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James Doyle Sell Mining Collection

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JHC - a real example of a good job
ASARCO

JHC / WJK
Southwestern Exploration Division

October 7, 1976

*copy with file
Perth Co Arizona*

FILE MEMORANDUM

Safford

Sol Property
AMAX Exploration
Graham County, Arizona

Charlie Miller of AMAX called on 6/8/76 concerning a possible joint venture of their Sol Prospect. On 6/11/76, W. L. Kurtz, F. T. Graybeal, and J. D. Sell inspected the Sol data, but not the core, in the AMAX office. This memo is from the inspection and conversations.

The Sol Prospect is 15 miles E and NE of Safford along the Morenci highway and is covered by 512 unpatented claims. The surface geology is post-mineral basalt and gravel cover with some valley lake beds. The post-mineral cover varies from 200 to 500 feet in thickness. The target area was found in 1971 with a gravity anomaly and follow-up IP work. Drilling since that date has been: AMAX 4 holes, Phelps Dodge 12 holes, and Quintana 2 holes. All but one penetrated the valley fill deposits and most holes were between 2 and 3 thousand feet in depth. The deepest hole was 3600 feet with a bottom hole temperature of 70°C. A bedrock high extends north-south under the Sol VABM and drops off quickly to the east. An Exxon hole to the east bottomed in gravels at a depth in excess of 3000 feet.

The drilling has defined a steeply dipping, thousand-foot-wide granodiorite dike trending N10°E. The dike cuts a sequence of metavolcanics and volcaniclastics which strike N20°W and dip SW. The bedrock surface dips to the SW.

Centered on the south end of the granodiorite is an elliptical potassic zone 3000 x 4500 feet elongated N10°E, containing 1-3% pyrite; surrounded by a phyllic zone 4000 x 7000 feet with 3-8% pyrite; followed by a propylitic zone of 1-5% pyrite. The alteration zone of interest is 6000 x 9000 feet, containing 1-8% pyrite. Copper within the zone assays between 0.05 and 0.06% copper. The best ten-foot run in the potassic zone returned 0.46% copper while the best ten-foot run in the phyllic zone returned 0.68% copper.

The alteration is dominantly sericite-carbonate-chlorite-epidote with or without quartz. Although coarse breccia and retrograde alteration is extensive at KCC Safford and PD Dos Pobres, they are only locally developed at the Sol Prospect. The anomalous mineralization is near the phyllic-potassic contact and within the metavolcanic-volcaniclastic sequence. Molybdenum is anomalous in the phyllic zone. Inferred mineral resource at Sol is 54 million tons at 0.14% copper with a 0.10% cutoff.

Safford

Kenn	-	800 m	.55 Ext + Sul
		280	.92
PD		400	.72
Sanchez		80	.36

San Juan — large vol $\neq .40$

PD — shaft dev. on 1800

± 1500 below outcrop

So top of sul ore at
800 to 1000' below outcrop
ore contin to $\neq 2000'$

October 7, 1976

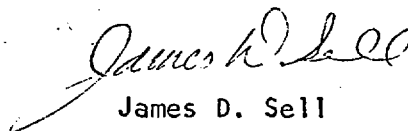
AMAX and PD drilled 41,967 feet of rotary and core footage. Of this PD in 12 holes drilled 26,460 feet at a total cost of \$420,000.00.

Two age dates have been determined. Hole SOL-4 sampled weakly mesozonally altered granodiorite with less than 4% secondary biotite. The whole rock K-Ar date is 60.7 ± 2.4 m.y. Hole Sol-6 sampled sericitized metavolcanics at a depth of 1,558 feet. The age of sericite K-Ar is 67.5 ± 2.9 m.y.

The Sol alteration zone is the second largest in the Safford district. The phyllic zone is similar to the KCC zone but not to the PD zone.

Other tonnage-grade figures for the district include:

KCC Safford	2 billion tons at 0.20% copper
PD Dos Pobres	400 million tons at 0.72% copper
ICC Sanchez	80 million tons at 0.36% copper
San Juan	50 million tons at 0.52% copper


James D. Sell

JDS:lb

cc: FTGraybeal
WLKurtz ✓

PD shaft

20

5

2.10

ore

± 1.2

Essex

5

Surface

PD ore

± 1.0% Cu

PD ore
± 25-50'

Valley F?

