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I. P. Survey

General Grant Area

near

Wickenburg, Maricopa County

Arizona

for

Geochemical Surveys, Inc.

Job 527

August 1970

INDUCED POLARIZATION SURVEY

IN THE

GENERAL GRANT AREA

NEAR

WICKENBURG, MARICOPA COUNTY

ARIZONA

FOR

GEOCHEMICAL SURVEYS, INC.

AUGUST 1970

BY

HEINRICHS GEOEXPLORATION COMPANY
P.O. BOX 5964, TUCSON, ARIZONA 85703
Tel: 623-0578

GEOEX Job # 527

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In Map Pocket:

Induced Polarization Location and Interpretation Plan

GENERAL LOCATION
OF
GENERAL GRANT AREA
FOR
GEOCHEMICAL SURVEYS, INC.

ARIZONA

HEINRICHS
GEOEXPLORATION COMPANY
GEOPHYSICAL ENGINEERS

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INTRODUCTION

At the request of Mr. W.R. Ransone of Geochemical Surveys, Inc., Heinrichs GEOEXploration Company conducted a reconnaissance induced polarization survey over portions of the General Grant Area near Wickenburg, Maricopa County, Arizona. The field work was done in the interim July 30 to August 14, 1970.

A total of 13 lines were completed all on 500 foot dipole spacings and at various orientations. See the accompanying plan for details of location.

The dual frequency induced polarization system was employed with sending frequencies of 0.3 and 3.0 Hz. The collinear dipole-dipole electrode configuration was used which on a 500 foot dipole spacing typically gives resolvable penetration within the zone from about 150 to 600 or so feet below surface. Equipment used was a GEOEX MK-4C receiver and a GEOEX MK-7 sender.

The purpose of this survey was to search for sulfide mineralization at depth possibly related to geochemical copper and molybdenum anomalies located by Geochemical Surveys, Inc. in an area of numerous copper oxide showings. Rock types involved are Laramide (?) granitics intrusive into Precambrian schists and gneisses with some extrusive and intrusive Tertiary volcanics.

Data are presented on Sectional Data Sheets, one for each line, showing resistivity, percent frequency effect (PFE) and metallic conduction factor (MCF) contoured in section and self potential (SP) in profile form. An Induced Polarization Location and Interpretation Plan is also included which shows the line locations and surface projected anomalism interpretation relative to geochemical copper and molybdenum anomalism and roads and section corners.

GEOEX personnel involved in the field work were W. Freeman, Geophysicist-Crew Chief, S. Cruze and A. Wilder, technical assistants. Compilation, interpretation and report by C. Ludwig, Senior Geophysicist, with the assistance of the Tucson staff.

CONCLUSIONS AND RECOMMENDATIONS

No definite, obviously sulfide related, anomalous induced polarization response was noted on any of the thirteen lines. There are several areas of higher background response which are probably only rock type effects and not actually related to significant increases in sulfide mineralization. A zone of very weak questionable anomalism is noted on Line 6 but with no support on nearby Lines 5 and 7 and is therefore not felt to be of much significance at this time.

Therefore, at least in the immediate vicinity of the I.P. coverage, down to roughly 600 feet below surface, no geophysically significant concentrations of polarizable sulfides are seen. Apparently the geochemical anomalism is reflecting the minor mineralization noted in small veins throughout the area rather than significant concentrations of copper-molybdenum sulfides at depth. Based on the data available to us, no further geophysical work is recommended in the area unless to test other geologic or geochemical targets, not covered by the subject work of this report.

For the most part, the apparent resistivities are quite high indicating the rather fresh igneous or metamorphic material covered by most of the lines. Several lines show lower near surface resistivities probably reflecting an alluvial cover. Also some of the volcanic rocks crossed show lower resistivities. The self potentials show no significant appearing lows. This suggests the lack of appreciable quantities of near surface, actively oxidizing, relatively interconnected, sulfides in the vicinity of the lines.

INTERPRETATION

Line 1:

Only minor background variation is seen in the induced polarization response. The resistivities on the south half of the line are fairly high and uniform - typical of the granitic rocks involved. The north half of the line, particularly north of about 10N shows rather low near surface resistivities increasing with depth to values similar to those noted on the granite on the south half of the line. The near surface low resistivities are apparently caused by several hundred feet of overlying alluvium or other relatively conductive material. No significant appearing self potentials are seen.

Line 2: (Spreads 1 and 2):

Only background induced polarization response is noted. The highest resistivity material has the highest background response - as is typical in crystalline rocks. The apparent resistivity is generally quite high but variable, probably as a result of crossing several rock types (granites and volcanics),plus the effect of washes and topographic variations. A narrow, pronounced resistivity low noted near 10E is likely due to a small block of conductive volcanics. No significant appearing self potential lows are seen. A zone of erratic self potential near 70W is probably due to the effects of topographic variations and rock type changes.

Line 3:

No significant induced polarization effects are noted. Higher PFEs on the south end of the line relate to very high apparent resistivities and are probably not of significance. The MCFs are unusually low and uniform. The apparent resistivities are quite high throughout the lines, typical of granite, and show a minor increase with depth perhaps caused by decreased weathering with depth. The self potentials show only minor background variations.

Line 4:

Only background induced polarization effects are seen. The resistivities are again quite high and increase slightly with depth. The line is mostly on granitic rocks. A sharp low pointing towards station 27.5W may be reflecting a sharp canyon and a rock type change to volcanics. No significant self potential lows are noted.

Line 5:

Only low background induced polarization effects are evident. The resistivities show a zone of relatively conductive near surface material thickening to the south and overlying higher resistivity material. This line is apparently within the metamorphics as mapped but the resistivities suggest that several materials of differing conductivity or possibly variable weathering effects are involved. No significant self potential effects are seen.

Line 6:

The north half of this line has slightly higher than usual background PFEs and therefore has been interpreted as very weak strength questionable induced polarization anomalism. This possibly anomalous zone is mainly north of 10N and goes to at least 20N to the north. The PFE pattern suggests a deep source, say 500 feet or more below surface. In that the MCFs are quite low over this zone and that the zone is mostly outside nearby geochemical anomalism it is not considered to be indicative of significant quantities of sulfide. Also, there is no correlating anomalous response on the nearby Lines 5 and 7.

The rest of the line shows only low background induced polarization effects. Resistivities are somewhat erratic but generally high. Some increase with depth is also noted in the resistivities which may be due to minor alluvial zones or increased near surface weathering. No significant appearing self potentials were noted.

Line 7:

No anomalous induced polarization response is noted. The resistivity is quite high on the west half of the line. A pronounced apparent resistivity low near 2.5E is probably the result of the array straddling a conductive block of volcanics as indicated on the geologic map. The self potentials show no significant appearing variations.

Line 8:

Very uniform and low background induced polarization is noted. The resistivity is fairly uniform but minor variations may be reflecting the granite-gneiss contact that the line sub-parallels on its south end. No anomalous self potentials are seen.

Line 9:

Very low background induced polarization response is evident. The resistivities are much lower than usual and show a pronounced increase with depth particularly on the south half of the line - perhaps due to a several hundred foot thick section of alluvium and relatively conductive metamorphics at depth. The self potentials show only minor background variations.

Line 10:

Quite uniform and low induced polarization response is seen on this line. The resistivities are fairly high but erratic. The zone of volcanics the line is centered on is not obvious on the resistivities. No anomalous self potentials are seen.

Line 11:

Again only low background induced polarization response is noted. The resistivities are quite uniform except for a minor increase with depth and a small near surface low near 15S. The self potentials are quite flat.

Line 12:

Again only background induced polarization effects are evident on the line. The resistivities decrease somewhat to the south but are generally high. No anomalous self potentials are seen.

Line 13:

Extremely uniform PFEs are seen with typical background strength. The resistivities are fairly high but erratic probably due to the effect of approximately running along the volcanic-metamorphic contact. The self potentials are quite uninteresting.

Respectfully submitted:
HEINRICHS GEOEXPLORATION COMPANY

Chris S. Ludwig

Chris S. Ludwig
Senior Geophysicist

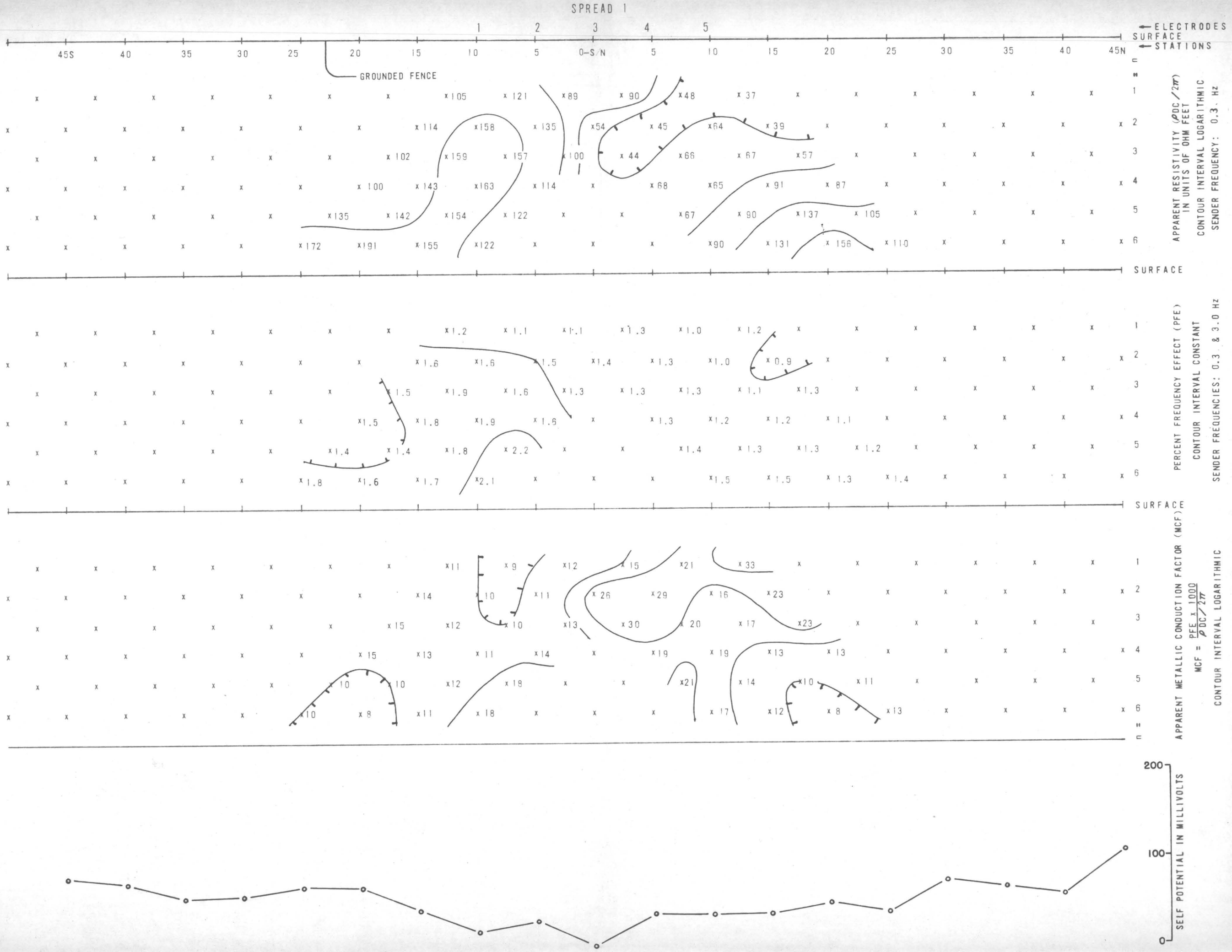
Approved By: _____
Walter Heinrichs, Jr.
President

527-70

LINE NO.

SPREAD(S)

INDUCED POLARIZATION TRAVERSE SECTIONAL DATA SHEET for GEOCHEMICAL SURVEYS, INC.



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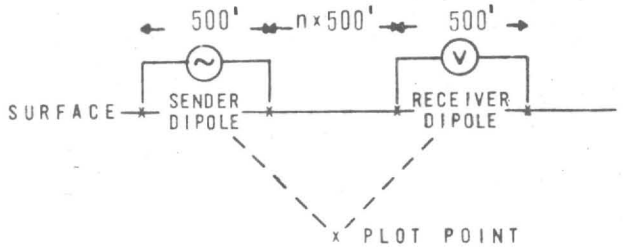

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LINE NO. 2

SPREAD(S) 1 & 2

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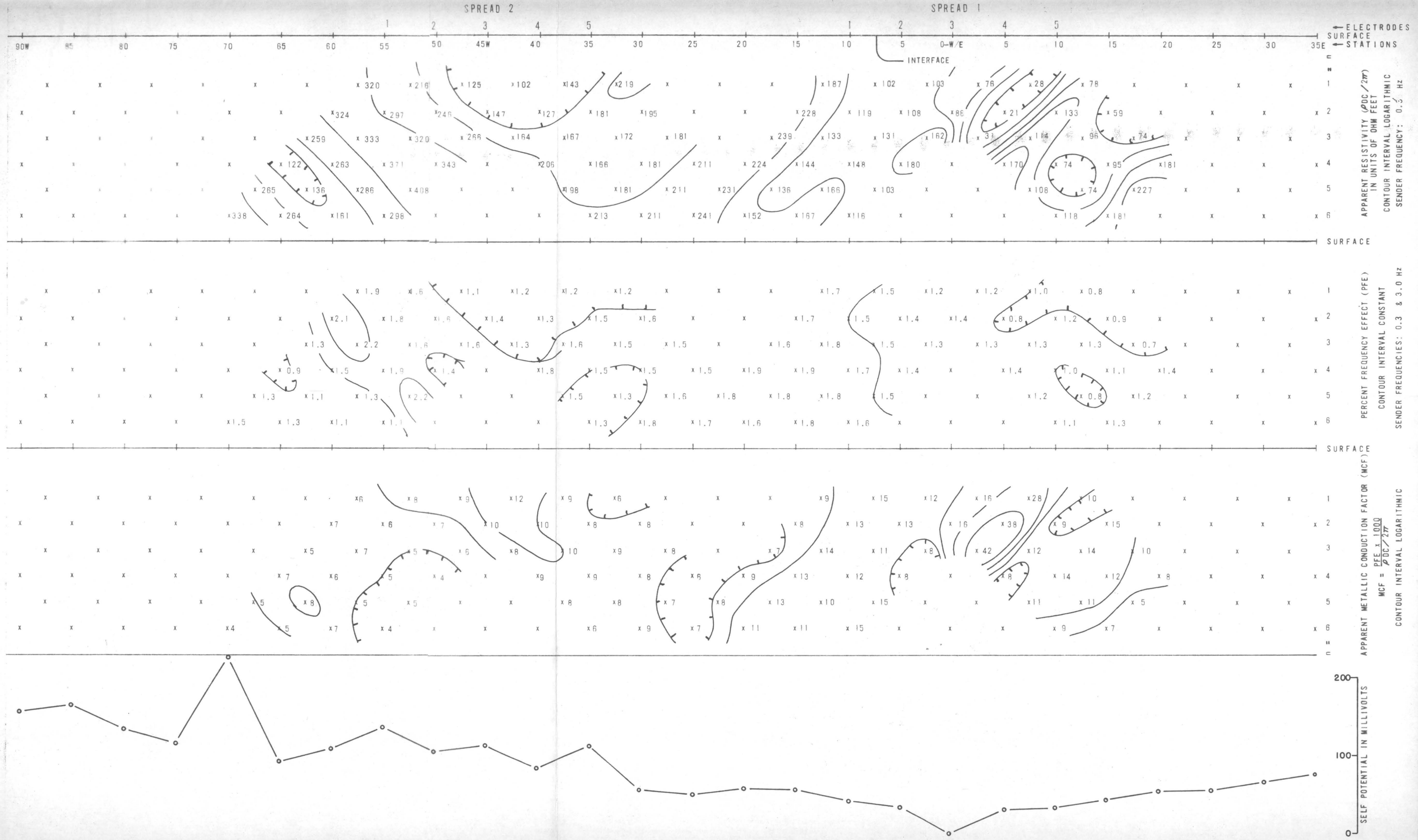

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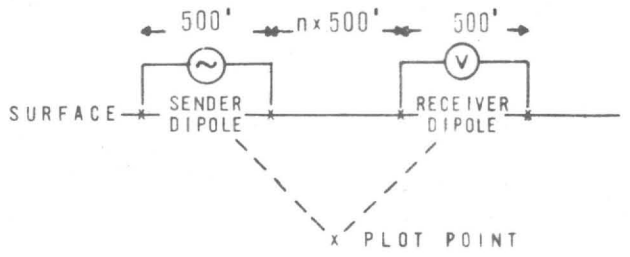

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LINE NO.
3
SPREAD(S)
1

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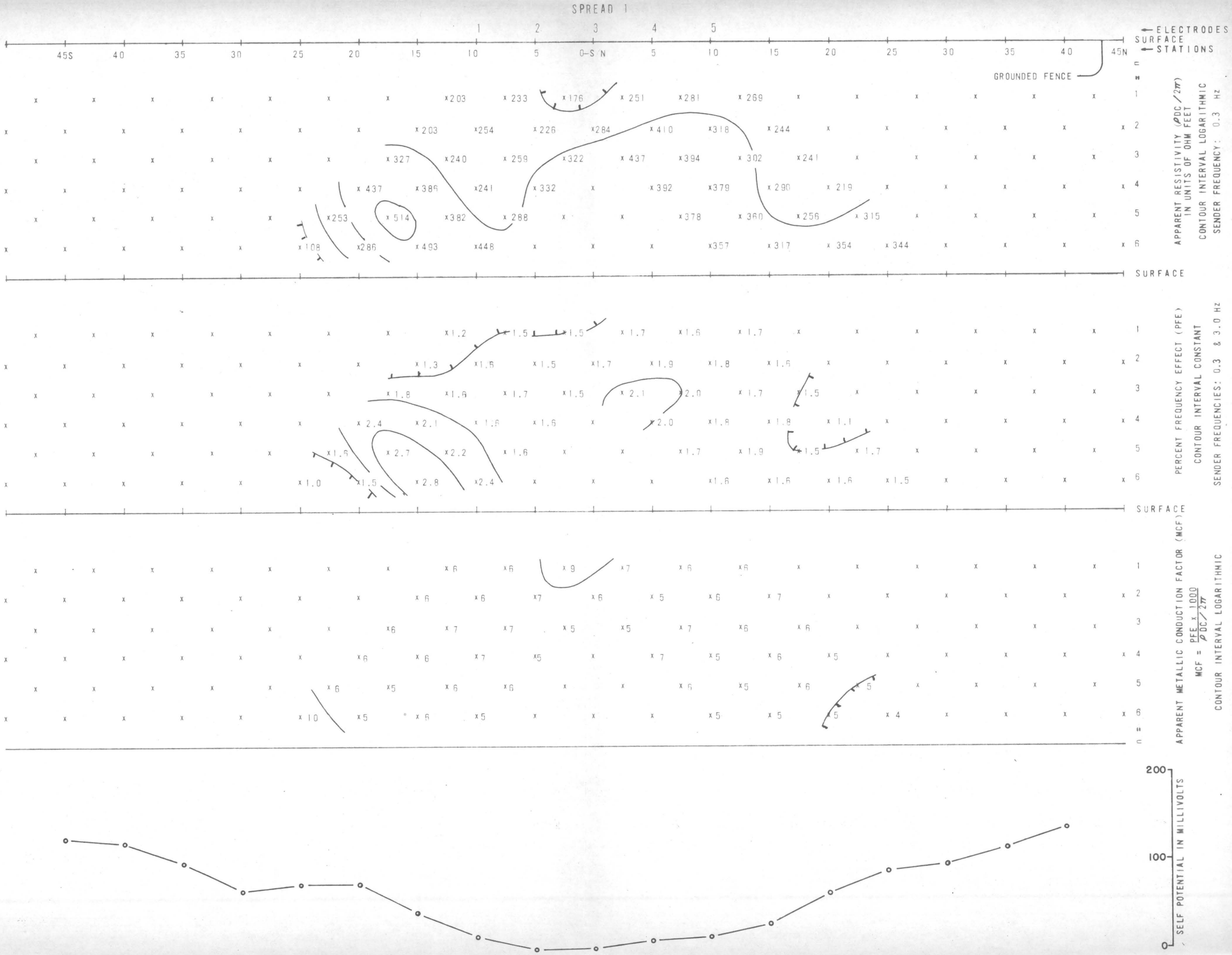

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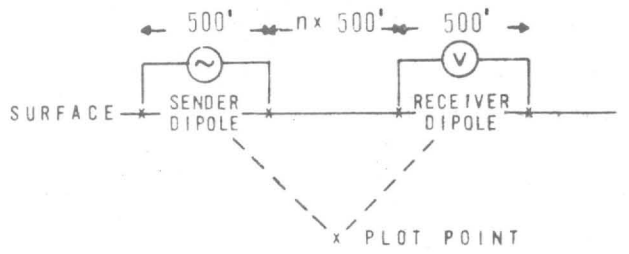

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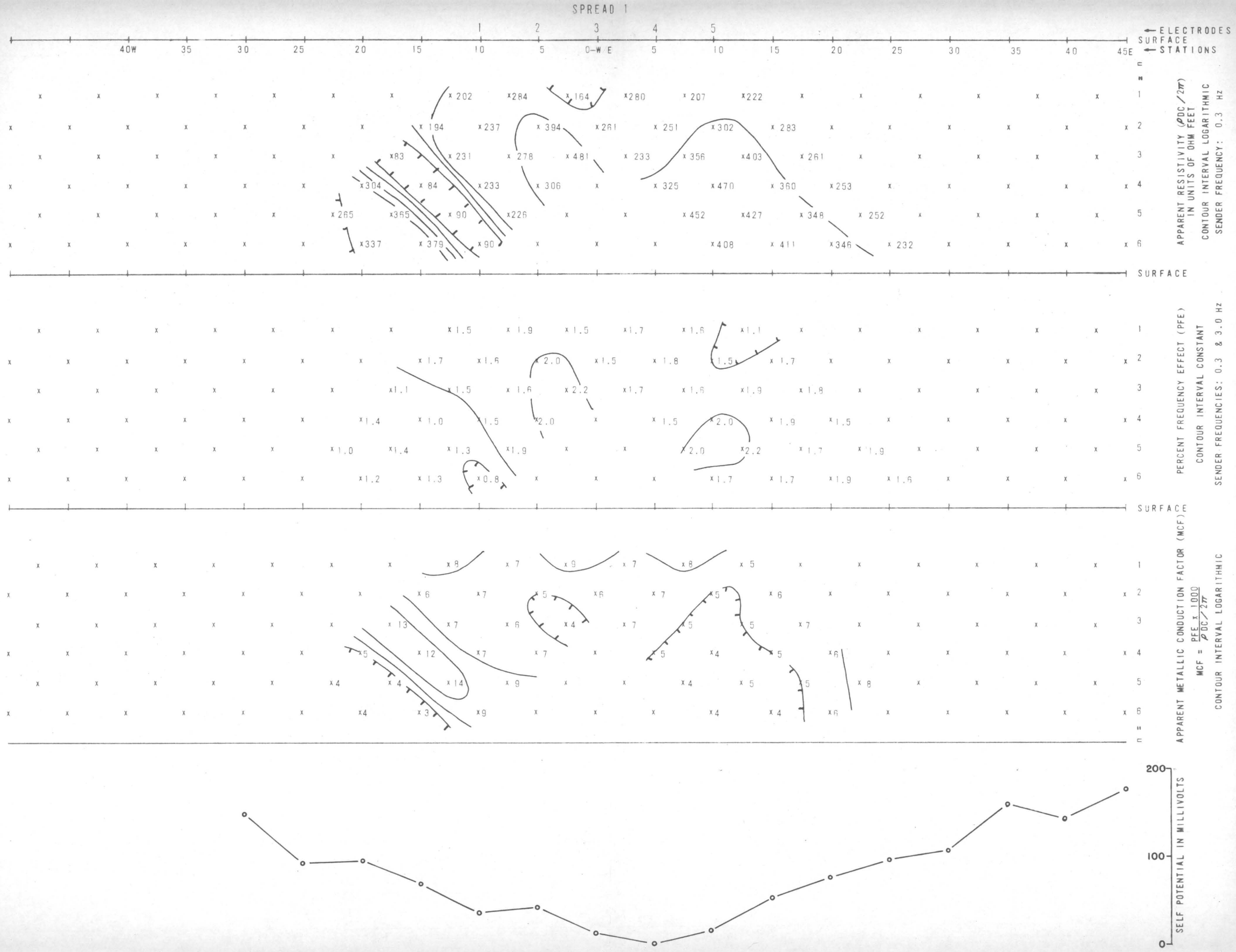

