556.7	527.5	405.3		<u>949.2</u>	<u>743.0</u>	<u>300.7</u>
Minerals	224.1	276.3	241.5	Identifiable assets			
Other	8.6	.1	.5	Energy Resources	2,333.4	1,868.6	1,781.2
	<u>7,786.3</u>	<u>6,276.5</u>	<u>4,660.9</u>	Refining, Marketing and Transportation	1,141.6	985.3	881.0
United States	7,300.7	5,945.2	4,497.4	Natural Gas Transmission	637.0	532.4	365.3
Canada	241.8	147.5	61.6	Chemicals	519.0	400.2	289.3
Other International	243.8	183.8	101.9	Minerals	278.6	298.9	302.6
Intersegment sales (eliminated)				Other	5.3	3.7	13.2
Energy Resources	777.5	506.9	289.1	Eliminations	(2.8)	(.9)	(.7)
Refining, Marketing and Transportation	95.6	73.0	79.5		<u>4,912.1</u>	<u>4,088.2</u>	<u>3,631.9</u>
Natural Gas Transmission	72.6	56.7	50.2	United States	4,207.0	3,447.2	2,837.9
Chemicals	10.3	9.7	10.5	Canada	542.0	514.5	583.9
Minerals	6.0	.5	—	Other International	163.1	126.5	210.1
	<u>962.0</u>	<u>646.8</u>	<u>429.3</u>	Equity investments			
Intergeographic sales (eliminated)				Energy Resources	11.3	4.5	2.8
United States	5.9	4.7	7.1	Refining, Marketing and Transportation	6.5	8.4	9.1
Canada	.9	1.0	1.5	Chemicals	69.1	62.4	50.2
Other International	757.8	715.1	357.6	Other	(.5)	(.4)	1.5
	<u>764.6</u>	<u>720.8</u>	<u>366.2</u>		<u>86.4</u>	<u>74.9</u>	<u>63.6</u>
Operating profit (loss)				United States	7.9	10.6	12.4
Energy Resources	635.2	488.5	279.9	Other International	78.5	64.3	51.2
Refining, Marketing and Transportation	170.8	129.3	94.1	Corporate assets	359.5	609.9	309.8
Natural Gas Transmission	82.6	63.5	75.8	Total assets	<u>5,358.0</u>	<u>4,773.0</u>	<u>4,005.3</u>
Chemicals	(37.3)	(4.1)	7.9	Capital expenditures			
Minerals	16.3	25.4	(23.9)	Property, plant and equipment			
Other	19.5	(.4)	(1.1)	Energy Resources	663.7	412.8	439.7
Intersegment eliminations	(1.7)	(.2)	1.1	Refining, Marketing and Transportation			
	<u>885.4</u>	<u>702.0</u>	<u>433.8</u>	Transportation	114.9	53.1	47.2
Equity income				Natural Gas Transmission	120.4	156.5	58.9
Energy Resources	6.8	1.9	.4	Chemicals	89.5	95.9	56.4
Refining, Marketing and Transportation	14.7	15.1	16.8	Minerals	23.5	10.9	20.9
Chemicals	5.7	6.6	8.3	Other and general corporate	68.9	26.4	13.0
Other	—	.1	.1		<u>1,080.9</u>	<u>755.6</u>	<u>636.1</u>
	<u>27.2</u>	<u>23.7</u>	<u>25.6</u>	Investments and advances	10.1	2.1	1.1
Other nonoperating income (net) and general corporate expenses					<u>1,091.0</u>	<u>757.7</u>	<u>637.2</u>
Energy Resources	4.6	(.4)	(7.2)	United States	967.1	653.8	474.8
Refining, Marketing and Transportation	17.3	9.1	2.9	Canada	56.0	46.1	133.5
Natural Gas Transmission	1.6	.8	1.9	Other International	67.9	57.8	28.9
Chemicals	(6.1)	(3.7)	.1	Depreciation, depletion and amortization			
Minerals*	.6	.4	(159.7)	Energy Resources	144.2	132.7	97.1
Other and general corporate	18.6	11.1	3.3	Refining, Marketing and Transportation	33.4	50.5	22.1
	<u>36.6</u>	<u>17.3</u>	<u>(158.7)</u>	Natural Gas Transmission	48.3	21.3	18.1
Contribution to profit				Chemicals	20.8	17.2	17.1
Energy Resources	646.6	490.0	273.1	Minerals	11.0	13.9	22.1
Refining, Marketing and Transportation	202.8	153.5	113.8	Other and general corporate	5.8	4.9	3.1
Natural Gas Transmission	84.2	64.3	77.7		<u>263.5</u>	<u>240.5</u>	<u>182.3</u>
Chemicals	(37.7)	(1.2)	16.3	Dry hole costs and unproved lease impairment			
Minerals*	16.9	25.8	(183.6)	Energy Resources	151.1	105.7	127.0
Other and general corporate	36.4	10.6	3.4	Natural Gas Transmission	4.5	6.1	13.2
	<u>949.2</u>	<u>743.0</u>	<u>300.7</u>		<u>155.6</u>	<u>111.8</u>	<u>140.2</u>
Interest expense	(78.8)	(91.6)	(75.5)	*1978 included a charge of \$159.5 million resulting from a write-down of the industrial chemicals complex.			
Federal, state and foreign income taxes	(379.6)	(290.1)	(99.0)				
Income applicable to minority interests	(13.3)	(13.8)	(8.2)				
Net income	<u>477.5</u>	<u>347.5</u>	<u>118.0</u>				

## Other Mineral Reserve Information

The following information is disclosed in accordance with FASB Statement No. 39. The reserve estimates are for those proven and probable reserves that are commercially recoverable.

**Metals**—The following tabulation represents consolidated mineral reserve information for Miami, Arizona, operations, which includes the Pinto Valley open pit mine and an underground mine under development.

Ore reserves for the open pit mine are 413.4 million tons, of which 58 million tons represent additions confirmed in 1980. The remainder of the reserves are for the underground mine from which production is expected in mid-1982.

By-product values are realized from gold, silver and turquoise recovery.

	1980
Proven and probable ore reserves at July 1, 1980	
Tons (millions) .....	419.4
Copper (percent) .....	.449
Tons of ore milled (millions) .....	11.1*
Production of primary products (thousands of pounds)	
Copper from milling .....	90,056
Copper from leaching .....	15,581
Molybdenum in concentrate .....	595
Market prices (average for the year)	
Copper \$/Lb (COMEX average) .....	96.76¢
Molybdenum in concentrate \$/Lb (average realized price) .....	\$10.25

\*The Pinto Valley mine and mill were shut down by an industry strike for 18 weeks in 1980.

**Industrial Chemicals**—Tabulated below is mineral reserve information for Copperhill, Tennessee operations. The sulfur content of the ore is produced primarily as sulfuric acid with lesser quantities of sulfur dioxide. A significant amount of the copper produced is upgraded into copper chemicals within the Copperhill complex.

Based on past experience, it is anticipated that additional ore reserves, presently classified as possible, have the potential to be upgraded and will provide a mine life of approximately 18 years.

	1980
Proven and probable ore reserves at January 1, 1980	
Tons (millions) .....	23.7
Sulfur (percent) .....	24.1
Copper (percent) .....	.95
Tons of ore milled (millions) .....	2.2
Production of primary products	
Sulfuric acid — 100% (thousands of tons) .....	1,025
Copper (thousands of pounds) .....	21,876
Market prices (average for the year)	
Sulfuric acid — 100% \$/Ton (Copperhill average posting) ..	\$44.81
Copper \$/Lb (COMEX average) .....	96.76¢

## Changing Price Information

Under historical cost accounting, inflation often yields increasing profits while eroding the "real" capital base of a company. The accompanying schedules report supplementary financial data, as prescribed by the FASB, in an attempt to adjust historical costs for inflation. The adjustment of historical costs has been calculated using two different methods, constant dollar and current cost.

Constant dollar is defined as a unit of constant purchasing power as measured by the Consumer Price Index for all Urban Consumers. This is the familiar CPI-U announced monthly as a measurement of overall inflation in the general economy. The mechanics of applying this index to adjust historical costs are straightforward and may yield comparable results for companies in the same industry. Inflation has not affected all industries and companies to the same degree and this is the rationale for the second method, current cost.

Current cost is a less well-defined concept than constant dollar but is intended to measure specific inflation. In the accompanying disclosures, it has been interpreted as today's cost of repeating the activities and transactions that resulted in the assets reported in the traditional financial statements. Clearly the data is subjective as it would be neither feasible nor desirable for the Company to repeat history today. The use of indices reflecting price changes for specific types of assets was the predominant technique used to estimate current costs. Typical of this approach, Nelson's Refinery Construction Cost Index was utilized for the majority of the Company's refining and natural gas liquids operations while the Oil Field Machinery and Tools Index and an index derived from the Joint Association Survey on Drilling Costs were the more important indices relative to oil and gas activities.

The Company's financial data adjusted for inflation highlight the erosion of income, the increased cost of assets and the reduced return on owners' equity from that reported by historical cost accounting. These data demonstrate that capital intensive companies, such as Cities Service, are severely impacted by inflation. The lower income from continuing operations results primarily from higher depreciation charges occasioned by inflation-adjusted capital expenditures.

In an inflationary environment, liabilities recorded in the Company's financial statements will be satisfied with dollars of lesser value. Thus, the excess of liabilities over monetary assets results in "gain from the decline in purchasing power of net amounts owed".

The reader's attention is directed to the return on stockholders' equity and computed effective tax rates shown at the bottom of the following schedule. The computation of return includes income from continuing operations and the gain from the decline in purchasing power.



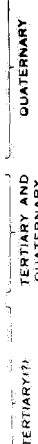


Figure 1 is a plan view map of the study area. It includes a scale bar at the top indicating a scale of 1:24,000. Below the scale bar, there are two horizontal axes with distance markings. The top axis is labeled in feet, with markings at 0, 2000, 4000, 6000, and 8000. The bottom axis is labeled in kilometers, with markings at 0, 1, 2, 3, and 4. The map shows a coastline with various features, including a large bay and several smaller inlets. A contour interval of 25 feet is indicated, and the datum is noted as mean sea level.

Northwood Books  
PO Box 21203  
Portland, Oregon 97220



around 1000 ft. -

JH-1 Mostly, *Scabrotylus*,  
at least 1000 ft. - 1000 ft.  
JH-2 Same loc. Only a few  
of the *Scabrotylus* - 1000 ft.  
at 1000 ft. - 1000 ft.

1000 ft. is *Scabrotylus* zone -  
mostly, then *Scabrotylus*, *Scabrotylus*.

Most below 1000 ft.

JH-3 Mostly, *Scabrotylus* - 1000 ft.  
at 1000 ft.

JH-4 Red dr, somewhat all *Scabrotylus*  
at 1000 ft. - 1000 ft. Red dr,  
1000 ft. - 1000 ft. *Scabrotylus* zone  
gr. Mostly *Scabrotylus* up with *Scabrotylus*  
here 1000 ft. (+ 1000 ft) 1000 ft. - 1000 ft.

Down below in *Scabrotylus* zone of *Scabrotylus*  
there would be *Scabrotylus* - No *Scabrotylus*  
to see.

Lyle M. Talbot - Geo.  
Charles Duvall - Surveyor  
Nimmons  
10/11/00 @ 0.7% Sulfide Co  
4/11/11 @ 1.0% Sulfide Co  
to extent of drilling.  
Potential sulfide ore.  
100 lbs in aqua regia ss

Paul Kaiser - Gibson Mine

Bob Franks - Kaiser sept

Nick <sup>Carson</sup> ~~Carson~~ - Lessee

12 claims

Dave Johnson Sept 11, 1972

Upper (Schist) Ochoco

± 15-20 mill tons @ 0.4%

Lower (Granite) Ochoco

± 20-25 mill tons @ 0.4%

Lower Och. 1000 feet bed (from

old surface) has 3 zones of

acid sulfide

Errol Anderson Sept. 12

DH mineral settles into  
Sediment. Recently faulted as does  
the Rind Schist & hence cutting  
out or. Maybe more  
hazardous (some ge)

Then variable for most part.  
Copper etc also variable. whereas  
O has been

Eqm - 51/2 may be fault  
CC 250' level still in  
0.5-0.7 values



New Holes 1970-1972

+ Miami Holes

+ Occidental Holes

+ AMAX

+ High International

+  
Barney's 1970-1972  
report (reported  
by W. W. Simmons)

"Barney Granite (K.O. 18 Cu) intrudes  
into Pinal Schist (> 18 Cu)  
@ depth of 3400 ft.

K-A<sub>1</sub> = 54.5 ± 1.2 mg  
on granite.

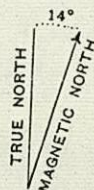
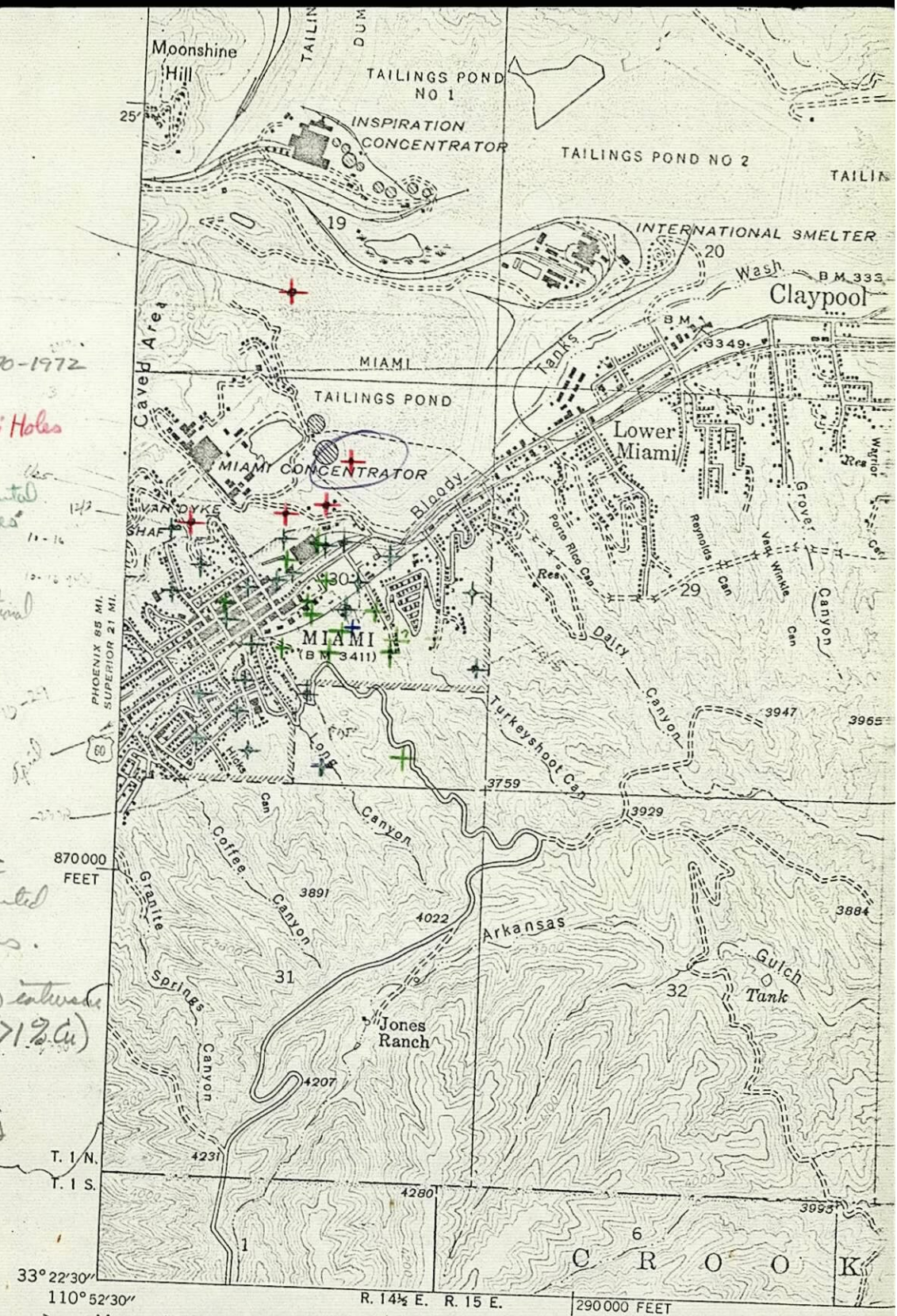
(Globe)  
1:62,500

Mapped by the Geological Survey  
1945

Gray tint indicates area in which  
only landmark buildings are shown

ROAD CLASSIFICATION  
1947  
Dependable hard-surface heavy-duty road  
Secondary hard-surface all-weather road  
Dry weather roads  
Loose-surface graded  
Unsurfaced, graded  
Dirt road  
U. S. Route 15  
State Route 26  
More than two lanes indicated along road with tick at point of change

APPROXIMATE MEAN  
DECLINATION, 1945



62.6  
59.9



Barren

Granite (<0.18 cu) intrudes  
into Pinat Schist (>18 cu) 30 scale.

