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ASARCO **Southwestern Exploration Division** JDS

April 27, 1989

M.A. Miller

Rawhide Project
Planet District
Mohave County, AZ

Mr. Andy Nevin has supplied Asarco with some data on their Rawhide Project, which they have secured from Phelps Dodge.

Please review this data and data which Andy from time-to-time will submit (such as the full geochem and drill data of PD) and decide if:

1) The target in Section 24
2) The pediment zone of Section 24/19 might be the type Asarco should get into.

Plan on a field visit for firsthand knowledge.

Nevin's crews are presently finishing up a staking job in the area.

Also see Viva Gold Project in T12N, R14W.

JDS:mek

James D. Sell

cc: W.L. Kurtz

ASARCO

Southwestern Exploration Division — JDS

April 27, 1989

No

M.A. Miller

Did you set out there?
MAS

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Planet District
Mohave County, AZ

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... for the quarter ended be selected where geophysical anomalies are coincident

The Artillery Manganese District in West-Central Arizona

by Jon E. Spencer
Arizona Geological Survey

Pure manganese is a grayish-white metal that resembles iron, but is harder and very brittle. These two elements lie side-by-side in the periodic table of the chemical elements and have similar chemical behavior. Manganese is essential to modern industrial society. It is a strategic and critical mineral primarily required for the production of steel, but also used in other commodities, such as some types of batteries.

Manganese deposits are abundant in west-central Arizona and southeastern California, where they are scattered over an area of approximately 40,000 square kilometers, herein referred to as the western Arizona manganese province. Most of the deposits are vein deposits, which formed when mineralizing aqueous fluids filled fractures within host rocks and the minerals precipitated because of chemical or physical changes within the fluid. The greatest amount of manganese, however, is in the stratiform manganese deposits in the Artillery Mountains. Stratiform deposits are deposits that are parallel to the enclosing sedimentary beds. The origin of the stratiform manganese deposits in the Artillery Mountains is not well understood, but may be related to low-temperature, alkaline, saline water that flowed beneath playas or lakes, which were present in the area several million years ago. This same water may have caused potassium metasomatism, a chemical alteration during which the amount of potassium in the rock was greatly increased.

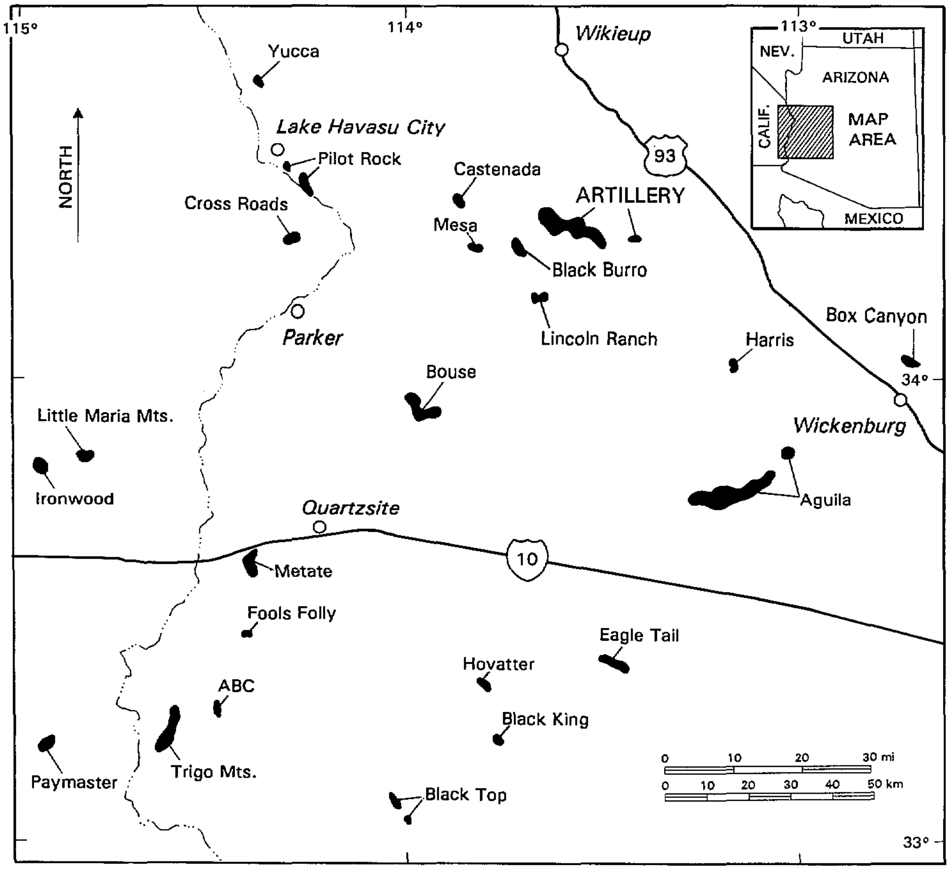

Figure 1. Mineral districts in the western Arizona manganese province that have recorded manganese production (see Table 1). Data from Davis (1957) and Keith and others (1983).

The manganese deposits of the Artillery manganese district are the largest and perhaps only significant group of manganese deposits in the United States. This technical article describes the uses and economics of manganese, as well as the geology and origin of manganese deposits within this district.

USES AND ECONOMICS OF MANGANESE

Manganese is the fourth most widely used metal in the United States, following iron, aluminum, and copper. It is an essential ingredient in steel: When added to iron, manganese acts as a deoxidizer that impedes the formation of defects ("pinholes"); combines with residual sulfur and prevents the formation of iron sulfide, an impurity that detracts from the desired metallurgical properties of steel; and improves mechanical properties, such as hardness, strength, wear resistance, and rolling and forging qualities. Manganese is also used for dry-cell batteries, ceramics, bricks, agricultural fertilizers and fungicides, water and waste treatment, fuel additives, welding, and many other processes and products (Weiss, 1977).

Virtually all manganese used in the United States is imported (90 percent) or obtained from recycling (10 percent). More than 800,000 tons of manganese were imported in 1988 (the last year for which statistics are available), primarily as manganese ore, concentrated ore, and ferromanganese. Ferromanganese is a manganese-iron alloy that contains 78 percent manganese. In 1988, approximately 416,000 tons of manganese were imported in the form of ferromanganese at a cost of $340 to $550 per ton of manganese. Most of this was imported from France and South Africa. In addition, 250,000 tons of manganese in the form of ore or concentrate, which contained an average of 48 percent manganese, were imported from Gabon, Australia, Mexico, and Brazil at a cost of about $120 per ton of manganese (Jones, 1990).

Although manganese deposits in western Arizona are not of sufficient grade or tonnage to mine them economically today, minor production from several mines in this area occurred intermittently during much of this century. Most of the production occurred between 1953 and 1955, when the U.S. government purchased manganese at depots in Arizona and New Mexico (Farnham and Stewart, 1958). Much of the manganese mined during this brief period still sits in a large black pile at a U.S. Bureau of Mines storage facility next to the railroad tracks just east of the town of Wenden in west-central Arizona. It is part of the U.S. strategic- and critical-mineral stockpile that is intended to provide domestic manganese if foreign sources are suddenly cut off.

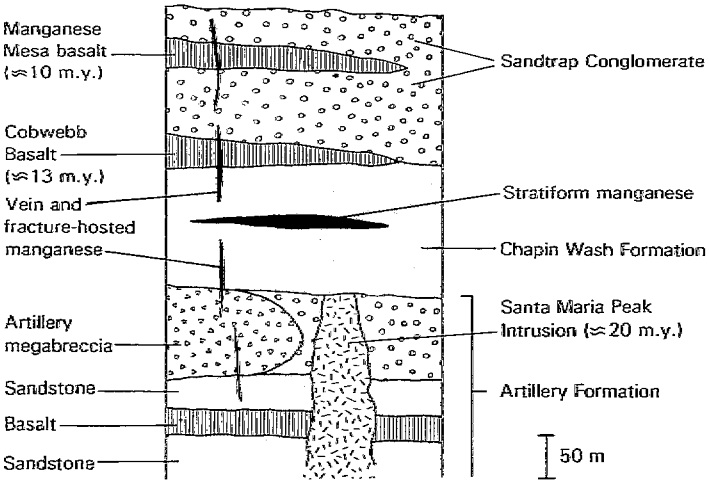

Figure 2. Schematic stratigraphic column of the upper Artillery Formation, overlying pre-Quaternary strata, and manganese deposits. Data from Lasky and Webber (1949), Spencer and others (1989a), and J.E. Spencer (unpublished data).

THE ARTILLERY MANGANESE DISTRICT

Numerous small to moderately sized, low- to medium-grade manganese deposits, many of which have recorded production (Keith and others, 1983), are present in western Arizona and southeasternmost California (Figure 1) and make up the western Arizona manganese province. Parts of the Artillery and adjacent Lincoln Ranch and Black Burro manganese districts contain stratiform manganese deposits. In contrast, virtually all other deposits in the province are vein and fracture-filling deposits that are typically associated with calcite and barite. Both types of deposits are known or suspected to be of Miocene age and probably formed during or shortly after an episode of volcanism, normal faulting, and basin formation that greatly modified the geology and landscape of western and southern Arizona (Spencer and Reynolds, 1989).

The Artillery manganese district (Figure 1) contains both stratiform and vein manganese deposits that are hosted in Tertiary strata (Figures 2 and 3). More than 95 million pounds of manganese have been produced from the district (Table 1; Keith and others, 1983).

Geologic Setting

The manganese deposits of the Artillery manganese district are within a thick sequence of sedimentary and volcanic rocks (Figure 2) that are estimated to range in age from about 8 to 25 million years (m.y.). The strata are tilted to the southwest, and the dip of the strata decreases stratigraphically upward. Strata at the base of the sequence dip approximately 30° to 40°, whereas dips at the top of the sequence are approximately 10° to 20° (Figure 3; Spencer and others, 1989a). The upward-decreasing dip of the sequence indicates that the strata were deposited during tilting.

The Artillery manganese district lies above a gently northeast-dipping, large-displacement normal fault known as the Buckskin-Rawhide detachment fault. This detachment fault is exposed along the southwestern side of the district (Figure 3). Granitic and gneissic rocks below the detachment fault were displaced out from beneath the Artillery Mountains and ranges to the east. Tilting of strata in the Artillery Mountains was related to movement on this underlying fault. Normal faulting, basin formation, sedimentation, volcanism, and formation of stratiform manganese deposits all occurred within an approximately 10-m.y. period.

The strata that make up the lower and middle part of the sequence were designated the Artillery Formation (Figure 2; Lasky and Webber, 1949). The Artillery megabreccia, an enormous, catastrophic debris-avalanche deposit that contains intact blocks of rock hundreds of meters across, forms the top unit of the Artillery Formation. The formation is overlain by the Chapin Wash Formation, a characteristically brick-red sandstone that is black where it contains stratiform manganese. The Artillery Formation is cut by an igneous intrusion at Santa Maria Peak that is, in turn, depositionally overlain by the Chapin Wash Formation. Biotite from the intrusion has been dated by the K-Ar method at 20.3 m.y. (R. Miller, oral commun., 1988). The Artillery Formation, therefore, is older than approximately 20 m.y., and the Chapin Wash Formation is younger. The Cobwebb Basalt, dated at 13.3 m.y. by the K-Ar method (Eberly and Stanley, 1978), overlies the Chapin Wash Formation, and is, in turn, overlain by the Sandtrap Conglomerate. The Manganese Mesa basalt is interbedded with the Sandtrap Conglomerate and has been dated by the K-Ar method at 9.5 m.y. (Shafiqullah and others, 1980).

Stratiform Manganese Deposits

The Chapin Wash Formation contains large, low-grade, stratiform manganese deposits that are exposed in two northwest-trending belts (Figure 3). The southwestern belt contains numerous lenses, up to several tens of meters thick, of manganiferous sandstone that are within and separated by nonmanganiferous sandstone. Little mining has occurred within this zone. The northeastern belt contains a 5-kilometer-long zone of stratiform manganiferous sandstone and siltstone that ranges in thickness from a few meters to many tens of meters. Most of the manganese is, by far, in the northeastern belt.

Lasky and Webber (1949) estimated that the Chapin Wash Formation contains a total of at least 200 million tons of material averaging 3 to 4 percent manganese, which includes about 2 to 3 million tons of material containing more than 10 percent manganese. Most of this manganese consists of very fine-grained oxides within pore spaces in sandstone and siltstone. Approximately 15 million tons of material described as "hard ore" averages 6.5 percent manganese. The hard ore is recrystallized, possibly because of interaction with ground water long after the deposit originally formed.

Table 1. Recorded manganese (Mn) production from mineral districts in the western Arizona manganese province. Data from Davis (1957) and Keith and others (1983).

MINERAL DISTRICT	COUNTY	MANGANESE PRODUCTION (LBS)
Artillery	Mohave	95,108,000
Aguila	Maricopa	42,457,000
Lincoln Ranch	La Paz	24,000,000
Paymaster	Imperial (Calif.)	24,000,000 ± 8,000,000
Ironwood	Riverside (Calif.)	12,800,000 ± 7,200,000
Little Maria Mts.	Riverside (Calif.)	10,000,000 ± 6,000,000
Bouse	La Paz	9,659,000
Cross Roads	San Bernardino (Calif.)	2,800,000 ± 1,200,000
Trigo Mts.	La Paz	2,096,500
Box Canyon	Yavapai	1,002,000
New Water*	La Paz	512,900
Black Burro	Mohave	331,000
ABC	La Paz	300,000
Planet*	La Paz	237,500
Black Top	Yuma	224,000
Yucca	Mohave	175,400
Kofa*	Yuma	148,000
Fools Folly	La Paz	105,700
Harris	Yavapai	100,500
Hovater	Yuma	93,000
Mesa	Mohave	60,000 ± 20,000
Black King	Yuma	29,000
Eagle Tail	La Paz	19,000
Bonegas	Mohave	15,000
COMBINED TOTAL		226,273,500 ± 22,420,000

*Most Mn production was as a byproduct of other metal production.

Vein Manganese Deposits

Many vein deposits of manganese oxides, calcite, and barite are within or near the northeastern belt of stratiform deposits (Figure 3). Vein deposits in the northwestern part of this belt, at the Shannon mine and along faults north of this mine, typically consist of fine-grained to microcrystalline manganese oxides and coarse white and black calcite. Manganese oxides form colloform (globular) encrustations up to 1 centimeter thick along fractures at the Shannon mine. These deposits are within the Sandtrap Conglomerate and interbedded 9.5-m.y.-old Manganese Mesa basalt (Spencer and others, 1989a).

The Priceless mine, which is near the southeastern part of the northeastern belt of stratiform manganese deposits, contains pervasive, fracture-filling, colloform manganese-oxide encrustations up to 1 centimeter thick that are composed of ramsdellite and cryptomelane. A several-meter-thick barite vein projects toward the mine from the north, but no barite is present at the mine. Near Black Diamond and Neeye mines, manganese oxides are within numerous subvertical veins of black, gray, and white calcite. Analysis of fluid inclusions within calcite, barite, and chalcedonic quartz associated with all of these vein deposits indicates that mineralizing fluids were of fairly low salinity (0 to 3 weight percent NaCl equivalent; Figure 4; Spencer and others, 1989a).

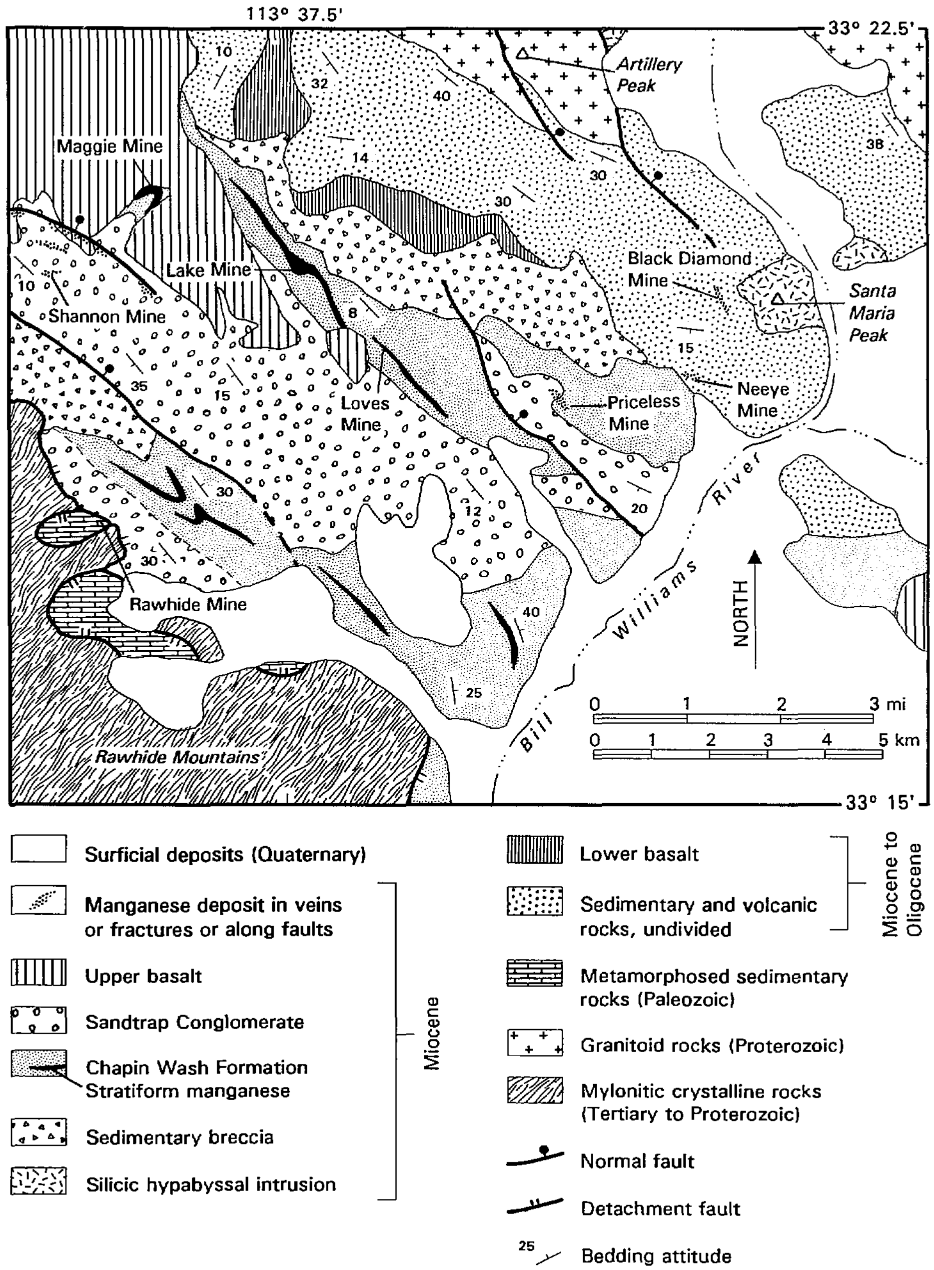

Figure 3. Simplified geologic map of the southern Artillery Mountains and adjacent areas. Data from Lasky and Webber (1949), Shackelford (1989), Spencer and others (1989a), B. Bryant (unpublished data), and J.E. Spencer (unpublished data).

