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Marked

See Loghry memo of Nov. 22, 1974 for ARKLA assay values

To: David J. Hoffman

December 26, 1973

From: James D. Loghry

The Diamond Joe Porphyry Copper Prospect,
secs. 19, 20, 28, 29, 30, T 17 N, R 14 W,
Leviathan mine area, Cedar Valley district,
T 17 N, R 14 W, Mohave County, Arizona

## Introduction

Harold Downey and I examined the prospect area during the period December 11-14, 1973 (3 field days), camping at the Leviathan mine. Eight years since Harry's last visit and ten for me. We were pleased with improved access and the ease with which we could record new and old impressions on the Diamond Joe quadrangle map unavailable during our 1962-65 examinations. Still, it remains an isolated and little-known prospect with the earmarks of a porphyry copper, and the main target has not been tested. The enclosed map illustrates our findings.

## Geology and Mineral Potential of Diamond Joe Stock

The Diamond Joe stock, mapped as a Laramide granite by Eldred Wilson (Arizona Bureau of Mines, Mohave County Geologic Map, 1959) intrudes Precambrian granite gneisses. The gneisses and other rocks south of the stock are dark colored and mafic rich, while those on the north are felsic, granitic gneisses intruded by granites, aplites, and pegmatites. Diabase dikes intrude the Precambrian rocks. Observed near the stock, they have not been seen intruding, so they are believed to be pre-Laramide, possibly Precambrian. Megascopically, the stock appears to have had little effect on the Precambrian metamorphics. Small dikes, sills, and quartz veinlets, many with limonite after pyrite, emanating from the stock, are found in the Precambrian close to the contact. Were the stock concealed, there would be no hint of it 500 feet or less from the contact. It is unlikely that the Precambrian rocks exposed will be porphyry copper ore hosts. If granitic rocks seen at Copperville northwest of Diamond Joe are present at depth, they could be hosts for ore. Present knowledge suggests that any ore body will be in the stock in its arcuate southwest "corner."

The Diamond Joe stock is somewhat elongate; its maximum east-west dimension is about 4 miles, its maximum north-south dimension about 3 miles. Its south contact is south of and roughly parallels Deluge Wash. Its north and east contacts are in and adjacent to Crow Canyon. The southeast corner of the stock was seen in contact with Precambrian mafic-rich rocks, so its east contact is not entirely with Quaternary-Tertiary sediments, as suggested by regional geologic maps. The south contact of the stock is locally irregular but trends N. 75° W. and is steeply dipping. Low-angle (-45°) sills and projections of the stock may be seen along the contact. They were once extensive but have been largely removed by erosion. The stock's highest elevation is Diamond Joe Peak at 5,132 feet. Any drilling would take place at elevations between 3,800 and 4,700 feet, probably around 4,100 feet.

The Diamond Joe stock is a passive, composite stock. Diamond Joe Peak and the surrounding area is a coarse-grained granite porphyry presumed to be the deep "inner" facies of the stock. It has abundant phenocrysts--rounded quartz eyes averaging 0.2 inches and euhedral K-feldspars as large as one inch. Most of the numerous joints carry muscovite, quartz, or both. The rock is shot through with intersecting quartz veinlets, mostly trending north-northwest. Other joint sets are present, but the dominant set is N. 20° W., dipping about 70° E. A more equigranular "quartz monzonite" phase of the stock was observed south of Diamond Joe Peak, and a possible gradational contact is proposed (see enclosed map). This rock has numerous, rounded quartz phenocrysts and sparse to moderate amounts of K-feldspar phenocrysts. It is tentatively correlated with "quartz monzonite" in the Hamme mine area. Further mapping may show that this "intermediate" phase of the stock rims the "inner" coarse granite porphyry.

Except for the Diamond Joe vein, the eastern two-thirds of the stock has no known significant mineralization. Sparse, weak limonite stains suggest sparse pyrite. The coarse porphyry dominating the eastern two-third of the stock is truncated by and apparently upthrown along a high-angle N. 35° W. fault. The one-third of the stock west of the fault contains the Hamme quartz monzonite or "intermediate" facies of the stock and an "outer" fine-grained equigranular facies--the Leviathan biotite granodiorite. This southwestern block also contains an arcuate zone of significant Cu-Mo mineralization, mostly in the granodiorite, whose width is 3,000-4,000 feet and circumference is more than 15,000 feet. Within this arc, one can observe prominent quartz-pyrite-chalcopyrite veins trending mostly northeast, also east, north, and northwest. Abundant, close-spaced fractures contain muscovite, quartz, and limonite after sulfides--pyrite and minor chalcopyrite and molybdenite.

On the inner or eastern edge of the mineralized arc, along Robbie's Wash, Dalton Robinette discovered numerous small molybdenite shows associated with abundant quartz-muscovite-K-feldspar veinlets and veins, which are mostly high-angle, striking N. 60°-85° E. Veinlets with other attitudes are present and locally form stockworks of intersecting veinlets attended by intense muscovite-K-feldspar "greisen" alteration. Pyrite and chalcopyrite are rare. This zone of "greisen" mineralization trends north-northwest, is at least 1,500 feet long and 300 feet wide. Six samples taken from location pits on Robinette's Potlicher claims by Loghry in 1963 varied from 0.352% Mo (chip over 25 inches) to 0.007% Mo. A similar, smaller "greisen" zone was noted in Copper Canyon about 1,000 feet southeast of the Leviathan mine.

Within the arcuate mineralized zone, it is easy to discern an area of more intense quartz-muscovite-sulfide mineralization about 4,000 by 1,500 feet, including the Leviathan and American mines. Seventeen prominent quartz-sulfide veins (more are present) were mapped in this area, most of them striking northeasterly, and abundant, close-spaced quartz sulfide and sulfide veinlets, some with muscovite-rich alteration envelopes. Secondary K-feldspar is associated with some veinlets and many of the biotite phenocrysts in the granodiorite host are chloritized. Megascopically, the alteration of the rock a few centimeters away from the veins and veinlets appears to be weak, but thin-section studies might alter this observation. This need not be a serious drawback because

alteration not pervasive.

economic porphyry copper ores have been found in or near weakly altered intrusive rocks. The large arcuate zone of mineralization may be compared with arcuate zones containing ore bodies at Mineral Park and Sierrita-Esperanza, Arizona. The smaller American-Leviathan zone within the mineralized arc could reflect a buried porphyry copper deposit. There are differences, but as Downey points out, the situation could be analogous to the Copper Creek (Arizona) discovery where a not-too-impressive zone of close-spaced pyritic fractures in weakly altered granodiorite reflect the upper prong of a 100,000,000-ton ore body. Except for two shallow angle holes testing the Leviathan vein and a shallow vertical hole northwest of the Leviathan, the American-Leviathan zone has not been tested. On the enclosed map, two areas within the American-Leviathan zone are designated as drill targets. One includes the Leviathan vein and a swarm of mineralized fractures southeast of the vein. This target can be readily drilled from an existing road on the south side of Copper Canyon. The other target includes an area of splashy pyrite and copper oxide mineralization 1,100 to 1,800 feet southeast of the Leviathan mine, possibly the reason for the name, Copper Canyon. It might be difficult to drill the heart of this area, but repair of existing trails would permit drilling on its northwest or southeast side. Two 3,000-foot diamond drill holes are required to test these targets. Cost of such a drilling program is estimated at $100,000.

tourmaline + CuOx present at Cu Creek

## Geochemical Sampling

Stream sediment samples taken in sec. 29 near the proposed drill targets by Downey and Gallan were: DE-1, 290 ppm Cu and 59 ppm Mo (Deluge Wash below American mine); DE-2, 90 ppm Cu and 58 ppm Mo (Robbies Wash); DE-3, 170 ppm Cu and 10 ppm Mo. These values are comparable to or greater than those taken adjacent to other Mohave County Cu-Mo properties, including Mineral Park (Ithaca Peak). Histograms, including 151 Mohave County stream sediment samples taken by Downey and Gallan, indicate that background is 30 ppm Cu and 2 ppm Mo. Anomalous values are +85 ppm Cu and +10 ppm Mo.

Nineteen rock-chip samples range from 5 to 1,550 ppm Cu and 2 to 380 ppm Mo. Fourteen of these 19 samples are anomalous in Cu or Mo, or both. Considering the visible mineralization, these anomalous values are not surprising, but they serve to support the contention that Diamond Joe is a significant prospect.

## Previous Exploration and Development

Past production in the Cedar Valley district has been from the small gold mines at Cedar, copper, lead, and precious metals from the Copperville vein (Siamese patented claims), and molybdenite from the Leviathan, American, and Hamme mines. Chalcopyrite, an important byproduct of the molybdenite ores was shipped but not paid for.

The Leviathan vein is about 1,500 feet long and 7 to 20 feet wide. It was mined last in 1917 from a 220-foot shaft. The ore carried about 1% molybdenite and almost as much copper in chalcopyrite (Frank Hess, 1924, U.S. Geological Survey Bull. 761, p. 41). Sometime later, the Inspiration copper Company drilled one or two shallow holes near the Leviathan vein. One of them is a south-trending core hole at 50°, apparently to test the south part of the Leviathan vein. The drill collar is in the wash about 200 feet west of the Leviathan vein. Another site was found southeast of the shaft and may also be an Inspiration angle hole. Core from one or both of these holes is scattered near the first-described hole.

A more recent vertical core hole was probably drilled by ARKLA about 800 feet northwest of the Leviathan shaft. Granodiorite core chips show quartz-pyrite veinlets, some with chalcopyrite and molybdenite. Hugh Steele, Newmont, recalls that the hole is 1,500 feet deep and averaged 100-150 ppm Mo. The three holes described above are the only ones known to have been drilled in or near the American-Leviathan zone. Two vertical holes, 1,500 feet northeast and 2,300 feet east of the Leviathan shaft, are also believed to be ARKLA holes. Five shallow vertical core holes north of the Leviathan were drilled on geochemical and IP anomalies by Western Equities in 1964. None of the holes drilled to date have tested the possibility that the American-Leviathan zone of quartz-sulfide veins and veinlets is the surface expression of a buried primary copper-molybdenum ore body.

## Land Situation

The drill target areas are covered by 12 patented claims. Taxes are paid by out-of-state individuals, so the claims are probably not in company hands. An option to purchase the patented claims is essential to any exploration project.

The "Leviathan group" of 7 patented claims (Mineral Survey No. 3290A) is owned by Frank McCarthy, 3328 West First Avenue, Vancouver, British Columbia, Canada. Taxes were paid by Mrs. R. Burnnett (same address) on October 29, 1973: Parcel #208-46-01, Summit and Whale #3 claims--$8.74; Parcel # 208-48-01, Copper Wonder #1, Copper Wonder #2, Whale, Leviathan, Water Claim--$22.48.

The "American group" of 5 patented claims (Mineral Survey No. 3527) is owned by Walter and Annet Russel, 1420 253rd Street, Harbor City, California 90710. Taxes were paid by Mr. Russel on October 29, 1973: Parcel #208-47-01, Copper Wonder #3, Copper Wonder #4, Copper Wonder #5, Copper Canyon, Great Canyon--$24.98.

The 5-acre Leviathan Millsite claim (Mineral Survey No. 3290B) is in the N1/2NW1/4 sec. 31, T 17 N, R 14 W. In unaltered Precambrian rocks 5,700 feet S 40° W of the Leviathan shaft, well outside of the target area, it is not of immediate interest. Owner is unknown.

The Congress patented mining claim is about 4,000 feet S 10° W of the Leviathan shaft in the SE1/4 sec. 30 out of the area of present interest, according to the GLO and BLM maps. However, the Mohave County Assessor's Map 48, Book 203, suggests the Congress may actually be near the center of sec. 30, about 2,000 feet southwest of the Leviathan shaft. If this alternate location is correct, the Congress is close to the Diamond Joe stock, but its purchase would be necessary only if we struck ore near the Leviathan mine. Owner is unknown.

Unpatented claims noted during this investigation are the Purl 1-7 and the Big John and others staked by Arkansas-Louisiana Gas in a 1966-67 program. The Luv 17, 18, 19, and others were staked over the Purls by Denys Poyner of Kingman September 7, 1972. There are no new location pits or drill holes and Downey reports (1/2/73) that the Luvs were never recorded. Assessment work was last recorded in April 1968 on the ARKLA claims. No locations or work have been recorded by Denys Poyner in the last 6 years.

In 1962, Dalton Robinett of Kingman staked the Potlicker Junior, the Potliher Senior, and the Potlicker 1-7 claims on molybdenite showings in the S1/2 sec. 20 and N1/2 sec. 29. He also staked the Peco 1-6 around the Hamme mine in secs. 17 and 20 in May 1962. Robinette and Poyner staked but never recorded the Asp 1-4 (others?) in September 1965 (NW1/4 sec. 20). Robinette and Dadlink You staked the Sunshine 1-6 in February 1965.

Affidavits of labor for 1971-72 were recorded by Robinett on November 22, 1972 for the Potliker Junior, Potliker Senior, Potliker 1-7; Sunshine 1-6; Big John 1-7, Peco 1-6. No affidavits have been recorded by Robinett or anyone else for 1972-73 on the known unpatented claims in the Diamond Joe area, so the unpatented claims are open to location.

Recommendations

It is recommended that You, Downey, and I make a 2-day (allow 4 days) examination of the Diamond Joe prospect. If you feel that the Leviathan-American zone is a porphyry copper target and are prepared to finance the necessary drilling (6,000 feet or more), I recommend we stake 100-130 claims and move to option the 12 patented claims essential to the proposed project.

James D. Loghry

JDL:h

January 1974

Diamond Joe Prospect, Mohave County, Arizona

Thin-section specimens and geochemical samples, T 17 N, R 14 W

DJ 1 About 1200' S 77 E of NW cor. sec. 29. Field description: equigranular, fine-grained biotite granodiorite, nonporphyritic except for biotite and rare quartz blebs. Judged to be same rock as at Leviathan, American mines. Limonite after minor pyrite on fractures, weak chlorite alteration of biotite; otherwise a fresh-appearing rock. Petrologist: biotite quartz monzonite. 188 ppm Cu, 16 ppm Mo, 0.11 ppm Au.

DJ 2 Drill core, scattered by cement building, judged to come from Inspiration Copper Co. drill hole about 1150 feet S 25 W of NE cor. sec. 30, in wash 200 feet west of Leviathan mine, a south-trending hole at 50° to probe south extension of Leviathan vein; no vein core is present. Field description: same as DJ 1, but quartz veinlets, disseminated pyrite present and matrix appears more altered. DJ 1 and DJ 2 are from the southwest equigranular facies of the Laramide Diamond Joe stock. Biotite quartz monzonite. 627 ppm Cu, 10 ppm Mo, < 0.10 ppm Au.

DJ 3 Southwest face, Hamme mine drift, about 2400 feet east of NW cor. sec. 20. Medium-grained quartz monzonite porphyry with 0.1-inch quartz eyes, some 0.1-0.3-inch K-feldspar phenocrysts. Alteration and copper stain due to adjacent Cu-Mo vein. Normally the rock is fresh appearing. This specimen has less biotite than DJ 1, DJ-2, DJ 5, same amount as DJ 4. Hamme porphyritic quartz monzonite. 267 ppm Cu, 127 ppm Mo, < 0.1 ppm Au.

DJ 4 About 2300 feet N 52 E of SW cor. sec. 27. Unmineralized, unaltered stock rock, quartz monzonite porphyry with numerous quartz eyes, no K-feldspar phenocrysts noted; except for quartz eyes similar to DJ 1 and DJ2, but because of quartz eyes it is tentatively correlated with DJ 3, the Hamme porphyritic quartz monzonite, which is a variable rock--also quartz eyes, but can have no or few K-feldspar phenocrysts. Muscovite on fractures, weak limonite stains. 14 ppm Cu, 5 ppm Mo, < 0.1 ppm Au.

DJ 5 About 2000 feet S 17 E of NW cor. sec. 21. East of N 33 W fault, it is the core of the Laramide Diamond Joe stock, a coarse "granite" porphyry, with abundant, 0.2-inch, euhedral K-feldspar phenocrysts; reminds me of the Schultze Granite at Miami, Arizona. Biotite phenocrysts. Many quartz veinlets, intersecting but roughly paralleling the predominant N 20 W dip 72 E joints which carry muscovite. Rock is fresh appearing. This specimen has fewer than normal K-feldspar phenocrysts.
19 ppm Cu, <1 ppm Mo, <0.1 ppm Au.

DJ 6 1000 feet N 60 E of SW cor. sec. 28. Precambrian, mafic-rich diorite(?) gneiss. Precambrian rocks south of the Diamond Joe stock are dark, much more mafic than the granite gneisses, granites, and aplites north of the stock in the Copperville area.
36 ppm Cu, 82 ppm Mo, 0.17 ppm Au.

DJ 7A 7B Inspiration drill-core specimen demonstrating 1-inch wide alteration of Leviathan biotite quartz monzonite along a quartz muscovite $MoS_2$ veinlet. Same presumed location as DJ 2.
32 ppm Cu, 10 ppm Mo, <0.10 ppm Au.

DJ 8 "Greisen," orthoclase rock with quartz, muscovite, $MoS_2$, rare pyrite veinlets; dump of Robinett's shallow shaft, about 2100 feet S 80 E of NW cor. sec. 29.
301 ppm Cu, 44 ppm Mo, 0.11 ppm Au.

DJ 9 "Greisen" with $MoS_2$, rare pyrite, orthoclase rock with quartz, muscovite veinlets, ledge north of Robinett's shaft, about 1840 feet S 80 E of NW cor. sec. 29. No geochemical assay made.

James D. Loghry

JDL:h

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# Laboratory Analysis Report

Towne Exploration, Inc.
% James D. Loghry
2121 E. Monte Vista Dr.
Tucson, Arizona 85719

REPORT NO. 743805
DATE SUBMITTED 1-11-74
DATE REPORTED 1-19-74

| Sample Number | PPM Copper | PPM Molybdenum | PPM Gold |
|---|---|---|---|
| CC - 1 Copper Creek, Az. recon | 446 | 6 | 0.26 |
| CC - 2 | 878 | 13 | <0.10 |
| CC - 3 | +1000 | 4 | 0.14 |
| CC - 4 | 427 | 10 | 0.12 |
| DJ - 1 Dr[illegible] Zone, Mohave Co., Az. | 188 | 16 | 0.11 |
| DJ - 2 [illegible] | 627 | 10 | <0.10 |
| DJ - 3 | 267 | 127 | <0.10 |
| DJ - 4 | 14 | 4 | <0.10 |
| DJ - 5 | 19 | <1 | <0.10 |
| DJ - 6 | 36 | 82 | 0.17 |
| DJ - 7 | 32 | 10 | <0.10 |
| DJ - 8 | 301 | 44 | 0.11 |
| Hamme Mine | 366 | +500 | - |

## GEOCHEMICAL ASSAY

| Sample Number | % Copper | % Molybdenum |
|---|---|---|
| CC - 3 | 0.11 | - |
| Hamme Mine | - | 0.28 |

Nancy Nightswanger
Signed

January 18, 1974

Diamond Joe Project, Mohave County, Arizona

Discussion of prospect petrology with Richard Leisure. See Leisure's thin-section reports for details.

