CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
416 W. Congress St., Suite 100
Tucson, Arizona 85701
520-770-3500
http://www.azgs.az.gov
inquiries@azgs.az.gov

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James Doyle Sell Mining Collection

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ASARCO

Southwestern Exploration Division

September 28, 1976

FILE MEMORANDUM

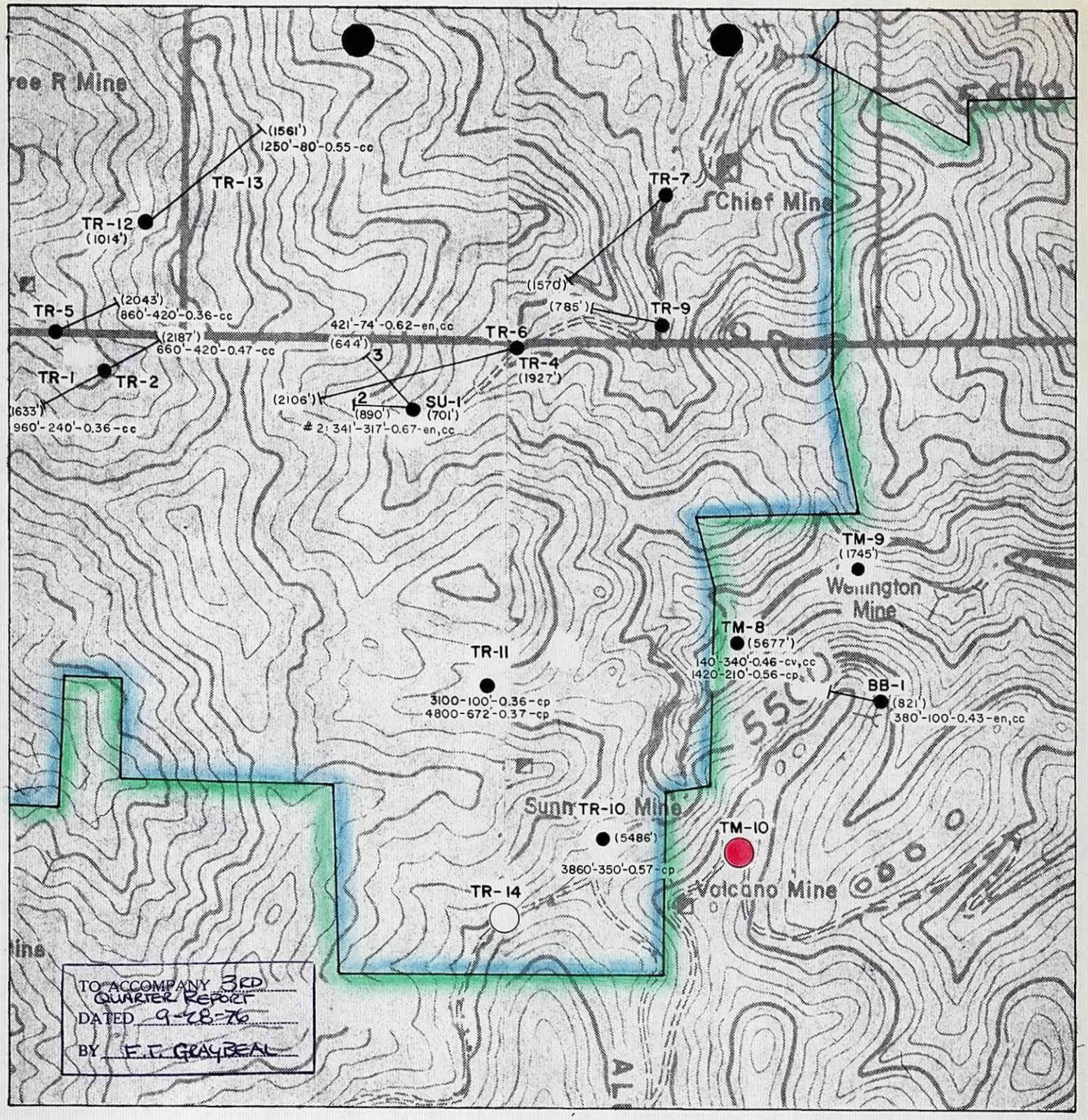
Thunder Mtn. Project - 0042
Monthly Report - Sept. 1976

Hole TM-10 advanced 19 ft. from 548-567 ft. in strongly silicified lapilli tuff and was bottomed at 567 ft. Expenses for the month were $700, leaving an estimated balance of $5,000.

F. T. Graybeal

F. T. Graybeal

FTG:lb
Att.



SCALE: 1" = 1000'

EXPLANATION

(821') BB-1 — drill hole showing depth

P — Current drill hole (P-Proposed)

Kerr-McGee—Thunder Mtn

Anaconda-3R

ASSAY DATA KEY

depth-length-%Cu-mineral

3860'-350'-0.59-cp

GEOLOGIC LEGEND

cp – chalcopyrite
cv – covellite
cc – chalcocite
en – enargite

DRILL MAP

3R – THUNDER MTN. PROJECT

PATAGONIA MTNS.

Santa Cruz County, Arizona

F.T.G. Sept. 1973

MVK 2638

~~JNC~~/WLK

ASARCO

Southwestern Exploration Division

August 27, 1976

FILE MEMORANDUM

Thunder Mtn. Project - 0042
Monthly Report - Aug. 1976

Hole TM-10 advanced 548 ft. from 0-548 ft. in moderately silicified lapilli tuff of the Chief formation. The core was mostly leached of sulfides, estimated at 3 vol. percent pyrite, and was extremely broken. The broken and silicified nature of the core resulted in slow drilling rates and high costs. Expenses for the month were $17,200, leaving an estimated balance of $5,500.

F. T. Graybeal

F. T. Graybeal

FTG:lb

AMERICAN SMELTING AND REFINING COMPANY
TUCSON ARIZONA

J. H. C.
MAY 2 1975

April 29, 1975

TO: W. L. Kurtz

FROM: F. T. Graybeal

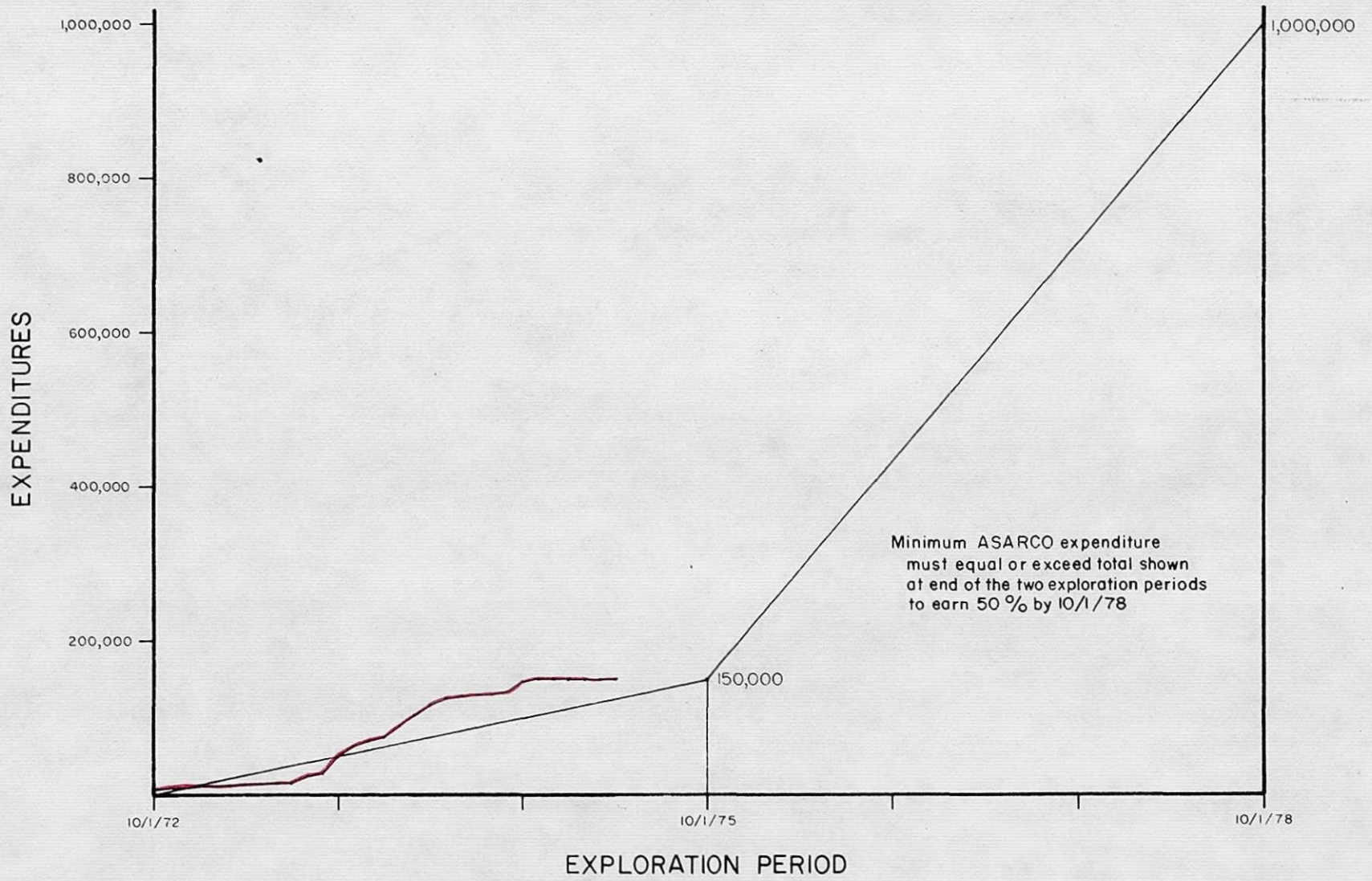
Thunder Mtn. Project -- 0042
Monthly Report -- Apr. 1975

The project was inactive this month. A graph showing cumulative expenditures through March 1975 is attached.

F. T. Graybeal

F. T. Graybeal

FTG:lb
Att.



Cumulative ASARCO Expenditures Through March, 1975.

TO ACCOMPANY Monthly Drilling Report
DATED April 28, 1975
BY F.T. Graybeal

EXPENDITURE RATE

THUNDER MTN. PROJECT

Patagonia Mtns.

Santa Cruz County, Arizona

MVK 2671

JHC

AMERICAN SMELTING AND REFINING COMPANY
TUCSON ARIZONA

J. H. C.
MAR 19 1975

March 13, 1975

Mr. T. C. Osborne
Assistant Director of Exploration
New York Office

Supplemental Exploration
Authorization Request
Thunder Mountain Project
Santa Cruz County, Arizona

Dear Sir:

As we discussed during your visit to Tucson in December 1974, we have received sufficient encouragement in our drilling on the adjoining 3R and Thunder Mountain Projects to justify continued exploration.

Our first diamond drill hole, TR-10, on the 3R Project area intersected:

110 feet to 160 feet;	50 feet @ 0.63% copper
3860 feet to 4210 feet;	350 feet @ 0.57% copper, 0.033% MoS_2, 0.004 oz. gold, 0.10 oz. silver

Diamond drill hole TM-8 on the Thunder Mountain Project are intersected:

140 feet to 210 feet;	70 feet @ 0.58% copper
210 feet to 370 feet;	160 feet @ 0.25% copper
370 feet to 480 feet;	110 feet @ 0.68% copper
1420 feet to 1630 feet;	210 feet @ 0.56% copper
4300 feet to 5500 feet;	1200 feet @ 0.25% copper, 0.017% MoS_2, 0.10 oz. silver

The 1745-foot diamond drill hole, TM-9, on the Thunder Mountain Project area intersected copper mineralization averaging less than 0.20% above a thousand feet.

Drill holes TM-8 and TR-10 confirm the existence of a vertically zoned porphyry copper system and demonstrate that higher primary copper values are associated with a potassic zone of alteration into which the phyllic zone has collapsed. The exploration chances for finding significant ore grade copper mineralization are considered good.

On the 3R Project area I have recommended completing drill hole TR-11 and the drilling of a new hole. For the Thunder Mountain Project area I request $7500 to continue geochemical, geologic, and petrographic studies. If you approve, please request a Supplemental Exploration Authorization in this amount. Forms 302-EA and 302-EB are attached.

Respectfully submitted,

W. L. Kurtz/lb

W. L. Kurtz

WLK:lb
Atts: Map, Forms

cc: JHCourtright - w/o atts.
RBCrist - w/o atts.
FTGraybeal - w/o atts.
WGKellogg - w/forms only

J.H.C.

