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File: Exploration Targets

Kuitz

AMERICAN SMELTING AND REFINING COMPANY
ROCKY MOUNTAIN EXPLORATION DIVISION
1805 SOUTH BELLAIRE STREET, SUITE 301
DENVER, COLORADO 80222
303-757-5107

RECEIVED
SEP 17 1971
EXPLORATION DEPT.

September 15, 1971

J. H. C.

SEP 20 1971

Mr. John J. Collins
Director of Exploration
American Smelting and Refining Co.
120 Broadway
New York, New York 10005

Initial Exploration Targets
Minimum Size and Grade

Dear Sir:

A question is arising in regard to the definition of a desirable minimum exploration target for Asarco, as understood prior to beginning exploration, in regard to deposits in the bedded copper environment. Such a definition presumably depends on whether the exploration geologist understands that the function of exploration is to either, (1) find large mines in which the company can invest very large amounts of money at some specified rate of return, or (2) find mines from which the company can realize the maximum profit, or ? - (3) find mines from which the company can acheive the greatest net profit per unit increment. Any of these three concepts requires some sort of conceptual model in the sense of tons, grade, operating costs, etc.

Historically, in the recent past, (1955-1960), a minimum target model for open pit porphyry copper exploration was defined by some groups to be a chalcocite blanket of 10 million tons at a grade of .77% Cu, and a stripping ratio of no more than three to one, at a Cu price of 30 cents per pound. The four variables are all related, and a change in one would produce corresponding changes in the others. Hopefully, exploration would increase the worth of the initial target. In other words, the hoped for exploration success would be better then the minimum initial exploration model.

.77 x 80% = 61c

12 lb x 2.3 = 27c

at 80% rec

say 7.00 per ton

Au mo 50

3.50

mt 3.50

op 2.00

1.50 prof

At 30 cent copper, and normal minor metal credits, a general magnitude economic analysis shows that such a deposit would have a gross metal value of about $50 million, or about $5.00 per ton of ore. Operating costs were such that an operating net of $2.00 to $2.50 per ton could be realized, or a gross total operating net of about $20 million would be obtainable.

It appears now (1971) that a minimum open pit porphyry copper exploration target is thought of in terms of 50 million tons, at a grade of .60% Cu, a similar 3 to 1 stripping ratio, and a .40 cent copper price. Similar calculation as the preceeding shows general gross metal value of the model has risen to $250 million, but gross per ton value is still about $5.00. Operating net is still about $2.00/ton so a gross operating net of about $100 million is obtainable.

In Mississippi Valley lead-zinc searches, a desired minimum order of magnitude exploration target was something on the order of 10 million tons of 5% Pb, at a lead price of about .15 cents/pound. Such a deposit has a gross metal value of about $150 million. Operating net would be about $6.00/ton. If the minimum size concept has expanded for such lead deposits in a manner similar to porphyry copper bodies, a minimum body of about 17 million tons is now in order.

In such conceptual models a common factor may be the approximate contained metal grosses, and gross operating nets. None of these models is concerned directly with thickness of an ore deposit. Bedded ore, or any rock, either can or cannot be mined, at some specific cost. Thickness of beds is of real concern only as it bears on costs.

In the bedded environment, if I consider a widespread bed 1 to 1.5 feet thick, at 3% copper, and a .40 cent copper price, each square mile contains approximately 2 to 3 million tons, at a metal gross of $24.00 per ton, or $48 to $72 million per square mile. Ten million tons would have a gross $240 million from some 3.3 to 5 square miles. We are concerned with beds which dip 20 feet per mile. We can thus choose stripping ratios so that operating costs are no more than some specific desired figure, say $14 per ton. (Actually $ 8.00 costs should be acheivable.) Gross operating profit would then be $100 million.

The U. S. Bureau of Mines, in their Report of Investigations 7422, August, 1970, portrays a bedded copper model. They are concerned with about a one foot bed, with a gross copper grade of about 1.20 (1.195) % Cu, with about a 35 to 1 stripping ratio, with overburden ranging from 0 to 60 feet. They show 2.8 million tons of ore (with ample future tonnage assured by geological conditions) or better then one square mile of mineralized host. They model a 1000 TPD operation (260 day year) at an operating cost of $5.10 per ton. They state this includes mining, milling, smelting, incidental operating,

and depreciation allowances. This is in error. Smelting, freight, royalty, and severance amount to an additional $1.685 cents per ton, so total actual operating costs should be $6.785, say $6.80 per ton. Copper recovery losses (they model oxide copper in part) are another $2.16 so total "operating costs" are $8.96, say $9.00 per ton. Gross "operating profit" is thus $1.68 million. They suggest this figure might be improved with an oxide leach. Their direct actual mining costs calculate out to $2.06/ton milled or about .12 cents/yard, a probable reasonable figure for the soft rocks involved.

In the form of a table at 30 (old) and 40 (new) cent copper, and 15 cent lead:

# MODELS

| | Size | Grade | Gross contained Value | Operating Net Value | Tonnage/year @ 10 yr. life | Operating Net/Year @10 yr. life |
|---|---|---|---|---|---|---|
| Old (1955) ppy Cu | 10MT | .77% Cu | $ 50 million | $ 20 million | 1 million | $ 2 million |
| New (1971) ppy Cu | 50MT | .60% Cu | $250 million | $100 million | 5 million | $ 10 million |
| Miss. Valley | 17MT | | $250 million | $ 102 million | 1.7 million | $10.2 million |
| Lead | 10-20MT | 5% Pb | $150-300 million | $60-120 million | 1-2 million | $6-12 million |
| Bedded Cu | 10MT | 3% Cu | $240 million | $ 100 million | 1 million | $ 10 million |
| USBM Bedded Cu | 2.8MT (2.7) | 1.20% Cu | $26.8 million | $1.68 million | .28 million | $.168 million |

| | Approx. TPD/ 360 day year | Approx. Mill Investment | Ratio: Operating Net Value/Mill Investment | Ordered Rating of Operating Net Per Yr. |
|---|---|---|---|---|
| Old (1955) ppy Cu | 3,000 | @$2,000/ton cap $ 6,000,000 | 3.3 | 2 |
| New (1971) ppy Cu | 15,000 | @$5,000/ton cap $75,000,000 | 1.3 | 1 |
| Miss. Valley | 5,000 | @$5,000/ton cap | | |
| Lead | 3-6,000 | $25,000,000 $15 - 30,000,000 | 4.08 | 1 |
| Bedded Cu | 3,000 | @$5,000/ton cap $15,000,000 | 6.6 | 1 |
| USBM Bedded Cu | 800 | @$5,000/ton $4,000,000 | 0.42 | 3 |

Ostensibly, this crude initial approach to analysis seems to indicate that the bedded copper deposit returns the greatest total net value to the mill investment, and has the approximate gross metal value of the modern 50 million ton target ppy Cu, or the 17 MT Mississippi Valley exploration target. Interesting aspects are evident when limits of normal size are approached. A large porphyry copper would be one which mills about 45,000 TPD. On the minimum grades considered here, a three fold increase in annual operating net to about 30.0 million is obtained, and an investment of $225,000,000 may be implied. In bedded coppers, if we double the thickness of the one foot bed to two feet, and double the milling rate, to 6,000 TPD, we are in magnitudes of about $28 million annual operating net and an investment of $30 million is involved. This would still be mining ore from about .9 acre per day in a deposit contained in 2.5 square miles.

Presumably, if 5 square miles of a one foot bed of 3% Cu at a gross metal value of $240,000,000 is not a desirable initial exploration target, on the grounds that it is too thin for Asarco to mine, there is some specific thicker bed or greater gross value which is desirable. We need to have the desired minimum acceptable thicknesses and gross value defined, as this affects directly our field activity, and in turn the likelihood of finding such a deposit.

For example, there is widespread evidence of beds one foot thick at about 3% Cu, showing substantial continuity. We know areas showing 18 inch beds of about the same grade. We are aware of a few outcrops (remainder covered) showing three to four feet of 3% Cu. The tonnage potential may decrease as the thickness increases. In a similar manner, the chances for finding a deposit may decrease as the thickness increases, and we expect that exploration costs to find a deposit will increase as the thickness increases (holding grade to 3% Cu).

We think the problem of initial target size that we should consider is significant. We would like to have some general guidelines as to minimum gross value, minimum operating net, and the minimum thickness the mining department would accept, so that we can effectively explore in this sedimentary environment.

Very truly yours,

Stephen Von Fay

Stephen Von Fay

SVF/jlk

cc: JHCourtright

WLK/ An interesting observation,
and the comparison —
Jerome-Ironking to
Australian occurrences
— may be valid —
But how valid
is the assumption that
pyrite - chlorite may represent
(a part of) a halo ?
The prevailing steep
dips of Pre-€ in Arizona
— ~~decrease~~ increase the odds ~~for~~
against expl success —
JFR

FHC — do you think any justification to look for there?

FILE: Expl. TARGETS

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

W. L. K.

JAN 13 1972

January 5, 1972

cpy for Walk File

TO: W. L. Kurtz

FROM: J. D. Sell

Massive Sulfide
Exploration Technique
Jerome-Prescott Area
Yavapai County, Arizona

This is to transmit Mr. Peter Walker's file memo on the subject. Peter reviewed the literature while in Tucson and noted the similarity of features and geology of the Jerome area to other areas of Precambrian geology elsewhere in the world. His original sketch on C. A. Anderson's Bulletin 1324-C, Figure 3, paper is included for reference, although the redrafted figure clearly shows Peter's subdivisions.

As pointed out verbally by Walker, prospecting for new Jeromes and Iron Kings would be primarily along the two main horizons, but the other favorable zones could contain good mineralization. All pyritic and chloritic zones would be sampled in looking for indicative trace mineralization or halo effects. The down dip projections would then need to be drilled in looking for the massive sulfide zone.

USGS geologic maps, mainly at 1:24,000, are available for the area and would greatly facilitate an exploration program in the district.

James D. Sell

James D. Sell

JDS:lad
Enc.

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

December 10, 1971

FILE MEMORANDUM

Jerome-Prescott Area

A brief examination of literature on the massive sulfide deposits in the area, particularly the United Verde and Iron King deposits, indicates that these deposits show many features typical of the socalled "volcanic exhalutive" deposits found in many parts of the world, particularly in Precambrian rocks. In particular, these deposits show very similar features both on a regional and local scale to the large producers of this type found in Archean rocks.

The stratigraphic column in this area shows the same features of cyclic volcanism found in these other areas. In particular, they show several cycles of basaltic-rhyolitic volcanism with each successive cycle becoming more acidic as a whole ascending the column. In general, mineralization appears at the top of the rhyolitic phase immediately before the change to a more basic phase of volcanism and is usually confined to rhyolite fragmentals, but often with associated pipe-like bodies in the underlying rhyolites.

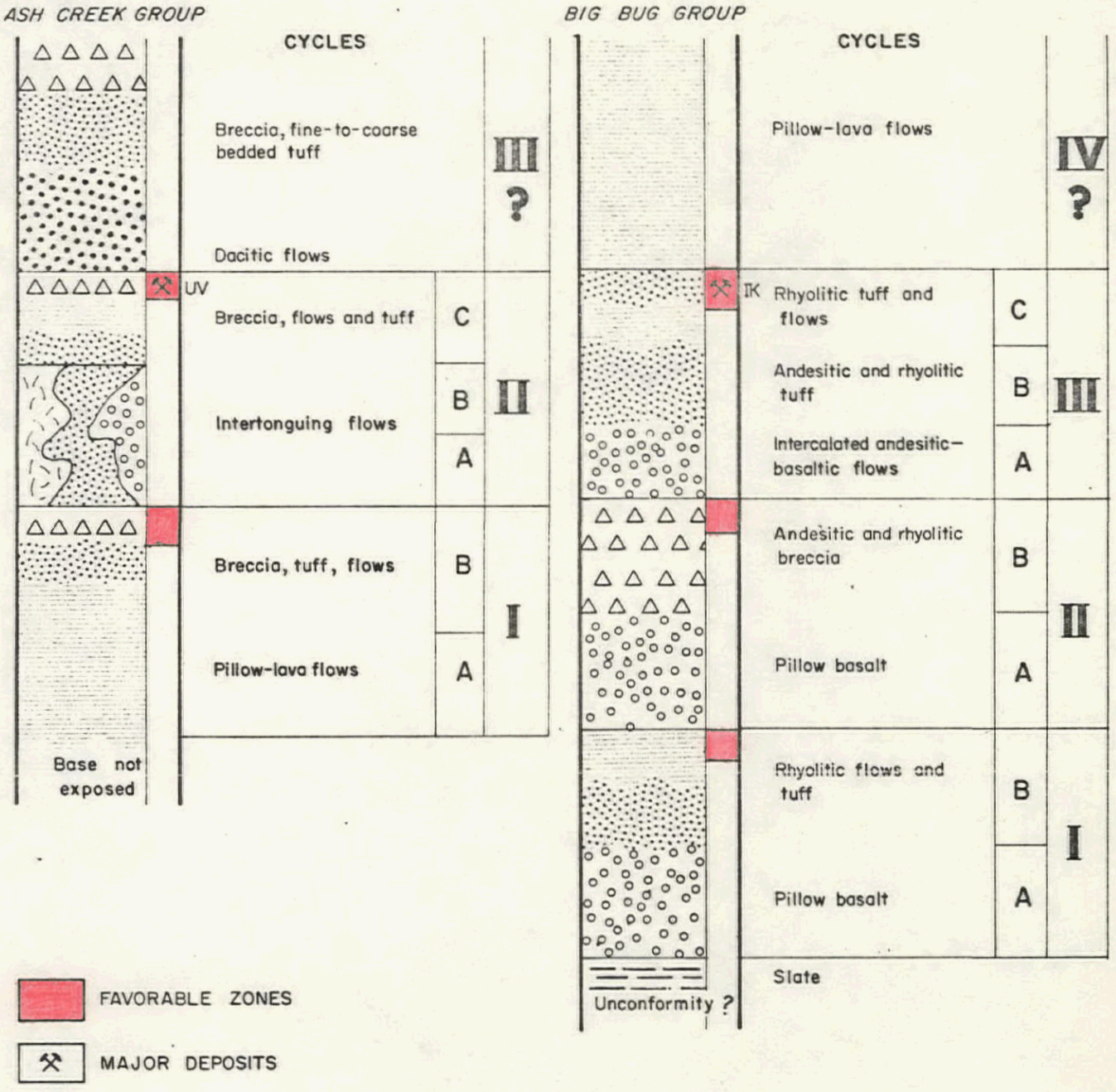
These bodies typically show a halo of chloritic alteration in the underlying rocks and around the pipe-like stockwork deposits as is shown at United Verde. At one deposit in Australia, this chloritic alteration zone showed as a prominent colour anomaly. The mineralized horizons often are highly siliceous and show marked concentrations of hematite and pyrite features well displayed apparently at the Iron King deposit.

Both the Iron King and United Verde occur near the top of the cyclic sequence at the close of the last full recognizable cycle (see attachment). Two full cycles can be recognized in the Ash Creek Group and three in the Big Bug Group. The tops of the lower sequences; e.g., the Buzzard rhyolite, the top of the Green Gulch Volcanics rhyolitic member, and of the Spud Mountain rhyolitic members, are also favourable zones for mineralization. Deposits of this type tend to form clusters near vent zones and may show very large variations in size in one area and a copper-zinc tabular ore body may overlie a pipe-like copper ore body.