Origin of Deposits

The origin of the stratiform deposits is unclear. Earlier studies (Lasky and Webber, 1949; Mouat, 1962) indicated that manganese mineralization occurred at or near the Earth's surface and that surface water eroded sandy and silty manganiferous sediments and redeposited them within less manganiferous or nonmanganiferous sediments. This indicates that manganese either was detrital (Lasky and Webber, 1949; Mouat, 1962) or was deposited by chemical processes so near the surface that manganiferous sediments were locally reworked by sedimentary processes.

The brick-red sandstone that hosts the manganese deposits in most of the Artillery Mountains is strongly altered by potassium (K) metasomatism (R. Koski, oral commun., 1991). K metasomatism is thought to occur under low-temperature conditions in the presence of saline alkaline water beneath or near lakes or playas and occurred over large areas in west-central Arizona during the Miocene (e.g., Roddy and others, 1988; Spencer and others, 1989b). In some areas, K metasomatism has completely converted rocks to an assemblage of potassium feldspar, quartz, and hematite. Because K metasomatism can chemically modify large volumes of rock and apparently removes manganese, it seems feasible that chemical and hydrological conditions associated with this type of alteration could liberate, transport, and reconcentrate manganese (Roddy and others, 1988).

The vein deposits are several million years younger than the stratiform deposits; thus, the two types are not obviously related. The spatial association of the two deposits, however, suggests that manganese in the vein deposits was derived from the stratiform deposits. This movement of manganese could be due to hydrothermal circulation associated with basaltic magmatism or to ground-water movement unrelated to magmatism. Four fluid inclusions in chalcedonic quartz from the Priceless mine formed at a minimum temperature of approximately 165°C, which is consistent with either mineralizing process. Mineralization, however, was not related to movement of basin brines (10 to 25 weight percent NaCl equivalent), such as those that caused detachment-fault-related mineralization (e.g., Roddy and others, 1988).

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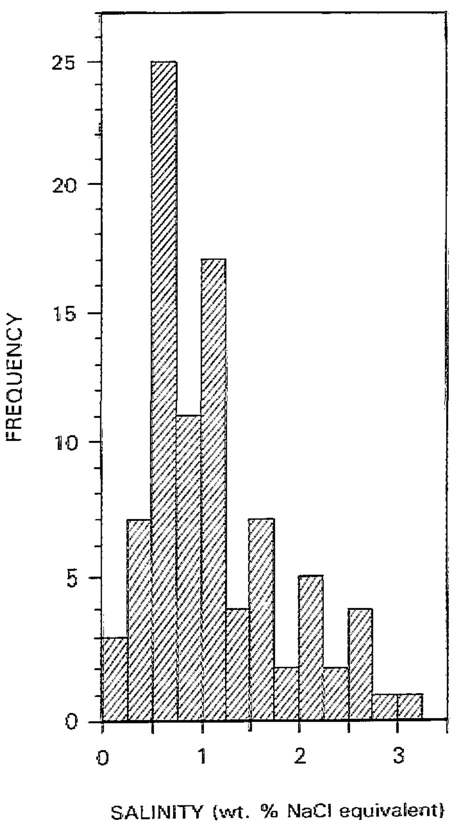

Figure 4. Histogram of fluid-inclusion salinities from vein deposits in the Artillery manganese district. Samples are from the Shannon mine area (33 inclusions in calcite), Priceless mine area (43 inclusions in barite and 4 in chalcedonic quartz), and Black Diamond mine (9 inclusions in calcite). Analyses by J.T. Duncan (unpublished data) and Spencer and others (1989a).

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Thesis Discusses Oil and Gas Potential

A new M.S. thesis by David A. Cook contains detailed information on the depositional environments and oil and gas potential of a hydrocarbon source rock in Arizona. The 800-foot-thick Walcott Member of the Kwagunt Formation (Chuar Group) was deposited in a northwest-trending rift basin on a carbonate ramp that was probably connected to the sea. Eustatic or tectonic changes in base level created alternating deposits of carbonates and organic-rich black shale. This 158-page thesis includes section descriptions from Nankoweap Butte and Sixtymile Canyon in the Grand Canyon, Rock-Eval TOC data, Van Krevlen diagrams, burial-temperature indicators, outcrop maps, and clay-mineralogy data used to predict oil potential. To purchase a copy of *Sedimentology and Shale Petrology of the Upper Proterozoic Walcott Member, Kwagunt Formation, Chuar Group, Grand Canyon, Arizona*, with color plates and vellum cover, contact David A. Cook, Dept. of Geology, Northern Arizona University, Flagstaff, AZ 86011; tel: (602) 774-3577.

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2762 W HOLLADAY ST
TUCSON, AZ 85746

Rawhide Project
Mohave Co, AZ

Andy Nevin will send more data as they get it out.

N sec 24 small target

Sec 19/24 ~~??~~ larger pediment play.

JDSell — package coming federal express 3/22

Andy Herin after Easter will be in Tucson and will have additional data

P.D. gentleman's agreement for helping development if necessary

1983 #18 #2 Arizona Field Notes

locates this prospects Cost in data being sent.

from Call from FTG

Mel copy ~~this~~ for me.

J

FEDERAL EXPRESS

3/22/89

To: JDSell

Rawhide Project
Planet District Region, Ariz

Attached report by A. Nevin given to me by Morrow Elias. Property controlled by group shown on cover. Read it and see what you think.

Nevin will be in Ariz. after Easter - I gave him your + WLK names + office phone. He has great deal of detailed info. not amenable to inclusion in summary. You can visit property with or without him - as you wish.

The Phelps Dodge deal is a gentlemen's agreement for 1st refusal at development only. Nevin told PD his group may get a major company to drill it and group would not need PD. PD said fine, they're not interested in drilling, but if money or help needed to develop, PD wanted 1st refusal then.

If you don't go further please call Nevin, tell him of your decision, and let me know. I briefed WLK by phone today.

FT Graybeal

From: L. A. POLLITT

To:

J. D. SELL

TUCSON OFFICE

EXPLORATION

GOLDSTONE SYNDICATE
P.O. Box 14230
Chicago, IL 60614
312-528-4863

CONFIDENTIAL

Memo to Partners: J. Morrow Elias
Bruce Hale
Siegfried Muessig
Bardon Stevenot
John Schulz

Re: RAWHIDE PROJECT, Progress Report

From: Andrew E. Nevin, Manager February 25, 1989

SUMMARY

The quality and quantity of information acquired from Phelps Dodge were better than expected. As a result we have acquired 88 claims by staking and 56 by option for a total of 144. All are in the Bonanza and Little Kimble mine areas, Cleopatra Mining District, Mohave County, Arizona.

The prospect is ready to drill for a detachment-type gold deposit. Shackelford, state geologists, and PD's people all recognized some degree of "stacked" detachment plates in the "basement" of the principal fault. I agree and have found that fractured and porous rocks are more prevalent in the "basement" than previously believed.

The target is premised on high geochemical gold values associated with quartz, hematite and copper oxides in the main detachment fault, other high-angle faults, fractures and veins; on mineralogic concepts developed by Dr. Sidney A. Williams and others that a magnetite zone underlies some detachment-type ore bodies; and on a 100-gamma magnetic anomaly covering a 2,000 by 5,000-foot area.

Work in progress consists of finalizing the letter-of-intent to option, recording the last of the claims staked, additional sampling and mapping, and selecting specific drill sites. I put this summary together to brief you on the project. I will be in touch by telephone for your advice.

CLAIMS

Location is 50 miles NE of Cyprus' Copperstone mine, or 5 miles west of Alamo Lake. Access is via dirt road from Yucca or Wikieup.

Sections 22, 23 and 24, T 11 N, R 14 W, are completely covered, as are parts of adjacent Sections 13-15 and 25-27, same township. 88 of these were located; 56 acquired by letter of intent to lease and option from J. Smock and E. Marsh, Valentine, AZ, and J. Carlson of Kingman. They form a solid block without known open fractions. (See the various maps.)

Terms with the lessors/optionors are a $5,000 payment due May 19, 1989; 10 year exploration lease renewable; sum of annual payments and work commitments starts at $17,000 and escalates to $24,000; upon production they get 2.5% NSR or we can buy them out for $1.25 million.

Phelps Dodge has right of first refusal at the development stage. They have no interest in proceeding at present and acknowledge our right to partners in the exploration stage.

HISTORY

Cleopatra, Rawhide, Deer Trail and Cactus Queen mines have produced small tonnages (20,000 tons estimated) of Cu, Ag, Pb and Au ores. Some of the gold ores averaged between 0.4 and 0.5 ounce per ton. Main productive zone was directly related to the regional detachment fault that separates late Paleozoic silicified cherty carbonates in the upper plate from schists, argillites, quartzites and gneisses in the lower.

In the early 1980s PD, following reconnaissance by Sid Williams, began to acquire claims and options in a block which eventually reached 20 square miles. After considerable field work, including shallow air track and rotary holes and 3 diamond drill holes, PD began to drop claims in the mid-1980s, owing to disappointing results in the northern part of the block and to personnel changes and industry conditions.

What caught our attention was that a magnetic survey had been recommended for the southern part of their block; it was run and it measured the type of anomaly they were looking for; however, it was never followed up.

GEOLOGIC MODEL

Williams and others have proposed that detachment-type ore fluids are sulfur deficient. The observed gold-hematite-quartz-copper oxide assemblage can be underlain by a magnetite alteration zone. The gold was precipitated as the fluids moved upward by the higher oxidation state in the hematite-stable zone.

Anthony Hauck and Phil Mathews of PD ran a mag survey over the southern half of the area in 1985. They used EDA equipment with base recording; they read 100-foot stations; smoothed the data with a computer program.

They reported a 100-gamma high in the center of Section 24 (bordered on the north by the Bonanza and Cactus Queen mines) and 50-gamma highs in Section 22 (west of the Little Kimble mine). These are the anomalies we propose to test.

GENERAL GEOLOGY

The main detachment surface is a well-known regional feature and I understand it is dated at 15 to 23 M.Y. In general cherty carbonates, subsequently silicified, make up the erosion remnants of the upper plate and rest on rocks mapped as "mylonitic gneisses," with or without mylonite, quartz breccia, basal Chapin Wash landslide breccias, or mineralization incorporated in the fault zone as well.

The lower plate or "basement" has not yet been scutinized as closely as the upper plate. Prior workers have mapped some imbricate faults in the "basement" and I see evidence for at least three underlying Section 24.

BASEMENT GEOLOGY

Three rock types are present:

(1) Amphibolite or chlorite-plagioclase schist; old tuff or andesite flow or sill; hard; dense; bleached near faults; present at SW corner Section 24 and w of Bonanza mine.

(2) Quartzite-argillite series; layered, only slightly schistose; often altered to K-spar, sericite, illite-type clay; sometimes dense and sometimes highly porous.

(3) Carbonate-shale or dirty limestone/dolomite series; layered; minor chert nodules; soft; usually fractured; recessive and does not crop out as much as others.

There series are usually gently dipping, cut by late high-angle faults; low-angle faults which cut into and out of the layering surfaces; high-angle silicified zones and quartz-hematite-copper oxide veins.

MINERALIZATION

PD supplied geochem and assay data in the Bonanza mine area (this material is not included in this summary). Underground sampling produced values in the range of nil to about 0.5 ounces Au per ton; surface work showed values in the range of nil to several ppm Au. They did not work very much south and west of the Bonanza mine.

Our sampling and report is included. Dump samples of the Little Kimble ran 1/4 and 1/2 ounce; one sample in a wash was anomalous. Other analyses are still pending.

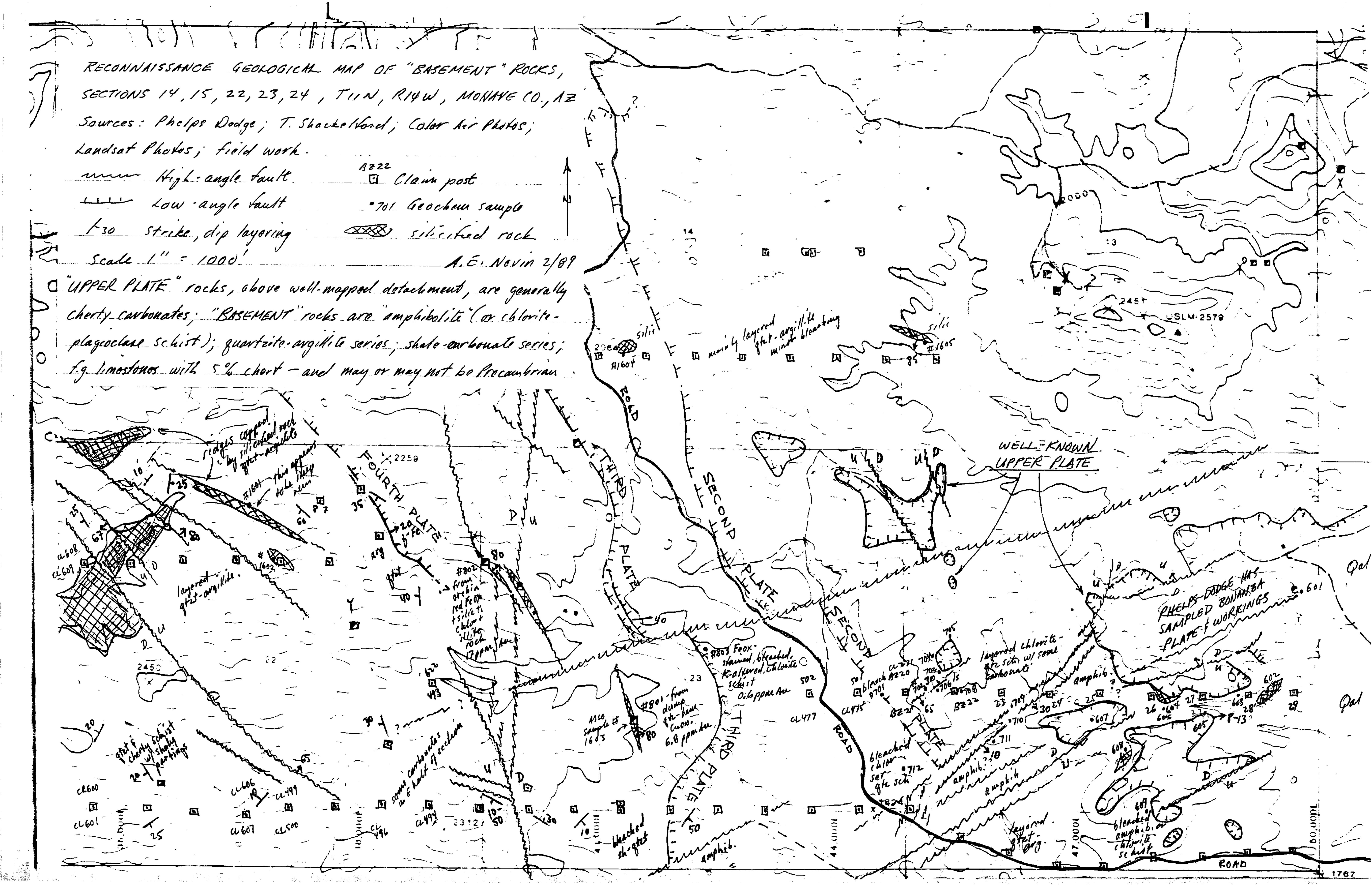
In summary: almost all quartz has some traces of iron oxides; some has cavities after hematite; some quartz is drusy and inviting, and some looks metamorphic and sterile. The bleached zones, which are common, report less than 0.01 ppm Au. Quartz-hematite reports anomalous Au, especially where the quartz is drusy or the hematite exceeds 1% and copper oxide is present.

