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AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

January 20, 1971

TO:

J. Balla	J. Harper
G. Barnett	D. Hedrick
S. J. Bellock	J. R. King
H. L. Crittendon	W. L. Kurtz
A. Dalla Vista	J. D. Sell
S. R. Davis	R. P. Shannon
W. G. Farley	G. J. Stathis
B. E. French	R. Van Blaricom
D. T. Friel	N. P. Whaley
F. Graybeal	J. R. Wojcik

Re: Porphyry Note Files

FROM: W. E. Saegart

Attached for your review is a copy of my memo dated January 26, 1970 concerning the use of the Porphyry Copper Exploration Note Files. Mrs. Wittl has refiled these notes according to mining district and has re-indexed them for easier research. She will file the new reports and maintain the index.

If you do not have a supply of these forms on hand for your use, please see Marge and she will get them for you.

W. E. Saegart

W. E. Saegart

WES:mw

Exploration Note File
W E S
(new File)

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

January 26, 1970

TO:

C. E. Beverly	B. E. French
S. I. Bowditch	R. D. Karvinen
H.L.Crittendon	B. E. Kilpatrick
A. Dalla Vista	Wm. L. Kurtz
S. R. Davis	R. H. Luning
B. J. Devere	J. D. Sell
W. G. Farley	N. P. Whaley

FROM: W. E. Saegart

Attached is a copy of a Memorandum from J. H. Courtright regarding the use of standard Exploration Note Files under the categories of "Research","Reconnaissance", and "Summary".

While in the field, you will be primarily concerned with the "Reconnaissance" Form (2) and you are requested to maintain a supply of these at all times.

In the course of regional or district studies, the "Reconnaissance" Form should be used to record field observations which may directly or indirectly be related to bulk low grade metal occurrences (porphyry copper or porphyry molybdenum, etc). Information should be recorded on observations such as the following:

1. Fringe alteration-mineralization which might be related to a concealed ore deposit.

2. Exotic copper mineralization which might be related to a concealed ore deposit.

3. Large pyritic altered areas with consideration for vertical metal zoning.

4. Fragments of leached capping occurring as stream float or in conglomerate units which could have been derived from a concealed ore deposit.

5. Geophysical or geochemical results of the kind which are commonly related to bulk low grade base metal deposits.

Small mineral occurrences surrounded by barren country rock should not be reported in the "Reconnaissance" file unless they are considered as possible fringe manifestations of bulk low grade occurrences.

The most important aspect of these forms is that they provide a convenient method of reviewing prior work in any individual area. We anticipate thereby to eliminate future duplication of efforts. Periodic review of these files will also be advantageous to our assessment of prospects that should be reconsidered due to changes in economics or technology.

The "Research" Exploration Note File (1) should be utilized whenever data is obtained through sources other than field observation which may suggest an important metal occurrence. Such sources would include publications, company files, and personal communications.

Whenever additions of the "Reconnaissance" or "Research" forms are made, it will be your responsibility to see that the "Summary" sheet is updated accordingly. New entries should be made on the "Summary" sheet in chronological sequence.

The Porphyry Note Files are maintained in hard bound note books in the Library. Any of the staff not presently familiar with these files should review them as time permits to gain a working familiarity with their format.

Your Note File Reports should be directed to my attention prior to filing.

W. E. Saegart

W. E. Saegart

WES:lab
Enclosures

Jim: Thanks for the information you sent on the copper porphyry deposits. I imagine it included Bingham. I'm ordering a copy from office will be in during a day or two before long through Bob Lowry, Regards Parker

AEROMAGNETICS AND GEOLOGY

OF

36 COPPER AND MOLYBDENUM PORPHYRY DEPOSITS

IN THE

WESTERN UNITED STATES AND BRITISH COLUMBIA

DECEMBER 1970

S. PARKER GAY, JR.
CHARLES A. MARDIROSIAN

SALT LAKE CITY, UTAH

American Stereo Map Company
430 South 6th East
Salt Lake City, Utah 84102

ph. 801/521-7424

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*These numbers are the same as the corresponding figure numbers of the "Aeromagnetics and Geology" maps.