527-70

LINE NO 4

SPREAD 1

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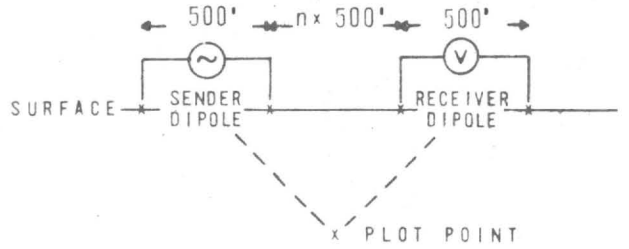

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LINE NO.
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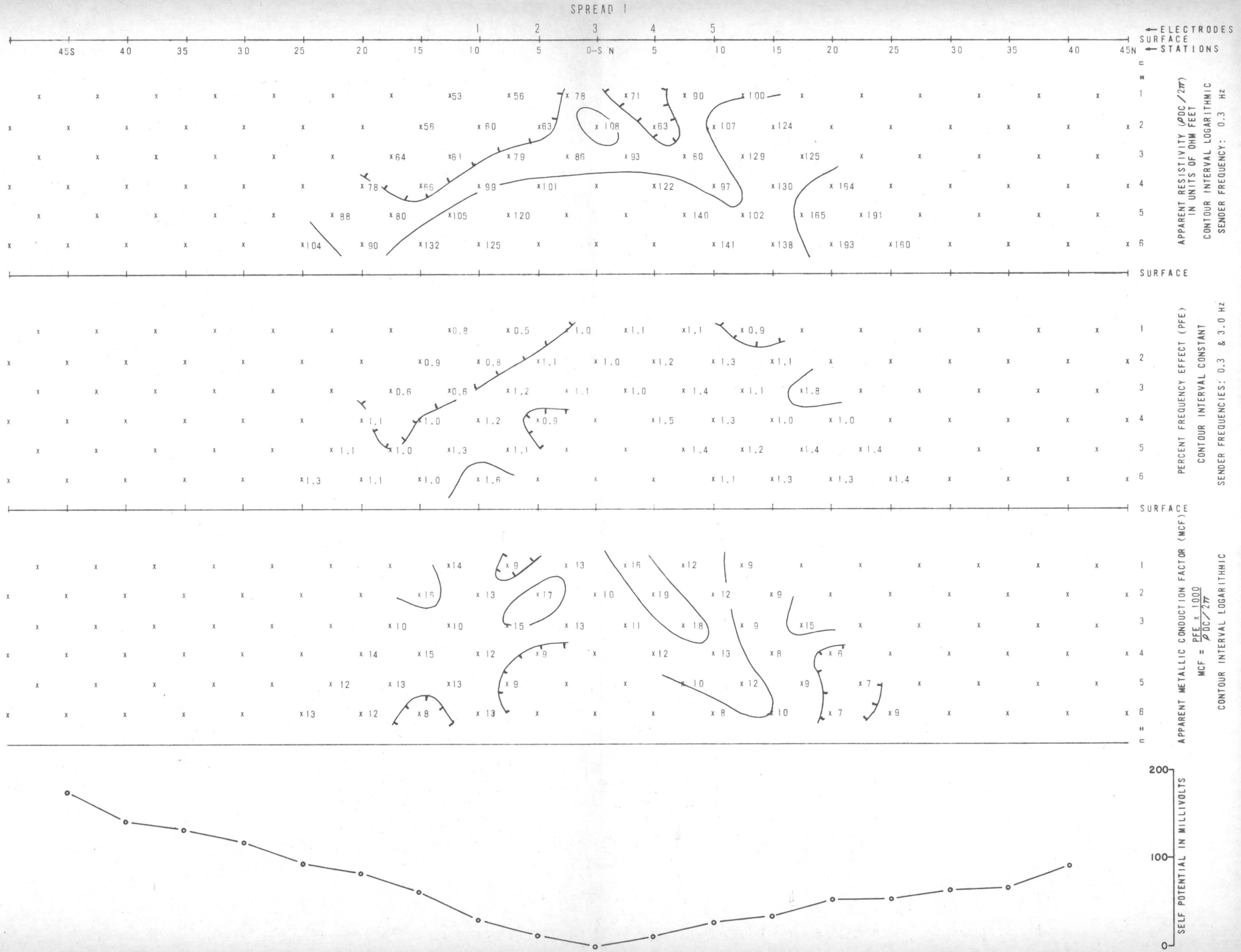

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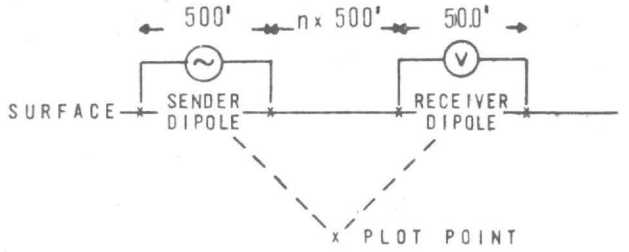

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527-70

LINE NO.
6
SPREAD(S)
1

INDUCED POLARIZATION TRAVERSE SECTIONAL DATA SHEET for

GEOCHEMICAL SURVEYS, INC.

RELATIVE ANOMALY STRENGTH

VERY WEAK — WEAK — MODERATE — STRONG

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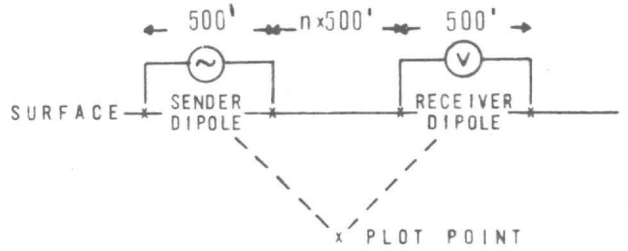

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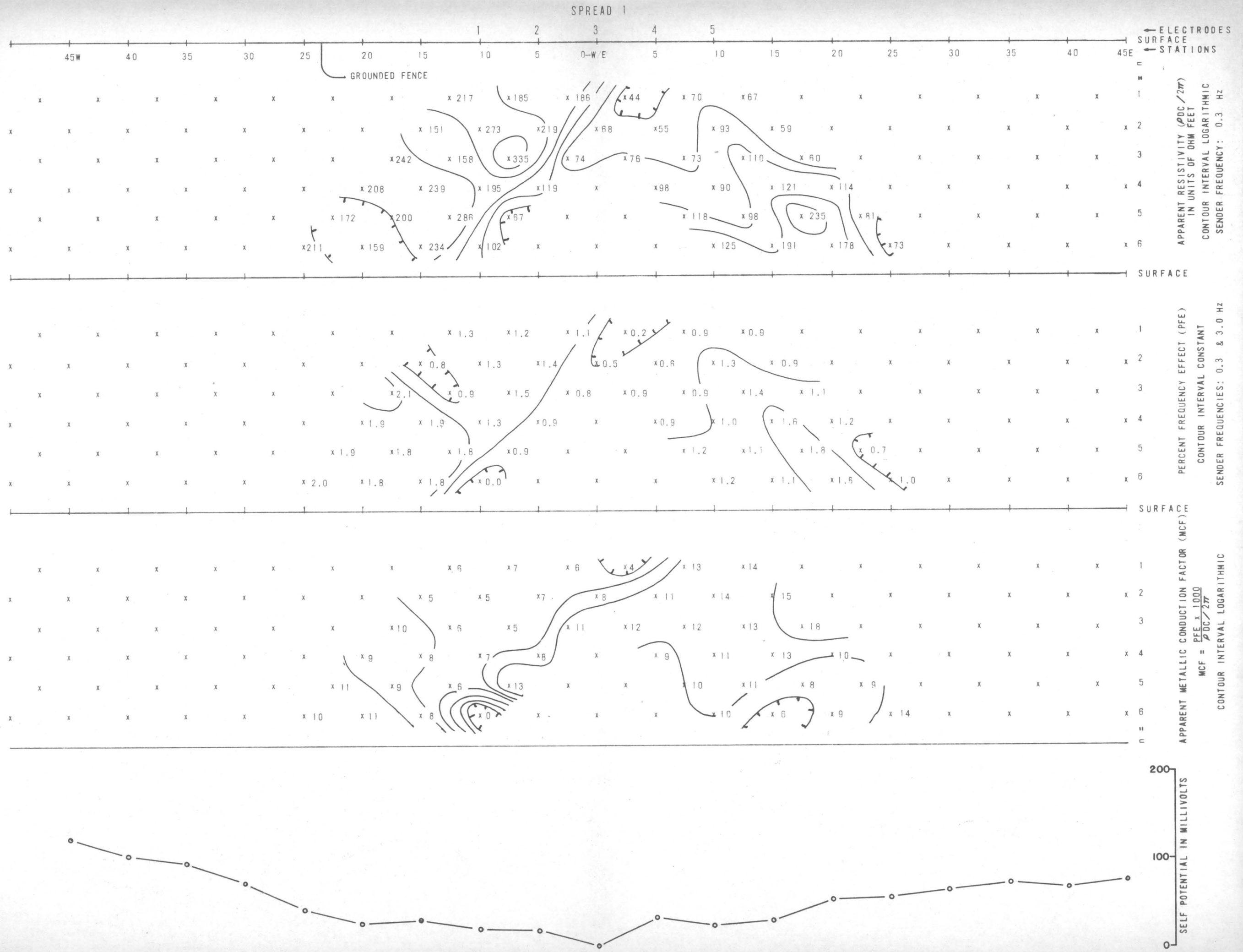

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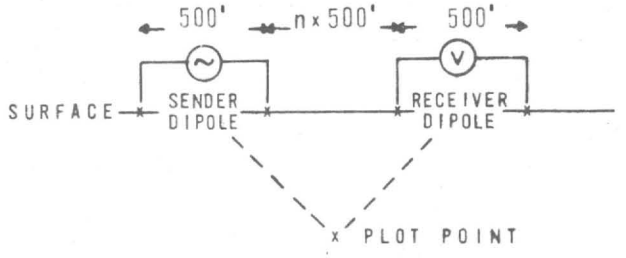

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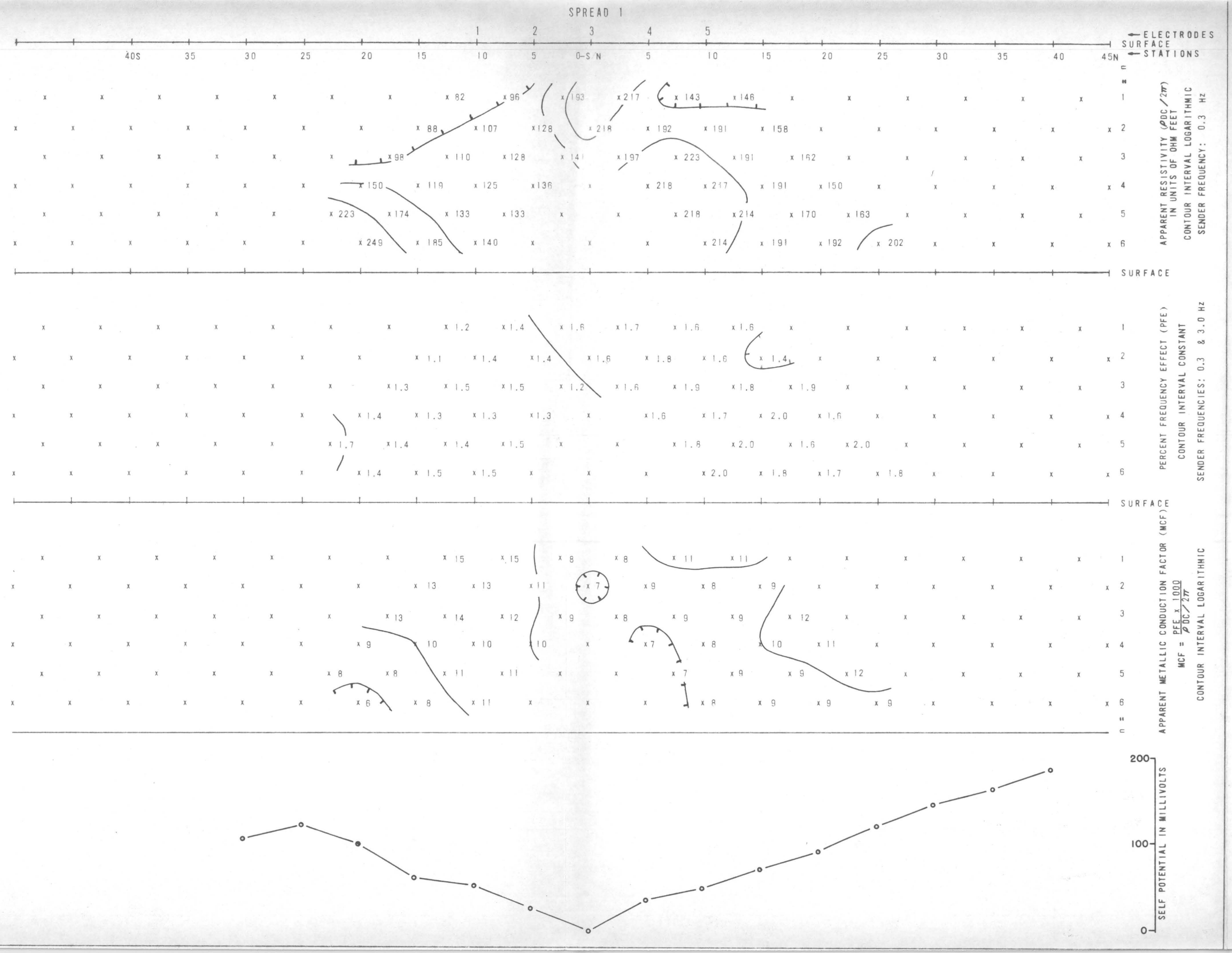

527-70

LINE NO.
8
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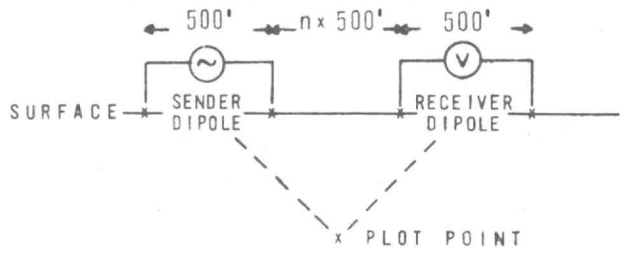

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LINE NO.
9
SPREAD(S)
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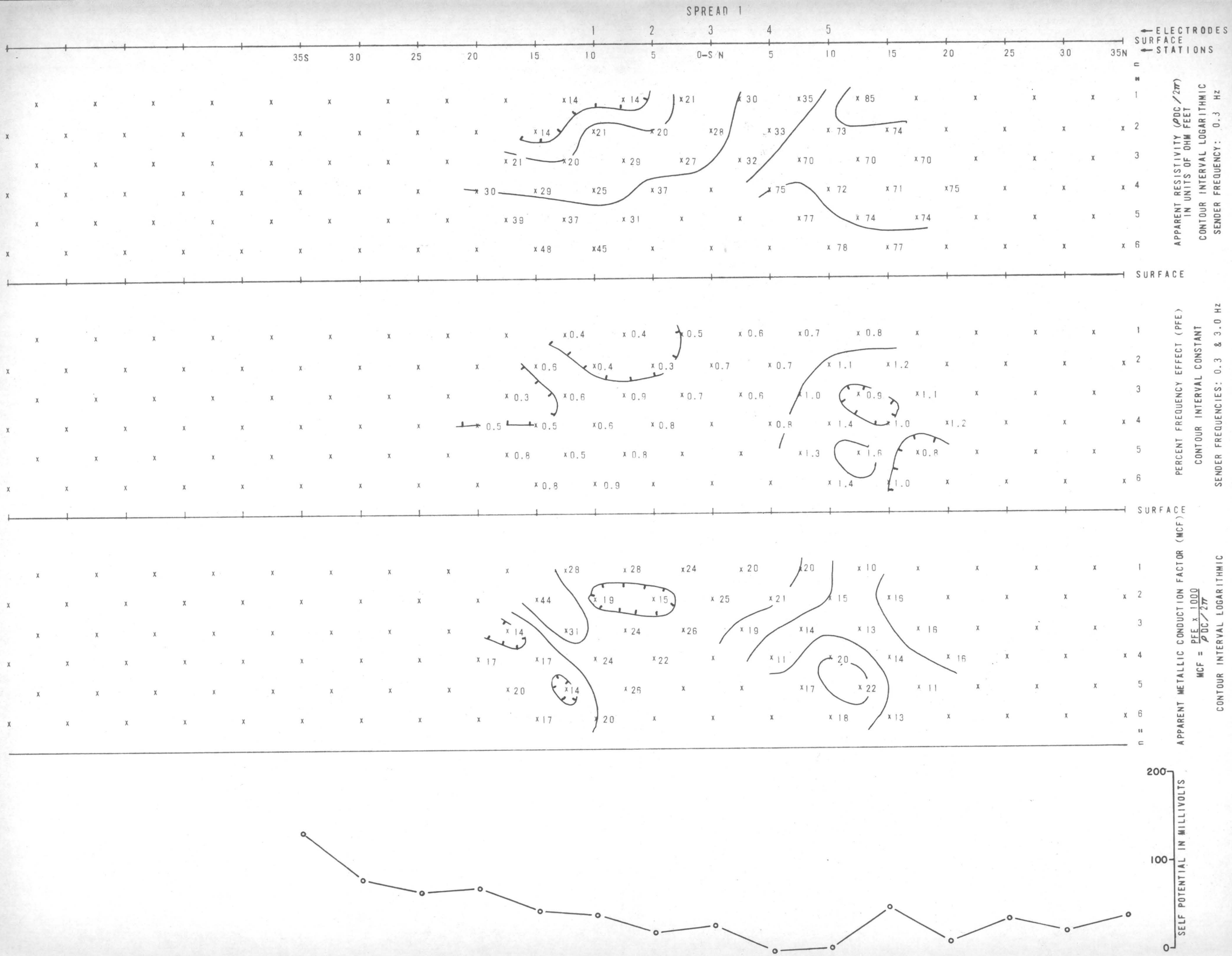

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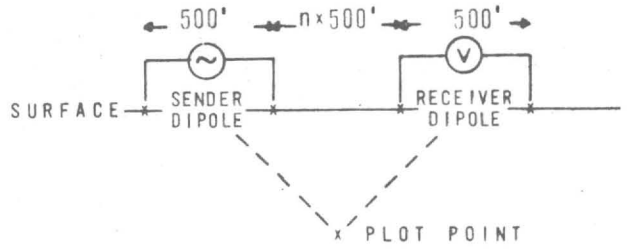

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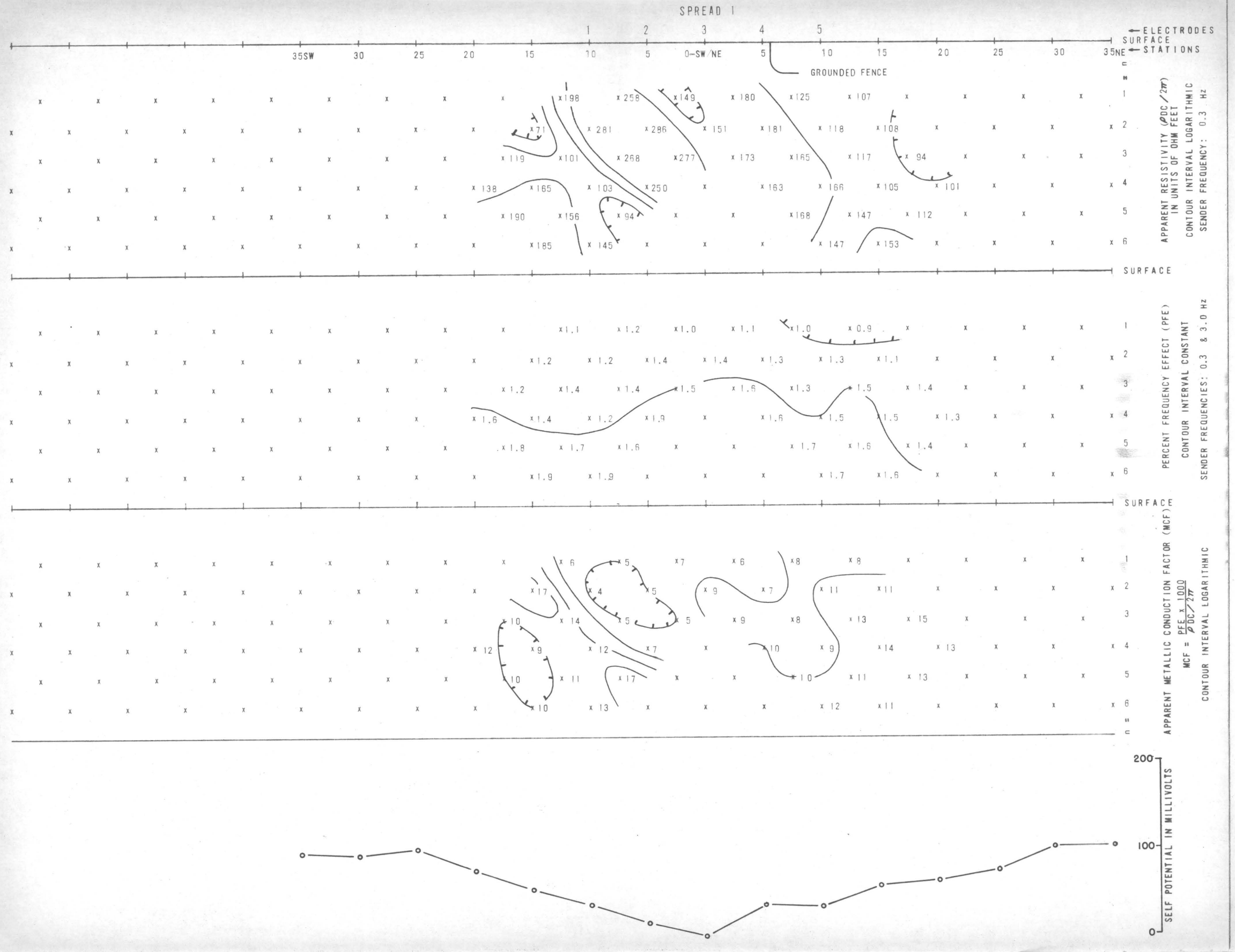


527-70

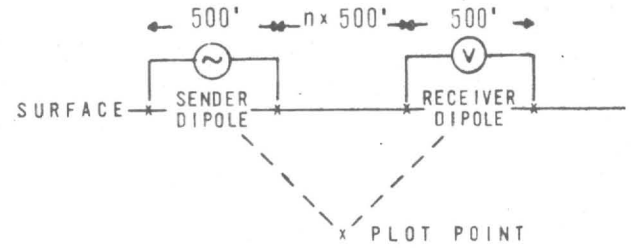
LINE NO.
10
SPREAD(S)
I

INDUCED POLARIZATION TRAVERSE SECTIONAL DATA SHEET for

GEOCHEMICAL SURVEYS, INC.