AMERICAN SMELTING AND REFINING COMPANY
TUCSON ARIZONA

J. H. C.
FEB 6 1975

January 30, 1975

TO: W. L. Kurtz

FROM: F. T. Graybeal

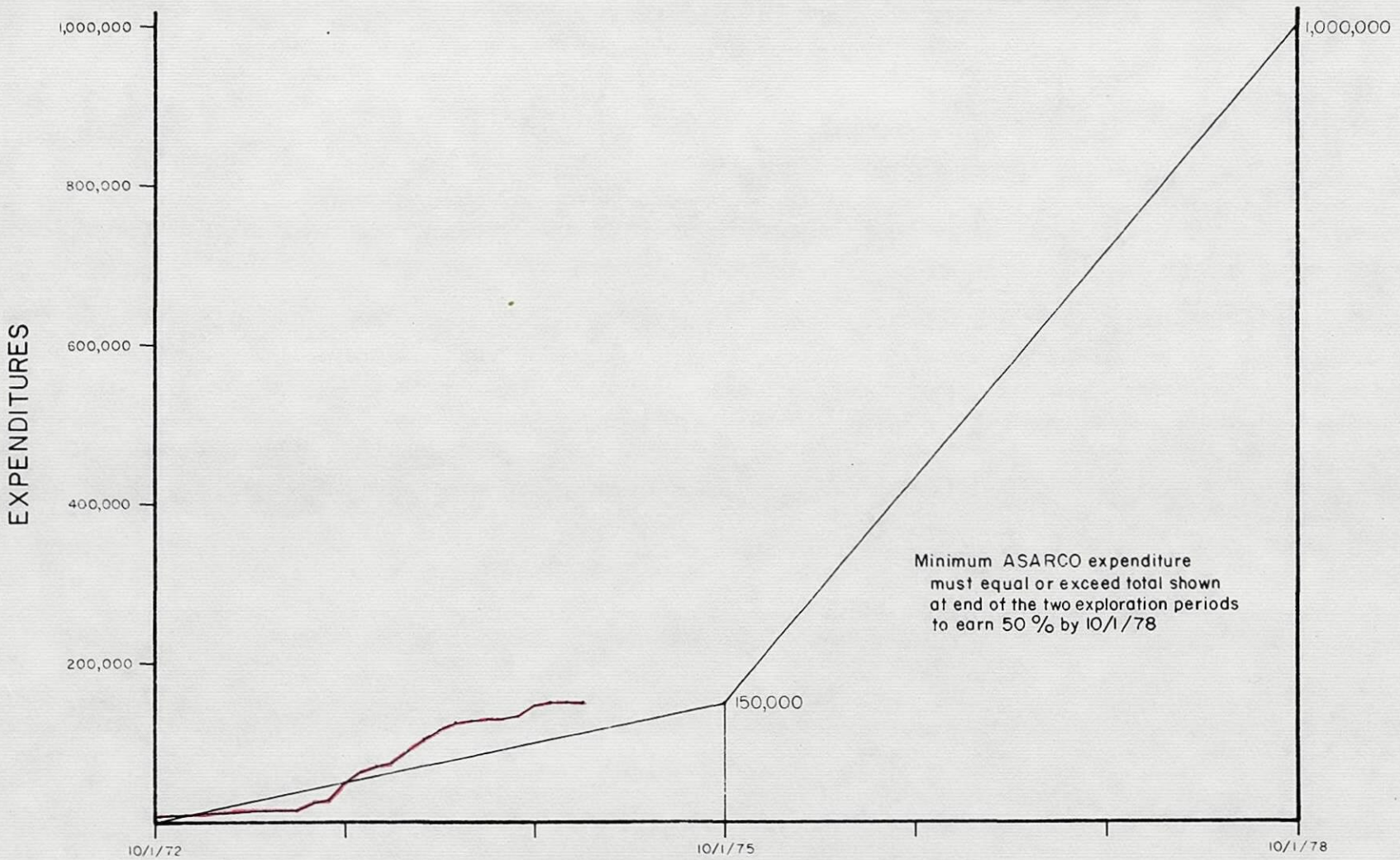
Thunder Mtn. Project -- 0042
Monthly Report -- Jan. 1975

Minor fluid inclusion work was continued. There were no invoiced charges. The expenditure rate graph for the fourth quarter is attached.

F. T. Graybeal

F. T. Graybeal

FTG:lb
Attach.



Cumulative ASARCO Expenditures Through December 1974.

EXPENDITURE RATE

THUNDER MTN. PROJECT

Patagonia Mtns.

Santa Cruz County, Arizona

TO ACCOMPANY Report

DATED Jan. 30, 1975

BY F.T. Graybeal

MVK 2671

JHC

AMERICAN SMELTING AND REFINING COMPANY
TUCSON ARIZONA

December 23, 1974

TO: W. L. Kurtz

FROM: F. T. Graybeal

Thunder Mtn. Project -- 0042
Monthly Report -- Dec. 1974

The summary report on TM-9 was submitted and minor additional work on fluid inclusion distributions was completed. All time distributions this month were charged to 3R. There were no invoiced charges.

F. T. Graybeal

F. T. Graybeal

FTG:lb

J.H.C.

AMERICAN SMELTING AND REFINING COMPANY
TUCSON ARIZONA

October 28, 1974

J. H. C.
OCT 30 1974

TO: W. L. Kurtz

FROM: F. T. Graybeal

Thunder Mtn. Project - 0042
Monthly Report - Oct. 1974

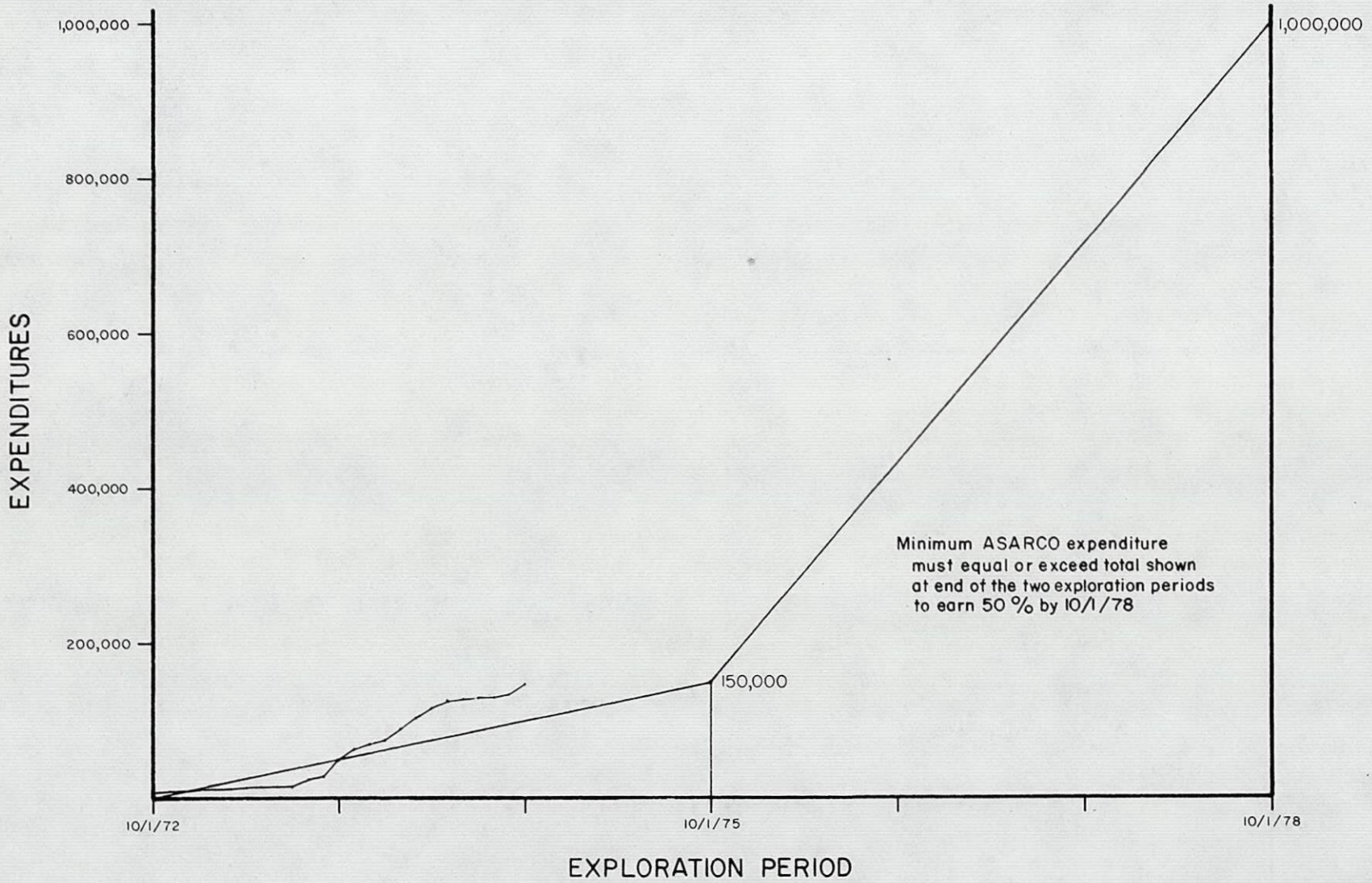
Hole TM-9 was advanced 303 ft. from 1442-1745 ft. and bottomed at 1745 ft. It cut strongly altered lapilli tuff carrying 3-8 vol. percent disseminated pyrite and no visible copper minerals. Assay and geochemical work is not yet complete.

Expenditures for the month were $5,000.00, leaving an estimated deficit of $2,300.00. This exceeds the minimum expenditure required through Oct. 1, 1975 by the Thunder Mtn. option agreement with Kerr-McGee, as shown on the attached expenditure rate graph.

F. T. Graybeal

F. T. Graybeal

FTG:lb
Attachs.



Cumulative ASARCO Expenditures Through SEPT 30, 1974.

EXPENDITURE RATE

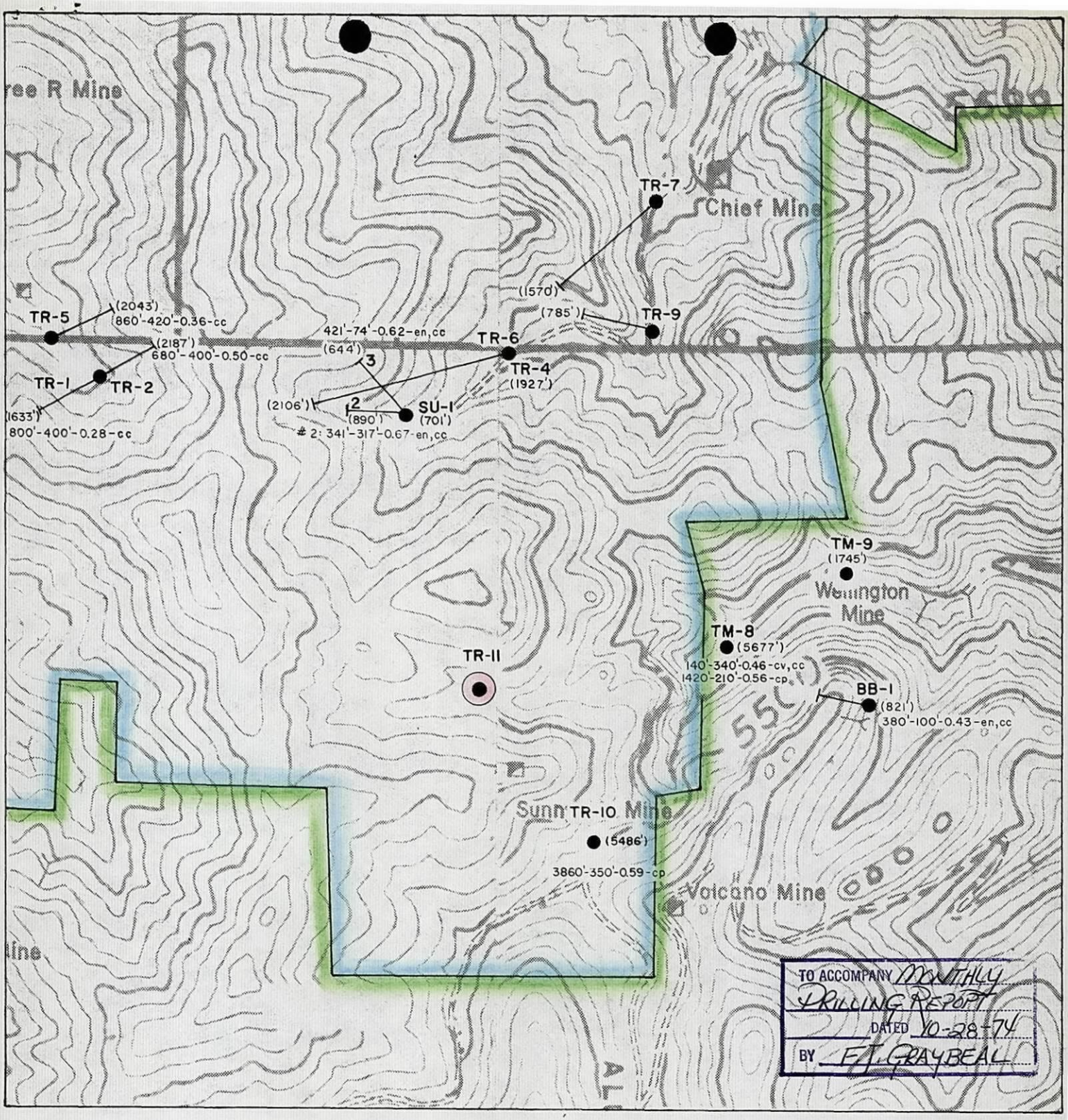
THUNDER MTN. PROJECT

Patagonia Mtns.

Santa Cruz County, Arizona

TO ACCOMPANY MONTHLY DRILLING REPORT
DATED OCT 28-74
BY E.T. GRAYBEAL

MVK 2671



SCALE: 1" = 1000'

EXPLANATION

(821') BB-1 — drill hole showing depth

Current drill hole

Kerr-McGee—Thunder Mtn

Anaconda-3R

ASSAY DATA KEY

depth-length-%Cu-mineral

3860'-350'-0.59-cp

GEOLOGIC LEGEND

cp - chalcopyrite
cv - covellite
cc - chalcocite
en - enargite

DRILL MAP

3R - THUNDER MTN. PROJECT

PATAGONIA MTNS.

Santa Cruz County, Arizona

F.T.G. Sept. 1973

MVK 263

J.H.C.

