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

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James Doyle Sell Mining Collection

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Contents

Expenditures
Quarterly/Monthly Reports
Summary Reports

Expenditures

JD 5

1803 E. 10TH ST.
TUCSON, AZ 85719

(602) 884-5345

H. J. DOWNEY, INC.

EXPLORATION & DEVELOPMENT

February 24, 1993

Mr. James D. Sell
ASARCO, Inc.
1150 North 7th Avenue
Tucson, AZ 85703

INVOICE

Services relating to the Thunder Mountain Project through 2/23/93.

Miscellaneous work finishing assays, logs, drafting, and report writing.

2 days @ $250.....$ 500.00

Harold J. Downey
Harold J. Downey

2/24/93
Date

OK for payment
James D. Sell
Thunder Mtn Project
EA-0042

Original
Sent to Accounting 2/24/93

ASARCO

Southwestern Exploration Division

May 4, 1982

To: W. L. Kurtz
J. D. Sell

From: F. R. Koutz

Expenditures - Trench
Thunder Mountain Area
Santa Cruz County, Arizona

Expenditures to date (May 1, 1982) total:

0057-	Mendoza Option	$ 72,267	(3732.24 remaining)
0200-00	Trench (TCH-1)	190,000	
0200-01	(TCH-2)	224,000	
0200-02	(TCH-2A)	175,000	
0200-02	Overrun (May 1, 1982)	65,785	
	Trench Total:	$654,785	
	Trench & Mendoza Total:	$727,052	

TM-13 Cost (NPW)	$150,221.69	
TCH-1 Cost (Jan. 12, 1981, NPW)	196,427.78	
TCH-2 Cost (Nov. 13, 1981, FRK)	224,409.02	
TCH-2A Cost (March 24, 1982, FRK)	215,916.00	(through Feb. 82)

From cost/performance summaries

0042-	Thunder Mountain (to Oct. 1, 1978)	$233,146.44	(00-05 (part))
0042-05	(Part past Oct. 1, 1978)	71,853.56	
0042-06		40,000.00	
0042-06	Overrun (1 May 1982)	29,352.73	
	Total since Oct. 1, 1978	$141,206.29	(confirmed by Acc't. Dept.)

*Note: the $158,000 figure for TM since Oct. 1978, often mentioned, is probably the total cost of TM-13 which was started previous to Oct. 1978. I do not know if all TM-13 expenditures were included in the post-Oct. 1, 1978 figure.

Future planned and possible TM charges:

J. Yanez (surveying)	$ 1,200
SLC Geophysics (1/3 of ground mag. + all VLF work)	5,000
G. McLain (aerial photog.)	1,000
G. McLain (map making)	2,000
Repapering and paneling (TCB+HMS+?)	3,000
New road and drill site on Jesse 23 from TM-13	12,000
	$24,200

F. R. Koutz

FRK/cg
cc: RBCrist

*R. B. Crist says that the contract amendment date for figuring the $1,000,000 expenditure by Oct. 1, 1984 is from Dec. 1, 1977. We have expended $174,352.73 from Dec. 1, 1977 to May 1, 1982. This leaves $25,647.27 to be spent by Oct. 1, 1982.

ASARCO

Southwestern Exploration Division

JDS

May 25, 1983

To: J. D. Sell

From: F. R. Koutz

1982-84 Assessment Drilling
Thunder Mountain (EA-0042)
Three-R (EA-0040) and
Trench (EA-0200) Projects
Santa Cruz County, AZ

We have 160 Thunder Mountain claims, 97 Three-R claims, and 7 Trench (Mendoza-Humboldt) claims (264 total) that need Federal assessment work completed by September 1, 1983. In addition we must complete a $50,000 work commitment to Kerr-McGee on TM ground by October 1, 1983. From October 1, 1982 through April 1983 we have spent $12,352.42 on the Thunder Mountain claims, mostly in survey work on the boundary with the Argentor Group, problems with Gold Depository and completing new topography.

I think it is agreed among all that our required expenditure be done by deepening DDH TM-14 drilled 910' (NC) last summer in Upper Alum Gulch on the Warren Harding claim. You obtained a bid for this work from Joy as of January 7, 1983 and I believe those prices will hold the rest of the year.

I do not know what proportion of the $12,352.42 can be applied to the Kerr-McGee work commitment, although last year some $25,000 or so of non-drilling money was used for the work commitment. I would suggest that we try to do a back-to-back August-September deepening of TM-14 to save doing 1983-84 assessment work next year. This would require an expenditure of $52,800 - only a few dollars more than the required $50,000 (not counting non-drilling work). Even if we are allowed only $37,000 ($50K - $13K) I believe we should carry work over into September to start on 1983-84 assessment work. Part of the reasoning behind this request is that the work commitment to Kerr-McGee must be modified by October 1, 1984 (possibly by a trade) since we will not have spent the required $1,000,000 by that time. There is no reason to "waste" assessment money for this year that could be applied to next year - <u>possibly</u> <u>without</u> the Kerr-McGee work commitment.

As an estimate (with footage costs escalated 20% for mud, assays, supervision, etc) from the Joy bid, we should be able to deepen TM-14 NC to 2330' with $37,000 and to 2870' with $52,800. In any case, as I have recommended in my TM-14 report of October 6, 1982, we should drill TM-14 as deep as possible NC to avoid casing rental charges and avoid the

drilling problems encountered in TCH-2A. Drift should be checked periodically by HF acid vial and if beyond 5° from vertical should be surveyed by gyro. I would reserve a Joy drill for late July for Ventura ($9100) with a move to TM-14 in early August. Over March 1981 it took 24 drilling days (3 shifts) to drill TCH-2 from 960 to 2500' for comparison. This should allow drilling to run into September with $26,400 spent in August. Good drilling.

F. R. Koutz

FRK/cg

cc: TCB

EA-0042 Thunder Mountain 160 UNPATENTED CLAIMS

AGREEMENT WITH: Kerr-McGee Resources 12/1/77
P.O. Box 25861 Oklahoma City, OK 73125
Attn: George Carlyle

EXPENDITURE AGREEMENT:

To earn 50% interest, due to have spent by 10/1/84 the sum of $1,000,000; with $100,000 to be spent in period 12/1/77 to 10/1/80, then $50,000 per year; with all monies carried forward from 12/1/77.

Period	$ Expenses	$ Expenses ~~to Oct 1~~ accumulated	$ Cum. Contract K-M, due Oct 1.
12/1/77 - 10/1/78	32,709.64	32,709.64	—
10/1/78 - 10/1/79	124,361.80	157,071.44	—
10/1/79 - 10/1/80	6,108.46	163,179.90	100,000
10/1/80 - 10/1/81	1,736.58	164,916.48	150,000
10/1/81 - 10/1/82	49,360.29	214,276.77	200,000
~~10/1/82 - 10/1/83~~	~~(illegible)~~	~~(illegible)~~	~~250,000~~
10/1/82 - 10/1/83	(13,313.58 to 6/31/83)	(227,590.35)	250,000

need 22,409.65 by 6/31/83 to Oct 1, 1983

Comptrollers Statement #8, June '83 Thunder Mtn.

Total Expenditures to date	428,666	428,666
Deduct, from 11/72	−182,000	246,666
Deduct, 08/03/77	− 18,000	228,666
Deduct 08/03/77–12/01/77	− 1,077	227,589
∴ 12/01/77 to date 6/31/83	—	227,589

~~Dec 1, 1977 - Oct 1, 1978~~ ~~Oct 1, 79~~

Dec 1977	470.76	
Jan 78	896.01	
Feb 78	802.98	32,709.64
March - ~~Oct 1~~ Sept 78	33,786.48 - 3,246.59 = 30,539.89	
Oct 78 - Dec 78	444.93	
Jan 79 - July 79	116,348.44	
Aug 79	52,979.34 - 45,579.85 = 7,399.49	124,361.80
Sept 79	168.94	
Oct 79 - Dec 79	~~120.15~~ 289.09	6,108.46
Jan 80 - Sept 80	5,819.37	
Oct 80 - Dec 80	200	1,736.58
Jan 81 - Sept 81	1,736.58	
Oct 81 - Dec 81	178.61	49,360.29
Jan 82 - Sept 82	49,181.68	
Oct 82	1,867.12	
Nov 82	72,930.43 - 72,220.73 = 709.70	~~11,446.46~~
Dec 82	73.50	13,313.58
Jan 83 - June 83	10,663.26	

Comptroller's Statement #8, June '83

~~Total to date, June 83~~ 428,666

Deduct, from 11/72	- 182,000	
Deduct, 08/03/77	- 18,000	
Deduct, 08/03/77 - 12/01/77	1,076.84 - 1,006.95	
	- 201,077	227,589
	~~201,001~~	~~201,001~~
		~~227,589~~
		~~301,669~~

2

By Acct sheets. w/ AS Rdlee

Dec. 1977	470.76	
Jan 78	896.01	33,154.57
Feb	802.98	
March-Dec 78	34,231.41 − 3,246.59 = 30,984.82	
Jan 79-July 79	116,348.84	
Aug	52,979.34 − 45,579.85 = 7,399.49	124,205.96
Sept-Dec 79	168.94 + 289.09 = 458.03	
Jan 80-Dec 80	5,819.37	5,819.37
Jan 81-Dec 81	1,915.19	1,915.19
Jan-Oct 82	51,048.80	
Nov 82	72,930.43 − 72,220.73 = 709.70	51,832.00
Dec 82	73.50	
Jan 83-June 83	10,663.26	10,663.26

		Acct Cum	Cum due till-m Oct 1,
Dec 1 '77 - Dec 31, 78	33,154.57	33,154.57	~~50,000~~
Jan 79 - Dec 79	124,205.96	157,360.53	~~100,000~~
Jan 80 - ~~Dec 80~~ Oct 80	5,819.37	163,~~179.90~~ 180	~~150,000~~ 100,000
Jan 81 - ~~Dec 81~~ Oct 81	1,915.19	165,095.09	~~200,000~~ 150,00
Jan 82 - ~~Dec 82~~ Oct 82	51,832.00	216,927.09	~~250,000~~ 200,00
Jan 83 - June 83	10,663.26	227,590.35	~~300,000~~ 250,000 (Oct 1 83)

as of July 1, 1983 in arrears ~~in arrears 72,409.65 to Dec 1, 1983~~

Comptrollers Statement 8 June 83 (201,077)

From 11/72		182,000	~~acct sheet~~ ~~08/77 4,813.84~~ ~~09/77 11,443.42~~ ~~10/77 :~~ ~~11/77 : 1,820.89~~
08/03/77		18,000	
	1077 +		aus-Dec 1 1076.84
Total to date (June 83)	428,666		

∴ from 08/03/77 to date = 228,666 or Dec 1 '77 to date: 227,589.16

Thunder Mtn: 8/2/83 NYC thinks we're 25,000 over on carryforward expenses. Tucson says deficit of 8,500 (on SEA) CHECK

Doc. 1-F. 3rd Amendment Dec-1, 1977.

"... ASARCO has, as of Dec. 1, 1977, expended $202,827.84 ...."

1b. ASARCO to expend 100,000 from Dec. 1, 1977 to Oct 1, 1980 to be able to continue operating agreement.

1c. if above reached, then must expend 50,000/year (up to total of 1 million by Oct-1, 1984.) need ie Oct 1, 1980 = 100,000 Oct 1, 1981 = 150,000 etc.

1d. all expend over above min of any fiscal year after the effective date of this amendment shall be carried forward [I interpret this to mean from Dec 1, 1977 & include any expenditure over the 100,000 as in 1b] JDS.

1e Expenditure procedures as in Exh B of Operating Agreement.

Doc. 1-FF.

	Year	Spent	Cumulative	Cumulative Act Due Dec-1
42-04 overspent	Dec 1977	(1,280) actually + 470.76	-1,280 470.	—
	1978	32,684	31,404 33,154	50,000
	1979	124,206	155,610 157,360	100,000
	1980	5,819	161,429 163,179	150,000
	1981	1,915	163,344 165,093	200,000
	1982	51,832	215,176 216,926	250,000
	1983 (June 30)	10,663	227,589	300,000

Comm @ 50,000/yr.

Dec. 1, 1977

Oct 1	80	100,00
	81	50
	82	50
Oct	83	50
		$250,00

EXPLORATION AUTHORIZATION NO. 0042-04
THUNDER MOUNTAIN PROJECT
SANTA CRUZ COUNTY, ARIZONA

TUCSON OFFICE

December - 1977

Account No.	Item	This Month	This Year	Total to Date
506-950	Rental Payments - Other	$	$	$
521-100	Surface Drilling - Salaries	-	477.92	477.92
521-200	- Add. Labor	-	94.18	94.18
521-750	- Services	(1751.00)	17724.24	17724.24
530-100	Geology - Salaries	331.82	331.82	331.82
530-200	- Add. Labor	65.09	65.09	65.09
540-150	Sampling, etc. - Wages	68.00	108.38	108.38
540-200	- Add. Labor	5.85	9.24	9.24
540-350	- Equip. Rental	-	76.00	76.00
540-550	- Freight	-	3.40	3.40
540-750	- Services	-	143.06	143.06
540-800	- Taxes	-	4.56	4.56
620-100	General Administration - Salaries	-	260.84	260.84
620-200	- Add. Labor	-	48.79	48.79
620-400	- Supplies	-	4.45	4.45
620-800	- Taxes	-	.27	.27
620-950	- Other	-	3.00	3.00
641-400	Distributable Accounts Auto - Supplies	-	189.42	189.42
641-800	- Taxes	-	2.94	2.94
		$ (1280.24)	$ 19547.60	$ 19547.60

Authorized	$ 18000.00
Expended	19547.60
Balance Unexpended	$ (1547.60)

Orig: TCOsborne
cc: RR, NV, CWC, TES, FTG, File-2

To correct Vo. 10-211-77 1751.00

Expenditures 12/77 470.76

MOLLEN-HAUER SURVEYING COMPANY

P.O. Box 17376 • Tucson, Ariz. 85731 • Phone (602) 298-2779

RT.2 BOX 242-S SEGUIN, TEXAS 78155

ASARCO INCORPORATED S.W. EXPLORATION
U.S. EXPLORATION DIVISION
P. O. BOX 5747
TUCSON, ARIZONA 85703

ASARCO Incorporated
JUN 1 1984
SW Exploration

Date: MAY 30, 1984

Customer's Order No.

Job No. G 2131 & T 2132

Invoice No. G 2131

rt Date	Stop Date	Hole Name & No.	Area	Charges	
		TM 14	THUNDER MOUNTAIN	AS LISTED	
		GYROSCOPIC DIRECTIONAL SURVEY			
24-84		Surveyed hole from 0' to 3050' @ 24¢ Per Ft.		$ 732	00
		Temperature survey		300	00
		Wireline charges 4¢ Per Ft.		122	00
		A Frame charges		14	00
		1 nights lodging for 1 man		21	00
		3 meals for 1 man		17	10
		Blueprint		4	50
		Round trip mileage from Tucson to core hole 158 miles @ 40¢ Per Mile		62	20
		TOTAL		$1272	80

APPROVED FOR PAYMENT

By: James D. Sell
(Signature)

INVOICE

MOLLEN-HAUER SURVEYING COMPANY

WORK ORDER AND RECEIPT

[redacted]

RT 2 Box 242-S Seguin, Tex 78155

Customer Asarco Inc. S.W. Exploration Date 5-29-84

U.S. Exploration Div

Invoice Address P.O. Box 5747 Well Name & No. TM 14

Tucson Ariz 85703 Job No. G2131 & T 2132

Field Thunder Mountain County Santa Cruz State Ariz

Hole size NX to _____ ft. size _____ to _____ Ft. Others _____

This is to verify the order for a Gyro & Temperature survey on the above mentioned well.

The Customer agrees to the Rates, Terms and Conditions as set forth in Price List No. as quoted.

Is filing of survey with Governing Agency required by existing Law, Rule or Regulation? _____

By _____

Customer/Agency thereof

Arrived at well: Date 5-24-84 Time — Left well: Date 5-24-84 Time — Standby time —

Travel from Tucson to Core Hole Round trip 158 miles. Surveyed from 0 to 3050

Footage surveyed 3050

Distance between Survey Stations: Gyro 100 Temp 500 Traversed from — to — Footage traversed —

Remarks: _____

By Otto H Mollenhauer

Mollen-Hauer Surveying Company

By _____

Customer/Agency thereof

TM

ASARCO

7-11-85

From: J. R. Stringham

To: JDS

The Ventura Warehouse costs us about $1910 per year, all charged to gen. Ex. A fair split might be 30% T.M, 30% Ventura, 40% gen Ex (or other)

JRS

ASARCO

Exploration Department
Western USA

W. L. Kurtz
Manager

July 21, 1987

Mr. Harold W. Holmberg
Director Metals Exploration
Kerr-McGee Corporation
Kerr-McGee Center
P.O. Box 25861
Oklahoma City, OK 73125

Dear Mr. Holmberg:

Mr. Brown requested I send you the following data pertaining to the Thunder Mountain and Humbolt Project Areas:

1. Expenditure Statement from our Chief Accountant
2. Drill Logs TM 8-14; TCh 2, 2A
3. Geologic Map 1" = 1,000'.

Your geologists Ross Corn, Zeb Jones, and Jim Quinlan had standing invitations to review all our data and log the core, but to my knowledge never did so.

Sincerely,

W. L. Kurtz

W. L. Kurtz

WLK:mek
encs.

cc: R.L. Brown (w/o data)
J.D. Sell (w/o data)

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703
1150 North 7th Avenue (602) 792-3010

ASARCO

Southwestern Mining Department

July 21, 1987

TO: W. L. Kurtz
Western Exploration Department

Expenditures on the Thunder Mountain and Humboldt Project Areas are:

Pre Dec. 1, 1977	$ 243,595.42
Dec.1,1977-June 30,1987	918,572.37
Total	$1,162,167.79

A. J. Robles
Chief Accountant

AJR/mck
cc: RLBrown
JDSell
FRKoutz

ASARCO

Southwestern Exploration Division

JDS

August 11, 1987

R.L. Brown
New York Office

Thunder Mtn.-Humbolt Expenditures
Patagonia Mountains
Santa Cruz County, Arizona

I submit a copy of the July 13, 1987, memo with the blind note which breaks out the three EA's involved in the subject area. The July 13 copy was unintentionally not attached to the July 21 copies which you have previously received.

Note that both the Mendoza option and the Trench Project are part and parcel of the Humbolt claim group costs, as the Mendoza claim group is the same group of claims which we now call the Humbolt group.

Since June 30, 1987, the drilling costs by Joy, etc., for the assessment year ending August 31, 1987, have been incurred and the prorated share for the Humbolt group should be added to the Humbolt costs and the remainder to the Thunder Mountain Project where the work was actually done (TM-14 drill hole).

I hope this additional data serves your purpose in finalizing the new Thunder Mountain operating agreement.

James D. Sell

James D. Sell

JDS:mek
Atts.

cc: W.L. Kurtz
W.D. Gay
C.L. Snow

July 13, 1987

To: W. L. Kurtz
Western Exploration Department

Total expenditures through June 30, 1987 on the Thunder Mountain Project Area and the Humboldt Project Area are $1,162,167.79.

Original Signed By
A. J. Robles

A. J. Robles
Chief Accountant

AJR/kh

cc: JDSell
WEGay
FRKoutz

Blind Note:

The above figure was calculated as follows:

Thunder Mountain Project (EA-0042) through 6/87	$615,468.60
Mendosa Option (EA-0057) 9/73 - 12/80	72,267.76
Trench Project (EA-0200 - D1,02,03 w/500)	474,431.43
	$1,162,167.79

The Mendosa Option includes property payments for the 7 Humboldt Group unpatented claims. All unknown Mendosa-Humboldt ground (DDH TCH-2,2A) has been included in the Trench Project starting January 1981. The Trench Project expenditures above do not include the cost of DDH TCH-1 ($190,000: EA-0200-00) collared on Trench Group patented claims. The actual cost of DDH TCH-2 & 2A was $464,785 including SEA-0200:01, 02 & 03 (through April 30, 1982). All expenditures since 1982 on the Trench Project have primarily benefited the Humboldt claims. Note that no property taxes, etc. are included in Trench Project costs. These are carried by the Southwest Mining Department as part of the old Trench Unit.

F. R. Koutz

Exploration Department
Western USA

W. L. Kurtz
Manager

July 21, 1987

Mr. Harold W. Holmberg
Director Metals Exploration
Kerr-McGee Corporation
Kerr-McGee Center
P.O. Box 25861
Oklahoma City, OK 73125

Dear Mr. Holmberg:

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1. Expenditure Statement from our Chief Accountant
2. Drill Logs TM 8-14; TCh 2, 2A
3. Geologic Map 1" = 1,000'.

Your geologists Ross Corn, Zeb Jones, and Jim Quinlan had standing invitations to review all our data and log the core, but to my knowledge never did so.

Sincerely,

W. L. Kurtz

W. L. Kurtz

WLK:mek
encs.

cc: R.L. Brown (w/o data)
J.D. Sell (w/o data)

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703
1150 North 7th Avenue (602) 792-3010

ASARCO

Southwestern Mining Department

July 21, 1987

TO: W. L. Kurtz
Western Exploration Department

Expenditures on the Thunder Mountain and Humboldt Project Areas are:

Pre Dec. 1, 1977	$ 243,595.42
Dec.1,1977-June 30,1987	918,572.37
Total	$1,162,167.79

A. J. Robles
Chief Accountant

AJR/mck
cc: RLBrown
JDSell
FRKoutz

ASARCO

Southwestern Exploration Division

JDS

August 7, 1987

Coy Snow
Accounting

Thunder Mountain
Santa Cruz Co., AZ

Attached is a letter of a new Operating Agreement to be finalized shortly.

In order to put some numbers on it and to know where Asarco stands, I (New York City) need the following information:

1. The total expenditures applicable to the Thunder Mountain Project under the present Agreement.

2. The total cost of Asarco on the seven unpatented mining claims known as the Humbolt Group.

James D. Sell

James D. Sell

JDS:mek
Att.

cc: W.D. Gay (w/att.)

JDS → file Need to find out actual Thunderbolt Expenses to see total close to $1M

From: R. L. Brown

To: Bill Kurtz

This guy Barry Hill is a disaster but after we had come to some sort of an agreement to continue the Thunder Mtn JV he insisted in drawing up a letter.