RELATIVE ANOMALY STRENGTH

DIPOLE DIPOLE ELECTRODE ARRAY



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AUGUST 1970

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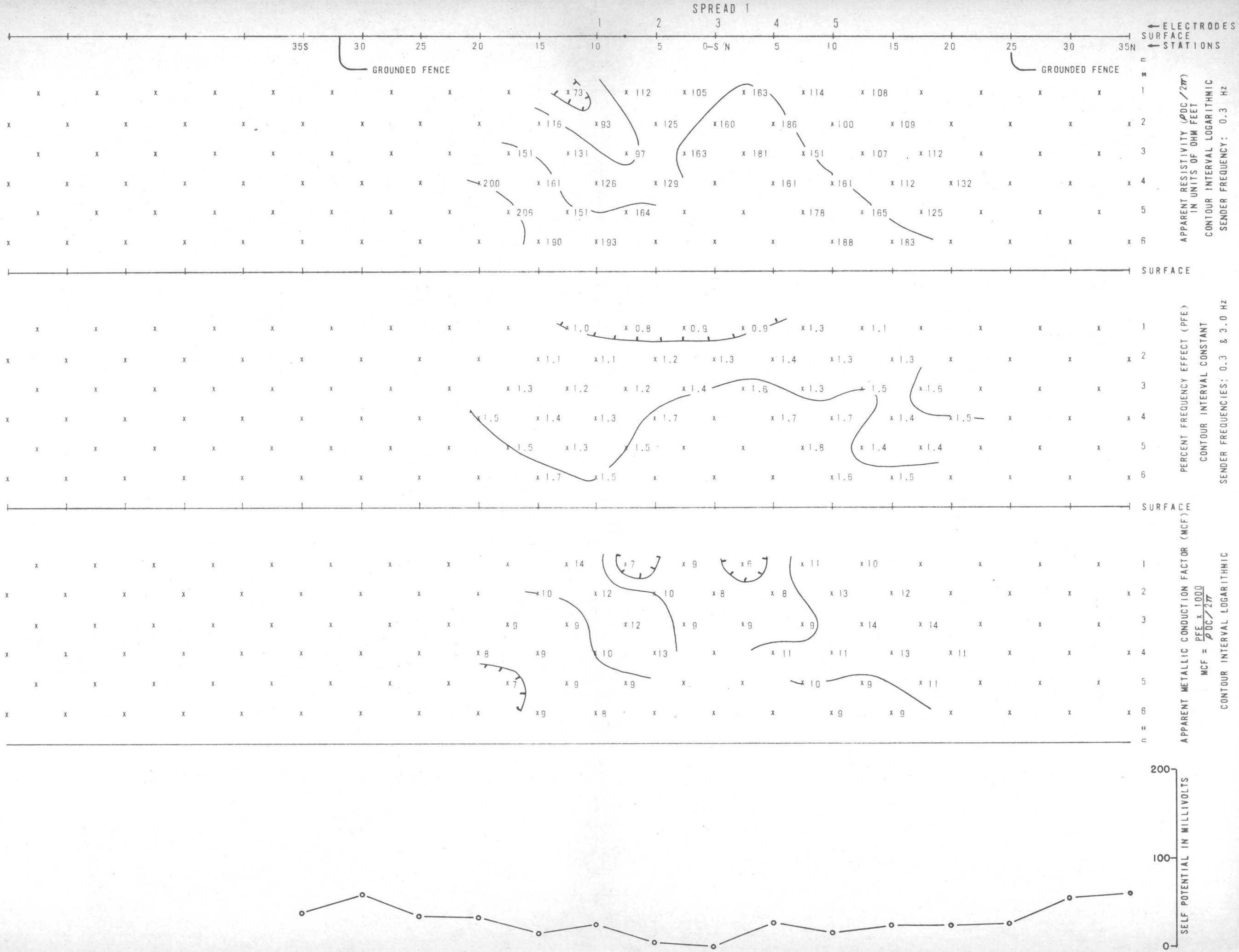
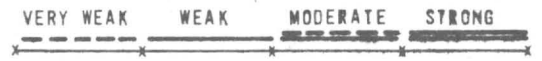
LINE NO. II

SPREAD(S) I



INDUCED POLARIZATION TRAVERSE SECTIONAL DATA SHEET for GEOCHEMICAL SURVEYS, INC.

RELATIVE ANOMALY STRENGTH



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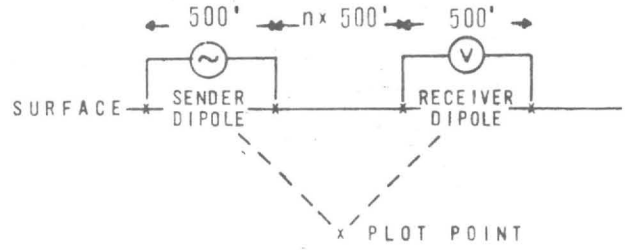

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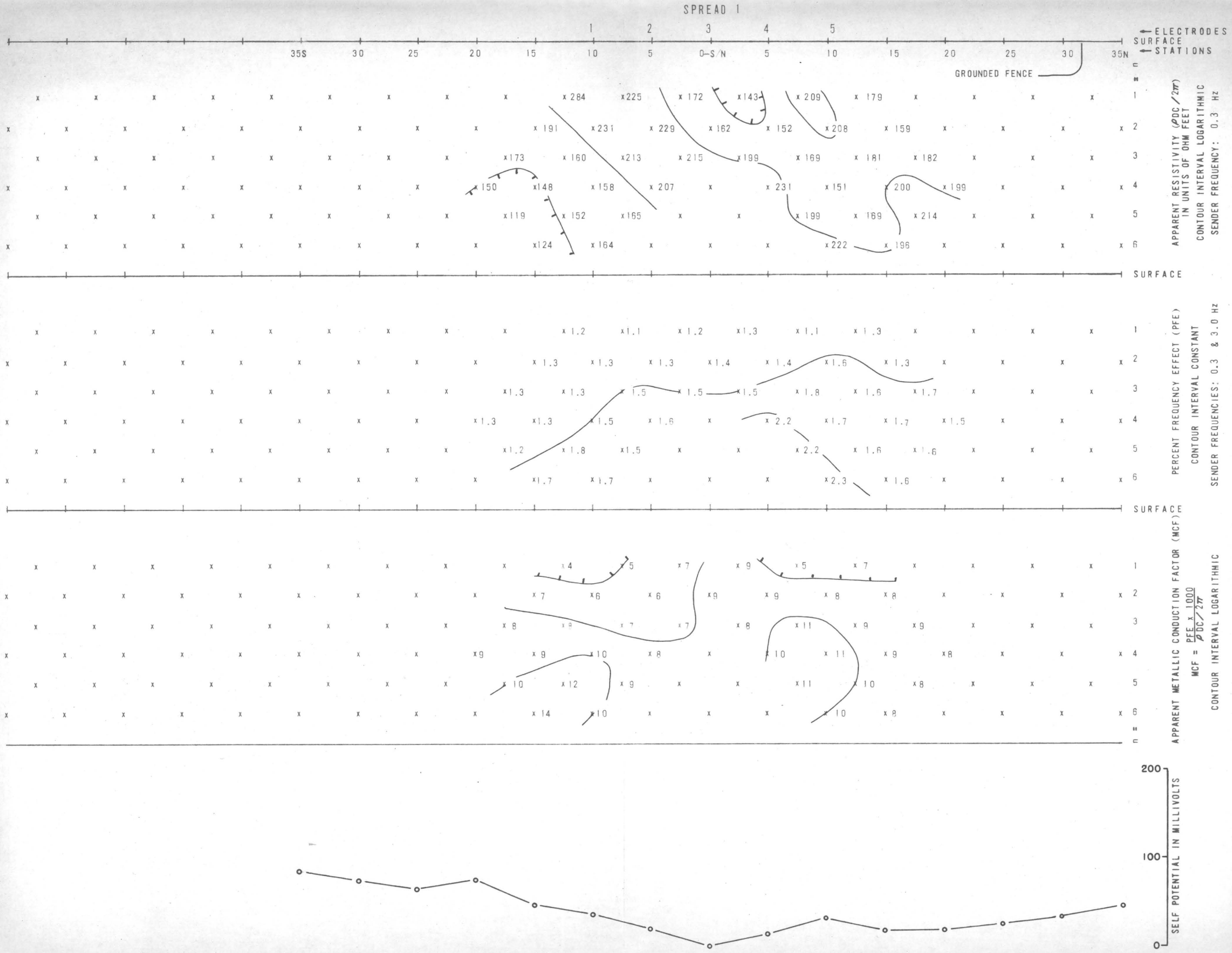
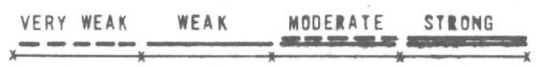
LINE NO.
12
SPREAD(S)
1

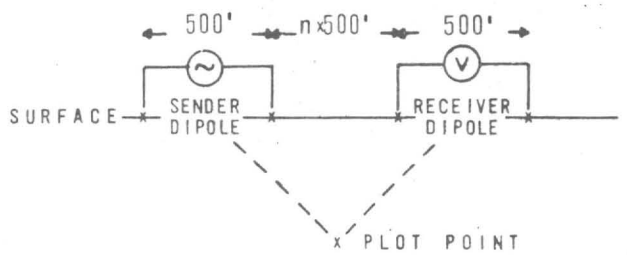
INDUCED POLARIZATION TRAVERSE SECTIONAL DATA SHEET for GEOCHEMICAL SURVEYS, INC



RELATIVE ANOMALY STRENGTH



DIPOLE DIPOLE ELECTRODE ARRAY



AREA
GENERAL GRANT

LOOKING
N 78° W

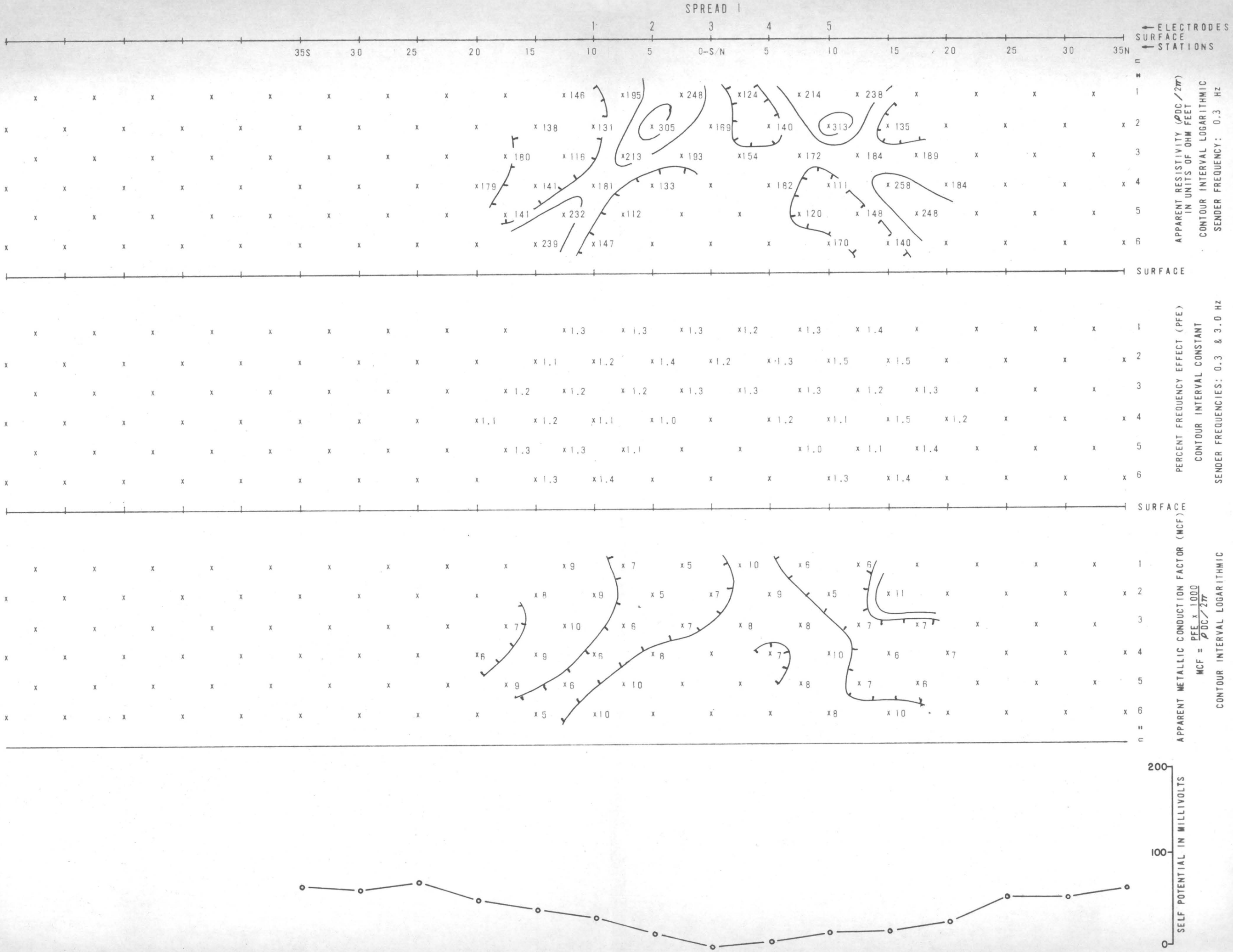
DATE
AUGUST 1970

HEINRICHS
GEOEXPLORATION COMPANY
GEOPHYSICAL ENGINEERS
AUSTRALIA
(SYDNEY)
39 Hume Street
Crows Nest, NSW
Phone: 439-1793
U.S.A.
Post Office Box 5964
Tucson, Arizona 85703
Phone: (602) 623-0578
Cable: GEOEX, Tucson

527-70

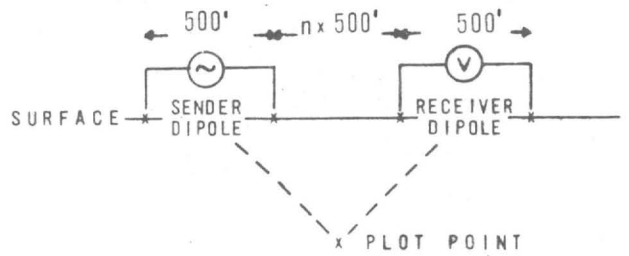
LINE NO.
13
SPREAD(S)
1

INDUCED POLARIZATION TRAVERSE SECTIONAL DATA SHEET for GEOCHEMICAL SURVEYS, INC.



RELATIVE ANOMALY STRENGTH

DIPOLE DIPOLE ELECTRODE ARRAY



AREA

GENERAL GRANT

LOOKING

WEST

DATE

AUGUST 1970

HEINRICHS
GEOEXPLORATION COMPANY
GEOPHYSICAL ENGINEERS

AUSTRALIA
(SYDNEY)
39 Hume Street
Crows Nest, NSW
Phone: 439-1793

U.S.A.
Post Office Box 5964
Tucson, Arizona 85703
Phone: (602) 623-0578
Cable: GEOEX, Tucson

INDUCED POLARIZATION SURVEY

IN THE

GENERAL GRANT AREA

NEAR

WICKENBURG, MARICOPA COUNTY

ARIZONA

FOR

GEOCHEMICAL SURVEYS, INC.

AUGUST 1970

BY

HEINRICHS GEOEXPLORATION COMPANY
P.O. BOX 5964, TUCSON, ARIZONA 85703
Tel: 623-0578

GEOEX Job # 527

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Line 8

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Line 10

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Line 12

Line 13

In Map Pocket:

Induced Polarization Location and Interpretation Plan

INTRODUCTION

At the request of Mr. W.R. Ransone of Geochemical Surveys, Inc., Heinrichs GEOEXploration Company conducted a reconnaissance induced polarization survey over portions of the General Grant Area near Wickenburg, Maricopa County, Arizona. The field work was done in the interim July 30 to August 14, 1970.

A total of 13 lines were completed all on 500 foot dipole spacings and at various orientations. See the accompanying plan for details of location.

The dual frequency induced polarization system was employed with sending frequencies of 0.3 and 3.0 Hz. The collinear dipole-dipole electrode configuration was used which on a 500 foot dipole spacing typically gives resolvable penetration within the zone from about 150 to 600 or so feet below surface. Equipment used was a GEOEX MK-4C receiver and a GEOEX MK-7 sender.

The purpose of this survey was to search for sulfide mineralization at depth possibly related to geochemical copper and molybdenum anomalies located by Geochemical Surveys, Inc. in an area of numerous copper oxide showings. Rock types involved are Laramide (?) granitics intrusive into Precambrian schists and gneisses with some extrusive and intrusive Tertiary volcanics.

Data are presented on Sectional Data Sheets, one for each line, showing resistivity, percent frequency effect (PFE) and metallic conduction factor (MCF) contoured in section and self potential (SP) in profile form. An Induced Polarization Location and Interpretation Plan is also included which shows the line locations and surface projected anomalism interpretation relative to geochemical copper and molybdenum anomalism and roads and section corners.

GEOEX personnel involved in the field work were W. Freeman, Geophysicist-Crew Chief, S. Cruze and A. Wilder, technical assistants. Compilation, interpretation and report by C. Ludwig, Senior Geophysicist, with the assistance of the Tucson staff.

CONCLUSIONS AND RECOMMENDATIONS

No definite, obviously sulfide related, anomalous induced polarization response was noted on any of the thirteen lines. There are several areas of higher background response which are probably only rock type effects and not actually related to significant increases in sulfide mineralization. A zone of very weak questionable anomalism is noted on Line 6 but with no support on nearby Lines 5 and 7 and is therefore not felt to be of much significance at this time.

Therefore, at least in the immediate vicinity of the I.P. coverage, down to roughly 600 feet below surface, no geophysically significant concentrations of polarizable sulfides are seen. Apparently the geochemical anomalism is reflecting the minor mineralization noted in small veins throughout the area rather than significant concentrations of copper-molybdenum sulfides at depth. Based on the data available to us, no further geophysical work is recommended in the area unless to test other geologic or geochemical targets, not covered by the subject work of this report.

For the most part, the apparent resistivities are quite high indicating the rather fresh igneous or metamorphic material covered by most of the lines. Several lines show lower near surface resistivities probably reflecting an alluvial cover. Also some of the volcanic rocks crossed show lower resistivities. The self potentials show no significant appearing lows. This suggests the lack of appreciable quantities of near surface, actively oxidizing, relatively interconnected, sulfides in the vicinity of the lines.

INTERPRETATION

Line 1:

Only minor background variation is seen in the induced polarization response. The resistivities on the south half of the line are fairly high and uniform - typical of the granitic rocks involved. The north half of the line, particularly north of about 10N shows rather low near surface resistivities increasing with depth to values similar to those noted on the granite on the south half of the line. The near surface low resistivities are apparently caused by several hundred feet of overlying alluvium or other relatively conductive material. No significant appearing self potentials are seen.

Line 2: (Spreads 1 and 2):

Only background induced polarization response is noted. The highest resistivity material has the highest background response - as is typical in crystalline rocks. The apparent resistivity is generally quite high but variable, probably as a result of crossing several rock types (granites and volcanics),plus the effect of washes and topographic variations. A narrow, pronounced resistivity low noted near 10E is likely due to a small block of conductive volcanics. No significant appearing self potential lows are seen. A zone of erratic self potential near 70W is probably due to the effects of topographic variations and rock type changes.

Line 3:

No significant induced polarization effects are noted. Higher PFEs on the south end of the line relate to very high apparent resistivities and are probably not of significance. The MCFs are unusually low and uniform. The apparent resistivities are quite high throughout the lines, typical of granite, and show a minor increase with depth perhaps caused by decreased weathering with depth. The self potentials show only minor background variations.

Line 4:

Only background induced polarization effects are seen. The resistivities are again quite high and increase slightly with depth. The line is mostly on granitic rocks. A sharp low pointing towards station 27.5W may be reflecting a sharp canyon and a rock type change to volcanics. No significant self potential lows are noted.

Line 5:

Only low background induced polarization effects are evident. The resistivities show a zone of relatively conductive near surface material thickening to the south and overlying higher resistivity material. This line is apparently within the metamorphics as mapped but the resistivities suggest that several materials of differing conductivity or possibly variable weathering effects are involved. No significant self potential effects are seen.

Line 6:

The north half of this line has slightly higher than usual background PFEs and therefore has been interpreted as very weak strength questionable induced polarization anomalism. This possibly anomalous zone is mainly north of 10N and goes to at least 20N to the north. The PFE pattern suggests a deep source, say 500 feet or more below surface. In that the MCFs are quite low over this zone and that the zone is mostly outside nearby geochemical anomalism it is not considered to be indicative of significant quantities of sulfide. Also, there is no correlating anomalous response on the nearby Lines 5 and 7.

The rest of the line shows only low background induced polarization effects. Resistivities are somewhat erratic but generally high. Some increase with depth is also noted in the resistivities which may be due to minor alluvial zones or increased near surface weathering. No significant appearing self potentials were noted.

Line 7:

No anomalous induced polarization response is noted. The resistivity is quite high on the west half of the line. A pronounced apparent resistivity low near 2.5E is probably the result of the array straddling a conductive block of volcanics as indicated on the geologic map. The self potentials show no significant appearing variations.

Line 8:

Very uniform and low background induced polarization is noted. The resistivity is fairly uniform but minor variations may be reflecting the granite-gneiss contact that the line sub-parallels on its south end. No anomalous self potentials are seen.

Line 9:

Very low background induced polarization response is evident. The resistivities are much lower than usual and show a pronounced increase with depth particularly on the south half of the line - perhaps due to a several hundred foot thick section of alluvium and relatively conductive metamorphics at depth. The self potentials show only minor background variations.