WILDERNESS STUDY AREA

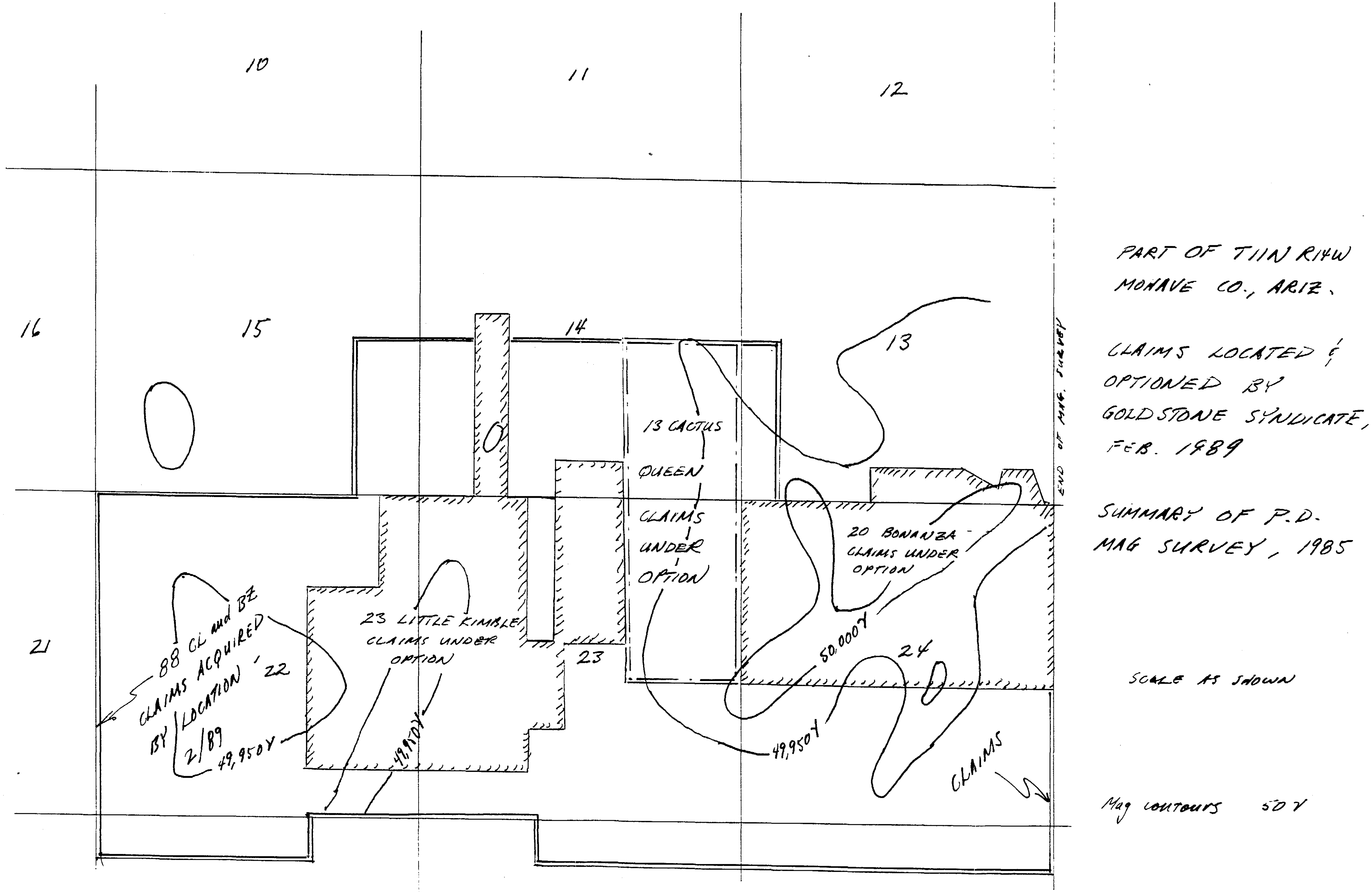
The property lies in the Rawhide WSA, but outside BLM's recommended wilderness area (see attachments).

ATTACHMENTS

Recon basement geologic map, 1:12,000
Claims and magnetic anomaly map, summary
Assay certificate
Arizona "Fieldnotes" on Copperstone and region, 3 pages
Shackelford's geologic map, 2 p.
Phelps Dodge reports:
-- June 1984 memo, 3 p.
-- Geologic map, 2 p.
-- Geochem maps, 2 p.
-- November 1984 memo, 11 p.
-- Mag lines and map, 3 p.
Nevin-PD agreement, 2 p.
BLM's EIS for WSA, 7 p.



RECONNAISSANCE GEOLOGICAL MAP OF "BASEMENT" ROCKS,
SECTIONS 14, 15, 22, 23, 24, T11N, R14W, MOHAVE CO., AZ
Sources: Phelps Dodge; T. Shackelford; Color Air Photos; Landsat Photos; field work.
High-angle fault
Low-angle fault
30 strike, dip layering
Scale 1" = 1000'
BZ22 Claim post
•701 Geochem sample
silicified rock
N
A.E. Nevin 2/89
"UPPER PLATE" rocks, above well-mapped detachment, are generally cherty carbonates; "BASEMENT" rocks are amphibolite (or chlorite-plagioclase schist); quartzite-argillite series; shale-carbonate series; f.g. limestones with 5% chert – and may or may not be Precambrian
ROAD
SECOND PLATE
THIRD PLATE
FOURTH PLATE
WELL-KNOWN UPPER PLATE
PHELPS-DODGE HAS SAMPLED BONANZA PLATE & WORKINGS
layered qtzt-argillite
mainly layered qtzt-argillite minor bleaching
layered chlorite-qtz schist w/ some carbonate
bleached chlor-ser-qtz sch
bleached amphib. or chlorite schist
bleached sh-qtzt
layered qtzt-arg.
amphib.
Qal
2000
2457
USLM 2579
2258
2450
2372
1767
14
13
22
23



10
11
12
16
15
14
13
21
22
23
24
13 CACTUS QUEEN CLAIMS UNDER OPTION
20 BONANZA CLAIMS UNDER OPTION
23 LITTLE KIMBLE CLAIMS UNDER OPTION
88 CL and BZ CLAIMS ACQUIRED BY LOCATION 2/89
49,950γ
50,000γ
CLAIMS
END OF MAG. SURVEY
PART OF T11N R14W
MOHAVE CO., ARIZ.
CLAIMS LOCATED & OPTIONED BY GOLDSTONE SYNDICATE, FEB. 1989
SUMMARY OF P.D. MAG SURVEY, 1985
SCALE AS SHOWN
Mag contours 50γ

Arizona Testing Laboratories

817 West Madison Street □ Phoenix, Arizona 85007 □ 602/254-6181

For Andrew E. Nevin, Ph.D.
Post Office Box 14230
Chicago, IL 60614

Date February 17, 1989

GOLDSTONE PROJECT
RAWHIDE MTNS,
MOHAVE CO., ARIZ.
T11N, R14W

ASSAY CERTIFICATE

LAB NO.	IDENTIFICATION	PFO[illegible]		PERCENTAGES			
		GOLD	SILVER	COPPER			
4168	81221-1	<0.1					
	2	<0.1					
	3	<0.1					
	90206-01	<0.1					
	02	<0.1					
	03	<0.1					
	04	<0.1					
	05	<0.1					
	06	<0.1					
	07	<0.1					
	08	<0.1					
	09	<0.1					
	90207-01	<0.1					
	02	<0.1					
	03	<0.1					
	04	<0.1					
	05	<0.1					
	06	<0.1					
	08	<0.1					
	09	<0.1					
	10	<0.1					
	11	<0.1					
	12	<0.1					
	90208-01	6.8					
	02	17.0					
	03	0.6					

South shaft - Little Kimble - dump. Qtz - hem - malachite

Main shaft - Little Kimble - grab from old ore bin - rich in hematite; silica, chlorite, illite, chrysocolla

Mississippi Wash, center of Sec. 23. bluff of hematite-stained rock: chlorite schist altered w/ qtz, k-spar, sericite, illite.

< = less than the detection limit given

Respectfully submitted,

ARIZONA TESTING LABORATORIES

Claude E. McLean, Jr.

Arizona Bureau of Geology and Mineral Technology
FIELDNOTES
Vol. 18, No. 2 Summer 1988

The Copperstone Mine: Arizona's New Gold Producer

by Jon E. Spencer
and John T. Duncan
Arizona Geological Survey

and William D. Burton
Cyprus Minerals Company
P.O. Box 3299
Englewood, CO 80155

Arizona's annual gold output will almost double in 1988 as a result of production from Cyprus Minerals Company's Copperstone gold deposit in La Paz County, west-central Arizona. During 6 years of expected mine life, the deposit is predicted to yield approximately 510,000 troy ounces of gold worth $230 million, based on a value of $450 per ounce. Unlike many recent gold discoveries in the Southwest, Copperstone is a new discovery in an area not previously identified as a mineral district. In this article, the geology and regional setting of the Copperstone deposit are described. Although the deposit is still not completely understood, enough is known to warrant reassessment of estimates of mineral-resource potential in west-central Arizona.

Regional Geologic Setting

West-central Arizona and adjacent areas of California and southern Nevada contain some of the most spectacularly exposed detachment faults in the world. The term "detachment fault" is commonly applied to large-displacement, gently dipping (inclined) normal faults. In this region, hanging-wall rocks, or rocks overlying the detachment faults, were displaced northeastward relative to footwall rocks, rocks that underlie the faults. The faults originally dipped to the northeast, but are now rotated and warped to form undulating surfaces that are nearly horizontal over large areas.

The north- to northeast-dipping Moon Mountains detachment fault, exposed at the northern tip of the eastern Moon Mountains, separates two large, geologically distinct areas: to the northeast lie numerous detachment faults, such as those in the Buckskin, Rawhide, and northern Plomosa Mountains; to the south, in the Dome Rock, southern Plomosa, and most of the Moon Mountains, detachment faults are absent. The Copperstone gold deposit lies within the hanging wall of the Moon Mountains detachment fault and flanks the area of pervasive faulting.

Miocene (5- to 24-million-year [m.y.]-old) detachment faults in west-central Arizona are associated with numerous copper, iron, and gold deposits, especially in the Buckskin and Rawhide Mountains, that have yielded metals worth many millions of dollars (Figure 1; Table 1; Wilkins and Heidrick, 1982; Spencer and Welty, 1986). Copper-gold deposits associated with detachment faults typically lie along or within a few tens of meters of the faults; a few, however, are hundreds of meters above the faults. Detachment-fault deposits contain fractures and thick, irregular zones that are commonly filled with the minerals specular hematite, chrysocolla, quartz, barite, fluorite, calcite, and manganese oxides. Pyrite and chalcopyrite, which are commonly oxidized, are also present in many deposits.

The northeastern tip of the Moon Mountains is primarily composed of Mesozoic (63- to 240-m.y.-old) granitic rocks that form the footwall of the Moon Mountains detachment fault. Hanging-wall rocks are mostly metamorphosed Jurassic (138- to 205-m.y.-old) volcanic rocks. Older (Paleozoic; 240- to 570-m.y.-old) metamorphosed sedimentary rocks that are brecciated (composed of

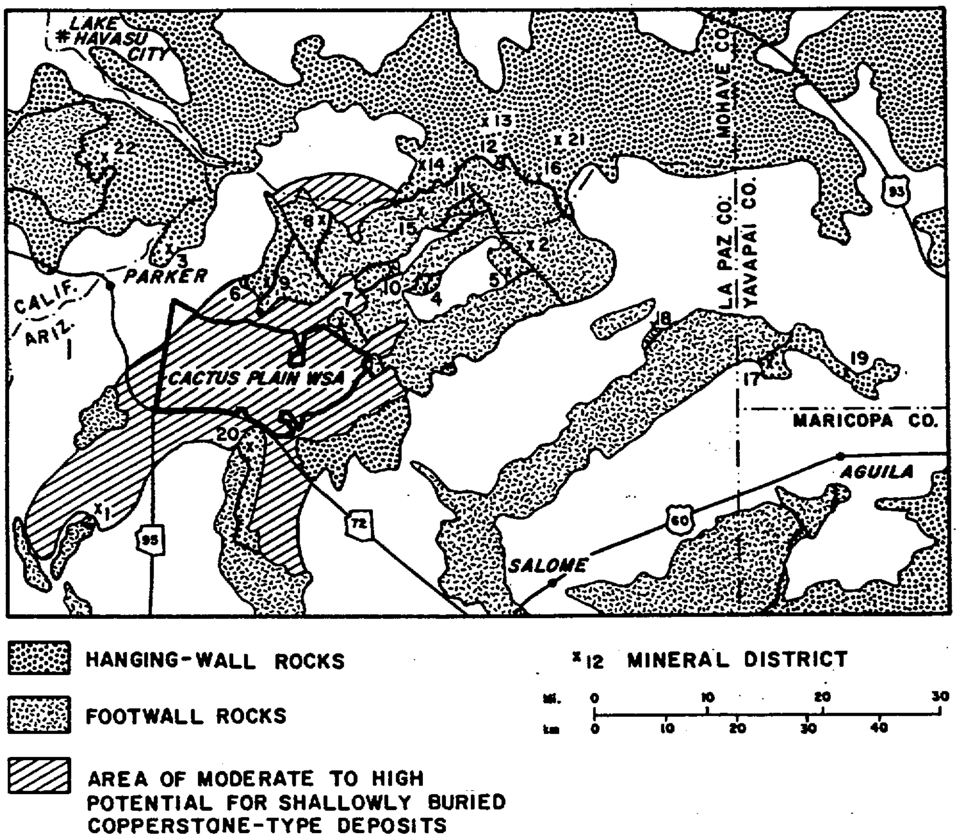


Figure 1. Map of part of west-central Arizona showing mineral districts where mineral deposits are known or suspected to be related to detachment faults. Middle Tertiary and older rocks are divided into hanging wall and footwall rocks, which lie above and below, respectively, regionally northeast-dipping detachment faults. Also shown is the outline of the Cactus Plain and Cactus Plain East Wilderness Study Areas. Numbers refer to mineral districts listed in Table 1.

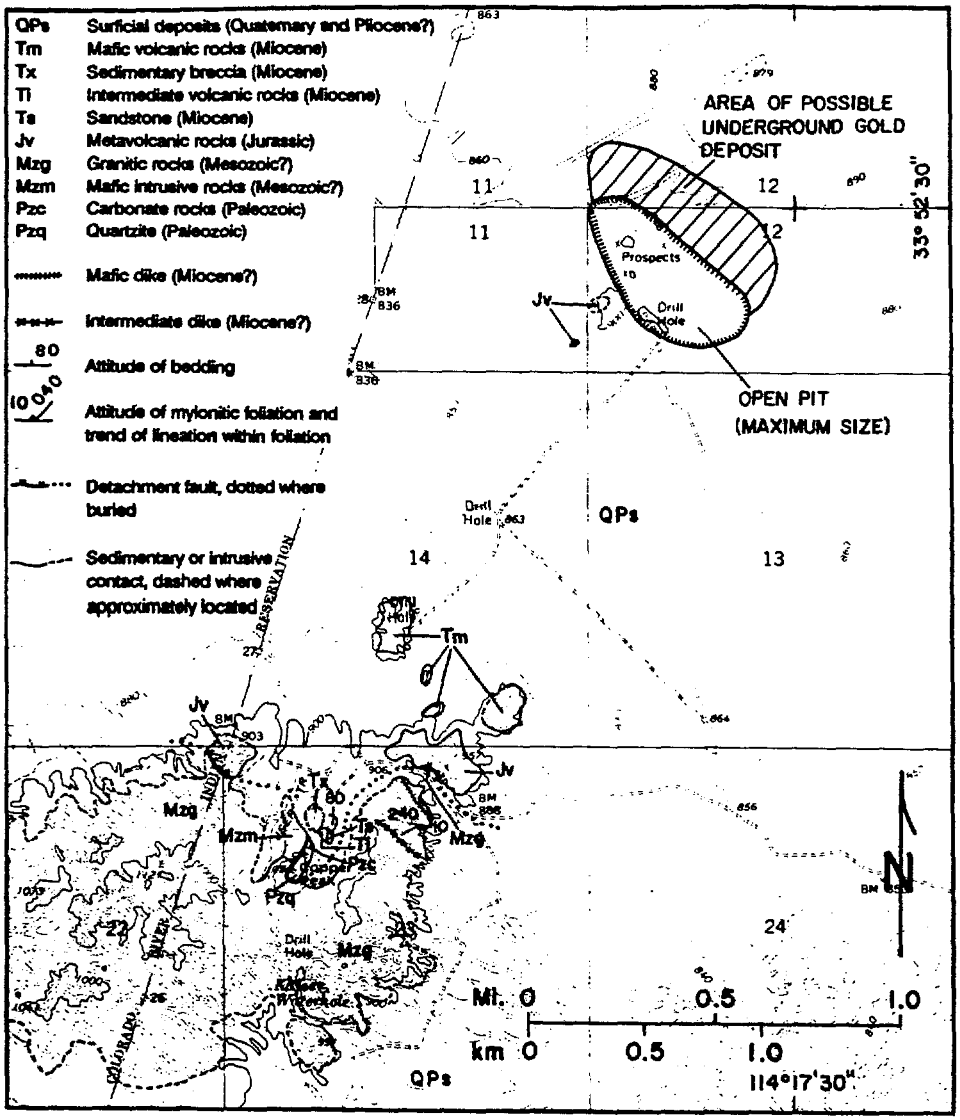


Figure 2. Geologic map of northeastern Moon Mountains showing location of Copperstone mine.

broken rock fragments) underlie Copper Peak; steeply dipping, younger (Miocene) volcanic and sedimentary rocks, including sedimentary breccias derived from the Jurassic volcanic rocks, are also present adjacent to Copper Peak (Figure 2). The copper-iron mineralization that characterizes detachment-fault deposits elsewhere in west-central Arizona is also evident in brecciated rocks along the Moon Mountains detachment fault at Copper Peak and at the edge of the Colorado River Indian Reservation.

Geology

The Copperstone mine is approximately 1½ miles northeast of exposed bedrock in the northeastern Moon Mountains (Figure 2). Bedrock exposures in several very small hills surrounded by alluvium contain evidence of gold mineralization and led to the discovery of the Copperstone deposit. Mineral deposits are present above and along a gently dipping contact that is probably a fault; the contact separates Jurassic metamorphosed volcanic rocks and overlying sedimentary breccias derived from them. The mineralized contact zone dips approximately 30° to the northeast, extends horizontally for 3,000 feet and at least 1,000 feet down dip, and is generally several tens of feet thick. The sedimentary breccia and a volcanic rock that contains vesicles (relict gas bubbles) are almost certainly Miocene in age and are mineralized, indicating that mineralization is Miocene or younger.

Drill-core samples reveal that some brecciation occurred after quartz veins were formed; however, numerous northwest-trending quartz-amethyst veins exposed in the mine pit are not brecciated. Steeply dipping, northwest-striking fractures and narrow shear zones exposed in the mine pit locally cut quartz-amethyst veins and contain subhorizontal slickenside lineations, which are smooth and polished striations that result from friction along a fault plane.

Gold is present where quartz and specular hematite are abundant in the breccia zone and locally within veins in the metamorphosed volcanic rocks. Chrysocolla, barite, earthy red hematite, and malachite are also common in the gold-mineralized zone. Fluorite, adularia, magnetite, calcite, chalcopyrite, pyrite, and manganese oxides are present in smaller quantities. Gold, however, is rarely visible. The presence of quartz, hematite, and chrysocolla is a good indicator of gold mineralization.