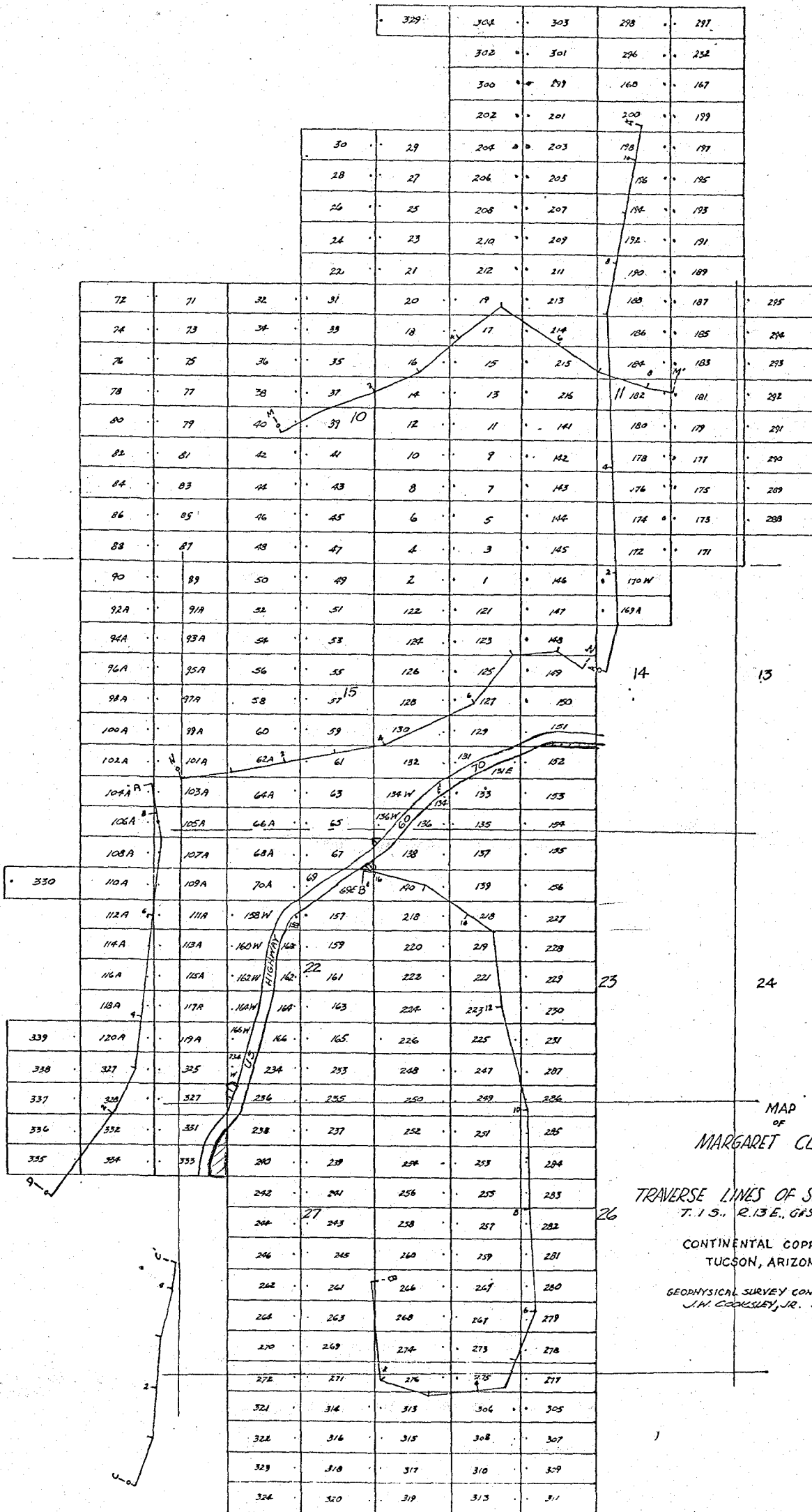
③ 33° 24' 20" N 60.8 ↓  
110° 51' 58" W 40.3 →

colln elev = 3621 ft

Suph ~~alt~~ elev. 139-212' above  
sea level.

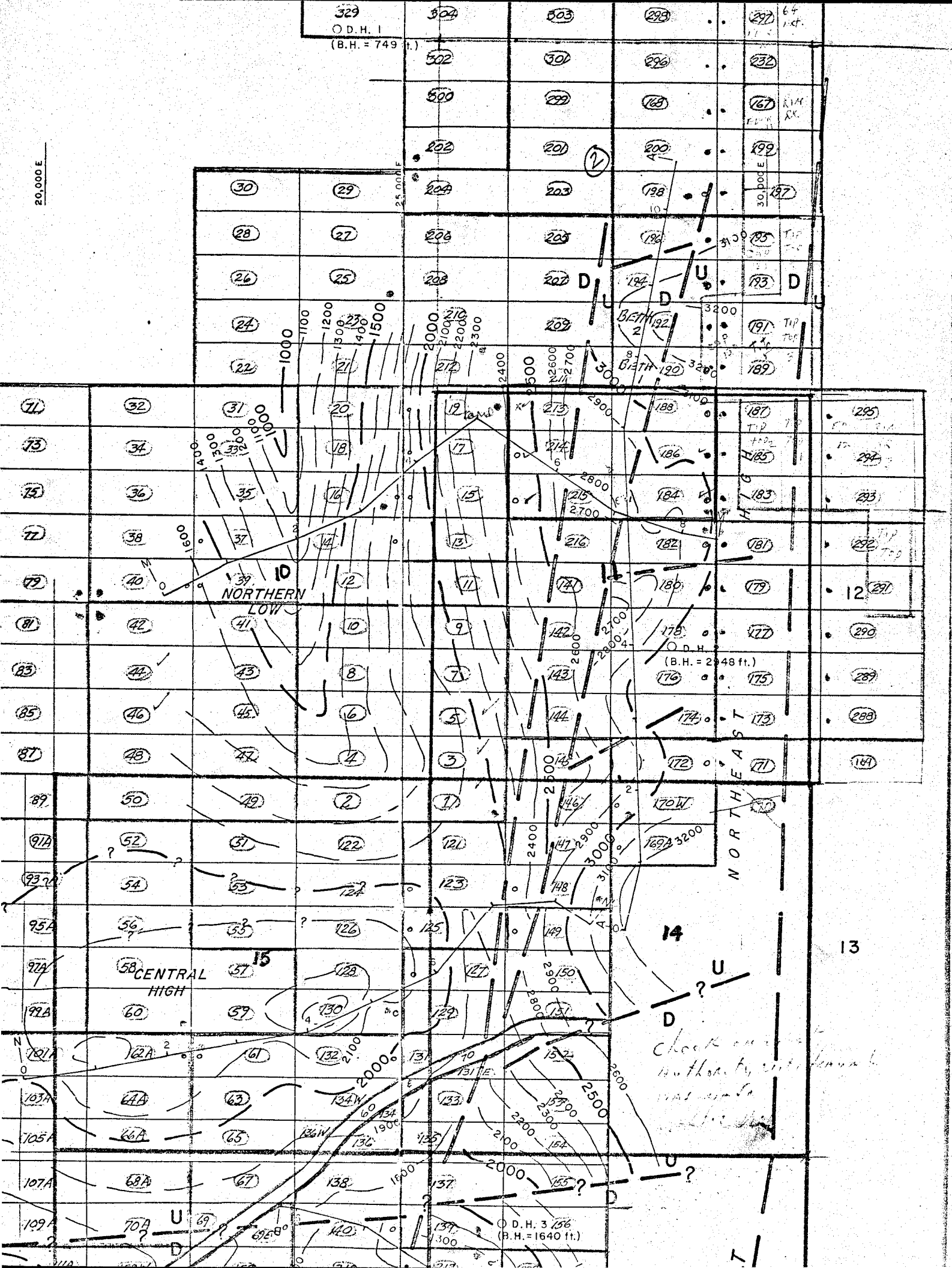
Gldo Quach.

K-Ar = 54.5 ± 1.2 my.



○ D.H. 1  
(B.H. = 749 ft.)

20,000 £



Cactus ore body? PINTO VALLEY

## ORE RESERVES

### Ore

Golden associates report?

1. Sulfide - tons - grade - low grade & possible - oxide content
2. Oxide or leachable ore - tonnage and grade
3. Assays of above and any other minerals for which assays are available (Suite of minerals). *As, Mo & Ag throughout or concentrated.*

### Waste

1. Any gravels
2. Waste rock

Any classification that would substantially effect mining costs. (conglomerate)

### General

1. Undrilled areas - exploration potential
2. Tonnage and grade of present reserves.
3. Lifetime schedule
4. Schedules with stripping ratios.
5. Has ore reserve calculation method been tested to see if it truly reflects mining results? (Compare mined out area with reserve for mined out area). *Relationship of drill hole assays to mill heads & concentrate*
6. What maps are used for scheduling and planning.

### Waste

1. Adequate water supply? *old Dom. Min. obligation to town?*
2. Wells?
3. How much pumping? - head? - pumping distance from well head?

### Dumps and Tailing Pond

1. Enough dump room for present reserve.
2. Enough pond room for present reserve.
3. Pumping tails.

### Property

1. Ownership - State, Indian, Federal, etc. -
2. Contractual commitments that might effect costs, royalties, right of ways. *Inspiration agreement.*
3. Pending lawsuits re: property or water *labor contracts*  
*U.C. problem*

### EQUIPMENT

1. Hours on trucks, shovels, - replacement schedule
2. Mill equipment maintenance & replacement
3. Mill recoveries, tailings grade.

Depreciation schedules

\$60M investment thru 1984 what?

leaching  
reserve  
at 3  
location's p.v.  
Miami

C.C.

Cost of SKEW  
leach?

Cost of  
cement Cu  
mill-ways

conc. grade Cu } turquoise sale??  
& MO }

Refining costs of SKEW Cu.

Value of Hotgit Sec. Corp?



Arrived  
Federal Express  
received 11:05 am

SIV. MEXING DEPT.  
JUL 15 1981  
TUCSON

July 14, 1981

Mr. Robert Hunt  
Cities Service Company  
Box 300  
Tulsa, Oklahoma 74102

Dear Mr. Hunt:

Asarco is seriously interested in possible acquisition of your Miami Metals Division and we have been in contact with Messrs. Breck and Friedland of Lehman Brothers Kuhn Loeb. In that connection Mr. Friedland has supplied us with some preliminary information and at his request I am sending you the enclosed Confidentiality Letter in a form requested by him.

Very truly yours,

T. C. Osborne

Encl.

cc: Mr. Dennis Friedland  
Lehman Brothers Kuhn Loeb

bcc: RLHennebach  
NVisnes

Blind Note on Company Copies:

As discussed, Mr. Visnes will send copies of the two brochures to Mr. Scartaccini with a request that he and Mr. Skidmore give immediate attention to a financial evaluation of the Miami operations as far as that may be done with the available data. At this end we will attempt to arrange through Lehman Brothers Kuhn Loeb to set up direct discussions with Miami management to get more detailed information which will be required for any definitive analysis, particularly in areas related to forecast costs at the Miami East operation, schedule of capital expenditures there, etc. Meanwhile, it would be of great interest if Messrs. Scartaccini and Skidmore could work up a preliminary idea of the present value of the future income stream, given several copper prices in the range \$1 - \$1.25, 1981 constant dollars. They should not hesitate to call me if there are any questions. TCO

7/14/81-NY-MD-xc: TEScartaccini

*pl note*

Confidential Descriptive Memorandum

Metals Division

A Division of Cities Service Company

Lehman Brothers Kuhn Loeb  
Incorporated

The First Boston Corporation

June 1981

Cities Service Company

Metals Division

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CITIES SERVICE COMPANY

Metals Division

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This memorandum is based upon information being supplied by Cities Service Company and is being furnished through Lehman Brothers Kuhn Loeb Incorporated and The First Boston Corporation as exclusive authorized agents, solely for use by prospective purchasers in considering their interest in acquiring the Metals Division of Cities Service Company described herein. This memorandum does not purport to be all-inclusive or to contain all of the information which a prospective purchaser may desire. No representation or warranty is made by the undersigned as to the accuracy or completeness of any of the information contained herein.

Each recipient of this memorandum agrees that all of the information contained herein is of a confidential nature, that they will treat it in a confidential manner, and that they will not, directly or indirectly, disclose or permit their agents or affiliates to disclose any of such information without the prior written consent of Cities Service Company.

Neither this memorandum nor its delivery to any prospective purchaser shall constitute an offer to sell or the solicitation of any offer to buy any securities of Cities Service Company nor shall this memorandum be considered to indicate that there has been no change in the affairs of the Metals Division of Cities Service Company.

Cities Service Company will assume responsibility for all fees to Lehman Brothers Kuhn Loeb Incorporated and The First Boston Corporation that may arise from the sale of assets proposed herein.

Lehman Brothers Kuhn Loeb  
Incorporated

The First Boston Corporation

I. Introduction

The Metals Division of Cities Service Company located in Miami, Arizona, (hereinafter "Miami"), mines copper in the Globe-Miami district of Arizona and sells copper to fabricators in the United States. Miami operates as an independent business and is involved in all phases of the mining and processing of copper through its delivery to the customer. Miami's copper production represents approximately 5% of the copper mined annually in the United States, ranking it 8th in size among U.S. copper mining companies.

Miami's operating facilities are located on approximately 21,300 acres in East Central Arizona. The Pinto Valley open pit mine is Miami's principal operating facility. Pinto Valley's mining and milling capabilities enable it to process approximately 50,000 tons of ore daily. Together with Miami's other copper producing facilities, the Division's combined operations have a total capacity of approximately 170 million pounds of copper annually.

These other facilities include three low-cost leaching operations, one at the old Miami underground mine, one at the abandoned Copper Cities pit, and one on the existing Pinto Valley waste dump. A small underground mine, Miami East, is due to start production in mid-1982 and reach full production by 1984.

<u>Projected Production (MM lbs)</u>	<u>1984</u>
Pinto Valley	128.9
Pinto Valley SXEW	8.4
Miami SXEW	10.7
Copper Cities Cement	3.2
Miami East	25.4
	<u>176.6</u>

Smelting and refining are handled under contractual agreements with Inspiration Consolidated Copper Company and ASARCO respectively.