DJ-1 Biotite quartz monzonite, same as Leviathan biotite quartz monzonite and Inspiration drill-core specimen DJ 2. Minor alteration of plagioclase to sericite, biotite to Mg Fe chlorite. This weakly altered outcrop specimen is a short distance west of $MoS_2$ "greisen" and in the midst of ARKLA close-spaced holes 6, 10, 11, 12, which cut numerous intercepts of ore grade (0.1 to 4%) $MoS_2$. A geochemical sample DJ-1 analyzed at 188 ppm Cu and 16 ppm Mo. This is evidence for a radical and favorable change in alteration and mineralization in a few hundred feet or less. Alteration in the well-exposed rocks adjacent to DJ 1 is not encouraging. Geochemical sampling is encouraging. Adjacent drill-hole assays and the "greisen" alteration are startling when compared with the outcrop. 12

DJ-2 Inspiration drill-core specimen. Biotite quartz monzonite cut by 1/4-inch quartz, orthoclase, fluorite, muscovite veinlets with 1/4 inch of wall-rock alteration with biotite altered to muscovite, Mg Fe chlorite, fluorite, calcite, rare tourmaline, plagioclase altered to muscovite and fluorite, sericite, calcite, kaolinite.

DJ-2B Another Inspiration core specimen, biotite quartz monzonite with quartz vein and successive alteration zones with secondary muscovite. Fluorite, sericite, quartz, orthoclase, calcite, biotite, kaolinite, chlorite, pyrite, $MoS_2$ are present.

DJ-2C Inspiration core specimen similar to DJ-1 outcrop specimen; chosen for its "fresh" appearance but found to have microveinlets with fluorite, calcite, pyrite, quartz, muscovite.

DJ-3 Hamme mine specimen adjacent to quartz-muscovite-$MoS_2$-chalcopyrite vein. Hamme porphyritic quartz monzonite with quartz and muscovite phenocrysts in a medium-grained matrix. Moderate plagioclase alteration to sericite, clay, minor calcite and fluorite veining, some biotite altered to chlorite, leucoxene.

DJ-4 Porphyritic quartz monzonite with aggregate quartz phenocrysts. It is reasonable to correlate this with DJ-3. Biotite shows some alteration to chlorite, muscovite, sphene. Two bands where plagioclase is altered to clay and gunk epidote. Megascopically, the hand specimen appears unaltered.

DJ-5 Fresh, coarse quartz monzonite porphyry. Diamond Joe quartz monzonite porphyry; "deep" core of stock.

DJ-6 Precambrian biotite amphibolite gneiss; all minerals recrystallized and unaltered. Geochemical anomaly in Mo and Au is interesting.

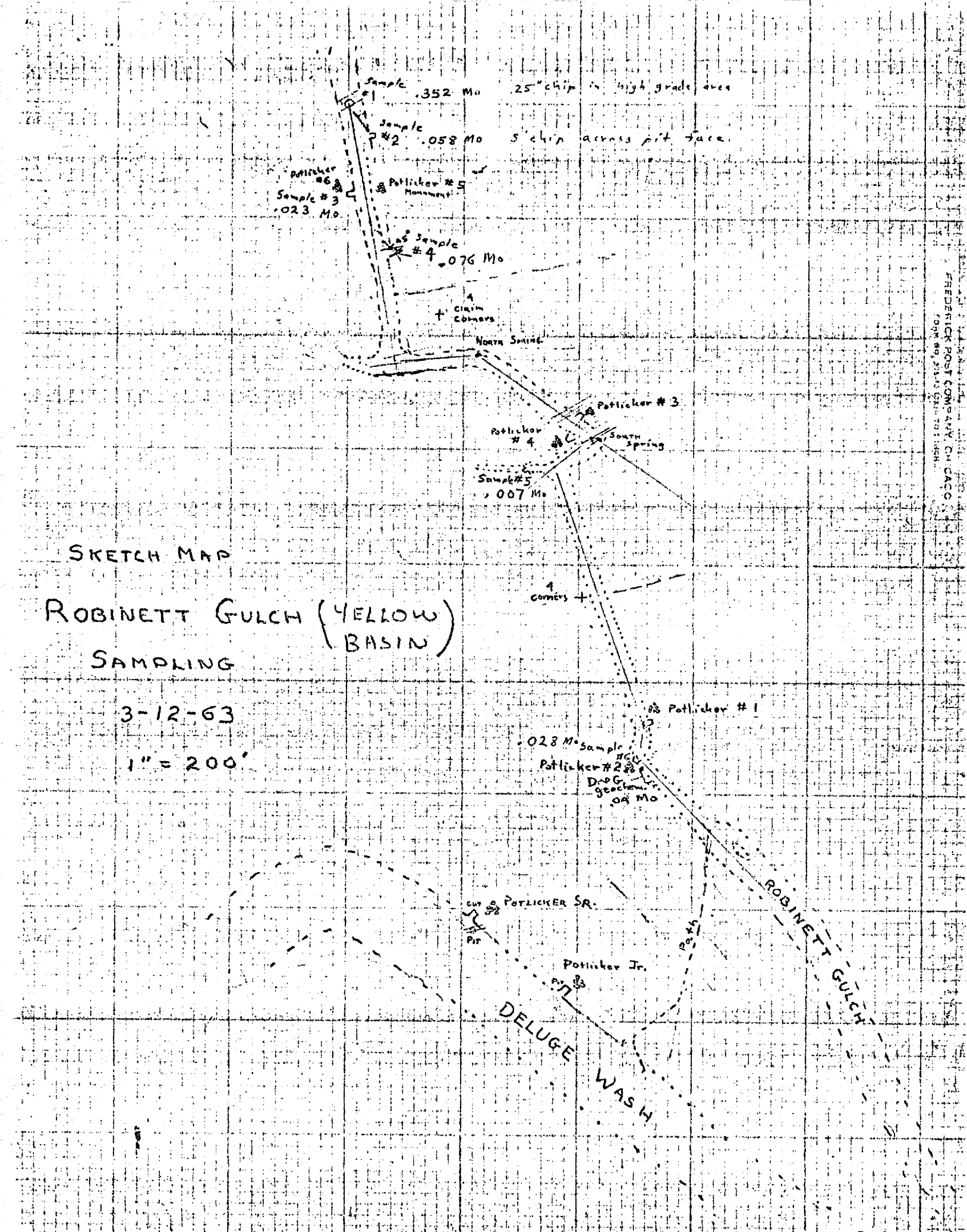
DJ-7A -7B Inspiration drill core specimen demonstrates alteration of Leviathan quartz monzonite porphyry to secondary orthoclase, muscovite; sericite; kaolinite, chlorite, biotite along a quartz-$MoS_2$ veinlet. Thin, 0.1-0.4 mm wall-rock alteration as in DJ-2, DJ-7A, DJ-7B was noted on most of the billions of quartz-pyrite veinlets in the Leviathan-American mine zone and is judged to be favorable. Similar thin wall-rock alteration, but without fluorite and muscovite, was noted in outcrops at Bear Creek DDH-1 site, Copper Creek, Arizona, a drill hole that encountered ore-grade Cu-Mo intercepts.

DJ-8 "Greisen," completely altered rock, 50% muscovite, 30% orthoclase, 20% quartz, bleached biotite.

DJ-9 "Greisen," almost completely altered rock, secondary K-feldspar, quartz, muscovite, also fluorite, scheelite(?), molybdenite, pyrite.

James D. Loghry

JDL:h




SKETCH MAP

ROBINETT GULCH (YELLOW BASIN)

SAMPLING

3-12-63

1" = 200'

[illegible]

DJ-1 ½ T.S. stained for K

Equigranular, phaneritic Quartz Monzonite

Quartz - not many phenocrysts in hand specimen 25%
interlocking grain groups - all looks primary

Plagioclase - with perthitic structure which grades into 35%
adjacent orthoclase at some places - sericite alteration
in plagioclase is minor and deuteric - Michel Levy gives
An 30 to 34 - minor orthoclase in plagioclase is deuteric -

Orthoclase - all looks primary 30%

Biotite - @ 2, 129.7 and elsewhere - bent flakes show curved 10%
cleavage @ 6, 105 - hand specimen has 15% biotite - some biotite
grains show alteration to mixed Mg=Fe chlorite alteration -
biotite patch largely altered to chlorite & muscovite @
15.7 , 121.4 - flame intergrowth biotite, chlorite, muscovite,
sphene @ 9.8 , 113

Kaolinite - replacing ? grains @ 1.0 , 116.2

Apatite - @ 13 , 93.2 also 14 , 116.1

Sphene - @ 9.2 , 111.6 symetrical extinction of rhombs - some ½%
hematite replacing rims or terminal points of rhombs

Muscovite - @ 16.4 , 110.5 pale green color may be alt, of
biotite - @ 22.8 , 105.3 looks primary - muscovite & chlorite
perpendicular to surface of magnetite @ 18.4 , 104.7 may be alt.
of biotite -

DJ-1 (cont.)

Opaques - magnetite w/ metallic luster - no hint of red earthy 1%
hematite - no hint of pyrite - some prefered magnetite assoc.
with sphene - but magnetite associated with all other minerals -
magnetite octahedrons cut @ 7.4 , 124.1 also 11.1 , 112.2 but
most are irregular to subhedral - X'l outline @ 12.5 , 96.7
may show octahedral parting - no hint of ilmenite in magnetite

DJ-2A ½ of T.S. stained for K

Original rock like DJ-1, an equigranular, phaneritic

Quartz Monzonite

now cut by a ¼ inch quartz, orthoclase, fluorite, muscovite

vein which has altered the adjacent rock ¼ inch on each side

Original rock - quartz = 30%
at edge of plagioclase = 35%
thin section orthoclase = 25%
biotite = 10%
w/ minor sphene & magnetite

Vein is as described above w/ the orthoclase, muscovite &

fluorite generally in median of vein see @ 12.9 , 121.7 -

all minerals in vein are anhedral suggesting veining by replaeement

rather than open space filling -

Rock alteration along vein

Biotite altered to muscovite, Mg chlorite, Fe chlorite, epidote,

hydrobiotite ? , sphene w/ distance from vein @ 12.3 , 101.7

Biotite altered to Mg chlorite, Fe chlorite, hydrobiotite ? ,

sphene, fluorite, calcite, muscovite, quartz @ 10.7 , 104.1

Biotite w/ rutile ? needles @ 8.6 , 113.7

hexagonal outline of Biotite w/ rutile needles in pattern @

6 , 118.5

Biotite altered to Mg chlorite, spindle sphene & calcite @

9.1 , 123.9

Biotite altered to chlorite, "bird's eye" structure still

preserved @ 16.6 , 113.4 some sphene spindles in chlorite

DJ-2A (cont.)

Tourmaline & kaolinite as altered bleb in biotite which is completely altered to Mg = Fe chlorite @ 18.2 , 125.8

Quartz possibly replaced by muscovite - at edge of vein @ 11 , 111.3

Plagioclase - core altered to muscovite patches & flourite @ 10.1 , 96.8 - core altered to calcite & sericite @ 7.1 , 126
Kaolinized plagioclase core @ 3 , 96.8
Kaolinite replacing ? grain @ 12.5 , 93.1
Sphene outline almost completely replaced ? by specular hematite or as an intergrowth @ 19 , 95.3
Zircon @ 21.9 , 130.2 also 3.1 , 119.4
Apatite @ 2.8 , 99.1
Tourmaline needle in quartz @ 8.5 , 126.4
Rutile needles in chlorite after biotite @ 9.4 , 96.7
Pyrite cube in vein @ 10.8 , 115.2 - also scattered cubes and masses in vein -

DJ-2B ½ of T.S. stained for K - T.S. Made from core

same rock type as DJ-1 Equigranular, phaneritic

Quartz Monzonite - now cut by quartz, muscovite alteration

vein at least 1 inch thick - core broken across zone

Original rock - quartz = 25%
at edge of plagioclase = 45%
thin section orthoclase = 20%
biotite = 10%
w/ minor magnetite, apatite
may border on Granodiorite

Quartz vein minerology - interlocking grains of quartz -

no straight line boundaries - most quartz has undulatory

extinction - some orthoclase, pyrite, muscovite, fluorite in

vein - all secondary, - 1 mm. clots $MoS_2$, on vein wall, in veinlet.

Adjacent zone - muscovite, quartz, flourite, orthoclase, calcite
all secondary
Next adjacent zone - muscovite, quartz, fluorite
all secondary
Next adjacent zone - muscovite & fluorite at left edge of T.S.
all secondary mineralization and replacement

On opposite side of vein - closest to vein -

Plagioclase altered to kaolinite & calcite

Shready, patchy secondary biotite - some secondary orthoclase
near quartz vein
Biotite w/ red transluscent hematite, probably primary

some distance from vein - Biotite altered to colorless chlorite

& lamellar goethite & lamellar goethite stained calcite @

21.2 , 110.1

Zoned plagioclase altered to iron stained calcite & vermicular

kaolinite - zoned plagioclase altered to kaolinite, sericite,

allophane clay, & yellow brown goethite @ 6 , 103

DJ-2B (cont.)

some distance from vein (cont.)

Plagioclase altered to sericite along albite twinning planes - some alteration to orthoclase - alteration to medium calcite, kaolinite, sericite @ 2.9 , 93.8 -

Biotite - w/ alteration calcite, goethite, rutile @ 19 , 99.4
w/ lamellar goethite alteration @ 7.9 , 96.6
Secondary biotite clot w/ goethite & quartz @ 3 , 94.3
Ragged patches of various orientation @ 6.4 , 88.4 is probably secondary

Muscovite - veinlet controled mineralization or plumose replacement - muscovite blade cutting quartz grain @ 5 , 116.7

Opaques - specular hematite w/ earthy red hem @ 7.4 , 97.9 probably redistributed iron away from vein -
pyrite @ 1.9, 115.7 near vein irregular rounded blebs, few straight edges - some"included" quartz, muscovite, orthoclase in 2 dimensions -
hematite w/ leucoxene @ 14. , 91.2 is probably alt. of ilmenite
Fluorite - anhedral - fills open spaces or intergranular surroundee by muscovite @ 2.8 , 141.1
Chlorite - green Fe-rich @ 6.5 , 90 as alteration of primary biotite - w/ goethite & calcite also alt. of 1st biotite @ 15.1 , 86.4

DJ-2B (cont.)

Colorless chlorite - w/ goethite @ 7.4 , 84.8 as alt. of 1st biotite

Green chlorite - w/ lamellar geothite @ 10, 85.1 also 12.2 , 100.6 as alt. of 1st biotite

Rutile - @ 9.1 , 104.1 also 4.2 , 114.3 as single grains

Calcitegroup @ 17 , 109.4 iron stained

Rutile needle in quartz @ 7.3 , 99

DJ-2C ½ of T.S. stained for K

Geochemical analysis

Original rock like DJ-1, an equigranular, phaneritic

Quartz Monzonite

Now mineralized by thin veinlets not visible in hand specimen

Original rock at edge of thin section - Quartz = 30%
Plagioclase = 35%
Orthoclase = 30%
Biotite = 5%
w/ minor magnetite
& sphene

Present alteration & mineralization includes:

Fluorite @ 6 , 116.1 octahedral cleavage visible

Fluorite veinlet @ 11.7 , 102.3

Calcite veinlet in cracks thru magnetite, biotite, plagioclase, quartz @ 22.8 , 125.6

Biotite book with sphene & rutile alteration in rim

Biotite altered to Mg chlorite with interlamellar sphene, muscovite & calcite ? 11.5 , 100.2

Biotite book with rim alteration to Fe chlorite @ 7.8 , 98 also 8.5 , 93.2

Pyrite veinlet @ 9.3 , 129.5 - pyrite disseminated as @ 0 , 115

Pyrite inside fluorite grain @ 4.9 , 114.1

Primary magnetite w/ geniculate twinned rutile prisms @ 1.5 ,110.8

Muscovite veinlet thru orthoclase @ 14.5 , 99.1

Plumose radiating muscovite in plagioclase @ 3.8 , 112.6 may be only deuteric rather than hydrothermal

DJ-3 ½ of T.S. stained for K

Equigranular, phaneritic Quartz Monzonite

Quartz - aggregate phenocrysts (slightly larger than other minerals) 30%

Plagioclase - medium clay and sericite alteration 20%

plag lath cut by calcite veinlet, some muscovite & orthoclase next to veinlet in plag. @ 20 , 112.3 - Michel-Levy gives An 26 = Oligoclase -

Orthoclase - intergranular patches - orthoclase , muscovite, fluorite veinlet cutting plagioclase and some quartz @ 3.2 , 110 - w/ many inclusions @ 10.2 , 119.6

Biotite - some fresh - some altered to chlorite, leucoxene, earthy red hematite, geothite - single lath of Lepidomelane ? high Fe variety of biotite @ 20.5 , 122.4 check also @ 9.6 , 106 5%

Apatite - @ 6.7 , 107

Sphene - w/ leucoxene & magnetite @ 6.2 , 107.5 ½%

Rutile - needles in quartz @ 19.8 , 107.7 - needles in biotite & plagioclase @

Tourmaline - needles in plagioclase @ 9.5 , 117.3

Calcite - intergranular @ 5.3 , 106.3 also in veinlets ½%

Fluorite - @ 11.9 , 113.8 ¼%

Unknown @ 10.5 , 130.7 try monazite or similar rare earth min.

Zircon -

DJ-3 (cont.)

Opaques -

magnetite - no octahedrons - $\frac{1}{2}$% of T.S.

red transluscent hematite.

leucoxene

magnetite in sphene @ 1.7, 119

All opaques are primary or deuteric - none seem to be late secondary mineralization - did not find any pyrite

Muscovite - radiating laths in orthoclase @ 3 , 98.7 - 2%
radiating laths in zoned plagioclase @ 16.3 , 109.8 also plumose in plagioclase @ 15.5 , 126.7 - all muscovite looks like inclusions or late deuteric, but not late secondary hypogene alteration.

DJ-4 ½ of T.S. stained for K

Equigranular, phaneritic, only slightly porphyritic

Quartz Monzonite

Quartz - aggregate phenocrysts slightly smaller than in DJ-3 25%
measure sign @ 9.6 , 119.6

Plagioclase - minor perthitic structure in rim of grains - 35%
T.S. cut by two bands in which plagioclase is saussurized to
a very fine-grained mixture of allophane clay and gunk type
epidote see 12.4 , 121.5

Orthoclase - intergranular - some larger patches with minor 30%
inclusions - all looks primary

Apatite - @ 4.9 , 113.7

Sphene - @ 0.6 , 108.8 ¼%

Opaques - magnetite @ 4.5 , 99.2 - magnetite in sphene @ ¼%
6.9 , 114.8

Sphene @ 0.6 , 108.8 ¼%

Biotite - some alteration to chlorite & minor muscovite & 10%
sphene

DJ-5 ½ of T.S. stained for K

Porphyritic, phaneritic groundmass

Quartz Monzonite Porphyry

fresh rock, almost no alteration throughout

Quartz - large aggregate phenocrysts - hexagonal edge on one 35%
phenocryst @ 1.7 , 122.6 - also fine grained interstitial

Plagioclase - some phenocrysts - very minor deuteric allophane 30%
clay & sericite alteration - Michel-Levy gives An 32 = Andesine -
gives An 28 = Oligoclase on rims

Orthoclase - mostly fine-grained interstitial & around quartz 30%
grains - one large phenocryst w/ plagioclase, biotite, & quartz
inclusions - orthoclase phenocryst larger than quartz phenocryst -

Muscovite - minor intergranular @ 9 , 97.6 - as inclusions in 1%
orthoclase @ 15.1 , 128.4 - as inclusions in plagioclase @
15.5 , 125.1 -

Biotite - w/ lamellar strings of leucoxene @ 8.7 , 94 - 3%
5% in hand sample - no trace of chlorite alteration -

Zircon - @ 10 , 103.3 interstitial to plagioclase grains

Opaques - magnetite, irregular, no X'l outlines 1%
hematite after magnetite ?
minor goethite staining ?