Essex prop

Butte F

Butte F

5' - at 3900 - 1/2 - 2 cu - at 4900 bot 50' 18 Cu

from Paul Emmon - 4-14-75

JHC

J. H. C.
APR 14 1975

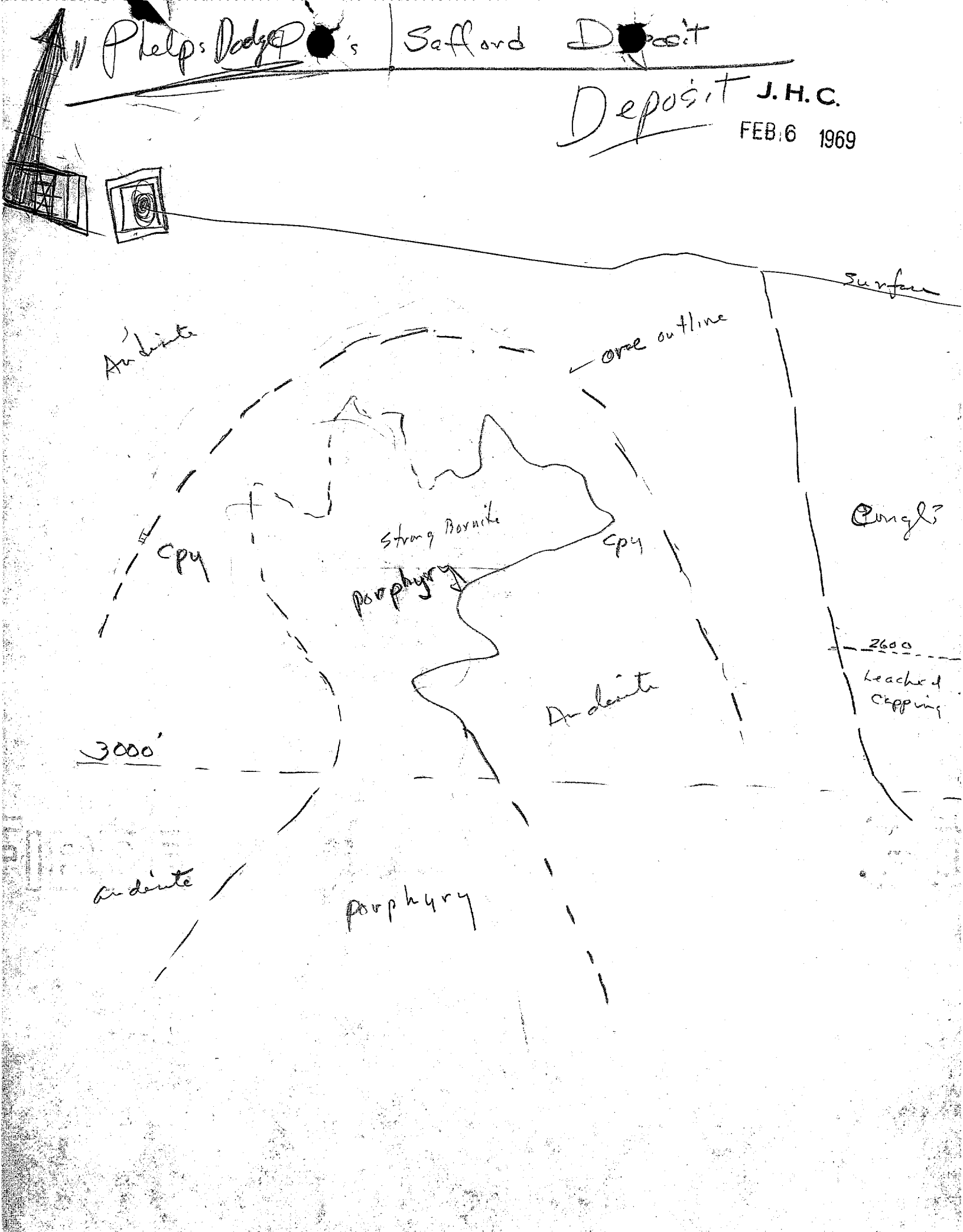
Phelps Dodge's

Safford

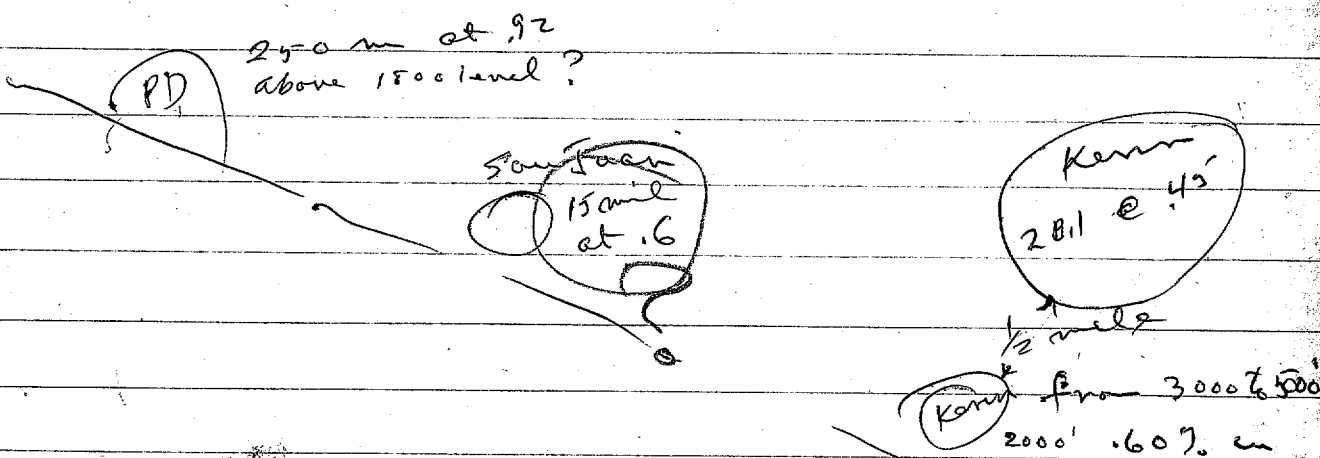
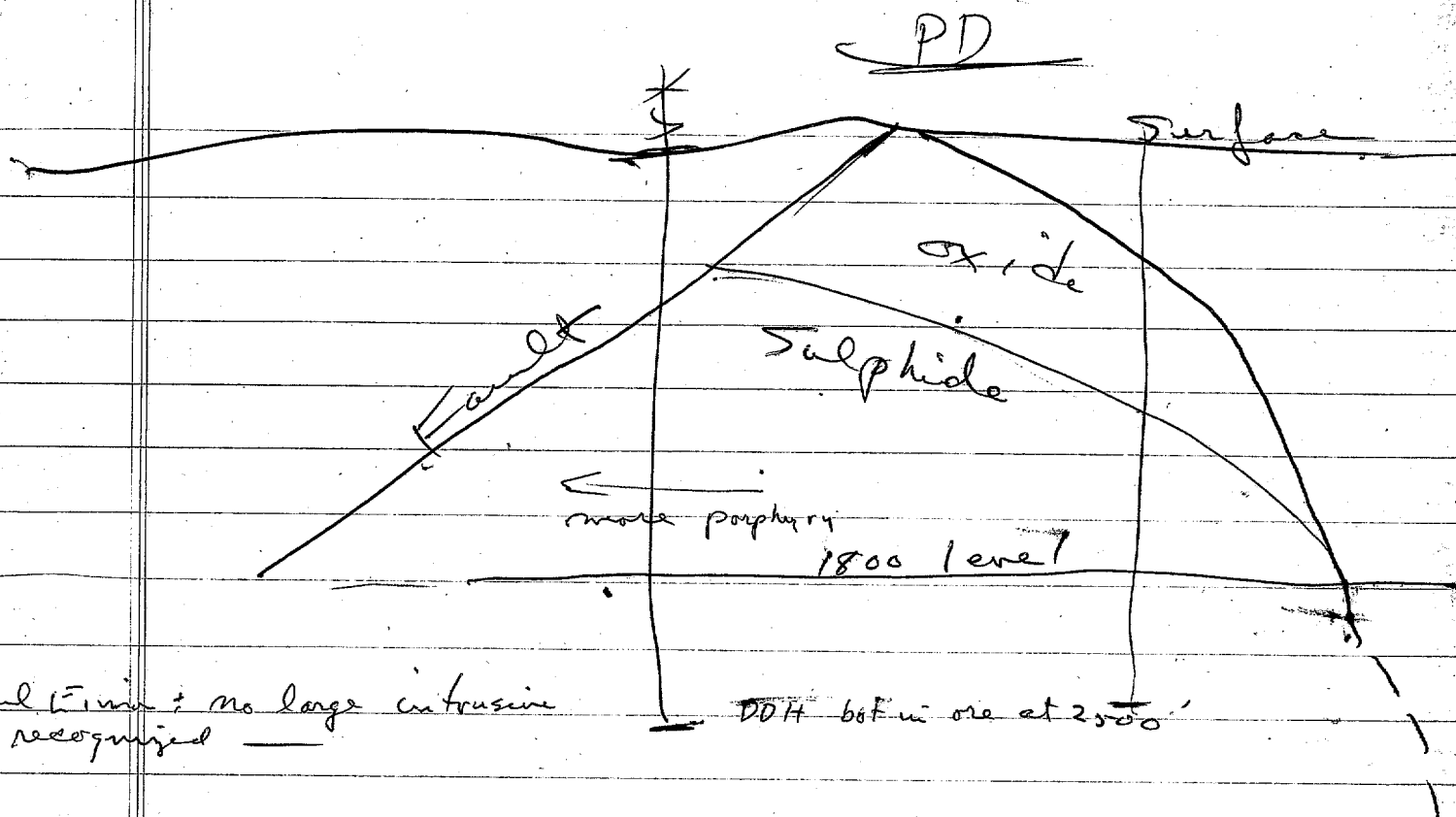
Deposit

Deposit J.H.C.