Audited reserve reports indicate that Pinto Valley's open pit mineable copper ore reserves as of June 30, 1980 were approximately 415 million tons. The Miami East underground mine has stated reserves as of June 30, 1980 of 6 million tons of high grade ore. Both Pinto Valley and Miami East contain mineralized deposits substantially larger than presently stated mineable ore reserves. Improvements in mining technology, changes in the design of the existing mines, new facts and circumstances discovered during the mining process, or a significant increase in the projected sales price of copper could substantially increase stated mineable ore reserves. Miami also produces small amounts of molybdenum, silver, gold and turquoise.

Miami's mining and milling equipment is modern and in excellent operating condition. \$45 million have been expended during the past 5 years (1976 through 1980) to improve and modernize

Miami's facilities. Expenditures for 1981 are estimated to be \$24.2 million. Management believes that not more than \$35 million of additional capital expenditures are required during the next 3 years (1982 through 1984) to maintain Miami's facilities.

Completion of the development of the Miami East mine, which is scheduled for full production by 1984, will require the expenditure of an additional \$23 million from 1981 through 1983.

Table I below summarizes Miami's operating results for the most recent 5 years.

Table I  
Summary Operating Data, 1976 - 1980

For fiscal years ended December 31	<u>1976</u>	<u>1977(b)</u>	<u>1978</u>	<u>1979</u>	<u>1980(b)</u>
Copper Produced (MM lbs.)	145.9	132.5	161.7	154.8	105.6
Copper sold (MM lbs.)	152.9	128.8	195.1	162.2	112.3
Revenues (MM \$)	\$107.4	\$ 88.4	\$127.6	\$147.3	\$124.6
Costs and Expenses (MM \$)	<u>101.5</u>	<u>86.4</u>	<u>125.0</u>	<u>127.3</u>	<u>113.0</u>
Income Before Income Taxes (MM \$) (a)	<u>\$ 5.9</u>	<u>\$ 2.0</u>	<u>\$ 2.6</u>	<u>\$ 20.0</u>	<u>\$ 11.6</u>

(a) Before allocation of Group and Corporate Overhead and Interest Expense.

(b) Results reflect strikes of 18 weeks in 1980 and 4 weeks in 1977.

In light of industry projections of a 3% annual increase in copper consumption, the high cost of replacing depleted mines, and the relatively small amount of new world-wide copper production coming on stream over the next five years, Miami's management

projects a growth trend in earnings, assuming, of course, an increase in the price of copper. Notwithstanding Miami's potential, Cities Service has recognized that the Division is not an integral part of its principal business which is the search for and development of oil and gas reserves. Accordingly, Cities Service has authorized Lehman Brothers Kuhn Loeb Incorporated and The First Boston Corporation, on an exclusive basis, to explore the possible sale of the Division.



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## II. Important Considerations

1. Miami's presently mineable ore reserves at Pinto Valley are sufficient to maintain production at current levels for at least twenty (20) years, and at the Miami East mine for fifteen (15) years (through 1998). The reserves, both at the Pinto Valley and the Miami East mine, could increase substantially in the event circumstances affecting mineability change to include presently accessible large mineralized deposits.
2. Most major capital expenditures required to fulfill Miami's projected operations were made in the early 1970's. Expenditures totaled approximately \$45 million for the past five years. Other forecasted capital expenditures are relatively low in relation to those of other major copper producers. Besides the \$23 million being spent from 1981 through 1983 to complete development of the Miami East underground mine, capital expenditures are forecasted to be only \$60 million over the four-year period 1981 through 1984.
3. Leaching operations at Copper Cities and old Miami have anticipated lives of roughly ten years. The leaching operation at Pinto Valley should have a life which is 10-15 years longer than the life of the open pit.
4. Miami's cost of operation is competitive. Pinto Valley's present competitive cost of producing copper, \$0.92 before by-product credits (which are currently roughly \$0.03 - \$0.04 per pound), is attributable to efficient operations and low stripping ratios. This cost advantage is great when compared to the time and costs involved in developing new mines to replace existing sources of supply. Production costs of Miami's leaching solvent extraction-electrowinning operations are among the lowest in the industry. The overall cost of production at Miami, at all facilities, is roughly \$0.90 per pound before by-product credits.
5. Increases in the sales price of copper will substantially increase Miami's earnings. Miami is primarily a "copper play". Because Miami's average ore is low in by-product content, Miami's cost of copper production is relatively less affected by credits from the recovery of by-products. Fluctuations in the prices paid for traditional copper mining by-products (gold, silver and molybdenum) have a relatively small effect on Miami's basic costs. Accordingly, increases in the sales price of copper have a direct positive impact on Miami's profitability.

6. Miami faces no major environmental problems or related expenditures. Because Miami does not own or operate a smelter or refinery, it is not involved with most of the environmental regulations that must be dealt with by many of Miami's competitors. Miami's smelting and refining is tolled under contractual agreements with other companies. Miami does operate under certain effluent restrictions and does budget for pollution control approximately \$1 million annually.

7. Miami has an excellent supply of water and electrical power. Water is in more than ample supply and plans are presently being made to assure future requirements. Electrical power comes from coal and will in the future come from nuclear sources, assuring availability at advantageous cost.

8. Miami's plant and equipment is modern and in excellent condition. Computerized controls are utilized where possible.

### III. Financial Information

Table II  
CITIES SERVICE COMPANY

Metals Division  
Historical Operating Data

	1976	1977(b)	1978	1979	1980(b)	1981	
						4 Months Actual	Estimate Total Year
<u>Copper Production &amp; Purchases (MM lbs)</u>							
Concentrates	128.7	117.2	145.6	137.0	90.0	50.4	147.6
SXEW	7.5	11.7	11.7	12.6	11.2	3.3	17.4
Cement	9.7	3.6	4.4	5.2	4.4	1.2	3.5
Purchased	-	-	-	8.0	8.1	4.1	4.8
Total	145.9	132.5	161.7	162.8	113.7	59.0	173.3
Copper Sales (MM lbs)	152.9	128.8	195.1	162.2	112.3	56.7	172.6
Average Net Back Sales Price (¢ lb)	68.3	65.7	63.2	85.0	99.5	84.3	
<u>Sales Revenue (MM \$)</u>							
Copper	\$105.7	\$84.7	\$123.2	\$137.8	\$111.7	\$47.8	
Molybdenum	1.3	1.0	2.1	5.6	7.1	1.7	
Gold, Silver & Turquoise	2.3	1.2	1.6	2.9	4.4	.7	
Sulfuric Acid	.1	.4	.5	.6	1.0	.5	
Total	\$109.4	\$87.8	\$127.4	\$146.9	\$124.2	\$50.7	
<u>Cost and Expense (MM \$)</u>							
Cost of Sales & Operating Expense	86.5	71.3	105.0	110.5	98.3	46.7	
Selling Expense	.2	.2	.2	.3	.3	.1	
Taxes other than Income Tax	6.3	6.5	8.3	6.3	6.3	2.7	
Depletion and Depreciation	8.5	8.4	11.5	10.2	8.1	3.1	
Total	101.5	86.4	125.0	127.3	113.0	52.6	
Net Operating Income	7.9	1.4	2.4	19.6	11.2	(1.9)	
Other Income (Expense)	(2.0)	.6	.2	.4	.4	.1	
Income Before Income Tax (MM \$) (a)	\$5.9	\$2.0	\$2.6	\$20.0	\$11.6	\$(1.8)	
Capital Expenditures (MM \$)	\$ 4.8	\$11.3	\$2.5	\$ 4.9	\$20.4	\$ 4.3	\$37.2
<u>Copper Inventory-End of Period (MM lbs)</u>							
Finished	43.6	39.8	5.9	12.0	11.4	9.1	
In Process	49.0	56.5	56.9	51.5	53.5	58.1	
Total	92.6	96.3	62.8	63.5	64.9	67.2	

(a) Before Allocation of Group & Corporate Overhead and Interest Expense.

(b) Results reflect strikes of 18 weeks in 1980 and 4 weeks in 1977.

Table III  
CITIES SERVICE COMPANY

Metals Division  
Selected Financial Information  
At 12-31-80  
(MM\$)

Trade Receivables	\$ 6.8
Product Inventory (a)	42.8 ✓
Materials & Supplies Inventory	10.9
Advances (b)	5.5
Prepaid Expense, Deferred Charges and Other Receivables	.5
	<u>66.5</u>

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(a) Estimated market value of copper inventory at 12-31-80.

(b) Principally an advance to Inspiration Consolidated Copper Company recoverable in 46 monthly installments as a credit against ongoing smelting charges.

#### IV. Description of Facilities and Operations

##### A. Copper Producing Facilities

Miami's principal ore bodies are located at the Pinto Valley open pit mine and the Miami East underground mine. Miami also produces significant quantities of copper through leaching operations at an old underground mine known as the Miami Unit, an old open pit mine known as Copper Cities, and at the Pinto Valley mine.

Miami's ore reserves at Pinto Valley and Miami East have been audited by Golder Associates, consulting, mining, and geo-technical engineers. In both cases their conclusion regarding ore reserves included considerations of mineability and therefore the reserves constitute a valid target for extraction by plant operations.

Criteria of mineability include, among other considerations, the accessibility of ore, which is affected by technology and mine design, ore grade and the economics of recovery giving due regard to the sales price of copper. Improvements in any of these factors could substantially increase mineable ore reserves at both Pinto Valley and Miami East.

No reserve figures are available for possible by-products. Accordingly, in arriving at cutoff grades no by-product credits were used.

##### (i) Pinto Valley

The ore body in the Pinto Valley open pit mine is of the porphyry type. Pinto Valley's mineable ore reserves as of



June 30, 1980, based on a cutoff grade which varies over time from 0.36 - 0.23% copper are as follows:

Proven ore: 301,800,000 short tons at an average grade of 0.411% copper.

Probable ore: 111,600,000 short tons at an average grade of 0.406% copper.

Reserve estimates are based on the presently designed twenty-two (22) year open pit mine. The designing of a larger pit to take advantage of additional ore reserves may be possible.

Waste material containing copper between 0.1% and the cutoff grade is accessible for dump leaching at economic costs.

Pinto Valley's basic mining and milling operation produces approximately 12,000,000 pounds per month of copper in concentrates.

In addition, a new solvent extraction-electrowinning plant built at a cost of approximately \$22 million began operating at Pinto Valley in June, 1981. This plant produces 800,000 pounds per month of electrowon cathode.

The mining and milling plant at Pinto Valley is based on a conventional flow sheet, but sized and designed to take advantage of the most modern technology. Three-stage crushing of mine-run rock is followed by grinding in ball mills with cyclone classification in closed circuit. The pulp is continuously charged into mechanical flotation cells to produce a copper-molybdenum concentrate. This intermediate product is thickened and then refloated in order to separate molybdenum sulfide. The

final copper concentrate is then thickened, slurried and pumped via a 10.5 mile pipeline to a filter plant adjacent to the Inspiration smelter. Smelting and subsequent refining is done on a toll basis under long term contracts with Inspiration Consolidation Copper Company and ASARCO, with Cities retaining ownership of the copper. Molybdenum sulfide is sold as drummed concentrate, mostly on a contract basis.

Provision was made in the mill design for extensive instrumentation. A digital computer was installed in early 1975, and presently provides process information to the operators and periodic production reports to management. Five grinding lines are now on computer control using particle size analyzers. The sixth line is used for development of improved operation and control methods.

Mining equipment is also sized for efficient, large tonnage production. The total mining requirement for ore, associated waste, and stripping is approximately 150,000 tons per day at present, with lower stripping requirements later in the mine life. Primary loading equipment consists of two 15-cubic yard shovels and three 20-cubic yard shovels. The haulage fleet consists of twenty-four 150 ton capacity rear dump trucks. A computer has been installed in the mine to provide computerized ore truck dispatching.

An additional mineral deposit called Cactus is expected to be mined as an open pit later in the life of the Pinto Valley mine. No reliable information as to ore reserves or grade is presently available.

(ii) Miami East

Miami East's mineable ore reserves as of June 30, 1980 based on a cutoff grade of 1.4% copper, resulting in an average grade of 3.14% copper, are 5,976,000 short tons.

The Miami East ore body is from 2,900 - 3,300 feet below ground. The Miami East mine currently under development consists of the production shaft and one ventilation shaft, plus drifts, stations and trackage underground.

Management presently expects Miami East to begin operating by mid-1982 and to reach full capacity of 25 million pounds of refined copper per year by 1984.

At this rate of production and at presently stated mineable ore reserves, the mine is expected to have a life of approximately 15 years. Mined ore at the projected rate of 1800 tons per day will be milled at Pinto Valley.

Total costs of developing the Miami East mine expended during the period 1979 to 1983 are estimated to be \$29 million representing 31% of Miami's total capital expenditures during that period.

(iii) Miami Unit

Leach solution from previous Miami underground workings are collected and pumped to the surface. Recovery of copper from solution was achieved in cementation launders until completion of the solvent extraction-electrowinning plant in 1976. This SXEW plant produces about 900,000 pounds per month of electrowon cathode.

(iv) Copper Cities

The Copper Cities precipitation plant and the associated solution distribution and collection systems remain in operation. This facility produces approximately 300,000 pounds per month of cement copper.

B. Landholdings

The physical resources of Miami are located in East Central Arizona and comprise approximately 21,300 acres over an area of 135 square miles. Of this land, approximately 10,000 acres are owned by Miami, 5,300 acres are subject to patented mining claims and approximately 6,000 acres are unpatented claims on public land. The land owned by Miami and the land subject to patented mining claims includes oil and gas rights.

C. Other Facilities

(i) Old Dominion

The Old Dominion mine's remaining value is as a producer of domestic and industrial water, producing about 750 gallons per minute of industrial water and 225 gallons per minute of domestic water. Facilities consist of the mine shaft, and nearby pipe shaft, hoist house, underground pump station, two surface booster pump stations, water storage tanks and electrical substation.

(ii) Solitude Area

A large area south of the highway between Miami and Globe was acquired by purchase of homestead lands. Part of this area is occupied by the inactive Solitude tailings pond.

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This pond may need to be reactivated as a disposal site for the Miami tailings overlying the Miami East deposit should it be decided to reprocess them.

(iii) Holgate Development Corporation

Holgate was set up by Cities Service to acquire and administer property required for office space and public housing needs coincident with the construction and startup of the Pinto Valley Project. The Miami Operations General Office and a mobile home park occupy part of this land. Part of the remaining ground is suitable for residential development. The part adjoining the highway is potential commercial land.

The Miami Operations' general office is a modern two story building which was completed and first occupied in January, 1975. It houses the executive, administrative and service functions and is the communications center for the operations. Miami installed its own computer facilities in 1980 and is well along in converting from the Tulsa central computer to Miami for accounting, payroll, materials management and scientific applications.

The map on the following page illustrates Miami's land holdings and facilities. The photograph that follows is an overview of Pinto Valley.