Line 10:

Quite uniform and low induced polarization response is seen on this line. The resistivities are fairly high but erratic. The zone of volcanics the line is centered on is not obvious on the resistivities. No anomalous self potentials are seen.

Line 11:

Again only low background induced polarization response is noted. The resistivities are quite uniform except for a minor increase with depth and a small near surface low near 15S. The self potentials are quite flat.

Line 12:

Again only background induced polarization effects are evident on the line. The resistivities decrease somewhat to the south but are generally high. No anomalous self potentials are seen.

Line 13:

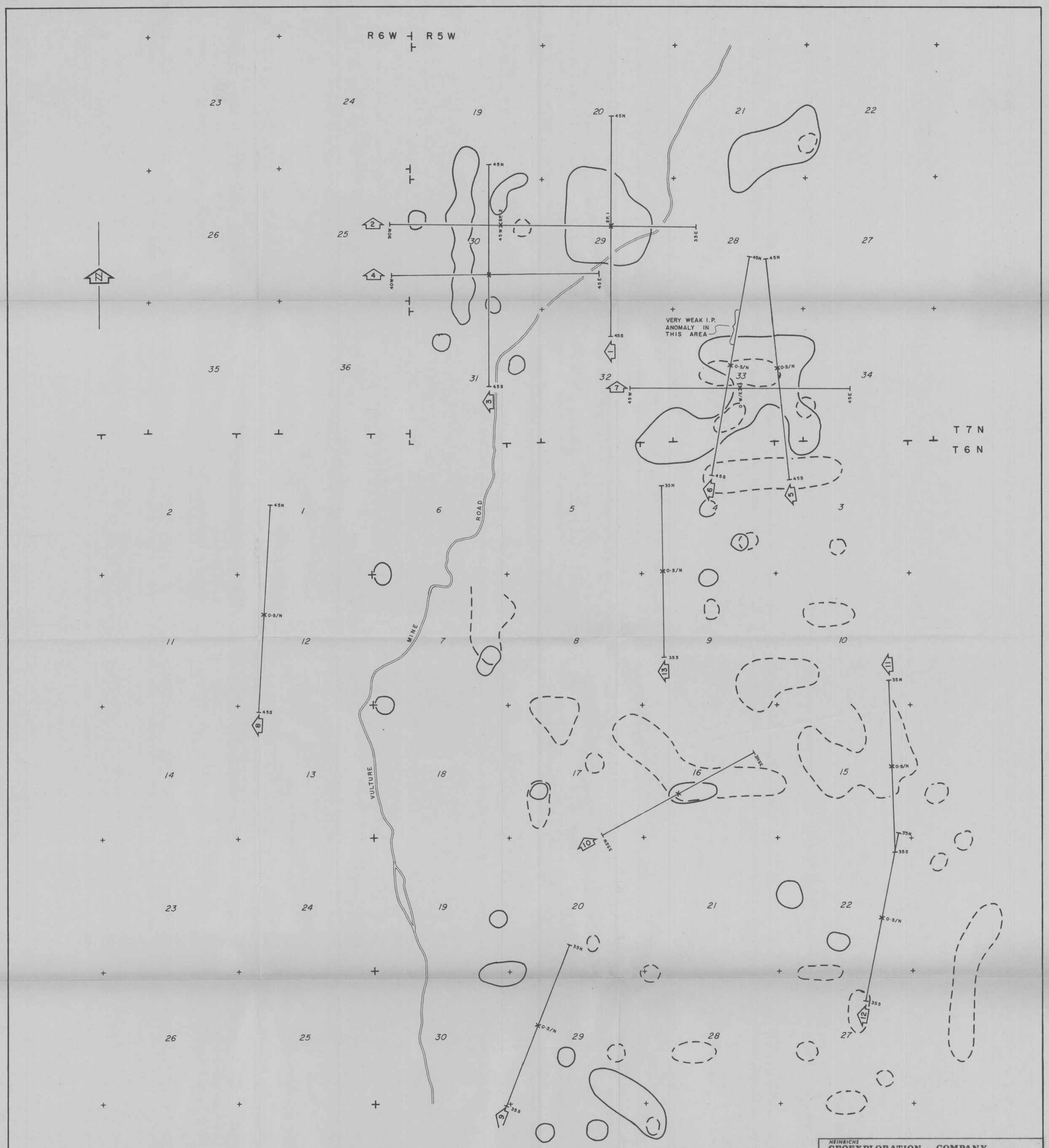
Extremely uniform PFEs are seen with typical background strength. The resistivities are fairly high but erratic probably due to the effect of approximately running along the volcanic-metamorphic contact. The self potentials are quite uninteresting.

Respectfully submitted:
HEINRICHS GEOEXPLORATION COMPANY

Chris S. Ludwig

Chris S. Ludwig
Senior Geophysicist

Approved By: _____
Walter Heinrichs, Jr.
President

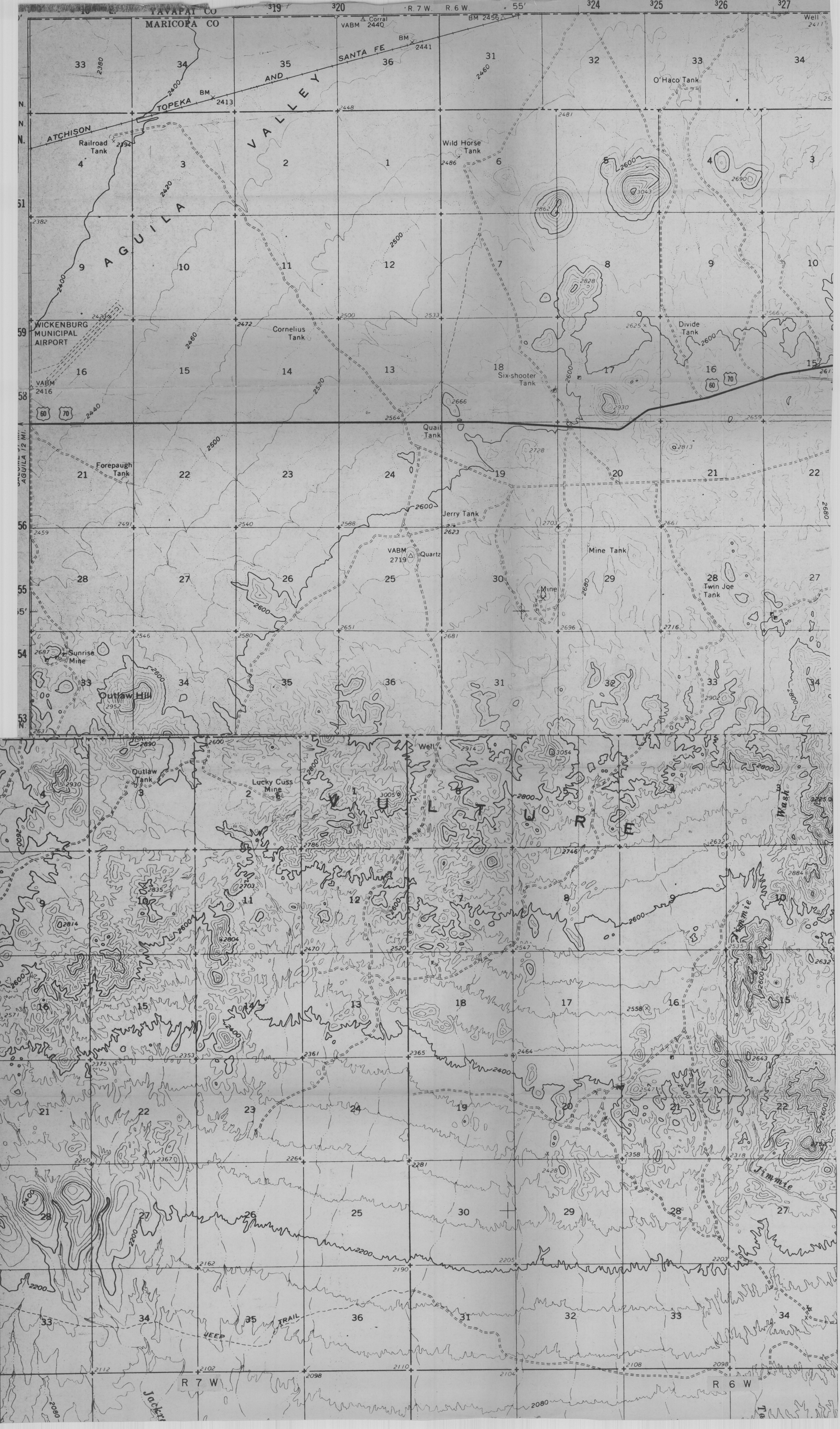


HEINRICHS
GEOEXPLORATION COMPANY
geophysical engineers
POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
Phone: 602/623-0578 Cable: GEOEX, Tucson
vancouver
sydney

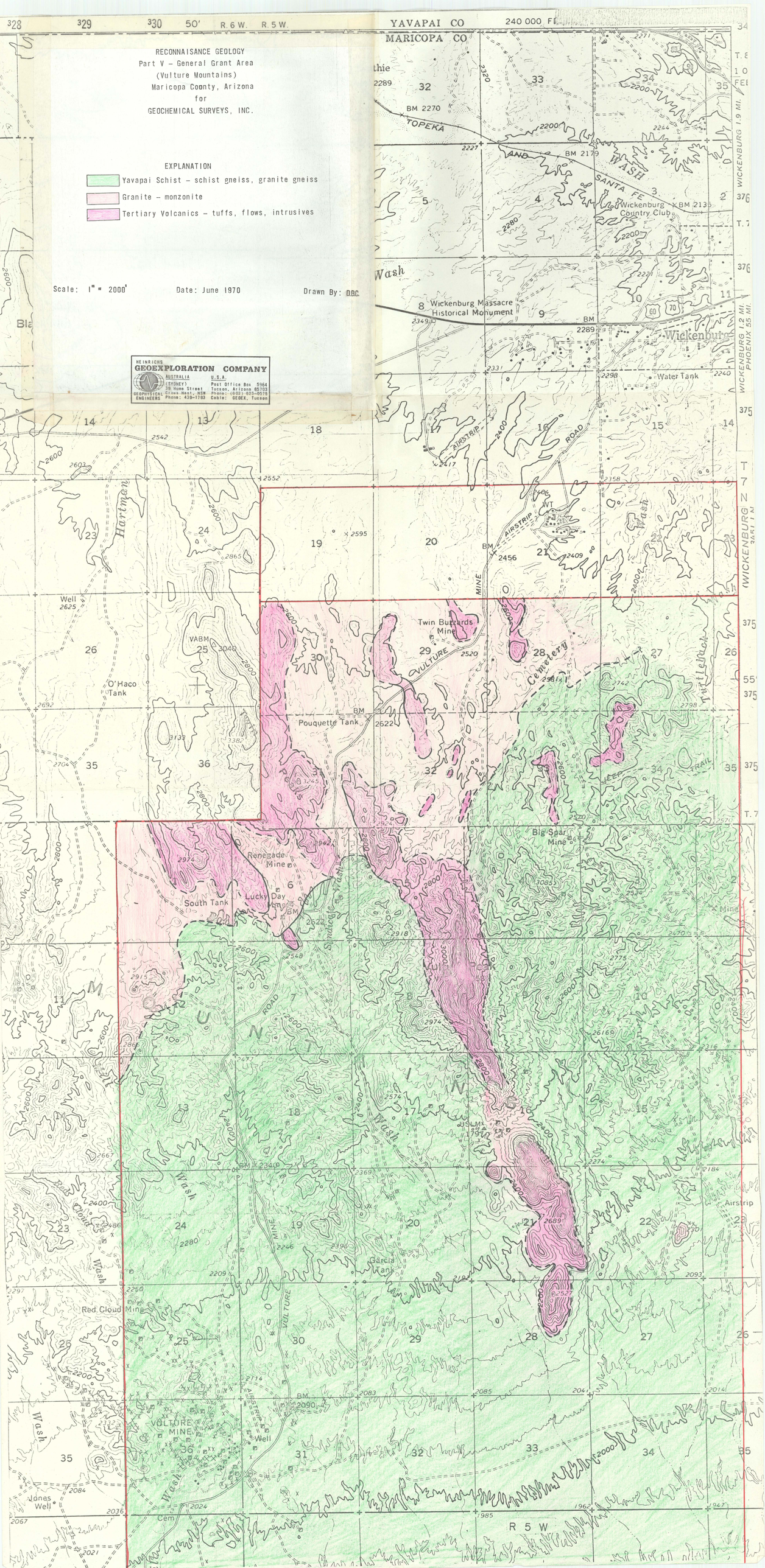
INDUCED POLARIZATION LOCATION AND INTERPRETATION PLAN
GENERAL GRANT AREA
MARICOPA CO., ARIZONA

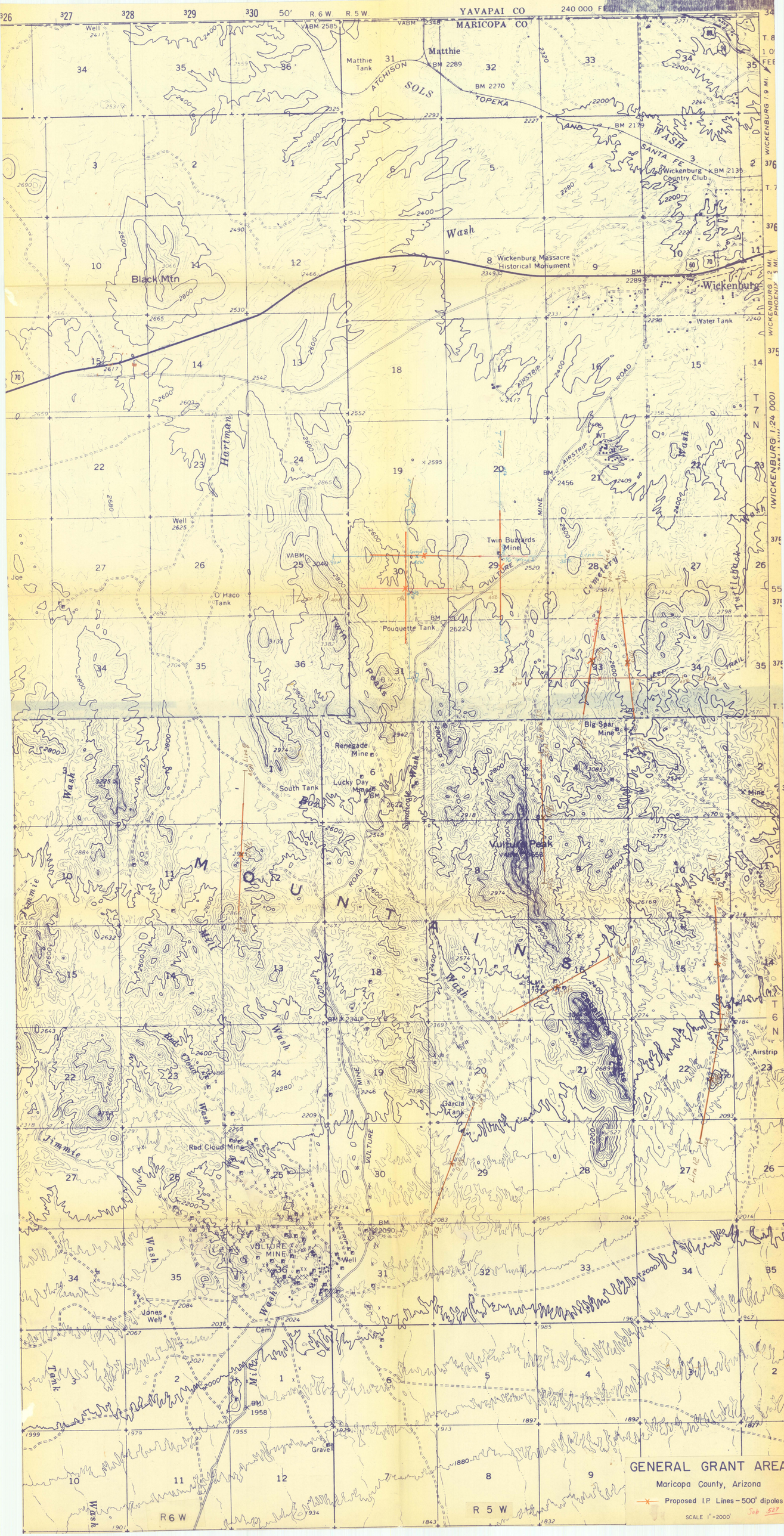
FOR
GEOCHEMICAL SURVEYS, INC.

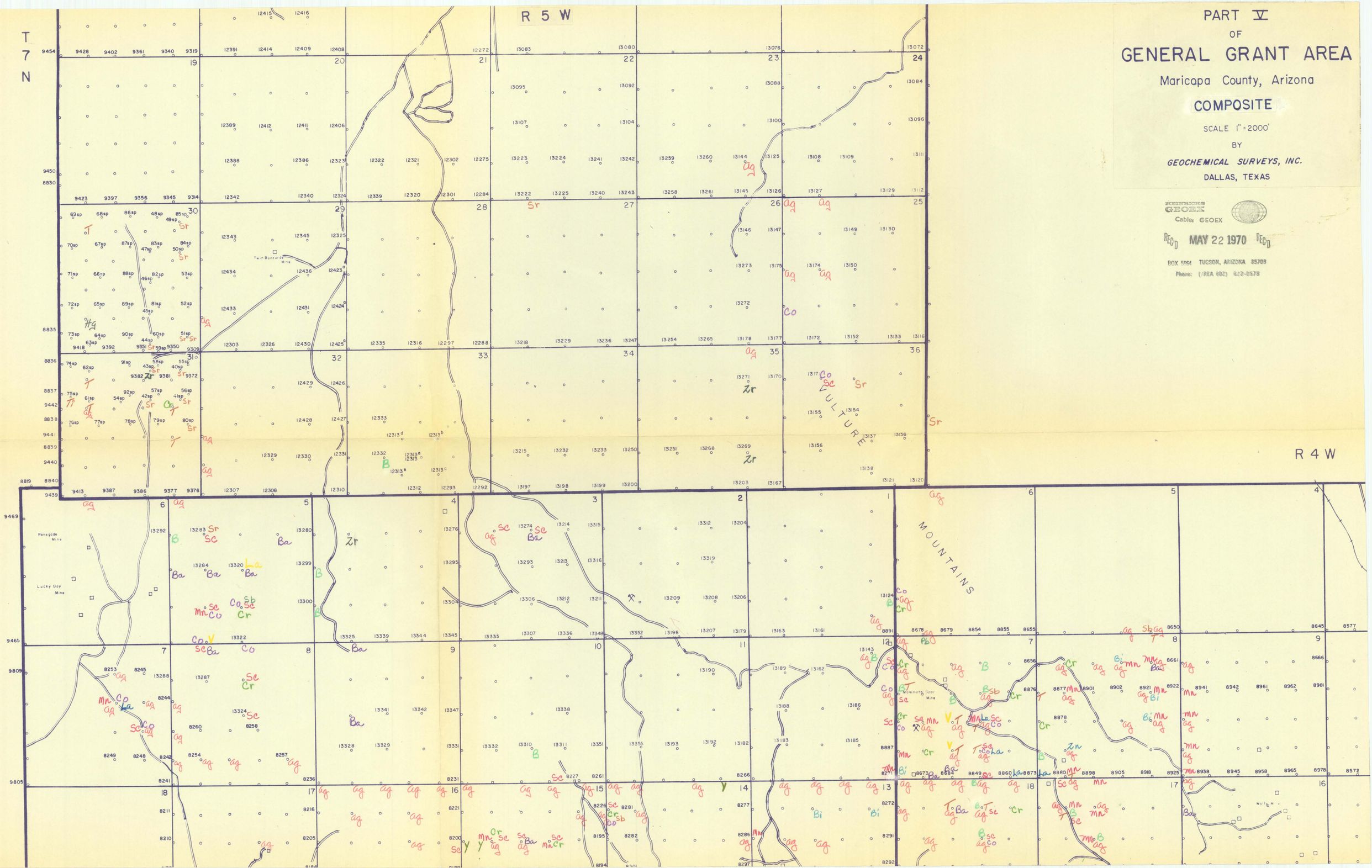
SCALE: 1 : 24 000 | DRAWN BY: JAY DOWNS | DATE: AUG 1970


YAVAPAI CO
MARICOPA CO
R. 7 W.
R. 6 W.
SANTA FE
AND
TOPEKA
ATCHISON
AGUILA VALLEY
Corral
VABM 2440
BM 2456
BM 2441
BM 2413
Railroad Tank
O'Haco Tank
Wild Horse Tank
WICKENBURG MUNICIPAL AIRPORT
VABM 2416
Cornelius Tank
Six-shooter Tank
Divide Tank
Quail Tank
Forepaugh Tank
Jerry Tank
VABM 2719
Quartz
Mine Tank
Twin Joe Tank
Sunrise Mine
Outlaw Hill
Outlaw Tank
Lucky Cuss Mine
VULTURE
Jimmie
Jackrabbit
JEEP TRAIL
AGUILA 12 MI.

Twin Peaks Mill - Renegade Pros. Area
Maricopa County, Arizona
1" = 2000'


RECONNAISANCE GEOLOGY
Part V – General Grant Area
(Vulture Mountains)
Maricopa County, Arizona
for
GEOCHEMICAL SURVEYS, INC.
EXPLANATION
Yavapai Schist – schist gneiss, granite gneiss
Granite – monzonite
Tertiary Volcanics – tuffs, flows, intrusives
Scale: 1" = 2000'
Date: June 1970
Drawn By: DBC
HEINRICHS GEOEXPLORATION COMPANY
AUSTRALIA (SYDNEY) 38 Hume Street Crows Nest, NSW Phone: 439-1783
U.S.A. Post Office Box 5964 Tucson, Arizona 85703 Phone: (602) 623-0578 Cable: GEOEX, Tucson
GEOPHYSICAL ENGINEERS
YAVAPAI CO
MARICOPA CO
240 000 FT
R 6 W
R 5 W
T 7 N
Wickenburg Massacre Historical Monument
Wickenburg Country Club
Wickenburg
Water Tank
Twin Buzzards Mine
Pouquette Tank
O'Haco Tank
Renegade Mine
Lucky Day Mine
South Tank
Big Spar Mine
Garcia Tank
Red Cloud Mine
VULTURE MINE
Jones Well
Airstrip
Cemetery
Hartman Wash
Turtleback Wash
Sandicate Trail
Vulture Wash
Red Cloud Wash
Jones Wash
WICKENBURG 1.9 MI.
WICKENBURG 1.2 MI.
PHOENIX 55 MI.