FEB. 6 1969



Safford



3-10-75 — Skip Clark — Oxidation down 1100' below shaft collar —
 Sinking to ± 2000' new shaft — first extraction level — Block cave will be on Climax scale —
 — (Trial slope failed to cave) —

no Diorite (or por) stock at depth — small masses, dikes and stockwork of intrusives at depth mostly all ore in andesite —

Phelps Dodge Evaluating Test Results At Safford

With a five-year feasibility study apparently successfully completed, engineers of Phelps Dodge Corporation are at work preparing a detailed report for presentation to the board of directors for development of its major copper orebody near Safford.

The announcement was made by a company spokesman after operations at the Safford property were shut down on Monday, October 8th and between 60 and 80 workers were terminated by a contracting company that had been performing much of the test work.

The Phelps Dodge spokesman told the Eastern Arizona Courier, weekly newspaper in Safford, that the shut-down had been envisioned at the start of the project and was not a "surprise" move. "We intended to suspend the project for a time in order to analyze its progress, after sufficient information was obtained."

The company official said the planned analysis is to be an "evaluation," rather than a "feasibility" study. "It's more a case of when than whether we will continue developing the mine to its production stage," he explained.

Company officials previously revealed the deposit, located several miles north of Safford on the other side of the Gila River, contains in

excess of 250 million tons of ore averaging about 0.90 percent copper.

Mining will require some form of block caving. Since the mineralization is contained in an extremely hard rock, andesite, it was decided to test how it would cave by conducting a full-scale test on a large block.

To do so, the company sank a deep shaft and drove a large footage of drifts to the orebody and then conducted the test, as well as doing considerable drilling from underground stations to evaluate the deposit.

It is understood difficulty was encountered in the test caving, but information was gained indicating an economic solution can be worked out. The general impression is that the property will become an excellent operation, but it will be up to the board of

directors to determine "when." Several months will be required to work up the detailed studies.

Phelps Dodge was one of the early arrivals in the Safford area and is believed to have the best thus far discovered. Many other companies are working in the general area and there are excellent indicators additional properties will be discovered.



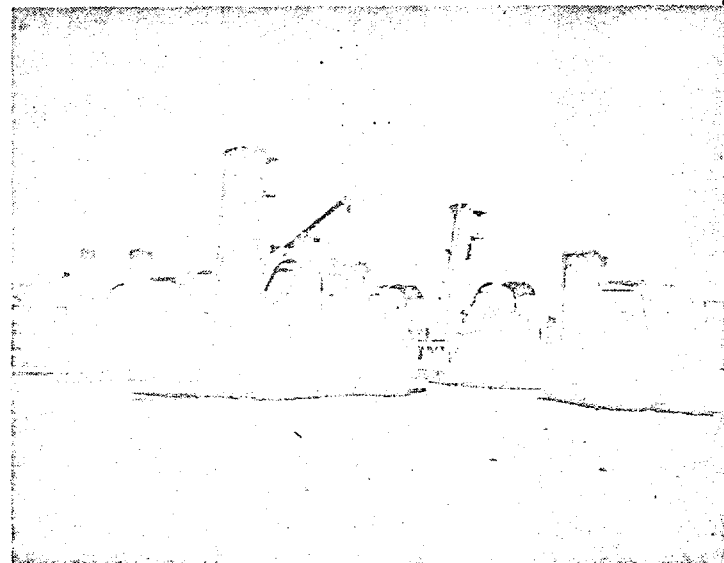
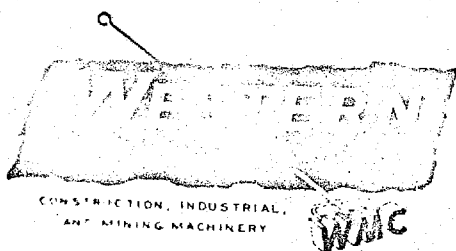
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Phone (602) 294-7677

THE ARIZONA DAILY STAR

May , 1972

Safford Copper-Mining Activity Stepped Up By Four Companies

Scouting activity and drilling in the Safford area have been stepped up in recent months as copper companies pour more money into exploration work and laboratory tests.