# CITIES SERVICE COMPANY MIAMI OPERATIONS

**PRESENT OPERATIONS**  
MIAMI LEACHING WITH SX/EW  
COPPER CITIES LEACHING  
PINTO VALLEY

**DEVELOPMENT PROJECTS**  
MIAMI EAST  
SX/EW (PINTO VALLEY)

**POSSIBLE PROJECTS**  
COPPER CITIES EXT.  
MIAMI NORTH  
OLD DOMINION  
CACTUS

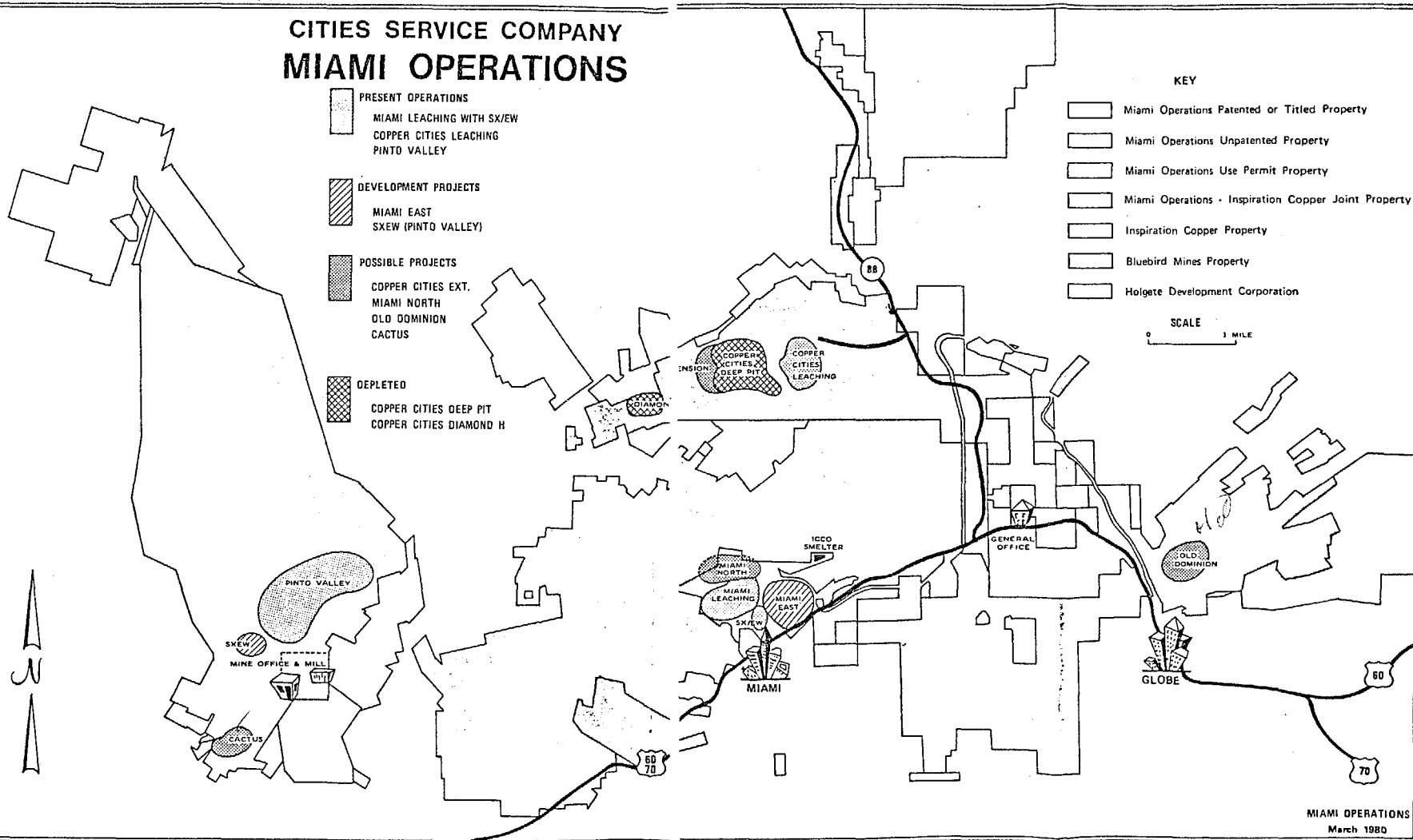
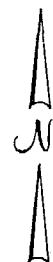
**DEPLETED**  
COPPER CITIES DEEP PIT  
COPPER CITIES DIAMOND H

## KEY

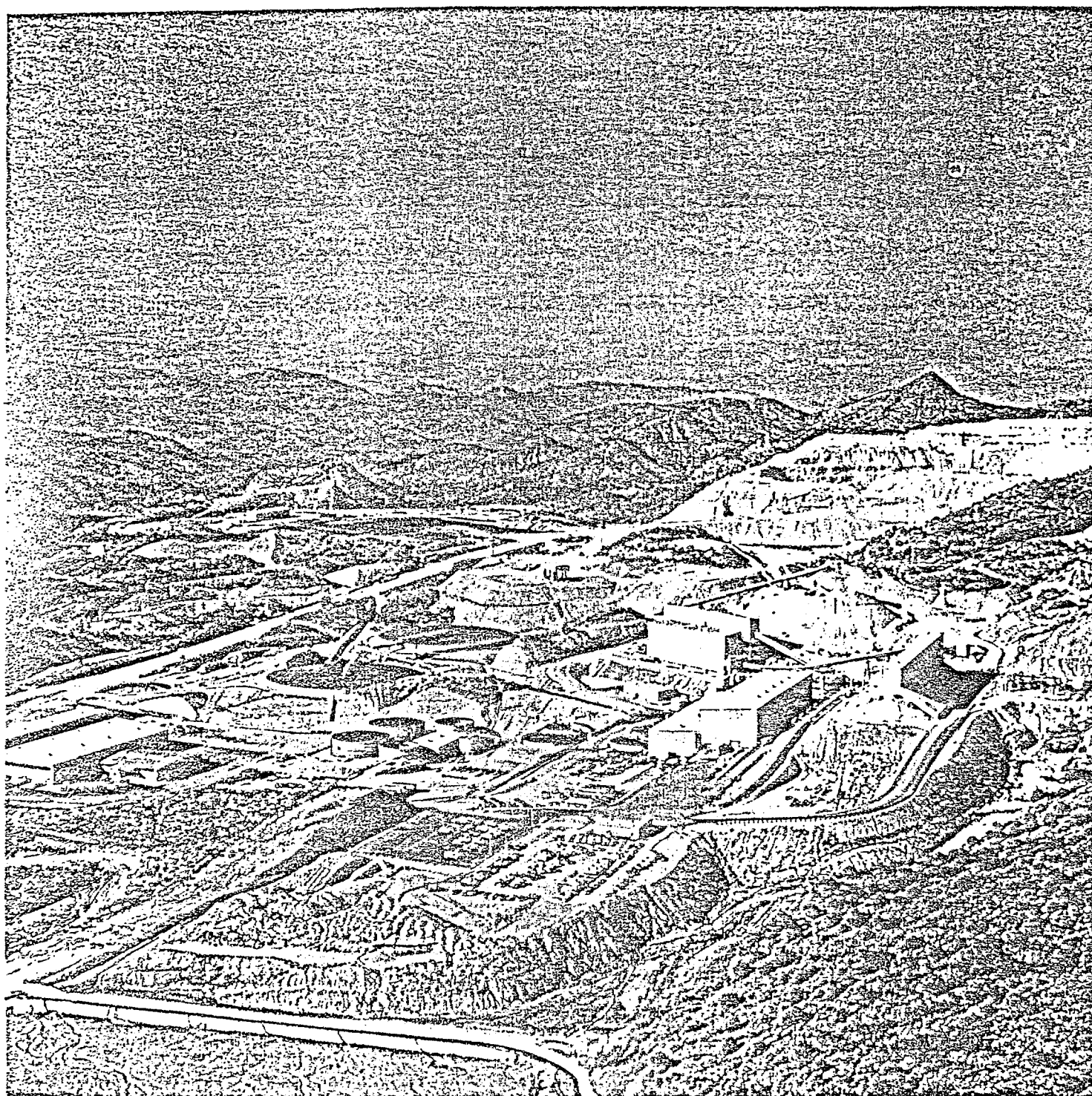
- Miami Operations Patented or Titled Property
- Miami Operations Unpatented Property
- Miami Operations Use Permit Property
- Miami Operations - Inspiration Copper Joint Property
- Inspiration Copper Property
- Bluebird Mines Property
- Holgate Development Corporation

## SCALE

0 1 MILE



MIAMI OPERATIONS  
March 1980



V. Products and Marketing

A. Products

Miami's copper concentrates are processed into blister copper at Inspiration Consolidated Copper Company's smelter adjacent to Miami. The blister copper is refined into cathodes and other shapes by ASARCO at Amarillo, Texas.

Miami also sells continuous cast rod wirebar, cakes, billets and other shapes of copper provided by ASARCO or through trades with other copper producers. Small quantities of gold, silver, molybdenum and turquoise are by-products of Miami's copper mining and production.

Miami's smelting agreement with Inspiration expires in September 1984 subject to two five year extensions at the option of Miami but subject to the continued operation of the plant. The refining agreement with ASARCO extends to September 1987 subject to cancellation by either party on not less than 18 months written notice to be effective no earlier than September 1984.

Some of Miami's smelting is presently being done on a spot basis due to Inspiration's inability to operate at designed capacity. Presently, approximately 550 tons per day are handled by Inspiration (50% of their current operating capacity) and an additional 150 tons per day through spot agreements with other smelters.

Inspiration is presently undertaking pollution control improvements and expanding the designed capacity of its plant to 1600 tons per day (concentrate charge).

B. Marketing

Miami sells approximately 60% of its copper to wire mills and the balance to the brass industry through its sales department which is based in Atlanta, Ga.

Miami sells its product to approximately thirty (30) active consumers. Miami's major accounts are: Western Electric, Chester Cable Corporation, New Haven Copper company, Continental Copper and Steel Corporation - Hatfield Wire and Cable Division, Revere Copper and Brass, United Technologies Corporation - Essex Group, Olin Industries and Westinghouse.

Miami follows a flexible pricing system which is a Comex-related price. 100% of Miami's projected production for 1981 has been contracted for at present.

20% of Miami's annual projected production (approximately 35 million pounds) is subject to requirements contracts with two customers, Chester Cable Corporation and New Haven Copper company, both of which were formerly divisions of Cities Service Company. The term of the contracts run from 1980 through 1984 and they are subject to Miami's flexible pricing system.

VI. Utilities and Water

Miami's source of electrical power, the Salt River Project, is based principally on coal and in the future nuclear energy which should continue to give it a substantial cost advantage. Power cost is currently in the area of \$.033 per KWH. Rates are subject to change on a monthly basis but tend to be set for one year. Electrical costs in 1981 are forecasted to be roughly \$12 million.

Miami's present operations require 3,500 - 4,000 gallons per minute of new make-up water in excess of reused processed water and surface run-off. At present this supply comes from wells and from the Old Dominion mine. As present sources become depleted, wells will have to be drilled in new locations. One possible future source of additional water may be the Central Arizona Project from which Miami has agreed to accept 5,000 acre feet per year of CAP water beginning in 1985. (Equivalent to approximately 3,000 gallons per minute). Realization of this supply however, depends on final allocations by the project, confirmation of an exchange arrangement and construction of a pumping and pipeline system in cooperation with other mining and utility companies in the Miami area.



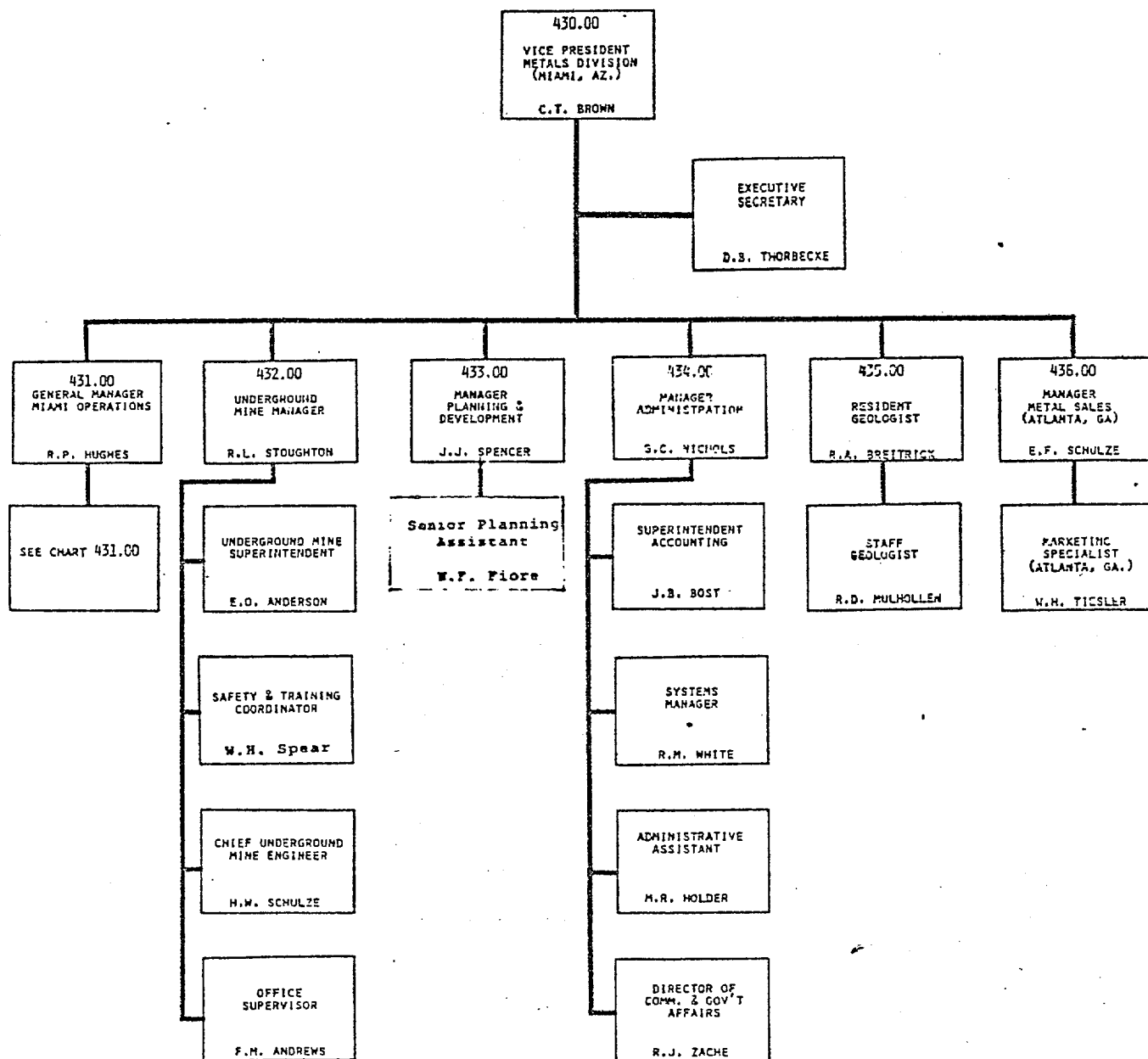
VII. Management and Personnel

Miami currently employs approximately 1,000 people, including operations, maintenance, technical, administrative, and management personnel. The Miami staff also includes a number of technicians and professional personnel trained in mechanical, electrical and civil engineering, metallurgical sciences, geology and mine engineering. This staff includes personnel with experience in both open pit and underground mining.