EXPLORATION NOTE FILE - RECONNAISSANCE

Property: Monitor & other claims of Harry J. Hagen
Area:
District:
Mt. Range: Dripping Spring Mtns.
State: Arizona
County: Pinal & Gila

Location: NE of Ray Pit in Dripping Spring Mountains

Field Check by: W. E. Saegart

Date: May 18, 1970

Recommended Company Interest Classification:

- [ ] First Order
- [ ] Second Order
- [ ] Inactive
- [x] None
- [ ] Technical

Conclusion: Copper mineralization limited to NE trending faults cutting pre-Cambrian Apache Group Sediments - No intrusives - No pervasive hydrothermal alteration - No Breccia pipes - No immediate interest but future exploration reconnaissance suggested below.

Notes on Recconnaissance:

Made vehicle traverse (as shown on attached map) with owner of claims and fee land, Harry J. Hagen. Dripping Spring Mountains south of Mineral Creek and Dripping Spring Wash and north of Troy Mountains appear to be entirely underlain by pre-Cambrian Apache Group sediments and minor Pinal schist.

Copper mineralization occurs in vicinity of Monitor Mine (Sections 29, 30, 31, and 32, T2S, R14E) associated with and confined to Northeast faults. Structure on which the Monitor is located forms contact between Mescal limestone and diabase on the North and Pioneer shale on the south. Oxide copper paint on bedding planes and along fracture surfaces disappears within a few feet of controlling fault structures.

No hydrothermal alteration or pervasive mineralization observed. Small dyke of quartz latite type occupies fault near Monitor Mine - otherwise, no intrusive rocks or breccia pipes seen.

Two small color zones observed from distances of 1/2 to 1 mile, but not field checked. These are located in Section 30, T2S, R14E, and Section 5, T3S, R14E. Latter zone should be examined as it is near edge of pre-mineral outcrops (to east, area between Dripping Spring Mountains and Pinal Mountains is covered by Gila Conglomerate). Color zone in Section 30 is too small to be of interest.

ASARCO should schedule a detailed reconnaissance along the north and east margin of Dripping Spring Mountains from Hagen Ranch (Section 24, T3S, R14E) to Government Springs Ranch (Section 18, T2S, R14E) to check for alteration going under Gila Conglomerate to East. Such a reconnaissance traverse would cross the north-east projection of the Sacaton-Poston Butte- Ray lineament.

Hagen claims of no interest.

WES:lab
cc: WmLKurtz, w/small map
JDSell, w/o map
WESaegart, w/large map
File w/small map
JJCollins, w/small map

[x] Map Attached

Date May 20, 1970

By W. E. Saegart

SW Expl. Conference — April 27, 1970

Kurtz - [illegible], New

low grade [illegible] prospects

[illegible] 1½-2%

Greg Stokes Pennsylvania Hollow, New

Bob [illegible]: Eastern Molybdenum Recom. New Arg

Ron [illegible] Both revisited

Barry [illegible] S. Santa Rosa - Vidria No.

Bruce [illegible] Tod, Mexico

Steve [illegible]

Norm Wolfy: [illegible] and Hadshell

Dulcie [illegible] IP

Wayne [illegible] et al.

Sam Bond [illegible] & Wal Qualificate

Bill [illegible] Vist., NM

[illegible] Arg.

[illegible] Arg.

SW - Globe-Superior.

Target Colas [illegible]

1) [illegible] indications

2) [illegible] small windows

3) [illegible] extrapolation

4) County slide, description of known [illegible]

5) Vent [illegible] - elevation & or rel. type for [illegible] (Silurian intrusive)

6) [illegible] to have [illegible] from mineralization

7) [illegible] - blind target under cover

8) Known low grade deposits w/ chance of recovery small size

9) Give comp. w fresh rock

10) Stream sediment & rock geochemistry, & mineral fragments in soil-mind cols.

SW Exploration Conference
April 27, 1970
W.E. Sargent Summary.

Target Catagories and Priorities:

1. Large areas of good indications.
2. Fringe exposures and small windows
3. Lineament extensions and extrapolation.
4. Gravity slide and fault extensions.
5. Vertical zoning through alteration, mineralization, & rock favorability
6. Mineralization in intermediate to basic rocks.
7. Geophysical studies for blind targets undercover.
8. Known low-grade and/or small tonnage — economic-sig change
9. Exotic copper in fresh rock.
10. Stream sediment - rock chip geochem & conglomerate studies.