AMERICAN SMELTING AND REFINING COMPANY
TUCSON ARIZONA

August 29, 1974

J. H. C.
AUG 29 1974

TO: W. L. Kurtz

FROM: F. T. Graybeal

Thunder Mtn. Project -- 0042
Monthly Report -- Aug. 1974

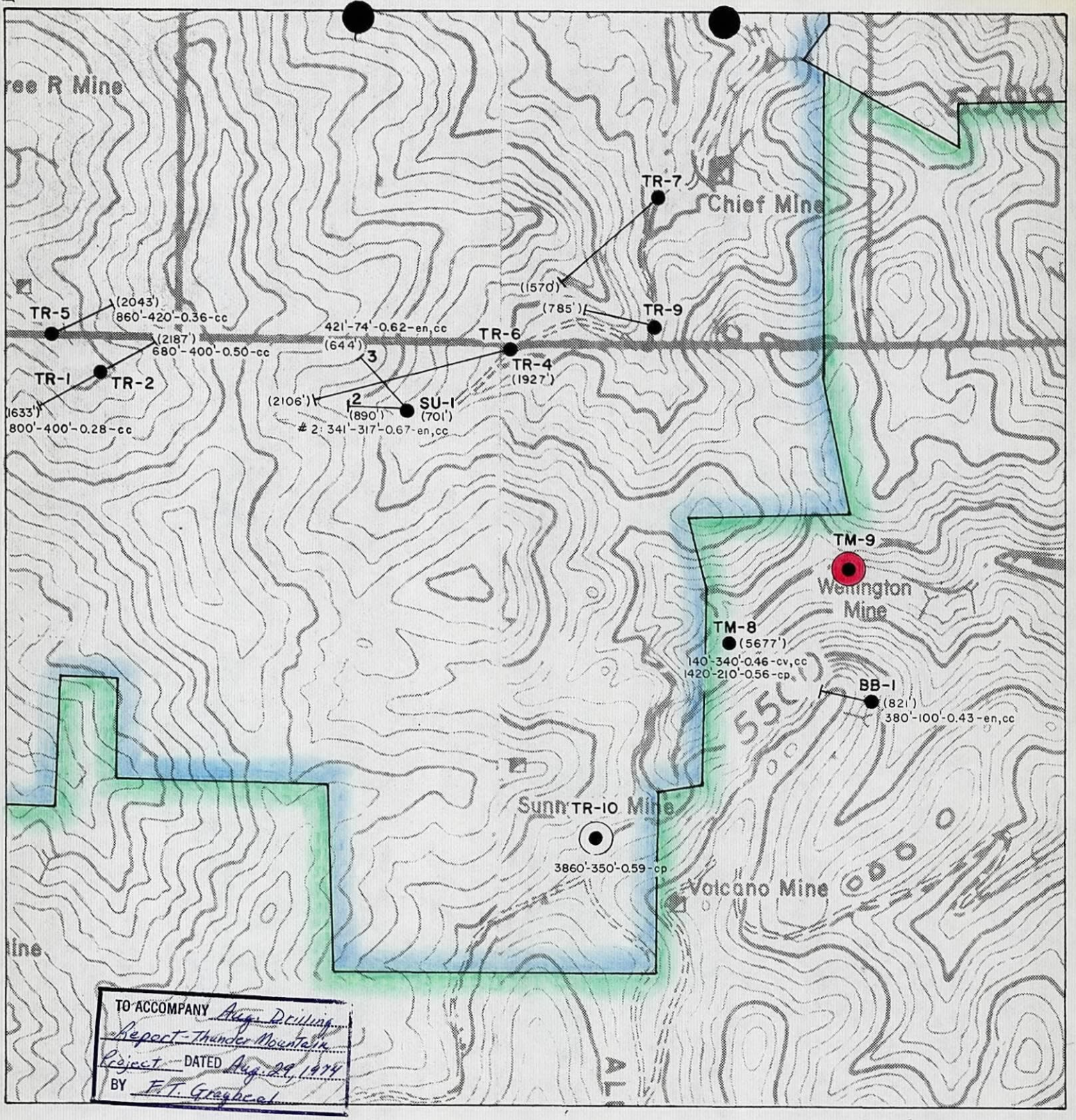
Hole TM-9 was collared and advanced 459 ft. from 0-459 ft. Mixed lapilli tuff and quartz feldspar porphyry were intersected and both were strongly sericitized with variable amounts of pyrite. Traces of chalcocite were logged from 130-250 ft. in a fault zone and an underlying quartz feldspar porphyry dike; however, the highest assay in this interval was 0.15% Cu. The remainder of the core contains no visible copper sulfides.

A summary report for TM-8 was submitted in spite of extensive delays by service groups working on sulfide mineral identification. Expenditures for the month were $5,600, leaving an estimated balance of $13,750.

F. T. Graybeal

F. T. Graybeal

FTG:lb
Attachs.



SCALE: 1" = 1000'

EXPLANATION

(821') BB-1 — drill hole showing depth

Current drill hole

Kerr-McGee—Thunder Mtn

Anaconda-3R

ASSAY DATA KEY

depth-length-%Cu-mineral

3860'-350'-0.59-cp

GEOLOGIC LEGEND

cp – chalcopyrite
cv – covellite
cc – chalcocite
en – enargite

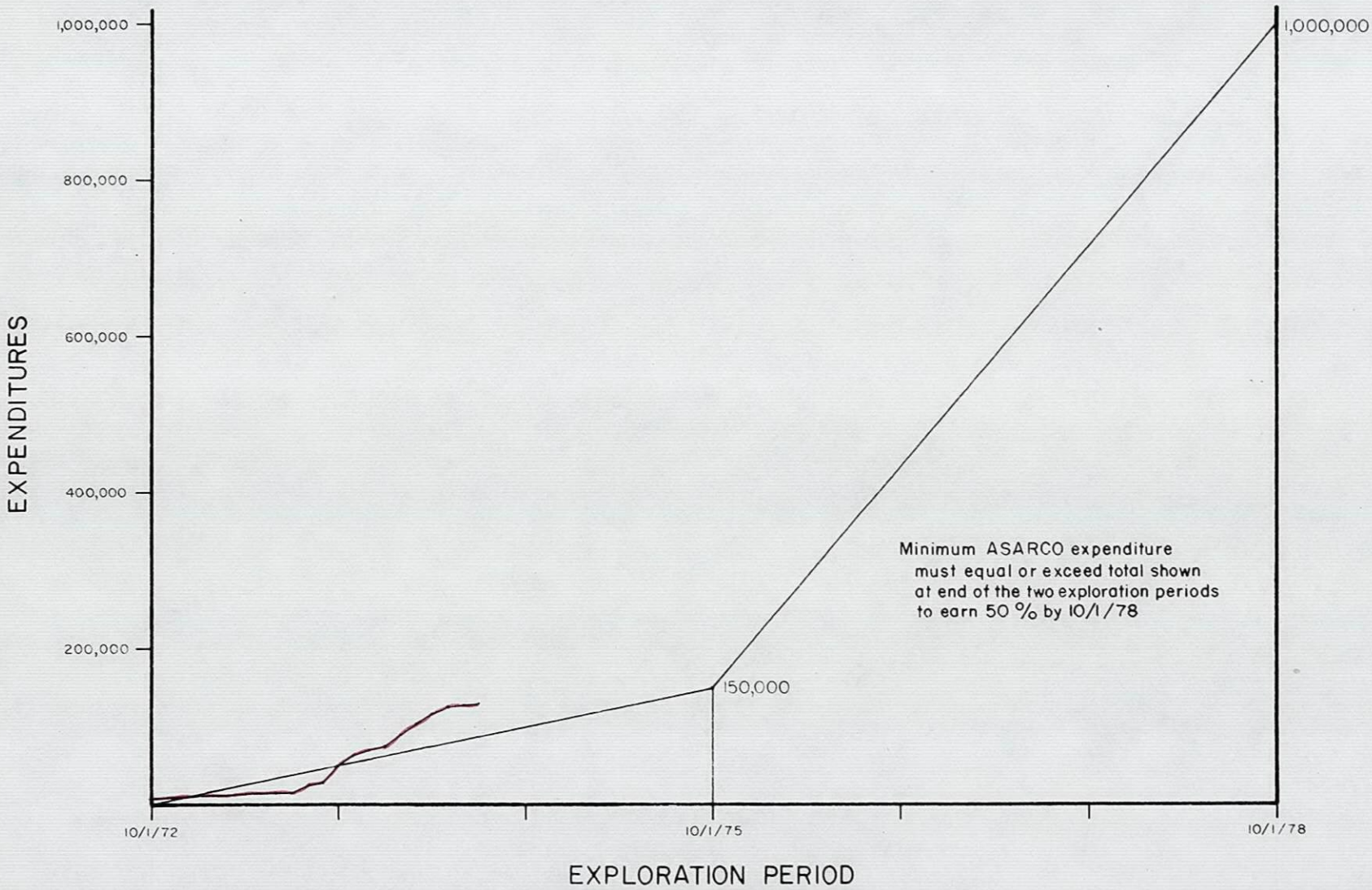
DRILL MAP

3R – THUNDER MTN. PROJECT

PATAGONIA MTNS.

Santa Cruz County, Arizona

F.T.G. Sept. 1973



Cumulative ASARCO Expenditures Through June, 1974.

TO ACCOMPANY Monthly Drilling Report
DATED Aug. 29, 1974
BY F. T. Graybeal

EXPENDITURE RATE

THUNDER MTN. PROJECT

Patagonia Mtns.

Santa Cruz County, Arizona

MVK 2671

J. H. C.

AMERICAN SMELTING AND REFINING COMPANY
TUCSON ARIZONA

J. H. C.
MAY 31 1974

May 31, 1974

Memorandum to: W. L. Kurtz

From: F. T. Graybeal

Thunder Mtn. Project -- 0042
Monthly Report -- May 1974

A number of core samples were sent to the ASARCO Central Research laboratories for mineralogical work, particularly with regard to sulfides. The very low As geochemical values in the copper zone at 140-480 ft. suggest the dark mineral was not enargite. The other alternative is chalcocite, however the mineral is rather lustrous and relogging of the interval did not resolve the problem.

Assaying of 100 ft. composite samples from the copper zone at 1420-1650 ft. gave the following weighted averages for MoS_2, Au, and Ag:

Interval	Length	% Cu	% MoS_2	oz. Au	oz. Ag
1420-1650	230 ft.	0.54	0.030	0.004	0.24

Using $.80 lb. Cu, $150 oz. Au, $5.00 oz. Ag, and $1.60 lb. MoS_2 (byproduct conc.), an equivalent value of 0.71% Cu is obtained for the entire interval. Applying approximate metallurgical recoveries of 90% for Cu and Ag, and 50% for Au and MoS_2, a total recoverable value of $9.64/ton is calculated. The recovery figures are approximate and are similar to those at Mission (Cu, MoS_2) and Silver Bell (MoS_2, Au, and Ag). The byproduct values of this rock are clearly significant and further assaying with independent check work is planned.

Expenditures for the month were $500.00, leaving an estimated balance of $22,000.00.

F. T. Graybeal

F. T. Graybeal

FTG:lb

J.H.C.

AMERICAN SMELTING AND REFINING COMPANY
TUCSON ARIZONA

J. H. C.
MAY 2 1974

May 1, 1974

Memorandum to: W. L. Kurtz

From: F. T. Graybeal

Thunder Mtn. Project -- 0042
Monthly Report -- April 1974

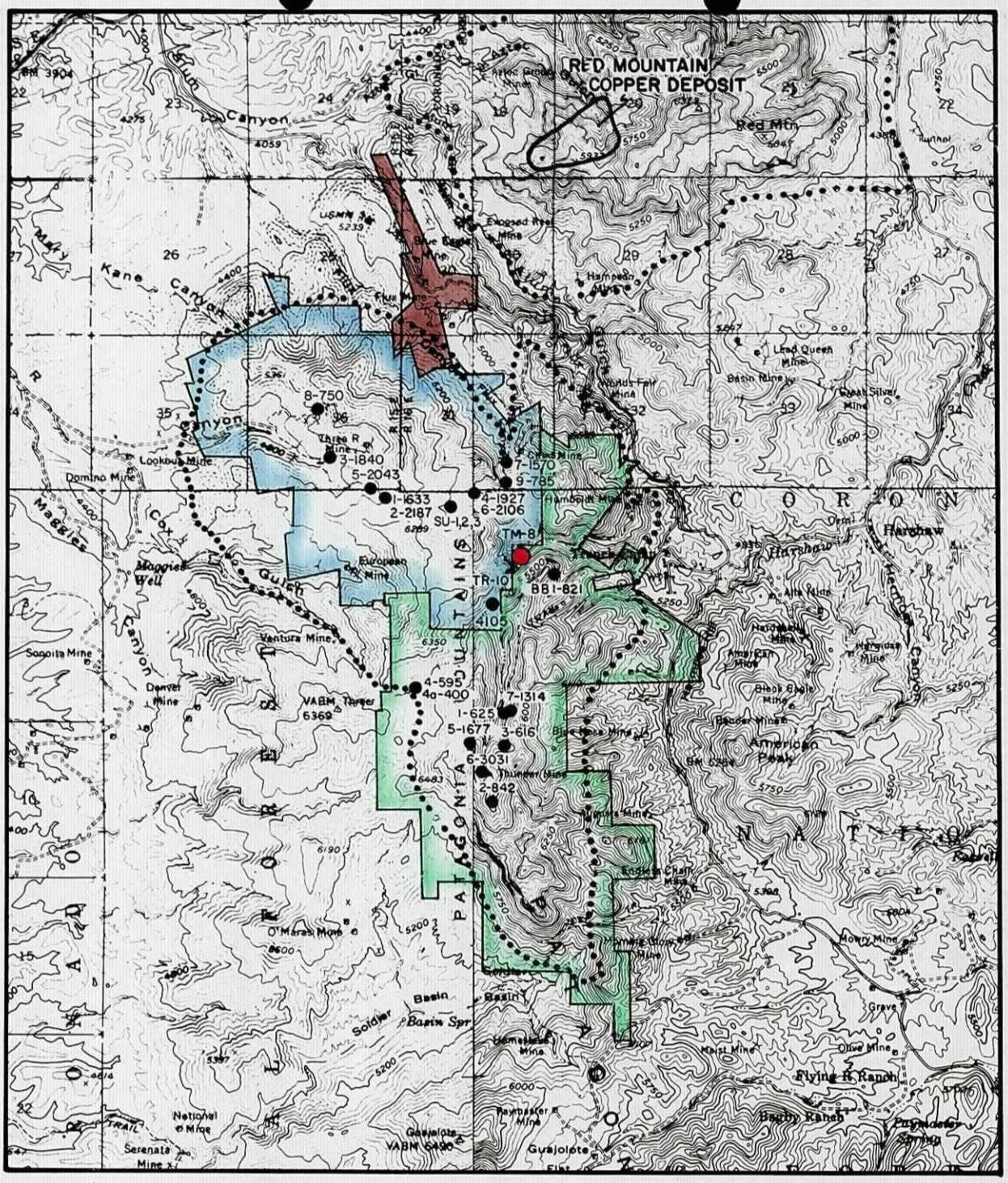
Hole TM-8 was advanced 191 ft. from 5486-5677 and bottomed at 5677 ft. The alteration strength continued as intense with no indication of the original rock type. A sharp alteration change was encountered at 5500 ft., although it still appears to be of mixed potassic-phyllic type. However, the assays dropped to the 0.01-0.05% Cu range and as the drill had reached its approximate depth limit, I decided to terminate the hole. The completed log with a detailed discussion will be submitted when assaying is complete. All rods were successfully extracted from the hole. One hundred feet of NX casing was lost.