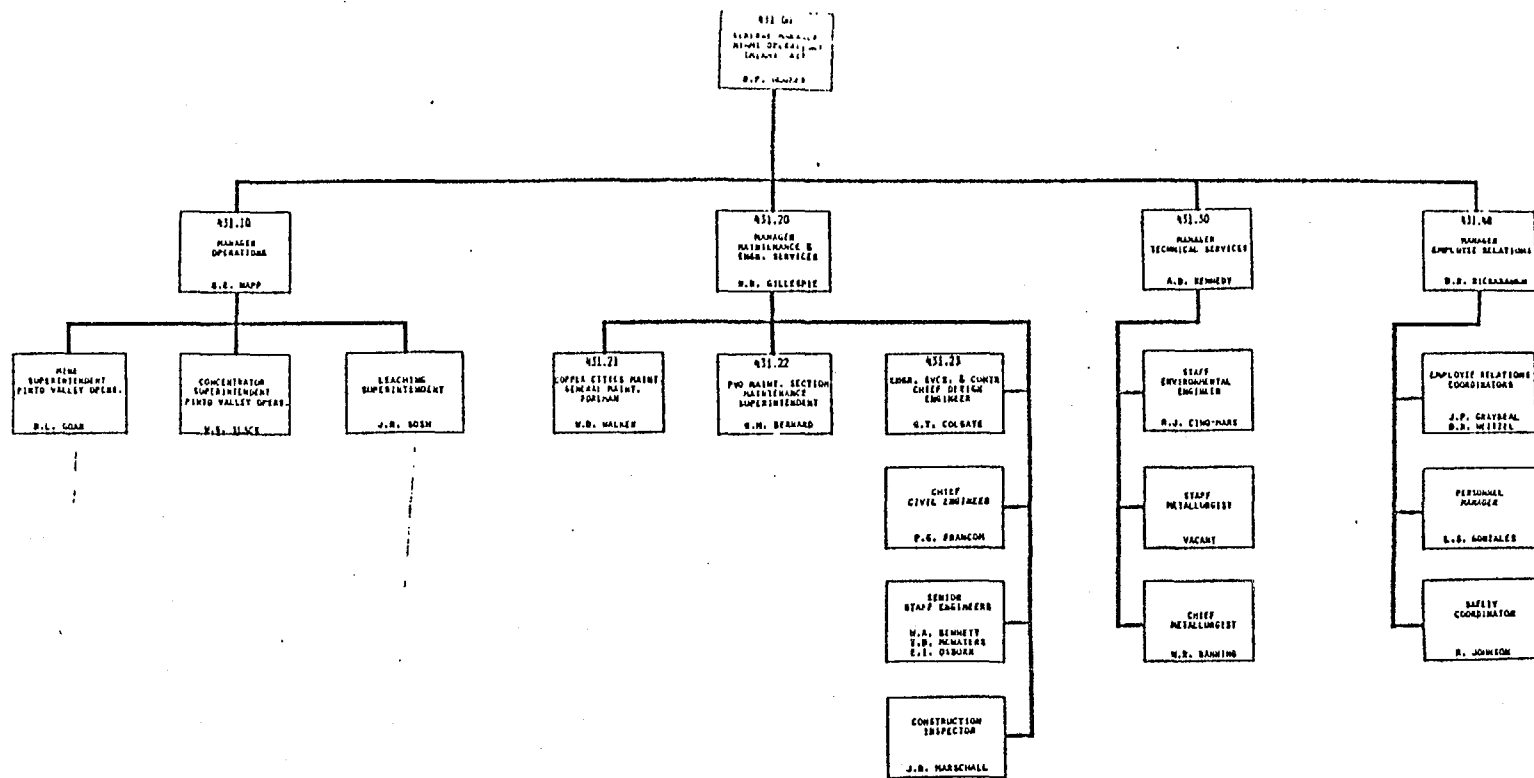
Miami's staff deals with the most modern, largest practicable equipment and computerized controls. Miami's comprehensive planning methods and efficient mining and processing operations result in a high level of productivity and advanced expertise of personnel capable of improving and expanding operations in the future.

# A. Organization Chart

CHEMICALS & MINERALS GROUP  
METALS DIVISION  
CHART NUMBER 430.00  
AS OF APRIL 1981



NOTE: MIAMI, AZ. BASED EXCEPT AS NOTED



B. Background of Key Employees

Charles T. Brown, Vice President, Metals Division

B.S. Chemical Engineering, Texas A&M University. 34 years with Cities Service, 10 years in Miami, 5 years in present position.

Robert P. Hughes, General Manager, Miami Operations

B.S. Mechanical Engineering, University of Wisconsin. 34 years Cities Service in Miami, 5 years in present position.

Richard A. Breitrick, Resident Geologist

B.A. Geology, University of Wisconsin. 15 years with Cities Service, 3 years in Miami, 3 years in present position.

Gene C. Nichols, Manager of Administration

2 years Business Administration, Oklahoma State University. 33 years with Cities Service, 10 years in Miami.

Eugene F. Schulze, Manager of Metal Sales

B.S. Accounting, New York University. 11 years with Cities Service Metals Division in present position.

John J. Spencer, Manager of Planning

B.S. Geology, Michigan State University. 33 years with Cities Service in Miami, 7 years in present position.

Robert L. Stoughton, Underground Mine Manager

2 years Mining Engineering, Haileybury College. 1 year with Cities Service in Miami in present position.

Noel B. Gillespie, Manager, Maintenance and Engineering Services

2 years Liberal Arts-Arch., Kansas City University. 25 years with Cities Service in Miami, 2 years in present position.

Allen D. Kennedy, Manager of Technical Services

M.S. Metallurgical Engineering, Michigan Technical University. 11 years with Cities Service in Miami, 4 years in present position.

Dale D. Rickabaugh, Manager of Employee Relations

B.A. Math, Westmar College. 30 years with Cities Service, 10 years in Miami, 7 years in present position.

Bobby L. Beydler, Purchasing Agent

High School, 20 years with Cities Service in Miami, 4 years in present position.

C. Union Relationships

Pinto Valley Operations (including the new SXEW facilities) has one production and maintenance bargaining unit. The single bargaining unit, which has no jurisdiction lines, is represented by a joint pact of 7 Unions. The Union is comprised of Teamsters, Operating Engineers, Electrical Workers, Steelworkers, Boilermakers, Pipefitters and Carpenters.

Miami-Copper Cities Operations, Solvent Extraction-Electro-winning and Leaching Operations has 7 separate bargaining units. The Unions representing each bargaining unit are Steelworkers, Teamsters, Operating Engineers, Electrical Workers, and Globe-Miami Metal Trades Council (Boilermakers, Pipefitters and Carpenters).

Miami East Operations has 2 separate bargaining units. The Unions representing each bargaining unit are Steelworkers and Electrical Workers.

Miami's existing union contracts expire on June 30, 1983.



VIII. Environmental

Miami operates under federal and/or state environmental permitting regulations concerning waste water, air emissions, and solid waste disposal. The Division does not own or operate a smelter or refinery and therefore presently faces no major environmental requirements.

Miami, however, is faced with a potential problem concerning sulphuric acid, a by-product of smelting, for which there is presently reduced demand. This reduced demand could necessitate large volume disposals of acid which would adversely effect copper production costs and could lead to potential pollution difficulty.

Miami has expended \$3.4 million on pollution abatement during the last five (5) years and budgets \$1 million annually for pollution abatement facilities.

Supplement To Confidential Descriptive Memorandum  
Metals Division  
A Division of Cities Service Company

Lehman Brothers Kuhn Loeb  
Incorporated

The First Boston Corporation

June, 1981

The information contained in this Supplement to the Confidential Descriptive Memorandum concerning the Metals Division of Cities Service Company is based upon information supplied by Cities Service Company and is being furnished through Lehman Brothers Kuhn Loeb Incorporated and The First Boston Corporation as exclusive authorized agents, solely for use by prospective purchasers in considering their interest in acquiring the Metals Division of Cities Service Company. This Supplement and the Memorandum do not purport to be all-inclusive or to contain all of the information which a prospective purchaser may desire and no representation or warranty is made as to the accuracy or completeness of any of the information contained therein.

All of the information contained in the Memorandum, this Supplement thereto, and any additional information concerning the Metals Division supplied by Cities Service Company or its agents (except information in the public domain), is of a confidential nature. Recipients of this Supplement have agreed to treat the information contained herein in a confidential manner, and not, directly or indirectly, to disclose or permit their agents or affiliates to disclose any of such information to any person or organization not affiliated with such recipient without the prior written consent of Cities Service Company.

Delivery of the Memorandum or this Supplement to any prospective purchaser shall not constitute an offer to sell or the solicitation of an offer to buy any securities of Cities Service Company nor shall the Memorandum or this Supplement be considered to indicate that there has been no change in the affairs of the Metals Division of Cities Service Company.

## I. Smelting and Refining

A. Smelting and Refining Agreement between Cities Service Corporation and Inspiration Consolidated Copper Company, dated November 15, 1971 and subject to numerous amendments.

- a. Agreement provides for the treatment of up to 750 tons per day, but not less than 500 tons per day of dry copper concentrates. "Concentrates", referred to in the Agreement means sulphide copper concentrates produced at Miami, Arizona area mines and concentrators owned and operated by Cities Service.  
  
Agreement includes accounting for copper, gold, silver and acid.
- b. The initial term of the Agreement extends to September, 1984, subject to two five year extentions, at the option of Cities, contingent upon the continued operation of the plant.
- c. The plant includes a smelter and smelter emission control facilities and facilities for producing and handling sulphuric acid.
- d. Inspiration, at the request of Cities Service, expanded the capacity of its Base Plant from 1,000 tons per day to 1,500 tons per day. Cities agreed to deliver not less than 500 tons of concentrates per day and to pay toll charges based on that amount notwithstanding possibility of smaller shipments.

e. Toll charges for smelting are 110 percent of Inspiration's Operating Costs in handling and treating concentrates delivered by Cities, plus 110 percent of:

- i) shut-down, shut-in and start-up expenses normally encountered in smelting operations,
- ii) any increase in costs of electric power caused by the increase in plant capacity,
- iii) any charges made by Salt River Project caused by Cities' failure to deliver certain amounts of concentrates,
- iv) a pro-rata share of depreciation of the Plant including replacements and improvements made during the term of the Agreement and
- v) a pro-rata share of financing and interest expenses on funds borrowed for the construction of the originally designed plant.

Cities is subject to an additional charge for excess moisture content in concentrates.

The Agreement provides that Cities retain ownership at all times of the copper contained in the concentrates.

f. Sulphuric acid produced as a by-product of the smelting process belongs to Cities. Some of the acid is used by Cities for leaching; the remainder is sold. Excess above use and sales must be disposed of by Cities.

B. On October 23, 1973 Cities Service Company entered into a Boundary Mining Agreement with Inspiration Consolidated Copper Company, allowing for Inspiration to mine ores by open-pit methods, within a defined area of Cities' property and providing for certain royalties to be paid by Inspiration to Cities.

C. Refining Agreement between Cities Service Company and ASARCO, Incorporated, dated January 1, 1981.



- a) Agreement provides for the refining of not more than 7,000 tons of blister copper per month, produced under contractual agreements between Cities and copper smelters. The blister copper is required to be in a size and shape suitable for handling by ASARCO's Amarillo, Texas refinery, electrolytic refining, and to contain not less than 98 percent copper.
- b) The term of this Agreement extends to September 30, 1987 subject to cancellation by either party at not less than 18 months written notice to be effective no earlier than September 30, 1984.
- c) Refining charges are scaled from \$212 for the first 1,000 tons of \$172 for the last 2,000 tons up to a maximum of 7,000 tons delivered during any calendar month. These charges are subject to adjustment based on increases or decreases in hourly costs of employment, costs of fuel and electric power at the Amarillo refinery.

ASARCO returns the refined copper to Cities or ships it in accordance with Cities' instructions in the form of full-plate electrolytic copper cathodes or in such other form or shape as Cities may request. Title to refined copper remains with Cities.

- d) ASARCO credits Cities for gold and silver.
- e) ASARCO and Cities retain the right to terminate the Agreement under certain conditions including circumstances that would cause financial loss, the inability to agree on adjustments for any increase in certain taxes, and the inability to agree on price renegotiation occasioned by ASARCO's being required to comply with any environmental pollution regulation or to build any pollution control device, the cost of which creates an economic burden on ASARCO.

## II. Key Operating Factors

	1981 Forecast as of 4/30/81	Four Months to 4/30/81	1980(a)
I. <u>Copper Production (M Lbs.)</u>			
Pinto Valley - Copper in Concentrate	147,618	50,425	90,056
- Solvent Extraction-Electrowinning	6,410	-	-
Miami Unit - Solvent Extraction-Electrowinning	10,995	3,306	11,187
Miami Operations - Cement Copper	3,525	1,206	4,394
Total	<u>168,548</u>	<u>54,937</u>	<u>105,637</u>
II. <u>Copper Production Costs (¢/Lb.)</u>			
Pinto Valley - Concentrates			
Operating Cost	56.60 ✓	51.25 -	53.55
Smelting, Freight & Refining	32.73 ✓	35.47 ✓	28.35
Depreciation and Amortization	6.06 ✓	5.97 ✓	6.68
Total	<u>95.39</u>	<u>92.69</u>	<u>88.58</u>
Pinto Valley - Solvent Extraction			
Operating Cost	44.18	-	-
Depreciation and Amortization	7.86	-	-
Total	<u>52.04</u>	-	-
Miami Unit - Solvent Extraction			
Operating Cost	54.36	58.66	46.84
Depreciation and Amortization	5.55	6.16	5.49
Total	<u>59.91</u>	<u>64.82</u>	<u>52.33</u>
Miami Operations - Leaching			
Operating Cost	62.30	55.91	48.09
Smelting, Freight & Refining	26.41	26.43	26.68
Depreciation and Amortization	4.24	4.14	3.31
Total	<u>93.45</u>	<u>86.48</u>	<u>78.08</u>
Total All Operations			
Operating Cost	56.10	51.79	52.62
Smelting, Freight & Refining	29.22	33.14	25.28
Depreciation and Amortization	6.06	5.95	6.41
Total	<u>91.38</u>	<u>90.88</u>	<u>91.38</u>

(a) Production figures reflect strike of 18 weeks in 1980

				N.P.U.	
1982	46	.5 years @ .20%	4/2	42	
1983	<del>41</del> 40	1.5 - @ .20%	<del>24</del>	31	
1984	<del>32</del> 38	2.5 -	16	25	
1985	<del>32</del> 38	3.5 -	17	20	
1986	<del>31</del> 32	4.5 -	14	17	
1987	<del>32</del> 32	5.5 -	8	12	
1988	<del>31</del> 32	6.5 -	3	10	
1989	32	7.5 -		8	
1990	32	8.5 -		7	
				<u>7</u>	
				161	

$$\text{Mini, Mill, \& overhead} @ 0.481 = \underline{\$0.8886 / lb.}$$

$$\underline{.8886} \times .97 = \underline{\$0.8619 / mill lbs recovered.}$$

8937 to Rec.