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.

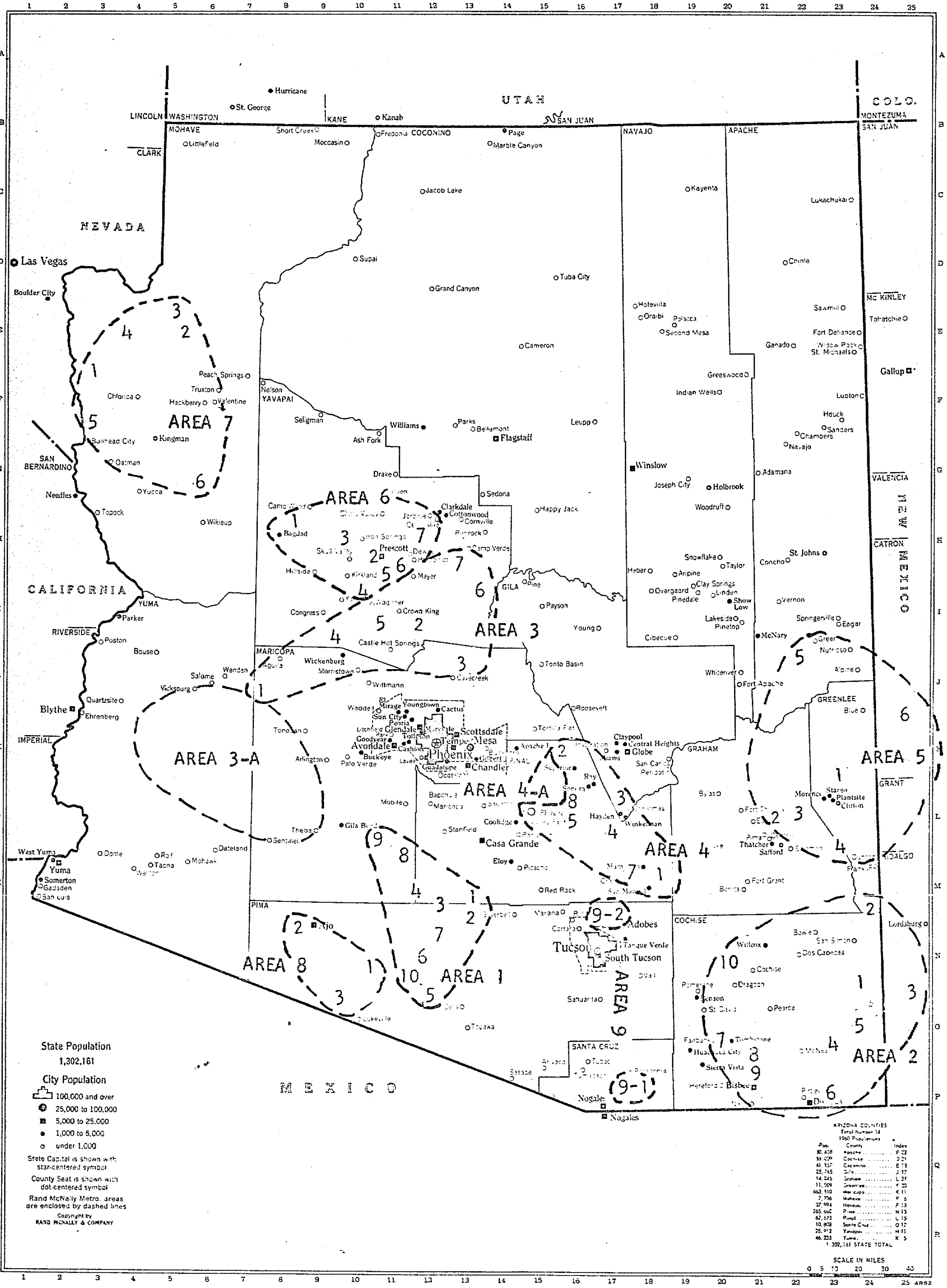
Target areas within Area 1, Papago Central, are presently under field investigation and reports on completed areas have been submitted by R.D. Karvinen and J.E. Kinnison.