Obviously there are many unnegotiated points (such as will Asarco expenditures at Hembolt count) were not considered or settled. I did not want the letter showing that it might cause more problems than it would cure. Anyhow here is a copy for your file RB

KERR-McGEE CORPORATION
KERR-McGEE CENTER • OKLAHOMA CITY, OKLAHOMA 73125

RECEIVED
AUG 6 1987
EXPLORATION DEPARTMENT

July 2, 1987

T. Hvalu MTM

Mr. R. L. Brown, Vice President
Exploration Department
ASARCO INCORPORATED
180 Maiden Lane
New York, NY 10038

Re: OPERATING AGREEMENT
Thunder Mountain Project
Santa Cruz County, Arizona

Dear Mr. Brown:

Pursuant to your proposals set forth in your June 24, 1986 and today's discussion, we outline herein certain terms and conditions for a proposed amendment to our existing Thunder Mountain OPERATING AGREEMENT as follows:

1. The inadvertent failure of Asarco to meet its minimum expenditure commitment for 1985 will be excused.

2. The present requirement for Asarco to expend $1,000,000 to earn a 50% interest will still remain, however, the present Initial Exploration Period termination date of October 1, 1990 will be waived.

3. Asarco will agree to annually perform the minimum required assessment work for each assessment year through September 1, 1991 and failure to perform the minimum assessment will result in forfeiture of the property; provided, however, Asarco shall give to Kerr-McGee written notice ninety(90) days prior to the end of any assessment year in order to be relieved of this obligation.

4. On October 1, 1991 and annually thereafter Asarco will propose a budget and program costing at least $100,000 annually until Asarco has spent the required $1,000,000 earn-in. After earn-in Kerr-McGee will have the option of contributing on a pro-rata basis to the annual budget or of accepting a pro rata dilution of its interest down to 15%. As provided in the present agreement a party diluted to 15% would convert to a 5% NSR royalty interest.

5. Asarco will agree to make the seven(7) unpatented mining claims known as the Humbolt Group a part of the lands in the Operating Agreement, as if said mining claims had been originally described in Exhibit A attached thereto. If Asarco does not earn a 50% interest in all the lands, then all interest in the Humbolt Group will revert to Asarco.

6. Asarco will agree to submit, within thirty(30) days after an amendment is entered into, a summary report of all exploration operations conducted on the property to date of the amendment, and annually thereafter on or before February 1 of each year Asarco will submit a summary of all activities.

If you concur with the above terms, please acknowledge your acceptance by executing and affixing the current date on the attached copy of this letter and return same to me. Upon receipt of the letter we will immediately begin preparations of a definitive amendment form for your review and our mutual acceptance thereof.

Should you have any questions, please call me at 405/270-3868 or W. K. John at 405/270-3326.

Sincerely,

KERR-McGEE CORPORATION

Barry N. Hill

Barry N. Hill
Vice President-Land

BNH:vk

Acknowledged the 2 day of July 1987.

ASARCO Incorporated

BY: R. L. Brown

R. L. Brown
Vice President Exploration Department

1990 Drilling

$144,137 in 4 holes, totally 4375' = $37.52 per foot drilling, assay, supervision, report etc.

From East to West, Roadway

Depth of Drag Holes

900
850
750
700 — 3200'
700
650
550
450
450 — 2800'

roadway holes

Hallinan holes

850
700
750
700 — 3000'

9,000' all vertical.

using $38/ft costs: Per $100,000 = 2635' of drilling

rotary drilling — double amount of footage; i.e. costs most of road drilling thoughts

Single holes to be drilled at each location, x 2.

Based on rotary costs, probably drill all of present roadway, further one to establish continuity & grade distribution of 700' ave +0.30 zone.

CBC DRILLING

Formerly Joy Contract Drill Division

707 BOYD BLVD.
LA PORTE, IN 46350

DUPLICATE JDS

PLEASE REMIT TO
P.O. BOX 30777
SALT LAKE CITY, UTAH 84130

CBC Account Number	Customer's Order Number	Customer's Contract Number	CBC Contract Number
03966			03-0966-24

SOLD TO
ASARCO INC.
ATTN: MR. JIM SELL
P.O. BOX 5747
TUCSON, AZ 85703

TERMS NET 30 DAYS
NO CASH DISCOUNT
PAST DUE ACCTS. SUBJECT TO 18% PER ANNUM

PLEASE REMIT TO
CBC DRILLING
P.O. BOX 30777
SALT LAKE CITY, UTAH 84130

ANY QUESTIONS ON INVOICE
PLEASE CALL 219-362-2191

INVOICE NO. AZ1270

INVOICE DATE 8/3/90

DATE SHIPPED

SHIPPED VIA

SHIPPED TO
PATAGONIA, ARIZONA

P. O. ADDRESS

MARKS

REQUESTED ROUTING

SHIPPED FROM

For 174.' core drilling near Patagonia, Arizona for period ending 7/25/90 as per agreement.

(586-1004)	HOLE NO.	SIZE	FROM	TO	TOTAL FEET	UNIT COST	TOTAL COST
	BB-2	5 7/8 Rotary	0.	12.	12.	Hourly	-
	BB-2	5 7/8 Rotary	0.	12.	12.	Hourly	-
		NC	12.	162.	150.	18.90	2,835.00
					174.		2,835.00

(586-1004) OVERBURDEN DRILLING

BB-2	July 13	10 Hours	
	July 18	4 Hours	
		14 Hours @ $60.00/hour	840.00

(586-1007) SETTING AND PULLING CASING

BB-2	July 14	4 Hours	
	July 18	2 Hours	
		6 Hours @ $55.00/hour	330.00

(586-1007) CEMENTING, PLUGGING, HOLE CONDITIONING AND CLOSING HOLES

BB-2	July 13	6 Hours	
	July 14	4 Hours	
	July 19	1 Hour	
		11 Hours @ $55.00/hour	605.00

FORM
INV.-89-1

F. O. B. SHIPPING POINT UNLESS OTHERWISE SPECIFIED
NO RETURNS ALLOWED UNLESS AUTHORIZED BY THIS OFFICE
GOODS COVERED BY THIS INVOICE WERE PRODUCED IN COMPLIANCE WITH THE REQUIREMENTS OF THE FAIR LABOR STANDARDS ACT OF 1938, AS AMENDED, INCLUDING SECTION 12(A).

CBC DRILLING

Formerly Joy Contract Drill Division

DUPLICATE

SOLD TO ASARCO INC. ATTN: MR. JIM SELL

PAGE NO. 2 | INVOICE NO. AZ1270

(586-1009) STANDBY

BB-2	July 17	3 Hours @ $50.00/hour (Per understanding with Nino Trujillo)	150.00

(587-1101) MUD AND ADDITIVES

1	Soda Ash @ $26.84 each	26.84	
3	5 Gallon EZ Mud @ $131.04 each	393.12	
			419.96

(587-1102) CEMENT

7	94# Cement @ $6.02 each	42.14

(586-1008) WATER HAUL

July 10 through July 25

1	Truck @ $600.00/month (16/30)	320.00

(587-1104) CORE BOXES

Boxes By Asarco -

(587-1104) EXCESS BIT COST

To be determined, if any. -

(586-1009) PER DIEM

Underwood	5 Days	
Figueroa	13 Days	
Contreras	12 Days	
Sanchez	7 Days	
Johnson	1 Day	
	38 Days @ $15.00/day	570.00

(586-1005) MOBILIZATION

Rig 7955 500.00

TOTAL INVOICE: $6,612.10

THANK YOU

FORM
NV-89-2

J DO

1803 E. 10TH ST.
TUCSON, AZ 85719

(602) 884-5345

H. J. DOWNEY, INC.

EXPLORATION & DEVELOPMENT

I.D. #86-0636964

Mr. James D. Sell
ASARCO, Inc.
1150 North 7th Avenue
Tucson, AZ 85703

INVOICE

Services relating to the Thunder Mountain and Ventura Projects for the period 7/16/90---8/15/90.

Thunder Mountain Project: 3 days @ $ 250	$ 750.00	EA-0042
Ventura Project: 1,1/2 days @ $ 250	375.00	EA-0165
TOTAL DUE	$ 1125.00	

Harold J. Downey
Harold J. Downey

8/15/90
Date

OK for Payment
James D Sell

cc: J.J. Malusa

JDS

1803 E. 10TH ST.
TUCSON, AZ 85719

(602) 884-5345

H. J. DOWNEY, INC.

EXPLORATION & DEVELOPMENT

I. D. #86-0636964

September 4, 1990

Mr. James D. Sell
ASARCO, Inc.
1150 North 7th Avenue
Tucson, AZ 85703

INVOICE

Services relating to the Thunder Mountain and Ventura Projects for the period 8/16/90 -- 8/31/90.

Thunder Mountain Project:	
2 days @ $ 250	$ 500.00
Ventura Project:	
1, 1/2 days @ $ 250	375.00
TOTAL DUE	$ 875.00

Harold J. Downey

Harold J. Downey

9/4/90

Date

approved for payment by

9/5/90

ASARCO

Southwestern Exploration Division

September 7, 1990

W.D. Gay

Thunder Mountain Project
Patagonia Mountains
Santa Cruz County, Arizona

The following is a list of expenditures on the Thunder Mountain Project. Total expenditures without assaying are more than enough to satisfy the assessment work requirement for the assessment year ending Sept. 1, 1990.

1. Drilling

CBC Drilling Company 707 Boyd Blvd. La Porte, Indiana 46350	$34,320.57

2. Road Work

Patagonia Excavating P.O. Box 482 Patagonia, Arizona	1,493.59

3. Surveying Device Rental

Boyles Bros. Drilling Company 1707 South 4490 West P.O. Box 25068 Salt Lake City, Utah 84125	919.44

4. Supervision

Mr. J.J. Malusa	2,325.00

5. Expense

Vehicle Operation	874.32
Total	$39,932.92

John J. Malusa

JJM:mek

John J. Malusa

cc: J.D. Sell

Both the Ventura and Thunder Mtn bills are correct. However, there is some problems with the BB-2 camera standby charge that I would like to discuss with you.

John Malusa

JDS

Formerly Joy Contract Drill Division

707 BOYD BOULEVARD / LaPORTE, INDIANA 46350 / PHONE & FAX: (219) 362-2191

September 7, 1990

ASARCO Incorporated

SEP 1 0 1990

SW Exploration

Mr. Jim Sell
Asarco Inc.
P.O. Box 5747
Tucson, AZ 85703

Dear Jim:

I have reviewed the situation on August 15 and August 16 which involved a short work interruption. There are 15 hours of standby on the two drill reports. The attached invoice reflects a charge for only 7 of these hours at the standby rate. If you feel that this is not appropriate, deduct up to 7 hours as you think fair and reasonable.

This experience emphasizes the need to plan ahead or at least address the problem potential when it occurs. I suggest with all future sites that you tell us prior to moving on or we will ask you when we get there:

1. Where is mud to be disposed of when it needs to be changed out.

2. Where are cuttings to be disposed of.

When cuttings need to be hauled from the site we will contain them on a temporary basis in buckets, etc. until they are hauled away on an "as required" schedule. We will try to avoid accumulations that may result in a reoccurence of the recent experience.

Any of this work that interrupts drilling operations during shift hours will be invoiced at the standby rate.

We are aware of increasing environmental sensitivity and requirements and will do our best to cooperate.

Yours very truly,

CBC DRILLING

J. H. Koontz
Vice President &
General Manager

JHK/ts
attachment:
cc: J.J. Malusa (9/10/90)

ASARCO Incorporated

SEP 1 0 1990

SW Exploration

CBC DRILLING

Formerly Joy Contract Drill Division

707 BOYD BLVD.
LA PORTE, IN 46350

ORIGINAL

PLEASE REMIT TO
P.O. BOX 30777
SALT LAKE CITY, UTAH 84130

CBC Account Number	Customer's Order Number	Customer's Contract Number	CBC Contract Number
03966			03-0966-24

SOLD TO
ASARCO INC.
ATTN: MR. JIM SELL
P.O. BOX 5747
TUCSON, AZ 85703

SHIPPED TO
PATAGONIA, ARIZONA

TERMS NET 30 DAYS
NO CASH DISCOUNT
PAST DUE ACCTS. SUBJECT
TO 18% PER ANNUM

PLEASE REMIT TO
CBC DRILLING
P.O. BOX 30777
SALT LAKE CITY, UTAH 84130

ANY QUESTIONS ON INVOICE
PLEASE CALL 219-362-2191

INVOICE NO. AZ1289

INVOICE DATE 9/7/90

DATE SHIPPED

SHIPPED VIA

P. O. ADDRESS

MARKS

REQUESTED ROUTING

SHIPPED FROM

For 894.5' core drilling near Patagonia, Arizona (Trench Project) for period ending August 25, 1990 as per agreement.

(586-1004)	HOLE NO.	SIZE	FROM	TO	TOTAL FEET	UNIT COST	TOTAL COST
	BB-2(36°)	NC	162.	500.	338.	18.90	6,388.20
		NC	500.	516.5	16.5	19.70	325.05
	BB-3(45°)	NC(OB)	0.	14.	14.	Hourly	-
		NC	14.	500.	486.	18.90	9,185.40
		NC	500.	540.	40.	19.70	788.00
					894.5		16,686.65

(586-1004) OVERBURDEN DRILLING

BB-3	Aug. 13	3½ Hours @ $60.00/hour		210.00

(586-1007) CEMENTING, PLUGGING, HOLE CONDITIONING AND CLOSING HOLES

BB-3	Aug. 13	6 Hours	
	Aug. 14	6 Hours	
	Aug. 15	7 Hours	
	Aug. 16	1 Hour	
		20 Hours @ $55.00/hour	1,100.00

(586-1009) SURVEY

BB-2	Aug. 7	1 Hour	
	Aug. 8	1½ Hours	
		2½ Hours @ $55.00/hour	137.50

(CONTINUED)

F. O. B. SHIPPING POINT UNLESS OTHERWISE SPECIFIED
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CBC DRILLING

Formerly Joy Contract Drill Division

ORIGINAL

SOLD TO ASARCO INC. ATTN: MR. JIM SELL

PAGE NO. 2 | INVOICE NO. AZ1289

(586-1009) STANDBY

BB-2	July 27	2½ Hours (Haul Mud)	
	July 31	2 Hours (Haul Mud)	
	Aug. 7	11 Hours (Camera) ASARCO	
	Aug. 8	5 Hours (Camera)	
	Aug. 16	7 Hours (USFS Shutdown)	
		27½ Hours @ $50.00/hour	1,375.00

(586-1006) MOVE BETWEEN HOLES

To BB-3 One Move @ $500.00 — 500.00

(587-1101) MUD AND ADDITIVES

2 5 Gallon EZ Mud @ $131.04 each — 262.08

(587-1102) CEMENT

8 Cement @ $6.02 each	48.16	
1 Calseal @ $35.72 each	35.72	
		83.88

(5[illegible]-1008) WATER HAUL

July 26 through August 25

1 Truck @ $600.00/month — 600.00

(587-1104) CORE BOXES

By Asarco — -

(587-1104) EXCESS BIT COST

To be determined, if any — -

(586-1009) PER DIEM

Johnson	25 Days	
Figueroa	24 Days	
Contreras	25 Days	
Sanchez	25 Days	
	99 Days @ $15.00/day	1,485.00

TOTAL INVOICE: $22,440.11

OKed 9-11-90 JDS

THANK YOU

FORM INV-89-2

JDS

1803 E. 10TH ST.
TUCSON, AZ 85719

(602) 884-5345

H. J. DOWNEY, INC.

EXPLORATION & DEVELOPMENT

September 17, 1990

I.D. # 86-0636964

Mr. James D. Sell
ASARCO, Inc.
1150 North 7th Avenue
Tucson, AZ 85703

INVOICE

Services relating to the Thunder Mountain and Ventura Projects for the period 9/4/90--9/15/90.

Thunder Mountain Project: Core logging-- BB-3 440`-725` 5 Hrs. BB-4--0-200` 4 Hrs. Misc. with J.Briscoe, J. Sell, J. Malusa 3 Hrs. 1,1/2 days @ $250.....$ 375.00

Ventura Project: Core logging--V-39 1010`-1220` 4 Hrs. 1/2 day @ $250 125.00

TOTAL DUE $ 500.00

Harold J. Downey
Harold J. Downey

9/17/90
Date

CBC DRILLING

Formerly Joy Contract Drill Division

707 BOYD BLVD.
LA PORTE, IN 46350

ORIGINAL JDS

PLEASE REMIT TO
P.O. BOX 30777
SALT LAKE CITY, UTAH 84130

CBC Account Number	Customer's Order Number	Customer's Contract Number	CBC Contract Number
03966	ASARCO Incorporated		03-0966-24

OCT 9 1990
SW Exploration

SOLD TO
ASARCO INC.
ATTN: MR. JIM SELL
P.O. BOX 5747
TUCSON, AZ 85703

TERMS NET 30 DAYS
NO CASH DISCOUNT
PAST DUE ACCTS. SUBJECT
TO 18% PER ANNUM

PLEASE REMIT TO
CBC DRILLING
P.O. BOX 30777
SALT LAKE CITY, UTAH 84130

ANY QUESTIONS ON INVOICE
PLEASE CALL 219-362-2191

INVOICE NO. AZ1301
INVOICE DATE 10/4/90
DATE SHIPPED
SHIPPED VIA

SHIPPED TO
PATAGONIA, ARIZONA

P. O. ADDRESS

MARKS

REQUESTED ROUTING

SHIPPED FROM

For 982.' core drilling near Patagonia, Arizona (Trench Project) for period ending September 25, 1990 as per agreement.

(586-1004)	HOLE NO.	SIZE	FROM	TO	TOTAL FEET	UNIT COST	TOTAL COST
	BB-3(45°)	NC	540.	725.	185.	19.70	3,644.50
	BB-4(90°)	5 7/8 Rotary	0.	7.	7.	Hourly	-
		NC	7.	500.	493.	17.40	8,578.20
		NC	500.	797.	297.	18.20	5,405.40
					982.		17,628.10

(586-1004) OVERBURDEN DRILLING

BB-4	Sept. 7	2½ Hours @ $60.00/hour		150.00

(586-1007) SETTING AND PULLING CASING

BB-4	Sept. 7	1 Hour @ $55.00/hour	55.00

(586-1009) CEMENTING, PLUGGING, HOLE CONDITIONING AND HOLE CLOSURE

BB-2	Aug. 27	3 Hours	
BB-3	Aug. 31	2 Hours	
BB-4	Sept. 25	2 Hours (Shown as Standby)	
		7 Hours @ $55.00/hour	385.00

(586-1009) SURVEY

BB-3	Aug. 30	2½ Hours	
	Aug. 31	1½ Hours	
BB-4	Sept. 25	1½ Hours	
		5½ Hours @ $55.00/hour	302.50

FORM
INV.-89-1

F. O. B. SHIPPING POINT UNLESS OTHERWISE SPECIFIED
NO RETURNS ALLOWED UNLESS AUTHORIZED BY THIS OFFICE
GOODS COVERED BY THIS INVOICE WERE PRODUCED IN COMPLIANCE WITH THE REQUIREMENTS OF THE FAIR LABOR STANDARDS ACT OF 1938, AS AMENDED, INCLUDING SECTION 12(A).

CBC DRILLING
Formerly Joy Contract Drill Division

ORIGINAL

OLD TO ASARCO INC. ATTN: MR. JIM SELL	PAGE NO. 2	INVOICE NO. AZ1301

(586-1009) STANDBY

BB-4	Sept. 24	3 Hours (Mud and Cuttings Disposal)	
	Sept. 25	½ Hour (Fill in Sump)	
		3½ Hours @ $50.00/hour	175.00

(586-1006) MOVE BETWEEN HOLES

To BB-4	One Move @ $500.00	500.00

(587-1101) MUD AND ADDITIVES

8	50# Mud @ $5.67 each	45.36	
10	Barite @ $11.34 each	113.40	
1	5 Gallon EZ Mud @ $131.04 each	131.04	
			289.80

(587-1102) CEMENT

11	94# Cement @ $6.02 each	66.22

(586-1008) WATER HAUL

August 26 through September 25		
1	Truck @ $600.00/month	600.00

(587-1104) CORE BOXES

By Asarco	-

(587-1104) EXCESS BIT COST

To be determined, if any	-

(586-1009) PER DIEM

Johnson	23 Days	
Figueroa	23 Days	
Contreras	20 Days	
Sanchez	19 Days	
	85 Days @ $15.00/day	1,275.00

TOTAL INVOICE: $21,426.62

ASARCO Incorporate
OCT 9 1990
SW Exploration

THANK YOU

FORM
INV-89-2

ASARCO Incorporated

OCT 9 1990

SW Exploration

PAYLESS CASHWAYS

S. TUCSON, AZ

C

CRYSTAL SALE
TOS 01 YARD
SLPN 033
137943
94# PORTLAND CEMENT
8@4.69 37.52 T
7% T 2.63
TOTAL 40.15
CASH 41.00-
CHANGE .85

11113607 58 6213
08/29/90 09:24:10

D CEMENT 37.52 T
7% T 2.63
TOTAL 40.15
41.00-
CHANGE .85
08/29/90 09:24:10

Job # 03-0966-24
Asarco trench # 9

ORDER # EMP. ID

CUSTOMER NAME PHONE #

JDS

ASARCO Incorporated

NOV 6 1990

SW Exploration

CBC DRILLING

Formerly Joy Contract Drill Division

707 BOYD BLVD.
LA PORTE, IN 46350

ORIGINAL

PLEASE REMIT TO
P.O. BOX 30777
SALT LAKE CITY, UTAH 84130

CBC Account Number	Customer's Order Number	Customer's Contract Number	CBC Contract Number
03966			03-0966-24

SOLD TO

ATTN: MR. JIM SELL
ASARCO INC.
P.O. BOX 5747
TUCSON, AZ 85703

TERMS NET 30 DAYS
NO CASH DISCOUNT
PAST DUE ACCTS. SUBJECT
TO 18% PER ANNUM

PLEASE REMIT TO
CBC DRILLING
P.O. BOX 30777
SALT LAKE CITY, UTAH 84130

ANY QUESTIONS ON INVOICE
PLEASE CALL 219-362-2191

INVOICE NO. AZ1318

INVOICE DATE 11/2/90

DATE SHIPPED

SHIPPED VIA

SHIPPED TO

PATAGONIA, ARIZONA (TRENCH PROJECT)

P. O. ADDRESS

MARKS

REQUESTED ROUTING

SHIPPED FROM

For 767.' of drilling near Patagonia, Arizona (Trench Project) for period from September 26, 1990 to October 25, 1990 as per agreement.