YAVAPAI CO
MARICOPA CO
240 000 FEET
R 6 W
R 5 W
Matthie
Matthie Tank
ATCHISON
TOPEKA
AND
SANTA FE
SOLS
WASH
Wickenburg Country Club
Wickenburg Massacre Historical Monument
Wickenburg
Water Tank
Black Mtn
Wash
Hartman
Airstrip
Road
Mine
Twin Buzzards Mine
Vulture
Cemetery
Pouquette Tank
O'Haco Tank
Renegade Mine
South Tank
Lucky Day Mine
Big Spar Mine
Vulture Peak
MOUNTAINS
Red Cloud Wash
Red Cloud Mine
Garcia Tank
Airstrip
VULTURE MINE
Jones Well
Cem
Grave
WICKENBURG (1:24 000)
WICKENBURG 1.9 MI.
WICKENBURG 1.2 MI.
PHOENIX 5 MI.
GENERAL GRANT AREA
Maricopa County, Arizona
Proposed I.P. Lines – 500' dipoles
SCALE 1" = 2000'



PART V
OF
GENERAL GRANT AREA
Maricopa County, Arizona

COMPOSITE

SCALE 1" = 2000'

BY

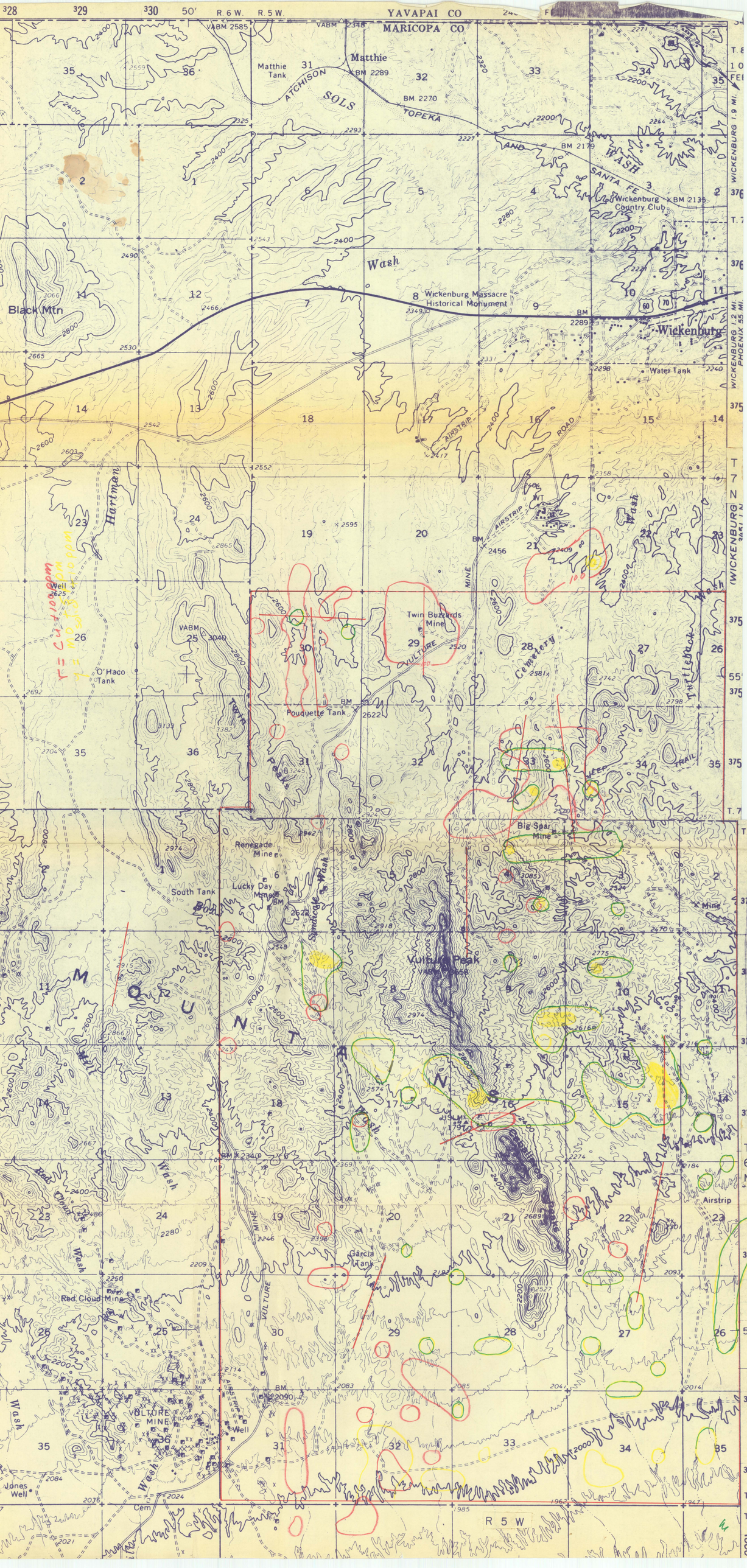
GEOCHEMICAL SURVEYS, INC.

DALLAS, TEXAS

INTERNATIONAL GEOEX
Cable: GEOEX

RECD MAY 22 1970 RECD

BOX 5964 TUCSON, ARIZONA 85703
Phone: (AREA 602) 622-0578


YAVAPAI CO
MARICOPA CO
R 6 W. R 5 W.
Matthie Tank
Matthie
ATCHISON TOPEKA AND SANTA FE
SOLS WASH
Wickenburg Country Club
Wash
Black Mtn
Wickenburg Massacre Historical Monument
Wickenburg
Water Tank
AIRSTRIP
ROAD
Hartman
Well
O'Haco Tank
Twin Buzzards Mine
VULTURE MINE
Cemetery
Pouquette Tank
Tiger
Turtleback Wash
Big Spar Mine
Renegade Mine
Lucky Day Mine
South Tank
Sandcage Wash
Vulture Peak
MOUNTAINS
Red Cloud Wash
Garcia Tank
Red Cloud Mine
VULTURE MINE
Jones Well
Cem
Airstrip
R 5 W

Don Goley-

RECEIVED FROM GEOCHEMICAL SURVEYS (Received May 14, 1970)
P.O. BOX 19508
DALLAS, TEXAS 75219

Blue line of Twin Peaks Mill - Renegade Pros. Areas (2 each)
Maricopa County, Arizona
1" = 2000'

U.S. Department of the Interior
Geological Survey maps of:

Wickenburg, Ariz. (2 each)
N3352.5 - W11237.5/7.5
1964

AMS 3451 1 NW - SERIES V898

and

U.S. Department of the Interior
Geological Survey maps of:

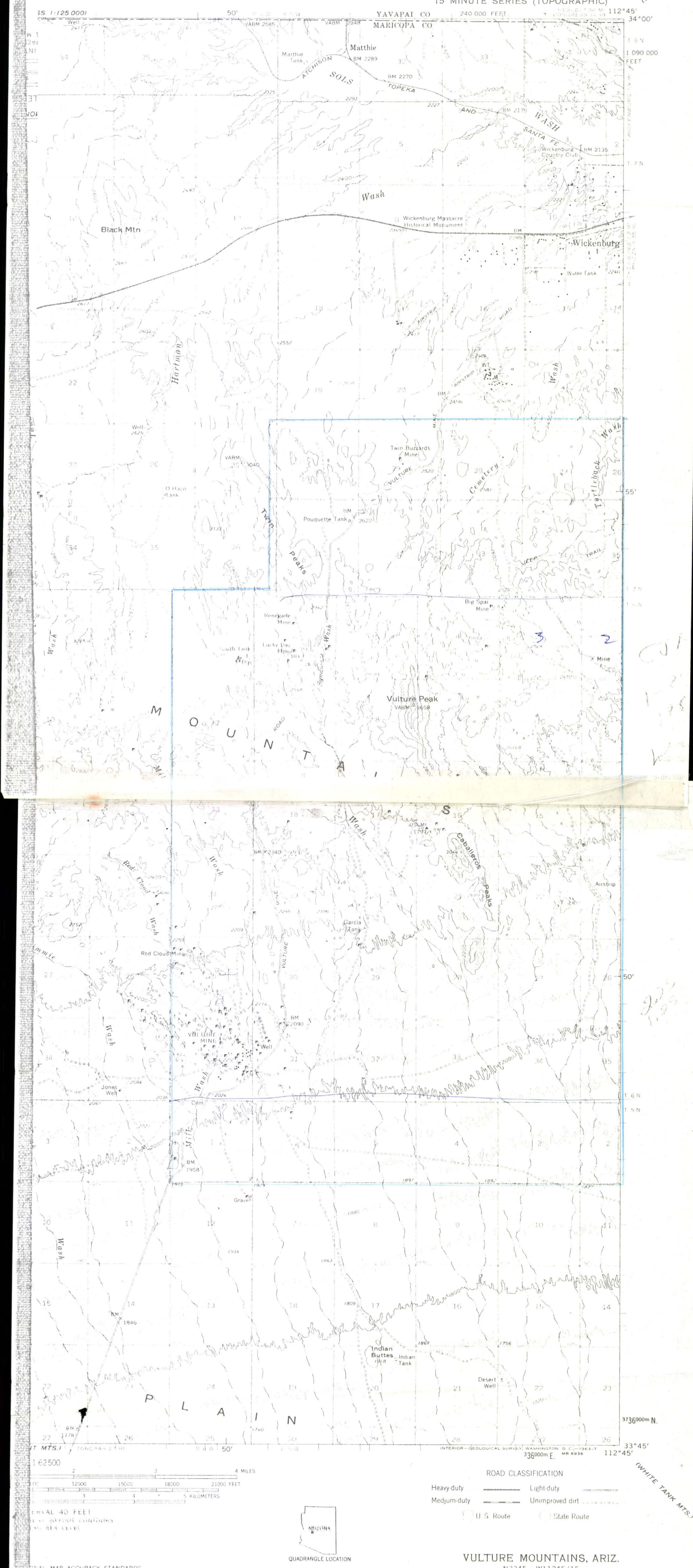
Wickenburg SW, Ariz. (2 each)
N3345-W11237.5/7.5
1965

AMS 3451 1 SW - SERIES V898

RECEIVED FROM: GEOCHEMICA,LSURVEYS

VULTURE MOUNTAINS QUADRANGLE
ARIZONA
15 MINUTE SERIES (TOPOGRAPHIC)

(WAGONER)



1:62500

2 3 4 MILES

12000 15000 18000 21000 FEET

3 4 5 KILOMETERS

ROAD CLASSIFICATION

Heavy-duty — Light-duty

Medium-duty — Unimproved dirt

U. S. Route — State Route

QUADRANGLE LOCATION

ARIZONA

VULTURE MOUNTAINS, ARIZ.
N3345—W11245/15

1961

NAL MAP ACCURACY STANDARDS
VER 25, COLORADO OR WASHINGTON 25, D. C.
S AND SYMBOLS IS AVAILABLE ON REQUEST

CJN
1:20,000

GEOCHEMICAL SURVEYS, INC.
2505 TURTLE CREEK BOULEVARD
DALLAS, TEXAS 75219

MAILING ADDRESS
P. O. BOX 19508

TELEPHONE
521-5145

May 20, 1970

HEINRICHS
GEOEX
Cable: GEOEX

REC'D MAY 22 1970 REC'D

BOX 5964 TUCSON, ARIZONA 85703
Phone: (AREA 602) 623-0578

Mr. Don Cooley
Heinrichs Geoexploration Company
P. O. Box 5671
Tucson, Arizona 85703

Dear Don:

Attached you will find geochemical maps for copper, molybdenum and other minerals for portions of Townships 6 and 7 North, Ranges 4 and 5 West, Maricopa County, Arizona. I have also attached a copy of analytical data sheets covering most of the deeper samples taken in Sections 30 and 31, T7N, R5W. You will note that one to seven samples were taken at each location, the depth of each sample is shown. There are three or four samples missing but I do not think these will affect your decision in this particular area. You will note that I have shown the outline of the claims under our control in what we call the Renegade Prospect, Section 30, T7N, R5W.

These data should allow you to complete your report. If there is additional information you require, please let me know.

Sincerely,

GEOCHEMICAL SURVEYS, INC.

I. C. Stone

I. C. Stone

ICS:bkc

Attachments

Weighed by Blanchard Run by J. Stringer Read by Bruington

Film No. 6823B #2 GEOCHEMICAL SURVEYS SPECTROGRAPHIC ANALYSIS PROSPECT Renegade General Grant

Date 5-19-70 COUNTY, STATE Maricopa, Arizona

PAGE 2

Rack 9	Sample No.		Cd	Cu	Zr	Ag	La	Zn	Sc	Co	Sr	As	Sb	W	Fe
			PARTS PER MILLION												
10		Res.		75											
11	F-65	58'	<50	350	100	<.5	20	<200	<5	<5	200	<200	<100	<50	20,000
12	F-65	68'		350	100		20	200			500				20,000
13	G-65	78'		2,000	100		20	350			150				20,000
14	A-66	18'		350	75		20	200			1000				20,000
15	A-68	18'		200	100	.5	20	<200	10	15	350				20,000
16	B-68	28'		150	75	.5	20		10	15	200				20,000
17	C-68	38'		350	75	<.5	<20		<5	<5	150				20,000
18	A-79	18'		100	100		20		<5	10	200				20,000
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20	C-79	38'		50	75		20		5	<5	350				20,000
21	D-79	48'		75	100		20		7	15	200				20,000
22	A-81	11'		15	200	.5	20		5	5	200				20,000
23	A-82	18'		10	150	.5	35		10	15	500				35,000
24	B-82	18'		10	100	<.5	<20		<5	<5	200				20,000
25	A-83	18'		100	150	<.5	20		7	7	200				20,000
26	B-83	24'		50	150	.5	35	200	15	20	350				35,000
27	A-84	18'		150	50	<.5	<20	<200	<5	<5	200				20,000
28	B-84	28'		75	75		<20		<5	<5	150				20,000
29	A-85	18'		100	50		20		<5	<5	200				20,000
30	B-85	28'		35	75		20		5	5	350				20,000
31	C-85	38'		75	50		<20		<5	<5	150				20,000
32	A-86	18'		50	150		20		5	7	200				20,000
33	B-86	28'		20	50		<20		<5	<5	350				20,000

Film No. 6823C

Date 5-19-70

GEOCHEMICAL SURVEYS
SPECTROGRAPHIC ANALYSIS

PROSPECT Renegade General Grant

COUNTY, STATE Maricopa, Arizona

#2

PAGE 1

Rack 9	Sample No.	Fe	PPB Hg	PARTS PER MILLION Ba	B	Au	Pb	Bi	Ga	Mn	Cr	Ni	V	Be	Ti	Mo	Sn	Y
10		Ref																
11	C-86	✓	18	750	<10	<10	20	<10	35	350	50	15	75	1	1500	<2	<10	20
12	D-86	✓	52	500			15		15	200	35	7	35	<1	1000			10
13	A-87	✓	18	750			100		35	500	50	10	50	1	2000			20
14	B-87	✓	36	500			15		35	200	50	15	50	<1	2000			20
15	C-87	✓	52	500			15		20	350	50	10	50	<1	2000			15
16	D-87	✓	18	200			15		15	200	20	10	50	1	2000			15
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20	A-88	✓	36	200			75		20	350	35	7	35	1	1500			15
21	A-89	✓	18	350			10		35	350	50	20	75	1	3500	7		35
22	B-89	✓	18	500			10		35	350	35	20	75	1	3000	5		35
23	C-89	✓	36	350			15		20	200	35	10	50	<1	2000	<2		15
24	A-90	✓	52	500			15		50	200	50	15	50	<1	2000			15
25	B-90	✓	36	500			10		5	200	20	7	50	1	2000			20
26	C-90	✓	36	500			15		20	200	35	15	75	<1	2000			15
27	91	✓	18	350			10		10	200	35	15	75	1	3500			20
28	A-91	✓	36	500			10		20	350	20	15	50	1	3500			20
29	B-91	✓	52	500			10		35	350	35	15	50	1	5000			35
30	C-91	✓	89	200			10		7	200	20	7	35	1	2000			15
31	D-91	✓	18	750			15		20	350	50	20	50	1	3000			20
32	A-92	✓	36	750			15		10	350	50	20	50	1	7500			35
33																		

Weighed by B Blanchard Run by J Stuniga Read by [illegible]

Film No. L833C

Date 5-19-76 #2

GEOCHEMICAL SURVEYS
SPECTROGRAPHIC ANALYSIS

PROSPECT Renegade General Grant

COUNTY, STATE Maricopa, Arizona

PAGE 2

Rack 9	Sample No.		Cd	Cu	Zr	Ag	La	Zn	Sc	Co	Sr	As	Sb	W	Fe		
			PARTS PER MILLION														
10		Ref.		75													
11	C-86	38'	<50	50	150	.5	20	<200	10	10	350	<200	<100	<50	20,000		
12	D-86	48'		35	50	<.5	<20	<200	<5	<5	200				15,000		
13	A-87	18'		500	75	1	20	200	5	10	350				20,000		
14	B-87	22'		5000	150	7	35	350	5	7	350				20,000		
15	C-87	28'		1000	100	<.5	20	200	5	10	350				20,000		
16	D-87	38'		150	75		20	<200	<5	5	200				20,000		
17	E-87	48'		100	75		20		5	10	350				20,000		
18	F-87	58'		75	150		20		<5	5	350				20,000		
19	G-87	68'		75	75		<20		<5	<5	200				20,000		
20	A-88	18'		75	200	.5	<20		5	<5	100				15,000		
21	A-89	18'		2000	200	3	35	350	10	15	350				20,000		
22	B-89	28'		2000	150	2	35	350	10	15	350				35,000		
23	C-89	38'		500	100	.5	20	<200	5	7	200				20,000		
24	A-90	18'		1500	75	.5	20	200	5	10	350				20,000		
25	B-90	28'		850	75	<.5	20	<200	5	<5	350				15,000		
26	C-90	38'		2000	100	1	20	350	5	5	350				20,000		
27	91	13'		1000	100	1	20	200	10	10	200				20,000		
28	A-91	18'		75	100	.5	20	<200	10	7	500				15,000		
29	B-91	28'		50	150	.5	20		7	10	350				20,000		
30	C-91	38'		75	100	<.5	20		5	5	200				20,000		
31	D-91	48'		75	150	.5	20		15	10	500				20,000		
32	A-92	6'		50	200	.5	50		15	10	750				20,000		
															20,000		

HEINRICHS GEOEX
Cable: GEOEX

GEOCHEMICAL SURVEYS
SPECTROGRAPHIC ANALYSIS

REC'D MAY 22 1970 REC'D

BOX 5964 TUCSON, ARIZONA 85703
Phone: (AREA 602) 623-0578

Film No. 6823A

Date 5-19-70

PROSPECT Renegade General Grant

COUNTY, STATE Maricopa, Arizona

All

5-20-70.

PAGE 1

Rack	Sample No.	Fe	PPB Hg	Ba	B	Au	Pb	Bi	Ga	Mn	Cr	Ni	V	Be	Ti	Mo	Sn	Y
			PARTS PER MILLION															
9																		
10		Rec																
11	55	✓	52	3500	<10	<10	15	<10	50	750	75	75	100	<1	10,000	<2	<10	35
12	A-56	✓	18	5000			35		75	750	20	10	75	<1	2000			20
13	B-56	✓	36	3500			15		75	1500	50	50	100	1	7500			35
14	C-56	✓	52	3500			15		50	750	50	15	75	<1	5000			20
15	D-56	✓	18	3500			35		75	1000	100	75	150		10,000			35
16	A-57	✓	36	1500			35		75	500	100	20	100		3500			35
17	B-57	✓	52	1500			15		50	350	75	15	100		3500			20
18	C-57	✓	79	15000			20		75	500	100	20	75		5000			20
19	D-57	✓	36	5000			20		75	750	75	20	150		7500			35
20	A-58	✓	52	3500			15		50	750	100	20	75		3500			20
21	B-58	✓	52	5000			20		75	750	75	15	150		7500			35
22	C-58	✓	52	2000			15		35	500	100	15	100		5000			20
23	A-59	✓	31	3500			1500		100	2000	50	35	100	20	5000	2		20
24	A-60	✓	36	5000			50		50	500	75	10	50	<1	2000	<2		20
25	B-60	✓	52	2000			35		75	750	75	20	100	<1	7500			20
26	C-60	✓	18	3500			35		75	750	100	20	150	<1	7500			20
27	A-64	✓	52	3500			50		50	1000	75	20	50	1	3500			15
28	B-64	✓	36	1000			20		15	1000	35	<2	<5	1	1500			20
29	C-64	✓	36	3500			50		50	1000	50	2	<5	1	3500			35
30	A-65	✓	18	5000			10		35	750	50	<2	50	<1	3500			50
31	B-65	✓	52	3500			50		75	1000	150	35	100		5000	2		35
32	C-65	✓	36	5000			50		100	750	150	50	150		7500	3		50
33	D-65	✓	36	2000			50		50	750	100	20	100		5000	<2		50

Weighed by Blanchard Run by Newell Read by Burroughs

Film No. 6433A GEOCHEMICAL SURVEYS SPECTROGRAPHIC ANALYSIS PROSPECT Renegade General Grant

Date 5-19-70 COUNTY, STATE Maricopa, Arizona

#1 ND

PAGE 2

Rack 9	Sample No.		Cd	Cu	Zr	Ag	La	Zn	Sc	Co	Sr	As	Sb	W	Fe
			PARTS PER MILLION												
10		Res.		75											
11	55	10'	<50	35	200	<.5	20	<200	10	7	1500	<200	<100	<50	35,000
12	A-56	18'		15	100	<.5	20		5	<5	1500				20,000
13	B-56	28'		10	200	.5	35		20	7	500				35,000
14	C-56	38'		15	100	<.5	20		10	<5	1500				20,000
15	D-56	48'		20	350	.5	35		15	7	1500				35,000
16	A-57	18'		10	100	<.5	<20		<5	<5	1000				20,000
17	B-57	28'		7	200	<.5	20		<5	<5	1000				20,000
18	C-57	38'		10	150	<.5	20		5	<5	2000				20,000
19	D-57	48'		5	200	.5	50		7	5	3500				20,000
20	A-58	18'		50	200	<.5	20		5	5	750				35,000
21	B-58	28'		15	150	.5	20		7	5	1500				20,000
22	C-58	38'		20	200	<.5	20		10	<5	1000				20,000
23	A-59	18'		100	200	5	35	500	5	20	1000				50,000
24	A-60	18'		7	100	<.5	20	<200	<5	<5	2000				20,000
25	B-60	28'		10	200		20		10	10	1000				35,000
26	C-60	38'		10	350		35		7	10	1500				35,000
27	A-64	3'		5	500		35		7	<5	500				35,000
28	B-64	8'		<2	500		20		<5	<5	<50				20,000
29	C-64	13'		<2	750		35		15	<5	50				20,000
30	A-65	18'		<2	350		<20		<5	<5	350				20,000
31	B-65	28'		15	350	.5	35	200	15	7	1500				35,000
32	C-65	38'		15	350	1	50	350	20	15	1500				50,000
33	D-65	48'		10	200	<.5	<20	<200	7	7	500				35,000