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 Baboquivari 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-syncline 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

2-9

Bisbee Area

A study of pebbles in the Cretaceous Gl~~eeson~~ance conglomerate for determining other buried ore-bodies of the Bisbee camp area.

Bisbee 15' Quadrangle
Hereford 15' Quadrangle
Gleeson 15' Quadrangle
Douglas AMS sheet
Nogales AMS sheet

USGS P.P. 21. Geology & Ore Deposits of the Bisbee Quadrangle (Ransome, F.L.) 1908.
USGS map I-418. Geologic map of the Southern part of the Mule Mountaims (P.T. Hayes) 1964
GSA Memoir 38. Lower Cretaceous stratigraphy in SE Arizona (Stoyanow,A.A) 1949

2-10

Johnson Gamp

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 7½' Quadrangle
Wickenburg SW 7½' 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 Pine 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.

Terret 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 tonnage 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.

ASARCO

Southwestern Exploration Division

July 13, 1977

TO: F. T. Graybeal

FROM: J. D. Sell

Whitetail and Intra Lower Volcanics
Equivalent Sedimentary Trends
Open File Report 77-343
by M. E. Cooley

In response to your question, I have taken Cooley's small map (upper right side of Plate 1) and separated out the Division M (Whitetail equivalent) deposit trend directions and the Division K (Intra Lower Volcanic equivalent) deposit trend lines.

From this I have reconstructed probable drainage directions and trends for the two groups with the following interpretation:

During Division M time a probable ridge or divide extended south from Kingman to around Parker where it turned northeast toward Prescott, then southeasterly toward Phoenix, then easterly past Globe and toward Safford, prior to being lost. It may extend southward or continue southeasterly. All trends north of this ridge line show a northeasterly component whereas those to the south show a southwesterly component. A slightly high area may have extended northeasterly between Yuma and Phoenix. Another north-trending divide appears to be around Covered Well-Vekol area and trends on the east of this ridge traverse to the north and join a major grouping from the Nogales via Tucson to Casa Grande trough, which also picked up the southwest trends from the northern ridge. Other trends west of Phoenix are apparently deflected by the northeast-trending high and all funnel thru the Gila Bend area and traverse to the southwest thru Ajo. A few trend southwesterly from Prescott, apparently flank and parallel to the north side of the high, and extend towards Yuma.

The major conclusion is that during Division M time through-going non-channelled flow extended north of the northern ridge, whereas to the south of the ridge the trends were channelled into a trough which extended from Tucson thru Eloy-Casa Grande and on to Gila Bend where they joined others from the Phoenix-Buckeye area and all funnelled southwesterly past Ajo.

During Division K time several major revisions had taken place. Included, during this time, a major shift of the northern divide or ridge line to a position further north and more limited, as expressed by the present Mogollon Rim trend. Again, north of the divide the deposit trends are northerly, whereas to the south they are southerly. The other ridge, of Covered Wells-Vekol, appears to have continued as is, whereas the Tucson-Casa Grande trough was partially destroyed by a new ridge trending northwesterly east of Tucson toward Phoenix (i.e., essentially the San Pedro trend). East of this ridge the southerly-flowing trends from the Mogollon Rim area were diverted and trend south through Nogales, Patagonia, and

Douglas. West of the ridge the north-trending lines follow the Tucson-Casa Grande line and again gather southwest trends from Phoenix and curl back southwesterly thru Gila Bend and Ajo. Some trends around Yuma suggest they flow easterly and bend southeasterly to join the main escape route past Yuma toward Sonoita.

As expressed by Cooley, these depositional trends were essentially established prior to the break-up into the classic basin-and-range topography which created a number of closed to semi-closed basins, which then were integrated into the through-going Colorado, Gila, Salt, Santa Cruz, and San Pedro River drainages. Thru all of this it is apparent that the Santa Cruz and modified lower Gila (via Ajo-Sonoita) drainages were initiated and maintained from the earliest Tertiary time to the present.