Fluid-Inclusion Characteristics

Fluid inclusions are bubbles of liquid and gas that are commonly trapped inside minerals during mineral formation. The composition of fluid inclusions in mineral deposits reflects the composition of the aqueous fluids that formed the deposits. One can determine the salinity of the inclusions by determining the freezing temperature of the fluid within them. The minimum temperature of the fluid at the time it was trapped can be determined by heating the sample until the two phases (liquid and gas) in the inclusion become one. Fluid inclusions in quartz-amethyst from the Copperstone mine contain between 16 and 22 percent sodium-chloride equivalent (by weight) and were trapped at minimum temperatures between 200° and 260° C. These characteristics are similar to those of other mineral deposits along Miocene detachment faults in west-central Arizona, but are substantially different from those of most other types of deposits, such as epithermal-vein gold deposits (Figure 3; Wilkins and others, 1986).

Origin

The following characteristics of the Copperstone deposit suggest that it originated from the same processes that formed mineral deposits along numerous other Miocene detachment faults: (1) fluid-inclusion salinities and temperatures of entrapment; (2) abundant specular hematite with less abundant copper minerals such as chrysocolla, malachite, and chalcopyrite; (3) geographic proximity to a detachment fault; and (4) probable Miocene age. Two characteristics of the Copperstone deposit, however, differ from those of other detachment-fault deposits: abundance of quartz-amethyst veins and abundance of gold. These authors believe that most evidence at the Copperstone deposit supports a relationship between mineralization and detachment faulting.

A working model for the origin of the Copperstone deposit is as follows: hot, saline, aqueous fluids containing dissolved gold, copper, iron, and other elements moved updip along the north- to northeast-dipping Moon Mountain detachment fault. These fluids encountered highly porous and permeable sedimentary breccias in the hanging wall of the detachment fault and began ascending through the breccia zone. As a result of cooling or mixing with more oxygen-rich, shallow-level ground water, largely within the sedimentary breccias, gold and

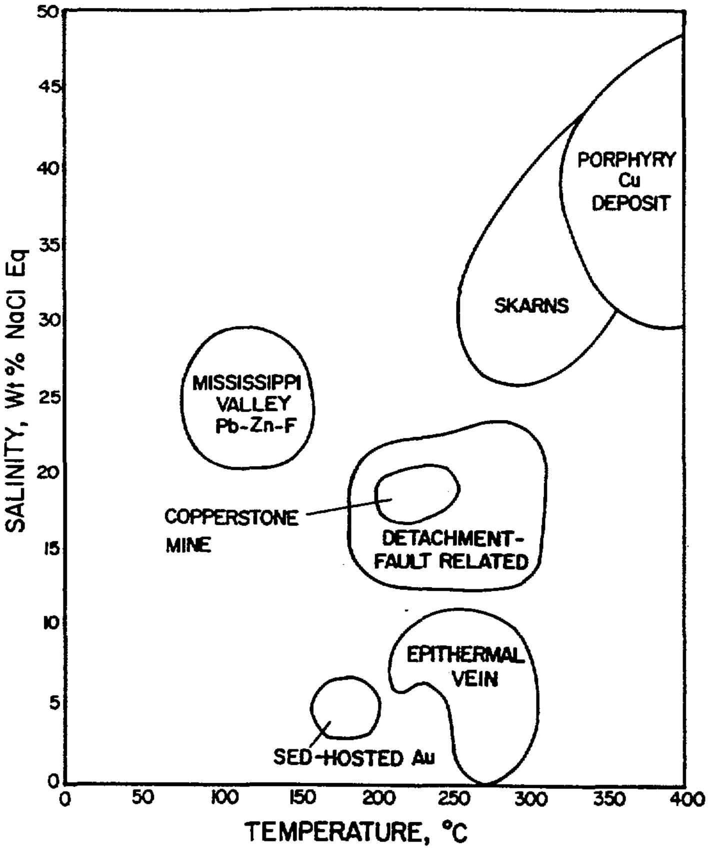


Figure 3. Diagram of salinity and homogenization temperature fields for fluid inclusions from several major mineral deposits, including those associated with detachment faults. Fluid inclusions from the Copperstone deposit clearly fall within the field of other detachment-fault-related deposits. Many geologists suspected that the Copperstone deposit was an epithermal-vein deposit, as are many other gold deposits in the Southwest; fluid-inclusion data, however, strongly suggest otherwise. Modified from Wilkins and others (1986), with additional data from the Copperstone mine.

Table 1. Value of production for commodities from mineral districts in west-central Arizona that are known or suspected to be related to detachment faults. Manganese mineral deposits, although not clearly understood, are suspected to be related to detachment faults. District locations are shown on Figure 1.

District	Commodities*	1986 Value**
1. Copperstone	Au (reserves)	$189,306,900
2. Alamo	Cu, Pb, Ag, Au	72,303
3. Cienega	Cu, Ag, Au	5,571,167
4. Clara	Cu, Ag, Au	3,066,661
5. Lincoln Ranch	Mn	18,960,000
6. Mammon	Cu, Ag, Au	93,913
7. Midway	Cu, Ag, Au	43,743
8. Planet	Cu, Ag, Au	12,771,828
9. Pride	Cu, Ag, Au	37,679
10. Swansea	Cu, Ag, Au	17,471,085
11. Black Burro	Mn	261,490
12. Cleopatra	Cu, Pb, Ag, Au	1,118,459
13. Lead Pill	Cu, Pb, Ag, Au	303,365
14. Mesa	Mn	47,400
15. Owen	Cu, Pb, Zn, Ag	107,561
16. Rawhide	Cu, Pb, Zn, Ag	116,573
17. Bullard	Cu, Ag, Au	1,763,481
18. Burnt Well	(unknown)	(minor)
19. Harris	Mn	79,395
20. Northern Plomosa	Cu, Pb, Ag, Au	2,123,413
21. Artillery	Mn	75,135,320
22. Whipple	Cu, Pb, Zn, Ag, Au	683,550
TOTAL		$329,135,287

* Ag = silver; Au = gold; Cu = copper; Mn = manganese; Pb = lead; Zn = zinc.
** Values do not add to total because of rounding.

other elements precipitated from the fluids to form the Copperstone deposit.

Implications for Land-Use Planning and Management

The presence of the Copperstone gold deposit in a geologic setting that is characteristic of large areas of west-central Arizona indicates that the mineral-resource potential of this area in the State is greater than previously suspected.

The Copperstone deposit was probably not discovered until recently because it was almost entirely concealed by young surficial deposits. Undiscovered mineral deposits similar to Copperstone may also be concealed beneath other surficial deposits, such as those covering nearby Cactus Plain (Figure 1). Application of more sophisticated geophysical techniques may eventually result in discovery of such deposits. Many areas in west-central Arizona, such as the Cactus Plain and Cactus Plain East Wilderness Study Areas, are presently under consideration for Federal wilderness-area status. If designated to be managed as wilderness, these areas would no longer be open to mineral exploration or mining activity.

Mineral deposits associated with detachment faults have only been recognized as a distinct deposit type during the past 10 years. The recent discovery of the Copperstone deposit and recognition of its association with a detachment fault are generating renewed interest in detachment-fault-related deposits and in areas where such deposits might be located. Future improvements in our understanding of Arizona geology and future mineral-deposit discoveries will undoubtedly lead to renewed interest in areas that presently receive little attention from research or exploration geologists.

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Wilkins, Joe, Jr., Beane, R.E., and Heidrick, T.L., 1986, Mineralization related to detachment faults; a model, *in* Beatty, Barbara, and Wilkinson, P.A.K., eds., Frontiers in geology and ore deposits of Arizona and the Southwest: Arizona Geological Society Digest, v. 16, p. 108-117.

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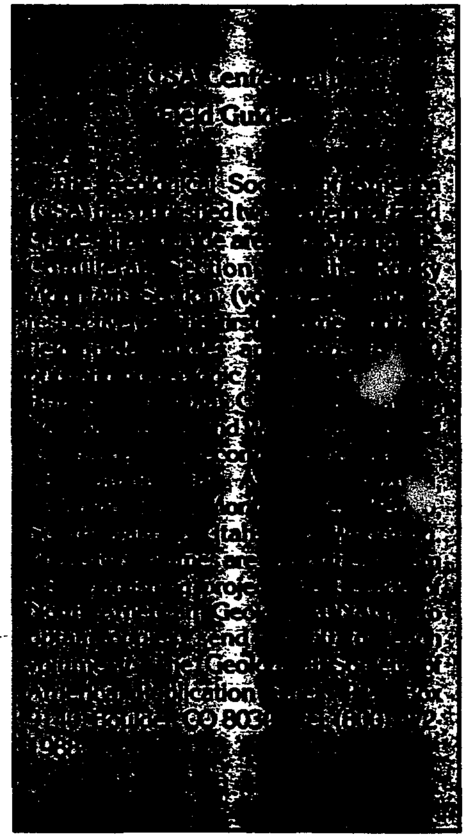
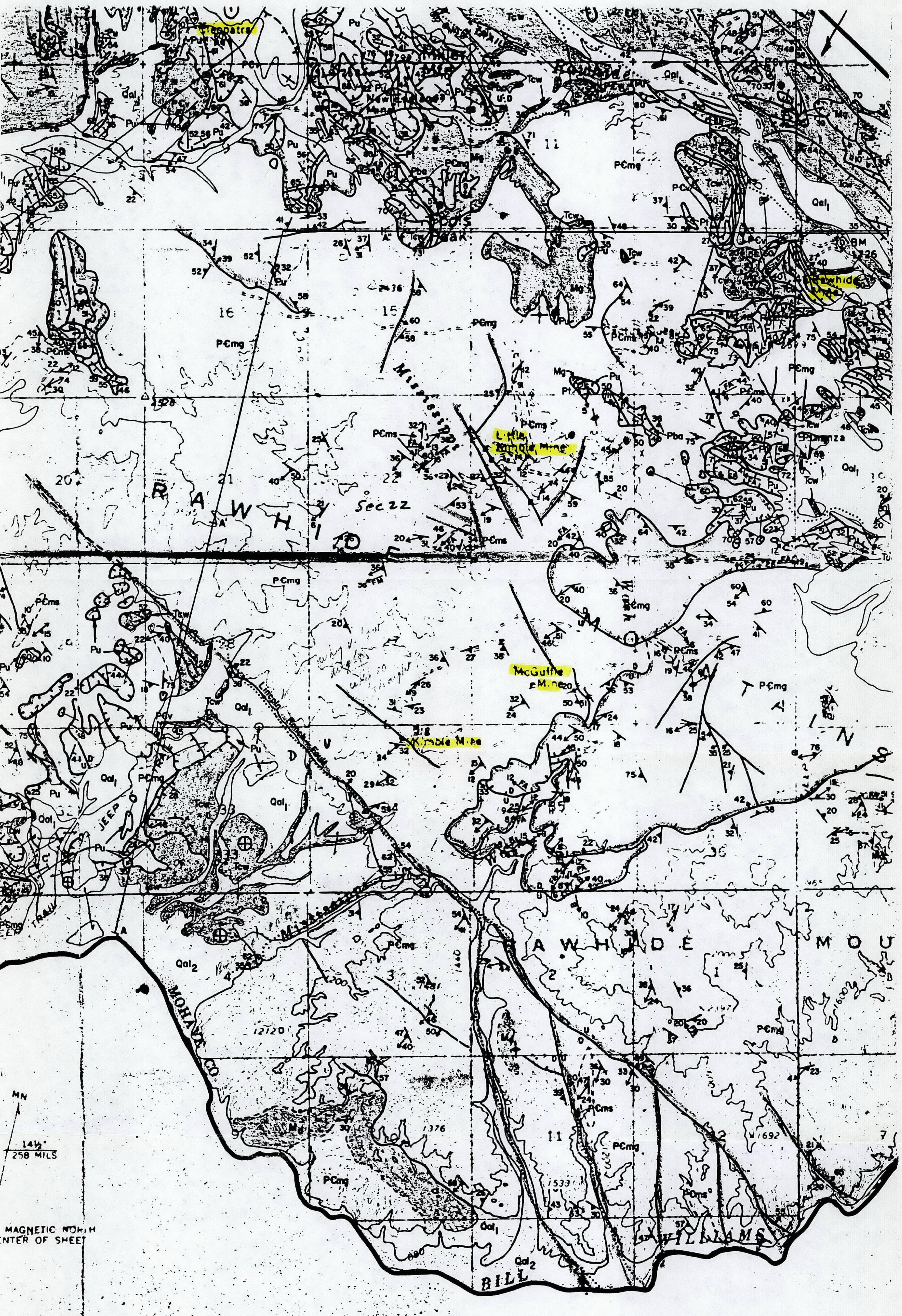
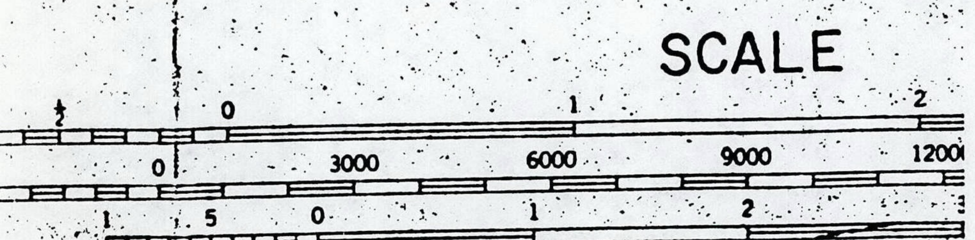






Part of Terry Shackelford, 1975, Geol. Map. as reproduced by S.J. Reynolds

STEPHEN J. REYNOLDS

PLATE I
E RAWHIDE MOUNTAINS, MOHAVE COUNTY, ARIZONA

by
Terry J. Shackelford
1973-1975

EXPLANATION

QUATERNARY

Qal2 — Alluvium of modern washes

Qal1 — Younger alluvial fans and talus

Qts — Older alluvium: buff colored, well consolidated

TERTIARY

Tb — Late Tertiary basalt: vesicular, olivine-bearing

UNCONFORMITY

Tcw — Chapin Wash Formation: red clastic sedimentary rocks, basalt, latite, monolithologic breccia, and sedimentary manganese; b = basalt

Tv — Miocene(?) volcanics: gray to yellow felsite and tuff

Ta — Artillery Formation: varicolored conglomerates, arkoses, siltstones, and limestones

MESOZOIC

Md — Hornblende diorite: dark green, medium to coarse-grained (green)

Mg — Alkali granite: red-brown to green, coarse-grained, highly sheared (red, scarlet)

Mqm — Quartz monzonite: light green, medium-grained, biotite, foliated outer margin (dk red, carmine)

PALEOZOIC

Pu — Paleozoic rocks, undifferentiated: consists of brown, white, and gray limestone and dolomite with interbedded white quartzite and green phyllite

Pba — Bright Angel Shale(?): green to purple phyllite with thin interbedded limestones and quartzite

Pt — Tapeats Sandstone(?): gray to red-brown quartzite, fine to coarse-grained, minor cross-bedding

PRECAMBRIAN or MESOZOIC

P€v — Metavolcanics: metadacite to metabasalt flows with interbedded metatuffaceous sandstone and metagraywacke

PRECAMBRIAN

P€bg — Biotite granite: red-brown, coarse-grained, microcline phenocrysts (gray)

P€gg — Granitic gneiss: light pink to green, highly sheared and weathered

P€mg | P€ms — Mylonitic gneiss: banded gneiss, well-developed foliation and lineation
P€mg: quartzo-feldspathic gneiss, augen of k-feldspar
P€ms: marble, calc-silicates, and quartzite

Contact
dashed where approximately located

U 50 D
Fault, showing dip
dashed where approximately located; dotted where concealed; U, upthrown side; D, downthrown side; arrows indicate relative direction of lateral movement

10
Gravity slide, showing dip
dashed where approximately located; dotted where concealed; teeth on upper plate

B — horizontal; 19 FA — inclined
bearing and plunge of structural features
B, long axis of boudins; FA, B1 minor fold axis; FM, fold mullion

horizontal; 25 inclined; vertical; 58 overturned
strike and dip of beds
top of beds generally not known in pre-Tertiary rocks

horizontal; 31 inclined; vertical
strike and dip of foliation

horizontal; inclined
bearing and plunge of mineral lineation

Combined linear and planar symbols indicate that linear feature lies within the planar structure.

hhh
hematite
supergene concentrations of specular hematite

Part of Terry Shackelford, 1975, Geol. Map. as reproduced by S.J. Reynolds cc: NLC 7/2/84

phelps dodge Corporation • INTEROFFICE CORRESPONDENCE

ccpls →

RBL ✓	AMH
CFA	RTB
BSK	JPM
DAS	WDB
JED	GCC
JDF	EGW
JSL	VAW
HAM	RKZ
RWL	NMP
	RBR

DATE: June 20, 1984

FROM: R. K. Zimmerman

TO: J. D. Forrester

RE: Recommendations for Cleopatra Project, AZ 220

Introduction

As we have discussed, expenditures to date attributable to the Cleopatra Project are insufficient to fulfill the 1984 assessment requirement necessitating further work or abandonment of some claims. It seems appropriate to review at this time not only what need be done for the current assessment year, but also what the long term evaluation strategy might be. Among the factors that should be considered in the planning process are: 1) that the mineralization at Cleopatra is of a type which can be quite important economically and toward which we are planning to direct considerable reconnaissance work; 2) that while we can identify mineralization of this type quite easily, we do not know what the essential criteria are by which to separate major deposits from minor occurrences; and 3) that 495 of the claims in the Cleopatra block were acquired barely a year ago and efforts to evaluate their mineral potential have been limited. All of these factors suggest that our approach should be systematic, well planned, and thorough in order to maximize our understanding of the deposit type and to enhance exploration effectiveness locally and in the region.

Recent Developments

Since the 1983 annual progress report was written, the size and grade potential of the target type has been clarified by acquisition of information on Amoco's Copperstone discovery south of Parker, Arizona and by discussions with Dr. S. A. Williams. The Copperstone deposit is reported to be at least 4 million tons of surface minable material at a grade of about 0.10 ounce per ton. The flat-lying mineralized zone is about 50 feet thick over a minable area 1,200 feet x 800 feet. The deposit continues to depth, so is geologically larger than the above tonnage. Dr. Williams has information derived from work for other clients that suggests these deposits can grade up to 0.33 ounce gold per ton with tonnages in excess of 50 million.