Film No. 6823B

Date 5-19-70

GEOCHEMICAL SURVEYS
SPECTROGRAPHIC ANALYSIS

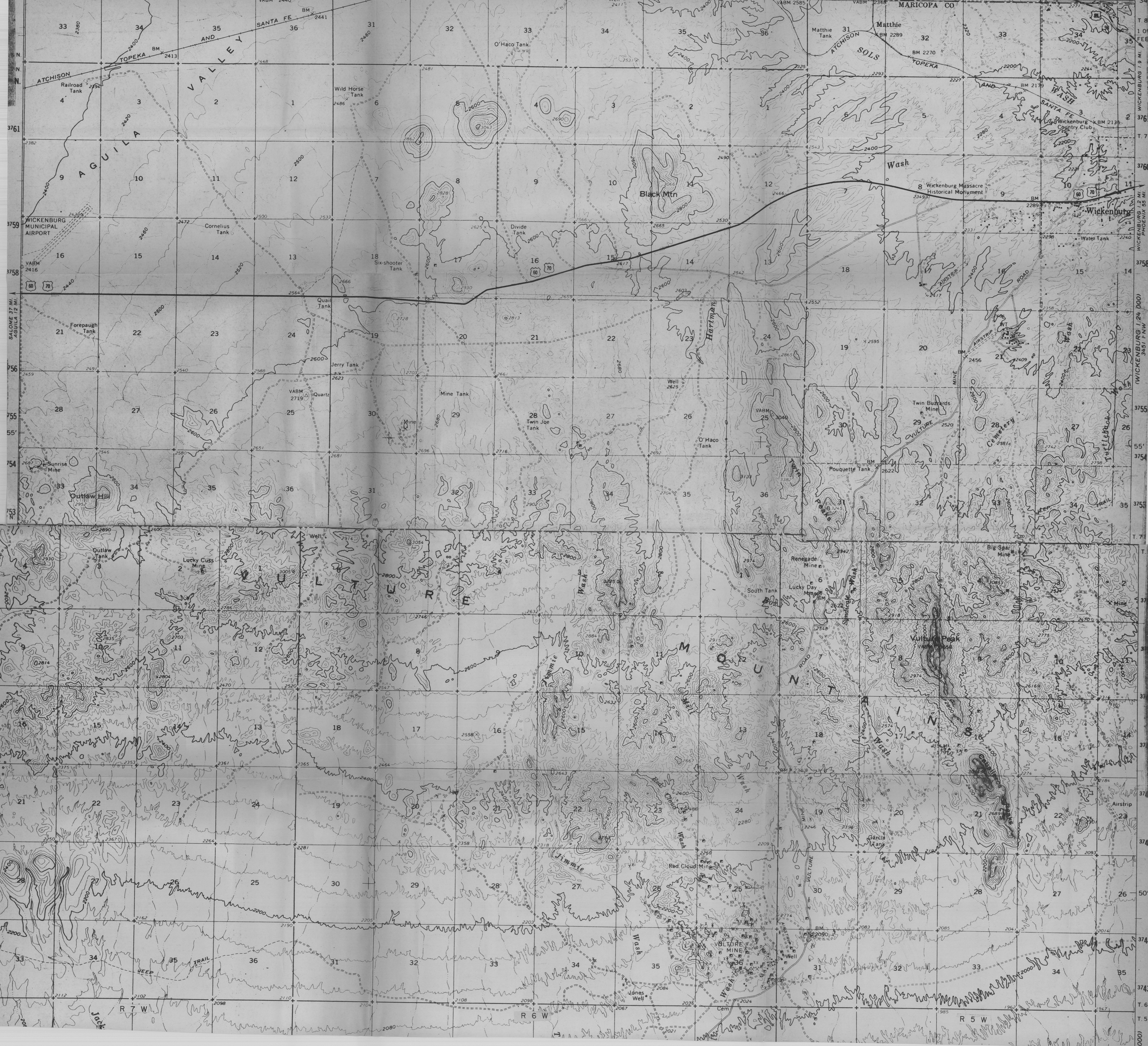
PROSPECT Renegade (General Grant)

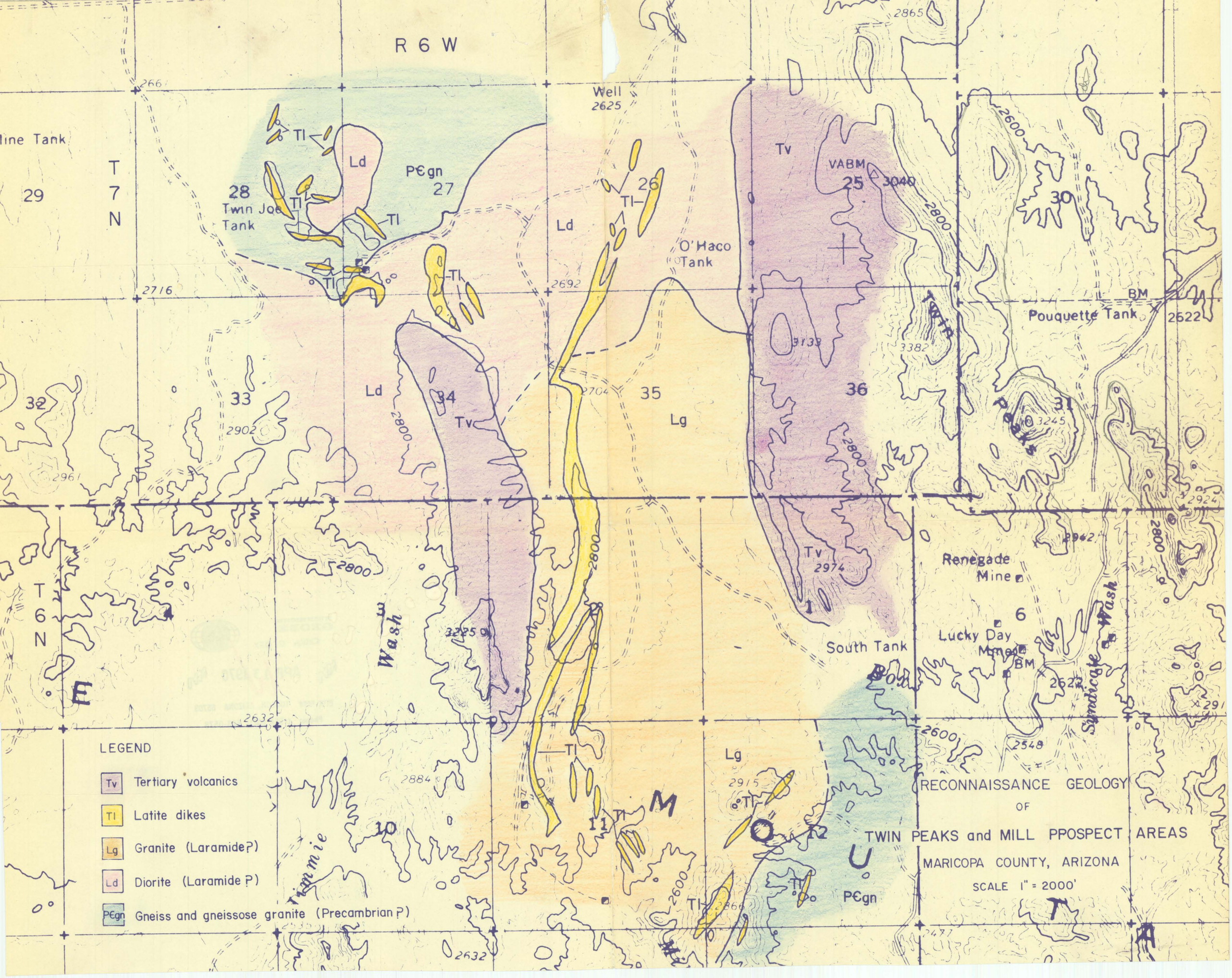
COUNTY, STATE Maricopa, Arizona

#20

PAGE 1

Rack	Sample No.	Fe	Hg (PPB)	Ba	B	Au	Pb	Bi	Ga	Mn	Cr	Ni	V	Be	Ti	Mo	Sn	Y
9																		
10		Rec																
11	E-65	1	89	350	<10	<10	20	<10	20	200	35	10	50	1	1000	<2	<10	15
12	F-65	1	52	750			15		20	200	35	10	75	<1	1500	2		20
13	G-65	1	36	350			20		35	200	50	10	50	<1	1500	<2		15
14	A-66	1	18	1500			15		35	200	75	7	50	1	1500			15
15	A-68	1	36	500			15		20	200	50	15	75	<1	2000			20
16	B-68	1	18	350			20		20	350	50	10	75	<1	2000			20
17	C-68	1	36	500			10		15	150	35	5	50	<1	1000			10
18	A-79	1	18	500			20		20	200	50	10	75	<1	1000			10
19	B-79	1	36	500			15		15	150	75	7	50	<1	1500			15
20	C-79	1	52	750			15		20	200	75	10	50	<1	1500			15
21	D-79	1	70	200			15		15	350	50	10	50	<1	2000			15
22	A-81	1	52	200			20		20	500	50	10	50	2	2000			35
23	A-82	1	70	750			20		35	350	100	15	75	1	3500			35
24	B-82	1	52	350			20		35	200	75	7	35	<1	1000			10
25	A-83	1	36	350			20		20	200	75	10	50	<1	2000			20
26	B-83	1	52	500			15		20	350	100	20	75	<1	5000			35
27	A-84	1	52	350			15		10	200	50	7	35	1	750			10
28	B-84	1	36	350			20		20	150	75	5	35	<1	1000			10
29	A-85	1	52	500			20		20	350	75	10	35	1	1500			10
30	B-85	1	36	750			15		20	350	100	10	35	<1	2000			20
31	C-85	1	36	500			15		20	200	50	7	35	<1	1000			10
32	A-86	1	36	500			20		35	350	75	10	50	1	2000			20
33	B-86	1	52	500			15		15	200	75	3	35	<1	1000			10

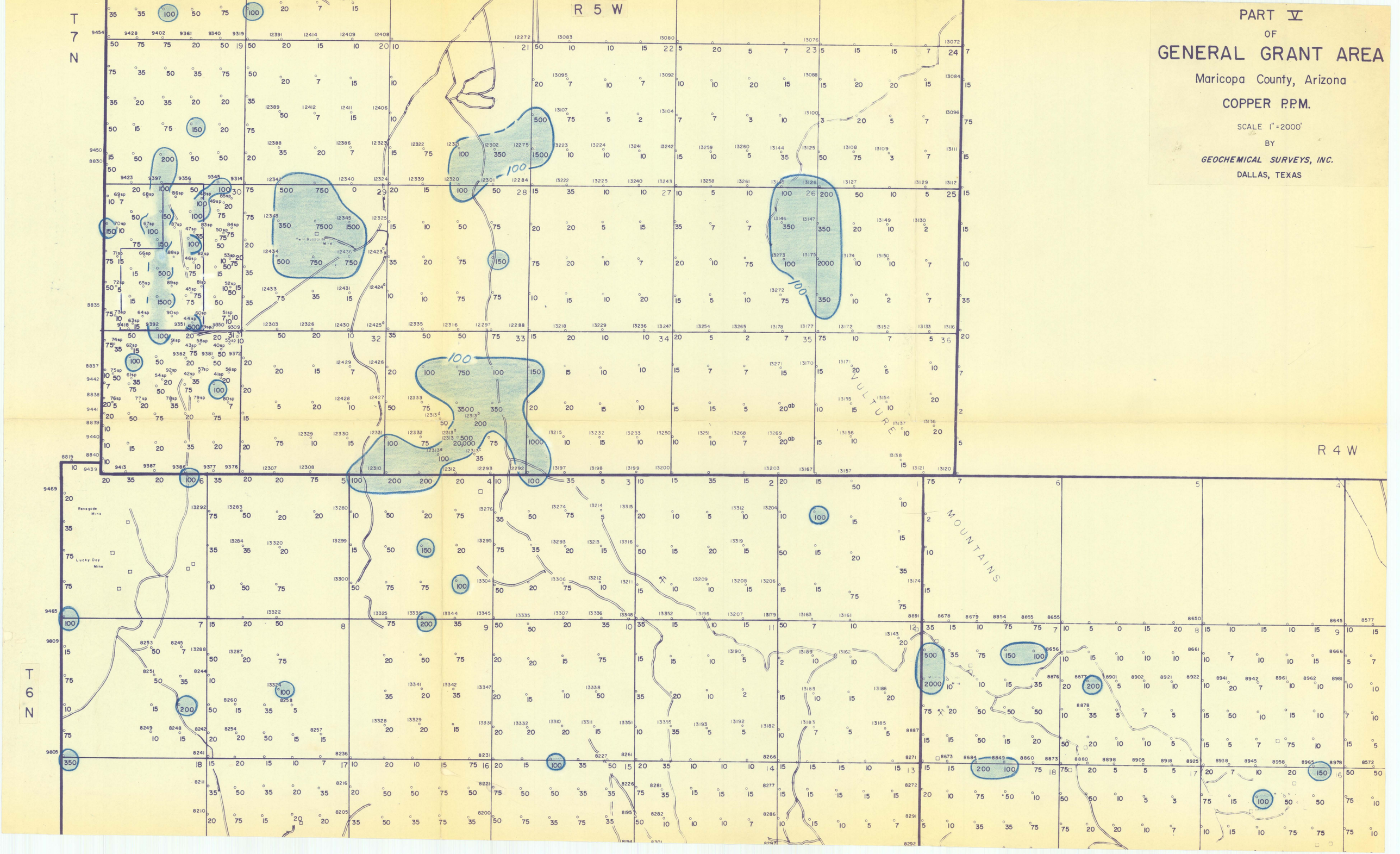

MARICOPA CO
ATCHISON TOPEKA AND SANTA FE
AGUILA VALLEY
Railroad Tank
Wild Horse Tank
O'Haco Tank
Matthie Tank
Matthie
SOLS WASH
Wickenburg Country Club
Wash
Wickenburg Massacre Historical Monument
Wickenburg
Water Tank
Black Mtn
WICKENBURG MUNICIPAL AIRPORT
Cornelius Tank
Divide Tank
Six-shooter Tank
Quail Tank
Forepaugh Tank
Jerry Tank
Quartz
Mine Tank
Mine
Twin Joe Tank
Hartman
Well
O'Haco Tank
Twin Buzzards Mine
Cemetery
Pouquette Tank
Sunrise Mine
Outlaw Hill
Outlaw Tank
Lucky Cuss Mine
VULTURE MOUNTAINS
Renegade Mine
Lucky Day Mine
South Tank
Big Spar Mine
Vulture Peak
Jimmie
Red Cloud Mine
Garcia Tank
Airstrip
VULTURE MINE
Jones Well
Cem
R 7 W
R 6 W
R 5 W
T. 7 N
T. 6 N
SALOME 37 MI.
AGUILA 12 MI.
WICKENBURG 1.9 MI.
WICKENBURG 1.2 MI.
PHOENIX 55 MI.
(WICKENBURG 1:24 000)
3451 PNW

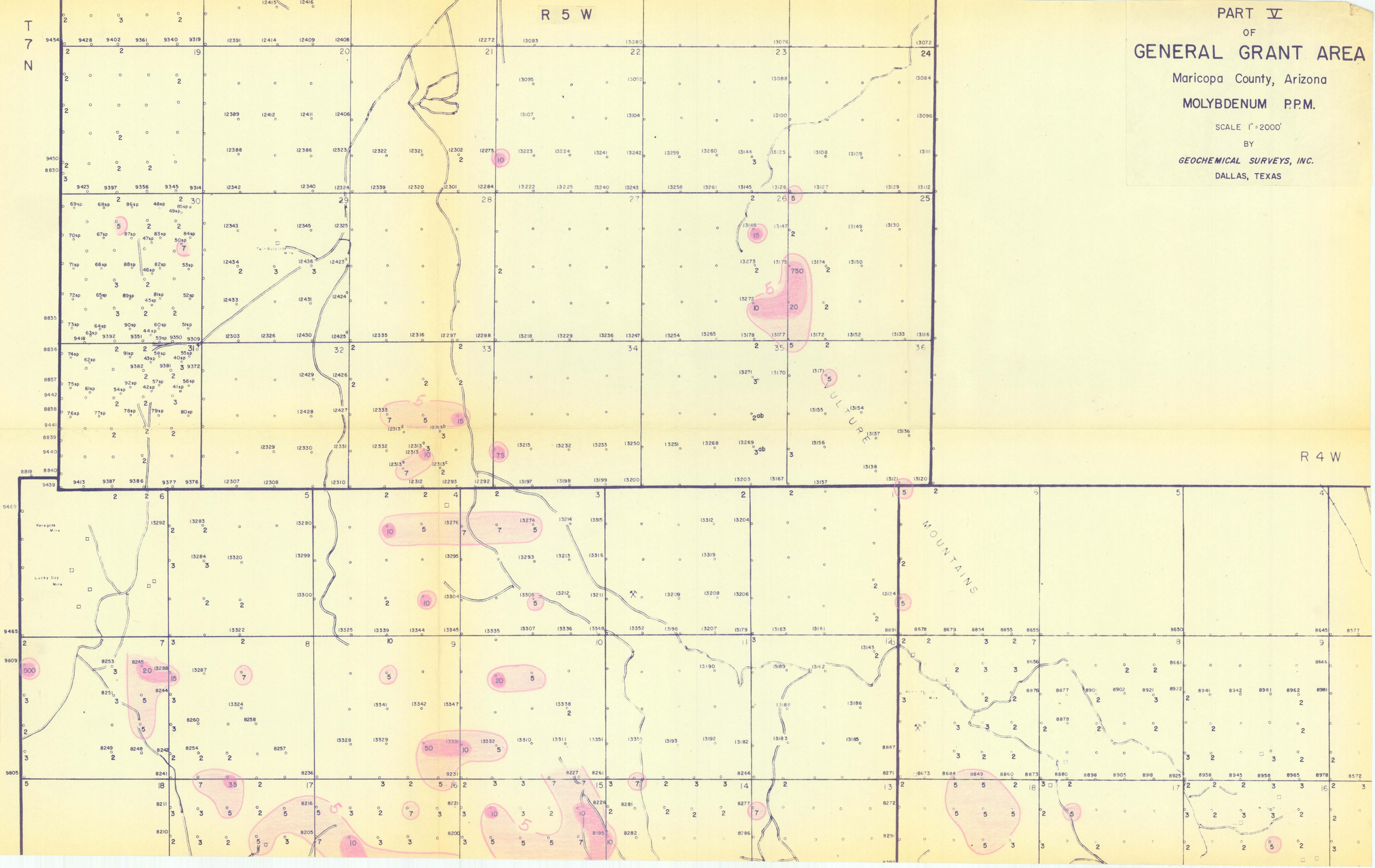

R 6 W
T 7 N
T 6 N
Mine Tank
29
28
Twin Joe Tank
27
26
25
30
32
33
34
35
36
31
6
1
10
11
12
Well
2625
O'Haco Tank
VABM
3040
Pouquette Tank
BM
2622
Renegade Mine
Lucky Day Mine
South Tank
Wash
Timmie
Syndicate Wash
Ld
Tv
Lg
Tl
PЄgn
2716
2692
2704
2865
2800
2600
2902
2961
2924
2962
2974
3245
3382
3139
2632
2884
2915
2548
2471
LEGEND
Tv Tertiary volcanics
Tl Latite dikes
Lg Granite (Laramide?)
Ld Diorite (Laramide?)
PЄgn Gneiss and gneissose granite (Precambrian?)
RECONNAISSANCE GEOLOGY
OF
TWIN PEAKS and MILL PPOSPECT AREAS
MARICOPA COUNTY, ARIZONA
SCALE 1" = 2000'

HEINRICHS
GEOEX
Cable: GEOEX

REC'D APR 13 1970 REC'D

BOX 5964 TUCSON, ARIZONA 85703
Phone: (AREA 602) 623-0578


PART V
OF
GENERAL GRANT AREA
Maricopa County, Arizona
COPPER P.P.M.
SCALE 1" = 2000'
BY
GEOCHEMICAL SURVEYS, INC.
DALLAS, TEXAS
R 5 W
R 4 W
T 7 N
T 6 N
VULTURE
MOUNTAINS
Renegade Mine
Lucky Day Mine


PART V
OF
GENERAL GRANT AREA
Maricopa County, Arizona
MOLYBDENUM P.P.M.
SCALE 1" = 2000'
BY
GEOCHEMICAL SURVEYS, INC.
DALLAS, TEXAS
R 5 W
R 4 W
T 7 N
T 6 N
VULTURE
MOUNTAINS
Renegade Mine
Lucky Day Mine

ROBERT A. ZELLER, JR.
Consulting Geologist

P. O. BOX 1
HACHITA, NEW MEXICO
88040

April 9, 1969

Preliminary Geologic Reconnaissance of the General Grant Area, Arizona

The General Grant area or prospect southwest of Wickenburg, Arizona, includes the Vulture, Belmont, Big Horn, and Harquahala mountain ranges as well as the Hassayampa Plain, Tonopah Desert, and other valley areas. The following topographic maps, which show the area, are included with this report:

Wickenburg
Wickenburg SW
Vulture Mts.
Aguila
Gladden
White Tank Mts.
Belmont Mts.
Big Horn Mts.
Lone Mountain

The purpose of this preliminary study was to determine areas suitable for our geochemical sampling program. Suitable areas are those in which the geologic environment is definitely or possibly favorable for the occurrence of concealed porphyry copper deposits at a shallow enough depth to be detectable. Areas that definitely do not have a favorable geologic environment or where bedrock is too deep were excluded. Favorable areas in which I recommend geochemical exploration are shown with red shading on the included maps.

As a whole, the General Grant area is one of the most promising we have worked to date. There are a number of quartz monzonite stocks of presumed Laramide age having associated copper and other mineralization. These intruded strongly metamorphosed rocks - gneiss and schist - of probable Precambrian age. Copper mineralization is found in fractures in the Precambrian rocks near the borders of Laramide stocks. The Laramide intrusive rocks and the pre-Laramide rocks near Laramide stocks are potential hosts for porphyry copper deposits.

Briefly, the geologic history of the area was as follows:

1. Early events led to the emplacement and strong metamorphism of Precambrian basement rocks.
2. Paleozoic and Mesozoic sedimentary rocks and andesite flows of probable Late Cretaceous age were deposited.
3. The Laramide orogeny in Late Cretaceous or early Tertiary time produced high-angle faulting, probable overthrust faulting, intrusion of quartz monzonite stocks, and mineralization associated with the stocks. The area of the Vulture Mountains was elevated and subjected to deep erosion which removed all Paleozoic and Mesozoic stratified rocks. (This elevation seems to have been along a northwest-trending "arch" which may have regional significance to the structural control of porphyry copper

distribution. The "arch" along which post-Laramide strata rest upon Precambrian crystalline rocks with only a few local areas of thin Paleozoic or Mesozoic rock preserved, may be traced southeastward through Globe-Miami, Safford-Morenci, Tyrone-Santa Rita, and to the Texas Lineament. Detailed structural studies are insufficient at present to prove the significance of this "arch", but present knowledge at least suggests that it may have been important in localizing some of the large copper deposits.) From the Vulture Mountains southwestward away from the crest of the "arch", Late Cretaceous (?) andesite is preserved under the Tertiary rocks in the Belmont Mountains.

4. Mid-Tertiary volcanics, mostly tuffs, were deposited upon the post-Laramide erosion surface. This was followed by faulting, tilting of fault blocks, and deep erosion. As a result, only thin remnants of the Tertiary volcanics are preserved in most fault blocks, though locally there seems to be thicker sections. The base of the volcanics rests upon a thin unit of red cobble conglomerate. Should porphyry copper deposits be present in the region, secondary enrichment of copper would be expected if this mid-Tertiary erosion surface is preserved at that particular place.