(586-1004)	HOLE NO.	SIZE	FROM	TO	TOTAL FEET	UNIT COST	TOTAL COS
	BB-5(30°)	5 5/8 Rotary	0.	10.	10.	Hourly	-
		NC	10.	500.	490.	18.90	9,261.0(
		NC	500.	767.	267.	19.70	5,259.9(
					767.		14,520.9(

(586-1004) OVERBURDEN DRILLING

BB-4	Sept. 23	2 Hours		
	Oct. 1	5 Hours		
		7 Hours @ $60.00/hour		420.0(

(586-1007) REAMING

BB-5	Oct. 1	4½ Hours @ $55.00/hour	247.5(

(586-1007) SETTING AND PULLING CASING

BB-5	Oct. 1	2 Hours @ $55.00/hour	110.0(

(586-1007) CEMENTING, PLUGGING, HOLE CONDITIONING AND HOLE CLOSURE

BB-4	Sept. 26	2 Hours	
	Oct. 5	1½ Hours	
		3½ Hours @ $55.00/hour	192.50

(586-1009) STANDBY

BB-4	Oct. 4	2 Hours (Mud Disposal)	
	Oct. 8	2 Hours (Mud Disposal)	
	Oct. 18	1 Hour (Mud Disposal)	
		5 Hours @ $50.00/hour	250.00

FORM
INV.-89-1

F. O. B. SHIPPING POINT UNLESS OTHERWISE SPECIFIED
NO RETURNS ALLOWED UNLESS AUTHORIZED BY THIS OFFICE
GOODS COVERED BY THIS INVOICE WERE PRODUCED IN COMPLIANCE WITH THE REQUIREMENTS OF THE FAIR LABOR STANDARDS ACT OF 1938, AS AMENDED, INCLUDING

CBC DRILLING

Formerly Joy Contract Drill Division

ORIGINAL

SOLD TO	ATTN: MR. JIM SELL	ASARCO INC.	ASARCO Incorp.	PAGE NO. 2	INVOICE NO. AZ1318

NOV 6 1990

SW Exploration

(586-1006) MOVE BETWEEN HOLES

To BB-5	One Move @ $500.00		500.00

(587-1101) MUD AND ADDITIVES

2	Dextrid @ $87.19 each	174.38	
1	5 Gallon Sol. Oil @ $30.18 each	30.18	
2	5 Gallon EZ Mud @ $131.04 each	262.08	
			466.64

(587-1102) CEMENT

1	Calseal @ $35.72 each	35.72	
4	94# Cement @ $6.02 each	24.08	
			59.80

(586-1008) WATER HAUL

September 26 through October 25

1 Truck @ $600.00/month		600.00

(587-1104) CORE BOXES

By Asarco	-

(587-1104) EXCESS BIT COST

To be determined, if any	-

(586-1009) PER DIEM

Johnson	23 Days	
Figueroa	23 Days	
Contreras	22 Days	
Sanchez	20 Days	
Perez	1 Day	
	89 Days @ $15.00/day	1,335.00

(586-1103) CASING MATERIAL

BB-4	7' NC Casing @ $12.00/foot	84.00	
	1 Cap @ $25.00 each	25.00	
			109.00

APPROVED FOR PAYMENT

By: James D. Sell

(Signature)

Thunder Mtn

EA-0042

TOTAL INVOICE: $18,811.34

THANK YOU

FORM INV-89-2

CBC DRILLING

Formerly Joy Contract Drill Division ASARCO Incorporate.

707 BOYD BLVD.
LA PORTE, IN 46350

DEC 1 3 1990

SW Exploration

ORIGINAL JDS

PLEASE REMIT TO
P.O. BOX 30777
SALT LAKE CITY, UTAH 84130

CBC Account Number	Customer's Order Number	Customer's Contract Number	CBC Contract Number
03966			03-0966-24

SOLD TO

ATTN: MR. JIM SELL
ASARCO INC.
P.O. BOX 5747
TUCSON, AZ 85703

TERMS NET 30 DAYS
NO CASH DISCOUNT
PAST DUE ACCTS. SUBJECT
TO 18% PER ANNUM

PLEASE REMIT TO
CBC DRILLING
P.O. BOX 30777
SALT LAKE CITY, UTAH 84130

ANY QUESTIONS ON INVOICE
PLEASE CALL 219-362-2191

INVOICE NO. AZ1333

INVOICE DATE 12/10/90

DATE SHIPPED

SHIPPED VIA

SHIPPED TO

PATAGONIA, ARIZONA (TRENCH PROJECT)

P. O. ADDRESS

MARKS

REQUESTED ROUTING

SHIPPED FROM

For 833.' of drilling near Patagonia, Arizona (Trench Project) for period from October 26, 1990 to November 25, 1990 as per agreement.

(586-1004)	HOLE NO.	SIZE	FROM	TO	TOTAL FEET	UNIT COST	TOTAL COST
	B5-5(30°)	NC	767.	800.	33.	19.70	650.10
	BB-6(45°)	5 7/8					
		Rotary	0.	16.	16.	Hourly	-
		NC	16.	500.	484.	18.90	9,147.60
		NC	500.	800.	300.	19.70	5,910.00
					833.		15,707.70

(586-1004) OVERBURDEN DRILLING

BB-6	Nov. 2	3 Hours	
	Nov. 3	5 Hours	
		8 Hours @ $60.00/hour	480.00

(586-1007) SETTING AND PULLING CASING

BB-5	Oct. 31	2 Hours	
BB-6	Nov. 3	1 Hour	
	Nov. 6	6 Hours	
	Nov. 12	1 Hour	
		10 Hours @ $55.00/hour	550.00

(586-1007) CEMENTING, PLUGGING, HOLE CONDITIONING AND CLOSING HOLE

BB-6	Nov. 3	2 Hours	
	Nov. 5	13 Hours	
	Nov. 14	1 Hour	
		16 Hours @ $55.00/hour	880.00

FORM
INV.-89-1

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CBC DRILLING

Formerly Joy Contract Drill Division

ORIGINAL

OLD TO ATTN: MR. JIM SELL ASARCO INC.	PAGE NO. 2	INVOICE NO. AZ1333

(586-1009) STANDBY

BB-6	Nov. 9	1½ Hours @ $50.00/hour (Mud Disposal)	75.00

(586-1006) MOVE BETWEEN HOLES

To BB-6	One Move @ $500.00		500.00

(587-1101) MUD AND ADDITIVES

4	50# Mudgel @ $5.67 each	22.68	
1	Dextrid @ $87.19 each	87.19	
1	Mudseal @ $18.90 each	18.90	
1	5 Gallon EZ Mud @ $131.04	131.04	
			259.81

(587-1102) CEMENT

6	94# Cement @ $6.02 each	36.12	
2	94# Cement @ $7.28 each	14.56	
			50.68

(586-1008) WATER HAUL

October 26 through November 25

1 Truck @ $600.00/month 600.00

(587-1104) CORE BOXES

By Asarco -

(587-1104) EXCESS BIT COST

To be determined, if any. -

(586-1009) PER DIEM

Johnson	21 Days	
Figueroa	21 Days	
Contreras	20 Days	
Perez	18 Days	
	80 Days @ $15.00/day	1,200.00

FORM
INV-89-2

CBC DRILLING

Formerly Joy Contract Drill Division

ORIGINAL

SOLD TO ATTN: MR. JIM SELL ASARCO INC.	PAGE NO. 3	INVOICE NO. AZ1333

(587-1103) CASING MATERIAL

BB-5	15' NC Casing @ $12.00/foot	180.00	
	Less 30% Lost	(54.00)	
			126.00

TOTAL INVOICE: $20,429.19

THANK YOU

APPROVED FOR PAYMENT

By: James O. Sell

(Signature)

Thunder Mountain

EA-0042

FORM
INV-89-2

WRIGHT'S HARDWARE
P.O. Box 414
SONOITA, ARIZONA 85637
(602) 455-5523

CUSTOMER'S ORDER NO.	PHONE	DATE
		11-3-96

NAME

ADDRESS

SOLD BY	CASH	C.O.D.	CHARGE	ON ACCT.	MDSE. RET'D.	PAID OUT	

QTY.	DESCRIPTION	PRICE	AMOUNT
5	Sik Cuma	5.25	11 50
			63
			12 13

Robert E. Johnson

ASARCO Trench #9

03 096624

Approved DP

RECEIVED BY

All claims and returned goods MUST be accompanied by this bill.

Thank You

67479

PAYLESS CASHWAYS

S. TUCSON, AZ

CRYSTAL SALE
SLPN 033
SUBTOTAL .00
TOS 01 YARD
137943
94# PORTLAND CEMENT
6 @ 4.69 28.14 T
SUBTOTAL 28.14
7% T 1.97
TOTAL 30.11
CASH 35.00
CHANGE 4.89

11113605 58 9926
10/26/90 10:31:18

Job# 03-0966-24

6 bags @ $4.69

Accounting

1803 E. 10TH ST.
TUCSON, AZ 85719

(602) 884-5345

JDS

H. J. DOWNEY, INC.

EXPLORATION & DEVELOPMENT

December 31. 1990

I.D. # 86-0636964

Mr. James D. Sell
ASARCO, Inc.
1150 North 7th Avenue
Tucson, AZ 85703

Thunder Mtn 1,407.05
Ventura 95.32
Gen. & (Copper Creek) 276.32

INVOICE

Services and expenses relating to the Thunder Mountain and Ventura Projects for the period 12/1/90--12/31/90.

Thunder Mtn: Core logging-- BB-6, finish log, 2 Hrs.; BB-7, logging 0`-735.5`, 14 Hrs.; Work on Thunder Mtn. Summary, 30 Hrs.
5,1/2 days @ $250.....$ 1,375.00

Miscellaneous work on Copper Creek Summary , discussions with J. Sell, J. Malusa.
1 day @ $250.....250.00

1,625.00

Expenses:

Meals & lunch materials (charge to Ventura Proj.)	$ 95.32		Ventura
Maps & materials (Thunder Mtn. Proj.).....	32.05		TM
Copper Creek maps and duplicating.....	26.32		CC
Total Expenses	$ 153.69		153.69

Total Due $ 1,778.69

Harold J. Downey
Harold J. Downey

12/31/90
Date

OK for Payment
James D. Sell

CBC DRILLING

Formerly Joy Contract Drill Division

707 BOYD BLVD.
LA PORTE, IN 46350

DUPLICATE

PLEASE REMIT TO
P.O. BOX 30777
SALT LAKE CITY, UTAH 84130

CBC Account Number	Customer's Order Number	Customer's Contract Number	CBC Contract Number
03966			03-0966-24

SOLD TO
ATTN: MR. JIM SELL
ASARCO INC.
P.O. BOX 5747
TUCSON, AZ 85703

TERMS NET 30 DAYS
NO CASH DISCOUNT
PAST DUE ACCTS. SUBJECT
TO 18% PER ANNUM

PLEASE REMIT TO
CBC DRILLING
P.O. BOX 30777
SALT LAKE CITY, UTAH 84130

ANY QUESTIONS ON INVOICE
PLEASE CALL 219-362-2191

INVOICE NO. AZ1346
INVOICE DATE 1/3/91
DATE SHIPPED
SHIPPED VIA

SHIPPED TO
PATAGONIA, ARIZONA (TRENCH PROJECT)

P. O. ADDRESS

MARKS

REQUESTED ROUTING

SHIPPED FROM

For 0.' of drilling near Patagonia, Arizona (Trench Project) for period from November 26, 1990 to November 27, 1990 as per agreement.

(586-1007) SETTING AND PULLING CASING

BB-6 Nov. 27 1 Hour @ $55.00/hour 55.00

(586-1007) CEMENTING, PLUGGING, HOLE CONDITIONING AND HOLE CLOSURE

BB-6 Nov. 26 4 Hours (Showan as Standby)
Nov. 27 1 Hour
5 Hours @ $55.00/hour 275.00

(586-1009) SURVEY

BB-6 Nov. 26 3 Hours
Nov. 27 1 Hour
4 Hours @ $55.00/hour 220.00

(587-1101) MUD AND ADDITIVES

3 Mudgel @ $5.67 each 17.01
Mud Surcharge (Detail attached) 25.29
Includes tax and handling
42.30

(587-1102) CEMENT

2 94# Cement @ $7.28 each 14.56

ASARCO Incorporated
JAN 9 1991
SW Exploration

FORM
INV.-89-1

F. O. B. SHIPPING POINT UNLESS OTHERWISE SPECIFIED
NO RETURNS ALLOWED UNLESS AUTHORIZED BY THIS OFFICE
GOODS COVERED BY THIS INVOICE WERE PRODUCED IN COMPLIANCE WITH THE REQUIREMENTS OF THE FAIR LABOR STANDARDS ACT OF 1938, AS AMENDED, INCLUDING SECTION 12(A).

CBC DRILLING

Formerly Joy Contract Drill Division

DUPLICATE

SOLD TO ATTN: MR. JIM SELL	ASARCO INC.	PAGE NO. 2	INVOICE NO. AZ1346

(586-1008) WATER HAUL

November 26 through November 27

1 Truck @ $600.00/month (2/30) 40.00

(586-1009) PER DIEM

Johnson	2 Days	
Figueroa	2 Days	
Contreras	2 Days	
Perez	2 Days	
	8 Days @ $15.00/day	120.00

TOTAL INVOICE: $766.86

THANK YOU

ASARCO Incorporated

JAN 9 1991

SW Exploration

FORM
INV-89-2

Invoice

Baroid Drilling Fluids, Inc.
P.O. Box 1675, Houston, TX 77251
Phone: (713) 987-5900

PLEASE REMIT TO:
Baroid Drilling Fluids, Inc.

P.O. BOX 297011
HOUSTON TX 77297

Please quote our invoice number.

SOLD TO
C R C DRILLING CO
750 E. EVANS BLVD
TUCSON AZ 85713

(SAME AS "SOLD TO" UNLESS OTHERWISE SHOWN)

SHIP TO
C & C DRILLING CO
ASARCO TRENCH #9
FC3-0966-24

DATE	INVOICE NUMBER	PAGE
11/30/90	08352400	1

CUSTOMER REFERENCE NUMBER	WELL CODE	CUSTOMER NO.	TERMS	SHC	COPIES
ONE		1294000	NET 30 DAYS		1

PRODUCT NUMBER	DESCRIPTION	QUANTITY SHIPPED	PRICING QUANTITY	UNIT PRICE	PR UNIT	AMOUNT
HIP DOC 08352400		SHIP DT 11/30/90				
08 WAREHOUSE		FROM TUCSON AZ				
1A		FRT TRM COLLECT/CHARGE				
04170100 BAG	SODA ASH	200	200	21 30	BAG	42 60
99920001 EA	SURCHARGE (2 1/2%)	100	100	1 07	EA	1 07

SP 29
70501
434

TAXABLE 2.00 TAX CHARGED 0.00 NON TAXABLE 43.67

Seller represents and warrants that all of the goods or materials herein specified and/or the performance of the services covered by this invoice have been produced and/or furnished in full compliance with the Federal Labor Standards Act of 1938 as amended.

REMITTANCE

TOTAL 43 67

4

Invoice

Baroid Drilling Fluids, Inc.
P.O. Box 1675, Houston, TX 77251
Phone: (713) 987-5900

PLEASE REMIT TO:
Baroid Drilling Fluids, Inc.

P.O. BOX 100974
HOUSTON TX 77212

Please quote our invoice number.

SOLD TO
C B C DRILLING CO
750 E. EVANS BLVD
TUCSON AZ 85713

(SAME AS "SOLD TO" UNLESS OTHERWISE SHOWN)

SHIP TO
C B C DRILLING CO
ASARCO TRENCH #9
#03-0966-24

DATE	INVOICE NUMBER	PAGE
12/04/90	08351300	1

CUSTOMER REFERENCE NUMBER	WELL CODE	CUSTOMER NO.	TERMS	SHC	COPIES
ONE		1294000	NET 30 DAYS		1

PRODUCT NUMBER	DESCRIPTION	QUANTITY SHIPPED	PRICING QUANTITY	UNIT PRICE	PR UNIT	AMOUNT
HIP DOC 08351300		SHIP DT 11/05/90				
OR WAREHOUSE		FROM TUCSON AZ				
IA		FRT TRM COLLECT/CHARGE				
001230100BAG	CAL-SEAL	2.00	2.00	28.35	BAG	56.70
003080050BAG	MUD GEL	10.00	10.00	4.50	BAG	45.00
999920001EA	SURCHARGE (2 1/2%)	1.00	1.00	2.54	EA	2.54

TAXABLE 2.00 TAX CHARGED 2.00 NON TAXABLE 104.24

4

Seller represents and warrants that all of the goods or materials herein specified and/or the performance of the services covered by this invoice have been produced and/or furnished in full compliance with the Federal Labor Standards Act of 1938 as amended.

REMITTANCE

TOTAL 104.24

Invoice

Baroid Drilling Fluids, Inc.
P.O. Box 1675, Houston, TX 77251
Phone: (713) 987-5900

PLEASE REMIT TO:
Baroid Drilling Fluids, Inc.

P.O. BOX 297011
HOUSTON TX 77297

Please quote our invoice number.

SOLD TO
C & C DRILLING CO
750 E. EVANS BLVD
TUCSON AZ 85713

(SAME AS "SOLD TO" UNLESS OTHERWISE SHOWN)

SHIP TO
C & C DRILLING CO
ASARCO TRENCH #9
#03-0966-24

DATE	INVOICE NUMBER	PAGE
11/30/90	08350700	1

CUSTOMER REFERENCE NUMBER	WELL CODE	CUSTOMER NO.	TERMS	SHC	COPIES
ONE		1294000	NET 30 DAYS		1

PRODUCT NUMBER	DESCRIPTION	QUANTITY SHIPPED	PRICING QUANTITY	UNIT PRICE	PR UNIT	AMOUNT
HIP DOC 08350700	SHIP DT 10/22/90					
OD WAREHOUSE	FROM TUCSON AZ					
IA	FRT TRM COLLECT/CHARGE					
01770005	CANE Z MUD	500	500	104.00	CAN	520.00
00430050	BAG DEXTRID EX	200	200	69.20	BAG	138.40
99920001	EA SURCHARGE (2 1/2%)	100	100	16.46	EA	16.46

87024
705-501
924

TAXABLE 0.00 TAX CHARGED 0.00 NON TAXABLE 674.86

Seller represents and warrants that all of the goods or materials herein specified and/or the performance of the services covered by this invoice have been produced and/or furnished in full compliance with the Federal Labor Standards Act of 1938 as amended.

REMITTANCE

TOTAL 674.86

4

CBC DRILLING

Formerly Joy Contract Drill Division

707 BOYD BLVD.
LA PORTE, IN 46350

DUPLICATE JDS

PLEASE REMIT TO
P.O. BOX 30777
SALT LAKE CITY, UTAH 84130

CBC Account Number	Customer's Order Number	Customer's Contract Number	CBC Contract Number
03965			03-0965-24

SOLD TO
ATTN: MR. JIM SELL
ASARCO INC.
P.O. BOX 5747
TUCSON, AZ 85703

TERMS NET 30 DAYS
NO CASH DISCOUNT
PAST DUE ACCTS. SUBJECT
TO 18% PER ANNUM

PLEASE REMIT TO
CBC DRILLING
P.O. BOX 30777
SALT LAKE CITY, UTAH 84130

ANY QUESTIONS ON INVOICE
PLEASE CALL 219-362-2191

INVOICE NO. AZ1347

INVOICE DATE 1/3/91

DATE SHIPPED

SHIPPED VIA

SHIPPED TO
PATAGONIA, ARIZONA (THUNDER MTN. PROJECT)

P. O. ADDRESS

MARKS

REQUESTED ROUTING

SHIPPED FROM

For 735.' of drilling near Patagonia, Arizona (Thunder Mtn. Project) for period from November 26, 1990 to December 25, 1990 as per agreement.

(586-1004) HOLE NO.	SIZE	FROM	TO	TOTAL FEET	UNIT COST	TOTAL COST
BB-7(90°)	5 7/8 Rotary	0.	10.5	10.5	Hourly	-
	NC	10.5	130.0	119.5	17.40	2,079.30
	NX	130.0	500.0	370.0	15.40	5,698.00
	NX	500.0	735.0	235.0	16.20	3,807.00
				735.0		11,584.30

(586-1004) OVERBURDEN DRILLING

BB-7	Dec. 1	4 Hours @ $60.00/hour	240.00

(586-1007) SETTING AND PULLING CASING

BB-7	Dec. 1	1 Hour	
	Dec. 11	2 Hours	
		3 Hours @ $55.00/hour	165.00

(586-1007) CEMENTING, PLUGGING, HOLE CONDITIONING AND HOLE CLOSURE

BB-7	Dec. 4	8½ Hours	
	Dec. 5	14 Hours	
	Dec. 6	8 Hours	
	Dec. 7	4 Hours	
		34½ Hours @ $55.00/hour	1,897.50

ASARCO Incorporated

JAN 9 1991

SW Exploration

FORM
INV.-89-1

F. O. B. SHIPPING POINT UNLESS OTHERWISE SPECIFIED
NO RETURNS ALLOWED UNLESS AUTHORIZED BY THIS OFFICE
GOODS COVERED BY THIS INVOICE WERE PRODUCED IN COMPLIANCE WITH THE REQUIREMENTS OF THE FAIR LABOR STANDARDS ACT OF 1938, AS AMENDED, INCLUDING SECTION 12(A).