A more knowledgeable study of the uraniferous source rocks for the Tertiary basin-sediment deposits coupled with the drainage direction knowledge would greatly aid in developing working thoughts on probable depositional sites for accumulations of uranium. Preliminary expressions may be along the older trough-channel areas where different source derivatives came together and mixed, such as in the Tucson-Casa Grande-Gila Bend-Ajo trough zone.

A study of the individual basins as established in Divisions A, B, C, E, F, and H on the main map of Plate 1 would add some insight into trends during the apparent Tertiary uranium depositional period.

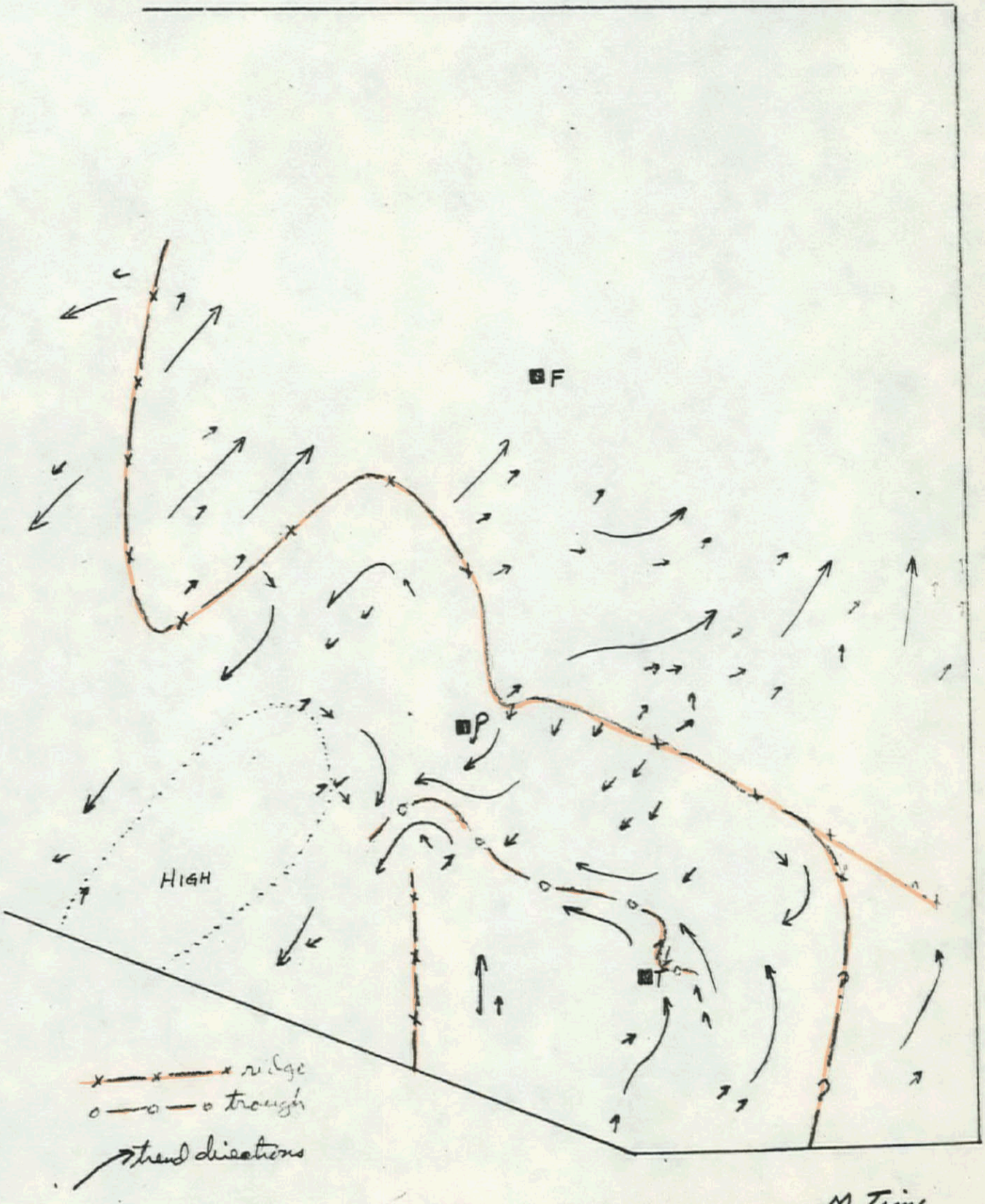
Cooley's Plate 1 is indeed a product of his labor-love of the Tertiary to Recent geology of Arizona.