P. N. Walker

PNW:lad
Attach.

cc: JDSell




(Modified from Figure 3, U.S.G.S. bulletin 1324-C, p.C7) Revision of Precambrian Stratigraphy in the Prescott-Jerome area, Yavapai County, Arizona

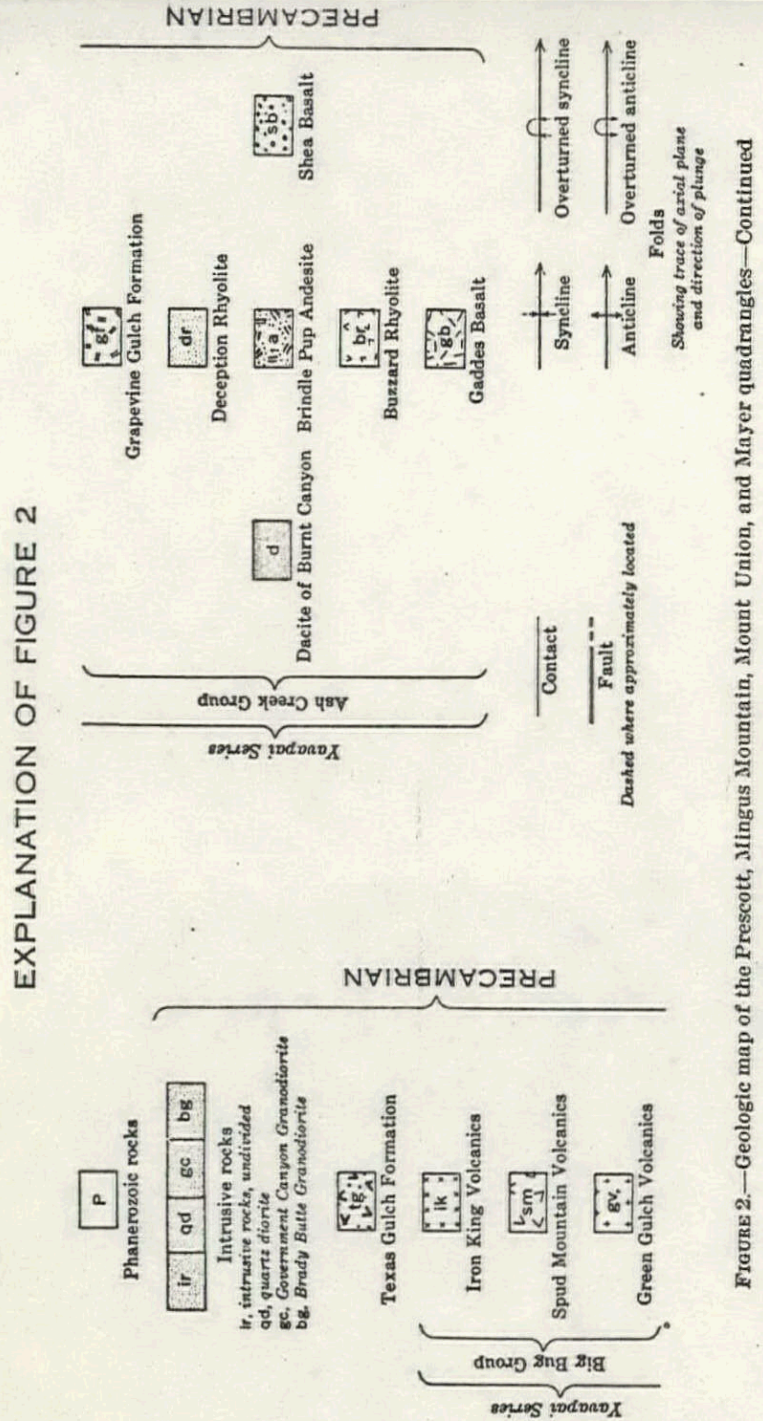



FIGURE 2.—Geologic map of the Prescott, Mingus Mountain, Mount Union, and Mayer quadrangles—Continued

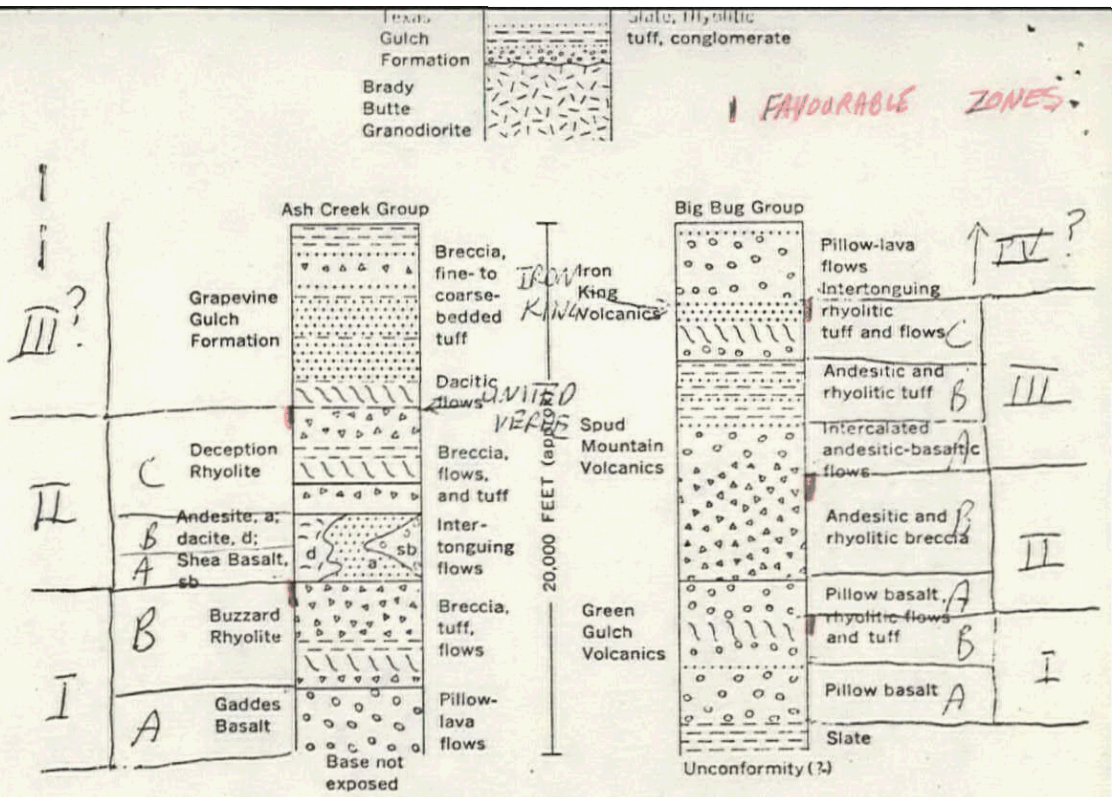



FIGURE 3.—Generalized sections of the Ash Creek and Big Bug Groups and of the Texas Gulch Formation.

## BIG BUG GROUP

The Big Bug Group is exposed more or less continuously southward from the Prescott and Mingus Mountain quadrangles into the Mount Union quadrangle and western margin of the Mayer quadrangle (fig. 2). It is also exposed east of the Shylock fault zone and south of the younger pluton of quartz diorite in the Mayer quadrangle. The Big Bug Group is here named for its exposures along Big Bug Creek, originating west of Big Bug Mesa in the Mount Union quadrangle and joining the Agua Fria River in the Mayer quadrangle (fig. 2). This type locality cuts across a complete section of the Spud Mountain Volcanics and Iron King Volcanics. In the eastern half of the Mount Union quadrangle and the western part of the Mayer quadrangle, the Big Bug Group is isoclinally folded and, in general, well foliated. East of the Shylock fault zone and northwest of the

Cal Misc

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

June 20, 1969

TO J.H. Courtright

FROM J.D. Sell

Communication and Literature Research
Exploration Technique (?)
Deeply Buried Plutons

As a follow-up on my File Memorandum of April 14, 1969, the following notes are submitted concerning the possible usefullness of age-dating techniques in determining the presence of a deeply buried pluton (or the equivalent lateral dimension in that we are discussing a three-dimensional model).

Several exchanges of letters have been made with Dr. Zell Peterman, Branch of Isotopic Geology, Denver Federal Center, who does much of the Rb-Sr age work for the Survey. Several items were brought out in the correspondence: 1)biotite is much more readily reset than hornblende, 2) a knowledgeable biotite-hornblende sampling pair program would be necessary for interpretation of data, 3)interpretation of geologic history prior to emplacement time of suspected younger intrusive is essential, 4)the higher the number of plutons or structural events involved in the area, the greater complexing of factors which will cloud the interpretive results, 5)total (whole) rock Rb-Sr ages are commonly not affected by thermal events alone, but may be highly disturbed by hydrothermal events, and 6)mineralization often highly disturbes age-dates.

Peterman also recommended two papers for further insight into this problem. Abstracts for both papers are attached.

The Hart (1964) paper is a study involving a Tertiary (54 my) pluton intruded into Precambrian (1200-1400 my) terrane. The intrusive is several miles in diameter. Hart found in sampling the Precambrian terrane outcrop outward from the intrusive

1) Rb-Sr ages of potassium feldspar is not affected beyond 50 feet.
2) K-Ar ages of hornblende is relatively unaffected beyond 100 feet.
3) K-Ar ages of potassium feldspar is less affected than K-Ar biotite ages in the first 1,000 feet.
4) Rb-Sr and K-Ar biotite ages undergo a complete transition from unaffected Precambrian ages beyond one intrusive width (10,000 feet) from the contact to strongly affected ages near the contact.

The Hanson (1967) paper involved studies on very old rocks (800-2600 my) and came up with the order of "relative stability of mineral ages in a contact zone is hornblende K-Ar muscovite Rb-Sr muscovite K-Ar biotite Rb-Sr biotite K-Ar, although for the micas the Rb-Sr and K-Ar ages are essentially concordant."

In an attempt to resolve some of the data and apply it to the age-dating available at Silver Bell, as discussed at lunch the other day, we are reminded that the K-Ar dates published for units at Silver Bell are not totally in agreement with the field information. Conflicting ages are given for the Quartz Monzonite and the age differences are resolved back to mineralization, weathering, leaching, etc., factors. A recheck of the K-Ar dates show they range from 57 to 67 with a ±2 my factor. In rather close dating of this type a small error could account for the apparent reversal of units, and by manipulation of the ±factors we can come up with a similar age dating sequence as that revealed in the geologic field studies.

| Field Relations | First Figure K-Ar dates | ± Manipulation |
|---|---|---|
| Quartz Monzonite(youngest) | Dacite 57.7 ±2.0(biotite) | |
| Mt. Lord Ignimbrite | Mt.Lord 59.7 ±1.8(feldspar) | Mt. Lord - 57.9 |
| Silver Bell formation | Alaskite 64.6 ±2.5(biotite) | Dacite - 59.7 |
| Dacite | Q.Monzonite 67.1 ±2.7(biotite)* | QM-64.4 (or 61.2) |
| | | Alaskite 67.1 |
| Alaskite (oldest) | (*lowest QM date given is 63.4 ±2.2) | |

(NOTE: All age-date figures from Mauger, R.L., 1966, PhD Dissertation, U of A, ASARCO library.)

The Quartz Monzonite is out of place in either the first figure or the ± manipulation schemes. As pointed out earlier, the large number of events within the geologic history of the area tend to complicate and cloud any interpretation of dating values.

In view of the field date, there seems little doubt that the Alaskite is indeed the oldest unit of this group, and as a consequence of the history of the area, the K-Ar date of the Alaskite may have been strongly affected by these later events.

Apparently lost in the publications of the Silver Bell district is a whole rock Rb-Sr date of 112 ±6 my for the Alaskite. This age (late Early Cretaceous) is very compatible to the known history of the area, being earlier than the Silver Bell formation activity sequence.

In resolving the two Alaskite dates in terms of the literature and field studies as discussed above, it can be strongly suggested that the whole rock Rb-Sr date of 112 my is the emplacement date of the Alaskite and the biotite K-Ar date of 65 my (late Late Cretaceous) is a reset date as an effect of the later Monzonite intrusive. The Dacite and the Mt. Lord Ignimbrite undoubtedly have also been affected and their emplacement date reset by the Monzonite episode.

As stated in the literature, the sample site for the Alaskite was some 4000 feet away from a known Monzonite outcrop (small dikes excepted). If by chance the only outcrop available was the Alaskite sample area, and the remaining area was covered by alluvium and post-ore volcanics, the Alaskite data of reset dates could be utilized in postulating the proximity of a heat and metallizing source in the district. With other observations such as the amount and type of alteration in the Alaskite, mineral belt analysis, structural continuity into the area, etc., the discrepancy in the isotopic dates would be an important addition to the overall study and programming continued exploration activity in the area.

James D. Sell

JDS:lzb
Encl.

Cal Misc.

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

April 14, 1969

FILE MEMORANDUM

TO: Mr. J.H. Courtright

FROM: Mr. J.D. Sell

Exploration technique (?)
Deeply Buried Pluton

A recent article in USGS Prof. Paper 600-A, p. A-110, entitled, "Chronology of Emplacement of Mesozoic Batholithic complexes in California and Western Nevada" perhaps adds a tool in the search for deep intrusive complexes capable of being hosts for copper-moly deposits. To quote the article:

> "A granite body emplaced into an older plutonic terrane was shown to exhibit a pronounced effect in disturbing or resetting the mineral ages in the older plutons. In fact, in the older terrane at distances from the contact equal to the dimensions of the intruding body, the K-Ar and Rb-Sr ages of biotites were reset to the age of the intruding unit. Because of the better argon retention properties of hornblende this same effect was noticeable for only half this distance."

The first part of the quote is well documented by geochronologists, and the remainder of the quote opens another dimension in the search for deeply buried ore deposits. For example, if an area of weakly altered rocks were found (perhaps like the Copperosity area, See JEKinnison memo dated April 4, 1969), and it might be suspected that deeper intrusives be present then the premise could be tested by K-Ar dating of biotites and hornblendes in the surface exposures. Outside the altered zone the age of the biotites and hornblendes should be essentially the same but within the zone the dates would be discordant depending upon the size and sub-surface depth of the younger intrusive. A younger intrusive of several thousand feet in plan emplaced several thousand feet below the present surface outcrop of the older pluton would reset the K-Ar date of the biotite (to a younger age) in the older pluton but would not effect the K-Ar date of the hornblende in the older pluton.

No further biteroture research has been made, nor talks with the U of A people, but with the precision now being made with age dating of samples it is probably that some confidence limit could be established on interpreting complex intrusive areas.

James D. Sell

JDS:lr

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

May 19, 1969

TO: Mr. J.H. Courtright

FROM: Mr. J.D. Sell

Exploration Proposal Areas

Attached are notes gathered during late 1968 in a preliminary concept of exploration areas in Arizona and adjacent New Mexico. No further research has been undertaken.

Target areas within Area 1, Papago Central, are presently under field investigation and reports on completed areas have been submitted by R.D. Karvinen and J.E. Kinnison.

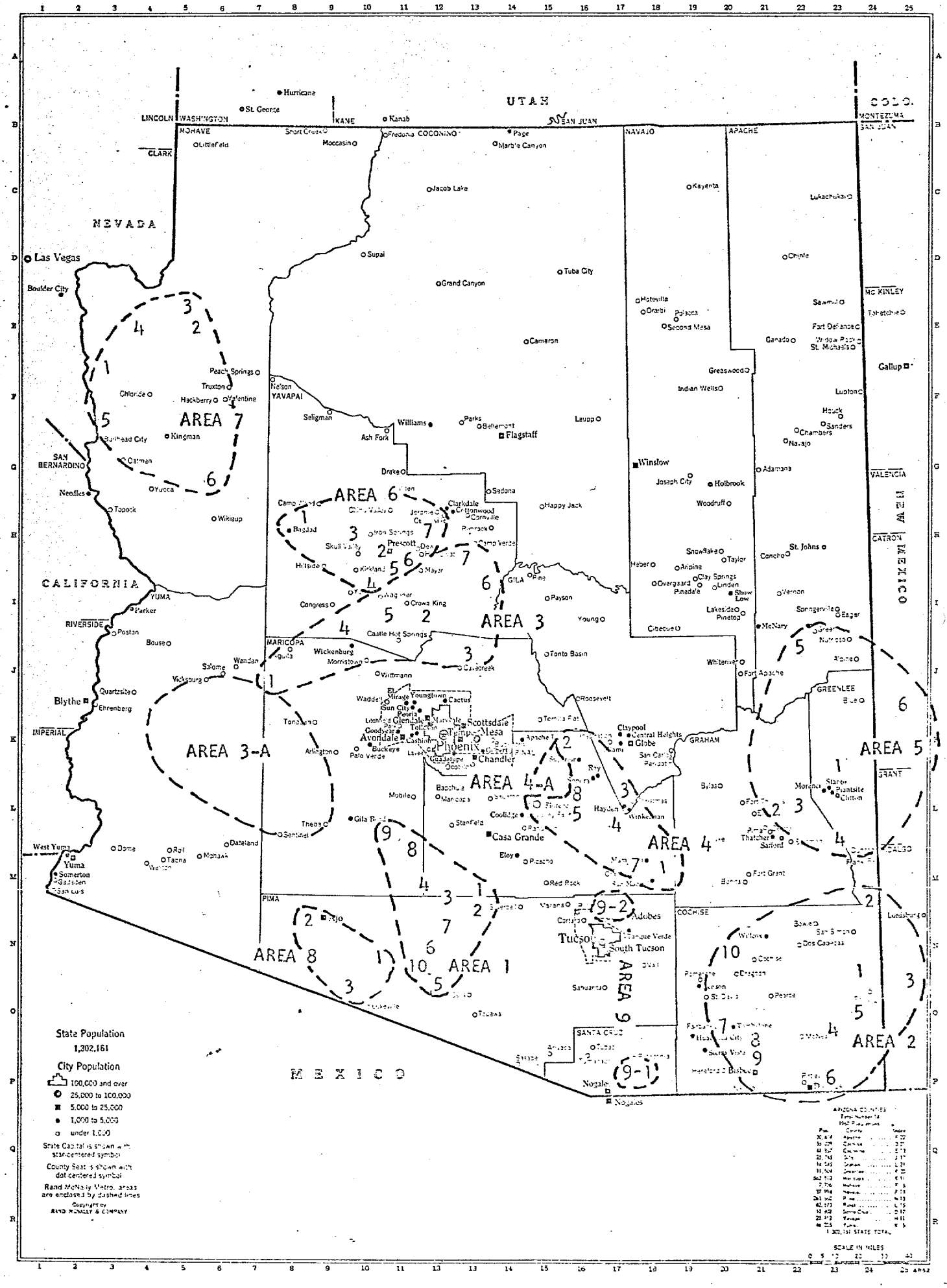
James D. Sell

JDS:ir
cc: WESaegart

# STATE COUNTY-CITY MAP

ARIZONA

SIZE 8½ x 11



## Exploration Proposal Areas

Area 1. Papago Central.