CBC DRILLING

Formerly Joy Contract Drill Division

DUPLICATE

SOLD TO	ATTN: MR. JIM SELL	ASARCO INC.	PAGE NO. 2	INVOICE NO. AZ1347

(586-1009) STANDBY

BB-7	Nov. 29	2 Hours @ $50.00/hour	100.00

(586-1006) MOVE BETWEEN HOLES

To BB-7	One Move @ $500.00		500.00

(587-1101) MUD AND ADDITIVES

1	Soda Ash @ $26.84 each	26.84	
1	Five Gallon EZ Mud @ $131.04 each	131.04	
1	Multiseal @ $25.44 each	25.44	
1	Mud Seal @ $18.90 each	18.90	
			202.22

(587-1102) CEMENT

6	Cement @ $7.28 each	43.68	
3	Calseal @ $35.72 each	107.16	
			150.84

(586-1008) WATER HAUL

November 28 through December 25

1 Truck @ $600.00/month (28/30)	560.00	
332 Miles @ $.75/mile	249.00	
		809.00

(587-1104) CORE BOXES

25 NX Boxes @ $2.75 each		68.75

(586-1009) PER DIEM

Johnson	20 Days	
Figueroa	20 Days	
Contrearas	20 Days	
Perez	20 Days	
	80 Days @ $15.00/day	1,200.00

(587-1103) CASING MATERIAL

19' NC Casing @ $12.00/foot	228.00	
Less 30% Lost	(68.40)	
NC Casing Shoe (S.N. 82723)	330.00	
		489.60

ASARCO Incorporated

JAN 9 1991

SW Exploration

TOTAL INVOICE: $17,407.21

THANK YOU

FORM
INV-89-2

Orig to Acct'g 1/7/91 1/7

JDS

DIAMOND CORE DRILLING
ROTARY DRILLING
GROUTING
FOUNDATION TESTING
DIRECTIONAL DRILLING
CORE ORIENTATION
HAZARDOUS WASTE DRILLING
WATER MONITORING DRILLING

Boyles Bros.
DRILLING COMPANY

General Office and Plant
1707 South 4490 West P.O. Box 25068
SALT LAKE CITY, UTAH 84125
(801) 972-3333 TELEX: 388-321
Cable: BOYLESCO

GENERAL OFFICE:
P.O. BOX 25068
SALT LAKE CITY, UTAH 84125
PHONE (801) 972-3333
TELEX: 372-3464
FAX: 972-6769

DISTRICT OFFICES:
ANCHORAGE, ALASKA
PHOENIX, ARIZONA
GOLDEN, COLORADO
SPARKS, NEVADA
READING, PA.
MURFREESBORO, TENN.
SALT LAKE CITY, UTAH
SPOKANE, WASHINGTON
SANTIAGO, CHILE
cable: BOYLESBROS
LIMA, PERU
cable: BOYLESCOP

I N V O I C E

FILENAME: ASARCO.DEC

CONTRACTOR: ASARCO

INVOICE PERIOD: 12-02-90 to 12-29-90.
INVOICE DATE: 01-04-91.
INVOICE NUMBER: ND-1457.
CONTRACT: 03-0952-12CCRN.
TERMS: NET 30 DAYS.

ADDRESS: 1150 NORTH 7TH AVENUE
BOX 5747
TUCSON, AZ 85703
ATTN: JOHN MALUSA

PLEASE PAY THIS AMOUNT $1,522.06

RENTAL OF	QUANTITY	UNIT	UNIT PRICE	TOTAL
PEE WEE SINGLE SHOT CAMERA - #102.	1	MONTH	$1,400.00	$1,400.00

OTHER CHARGES:	QUANTITY	UNIT	UNIT PRICE	TOTAL
TRANSPORTATION CHARGES: DELTA DASH #1519-3345 (SEE ATTACHED)				$52.06

TOTAL RENTAL, SUPPLIES, & PART $1,400.00

TOTAL $1,452.06
5% ARIZONA STATE TAX $70.00
TOTAL INVOICE $1,522.06

0412-70621 WAYBILL 7-87 SP 2015

DELTA AIR LINES SPECIAL HANDLING AIR WAYBILL

0/ 006 1519 3345 DASH

CONSIGNEE NAME: 2/ ASARCO mining
STREET: c/o Airport
CITY: Tucson STATE: Az ZIP:
ACCOUNT #:
TELEPHONE NO.(S):

DASH®
DELTA AIR LINES, INC.
HARTSFIELD ATLANTA INTERNATIONAL AIRPORT
ATLANTA, GEORGIA 30320

EXECUTED AT/BY
DATE/TIME

RECEIVED IN GOOD ORDER EXCEPT AS NOTED
SIGNATURE DATE TIME

INSTRUCTIONS TO CARRIER INCLUDING CUSTOMER REF. NO. + BILLING INSTRUCTIONS
3/ Hold For pickup
Att Jhon Malosia

ACCOUNT #:
TELEPHONE NO.(S):
DECLARE VALUE *SEE BACK $

CARRIER	FLIGHT	DESTINATION
1/ DL		

FINAL CONN ORIGIN

A	3RD CHARGE 8/	
A	2ND CHARGE	
A	1ST CHARGE	
F	OTHER	
I	TAX	
B	PICK-UP/CHGS. ADVANCED	
C	DELIVER	
R	TOTAL	$ 52.06

SHIPPER NAME: 4/ NAVi Drill
STREET: 17076 4490 W
CITY: SALT LAKE city UT STATE: ZIP:
(SUBJECT TO CONDITIONS OF CONTRACT ON REVERSE)
Greg Williams SHIPPER SIGNATURE
CONTENTS: Survey Equip

	PIECES	WEIGHT
RATE A 0-50	1	45#
RATE B 51-70		
TOTAL		

FINAL DESTINATION (SPELLED OUT)
INTERLINE TAG #

FORM OF PAYMENT (PREPAID ONLY)
CASH/CK. ☐
C.R. CARD ☐
CARGO BILLING ☐
GBL ☐
PTA ☐

CHECK SERVICE DESIRED
PICK UP ☐ DELIVERY ☐
HOLD AT AIRPORT ☐

FOR EXPEDITED PICK-UP AND DELIVERY SERVICE CALL TOLL FREE 800-638-7333

1519 3345

1. SHIPPER'S RECEIPT

Next Week Will be Shipped back. Other Camera

ASARCO Inc.

JAN 1 1 1991

SW Exploration

CBC DRILLING

Formerly Joy Contract Drill Division

707 BOYD BLVD.
LA PORTE, IN 46350

DUPLICATE

PLEASE REMIT TO
P.O. BOX 30777
SALT LAKE CITY, UTAH 84130

CBC Account Number	Customer's Order Number	Customer's Contract Number	CBC Contract Number
03965			03-0965-24

SOLD TO
ATTN: MR. JIM SELL
ASARCO INC.
P.O. BOX 5747
TUCSON, AZ 85703

TERMS NET 30 DAYS
NO CASH DISCOUNT
PAST DUE ACCTS. SUBJECT TO 18% PER ANNUM

PLEASE REMIT TO
CBC DRILLING
P.O. BOX 30777
SALT LAKE CITY, UTAH 84130

ANY QUESTIONS ON INVOICE PLEASE CALL 219-362-2191

INVOICE NO. AZ1354

INVOICE DATE 1/8/91

DATE SHIPPED

SHIPPED VIA

SHIPPED TO
PATAGONIA, ARIZONA
(THUNDER MTN. PROJECT)

P. O. ADDRESS

MARKS

REQUESTED ROUTING

SHIPPED FROM

For 0 feet of drilling near Patagonia, Arizona (Thunder Mtn. Project) for period from 12/26/90 to 12/29/90 as per agreement.

(586-1007) SETTING AND PULLING CASING

BB-7	Dec. 27	2 Hours @ $55.00/hour	110.00

(586-1007) CEMENTING, PLUGGING, HOLE CONDITIONING AND CLOSING HOLES

BB-7	Dec. 27	1 Hour	
	Dec. 29	1 Hour	
		2 Hours @ $55.00/hour	110.00

(586-1009) SURVEY

BB-7	Dec. 26	1½ Hours	
	Dec. 27	½ Hour	
		2 Hours @ $55.00/hour	110.00

(587-1101) MUD AND ADDITIVES

3 Mudgel @ $5.67 each	17.01

(587-1102) CEMENT

3 Cement @ $7.28 each	21.84

(586-1008) WATER HAUL

December 26 through December 27	
Truck @ $600.00/month (2/30)	40.00

FORM
INV.-89-1

F. O. B. SHIPPING POINT UNLESS OTHERWISE SPECIFIED
NO RETURNS ALLOWED UNLESS AUTHORIZED BY THIS OFFICE
GOODS COVERED BY THIS INVOICE WERE PRODUCED IN COMPLIANCE WITH THE REQUIREMENTS OF THE FAIR LABOR STANDARDS ACT OF 1938, AS AMENDED, INCLUDING SECTION 12(A).

CBC DRILLING

Formerly Joy Contract Drill Division

DUPLICATE

SOLD TO ATTN: MR. JIM SELL ASARCO INC.	PAGE NO. 2	INVOICE NO. AZ1354

(586-1009) PER DIEM

Johnson	4 Days	
Figueroa	3 Days	
Contreras	3 Days	
Perez	2 Days	
	12 Days @ $15.00/day	180.00

(587-1104) EXCESS BIT COST

Bit Cost for all holes (BB-2 through BB-7) did not exceed $2.50/foot. -

(586-1005) DEMOBILIZATION

Rig 7955 500.00

TOTAL INVOICE: $1,088.85

THANK YOU

FORM
INV-89-2

J/DS

DIAMOND CORE DRILLING
ROTARY DRILLING
GROUTING
FOUNDATION TESTING
DIRECTIONAL DRILLING
CORE ORIENTATION
ENVIRONMENTAL DRILLING
MONITOR WELLS

BOYLES BROS.
DIRECTIONAL DRILLING
NaviDrill®
A CBC COMPANY

General Offices and Plant
1707 South 4490 West P.O. Box 25068
SALT LAKE CITY, UTAH 84125
(801) 972-3333 FAX 972-6769

DISTRICT OFFICES:
ANCHORAGE, ALASKA
PHOENIX, ARIZONA
GOLDEN, COLORADO
SPARKS, NEVADA
READING, PENN.
MURFREESBORO, TENN.
SALT LAKE CITY, UTAH
SPOKANE, WASHINGTON
SANTIAGO, CHILE
LIMA, PERU

January 8, 1991

ASARCO Incorporated
JAN 11 1991
SW Exploration

John Malusa
ASARCO
1150 North 7th Avenue
Box 5747
Tucson, AZ 85703

Dear John:

Please find attached a copy of Invoice ND-1312(CM) for the amount of $404.44. This credit was issued in error. On check #3728 you short paid Invoice ND-1312 by $300.30 dated September 14, 1990. We agreed with your decision on the reasons you short paid this invoice so we issued a credit (In House Only) for the amount of $300.30. You then took our Invoice ND-1312(CM) on check #3975 dated October 15, 1990 for the amount of $404.44. I remind you this credit was issued in error and was cancelled, but not before you had already used it against another invoice.

We would appreciate you issuing us a check for the amount of $404.44 that is due Boyles Bros. Drilling Company.

If you have any question please feel free to call me at (801) 972-3333.

Sincerely,

Annette Anderson

Annette Anderson
Administrative Assistant

Enclosure

cc: G. Taylor
G. Miller
File

john.let

DIAMOND CORE DRILLING
ROTARY DRILLING
GROUTING
FOUNDATION TESTING
DIRECTIONAL DRILLING
CORE ORIENTATION
HAZARDOUS WASTE DRILLING
WATER MONITORING DRILLING

Boyles Bros.
DRILLING COMPANY

General Office and Plant
1707 South 4490 West P.O. Box 25068
SALT LAKE CITY, UTAH 84125
(801) 972-3333 TELEX: 388-321
Cable: BOYLESCO

GENERAL OFFICE:
P.O. BOX 25068
SALT LAKE CITY, UTAH 84125
PHONE (801) 972-3333
TELEX: 372-3464
FAX: 972-6769

DISTRICT OFFICES:
ANCHORAGE, ALASKA
PHOENIX, ARIZONA
GOLDEN, COLORADO
SPARKS, NEVADA
READING, PA.
MURFREESBORO, TENN.
SALT LAKE CITY, UTAH
SPOKANE, WASHINGTON
SANTIAGO, CHILE
cable: BOYLESBROS
LIMA, PERU
cable: BOYLESCOP

CREDIT INVOICE

FILENAME: ASRCOAUG.CM

CONTRACTOR: ASARCO

INVOICE PERIOD: 08-05-90 to 09-01-90.
INVOICE DATE: 08-22-90.
INVOICE NUMBER: ND-1312(CM).
CONTRACT: 03-0952-12CCRN.
TERMS: NET 30 DAYS.

ADDRESS: 1150 NORTH 7TH AVENUE
BOX 5747
TUCSON, AZ 85703
ATTN: JOHN MALLISA

THIS AMOUNT CREDITED ($404.44)

RENTAL OF	QUANTITY	UNIT	UNIT PRICE	TOTAL
PEE WEE SINGLE SHOT CAMERA - #102.	0.25	MONTH	$1,400.00	($350.00)

CAMERA OUT ON 7/21/90.

OTHER CHARGES:	QUANTITY	UNIT	UNIT PRICE	TOTAL
FIRST TIME HANDLING CHARGE				$50.00
TRANSPORTATION CHARGES:				
DELTA AIR WAYBILL #8746-0833 (SEE ATTACHED)			$44.10	
DELTA AIR WAYBILL #8746-0800 (SEE ATTACHED)			$31.50	
TOTAL TRANSPORTATION CHARGES				($75.60)
MARKUP			15%	($11.34)

TOTAL RENTAL, SUPPLIES, & PART ($300.00)

TOTAL ($386.94)
5% ARIZONA STATE TAX ($17.50)
TOTAL INVOICE ($404.44)

1/15/90
Correct for payment

JM

Orig to Acctg 1/14/91

JDS

BOYLES BROS.
DIRECTIONAL DRILLING
NaviDrill®
A CBC COMPANY

General Offices and Plant
1707 South 4490 West P.O. Box 25068
SALT LAKE CITY, UTAH 84125
(801) 972-3333 FAX 972-6769

DISTRICT OFFICES:
ANCHORAGE, ALASKA
PHOENIX, ARIZONA
GOLDEN, COLORADO
SPARKS, NEVADA
READING, PENN.
MURFREESBORO, TENN.
SALT LAKE CITY, UTAH
SPOKANE, WASHINGTON
SANTIAGO, CHILE
LIMA, PERU

January 8, 1991

ASARCO Incorporated
JAN 11 1991
SW Exploration

John Malusa
ASARCO
1150 North 7th Avenue
Box 5747
Tucson, AZ 85703

Dear John:

Please find attached a copy of Invoice ND-1312(CM) for the amount of $404.44. This credit was issued in error. On check #3728 you short paid Invoice ND-1312 by $300.30 dated September 14, 1990. We agreed with your decision on the reasons you short paid this invoice so we issued a credit (In House Only) for the amount of $300.30. You then took our Invoice ND-1312(CM) on check #3975 dated October 15, 1990 for the amount of $404.44. I remind you this credit was issued in error and was cancelled, but not before you had already used it against another invoice.

We would appreciate you issuing us a check for the amount of $404.44 that is due Boyles Bros. Drilling Company.

If you have any question please feel free to call me at (801) 972-3333.

Sincerely,

Annette Anderson

Annette Anderson
Administrative Assistant

Enclosure

cc: G. Taylor
G. Miller
File

john.let

APPROVED FOR PAYMENT
By: (Signature)

EA-0042
Thunder Mtn

DIAMOND CORE DRILLING
ROTARY DRILLING
GROUTING
FOUNDATION TESTING
DIRECTIONAL DRILLING
CORE ORIENTATION
HAZARDOUS WASTE DRILLING
WATER MONITORING DRILLING

Boyles Bros.
DRILLING COMPANY

General Office and Plant
1707 South 4490 West P.O. Box 25068
SALT LAKE CITY, UTAH 84125
(801) 972-3333 TELEX: 388-321
Cable: BOYLESCO

GENERAL OFFICE:
P.O. BOX 25068
SALT LAKE CITY, UTAH 84125
PHONE (801) 972-3333
TELEX: 372-3464
FAX: 972-6769

DISTRICT OFFICES:
ANCHORAGE, ALASKA
PHOENIX, ARIZONA
GOLDEN, COLORADO
SPARKS, NEVADA
READING, PA.
MURFREESBORO, TENN.
SALT LAKE CITY, UTAH
SPOKANE, WASHINGTON
SANTIAGO, CHILE
cable: BOYLESBROS
LIMA, PERU
cable: BOYLESCOP

CREDIT INVOICE

FILENAME: ASRCOAUG.CM

CONTRACTOR: ASARCO

INVOICE PERIOD: 08-05-90 to 09-01-90.
INVOICE DATE: 08-22-90.
INVOICE NUMBER: ND-1312(CM).
CONTRACT: 03-0952-12CCRN.
TERMS: NET 30 DAYS.

ADDRESS: 1150 NORTH 7TH AVENUE
BOX 5747
TUCSON, AZ 85703
ATTN: JOHN MALLISA

THIS AMOUNT CREDITED ($404.44)

RENTAL OF	QUANTITY	UNIT	UNIT PRICE	TOTAL
PEE WEE SINGLE SHOT CAMERA - #102.	0.25	MONTH	$1,400.00	($350.00)

CAMERA OUT ON 7/21/90.

OTHER CHARGES:	QUANTITY	UNIT	UNIT PRICE	TOTAL
FIRST TIME HANDLING CHARGE				$50.00
TRANSPORTATION CHARGES:				
DELTA AIR WAYBILL #8746-0833 (SEE ATTACHED)			$44.10	
DELTA AIR WAYBILL #8746-0800 (SEE ATTACHED)			$31.50	
TOTAL TRANSPORTATION CHARGES				($75.60)
MARKUP			15%	($11.34)

TOTAL RENTAL, SUPPLIES, & PART ($300.00)

TOTAL ($386.94)
5% ARIZONA STATE TAX ($17.50)
TOTAL INVOICE ($404.44)

JDS

1803 E. 10TH ST.
TUCSON, AZ 85719

(602) 884-5345

H. J. DOWNEY, INC.

EXPLORATION & DEVELOPMENT

January 31, 1991

I.D. # 86-0636964

Mr. James D. Sell
ASARCO, Inc.
1150 North 7th Avenue
Tucson, AZ 85703

INVOICE

Services relating to the Thunder Mountain Project for the period 1/1/91--1/31/91.

Thunder Mtn: Finish report, map & sections, scouted out possible drill roads with J. Sell.

2,1/2 days @ $250.....$ 625.00

Harold J. Downey

Harold J. Downey

1/31/91

Date

APPROVED FOR PAYMENT

By: JDSell
(Signature)

ASARCO Incorporated

JAN 31 1991

S.W. Exploration

JDS

METCON Research Inc.

1844 W. Grant Road, Suite 106
Tucson, Arizona 85745

Telephone: (602) 623-1327
Facsimile: (602) 620-0268

19 March 1991
Invoice #8923

ASARCO Incorporated
P.O. Box 5747
Tucson, AZ 85703-0747

ATTN: Mr. Don Crowell

MINERAL
MAR 25 1991
BENEFICIATION DEPT.

INVOICE

This invoice covers costs associated with sulfuric acid bottle roll leach testing. The test work performed included 5 leach tests conducted on various copper ore samples from the Thunder Mountain Project. Charges are as follows:

LABORATORY SERVICES:

(4) Bottle Roll Leach Tests @ $250.00 ea.	$1,000.00
(1) Extended Acid-Ferric Leach Test @ $500.00	500.00
TOTAL THIS INVOICE	$1,500.00

This invoice is due and payable upon receipt. Please make check payable to Metcon Research Inc.

Thank you,

Joseph M Keane /tlc

Joseph M. Keane, P.E.
President

JMK:tlc

D. E. C.
MAR 26 1991

ASARCO Incorporated
MAR 26 1991
SW Exploration

Signed for collecting 4/1/91

Thunder Mtn

Thru 9-1-90		$476,837
Sept 1990	28,677	
Oct 1990	29,235	
Nov 1990	24,835	
Dec 1990	24,726	
Jan 1991	30,995	
Feb 1991	6,933	
March 1991	263	
April 1991	1,934	
May 1991	48	
June 1991	475	
	148,121	
		$624,958 *
July 1991	Zero	
August 1991	Zero	
Sept 1991	Zero	
Oct 1991	143	

Starting Oct. 1, 1991, need to spend 100K annually, no carried forward until 1,000,000 is spent, to earn 50% vested.

Nov 91	180	
Dec 91	476	625,957
		32,860 (1992 year)
Jan 92	1046	$658,817
Feb 92	313	
March 92	?	2358
		627,316

year 1992 32,860 ~~1359~~

EA-0042-14, $113,645 unexpended as of June 1991.

JDS

ASARCO

Southwestern Exploration Division

December 17, 1990

R.L. Brown
New York Office

Expenditures (thru 11/30/90)
Thunder Mountain Project
Patagonia Mountains
Santa Cruz County, Arizona

As you have requested, I have compiled the project costs applicable to vesting in the Thunder Mountain Project, Santa Cruz County, Arizona.

Expenditures:

Through December 31, 1989	$458,364
January 1 thru November 30, 1990	101,220 + 24,726 Dec
Total	$559,584 + 24,726 = 584,310 end 12/31/90

Asarco must spend $1,000,000 to be vested at 50% with Kerr-McGee.

Starting the assessment year on September 1, 1991, Asarco must spend a minimum of $100,000 per assessment year.

Hole BB-7 is the last hole being drilled and should be completed early in January 1991.

A full report on the mineralized intercepts and the configuration of the shallow blanket of mineralization is in progress.

James D. Sell

James D. Sell

JDS:mek

cc: W.L. Kurtz

THUNDER MOUNTAIN

EA-0042 (includes 3-R & Humbolt)

Period	From	To	To be Spent	"F" For Year	should be Spent ~~Long~~	amount spent	~~Spent~~ Actually Spent	
Amount	carried	forward	8th	Amendment	thru 12-31-87		406,557	
Months	—	12-31-88	$10,000	1988	$416,557	$50,147	456,704	
Year	12-31-88	9-1-89	10,000	1989	426,557	1,660	458,364	←
Year	9-1-89	9-1-90	10,000	1990	436,557	18,473	476,837	
Year	9-1-90	10-1-91	~~100~~ 10,000	1991	~~536,557~~ 446,557	148,121 through 9-1-91	624,958	
Year	10-1-91	10-1-92	100,000	1992	~~636,557~~ 546,557			
Year	Oct. 1 to Oct. 1 each year - until amount is $1,000,000 Earns 50% interest		100,000	1993	~~736,557~~ 646,557			
	sept 9-1-90	4-9-91				92,442	569,279	1,000,000 - 569,279 = 430,721 x2 = 861,442
						162,722		
							= 18.89%	

3-13-91

From: W. D. Gay

To: J. D. Sell

Accumulated costs thru yr. 1990. to end of contract year! Not Jan-Dec.

ASARCO

Southwestern Exploration Division

April 9, 1991

W.D. Gay

Assessment Expenditures
Thunder Mountain Project
Patagonia Mountains
Santa Cruz County, Arizona

The following is a list of Thunder Mountain Project expenditures from September 1, 1990 through April 9, 1991. Total expenditures are adequate to satisfy the assessment work requirements for the Assessment Year ending September 1, 1991.