James D. Sell

James D. Sell

JDS:lb
Atts.

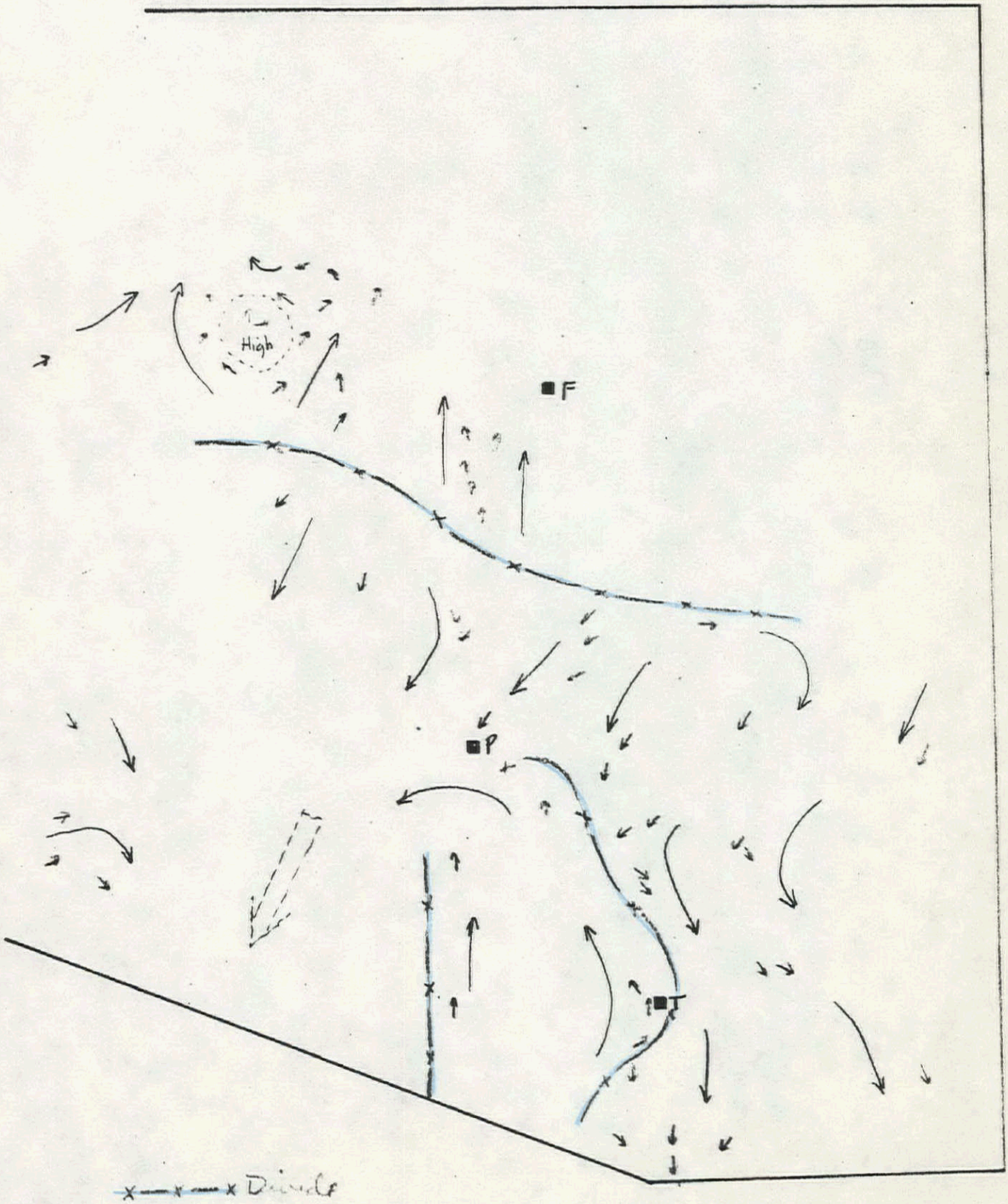
after: M.E. Cooley, OF-77-343



Whitetail Equivalent

M Tim