1. Southern Slate Mountains
2. Santa Rosa Mountains
3. Cimarron Mountains (Sheridan Prospect).
4. Copperosity.
5. South Ben Nevis Mtn.
6. Papago Native Copper
7. Drew Spring Manganese
8. Vekol Valley
9. Lost Horse Zone.
10. Quijotoa District

Area 2. Cochise County-Hidalgo County.

1. Nippero-Paradise-Jhus Canyon.
2. Peloncillo Mtns.
3. South Pyramid Mtns.
4. Pedregosa Mtn.
5. South Portal
6. Perilla Mtns.
7. Tombstone Hills
8. Stockton Hills
9. Bisbee Area.
10. Johnson Camp

Area 3. Wickenburg

1. NW Big Horn Mountain
2. Cordes-Cleator
3. Gold Mountain.
4. NW Wickenburg-Congress Valley
5. "Copper Mountain"
6. Francis Young Prospect
7. Squaw Peak Copper Company Area.
8. Radioactive (Thorium) deposits-Verde Fault Zone.

Subarea 3-A. Central Yuma.

1. Painted Rock
2. Gila Bend Mtns.
3. Eagle Tail Mtns.
4. Little Horn Mtns.
5. New Water Mtns.

Area 4. East Pinal

1. Clark Wash-Spring Creek
2. House Rock
3. Troy Basin
4. Smith Wash (Meyer) Prospect.
5. Pinal Parkway
6. Posten Butte
7. North San Manuel
8. Copper Butte

Subarea 4. Gila River Zone

1. Pioneer
2. Kelvin

Area 5. Graham-Greenlee

1. Northeast Morenci
2. Gila Mountains
3. Bonita Creek
4. Ash Peak
5. White Mountains
6. NW Copperas Canyon

Area 6. Prescott-Bagdad.

1. Bagdad
2. Copper Basin
3. Prescott-Bagdad
4. Black Mtn (Kirkland)
5. Porphyry flat Investigations
6. Big Bug Mesa
7. Jerome Area.

Area 7. Mohave County.

1. Black Mtn (Gold Bug).
2. Music Mountain
3. Clay Springs Wash.
4. Lost Basin
5. Katherine
6. Cane Springs

Area 8. Ajo District

1. East Gunsite
2. West Ajo
3. Organ Pipe.

Area 9. Unassigned.

1. Red Mountain. Kerr-McGee.

2. North Slope of Catalina Mountains.

1-1

Southern Slate Mountains

A study should be made in the area east and southeast of the Lakeshore property. The schist needs to be included as the sericite content might be misleading. Elsewhere the extension of the poorly mineralized tactite limestones, occurrence of pyrite in volcanic sediments of the Silver Bell type, and the southeast trending contact of the Lakeshore granite outcrop, suggest continued reconnaissance.

Silver Reef 15' Quad.
Santa Rosa Mountains 15' Quad.
Tucson AMS Sheet
Pinal County Geologic Map.
Pima County Geologic Map.

ASARCO Files 16A.19.8 House Group
ASARCO Files 16A.22.15 Lakeshore folders.
Lakeshore Copper deposits RI 4706 (1950).
Files of Bur. Ind. Affairs, Sells, Arizona on all work done by Hunting Group.
Spec. Collect of Map Library-U of A. All photos used by Hunting Group.
Recon. of the Casa Grande Mining Dist, by J.B. Tenney. (1934, C.G. Chamber of Commerce).

Others include:

USBM RI. 3975 . Exploration for lead-zinc--copper at Vekol (Reward).
ASARCO File Aa-16A.22.22 Vekol (Reward).
ASARCO File Aa-16A.10.18 Reward Mine. Newmont-New Jersey Results.

1-2

Santa Rosa Mountains

The range contains multiple intrusive types. It has a NE-trending quartz dike swarm w/minor copper reported on the northeast side. The range could be the offset portion from the Slate Mountains based on the concept of a regional fault going between the two.

Santa Rosa Mountains 15' Quad.
Tucson AMS Sheet
Pima County Geologic Map.

ASARCO Files 16A.3.3G. Copper Mountain Group.
ASARCO Files 16.17.0 Quijotoa District, general.
Files of BIA (See Southern Slate Mountains note).
Photo collection at U of A (See So. Slate Mtn note).

1-3

Cimarron Mountains (Sheridan Prospect).

On the east side, Blucher mapped part of an intrusive mass containing weak alteration features. With alluvium to the east and some late volcanic cover on the west, the edges should be carefully studied.

Gu Achi 15' Quad.
Ajo AMS Sheet
Pima County Geologic Map.

ASARCO Files As-16.19.20A. Sheridan District
Blucher's report, dated July 10, 1957, in above file.
ASARCO File Aa-16.3.H. Copper Union Mining Co. (So. of Drew Springs).
Files of BIA. (See So. Slate Mtn).
Photo Collection at U of A. (See So. Slate Mtn.)

Note: Drew Springs area is in the altered area zone, see Drew Springs reference section for items on manganese.

1-4

Copperosity (Greenback).

The property has been under study by El Paso Nat. Gas in recent years. It has also been drilled by several companies in the past but only low-grade values found. The alteration is weak and the dominant phase is silicification. During the helicopter program it was noted that an increase in color-alteration features was somewhat evident just before the exposed granite passed under volcanics on the Northwest side. Preliminary work also suggests that the volcanics are near the base of the post-mineral sequence.

Gu Achi 15' Quad.
Vekol Mtns. 15' Quad.
Ajo AMS Sheet
Pima County Geol. Map
Pinal County Geol Map
Maricopa Geol. Map.

ASARCO Files 16A.3.7B. Greenback Mining Company
ASARCO Files 16A.3.16A. Papago Mine.
ASARCO Files 16A.10.16 Pinal Grande Group.
RH Carpenters PhD thesis on Vekol Mtns (Stanford 1947)
J.B. Tenney Geol. Report of C.G. Mining Dist. (1934) in ASARCO file Aa-16A.3.0.

I-5

South Ben Nevis Mountain

A color zone was inspected during a set-down in the 1966 helicopter program. Watson reports the occurrence of a dacite porphyry similar to the unit at Silver Bell. Although no mineralization was noted and only weak alteration effects exhibited, a study of the area may turn up additional information.

Quijotoa Mountains 15' Quad.
Ajo AMS Sheet
Pima County Geological-Map.

1-6

Papago Native Copper

Three areas of native copper mineralization in laramide (?) volcanic conglomerate are known in the Central Papago Indian Reservation. The mineral occurrences are found from the North Coyote Mountains on the east, into the North Comobabi Mountains, and extending at least to the North Borwnell Mountains on the west. No outcrop area has apparently supported any mine project, but with the widespread occurrence, possibly a low-grade, large tonnage zone is present.

West East

Cocoraque Butte 15' Quadrangle (Between Roadside Mine & Bell Mountain)
San Vicente 15' Quadrangle
Comobabi 15' Quadrangle
Quijotoa Mountains 15' Quadrangle
Gu Achi 15' Quadrangle
Santa Rosa Mountains 15' Quadrangle
Tucson AMS Sheet
Ajo AMS Sheet
Pima County Geologic Map.

ASARCO file Aa-16.17.0 Quijotoa District
Chukukum Copper Prospect in file Aa-16.17.0
Noipa Kam Hills in helio file Aa-16.0.0.0(Pima Co.,General), dated December 2, 1967.
B.S. Butler & W.S. Burbank, The Copper Deposits of Michigan, USGS P.P. 144, Page 144.
L.Boyner, Geology of the South Comobabi Mountains & KoVaya Hills, University of Arizona Ph.D. Thesis (1959)

1-7

Drew Springs Manganese

In the southern part of the Cimarron Mtns. (Sheridan Prospect) area is a strong vein of high-grade manganese. Although no specific study has yet been made on the deposit, it is undoubtably a primary hypogene manganese deposit.

The limestones in the area are metamorphosed probably as a result of the nearby intrusive. Some study of the area is proposed to possibly gleam some thoughts on the possibility of a silver-area being present as suggested in Hewett's manganese barite-silver concept (USGS Circular 553).

Gu Achi 15' Quad.
Ajo AMS sheet
Pima County Geol Map.

USGS Circular 553. Silver in Veins of Hypogene Manganese. Oxide, by D.F. Hewett (1968).
D.F. Hewett, Veins of Hypogene Manganese Oxide Minerals in the SW United States. Econ. Geol., Vol. 59, No. 8, p. 1429-1472 (1964)
D.F. Hewett. Deposits of the Manganese Oxides. Econ. Geol. vol. 55, no. 1, p. 1-55 (1960).
D.F. Hewett. Deposits of the Manganese Oxides _ A Supplement. Econ. Geol, vol. 58, no. 1, p. 1-51 (1963).
L.L. Farnham. Manganese deposits of Eastern Arizona. USBMIC 7990 (1961).

1-8

Vekol Valley

The recent preliminary copy of ASARCO's hi-level aeromagnetic map shows a "low" crosslink between the proposal northeast-trending Sacaton-Lost Horse shear zone and the northwest-trending Reward-Johnson Ranch shear zone. Many of the ore districts in Southern Arizona have features which suggest strong control in these two directions. Some "line features" on the photos (Arizona Project 120 series) of Vekol Valley in the areas also show these directions.

Vekol Mountains 15' Quadrangle
Kaka 15' Quadrangle
Antelope Peak 15' Quadrangle
Estrella 15' Quadrangle
Ajo AMS Sheet
Pinal County Geologic Map
Maricopa County Geologic Map

RHCarpenter, Ph.D. Thesis--Geology of Vekol Mountains, Stanford (1947)
ASARCO file Aa-16A.3.20A. Table Top Region
ASARCO file Aa-13.19D.0. Sand Tank Region

Lost Horse Zone

This zone of interest has been covered by geophysical means, including IP, and only one small "anomaly" was found in the potential zone. The low sulfide content and shallow polarizer source placed this anomaly outside the range of interest. Question: Could this have been a perched sulfide zone with the main oxidation extending below the effective limit of the equipment at that time?

Estrella 15' Quadrangle
Ajo AMS Sheet
Maricopa County Geologic Map

ASARCO file Aa-13.19D.0 Geological Mapping, Sand Tank Region (March 1965)
ASARCO file Aa-13.19D.0 Geophysical Surveys, Sand Tank Mountains (April 1965)

1-10

Quijotoa District

A restudy of the entire alteration zone with mapping of limits and types of alteration. Geochemical sample collection.

Quijotoa 15' Quadrangle
Gu Achi 15' Quadrangle
Ajo AMS Sheet

ASARCO file Aa-16.17.0 Quijotoa District

2-1

Nipper-Paradise-Jhus Canyon

The area is along a proposed lineament from Santa Rita-Tyrone-Bisbee and is Tertiary intrusives into Cretaceous sediments. Near the Nippers is an area of Silver Bell-type andesites with pyrite and chalcopyrite. At Paradise, where Devere mapped and later Superior Oil Company drilled, variable tactite shown development is found. In Jhus Canyon, the intrusives have fresh pyrite and the tactites are spotty. The entire area has abundant alteration and mineralization features and should be totally integrated.

Vanar 15' Quadrangle
Cochise Head 15' Quadrangle
Chiricahua Peak 15' Quadrangle
Portal 15' Quadrangle
Silver City AMS Sheet
Douglas AMS Sheet
Cochise County Geologic Map

ASARCO file 3.3.14. The Nippers Group (Sec. 25, T16S, R30E) Oct.23, 1918
Nippens, Stop 5 of February 9, 1967, Helicopter Reconnaissance with report by B.J. Devere.
ASARCO File 3.3.0. Paradise Prospect (Sec. 25, T17S, R30E) Feb. 24, 1967.
ASARCO File 3.0.0. Cedar Stump (Jhus Canyon) area, (Sec. 10, T17S, R30E) November 9, 1967.
Sabins, F.F. Geol of the Cochise Head-Vanar Quadrangles, GSA Bulletin, vol 68, No. 10, p.1315-1341 (1957).
Sabins, F.F. Stratigraphic relations in Chiricahua-Dos Cabezas Mountains, AAPG Bulletin, Vol.41, No. 3, p.466-510 (1957)
Cooper, J.R. Reconnaissance Geologic map of SE Cochise County, USGS Map MF-213 (1960)
ASARCO file Aa.3.0.0. Fort Bowie Prospect (Sec. 32-33, T14S, R29E) Oct. 7, 1966
ASARCO File Aa.3.0.0. Little Emigrant Canyon (Sec.8-9, T15S, R29E) June 10, 1968
Lawhon Ranch (See Little Emigrant Canyon report)
Round Valley (See Cedar Stump Area report)

2-2

Peloncillo Mountains

This range contains numerous color altered zones and pyrite in Silver Bell-type andesite. From the few samples taken only low copper-moly values were found. More critical sampling and analytical work is suggested.

Duncan 15' Quadrangle (Arizona)
San Simon 15' Quadrangle (Arizona)
Cavador Peak 15' Quadrangle (New Mexico)
Cochise County Geological Map

E.Gillerman, Geology of the Central Peloncillo Mountains, N.M. Bureau of Mines Bulletin 57 (1958)
USGS map I-442, Geologic map of the Duncan & Cavador Peak Quadrangles, Arizona-New Mexico (1965)
USGS map I-344, Preliminary Geologic map of SW New Mexico (1961)
Stop 5 of February 12, 1967. Helicopter Reconnaissance (Vanar Quadrangle)
Stop 2 of February 13, 1967. Helicopter Reconnaissance (San Simon Quadrangle)
USGS Map MF-160, Reconnaissance Geologic map of the Southern Peloncillo Mountains, (1961)

2-3

South Pyramid Mountains (Hidalgo County, New Mexico)

Float was found in the west side drainage ~~following~~ showing altered volcanics with seams and disseminated limonite types after sulfides. A report by the N.M. Bureau of Mines shows a monzonite stock intruding pyroxene andesite volcanics. The dike pattern suggests that the stock may underlie a large area of the volcanices.

Lordsburg Special Quadrangle sheet.

RF Flege, Geology of the Lordsburg Quadrangle, N.M. Bureau of Mines Bulletin No. 62, 1959.
SGLasky, Geology and Ore Deposits of the Lordsburg Mining District, New Mexico. USGS Bulletin 885 (1938)
Mineral and Water Resources of New Mexico. NM Bureau of Mines Bulletin 87 (1965)
ASARCO File New Mexico 8.12.13. Pyramid District, Nov., 27, 1967.
USGS map I-344, Preliminary Geologic map of SW New Mexico (1961)

2-4

Pedregosa Mountains

A large area of Cretaceous sediments and Cretaceous andesite has been intruded by Tertiary dikes or plugs. Also in the Swisshelm Mountains are large expanses mapped as Tertiary sediments. Along with the exposure of Tertiary granite to the north, these outcrops are windows and edges to the large late Tertiary rhyolite ignimbrite sheet of the area. All edges and transported peeble material should be checked for clues to what might be covered beneath the rhyolite sheet.

Pedregosa Mountains 15' Quadrangle
Chiricahua Peak 15' Quadrangle
Douglas AMS Sheet
Cochise County Geologic Map.

ASARCO file Aa-3.19.0 Swisshelm District
ASARCO file Aa-3.19.12A Little Lulu Beryllium Area
USGS Map MF-213. Reconnaissance Geologic map of SE Cochise County, by J.R. Cooper (1960)
HEEnlows: Welded tuffs of the Chiricahua National Monument, GSA Bulletin volume 66, No. 10, P.1215-1246 (1955)
Fernandez, L.A., Enlows, H.E., Petrography of the Faraway Ranch formation Chiricahua National Monument, GSA Bulletin volume 77, P-795-842 (1966)
Check several USGS papers on Beryllium Belts, etc,, in Arizona

2-5

South Portal

A helicopter target showed quartz veins with pyrite in Cretaceous andesite going under alluvium to the northeast. Samples returned low copper (32 ppm)-moly (5 ppm) values. No assays for gold-silver. Westward, the Silver Stubs area indicated pervasive low silver values in a restricted area. Further work around existing exposures, and possibly other unknown window areas, on gold-silver potential.

Portal 15' Quadrangle
Douglas AMS sheet

ASARCO file Aa-3.3.19a. Silver Strike Prospect, October 18, 1967.

2-6

Perilla Mountains

Helicopter target shows weak alteration and pyrite in volcanics (Sec. 11, R28E, T24S). Area underlain by Cretaceous sediments. Nearby, the Cretaceous sediment areas are cut by Tertiary dikes & plugs which might also indicate zones of weakness for earlier intrusives.