1.	Drilling	
	CBC Drilling Company 707 Boyd Blvd. La Porte, Indiana 46350	$76,360
2.	Surveying Device Rental	
	Boyle Bros. Drilling Company 1707 South 4490 West P.O. Box 25068 Salt Lake City, Utah 84125	3,811
3.	Supervision	
	J.J. Malusa	5,125
4.	Core Logging	
	H.J. Downey, Inc. 1803 E. 10th St. Tucson, AZ 85719	3,907
5.	Road Work	
	Dave Martin Excavating P.O. Box 451 Patagonia, AZ 85624	1,993
6.	Miscellaneous Expense	
	Vehicular Operation (4984 miles x .25/mile)	1,246
	TOTAL	$92,442

John J. Malusa

JJM:mek

cc: J.D. Sell

Thunder Mtn

updated
12/31/90

FROM: J. D. SELL 5-18-90

TO: WD Gay

Please submit your figures on $ spent and $ need to be spent for vesting in the Thunder Mtn Project & Ventura Project.

attached

THUNDER MOUNTAIN

Period	From	To	To be Spent	For Year	should be Spent	amount spent	Actually Spent
Amount	carried	forward	8th	Amendment	thru 12-31-87		406,557
Months	—	12-31-88	$10,000	1988	$416,557	$50,147	456,704
Year	12-31-88	9-1-89	10,000	1989	426,557	1,660	458,364
Year	9-1-89	9-1-90	10,000				
Year	9-1-90	9-1-91	100,000				
Year	10-1-91	10-1-92	100,000				
Year	Oct. 1 to Oct. 1 each year - until amount is $1,000,000 Earns 50% interest						

Thunder Mtn 1990

			1989	
Jan	6			
Feb	–		Sept	10
March	–		Oct	–
April	365		Nov	–
May	171		Dec	–
June	7,285			10
July	1,380			
Aug	9,266	→ ~~18,473~~		18,473
				18,483
Sept	28,477			
Oct	29,235	107,473	→	107,473
Nov	24,835			
Dec	24,725			
	125,946			129,956
		+		458,364
				584,320

THUNDER MOUNTAIN

Period	From	To	Spent	For Year	be Spent thru	spent	Actually Spent
Amount	carried	forward	8th	Amendment		12-31-87	406,557
Months	—	12-31-88	$10,000	1988	$416,557	$50,147	456,704
Year	12-31-88	9-1-89	10,000	1989	426,557	1,660	458,364
Year	9-1-89	9-1-90	10,000	1990	436,557	18,483	474,847
Year	9-1-90	9-1-91	100,000	1991	536,557	107,473	584,320
Year	10-1-91	10-1-92	100,000	1992	636,557		
Year	Oct. 1 to Oct. 1 each year - until amount is $1,000,000 Earns 50% interest						

Thru 12/31/90

TUCSON OFFICE

DECEMBER, 1990

STATUS OF EXPLORATION AUTHORIZATIONS

AS OF DECEMBER 31, 1990

AUTHORIZATION NUMBER	AMOUNT AUTHORIZED	AMOUNT EXPENDED MONTH	AMOUNT EXPENDED YEAR	AMOUNT EXPENDED TO DATE	BALANCE UNEXPENDED
TOTAL	643,200.00	920.00	50,972.68	810,198.58	166,998.58CR
3R PROJECT, SANTA CRUZ COUNTY, ARIZONA					
0040-00/02	335,000.00	.00	.00	335,000.00	.00
0040-03	161,000.00	.00	.00	161,000.00	.00
0040-04	200,000.00	.00	.00	200,000.00	.00
0040-05	85,000.00	.00	.00	85,000.00	.00
0040-06	6,500.00	.00	339.63	6,404.43	95.57
TOTAL	787,500.00	.00	339.63	787,404.43	95.57
THUNDER MOUNTAIN PROSPECT, SANTA CRUZ COUNTY, ARIZONA					
0042-00/02	160,000.00	.00	.00	160,000.00	.00
0042-03	22,000.00	.00	.00	22,000.00	.00
0042-04	18,000.00	.00	.00	18,000.00	.00
0042-05	105,000.00	.00	.00	105,000.00	.00
0042-06	40,000.00	.00	.00	40,000.00	.00
0042-07	76,000.00	.00	.00	76,000.00	.00
0042-08	32,000.00	.00	.00	32,000.00	.00
0042-09	60,000.00	.00	.00	60,000.00	.00
0042-10	25,000.00	.00	.00	25,000.00	.00
0042-11	130,000.00	.00	.00	130,000.00	.00
0042-12	20,000.00	.00	238.54 +	20,000.00	.00
0042-13/14	280,000.00	24,725.88	125,707.37	125,707.37	154,292.63
TOTAL	968,000.00	24,725.88	125,945.91 = 125,955.91	813,707.37	154,292.63
VENTURA PROPERTY, ARIZONA					
0165-00	10,000.00	.00	.00	10,000.00	.00
0165-01	99,000.00	.00	.00	99,000.00	.00
0165-02	200,000.00	.00	.00	200,000.00	.00
0165-03	10,000.00	.00	.00	10,000.00	.00
0165-04	10,000.00	.00	.00	10,000.00	.00
0165-05	5,000.00	.00	.00	5,000.00	.00
0165-06/07	346,500.00	3,499.48	80,217.99	81,634.07	264,865.93
TOTAL	680,500.00	3,499.48	80,217.99	415,634.07	264,865.93

+ 10 offers in sept 89

JDS

ASARCO

Southwestern Exploration Division

June 1, 1992

G.D. Van Voorhis
New York Office

Expenditure Request
EA-0042
Thunder Mountain Project
Santa Cruz County, AZ

SEA EA-0042-14 had been approved on June 21, 1990 for the sum of $250,000 for drilling in the Bucket Breccia mineral zone within the Thunder Mountain Project

As of March 1, 1992, $111,000 remained under EA-0042-14, due to the early termination of the drilling program.

I request the approval to expend $100,000 for the 1992 work commitment under Agreement No. 8 with Kerr-McGee Corporation.

The Thunder Mountain Project is under an agreement with Kerr-McGee Corporation covering 101 claims. Using the above work commitment funds will also cover the assessment work needed on the adjacent 49 Three R claims owned by Asarco.

I propose to diamond core 3300 feet in four or five vertical holes, located 100 feet apart between previous holes TM-8 and BB-4. This drilling will confirm the grade and continuity of the mineralization in this portion of the mineralized zone.

Drilling will commence as soon as practical and be completed prior to October 1, 1992, the end of the fiscal year of the agreement. Based on previous rates, it is expected to take about three months to complete the drilling.

Expected cost allocation:

Drilling 3300 feet	$83,000
Road Work	3,000
Supervision/Logging	10,000
Assaying	4,000
	$100,000

A reserve of plus 30 million tons at a grade of around 0.30% copper as chalcocite is suggested within the Bucket Breccia zone.

I attach a set of maps showing the location, proposed holes, previous drilling in the Bucket Breccia area, and three cross-sections of the mineral zone.

Approval for this expenditure under the remaining funds of EA-0042-14 would be appreciated. The expenditure and work will comply with the assessment work and work agreement of the K-M agreement.

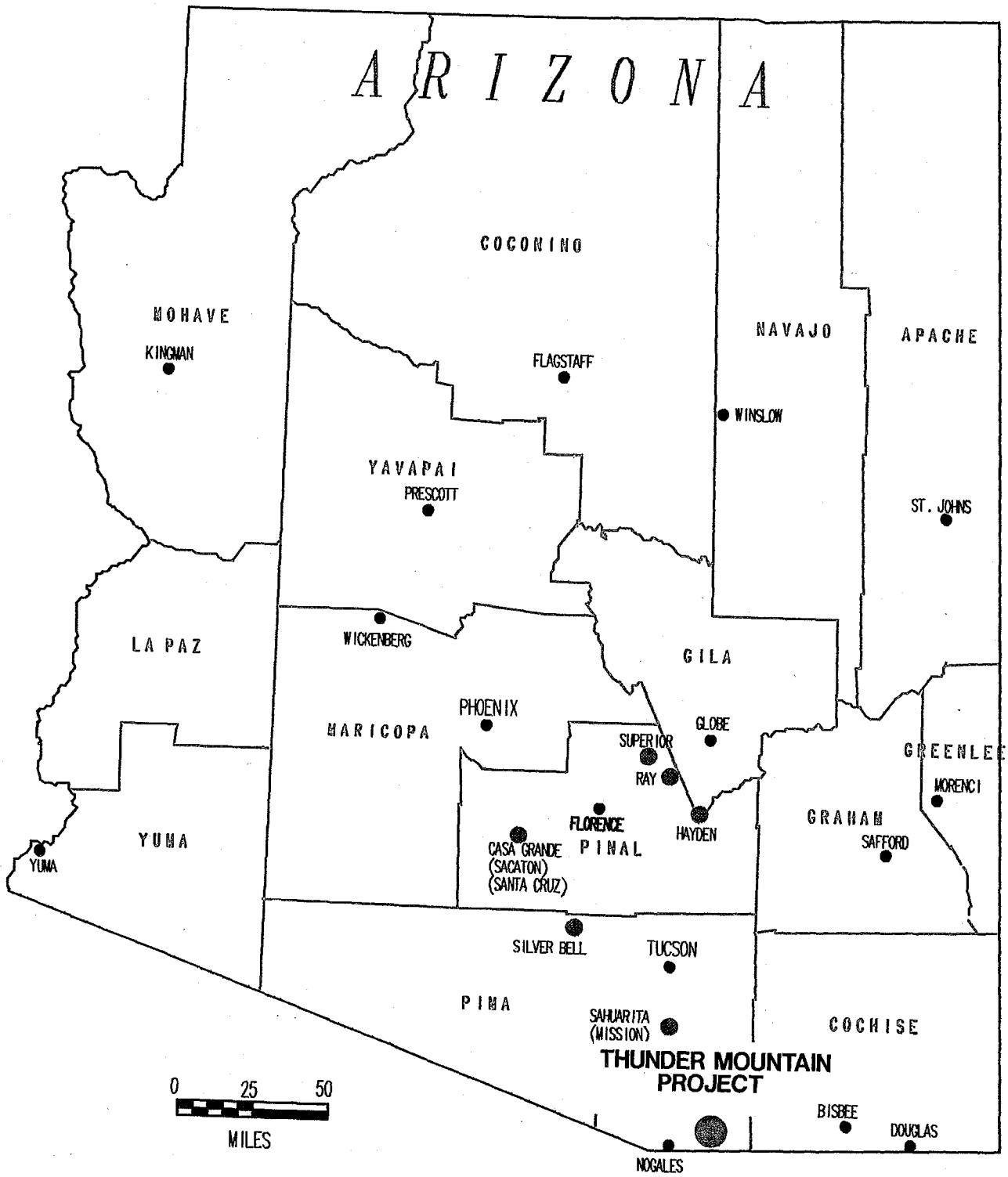
James D. Sell

James D. Sell

JDS:mek
Attachment

cc: F.T. Graybeal
W.L. Kurtz

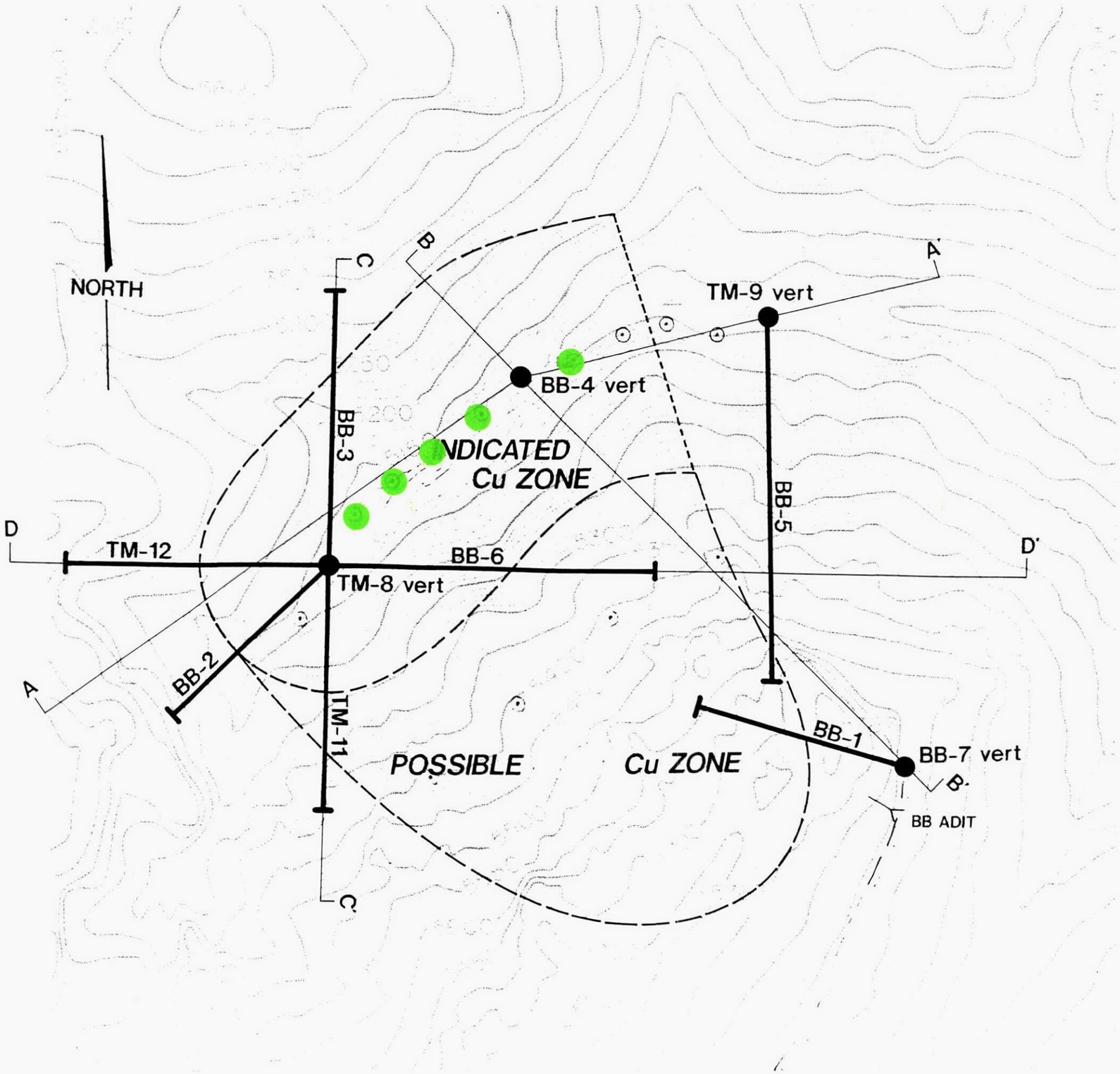
FIGURE 1



ASARCO SOUTHWESTERN EXPLORATION

THUNDER MOUNTAIN PROJECT
INDEX MAP

mn TM9201010 DAM/JDS TUC 01/03/92



PROPOSED 1992 DRILLING

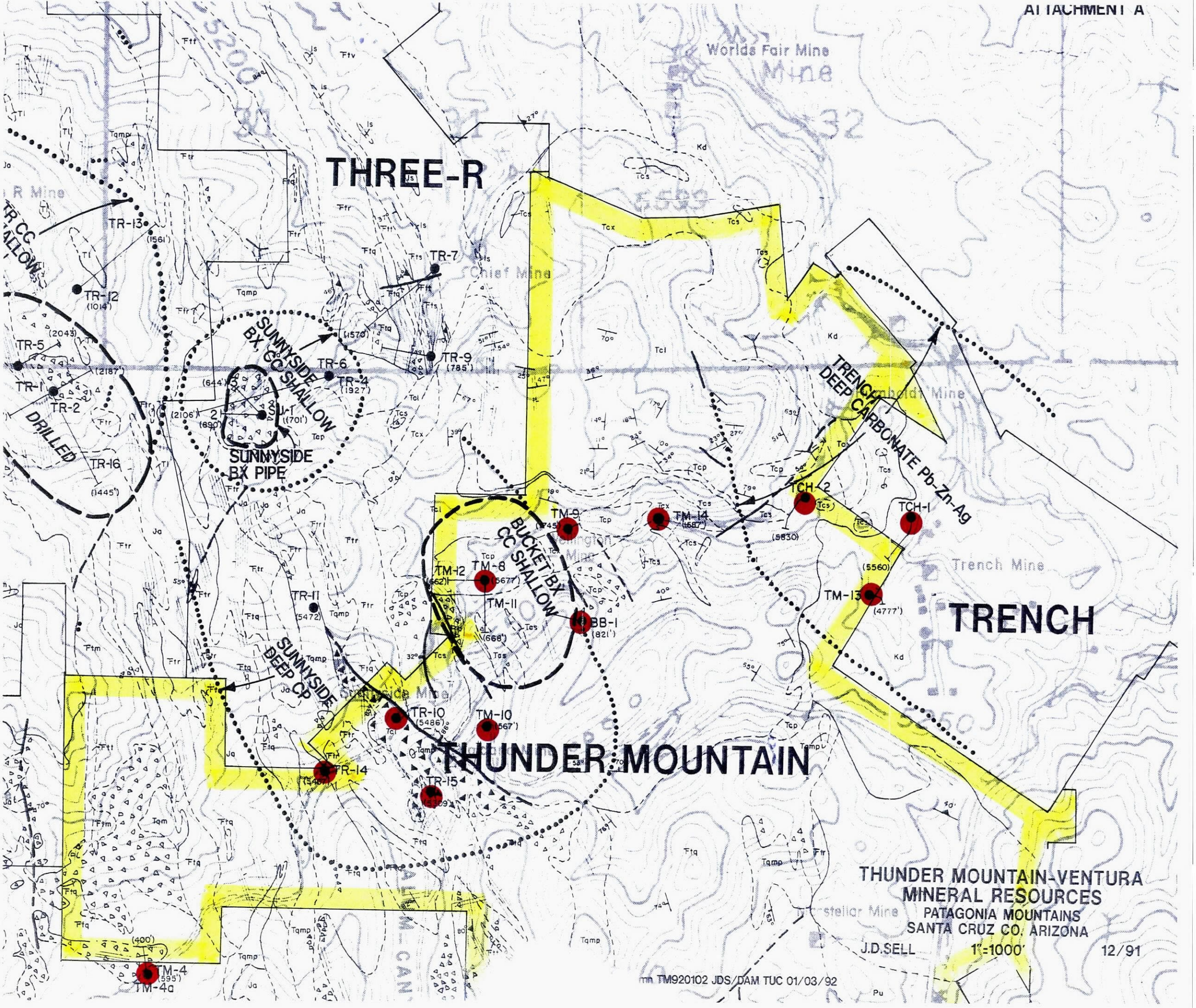
ASARCO Incorporated
THUNDER MOUNTAIN PROJECT