A spokesman for Kennecott Copper Co.'s Ray Mines Division, one of six copper organizations actively exploring in the area 124 miles northeast of Tucson, said his firm was the first to begin exploration there back in 1960.

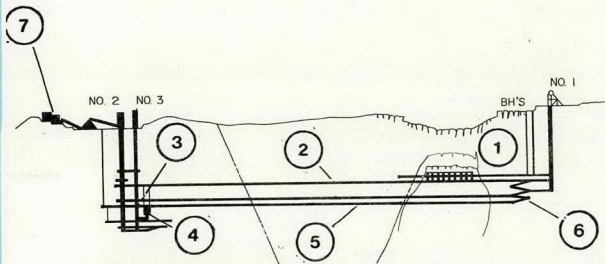
The Kennecott ore body in the Gila Mountains contains an estimated two billion tons. The company official said it is buried "damn deep" — about 5,000 feet down — and averages out to .40 per cent copper. At 50 cents a pound.

the current market price for copper, that's about \$8-billion worth of ore.

Also active in the area, known as the Lone Star Mining District, are Phelps Dodge Corp., American Metals Climax, Inc., Essex International, Inc., Inspiration Consolidated Copper Co. and Quintana Minerals Co.

Activity has been increasing steadily since Essex International opened a natural resources office at 5315 E. Broadway in September 1969. The firm uses copper as conductor material in a broad line of electrical wire and cable products made for the automotive, appliance, electronic, communications, construction and utility industries.

Tailings disposal will utilize two starter dams with a combined tailings pond capacity in excess of 400 million tons.



PRODUCTION AND DEVELOPMENT

LEGEND

- ① First Lift Cave.
- ② First Haulage Level.
- ③ Ore Passes.
- ④ Primary Crusher.
- ⑤ Second Haulage Level.
- ⑥ Ramp to Second Lift Haulage Level.
- ⑦ Concentrator.

This diagram illustrates caving of the first lift and the haulage of ore by rail to two ore passes that will lead to a primary crusher. The crushed ore is then to be hoisted up No. 2 and No. 3 Shafts to the surface.

Stope Panel

The stope panel cave system involves undercutting along the width of the ore body from the center outward and extracting the caved ore that drops into the drawbells. Rubber-tired loaders (LHDs) are used to extract the ore from drawpoints.

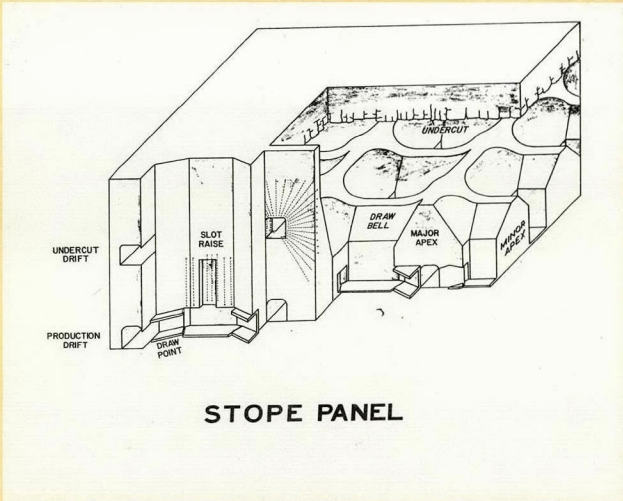
The wide openings of the drawbells provide means for boulders up to 10 feet by 15 feet by 20 feet to slip down close enough to the drawpoint so that they can be reduced in size. This reduction is accomplished by drilling and subsequent blasting of the oversized boulder. Run-of-the-mine muck is to be sized to four feet or less before extraction begins with five-yard loaders at the drawpoints.

One-way LHD hauls of ore through the production drifts will be up to a maximum of 320 feet. This muck will pass without further reduction through 8-foot diameter ore passes to 250-ton capacity trains on the rail haulage level below.

Panel development will begin with excavation of production drifts and interconnecting drawpoints. After a slot raise has been driven and enlarged, funnel-like drawbells will be drilled out from the undercut drifts and blasted just ahead of undercutting overhead.

Approximately twenty production drifts will be needed to mine out the first cave lift. At present, several production drifts are being driven concurrently with haulage level development.