College Peaks 15' Quadrangle
Douglas AMS sheet

2-7

Tombstone Hills

The area west of a major north-south line of faulting has been down-dropped and the present exposures show Cretaceous sediments intruded by "Uncle Sam Porphyry." It appears that the area is southwest (and only slightly offset horizontally by faulting?) of the projection of the zone of anticline-sepicline structures which was the major productive region on the east side of the fault structure. Examination and sampling in the area might reveal weak mineralized structures above the productive zone at the base of the Cretaceous sections.

Tombstone and Vicinity (Special) 1907
Tombstone 7½' Quadrangle
Tombstone 15' Quadrangle
Nogales AMS sheet

Arizona Bureau of Mines Bulletin 143. Geology of Ore Deposits of the Tombstone District (B.S. Butte)
USGS P.P. 281. General Geology of Central Cochise County (J.Gilluly)
ASARCO file Aa-3.20.0 Tombstone, February 3, 1967.

2-8

Stockton Hills

2-10

Johnson Camp

With the major amount of mineralization found in the lower Paleozoics it is conjectured to place a mineralized intrusive buried under alluvial cover to the east. Geochemical results of fractures in the area of upper Abrigo formation in the Gunnison Hills suggests the possibility of commerical mineralization in the main productive horizon of the Abrigo. Thermal metamorphic zoning, Cooper, also suggests a heat-source. To the southwest in roadcuts in lower Texas Canyon weak alteration-coloration is noted. Does this suggest additional sources areas to the southwest?

Dragoon 15' Quadrangle
Cochise 15' Quadrangle
Silver City AMS sheet
Tucson AMS sheet

GSA Bulletin, volume 68, No. 5, P.577-610. Meta & volume losses in carbonate rocks near Johnson Camp (Cooper, 1957)
Arizona Geological Society Guidebook II. Some features of the Dragoon Quadrangle (Cooper, 1959).
USGS Mf-231. Reconnaissance map of Willcox, Fisher Hills, Cochise and Dos Cabezas Quadrangles (Cooper, 1960)
USGS map GP-412. Aeromagnetic-Dragoon Quadrangle, Arizona
USGA map GP-413. Aeromagnetic map--Cochise County, Arizona

3-1

NW Big Horn Mountains

The SW extension of the Wickenburg lineament should be traced into the area of mine symbols and possibly beyond into the area of Laramide volcanics.

Wickenburg $7\frac{1}{2}'$ Quadrangle
Wickenburg SW $7\frac{1}{2}'$ Quadrangle
Vulture Mountains 15' Quadrangle
Belmont Mountains 15' Quadrangle
Big Horn Mountains 15' Quadrangle
Phoenix AMS sheet

3-2

Cordes-Cleator

The NE extension of the Wickenburg trend intersects the north-trending Bradshaw Mountains schist belt of massive sulfide deposits in this area. The area is strongly metamorphosed Yavapai Schist and the complex Bradshaw granite.

Mayer 15' Quadrangle
Mount Union 15' Quadrangle
Crown King 15' Quadrangle
Prescott AMS sheet

USGS Bulletin 782. Ore Deposits of the Jerome & Bradshaw Mountains quads., (Lindgren, 1926)
USGS Folio 126. Bradshaw Mountains (Jagger & Polache, 1905)
Open file. Preliminary Geology of SW $\frac{1}{4}$ Mayer Quadrangle (Anderson, 1967)
Preliminary Geology of SE $\frac{1}{4}$ Mount Union Quadrangle (Blacet, 1968)

3-3

Gold Mountains

The helicopter survey (1966) showed that Northeast of Cave Creek the general trend of the color zones are to the northwest and of narrow width. Toward Gold Mountain they noted a northeast color zone. Further study is suggested to verify a cross-trend intersection and possible target areas.

3-4

Northwest Wickenburg-Congress Valley

The width of the Wickenburg-Jerome lineament is unknown and may well extend northwestward under the gravel cover. The gravels should be closely checked for content and possible exposures of other conglomerate and pre-conglomerate outcrops.

3-5

Copper Mountain
ie, Copper Basin Prospect, Tiger Mining District

This area is along the Northeast Wickenburg lineament and was remembered by JEK to have been looked at. LPE visited the area and took a few samples of the sulfide mineral showing copper values ranging from 0.02-0.40 % Cu. In July-October, 1966, the area was drilled by Ford & Associates with a total of 12 holes. Total average of 9 holes within the principal zone was copper 0.137 %, Mo 0.017 % with an estimated 500,000,000 tons at the average grade as above.

Crown King 15' Quadrangle
Prescott AMS sheet
Yavapai County

NE $\frac{1}{4}$Sec. 10, NW$\frac{1}{4}$ Sec. 11, T9N, R1W
Aa-25.20.3, Copper Basin Prospect, Tiger Mining District

3-6

Francis Young Prospect

This area was checked by JEK in late 1965. It has a pervasive, mainly pyritic, altered zone in Precambrian granite and trends N70° E. It is apparently cut off on the east by a northwesterly trending fault which drops volcanic in contact with the altered zone.

As this is along a productive direction, it is believed that further investigations are warranted.

Turret Peak 30' Quadrangle T11N, R6E. NE$\frac{1}{4}$ Sec. 28?
Yavapai County Geologic Map

ASARCO file Aa-25.2E.6. Francis Young Prospect, Bloody Basin District
USGS Bulletin 1230-J. Mineral Resources of the Pime Mountain Primitive Area, Arizona (1967)
Also check NM GB13, Mogollon Rim

3-7

Squaw Peak Copper Company area

The area contains a zone of disseminated copper-moly mineralization but submarginal in grade. (Several million tons running o.25-0.30 % Cu and 0.02-0.03 Mo $S_2$). A breccia area possibly contains 100,000 tons of 2.0% Cu and 0.20 Mo $S_2$ is located within the larger zone.

Turret Peak 30' Quadrangle
Prescott AMS sheet
7 miles S of Camp Verde
(NE $\frac{1}{4}$ Sec.31, T13N, R5E) (Claims cover parts of Sec. 29, 30 and 31 of T13N, R5E)

ASARCO file Aa-25.19.19. (Note" inspected by JHC & others & though to have only limited potential)
Also check USGS Bulletin 1177. Geology & ground water in Verde Valley (1963)
Also check NM Guidebook 13--Mogollon Rim area (1962)

3-8

Radioactive (Thorium) Deposits - Verde Fault zone

JEK observes that the area along the Verde fault zone is known to contain radioactive (Thorium) occurrences. In any study of the area--including areas such as the Francis Young Prospect (3-6) and the Squaw Peak Copper (3-7) area, should include investigation of radioactive deposits.

Sub Area 3-A

Although scattered investigations have been made in Central Yuma County and adjacent areas, it is now known that intrusives and color-alteration zones of the pervasive porphyry-type do extend into the area. A helicopter survey of the known intrusives and zones should be made and extended.

1. Painted Rock ASARCO file No. Aa-13.7.16
2. Gila Bend Mountain
3. Eagle Tail Mountains
4. Little Horn Mountains
5. New Water Mountains USGS Open file map - Quartzite Quadrangle

4-1

Copper Creek (Clark Wash - Spring Creek) Helicopter Target

The Clark Wash area was noted during the helicopter work and followed up by Watson and Hoskins, The area has a number of small breccia pipes with moderate alteration and low copper-moly values. The Spring Creek area was also noted but landing was not possible at the time. The area was not followed up. The pyritic area needs to be investigated as well as follow-up on clues for postulating mineralization extending under the thick volcanic section.

Galiuro 15' Quadrangle
Pinal County Geologic Map
Graham-Greenlee Counties Geologic Map

ASARCO files Aa-16A.3.3, Clark Wash Helicopter Target (1-23-67)
ASARCO file Aa-16A.3.3, Possible Moly prospect South of Copper Creek (12-20-68)
USGS Mf-238, Reconnaissance geologic map of San Pedro and Aravaipa Valleys, south-central Arizona (1961)
Also near-by include: USGS P.P. 461, Klondyke Quadrangle; Map GQ-669, Holy Joe Peak 7½' Quadrangle

4-2

House Rock

This area, worked by Blucher, was thought to have marginal tonnage features. It should be reevaluated for possible extension of both tonhage and grade. All four or five Laramide intrusives north of Superior should be re-checked--especially in the schist and diabase areas where indications of mineralization and alteration might be subdued.

With the occurrence of the silver production at the Silver King Mine from a small exposure, all stock-work areas should be evaluated for gold-silver.

Superior 15' Quadrangle
Iron Mountain 7½' Quadrangle
Haunted Canyon 7½' Quadrangle
Picketpost Mountain 7½' Quadrangle
Superior 7½' Quadrangle
Pinal County Geologic map

ASARCO file Aa-0.0.16. Porphyry Copper Reconnaissance. Globe Superior Region (1958) by A. Blucher
USGS Map MF-253, Geologic map of the Western Part of the Superior Quad. (1962)
USGA map GQ-128. Geology of the Haunted Canyon Quadrangle (1960)

4-3

Troy Basin

The area contains some good alteration and poor surface indications of copper values in Laramide intrusives which have invaded the Apache Group and younger sediments. Values are found as tactite and dissemination development in the sediments. Close appraisal, to the north and south of the exposed sediments may lead to a near surface intrusive mass and values in both the intrusives and the sediments.

Sonora 7½' Quadrangle
Pinal County Geologic Map
Gila County Geologic Map

ASARCO file Aa-16A.0.0. Helicopter follow-up: Troy Basin (Dec. 13, 1967)
USGS Bulletin 771, Ore Deposits of the Saddle Mountains & Banner Mining District (1925)

4-4

Smith Wash (Meyer) Prospect

The area contains an alteration zone of unknown dimensions with areas of quartz-sericite and probably secondary biotite alteration. In the limited sampling conducted a few samples showed anomalous values. Also in the apparent hi-intensity secondary biotite-feldspar area some contained chalcopyrite was noted.

Winkelman 7½' Quadrangle
Pinal County Geologic Map

ASARCO file Aa-16A.0.0 Meyers Prospect Geochemistry results (Dec.2, 1964)
U of A MS Thesis. Detailed geological reconnaissance of the Central Tortilla Mountains, Pinal County, Arizona, by Roland J. Schwartz (1954)

4-5

Pinal Parkway Manganese

This geophysical target is a small outcrop of highly broken rock having abundant manganese veinlets. Precambrian granite has been intruded by Laramide granite and some Cretaceous (?) conglomerates are present. Some copper associated.

Picacho Reservoir NE, 7½' Quadrangle (Preliminary map)
96 Hills NW, 7½' Quadrangle (Preliminary map)

ASARCO file Aa-16A.0.0. Pioneer Parkway Geophysical Target by BNWatson (November 18, 1966)

4-6

Poston Butte Prospect

A restudy of the core from the project should be made and evaluated with the renewed and expanded interest in alteration and mineralization trends. Were any halo zones cut which might point to an untested area?

Florence 7½' Quadrangle
Florence SE, 7½' Quadrangle

ASARCO file Aa-16A.2.0. Blackwater Mining District
ASARCO file Aa-16A.2.0A. Poston Butte Prospect
(Numerous reports in the above files)

4-7

North San Manuel

Evaluation of the general geology and especially of the Laramide type volcanic=sediments, and the positions and significance of the flat-faults which dip valley-ward (JEK)

Oracle 15' Quadrangle
Mammoth 15' Quadrangle

See numerous references under "Mammoth" & "San Manuel" areas in Arizona Bureau of Mines Bulletin 173 (Biblio. of Geology of Arizona, 1965)

Copper Butte

The area of copper mineralization in Tertiary conglomerate should be reviewed as to mineralization, sediment transport, etc., with possible clues to source and other similar type deposits. If the deposit at Ray is not the source then the question is open as to where the source is and is it itself a potential mineable deposit.

Mineral Mountain 7½' Quadrangle
Teapot Mountain 7½' Quadrangle
Sonora 7½' Quadrangle

ASARCO file Aa-16A.2.3. Copper Butte Mine (See especial LKW Report of 12-1-49)
USGM, RI 3914, Exploration of the Copper Butte Mine (1946)

Sub Area 4-A. Gila River Zone

Several color-alteration zones on both sides of the river have been looked at, mapped over, sampled, and some drilling performed. All apparently without a commercial discovery. As all of these were known prior to the 1930's (?) is there room for reinterpretation as a guide for additional discoveries?

1. Pioneer
2. Kelvin.

Note: Areas of diabase masses should be carefully checked for values, as often, they are easily overlooked in such outcrops.

JEK memo to JHC on Bryant's work at Old Dominion-Globe.

Northeast Morenci

The elongated axis of the intrusive mass and the potential extension of a continuous structure to the northeast enhances the thought of reconnaissance geochemical stream sediment sampling etc in this direction. The often difficult task of separating pre-from post-mineral volcanic rocks and the difficult terrain may have led all to place the volcanic sequence as post-mineral cover rocks, but possibly other Safford-type windows may exist.

Morenci 30' Quad.
Clifton 15' Quad.
Big Lue Mtns 15' Quad.

ASARCO file No.
USGS, PP 43, Copper Deposits of the Clifton-Morenci District (1905).
Ariz Geol. Soc. GB 2. Tectonic Map of Clifton Quad. (p.98) (1959).

Gila Mtns.

Some windows were checked but possibly others remain in the NW part of the Gila Mountains, especially in the area of exposed Paleozoic units and where the intrusive (dikes and plugs) cut the T andesite.

Bonita Creek Drainage

Although the total area appears to be covered by Post-mineral volcanics, it si also known that what are probably basal units are exposed in the lower canyon areas. A stream sediment sampling program might lead to windows exposing pre-mineral units. Such windows are known on the southwest side, not only of the San Juan-Safford mineralized areas but also further to the northwest along the Gila Mtns. front.

Ash Peak (Veta) Silver Mine, (between Duncan and Safford)

This persistant structure trends NW and is traceable for several miles. Others may be present such as associated with the two apparent trends of T intrusives which also strike NW. More research needs to be done but it looks like all three trends intersect in an area crossed by an E-W anticline. The rock units involved are mapped as K andesite, T rhyolite, and T andesite.

White Mtns

A ring of Tertiary sediments are shown to be around the White Mountain. Sampling and inspection of these units would provide clues to what might underlie this composite pile of volcanics.

NW Copperas Canyon, New Mexico.

LPE believes NW trend to pyritic sulfatoric zones from Copperas Canyon toward alpine. (Verify this with LPE). JEK recalls some info about gold deposits near alpine. Also NE Morenci zone should cut the NW zone.

Bagdad

Special investigation of the conglomerates underlying the basalts around and north of Bagdad should be checked and geochemically analyzed for possible clues to covered Laramide intrusives.

Copper Basin

A preliminary reconnaissance indicates that the intrusive rocks (breccia pipes) were emplaced at some depth below the surface and are exposed now only thru erosion in the basin area. Many pipes are in the area and another sampling and study of the district is suggested. Gold values are apparently higher in the northern area and deserve closer reconnaissance for large-tonnage possibilities.

Prescott-Bagdad

The recent AFMAG survey through this area showed E-W trending zones. This E-W direction is a factor in both the Copper Basin and Bagdad areas and cross-cuts the regional Precambrian trend. As much of the intervening area is covered by alluvium and volcanic cover, a careful survey of the area should be made.

Black Mtn. Kirland Quadrangle

This helicopter target, which found altered quartz porphyry float two miles northeast of Walnut Grove, has not been checked.

Porphyry Flat Investigations

Originally pointed out by Beck is the incident of mineralized porphyry areas occupying small basin areas in the Prescott National forest. Some 30 basins have been outlined in the area and of these, eight have been looked at. Three contain pervasive alteration and interesting mineralization, four contain intrusives and some color and need further reconaissance, and one area was void of any intrusive material or color. As only one area (Copper Basin) was previously shown as a Laramide intrusive it should show that all basin areas should be checked for intrusive materials and possible covered alteration-mineralization.

Big Bug Mesa

A preliminary check of the mapped Tertiary sediments peaking out froj under the basalt cap has been made. Only three of the eight mapped occurrences were looked at but no real clue to suggest a mineralized porphyry under the cap was noted. It is proposed that all occurrences be investigated and samples of the sediment debris be taken for geochemical analysis.

Jerome Area

A study of the basal Paleozoic conglomerate (Tepeats SS) for indications of drainage directions and transported material. Checking for both copper (Jerome type) and gold (derived from Bradhaw Mtns?).

Black Mountain Prospect, Gold Bug District

Mt. Perkins (15') Quad. Secs. 9,10,15,16,17, T27N, R21W.
Kingman, Arizona, AMS Sheet.