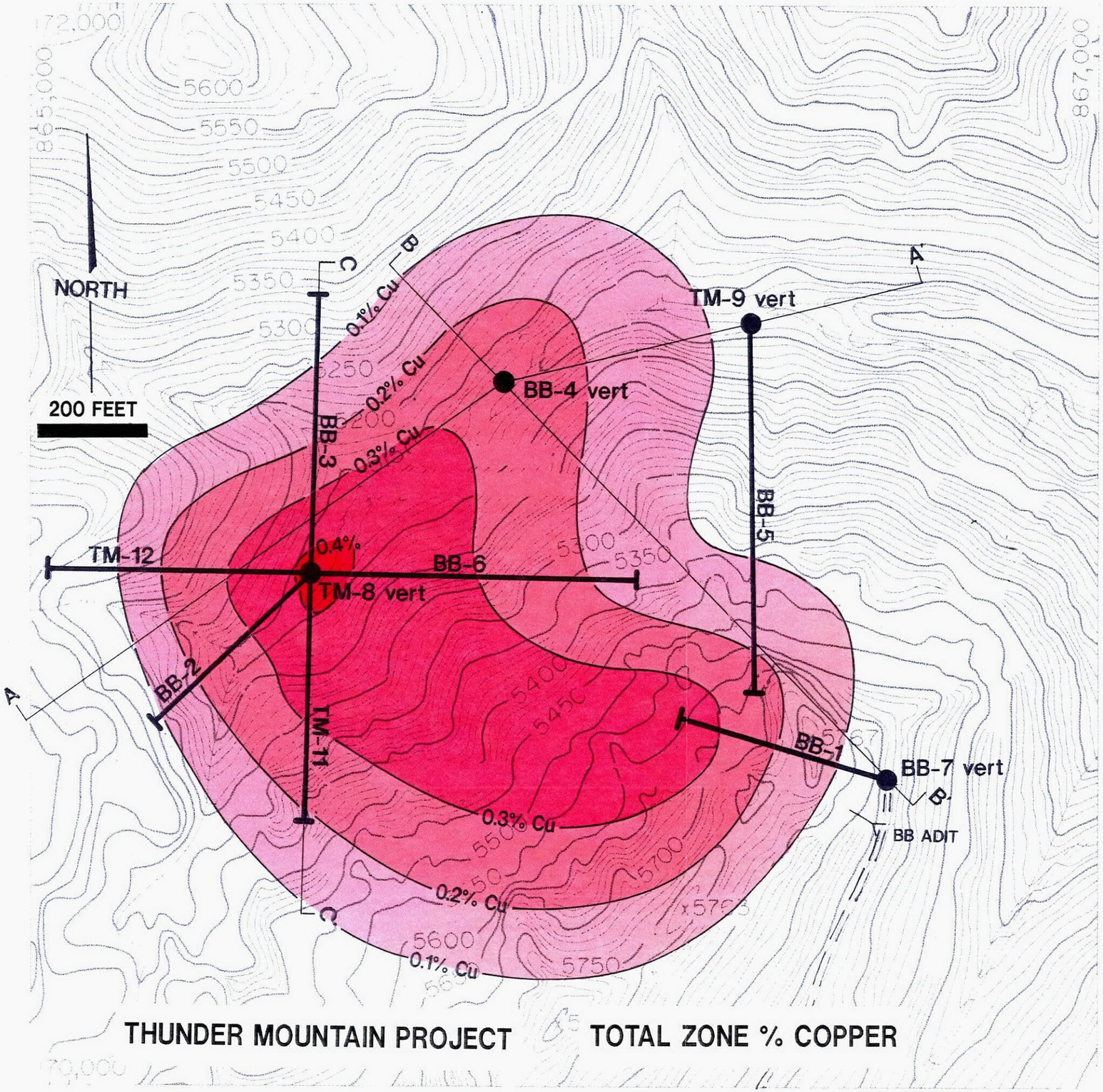
1990 BB-DRILLING MAP

SANTA CRUZ CO., ARIZONA

HJD 1"=200' 01/91

ATTACHMENT A





THUNDER MOUNTAIN PROJECT TOTAL ZONE % COPPER

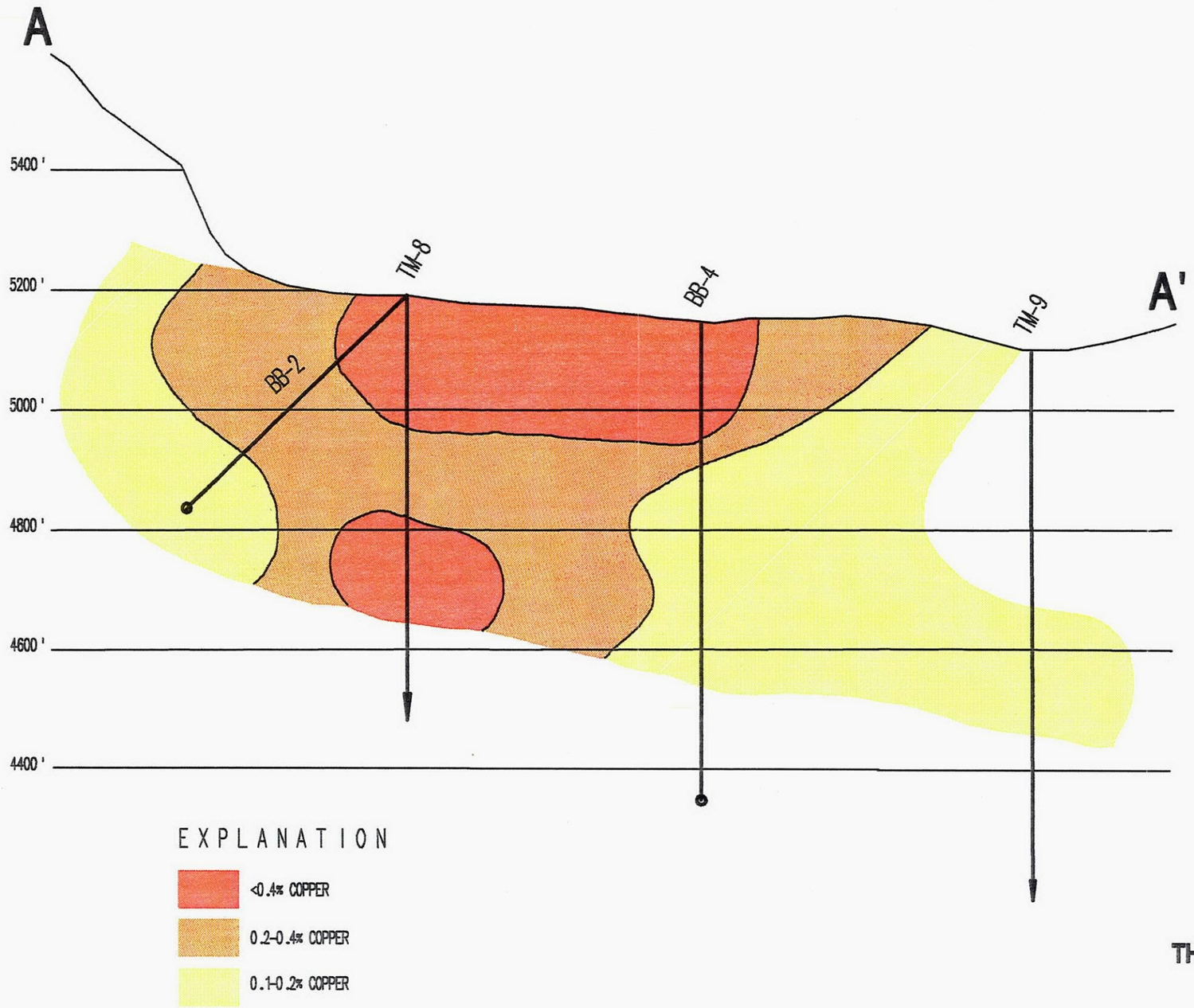
ASARCO Incorporated
THUNDER MOUNTAIN PROJECT

TOTAL ZONE % COPPER

SANTA CRUZ CO., ARIZONA

J.D.S. 1"=200' 12-91

mn TM911205 JDS/DAM TUC 12/22/91



PLOT CHG:
SP9-119
SP10-166
SP11-194
SP14-7/.7

ASARCO SOUTHWESTERN EXPLORATION

THUNDER MOUNTAIN PROJECT

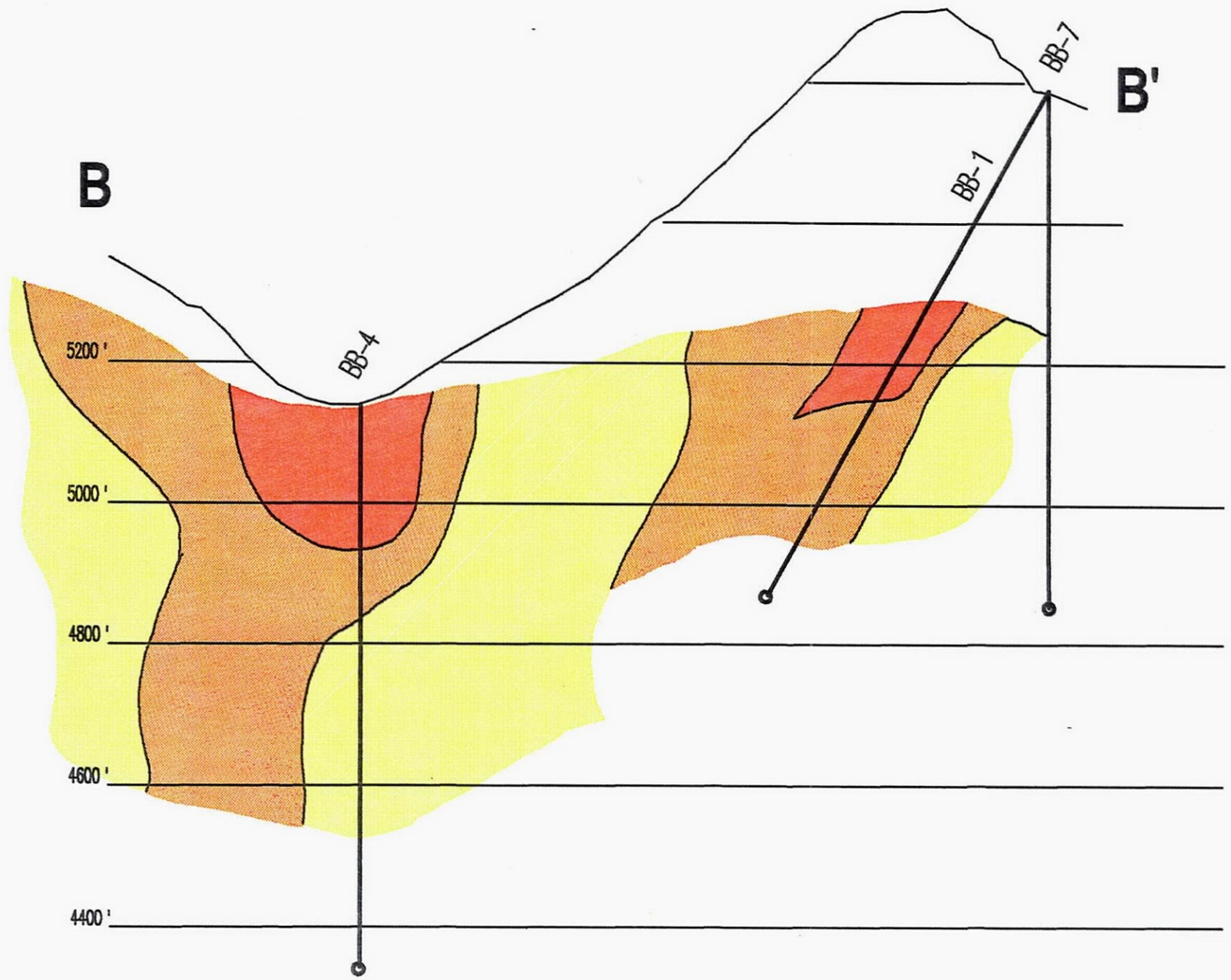
SECTION A-A'

PATAGONIA MOUNTAINS, ARIZONA

J.D.S. 01-91

0 100' 200'

mn TM911202 JDS/DAM TUC 12/19/91



EXPLANATION

- <0.4% COPPER
- 0.2-0.4% COPPER
- 0.1-0.2% COPPER

ASARCO SOUTHWESTERN EXPLORATION

THUNDER MOUNTAIN PROJECT

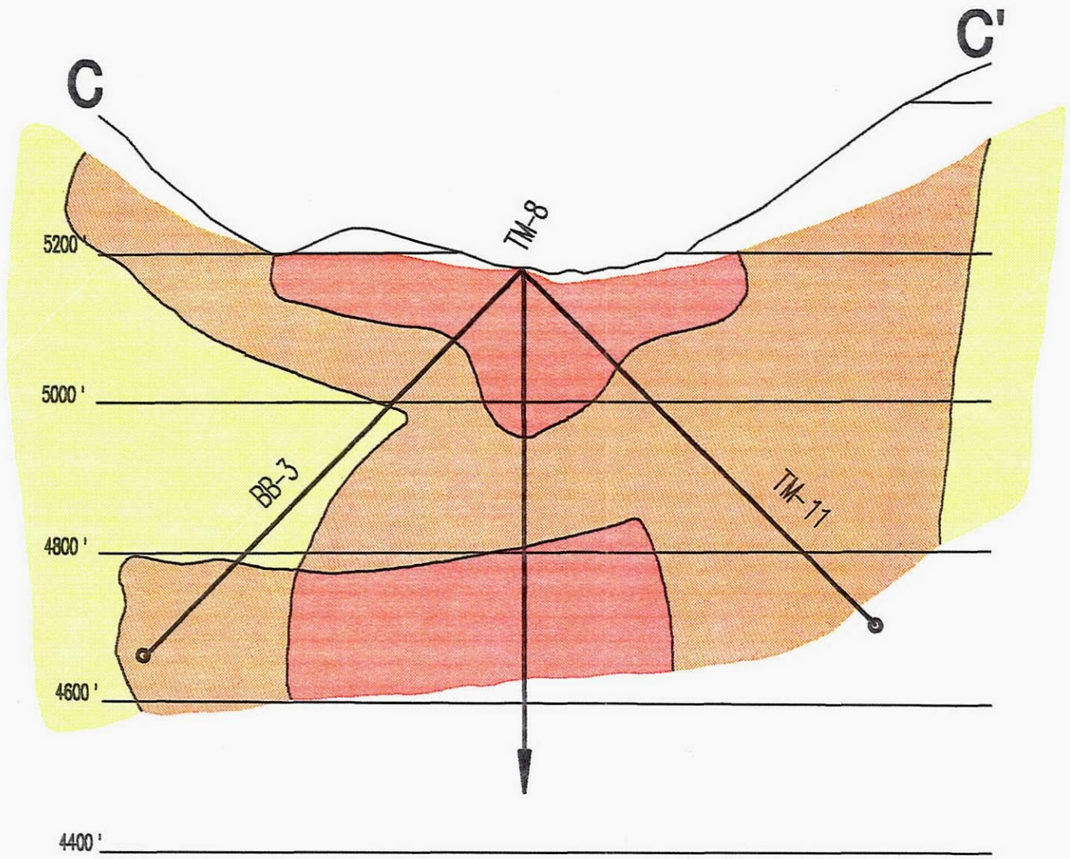
SECTION B-B'

PATAGONIA MOUNTAINS, ARIZONA

J.D.S. 0 100 ' 200 ' 01-91

mn TM911203 JDS/DAM TUC 12/19/91

PLOT CHG:
SP14-7/.7
SP9-119
SP10-166
SP11-194



EXPLANATION

- <0.4% COPPER
- 0.2-0.4% COPPER
- 0.1-0.2% COPPER

ASARCO SOUTHWESTERN EXPLORATION

THUNDER MOUNTAIN PROJECT

SECTION C-C'

PATAGONIA MOUNTAINS, ARIZONA

J.D.S. 0 100' 200' 01-91

mn TM911204 JDS/DAM TUC 12/20/91

PLOT CHG:
SP14-7/.7
SP9-119
SP10-166
SP11-194

JDS

ASARCO

Exploration Department
G.D. Van Voorhis
Vice President

ASARCO
JUN 8 1992
SW Exploration

June 5, 1992

To: J.D. Sell

Re: Thunder Mountain Project, Arizona

I have received your request to spend $100,000 to meet the requirements of the joint venture with Kerr McGee.

Considering the small size and low grade of the target we need either to renegotiate the work commitment with Kerr McGee so that we are obligated to only cover land holding costs, or, we should terminate the agreement. I do not want to spend anything above the minimum holding costs on this property for the forseeable future.

GDV
G.D. Van Voorhis

GDV/lj

cc: F.T. Graybeal
W.L. Kurtz

ASARCO Incorporated 180 Maiden Lane New York, N.Y. 10038 (212) 510-2000
Telex:RCA 232378 Cable: MINEDEPART Fax: (212) 510-1978

ASARCO

Southwestern Exploration Division

September 16, 1992

FILE NOTE

1991-1992 Assessment Year
Ventura Project
Thunder Mountain Project
3-R Project
Trench Project
Santa Cruz County, Arizona

For the record, between August 3, 1992 and August 29, 1992 the following work and improvements were done as follows:

1. Drilling

CBC Drilling
750 East Evans Blvd.
Tucson, AZ 85713 $24,482.10

2. Road Work

Dave Martin Excavating
P.O. Box 451
Patagonia, AZ 85624 $955.52

Total Contiguous Claims are:

Ventura	32
Thunder Mountain	94
3-R	49
Trench	7
Total	182

W. D. Gay

W.D. Gay

WDG:mek

cc: J.D. Sell

Original to Acctg 9/17/92

TM
EA0042

JDS

STATEMENT

DAVE MARTIN EXCAVATING
P.O. Box 451
PATAGONIA, ARIZONA 85624

Phone 394-2435

DATE 9-15-92
NUMBER

Asarco
P.O. Box 5747
Tucson, Az. 85703

TERMS:

PLEASE DETACH AND RETURN WITH YOUR REMITTANCE $

DATE	CHARGES AND CREDITS	BALANCE
	BALANCE FORWARD	
9 hrs.	loader work - Trench road repairs over holes	$675.00
5½ hrs	backhoe work - Trench digging holes	247.50
		$922.50
	Tax	33.02
		$955.52
	APPROVED FOR PAYMENT	
	By: (Signature)	
	SEP 16 1992 F.E.N.	

DAVE MARTIN EXCAVATING

Thank You

PAY LAST AMOUNT IN THIS COLUMN

PRODUCT 96-2 NEBS Inc., Groton, Mass. 01471. To Order PHONE TOLL FREE 1-800-225-6380

JDS

CBC DRILLING

INVOICE

750 EAST EVANS BLVD.
TUCSON, AZ 85713

PLEASE REMIT TO:
CBC DRILLING
P.O. BOX 30777
SALT LAKE CITY, UT 84130

TERMS NET 30 DATE
NO CASH DISCOUNT
PAST DUE ACCTS. SUBJECT TO 18% PER ANNUM

INVOICE TO
ATTN: MR. JAMES D. SELL
ASARCO, INC.
P.O. BOX 5747
TUCSON, AZ 85703

ANY QUESTIONS ON INVOICE PLEASE CALL 602-944-1731

INVOICE NO. AZ1458

INVOICE DATE 08-14-92

INVOICE TOTAL FOR ALL PAGES $1300.72

CONTRACT NO: 03-0100-24

FOR DRILLING ON YOUR ASARCO THUNDER MTN PROJECT FOR THE PERIOD 08-02-92 TO 08-08-

RIG#	HOLE#	SIZE	FROM	TO	TOTAL	UNIT COST	TOTAL COST
MOBILIZE RIG #20433							$300.00
	HOLE #BB-9						
		CEMENT HOLE			4	$60.00	$240.00
		OVERBURDEN DRILLING			3	$60.00	$180.00
		***DISMANTLE			4	$60.00	$240.00
		MOVE			1	$60.00	$60.00
		CALSEAL (100#)			2	$34.03	$68.06
		50# BAG MUD			1	$5.66	$5.66
		CLEARMUD			1	$117.00	$117.00
PER DIEM / MAN / DAY					6	$15.00	$90.00

*** REQUESTED BY ASARCO

APPROVED FOR PAYMENT
By: W. A. Kay
(Signature)
EA 0042

ASARCO Incorp.
AUG 18 1992
SW Exploration

Original to Acctg 8/24/92 JDS

CBC DRILLING

INVOICE

750 EAST EVANS BLVD.
TUCSON, AZ 85713

PLEASE REMIT TO:
CBC DRILLING
P.O. BOX 30777
SALT LAKE CITY, UT 84130

INVOICE TO
ATTN: MR. JAMES D. SELL
ASARCO, INC.
P.O. BOX 5747
TUCSON, AZ 85703

TERMS NET 30 DAYS
NO CASH DISCOUNT
PAST DUE ACCTS. SUBJECT TO 18% PER ANNUM

ANY QUESTIONS ON INVOICE PLEASE CALL 602-944-1731

INVOICE NO. AZ1469

INVOICE DATE 08-21-92

INVOICE TOTAL FOR ALL PAGES $2591.90

CONTRACT NO: 03-0100-24

FOR DRILLING ON YOUR ASARCO THUNDER MTN PROJECT FOR THE PERIOD 08-09-92 TO 08-15-92

RIG# HOLE#	SIZE	FROM	TO	TOTAL	UNIT COST	TOTAL COST
RIG #20433						
HOLE #BB-9 8?						
	NXE DRILLING	3	125	122	$16.40	$2000.80
	CEMENT HOLE			2	$60.00	$120.00
	***SETUP			3	$60.00	$180.00
	MOVE			2	$60.00	$120.00
	CALSEAL (100#)			1	$34.03	$34.03
	50# BAG MUD			2	$5.66	$11.32
	NX CORE BOXES			13	$2.75	$35.75
PER DIEM / MAN / DAY				6	$15.00	$90.00

ASARCO Incorpor.
AUG 24 1992
SW Exploration

Original to Acct 8/31/92

ASARCO Inc.

AUG 31 1992

SW Exploration

CBC DRILLING

INVOICE

750 EAST EVANS BLVD.
TUCSON, AZ 85713

PLEASE REMIT TO:
CBC DRILLING
P.O. BOX 30777
SALT LAKE CITY, UT 84130

INVOICE TO
ATTN: MR. JAMES D. SELL
ASARCO, INC.
P.O. BOX 5747
TUCSON, AZ 85703

TERMS NET 30 DAYS
NO CASH DISCOUNT
PAST DUE ACCTS. SUBJECT TO 18% PER ANNUM

ANY QUESTIONS ON INVOICE PLEASE CALL 602-944-1731

INVOICE NO. AZ1475

INVOICE DATE 08-28-92

INVOICE TOTAL FOR ALL PAGES $8550.14

CONTRACT NO: 03-0100-24

FOR DRILLING ON YOUR ASARCO THUNDER MTN PROJECT FOR THE PERIOD 08-16-92 TO 08-22-9

RIG# HOLE#	SIZE	FROM	TO	TOTAL	UNIT COST	TOTAL COST
RIG #20433						
HOLE #BB-8						
	NXE DRILLING	125	500	375	$16.40	$6150.00
	NXE DRILLING	500	600	100	$17.20	$1720.00
	CEMENT HOLE			1	$60.00	$60.00
	CONDITION HOLE			1.5	$60.00	$90.00
	CLEARMUD			1	$117.00	$117.00
	MUD 2			1	$7.14	$7.14
	PORTLAND CEMENT			2	$9.00	$18.00
PER DIEM / MAN / DAY				12	$15.00	$180.00
OVERTIME PREMIUM				32	$6.50	$208.00

10 Acctg 9/8/92

JDS

CBC DRILLING

INVOICE

750 EAST EVANS BLVD.
TUCSON, AZ 85713

PLEASE REMIT TO:
CBC DRILLING
P.O. BOX 30777
SALT LAKE CITY, UT 84130

INVOICE TO
ATTN: MR. JAMES D. SELL
ASARCO, INC.
P.O. BOX 5747
TUCSON, AZ 85703

TERMS NET 30 DAYS
NO CASH DISCOUNT
PAST DUE ACCTS. SUBJECT TO 18% PER ANNUM

ANY QUESTIONS ON INVOICE PLEASE CALL 602-944-1731

INVOICE NO. AZ1489

INVOICE DATE 09-03-92

INVOICE TOTAL FOR ALL PAGES $11573.20

CONTRACT NO: 03-0100-24

FOR DRILLING ON YOUR ASARCO THUNDER MTN PROJECT FOR THE PERIOD 08-23-92 TO 08-29-9

RIG# HOLE#	SIZE	FROM	TO	TOTAL	UNIT COST	TOTAL COST
RIG #20433						
HOLE #BB-9						
	NCD DRILLING	0	11	11	$17.40	$191.40
	NXE DRILLING	11	500	489	$16.40	$8019.60
	NXE DRILLING	500	600	100	$17.20	$1720.00
	CEMENT HOLE			2	$60.00	$120.00
	CONDITION HOLE			1	$60.00	$60.00
	STANDBY DELAY			3	$55.00	$165.00
	CLEARMUD			2	$117.00	$234.00
	MUD 2			1	$7.14	$7.14
	CALSEAL			2	$34.03	$68.06
PER DIEM / MAN / DAY				12	$15.00	$180.00
OVERTIME PREMIUM				32	$6.50	$208.00
WATER TRUCK RENTAL				1	$600.00	$600.00

APPROVED FOR PAYMENT
By: W. D. Gay
(Signature)

~~VENTURA~~
~~THUNDER MTN~~

ASARCO Incorporated
SEP 8 1992
SW Exploration

CHARGE
VENTURA (EA-0165-06) $4,082.00
THUNDER MTN (EA-0042) $7,491.20

Original to Acctg 9/15/92

JDS

CBC DRILLING

INVOICE

750 EAST EVANS BLVD.
TUCSON, AZ 85713

PLEASE REMIT TO:
CBC DRILLING
P.O. BOX 30777
SALT LAKE CITY, UT 84130

TERMS NET 30 DAYS
NO CASH DISCOUNT
PAST DUE ACCTS. SUBJECT TO 18% PER ANNUM

INVOICE TO
ATTN: MR. JAMES D. SELL
ASARCO, INC.
P.O. BOX 5747
TUCSON, AZ 85703

ANY QUESTIONS ON INVOICE PLEASE CALL 602-944-1731

INVOICE NO. AZ1496

INVOICE DATE 09-11-92

INVOICE TOTAL FOR ALL PAGES $466.14

CONTRACT NO: 03-0100-24

FOR DRILLING ON YOUR ASARCO THUNDER MTN PROJECT FOR THE PERIOD 08-30-92 TO 09-05-9

RIG#	HOLE#	SIZE	FROM	TO	TOTAL	UNIT COST	TOTAL COST
DEMOBILIZE RIG #20433					1	$300.00	$300.00
HOLE #BB-9							
		REMOVE CASING			1	$60.00	$60.00
		CEMENT HOLE			1	$60.00	$60.00
		MUD 2			1	$7.14	$7.14
		PORTLAND CEMENT			1	$9.00	$9.00
PER DIEM / MAN / DAY					2	$15.00	$30.00

ASARCO Inc.
SEP 14 1992
SW Exploration

APPROVED FOR PAYMENT
By: W. W. Gay
(Signature)

EA 0042

1/1/93

Thunder Mtn:

Expenses thru Dec. 31, 1992 $ 658,817

EA-0042-14 $ 79,784 unexpended.