The arroyo sediment survey is now complete and analysis of the results leads to the following conclusions. 1) Anomalous gold values are confined to areas known to be mineralized, relieving any lingering doubts that there are any mineralized areas exposed on the surface which we have overlooked. 2) Lead anomalies, which are believed to be upper level manifestations gold mineralization, are present in the northern part of the claim block, Section 34, T.12N., R.14W., and on the southern border of the block, Section 23, T.11N., R.14W. The Section 34 anomalies coincide with an area which produced anomalous silver values from claim validation sampling, supporting the inference of gold mineralization at depth.

Target Selection

The two criteria necessary for devloping drilling targets on the property are: 1) the presence of a major low-angle structure of a size sufficient to host a body of economic proportions, and 2) some indication that this structure is mineralized. Geologic mapping provides us with numerous areas for which the first criterion is fulfilled; the second criterion is the crux of the problem in target development.

Two major hosting structures are known in the Cleopatra area, and at least one more is indicated. The known hosts are the detachment fault and the thrust fault which places Paleozoic sediments over the Mesozoic sequence. Exposed mineralization along both of these structures is limited in scope and discontinuous, providing no clear leads to follow under cover. If economic mineralization is present, these exposed examples are either satellitic or high-level manifestations of the orebody, requiring that our search be expanded laterally and to depth from known indications. Other flat-lying structures may be present at reasonable depths as exemplified by the exposure of such a structure in Section 35, T.11N., R.14W., south of the claim block. This horizon projects under our property at reasonable depth (<1,500 feet) and could be the source of the Section 23 lead anomalies disclosed by the arroyo sediment survey. Stacked structures are common in the region and several may host economic mineralization.

Recommendations

Work recommended to complete the next phase of evaluation at Cleopatra includes performance of a ground magnetic survey and core drilling of six specific target areas. Completion of these tasks should provide sufficient information to bring us to the next decision point.

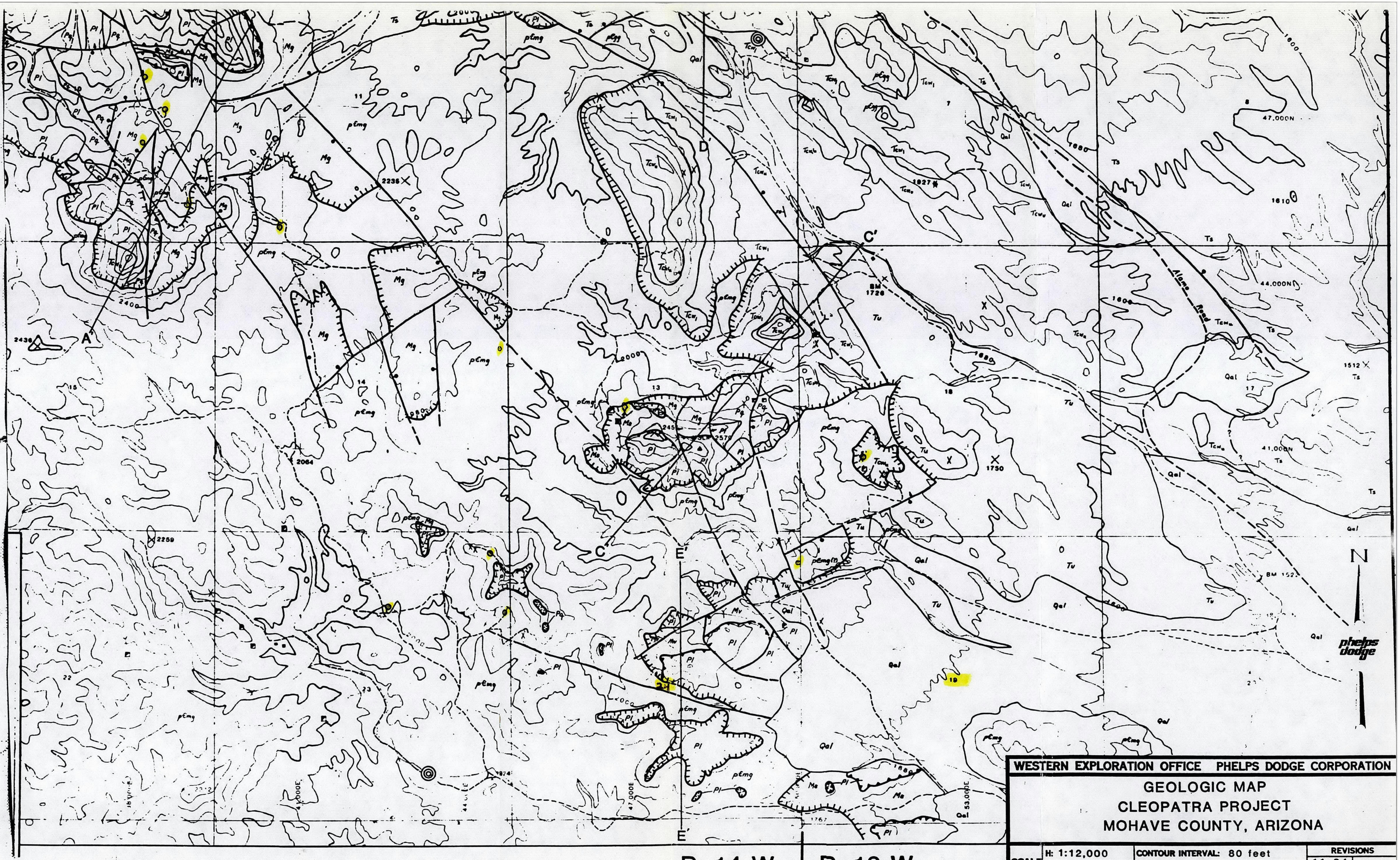
A magnetic survey is recommended for the south part of the property where there are indications of buried, mineralized structures as mentioned above. The area recommended for such a survey is included in Sections 11, 13, 14, 15, 22, 23, and 24 of T.11N., R.14W., wherein the bedrock is composed of mylonitic gneiss. The survey should be easy and inexpensive to run and Dr. S. A. Williams implied the technique had been used successfully elsewhere. The mylonitic gneiss is mafic-poor, presenting a low background value over which anomalous values should be in marked contrast. Any anomalies so derived could then guide what would otherwise be blind drilling.

Core drilling is recommended rather than percussion methods because intact samples provide so much more information about such factors as the presence of major faults, character and intensity of fracturing, and lithology and lithologic changes. The six target areas recommended for drilling (see attached map) are given as follows in order of priority: 1) one hole about 750 feet in depth located to the northeast of hole C-48 to test the lateral extent of mineralization at the Cleopatra Mine and also to test the detachment surface below; 2) a hole about 1,500 to 2,000 feet deep in Section 34, T.12N., R.14W., to test the detachment surface at depth beneath the area of the lead and silver anomalies mentioned earlier; 3) a 500 to 750 foot hole in the Rawhide North area to test the detachment surface beneath this area of scattered, widespread mineralization; 4) a hole about 1,000 feet deep in the southwest part of the claim block (Section 23, T.11N., R.14W.) to explore buried, flat-lying structures in the vicinity of the above mentioned lead anomalies in that area; 5) one or two 200-foot holes in the Bonanza Mine area to test the extent of high grade gold mineralization exposed in the workings and to test the detachment surface beneath those workings; and 6) a 200 foot hole in the Cactus Queen area to test the extent of mineralization in both the Mesozoic metasediments and the underlying detachment surface.

The proposed drilling, if performed near the end of August, would fulfill assessment work requirements for 1984 and 1985. Only rehabilitative road work and site preparation would be required, except for the hole(s) in the Bonanza area, which would require 24 hours or so of road building.

RKZ:cc

Attachment



WESTERN EXPLORATION OFFICE PHELPS DODGE CORPORATION

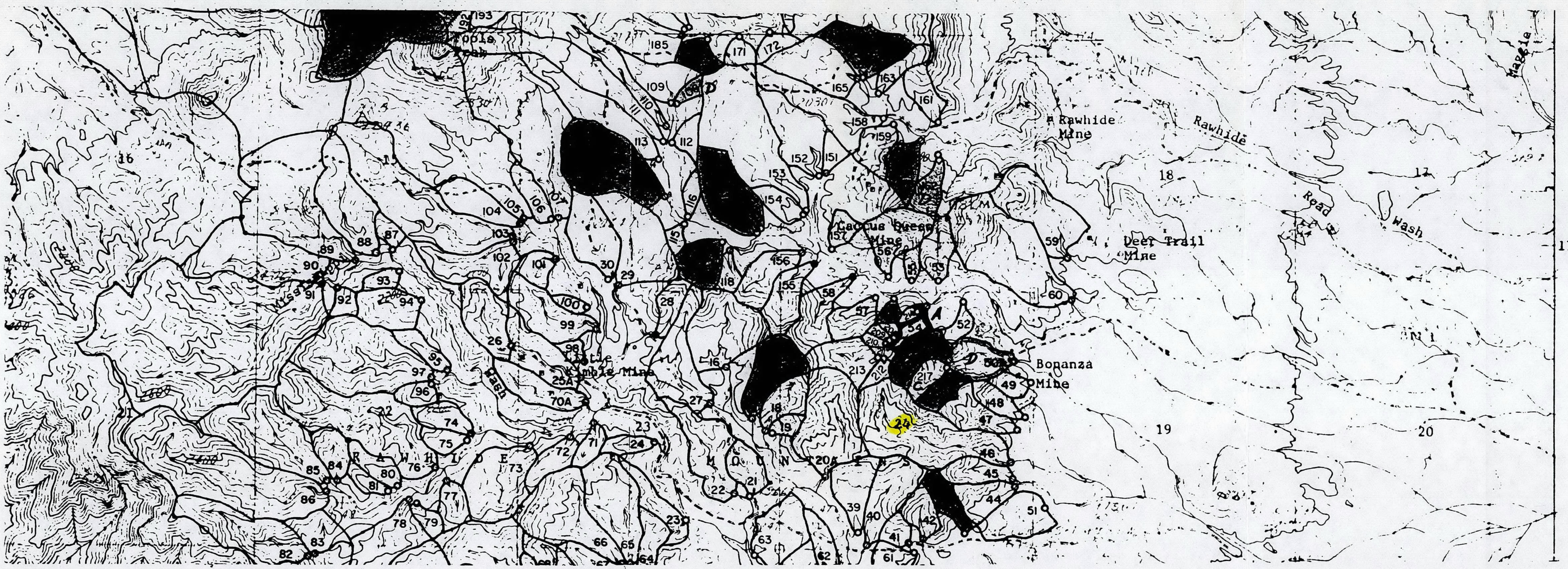
GEOLOGIC MAP
CLEOPATRA PROJECT
MOHAVE COUNTY, ARIZONA

SCALE	H: 1:12,000	CONTOUR INTERVAL: 80 feet		REVISIONS
	V:	DATE: 3-84	BY: RKZ/mbc	11-84
SHEET	OF	DRAWING NO:		FILE: AZ 220

EXPLANATION

Unit	Group	Description
Qal		Quaternary alluvium
Ts	Tu	Tertiary Sandtrap Formation: poorly .4 indurated postmineral conglomerates.
Tcwu	Tu	Tertairy Chapin Wash Formation-upper: well indurated, dark red sandstones and conglomerates.
Tcw	Tu	Tertiary Chapin Wash Formation-lower: poorly indurated breccias and conglomerates
Ta	Tu	Tertiary Artillery Formation: pretectonic sedimentary and volcanic rocks.
Mg		Mesozoic granite: crushed, coarse-grained intrusive rocks, mostly granites.
Ms	Mu	Mesozoic sediments: weakly metamorphosed, fine-grained sedimentary rocks.
Mv	Mu	Mesozoic volcanics: fresh to weakly metamorphosed or altered volcanics, mostly tuffs.
Pl	Pu	Paleozoic limestones: generally lower Paleozoic, Abrigo, Martin, and Escabrosa Fm equivalents.
Pq	Pu	Paleozoic quartzites: Coarse grained sedimentary quartzites, probably Bolsa Fm equivalents.
pЄgg		Precambrien (?) granitic gneiss: unmylonitized gneisses of granitic composition.
pЄmg		Precambrian mylonitic gneiss: lower plate gneisses, variably mylonitized.

Symbol	Explanation
	Low angle normal fault spikes on upper plate
	Thrust fault, teeth on upper plate
	Fault, ball on downthrown block
	Contact, dashed where uncertain
X'———X'	Cross section location lines
	Road
	Dip and strike of fault
	Dip and strike of bedding
	Mine workings, shaft and adit
	1982 Air Trac drill holes
	1983 Reverse Circulation drill holes
	Proposed diamond drill holes ← Not drilled



vey

1 manu-
in 1965

APPROXIMATE MEAN DECLINATION 1965

SCALE 1:24000

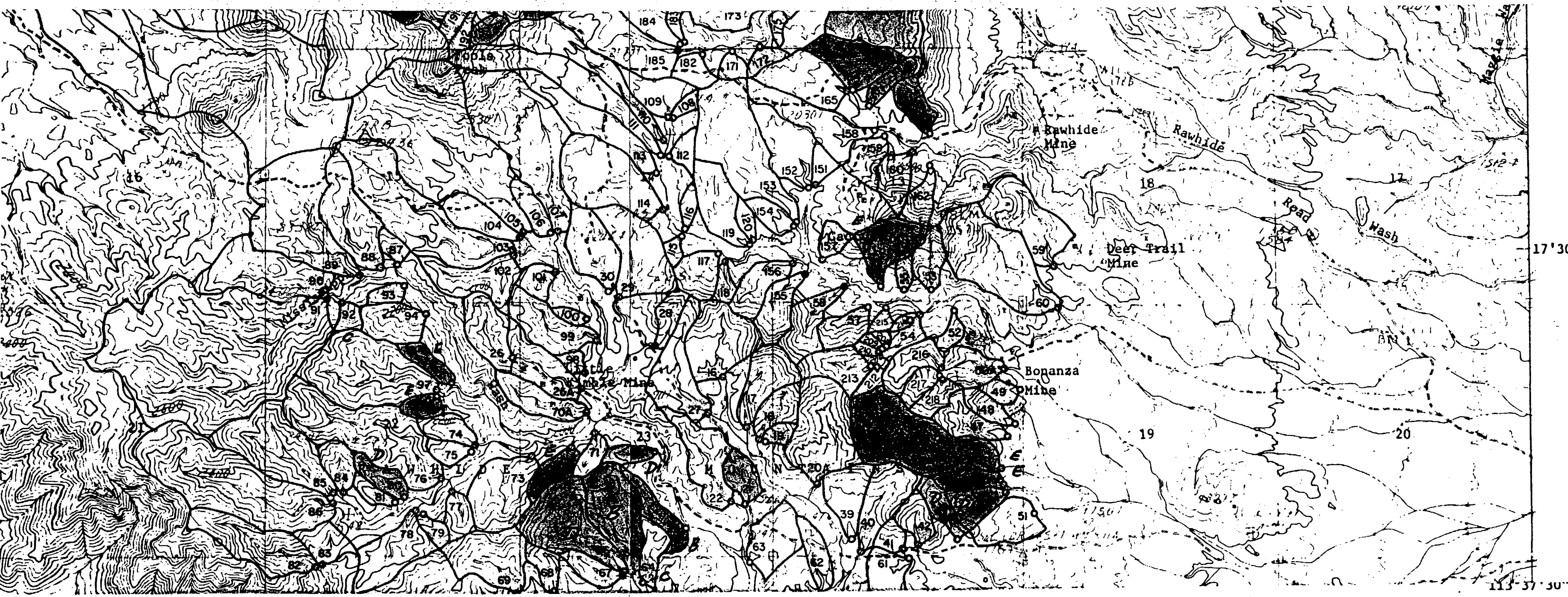
CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

	ppb Au
A	200
B	100-200
C	50-100
D	25-50
E	12-25
	0-12

FIGURE 11: Gold Values
Stream Sediment Survey
CLEOPATRA AZ. 220

ARTILLERY PEAK SW, ARIZ
MOHAVE CO.

Signal Project



rvey

al manu-
in 1965

TRUE NORTH
MAGNETIC NORTH
14½°
APPROXIMATE MEAN DECLINATION, 1965

SCALE 1:24000

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

	ppm Pb
A	160+
B	100-160
C	65-100
D	40-65
E	25-40
	0-25

FIGURE 12: Lead Values
Stream Sediment Survey
CLEOPATRA AZ. 220

ARTILLERY PEAK SW, ARIZ
MOHAVE CO.

Signal Project

1984 ANNUAL REPORT
CLEOPATRA PROJECT

MOHAVE COUNTY, ARIZONA
1N., R.14W., SECTIONS 1-5, 8-15, & 22-27
1N., R.13W., SECTIONS 6, 7, 18, 19, & 30
ARTILLERY PEAK QUADRANGLE 220

R. K. Zimmerman   November, 1984

phelps dodge Corporation

Western Exploration Office-Tucson, Arizona 85703-1427

SUMMARY

The Cleopatra Project, located about 65 miles south-southwest of Kingman, Arizona, is being explored for large gold deposits of low to moderate grade. Potential size and grade range up to 50 million tons and 0.33 ounce gold per ton. Mineralization present at the property consists of quartz, gold, hematite, chlorite, fluorite, and copper minerals. Recent information indicates deposits of economic significance will be hosted by mylonitic gneiss in the footwalls of major low-angle structures. Similar mineralization is often present on high-angle faults in the hanging walls. Such mineralization is widespread in the upper plate of at least one such structure at Cleopatra. Magnetite is present beneath known deposits of this type, and ground magnetic surveys have proven useful in their discovery and delimitation.

Previous work concentrated on evaluation of surface mineralization, mostly in upper plate rocks. Recent work included geologic mapping, a stream sediment survey, and an orientation magnetic survey, and was directed at a comprehensive evaluation of property and delimitation of target areas. Mapping outlined favorable structures, and the stream sediment survey produced some interesting geochemical anomalies which indicate mineralization at depth. The orientation magnetic survey suggested that the technique is applicable for at least part of the project area.