Attached is a drilling map and an expenditure rate chart for the first quarter of 1974. Expenditures for the month were $8,200, leaving an estimated balance of $22,600.

F. T. Graybeal

F. T. Graybeal

FTG:lb
Attachs.



LEGEND

- Anaconda
- ASARCO
- Kerr McGee

8-750 ● previous drill hole showing depth
(Anaconda prefix-TR)
(Kerr-McGee prefix-TM)

TM-8 ● ASARCO drill hole

areas of pervasive hydrothermal alteration

TO ACCOMPANY Memo
DATED May 1, 1974
BY F.T. Graybeal

DRILLING PROGRESS MAP

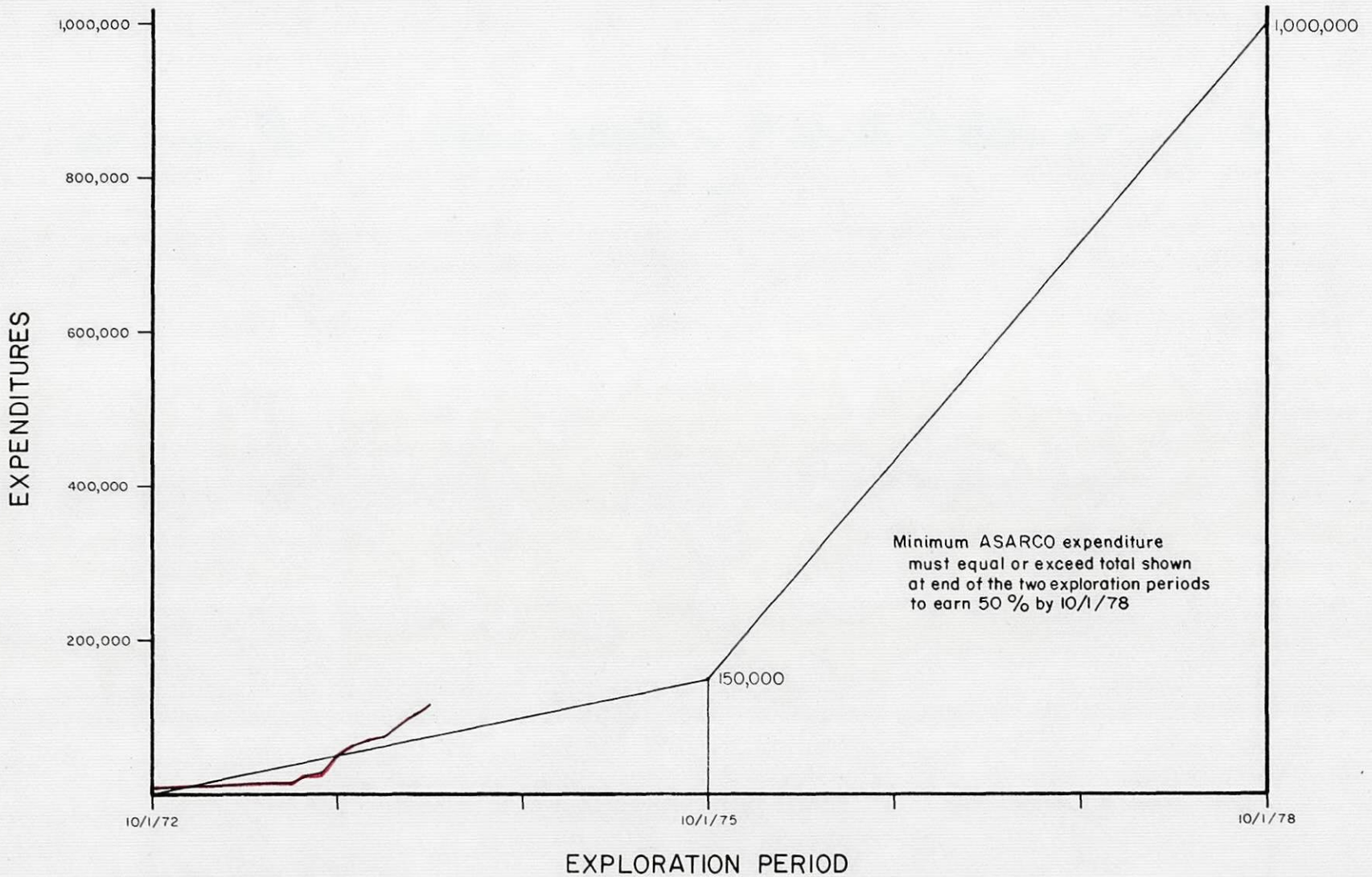
for the month of April, 1974

TM PROJECT

SANTA CRUZ COUNTY, ARIZONA

1" = 1 mile

MVK 257



TO ACCOMPANY Memo.
DATED May 1, 1974
BY F.T. Graybeal

Cumulative ASARCO Expenditures Through March, 1974.

EXPENDITURE RATE

THUNDER MTN. PROJECT

Patagonia Mtns.

Santa Cruz County, Arizona

MVK 2671

JHC

AMERICAN SMELTING AND REFINING COMPANY
TUCSON ARIZONA

March 27, 1974

Memorandum to: W. L. Kurtz

From: F. T. Graybeal

Thunder Mtn. Project -- 0042
Monthly Report -- March 1974

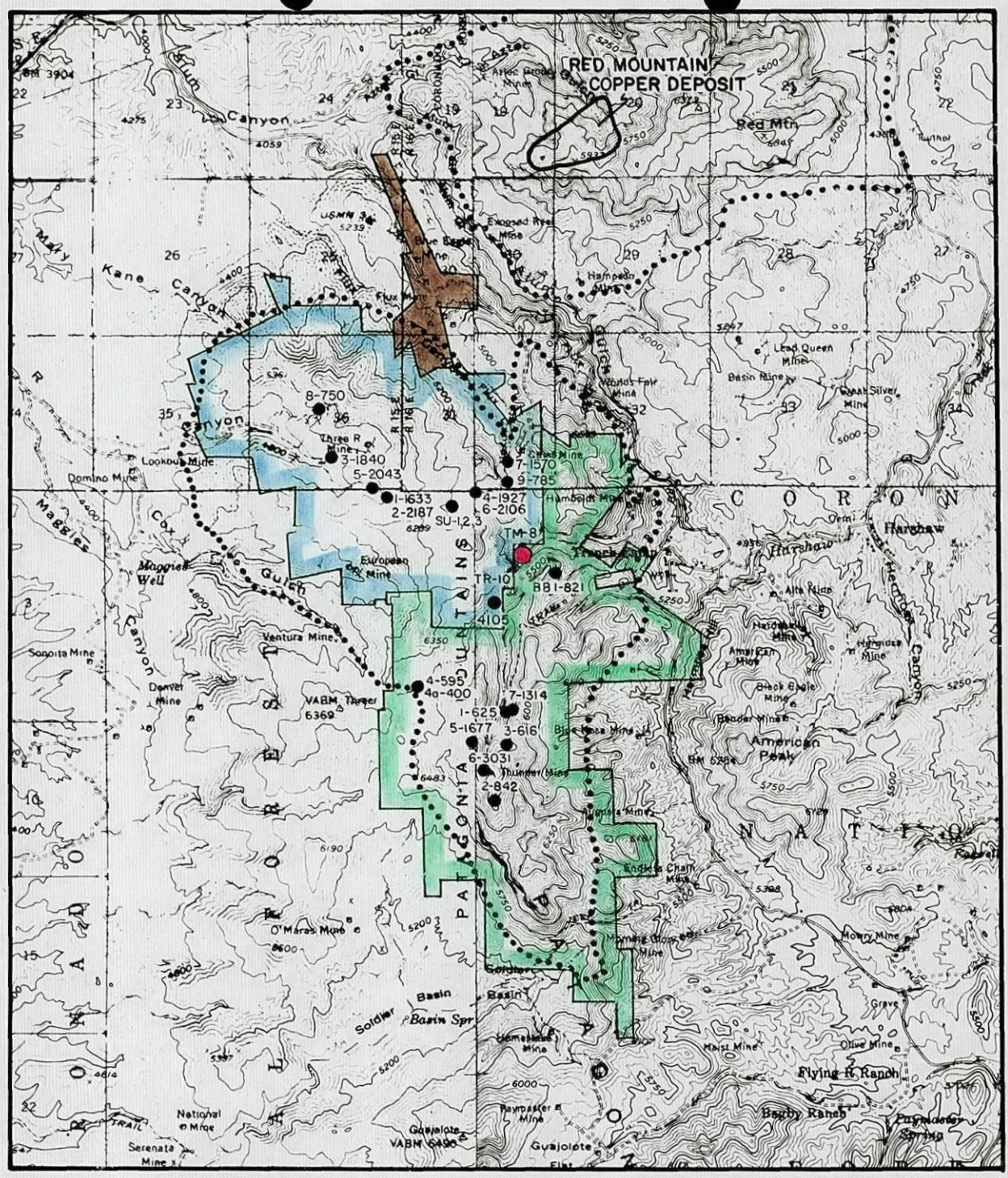
Hole TM-8 was advanced 532 ft. from 4954-5486 ft. The alteration has slowly changed into a well-defined but slightly atypical potassic assemblage and assays are increasing slowly with erratic highs above 0.50% Cu. The rock still appears to be a quartz feldspar porphyry, although its identity is obscured by the strong alteration.

Expenditures for the month were $13000, leaving an estimated balance of $31,100.

F. T. Graybeal

F. T. Graybeal

FTG:lb
Attach.



LEGEND

- Anaconda
- ASARCO
- Kerr McGee

8-750 ● previous drill hole showing depth
(Anaconda prefix-TR)
(Kerr-McGee prefix-TM)

TM-8 ● ASARCO drill hole

areas of pervasive hydrothermal alteration

TO ACCOMPANY Monthly Report
DATED March 27, 1974
BY F.T. Graybeal

DRILLING PROGRESS MAP

for the month of March, 1974

TM PROJECT

SANTA CRUZ COUNTY, ARIZONA

1" = 1 mile

MVK 2574

J. H.C.

AMERICAN SMELTING AND REFINING COMPANY
TUCSON ARIZONA

March 1, 1974

MAR 15 1974

Memorandum to: W. L. Kurtz

From: F. T. Graybeal

Thunder Mtn. Project -- 0042
Monthly Report -- Feb. 1974

Hole TM-8 was advanced 679 ft. from 4275-4954 ft. The alteration continues as very strong quartz-sericite with small amounts of barite. The Cu assays have shown a very slow, progressive increase to grades averaging about 0.30% Cu with accompanying 0.10 oz. Ag. At the present bottom of the hole sections of intrusive(?) breccia alternate with greenish, strongly altered sections of a quartz(?) feldspar porphyry. This greenish porphyry appears to be less-well mineralized than the intrusive breccia and may be intra-mineral in age.