12,113,065 lbs recovered from 1,534,754 dry tons @  $\$7.0132 / ton.$

Total Cost =	\$10,763,553	
Less Dep.	664,364	
Amort.	<u>118,176</u>	
Sum. Ref. Acc.	3,137,017	= 29.14% $\times 0.8886 = \$0.259$
	+ 32,289	
	0.481 Head	
	0.047 tail.	

$$\text{For 1982: } \frac{173,500}{148,000} \times .60 \div 50,000 = \frac{20820}{1.7760} = \underline{\$0.3060 / ton of ore}$$

$$\frac{0.466 - 0.051}{0.466} = 0.8906 \times .96 = 0.8549$$

7.88#

$$50,000 \times 0.00466 \times .8549 + 2000 = 398,383 \text{ lbs dry}$$

$$= 11,951,602 / month.$$

$$= 142,007,747 / year$$

$$@ 0.306 p TM more \times 50,000 \times 35\% = \$5,497,400 = \underline{\$0.0384 / lb.}$$

1982

$$142,621,259 \times 0.927 = 131,641,000 \text{ Sat}$$

$$\times 1.250 = 164,551,250$$

45,869 before taxes ~~log~~

$$179 \times 0.60 \div 50 = 2.148 - 2.082 = 0.066 \text{ then at } 0.005 \text{ move } 0.927 \text{ move}$$

$$\frac{0.066}{7.238} = 0.0091$$

$$\frac{0.428 - 0.051}{0.428} \times .96 = 0.8456 \quad 0.932$$

1983

$$17,880,000 \times 0.00428 \times .8456 \times 2000 = 129,421,448$$

$$129,421,448 \times \frac{.932}{.943} = 120,621,000$$

$$\times 1.25 = 150,776,250$$

41,156

1984

$$\frac{179.5}{179} = 2.154 - 2.082 = 0.072$$

$$\frac{0.072}{7.200} = 0.01$$

$$\frac{0.01}{0.932} = 0.0107$$

$$\frac{0.426 - 0.051}{0.426} \times .96 = 0.8451$$

$$19,788,000 \times 0.00426 \times .8451 \times 2000 = 128,078,083$$

$$128 \times 10^6 \times \frac{.942}{.949} = 127,950,000$$

$$\times 1.25 = 159,937,500$$

32,148,000 39.6

$$1985 = 179,000 \quad 0.927$$

$$\frac{0.415 - 0.051}{0.415} \times .96 = 0.842$$

1985

$$17,788,000 \times 0.00415 \times .8420 \times 2000 = 124,317,000$$

$$124,317,000 \times \frac{.942}{.949} = 123,447,000$$

1.25

154,308,750

38.3



Cont

1986

$$\frac{.408 - 0.057}{.408} \times .96 = 0.8400$$

0999

$$17,788,000 \times .00408 \times .84 \times 2000 = 121,926,000$$

$$\text{tot } @ .999,942 = 121,824$$

$$\text{Return } @ 1.25 = 152,407 \quad 30,621 \quad 37,583$$

1987

88

$$\frac{0.386 - 0.051}{0.386} \times .96 = 0.8332$$

$$\frac{194,000}{179,000} \times .60 \div 50,000 =$$

$$2.328$$

$$2.148$$

$$6.43165$$

$$0.180 \div 0.028/16$$

$$+ .993$$

$$0.942$$

$$1.173$$

$$0.970$$

$$17,770,500 \times .00386 \times .8332 \times 2000 = 114,305,258$$

$$0.970$$

$$110875$$

$$134080$$

$$1.250$$

$$142,881$$

$$8,801 \quad 32,005$$

89

90

$$\frac{.406 - 0.051}{.406} \times .96 = .8394$$

$$208,000 \times .6 \div 50,000 = 2.496$$

$$179,000 \times .4 \div 50,000 = 2.148$$

$$0.348$$

$$00,406 \times .8394 \times 2000 = 6.82165$$

$$0.051$$

$$0.942$$

$$0.993$$

$$17,800,000 \times .8394 \times 0.00406 \times 2000 = 121,323,518$$

$$121,323,518 \times (1.25 - 0.993) = 31,180$$







DF P14.5-1 -

X

T.D.H.

DEC 2 1974

THE PINTO VALLEY CONCENTRATOR

by

Wayne D. Gould  
Metallurgical Superintendent  
Miami Operations  
Cities Service Company

Presented at the December 2, 1974 Meeting  
Arizona Section  
American Institute of Mining & Metallurgical Engineers

D. E. C.

MAR 21 1975



## THE PINTO VALLEY CONCENTRATOR

The Cities Service Company's Pinto Valley Concentrator started partial operation in July and full operation in November. The nominal capacity is 40,000 tons per day. The flow sheet is 3 stage crushing, single stage grinding followed by regrinding of the rougher concentrate before cleaning.

The major equipment list is:

- 1 60 x 89 Traylor Primary Crusher
- 3 7' Nordberg Secondary Crushers
- 6 7' Nordberg Shorthead Crushers
- 6 18' x 21' Allis-Chalmers Ballmills
- 6 Clusters of 8 - 26" Wemco Cyclones
- 6 14 x 12 Warman Pumps
- 84 300 Cubic Foot Wemco Copper Rougher Cells
- 2 11' x 15' Traylor Regrind Mills
- 28 300 Cubic Foot Wemco Cleaner and Recleaner Cells
- 2 90' Dorr Cu-Mo Thickeners
- 18 300 Cubic Foot Wemco Moly Rougher Cells
- 20 #24 Denver Cell to Cell Cleaner Flotation Cells
- 2 5' x 8' Denver Regrind Mills
- 2 90' Dorr Cu Thickeners
- 3 350 ft. Dorr Tailings Thickeners
- 2 Ingersoll-Rand Triplex Positive Displacement Pumps
- 2 Denver 9' x 9 Disc Cu Filters with 2 Nash Vacuum Pumps

Various product Conveyor Belts mainly 60" wide except for feeder belts which are 42".

Other auxiliary equipment.

I intend to cover only those phases of the operations which are somewhat unique.

Hydraulic motors have been used on reclaim feeders in place of some form of electric motor control. So far the choice appears good.

The grinding sections consists of 6 - 18' x 21' single stage, spout fed ballmills. Each mill is driven by a 4000 H.P. synchronous motor connected to the mill by an airclutch. Five of the mills operate at

66.8% of critical speed while the sixth operates at 72.6% of critical speed.

The fine ore is reclaimed by twelve belt feeders, two per mill, which discharge to 6 ballmill feed conveyors. Each belt feeder has a variable speed hydraulic motor drive. The feed rate is controlled from the control room and can be set to maintain a fixed tonnage or automatically adjusted to maintain a constant mass flow to the cyclones.

Since little was known about the grinding ability of this size mill, they were lined with four different styles of liners. Three mills were lined with single wave liners with 2-1/2 inch lifters. One mill has single wave liners with 3 inch lifters. One mill has double wave liners with 2-1/2 inch lifters. One mill has U.S. Steel plate liners with 3 inch replaceable lifter bars.

A liner handler is available for installing liners. The mill feed spout is mounted on a cart which is movable on rails. When liners are to be installed, the feed spout is moved out of the way and the liner handler moved into place at the feed opening of the mill. Liners are stored adjacent to each mill for easy movement to the liner handler. The handler is hydraulic actuated and can place the liners in most positions.

The original planned feed to the ballmills was to be minus 1/2 inch with the possibility of going to minus 3/8 inch for increased tonnage. The economic grind was determined to be 15% plus 65 mesh. The circulating load was expected to be 500%.

The following is a fairly typical sizing of the cyclone overflow when grinding 350 tons per hour:

	<u>Cum. % on</u>
+ 28 mesh	0.5
+ 35 mesh	2.2
+ 48 mesh	8.0
+ 65 mesh	18.4
+100 mesh	31.9
+150 mesh	43.2
+200 mesh	53.2
-200 mesh	46.8

Allis-Chalmers performed a bond work index determination on a sample of mill feed taken in September. The results compared favorably with the results from the special sample used in the pilot plant study.

The sizing of the ballmill feed was:

<u>Mesh Size</u>	<u>% Passing</u>
.75"	100
.53"	98.51
.375"	91.89
3 mesh	75.14
4 mesh	63.68
6 mesh	53.19
8 mesh	45.10
10 mesh	37.34
14 mesh	31.42
20 mesh	25.95
28 mesh	21.18
35 mesh	17.64
48 mesh	14.00

Calculations from these data are:

Work index	11.56
Kw Hr/ton	6.82

The work index and power requirements calculated from laboratory grinding of the sample is:

Work index	12.5
Kw Hr/ton	7.52

The original work done at the pilot plant stage showed:

Work index 100 mesh	13.4
Kw Hr/ton	9.55

The reason for the power requirement being greater on this calculation is that the mill feed was originally planned to be minus 1/2 inch.

The ore at this point appears to have a slightly lower work index than the anticipated overall average for the ore body. The required power is influenced largely by the finer feed size. The data is suspect since it is a small sample; consequently, no conclusions should be drawn. However, the results are encouraging that big diameter ballmills will grind as well as 16-1/2 foot diameter mills and smaller. Some design changes are indicated since it has not been possible to maintain a 40% of volume ball load.

The mills started operating at a nominal 300 tons per hour, but were varied up to 400 tons per hour. They were then set at 350 tons per hour and are now operating at that setting. At 350 tons per hour the motors draw approximately 3800 H.P. from a possible full load 4000 H.P. except the mill running at 72.8% of critical which draws approximately full load of 4000 H.P.

The ballmill discharge is pumped to a cluster of 8 - 26 inch Wemco cyclones by a 14 x 12 Warman pump. Each pump is driven by a 400 H.P. motor.

Copper-Moly flotation is carried out in 300 cubic foot Wemco flotation cells for both roughing and cleaning operations. The rougher cells are arranged in 6 rows of 14 each. New feed is introduced into the third cell of each row. Cells 3 through 6 produce a rougher concentrate. This arrangement allows more slimes to be removed before regrinding. Pilot plant work indicated a better grade of final concentrate by this arrangement.

The copper-moly rougher concentrate goes to a pump sump along with scavenger concentrate from the cleaner circuit and the regrind ballmill discharge. The combined products are cycloned twice with the underflow from both cyclones going to the regrind ballmill. The copper-moly reground rougher concentrate is cleaned in a 14-300 cu.ft. cell circuit which is broken into 4 cell cleaners, 4 cell recleaners and 6 cell scavengers.

The copper-moly separation is made in a circuit patterned after the Copper Cities' plant. The first cleaner steps are performed in 300 cu. ft. Wemco cells with the final cleaning being done in #24 Denver cells.

In the flotation circuit walkways are provided above the launders on the flotation cells. This allows the cells to be moved nearer together and provided with a common launder between cells. With powered level controls it is not necessary to remove or add weir bars on cell lips or overflow weirs. The result is a saving in building costs. The idea was pilot planted at the Copper Cities' mill before being designed into the Pinto Valley mill.

The final copper concentrate at 55 to 65% solids flows from the copper thickeners to either of two 238,000 gallon storage tanks. The slurry is withdrawn from the tanks by either of two 3" x 3" Allen-Sherman-Hoff centrifugal pumps. The slurry is passed through a test loop 170 ft. long x 3.5" inside diameter to determine its pumpability. The test loop is instrumented to indicate flowrate; density and pressure differential in the loop. The pressure differential across the test loop is a critical criterion in determining if the slurry is safe to pump. The copper concentrate slurry reacts like a true liquid, providing

that the following conditions are satisfied.

- (1) The solids particles are small enough to be carried by the slurry.
- (2) The slurry is kept flowing at a sufficient velocity to keep the solids suspended.
- (3) The slurry contains a weight percent of solids high enough to assure that the fine particles will carry the coarser particles in suspension.

When it is determined that the slurry meets pipeline specifications the flow from the A-S-H pumps is diverted to the suction of either of two triplex positive displacement pumps. The pump speed can be varied to give a slurry velocity between 4 to 5 ft/sec.

The pipeline is approximately 10.7 miles long. The pipeline is constructed from 4 inch outside diameter pipe having 0.318 inch wall thickness for the first 7000 feet and 0.250 inch wall thickness for the remainder of its length. The maximum allowable operating pressure is 2340 psig.

The two mainline pumps are positive displacement, triplex, single acting, reciprocating plunger pumps driven by 300 H.P. motors. Each pump is capable of 190 g.p.m. at a maximum discharge pressure of 2250 psig. The actual pressure needed is about 1500 psig. Only one pump operates at a time.

The pipeline terminal is at the filter plant located adjacent to Inspiration's smelter. One receiving tank of 542,000 gallon capacity is provided at the terminal. Filtering of the concentrate is by two 9 foot - 9 disc Denver filters. These are located above a railroad track for discharge directly into cars.

The area around Pinto Valley for tailings disposal is one of high relief with narrow valleys. The amount of material that can be stored behind a dam is very limited. Tailing dams are stable if water is kept far removed from the face. Historically this has been done by providing a drainage line under the dam. We have taken a different approach and provided a controlled drainage through the starter dam.

The criteria established for the tailings dams were: (1) a starter dam would be built as a homogenous embankment; (2) the starter dam would have a drainage blanket at its base; (3) the upstream side of the embankment would also be a filter bed connected to the filter bed through the embankment; (4) sand tailings would be deposited behind the embankment and built up to such an elevation that sand will extend underneath the final completed dam; and (5) after the elevation in 4 is reached, the dam will be built from whole tailings.

The dam as designed should allow water to drain freely from its face and thus insure a low phreatic line in the dam without the potential weak point that is present when a drain line is installed beneath a tailing dam. Water that percolates through the drainage blanket will be caught in a small dam downstream and pumped back into the water system.

A single cyclone station was established for the sand-slime separation. From this point sands could flow by gravity, in a 4 degree sloped line, to all 3 starter dams. The slimes are returned by a pump to the top of a previously used tailing area.

The subsurface conditions are different for each of the starter dams ranging from volcanic bedrock to weathered volcanic rock exposed or covered by residual soils for alluvium to slope wash deposits. The dam areas were cleared down to solid material to provide a strong and relatively incompressible base for the starter dams. Embankment slopes were designed for a minimum factor of safety of 1.5 for all normal operating conditions.

Borrow pits near each dam supplied the necessary material of construction.

The height of the starter dam was fixed by the drainage area behind the dam. The volume behind the dam was projected to contain a 100 year storm plus 3 feet of freeboard. As the dam rises in height its storm containing capacity increases. The final dam will be provided with a spillway to insure its complete stability without attention.

The primary crushing plant, the fine crushing plant, the mill and the concentrate slurry pump house all have conventional instrumented control rooms. Provision has been made to bring all of the essential information and alarms to the central mill control room. A Hewlett-Packard computer is in the process of being installed with the objective of step by step development of computer control. The first scheduled use of the computer is data gathering followed by control of the primary ballmill grinding circuit. The exact form of ballmill control has not been fixed as yet.











TOTALS .....\$1,216,867,100 \$1,271,725,910

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TABLE

W&K - W&P

ASARCO Incorporated

7/81

JUL 2 1981

S. Exploration

COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE CU CONTENT (%)	REMARKS
ANAMAX MINING COMPANY	Twin Buttes	Sulfide	305	0.65	With 0.03% Mo; cutoff @ 0.2% Cu
	"	"	300	0.80	Pub. 1973; "outside current mine plans"; cutoff @ 0.4% Cu
	"	Oxide	41	0.96	Cutoff @ 0.6% Cu
	"	"	28	0.49	Pub. 1973; cutoff @ 0.4% Cu
	— Helvetia	Sulfide	320	0.64	Pub. 1973; cutoff @ 0.3% Cu
	— "	Oxide	20	0.55	Pub. 1973; acid soluble Cu; cutoff @ 0.3% acid soluble Cu
	— Peach Elgin	Mixed	23	0.75	Pub. 1973; cutoff @ 0.4% Cu
ASARCO INCORPORATED	Mission	Sulfide	94.003	0.76	With 0.14 oz Ag/ton
	? Poston Butte	Mixed		0.47	Pub. 1972; 32-42.5 Mt possible
	Sacaton (OP)	Sulfide	13.503	0.70	Pub. 1980
	Sacaton East (UG)	"	14.898	1.25	Pub. 1980
	San Xavier	"	165.805	0.52	With 0.06 oz Ag/ton
	Silver Bell	"	19.627	0.67	With 0.05 oz Ag/ton
	"	Oxide	2.2		
AZTEC MINING CORPORATION	Mame	Oxide	2	1.00	Unpublished est.
BS & K MINING COMPANY	Atlas	Mixed			
CASA GRANDE COPPER COMPANY	— Casa Grande	Mixed	351.4	1.05	Pub. 1980