DJ-6 ½ of thin section stained for K

Precambrian biotite amphibolite gneiss

All minerals are recrystallized and fresh

No sign of hydrothermal alteration

Mineral % in dark part of rock which is predominant.

Amphibole - perhaps hornblende variety 70%

Quartz - 2%

Plagioclase - with minor sericite ? or illite ? very-fine-grained 3%
alteration @ 19 , 127.3 which is probably metamorphic

Orthoclase - in a band w/ plagioclase @ 13 , 128.orthoclase 5%
does not look like hydrothermal -

Biotite - all is unaltered - no chlorite found 20%

Apatite - 1%

Sphene 1%

Zircon - rounded grains @ 15.7 , 125.4 also @ 10 , 121.2

DJ-7A ½ of T.S. stained for K

Equigranular, phaneritic Quartz Monzonite

Now sheared, altered & mineralized

Original rock at edge of thin section - Quartz 30%
Plagioclase 35%
Orthoclase 30%
Biotite 5%
w/ magnetite, apatite,
some muscovite may be
primary deuteric

Present alteration & mineralization includes:

Quartz. + calcite veining in quartz

Plagioclase - altered to kaolinite, allophane, dirty calcite
altered to sericite @ 12.3 , 105.5 also 24 , 126.5

Orthoclase -

Biotite - some slightly bleached

some completely altered to Fe chlorite w/ goethite, apatite, leucoxene, rutile, muscovite @ 21.3 , 119.2 - ragged patches of secondary biotite @ 6.5 , 100.7 - biotite w/ dendritic leucoxene & 1 large apatite X'l @ 0.5 , 124.4 - colorless chlorite after biotite @ 7 , 117.8 also 11.5 , 109.8 & elesewhere- Colorless chlorite w/ goethite @ 15.6 , 128 - Colorless chlorite w/ goethite as alteration of biotite inclusion in orthoclase -

Muscovite - @ 4.7 , 104.8 - pale yellow-green

DJ-7A (cont.)

Muscovite (cont.) pale yellow-green - patches in plagioclase phenocrysts @ 18 , 122 also 17.5 , 110.1 also 21.1 , 115.3 are probably deuteric -

patch in quartz @ 4.6 , 104.9 (quatz grains) is probably primary -

patch in orthoclase @ 19 , 123.5 is probably deuteric

Opaques -

octahedrons & X'l outlines of hematite after magnetite @ 22.8 , 114.3 -

magnetite w/ alteration to hematite along cracks @ 0.3 , 123.7

Molybdenite - shreaded laths @ 23.4 , 103.9 w/ muscovite in aggregate quartz grains

Goethite - @ 19.7 , 105.7 also 13.4 , 112.2 & elsewhere

Calcite - in center of orthoclase grain @ 19 , 107.8

Calcite grains @ 17.1, 105 w/ quartz grains

Calcite veinlet thru all minerls @ 18.7 , 119.8

Calcite patch relacing center of plagioclase @ 19.5 , 107.2

Fluorite - @ 18 , 110.3 as replacement of plagioclase

Sphene - irregular pathes
Apatite @ 6.9 , 117.3 also 5.8 , 103.4
Rutile @ 5.7 , 112. 8 also 3.3 , 116.8

DJ-7B ½ of T.S. stained for K

Cut from same hand specimen as DJ-7A but at right angles

Equigranular, phaneritic Quartz Monzonite

Now sheared, altered & mineralized

Original rock at edge of thin section - Quartz = 25%
Plagioclase = 40%
Orthoclase = 25%
Biotite = 10%

Present alteration & mineralization includes:

Quartz - sphene in quartz @ 15.4 , 104.4 is twinned along (100)

Plagioclase - w/ heavy alteration to sericite

Orthoclase - interstitial - most looks primary

Biotite - altered to colorless chlorite with lamellar yellow-brown goethite @ 6.4 , 124.3 also with muscovite alteration. - altered to colorless chlorite w/ apatite @ 16. 8 , 98.3 - altered to colorless chlorite, was an inclusion in orthoclase @ 11.9 , 99.1 - calcite veinlet cutting biotite book @ 11.5 , 104.2 which is altered to colorless chlorite and yellow-brown goethite -

DJ-7B (cont.)

Muscovite - colorless - intergranular @ 7.3 , 100
pale green @ 7.4 , 103.6

muscovite patches in plagioclase & orthoclase @ 1 , 101-

intergrowth of muscovite & hematite in blade form or dendritic @ 0.7 , 120 also 3.2 , 115.6

Calcite - as veinlets & parallel stringers -

calcite vein w/ muscovite & hematite @ 11.0 , 104.3 may be altered phenocryst of ? min. -

Calcite & fluorite veinlet @ 8.4 , 105.1

Calcite patch in colorless chlorite w/ goethite & leucoxene @ 3.7 , 96.7

Apatite @ 14.3 , 94.5

Rutile @ 6.4 , 130.5 - rutile needles 7.8 , 97.3

Opaques -

magnetite massive & cubes altered to earthy red hematite @ 20.5 , 103.2 - magnetite altered to red transluscent hematite @ 0.7 , 129.3

Pyrite cube @ 6.1 , 96.7

DJ-8 ½ of T.S. stained for K, lots of holes in rock

Completely altered rock, hard to see any primary features, some quartz or orthoclase may be residual but I doubt it.

Quartz - yellow, orange int. colors section is a little thick 20%

Muscovite - pale yellow - pale green - medium grained patches 50%
laths - some plumose - no prefered orientation of grains - intergranular or cutting orthoclase @ 14.3 , 99 - w/ apatite inclusions as @ 0.5 , 121.2 -

Orthoclase - rib-like veinlets or residual veinlets, some 30%
intergranular to muscovite - all cloudy to brownish w/ allophane clay -

Biotite - bleached @ 2.4 , 94 - biotite, bleached & surrounded ¼%
by muscovite @ 1.9 , 99.3

Apatite - hexagonal outline @ 2.5 , 95.3

Zircon - @ 5 , 98.3

Opaques - magnetite octahedron @ 9 , 115.3 - some magnetite 2%
w/ leucoxene after ilmenite @ 9 , 125.9 -

DJ-9 1×3 slide
stained for K

Band of

muscovite
apatite - hexagonal outline @ 15.4, 89 also - 18.6, 99
~~fluorite~~: colorless isotropic grain @ 6.9, 85.9
but no cleavage, high relief ~~n = 1.434 = fluorite~~
grain > quartz = {1.544, 1.553} n = (1.633 - 1.630) - 1.655

fluorite - 3.7, 85.2 - also 15.5, 96 also 5.8, 95 w/ K-spar
2 directions of cleavage
in calcite

molybdenite - shreads - @ 4, 85.1 w/ unknown surrounding rim
in muscovite, calcite
try also @ 14, ~~50~~ 95.9 try also 6.7, 99
unknown ~~in~~ between calcite and muscovite @ 9.9, 85
unknown between quartz and muscovite @ 12.3, 88.7

unknown high bref - try zircon or rutile, @ 14.9, 88.6 also 20.8, 94.6
beta grain

~~anhydrite~~ calcite @ 23.8, 90.2 not gypsum
(-) try calcite - relief changes when turn stage
edge of slide may be thin

~~sphene~~ - recheck unknown w/ molybdenite @ 3.6, 100 ω = 1.918 ε = 1.934
try ~~molybdate~~ scheelite length fast - (.016)
see also - 6.5, 100.2 for rim structured unknown
excellent @ 5.4, 101.2 also bladed in muscovite @ 16.7, 100.1
try 14.5, 100 also blade @ 5.6, 101.2

DJ-9

clot of calate - @ 17, 104.6
K-spar ?
jarosite ?
goethite

K-spar alteration of ? @ 9.5, 106.3

clot of ~ thin muscovite or chlorite goethite spindels @ .4, 112.7

plagioclase lath w/ scattered flakes of calate,

Opaque sweep.

molybdenite @ 3, 84.9 also 7.1, 93.5
@ 14.3, 92.1 no muscovite w/ rim of unknown alt min.
hematite - red earthy

bladed hematite - slightly altered to leucoxene @ 17, 84.6
slightly w/ red earthy @ 7.8, 87.8, hexagonal outline @ 19.4, 89.2
molybdenite @ 4.8, 87.3. w/ minor unknown.

goethite after ? @ 17, 89.7

small unknown opaque @ 23.5, 88.9. try magnetite

hematite 13.9, 90.8 also 18.1, 95.7

hematite or magnetite @ 12.7, 102.7

DJ 9

brown - K stained unknown clots - best represented @ 16.2, 93.2

molybdenite rose @ 7.2, 94.4 ✓
w/ minor unknown intergrowing
molybdenite ? @ 1.9, 99.3

hematite - leucoxene after ilmenite between muscovite - quartz
@ 18.4, 95.7

~~tabular~~
apatite alteration to calcite @ 21.4, 96.1
2

$3\,Ca_3(PO_4)_2 \cdot CaF_2$
length fast
apatite $n = 1.630$ to $1.651$
calcite $n_e = 1.486$
$n_\omega = 1.658$

plagioclase grain @ 21.9, 98.1 fair grain for measuring
Michel-Levy (−) sign

288.5°
302.0
288.5
13.5

288.5°
269.5
19.0°

n < quartz
oligoclase

unknown @ 5.3, 98.3 v fine grained green tinge - thy Tourmaline

buckwork cleavage of orthoclase @ 19.8, 96.5
K-spar alteration of ? @ 18.4, 98.1 also nearby @ 18.8, 97.6
also 5.6, 99.1
also 8.0, 104.1

DJ 9

Silver molybdenite
gold pyrite
brown - bleached + alt biotite

plagioclase - partly replaced by K-spar almost with picture 15.9, 116.3
also @ 15.1, 115.4
also @ 6.8, 137.4 with calcite core
plagioclase w/ flakes of ~~illite~~? sericite? 11.5, 116.7
w/ flakes of sericite (muscovite) + hematite blades @ 13.9, 119

quartz altering plagioclase @ 18, 121.4
see also @ 16.7, 126.1 , also 3.7, 127.8
goethite alt ~~from~~ @ 10.3, 124

biotite books? alt to muscovite + red earthy hematite @ 19.8, 129.9

muscovite parallel pattern in plag @ 23, 132.4
even better @ 22.6, 133.4

plagioclase laths altered to kaolinite (supergene) @ 2, 135.9
2, 135.6 also 2.7, 135.7

supergene
kaolinite surrounded by calcite + muscovite as alt of plag? lath?
see also 12.4, 136.1

Brown biotite altering to muscovite, quartz, hematite, goethite?
@ 8.8, 142.2

Towne Mines Exploration Co.
November 22, 1974

To: D. J. Hoffman

From: J. D. Loghry

Subject: Diamond Joe Project, Mohave County, Arizona

Drilling Information and Previous Exploration Programs
Claims and Drill Hole Map

This report will review drilling information from various sources and our field examinations.

Inspiration Copper Company

Sometime in the 1950's, ICC drilled at least two shallow angle core holes to test the Leviathan or Whale Cu-Mo quartz vein. One source said they drilled a total of five holes. Casing of one hole dipping 50° southerly is found about 200 feet west of the Whale vein in the sands of Copper Canyon. This hole apparently tested the south portion of the Whale vein. Another drill site was found 300-400 feet south-southeast of the Leviathan shaft. Core from these and possibly other holes is scattered around a concrete block house near the first hole and scattered down Copper Canyon. The core is largely equigranular fine-grained biotite quartz monzonite (referred to as Leviathan granodiorite in my report and map of December 26, 1973). Some porphyritic core was also found. Most of the core is fresh appearing, but most has quartz pyrite veinlets, often with associated sericite-chlorite-orthoclase alteration. Chlorite and muscovite replacing biotite are common. Minor fluorite , calcite, and secondary biotite are noted in thin section examinations of core and outcrop rocks. Muscovite and fluorite replacing plagioclase feldspars was seen in thin section. Rare chalcopyrite and molybdenite are present. One core specimen, sample DJ-2, contained 627 ppm Cu and 10 ppm Mo.

Western Equities

Western Equities, owners of the Orphan $U_3O_8$ mine, Grand Canyon, Arizona, conducted a brief exploration program in 1963-64(?). Geochemical sampling and an IP survey were carried out, but no drilling is reported.

ARKLA Exploration

Arkansas Louisiana Gas Exploration Company conducted an extensive staking, geologic mapping, geochemical sampling, IP survey, and drilling program during the period 1965-1971. The last ARKLA affidavits of labor were recorded October 1, 1971, and no assessment work has been accomplished in the district since then, except by Dalton Robinett who maintained his 16 Potlicker, Smokey and Pico claims through September 1974.

A brief examination of an ARKLA geochemical Mo sampling map by Downey and Loghry showed a large Mo anomaly with values from 25 to 1200 ppm Mo covering most of the Copper Wonder, Copper Wonder No. 1, Whale and Leviathan patented claims. This anomaly spilled over into Yellow Basin northeast and east of the Leviathan claim to cover the area of ARKLA drill holes YB 6, 9, 10, 11 and 12. It also extended down Copper Canyon to cover much of the "American Group" of patented claims and the American mine area. Other smaller anomalies were present. The copper map was not shown to us. Brief examination of a detailed geologic map provided no surprises and confirmed our recon mapping.

ARKLA drilled holes A through F, which are location or assessment holes less than 100 feet deep. They drilled 14 vertical and angle exploration diamond drill holes YB 1-14. Core and assay logs are not available to us. The information below comes from a brief examination of two crude drill hole cross sections prepared by an ARKLA geologist, some ARKLA maps and a tabulation, plus our additions, of the higher grade $MoS_2$ intercepts in holes YB1-14 prepared by a geologist who evaluated the property in 1968. It appears that ARKLA analyzed 5- or 10-foot core intervals but broke out for assay a much smaller high-grade intervals when they noted them.

YB-1 -75° S 18°32' E TD 1,192 (1151 vertical, 308' horizontal advance)

| | | | |
|---|---|---|---|
| 102.4—103.3 | 0.9' | 0.600% $MoS_2$ | VN |
| 159—159.5 | 0.5 } 2.0 | 4.832 } 1.640 | VN |
| 159.5—161 | 1.5 | 0.576 | |
| 189.4—190.2 | 0.8 | 0.292 | |
| 198—200 | 2.0 | 0.392 | |
| 245.3—246.1 | 0.8 | 1.084 | VN |
| 470.6—471.6 | 1.0 | 0.317 | |
| 521—521.2 | 0.2 | 0.334 | |
| 597.2—597.7 | 0.5 | 0.641 | VN |
| | 8.2 | 0.782 | |

ft%
wt = 6.4091

Highest $MoS_2$ not shown above is 0.062%
Highest Cu is 0.125%
All others <0.10%, most <0.05%

| YB-2 | 90° | TD 1232' | |
|---|---|---|---|
| 46.5—48 | 1.5 | 0.254 | $MoS_2$ |
| 75—79.9 | 4.9 | .124 | |
| 154—155 | 1.0 | .102 | |
| 173—178.5 | 5.5 | .162 | |
| 217—222 | 3.0 | .124 | |
| 422—427 | 5.0 | .158 | |
| 584.7—585 | 0.3 | .601 | Vn |
| 591—593 | 2.0 | .242 | |
| 639.4—640 | 0.6 | .952 | Vn |
| 643—645 | 2.0 | 2.338 | Vn |
| 692.4—695 | 2.6 | .174 | |
| 705.6—706.8 | 1.2 | .160 | |
| 720.7—723.6 | 3.2 | .134 | |
| 958.4—960 | 0.6 | .334 | |
| 966—963.7 | 2.7 | .174 | |
| 973.9—975 | 1.1 | .204 | |
| 981—983.2 | 2.2 | .154 | |
| 1060.4—1061.4 | 1.0 | .326 | wt = 11.6877 |
| | 40.4 | 0.289 | |

Highest $MoS_2$ not listed 0.092%
highest Cu .55
Most Cu assays < .10% Cu

| YB-3 | 90° | TD 750' | |
|---|---|---|---|
| 155—160 | 5 | 1.052 | Vn |

Highest $MoS_2$ not listed 0.0029
Highest Cu .226
Most of Cu assays .06

| YB-4 | 90° | TD 1134' | |
|---|---|---|---|
| 164—165 | 1.0 | 0.120 | $MoS_2$ |
| 530—535 | 5.0 | .109 | |
| 681—682 | 1.0 | .356 | |
| 774.7—775 | 0.3 | .100 | |
| 848—850 | 2.0 | .154 | |
| 1055—1056 | 1.0 | .341 | |
| 1104—1105 | 1.0 | .187 | |
| 1112.2—1115 | 2.3 | .109 | |
| 1120—1120.5 | 0.5 | .276 | wt = 2.2757 |
| | 14.1 | 0.161 | |

Highest $MoS_2$ not shown above 0.098
Highest Cu value .302
Most Cu < .10

YB-5 -60° S 30° W TD 842' (775' vertical, 446' horizontal advance)

| | | | |
|---|---|---|---|
| 258.3—259 | 0.7 | 0.244 $MoS_2$ | |
| 530—535 | 5.0 | .135 | |
| 577.7—578 | 0.3 | .251 | wt = 0.9211 |
| | 6.0 | 0.154 | |

Highest $MoS_2$ not shown 0.068
Highest Cu assayed .135
Most Cu under < .050

Hamme mine area; should have cut a quartz-muscovite-$MoS_2$ vein

YB-6 90° TD 1727

| | | | |
|---|---|---|---|
| 305—310 | 5' | 0.131 $MoS_2$ | |
| 320-325 | 5 | .163 | |
| 606—608 | 2 | .130 | |
| 640—642 | 2 | .105 | |
| 752—755 | 3 | .262 | |
| 922—926 | 4 | .396 | |
| 963—965 | 2 } 7 | .104 } 0.103 | |
| 965—970 | 5 | .103 | |
| 1005—1010 | 5 | .127 | |
| 1030—1040 | 10 | .118 | |
| 1060—1065 | 5 | .830 VR | |
| 1080—1085 | 5 | .182 | |
| 1090—1095 | 5 | .214 | |
| 1476.8—1480 | 3.2 | .530 VR | wt = 14.6740 |
| | 61.2 | 0.240 | |