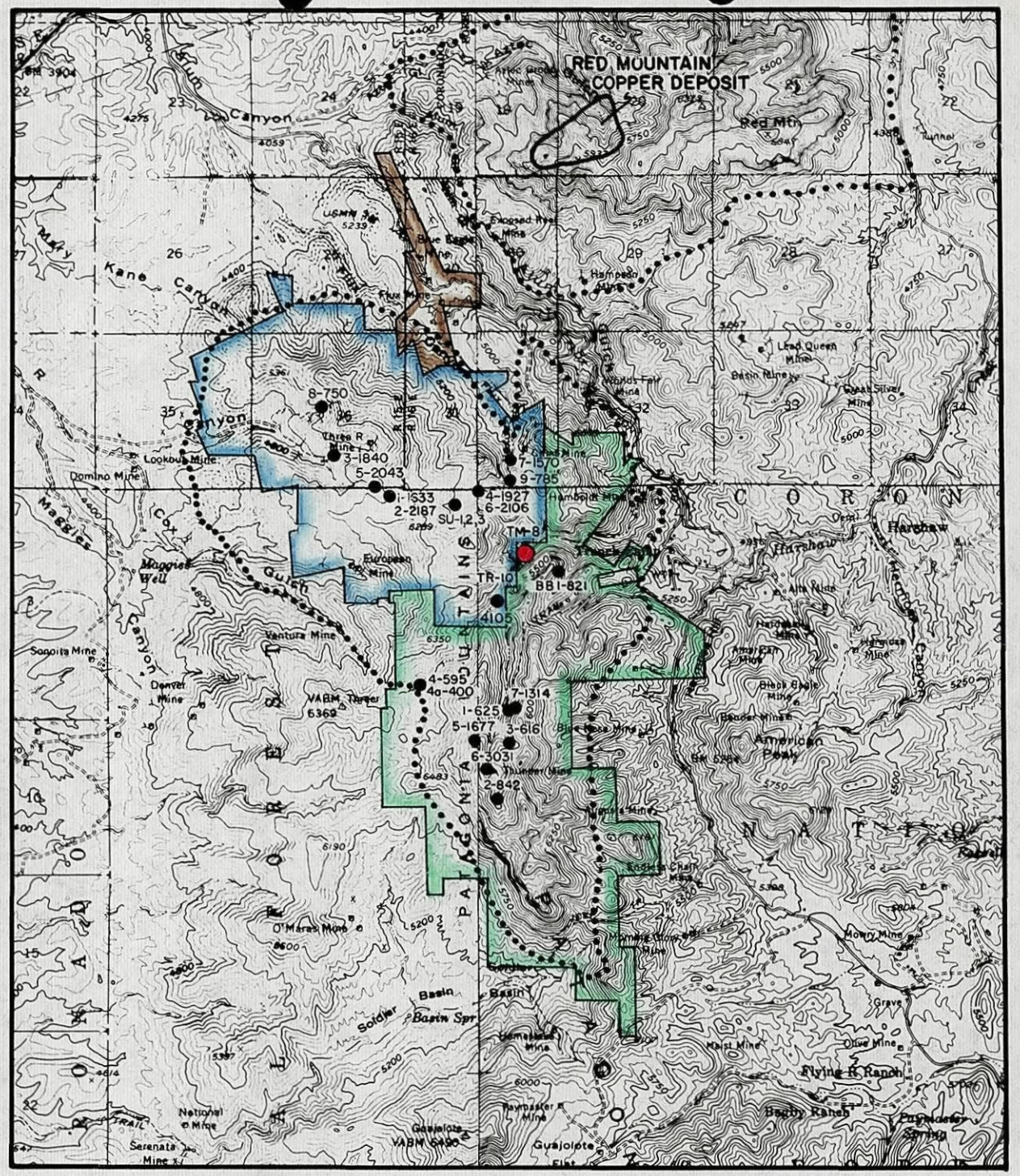
Although the grades are not encouraging at this depth, the exceptionally well-altered nature of the intrusive breccia in addition to changes in several aspects of the rock types and alteration suggest that further drilling is warranted. Also, the location of this hole in a deep canyon provides us with a 400-500 ft. topographic advantage for examining a deep section of alteration within the diatreme.

Expenditures for the month were $15,500, leaving an estimated balance of $44,400.

F. T. Graybeal

F. T. Graybeal

FTG:lb
Attach.



LEGEND

- Anaconda
- ASARCO
- Kerr-McGee

8-750 ● previous drill hole showing depth
(Anaconda prefix-TR)
(Kerr-McGee prefix-TM)

TR-10 ● ASARCO drill hole

areas of pervasive hydrothermal alteration

TO ACCOMPANY Monthly Report
DATED March 1, 1974
BY F.T. Graybeal

DRILLING PROGRESS MAP

for the month of Feb., 1974

TM PROJECT

SANTA CRUZ COUNTY, ARIZONA

1" = 1 mile

MVK 2574

JHC

AMERICAN SMELTING AND REFINING COMPANY
TUCSON ARIZONA

February 1, 1974

J. H. C.

MAR 15 1974

Memorandum to: W. L. Kurtz

From: F. T. Graybeal

Thunder Mtn. Project - 0042
Monthly Report - Jan. 1974

Hole TM-8 was advanced 517 ft. from 3758-4275 ft. The alteration continues to be exceptionally strong quartz-sericite which contains increasing amounts of mineralized quartz veins, pyrite veins, and chalcopyrite with depth. The host rock is still an intrusive porphyry.

Core splitting has been brought up to date and significant assays, not previously reported, are as follows:

depth	length	% Cu	oz. Ag	oz. Au
140-480'	340'	0.46	0.23	0.005

The interval from roughly 2500-3500 ft. averaged roughly 0.06-0.07% Cu. Assays from 3500 ft. to the present bottom of the hole have been slowly increasing and are currently averaging about 0.20% Cu.

The interval from 140-480 ft. appears to be primarily enargite and is almost certainly related to the As geochemical anomalies in outcrop. The higher grade interval in hole BB-1 occurred in and next to a quartz feldspar porphyry dike at the same elevation as in TM-8. There is, therefore, a possibility that this mineralization is blanket-like in distribution, indicating the need for further drilling east of TM-8 particularly in the intrusive stocks.

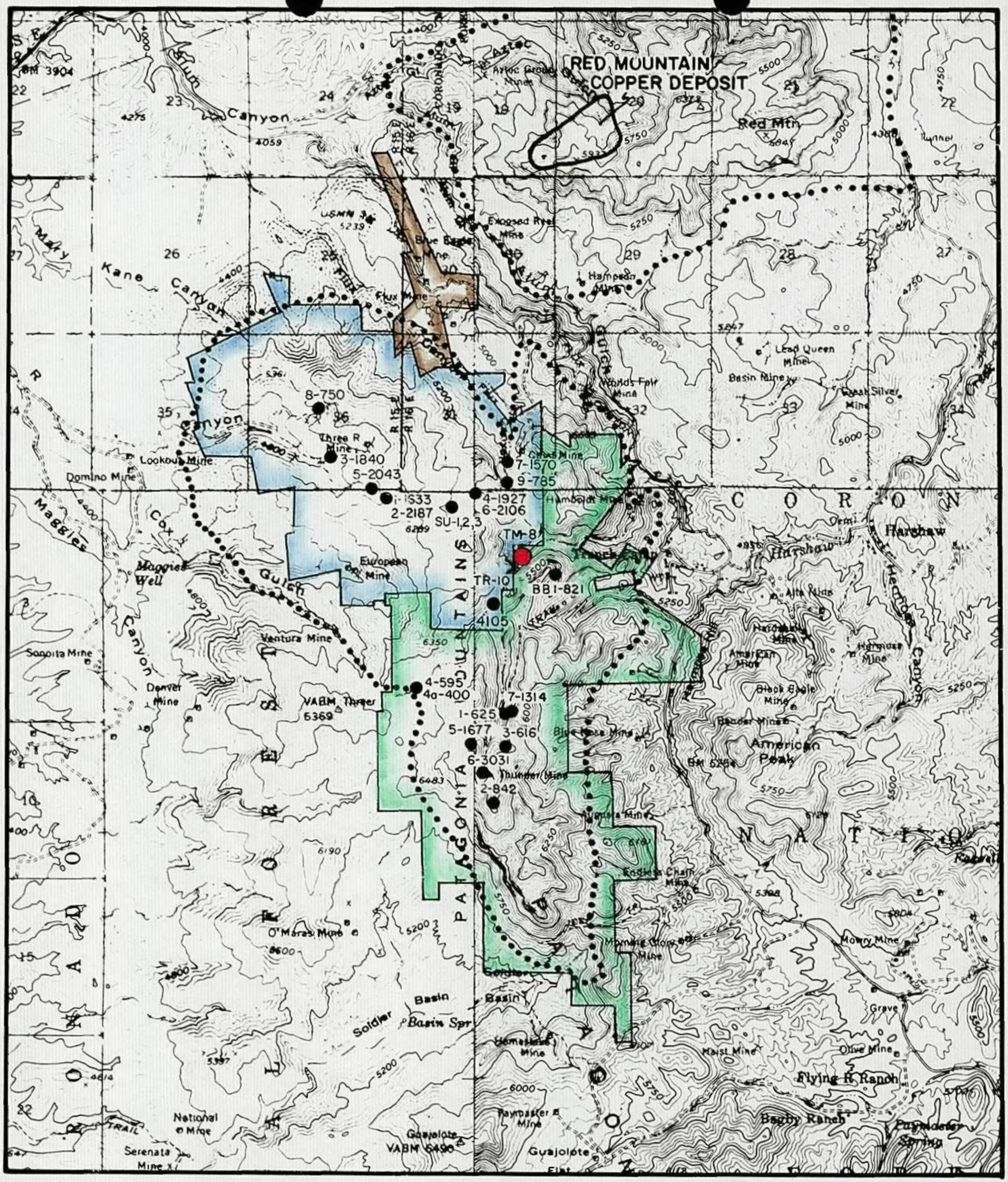
Fluid inclusion studies of some surface samples indicate a possible relationship to the deep chalcopyrite zone in TR-10 and studies will be continued as time permits.

Expenditures for the month were $12,700, leaving an estimated balance of $60,800.

F. T. Graybeal

F. T. Graybeal

FTG:lb
Attachs.



LEGEND

Anaconda	8-750 ● previous drill hole showing depth (Anaconda prefix-TR) (Kerr-McGee prefix-TM)
ASARCO	
Kerr-McGee	

TR-10 ○ ASARCO drill hole

⁘ areas of pervasive hydrothermal alteration

TO ACCOMPANY *Monthly Report*
DATED *Feb. 1, 1974*
BY *F. T. Graybeal*

DRILLING PROGRESS MAP

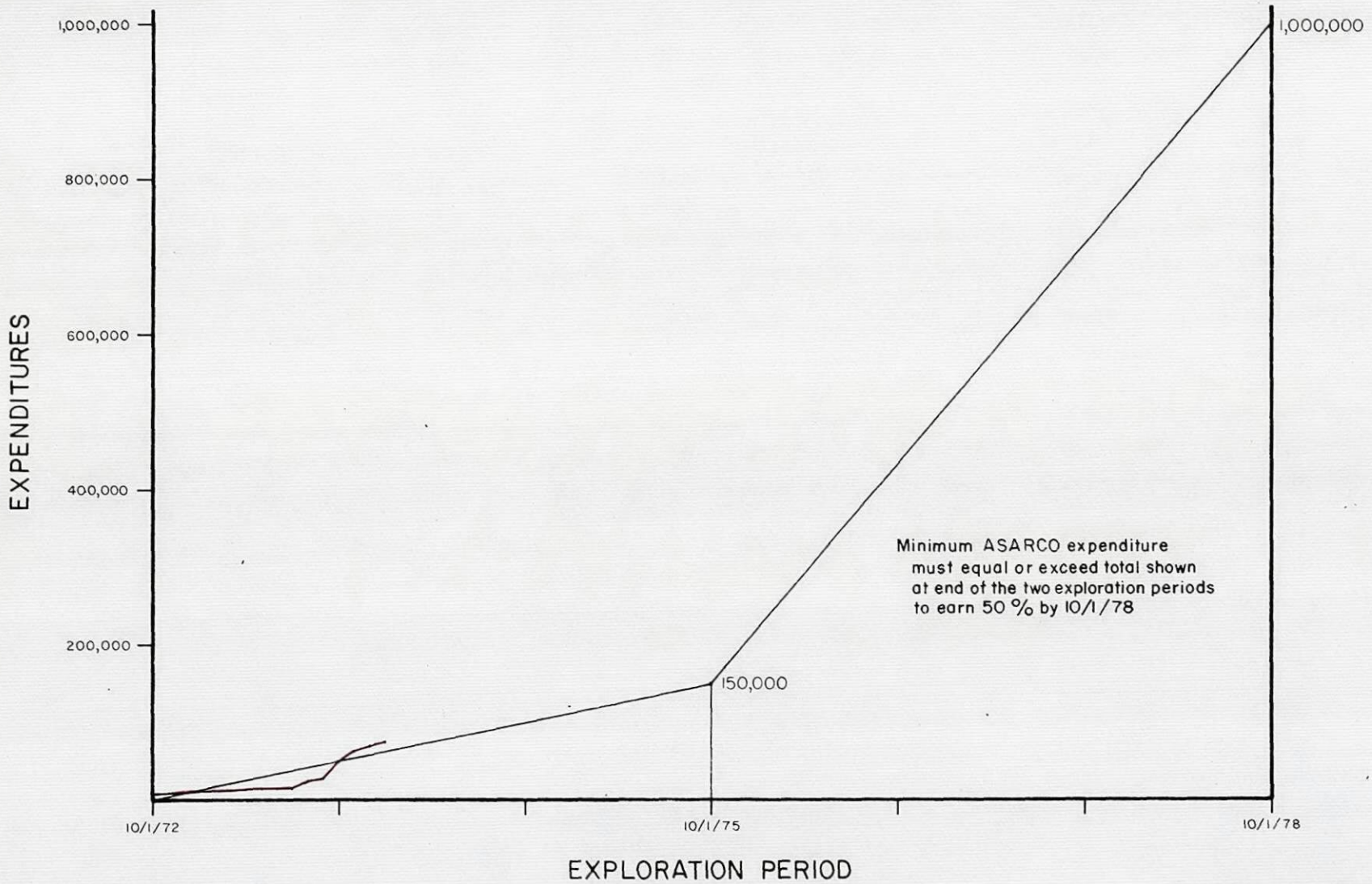
for the month of *Jan, 1974*

TM PROJECT

SANTA CRUZ COUNTY, ARIZONA

1" = 1 mile

MVK 2574



Cumulative ASARCO Expenditures Through Dec. 1973.

TO ACCOMPANY Monthly Report
DATED Feb. 1, 1974
BY F. T. Graybeal

EXPENDITURE RATE

THUNDER MTN. PROJECT

Patagonia Mtns.