1. Eisenhower

TABLE

## COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE CU CONTENT (%)	REMARKS
CF&I STEEL CORP.	— Driagoon	Oxide			
CITIES SERVICE COMPANY	— Cactus	Mixed			
	Copper Cities	Sulfide			
	Miami	"			
	— Miami East	"	6	3.14	Reported 1981
	Old Dominion	"			
	Pinto Valley	"	413.4	0.41	Includes "probable" ore
? COCHISE DEVELOPMENT GROUP	? Bisbee- North	Mixed (?)	20	0.80	Unpublished est.
COCHISE MINING CORP.	? San Juan	Oxide	20	0.50	Unpublished est.
CONTINENTAL OIL COMPANY	Poston Butte	Mixed	800	0.40	Pub. 1979
CYPRUS MINES CORP.	Bagdad	Sulfide	326	0.49	Pub. 1979; with 0.03% Mo
	"	Oxide	38	0.33	Pub. 1979; acid soluble Cu
	"	"	97	0.19	Pub. 1979; stockpile; acid soluble Cu after prior leachi
	Bruce	Sulfide	0.1276	3.73	Pub. 1976; with 12.8% Zn
	I-10	Mixed	100	0.52	Unpublished est.; with 0.02% Mo
	Johnson	Oxide	6.643	0.50	Pub. 1980; acid soluble Cu
	"	Mixed	10	0.60	Pub. 1974
CYPRUS PIMA MINING CO.	Pima	Sulfide	144.959	0.498	Pub. 1980
DUVAL CORP	Esperanza	Sulfide	54.959	0.27	With 0.033% Mo
	"	Oxide			
	Mineral Park	Sulfide	43.832	0.19	With 0.051% Mo
	"	Oxide			
	Sierrita	Sulfide	398.752	0.30	With 0.035% Mo
EISENHOWER MINING CO.	Palo Verde	Sulfide	147.0029	0.64	
EL PASO COMPANY	Emerald Isle	Oxide	1.5	0.40	Pub 1977; or 3Mt @+ 0.1% Cu
FREEPORT MCMORAN INC.	Santa Cruz	Mixed			



TABLE  
COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE CU CONTENT (%)	REMARKS
INSPIRATION CONSOLIDATED COPPER COMPANY	Christmas (OP)	Sulfide	11.613	0.62	
	" (OP)	Oxide			
	" (UG)	Sulfide	20.131	1.78	Includes "probable" ore.
	Inspiration Area	Mixed	245.224	0.58	Pub. 1980
	Ox Hide	Oxide	29.309	0.31	Pub. 1980; plus recoverable Cu remaining in leach pads
	Sanchez	Oxide	79.362	0.36	
KENNECOTT CORP.	— Chilito	Mixed			
	Lone Star	"	2000	0.41	Reported 1977
	Lone Star Ext.	"			
	Ray	Sulfide	606.144	0.70	Pub. 1981; with 0.01% MoS <sub>2</sub>
	Ray	Silicate	225.760	0.68	Pub. 1981
KERR-MCGEE CORPORATION KEYSTONE MINERALS INC. MACMA COPPER CO.	Red Mountain	Sulfide		0.71	Pub. 1970; 100Mt possible
	Korn Kob	Oxide	8	0.50	Pub. 1973
	Copper Creek	Sulfide			
	— Kalamazoo	"	565	0.72	Pub. 1969
	San Manuel	"	474	0.67	Reported 1978
	"	Mixed	130	0.70	Pub. 1969
	Superior	Sulfide	9.8	4.80	Reported 1978
	— Vekol Hills	"	105	0.56	Pub. 1978; minable by open pit; with 0.014% Mo; 16Mt oxide Cu
MCALESTER FUEL COMPANY NAVAJO TRIBE (?) NORANDA MINES LTD.	! Zonia	Oxide	20.5	0.53	Pub. 1981
	White Mesa	Oxide	2	0.75	Pub. 1955
	Four Metals	Sulfide	6.3	0.26	Reported 1965; with 0.29% MoS <sub>2</sub>
	Lakeshore	Sulfide (dissm)	241	0.70	Pub. 1969
	"	" (tactite)	23.6	1.69	"
	"	Oxide	207	0.71	"
	Ventura	Sulfide	3	0.82	Reported 1965
ORACLE RIDGE MINING PARTNERS	Oracle Ridge	Mixed (?)	11	2.25	Reported 1977; with 0.64 oz Ag/ton (Pub. 1979)

TABLE  
COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE CU CONTENT (%)	REMARKS
S. B. OWENS	Carlota	Oxide	4	0.85	Reported 1979
PHELPS DODGE CORPORATION	— Copper Basin	Sulfide	175	0.55	Pub. 1974; minable by open pit; with 0.02% Mo
	Copper Queen	Mixed			
	— Dos Pobres	Sulfide	400	0.72	Pub. 1977
	Lavender	"			
	Metcalf	"	415.970	0.77	Pub. 1975
	Morenci	"	662.462	0.80	"
	New Cornelia	"	126.623	0.63	"
	United Verde	"			
RANCHERS EXPLORATION & DEVELOPMENT COMPANY	"	Oxide			
	Western Copper	Sulfide	175	0.60	Unpublished est. (Castle Hot Springs)
	Bluebird	Oxide	65	0.50	As of June 30, 1980
V.B. SMITH ESTATE	Dynamite	Sulfide			
SQUAW PEAK MINING CO.	Squaw Peak	Sulfide	30	0.35	Unpublished est.; with 0.012% Mo
STANDARD METALS CORP.	Antler	Sulfide	5.1	1.95	Pub. 1979; with 4.13% Zn, 0.94% Pb, & 1.05 oz Ag/ton; additional 2.5 Mt "possible" ore (Pub. 1980)
STRONG & HARRIS	Strong & Harris	Mixed	60	0.60	Unpublished est.; with 0.70% Zn
SUPERIOR OIL	Pine Flats	Sulfide	12	0.50	Unpublished est.

TABLE

COPPER RESERVES IN ARIZONA <sup>1/</sup>

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE CU CONTENT (%)	REMARKS
UNDETERMINED	<u>Mineral Hill</u>	Mixed			
UNION OIL	<u>Turquoise</u>	Oxide	10	0.50	Pub. 1975
UNITED STATES GOVERNMENT	<u>Park Hill</u>	Mixed (?)	30	0.45	Unpublished est.
UNITED STATES GOVERNMENT & U.S. METALS CORP.	<u>Apex</u>	Mixed (?)			
VAN DYKE COPPER CO. & SHO-ME COPPER CO.	<u>Van Dyke</u>	Oxide	100	0.50	Pub. 1977

Source: Company Annual Reports, Form 10-K's, and Prospectus; Professional Publications.

- <sup>1/</sup> Reserves are given with a grade of average total copper content as of December 31, 1980, unless stated otherwise under "Remarks." As used in this table, reserves generally mean those estimated quantities of ore which under presently and reasonably foreseen technical and economic conditions may be profitably mined and sold or processed for the extraction of their constituent values.

# ASARCO

MINING DEPT.

Mining Department

SEP 8 1981

TUCSON

September 3, 1981

J. R. S.  
SEP - 8 1981

TO: T.E. Scartaccini

FROM: S.A. Anzalone

Re: Cities Service - Miami  
Operations, Arizona

On August 27, 1981, D.E. Crowell, D.F. Skidmore, J.R. Stringham and the writer visited the Miami East operations of Cities Service Corporation. This examination was a followup to Asarco's initial visit on July 29, 1981. The purpose was to confirm the geological and mining data presented verbally by Cities Service during the July 29 meeting. D.E. Crowell took the opportunity to examine and review the Miami Unit leaching operations which are reached through the No. 5 shaft. This shaft is utilized for the development of the Miami East ore body as well as providing access to the underground collection and pumping facilities of the leaching operation. Skidmore and Stringham evaluated the mining methods, costs and current development program at Miami East. Mining costs and performance data for a proposed conventional mining system were provided by the staff of Cities Service in a brochure that will be included with the Skidmore and Stringham reports.

This memo will review the geological details of the Miami East prospect as they relate to the actual mining conditions and ore reserve figures.

## Summary

Based on examination of the Miami East underground workings, a proven ore reserve of 6,000,000 tons assaying 3.14% Cu is realistic. If anything, it is a bit conservative. In the opinion of the writer, with careful mine planning, the ore reserve could be increased 7,000,000 tons without diluting the grade.

[illegible]

Figure 1

Rock stability within the diabase host rock will be adequate to support the "sublevel cut-and-fill mining method" proposed by the Cities Service staff.

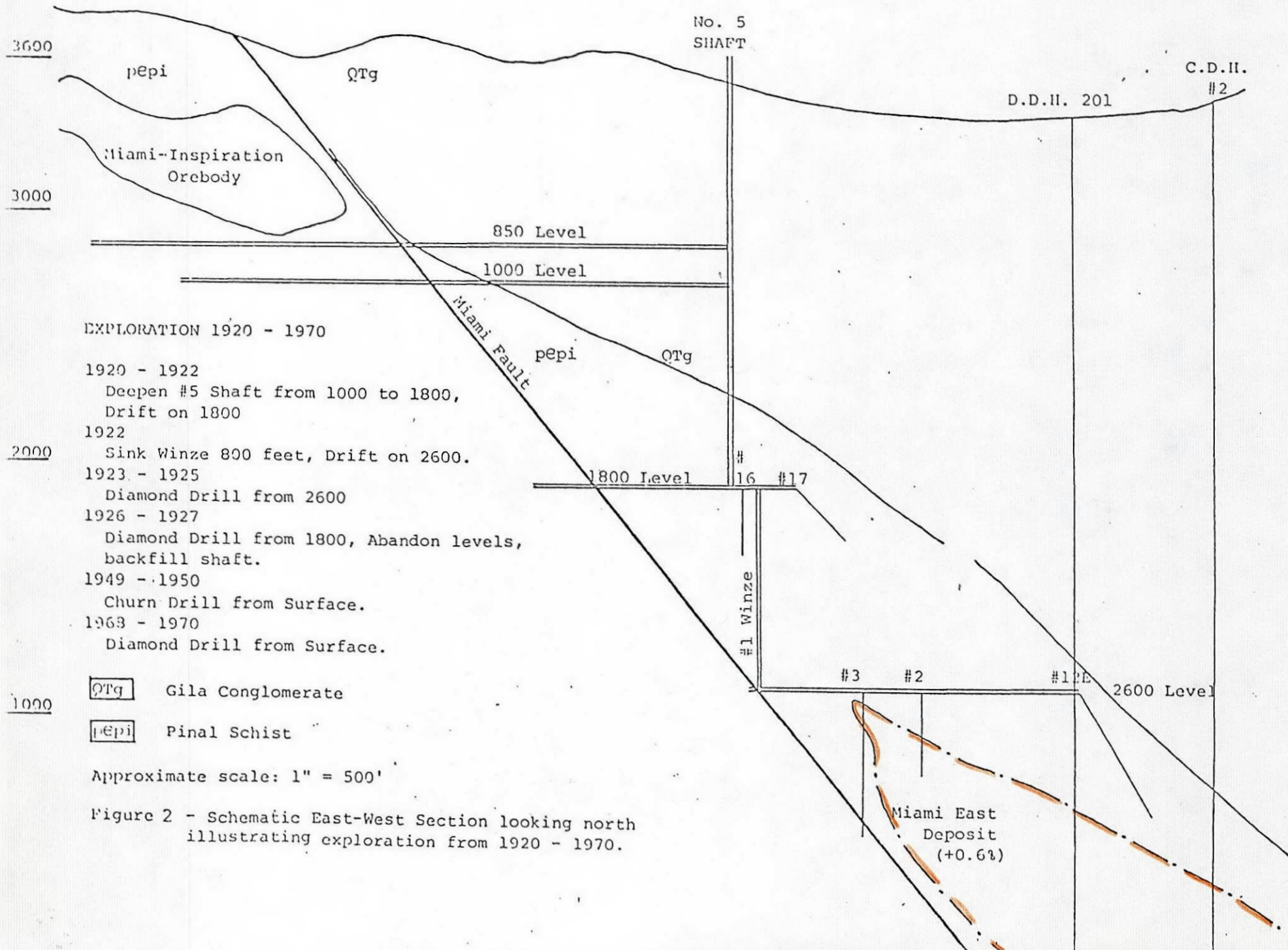
The remaining mineralization occurring in the Pinal schist will be difficult or impossible to mine under present economic conditions. Mine workings within the schist will not stand for long, the rock being weak and very unstable. Mine openings within the schist will require extensive support in all areas. This, coupled with the surface caving problems referred to below under geology, precludes mining large tonnages of this rock type.

### Geology

My memo of August 17 summarized the general geology of the Miami East property. For the sake of convenience, that part of the report pertaining to the Miami East is repeated here. This is followed by a more detailed review of the mineralization and rock conditions based on an examination of the underground workings as of August 27, 1981. Considerable assistance in examination and interpretation of the geology and rock conditions was provided by Errol Anderson, Mine Manager and former Senior Geologist at Miami East, as well as Stuart Morris, current Senior Mine Geologist at Miami East.

Miami East Underground. A reserve of 6,000,000 tons assaying 3.14% Cu at a 1.40% Cu cutoff is credited to the Miami East unit by Cities Service. This reserve is the high-grade core of a considerably larger deposit drilled out in the Miami East area. The larger deposit is thought to contain approximately 100,000,000 tons at a 1.42% Cu grade using a 0.60% Cu cutoff (See Figures 2 and 3). Initial studies considered mining this larger tonnage by block caving methods, but the location of the mining area, affecting the town of Miami, the Inspiration smelter, the main highway and river drainage precluded the use of large-scale mining methods. Surface damage anticipated from the ground subsidence presented difficult and perhaps insurmountable engineering problems. The mining method selected would have to preserve the present surface by backfilling the mined-out area. The end result of numerous studies was that only the high-grade chalcocite-bornite core occurring for the most part in an altered diabase sill could be mined. Cities Service believes the deposit can be mined economically by "mechanized sandfill methods".





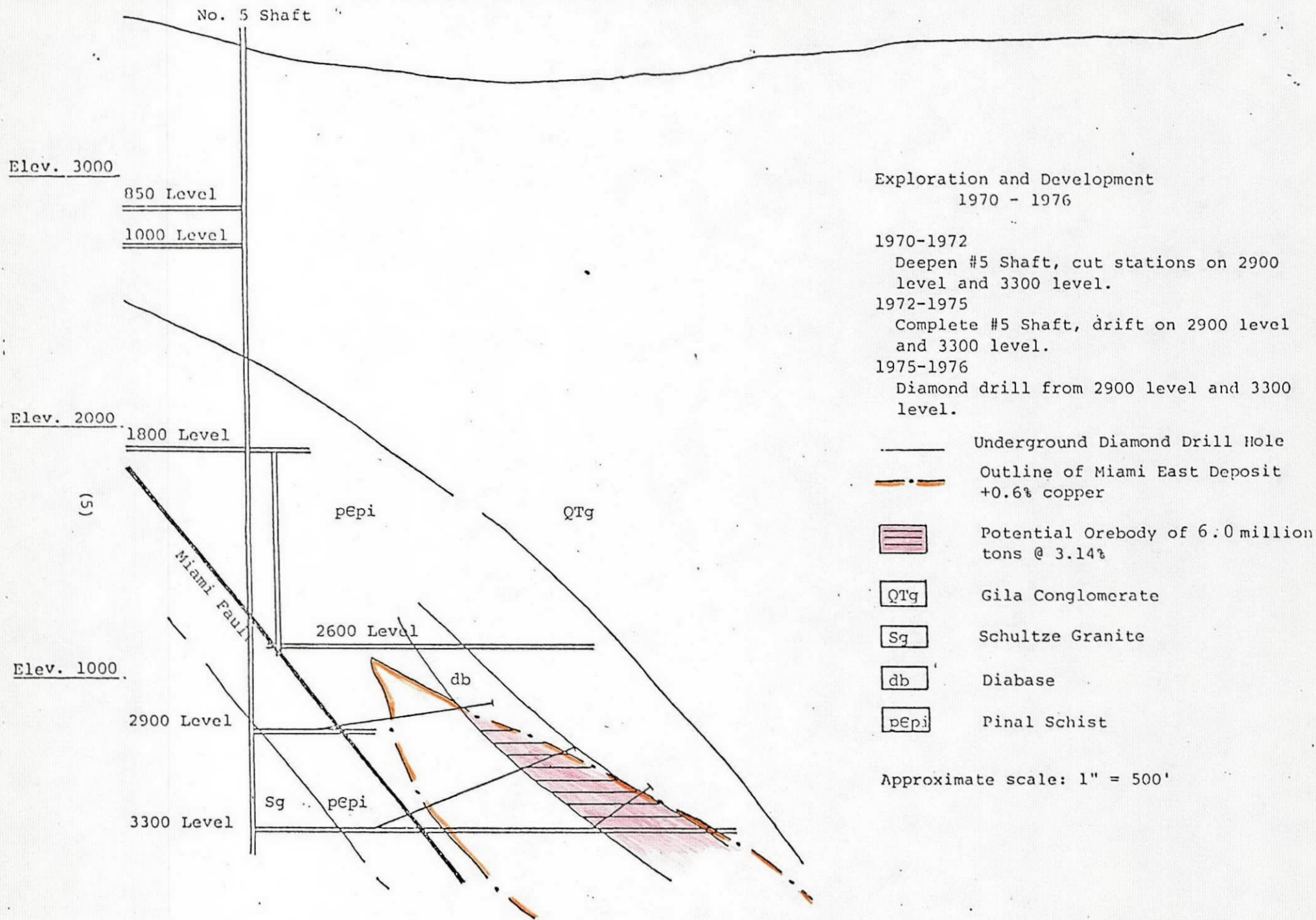


Figure 3 - Schematic East-West Section looking north illustrating exploration and development from 1970 - 1976