Highest $MoS_2$ not shown 0.099
Highest Cu .195
Most of Cu < .050

YB-7 -56° S 29° W TD 381' (316 vertical and 213 horizontal advance)

| | | |
|---|---|---|
| 345—350 | 5' | 0.152 $MoS_2$ |

High $MoS_2$ not shown 0.006
Highest Cu .093
Most Cu <.020

Hamme mine area; should have cut a quartz-muscovite-$MoS_2$ vein

YB-8 -45° S 10° W TD 705' (499' vertical and horizontal advance)

No $MoS_2$ over 0.0056
No Cu over .0055

YB-9 -45° N 24° W TD 1000' (about 707' vertical and horizontal advance)

| | | | |
|---|---|---|---|
| 10—15 | 5 | 0.123 $MoS_2$ | |
| 20-30 | 10 | .108 | |
| 380-390 | 10 | .178 | |
| 440-445 | 5 | .163 | |
| 450-455 | 5 | .102 | |
| 730-735 | 5 | .144 | |
| 750-755 | 5 | .102 | |
| 879-875 | 5 | .169 | wt = 6.8750 |
| | 50.0 | 0.138 | |

Highest $MoS_2$ not shown 0.0195
Highest Cu value .182
Most Cu < .020

YB-10 90° TD 1751'

| | | | |
|---|---|---|---|
| 30-40 | 10 | 0.139 $MoS_2$ | |
| 90-100 | 10 | .131 | |
| 110-120 | 10 ) 20 | .116 ) 0.154 | |
| 120-130 | 10 | .192 | |
| 180-190 | 10 ) 20 | .119 ) 0.139 | |
| 190-200 | 10 | .148 | |
| 210-220 | 10 ) 20 | .142 ) 0.153 | |
| 220-230 | 10 | .163 | |
| 300-310 | 10 | .146 | |
| 340-350 | 10 | .968 | |
| 360-370 | 10 | .108 | |
| 440-450 | 10 | .412 | |
| 560-570 | 10 | .100 | |
| 590-600 | 10 ) 20 | .325 ) 0.218 | |
| 600-610 | 10 | .111 | |
| 620-630 | 10 | .473 | |
| 660-670 | 10 | .291 | |
| 690-700 | 10 | .350 | |
| 740-750 | 10 | .420 | |
| 1430-1440 | 10 | .153 | wt = 52.5200 |
| 1570-1580 | 10 | .245 | |
| | 210 | 0.250 | |

Highest $MoS_2$ not shown 0.098
Highest Cu .195
Most Cu .020
590'-710', 110' 0.175 $MoS_2$ (from drill hole cross section)

| YB-11 | 90° | TD 1376' |
|---|---|---|
| 100-105 | 5 | 0.127 $MoS_2$ |
| 210-215 | 5 | .121 |
| 240-245 | 5 | .112 |
| 290-295 | 5 | .254 |
| 410-415 | 5 | .202 |
| 450-455 | 5 | .103 |
| 480-485 | 5 | .141 |
| 530-535 | 5 | .133 |
| 700-705 | 5 | .111 |
| 720-725 | 5 | .111 |
| 780-785 | 5 | .106 |
| 800-805 | 5 | .105 |
| 1110-1115 | 5 | .127 |
| 1220-1225 | 5 | .102 |
| 1270-1275 | 5 | .133 |
| 1280-1285 | 5 | .153 |
| | 80.0 | 0.130 |

wt = 10.3990

| | |
|---|---|
| Highest $MoS_2$ not shown | 0.073 |
| Highest Cu | .050 |
| Most Cu | .020 |

| | | |
|---|---|---|
| 1351.5-1376 (TD) | 24.5 | 0.279 |

From ARKLA drill hole cross section. This significant intercept seems to have been left out of the above tabulation.

| YB-12 | 90° | TD 1519' |
|---|---|---|
| 70-80 | 10 | 0.148 $MoS_2$ |
| 320-330 | 10 | .132 |
| 380-390 | 10 | .103 |
| 470-480 | 10 | .256 |
| 520-530 | 10 | .104 |
| 1290-1300 | 10 | .129 |
| | 60.0 | 0.145 |

wt = 8.720

| | |
|---|---|
| Highest $MoS_2$ not shown | 0.097 |
| Highest Cu | .050 |
| Most Cu | < .020 |

| YB-13 | -50° | S 4 SE | TD 1164' | (about 748' horizontal, 892 vertical advance) |
|---|---|---|---|---|
| 380-385 | 5 | | 0.252 | 10' 0.296% $MoS_2$ |
| 385-390 | 5 | | .340 | |
| 1033-1035 | 2 | | .670 | wt = 4.3000 |
| | 12.0 | | 0.358 | |

Highest $MoS_2$ not shown 0.062
Highest Cu .130
Most Cu < .010

ARKLA cross section shows that YB 13 cut the Copper Wonder and Whale veins. Biotite quartz monzonite core chips with quartz-muscovite-pyrite-chalcopyrite-molybdenite veinlets were found at the site

| YB-14 | -60° | S 20 E | TD 804' | (about 402' horizontal, 696' vertical advance) |
|---|---|---|---|---|

Highest $MoS_2$ 0.00179
Most under .00040
High Cu .0018
Most under .0005

Cross section and mapping show that YB-14 was collared in Precambrian rocks, cut "intermittent diorite," which ARKLA geologist thought might be the Diamond Joe stock or an indication that he was approaching the stock. Precambrian rocks are more granitic, more altered than usual, reddish with supergene limonites after pyrite. YB-14 was reportedly drilled to test an IP anomaly and possible buried Diamond Joe stock southwest of on strike of Whale and other veins.

In 1972, ARKLA was forced to cease their mineral exploration efforts in favor of a heavy gas exploration program to satisfy the demands of the Federal Power Commission and their customers. ARKLA personnel, according to a promotional letter I read, felt they had a significant molybdenum deposit and touted it as such to several mining companies but failed to enlist any partners and were forced to abandon the property in March (?) of 1972.

Except for holes YB-8 and YB-14, which are outside the mineralized arc which may be one of the loci for a major porphyry copper deposit (Loghry 12-26-73), all of ARKLA's diamond drill holes cut ore grade molybdenite values and some strong copper mineralization. We do not have the geological or assay logs, but individual assays reliably reported include 2 feet/2.33% $MoS_2$, 5 feet/0.83% $MoS_2$, 10 feet/0.968% $MoS_2$, YB-10 YB-1 0.5 feet/4.832% $MoS_2$, 5 feet/1.052% $MoS_2$, and many 5- to 10-foot intervals greater than 0.1% $MoS_2$. We do not know the assays between

YB-2 YB-3 YB-6

the reported intercepts averaging 0.1% $MoS_2$ or better. An ARKLA cross section examined by Downey and Loghry showed 110 feet/0.175% $MoS_2$, in YB-10 and 24.5 feet/0.279% $MoS_2$ at the bottom of YB-11. High-grade intercepts in YB 5, 7, 13, and possibly YB-3 are thought to be quartz-molybdenite veins. High-grade intercepts in YB6, 9, 10, 11, and 12 are probably sheeted zones of muscovite-quartz-molybdenite (fluorite) veinlets in K-feldspar-muscovite altered rocks like those exposed in the drainage of Yellow Basin. This rock might be described as a "greisen" or pegmatite and appears to be a total alteration of the fine-grained, equigranular biotite quartz monzonite facies of the Diamond Joe stock. Highest copper values reported range from 0.05 to 0.55% Cu, possibly over 5 or 10 feet, but most are less than 0.05% Cu. Vertical depths of these well-mineralized holes range from 707 to 1751 feet. Deeper molybdenum or copper-molybdenum ore cannot be ruled out. any vertical changes seen?

The YB holes, our location holes, and limited surface geochemical samples and extensive reconnaissance suggest that the mineralized arc is zoned, its inner portion being a low-grade, k-feldspar-muscovite altered "core" with molybdenite and few other sulfides, containing much more molybdenum than copper. The larger, outer portion of the arc consists largely of biotite quartz monzonite with much more copper than molybdenum and more sulfides than the inner zone. The dividing line is thought to be on or close to the arcuate ridge top between Copper Canyon and Yellow Basin. ARKLA's objective was apparently to search for a molybdenum deposit and most of their YB holes are in the molybdenum-rich zone. I anticipate that any porphyry copper will occur at depth in the mineralized arc in the Cu > Mo zone or Cu = Mo zone, most likely in the northeast quartz-chalcopyrite-molybdenite vein and veinlet systems between, and including the Leviathan and American mines. The only drill holes in this area are Inspiration's 2-5 shallow angle holes and ARKLA's YB-13 angle hole with the limited objectives of testing the Whale vein (Leviathan mine). Assuming a 50° dip (it may be only 40°), vertical depth of YB-13 is only 980 feet. This suggests to me that any porphyry copper deposit will be at least 1,000 feet below the surface, below the 3,000-foot elevation. There are no drill holes in the American mine area. In conclusion, ARKLA's drilling has enhanced the Diamond Joe prospect but has not even begun to test it.

James D. Loghry

James D. Loghry

JDL:h

Towne Mines Exploration Co.
November 25, 1974

To: D. J. Hoffman

From: J. D. Loghry

Diamond Joe Project, Mojave County, Arizona

TMEX location drillholes. Claims and drillhole map

Most TMEX percussion location holes varying from 10 to 100 feet deep show anomalous copper and molybdenum values. Large cuttings samples were taken over 10-foot intervals in each hole. One sample is missing--Hole 17, Block #21--but I am unable to account for it, since neither Downey nor I could be present to supervise the last few days of the drilling program.

| | |
|---|---|
| Hole # 1 (Block #8) | 0-80', 8 samples average 111 ppm Cu, 9 ppm Mo; 0-40' average 143 ppm Cu, 40-80' average 78 ppm Cu. Range 65-153 ppm Cu, 6-14 ppm Mo |
| Hole #2 (Block #14) | 0-100', 10 samples average 152 ppm Cu, 13 ppm Mo. Range 98-205 ppm Cu, 6-29 ppm Mo |
| Hole #3 (Block #13) | 0-100', average 78 ppm Cu, 6 ppm Mo Range 56-105 ppm Cu, 1-10 ppm Mo |
| Hole #4 (Block #10) | 0-80', average 270 ppm Cu, 13 ppm Mo Range 196-406 ppm Cu, 3-27 ppm Mo |
| Hole #5 (Block #9) | 0-100', average 211 ppm Cu, 15 ppm Mo Range 126-323 ppm Cu, 4-93 ppm Mo |
| Hole #6 (Block #4) | 0-50', average 229 ppm Cu, 18 ppm Mo Range 167-437 ppm Cu, 1-36 ppm Mo |
| Hole #7 (Block #6) | 0-50', 5 samples average 726 ppm Cu, 41 ppm Mo Range 540-800 ppm Cu, 29-51 ppm Mo. |
| Hole #8 (Block #5) | 0-10', 340 ppm Cu, 66 ppm Mo |
| Hole #9 (Block #1) | 0-100', average 108 ppm Cu, 14 ppm Mo Range 60-173 ppm Cu, 1-19 ppm Mo |

| | |
|---|---|
| Hole #10 (Block #2) | 0-80', average 30 ppm Cu, 7 ppm Mo<br>Range 14-53 ppm Cu, 1-21 ppm Mo |
| Hole #11 (Block #15) | 0-50', average 110 ppm Cu, 2 ppm Mo<br>Range 85-183 ppm Cu, <1-4 ppm Mo |
| Hole #12 (Block #17) | 0-100', average 127 ppm Cu, 3+ ppm Mo<br>Range 74-189 ppm Cu, <1-7 ppm Mo |
| Hole #13 (Block #16) | 0-80', average 96 ppm Cu, 6 ppm Mo<br>Range 60-112 ppm Cu, <1-11 ppm Mo |
| Hole #14 (Block #18) | 0-50', average 41 ppm Cu, 3+ ppm Mo<br>Range 34-60 ppm Cu, <1-7 ppm Mo |
| Hole #15 (Block #19) | 0-10', 106 ppm Cu, 23 ppm Mo<br>Only one sample from one of 8 10-foot holes was analyzed |
| Hole #16 (Block #20) | 0-10', 610 ppm Cu, 252 ppm Mo |
| Hole #17 (Block #21) | 0-10', sample missing |
| Hole #18 (Block #7) | 0-100', averages 157 ppm Cu, 14+ ppm Mo<br>Range 76-281 ppm Cu, < 1-36 ppm Mo |
| Hole #19 (Block #3) | 0-80', average 10 ppm Cu, 11 ppm Mo<br>Range <10-23 ppm Cu, 4-16 ppm Mo |
| Hole #20 (Block #11) | 0-30', average 16+ ppm Cu, 14+ ppm Mo<br>Range <10-27 ppm Cu, <1-21 ppm Mo |
| Hole #21 (Block #12) | 0-30', average 251 ppm Cu, 289 ppm Mo<br>Range 224-269 ppm Cu, 209-429 ppm Mo |
| Hole #22 (Block #22) | 0-10', 13 ppm Cu, 9 ppm Mo |

Harpoon claims No. 1-40 and 42-140, plus 48-A and 94-A were staked between Feb. 9 and April 4, 1974. Location drilling for 139 Harpoon claims was done between May 7 and May 14, 1974. Harpoon No. 41 was never located and H-67 and 69 proved to be too remote from a road to be validated by drilling. There are 139 Harpoon claims in good standing. 1974-75 assessment work must be accomplished prior to September 1975.

The distribution of the location holes and anomalous Cu-Mo values in many of them support the concept (Loghry 12/26/73) of an arcuate Cu-Mo mineral belt in the biotite quartz monzonite porphyry

**EFCO LABORATORIES**
North Freeway at Ruthrauf Road P. O. Box 5526
TUCSON, ARIZONA 85703
PHONE (602) 887-4241

# Laboratory Analysis Report

TOWNE MINES CORPORATION
SUITE 2524
551 5th AVENUE
NEW YORK, NEW YORK 10017
Harpoon Series

REPORT NO. 743843
DATE SUBMITTED 5-28-74
DATE REPORTED 6-6-74

Diamond Joe Project, Mohave Co., Arizona
Location Hole Samples

| Sample No. | | PPM Copper | PPM Molybdenum | |
|---|---|---|---|---|
| Group #1 | | | | |
| Hole #9 | 0-10 | 101 | 14 | |
| | 10-20 | 60 | 1 | |
| | 40-50 | 99 | 17 | |
| | 60-70 | 108 | 9 | |
| Group #4 | | | | |
| Hole #6 | 0-10 | 437 | 19 | |
| | 10-20 | 167 | 1 | |
| | 20-30 | 170 | 19 | |
| | 30-40 | 193 | 13 | |
| | 40-50 | 179 | 36 | |
| Group #5 | | | | |
| Hole #8 | 0-10 | 340 | 66 | |
| Group #6 | 30-40 | 900 | 61 | see p. 2 for other samples |
| " #7 | | | | |
| Hole #9 | 20-30 | 68 | 17 | |
| (Group #1) | 30-40 | 87 | 19 | |
| See above | 50-60 | 105 | 14 | |
| | 70-80 | 132 | 19 | |
| | 80-90 | 142 | 13 | |
| | 90-100 | 173 | 13 | |
| Group #8 | | | | |
| Hole #1 | 0-10 | 153 | 10 | |
| | 10-20 | 130 | 10 | |
| | 20-30 | 133 | 14 | |
| | 30-40 | 158 | 6 | |
| | 40-50 | 71 | 10 | |
| | 50-60 | 89 | 6 | |
| | 60-70 | 65 | 11 | |
| | 70-80 | 87 | 9 | |
| Group #9 | | | | |
| Hole #5 | 0-10 | 148 | 6 | |
| | 10-20 | 221 | 10 | |
| | 20-30 | 163 | 1 | |
| | 30-40 | 199 | 3 | |
| | 40-50 | 126 | 6 | |

XXXXX
Signed

| Sample No. | | PPM Copper | PPM Molybdenum |
|---|---|---|---|
| Group #9 | | | |
| Hole #5 | 50-60 | 212 | 7 |
| | 60-70 | 315 | 93 |
| | 70-80 | 323 | 7 |
| | 80-90 | 246 | 10 |
| | 90-100 | 159 | 4 |
| Group #10 | | | |
| Hole #4 | 0-10 | 283 | 6 |
| | 10-20 | 309 | 27 |
| | 20-30 | 200 | 13 |
| | 30-40 | 406 | 3 |
| | 40-50 | 281 | 13 |
| | 50-60 | 275 | 4 |
| | 60-70 | 212 | 19 |
| | 70-80 | 196 | 19 |
| Group #13 | | | |
| Hole #3 | 0-10 | 82 | 10 |
| | 10-20 | 77 | 1 |
| | 20-30 | 85 | 6 |
| | 30-40 | 100 | 9 |
| | 40-50 | 56 | 7 |
| | 50-60 | 57 | 1 |
| | 60-70 | 61 | 7 |
| | 70-80 | 74 | 10 |
| | 80-90 | 84 | 9 |
| | 90-100 | 105 | 4 |
| Group #14 | | | |
| Hole #2 | 0-10 | 186 | 10 |
| | 10-20 | 210 | 17 |
| | 20-30 | 197 | 6 |
| | 30-40 | 205 | 10 |
| | 40-50 | 139 | 11 |
| | 50-60 | 116 | 9 |
| | 60-70 | 134 | 13 |
| | 70-80 | 132 | 7 |
| | 80-90 | 101 | 14 |
| | 90-100 | 98 | 29 |
| Group #16 | | | |
| Hole #7 | 0-10 | 800 | 31 see p. 1 for 30-40 |
| | 10-20 | 670 | 29 |
| | 20-30 | 720 | 51 |
| | 40-50 | 540 | 33 |
| Blk #2 | | | |
| Hole #10 | 0-10 | 53 | 13 |
| | 10-20 | 25 | 21 |
| | 20-30 | 33 | 3 |
| | 30-40 | 25 | 1 |
| | 40-50 | 24 | 3 |
| | 50-60 | 30- | 7 |
| | 60-70 | 19 | 3 |
| | 70-80 | 21 | 10 |
| Blk #3 | | | |
| Hole #19 | 0-10 | 23 | 16 |

| Sample No. | | PPM Copper | PPM Molybdenum |
|---|---|---|---|
| Blk #3 | 10-20 | 10 | 13 |
| Hole #19 | 20-30 | 10 | 13 |
| | 30-40 | 10 | 9 |
| | 40-50 | 10 | 11 |
| | 50-60 | 10 | 20 |
| | 60-70 | <10 | 6 |
| | 70-80 | <10 | 4 |
| Blk #7 | 0-10 | 168 | 21 |
| Hole #18 | 10-20 | 76 | 9 |
| | 20-30 | 86 | 19 |
| | 30-40 | 194 | 14 |
| | 40-50 | 101 | 7 |
| | 50-60 | 77 | 36 |
| | 60-70 | 191 | 17 |
| | 70-80 | 281 | 7 |
| | 80-90 | 235 | <1 |
| | 90-100 | 256 | 13 |
| Blk #11 | 0-10 | 27 | 21 |
| Hole #20 | 10-20 | 21 | 21 |
| | 20-30 | <10 | <1 |
| Blk #12 | 0-10 | 260 | 209 |
| Hole #21 | 10-20 | 224 | 429 |
| | 20-30 | 269 | 229 |
| Blk #15 | | | |
| Hole #11 | 0-10 | 68 | 4 |
| | 10-20 | 183 | 1 |
| | 20-30 | 87 | 4 |
| | 30-40 | 85 | <1 |
| | 40-50 | 127 | 3 |
| Blk #16 | | | |
| Hole #13 | 0-10 | 112 | 4 |
| | 10-20 | 103 | 7 |
| | 20-30 | 78 | 7 |
| | 30-40 | 102 | <1 |
| | 40-50 | 66 | 11 |
| | 50-60 | 101 | 11 |
| | 60-70 | 103 | 4 |
| | 70-80 | 60 | 1 |
| Blk #17 | | | |
| Hole #12 | 0-10 | 85 | 7 |
| | 10-20 | 110 | 4 |
| | 20-30 | 86 | <1 |
| | 30-40 | 161 | <1 |
| | 40-50 | 158 | 4 |
| | 50-60 | 74 | <1 |
| | 60-70 | 80 | 7 |
| | 70-80 | 162 | 4 |
| | 80-90 | 159 | 7 |
| | 90-100 | 189 | <1 |