5. The area was subjected to complex "basin and range" faulting which caused uplift of some mountain structural blocks and depression of some valley blocks. Such faults lie along the northwestern flanks of the Harquahala Mountains and the Harcuvar Mountains.

6. Extrusion of Quaternary olivine basalt mainly along the "basin and range" faults.

7. Erosion to the present form. Basalt capped mesas were formed along the flanks of some of the ranges. Several large pediment areas were formed. Much of the Harquahala Plain, Hassayampa Plain, and Tonopah Desert are pediment areas.

The geologic maps of Maricopa County and Yuma County published by the Arizona Bureau of Mines are largely inaccurate in the General Grant area. For instance, the large area of Laramide intrusive rock shown in the Harquahala Mountains is probably Precambrian. The geologic map does not show Laramide intrusives in the Vulture Mountains, yet much of the range consists of Laramide stocks. The "Cretaceous Andesite" shown in the Vulture Mountains is actually mid-Tertiary tuff of latitic composition. The northwestern part of the Big Horn Mountains have stocks of Laramide or younger intrusive rocks, but the geologic map shows only Precambrian gneiss. The usefulness of the published geologic maps is limited.

In the following paragraphs various parts of the General Grant area are briefly described giving reasons for inclusion and exclusion of areas from the sampling program.

The Vulture Mountains are the most mineralized and most interesting part of the area. The range has long been known for gold mines and prospects, especially the Vulture Mine. But of more importance to us, it has a geologic environment favorable to porphyry copper.

A stock of biotite quartz monzonite lies southwest of Wickenburg. Exposures extend from the southern border of section 16, T. 7 N., R. 5 W. westward about 2½ miles and southward about 3½ miles. A thin unit of Tertiary tuff rests upon the intrusive along a ridge near the center of the exposed stock and along the flanks of the stock; the exposures of the stock are inliers eroded through the thin volcanic blanket. This stock is exposed at the

Prelim. Geol Recon., General Grant area, Zeller, continued

Rancho de los Caballeros and for convenience is here called the Caballeros stock.

The rock of the Caballeros stock is biotite quartz monzonite that has not been strongly altered; the biotite and feldspars are fresh. Copper occurs as chrysocolla coating fracture surfaces in many prospects and mines in the stock. A new open pit mine is presently being developed a few hundred yards northwest of the Rancho de los Caballeros on a fractured zone containing abundant chrysocolla and cuprite. The zone is more than 10 feet wide. The ore is being mined for copper leaching. In the area of the Twin Buzzards mine there are many such chrysocolla veinlets. Chrysocolla was noted in NW¼ sec. 4, T. 6 N., R. 5 W. The exposed part of the Caballeros stock is not a porphyry copper deposit as the concentration of copper is much too low. No primary copper minerals were noted. The outcrop of the stock is not iron stained. Thus the exposed part of the stock probably was not the primary source of the copper. The chrysocolla migrated from an unknown source and was deposited in open joints.

Mineralized parts of the Caballeros stock are blanketed by the Amigo group of 60 unpatented claims located mainly by Harold Fenix and Delane Gillum on August 5, 1968 (for location notices see records in Maricopa County Courthouse, docket 7208, pp 931-952). Proofs of labor were filed on the claims on November 25, 1968 (docket 7364, p. 651) and December 3, 1968 (docket 7374, p. 787) by Tom Richardson, James Loan, and George W. Craig, all of Wickenburg, and by Delane Gillum of Globe. Thus, the claims are valid. A major company probably is not involved in this operation.

Another stock of young biotite quartz monzonite having copper mineralization is exposed in the area from Renegade and Lucky Day Mines (sec. 6, T. 6 N., R. 5 W.) to section 11, T. 6 N., R. 6 W.; it is here called the Renegade stock Copper occurs mainly as chrysocolla fillings in fractures. There are some quartz veins having chrysocolla. Primary copper minerals are not obvious if present at all. Mr. Bill Reichel, who lives at the Renegade Mine, owns 36 unpatented claims in the eastern part of the stock. He mentioned that Phelps Dodge and Kerr McGee have examined and sampled the property. Harrison Schmitt, the consulting geologist specialized in porphyry copper exploration (now deceased), examined the property but apparently was not enthused.

An area that was drilled several years ago lies in the western part of the Renegade stock in W½ sec. 12, T. 6 N., R. 6 W. A large number of drill sites and roads were prepared, and at least 7 holes were drilled. Chrysocolla stains and fracture fillings are abundant in prospect pits. Some copper stained quartz veins are present. The overall concentration of copper is very small. The rock is not strongly altered. Outcrops are not conspicuously iron stained. Diorite dikes cut the intrusive rock.

The area of the drilling is included in La Mina group of unpatented claims located in 1960 by William C. Kinnon of Phoenix (for location notices see docket 3109, p. 538; docket 3118, p. 249; docket 3157, p. 995; docket 3210, p. 220). As a proof of labor was filed on these claims on September 4, 1968 (docket 7250, p. 834), the claims are currently valid. According to the proof of labor, work was done on a "northeast-trending copper zone 700-1200 ft. wide". Geologic work was done by J. E. Browne, Geologist, Natural Resources Division, Union Pacific Railroad Company.

Prelim. Geol. Recon, General Graht area, Zeller, continued

The Caballeros and Renegade stocks are separated by an area of mid-Tertiary volcanic cover. Probably, the stocks connect under the volcanic blanket. The rock and mineralization of the two stocks are very similar.

A young biotite quartz monzonite stock is exposed throughout much of the western half of T. 6 N., R. 6 W. Though copper is not abundant, azurite and malachite are present in a quartz vein opened by an old shaft along the border of sections 20 and 21, T. 6 N., R. 6 W. This stock may have originally been continuous with the other stocks.

Another stock of young intrusive rock is present in the gap between Vulture Peak ridge and Caballeros Peaks ridge in T. 6 N., R. 5 W. Prospects and mines are present in and near this stock.

All these stocks of relatively fresh biotite quartz monzonite intrude Precambrian rocks, are overlain by mid-Tertiary volcanics, and have associated mineralization. These characteristics strongly indicate Laramide age. Though commercial copper deposits are not present on the outcrops, thinly covered areas near the stocks are very promising for geochemical exploration. The areas to be sampled shown on the Vulture Mountains quadrangle were selected because of the proximity of nearby mineralized Laramide stocks and because bedrock is at shallow depths. The portion of the Hassayampa Plain shown on this quadrangle is a pediment with relatively thin alluvial covering the bedrock.

A small low hill slightly east of the center of section 7, T. 5 N., R. 5 W. on the pediment a few miles southeast of the Vulture Mine is of particular interest. The hill consists of Precambrian gneiss that has fairly heavy iron staining. Bedrock is quite shallow in the area but is largely concealed by recent alluvium. Because of the heavy iron-staining, samples in this area should be taken in bedrock using the drill truck. At least section 7 should be thus sampled, and possibly 4 to 6 adjoining sections should be sampled using the drill truck. The iron staining could indicate a nearby ore deposit.

Mr. Lindenburg examined the southeastern portion of the Vulture Mountains from the area of the Vulture Mine to the Hassayampa River. The rocks consist of Precambrian metamorphics cut by dikes and partly covered by volcanic flows and buff colored Quaternary (?) conglomerate. Most of the mines of this area are on quartz veins. The mines along the border between sections 19 and 20, T, 6 N., R. 4 W. are in schist and have copper minerals on the dumps. The mineralization of the area and the shallow bedrock justify the geochemical exploration recommended on the Wickenburg and Wickenburg SW quadrangles. The area east of the Hassayampa River was not examined.

A block of 110 claims of the Susan Mines group is located a short distance north of the Vulture Mine. These were located in 1966 by A. B. Boiarsky (docket 6038, p. 232 etc.; docket 6049, p. 562 etc.; docket 6157, p. 454 etc.) As a proof of labor was filed on the claims on October 31, 1968 (docket 7333, p. 1 136), the claims are valid. The nature of the described assessment work suggests that no major company controls these claims. However, a sign in the area near the claims by Colorado Fuel and Iron Company suggests that there has been some major company activity in the area.

Prelim. Geol Recon., General Grant area, Zeller, continued

Dr. Richard Moore, Arizona Bureau of Mines, mentioned that molybdenum is present in the Vulture Mountains, but he does not know the location or who found it.

Most of the western and northwestern part of the Vulture Mountains is not favorable for the the occurrence of porphyry copper. Precambrian basement rock is sparsely exposed. However, there are no Laramide stocks nearby and no mineral showings are known. Much of the area is covered by mid-Tertiary latite tuffs and Quaternary basalt. An area of drill sites near the center of section 20, T. 6 N., R. 7 W. in siliceous tuffaceous shale at the base of Black Butte apparently is a uranium prospect. The claims, the Blue Sky group, were located by Ralph G. Godfrey; validation drilling was done in February and March, 1969. Several prospects shown in and near sec. 36, T. 6 N., R. 8 W. on the Aguila quadrangle map are on manganese shows in Tertiary tuff. Mines shown on the small hills in the northern part of T. 6 N., R. 8 W. are in clay within young latite flows, None of these prospects suggest the presence of copper deposits.

A large area of geochemical exploration is recommended on all flanks of the Belmont Mountains. The Hassayampa Plain north of the range is a pediment. A portion of the Tonopah Desert south of the range is also a pediment. A pediment extends for about 10 miles southeast of the eastern point of the range.

The bulk of the Belmont Mountains consists of young coarsely crystalline granite and quartz monzonite that has intruded Precambian gneiss and phyllite. Latite and diorite dikes are common in the intrusive area. The age of this stock is unknown and could be Laramide or younger; as there is no gneissose structure the rock probably is not Precambrian. Mineral showings in the area may be associated with the stock, in which case the stock is probably of Laramide age. For the purposes of our exploration program, we should tentatively consider the age as Laramide and explore the flanks of the range. The young granitic rock is exposed for at least 6 miles southeast of the eastern point of the range. Mr. Lindenburg noted heavy epidote in the intrusive rock in section 9, T. 2 N., R. 5 W.

The largest mine of the area is the Tonopah-Belmont which, according to Dr. Richard Moore, was a lead-silver mine developed on a vein. The country rock of the mine area is brecciated andesite. The andesite is pre-mineral and is prbably of Late Cretaceous age. A little copper stain was noted in siliceous vein material on the dump.

Mines a mile east of the Tonopah-Belmont are also in the andesite. Several pieces of float found along a road in this area have inch-wide seams of chalcocite; presumably, these came from the nearby mines.

Mr. Lindenburg reported copper minerals, specularite, and epidote on the dump of the mine in SW corner of section 11, T. 3 N., R. 6 W.

The combination of young intrusive rock, copper mineralization, and flanking pediments justifies exploration along the flanks of the Belmont range.

The area of low bedrock exposures and pediment near the General Grant mine on the Hassayampa Plain north of the Belmont Mountains has exposures of young intrusive rock intruding Precambian phyllite. Most of the shafts shown on the map were sunk on quartz veins probably in search for gold. Most of the

mine dumps have small amounts of secondary copper minerals. Copper was noted at the General Grant mine; at the Scott mine: at the prospects in SW¼ sec. 34, T. 5 N., R. 7 W.; and at the shaft at the corner common to sections 13, 14, 22, and 24, T. 4 N., R. 7 W. Many of the higher hills of the area are capped with andesite.

The U S Mine in sec. 1, T. 4 N., R. 8 W. (Big Horn Mountains quadrangle) has an impressive amount of chrysocolla and specularite filling cracks in a breccia zone within altered andesite. Many dikes and silicified zones cut the area. The U S Mine is on one of the silicified zones. Mr. Lindenburg's note on the U.S Mine states "altered N. 15° E. zone approximately 100 feet wide, 1000 feet long; alteration, silicified, bleached, oxidized: dumps show good copper, some epidote ---". At the time of my visit on April 1st the road was posted and claim staking was apparently in progress. The claim names are "Furlough No.__". The type of staking and the professional appearance of the people at the mine suggest that a company, rather than prospectors, is staking the area. Geochemical exploration of this deposit and search of the area for others would require detailed bedrock sampling. As the area is apparently being actively explored at present, I suggest no immediate action by us except for sampling of the pediment north and west of the U S Mine.

Interesting

The bulk of the Big Horn Mountains consists of Tertiary volcanics and Quaternary basalt. However, these young strata rest upon older rocks exposed in low areas along the northern and western flanks of the range. Precambrian rocks are exposed near the northwest corner of T. 3 N., R. 8 W. in the low pass between the Big Horn and Belmont Mountains. A shaft in this area (section 6) was sunk on a northeast-striking quartz vein in Precambrian gneiss and phyllite. This was probably a gold prospect. Pyrite is present in the vein; some chrysocolla fills small cracks, though no primary copper minerals were noted. Latite dikes nearby cut the Precambrian rocks. This copper showing, the presence of pre-mineral rocks, and the shallow depth to bedrock on the pediment justify geochemical exploration in the area (see Big Horn Mts. quad.)

Check check

A young granite stock is exposed in sections 26 and 36, T. 4 N., R. 9 W. in a valley along the northeastern flank of the Big Horn Mountains. The area is claimed and roads are currently being bulldozed on the granite. Similar granite is exposed along the southwestern flank of the range in sec. 5, T. 3 N., R. 9 W. A sign posted on the road in section 30, T. 4 N., R. 9 W. states:" Notice --- sections 19, 20, 21, 22, 28, 29, 32, and half of 27, T. 4 N., R. 9 W. are legal mining claims located 1954-55. Recorded Maricopa County docket 1489 pages 478-503, docket 1538 pages 184-187, docket 1589 pages 448-451 .....". Presumably these claims are valid as work is currently in progress. Geochemical sampling is recommended for this area if we can obtain a permit to work the claims; if we can not obtain the permit, we should sample the portion of the indicated area outside the valid claims.

Obtain permits?

Many mines and prospects are indicated on the maps in the northwestern portion of the Big Horn Mountains. Many of the mines were visited; most are manganese mines in brecciated andesite. However, a few are old gold prospects on quartz veins in Precambrian gneiss; some of these show copper stains. The manganese may have been deposited during a late post-Laramide period of mineralization, but the quartz veins and associated mineralization are probably of Laramide age. Thus, geochemical sampling is recommended for the flanking pediment areas.

Prelim. Geol. Recon., General Grant area, Zeller, continued

The Ambrosia Mill is shown along Tiger Wash in the southwestern part of the Aguila quadrangle. The mill is gone, but the tailings indicate that large quantities of manganese ores were treated. Nearly all the mines shown in the southwestern part of this quadrangle were manganese mines. Some were very large. The principal mine near the corner common to sections 19, 20, 29, and 30, T. 5 N., R. 8 W. is an open pit 200 feet deep, 500 feet wide, and 1000 feet long. Manganese oxides fill cracks in brecciated andesite along a fault contact with Precambrian gneiss and schist; the main ore zone strikes north, though other undeveloped manganesezones strike in slightly different directions. These mines and the mill were active during the 1950's when the government subsidized manganese mining. As mentioned above, I believe the manganese mineralization was post-Laramide and thus is not of direct interest in our present program.

The Purple Pansy mine in sec. 19, T. 5 N., R. 8 W. is an old inclined shaft following a mineralized layer within Precambrian schist. A little copper stain is present on the dump; this was probably a gold prospect.

The western end of the Hassayampa Plain shown in the southeastern part of the Aguila quadrangle is a pediment having many exposures of Precambrian rocks and of young biotite quartz monzonite of probable Laramide age. A shaft in E½ sec. 15, T. 5 N., R. 8 W..has copper stain and free gold in a quartz vein cutting Precambrian schist. One and a half miles to the east the Lead Dike mine and nearby prospects were developed on siliceous veins cutting young biotite quartz monzonite. The base metal mineralization, probable Laramide stocks, pre-Laramide rocks, and the shallow depth of bedrock show the area to be potentially favorable for concealed ore deposits.

From the standpoint of mineral exploration, most of the Harquahala range is disappointing. The range consists mostly of Precambrian gneiss and gneissose granite. The Laramide intrusive rocks shown on the geologic map as occurring in the range are probably Precambrian. The northwestern flank of the Harquahala Mountains has a large concealed fault that downdropped the valley structural block. Practically no pediment exists on that flank of the range. The mines and prospects on the northwest flank of the range, with the exception of White Marble Mine, are on quartz veins cutting gneiss; these were gold prospects; no base metal minerals are present on the mine dumps. The White Marble Mine is a marble quarry developed on metamorphosed Paleozoic (?) limestone. Thus, I recommend no geochemical exploration along the northwestern flank or at the eastern end of the Harquahala Mountains.

The southern flank of the Harquahala Mountains is somewhat more favorable. The mines at the mouth of Sunset Canyon (sec. 14, T. 5 N., R. 10 W.) are in Precambrian schist and gneiss. Veins contain quartz, calcite, epidote, iron oxide, and chrysocolla. Some of the intrusive rock northeast of here has no gneissose structure. It could possibly be Laramide age, though I think it is Precambrian. A narrow pediment lies along this part of the range. A small area of geochemical exploration is recommended here.

The area where the northwest-trending Big Horn Mountains butt against the northeast-trending Harquahala Mountains is undoubtedly structurally complex. Copper is present in the Alaska and Rainbow mines and in fresh bulldozer cuts in this area (see northeastern corner of Lone Mountain quadrangle). The country

rock is Precambrian phyllite. Chrysocolla, fluorite, specularite, and limonite occur in certain layers and in fractures in the phyllite. Exploration is currently in progress. The appearance of the work and the claim markers suggests that a major company is not involved. The slope from the Harquahala Mountains south for 5 or 6 miles is a pediment indicated by small bedrock exposures. A large part of the pediment is recommended for geochemical sampling mainly on the shows of copper mineralization in the Alaska and Rainbow mine area.

The Hidden Treasure Mine in sec. 29, T. 5 N., R. 11 W. is in an iron stained silificied zone in weakly recrystallized limestone. This mine and others nearby were probably old gold prospects. No base metal mineralization is present.

The western boundary of the General Grant area was originally drawn along the line between Ranges 11 and 12 West. Due to the shortness of time and the urgency of other projects, I terminated geologic reconnaissance at this line. According to the topographic maps there are a great number of mines and prospects to the west and southwest in the western end of the Harquahala Mountains and in the Little Harquahala Mountains. At a later date, before the field crew finishes the General Grant area, geologic reconnaissance may be worthwhile in this area to determine its favorability for porphyry copper. This additional area is about 2 townships in size.

Several summarizing statements are in order. The General Grant area is one of the most promising we have worked. The best possibilities for porphyry copper discoveries are around the flanks of the Vulture Mountains and on the pediment of the Hassayampa Plain. Other areas, though less promising, are worth geochemical exploration. A program of detailed bedrock sampling of some of the copper-bearing parts of the outcropping Laramide intrusives may be worth considering; our present reconnaissance program of sampling pediments would not be suited to these areas.

Detailed work

Though chrysocolla is abundant as joint fillings, some of the other important characteristics of porphyry copper deposits are lacking. The Laramide intrusive rock is not strongly altered. There are no iron gossan zones or "iron cappings" (except possibly for the small exposure on the pediment southeast of the Vulture Mine). The Laramide intrusives seem to lack the "plumbing" of porphyry copper; quartz veining is rare. The chrysocolla migrated into the rocks from an unknown area. Possibly porphyry copper exists at the source area of the copper of the chrysocolla, but finding the source may be very difficult or impossible. Similar chrysocolla veinlets are present in otherwise barren rocks many miles from the Safford, Arizona, copper deposit from which the copper seems to have migrated. The General Grant area has been looked over by several major companies, but so far as I know, little serious exploration has been done.

In spite of some discouraging factors, the abundance of copper nevertheless shows this to be a copper-rich area. Hopefully, we will detect prospects on the pediment areas that others have not seen.

Robert A. Zeller, Jr.