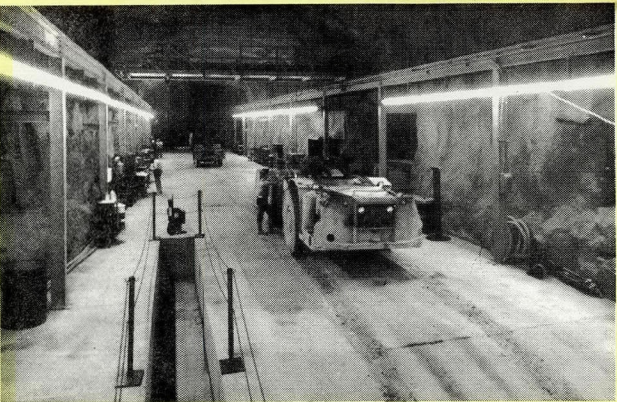
Thirty-five trackless vehicles are now in use.



The ore is expected to cave when the undercut has reached a 450-500 foot dimension in each direction.



Two boom drill jumbo, one of six used for drilling blast holes in the underground development headings.



Safford Branch employees working on a 5 yard LHD hauler in the No. 1 mechanical repair bay.

FRONT The No. 1 Shaft headframe at dawn—start of another dayshift.

The Safford Branch



phelps
dodge
Corporation

Safford, Arizona



LEGEND

- ① No. 1 Shaft Site.
- ② Ore Body.
- ③ No. 2 Shaft Site.
- ④ Concentrator Site.
- ⑤ Tailings Disposal Site.

The Mine Site

The Safford Branch of Phelps Dodge Corporation is an underground mine operation that is developing a large disseminated copper-bearing ore body. The operation presently consists of two shaft sites 10,000 feet apart which will be eventually interconnected underground. Two mine levels are currently expanding from the No. 1 Shaft. Future construction includes another shaft and several bore holes for hoisting and ventilation, a concentrator, and additional auxiliary shops and surface facilities for compressed air, water and power.

Development now proceeds at a modest rate with highly skilled crews who were transferred to the Safford Branch following the shutdown of the Bisbee mines.

Industrial water used at the mine site is pumped from the underground workings. Electrical power is generated on site.

Telephone communication is beamed to the Branch from the city of Safford by a microwave system.

Origin of a Mine

Phelps Dodge Corporation optioned the Ruskin Lines group of claims in September of 1957. Following detailed field work, geochemical sampling and interpretive geology by Richard T. Moolick, Mike Fitzgerald and Vance Bacon, the Corporation commenced exploratory drilling on November 21, 1957.

Concurrent core drilling of holes RL #1 and RL #2 encountered copper mineralization within 30 feet of the surface in both holes. The success of the initial two holes enabled Phelps Dodge to employ four drill rigs and commence accelerated exploration drilling of the property. This drilling program was conducted on an 800-foot grid spacing. The Dos Pobres Ore Body, as

it is now called, was well bracketed by 1959. As a result, the Corporation exercised its option to purchase the claim group in 1960. By January 1, 1976, more than 143,500 feet of rotary drilling and diamond core drilling had been completed in more than 50 holes.

Mineralization by iron, copper, molybdenum, gold and silver is associated with a granodioritic intrusive of highly irregular shape that has invaded the Late Cretaceous-Early Tertiary aged Safford volcanics. This mineralization occurs as a weak but persistent vein system within andesite porphyry of the Safford volcanics. The geometry of the Dos Pobres Ore Body resembles an inverted funnel with copper ore values wrapping around and over a relatively barren granodiorite stock at depth.



During the present program of mine development all men and materials enter the mine through No. 1 Shaft. The mine dump shown on the right contains over one-third million tons of stockpiled ore.

Test Block

In August 1967, following preliminary mine feasibility studies, a stope block to test cavability was designed for the center of the ore body.

The project involved sinking of the No. 1 Shaft, level and caving block development, additional core drilling and construction of a bulk sample preparation plant.

Although the 160-foot by 200-foot test block did not cave, significant information was gained on rock fabric strength, ore continuity and mining costs.

Currently the primary consideration is how coarse the rock will cave. Ore extraction designs based upon the test block results address the safety and cost effectiveness of caving the rock in the undercut panel for haulage and hoisting to the surface. The mine design is based upon handling rock as large as 4 feet in diameter.

Present Development

The Dos Pobres Ore Body has been sectioned into three vertical mine lifts. A single panel cave system will be operated for each lift. Pre-production development of the second lift will be phased in as production on the first lift is culminating.

Pre-operating development of the first lift panel is being performed concurrently with driving of the connecting drifts from No. 1 Shaft to No. 2 Shaft. All drift headings are driven by employees using rubber-tired diesel equipment.

Three haulage trains of 250 tons each will be loaded below the panels from ore chutes and will unload into the ore passes. Both operations will be conducted while the train is in motion.

A 54-inch gyratory crusher will size the coarse rock to 8 inches prior to skip loading.