| Sample No. | | PPM Copper | PPM Molybdenum | |
|---|---|---|---|---|
| BLK #18 | | | | |
| Hole #14 | 0-10 | 39 | 7 | |
| | 10-20 | 60 | 1 | |
| | 20-30 | 35 | <1 | Block 21, Hole # 17 |
| | 30-40 | 40 | 7 | Sample lost. |
| | 40-50 | 34 | 1 | |
| BLK #19 Hole #15 | 0-10 | 106 | 23 | |
| BLK #20 Hole #16 | 0-10 | 610 | 252 | |
| BLK #22 | | | | Diamond Joe Project |
| Hole #22 | | 13 | 9 | |
| LDH-1 | | | | |
| Hole #1 | 0-10 | <10 | <1 | Bug # 1-33 Claims |
| " #2 | 0-10 | <10 | <1 | |
| " #3 | 0-10 | <10 | <1 | Location Holes |
| " #4 | 0-10 | <10 | <1 | Post ore rocks |
| LDH-2 | | | | Safford, Ariz. |
| Hole #1 | 0-10 | < 10 | 3 | |
| " #2 | 0-10 | <10 | 4 | |
| " #3 | 0-10 | <10 | <1 | |
| " #4 | 0-10 | <10 | <1 | |
| LDH -3 | | | | |
| Hole #1 | 0-10 | <10 | 3 | |
| " #2 | 0-10 | <10 | <1 | |
| " #3 | 0-10 | <10 | 3 | |
| " #4 | 0-10 | <10 | <1 | |
| LDH-4 | | | | |
| Hole #1 | 0-10 | <10 | <1 | |
| " #2 | 0-10 | <10 | 10 | |
| " #3 | 0-10 | <10 | <1 | |
| " #4 | 0-10 | <10 | <1 | |
| " #5 | 0-10 | <10 | 4 | |
| " #6 | 0-10 | <10 | 4 | |
| " #7 | 0-10 | <10 | 4 | |
| " #8 | 0-10 | <10 | 4 | |
| " #9 | 0-10 | <10 | <1 | |
| " #10 | 0-10 | <10 | 10 | |
| LDH-5 | | | | |
| Hole #1 | 0-10 | <10 | <1 | |
| " #2 | 0-10 | <10 | 7 | |
| " #3 | 0-10 | <10 | 10 | |
| " #4 | 0-10 | <10 | 4 | |
| " #5 | 0-10 | <10 | <1 | |

| Sample No. | PPM Copper | PPM Molybdenum |
|---|---|---|
| LDH-5 | | |
| Hole #6 0-10 | <10 | <1 |
| " #7 0-10 | <10 | <1 |
| " #8 0-10 | <10 | 6 |
| " #9 0-10 | <10 | 10 |
| " #10 0-10 | <10 | 6 |

Nancy Tkachenko
signed

DAVID L. KUCK, P.G., P.E.

*Registered Professional Geologist (2646) and Mining Engineer (6776)*
*Mineral Exploration, Mining Engineering and Computer Applications*

P. O. DRAWER 369 • ORACLE, ARIZONA 85623 • PHONE (602) 896-2472

March 6, 1974

James D. Loughry
Towne Mines Exploration Co. Inc.
2121 E. Monta Vista Drive
Tucson, Arizona

Dear Jim:

The field examination of claims in the Leviathan Mine area revealed only one example of recent validation or assessment work, which was the shafts sunk by Mr. Robinett on the Potlicker group. All the other work was more than a year old, most of which was quite old. Except for Mr. Robinett's work on the Potlicker group or possibly the Pico group, all the work dates from when Arkla Exploration Company held the ground or before.

Most of the area is quite open with only low brush, so any recent work would be quite easily observed in the three days I was in the area.

Mr. Poyner has done no work in the area other than to place location notices in existing location monuments in 1972. There is no evidence of him doing location or assessment work on these claims either in the field or in the records in the Mohave Co. Courthouse in Kingman, though he has recorded assessment work in other areas for 1973.

Barbara McUlty, locator of the Bell, Starr, Golden Eagle, and Black Cat claims, has recorded no assessment or validation work affidavits that we could find in the Mohave County Records.

I conclude that all claims in the area of the Leviathin Mine prior to the Harpoon group, with the exception of the Potlicker and Pico groups of Mr. Robinett have been abandoned and the ground was open for relocation.

Details of various claims examined in the field follow with enclosed Poloroid and Ektachrome photographs.

Sincerely,

David L. Kuck

DLK:dlk

CLAIMS IN THE DIAMOND JOE PEAK AREA

SUBJECT: Field reconnaissance and examination of existing claim locations in conflict with Harpoon group nos. 1 through 138.

LOCATION: Secs. 17,18,19,20,21,28,29,30,31, & 32, T17N, R14W, Secs. 24 & 25 T17N, R15W, G & SRBL & M. Cedar Valley Mining District, Mohave Co., Arizona.

FIELD examination was February 20,21, and 22, 1974, with a visit to the Mohave Co. Courthouse in Kingman, Arizona, February 22, 1974.

CLAIMS visited were the Asp #3 and #4, Belle Starr #6, Bonus #25 and #26, Copper Wonder No. 1 and No. 2, Deluge #20, #21, @22, and #23, Faith #5 and #6, Golden Eagle #1 and #2, Harpoon Group, Luv #2, #8, #9, #18, #33, #34, and #35, M.P.L. No. 1, Peco #3, Potlicker #7, Purl #6, Shamrock, Sunshine #13,#14, #23, and #25, William C. #1 and #5, Wyatt #17 and #18.

CLAIM locators were Arkla Exploration Company; McCarthy, Donald P.; McCarthy, Frank Otto; McNulty, Barbara; McUlty, Barby; McUlty Barbara; Poyner, Denys W.; Robinett, Dalton; Weathers, Gerald; Yow, Dad Link.

DAVID L. KUCK used a Poloroid with black and white film and a Mamiyaflex, using 120 Ektachrome film for field photography. Photographs were enclosed with this report.

CLAIMS are listed alphabetically with their corresponding photographs and comments as follows:

ASP #3, located Sept. 10, 1965 by Dalton Robinett and Denys Poyner. The notice is in a rock monument on the ridgetop south of the "Helicopter Pad." The claim extends 100' E. and 1400' W. Examined before 10:05 a.m. February 21, 1974.

ASP #4, located Sept. 11, 1965 by Dad Link Yow and Denys Poyner. The notice is in a rock monument. Photographs are Poloroid T-7 and Ektachrome Roll 1T, #11. Examined between 10:05 and 10:45 a.m., February 21, 1974.

BIG JOHN, S.E. Corner post & N.E. Corner Sunshine 23 or 25, ridge line S. of turn around, 10:00 AM., February 22, 1974.

BELL STARR #6, located Feb. 15, 1970 by Barbara McUlty. The location monument is a propped up 4x4 in a rock monument. Two phases of mining activity or exploration are evident. The first was many years ago which is indicated by the iron stained dumps from which rain has washed the grey alteration minerals. The second, more recent phase, is indicated by the light grey muck piles overlying the iron stained muck. The most recent work was probably just after location in 1970 as plants are growing up through the freshest muck. Ektachrome photographs #8 and #9, roll 2T, show the claim notices and the location and other monuments. Examined 5:55 PM., February 21, 1974.

BONUS #25 and #26, located Jan. 11, 1966 for Arkla Exploration Company, relocated May 10, 1972 as FAITH #6 by Gerald Weathers, and again relocated as Luv #33 by Denys Poyner. These four location notices are shown in Polaroid photograph T-6. Examined 4:45 PM., Feb. 20, 1974.

DELUGE #21, located June 30, 1972 by Denys K. Poyner. There is a shallow pit in alluvium five feet south of the location monument. Polaroid photograph T-1 is of the location notice and Ektachrome #6, roll 1T is of the location pit, looking N. toward the locations of Deluge #22 and #23. Examined 12:30 PM. Feb. 20, 1974.

DELUGE #22, located June 30, 1972 by Denys K. Poyner. An old bulldozer cut with 6" to 8" paloverde growing in it is appa rently the location hole. Ektachrome photographs #3 and #4, roll 1T show the location notice and part of the location cut. Examined between 11:45 AM. and 12:30 PM., Feb. 20, 1974.

DELUGE #20; which lacks a monument or notice has a fire pit near the location hole. Ektachrome photograph #7, roll 1T shows the location pit and the locations of Deluge #22 and #23 in the background. Examined 12:50 PM., Feb. 20, 1974.

DELUGE #23, located June 30, 1972 by Denys K. Poyner. The location pit is barely visible and is much older than the bulldozer cut on Deluge #22. Ektachrome photographs #1 and #2, roll 1T. This was the first location examined in the field, time was 11:45 AM., Feb. 20, 1974.

FAITH #1 thru #10, recorded book 27, pp 399-405, Mohave Co. Courthouse, Kingman, Arizona.

FAITH #5, located May 10, 1972 by Gerald Weathers, was located as Luv #34, Sept. 7, 1972 by Denys Poyner. There is no sign of location work. Polaroid photograph T-5. Examined 4:20 PM. February 20, 1974.

FAITH #6, Re: Bonus #26.

GOLDEN EAGLE #1 and #2, located Aug. 4, 1969 by Barby McUlty, is oriented N.-S.. The location monument is a revived 4x4 post in a pile of rocks. Ektachrome photographs #6 and #7, roll 2T. Examined 4:20 PM., Feb. 21, 1974.

HARPOON #1 thru #138, located Feb. 7 thru Feb. 18, 1974 for Towne Mines Exploration Co. Inc,, by James D. Loughry, to cover ground surrounding patented claims in the Leviathin Mine area. Location notices were posted, but corner monuments were not yet placed in field. Examined Feb. 20 thru Feb. 22, 1974.

LUV #2, located Sept. 7, 1972 by Denys K. Poyner. No sign of location or assessment work. The location monument also held a can with a prior location notice for the M. L. P. No. 1 dated June 1, 1966 by Donald P. McCarthy. The course and description of both claims is the same, N.E.-S.W. and bordered on the S.E. sideline by the Copper Wonder No. 2, M. S. No. 3290A & B. Polaroid photographs T-13 and T14 and Ektachrome slide #3, roll 2T. Examined 12:30 PM., Feb. 21, 1974.

LUV #9, location notice missing. Examined 4:20 PM., Feb. 20, 1974.

LUV # 18, located Sept. 7, 1972 by Denys Poyner, over Purl #6 dated Dec. 7, 1966 and Purl #6 Amended, dated Feb. 8, 1967 for the Arkla Exploration Company. Polaroid photograph T-2 and Ektachrome slide #8, roll 1T, shownig an old location pit, probably dug by Arkla Exploration Company. Examined 2:15 PM., Feb. 20, 1974.

LUV #33, Re: Bonus #26.

LUV #34, Re: Faith #5.

LUV #35, Re: LUV #8.

M. L. P. No. 1, Re: Luv #2.

PECO #3. The location monument is on the dump at the Hammy Mine adit portal. It was located May 15, 1962 by Dalton Robinett. It is Recorded in the Book of Mines 5-R, page 97, Mohave Co. Court House. Polaroid T-17 and Ektachrome slide #11, roll 2T. Examined 11:50 AM., Feb. 22, 1974.

POTLICKER group. The shaft sites in the canyon is the most recent validation or assessment work observed in the three days spent examining the claims surrounding the Leviathin, Copper Wonder, and Whale patented claims. Examined 3:00 PM., Feb. 21, 1974.

POTLICKER #7 ??, Original N.E. corner on west side of ridge above triangulation station T-19. Ektachrome slide #4, roll 2T. Examined 3:36 PM., Feb. 21, 1974.

PURL #6, Re: Luv #18.

SHAMROCK, located July 20, 1958 by Frank Otto McCarthy, 750' N.E. and S.W.. Location pit showing molybdenum and copper mineralization and a drillsite show activity several years in the past. Polaroid photograph T-11 and Ektachrome slide #1, roll 2T. Examined 11:25 AM., Feb. 21, 1974.

SUNSHINE #13, located Feb. 25 or 28, 1965 by Dalton Robinett and Dad Link Yow extends 1450' S.E. and 50' N.W.. Polaroid photograph T-8 and Ektachrome slide #12, roll 1T, looking S.W., shows the location monument and two corner monuments. Examined 10:45 AM., Feb. 21, 1974.

SUNSHINE #14, located Sept. 7, 1964 by Dalton Robinett and Dad Link Yow extends 1450' westerly. No visible location or assessment work. Polaroid photograph T-12 and Ektachrome slide #2, roll 2T. Examined between 11:25 and 12:30 PM., Feb. 21, 1974.

SUNSHINE #23 or #25, Re: Big John.

WILLIAM C. #1, located Mar. 18, 1966 by Donald P. McCarthy extending E. 1400' and W. 100'. Recorded Mar. 30, 1966, Book of Mines 6-B, page 121. Polaroid photograph T-16 and Ektachrome slide #10, roll 2T. Examined 10:45 AM., Feb. 22, 1974.

WILLIAM C. #5, located Mar. 18, 1966 by Donald McCarthy. Notice is in a crack in the rock. Ektachrome slide #5, roll 2T is looking E. Pack is on spot where location notice was found. Examined 3:55 PM., Feb. 21, 1974.

WYATT #17, located May 25, 1968 for Arkla Exploration Company by Gerald Weathers, agent, extends 25'W. and 1475' E. Polaroid T-18 and Ektachrome #12, roll 2T shows Mr. Downey at common end center with location monuments for Wyatt #17 and #18, looking N.W.. Examined after lunch, just before leaving for Kingman and the Mohave Co. Courthouse, Feb. 22, 1974.

WYATT #18, extends 1500' west of the Wyatt #17., Re: Wyatt #17.

MEMORANDUM

To: James D. Loghry

From: Harold Downey, Consultant Geologist

Subject: Land status examinations of the Diamond Joe Peak area, T. 17 N., R. 14 W., Cedar Valley mining district, Mohave County, Arizona

1. This memorandum describes field and courthouse examinations undertaken during the period from December 1973 through February 1974 for the purpose of establishing ownership of certain patented and unpatented mining claims within the general area southwest of Diamond Joe Peak. Emphasis was placed on land status within secs. 17, 19, 20, 29, and 30, T. 17 N., R. 14 W.

   Excerpts from conversations with Denys K. Poyner, Kingman, Arizona, a possible conflicting party in the area, are included within this report.

2. During a field examination by Loghry and myself in December (10-13) 1973, claim location notices were found which indicated that a large number of unpatented mining claims had been staked through the years 1962 to 1972. In this period, Arkla Exploration Co. had conducted an extensive drilling program and had acquired land in the pertinent area by optioning existing claims and by staking open ground. Relocation of many Arkla claims by Denys K. Poyner of Kingman during 1972 was noted, indicating that Arkla had allowed its claims to expire.

3. I made a preliminary courthouse examination on December 18, 1973 in order to ascertain the present status of claims found in the field, also to determine ownership of patented claim groups in the Leviathan and American mine areas. This examination disclosed that the last work affidavits filed by Arkla were dated October 1, 1971. Claims subsequently located by Poyner were not recorded. Work affidavits by Dalton Robinett of Kingman for the assessment year 1971-1972 for the Potlicker 1-7, Potlicker Jr., Potlicker Sr., Sunshine 1-6, Big John 1-7, Peco 1-6, and Smokey 1-4 claims were noted. In March 1973, Dalton Robinett filed an affidavit of assessment work for the Potlicker 1-7, Potlicker, Jr. and Potlicker Sr, Smokey 1-4 claims and the Peco Nos. 1-3 for the assessment year 1972-73.

4. The patented claims were found to consist of two groups, the "Leviathan" group made up of 7 claims leased by a Mrs. R. Burnett, 3328 W. 1st Ave., Vancouver, B.C., heir of Frank McCarthy, and the "American" group of 5 claims owned by Walter and Annet Russel, ~~142~~-253rd St., Harbor City, California 90710. 1420

5. On the basis of the above examinations, Towne Mines Exploration Co. Inc. undertook staking of open ground, beginning February 7, 1974. The staking party consisted of Loghry, Downey, James Yanez, registered surveyor, and his rodman, John Cundiff. While we were staking the first discovery line, Denys Poyner, accompanied by Dadlink Yow, arrived at the scene and made several strongly worded remarks implying that we were jumping his valid claims. At that time, we were in the area about 1,500 feet southeast of the "American" shaft. Loghry stated that we had seen the location notices but had concluded that Poyner's claims were invalid since they had not been recorded and no location work had been done. He asked Mr. Poyner to name and show us the claims he considered valid. Poyner replied he could not remember the names but that he had a map he would show us. He then declared that Arkla had quitclaimed their claims to him after they terminated their program in 1971. When asked why he then subsequently relocated these claims, he said that he was not getting along with the Arkla people and that it appeared for awhile that they would not quitclaim the claims to him, so he overstaked them. Loghry and I pointed out that no assessment work was recorded on the Arkla claims for the assessment years 1971-72 or 1972-73 and no new work was seen. Mr. Poyner retorted that it was not necessary to file an affidavit of assessment in Arizona and that we had not seen the work because he had done some geochemical sampling.

6. Loghry and I met with Poyner at his home in Kingman on the morning of February 8, 1974. The discussion briefly centered on that of the previous day, that is, the validity of Poyner's claims. When asked to show the quitclaim deed from Arkla, he replied that it was "out-of-pocket." He then produced two blueprints, which he claimed showed some geochemical sampling done by him for assessment work. These undated maps were obviously prints from a company tracing (probably Arkla) with the title block either cut out or otherwise obliterated. These maps showed traverse lines with numbers spaced about every 200 feet apart and a written-in comment "ppm $MoS_2$" and "ppm Cu." The sample locations were near the American mine, and it is quite likely that all were on patented claims.