Recommendations for future work include completion of the magnetic survey and drilling of at least four target areas. Core drilling a total of 4,500 feet is proposed, and the targets were selected for the presence of a favorable structure at depth in conjunction with some indication of mineralization in the overlying area. The proposed work is considered the minimum necessary to adequately evaluate the property in its present state.

INTRODUCTION

Recent discoveries of deposits similar to our target at Cleopatra provide a greater understanding of its essential characteristics and increase its size and grade potential as well. Amoco's Copperstone deposit, south of Parker, Arizona, is reported to contain at least 10 million tons of material grading 0.10 ounce gold per ton in a body measuring 1,200 feet by 800 feet with a 75-foot thickness. Those dimensions, however, only represent that portion of the deposit which is surface mineable. Unconfirmed reports suggest that grade and tonnage potentials are as high as 0.33 ounce gold per ton and 50 million tons, respectively, making the target extremely attractive.

The project area exhibits many of the essential features of this deposit type, outlined by Williams (1984), which include 1) the presence of low-angle detachment faulting, 2) a mylonitized lower plate approximating microcline granite in composition, 3) gold-bearing mineralization composed of quartz, hematite, and copper minerals with iron-rich chlorites and fluorite erratically present and 4) lead-silver mineralization of quartz, chlorite, fluorite, hematite, galena, spalerite, barite, and calcite filling extensional fractures in the upper plate overlying the gold mineralization. Another characteristic of the deposit type is that economic mineralization is almost always confined to the footwall of detachment faults. This realization has only recently shifted emphasis to the lower plate at the property; previous work concentrated on evaluation of mineralization in the upper plate rocks. A schematic diagram of the geologic model is given in Figure 9.

HISTORY

Current interest in the area was generated by reconnaissance work as reported in DuHamel (1981). Property positions were established in two portions of the area: those near the Cleopatra and Rawhide mines. A program of 37 rotary drill holes was completed in the Cleopatra area during 1982, and while most of the holes were barren, one on the outside of the grid bottomed in ore-grade material (Applebaum, 1982b). Additional claims were staked in 1983 to consolidate the two project areas into one, now called Cleopatra. A drilling program totaling 5,892.5 feet of reverse circulation drilling on 24 sites was completed to: follow-up the previous drilling, test more deeply in the same area, and test several other mineralized areas. No significant intervals of mineralization were encountered in any of the holes (Zimmerman, 1983). Subsequently, the entire claim block has been geologically mapped, and rock-chip geochemical grid surveys have been performed. The mapping led to a comprehensive understanding of the geologic framework and the location of exposed mineralization and controlling structures along which additional mineralization might be found (Zimmerman, 1984). The geochemical surveys demonstrated that gold mineralization was confined to areas with visible showings (Zimmerman, 1983).

LOCATION

The Cleopatra Project is located 65 miles south-southwest of Kingman in Mohave County, Arizona (see Figure 1). Access is available via county roads from either Yucca on Interstate Highway 40 or Wikieup on U. S. Highway 93. From Yucca, follow the Alamo Lake road directly to the property. From Wikieup, take the Chicken Springs road which joins the Alamo road after a distance of some 15 miles.

PROPERTY

The property consists of a contiguous claim block comprising seven patented claims and 638 unpatented claims (Figure 2). The patented claims are leased from William Thompson, et. al. of 8681 Katella Avenue, Stanton, California 90680. Earlier in the year, some additional claims were staked in the southwest corner of the block to cover some recently available ground, and a noncontiguous block to the west of the present block was dropped.

GEOLOGY

Geologic Setting

The geologic setting of the project area is largely the result of a major tectonic event of extensional movement which culminated in the mid-Tertiary (Reynolds, 1980). This event is manifested in a major low-angle (detachment) fault separating upper and lower plates of contrasting lithology and deformational style (Rehrig and Reynolds, 1980). The upper plate is composed of Precambrian, Paleozoic, Mesozoic, and Tertiary sedimentary, intrusive, and volcanic rocks which responded brittlely to the extensional stress, primarily through normal faulting. The lower plate consists of gneiss, probably Precambrian, which initially responded plastically to imposed stress, but as depth of burial decreased shearing and mylonitization predominated. The detachment fault, then, formed the boundary between these two deformational regimes (Davis, et al., 1980).

Currently, the bedrock geology in the southwestern portion of the property consists of lower plate mylonitic gneisses, while the upper plate rocks are exposed mainly in the north and east (Figure 8). Erosion, deposition, and faulting that postdate the mid-Tertiary event complicate the geologic picture and make correlation of upper plate lithologies somewhat difficult. Also, at least one thrust faulting event predated the detachment event, producing another set of low-angle faults. There may be additional detachment faults underneath the main one and that greatly affects the potential for mineralization at depth as discussed below. Stacked deposits of this type are known, and an additional low-angle fault is present a few miles south of the property.

Mineralization

Mineralization at Cleopatra and throughout the detachment terrain of western Arizona is spatially and temporally, if not genetically related to the detachment event. Mineralized occurrences are most commonly found in close vertical proximity to the detachment fault, and all of the known deposits of significant size are at or below that level. The fluids responsible for the mineralization were most likely essentially metamorphic fluids derived from chemical and physical changes in the mylonitic gneisses coeval with the tectonic event. These fluids moved upward along fractures and faults, forming mineral deposits, with oxidation as the primary mechanism for precipitation. Gold was deposited with quartz in the oxidation zone which is characterized as the transition zone between magnetite and hematite as the dominant iron oxide species.

The process of mineralization was rather passive, relying on open spaces as depositional sites. High-angle faults in both upper and lower plate rocks provided open spaces necessary for deposition, but the volume of mineralized material along such structures is economically unimportant. However, mylonitization along the detachment fault extends to several hundred feet in depth, creating a large potential volume available for mineral deposition. Significant deposits resulted where such a volume of porous, permeable rock was exposed to the depositional portion of the hydrothermal system for an extended time period. Key elements of a productive zone are pervasive silicification, detectable gold, and the proper oxidation conditions as reflected in iron partitioning between the phases chlorite, magnetite, and hematite.

Mineralization on the property is difficult to characterize because of its intimate association with metamorphism and cataclasis. Gold mineralization is usually accompanied by silica/quartz, chlorite, hematite, fluorite, and copper minerals. The gold is submicroscopic and native, grading up to 0.73 ounce per ton in hand specimen. Copper exhibits a close association with gold and occurs typically as malachite and chrysocolla, although chalcopyrite probably predominated prior to surface oxidation.

At higher levels in the mineralizing system, the mineralization changes and becomes more silver-rich. This mineralization is confined to fractures, mostly high-angle, and is composed of galena, copper minerals, quartz, calcite, barite, and fluorite. Silver grades from hand-picked samples can be in excess of 10 ounces per ton, but the best example of this mineralization on the property consists of 2 million tons grading 2 ounces silver per ton (DuHamel, 1983). This higher-level mineral suite is not of interest per se, but it is a good indication of gold mineralization at depth.

RECENT WORK

Work completed since the last annual report includes completion of the geologic map, a stream sediment survey, and an orientation ground magnetic survey. In addition to completion of coverage, the geologic map (Figure 8) was refined with the separation of the Mesozoic and Tertiary into differentiated units. The Mesozoic rocks were divisible into two categories: sedimentary and volcanic. The Tertiary was broken down into Artillery Formation, Chapin Wash Formation, and Sandtrap Formation, based on previous work by Shakelford (1976) and Lasky and Webber (1944). The Chapin Wash Formation was further divided into upper and lower members. These subdivisions are particularly useful in the case of the Tertiary because the Artillery is pretectonic, the Sandtrap is posttectonic and the Chapin Wash seems to be syntectonic.

The stream sediment survey was completed by Richard E. Cribbs, a geological consultant, whose report is given in Appendix

B. The survey was designed to detect large areas of low-grade gold mineralization by sampling unsorted alluvial material in tertiary drainages. Some anomalous gold and copper values were detected as shown in Figures 11 and 13, respectively, but the highs are located in areas already known to exhibit gold-copper mineralization. More significantly, anomalous lead values are present in the extreme northern and southern areas of the claim block, as shown in Figure 12. These anomalies probably represent the lead- and silver-bearing mineralization previously discussed as indicating gold mineralization at depth, and as such, are quite interesting.

An orientation, ground magnetic survey was performed by Corporation personnel under the direction of A. M. Hauck, III. Ground magnetic surveys have been instrumental in the discovery and delimitation of this type of deposit elsewhere because the hematite associated with gold mineralization is known to pass into magnetite at depth. The orientation survey was designed to test the efficacy of the technique on the property, as previously recommended (Zimmerman, 1984). The results of that survey, shown in Figure 10, demonstrate that the bedrock in the area has a background value which is sufficiently low to allow the anomalous zones to stand in marked contrast. Of the results, Hauck (1984) concludes, "The orientation survey results indicate that additional surveys over the remaining six sections to the south will be in order." The additional work is essential in guiding evaluation of the area over which the work is recommended.

DISCUSSION

A comprehensive framework for the evaluation of the property's potential is possible due to advances in our knowledge of the mineralizing system and the geology of the property. Two criteria are necessary for the development of drilling targets, as discussed in Zimmerman (1984): 1) the presence of a major low-angle fault with lower plate gneiss as its footwall and 2) the area must have some indication of mineralization. The detachment fault known to underlie upper plate rocks in the north and east portions of the property fulfills the first criterion and is the most obvious structural target. However, another low-angle structure is present in outcrop south of the property and projects under the entire property; others are very likely present. Indications of mineralization include silver- and gold-bearing mineralization on high-angle structures, lead or silver anomalies in geochemical samples, and magnetic anomalies, especially broad ones in lower plate gneiss.

The nature of the proposed targets strongly influences the manner in which they should be tested. The "orebodies" should be essentially flat lying with short dimensions of at least 1,000 feet and long dimensions in excess of 2,000 feet. In addition, the halo of marginal material should be much larger and yet still discernable. A single diamond drill hole tells a great deal about the potential of a large surrounding area for hosting a deposit of mineable proportions. Thus, the specific areas recommended need only one core hole to determine whether further drilling is warranted; many rotary holes would be required to test the same area.

Specific areas that require testing include the Cleopatra area, the Rawhide North area, the area of anomalous lead and silver values from geochemical sampling in Section 34, and the Little Kimble Mine area in the south, Section 23, where both gold mineralization and lead geochemical anomalies are present (Figures 8 and 14). Other mineralized areas are not recommended for testing at this time either because significant mineralization at depth is contraindicated or because they are substantially on adversely held ground. Other targets might result from completion of the ground magnetic survey, and substantiation of additional low-angle structures in the lower plate gneiss would necessitate the reevaluation of the entire area.

COST SUMMARY

Given below is a summary of the expenditures on the project through September for 1984, added to the total spent on the project since its inception:

	1984	Previously
Wages and Benefits	$ 37,091	
Travel and Business	4,733	
Consulting Fees: Geochemical Survey	5,887	
Road and Site Work	20,267	
Land Payments	5,000	
All Other Expenses	4,682	
Total	$ 77,660	$386,032
Total Expenditures to Date		$463,692

CONCLUSIONS AND RECOMMENDATIONS

Further work is necessary to adequately evaluate the gold potential of the Cleopatra property. Completion of the ground magnetic survey is recommended prior to any further drilling for reasons discussed above. Four target areas have been selected for core drilling and others may be indicated by the magnetic survey. Drilling currently recommended includes: 1) a hole ca. 750 feet deep in the Cleopatra area to test the detachment surface beneath this area of abundant mineral showings; 2) a hole ca. 1,500 feet deep in Section 34, T.12N., R.14W., to test the detachment surface beneath this area of anomalous lead and silver values from geochemical samples; 3) a hole ca. 750 feet deep to test the detachment surface in the south part of the Rawhide North area; and 4) a hole ca. 1,500 feet deep in the Little Kimble area to test for additional low-angle structures in the lower plate near gold mineralization and lead anomalies from geochemical sampling. A proposed budget of the recommended activities is given below. These proposals represent the minimum work required such that if the results of all proposed work are negative, the project could be considered adequately evaluated.

PROPOSED BUDGET

Drilling: 4,500 feet	$180,000
Ground Magnetic Survey	15,000
Salaries	5,000
Travel and Business	2,000
Contingencies	20,000
Total	$222,000

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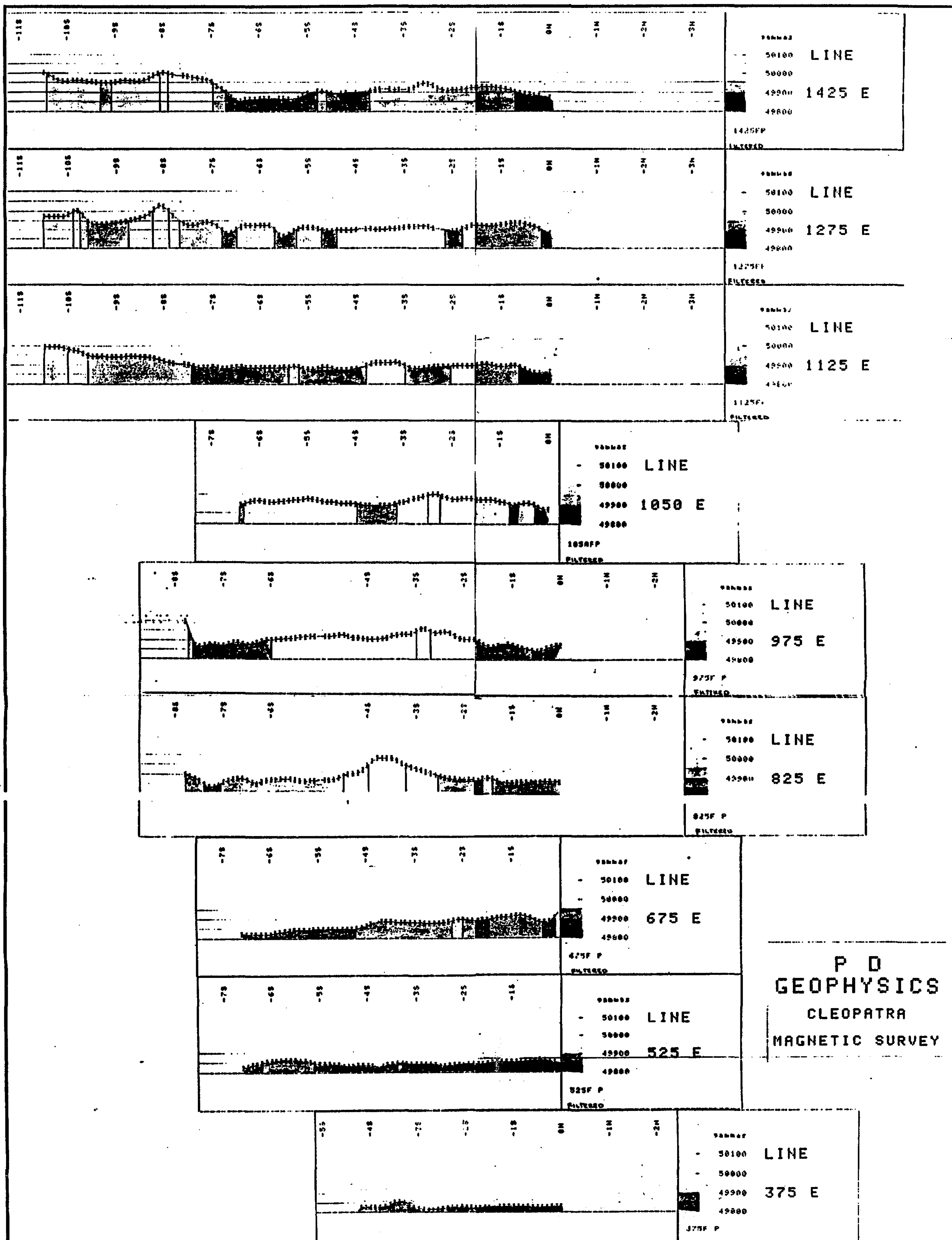
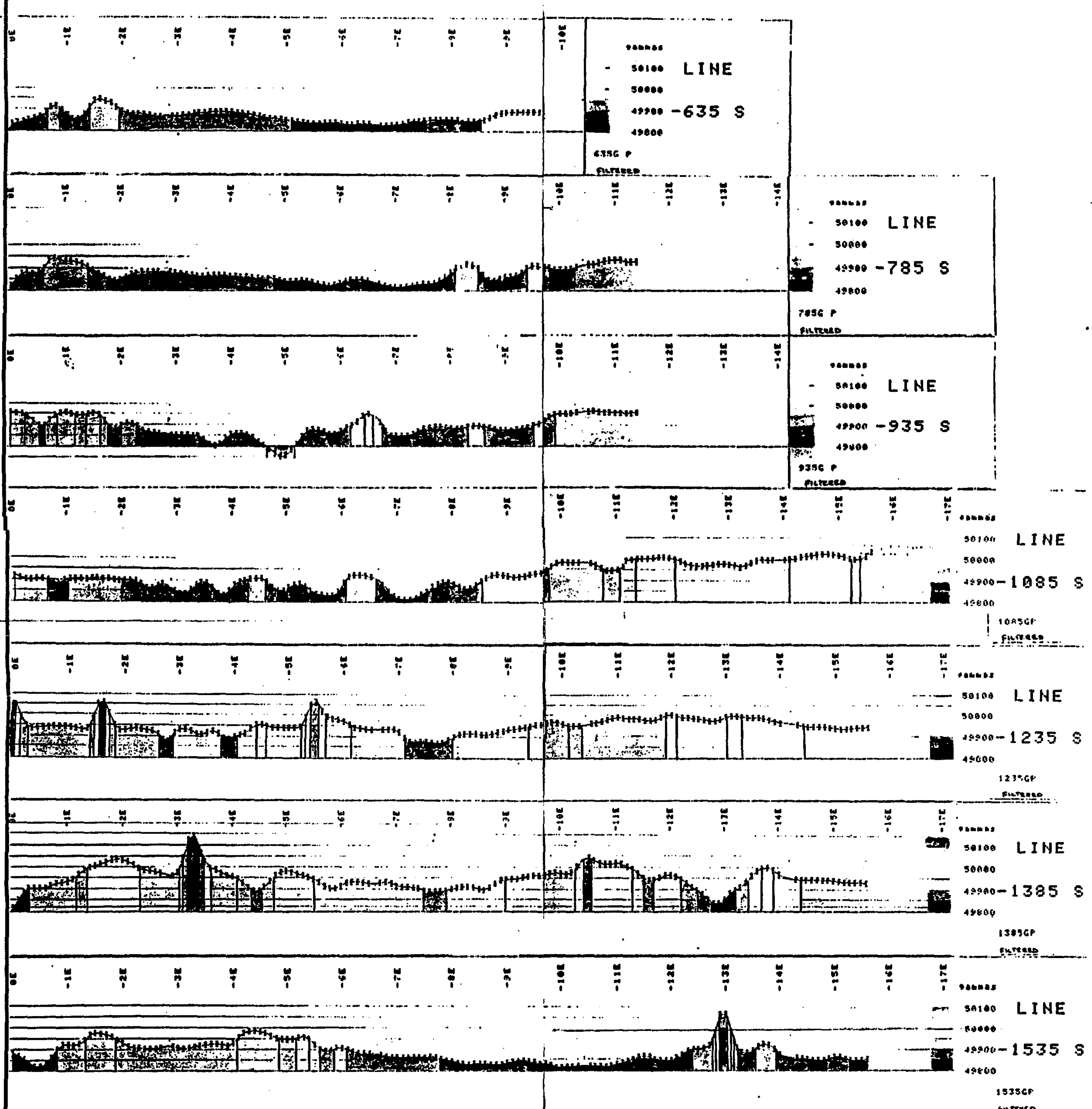
RKZ:cc
November 30, 1984