ASARCO Files Aa-13A.3.2
Report by D.B. Beck, June 24, 1966. Pope Mine Area.
File Note by J.D. Sell, March 24, 1964.
Copies of 3 drill hole and assays by New Jersey Zinc, Nov'65-Jan'66.
Geochem Samples GOC-GB-1thru-54. (May 11, 1966, RMG Labs.)
Geochem Samples GOC-GB-55thru-69. (May 31, 1966) RMG Lab).

Mineral Dep. of the Cerbial Range, Black Mtn, & Grand Wash Cliffs, Mohave. County, Arizona, by F.C. Schroder. USGS Bull 397 (1909).
Geologic Reconn. of a part of western Arizona, by W.T. Lee, USGS Bull 352 (1900). Reconn. geology between Lake Mead and Davis Dam, Arizona-Nevada by C.R. Longwell. USGS PP 374-E (1963).

Music Mountain.

The area (NW$\frac{1}{4}$, T26N, R15W) is reported by Schrader (1909,p.31) to contain a granite porphyry with secondary sericite. The porphyry intrudes the Precambrian granite complex and all are cut by basic andesitic dikes.

Williams AMS sheet.

Mineral Dep. of the Cerbat Range, Block Hills, and Grand Wash Cliffs, Mohave County, Arizona, by FC Schrader. USGs Bull. 307 (1909)
Geol. Reconn of a part of Western Arizona, by W.T. Lee. USGS Bull. 352 (1908). Geology and Promising Areas for Ground-Water Develop. in the Hualopai Indian Reservation, Arizona, by F.R. Twenter. USGSWSP 1576-A (1962).

Clay Springs Wash.

This area (NE$\frac{1}{4}$, T27N, R15W) is reported by Schrader (1909, p 144) to have a considerable extent of iron ore deposits, containing some copper, in carboniferous limestone.

See references under 7-2, Music Mountain.

Lost Basin

The area is reported by Schrader (1909, p. 150) to have north trending gold veins and northwest trending copper veins. The two systems should intersect north of the camp but apparently no work was undertaken in the junction area.

See references under 7-2, Music Mountain.

Katherine (Oatman) District.

The gold ore structure mined at Katherine appears to be part of a large ring structure. Part of this area is under post-mineral volcanics. Study of the zone may give dues to other rich gold ore shoots.

Geology and Ore Dep. of the Oatman and Katherine Dist, Arizona, by C. Lausen. Ariz Bur. of Mines Bull 131 (1931).
The Oatman & Katherine districts, Arizona, by C. Lausen. IN Ore Deposits as related to structural features, p. 226-229 (1942).
Geol. of the Oatman gold dist, Arizona, by F.L. Ranseme. USGS Bull 743 (1923).

Cane Springs

A red conglomerate is conspicuous in an area of grey conglomerate. What is the cause of the red area?

East Gunsite

West Ajo

Organ Pipe

1). Red Mountain-Kerr-McGee.

In view of the thoughts set out by Devere at the Phoenix meeting in regard to Tungsten and Fluorine being potential indicator minerals in association with porphyry molybdnum mineralization, it is proposed that deochemical samples be collected over the area and the drainages and tested W & Fl. Such a study would be helpful in assessing other pyritic areas of this type.

For this purpose we should already have samples from the following areas.

Area 1, No. 9. Lost Horse zone, plus Vaiva Vo Hills

Area 2, No. 1. Nippers-Paradise-Jhus Canyon.

Area 4, No. 1. Clark Wash (Galuiro)

Area 4, No. 3. Troy Basin

Area 4, No. 4. Meyer's Prospect

Area 4, No. 6. Posten Butte

Area 6, No. 2. Copper Basin

Area 7, No. 1. Black Mountain (Gold Bug)./

Plus Mission, Silver Bell, and Sacaton units.

North Slope of Catalina Mountains

A number of gold-silver-copper in or with tactite, scheelite, and powellite areas of minor interest.

# COMMENTS ON PROSPECTING UNDER VOLCANIC ROCKS

By
Joseph G. Wargo
Sept. 3, 1964

## INTRODUCTION

The volcanic fields of the Western United States are rapidly becoming the major areas of untested ground, insofar as the search for major porphyry copper deposits is concerned. The volcanic country, along with the pediment country, represents an area where prospecting by inference will be much more common than has been the case in outcrop analysis.

For the sake of discussion, I have listed below a number of comments on prospecting under volcanics, with special reference to how, why and when.

## TIMING OF THE STUDY

It is commonly known that competitors are engaged in a survey of pediment areas. Similarly, it is known that competitors are beginning to look under post ore volcanics (eg. Inspiration, Montana Phosphates, Kerr McGee). Some of these ventures involve what can almost be considered "wildcat" prospecting, based on the most indirect evidence. The point to be made is that it seems to be the time to get started on a comprehensive program of our own which is oriented toward discovery of ore under volcanics.

## ORGANIZATION OF THE STUDY

Several different approaches to the method of organizing the study of how to prospect under volcanics are available. I believe the idea has been considered that the Coordinating Unit should assume major responsibility for the work, because of the universal nature of the problem. It occurs to me that while the facilities and good advice of the Coordinating Unit are certainly to be considered and used, the type of information to be compiled can commonly be found among the personnel of the districts. Further, the purpose of the study is two fold: first to find targets now, second to understand the environment in which the targets occur. The first purpose has traditionally been the responsibility of the districts, and the second has commonly been the outgrowth of the first. The SWD pediment study parallels this concept.

Some of the organizational approaches are:

1. Task Force method--Selection of personnel and adoption of a budget to carry out the study. Each district might do this independently of others, with a nominal amount of liason.

2. Czar method--One man assumes responsibility and authority to reach into all phases of the study, using personnel as needed. This method is probably not too practical for this kind of study.

3. Inter-District Committee--One or two individuals from various Bear Creek districts and Units would meet, first in a planning capacity, later to evaluate execution of plans. Individuals should operate within a specified time and budget allotment. Geologists involved in district work which concerns volcanics might also have a specified portion of their time and budget to contribute to the effort.

Other approaches are no doubt possible.

TOPICAL ITEMS AND QUESTIONS

The following is a list (incomplete) of subjects which might be considered in a study of prospecting under volcanic rocks:

1. Distribution of post-ore volcanics, and relationship of these fields to known ore deposits.

2. Structural features and ore deposits around the edges of volcanic fields.

3. Reflected structures in post-ore volcanics, as indicated by geomorphic features.

4. Attitude of volcanic rocks and relation of folded and tilted volcanics to ore deposits and mega-structures.

5. Stratigraphy of volcanic rocks
   a. Areas of thinnest cover
   b. Provenance of volcanic rocks
   c. Correlation of units at group, formation and member level

6. Relationships between Upper Tertiary volcanics and Upper Tertiary consolidated gravels.

7. Establishment of petrographic provinces and relationship to ore deposits.

8. Alteration in volcanic rocks
   a. Autometamorphism
   b. Hot springs
   c. Significance of pyrite

9. Detection and significance of lateral petrographic and textural changes in volcanic units.

10. Petrographic and textural parameters of volcanic rocks at group, formation and member level.
    a. Use of chemical analyses, norms and element ratios
    b. Heavy metal profiles
    c. Phenocryst analysis
    c. Breccia fragment analysis

11. Geomorphic history of exposed porphyry copper deposits.

12. Age of volcanic units, as developed from physical-chemical, palynological and paleontological methods.

13. Response of IP methods in multi-layer volcanic environments.

14. Removal of "noise" from aeromagnetic surveys of volcanic regions.

15. General survey of geophysical methods applicable to prospecting in volcanics.

16. Strategy of "wildcat" drilling in favorable volcanic areas.

17. Methods of rapid, inexpensive drilling in volcanics.

Joseph G. Wargo
Sept. 3, 1964

Memo

Apple Valley, California
Feb. 10, 1964

To: T. N. Walthier
Fr: W. L. Kurtz

Subject: Recommendation for Molybdenum Exploration in Nev-Cal

In reviewing Woodcock's literature on Molybdenum deposits one fact, to me, stands out that can be used as a prime exploration tool for molybdenum exploration. This is simply that all deposits presently being mined and all those being actively explored are molybdenum occurrences that have been known for many years.

Therefore, inour present state of knowledge the most logical method, and also the method most likely to reap a molybdenum orebody fro Bear Creek Mining Company, is simply to evaluate(in many cases re-evaluate) all known molybdenum occurrences. I readily admit that this type of an exploration program does not contain any elements of the "new" but do think that it is the only method, at present, that will give us any chance of finding molybdenum targets.

I agree that not all occurrences are reported in the literature and it would be a coup to locate a virgin occurrence for Bear Creek Mining Company. We hope that our General Reconnaissance Programs (Color Anomalies, Property Examinations, Area Studies, Stream Geochemistry) will locate these virgin occurrences.

Thus I think it beneficial at this time to start a program of thoroughly examining onthe ground inthe field all reported poly occurrences. The field work could have to be a good geological evaluation plus imaginative thinking(like how many of the presently active drilling programs are in areas looked over previously by numerous geologists). Really I think that in the molybdenum exploration field the main potential still lies inthe outcrop area and that previous competitor activity does not, as inmany copper prospects, detract from active exploration on our part. I also think that "new type" molybdenum deposits are to be found.

I do feel confident that our field evaluation will be better than inthe past because of the information Woodcock has given us on the producers and potential producers. I tell you inthe past we have not made field examination of areas described inthe literature as being "one or two quartz veins with flakes of molybdenite" or "molybdenite is also reported to occur inthe contact zone". Occurrences of this nature may be the only clue to a larger mineralized zone overlooked by previous workers either because it was too barrely mineralized or not even recognized as being mineralized.

Last year Roy Robinson suggested, inmemo, that we start to study thoroughly some of the larger contact(skarn) zones inwhich molybdenite has been reported. Object of the study was to determine the grade of molybdenite mineralization, how and where it occurs in the contact zone, and whether large tonnages are available. I think a study of this type is warranted; I do not believe anyone in Bear Creek has done any field work onthis type of occurrence.

I feel rather strongly that we ought to accomplish a study of molybdenum occurrences this year. I think we are behind our competitors in examining molybdenum occurrences but I do think that we are as good or better in evaluating them. Thus their prior work is not a deterrent.

cc. H. Robinson

COPY

see also Hill 648 — KURTZ reduced photo to cover these districts

KRAL 1951 MIN. RESOURCES OF NYE COUNTY NEVADA

C

1. MOREY DIST.

COUCH - through 1948 $475,117 from 6,467 T
value principly silver in narrow veins in qtz latite.

GEOLOGY. Porphyritic qtz latite. Sediments 1/4 mile to south
also Lead Pipe property is NW of Morey
and Pb ore in bedding planes of ls/sh. width
usually 1-2 feet.

2. SILVERTON DIST

Reportedly silver ore is found in Penn ls introduced by
rhyolite dikes and sills.

3. TROY (Irwin Canyon, Terrell) DIST
also Sharp Area in vicinity of Adaven.

Aug '69 — Bonham rpts that IMC exploring MOREY

Gabbro in Wild Horse Canyon Fox Range
cpy, pyrrhotite Sleeper

Hi Line Group

~~Sec. 12 T14N, R23E south of Churchill Canyon. Said to Pb-Ag at surface over 800' wide~~

Hunter Co Prospect

no grade
didn't see any
alteration

~~East slope Trinity Range. 10 miles north Lovelock in Trinity Canyon. Alt QM, rhy & aplite dikes. Few small slips w/Cu doesn't seem pervasively altered.~~

Southern End Jackson Mtns about nine straight miles NW of Jungo. SE of Red Butte Dist

Alt schist, small occ. next to fresh schist. Alt float in drainage suggest larger source area. Rhy flow rx covers.

# GOLD-SILVER DISTRICTS IN PAC. SEDS EXCLUSIVE OF E. NEV.

SILVER, Pb, Zn

| Dist | County | |
|---|---|---|
| Sand Springs, | Churchill | Veins in schist, ls, andesite. |
| Lone mtn | Esmeralda | Repl Sulfides ∈ ls |
| Klondike | " | " " ∈ seds |
| Montezuma | " | Veins, repl, in ∈ $CO_3$ |
| Lida | " | " " " ∈ |
| Hornsilver | " | " " seds near Gt |
| | Eureka | |
| Mineral Hill | " | Replacement Sulfides in Dev ls. adj to Thrust fault |
| Union | | Repl in Dev ls |
| Lone mtn | " | Probably irreg repl adj to faults in $CO_3$ |
| Mount Hope | | Repl Sulfides in Permian Cl ls roof pendants |
| | Humboldt | |
| Paradise Valley | | fissure veins in calcareous slate |
| Winnemucca | | Veins along shear zones in Upper TR siltstone, shale, slate horizons & SS. |
| Gold Run | | veins in ls, qtzt, shale, schist |

| | | |
|---|---|---|
| ~~Nye~~ Jefferson Canyon | Nye | Veins with silver along xfault. Trap Rhy with Є-Ord. schist veins in rhy yielding gold. |
| Silver Star | Mineral | Vs in TR vol-sed ss & intrt vols |
| Candelaria | " | |
| Twin River | Nye | Veins in slate |
| Lodi | new Gasbe | Veins in TR lsi limy shale cut xfault gold |
| Union | Esmeralda | |
| Belmont | | |
| Manhattan | | |
| Tybo | | |
| San Antone | | |
| Reveille | | |

Holiday Inn
1659 West Temple
SLC

Geophys - geol.

Check literature on Sarpaulc eastern Nevada

Old aeromag anomalies eastern Nevada.

Carson City - Topaz Tr - Jr sed/vol Salt
and north Mi[illegible] Plumas County

I.P.
Rhodes Color Anomaly
No Name Prospect (Sante Fe)
East side Manhattan (gravity?)
Klondyke

Contact Nevada Petroleum Divide District

What about Silurian in Eastern Nevada or hard rock

S.P. Maps

33N 30E Scossa ; shear zone with 25 (Noble-Tapper line

26N R32E Tule Iron - pyrite some magnetite
any gold??

30N 32E Kqd - highly sericitized in part,
cut by qtz v. containing gold, lead,
antimony, and a little copper

See 24 T30N R36E Oxq

T36N 45-46E iron stain sheared zone
23, 24, 25, 24 Tin.
geochem survey by S.P. R-25-1A, 2A, 3A
R-26 - 4A-7A
R-23 - 8A - 11 A

South AUSTIN Area Lander Co, Nevada.

The rock in Birch Creek and north is a porphyritic granite to granodiorite with the eastern margin being mostly granite in composition. The rock is much better jointed than the normal granite in Nevada. In many places quartz veins occupy some of the joint surfaces. The topography is extremely rugged making access difficult and climbing worthy of a mountain goal.

In the area around sec T R

The granite contains quartz veins in fair abundance and specks of molybdenite and chalcopyrite were observed in a few of the larger (one foot) ones. Trace amounts of pyrite are present along some of the joint surfaces. In one places the rock for about a three foot width was completely altered to quartz and sericite destroying the original texture of the rock. This greenish rock is extremely light colored and contains less than 5% biotite. Except in local 10 to 20 foot square areas the quartz veins do not form a stockwork. A number of prospects are located in the metamorphosed lime and shale rocks adjacent to the granite. Copper oxides (malachite, azurite) are present

None of the storm zones are extensive. The TY metamorphosed sediments are quite extensive.

In sec T R a 525 foot tunnel was briefly examined. The adit starts in a conglomerate which apparently lies beneath the TY. Several prominent faults dipping moderately SE occur within this conglomerate. The tunnel the cuts a quartz vein and then into granite which is altered to clay, sericite and quartz and contains quartz veinlets. (This vein is not exposed at the surface). Between claims are controlled by a Mr. Cahill of Austin Nevada and his millsite a mile to the east is called Crown Point. The interesting feature of this tunnel is the fact that the veinlets and alteration are not recognized at the surface, as occurring in the granite. Perhaps this zone might be more extensive ~~that~~ than recognized at the surface. Two dump samples were collected to be assayed for Mo, Au, Ag. If there shown any values of interest work would be warranted in this immediate area.

The granite ~~north~~ west of the low cinder in the Four tunnel symbols on map is a good granite with occasional 3-1 quartz veins that carry some tetrahedrite. Also granite characteristically carries a few small gtz veins

and often has sericite formed along the joint surfaces. One gets the impression that somewhere within this intrusive there might be a good quartz-molybdenite stockwork.

(New Map
Birch Creek, Big Creek, Kingston)

Hill (1915) Some Mining Districts in NE Cal and (NW) Nev
USGS Bull 594

Toiyabe Range, South of Reese River District, including the Washington and Kingston Districts, Lander County, Nevada.

At the north of Birch Creek the eastern border of the "granite" mass is nearly white and has a coarse porphyritic texture.... This rock is cut by quartz veins some of which carry metallic minerals, and the surface of this whole hill is more or less iron stained.