Santa Cruz County, Arizona

MVK 2671

JHC

J. H. C.

AMERICAN SMELTING AND REFINING COMPANY
TUCSON ARIZONA

DEC 21 1973

December 19, 1973

J. H. C.

DEC 19 1973

Memorandum to: W. L. Kurtz

From: F. T. Graybeal

Thunder Mtn. Project -- MA 0042
Monthly Report -- December 1973

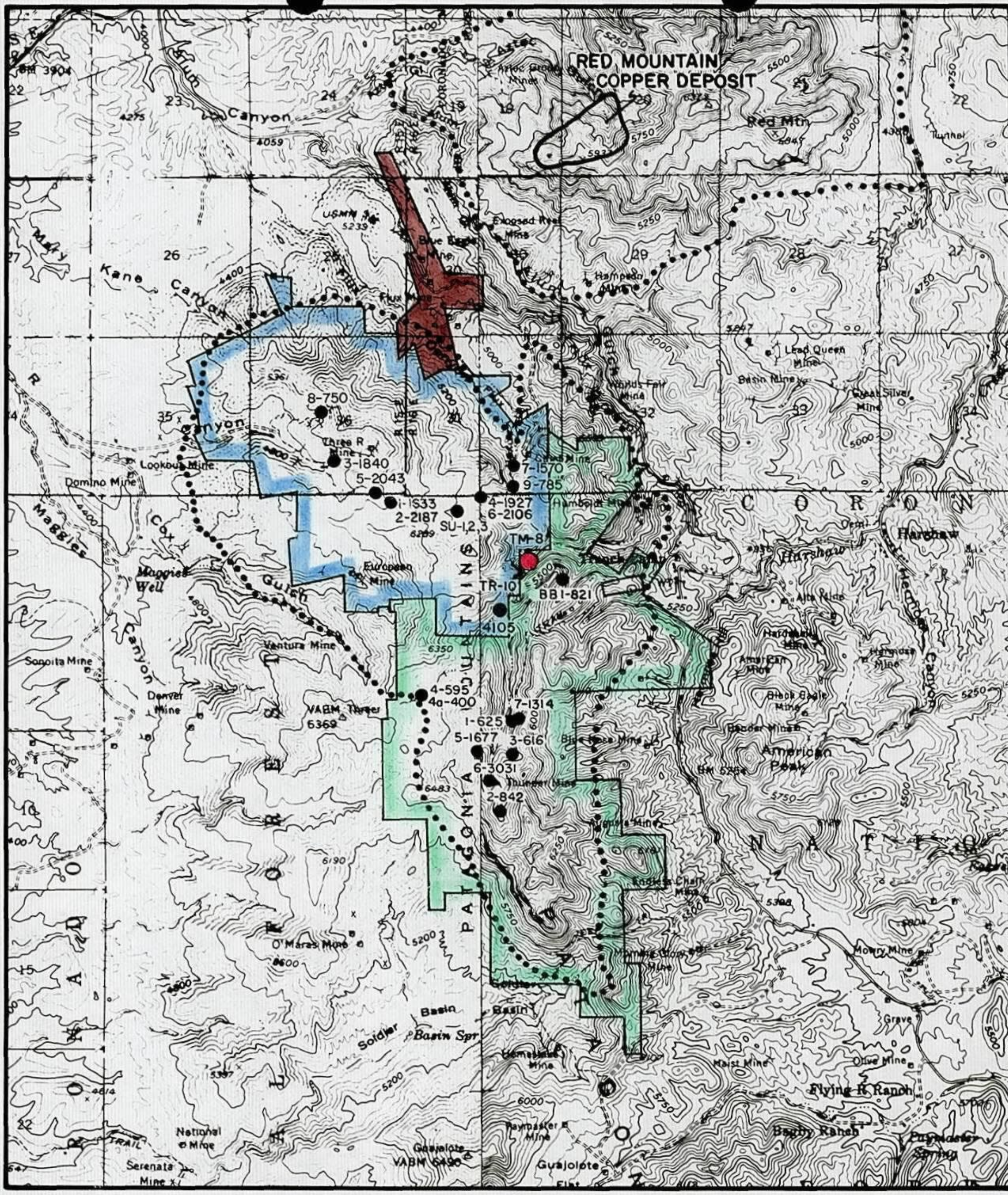
Hole TM-8 will be advanced from 3410 to approximately 3650 ft. by Dec. 25, 1973. The rock appears to be a strongly silicified quartz porphyry. Pyrite, with traces of chalcopyrite, is somewhat more abundant.

Expenditures for the month are estimated to be about $5,000, leaving a balance of $73,500.

F. T. Graybeal

F. T. Graybeal

FTG:lb
Attach.



LEGEND

Anaconda

ASARCO

Kerr-McGee

8-750
● previous drill hole showing depth
(Anaconda prefix-TR)
(Kerr-McGee prefix-TM)

TR-10
● ASARCO drill hole

areas of pervasive hydrothermal alteration

TO A COMPANY *Monthly Report*
DATED *Dec. 19, 1973*
BY *F. T. Greybeal*

DRILLING PROGRESS MAP

for the month of *Dec. 1973*

TM PROJECT

SANTA CRUZ COUNTY, ARIZONA

1" = 1 mile

MVK 2574

AMERICAN SMELTING AND REFINING COMPANY
TUCSON ARIZONA

December 3, 1973

J. H. C.
JAN 21 1974

Mr. T. C. Osborne
Asst. Director of Exploration
New York Office

Dear Mr. Osborne:

I am pleased to transmit Mr. Graybeal's report on the Three R and Thunder Mountain Project Areas in the Patagonia Mountains, Arizona, and his memoranda on Zoning in the Patagonia Mountains and Vertical Zoning in TR-10.

The report, though rather long, records the excellent original field work and thinking that we have come to expect from Mr. Graybeal. Mr. Graybeal's work has defined a diatreme, closely related to mineralization that was unrecognized by all previous workers in the Patagonias. His alteration studies, both of the surface and core, should help us both in further evaluation of this area and other vertically zoned deposits.

Of particular interest is Mr. Graybeal's description of the Chief group, page 10; origin of the Chief group, page 14; the Chief diatreme, page 18; discussion of alteration zoning, page 24; discussion of mineralization zoning, page 29; discussion of geochemical zoning, page 38; and section on Evaulation, page 39.

Very truly yours,

W. L. Kurtz

W. L. Kurtz

WLK:lb
Encs.

cc: JHCourtright - w/o encs.
FTGraybeal - w/o encs.

AMERICAN SMELTING AND REFINING COMPANY
TUCSON ARIZONA

November 30, 1973

J. H. C.
DEC 5 - 1973

Memorandum to: W. L. Kurtz

From: F. T. Graybeal

Thunder Mtn. Project -- 0042
Monthly Report - Nov. 1973

Hole TM-8 was advanced 541 ft. from 2869-3410 ft. The core graded from a hybrid breccia into a dense white quartz feldspar porphyry about 3100 ft. The latter is only weakly mineralized, although it is strongly altered to quartz and sericite. Chalcopyrite was the only copper mineral noted and its abundance is estimated to be everywhere less than 0.20% Cu. The pyrite content is also low, averaging 2-3 vol. percent mostly in veins. No assays or geochemical analyses were performed this month.

The hole remains in good condition and core recovery is mostly above 95 percent. The hole was reduced to BX at 3410 ft.

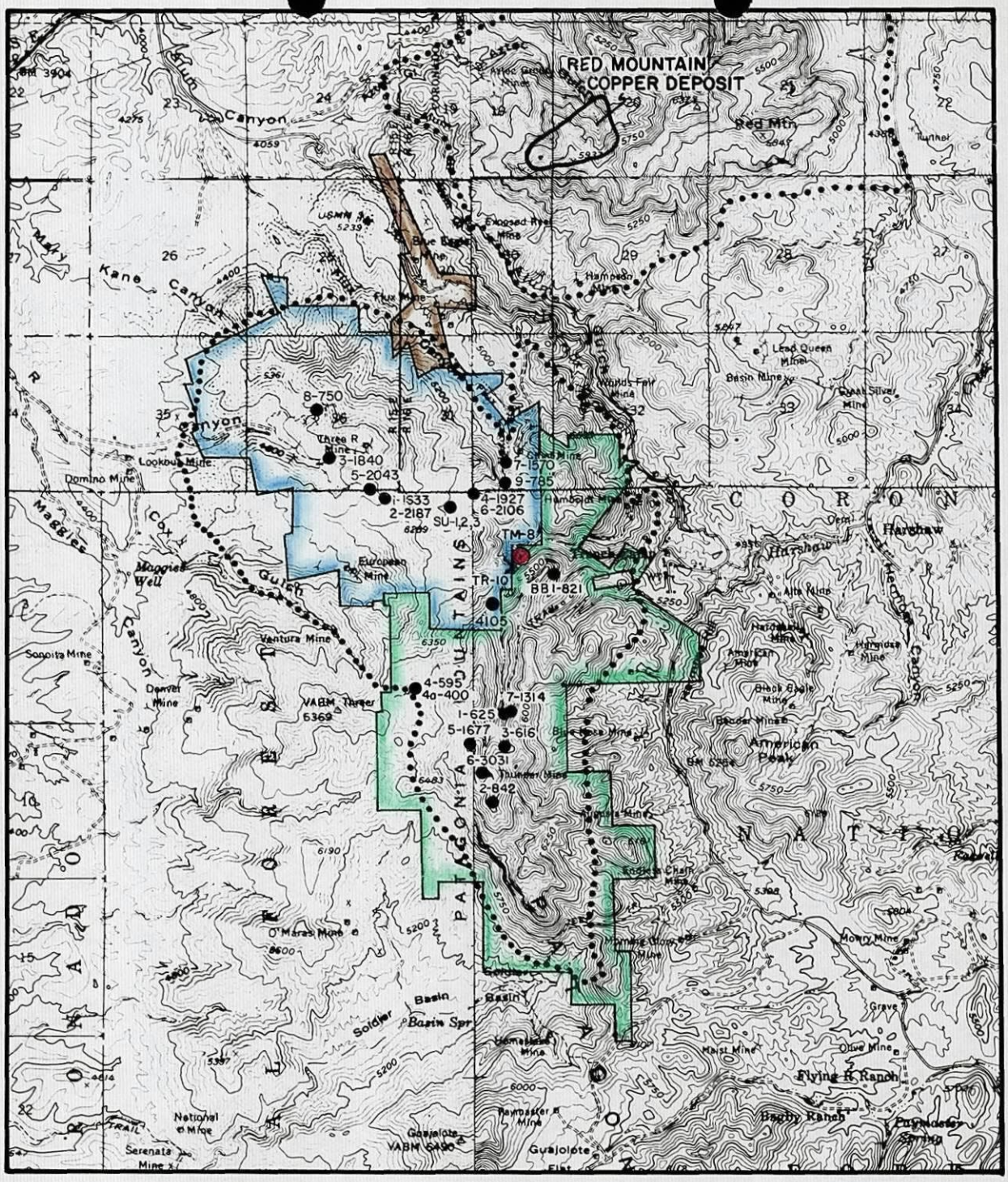
Petrographic studies of fluid inclusions indicate the chalcopyrite mineralization from 1370-2160 ft. may be a separate zone distinct from the mineralization encountered in TR-10. The TM-8 intersection could be related to the strong, NW-elongate As geochemical anomaly (trend surface) located about 1500 ft. NE of TM-8 which would indicate significant size to the zone.

Expenditures for this month were $9,000, leaving an estimated balance of $78,000.

F. T. Graybeal

F. T. Graybeal

FTG:lb
Attach.



LEGEND

- Anaconda
- ASARCO
- Kerr-McGee

8-750 previous drill hole showing depth
(Anaconda prefix-TR)
(Kerr-McGee prefix-TM)

TR-10 ASARCO drill hole

areas of pervasive hydrothermal alteration

TO ACCOMPANY Monthly Report
DATED Nov. 30, 1973
BY F. T. Graybeal

DRILLING PROGRESS MAP

for the month of November 1973

TM PROJECT

SANTA CRUZ COUNTY, ARIZONA

1" = 1 mile

MVK 2574

JHC

W. L. K.

MAY 4 1972

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

May 2, 1972

J. H. C.
MAY 5 - 1972

Memorandum to: W. L. Kurtz

From: F. T. Graybeal

Evaluation of Kerr-McGee's
Thunder Mtn. property,
Patagonia Mtns., Arizona

SUMMARY AND RECOMMENDATIONS

An evaluation of the Thunder Mtn. property revealed that the strongest mineralization occurs in the northern portion of the ground. Previous drilling by Kerr-McGee was concentrated in the central, less-well-mineralized part of the property due, in part, to errors in their interpretation of rock alteration. Therefore, this property still possesses good potential for the discovery of porphyry copper mineralization at moderate depth.

I recommend that the Thunder Mtn. property be acquired by ASARCO. As strong mineralization appears to continue northward, we should also continue our efforts to acquire the Anaconda ground.

INTRODUCTION

Approximately one week was spent on an examination of the Thunder Mtn. property owned by Kerr-McGee Corp. This property is located at the north end of the Patagonia Mtns. within the Sunnyside alteration zone and covers approximately 3.5 square miles as shown on Figure 1. Their property map indicates in excess of 1000 feet of overlap along a one-half mile joint border with ASARCO's Trench group and indicates the need for an accurate survey of this boundary.

Active exploration of the Thunder Mtn. property was begun by Kerr-McGee in 1962. Early work was guided by the discovery of strongly mineralized breccia pipes on adjacent ground held by West Range. Recent exploration has been guided by geological similarities between this property and the recent discovery under Red Mtn.

GEOLOGY

Mapping by Kerr-McGee located one large and several small monzonite porphyry intrusions in the vicinity of the Thunder mine, and later drilling was concentrated in this area. A brief reconnaissance revealed the presence

of a large quartz monzonite porphyry intrusion northeast of the Sunnyside mine and numerous other dikes not shown on the Kerr-McGee map. In addition, at least four other rock types were recognized including alaskite, agglomerate, tuff, and possibly argillite. The vastly differing response of these rocks to alteration emphasizes the need to understand their distribution more clearly.