101 claims

1 mill for verifying 50%

1803 E. 10TH ST.
TUCSON, AZ 85719

(602) 884-5345

H. J. DOWNEY, INC.

EXPLORATION & DEVELOPMENT

February 24, 1993

Mr. James D. Sell
ASARCO, Inc.
1150 North 7th Avenue
Tucson, AZ 85703

INVOICE

Services relating to the Thunder Mountain Project through 2/23/93.

Miscellaneous work finishing assays, logs, drafting, and report writing.

2 days @ $250.....$ 500.00

Harold J. Downey
Harold J. Downey

2/24/93
Date

OK for payment
James D. Sell
Thunder Mtn Project
EA-0042

Original to Accounting 2/24/93

TAB

The Ericksonloop

Monthly and Quarterly Reports.

~~Summary Report~~

Other Notes, Memos, Reports.

~~Expenditures~~

XTRA COPY

ASARCO

Southwestern Exploration Division

August 23, 1982

To: J. D. Sell

From: F. R. Koutz

Monthly Report - August, 1982
Thunder Mountain Project (EA-0042)
Santa Cruz County, AZ

DDH TM-14 advanced from 315 to 910 feet depth (NC) from July 26 to August 6 at which point the hole was terminated at the recommendation of R. B. Crist since required work-commitment monies had been spent. The hole was capped for re-entry (cap is 2 feet below ground surface). An acid-vial survey at 890' suggested the hole was between 1° and 3° from vertical. Collar (surface) elevation was leveled in at 4999.30 feet ASL or 110.75' above the TCH-2/2A collar. Direct drilling costs were $22.38/foot.

All detailed core logging has been completed and is being split for assay. Twelve samples were submitted for thin section. The drill hole summary should be completed in September.

Between 21 and 910 feet depth the rock is lithic lapilli tuff to tuff breccia of the Chief Formation (diatreme) cut by a 95 foot thick, partially fluidized zone of quartz-feldspar-porphyry-generated intrusive and intrusion breccias and dikes between 555 and 650 feet depth. The Chief Formation lapilli average 2-5 mm in size, although occasional clasts up to several hundred mm are common, set in a fine-grained, ashy-gray matrix making up 10-40% of the rock. The Chief contains a considerable epiclastic component but occasionally crystals predominate over lithics giving the rock an almost igneous intrusive texture similar to what Graybeal has described as xenolithic QFP. The TM-14 Chief is better consolidated but more poorly sorted then the Chief in TCH-2, perhaps because it is farther from the edge of the diatreme. ie TM-14 ? ie closer to the center

The lapilli tuff exhibits bedding of 10-40° and in some sections graded bedding and slump structures. Except for the QFP-BX-fluid zone and a well fractured area for about 30 feet above and an occasionally-fractured area for 150' above, faulting is not common. Although upper and lower contacts of the QFP zone are about 60°, fluid-streaming is about 20-40°.

The whole core is moderately to strongly clay-sericite altered with the QFP-BX zone exhibiting moderate silicification with weak silicification for 30-40' below. The amount of silicification including silicification of lapilli-clasts increases (pre-tuff) with depth while argillic alteration decreases. Several percent alunite is common in the first 300 feet of the hole and in and around the QFP-BX zone. Traces of green chlorite and epidote(?) were noted. Thin gypsum veins and vug fillings are locally common in and just below the QFP-BX zone. Vugs, porosity and soft pumiceous zones decrease with depth.

Most sulfides are disseminated and quartz-sericite selvages around pyrite stringer veinlets are not well developed. Sphalerite and minor galena tend to occur in late veinlets seldom over 1-2 mm wide and decrease with depth. Sulfide percentages average around 2% or slightly more in and around the QFP-BX zone. Thin coatings of covellite, chalcocite, sphalerite and enargite-tennanite-tetrahedrite(?) replace pyrite with the chalcocite/covellite ratio increasing with depth. Maximum Cu content is estimated at several tenths percent with the best zone below 740 feet to TD. Zinc may also locally average several tenths percent. Alteration and mineralization is similar to that at similar depth in TM-9 and TCH-2 although the percentage of sericite and clay may have been megascopically underestimated in TM-14.

From Graybeal's plan geology map of the Chief diatreme (Fig. 1, TCH-1 report) and the cross-section through TM-8 to TCH-1 (Fig. 2, TCH-2 report) I would have expected more QFP than so far encountered in TM-14. TM-14 appears to be more similar in character to TM-9 than TCH-2 and the QFP cropping out east of TM-9 and encountered in TM-9 and -14 probably consists of thin dikes. Minor amounts of clasts of welded tuff and tuff breccia encountered in the upper part of the QFP-BX zone may suggest that the older Hardshell Group welded tuffs and breccias may still be encountered at depth. The lack of major bodies of QFP in TM-14, so far, appears to be more favorable in precluding the cutting-out of carbonates by a major QFP intrusive body at depth such as in TM-8 3500 feet to the west.

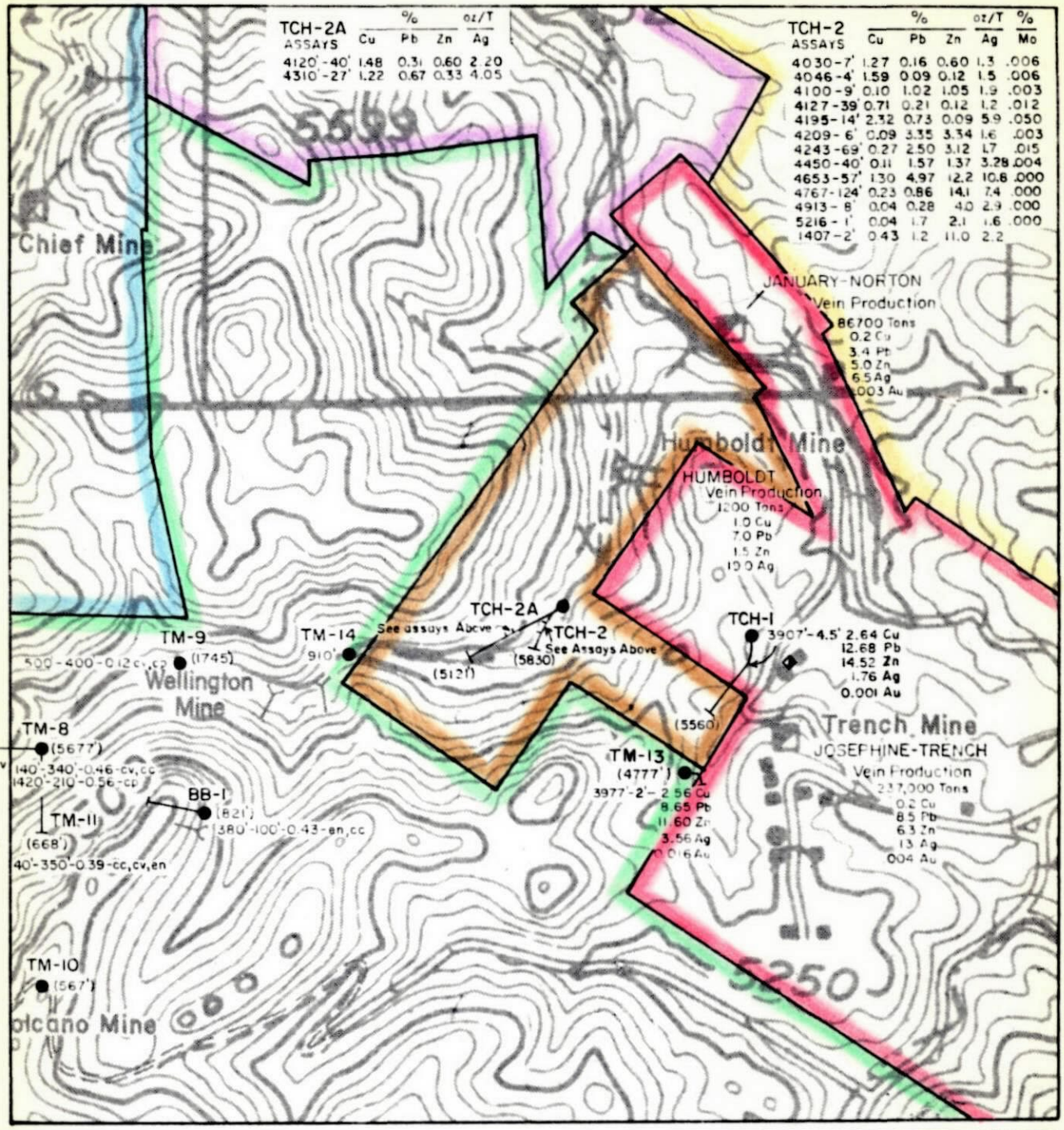
Expenditures for the month are estimated to be $23,405 leaving an estimated overrun of $78,373.

prob should be 70, 323

F. R. Koutz

FRK/cg

Drill map attached.



EXPLANATION

- ASARCO INC. Trench Group
- ASARCO-Kerr McGee Thunder Mtn. Joint Venture
- ASARCO-Anaconda 3R Joint Venture
- Mendoza-Humboldt Group (ASARCO INC.)
- Kerr-McGee-Red Mtn.
- Lichty-Argentor

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

⊙ Proposed drill hole

ASSAY DATA KEY

depth-length-%Cu-mineral

3860'-350'-0.59-cp

GEOLOGIC LEGEND

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

TO ACCOMPANY Monthly Report

DATED Aug. 23, 1982

BY F.R. Kautz

DRILL MAP
TRENCH PROJECT & THUNDER MTN. PROJECT
PATAGONIA MTNS.
Santa Cruz County, Arizona

SCALE: 1" = 1000'

F.R.K Dec., 1981

MVK 4048

ASARCO

Southwestern Exploration Division

October 1, 1984

FILE MEMORANDUM

Third Quarter Report
July - September 1984
Thunder Mountain Project (EA-0042)
Santa Cruz County, AZ

During the quarter the 2165 feet of core drilled in TM-14 (910-3075') during 1983-84 was logged with periodic intervals split for assay. The interval also had a skeleton made. A final report on this drill interval will be completed when assays are returned in the Fourth Quarter. No other activity is planned for the Fourth Quarter.

Fleetwood R. Koutz
Geologist

FRK:mek

cc: J. D. Sell
J. R. Stringham

JDS

ASARCO

Southwestern Exploration Division

December 19, 1984

FILE MEMORANDUM

4TH Quarter Report
October-December 1984
Thunder Mountain Project
Santa Cruz Co., AZ

In compliance with the agreement between Kerr-McGee and ASARCO Incorporated, I submit this quarterly report.

No activity occurred on the property during the quarter. The affidavit of labor has been filed to hold the claims for the 1984-85 year.

James D. Sell

James D. Sell

JDS:mek

cc: J.R. Stringham
G. D. Christiansen - K-M

ASARCO

Exploration Department
Southwestern United States Division

January 9, 1985

Mr. George D. Christiansen
Vice President, Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, Oklahoma 73125

4th Quarter Report
October-December 1984
Thunder Mountains Project
Santa Cruz County, AZ

Dear Mr. Christiansen:

In accordance with our Joint Venture Agreement dated October 1, 1972 attached is a copy of the 4th Quarter Report for 1984.

Sincerely yours,

J. R. Stringham
Assistant to the
Manager, SWED

JRS:mek
Att.

cc: J. D. Sell

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

ASARCO

Southwestern Exploration Division

December 19, 1984

FILE MEMORANDUM

4TH Quarter Report
October-December 1984
Thunder Mountain Project
Santa Cruz Co., AZ

In compliance with the agreement between Kerr-McGee and ASARCO Incorporated, I submit this quarterly report.

No activity occurred on the property during the quarter. The affidavit of labor has been filed to hold the claims for the 1984-85 year.

James D. Sell

James D. Sell

JDS:mek

cc: J.R. Stringham
G. D. Christiansen - K-M

JDS

ASARCO

Exploration Department
Southwestern United States Division

October 1, 1985

Mr. George D. Christiansen
Vice President, Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, Oklahoma 73125

3rd Quarter Report
July-September 1985
Thunder Mountain Project
Santa Cruz County, AZ

Dear Mr. Christiansen:

In accordance with our Joint Venture Agreement dated October 1, 1972, attached is a copy of the 3rd Quarter Report for 1985.

Sincerely yours,

J. R. Stringhan
Assistant to the
Manager, SWED

JRS:mek
Att.

cc: J. D. Sell

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

ASARCO

Southwestern Exploration Division

October 1, 1985

FILE MEMORANDUM

3rd Quarter Report
July-August-Sept. 1985
Thunder Mountain Project
Santa Cruz Co., AZ

In compliance with the agreement between Kerr-McGee and ASARCO Incorporated, I submit this quarterly report

During the quarter, the drill hole TM-14 was reentered and cleaned to the previous depth of 3075 feet. Coring continued in the hole to a depth of 3500 feet and heavy mud was emplaced and the hole recapped. The site has been cleaned and all affidavits of assessment for the year ending Sept. 1, 1985 have been sent to the various agencies.

TM-14 continued in quartz monzonite porphyry with quartz-sericite-pyrite stockwork veinlet alteration with only a trace of mineralization.

James D. Sell

James D. Sell

JDS:mek

cc: J. R. Stringham
G.D. Christiansen, K-M

ASARCO

Exploration Department
Southwestern United States Division

January 3, 1986

Mr. George D. Christiansen
Vice President, Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, Oklahoma 73125

4th Quarter Report
October-December 1985
Thunder Mountain Project
Santa Cruz County, AZ

Dear Mr. Christiansen:

In accordance with our Joint Venture Agreement dated October 1, 1972, attached is a copy of the 4th Quarter Report for 1985.

Sincerely yours,

Original Signed by
J. R. STRINGHAM

J. R. Stringham
Assistant to the
Manager, SWED

JRS:mek
Att.

cc: J. D. Sell

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

ASARCO

Southwestern Exploration Division

JPS

January 3, 1986

File Memorandum

4th Quarter Report
October-December 1985
Thunder Mountain Project
Santa Cruz County, AZ

In compliance with the agreement between Kerr-McGee and ASARCO Incorporated, I submit this quarterly report.

Character assays from eleven ten-foot intervals between 3090 and 3500 feet in the deepened portion of laramide quartz monzonite porphyry in drill hole TM-14 have been received. The results are appended as assay report TAJ 457.

James D. Sell

James D. Sell

JDS:mek
Att.

cc: J.R. Stringham
G.D. Christiansen, K-M

SKYLINE LABS, INC.
1775 W. Sahuaro Dr. • P.O. Box 50106
Tucson, Arizona 85703
(602) 622-4836

REPORT OF ANALYSIS

JOB NO. TAJ 457
November 20, 1985
PROJECT NO. TM-14
TM-14 3090-3100
PAGE 1 OF 1

ASARCO Incorporated
NOV 21 1985
SW Exploration

ASARCO INCORPORATED
Attn: Mr. Fleetwood R. Koutz
Southwestern Exploration
P.O. Box 5747
Tucson, Arizona 85703

Analysis of 11 Split Core Samples

ITEM	SAMPLE NUMBER	Cu (ppm)	Pb (ppm)	Zn (ppm)	Au (ppm)	Ag (ppm)
1	TM-14 3090-3100	590.	60.	445.	<.02	1.0
2	TM-14 3100-3110	590.	30.	170.	<.02	1.0
3	TM-14 3110-3120	550.	100.	740.	<.02	2.0
4	TM-14 3160-3170	1600.	30.	770.	<.02	1.0
5	TM-14 3170-3180	680.	45.	410.	<.02	.6
6	TM-14 3190-3200	840.	20.	1100.	<.02	.8
7	TM-14 3200-3210	710.	35.	780.	<.02	1.2
8	TM-14 3220-3230	950.	90.	1100.	<.02	2.0
9	TM-14 3290-3300	490.	110.	1300.	<.02	1.6
10	TM-14 3390-3400	230.	155.	730.	<.02	1.2
11	TM-14 3490-3500	385.	240.	1300.	<.02	1.6
	mean:	472	83	804	<.02	1.3

cc: Asarco Incorporated
Southwestern Exploration
P.O. Box 5747
Tucson, Arizona 85703
Attn.: Mr. James D. Sell
Ms. Mary Kavanagh

REGISTERED ASSAYER CERTIFICATE NO. 9425 WILLIAM L. LEHMBECK ARIZONA U.S.A.

ASARCO

Exploration Department
Southwestern United States Division

March 25, 1986

Mr. George D. Christiansen
Vice President, Exploration
Kerr-McGee Corporation
P. O. Box 25861
Oklahoma City, OK 73125

1st Quarter Report
January-March 1986
Thunder Mountain Project
Santa Cruz Co., AZ

Dear Mr. Christiansen:

In accordance with our Joint Venture Agreement dated October 1, 1972, attached is a copy of the 1st Quarter Report for 1986.

Sincerely yours,

W. D. Gay

W. D. Gay
Land Engineer, SWED

WDG/JDS/gb

Attachment

cc: JDSell

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

ASARCO

Southwestern Exploration Division

March 25, 1986

FILE MEMORANDUM

1st Quarterly Report
January-March 1986
Thunder Mountain Project
Santa Cruz Co., AZ

In compliance with the agreement between Kerr-McGee and ASARCO Incorporated, I submit this quarterly report.

No work was undertaken on the property during the quarter.

James D. Sell

James D. Sell

JDS/gb

cc: WDGay
GDChristiansen - K-M

ASARCO

Exploration Department
Southwestern United States Division

June 25, 1986

Mr. George D. Christiansen
Vice President, Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, OK 73125

2nd Quarter Report
April-June 1986
Thunder Mountain Project
Santa Cruz County, AZ

Dear Mr. Christiansen:

In accordance with our Joint Venture Agreement dated October 1, 1972, attached is a copy of the 2nd Quarter Report for 1986.

Sincerely yours,

William D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
Att.

cc: J.D. Sell

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

ASARCO

Southwestern Exploration Division

JDS

June 25, 1986

FILE MEMORANDUM

2nd Quarterly Report
April-June 1986
Thunder Mountain Project
Santa Cruz County, AZ

In compliance with the agreement between Kerr-McGee and ASARCO Incorporated, I submit this quarterly report.

Geologic studies are underway for "the benefit of the claims" and will be completed in the next quarter to fulfill the requirements for the assessment work for the assessment year ending September 1986.

James D. Sell

James D. Sell

JDS:mek

cc: W. D. Gay
G. D. Christiansen, K-M

ASARCO Southwestern Exploration Division JDS

September 26, 1986

FILE MEMORANDUM

3rd Quarter Report
July - September 1986
Thunder Mountain Project
Santa Cruz County, AZ

In compliance with the agreement between Kerr-McGee and Asarco Incorporated, I submit this quarterly report.

The annual assessment work has been completed on the Thunder Mountain Project for the assessment year ending August 31, 1986.

The work was recorded with the Santa Cruz County, Arizona, Recorder and the Bureau of Land Management.

A copy of the Affidavit of Labor and acknowledgement by the County Recorder and the Bureau of Land Management has been sent to Kerr-McGee Corporation (August 19, 1986) for their records.

James D. Sell

James D. Sell

JDS:mek

cc: W.D. Gay
G.D. Christiansen, K-M

ASARCO

Exploration Department
Southwestern United States Division

September 26, 1986

Mr. George D. Christiansen
Vice President, Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, OK 73125

3rd Quarter Report
July-September 1986
Thunder Mountain Project
Santa Cruz County, AZ

Dear Mr. Christiansen:

In accordance with our Joint Venture Agreement dated October 1, 1972, attached is a copy of the 3rd Quarter Report for 1986.

Sincerely yours,

Wm. D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
Att.

cc: J.D. Sell

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

ASARCO

Southwestern Exploration Division

September 26, 1986

FILE MEMORANDUM

3rd Quarter Report
July - September 1986
Thunder Mountain Project
Santa Cruz County, AZ

In compliance with the agreement between Kerr-McGee and Asarco Incorporated, I submit this quarterly report.

The annual assessment work has been completed on the Thunder Mountain Project for the assessment year ending August 31, 1986.

The work was recorded with the Santa Cruz County, Arizona, Recorder and the Bureau of Land Management.

A copy of the Affidavit of Labor and acknowledgement by the County Recorder and the Bureau of Land Management has been sent to Kerr-McGee Corporation (August 19, 1986) for their records.

James D. Sell

James D. Sell

JDS:mek

cc: W.D. Gay
G.D. Christiansen, K-M

ASARCO

JDS

Exploration Department
Southwestern United States Division

December 30, 1986

Mr. George D. Christiansen
Vice President, Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, OK 73125

4th Quarter Report
October - December 1986
Thunder Mountain Project
Santa Cruz County, AZ

Dear Mr. Christiansen:

In accordance with our Joint Venture Agreement dated October 1, 1972, attached is a copy of the 4th Quarter Report for 1986.

Sincerely yours,

Wm. D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
Att.

cc: J.D. Sell

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

ASARCO

Southwestern Exploration Division

December 23, 1986

FILE MEMORANDUM

4th Quarter Report
October - December 1986
Thunder Mountain Project
Santa Cruz County, AZ

In compliance with the agreement between Kerr-McGee and ASARCO Incorporated, I submit this quarterly report.

No work was done on the property during the quarter.

James D. Sell

James D. Sell

JDS:mek

cc: W.D. Gay
G.D. Christiansen, Kerr-McGee

ASARCO

Exploration Department
Southwestern United States Division

March 30, 1987

Mr. George D. Christiansen
Vice President, Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, OK 73125

1st Quarter Report
January-March 1987
Thunder Mountain Project
Santa Cruz County, AZ

Dear Mr. Christiansen:

In accordance with our Joint Venture Agreement dated October 1, 1972, attached is a copy of the 1st Quarter Report for 1987.