The mine ventilation network will distribute 1,300,000 cubic feet per minute of air through three geographically independent ventilation systems. No mine work area will reuse vitiated air from another section of the mine. Each air supply and flow is vented to an independent exhaust system.

The No. 2 Shaft service cage will handle 200 men per trip on a double deck cage or up to 54,000 pounds on a single deck.

Ore will be conveyed from the No. 2 and the No. 3 shafts to a stockpile and transported as needed to the concentrator nearby. Waste rock will be hoisted through No. 1 or No. 2 shafts for surface disposal.

AIME

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Program	J.C. Dotson - P.S. Flores
Registration and Arrangements	J. Hrabosky

PROGRAM OF TECHNICAL SESSIONS

Monday, December 5, 1977

Marriott Hotel, Tucson
9:30 a.m. - 11:30 a.m.

OPEN PIT DIVISION

Guadalajara Room - G1

Chairman, G.E. Calahan

ASARCO, Sacaton Unit, Casa Grande, Arizona

"Coal Mining with Truck and Shovel"

Ron Hicks, Chief Engineer

Carbon Coal, Inc., Gallup, New Mexico

"Environmental Enhancement from Mining Activities"

Steven J. Kirk, Graduate Student, College of Mines

University of Arizona, Tucson, Arizona

"Safety Aspects of Operating Large Mining Trucks

in British Columbia"

Victor E. Dawson, Senior Inspector of Mines-Me-

chanical-Electrical, Department of Mines and

Petroleum Resources

Victoria, British Columbia

"Bagdad 77"

Bob Bonnis, Mine Manager

Cyprus Bagdad Corp., Bagdad, Arizona

MINERAL DRESSING DIVISION

Guadalajara Room - G2

Chairman, Gaylord W. Dopson

Magma Copper Company, San Manuel, Arizona

"The Morenci Concentrator Process Control System"

Harold R. Wampler, Metallurgical Assistant

Morenci Branch, Phelps Dodge Corp., Morenci,

Arizona

"Hecla's Lakeshore Copper Complex"

Paul M. Musgrove, Jr., Metallurgical Manager

Lakeshore Division, Hecla Mining Co., Casa

Grande, Arizona

"Oracle Ridge Project - History, Concentrator Design
and Current Status"

Richard C. Laird, Concentrator Superintendent

Oracle Ridge Mining Partners, Oracle, Arizona

"A Different Lining System for Reducing Mill Power
Consumption"

Clyde J. Wilson, Products Development Engineer

Capitol Casting Division, Midland-Ross Corp.,

Phoenix, Arizona

SMEETING DIVISION

Guadalajara Room - G3

Chairman, J.D. McCain

Magma Copper Company, San Manuel, Arizona

"Copper Production in Chile"

R. Michael Smith, Manager, South American Sales

M.H. Detrick Company, Buenos Aires, Argentina

"A Review of the Physical Chemistry of Slags"

Arturo Bronson, Assistant Professor, Metallurgical

Engineering

College of Mines, University of Arizona, Tucson,

Arizona

Marriott Hotel, Tucson

2:00 p.m. - 4:00 p.m.

UNDERGROUND MINING DIVISION

Guadalajara Room - G1

Chairman, Frank Florez

Magma Copper Company, Superior, Arizona

"Underground Nonelectric Blasting Initiation Sys-
tems"

Peter Harvey, Southwest Regional Technical Ser-
vice Representative

Ensign Bickford Co., Louviers, Colorado

"The University of Arizona's Experimental Mine"

E.P. Jucevic, Assistant Professor, Mining and
Geological Engineering

University of Arizona, Tucson, Arizona

"Fullfacer Tunnelling Machines in Underground Min-
ing"

Jack DesLauriers, Marketing Manager, Tunnelling
Division

Fullfacer Equipment Co., Atlas Copco, Inc., St. Paul,
Minnesota

MINING GEOLOGY DIVISION

Guadalajara Room - G2

Chairman, G.D. Van Voorhis

Bear Creek Mining Company, Tucson, Arizona

"Geology of the Kennecott Safford Deposit"

Donald Fountain, Senior Geologist, Ray Mines
Division

Kennecott Copper Corp., Hayden, Arizona

"Breccia Pipes"

Kenyon Richard, Consulting Geologist

Tucson, Arizona

"Volcanogenic Iron Ore of Cerro De Marcado, Durango,
Mexico"

James I. Lyons, Geologist

Bear Creek Mining Company, Tucson, Arizona

"Geology of the BS&K Mine"

Chester A. Oakley, Geologist

Minerals Exploration Company, Tucson, Arizona

HYDROMETALLURGY DIVISION

Guadalajara Room - G3

Chairman, W.S. Hannan, Jr.