Shearing is common throughout the property particularly in the volcanic rocks. Numerous breccia structures have also been recognized. Several strong faults were noted in the core, although they were not obvious at the surface.

All rocks within the limits of the pyritic alteration shown on Figure 2 are thoroughly iron stained and altered to a fine-grained clay-sericite (?) mixture. The alteration pattern is clearly the result of supergene weathering by acid generated from the oxidizing pyrite and is not of hypogene origin, a fact I believe Kerr-McGee failed to consider when spotting their drill holes.

Mapping of alteration by Kerr-McGee defined a quartz-sericite-pyrite zone centering on the Thunder mine and surrounded by pyritic alteration. I have examined rocks inside and outside of the quartz-sericite-pyrite zone and have found them to be equally well altered. Although the monzonite porphyry in this area appears more strongly altered than the surrounding wall rocks, it is no more altered than the quartz monzonite porphyry found northeast of the Sunnyside mine.

Further mapping in this area should pay particular attention to the distribution of hypogene minerals such as pyrite, tourmaline, and pyrophyllite whose widespread occurrence must be regarded as favorable indications of porphyry copper mineralization. In addition, the presence of enargite, with minor chalcocite, in drill core and on small dumps confirms earlier interpretations that this area is within a central Cu-As metal zone and may possibly overly high grade disseminated copper mineralization.

GEOCHEMISTRY

Geochemical sampling was performed by Kerr-McGee on the northern half of the Thunder Mtn. property, and the results of their work for Mo and As are shown on Figure 3. It is important to note that the areas of +20 ppm Mo and +50 ppm As are only coincident in the northernmost portion of the area and both appear to continue beyond the limits of Kerr-McGee's sampling and on to the Anaconda ground.

To supplement and check Kerr-McGee's work, twenty-seven samples were collected and analyzed for Mo, As, Pb and Zn. The results for Mo and As confirm the pattern established by Kerr-McGee, although the area of +20 ppm Mo appears somewhat smaller. The results for Pb and Zn are shown on Figure 3. The 200 ppm Pb and 50 ppm Zn contours are almost exactly coincident and tend to form a halo around the Mo and As anomalies.

DRILLING

Nine diamond drill holes have been completed by Kerr-McGee with five of these in breccia pipes. The location and depth of these holes are shown on Figure 2. Drill logs for all holes and core for holes TM-5, 6, and 7 were examined in detail. Hole BB-1 carried by far the most copper, averaging roughly 0.30% Cu for the entire hole. All other holes averaged 0.10% Cu or less as shown on Figure 2. The most abundant copper minerals seen in the core were enargite, chalcocite, and traces of chalcopyrite. Examination of the core showed that bleaching and the development of clay was more common in the near surface oxidized zones, again indicating the presence of supergene alteration.

Hole TM-6, which was bottomed at 3031 feet, provided the one deep test on the Thunder Mtn. property. Kerr-McGee logged intense potassic alteration at 2000 feet continuing to the bottom. Within this interval, I counted four 1/8 inch chalcopyrite veins and a single one foot section of disseminated chalcopyrite. My interpretation of this interval is that the rock is a weakly pyritized, overall fresh quartz monzonite which lies outside of the area of strongest mineralization. This interpretation is supported by the very low overall copper content of the hole which averaged 0.02% Cu and by the distribution of geochemically anomalous rock samples.

The Kerr-McGee staff noted that similarities between this rock and that encountered at Red Mtn. provided sufficient encouragement to continue the hole, although they declined to discuss what these similarities were. The rock showed little resemblance to the strong potassic alteration at the Sierrita and San Manuel mines. However, the interval from roughly 1000-2000 feet did show strong clay, sericite, hydrothermal biotite, and 5-10 percent pyrite all of obvious hypogene origin, thus demonstrating the presence of alteration typically associated although not necessarily confined to porphyry copper ore zones.

Of additional interest are the results of three holes drilled in 1951 by ASARCO on the BX breccia which lies north of the Sunnyside mine and on ground now held by Anaconda. This work established a reserve of 2.7 million tons averaging 0.48% Cu mostly as enargite.

CONCLUSIONS AND RECOMMENDATIONS

The concentration of the Kerr-McGee drilling near the Thunder mine apparently resulted in part from the failure to recognize that the majority of the alteration in this area was of supergene origin. In addition, they did not attempt to map rocks other than monzonite, although differences in rock type exert a strong influence on the type and pattern

of resultant alteration and mineralization. Finally, they failed to locate the strongly pyritized quartz monzonite porphyry north of the Sunnyside mine. These errors emphasize that a complete reexamination of this property is needed to accurately guide further exploration.

The available evidence suggests that this property still possesses excellent potential for ore grade porphyry copper mineralization. This potential appears best in the northern portion of the ground due to:

1.) coincident Mo and As geochemical anomalies in the Sunnyside area

2.) increased copper grades in breccia pipes drilled in the Sunnyside area, and

3.) the absence of copper mineralization and strong alteration at depth in the Thunder mine area.

In addition, large altered areas south of the Thunder and east of the Volcano mines have not yet been evaluated. It is very difficult to predict the depth of the potential ore grade mineralization, however, it should be shallower than the 3900 feet encountered at Red Mtn.

If a reasonable agreement can be reached with Kerr-McGee, I strongly recommend that the Thunder Mtn. property be acquired by ASARCO. The location of the more strongly mineralized portion of this ground also emphasizes the need for successful negotiations with Anaconda.

F. T. Graybeal

F. T. Graybeal

FTG:sg
attach.

May 4

JHC

Fred has come up with some positive features (besides the large areal extent of the cultural zone) to justify an option agreement with Kerr-McGee.

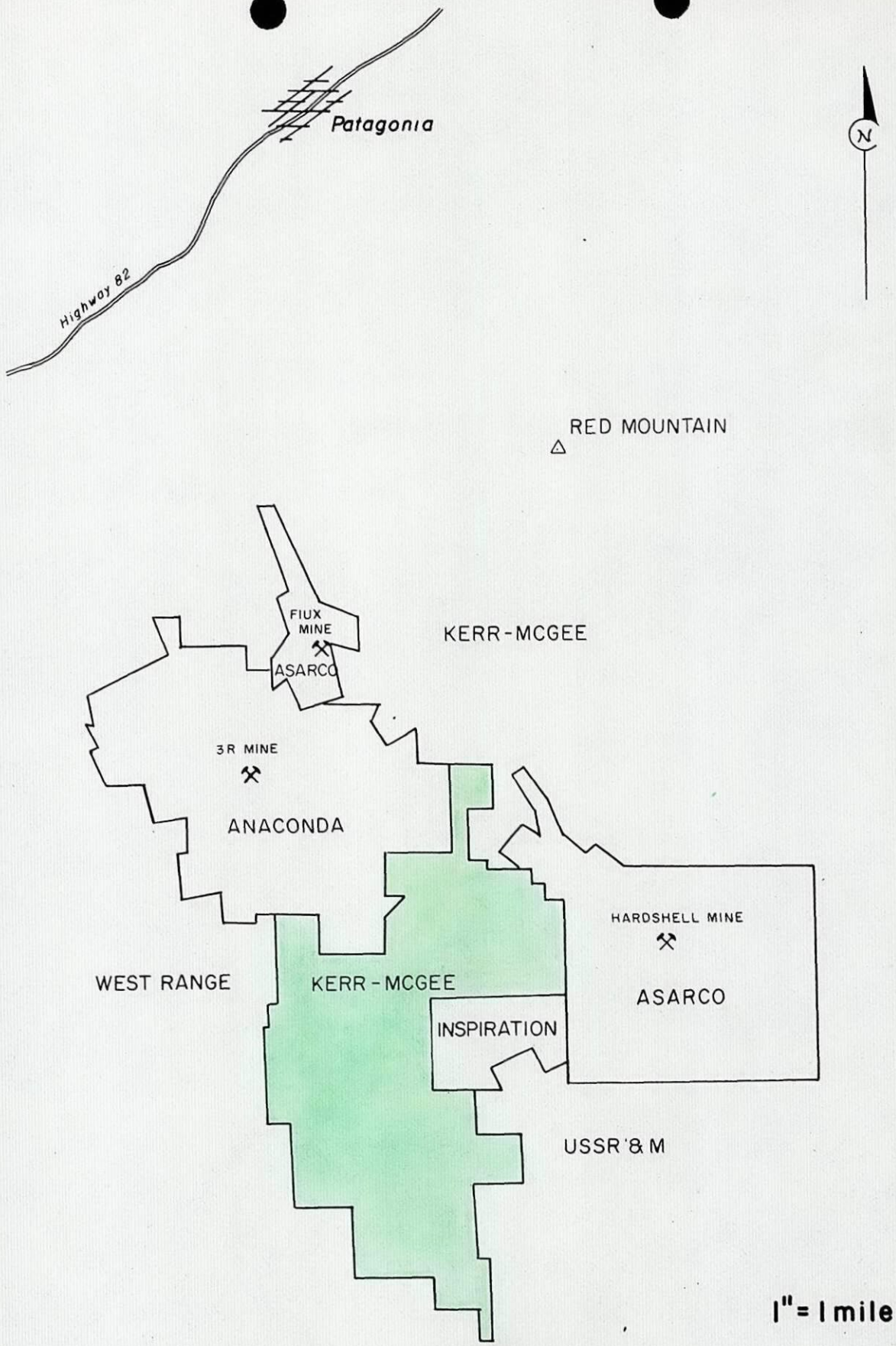
Thin sections are being made of 'K' zone of core from TM-6 and should be available next week.

I will arrange another meeting with Bob Jones. Any preferred time for you? no — I may leave weekend of May 21st.

JHC

Kurt

Figure I



PROPERTY MAP

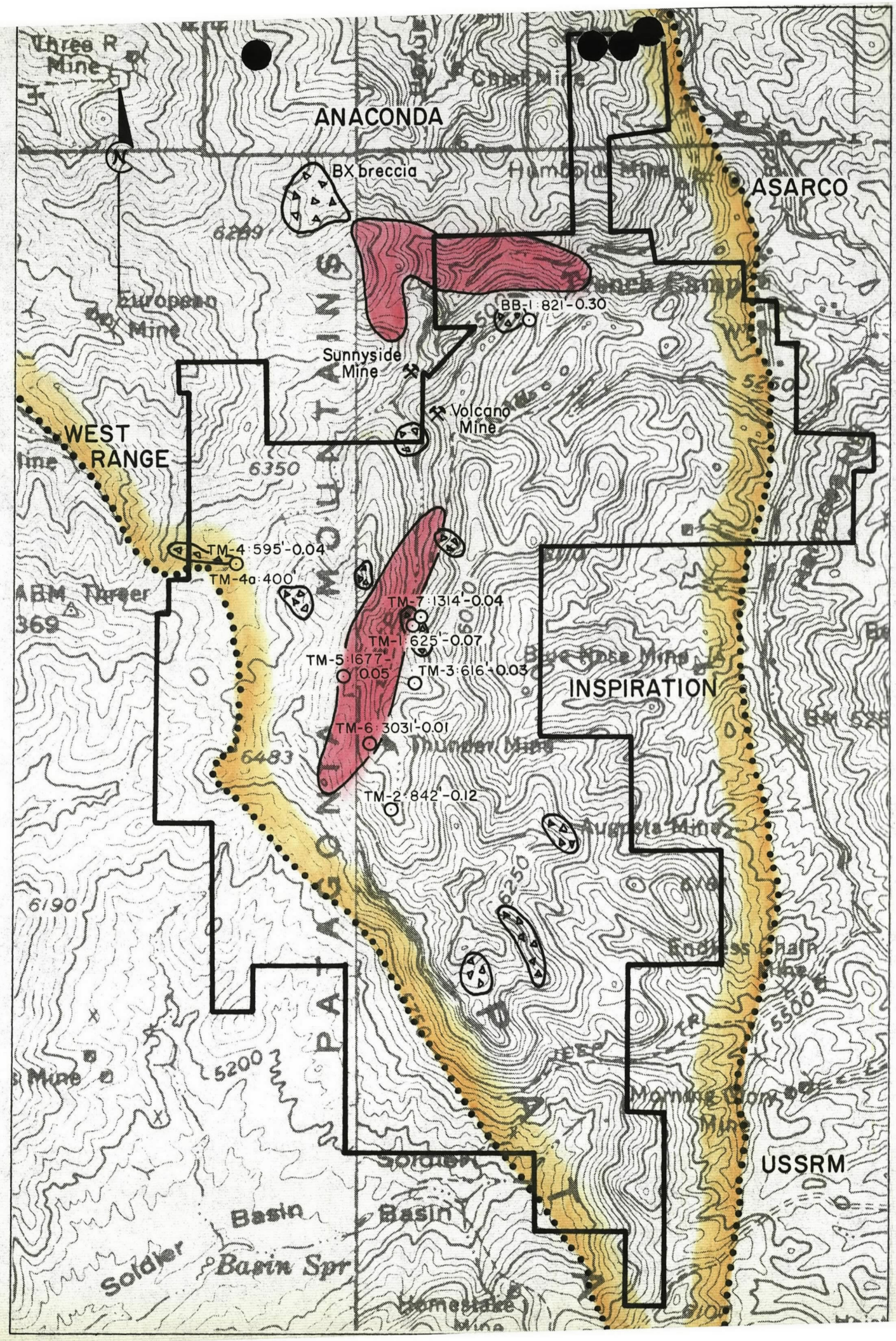
NORTHERN PORTION OF PATAGONIA MOUNTAINS

SANTA CRUZ COUNTY, ARIZONA

F.T.G. MAY 1972

MVK 2550-B

Figure 2



LEGEND

Breccia Pipes

Monzonite Porphyry

Limits Of Pyritic Mineralization

BB-1: 821'-0.30 — Drill Hole Showing Depth & Average Copper Assay Of Entire Hole.