7. At the request of Loghry, David L Kuck, registered geologist and mining engineer, and I made a field examination of the area and a subsequent courthouse check of field data. The examination verifies that the Arkla claims and others have been abandoned and that Poyner's relocation is invalid. Even if Arkla did transfer their claims to Poyner, the claims are no longer valid since no assessment work has been accomplished. Kuck's observations confirm ours and are summarized in his report to Loghry, March 6, 1974. With regard to this report, in paragraph 3, last line, Mr. Kuck refers to "other areas for 1973." This should be clarified; he means other areas in Mohave County separate from Diamond Joe Peak. On page 2, first line, Mr. Kuck says

says a post is inscribed "Big John S.E. Cr." My observation is that it is inscribed "S.E.Cr., P.1," probably meaning Peco 1.

Harold Downey

Harold Downey

4/24/74

HD:h

# SOUTHWESTERN ASSAYERS & CHEMISTS, Inc.

REGISTERED ASSAYERS

FELIX K. DURAZO
ARIZONA REG. NO. 8205
WIL WRIGHT
ARIZONA REG. NO. 5875

P.O. BOX 7517
TUCSON, ARIZONA 85725

710 E. EVANS BLVD.
PHONE 602-294-5811

American Smelting & Refining Company
Mr. James D. Sell
P.O. Box 5747
Tucson, Arizona 85703

JOB # 018110
RECEIVED 7-29-75
REPORTED 8-13-75

| SAMPLE NUMBER | GOLD OZ.* | SILVER OZ.* | LEAD % | COPPER PPM | ZINC % | | MOLYBDENUM PPM |
|---|---|---|---|---|---|---|---|
| DW- | | | | | | | |
| 0 | | | | 110 | | | 16 |
| 1 | | | | 31 | | | 10 |
| 2A | | | | 1100 | | | 180 |
| 2B | | | | 112 | | | 16 |
| 3A | | | | .11% | | | 28 |
| 3B | | | | 1.53% | | | .460% |
| 3C | | | | 168 | | | 34 |
| 3D | | | | .14% | | | .440% |
| 4 | | | | 202 | | | 56 |
| 5 | | | | .30% | | | 52 |
| 6 | | | | 48 | | | 90 |

REGISTERED ASSAYER
CERTIFICATE NO.
8888
Dnyanendra
Amrutlal Shah
DATE SIGNED 8-13-75
Arizona U. S. A.

CHARGE $ 49.50

TO REPLACE DATED INVOICE 8-1-75.

* Gold and Silver reported in troy oz. per 2,000 lb. ton.

INVOICE

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Shah
8-13-75

CHARGE $ 49.50 TO REPLACE DATED INVOICE 8-1-75.

* Gold and Silver reported in troy oz. per 2,000 lb. ton.

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PHONE 602-294-5811

American Smelting& Refining Company
James D. Sell
P.O. Box 5747
Tucson, Arizona 85703

JOB # 018110
RECEIVED July 29,1975
REPORTED August 1, 1975

| | SAMPLE NUMBER | GOLD OZ.* | SILVER OZ.* | LEAD % | COPPER % | ZINC % | | MOLYBDENUM % |
|---|---|---|---|---|---|---|---|---|
| | Geo | | | | | | | |
| fresh core | DW-0 | | | | 110 | | | 16 |
| fresh stock | 1 | | | | 31 | | | 10 |
| alt, gtz, cpy. | 2A | | | | 1100 | | | 180 |
| fresh wall of 2A | 2B | | | | 112 | | | 16 |
| 1/2" py, cp, mo vn (Dump) | 3A | | | | 1080 | | | 28 |
| freshwall of 3A (Dump) | 3B | | | | 1.53 % | | | 2920 |
| alt vns w/ 1/4" gtz-wolf | 3C | | | | 172 | | | 34 |
| Core, alt. bleached. | 3D | | | | 1400 | | | 2980 |
| gtz, sm py, cp' veinlet in gr. | 4 | | | | 202 | | | 56 |
| shattered zone w/ molybdite | 5 | | | | 3020 | | | 52 |
| shattered hornfels py - sericite veinlets. | 6 | | | | 48 | | | 90 |

OK for Payment
JDS
General Expl.

REGISTERED ASSAYER
CERTIFICATE NO.
8888
Dnyanendra
Amrutlal Shah
DATE SIGNED 8-1-75
Arizona U. S. A.

CHARGE $49.50

* Gold and Silver reported in troy oz. per 2,000 lb. ton.

INVOICE

Lines show probable mix of sample assays

ASARCO Incorporated
Tucson Arizona

August 12, 1975

TO: W. L. Kurtz

FROM: J. D. Sell

Diamond Joe Porphyry Copper Prospect
(Towne Mines Exploration Co., Inc.)
Mohave County, Arizona

As expressed to you verbally, I feel that the area is a low priority property, based on the lack of throughgoing alteration and mineralization features.

I contacted Mr. Gerald Weathers (Consulting Geologist, 3928 E. Meadowbrook Ave., Phoenix, ph. 955-3590), who was the geologist for ARKLA on the "Yellow Basin" project, on the advice of Grover Heinrichs, who was acquainted with part of the work. Mr. Weathers insisted that he did not have any maps, drill logs, assays, etc., concerning the property. He stated that Mr. Breedlove (Chief Geologist of ARKLA at the time of the project) retired on January 1, 1975. A Mr. Stevenson is the present Chief Geologist (ph. 318-425-1271, Shreveport, Louisiana) and early this spring Mr. Stevenson came out, closed down the core storage area at Wikieup, dumped all the core in a big pile out back(?), loaded all the records in a U-Haul trailer, and left. Thus, Mr. Weathers has no copies of any of the material. I did not inquire as to what building the core was in, but I imagine there would be no problem finding it in Wikieup if more of the core needed to be looked at.

ARKLA is Arkansas-Louisiana Gas Company, P.O. Box 1734, Shreveport, LA 71102.

Weathers also mentioned that the best way to reveal the mineralization was to trace it with a black light, since one product is Powellite which is fluorescent. He also stated that the drill results are low grade.

The maps supplied by J. D. Loghry of Towne Mines shows the location of the drill holes and extent of possible alteration-mineralization. Assay values of the ARKLA drill holes (YB-series) are enclosed in Loghry's report.

As noted from the assays, there are some mineralized intercepts in moly values. However, the extent of the values are not indicated and it indeed appears that a few veinlets of values are in the area, but that the vast majority of the drilled area is relatively barren.

Based on the figures given by Loghry, I have compiled a table of the ARKLA drilling separated into holes which were drilled vertically and those drilled at an incline. The dominant fracture pattern appears to be nearly vertical and it would appear that inclined holes would best crosscut the mineral system. It is interesting to note that the vertical holes, average depth of 1356 feet, cut 11.4 "significant" intercepts per hole with an average intercept of 5.9 ft. and an average $MoS_2$ content of 0.215%. However, the inbetween values were apparently quite low and the significant intercepts were only 5% of the total footage drilled. On the otherhand, the inclined holes averaged 916 feet in length, cut only 4.4 significant intercepts per hole averaging 3.7 ft. per intercept which ran 0.230% $MoS_2$, but only constituted 1.3% of the total footage drilled. All the holes except YB-8 and YB-14 are within Loghry's favorable arcuate zone.

Table 2 is a list description of the samples collected during my reconnaissance. The values are reported by Southwestern Assayers (see attached).

Note also the petrographic sample sites and descriptions by Loghry and the apparent unaltered characteristic of most of the samples.

James D. Sell

JDS:lb
Atts.

TABLE I. ARKLA Drill Holes

| Hole No. YB- | Total Depth Feet | Significant Intercept Number In Hole | Average Thickness | Ave. $MoS_2$% | Highest Value $MoS_2$ Not Significant | % of Signif. $MoS_2$ Value in Total Footage | Highest Cu Value | All Other Cu Values |
|---|---|---|---|---|---|---|---|---|
| Vertical Holes: | | | | | | | | |
| 2 | 1232' | 18 | 2.2' | 0.289% | 0.092% | 3.3% | 0.55 % | <0.10% |
| 3 | 750 | 1 | 5.0 | 1.052 | 0.003 | 0.7 | 0.226 | 0.06 |
| 4 | 1134 | 9 | 1.6 | 0.161 | 0.098 | 1.2 | 0.302 | <0.10 |
| 6 | 1727 | 13 | 4.7 | 0.240 | 0.099 | 3.5 | 0.195 | <0.05 |
| 10 | 1751 | 17 | 12.4 | 0.250 | 0.098 | 12.0 | 0.195 | 0.02 |
| 11 | 1376 | 16 | 5.0 | 0.130 | 0.073 | 5.8 | 0.050 | 0.02 |
| 12 | 1519 | 6 | 10.0 | 0.145 | 0.097 | 3.9 | 0.050 | <0.02 |
| Ave. | 1356' | 11.4 | 5.9' | 0.215% | 0.080% Arithmetic | 5.0% | | |
| Inclined Holes: | | | | | | | | |
| 1 | 1192' | 8 | 1.0' | 0.782% | 0.062% | 0.7% | 0.125% | <0.05% |
| 5 | 842 | 3 | 2.0 | 0.154 | 0.068 | 0.7 | 0.135 | <0.05 |
| 7 | 381 | 1 | 5.0 | 0.152 | 0.006 | 1.3 | 0.093 | <0.02 |
| 8 | 705 | None | --- | --- | 0.006 | None | 0.006 | --- |
| 9 | 1000 | 8 | 6.2 | 0.138 | 0.020 | 5.0 | 0.182 | <0.02 |
| 13 | 1164 | 2 | 6.0 | 0.358 | 0.062 | 1.0 | 0.130 | <0.01 |
| 14 | 804 | None | --- | --- | 0.002 | None | 0.002 | 0.0005 |
| Ave. | 916' | 4.4 | 3.7' | 0.230% | 0.044% | 1.3% | | |

discounting holes YB-8 and YB-14 which are outside arcuate zone.

TABLE 2. DW-Series (Deluge Wash). Samples of the Diamond Joe Peak Area, T17N, R14 W. All samples in Laramide biotite quartz monzonite.

| Sample Number | PPM Cu | PPM Mo | Description & Location |
|---|---|---|---|
| DW-0 | 110 | 16 | Fresh, core, few specks of py-cp, cut by few hairline sericite-muscovite films. Apparently from ICC drilling in Leviathan vein area, NE1/4, Sec. 30. |
| DW-1 | 31 | 10 | Fresh, two miles east of Leviathan Mine area on south-east side of stock. Few qtz-py stringers. SE1/4, Sec. 27. |
| DW-2A | 1100 | 180 | Altered, typical N60°E (1/4" qtz-sericite halo) and N30°W (hairline fracture) intersection zone. NW1/4, Sec. 29. |
| DW-2B | 112 | 16 | Fresh wall rock, one foot from sample 2A above. Few hairline cracks with qtz-sericite. Occasional py-cp bleb. |
| DW-3A | 1.53% | 2920 | From Leviathan Dump. Altered vein with 1/2 inch qtz-py-cp, minor moly, streak. NE1/4, Sec. 30. |
| DW-3B | 172 | 34 | As above. Wall rock sample from sample 3A above, fresh, hairline fractures with qtz-sericite. |
| DW-3C | 1400 | 2980 | As above. Altered vein with 1/4" qtz-moly-sericite mineralization. |
| DW-3D | 1080 | 28 | As above. Core, probably from vein area, altered, bleached with Fe-carbonate(?). |
| DW-4 | 202 | 56 | Typical N60°W, dipping 60°N sheeted at 10 fractures per foot of 1/8"-1/4" sericite veinlets, cut by qtz-py-cp?-sericite (1/4") veinlets (one per foot) striking N30°E, vertical dip. NW1/4, Sec. 20. |
| DW-5 | 3020 | 52 | Sheeted, N60°E, dipping 50°N of 6 to 10 per foot of thin sericite fractures, some with malachite stain. Weak to fresh between sericite veinlets. SW1/4, Sec. 20, ARKLA hole #4. |
| DW-6 | 48 | 90 | Fine, equigranular, weak(?) alteration of biotite, cut by numerous 1/2" - 1-1/2" qtz-sericite veinlets on one-foot spacing with numerous hairline fractures with sericite, and occasional thin film of oxidized py-cp. NW1/4, Sec. 29. ARKLA hole #12. |

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710 E. EVANS BLVD.
PHONE 602-294-5811

American Smelting& Refining Company
James D. Sell
P.O. Box 5747
Tucson, Arizona 85703

JOB # 018110
RECEIVED July 29,1975
REPORTED August 1, 1975

| SAMPLE NUMBER | GOLD OZ.* | SILVER OZ.* | LEAD % | COPPER % | ZINC % | | MOLYBDENUM % |
|---|---|---|---|---|---|---|---|
| Geo | | | | | | | |
| DW-0 | | | | 110 | | | 16 |
| 1 | | | | 31 | | | 10 |
| 2A | | | | 1100 | | | 180 |
| 2B | | | | 112 | | | 16 |
| 3A | | | | 1080 | | | 28 |
| 3B | | | | 1.53 | | | 2920 |
| 3C | | | | 172 | | | 34 |
| 3D | | | | 1400 | | | 2980 |
| 4 | | | | 202 | | | 56 |
| 5 | | | | 3020 | | | 52 |
| 6 | | | | 48 | | | 90 |

OK for Payment
JDS
General Expl.

REGISTERED ASSAYER
CERTIFICATE NO. 8888
Dnyanendra Amrutlal Shah
DATE SIGNED 8-1-75
Arizona U. S. A.

CHARGE $49.50

* Gold and Silver reported in troy oz. per 2,000 lb. ton.

INVOICE

——— Lines show probably sample number-assay correlation. Samples either misnumbered or mixed at assayers. Values being checked by SWA&C.

July 24, 1975
telephone conversation
with Grover Heinrich.

Leviathan Mine Area

ARKLA
Arkansas - Louisiana Gas Company
PO Box 1734 Shreveport, Louisiana 71102
Chief Geologist: Bob Breedlove Retired

Geologist in charge of Leviathan Project area:
Consultant Jerry Weathers
best to gather Phoenix, Ariz.
Probably has complete file on project.

Tell Jerry I'm all "Hatted" from Grover Heinrich

Chief Landman can Exploration Dept through purse-strings

Grover did not work on above project.

Was involved in area halfway between the Santa Claus Inn (highway 93 N of Kingman) and Davis Mineral Park property is a large aeromagnetic anomaly. (Also gravity).
(SE 1/4 T23N, R18W)

ARKLA picked up ground, drilled several holes and promptly dropped it. (± 6 years ago)
Bear Creek picked it up, drilled several more & dropped it.

Gerald Weathers, 3928 E Meadowbrook Ave.
Phoenix 955-3590.

"Yellow Basin"

Breedlove retired 1st of year.
A Mr. Stevenson (No 1st name) (ph. 318-425-1271) came out, dumped all the core in shed at Wickenburg, took total files in U-haul truck & Weathers has not seen him since (or heard from him).
Weathers says black light showing powellite will reveal extent of zone. Low grade.

Leviathan Mines
Moly in qtz veins cutting quartz diorite
Hess, 1924, p. 14 USGS Bull 761.
less than 1,000 tons of moly (prod x est content) Bull 180 p. 234-35

ck Romslo, 1948, Antler Mine. USBM RI 4214.

ck JS Vinich. Wheelerlebeh

Schrader, FC. AIME Bull. 119, p. 1935-1957
" 123, p. 379-384
" 124, p. 456-460.
Tran. vol. 56, p. 195-236 (1917) None

McDunes, W USBM IC 7784, p. 16 No new word

Kuig, RU MR-55 refers to Hess (1924)
AzBM 180, p. 230-238 mentions it.

~~Kerkemo H. USGS Bull 1182-E~~ No.

Diamond Joe

Jim Lafferty
Bob Lehner
Desert Inn Safford 428-0521

How to get there – east or west. Mail Box #69 on West turnoff
Sec. T R 7 miles from Co ie keep-
Where's Kerch? Silver Lynx Mark 112-117.

# 150-2907-064-M July 21, 1975 Leon 883-4684 JOB Home
to Desert Inn

American tin shack, tailings,
N canyon Cooper Canyon
ends at Leviathan Mine

All around Leviathan Mine

4 miles EW
X 3 miles NS

West 1/3 contains most mineral
target between Leviathan & Aurora mine
in qtz veins & pillow fractures
w/ py, cp, molly.

Boundinaged portion preserve middle portion of stock.

Eastern side exposes cored stock very coarse
surrounded by finer phase. porphyric g.m.

jest on Dean Joe is porp g.m.

Accurate struct. includes fev & Aurora
hinges g.m.

ARCLA drilling N of Doriathea
deepest 1700 feet. 100' ultramafic

Nichols Hall the Barber - See phone book.

Alt confined to rewalk, fresh inbetween
clouds, seen K-zyon, ? sec. biot, flurries

88.4 Turn off at Mailbox #69, left side (west) of road.
90.4 Keep right
2.6 windmill
6.0 fairly large dump on North, in gr. DW-1 fresh gr (Sov) w/ few gtz-qtz stringers
6.6 cross Deluse Wash. some gtz-sericite rewalk (rehash)
8.1 large side gulch on S ended Dec.
9.4 prospects in right (North)
99.8. Jct. keep left (west), rds North are to connect for the N W.
00.2 American Mine, tin covered building, ore bin, tailings, wooden headframe across Dec.
01.1 Leviathan Mine
2.0 new turn off of N. rd to drill site?
2.4 return to N rd. repair part of new road out made to road over the rewalk
3.3 get left to rock walled rd (old?), right to new road
3.4 another get left to rd or may form (an) to claim (hours), right on "trail" to new road
3.5 washout cut off-rail to NX (a new prospect walk)
3.7 new rd to right along contour.
4.0 fork in saddle, left (west) goes steeply down hill to appear to end on nose of ridge. may be 1 or 2 drill sites location (May not connect up to roads from 99.8 marker.)?
4.2 to next saddle south. drill holes, pad. Vent hole, 1-BX casing on site, broken, another 4
Also rd to west, fairly steep, overgrown, with drill hole NX casing ± 0.1 mile

American Mine area

Area fracture N30°E with discontinuous veinlets & cavity, py. No real moly oxide stain. Qtz stringers 1-6" wide in general strike width & crosscut area fracture; but do wiggle & at times assume N-S bearing. Amer. vein has moly paint & film + qtz, minor cp in qtz. Wallrock not greatly mor fract. but some minor w/ veinlets, minor Cu paint & ox py.

1st N portion of Cu Canyon above American is just a small 1'-2' qtz-py vein zone, walls have some qtz out along N30°E trend. All pyritic. Some open vuggy zone w/ feldspars in mine dump. Very fresh appearance between fractures & veinlets.

2nd stretch at N40°E fracture pattern contains several N to N10E qtz vein 1-3' wide w/ veinlets - mostly - contains minor cp. Offset slightly by N60E with qtz following trend. Few N60W chalcedony silica - veinlets fracture - vein, dipping 50-55° E w/ near vertical stickenside in chalcedony (may dip 75° to NW) in plane of slicks.

3rd stretch. Similar to #1, at top end a 20-30' zone trending N60W shows trend of canyon. This at has qtz mesovein, vugs, pyrite similar to a "gneiss", fresh wall rock between zones. Intersection w/ NW set trend form a mine type of stockwork, NW offset NG, 1-3" right lateral E end Sq-tr. not found elsewhere. Abundant BX core in gulch in #3 & #2

DW-2 site typical N60E + N30W intersection zone & wallrock sample.