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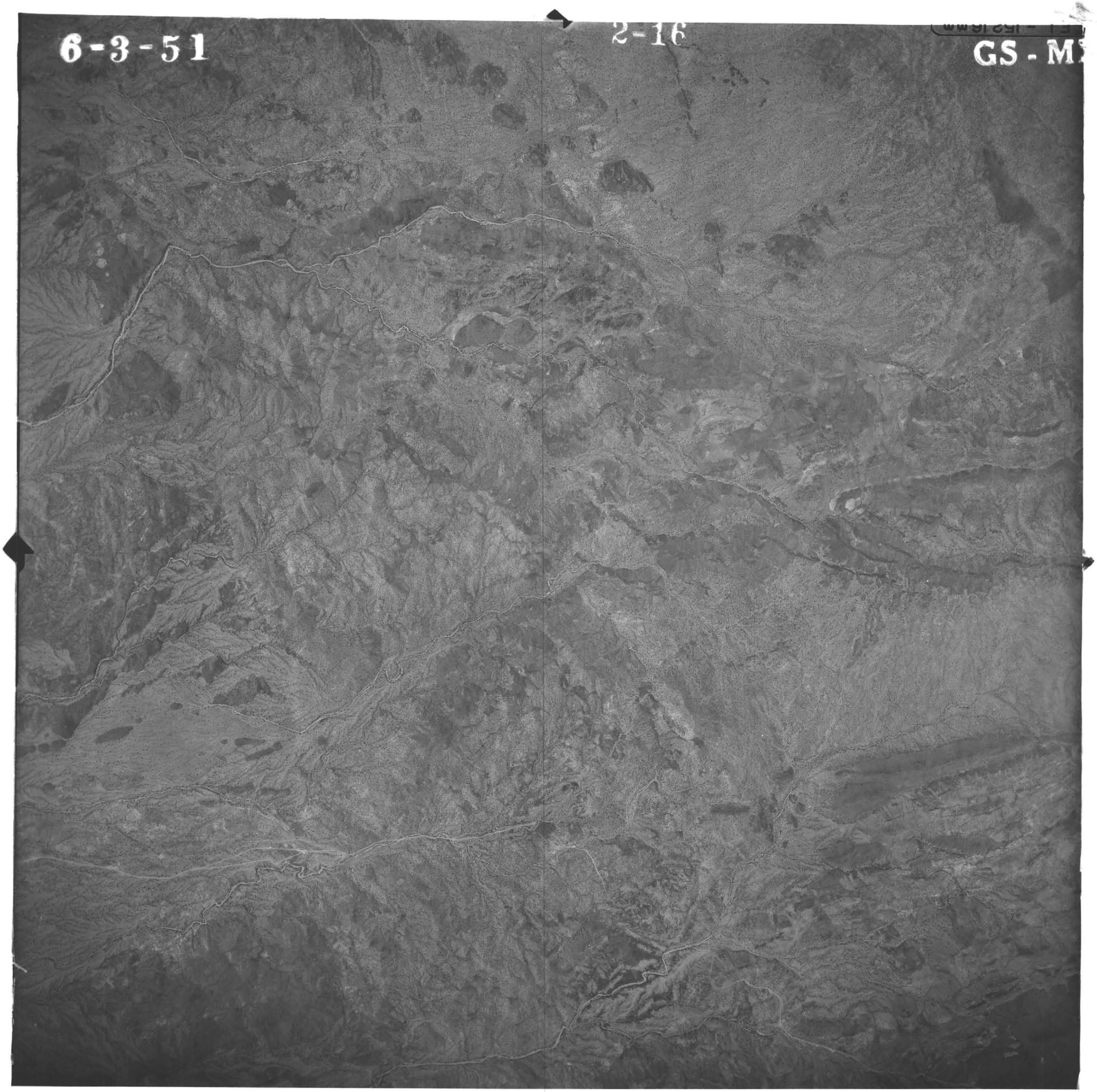
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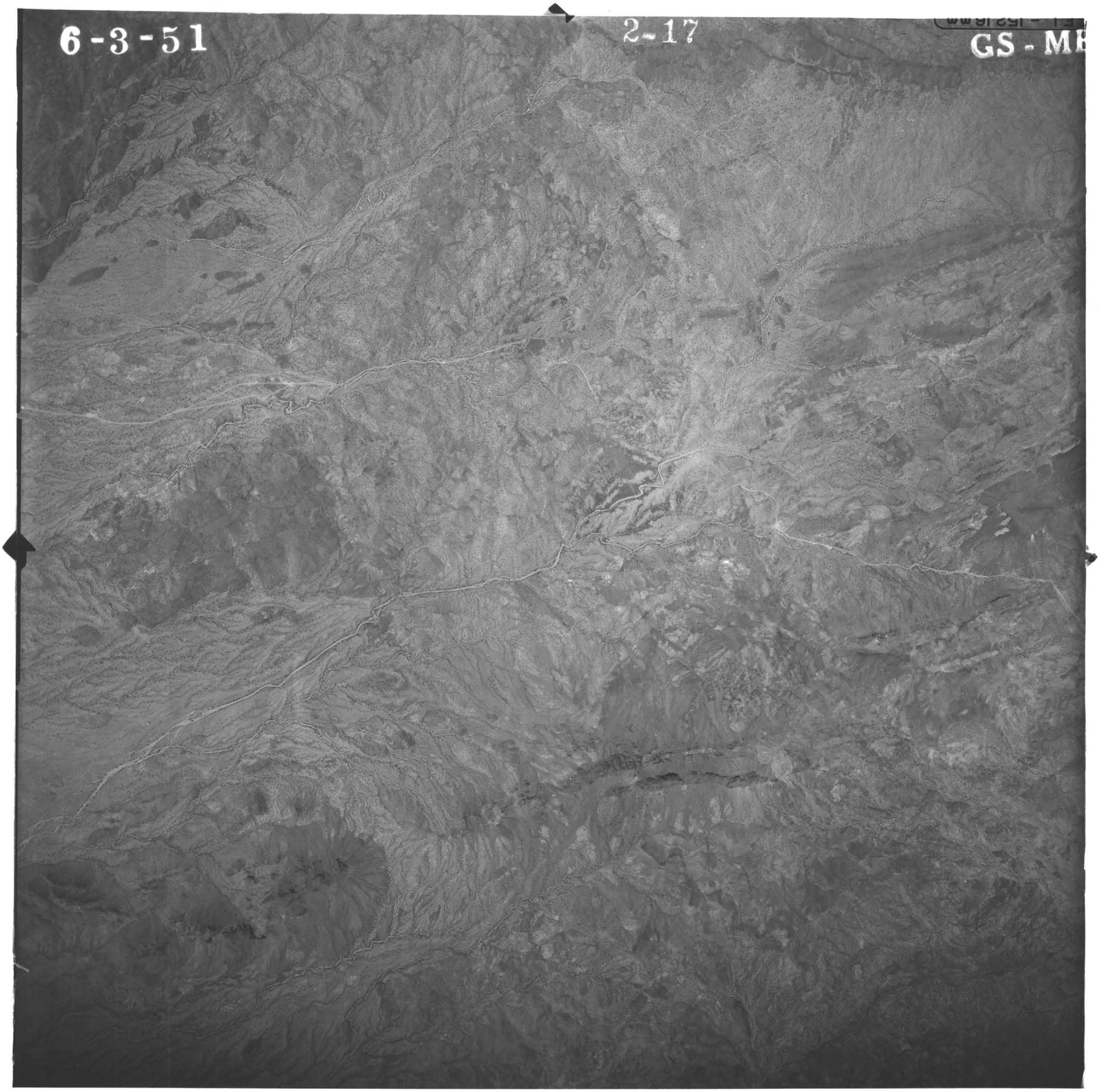
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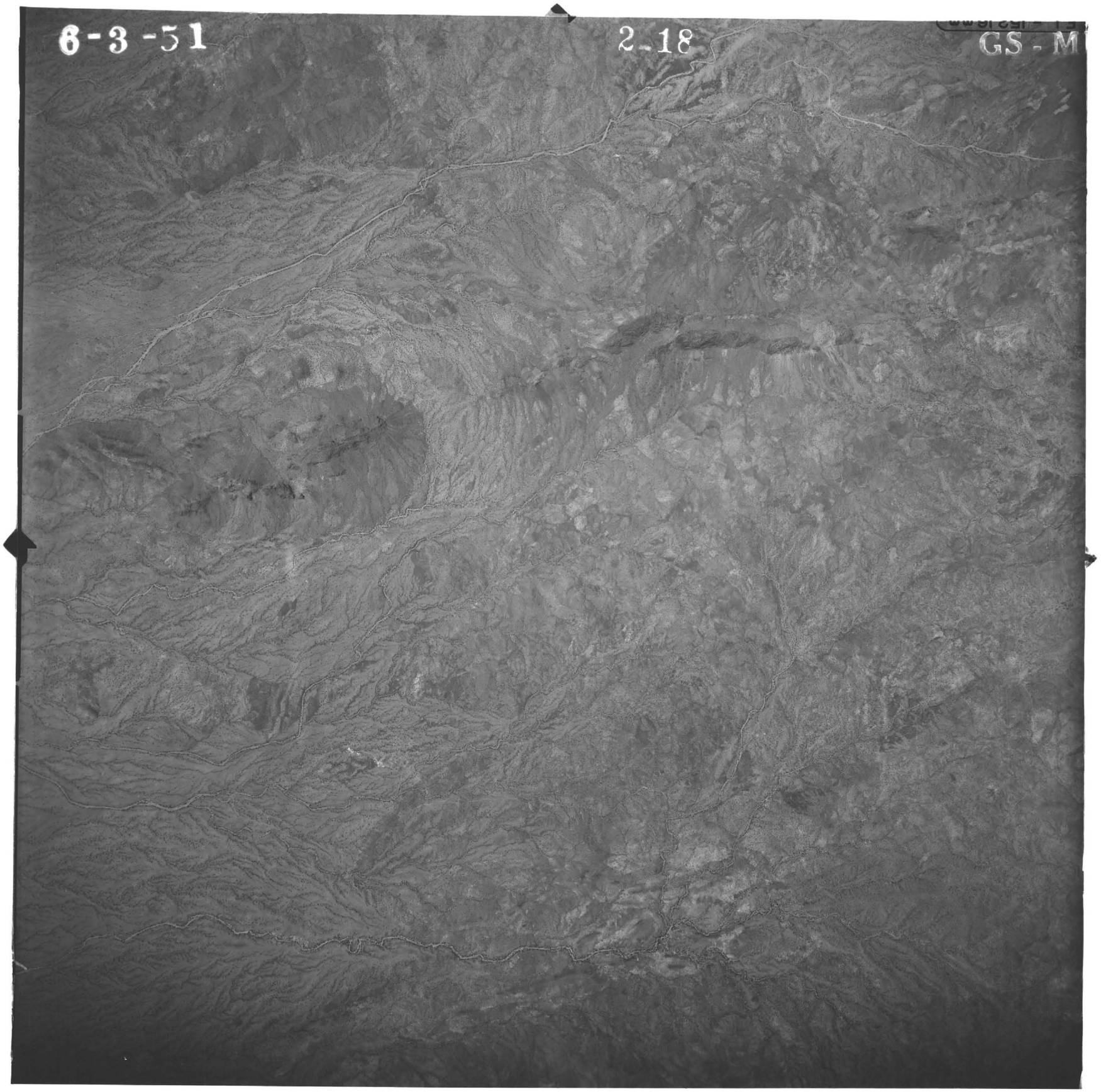
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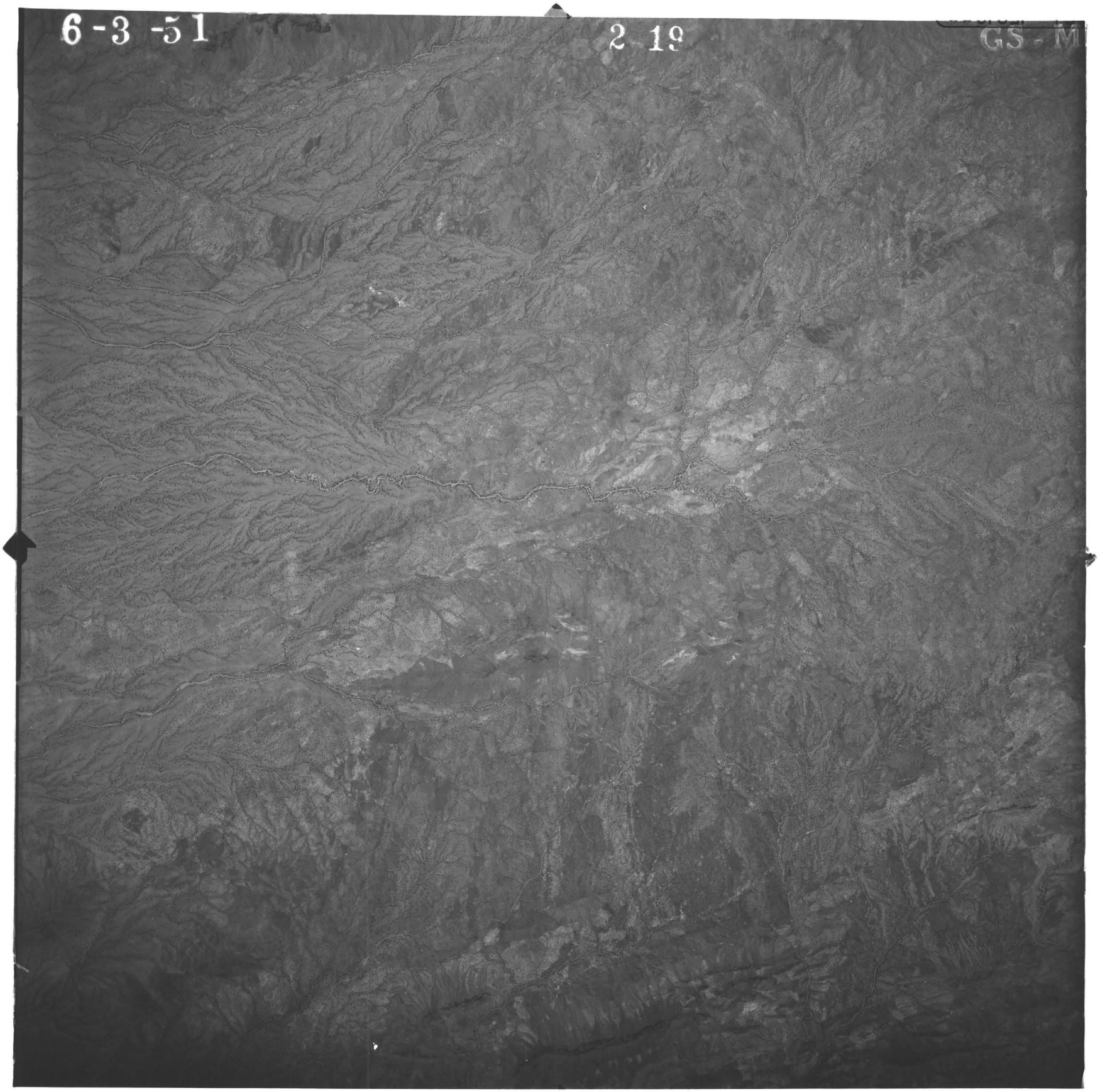
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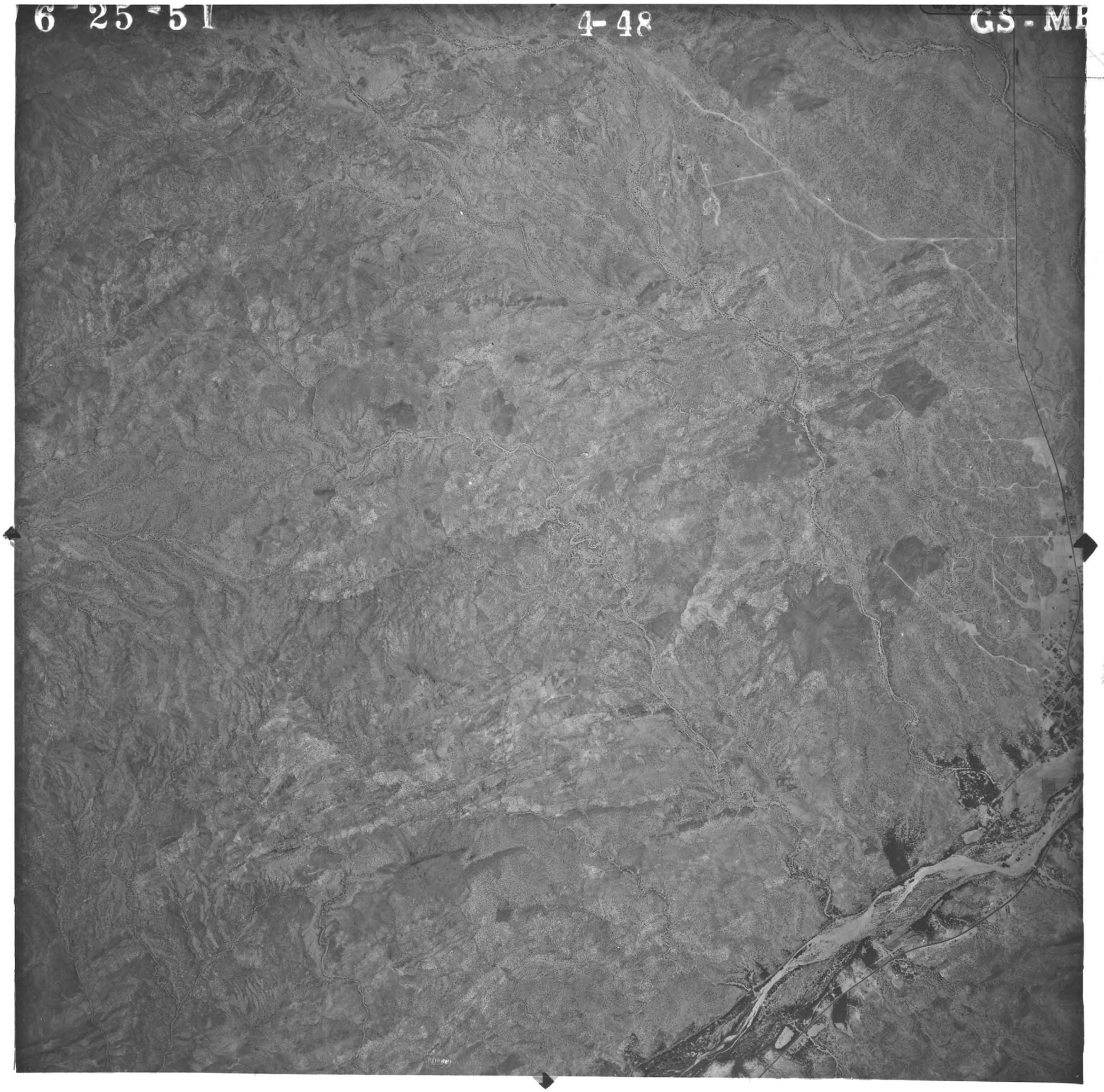
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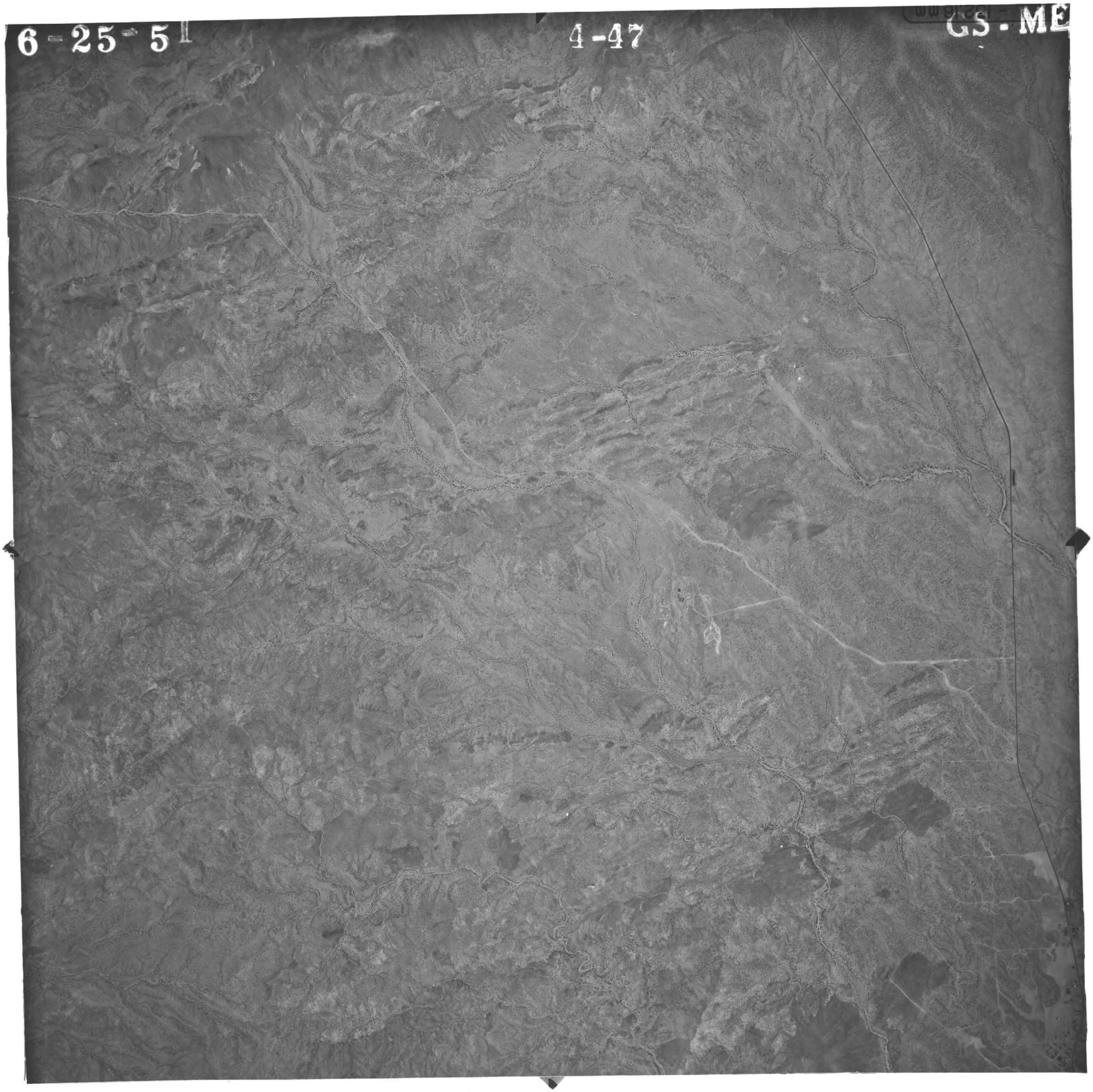
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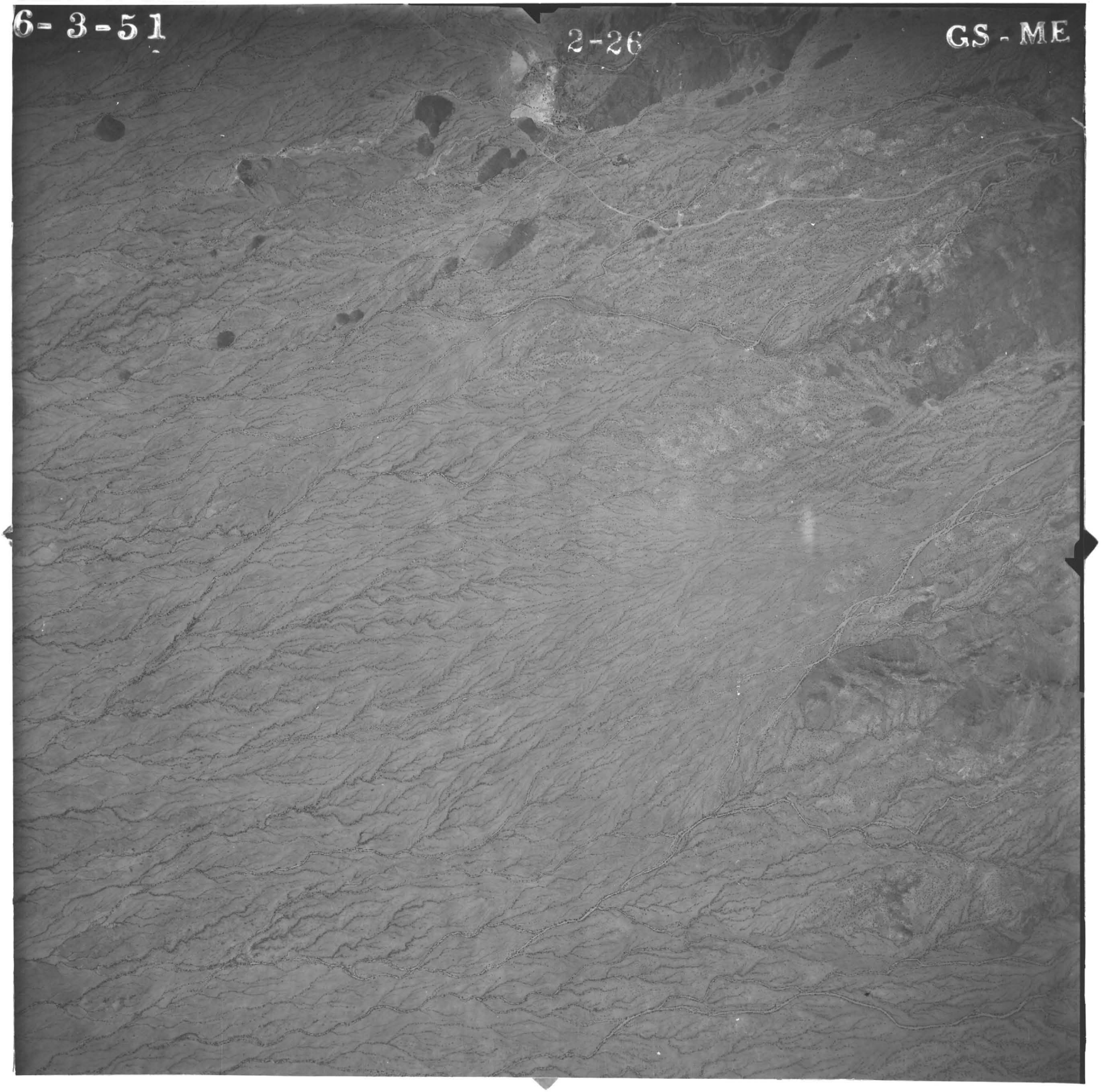
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