Dikes — ① granular quartz diorite to quartz-olivine gabbro mostly less than 20' wide and containing pyrite.
② Rhyolite? altered dikes heavily impregnated with pyrite mostly confined to area between Big Creek and Tour Creek
→ to sericite, quartz and calcite

Character of Deposits —
Pyrite common but not abundant
Principal constituents of value galena, usually containing antimony; tetrahedrite Ag bearing, Fe bearing sphalerite, locally cpy.
Stibnite in Big Creek
"At one place on contact of Range veins in gold carry Mn, cpy, sphal

Veins as open space filling (few with -2' some 4'
Lodes as networks of veins, usually in crushed shales (25-2,2')

Big Smoky & Cu to NE have character — common with skarn metal.

MINES — ~~DEER POINT GROUP~~ —
DEER POINT GROUP — ridge south of Birch Creek and west of Smoky Valley mine at elevations of 7300-7900. Country rock coarse porphyry. Veins N65E vert; N20W west at low angle. Along jts 1B.M. galena, sphal. Gold near min, jts contain disc py. At one place zone 20' cut by network of small vert jts and is deeply Fe st & sericitized

About 4½ miles NNW of Spencers ranch and a mile east of the stage road there are some Mo prospects in grd. Principal vein N50W 30S; exposure 50'; few inches to 18" frozen to walls; also small quantity of cpy.

3 to 4½ mile NW Spencers, number of prospects on small, irregular qtz vein carrying py, tetrahedrite, gal, sphal — most places frozen to walls

Bull Dog Creek group — divide between Tom Creek and north fork of Big Creek. metasiltstone; two set qtz veins N85E 75-80S; N15W steep east. 150' drift, "Apparently only small amt ore available in this vein". Ag, Pb, Au — possibly low grade area?

Bowman Group — north side of Clear Creek Canyon. The first large creek in the mountain south of Kingston.
Black slate intercalated with ls and light qtzite. Crumpled into schistose rocks along zone of crushing that strikes N to N25E and cut by trap basic dikes.
N55E tunnel 350'; multitude of small irregular qtz stringers running in all directions. Last 250' particularly abdt — whole mass seems to run Aug Ag? Best gold/T (now $).

---

Other Ref: Big Creek - Vanderburg I.C. 7043
Birch Creek - Gianella - New Common Min
Vanderburg I.C. 7043
Kingston Vanderburg I.C. 7043

EUREKA COUNTY

Schilling Mlo (1962)

Mineral Hill Mng Dist

Bx zone in Pal. ls. Bx trend N is 1/4 mile long and several Hundred feet wide. Three highly alt dikes striking east cut the ls in the vicinity of the ore deposits (Sissler 1898 p. 154-167

PROJECTS FOR WINTER 1968-69

BALLARAT

HANNAPAH

RECON - LIDA-SILVER PK - TONOPAH

RECON - BELMONT - BARCALONA (moly)

MANHATTAN - obtain old data - property

CHECK OF TURQUOISE SHOWS NORTH OF TEMPO

CHECK CACT REVIEW OF TOLEDO DATA

Remaining Monte Cristo Range

Map No 7 254
19 1.00

UGS Quadrangle 14:16 [illegible]

pp 173 Stockton; Fairfield Quads.

1. Check for I.P work Santa Fe

2. White Hill Copper ?

3. Bataan Copper Prospect

4. P.D.

5. Marietta area P.D. I.P.

Lake Shore Property
Sunset District

Goldfield.

Mathewlode

AMERICAN SMELTING & REFINING CO.
BOX 7637
RENO, NEVADA 89502

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504 Custom Use

USGS Bull 1089-A, B, C

GQ - 350 Big Maria NE

GQ 529

GP - 561

MF - 226 Hawes
222 Alpin Butte
MF - 214 Mohave
MF - 227 Stanwood
MF - 229 Victorville
MF - 232 Apple Valley
MF - 233 Barstow
MF - 251 Pendleton Butte
MF - 256 Blanco Mtn

I - 426 Lucerne Valley
I - 427 Ord Mtn
I - 430 Rodman Mtn
I - 431 San Gorgonio

Circular 523

PP - 408 Cave Creek

LEFAX, PHILADELPHIA 7, PA., MADE IN U.S.A.

Don Whitbread - Comstock
in charge

or contact: Hank Cornwall
John Abbey

TUCSON FILES

March 1960

TR. MK. REG. U.S. PAT OFF.

Kenyon Richard. Edna Dist.
18 miles S Warm Spring East side Kawich
stringers — peter out short depths

45 M S of Elko Co. Mining at
entering. (Sap claim?)

Ferguson (Delmar) — sample outcrop no good
for low grade gold &c

1917 — 28 k mi S Austin in Victorine Canyon
country Rx very altered greenstone
overlain by ch/ls.

King District, Dunnelly Prop (copy of file in S.L.C.)
low grade Au, near surface. My samples
pretty low

Mercur Rpt Misc File
3.5 mill tons of tails 0.005 Au & .045% thallium
(9.27)

ORIGINAL PAGE, 1960 BY J. G.
LEFAX PHILADELPHIA 7, PA. MADE IN U.S.A.

Gasquet quad Cal-Nev
USGS Bull 995-C

Weaverville quad MF-275

Medford quad GQ-89

Stanford PhD
Seyfert 1964
Geol of Sawyers Bar area

TR. MK. REG. U.S. PAT. OFF.

SCHRADER USGS Bull 497
JARBIDGE, CONTACT, ELKO MTN, ELKO CO.

JARBIDGE — Schrader's description on all of gold's gold Mg veins. Map shows Pal to west and cross sect shows Pal & Gd beneath Rhyolite cover. However no outcrops of Gd shown on map.

CONTACT —
Siliceous dikes (alaskite?) usually 1-4' Set at Salt Lake gravel near Contact They are 200' and on Camp Bird Claim 2 miles east of the River

Near Clark Cabin on Trout Creek the granodiorite is intruded by numerous dikes and small stock

Mineral deposits localized by contact Gd-Is and by dikes in Gd

IVY WILSON CLAIMS: T45N R65E sec 33 | sec 34
sec 4 T44N R65E | sec 3

ORIGINAL COPR. 1910 BY J. G. PARKER
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"so called sulphide zone" which is about 400' wide and extends thru' western tier of claims for about 6,000 feet. It lies about 1200' west of the contact

Contact type ls. Principal ore mineral cpy with some associated moly and bornite. Usually set in more or less widely diss set with some degree of conc. in certain bands.

15' foot shaft on N end. Dallas #3 show about 6' of solid massive green-gray mineralized ls. in a single bed which dips steeply in or stands vertical and thoroughly diss w/ cpy

50' tunnel Dallas #4 About 200 yds north of This 50' tunnel a bed qbt 1-3' contains diss moly. The rocks on either side contain diss cpy/bornite.

I have most of the maps [illegible] wikerts

Cal Div Mines V. 31, 1935

# Gold Siskiyou County

- Big Cliff - T40N, R10W 3 mi SE Findlay's Camp

Sawyers Bar Quad

2,000' tunnel; small amt high grade milled
whole mass siliceous schist said to carry low values
12 unpatented claims

- Hickey & Keaton - possible open pit. Rpt on file at Redding Office

Sawyers Bar Quad

T39N R11W; 8-9 miles SE Sawyers Bar
Hickey 3800' x 40-85'; Keaton 1600' x 40-120'

- Paradise Group

Ukonom Lake Quad
mine not shown

Sec 18 T15N, R7E 10 mi SW of Happy Camp
Bodies of mineralized schist with qtz vein - copper-iron
1934 was to be drilled & sampled for gold

- Queen of Sheba

recheck loc.

Sec 10 T40N R9W
600' wide metamorphic zone between gbd and serpentine.
Contact zone garnet, pyrite, free gold.
Tested with trenches. No rpt of grade.

- Soda Mint Mine

recheck loc.

Sec 29 T39N, R3W
Castle Crags dirt road up Soda Creek, Then rough road up
Little Soda Creek, from which prop. mile up mountain trail.
1100' tunnels. attempt dev. low grade gold. Said 200' wide. Decomposed
pyritic granite. Also tiny seams, vugs qtz.

I [illegible] Wright

Cal Div Mines V. 31, 1935

GOLD

## SISKIYOU COUNTY

- **BIG CLIFF** – T40N, R10W 3 mi SE Findlay's Camp

Sawyers Bar Quad

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whole mass siliceous schist said to carry low values
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T39N R11W; 8-9 miles SE Sawyers Bar
Hickey 3800' x 40-85'; Keaton 1600' x 40-120'

- **PARADISE GROUP**

Ukonom Lake Quad
mine not shown

Sec 18 T15N, R7E 10 mi SW of Happy Camp
Bodies of mineralized schist with qtz vein - copper-iron
1934 was to be drilled & sampled for gold

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recheck loc.

Sec 10 T40N R9W
600' wide metamorphic zone between gold and serpentine
Contact zone garnet, pyrite, free gold.
Tested with trenches. No rpt of grade.

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recheck loc.

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1100' tunnels. attempt dev. low grade gold. Said 200' wide. Decomposed pyritic granite. Also tiny seams, vugs qtz.

I have most of the maps [illegible] Cline. [illegible]

Cal Div Mines V. 31, 1935

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1100' tunnels. attempt dev. low grade gold. Said 200' wide. Decomposed
[illegible] Also tiny [illegible]

CAL DIV MINES Vol 34 #4 OCT 1938

INYO COUNTY

Gold; Cardinal Gold Mining Company — 17 mi SW Bishop; elevation 8,500.
middle fork of Bishop Creek.
zone of fracturing in central portion of qtzt body which is
800' wide partially enclosed by qtz & mnz. Fract N55°W 70NE.
Works determined by assay; cave width varies 8'
Fine free gold; auriferous py; pyrrhotite, arsenopy, cpy, sphal
Ore 10-12; 4,000 development work from 600' shaft.

Cobalt-Au, Ag
Sec 14 T 9S R 31E; 11-12,000' elevation; on ridge east of Longlake.
apparent dike-qtz content; 3,000' Au-Ag values for 30-100'
in to dolomite. Weathering ore outcrop (?) 500' wide.
values from 103 oz Au to 1503 Au & ~~144~~ 144 oz Ag.

Gold. Arando Mine; Sterman Mag Dist; 12 mi N Trona T23S R43E
Vein in porphyry intrusion 6,000 by 40' 4-8

Gold Spur (Lestro Mine) ridge betw. Coyote & Goler Canyons
So Park Mag Dist, 16 mi SE Ballarat
2 vein systems in gneiss plus andesite dike. Samples different
veins 8-20 Au/T

Gold Del Norte Emigrant Saddle (see the notes)

USGS Bull 308 Ball

LONE MTN AREA

General Thomas Mine — galena, py, cpy in ls/shale adj to dikes.

Nearby a tunnel driven 150' into diorite mass 1 mile NW of Gen. Thomas Mine. Some galena, azurite, malachite lining appear to fill cavities in diorite.

Montezuma District — mineralized area dies to west of Montezuma Peak in Cambrian rocks — copper, lead in ls Quartz veins; near dikes

① Strong qtz veins occur in ls heavily stained by limonite and hematite 5 miles north of west of Montezuma Pk

② Quartz veins also occur in the limestone 6 miles north of Montezuma Peak

③ Thin sheets of malachite replace limestone along joints planes 3 miles north of Montezuma Pk

USBM I.C. 6995 HUMBOLDT COUNTY

Donnelly District – west slope of Donnelly Peak in Black Rock Range 47 miles by road a little east of north from Gerlach.
Ore as lenses in narrow veins in grd intruded into shale and qtzt. Max width vein 2½ feet.
Anything in shale?

Golconda Dist –
2 mi south of Golconda; 2,000' workings – gold in qtzt. (oxidized)

Gold Run (Adelaide) – Under Expl by Superior Oil

Leonard Creek (Varyville Dist) – placer ground – Lord Thinks might be of interest. Lawal chalk.
check surrounding area source of gold.

Paradise Dist – described as veins in slate cut by rhyolite dikes. Ave width veins 4'.
Might be worth a chal to determine if any dispersion into wall rocks.

Potosi Dist – Getchell.
Recent claim activity by Homestake
sec 6 T 37N R42E; sec 12 T 37N R41E

Red Butte – see file from Tucson; float observed by Newman & Evans indicating cc/limonite in schists.

Sherman Dist  west side of Bloody Run Range, 28 miles by road northwest of Winnemucca. Two qtz veins that contain some MoS2 & scheelite in granite

east side of range 23 miles north of Winnemucca Slate cut by diorite dikes; vein system strikes NS dip 65° west. width of vein material 4 to 12'. Gold.

Sulphur Dist — silver occurs at southend of the sulphur deposits a short distance from a place called Devil's Corral, a natural amphitheater of colorful rocks. Cerargyrite is a cemented conglomerate. No ore found at depth greater than 20 feet.

WINNEMUCCA BASE

1. Check of Mo qtz veins around Leonard Creek
2. Source of Placer Gold in Leonard Creek
3. Paradise District — never checked by Asarco
   Qtz veins in slate cut by rhyolite dikes.

4. Jackson Mtns.
   (1) Gen Recon Copper possibilities
   (2) Old Evans rpt of limpee in schist — locate source

5. Kennedy Dist (East Range)
6. Check of west side of Range opposite Kennedy Dist

USBM I.C. 6902 Pershing County

Kennedy District — east side granite mtn in the East Range 57 miles south of Winnemucca
Mineralized area 5 miles long 1½ miles wide.

---

Unknown — color anomaly on west side of East Range T28N, R37E the projection of granite mountain into the alluvium
Area noted while working across valley in the Unionville area.

Nothing of Interest

---

Jersey District — virtually no description: qtzt + porphyry; ore argentiferous galena with lead carbonate.
~~Limestone in~~

Seven Troughs — check for any dispersion of values.

Humboldt District

Rochester

Rye Patch (Echo) — 2 miles south of Eldorado Canyon - Gold Standard min zone traced on surface 950'; crosscuts show zone 50-250' wide. Au and a little Ag in series of ls/sh that have been bx and silicified.
Stated (before work completed) — 600,000 T / $2.40 (April 1936)
3,000' of workings made in exploration

Sierra Dist - already on list of areas to check
Homestake has drilled in district.
Both placer and bedrock seem intriguing.

Trinity Dist - already on list to be checked
Company files show some alt QM

Velvet Dist - near Eagle Pitcher
altered rhyolite; gold occurs in free state in
clay mineralized joints and crevices. Very little
vein quartz was observed on the dumps.

Washiki Dist - goes into Homestake Co (Clear Creek Dist)
recent claim activity by Homestake.
small veins in granite.

see also Motherlode file

Possible Areas To Check

Nenzel Hill, Rochester, Pershing County.
Tunnel now all way through Hill.
The lower unit rhyolite altered; small thin veinlets might have dispersed values.
Note: Send letter to Mr. Osborn, [illegible]

Hannapah Dist., Nye County

Finish Reviolle, Kawich areas

~~Trinity Canyon, Leveloch~~

Rentler etc placer+lode

Osceola District (placer+bedrock)

Pine Grove Dist Lyon

Zaca - Leviathan (some one staking out leave at Zaca; will have long term 20yr lease from Cressbro; BCMI staked claim in District)

Gold Circle

Motherlode

Siskiyou County Gold

Tempiute Area - Moly-Tungsten in lacustrine. Silver

Gold Bath Examination of
Lake shore Mine.

Wells Three Sunset District

Ballarat

Gold in Shale near Lee Ranch <u>Not Good</u>

* I.P. WORK MINOR (check land status)

Bateman Co, Mineral Co, Nevada (replac. in b cod'xed)

Lincoln County – Bernice & Posey Mag Claims
Pahranagat Mag Dist, Prop located at Hiko, Knob Hill,
Nelson, No good description,

~~Zeca Mine, Alpine County, alluvial gold~~

1743 E Adelaide
Apt 8 Tucson

PERSHING SIERRA DISTRICT

DUN GLEN CANYON 4½ miles ave 200' width

old shaft 18-40' bedrock; 5-6' above bedrk ½-3 (at 20.67)

large flow water at bedrock

BARBIC CANYON - 2 miles ave width 300'; ave depth to bdrk 30'

Best values on bedrock and benches along sides of canyon

Ave value reported 28¢ including low grade surface mat.

Also gold reported in: Auburn, Wright, Rock Hill, & Spaulding Canyons

LYON - Check the Pine Grove Dist Lode

PERSHING LIMERICK CANYON & BASIN

WHITE PINE OSCEOLA DISTRICT (placer and lode)

Selected Notes From Ball USGS Bulletin 308

page 63 <u>Other Mineralized Areas</u>

Qtz veinlets are abdt in the Eagle Pass shale and are locally present in the limestone.

① Strong qtz veins in ls, heavily iron st, 5 mi N of W of Montezuma Pk

② Qtz V. 6 miles N of Montezuma Pk

③ Thin sheets of molybdenite replace ls along jt planes 3 mi N of Montezuma Pk

page 64 <u>Lida</u>

Bulletin 285 Ball Selected Notes

4 hours
1200

Emmons 1910 USGS 408 Review of Some Mining Dist in Elko, Lander, Eureka Cos

Gold Circle (Midas) area of 3 sq. miles hydrothermally altered (silicified) in rhyolite with some older andesite. Ore is within fault zones, shears and most of which 8' thick with some zones 25' wide, partially ox 100-152'. No mention of Au/Ag ratio.