after: M.E. Cooley, OF-77-343



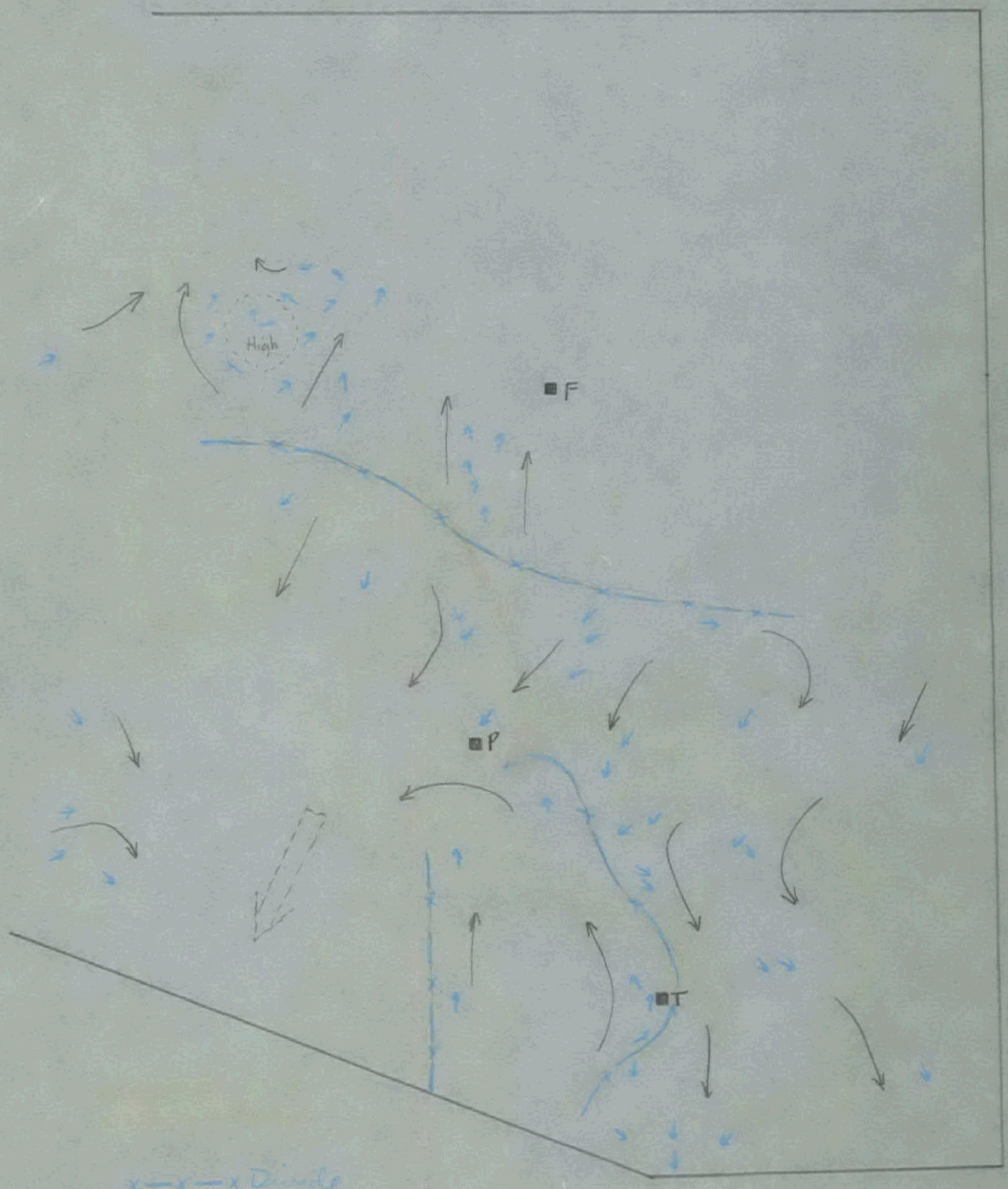
Divide

trend directions

Intra Lower Volcanic Equivalent

K Tim

after: M.E. Cooley, OF-77-343