GEOLOGIC CROSS SECTION  
 MIAMI EAST MINE  
 (LOOKING NORTH)

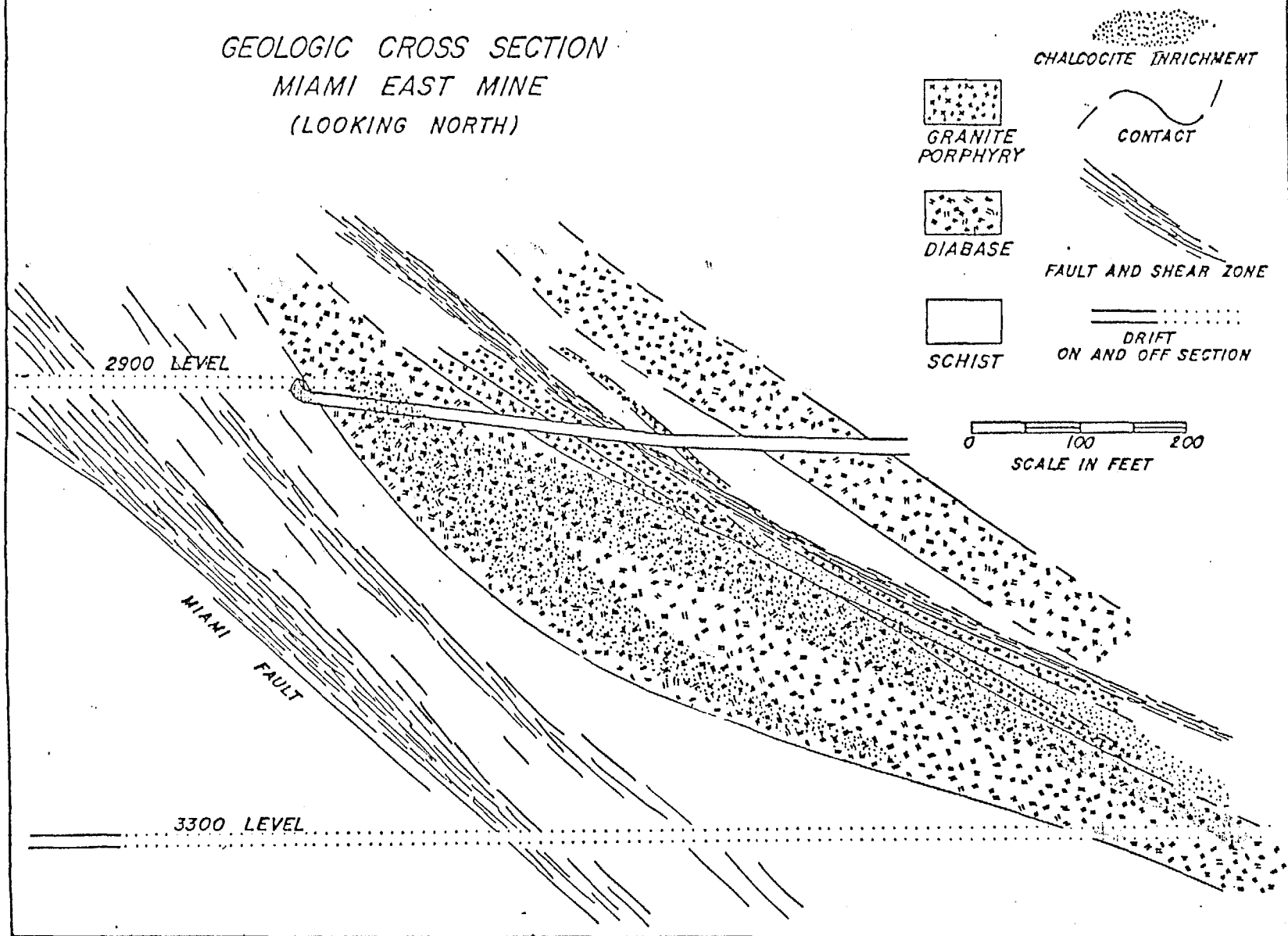


Figure 4

The Miami East mineralized zone is a down-faulted segment of the Miami-Inspiration ore body (See Figures 2 and 3). The deposit is offset along the Miami fault which strikes N20°E, dips 45°E and may have as much as 2000 to 3000 feet of displacement. The fault contains as much as 9 feet of gray-black gouge along the fault plain and up to 400 feet of breccia. The Miami East deposit is confined to the hanging wall of the fault above the gouge. The larger mineralized zone occurs principally within the Pinal schist and a dense, fine-grained aphanitic diabase. The 6,000,000 ton high-grade ore body (3.14% Cu at a 1.40% Cu cutoff) occurs as chalcocite, bornite and pyrite within the moderately dipping ( $\pm 40^\circ$ ) tabular mass of strongly altered diabase. The overall deposit is outlined by 16 surface drill holes averaging 3773 feet in depth, plus 39 underground drill holes averaging 500 feet. It covers an area 3000' by 1500' with a thickness varying from 65' to 645' and averaging 325'. The high-grade chalcocite ore body lies within the hanging wall portion of this larger mineral zone (See Figures 2 and 3). The average thickness of the minable diabase is estimated to be approximately 130 feet. The deposit consists of both hypogene and supergene sulfide mineralization. The economic ore body, however, occurs within the supergene zone and is a product of the replacement of chalcopyrite and pyrite by chalcocite. Chalcocite is by far the most abundant secondary mineral in the deposit. It is most abundant in the diabase and occurs in veinlets and as disseminated grains. Chalcocite in the schist is abundant near the diabase in the enriched zone and decreases with depth as the primary zone is approached. Minor amounts of purplish bornite are present, usually associated with the chalcocite. A zone of oxidation exists above the enriched zone and is characterized by abundant hematite, strong iron staining, moderate amounts of native copper and only traces of the oxides and silicates of copper.

Current exploration consists of diamond drilling from stations cut from the underground development that is presently underway.

Development work revealed that ground conditions were poorer than anticipated, particularly in the Pinal schist. Geologic mapping of the drifts and analysis of core samples indicated that only the diabase would allow the minimal support required in the selective mining method and that the schist would be too costly to support.

Rock types. Four rock types are encountered in the area of underground development at Miami East. They are:

- Granite porphyry
- Schultze granite-granodiorite
- Diabase
- Pinal schist



Of these, the granite porphyry, Pinal schist and diabase are directly involved in the Miami East ore body.

Pinal Schist. Two varieties of Pre-cambrian Pinal schist are found in the Miami East area. Both are essentially quartz-moscovite/sericite schists, but one shows a well-developed foliation while the other displays a granular texture. Both types contain as much as 75%-80% quartz-sericite with varying amounts of biotite, K-feldspar and clay comprising the remainder of the rock. The color of the schist varies from light to dark gray with the granular variety commonly being lighter in color.

The foliated variety of schist contains approximately equal amounts of quartz and sericite. The foliation results from thin layers of quartz alternating with layers of moscovite or sericite. Many of the alternating layers are severely contorted and may have been offset by microscopic fractures. Quartz-sulfide veinlets cut the foliation. This rock type is found in the footwall of the Miami fault.

The granular schist is composed predominately of quartz with varying amounts of interstitial sericite clay and K-feldspar. This is the principal rock found in the hanging wall area of the Miami fault. Obvious indications of hydrothermal alteration in the Pinal schists are rare. The rock has very poor strength characteristics and requires considerable support and guniting to maintain permanent openings.

Diabase. The diabase occurs as a dense, fine-grained to aphanitic rock which megascopically appears similar to other diabase units in the Globe-Miami district. The color ranges from greenish gray to nearly black. Close examination reveals a suggestion of a former ophitic texture and outlines of altered plagioclase laths are sometimes seen. Coarse hematite is commonly found in this rock unit and has served as an aid to its identification. The rock is highly altered and nowhere in the drifts has fresh diabase been encountered to date and this recognition in hand specimens is based more on textural and color characteristics than on the basis of mineralogy. Where the diabase is found in contact with granite porphyry, the alteration in the diabase becomes more quartz-sericitic as the contact is approached. Within 10 to 20 feet of the contact, quartz and sericite are the dominant alteration minerals in the diabase and appear identical to the quartz and sericite in the altered granite porphyry. However, the remnant quartz phenocrysts in the granite porphyry serve as a feature to distinguish the two strongly altered rock types.

The shape of the diabase sill is lenticular and is traceable from drill hole data over a continuous strike length for more than 3000 feet. The main mass strikes approximately N35°E and dips approximately 35° to the southeast. The diabase attains a maximum thickness of approximately 400 feet averaging approximately 130 feet. It thins toward both edges. Within the mine area, strong faulting and alteration make it difficult to determine an accurate age relationship between the diabase and other rocks.

Why the diabase, the most important host rock in the Miami East, remains a competent unit when it is so intensely altered is not presently known. The unit geologists feel that it is possible that the abundance of sulfide veinlets and the nearly ubiquitous quartz in the wall rock essentially "hold" the rock together. This rock will support the "sub level cut-and-fill" mining method proposed by Cities Service.

Schultze Granite-Granodiorite. This rock is believed to be a facies variation of the Schultze granite. It has been encountered in drifts on both the 2900 and 3300 levels in the footwall block of the Miami fault. It varies from an equigranular granite to a subporphyritic facies of the same rock. Locally, where relative abundance of quartz, plagioclase and K-feldspar change, the name granite-granodiorite is given to the rock. This unit is fresh to weakly altered. A potassium-argon age date of  $54.4 \pm 1.2$  m.y. indicates the granite is probably tertiary in age and probably a younger facies of the Schultze granite.

Granite porphyry. A rock identified as a granite porphyry has been encountered in the Miami East property generally near the hanging wall of the deposit. This rock type is very highly altered and ranges from weakly to very strongly mineralized. Large, well-defined quartz phenocrysts occur in a fine-grained groundmass of quartz and sericite with only minor amounts of clay. This rock is found only in the hanging wall area of the Miami fault zone and is found to be in sharp contact with both the Pinal schist and the diabase, but not with the Schultze granite-granodiorite. Where this rock occurs as ore, it appears to be strong enough to support mine workings.

### Structure

The major faults in evidence at Miami East parallel the structural trends within the Miami-Globe district and appear to control the physical location of the mineralized zone.



The most important system is the Miami fault which strikes N20°E, dips 45°E and may have as much as 2000 feet of displacement. The fault contains as much as 9 feet of gray-black gouge along the fault plain and up to 400 feet of breccia. The Miami East deposit is confined to the hanging wall of the fault above the gouge.

The Miami fault and the deposit have been displaced by a series of northwest trending, moderately steeply dipping normal faults. These northwest faults appear to drop the mineralized zone in a series of steps from south to north. The exact amount of displacement along these faults is unknown. Geologic mapping of the underground workings define a number of joint systems both parallel and perpendicular to the major faults. The dominant system was found to parallel the N30°-60°E trend of the schistosity developed in the footwall of the Miami fault. The joint systems in the footwall are well defined with fracture spacings varying from 1 inch to 2 inches in the schist and 1 to 2 feet in the granite. Joint patterns in the hanging wall of the fault are either poorly developed or have been destroyed by tectonics.

Ore Reserve. Following the mine visit, the cross-sections, plan maps and drill logs upon which the Miami East ore reserve is based were reviewed in detail with Stuart Morris, Senior Mine Geologist.

The reserve calculation has been done with considerable care. The projection of mineralized zones between drill holes is realistic and somewhat conservative. Only ore grade material within the diabase was included in the reserve. High-grade mineralization in the schist was omitted even when it occurred immediately adjacent to ore in the diabase. A number of large "bulges" in the ore zone within the diabase were omitted to ensure that the mining area would retain a smooth configuration. A considerable portion of this material could be recovered. While the deposit thins laterally, additional mineable ore reserves can be projected into these areas. The down dip extension of the mineralized diabase may be offset by a normal fault; however, additional reserves should be recovered in the down dip projection to this fault. Nothing is known of the diabase beyond the fault.

The 6,000,000 tons of proven ore assaying 3.14% Cu is realistic. Seven million tons could be recovered with careful mining. A minimum dilution of at least 10% should be anticipated, resulting in a production grade of approximately 2.83% Cu.

  
S.A. Anzalone

SAA:jm

cc: NVisnes  
DECrowell  
DFSkidmore  
JRStringham



35,000,000 tons

@ 0.33% Total Cu

11,550,000 tons

x 54% recovery

6,237,000 tons of electronic copper

or 12,474,000,000 pounds of copper total

÷ 8 year = 1,559,250,000 # Cu/year

may well make 50¢ per lb

≅ \$6 Billion profit ÷ 8 year life

≅ \$780,000,000 per year!

or  
actual

or 7,150 tons per year recovered copper

x 2000 = 14,300,000 lbs

x 50¢ profit/lb.

= \$7,150,000 profit.

? Should be  
715,000 tons/year?

= 1,430,000,000 #/year

Big Difference.

or actual  
12,000 tons <sup>or</sup>  $\frac{1}{2}$  x 300 dp year = 3,600,000 tons ore per year

x .33 Cu

1,188,000 tons Cu

x .54 recovery

641,520 tons rec

x 2000 #/ton

1,283,040,000 #/year

September 18, 1989

T.E. Scartaccini

Kocide's Van Dyke Property  
Miami District  
Gila County, Arizona

A Mr. Jimmy Whatley of Kocide Mining who is operating the in-situ Van Dyke copper deposit called to say that Kocide is now getting out of the mining business and is looking for buyers.

Mr. Whatley's Miami, Arizona, phone is 473-2421.

Mr. Paul Musgrove is General Manager at the Miami operations, at the same number.

Kocides main office is in Georgia at phone 1-800-237-1854.

Mr. Whatley reports others to say that the Van Dyke has 100 million tons of 0.5% copper.

At present Kocide has one injection well and one production well which has been in production since November of last year. At present they are recovering 200 gpm with 0.2 grams copper per liter, down from an initial 350 gpm injection recovery.

Full particulars on the operation and sale can be secured from Mr. Whatley or Mr. Musgrove, including a visit to the operation. Kocide has contacted Magma, Cyprus and others.

JDS:mek



James D. Sell

cc: S.A. Anzalone  
R.L. Brown  
W.L. Kurtz  
A.R. Raihl  
H.G. Kreis