1/2 in +2
10.
10.

# BULLFROG (RHYOLITE, PIONEER) DISTRICT

Reason: Hydrothermal has effected the wall rock very little
Gangue Qtz, calcite

Gold Bar lode N55-65E 65 NW
irreg fissures, silicated rhy filling 100' wide
no mentions of grade except low

Homestake-King Mine -

100' N of shaft N45E for 150' Then due north for.
The Homestake King Mine contains very purplish opal
40' in width.

Mayflower N50W 60-65SW - like a zone of
shearing and shattering 4-5' in width
claim widths of 40'

Coal

Pioneer - Coal seams same as Mayflower - attempt
to find large tonnage of low grade coal
shaft and 3 miles of adits
diamond drilling in 1949

Sunset Cop 3 miles W of Rhyolite two shafts 120'; 100'
gave them rhy and penetrated Qtz.
One reported small circle in flatty trend altitude
between the rhy-Qtz and small Qtz

Dec 6, 1960

Contact metamorphic zones
Head of IXL canyon Stillwater

Hawaiian Claim 10 miles NW Hawthorne in Gillis mtn.

metals. gossan (by ~~cop~~ $CO_2$) oxidation

50' deep - 100 x 150' x 4,000

Preston 1945

Pershing County

⟺ Cunningham Prospect

7-8 mile long prospect Co. 65 NW Lovelock

no answer to Preston last letter

suggesting look. July 18, 1947

Sunday group

⟺ 38 miles SE Winnemucca

Supposed altered andesite, limonite capping

never inspected. Rust Dec. 1956

White Pine County

Kansas Copper prop (45% ok. no answer to

letter June 19, 1956 asking for location etc.

Eureka Co. Ahnex

Cortez Metals Company

long range investigation. Is right along dike and / large shear — Pb-Zn-Au, Ag, Cu sulfides, oxides, carbonates.

Suggested study of workings & surface outcrops, if deal could be made with Cortez Company, — owner? Baker Nov 1967

Lincoln.

Bernice & Fossey Mining Claims, Pahranagat Mining District.

Prop located at Hiko, Kane Hill, Nelson

~~not~~ no assay or geol. description.

Sounds promising.

Mineral Co.

Bataan Copper prospect.

prop. submitted by Skylin Oil Co. Salt Lake

replacement in ls. 600' x 600'

option sent March 19, 1956

Champion Anderson Group, Santa Fe Mining Dist.

Churchill County

Medals group Claims, Task with Mining Dist
vein in porph., diorite mineralized Cu & Wi, val.
also mineralized

Douglas Co.

Brodie - Aurora Area
mineralized belt extends northerly to Stillwater, &
Pine Mtn Ranges. L. Brecken Jan 1949

Elko

Alladin Mine, 28 SW Elko. Railroad Min Dist.
complex structure, ls intruded by granodiorite & qtz porph,
contact meta copper, Ag, Pb, Zn with supposedly
some Copper disc. in porph.; Breckenridge 1951 letter
to owners saying no interest. (Report typed
above work)

Cleveland & Delano Mines (Hin)
rec. for work Aug 1956 P. Olson.

<HHH> Sylvania Mine 30 mi SW of Elko, Railroad
Mining District. Intr. qtz porph following granodiorite,
contact copper in skarns, lead away from contact
in ls. (See Alladin above) claims turned down
but Smythe July 1953 says should be
checked for porphyry alteration.

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[illegible] DESCRIPTS
TYPE [illegible]

| | | |
|---|---|---|
| MOL | FM | |
| ORD | PALMETTO | S. Nev. Pk. Quad. Turner 1902; [illegible] |
| PERM | DIABLO | MT. DIABLO mile W Candelaria for dolomite pavers a mile north Columbus, Mina Quad |
| Litwiler | Candelaria | Muller, Ferguson 1939 pp. 1581-86 2 miles SE Candelaria |
| Mt. Wassuk | Excelsior | Muller, Ferguson 1939 1586-92 E. part Excelsior Mtn. |

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CAL DIV MINES ; KERN COUNTY RPT 1
MINES & MINERALS OF KERN COUNTY, 1962

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ORIGINAL COPR. 1910 BY J. C. PARKER

LEFAX, PHILADELPHIA 7, PA. MADE IN U.S.A.

page 243 MoS (1) minor constituent of granite between Hoffman & Hubbard Canyons near Cinco (Murdoch & Webb 1956, Cal Div Mines Bull 173 452p, Minerals of Calif

CAL DIV MINES BULL 160

CAL DIV MINES BULL 171

Gems & Minerals Magazine, Mojave Desert published May 1958 — Treasure Map of the Great Mojave Desert

Friedman 2100

be exercised not to confuse the abundant malachite with the much less abundant torbernite. The latter is always in thin scales and is of a much lighter color. Malachite, being a carbonate, can always be identified positively by applying a drop of acid. For a time these claims were worked for the copper values but because of the remote location, lack of water and other inhibiting circumstances there has never been any profitable copper production. Currently the mine is producing uranium ore. It is not a real pleasure jaunt to the property because of the relative inaccessibility but if prepared for a hard trip with the prospects of good specimen material it can be undertaken providing the road conditions are not too bad.

In the vicinity of Flagstaff, which nestles at the foot of the San Francisco Peaks, are some collecting areas of interest. As an out-of-doors class room for the study of geology which is the result of volcanic activity the San Francisco Volcanic Field (U.S. Geological Survey Professional Paper 76) is a most interesting area. The principal rock masses are flows of lava of several different periods of volcanic activity separated by periods of quiescence. Three separate periods of activity can be recognized in the field. The distinctive feature of the first period is the wide outpouring of basalt from numerous small cones. During the second period a variety of lavas, ranging in composition from the basic andesite to acidic rhyolite, were erupted to form a few of the larger cones. In the final period many more cones were formed by a simpler type of basalt.

Red Mountain and Sunset Peak, features of the third and last period of volcanic activity, are the only places of interest to the mineral collector. Red Mountain is an excellent example of a dissected cone (Journal of Geology, Vol. 14, pp 138-146). The internal structure is clearly discernible through the gash caused by heavy erosion on the northeast slope. The interior is composed of volcanic tuff for the most part, fairly well solidified. In the tuff the collector may find volcanic bombs, clear phenocrysts of plagioclase feldspar, hornblende and olivine. The phenocrysts are either embedded in the tuff or washed free and lying in the soil resulting from the breaking down of the tuff. Selected fragments of the feldspar yield brilliant faceted stones though they may have a slight yellow tinge, which does not detract from the brilliance.

A visit to Sunset Crater National Monument will provide a novel experience, in fact a series of experiences. There's the Crater itself; an impressive mound of brilliantly colored cinders. Its ice caves offer something different in the way of thrills as well as specimens of white thenardite in silky tufts. Though sal amoniac has been reported from this area it has not been confirmed. Patient searching, supplemented by keen eyesight, may be rewarded by small crystals of native sulphur in the cinders on the flanks of the cone. Except for size these are as beautiful as any other sulphur crystals.

It is unusual to find a brown rather ordinary looking stone which will develop a lustrous black on being polished. Such is the "black onyx" from a small abandoned quarry east of Flagstaff near Winona. In the rough it is anything but attractive but polished it shows a beautiful velvety jet black. Of course it is soft so not at all suitable for jewelry. Book-ends, lamp bases, desk sets and similar objects may be fashioned from the larger blocks. Very little of this travertine is mottled or even faintly banded. Large fracture free blocks are rare.

Those who are familiar with the phenomena accompanying glaciation might get a thrill out of a short trip to Arizona's single glacier field. It was only a very small glacier in the extensive interior valley of the northeast slope of San Francisco Mountain, described in Journal of Geology, Vol. 13, pp 276-279. Its length did not exceed two miles while the maximum width was only about half a mile. The minimum thickness has been calculated at two hundred feet. The proof of the for[illegible] moraines [illegible] conspicuous out-wash plain.

In the wilderness at the extreme western end of the Plateau Province, in the



No File Possible Prospects ARIZ

northwest corner of the state, there is a little explored area accessible only from Utah and Nevada. For a long time this has been known as the Arizona Strip. Here, on the first terrace above the Grand Wash along the towering front of the Grand Wash Cliffs are two old copper mines which are no longer operating. Just after the turn of the century there was a modest production of copper which was maintained for a period of several years. The most extensively explored mine is known as the Grand Gulch mine. Because of the peculiar shape of the ore body it is something of a geological curiosity. "The ore bodies occur around the sides of a vertical pluglike mass of rock, which is sedimentary but is entirely different from the stratified rocks which enclose it." The ore minerals are azurite, malachite, brochantite, chalcocite and some chrysocolla. None of these occur in outstanding specimen quality. The item of greatest interest is cotunnite in minute veinlets in some of the chalcocite. So far no other minerals of interest have been discovered in the "Strip".

Availing themselves of the long water highway from Hoover Dam along Lake Mead and into the numerous side canyons which have been flooded by the rising waters of this great reservoir prospectors are getting back into a land that has had almost no exploration. Boats may be tied up on the shore of the lake and treks inland made on foot or mule back. There have been a few finds of lead and copper minerals but too little is known of them as yet to make possible any estimate of their importance. "The Strip" is the last frontier and invites exploration.

Fossil bearing strata occur on the opposite side of the Colorado River but not accessible from "The Strip". The approach is by a road leaving Highway 66 about two miles west of Peach Springs. This road, which leads to Meriwittica, is followed for about seven miles to a little used road running north past Miklweed Tanks, thence into and down Hindu Canyon for about eight miles. From Peach Springs to the end of the passable road (1937) is twenty-two miles. Originally the road left Hindu Canyon and climbed to the north to the rim of the Grand Canyon. It ended at a natural gap in the Redwall limestone at the head of Bridge Canyon. In all probability this last piece of road from Hindu Canyon to the rim cannot be negotiated by any kind of a vehicle. It was impassable in 1937 due to large washouts. The hike to the end of the original road is not long; just enough to prepare for what is beyond.

Through the gap, down the long vista, one sees the towering cliffs on the opposite side of the Colorado, framed in the V-shaped opening of Bridge Canyon. A switch-back trail of many short lengths and steep descents leads to the floor of Bridge Canyon. A good spring on the right just before reaching the canyon bed is a fine resting place. This is the last source of good drinking water until the river is reached. Incidentally, it requires some courage to drink the water from the river as it is dipped up.

About two miles below the spring the trail to Gneiss Canyon takes off to the northwest on the left side. The right hand trail continues another mile to the river. The Gneiss Canyon trail climbs sharply to the Tonto Platform over which it winds on the Tapeats sandstone following the contour generally to its terminus on a broad flat beside Gneiss Canyon. It is along this trail that the fossils occur. The hike from Hindu Canyon, through the Redwall limestone gap, over the trail to Gneiss Canyon and back can be made in a day but two full days makes a very much better schedule. The foot trip cannot be crowded into a day and allow any time for observing the fossil beds. Hualpai Indian guides, saddle and pack horses can be had through the proper agencies at Peach Springs.

The remains of an extinct giant sloth, — bones, hair and dung, hidden in a cave, are not of especial interest to mineral collectors, though caves are if they contain minerals. About one hundred miles upstream from Hoover Dam, eight miles from Pierce Ferry, there is a cave in the steep face of a cliff, many feet above the high-water mark. This is Rampart Cave. It holds the remains of an extinct giant sloth. The cave is mentioned only because its discovery points to the possible

KIRPATRICK Memorandum Jan 31, 1966

Gold Lake Dist, Gunnison Co Colo

small Au-Ag-Pb-Zn Prod gt-sch. No diss mat'

Summitville Mine Rio Grande Co Colo

Au-Cu veins, might make small underground. (info in file)

Crystal Hill, Saguache Co Colo

Two miles W La Garita Colo.

Bx vol flows

John Hum attempted dev't. (RKK thinks Hum would have made a go if mid heads had been [illegible]

PROPOSED GEOLOGIC WORK

NEVADA

Rapid check makes this area look promising summer 1987

REGION OF CONTACT DIST, ELKO CO, NEVADA

Particularly 3 areas:

① NW-SE trending contact of Grd/ls lying to the southwest of town of Contact. Here have described a contact meta zone up to 1200' wide. Certain portions being described as "sulfide zone". Apparently there is more diss cpy, bn, moly here than elsewhere in the metamorphic aureole surrounding the batholith.

② Zone of dikes (NE-SW) that extend from ① to town of Contact. Some described as being up to 200' wide with diss cpy, moly. Fissure veins mined past production

③ EW contact located NE of Contact townsite. Here described contact meta zone up to 1/2 mile wide plus two stocks of QM intrusive into the regional Grd. (This might be under exploration by Utah Cpm.

USGS Bulletin 847-A The Contact Mining District Nevada F.C. Schrader 1935

South slope Ellen D. mtn betw Ag Circle & Bonanza mines, a distance of about 2½ miles on is is a zone 100-200 feet wide along the contact in especially broken

Most extensive area of xtal mtn is so called "east contact zone" about 6 miles SW of Contact. Is 400-600 feet wide along gold xtal contact adjt limestone and related minerals and is intricately intruded by dikes and sheets of granodiorite and aplite

One of masses of mtn line of especial interest extends from Brooklyn mine Two Ag Circle to Rattler, a distance of about 1 mile. Actinolite dominant mineral. Ore bodies closely spaced except for a gap of about 1,000 feet between Brooklyn & Ag Circle.

Grd - fresh, prominent sphene and epidote
Actinolite - dikes up to 200' wide vary 5'. Enriched near ore bodies.

① Most of the bodies of contact mtn economic interest are 15-30' thick, but commonly only contain bands within the bodies contain much appo

II West Contact Zone (Early Rpt Ivy Wilson Group)

Ivy Wilson Group Schrader 1912 USGS Bulletin 497

Ivy Wilson No 9 claim: Tunnel 200 feet first 200' in Grd

Interesting feature "so called sulfide zone 400' wide 6,000' long. It lies about 1200' west of contact follows strike of rocks which dip steeply. This is contact meta type zone. Principal ore mineral is chalcopyrite usually assoc. with some mly and bornite. It is more or less widely disseminated throughout the rock but with some degree ~~cot~~ of conc. in certain bands or areas described:

① 15' "sulfide" shaft shows 6' massive min. 15 through diss w/cpy (on Walker #3 claim

② 50' crosscut tunnel Walker No 4; at 25' soft 1 foot band mineralized with CaCO3 & cpy. Also other hard parts contain cpy

③ About 200 yds N of 50' crosscut tunnel bed shale gray 1-3' thick more or less gametiferous contains diss MoS2 The rocks on either side contain diss cpy/bn.

END NOTE Bulletin 497

Schwabe 842-VA

② Fissure veins – cut across Grd/b – ∥ 1st grd stat.
usually 1-10' wide. Bx, altered wall ~~rock~~ rock
Quartz mass gauge minerals

③ Fissure ∥ to diabase dikes; locally ore minerals are
disseminated widely through fractured and altered dike rock.
Principal hypogene minerals quartz, cpy, $MoS_2$, specularite.

Oxidation 150-250' below surface. Ground water usually
reached before this depth.

## MINES & PROSPECTS

I. North Contact Zone

Helen B Tunnel portal NE2 km for 1,205' in Grd
at start mineralized 20'. The final contacts are
low silicates, dark slate and has a section of
300' contain 1% Cu as chalcopyrite. Face
of tunnel at old ~~Ore~~ vein.

Prob. area tube drilled by Utah
Hilty Pennsylvania Stanford

Bullet 497

Middle Stack; Trout Creek

Grd usually lot in places shows pronounced sheeting and at a point about 2 mi SE Middle Stack mtn and also few miles NE of this point on the contact near Clark Cabin it is intruded by alaskite-qm stocks accompanied by radial Dikes.

Mineralized zone (along contact) has maximum width of about 1/2 mile.

Clark Group - isolated hill or ridge several hundred feet high; contact zone compound (150 + feet wide) contains dikes and on SE slope stock of Qm.

Bulletin ~~847-A~~ 497

Yellow Girl Claim — (patented)

Poole dike opened by 200' shaft it rapidly widens from 60' level downward and on the 200' level crosscut for 38' with no wall yet reached it is stated to carry ~~[illegible]~~ 6' of 12% Cu and about 32' low-grade ore. No production reported

---

Bull 847-A Red Metal Mine stated to be porphyry dike 90' wide running about 2½% copper. It has 800' development work with encouraging results.

---

Bull 497

CHINA MTN AREA

Chinamin 22' wide in contact zone

Mail Eagle 500' from contact; lode 8' wide

Two-Sheckles 900' from contact width?

Turo 12' wide (near Two Sheckles)

High Ore — NE dike-vein 9" wide ore 1-2" of gangue — 1% grade

Camp Bird — dike up to 200' in width (multiple type) 40' shaft

ridged; stringers & diss. Not stated whether wide dike mean.