Kerr-McGee Property Boundary

GENERALIZED GEOLOGY MAP

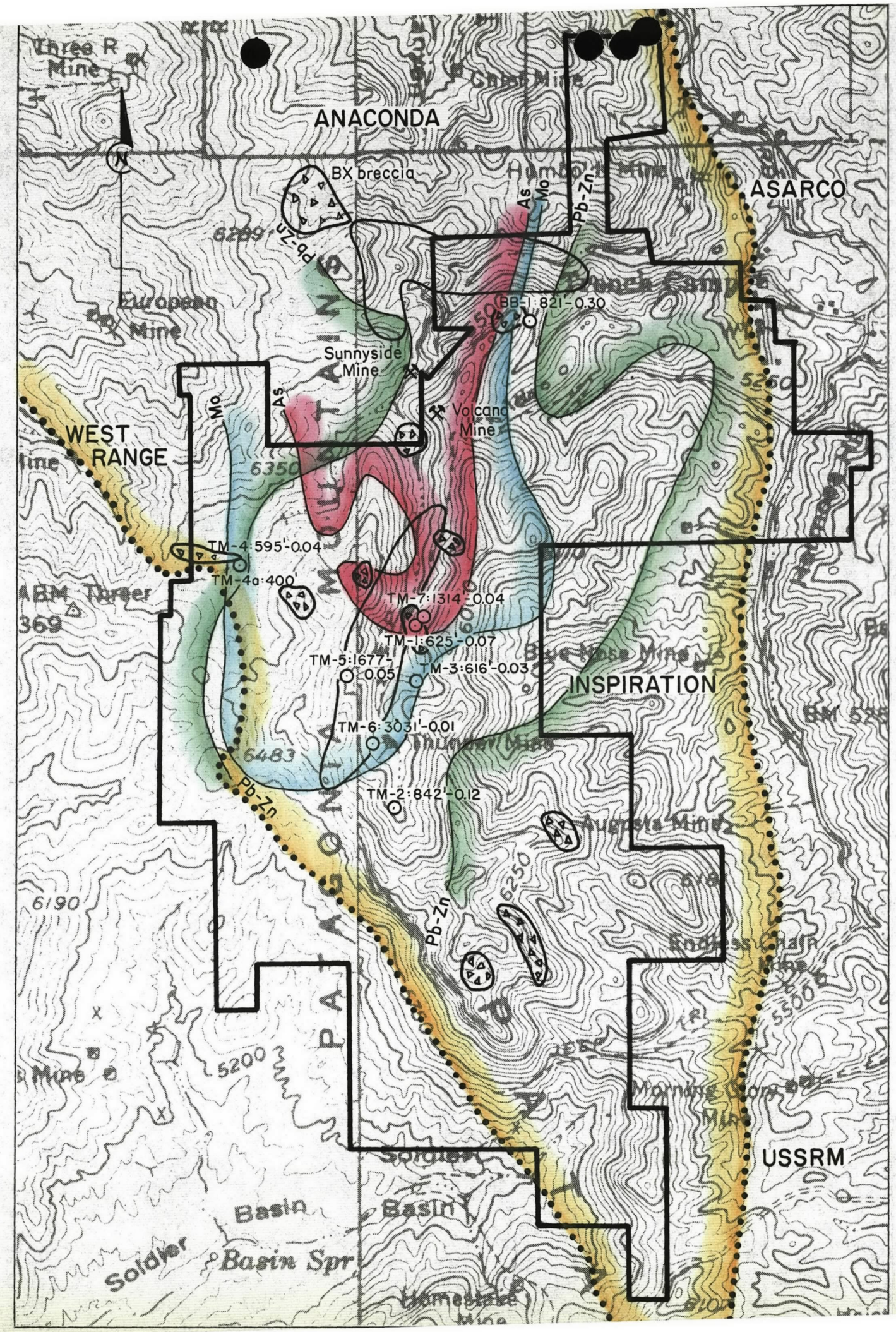
THUNDER MTN. PROPERTY

PATAGONIA MOUNTAINS

SANTA CRUZ COUNTY, ARIZONA

Scale 1" = 2000'

Figure 3



LEGEND

Breccia Pipes

Monzonite Porphyry

Limits Of Pyritic Mineralization

BB-1: 821'-0.30 — Drill Hole Showing Depth & Average Copper Assay Of Entire Hole.

Kerr-McGee Property Boundary

+ 20 ppm Mo

+ 50 ppm As

+ 200 ppm Pb & 50 ppm Zn

NOTE: All shading on anomalous side of contour.

GENERALIZED GEOLOGY MAP

THUNDER MTN. PROPERTY

PATAGONIA MOUNTAINS

SANTA CRUZ COUNTY, ARIZONA

Scale 1" = 2000'

J.H.C.

J. H. C.
SEP 2 - 1972

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

September 22, 1972

Mr. J. J. Collins
Director of Exploration
New York Office

Mining Authorization Request
Thunder Mountain Project
Kerr-McGee Joint Venture
Santa Cruz County, Arizona

Dear Sir:

My August 11, 1972 Mining Authorization Request -- Anaconda 3R Property -- included two enclosures: "Evaluation of Kerr-McGee's Thunder Mt. Property" and "Evaluation of the Sunnyside Area". Those reports pointed out that a deep, vertically zoned, primary copper target, similar to Kerr-McGee's Red Mountain deposit, exists within ground controlled by Anaconda and by Kerr-McGee and recommended that ASARCO participate in the exploration of both properties. The exploration proposal for the Anaconda property was approved September 6, 1972.

I am now requesting approval of a joint venture exploration program with Kerr-McGee on their Thunder Mountain property. I am again enclosing, for your convenience, the two reports mentioned above.

The general Land Status is shown on Attachment A. As you are aware, we are currently evaluating Kerr-McGee's data on their Red Mountain porphyry copper deposit and will probably make a recommendation for ASARCO to participate in the continued exploration of this important copper discovery. Participation in the three properties (Thunder Mountain, 3R, Red Mountain) will give ASARCO a commanding land position within the alteration zones in the northern Patagonia Mountains and provide room for any future mining operations.

Our program on the Kerr-McGee ground will be the drilling of three deep holes (+3000' each) over a 3-year period. These holes are tentatively located on Attachment B but final positioning may be changed upon completion of drill hole TR-10, currently 1300' deep in a strongly silicified, pyritized breccia with traces of enargite. Attachment B also shows:

A. Red Mountain altered and pyritized zone with the location of the +5 ppm moly-in-rock anomaly and outline of Kerr-McGee deep porphyry copper discovery.

B. 3R-Thunder Mountain altered and pyritized zone with location of the +5 ppm moly-in-rock anomaly.

Our terms with Kerr-McGee call for a firm work committment of $150,000 to be spent over a three-year period ($50,000 per year). Then ASARCO would have to spend an additional $750,000 over the next three years, with right to terminate at any time, to earn its 50% interest.

We do not plan to initiate any drilling until after the first of the year.

I have reviewed the Thunder Mountain request with Mr. Courtright and he concurs that this represents a legitimate exploration target.

If you agree, please request a Mining Authorization in the amount of $150,000 to cover ASARCO's firm work committment for the 3-year period. Forms 302-M and 302-MA are enclosed.

Respectfully submitted,

W. L. Kurtz

W. L. Kurtz

WLK:lad
Attachs A & B
Encs. - Forms 302-M & 302-MA
Reports as noted

cc: JHCourtright - w/attachs & forms
RBCrist - " "
FTGraybeal - w/o encs. or attachs.
ADCoumides - w/forms only

PROSPECT Thunder Mt. Project

LOCATION Santa Cruz Co., Arizona

COST ESTIMATE, MINERAL EXPLORATION

OFFICE SWED - Tucson

W. L. Kurtz

No.	Type of Work	Salaries/Wages Days	Salaries/Wages Amount	Material	Fees, Rent, Services	Traveling	Taxes	Other	Total Estimate Cost
501	Outright Purchase								
502	Option Payments								
503	Bonus Payments								
04	Minimum Royalties-								
	Deductible from								
	Future Production								
05	Minimum Royalties-Not								
	Deductible from								
	Future Production								
06	Rental Payments								
07	Staking Claims								
11	Surface Excavating								
12	Underground "								
21	Surface Drilling				115,000				115,000
22	Underground "								
30	Geologic		13,000			2,000			15,000
40	Sampling, Assaying, Lab.								
50	Geophysics								
60	Geochem		12,000		5,000	3,000			20,000
70	Engineering								
80	Construction (temp.)								
90	Construction (perm.)								
10	Administration, Field								
	Offices and Camps								
20	Administration, General								
41	Autos and Vehicles								
42	Aircraft and Boats								
50	Partner's Share								
	ASARCO'S SHARE		25,000		120,000	5,000			150,000
61	Commission or Fees								
63	Exchange								
	TOTAL		25,000		120,000	5,000			150,000

PRINTED IN USA. 9/69

FORM 302-M

N[illegible] York No. .....

AUTHORIZATION FOR MINERAL EXPLORATION

Sept. 22, 19.72 Originating Office ....Tucson - SWED.....

DESCRIPTION: THUNDER MOUNTAIN PROJECT

LOCATION OF PROSPECT/PROJECT: Six miles south of Patagonia, Santa Cruz County, Arizona

PARTNERS: Kerr-McGee Corporation

Partner's Per Cent .....50%.....

COMPANY: [X] ASARCO

[ ] Subsidiary. Specify .....

WORK CONTEMPLATED:

During a three-year period, complete three 3,000-foot holes to test for +0.7% primary copper mineralization.

Total estimated cost (FORM 302-MA ATTACHED) $.150,000.....

Reviewed by .....
Acct. Mgr. or Chief Acct.

Approved by .....
Vice President

Recommended by .....
Supervisor

Approved by .....
Comptroller

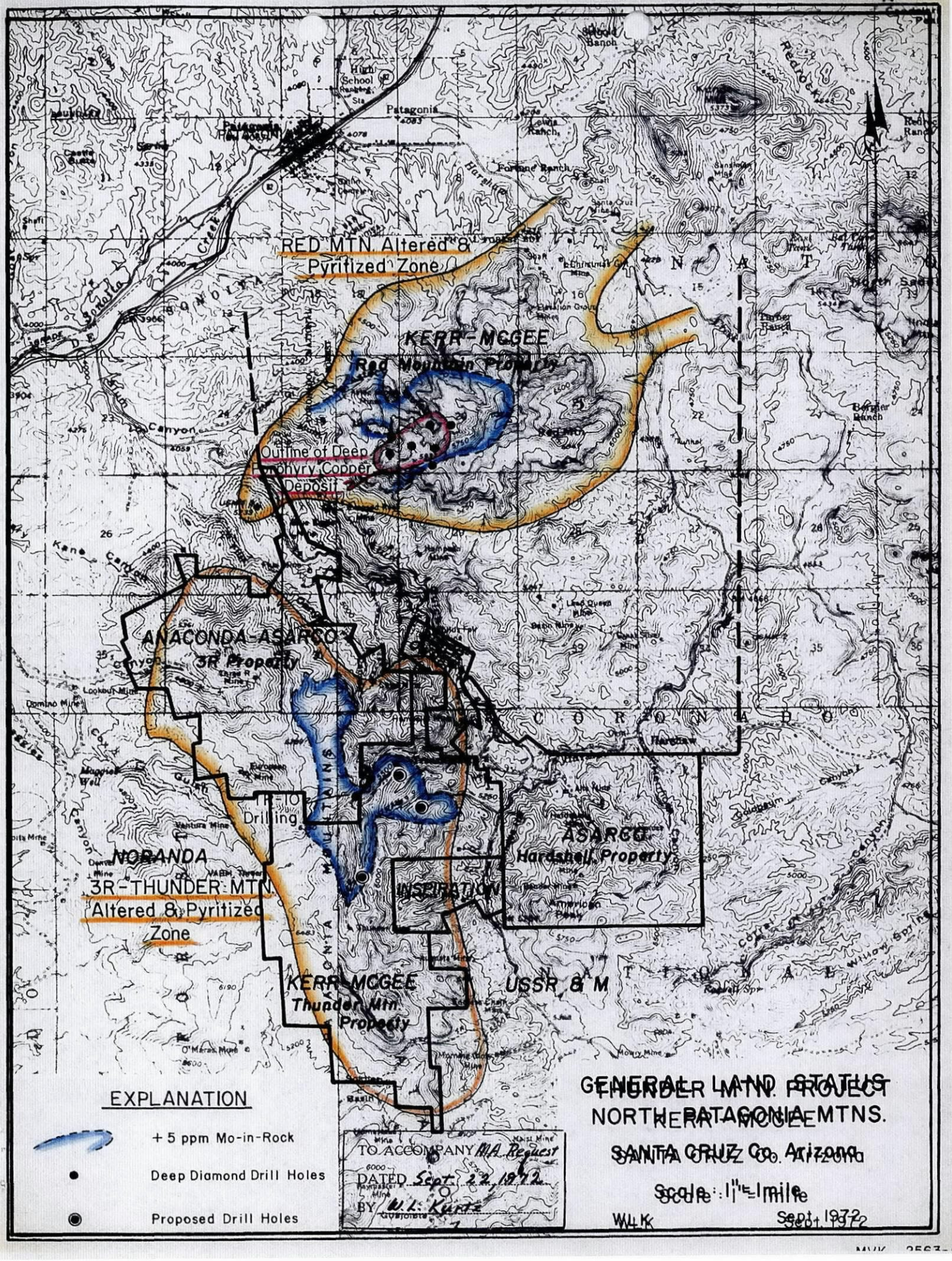
Account Chargeable to .....
To be designated by Comptroller

Approved by Advisory Committee

.....19 ...

Approved by Board of Directors

.....19 .....

.....
Secretary

Attachment B