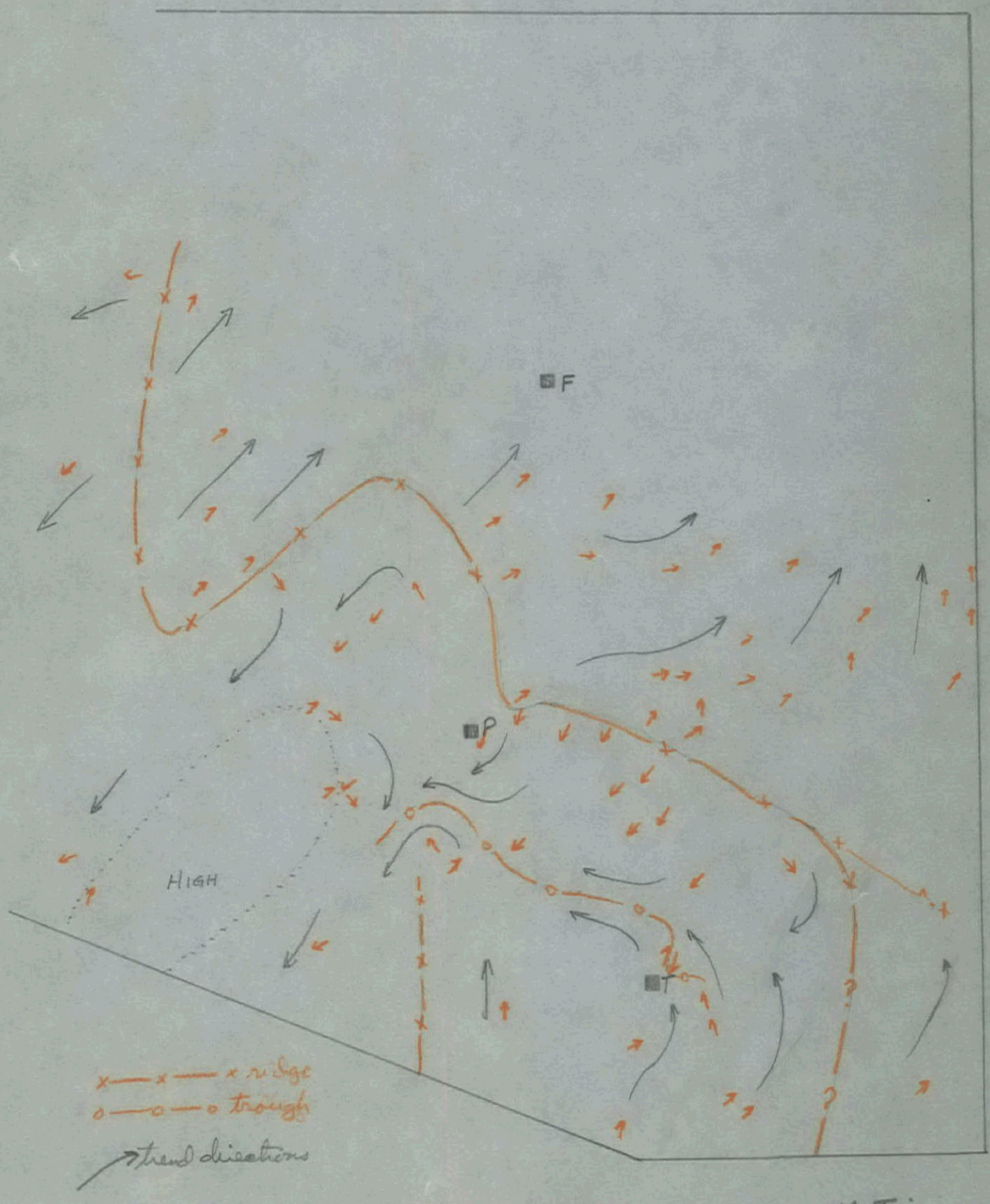


x—x—x Divide

→ trend directions

K Time

after: M.E. Cooley, OF-77-343



whitetail Equivalent

M Tiers