Blanchard Mtn Area

Zetta Blanchard Group (Christiansen) contact intra zone maximum 25'

Johnson Group same

Helm B:

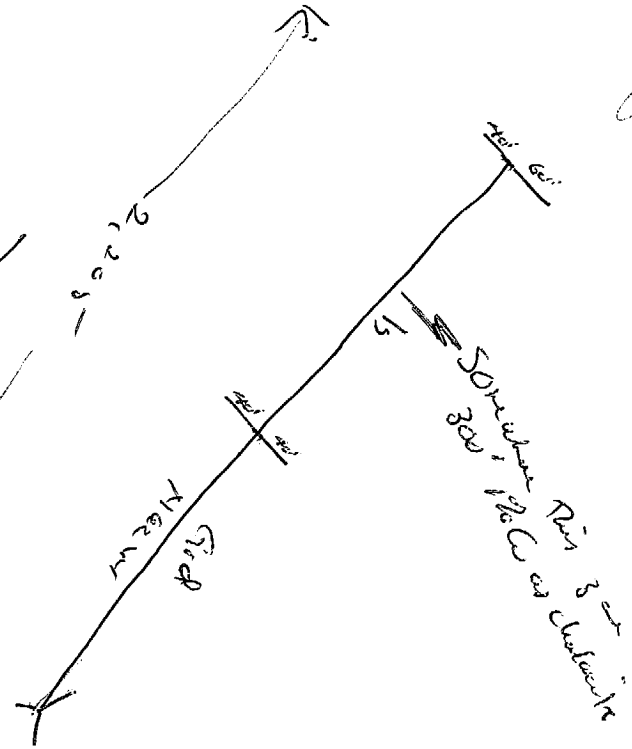
W.P.

329-2302

30' road =

16
5
90

24
3 cimi X
720
.06
43.20



O = base

| | | | |
|---|---|---|---|
| INYO | R 8, 10, 12, 15a, 17, 20c, 22d (34d) | 1938 | 1951 (V47#1) |
| MONO | R 8, 10, 12, 15a, 17, 18i, 23d, 36b | | |
| Alpine | 8 10 12 15a 17, 18h, 27d | | |
| El Dorado | 8 10 11 15c 17, 22d, 34c | | (V52#4) |
| Placer | 8 10 11 15c 17, 23c. (32c) | | |
| Nevada | 8 10 11 16a 17, 20d, 26b, (37c) | | |
| Sierra | 8, 10 11 16c 17, 20d, 25b, 38a | | |
| Plumas | 8 10 11 16b 17 24d, 33b | | |
| Lassen | 8 9 10 11 15b 17 25a 32d | | |
| Modoc | 8 10 15b 17, 25a 32d | | |
| AMADOR | 6b, 8, 10, 11, 14a 17, 23b | | |
| CALAVERAS | 6b 8 10 11 14a 17 21b 32c | | |
| TUOLUMNE | 6b 8 10 11 14a ~~14d~~ 17 ~~25~~ 24a | | |
| MARIPOSA | 8 10 14d 17 24b | | V53#2 |
| MADERA | 14d 17 24d | | |
| FRESNO | 6b 8 10 11 14d 17 25c | | |

INYO
MONO
Alpine
El Dorado
Placer
Nevada
Sierra
Plumas
Lassen
MODOC

AMADOR
CALAVERAS
TUOLUMNE
MARIPOSA
MADERA
FRESNO

PP -36 8 - Darwin
PP - 408 Corro Gordo

Oberlin Quad map GQ-95

Oberlin mineral dep Cuyahoga Spain Rept 42

Hall Spain Rept Permanente Butte Quad

Spain Rept 51 Dorris Quad

Moore & Hopson The Independence Dike Swarm

Am Jour Sci v. 259 p. 241–259 1961

| | | | | |
|---|---|---|---|---|
| 2N | 1E | 6, 7, 25, 31 | Goldman mine | |
| T | R | Sec | | typo |
| 6N, | 4W | Sec 2, 3 | Oro Grande Dist | Victorville |
| 6N, | 4W | 17 | Elmbridge | |
| 7N | 8E | | Stedman Dist | |
| 11N | 3E | 1, 2 | Alvord | |
| 15N | 14E | 27, 28, 33, 34 | morning star | 8 mi N Cima |
| 14N | R18E | 18, 19 | Oro Belle | |

# California

| Mine | | Topo Sheet |
|---|---|---|
| Sheehan - Kramer Hill | | Hawes |
| Oro Grande District | Sec 3 6N 4W (SB) Sec 2 King Int | Victorville |
| Oro Belle | 18, 19 T14N R18E S.B | Crescent Peak |
| Stedman District | | Ludlow |
| Dale District | | Dale Lake ✓ |
| Eclipse Reef | 14, 15 T7N R15E S.B | Danby |
| Emboley | 17 T6N R4W S.B | Victorville |
| Colosseum | 10, 14 17N, 13E S.B | Rodman Lake |
| Sky Blue No 3 (Big Pour) | 19 T14N R1E | Goldstone Lake — Bonding ? |
| Santa Fe | | Lucerne Valley |
| Alvord | 12 T11N R3E | Alvord Mtn ✓ |
| American Mining | 19 T4N R1E S.B. | Lead Mtn |

Goldstone Mine Sec 4, 7, 25, 3, T2N R1E SB — Lucerne Valley, Sa Gorgonio

McCoy Sec 35 T14N R1E — Goldstone Lake, Lane Mountain

Morning Star Sec 27, 28, 33, 34 T15N R14E — Ivanpah

Desert King Sec 16 T10N R1W — Nebo 7½ (or Daggett ½)

Silverado Copper — Isabella

REPORTS

Gamble Tin Sec 26 & 28 T36N R45E
Sec 2 T35N R45E
LIZZENHOOD TIN DIST.
by Adair
22 miles NNW Bettenson just
north old Lizzenhood Ranch.

Aurora Mine Dist - Roby Hillman Area
Adair
Jasperoid in Thrust Fault
(5) different thrusts.
Deposit maybe localized
by thrusts.
Look at

ORIGINAL COPR. 1910 BY J. C. PARKER

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Hg, Ag Nevada

Mill City (possibly called New Central Dist)
Humboldt, Pershing Co, Nev.

altered shales, crumpled shales with
Hg, Ag.

Birch Creek Dist, Lander County
(Hill USGS 594)

① Deer Point Group - ridge south of Birch Creek and west of Smoky Valley mine at elevation 7300-7900
Country rock purple grd. Joints N65E vert; N20W west at low angle. Along joints qtz, py, galena, sphalerite.
Grd near min, jts contain disp py. At one place zone 20' cut by network of small vert joints and is deeply Fe stained and sericitized

Hewitt 1959 examined Cahill-McGinnis Prospect 2 mi south Highway 50 and mile N Birch Creek - skarn zone; small patch alt qtz; several qtz veins w/ Mo, cpy. "Not of interest."

?

② 4½ miles NNW of Spencers Ranch, mile west of stage road - Mo prospects in grd; 50' incline on N50W 30S vein few inches to 15" thick also little cpy

③ 3 to 4½ miles NW Spencers number of small prospects on small irregular qtz veins carrying tetrahedrite, galena, sphalerite frozen to walls of grd

④ Bill Dogtack Group - divide between Tar Creek and North fork of Big Creek. meta shale;

LEFAX, PHILADELPHIA, 7 PA. MADE IN U.S.A.

two sets of veins N85E, 75SE S; N15W steep E
150' drift; "apparently small amt of ore
available in these veins" Ag, Pb, Au.
Size of area?

Bagdad — ① QMP aligns N60-70E - S60-70W and there is little PM cover in these directions

② A dike and system follow #1 direction and also N25W - S25E. Could exist in the N25W direction.

RKK recon. Greene Ranch (starts 15mi N of Bagdad). Stream check major drainages no alt frag.

Problem is probably a straight wildcat - graphite type. BE contact

Gila might be checked.

Areas of Interest

Bisbee — ① extension of Dividend fault may provide locus of another intrusive center

② Margins of Juniper Flat stock may provide locus for other intrusives

③ ??? If fault to Dividend formerly greater structure to preserve the Paleozoic sequence.

1-C - ~~Geochemistry~~ Exploration Targets

RECEIVED
MAR 27 1978
EXPLORATION DEPARTMENT

New York, March 16, 1978

MEMORANDUM FOR: Messrs. J. C. Balla
D. P. Cadwell
J. V. Desvaux
J. H. G. Fuchter
R. E. Gale
A. Giesecke
R. S. Gray
F. T. Graybeal
J. Manrique
J. J. Merz
L. Montoya
D. M. Smith
R. B. Sprague
H. C. Williamson

Permissive Environments
and Unexpected Elements

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T. C. Osborne

Attachments

cc: WLKurtz
SVonFay

Southwestern Exploration Division

January 11, 1978

RECEIVED

FEB 16 1978

EXPLORATION DEPT.

FEB 16 1978

TO: JDS, GWP, GJS, HGK, BJD, SRD, NPW, PGV

FROM: F. T. Graybeal

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Several examples of close encounters of the second kind may emphasize this point. The Cantung Mine in the Yukon Territory was originally drilled (10-12 holes) as a hypogene chalcopyrite target in skarn. The property was subsequently dropped because assays generally fell below 0.4% Cu. It was recognized shortly thereafter by the MacKenzie syndicate that scheelite occurred abundantly in the core, although it was virtually invisible, and the property ultimately became the highest grade tungsten mine in the world. The Telfer Gold Mine, recently brought to production in northwestern Australia by Newmont, was found by a prospector who collected several samples of the bedded gossan in limestone. The samples were taken to at least one mining company where they were assayed for Cu, Pb, Zn, and Ni. No anomalous values were found so the prospector eventually came to Newmont who included Au in their assay -- and the rest is history. A note was recently circulated on the Phosphoria Formation, a chemical sediment, which locally contains in excess of 1 oz. Ag, apparently syngenetic.

These and other examples demonstrate that you should be thorough when you have your geochemical samples analyzed. This does not mean you should routinely analyze for several dozen elements, but rather consider additional analyses of ore elements which may not be visually obvious and for which the geologic environment is permissive. Upon occasion a multi-element spectrographic analysis may be appropriate, but you should first check to see that the detection limit doesn't exceed anomalous values. Reviews of files or submittals should attempt to determine what elements might be present but lack an analysis.

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FTG:lb

cc: WLKurtz

GEOCHEMICAL OFFICE - EXPLORATION DEPARTMENT
3422 South 700 West
Salt Lake City, Utah 84119

March 1, 1978

RECEIVED
MAR 3 1978
EXPLORATION DEPT.

T. C. O.
MAR 3 1978

Mr. F. T. Graybeal
Tucson Office

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Other multi-element analytical procedures (e.g. X-ray emission, radio frequency argon plasma emission (MRFAPE) etc.) offer greater sensitivity, accuracy and precision than emission spectroscopy. However, X-ray emission analysis is not widely available from commercial

laboratories in North America whilst the effectiveness of the new MRFAPE technique is determined to some degree by the efficiency of sample digestion or fusion in the sample dissolution phase of analysis. There can be serious problems with elements of interest in certain refractory minerals unless special digestion or fusion procedures are used.

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Yours very truly,

Lloyd James.

L. D. JAMES

LDJ:am
Attch.

cc: T. C. Osborne
W. L. Kurtz

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- Soils
- Stream Sediments
- Plant Ash
- Water Residue

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| Cu | 2 |
| Ga | 10 |
| Ge | 20 |
| La | 20 |
| Mn | 10 |
| Mo | 2 |
| Ni | 5 |
| Nb | 20 |
| Pb | 10 |
| Sb | 100 |
| Sc | 10 |
| Sr | 50 |
| Sn | 10 |
| Ti | 20 |
| V | 10 |
| W | 50 |
| Y | 10 |
| Zn | 200 |
| Zr | 20 |

RECEIVED
MAR 20 1978
S. W. U. S. EXPL. DIV.

New York, March 16, 1978

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| Ga | 10 |
| Ge | 20 |
| La | 20 |
| Mn | 10 |
| Mo | 2 |
| Ni | 5 |
| Nb | 20 |
| Pb | 10 |
| Sb | 100 |
| Sc | 10 |
| Sr | 50 |
| Sn | 10 |
| Ti | 20 |
| V | 10 |
| W | 50 |
| Y | 10 |
| Zn | 200 |
| Zr | 20 |

# ASARCO EXPLORATION RECORD

check file - [illegible] possible target 3

☐ FIELD EXAMINATION ☐ LITERATURE SEARCH ☐ ASARCO FILE ☒ USGS OPEN FILE

## Section I General Indexing

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ① Name(s) of Property or Area: GOLDRUN CREEK QUAD. South Edna Mtn. Area -- Humboldt County Gold Run (Adelaide) Mining District | | | | | | ② Country: U.S.A. | ③ State or Province: Nevada | |
| | | | | | | ④ Co. or Map Sheet: Goldrun Creek 7-1/2' | ⑤ File or Gore No. | |
| ⑥ Latitude: 40° 47' 30" | ⑦ Longitude: 117° 27' 30" | ⑧ Mer.: MDB&M | Tws.: 33 & 34 N | Rng.: 40E | Sec. | ⑨ Examined by: G.J.Stathis | ⑩ Date: 9-4-73 | |
| | | | | | | ⑪ Office: Tucson, Arizona | ⑫ Field Days: --- | |

## Section II Sources of Information

⑬ References

| Author | Date | Title | Publications | Vol. No. |
|---|---|---|---|---|
| R.L. Krickson & S.P. Marsh | ---- | 1973 | | |
| U.S.G.S. Miscellaneous Field Studies Maps MF-506, 507, & 508 | | | | |

## Section III Appraisal

⑭ Recommendations
- ☐ Action Now
- ☐ Too Low Grade
- ☐ Too Small
- ☐ Ownership Problem
- ☐ Access Problem
- ☒ Examine if personnel available

⑮
- ☐ Past Producer
- ☐ Producer
- ☐ Mineral Deposit
- ☐ Prospect
- ☐
- ☐
- ☐ Geologic Concept
- ☒ Geochem Anomaly
- ☐ Geophy. Anomaly
- ☐

⑯ Production

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

⑰ Reserves ☐ Measured ☐ Estimated

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

⑱ Num. Drill Holes _____ Approx. Total Footage _____

⑲ Excavations

⑳ Spectro. Analysis Attached

㉑ Assays Attached

㉒ Geochem Results Attached

## Section IV Geologic Data

㉓ Commodity or Contained Metals

㉔ Ore Minerals - Major _____ Minor _____

㉕ Host Rocks - Major QUARTZITE, LIMESTONE, SHALE, PHYLLITE Minor Chert, greenstone

㉖ Age of Host Rocks Sediments are Cambrian, Permian, Pennsylvanian Intrusive rocks Cretaceous

㉗ Environment Granodiorite and related rocks intrude predominantly siliceous sedimentary of Havallah sequence, Pumpernickel formation, and Preble formation.

㉘ Alteration Suggestion that the granodiorite is not pervasively mineralized.

㉙ Total Extent

㉚ Structure

㉛ Ore Occurrence Geochem anomalies (As, Sb, Hg, Pb, W, Mo, Cu, Au, & Ag) occur in samples from shear and fault zones, fractures, jasperoid, breccia reefs and altered zones within sedimentary rocks.

㉜ Age of Mineralization Tertiary? & Recent

㉝ Conclusions and Recommendations A Cu-Mo-W-Ag-Au anomaly measuring about 2500' x 2500' occurs in section 13, T. 34 N., R. 40 E. and is related to an apophysis of the main granodiorite stock located 2000 feet to the west. The bulk of the samples collected within the geochem anomaly area are from the sedimentary rocks and may represent skarn, and/or, structure (fractures, faults, shears, etc.) controlled mineralization. It appears that samples should have been collected southwest of this particular anomaly; the absence of samples here probably indicates a

SEE OVER

(33) Continued:

lack of an opportunity to higrade, or that the area is devoid of surface mineralization. Nevertheless, this particular geochem anomaly rates a low priority for immediate field examination because of its rather small areal extent.

A second, Sb-Hg-As-Ag-Au-Pb anomaly occurs south of the granodiorite stock in sections 28, 32, 33, T. 34 N., R. 40 E., and sections 4 and 5, T. 33 N., R. 40 E., mostly within the Cambrian Preble formation. This anomaly and several smaller satellitic anomalies are controlled by a major, Basin & Range fault which extends northwest onto bedrock. Hot springs occur along the fault in vicinity of the geochem anomaly. The anomaly here is indicative of epithermal mineralization potential. It is difficult to make a firm recommendation on the anomaly without knowing the nature of the samples collected by the U.S.G.S. Nevertheless, the length of the fault and the obvious control it has on the distribution of the geochem anomalies makes it an area worthy of examination with the idea that significant mineralization may occur somewhere along the fault. The geologic situation here is somewhat reminiscent to the Comstock fault occurrence at Virginia City.