DW- core found in Copper Canyon Lower.

In general "vein zone" fracture are 3-10 per ft. whereas wall rock is 1 to 1½ or less per ft. Wall rock has discontinuous qtz-py & general no veinlets whereas vein zone has core of qtz w/ sericite walls & zoning out ½" or so

DW-3 from Aviatha Dump. Vein N40E. near vertical. Walled 1-3 feet (ft. fresh

Core box bid YB Hole No. 1 Box 97 912-921' Abundant BX Core as above

Pejeron wash @ S5°E, dip 50°S. L vein + 300' to south Core dump fragments of cement bind magnetite

At prospect symbol in NW ¼ Sec. 20, NX casing, vertical hole N of vein ±50 ft.
vein strike E-W dips 75° N, 4-5 feet wide very qtz, pyrite
sericite green granite between 1"-8" qtz sheet. Some fuchsite molybdenite.

DW-4 @ 040 in saddle. N60°W dipping 60°N sheated ±10/ft. sericite cut by qtz-seri. py in
N30°E, vertical (very few) (1 per ft or 2 ft)

DW-5 NX drill hole. Sheeting N60°E, 50°N, 6-10 per ft. marks thin sericite, non mineralized

NW ¼ Sec. 29 Capped NX & coring core hole vertical. fine equigranular sp. cut by
numerous fractures, mostly hair crack, & qtz & sericite stringers ½-1½" space. 1 per ft.
another cut hole NX coring due west. ±250 ft to west. old adit just east side.
Next to Tourner's Harper #8 & #87 location holes. New road near hole ??
Capped hole #10, old adit overgrown.
North of the above, in SW ¼ Sec. 20 ~~and hole~~ NX @ N20°W, -45°N (hole capped)
Several other pods proved on grid eastward but apparently not drilled

Very apparently color fringe Dw-6 by vein [illegible] [illegible]

Qtz vein, 3-5' wide in South of Sec. 29 are enclosed segments at N30°E but trend
overall N 10°E.

# ASARCO EXPLORATION RECORD

[X] FIELD EXAMINATION [X] LITERATURE SEARCH [ ] ASARCO FILE [ ] _____

Aa.13A.3A.4

## Section I General Indexing

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ① Name(s) of Property or Area: DIAMOND JOE<br>Owner: Towne Mines Expl. Co. | | | | | ② Country: U.S.A. | ③ State or Province: Arizona | |
| | | | | | ④ Co. or Map Sheet: Mohave Co. | ⑤ File or Gore No.: ~~Aa-13A-0-0~~ | |
| ⑥ Latitude: 34°50'N | ⑦ Longitude: 113°47'W | ⑧ Mer.: G&SR | Tws.: 17N | Rng.: 14W | Sec.: 20 29 30 | ⑨ Examined by: J.D.Sell | ⑩ Date: Aug.'75 |
| | | | | | | ⑪ Office: Tucson | ⑫ Field Days: 2 |

## Section II Sources of Information

⑬ References

| Author | Date | Title | Publications | Vol. No. |
|---|---|---|---|---|
| Report to Towne Mines by J. D. Loghry, 1973 (see files) | | | | |
| Report by J. D. Sell, Aug. 12, 1975 (see files) | | | | |

## Section III Appraisal

⑭ Recommendations
- [ ] Action Now
- [X] Too Low Grade
- [ ] Too Small
- [ ] Ownership Problem
- [ ] Access Problem
- [ ]

⑮
- [ ] Past Producer
- [ ] Producer
- [ ] Mineral Deposit
- [X] Prospect
- [ ]

- [ ]
- [X] Geologic Concept
- [X] Geochem Anomaly
- [ ] Geophy. Anomaly
- [ ]

⑯ Production

| Commodity | Tons | Grade |
|---|---|---|
| | | |
| | | |
| | | |

⑰ Reserves [ ] Measured [ ] Estimated

| Commodity | Tons | Grade |
|---|---|---|
| | | |
| | | |
| | | |

⑱ Num. Drill Holes 14 YB Series
Approx. Total Footage 15,577

⑲ Excavations Leviathan Mine, several ICC drill holes, several shallow workings & cuts, number of percussion holes.

⑳ Spectro. Analysis Attached

㉑ Assays Attached

㉒ Geochem Results Attached
See above reports.

## Section IV Geologic Data

㉓ Commodity or Contained Metals: Copper, moly

㉔ Ore Minerals - Major: Chalcopyrite Molybdenite Minor: pyrite

㉕ Host Rocks - Major: biotite quartz monzonite Minor:

㉖ Age of Host Rocks: Laramide

㉗ Nature of Exposures: Well exposed in rugged slopes with variable soil and brush cover.

㉘ Alteration: Fresh to weakly argillized rock cut by hairline to 1/4" quartz-sericite-rare feldspar veinlets.

㉙ Total Extent: Arcuate zone 1000-2000' wide, 9000' long

㉚ Structure: Myriad of barren sericite hairline to thin veinlets with some 1/4-1/2" qtz-py-cp-moly veinlets and 6-8 veins 5 to 30 feet wide. NE, NW, & N direction.

㉛ Ore Occurrence: In porphyry target, mainly as thin veinlets with minor disseminations.

㉜ Age of Mineralization: Laramide

㉝ Conclusions and Recommendations: Sulfides exposed on surface or at shallow depth. Low total sulfide and low overall values with fresh rock between veinlets suggest the target area not fully developed as a porphyry system. Low priority target system.

(For additional space use extra sheets)

ASARCO Incorporated
Tucson Arizona

August 15, 1975

TO: W. L. Kurtz

FROM: J. D. Sell

Diamond Joe Porphyry Copper Prospect
(Towne Mines Exploration Co., Inc.)
Mohave County, Arizona

Addenda:

In my report of August 12, I show the assay values in Table 1 and on the Assay Sheet for samples 3A, 3B, 3C, and 3D as what I visually felt the sample would match up with. Southwestern Assayers reran the pulps and have submitted a new sheet as attached. Their order of values is the same and I can only conclude that the sample number has been mixed either when I placed the sample in the sack or at the laboratory. I believe the sample-assay tie lines as proposed in the original memo are correct.

In the rerun of the samples, note that their sample 3B and 3D moly assay has been nearly doubled in value. As two of the samples were of vein material containing moly, I believe the values are in the ball park, though I would have estimated the original 0.29 values to be the range rather than the 0.4 values. Neither value changes the concept of evaluation of the prospect.

James D. Sell

JDS:lb
Att.

# SOUTHWESTERN ASSAYERS & CHEMISTS, Inc.

REGISTERED ASSAYERS

FELIX K. DURAZO
ARIZONA REG. NO. 8205
WIL WRIGHT
ARIZONA REG. NO. 5875

P.O. BOX 7517
TUCSON, ARIZONA 85725

710 E. EVANS BLVD.
PHONE 602-294-5811

American Smelting & Refining Company
Mr. James D. Sell
P.O. Box 5747
Tucson, Arizona 85703

JOB # 018110
RECEIVED 7-29-75
REPORTED 8-13-75

| SAMPLE NUMBER | GOLD OZ.* | SILVER OZ.* | LEAD % | COPPER PPM | ZINC % | | MOLYBDENUM PPM |
|---|---|---|---|---|---|---|---|
| DW- | | | | | | | |
| 0 | | | | 110 | | | 16 |
| 1 | | | | 31 | | | 10 |
| 2A | | | | 1100 | | | 180 |
| 2B | | | | 112 | | | 16 |
| 3A | | | | .11% | | | 28 |
| 3B | | | | 1.53% | | | .460% |
| 3C | | | | 168 | | | 34 |
| 3D | | | | .14% | | | .440% |
| 4 | | | | 202 | | | 56 |
| 5 | | | | .30% | | | 52 |
| 6 | | | | 48 | | | 90 |

REGISTERED ASSAYER CERTIFICATE NO. 8888 Dnyanendra Amrutlal Shah DATE SIGNED 8-13-75 Arizona U. S. A.

CHARGE $ 49.50

TO REPLACE DATED INVOICE 8-1-75.

* Gold and Silver reported in troy oz. per 2,000 lb. ton.

INVOICE

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INVOICE

13A.3A.16
aa- 13A.11.0
N.E.S.

AUG 19 1963

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

MR. ~~JHP, NES, JEK~~
READ AND RETURN
PREPARE ANSWERS ___ HANDLE ___
FILE ✓ INITIALS

163

9 August 1963

MEMORANDUM FOR MR. J. H. COURTRIGHT:

POYNER'S MOLYBDENUM-COPPER PROSPECT
Mojave County, Arizona
Kingman Area

By a letter dated July 15, addressed to our New York office, Mr. Denys K. Poyner of Kingman, presented a copper-molybdenum prospect for ASARCO's consideration. The property appeared to be of possible interest, so I arranged to meet him at Wikieup, Arizona, on July 30 to make an examination of the property.

Summary

The prospect is an area of numerous northeasterly-trending quartz stringers in a quartz monzonite. Sporadic molybdenite occurs in and associated with the stringers; more abundant pyrite occurs with the stringers and disseminated in the monzonite.

The molybdenum content of the area as a whole is estimated to be well below an ore grade; consequently no exploration is recommended.

Location and Claims

The prospect is 55 airline miles southeast of Kingman. It is in the Hualpai Mountains, on the west side of Diamond Joe peak, and in the Sections 20 and 29, T. 17N., R. 14W. The region is mountainous and the claims at an altitude ranging from 4000 to 5000 feet.

The prospect is not accessible by automobile. A jeep or 4-wheel vehicle can be driven to within about a mile of the prospect and ordinary cars within 3 or 4 miles. Access to the area is by winding mountain roads from the east or west, about 25 miles from a hard-surfaced highway in each direction.

The claims are owned by Denys Poyner and Dalton Robbinet. Only a rough sketch of the claims was available and the men are hazy about the number of claims they actually have staked. Robbinet had a list of 21 recorded claims. Although the claims appear to be in poor shape the men could probably maintain title by right of possession and the actual prospecting they have done.

for Mr. J. H. Courtright 9 August 1963

## Geology

Precambrian granite gneiss forms the bulk of the Hualpai Mountains in the vicinity of the prospect. However, on the east side is a granite, presumably Laramide in age, several square miles in extent. The molybdenum prospect occurs in a fine-textured granitic rock that has been reported to be a quartz monzonite. Rocks of the region are well exposed and practically unaltered except in the area of prospect.

The prospect consists of an area in the monzonite (?) roughly 2000 by 3000 feet in size in which a pronounced system of joints and quartz stringers occurs. The stringers strike northeasterly and are vertical or very steep. In addition to the northeast-striking system there are a few northwest-striking and random stringers, but probably over 95 per cent are in the main system. The width of quartz in the joints ranges nil to 3 or 4 inches; the spacing of the joints from close to several feet apart. I estimate that the overall average spacing is about one foot.

Associated with the stringers are bands of weak alteration in which the biotite has been bleached and secondary pink feldspar developed. Veinlets and patches of a light-colored mica occur in the joints and altered areas. Often veinlets of the mica and quartz occupy the same fracture. Within the zone of stringers are bands of unaltered monzonite several feet wide essentially devoid of stringers.

Pyrite, molybdenite, and chalcopyrite occur in the zone. Most of the molybdenite is erratically distributed along the stringers; pyrite occurs along the stringers and as disseminated small grains in the monzonite.

Bedrock over most of the area has been oxidized for a few feet and is partly covered with soil and residual material. However, nowhere is the cover thick enough to make the underlying bedrock or mineralization questionable. Sulphides are exposed at places along a ravine cutting through the central part of the zone and in several shallow pits.

## Exploration

Exploration to date consists of a few shallow pits, slabs shot from steep outcrops, and three diamond drill holes.

An "X-ray" diamond drill was packed in the three holes drilled in the central ravine. The holes are along a 600-foot length of the ravine, at -45 degree angles, and reported to be 30 feet deep. The cores are about 3/4 inch in diameter.

for Mr. J. H. Courtright 9 August 1963

Referring to the three holes in his letter, Poyner stated, "Assays have shown overall values to be 0.109% Mo and 0.15% Cu with the bottom 15 feet being above 0.23% Mo." No assays of the core could be shown to me. It was stated that Duval ran the samples from one hole, Union Carbide from another, and that the core from the third hole had been sent to an office in Prescott but that the results had not yet been received. A box of pieces of core, representing a total length of 3 or 4 feet, was available for examination.

Recommendation

I estimate, from an examination of outcrops in the field and specimens of rock and drill cores with a binocular microscope, that the overall content of Mo $S_2$ is probably less than 0.05 percent. Admittedly, this estimate could be very much in error, especially if the frequency of high-grade pockets and streaks is greater than is superficially evident.

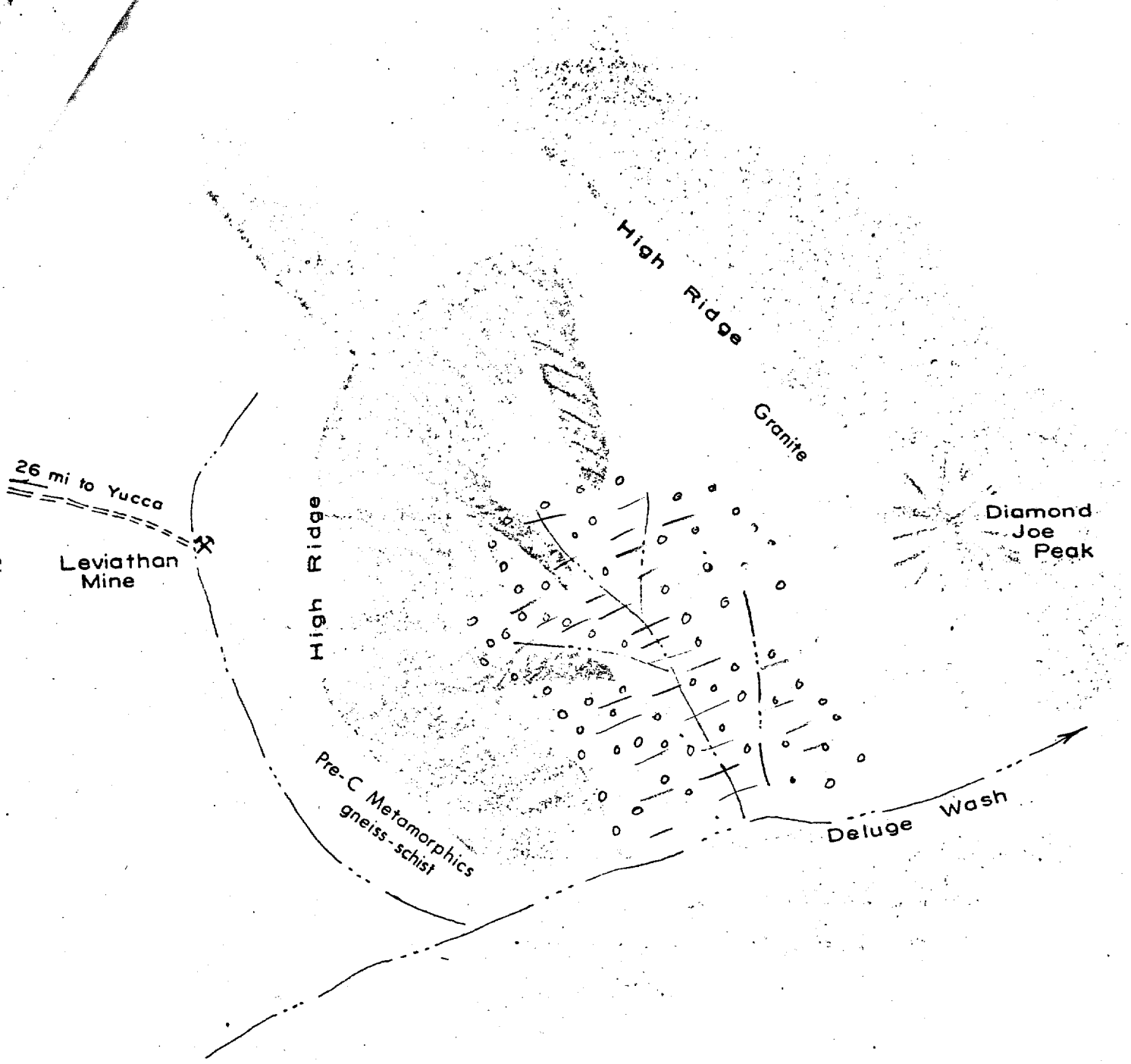
No exploration is recommended on the basis of present evidence. However, if any new, worthwhile drill hole information is obtained, the prospect should be reconsidered.

R. K. Kirkpatrick

R. K. KIRKPATRICK

RKK:bam

Attachments:
Index map of location.
Sketch map of area.




Granite gneiss

Granite

Quartz monzonite; brown where iron-stained at surface

Steep quartz stringers

Sketch Map
POYNER MOLYBDENUM PROSPECT
Kingman Area
Mojave County, Arizona
SCALE 1" = 1000'

Bulletin 111 Mineral Technology 15

DEPARTMENT OF THE INTERIOR
FRANKLIN K. LANE, SECRETARY
BUREAU OF MINES
VAN. H. MANNING, DIRECTOR

# MOLYBDENUM; ITS ORES AND THEIR CONCENTRATION

WITH A DISCUSSION OF

## MARKETS, PRICES, AND USES

BY

FREDERICK W. HORTON

WASHINGTON
GOVERNMENT PRINTING OFFICE
1916

in the ores of several prospects in the Bradshaw Mountains;[a] also with pyromorphite at the Accidental mine of the Poland Mining Co., of Prescott. The latter property is situated in Lynx Creek Valley near Prescott. The mineral is also said to occur at the Vulture mine in Maricopa County.[b]

## OCCURRENCE OF MOLYBDENITE AT THE LEVIATHAN MINES, MOHAVE COUNTY.

The molybdenite property of the Leviathan Mines Co. is situated in Copper Canyon, Mohave County, on the eastern slope of the Hualpai Mountains. It is in the Cedar Valley mining district, about 3 miles southeast of Copperville and about 25 miles east of Yucca, the nearest point on the Atchison, Topeka & Santa Fe Railway. The property is reached from Yucca by a good wagon road to Copperville, thence by trail down Copper Canyon to the claims, which at their low point in the canyon bottom are at an altitude of about 4,000 feet. The country is arid and as vegetation is confined to desert types no timber is available. Fortunately, water for domestic use can be obtained from springs in the canyon and additional supplies for other purposes from the mine seepage. The wagon road from Yucca to Copperville passes over the main range of the Hualpai Mountains, and reaches an elevation of about a mile. The altitude at Yucca is 1,789 feet, and from this point to the base of the mountains on the west the road has only a slight grade, averaging perhaps 1 or 2 per cent, but on the Yucca side of the range proper the grade is about 7 per cent, and on the Copperville side there are grades as high as 11 per cent. Notwithstanding these steep pitches the road is fairly passable, and auto trucks with loads of 4 to 5 tons make the trip from Copperville to Yucca in about two hours.