cc: AMH

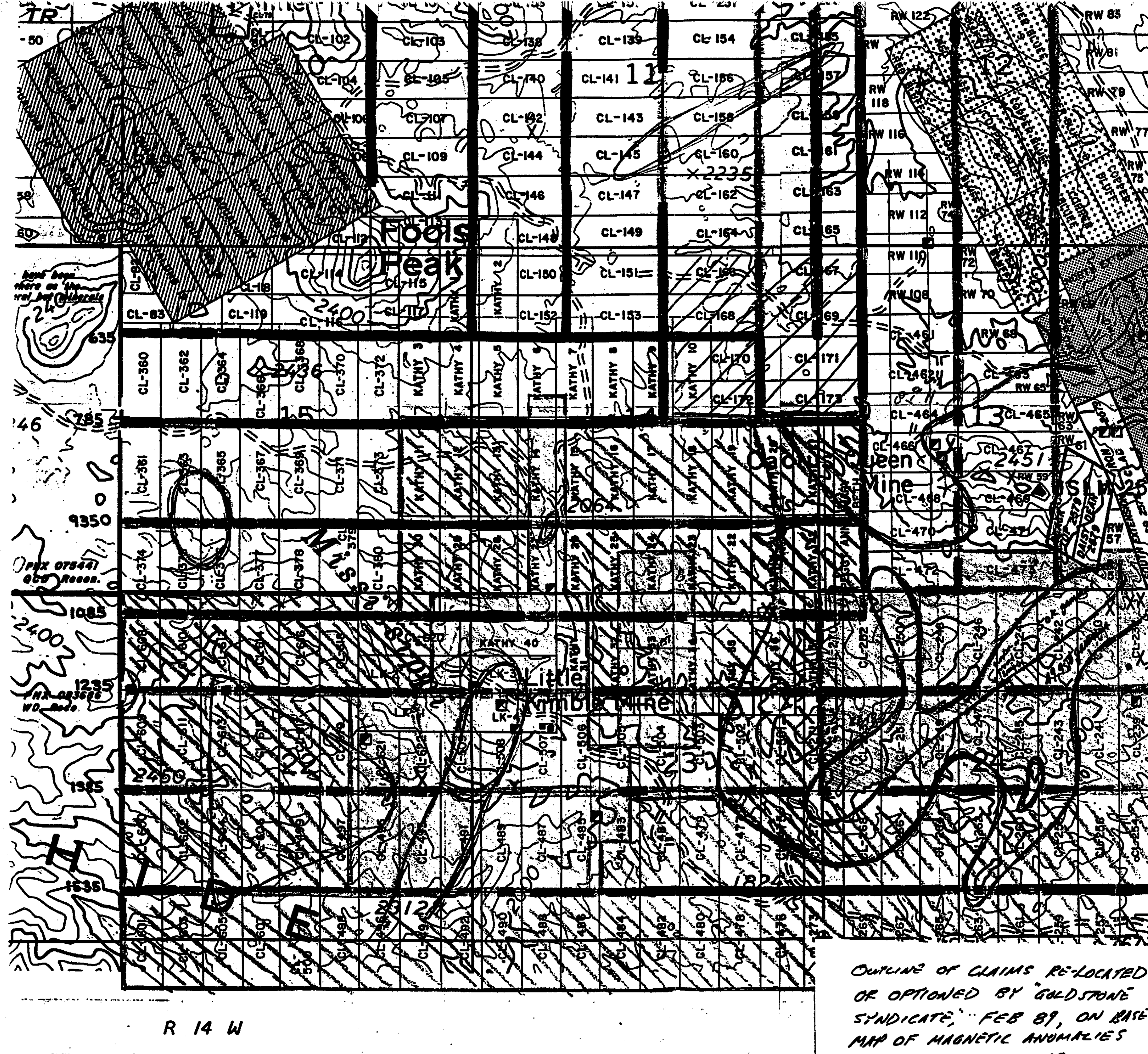


WESTERN EXPLORATION OFFICE PHELPS DODGE CORPORATION				
CLEOPATRA PROJECT MAGNETIC SURVEY				
SCALE	H:	CONTOUR INTERVAL:		REVISIONS
	V:	DATE: 8/85	BY:	
SHEET OF		DRAWING NO:		FILE: AZ. 220



P D
GEOPHYSICS
CLEOPATRA
MAGNETIC SURVEY

WESTERN EXPLORATION OFFICE	PHELPS DODGE CORPORATION		
CLEOPATRA PROJECT MAGNETIC SURVEY			
SCALE H:	CONTOUR INTERVAL:		REVISIONS
SCALE V:	DATE: [illegible]	BY:	
SHEET OF	DRAWING NO:		FILE: AZ. 220



MAG. CONTOURS
50,000 γ
49,950 γ

N

OUTLINE OF CLAIMS RE-LOCATED OR OPTIONED BY "GOLDSTONE SYNDICATE," FEB 89, ON BASE MAP OF MAGNETIC ANOMALIES AND OLD P.D. CLAIMS.

WESTERN EXPLORATION OFFICE PHELPS DODGE CORPORATION

CLEOPATRA

T. 11 N., R. 14 W. (G&S.R.M.) MOHAVE COUNTY, AZ.

SCALE	H: 1" = 1000'	CONTOUR INTERVAL: 80'		
	V:	DATE:	BY: mbc	
SHEET OF		DRAWING NO:		FILE: AZ 220

Andrew E. Nevin
2150 Lincoln Park West
P. O. Box 14230
Chicago, Illinois 60614

January 27, 1989

Mr. R. B. Ludden
Manager, Exploration Office
Phelps Dodge Corporation
P. O. Box 50427
Tucson, Arizona 85703

RE: Cleopatra and Rawhide Areas, Mohave County, Arizona

Dear Bob:

This acknowledges receipt of Phelps Dodge Corporation's geologic, geophysical and geochemical data on an area in Mohave County, Arizona.

The area is defined as: Sections 6, 7, 18, 19, 30, T.11N., R.13W.; Sections 1-27, T.11N., R.14W.; Sections 27-36, T.12N., R.14W.

I intend to acquire mineral rights and conduct exploration in this area and for the use of Phelps Dodge Corporation data, undertake to grant Phelps Dodge the right of first refusal to participate in development drilling and mine development.

I will have partners in the early stages of exploration, and each will be bound by the undertaking to Phelps Dodge and their participation does not imply Phelps Dodge's refusal to participate. It is our intention that if work should reach advanced stages of exploration drilling or development drilling, and we wish to transfer or sell any interest in the project or property, we shall promptly notify Phelps Dodge of that intention and Phelps Dodge shall have the opportunity to negotiate a participation agreement.

Very truly yours,

Andrew E. Nevin

phelps dodge Corporation Western Exploration Office, P.O. Box 50427, Tucson, AZ 85703-1427
1810 West Grant Road, Suite 103, Tucson, AZ 85745 • (602) 792-4981

February 2, 1989

Mr. A. E. Nevin
2150 Lincoln Park West
P. O. Box 14230
Chicago, Illinois 60614

RE: Cleopatra and Rawhide Areas, Mohave County, Arizona

Dear Andy:

This is in answer to your letter dated January 27, 1989, in which you detail the terms and procedures under which you will use the data provided by Phelps Dodge while exploring the area defined in the letter. We are agreeable to the terms and procedures as stated. You are welcome to use any of the data we may have. However, I expect you to use the data with a certain amount of discretion. Phelps Dodge Mining Compay makes no representation or warranty as to accuracy or completeness of the data or conclusions disclosed hereby. The information is furnished only upon the condition that Phelps Dodge Mining Company shall incur no liability on account of your acceptance or use of such information.

I will look forward to hearing about your progress in this venture from time to time.

Sincerely,

R. B. Ludden, Manager
Western Exploration Operatioons

RB:pc
cc: DER

FINAL
ENVIRONMENTAL IMPACT STATEMENT

PROPOSED WILDERNESS PROGRAM
for the
UPPER SONORAN WILDERNESS EIS AREA

LA PAZ, MARICOPA, MOHAVE AND YAVAPAI COUNTIES, ARIZONA

Prepared by

THE DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT
PHOENIX DISTRICT

STATE DIRECTOR

ARIZONA STATE OFFICE

For further information contact Bill Carter, EIS Team Leader, Phoenix District Office, Bureau of Land Management, 2015 West Deer Valley Road, Phoenix, Arizona 85027 or call (602)863-4464.

August 1987

Following are extracts referring to Rawhide Mtns. WSA.

RAWHIDE MOUNTAINS WSA

PROPOSED ACTION/Partial Wilderness (Map 2-5)

The *Proposed Action* for the Rawhide Mountains WSA would designate 40,025 acres as wilderness and 18,825 acres as nonwilderness. The boundary adjustments exclude some areas with high or moderate mineral potential and an area with numerous mining claims and private subsurface estate in the northwest part of the WSA. This alternative would enclose 200 acres of public land cherry-stemmed out of the WSA and 200 acres of state land recommended for acquisition. The following are expected.

LIVESTOCK AND RANGELAND ACTIONS

A four-mile boundary fence is planned. For location and description see Appendix 1. No range improvements are planned in the nondesignated area.

RECREATION USE ACTIONS

Use would increase to 2,300 from the present 1,500 visitor days/year. Hiking in the narrow six-mile-long canyon of the Bill Williams River during periods of low water would become increasingly popular. Some tubing, swimming and kayaking/canoeing would continue when water releases from the upstream Alamo Reservoir are sufficient. ORV use (mostly recreational 4-wheeling and some hunting) would continue on sand washes and on four miles of jeep trails in the nondesignated part. Projected visitor use by alternative in Table 2-2.

LAND USE ACTIONS

One additional oil/gas pipeline is anticipated (diameter up to 40 inches, 50-foot right-of-way) east and parallel to the existing San Juan crossover 30-inch El Paso Natural Gas Pipeline.

MINERALS ACTIONS

In the designated area one small and one moderate mine would disturb five acres across one mile of new access road and .25 mile of upgraded access would disturb two acres. Under present law exploration and development can continue on the 640 acres of nonfederal mineral lands.

In the nondesignated area one moderate and nine small mines would disturb 6.75 miles of upgraded access and .75 mile of new road would disturb 11 acres. For location and description of the actions see Appendix 1.

WILDLIFE ACTIONS

One wildlife development is proposed. For location and descriptions see Appendix 1.

No wildlife developments are planned in the nondesignated area.

ALL WILDERNESS (Map 2-6)

All of the Rawhide Mountains WSA's 58,850 acres would be designated wilderness under the *All Wilderness* alternative and the following are expected.

LIVESTOCK AND RANGELAND ACTIONS

Four miles of boundary fence are planned south of the Bill Williams River. For location and description see Appendix 1.

RECREATION USE ACTIONS

Use would decrease to 1,200 visitor days/year from the present 1,500; all is nonmotorized (hiking, backpacking and some water-based activities such as tubing, swimming and kayaking/canoeing when water releases from Alamo Dam are sufficient). Projected visitor use by alternative in Table 2-2.

LAND USE ACTIONS

None are expected.

MINERALS ACTIONS

One small and one moderate mine would disturb five acres; one mile of new road and 1.25 mile of upgraded access would disturb almost two acres. Current law does not restrict development of minerals on the 4,000 acres of nonfederal minerals. For location and description see Appendix 1.

WILDLIFE ACTIONS

One wildlife development is planned; for location and description see Appendix 1.

ENHANCED WILDERNESS (Map 2-7)

The *Enhanced Wilderness* alternative for the Rawhide Mountain WSA is basically the same as the *Proposed Action* except the eastern boundary west of the Bill Williams River was adjusted to the 1,260 foot contour. This adjustment increased the designated acreage from 40,025 acres to 40,665 acres. The nondesignated area would remain at 18,825 acres. The adjustment would not change any of the management actions described under the *Proposed Action*.

NO WILDERNESS/No Action (Map 2-6)

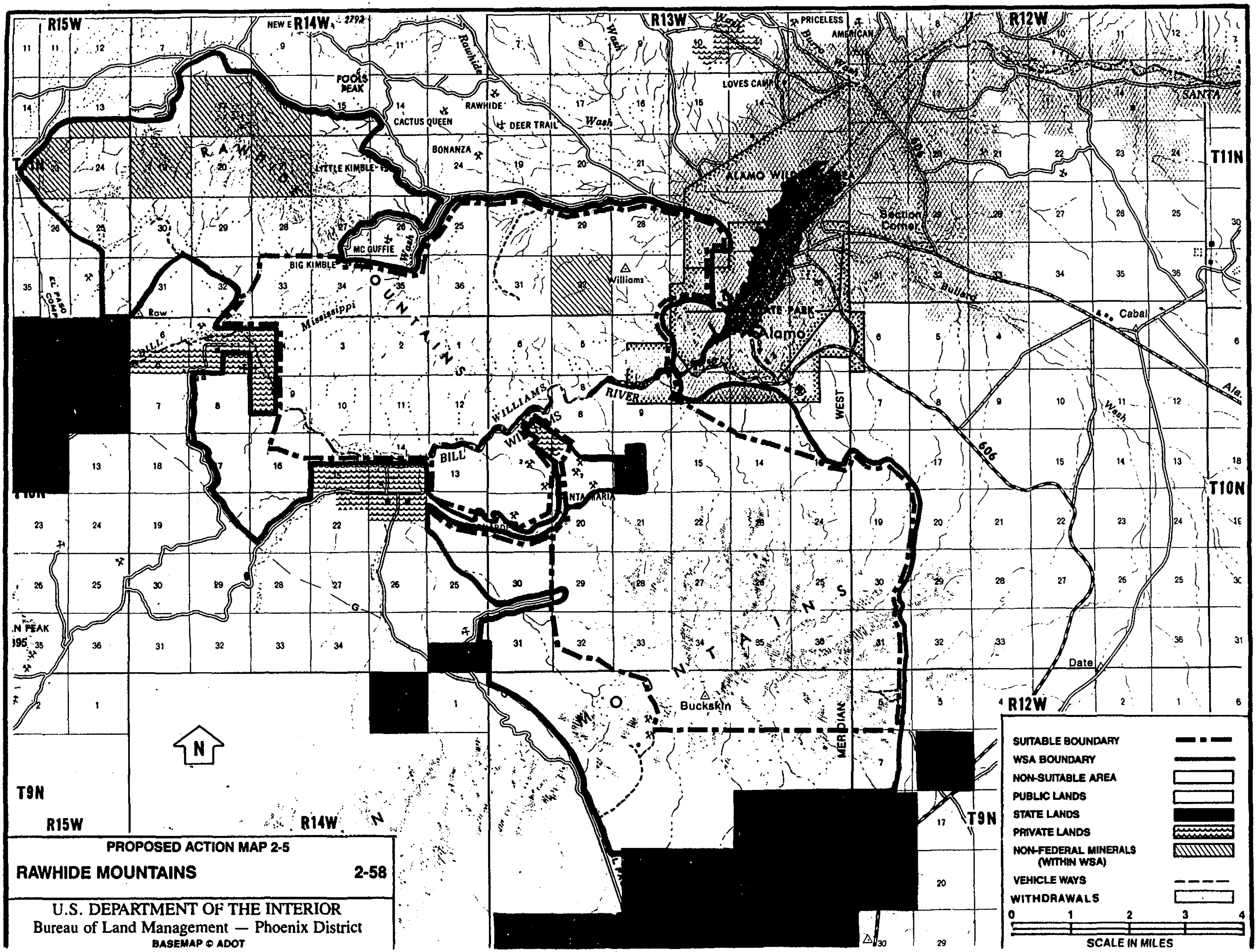
None of the Rawhide Mountains WSA's 58,850 acres would be designated wilderness under the *No Wilderness/No Action* alternative and the following are expected.

LIVESTOCK AND RANGELAND ACTIONS

Four miles of boundary fence is planned south of the Bill Williams River. For location and description see Appendix 1.

RECREATION USE ACTIONS

Use would increase to 2,300 from the present 1,500 visitor days/year. Two-thirds of the visitor use vehicle-based (recreational 4-wheeling, hunter access, rockhounding)



PROPOSED ACTION MAP 2-5

RAWHIDE MOUNTAINS 2-58

U.S. DEPARTMENT OF THE INTERIOR
Bureau of Land Management — Phoenix District
BASEMAP © ADOT

and the rest nonmotorized (day hiking, overnight backpacking, birdwatching, etc., which would increase because of opportunities in the scenic Bill Williams River Canyon). Off-road vehicle use within the WSA would be restricted to the existing eight miles of vehicle ways. Projected visitor use is shown by alternative in Table 2-2.