Phelps Dodge Corp., Morenci, Arizona

"Gold Extraction at Round Top, Nevada"

Clem Chase

Mountain States Research and Development Corp.
Tucson, Arizona

"Copper Cementation - State of the Art"

Walter W. Fisher, Metallurgist

Bureau of Geology and Mineral Technology
Tucson, Arizona

"Metallurgy and Economics of the Sherritt-Cominco
Copper Process"

Dennis Maschmeyer

Sherritt Gordon Corp.

"Use of Electrostatic Separators to Replace Mixer
Settlers in Solvent Extraction Plants"

Bruce Sinclair and Ken Warren

C-E Natco Division, Combustion Engineering Corp.

impossible to come up with
 these theories.
 good deal high grade
 remain to be found in bk pp
 texture - all matrix fine
 crystalline - unfortunate when
 brought up by high pressure
 fluids (gas?) - flakes
 in matrix - non violent

EVENING PROGRAM
 Late stage fluidization -
 6:00 p.m. - Social Hour
 7:00 p.m. - Dinner in Ballroom
 Introduction of Guests
 Business Meeting

Banquet Speakers:
 H. Ronald Fraser, Chairman of the Board
 Hudson Bay Mining and Smelting Company, Ltd.
 Toronto, Canada
 "Copper - What's Next?"

Dr. Charles Moore, Executive Director
 INCRA (International Copper Research Association)
 New York, New York
 "Copper in Non-Traditional Applications"

9:00 p.m. - Dancing
 origin - ex solution of
 gas - liquid fine small.
 intrusions below surface.
 trace debris fine rock.
 burning at depth -
 fluids in supercritical
 temp - press conditions
 first - then later alt min

Kenneth Eafford Don Fontaine
 400 m. 72-PP
 Kern - 2 bil 141 Total cu
 ardate 800 ft thick
 Butte Fault - displ down 2000
 8000 ft - 58 my
 Post min basalt 20 my



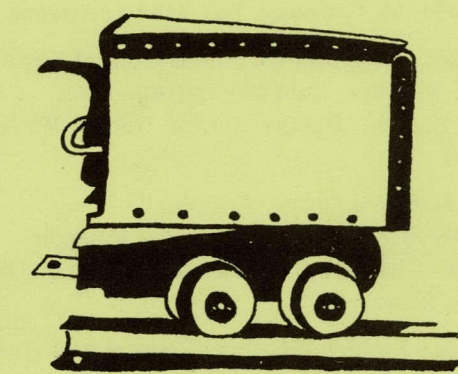
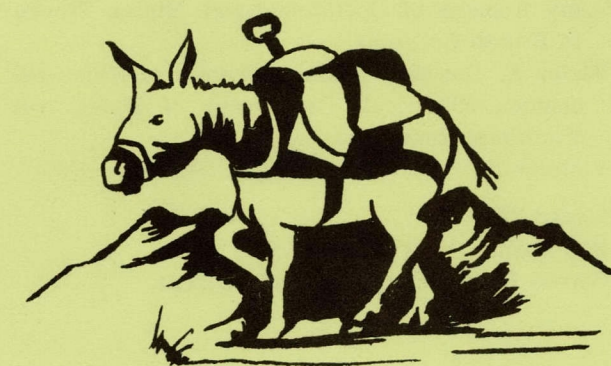
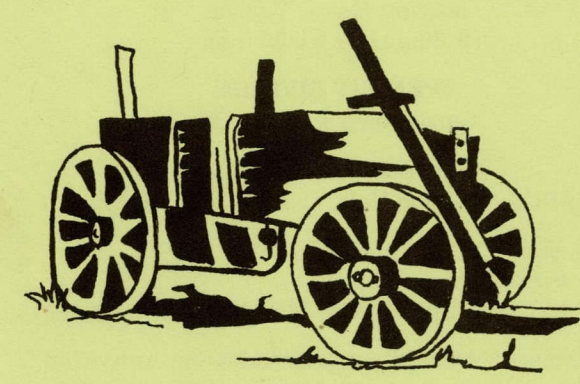
Deep drill holes hit 9 m p
 clay ser alt

Diagram showing concentric circles with handwritten notes: "inclusion core", "no signif cc zone", "biotite - 53-58 my", "2nd biotite 10 to 50? ardate".

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2700 to base of oxide

Joy L 22 L 23
 Cooper Smelter



DECEMBER 4-5
 1977

MARRIOTT HOTEL
 TUCSON

ANNUAL MEETING OF THE ARIZONA CONFERENCE
 OF

AIME