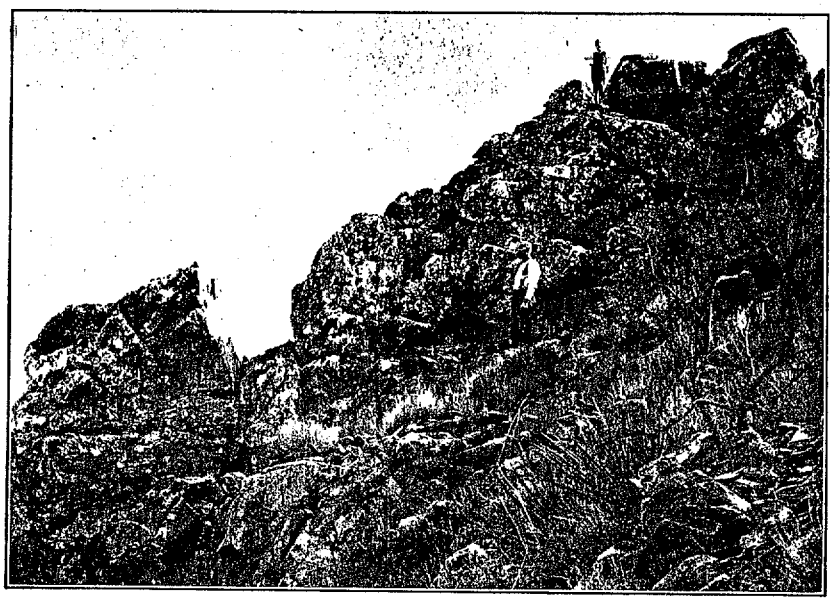
The Leviathan properties consist of a group of six claims located on two approximately parallel veins known as the "Whale" and the "Copper Wonder." These veins traverse a granite country rock and consist of white quartz carrying molybdenite and chalcopyrite as the principal ore-forming minerals. The strike of both veins is approximately north–south, and they dip between 85° and 90° west. As the granite country rock is more easily weathered than the hard quartz vein material, erosion has left the veins sticking into the air and made their outcrops easily traceable. In some places the outcrop of the Whale vein is 30 to 40 feet high and its outcrop on the south side of the canyon can be seen for miles. Plate VIII shows views of this outcrop, which can be traced for more than 1,500 feet. The Whale vein which is the larger of the two, varies in width from 6 to 40 feet, and the Copper Wonder vein from about 2 to 20 feet.

[a] Sanford, S., and Stone, R. W., Useful minerals of the United States: U. S. Geol. Survey Bull. 585, 1914, p. 19.

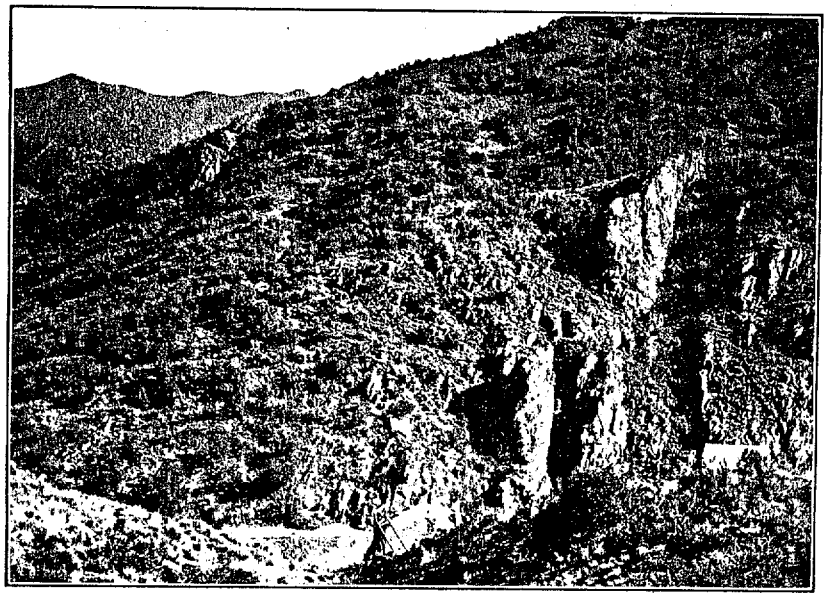
[b] Dana, E. S., A system of mineralogy, 6th ed., 1911, p. 991.

A. NEAR

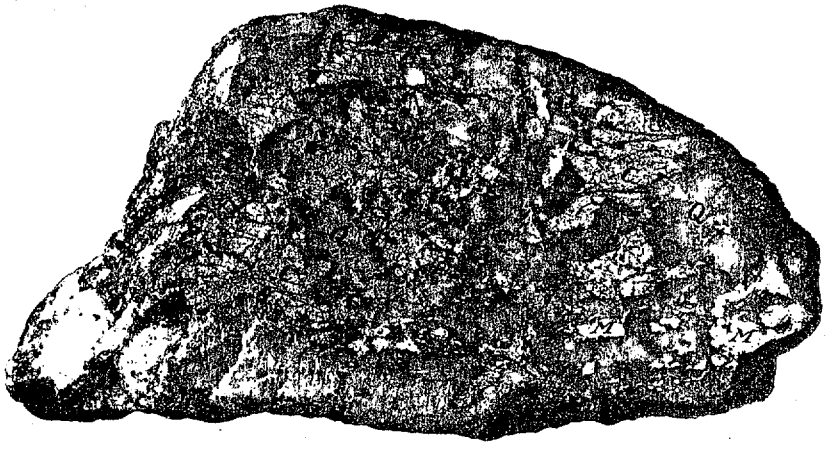
B. OUTCROP



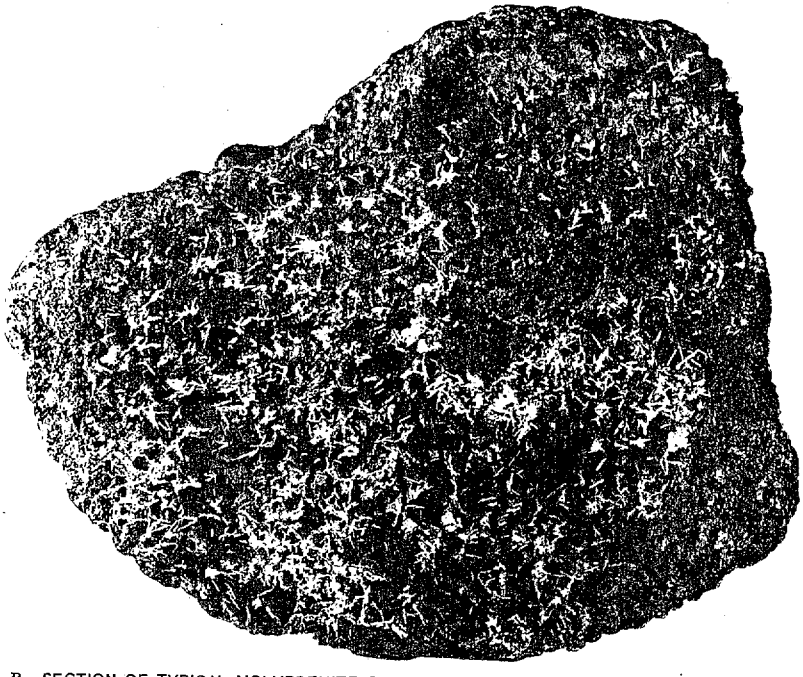
*A.* NEAR VIEW OF OUTCROP OF WHALE VEIN, COPPER CANYON, NEAR COPPERVILLE, ARIZ., SHOWING ITS HEIGHT.



*B.* OUTCROP OF WHALE VEIN, LOOKING SOUTH. HEADFRAME OF SHAFT AND PART OF WASTE DUMP ARE SHOWN IN MIDDLE FOREGROUND.



*A.* SECTION THROUGH TYPICAL ORE FROM WHALE VEIN, COPPER CANYON, NEAR COPPERVILLE, ARIZ. (TWO-THIRDS NATURAL SIZE.) *M*, MOLYBDENITE; *C*, CHALCOPYRITE; *Q*, QUARTZ.



*B.* SECTION OF TYPICAL MOLYBDENITE ORE FROM LEADER MINE, HELVETIA, ARIZ. (ONE AND ONE-HALF TIMES NATURAL SIZE.)



The molybdenite occu
thin veinlets and irregu
fine crystalline powder
veins. Much of it is so
rite, and in only a few
were free from copper.
molybdenite and chalco
of quartz, and in other
intermingled. Plate IX
typical ore showing the
ing has taken place bot
formed alteration prod
lybdite, and the chalco
copper sulphides have
Whale vein native copp
occurrences of pyrite a
reported to carry about
ton.

The country rock is
quartz, feldspar (orthoc
albite to labradorite) b
usual accessory mineral
amined there was muc
much alteration to seri
monzonitic in character
nevertheless.

Development work h
At the time of the write
sisted of two tunnels d
feet above the level of t
and of a shaft sunk on
the south side had bee
north for about 30 feet.
been driven from the b

The writer estimates
workings and in the o
$MoS_2$, and $1\frac{1}{2}$ to 2 per
by the results of 22 an
widths of 2 to 17 feet a
on the outcrop. These
writer by R. C. Jacobso
pany, averaged 2.73 p
indicate that the perce
the ore are approximate
are reported as contain

The molybdenite occurs in amorphous and finely crystalline form in thin veinlets and irregular masses throughout the quartz, and as a fine crystalline powder and as nuggets in vugs and cavities in the veins. Much of it is somewhat intimately associated with chalcopyrite, and in only a few places could the writer obtain specimens that were free from copper. In some places, the individual masses of molybdenite and chalcopyrite are large and are separated by masses of quartz, and in other places they may be very small and closely intermingled. Plate IX, *A*, illustrates a section through a piece of typical ore showing the relation of the two minerals. Where weathering has taken place both the molybdenite and the chalcopyrite have formed alteration products, the former changing to the yellow molybdite, and the chalcopyrite to malachite and azurite. Secondary copper sulphides have also been formed and in several places on the Whale vein native copper occurs. In this vein there are also occasional occurrences of pyrite and small patches of sphalerite, and the ore is reported to carry about 0.02 ounce of gold and 1.4 ounces of silver per ton.

The country rock is a medium-grained gray granite consisting of quartz, feldspar (orthoclase, microcline, and plagioclases varying from albite to labradorite) biotite, muscovite, and small amounts of the usual accessory minerals, zircon and apatite. In the specimen examined there was much zonal development in the feldspar and also much alteration to sericite and possibly kaolin. The rock is more monzonitic in character than the usual granite, but it is a granite nevertheless.

Development work has practically been confined to the Whale vein. At the time of the writer's visit to the property in June, 1915, it consisted of two tunnels driven along the strike of the vein only a few feet above the level of the canyon floor on opposite sides of the gulch, and of a shaft sunk on the north side of the canyon. The tunnel on the south side had been driven for about 210 feet, and that on the north for about 30 feet. The shaft was 100 feet deep and a drift had been driven from the bottom in a southerly direction for 20 feet.

The writer estimates that the average grade of ore exposed in the workings and in the outcrop contains between 2 and 3 per cent $MoS_2$, and 1½ to 2 per cent copper. This estimate is substantiated by the results of 22 analyses, each representing samples taken over widths of 2 to 17 feet at various points in the tunnel and shaft and on the outcrop. These analyses, which were kindly furnished the writer by R. C. Jacobson, general manager and engineer of the company, averaged 2.73 per cent $MoS_2$, and 1.71 per cent copper, and indicate that the percentages of molybdenum (metal) and copper in the ore are approximately equal. Several rich streaks in the ore body are reported as containing 5 to 8 per cent $MoS_2$ over widths of 4 to

6 feet. The ore that is richest in molybdenite appears to contain relatively less copper than that of average grade.

No particular difficulty should be encountered in concentrating this ore either by electrostatic or flotation methods, but the concentrates obtained would consist of a mixture of molybdenite and chalcopyrite, probably in almost equal parts, and in that form their molybdenite content would be of little value. A retreatment of the concentrate by any one of a number of mechanical methods would probably separate the greater portion of the copper from the molybdenite (see pp. 94 to 109), but the writer is of the opinion that none of these processes would completely eliminate the copper from a product containing such a large percentage of it. If such is the case, chemical methods of separation must be employed. The results of a concentration test on this ore by the Wood flotation process are given on page 104.

At the time of the writer's visit to the property, surface equipment consisted of a shaft house containing a Western Iron Works 10-horsepower gasoline hoist, a compressor house containing an Alamo 20-horsepower gasoline engine (type S) belted to a Clayton two-drill air compressor, a blacksmith shop, and a cookhouse. The miners were quartered in tents. The little water seeping into the shaft was removed by means of a small Cameron sinking pump, which delivered it when required to a 3,500-gallon galvanized-iron storage tank. This water supply was used for cooling the engine jackets.

It is estimated that the cost of mining will vary from $1 to $1.50 per ton, according to the scale on which it is carried on. A water supply sufficient for milling purposes could probably be developed and brought to the property at reasonable cost. Moreover, on account of the location of the mine in a canyon having a considerable drainage area, a considerable quantity of mine water will in all probability have to be pumped with further deepening of the shaft and extension of the workings. This water might be used as a supplementary supply for milling. At present the cost of transportation to and from the railroad at Yucca is high, but if a road were built connecting the claims with the road at Copperville this cost would probably not exceed $7 or $8 per ton.

The outcrop of the Whale vein is so exceptionally well defined and so wide and the molybdenite and the copper contents of the vein, as indicated by sampling of the outcrop and workings, are so regular and persistent that the writer considers the property a most promising one notwithstanding the unfortunate association of copper with the molybdenite.

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Please do not destroy or throw away this publication. If you have no further use for it write to the Geological Survey at Washington and ask for a frank to return it

DEPARTMENT OF THE INTERIOR
HUBERT WORK, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

BULLETIN 761

# MOLYBDENUM DEPOSITS

## A SHORT REVIEW

BY

FRANK L. HESS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1924

t. The elevation of the lower tunnel
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f Clear Creek, in Clear Creek
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ter.[31] The principal workings,

of Leadville, Colo.: U. S. Geol. Survey
ias, Tenmile district special folio (No.



though in unsurveyed land, are probably in sec. 29, T. 3 S., R. 75 W., and are at an altitude of about 11,300 feet; the camp is at 10,200 feet. From the descriptions given the mine seems to be on a sheared zone 200 feet wide, striking N. 65° W., in which are granite and alaskite(?) porphyry. In this zone are quartz veins carrying molybdenum and pyrite. The veins range from a small fraction of an inch to 3 or 4 feet across, and there is some ore-bearing breccia. The molybdenite is altered to molybdite near the surface, and the ore is said to be wholly free from copper. The rock is fairly soft and is apparently more or less sericitized. Horton says that the ore averaged approximately 2 per cent of molybdenum, but it is reliably reported as carrying only 0.5 to 0.6 per cent. Coghill and Bonardi[32] simply say that it "is of about the same grade as that of other workable molybdenite deposits." As to the size of the molybdenite particles they say, "The molybdenite ranges in size from large beautiful specimens to the minutest specks firmly locked in the siliceous gangue." Data as to the quantity of ore developed or in reserve are not at hand.

There are many other molybdenite deposits in Colorado, from several of which some production has been made.

### NEW MEXICO

Seven miles east of Questa, N. Mex., just south of the Colorado State line and a short distance east of the Rio Grande, the Molybdenum Corporation of America, successor to the R & S Molybdenum Co., has a rather extensive molybdenite deposit that in its general features seems to be of the same type as the deposit at Camp Urad, Colo. It has recently been described by Larsen and Ross.[33] The grade of the ore is very much higher than that of the Climax ores, but the quantity is much less.

### ARIZONA

In Arizona some ore has been produced from claims in Copper Canyon, about 25 miles southeast of Yucca. Copper Canyon drains southeastward in a trough about 3 miles long that has been cut longitudinally in the east side of the Hualpai Mountains and joins, at nearly right angles, Deluge Wash, which slopes eastward to Big Sandy River.

Beginning with the claims of the Arizona Molybdenite Consolidated, which are just across the narrow divide (north) from the head of Copper Creek, a succession of groups of claims held for molybdenum extends to Deluge Wash and spreads both up and down the

[32] Coghill, W. H., and Bonardi, J. P., Flotation of molybdenite at Empire, Colo.: Eng. and Min. Jour., vol. 109, p. 1210, 1920.

[33] Larsen, E. S., and Ross, C. S., The R & S molybdenum mine, Taos County, N. Mex.: Econ. Geology, vol. 15, pp. 567–573, 1920.

wash. Nearly all the workings are on the east side of the Copper Creek canyon and are on quartz veins cutting granite. The veins are all similar in character and differ only in size and richness. They were deposited near the surface of a granitic intrusion as comparatively pure white quartz, probably with a small quantity of pyrite, chalcopyrite, sphalerite, and galena and possibly some molybdenite. Movement along the veins continued, the quartz was broken, and in cracks molybdenite and more pyrite and chalcopyrite were deposited.

The Leviathan Mines Co. has been the largest operator and has a mine in Copper Canyon, about a mile from Deluge Wash. The company had sunk a shaft 220 feet deep on the Leviathan vein, a prominent quartz vein that crosses from one side of the canyon to the other and is as much as 20 feet but in most places is probably nearer 7 feet wide. The shaft, following the vein, has an inclination of 8 feet in 100 feet. Water was so scarce in 1917, when the mine was last operated, that the mill could run only two shifts a day, although a pipe line had been run 4 miles to a point in Deluge Wash, from which it was expected a plentiful supply would be obtained, but it gave out in August. Water was obtained from the shaft, but a strong taste of pine oil in the water showed that it was receiving the drainage from the mill. Counting the back flow, the shaft was furnishing about 5,000 gallons of water a day. The ore carried about 1 per cent of molybdenite, nearly as much copper in chalcopyrite, and less pyrite. Low-grade concentrates carrying 20 to 30 per cent of molybdenite and 18 to 25 per cent of copper were made by oil flotation. No pay was received for the copper in the concentrates. Several hundred feet of drifting had been done on the 100-foot level, and a considerable quantity of ore had been broken down on the stulls when I visited the mine in 1917.

There are many other molybdenite-bearing outcrops in the Hualpai Mountains, on some of which considerable work has been done and a small production made.

Molybdenite has been mined at Helvetia, Ariz.,[34] where it is found in both contact-metamorphic deposits and quartz veins cutting pre-Cambrian granite and associated with aplite; and at Duquesne and San Antonio Canyon, where it occurs in altered granite porphyry and altered granite, respectively.

### OTHER LOCALITIES

In Alaska a deposit at Shakan, in the northwestern part of Prince of Wales Island, has been developed by the Alaska Treadwell Co. It is in a mineralized shear zone in hornblende diorite, 600 feet above Shakan Bay.[35] The zone crops out for 500 feet. The ore averages

[34] Schrader, F. C., and Hill, J. M., Some occurrences of molybdenite in the Santa Rita and Patagonia mountains, Ariz.: U. S. Geol. Survey Bull. 430, pp. 154–163, 1910.

[35] Mertie, J. B., jr., Lode mining in the Juneau and Ketchikan districts: U. S. Geol. Survey Bull. 714, pp. 118–119, 1921.



from 1 to 2.28 per cent MoS
grade ore was blocked out, a
cent was indicated.[36]

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[36] Bradley, F. W., Min. and Sci.