LAND USE ACTIONS

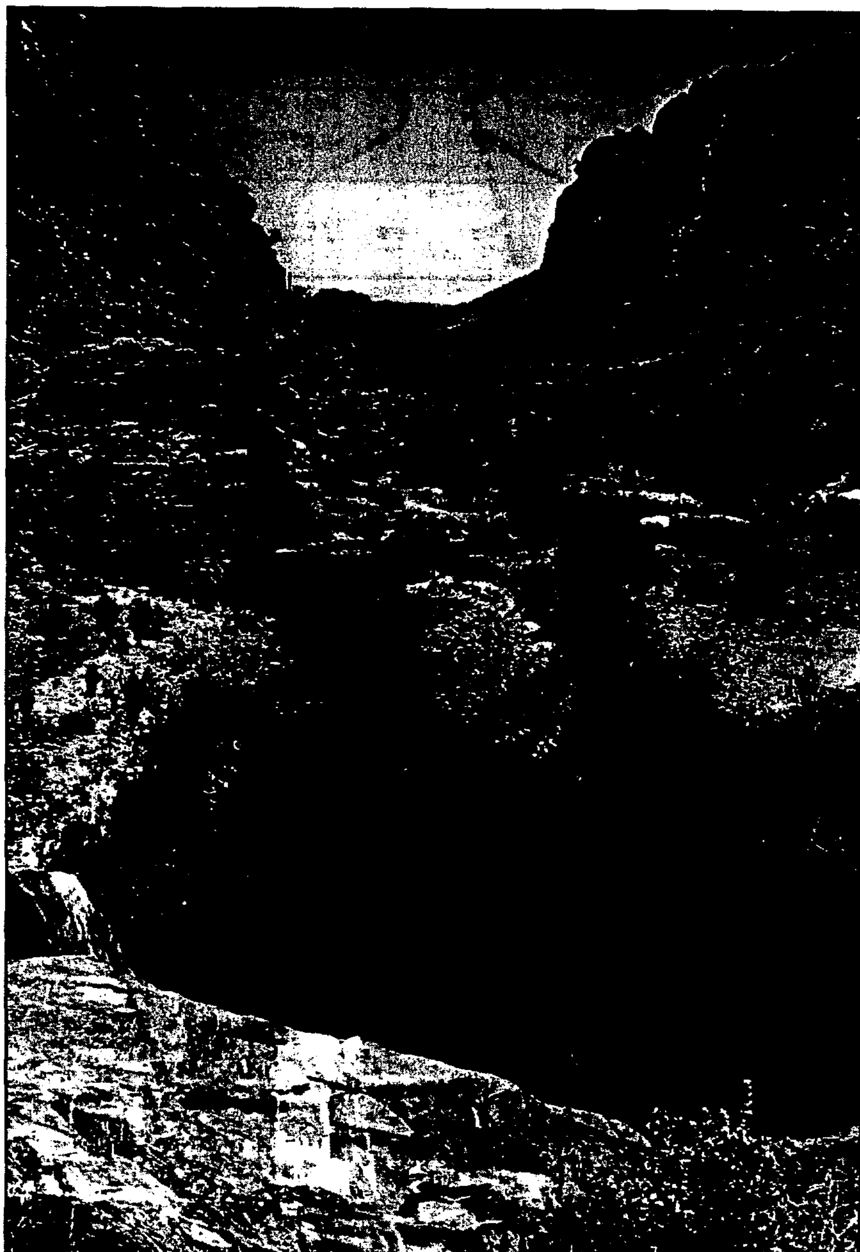
One additional oil/gas pipeline is expected (diameter up to 40 inches, 50-foot right-of-way) east and parallel to the existing San Juan crossover 30-inch El Paso Natural Gas Pipeline.

MINERALS ACTIONS

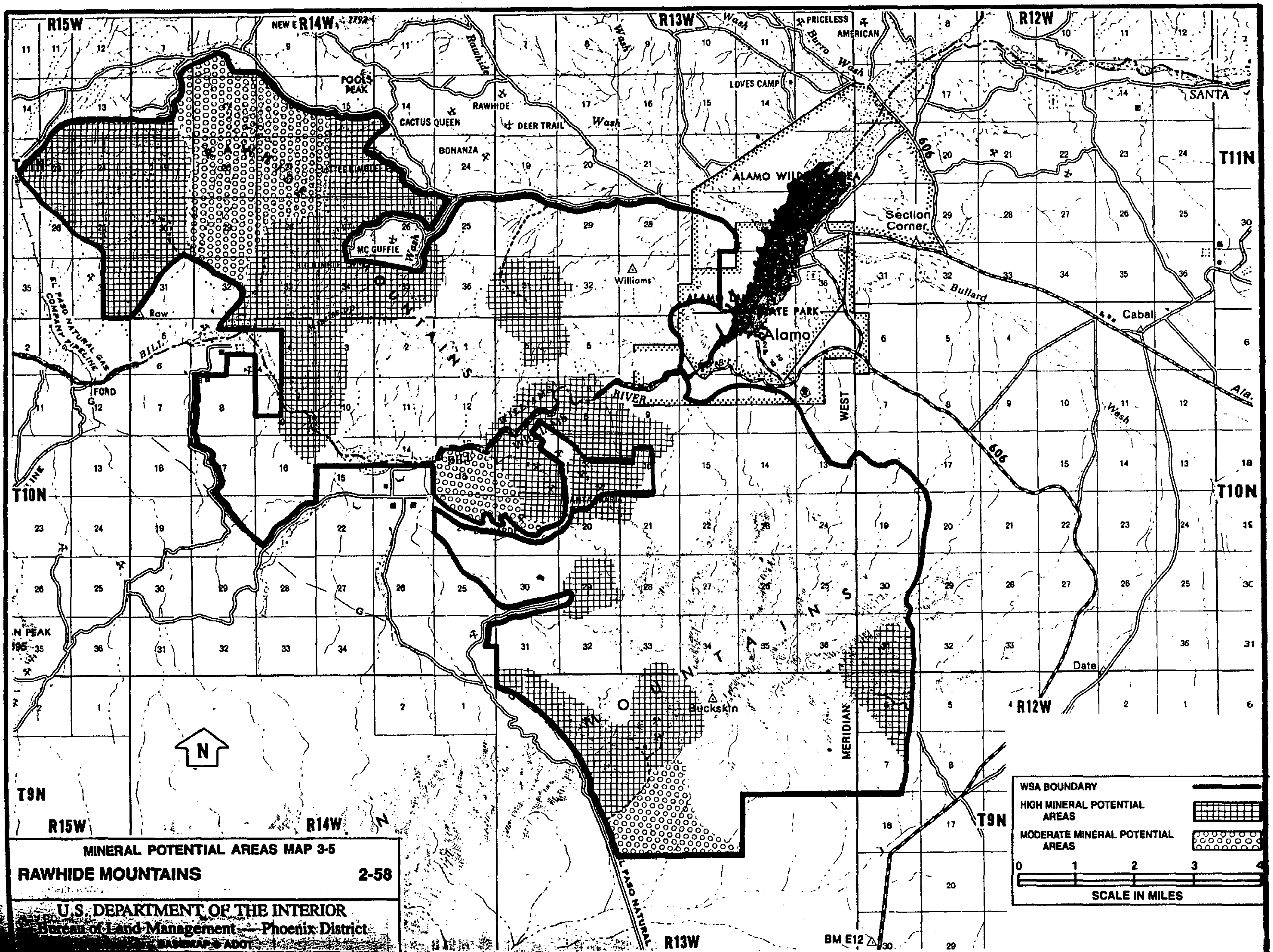
Ten small and two moderate mines would disturb 26 acres; 8.75 miles of upgraded access and 1.5 miles of new roads would disturb 16 acres. For location and description see Appendix 1.

WILDLIFE ACTIONS

One wildlife development is proposed; for location and description of the wildlife projects see Appendix 1.



The perennially watered Bill Williams Gorge reaches depths of 600 feet as it winds between the Buckskin and Rawhide Mountains in Rawhide Mountains WSA.


MINERAL POTENTIAL AREAS MAP 3-5
RAWHIDE MOUNTAINS
2-58
U.S. DEPARTMENT OF THE INTERIOR
Bureau of Land Management — Phoenix District
BASEMAP © ADOT
WSA BOUNDARY
HIGH MINERAL POTENTIAL AREAS
MODERATE MINERAL POTENTIAL AREAS
0
1
2
3
4
SCALE IN MILES
N
R15W
R14W
R13W
R12W
T11N
T10N
T9N
ALAMO WILDLIFE AREA
ALAMO LAKE STATE PARK
Alamo
Section Corner
Williams
Buckskin
Cabal
Date
BILL WILLIAMS RIVER
EL PASO NATURAL GAS COMPANY PIPELINE
WEST MERIDIAN
POOLS PEAK
CACTUS QUEEN
RAWHIDE
DEER TRAIL
BONANZA
MC GUFFIE
PRICELESS
AMERICAN
LOVES CAMP
Burro Wash
Bullard Wash
SANTA
BM E12
FORD

T. 12 N., R. 13 W., secs. 19, 20, 30 and 31.
A total of 3.5 miles of boundary fence is proposed.

T. 12 N., R. 14 W., sec. 22.
A total of .2 mile of drift fence is proposed.

Each fencing project will be designed to blend into the surrounding landscape. All materials will be packed or air lifted into the area.

MINERALS ACTIONS

A moderate operation on federal minerals will occur in T. 12 N., R. 14 W., sec. 22, utilizing the existing access road. In T. 12 N., R. 13 W., sec. 30 a moderate operation on federal minerals will require one mile of new road construction for access. In T. 12 N., R. 13 W., sec. 7, W½, a small mine will operate requiring .75 mile of new 12-foot-wide road. In T. 12 N., R. 14 W., sec. 9, S½, there will be a small mine which will utilize existing access roads.

ENHANCED WILDERNESS

LIVESTOCK AND RANGELAND ACTIONS

Actions in the designated area:

Proposed range improvements planned for resource protection and effective management of resource are identified as follows:

T. 12 N., R. 13 W., secs. 19, 20, 30 and 31.
A total of 3.5 miles of boundary fence is proposed.

T. 12 N., R. 14 W., sec. 22.
A total of .2 mile of drift fence is proposed.

Each fencing project will be designed to blend into the surrounding landscape. All materials will be packed or air lifted into the area.

Actions in the nondesignated area:

T. 12 N., R. 14 W., sec. 5
T. 13 N., R. 14 W., secs. 27, 33, and 34.
A pipeline project is proposed from an existing well. The pipe will be buried by backhoe along 1.6 miles of existing powerline road. Water will be delivered to a 14,000 gallon concrete plaster storage tank that will be painted to blend into the surrounding landscape. A trough will be installed.

MINERALS ACTIONS

Actions in the designated area:

In T. 12 N., R. 13 W., sec. 7, N½, another small mining operation will require .75 mile of 12-foot-wide new road. In T. 12 N., R. 13 W., sec. 30, S½, northwest of the Maggie mine, a moderate sized mining operation will require one mile of new 12-foot-wide road for hauling. In T. 12 N., R. 14 W., sec. 9, S½, north of the Lead Pill mine there will be a small operation that will utilize existing access roads. In T. 12 N., R. 14 W., sec. 22, a moderate operation will go into production, utilizing existing access roads.

RAWHIDE MOUNTAINS

PROPOSED ACTION

LIVESTOCK AND RANGELAND ACTIONS

Actions in the designated area:

Proposed range improvement planned for effective management of resources is identified as follows:

T. 11 N., R. 13 W., secs. 30 and 31.
T. 10 N., R. 13 W., secs. 6 and 7.
A total of four miles of boundary fence is proposed. The entire route will be designed to blend into the surrounding landscape. All materials will be packed or air lifted into the area.

MINERALS ACTIONS

Actions in the designated area:

In T. 11 N., R. 14 W., sec. 34, N½, south of the McGuffie mine, a moderate mining operation will require one mile of new road for access. In T. 10 N., R. 13 W., sec. 18, a small mining operation will be located just north of the Bernard mine. One-fourth mile of existing access road will be upgraded.

Actions in nondesignated area:

In the Cleopatra mining district T. 11 N., R. 14 W., sec. 22, E½, a small mining operation will take place just west of the Little Kimble mine. In the Mesa mining district, in T. 11 N., R. 15 W., sec. 24 E½, a small mine will be developed requiring upgrading of .5 mile of existing access. In the same mining district in T. 11 N., R 14 W., sec. 31, NW¼, a small mine will be developed using two miles of existing access requiring the construction of a .25 mile of new 12-foot-wide road. In T. 9 N., R. 13 W., sec. 9, N½, a small mining operation will require upgrading of 2.5 miles of existing access. In T. 9 N., R. 13 W., sec. 4, S½, a small mining operation will require upgrading of .5 mile of existing access.

WILDLIFE ACTIONS

The Mississippi Spring development will include:

1. fencing of spring (4-strand barbed wire or 3 pipe rail) with a 2 to 7 acre exclosure,
2. piping traditional livestock waters to a trough at least .25 mile from the spring,
3. enhancing cover conditions around the spring either naturally or artificially, and
4. maintaining at least two-thirds of the original wet area.

PROJECT NAME	TYPE	T	R	Section
Mississippi Spring	Spring Development	11 N.	14 W.	NE¼ 35

ALL WILDERNESS

LIVESTOCK AND RANGELAND ACTIONS

Proposed range improvements planned for effective management of resources are identified as follows:

T. 11 N., R. 13 W., secs. 30 and 31.
T. 10 N., R. 13 W., secs. 6 and 7.

A total of four miles of boundary fence is proposed. The entire route will be designed to blend into the surrounding landscape. All materials will be packed or air lifted into the area.

MINERALS ACTIONS

In T. 11 N., R. 14 W., sec. 34, N½, south of the McGuffie mine, a moderate mining operation will require one mile of new road for access. In T. 10 N., R. 13 W., sec. 18, a small mining operation will be located just north of the Bernard mine. One-fourth mile of existing access road will be upgraded.

WILDLIFE ACTIONS

The Mississippi Spring development will include:

1. fencing of spring (4-strand barbed wire or 3 pipe rail) with a 2 to 7 acre exclosure,
2. piping traditional livestock waters to a trough at least .25 mile from the spring,
3. enhancing cover conditions around the spring either naturally or artificially, and
4. maintaining at least two-thirds of the original wet area.

PROJECT NAME	TYPE	T	R	SECTION
Mississippi Spring	Spring Development	11 N.	14 W.	NE¼ 35

ENHANCED WILDERNESS

(Same as Proposed Action)

NO WILDERNESS

LIVESTOCK AND RANGELAND ACTIONS

Proposed range improvements planned for effective management of resources are identified as follows:

T. 11 N., R. 13 W., secs. 30 and 31.
T. 10 N., R. 13 W., sec. 6 and 7.
A total of four miles of boundary fence is proposed. The entire route will be designed to blend into the surrounding landscape. All materials will be packed or air lifted into the area.

MINERALS ACTIONS

Actions in the nondesignated area:

In the Cleopatra mining district T. 11 N., R. 14 W., sec. 22, E½, a small mining operation will take place just west of the Little Kimble mine. No road work is required. Big Kimble mine in the Cleopatra mining district in T. 11 N., R. 14 W., sec. 34, W½, a moderate mining operation will be developed and will require construction of .75 mile of new 12-foot-wide road. In the Mesa mining district, in T. 11 N., R. 15 W., sec. 24 E½, a small mine will be developed requiring upgrading of .5 mile of existing access. In the Cleopatra mining district, in T. 11 N., R. 13 W., sec. 31, W½, there will be a small mining operation requiring upgrading of 2.5 miles of existing access. In the same mining district in T. 11 N., R 14 W., sec. 31, NW¼, a small mine will be developed using two miles of existing access requiring the construction of a .25 mile of new 12-foot-wide road. In T. 10 N., R. 14 W., sec. 10, S½, a small mining operation will require upgrading of .25 mile of existing access. In the Alamo mining district T. 10 N., R. 13 W., sec. 9, S½, a small mining operation will require .5 mile of new 12-foot-wide road. Also, in the Alamo mining district T. 10 N., R. 13 W., Sec. 18, E½, north of the Santa Maria mine, a small mining operation will require no new road work. In the Lincoln Ranch mining district a moderate mining operation will take place at the end of the cherrystemmed road in T. 10 N., R. 13 W., sec. 29, W½. In T. 9 N., R. 13 W., sec. 9, N½, a small mining operation will require upgrading of 2.5 miles of existing access. In T. 9 N., R. 13 W., sec. 4, S½, a small mining operation will require upgrading of .5 mile of existing access. In T. 9 N., R. 12 W., sec. 6, N½, a small mining operation will require upgrading of .5 mile of existing access.

WILDLIFE ACTIONS

The Mississippi Spring development will include:

1. fencing of spring (4-strand barbed wire or 3 pipe rail) with a 2 to 7 acre exclosure,
2. piping traditional livestock waters to a trough at least .25 mile from the spring,
3. enhancing cover conditions around the spring either naturally or artificially, and
4. maintaining at least two-thirds of the original wet area.

PROJECT NAME	TYPE	T	R	SECTION
Mississippi Spring	Spring Development	11 N.	14 W.	NE¼ 35

ARRASTRA MOUNTAIN

PROPOSED ACTION

LIVESTOCK AND RANGELAND ACTIONS

Actions in the designated area:

Proposed range improvements planned for resource [illegible] tection and effective management of resources are [illegible] fied as follows:

T. 13 N., R. 12 W., secs. 31, 32, and 33.
A total of 2.5 miles of boundary fence is proposed.

T. 12 N., R. 13 W., sec. 13.
A total of .1 mile of gap fence is proposed.

T. 12 N., R. 12 W., sec. 33.
A total of .1 mile of gap fence in proposed.

The above fencing projects will be designed to [illegible] the surrounding landscape. All materials will [illegible] into the area.

T. 12 N., R. 11 W., sec. 8.
Spring development is proposed. Minimal [illegible] for access is required over 1.5 miles of existing [illegible] backhoe will be required to maintain one quar[illegible] this road, as well as to develop the spring [illegible] bury .1 mile of pipeline. Water will be piped to [illegible] lon trough constructed of rock from the surro[illegible] No other storage is proposed. The pipeline [illegible] claimed.