Sincerely yours,

William D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
att.

cc: J.D. Sell

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

ASARCO

Southwestern Exploration Division

JDS

March 27, 1987

FILE MEMORANDUM

1st Quarter Report
January-March 1987
Thunder Mountain Project
Santa Cruz Co., AZ

In compliance with the agreement between Kerr-McGee and ASARCO Incorporated, I submit this quarterly report.

No work was done on the property during the quarter.

James D. Sell

James D. Sell

JDS:mek

cc: W.D. Gay
G.D. Christiansen, Kerr-McGee

ASARCO

JDS

Exploration Department
Southwestern United States Division

June 23, 1987

Mr. George D. Christiansen
Vice President, Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, OK 73125

2nd Quarter Report
April-June 1987
Thunder Mountain Project
Santa Cruz County, AZ

Dear Mr. Christiansen:

In accordance with our Joint Venture Agreement dated October 1, 1972, attached is a copy of the 2nd Quarter Report for 1987.

Sincerely yours,

William D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
Att.

cc: J.D. Sell

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

ASARCO

Southwestern Exploration Division

June 19, 1987

File Memorandum

2nd Quarter Report
April-June 1987
Thunder Mountain Project
Santa Cruz County, AZ

In compliance with the Agreement between Kerr-McGee and ASARCO Incorporated, I submit this quarterly report.

The Forest Service and State Water Department have been notified that Joy Drilling will reoccupy the drill site TM-14, clean the hole to its depth at 3500 feet, and continue coring to complete the annual assessment work ending August 31, 1987.

James D. Sell

James D. Sell

JDS:mek

cc: W.D. Gay
G.D. Christiansen, Kerr-McGee

ASARCO

Exploration Department
Southwestern United States Division

September 29, 1987

Mr. George D. Christiansen
Vice President, Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, OK 73125

3rd Quarter Report
July-September 1987
Thunder Mountain Project
Santa Cruz County, AZ

Dear Mr. Christiansen:

In accordance with our Joint Venture Agreement dated October 1, 1972, attached is a copy of the 3rd Quarter Report for 1987.

Sincerely yours,

William D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
Att.

cc: J.D. Sell

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

ASARCO

Southwestern Exploration Division

JDS

September 25, 1987

FILE MEMORANDUM

3rd Quarter Report
July-September 1987
Thunder Mountain Project
Santa Cruz County, AZ

In compliance with the agreement between Kerr-McGee and ASARCO Incorporated, I submit this quarterly report.

The annual assessment work for the assessment year ending August 31, 1987, has been completed on the Thunder Mountain Project. Drill hole TM-14 was re-entered and BX casing was set from 2600 feet to 3500 feet, with BX core taken from 3500 feet to 3599 feet. The hole was recapped for further entry.

The "Affidavit of Labor Performed and Improvements Made" has been recorded in Santa Cruz County, Arizona, and filed with and acknowledged as received by the Bureau of Land Management, Phoenix, Arizona. A copy of this certified document was sent on September 10, 1987 to Kerr-McGee Corporation for their records.

James D. Sell/mek

JDS:mek

James D. Sell

cc: W.D. Gay
G.D. Christiansen, Kerr-McGee

ASARCO

Exploration Department
Southwestern United States Division

December 29, 1987

Mr. George D. Christiansen
Vice President, Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, OK 73125

4th Quarter Report
October-December 1987
Thunder Mountain Project
Santa Cruz County, AZ

Dear Mr. Christiansen:

In accordance with our Joint Venture Agreement dated October 1, 1972, attached is a copy of the 4th Quarter Report for 1987.

Sincerely yours,

William D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
Att.

cc: J.D. Sell

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

ASARCO

Southwestern Exploration Division

December 22, 1987

FILE MEMORANDUM

4th Quarter Report
October-December 1987
Thunder Mountain Project
Santa Cruz County, AZ

In compliance with the agreement between Kerr-McGee and ASARCO Incorporated, I submit this quarterly report.

No work was performed during the quarter.

James D. Sell

JDS:mek

James D. Sell

cc: W.D. Gay
G.D. Christiansen, Kerr-McGee

ASARCO

Exploration Department
Southwestern United States Division

April 7, 1988

Mr. George D. Christiansen
Vice President, Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, OK 73125

1st Quarter Report
January-March 1988
Thunder Mountain Project
Santa Cruz County, AZ

Dear Mr. Christiansen:

In accordance with our Joint Venture Agreement dated October 1, 1972, attached is a copy of the 1st Quarter Report for 1988.

Sincerely yours,

William D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
Att.

cc: J.D. Sell

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

ASARCO

Southwestern Exploration Division

JDS

April 4, 1988

FILE MEMORANDUM

1st Quarter Report
January-March 1988
Thunder Mountain Project
Santa Cruz County, AZ

In compliance with the agreement between Kerr-McGee and ASARCO Incorporated, I submit this quarterly report.

No work was performed during the quarter.

James D. Sell

JDS:mek

James D. Sell

cc: W.L. Kurtz
W.D. Gay
G.D. Christiansen, Kerr-McGee

ASARCO

Exploration Department
Southwestern United States Division

July 11, 1988

Mr. George D. Christiansen
Vice President, Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, OK 73125

2nd Quarter Report
April-June 1988
Thunder Mountain Project
Santa Cruz County, AZ

Dear Mr. Christiansen:

In accordance with our Joint Venture Agreement dated October 1, 1972, attached is a copy of the ~~1st~~ 2nd Quarter Report for 1988.

Sincerely yours,

William D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
Att.

cc: J. D. Sell

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

ASARCO

Southwestern Exploration Division

July 11, 1988

FILE MEMORANDUM

2nd Quarter Report
April-June 1988
Thunder Mountain Project
Santa Cruz County, AZ

In compliance with the agreement between Kerr-McGee and ASARCO Incorporated, I submit this quarterly report.

The work commitment for the year 1988 on the Kerr-McGee Thunder Mountain claim block will be completed by deepening drill hole TM-14. This hole will be drilled over the assessment year ending August 31, 1988 and continued into the assessment year ending August 31, 1989.

W. D. Gay for J. D. Sell

James D. Sell

JDS:mek

cc: W.L. Kurtz
W.D. Gay
G.D. Christiansen, Kerr-McGee

ASARCO

Exploration Department
Southwestern United States Division
James D. Sell
Manager

October 25, 1988

Mr. George D. Christiansen
Vice President, Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, OK 73125

3rd Quarter Report
July - September 1988
Thunder Mountain Project
Santa Cruz County, AZ

Dear Mr. Christiansen:

In accordance with our Joint Venture Agreement dated October 1, 1972, attached is a copy of the 3rd Quarter Report for 1988.

Sincerely yours,

William D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
Att.

cc: J.D. Sell

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703
1150 North 7th Avenue (602) 792-3010

JDS

ASARCO

Southwestern Exploration Division

October 24, 1988

FILE MEMORANDUM

3rd Quarter Report
July-August-September 1988
Thunder Mountain Project
Santa Cruz County, AZ

In compliance with the agreement between Kerr-McGee and ASARCO Incorporated, I submit this quarterly report.

Drill hole TM-14 was reentered on August 15, 1988 at the depth of 3599 feet and drilling was continued to a depth of 4037 feet by September 1, 1988. The hole continued in weakly altered and mineralized intrusive.

Complete logging and assaying of the core is pending.

The Affidavit of Labor covering the K-M and Asarco groups of claims in the project area has been sent for recording for the year ending August 31, 1988.

The drilling continued after September 1, 1988, and was sufficient to cover the coming year's assessment work.

James D. Sell

JDS:mek

James D. Sell

cc: W.L. Kurtz
W.D. Gay
G.D. Christiansen

ASARCO

Exploration Department
Southwestern United States Division

January 12, 1989

Mr. George D. Christiansen
Vice President, Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, OK 73125

4th Quarter Report
October-December 1988
Thunder Mountain Project
Santa Cruz County, AZ

Dear Mr. Christiansen:

In accordance with our Joint Venture Agreement dated October 1, 1972, attached is a copy of the 4th Quarter Report for 1988.

Sincerely yours,

William D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
Att.

cc: W.K. John - Kerr-McGee
J.D. Sell

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

ASARCO Southwestern Exploration Division

JDS

January 9, 1989

FILE MEMORANDUM

4th Quarter Report
October-November-December 1988
Thunder Mountain Project
Santa Cruz County, AZ

In compliance with the agreement between Kerr-McGee and ASARCO Incorporated, I submit this quarterly report.

The drill hole TM-14 was bottomed at 4587 feet in weakly altered and mineralized porphyry. The hole was lost at that point including the core barrel and the last seven feet of core.

The available core (to 4580) is awating splitting for representative assays.

A wedge was attempted to by-pass the lost drilling equipment, but a premature shearing of the wedge-pin at 4021 feet in the hole and retrieval problems (separation of the casing string) closed the entire hole down. It is unlikely that the hole will be reentered.

The 1988 Affidavit of Labor for the Thunder Mountain group of claims has been recorded and acknowledged by both the County and the BLM. A copy of this action has been sent to Mr. W.K. John of Kerr-McGee.

As drilling was conducted over the September 1 date, and sufficient costs incurred, an Affidavit of Labor covering September 1, 1988 to August 31, 1989 will be submitted.

James D. Sell

JDS:mek

James D. Sell

cc: W.L. Kurtz
W.D. Gay
G.D. Christiansen/W.K. John

ASARCO

Southwestern Exploration Division

April 17, 1990

only need yearly do 1989. is due Feb 1990

FILE MEMORANDUM

1st QUARTER REPORT
Jan.-Feb.-March 1990
Thunder Mountain Project
Santa Cruz County, AZ

In compliance with the agreement between Kerr-McGee and ASARCO Incorporated, I submit this quarterly report.

The Arizona Mine Inspector's Office is now examining claim blocks to evaluate the dangerous conditions which might exist, such as open shafts, non-posted tunnels, etc. Some owners of claims in the Patagonia Mountains have been notified. As of this date, the claims within the Thunder Mountain Project have not been notified, but Asarco SWED has started its appraisal of the dangerous situations.

No other work has been done on the property during this quarter.

See your summary

James D. Sell

JDS:mek

James D. Sell

cc: W.L. Kurtz
W.D. Gay
G.D. Christiansen/W.K. John

TAB

Summary Reports.

ASARCO

Southwestern Exploration Division

October 6, 1982

To: J. D. Sell

From: F. R. Koutz

Drill Hole Summary (0-910')
DDH TM-14, Thunder Mountain
Project, EA-0042
Santa Cruz County, AZ

Summary

DDH TM-14 was collared about 1430' S78W of DDH TCH-2, on Thunder Mountain ground. The hole was drilled NC to 910' and capped for re-entry to eventually test the Paleozoic near the quartz-feldspar porphyry contact. The rock encountered is a bedded, lithic lapilli tuff to tuff breccia, occasionally crystal-rich, of the Chief Formation cut by a 95-foot-thick, partially fluidized zone of intrusive porphyry-generated intrusive and intrusion breccias and dikes from 555 to 650' depth. Alteration can be considered advanced argillic and is dominated by sericite, clays and silica. Clays decrease significantly below the intrusive zone while increased silicification (locally amethystine) is associated with the intrusives. Pyrite, the most common sulfide, averages 2-3 volume percent and is mostly disseminated but ranges up to 6% in the intrusive zone where veinlet-controlled pyrite is a little more common. Sphalerite, galena, covellite, chalcocite, chalcopyrite, and trace molybdenite are present as disseminations and in veins. Higher Zn (up to 0.4%) and Pb (up to .03%) values are common in the upper 300 feet of the hole along with .01-.02% Cu, while Cu (.025% average) and Ag (3.3 ppm average) are the more significant elements in the lower 190 feet. The central portion of the hole generally contains much less Cu, Pb, Zn and Ag, with a negative correlation to the high pyrite-silica intrusive zone. TM-14 fits rather well into the elemental zoning pattern to equivalent depths in previous holes in Upper Alum Gulch. Less intrusive porphyry was encountered than expected which may be a favorable sign that the Paleozoic carbonate section has not been cut out by the porphyry at depth.

Introduction

In the four "Trench Area" drill holes completed thus far (TM-13, TCH-1, 2, and 2A) only minor indications (in the form of one 3-foot dike (TCH-2) and local intrusive breccia clasts of the quartz-feldspar-porphyry) of the geometry of the stock believed responsible for the significant igneous and sediment-hosted mineralization in the Sunnyside-Trench system have been encountered. The purpose of TM-14 is to explore the geometry/contact of this stock at depth where the best grades and thickest section of carbonate-hosted mineralization would be expected.

DIST
1-JDS/WLK/FRK
1- LIB File
1- FTG
1- FRK

Discussion

Much less intrusive quartz feldspar porphyry has been encountered so far in TM-14 than I predicted on cross section Y-Y' of the TCH-2 report (map MVK-5334) on the basis of QFP in outcrop and in TM-9. However the section is convienently about 600 feet north of the actual hole. Only minor amounts of QFP dikes may be present in the rest of TM-14. I would estimate--with difficulty because of the brecciation, alteration and presence of similar crystal lithic tuff (XQFP) fragments--that only 50-70% of the intrusive porphyry-breccia zone consists of intrusive QFP rock-types. This would also suggest that the 95 foot zone encountered in TM-14 is near the distal end of a dike zone. The presence of only minor dikes in TM-14 could be considered favorable for the continued presence of the Paleozoic at depth with the Paleozoic not cut out by a major QFP pluton as in TM-8 about 2000 feet to the WSW. The presence of minor amounts of Hardshell Group volcanics as lithic/breccia fragments (but not in the intrusive porphyry-breccia zone) may also suggest that the Hardshell Group is also present at depth. No paleozoic or quartz monzonite porphyry fragments were noted in TM-14 and from the slope of the upper contact to the east the Paleozoic should not be expected until about 5000 feet of drilling.

The alteration in TM-14 especially the presence of alunite and possible andalusite with silica-sericite and clays and significant total sulfide clearly places the first 910' of TM-14 in the advanced argillic zone of the Sunnyside hydrothermal system. This alteration-type weakens with depth becoming "phyllic"-argillic and is clearly weaker in TM-14 than to the west. Again this may suggest that TM-14 is along a significant alteration-dike zone out from TM-8 ENE along Upper Alum Gulch.

The several veinlets containing sphalerite and galena in silica-pyrite well-rounded lithic clasts in the lapilli tuff which terminate at the edge of the clast suggest that some mineralization was taking place before or during volcanism. However most Cu, Zn, Pb-bearing sulfide veinlets clearly crosscut both clasts and matrix of the lapilli tuff.

TM-14 may not yet be deep enough to encounter the strongest portions of the upper level covellite-chalcocite replacement/enrichment blanket on chalcopyrite-pyrite-sphalerite mineralization considering the dip of the zone to the east as shown on Figure 2 of the TM-9 report (Graybeal, 1974). Nevertheless some interesting metal-zoning patterns are shown if the first 900-910' of 4 drill holes along Alum Gulch are compared:

Table 2

Average Metal Values-ppm and
Minerals-volume percent (to 910' depth)

DDH	Cu	Pb	Zn	Ag	Mo	Total Pyrite	Sericite + Clay	Feet From TM-8
TM-8	2260	260	860	8.2	8.6	4.2	51	0
TM-9	730	60	50	4.2	30	3.8	49	1050
TM-14	220	80	2000	2.7	22	2.4 + .6	33	2100
TCH-2	600	108	1180	14	11	2.7 + 1.3	39	3600

Of course the metal values are not strictly comparable because incomplete character assays are used for many of the averages. Different host rocks are also present and the mineral estimates are by different loggers and made at different times. The second pyrite numbers for TM-14 and TCH-2 are for logged grey-black fine-grained sulfide which is mostly pyrite.

One can see the effects of both metal zoning (Graybeal, 1973) and probably an indication of total metal at depth if leakage from directly below is considered. Cu and Ag (and pyrite and sericite+clay) values are lowest in TM-14 (enrichment phenomena are not considered) but Zn values are highest. Mo increases and Pb decreases toward TM-8. TM-8 and TCH-2 are clearly the best mineralized (including pyrite) holes on the surface <u>and</u> were <u>well</u> mineralized at depth. We can hope that TM-14 will have something besides high zinc values at depth when drilling resumes.

With present knowledge I can only briefly reiterate the recommendations for TM-14 made in the recent Trench series of reports.

1. An additional drill-out from TCH-2 to the N to NNW should have priority over completion of TM-14.

2. Additional drilling in TM-14 should be with a rig large enough (Joy-36/CP-50) to carry NC drilling to great depth (+4000') before reduction to NX. Drift should be periodically checked by HF vial and if beyond 5° should be surveyed by gyro.

3. No matter what the results of TM-14 we should be prepared for drill-outs from this hole.

4. Negative results from TM-14, in light of the strength of TCH-2 mineralization, should not preclude the testing the QFP/Paleozoic contact at other locations nor the Paleozoic section at greater distances and different directions than along Upper Alum Gulch.

References

Graybeal, F. T., 1973, Geology and Economic Evaluation of the Sunnyside Area, Three-R and Thunder Mountain Projects, Patagonia Mountains, Santa Cruz County, AZ, August 24.

_____, 1974, Summary of TM-9, Thunder Mountain Project, Santa Cruz County, AZ, 6 p., 2 Fig. + logs.

Koutz, F. R., 1982, Summary Report, DDH-TCH-1, Trench Project, Santa Cruz County, AZ, April 28.

_____, 1982, Summary Report, DDH-TCH-2, Trench Project (EA-0200-01) Santa Cruz County, AZ, May 13.

_____, 1982, Trench Area Exploration: Trench (0200), Three-R (0040) and Thunder Mountain (0042) Projects, Santa Cruz County, AZ, May 24.

F. R. Koutz

F. R. Koutz

FRK/cg

Attachments: 2 Figures
Drill Logs

ASARCO

Southwestern Exploration Division

JDS

September 19, 1983

To: J. D. Sell

From: T. C. Benavidez

TM-14 Drilling Summary
Thunder Mountain Project (EA-0042)
Santa Cruz County, AZ

The required annual assessment work has been completed by deepening DDH TM-14 from 910' to 1705' (795' NC core). The hole was conditioned with a heavy gel and capped for future re-entry.

A truck mounted Joy HD-22 was mobilized on August 15 and demobilized on September 1 of this year.

A summary of estimated costs is shown below:

		Cost/Ft.
a) Road and Site work	$ 225.00	$ .28
b) Drilling and Materials	$18,957.05	$23.85
Total of a) and b)	$19,182.05	$24.13

These figures do not include supervision and assay costs.

T. C. Benavidez

T. C. Benavidez/cg

TCB/cg

cc: FRK

JDS

ASARCO

Southwestern Exploration Division

October 1, 1985

F. T. Graybeal
New York Office

1985 Operations/Geology
Thunder Mt. Project (EA-0042)
Santa Cruz Co., AZ

Attached is F.R. Koutz's report on the drilling in TM-14 for this year's assessment work. The work also covered the 3-R and Ventura claims under control of Asarco's joint ventures.

I agree with Koutz on the double assessment work next year for the reasons stated. A secondary reason is that we have been able to drill the hole NX with only the first casing in the NC portion of the hole to 2613 feet. This last 900 feet of open hole is at present quite stable in the porphyry, but it is unlikely that another year of 500 feet of drilling will leave the open portion in good shape for reentry and a new set of costly casing may be necessary to ensure reentry. However, by continual drilling over two assessment years, we may be able to continue the hole to the depth that further decisions can be made as stated by Koutz.

James D. Sell

James D. Sell

JDS:mek
Att.

cc: W. L. Kurtz
F. R. Koutz

JDS

ASARCO

Southwestern Exploration Division

September 23, 1985

To: J. D. Sell

From: F. R. Koutz

1985 Operations/Geology
Thunder Mt. Project (EA-0042)
Santa Cruz Co., AZ

Operations

From July 29 to August 14, Joy Manufacturing (John Sanchez, driller) deepened DDH TM-14 425 feet (NX) from 3075-3500'. Minor problems were encountered getting back to bottom below the NX casing (2613') due to settled cuttings, bridges and rig in poor repair (disuse), but otherwise drilling (2 shifts) went well. D.A. Melhado handled all field supervision. The hole was left full of thick EZ-mud and capped for next re-entry. Costs are tabulated below. Although the cost of EZ-mud ($.94/ft.) was more than the Cellex-Dextrid - bentonite mud mixture used previously ($0.67/ft.-1984) it was more convenient for this short job but I don't think it works as well.

Item	Cost	Cost/Ft.
Drilling (NX)	$10,922.50	$25.70
Mobe & demobe	1,000.00	2.35
EZ-mud	400.68	.94
Water truck	304.50	.72
Re-entry	1,017.00	2.39
Misc.	73.35	.17
Road work	360.00	.85
	$14,078.03	$33.12

Administrative - property, geology and drafting salaries were added to make the required expenditures on the 181 claims in the revised Thunder Mt., 3-R, Ventura and Mendosa claim blocks assessed by this work. All State water and Forest Service permit work has been completed.

Geology

The core has been logged and ten intervals will be split for character assay. The hole was surveyed to 3050' depth in 1984 and was 33' N13E of the collar (1¼° from vertical and trending N71E) at that depth.

When we left TM-14 in 1984 the hole was in Quartz Monzonite Porphyry (QMP) after passing through the Chief lithic lapilli tuff and tuff breccia to 2155', the Quartz Feldspar Porphyry (QFP) from 2155 to about 2560' which is apparently intrusive into the QMP which continued to 3075'. The 425'

drilled this year continued in QMP to TD with the partial exception of an intrusive breccia (IBX) and associated intrusion breccia from 3094.5-3100'. The IBX zone included 20-30% fragments of Chief tuff, QFP, and Hardshell ash-flow breccias and tuffs. In DDH TCH-2/2A some 1000-1200' ENE the hole had passed into Hardshell ignibrites-hornfels by 3000' depth. TM-14 is passing through a thicker QMP section than TCH-2 either due to the attitude of the QMP body or nearness to the QMP source.

The QMP in TM-14 2560-3500' is much more strongly quartz-sericite-pyrite stockwork veinlet altered than the QMP in TCH-2. In addition a local micropegmatic micrographic-aplitic textured ground mass is more common in the deeper parts of TM-14 and is similar but considerably more fine-grained than that in the Jurassic Monzonite over the Ventura deposit some 2 miles to the SW.

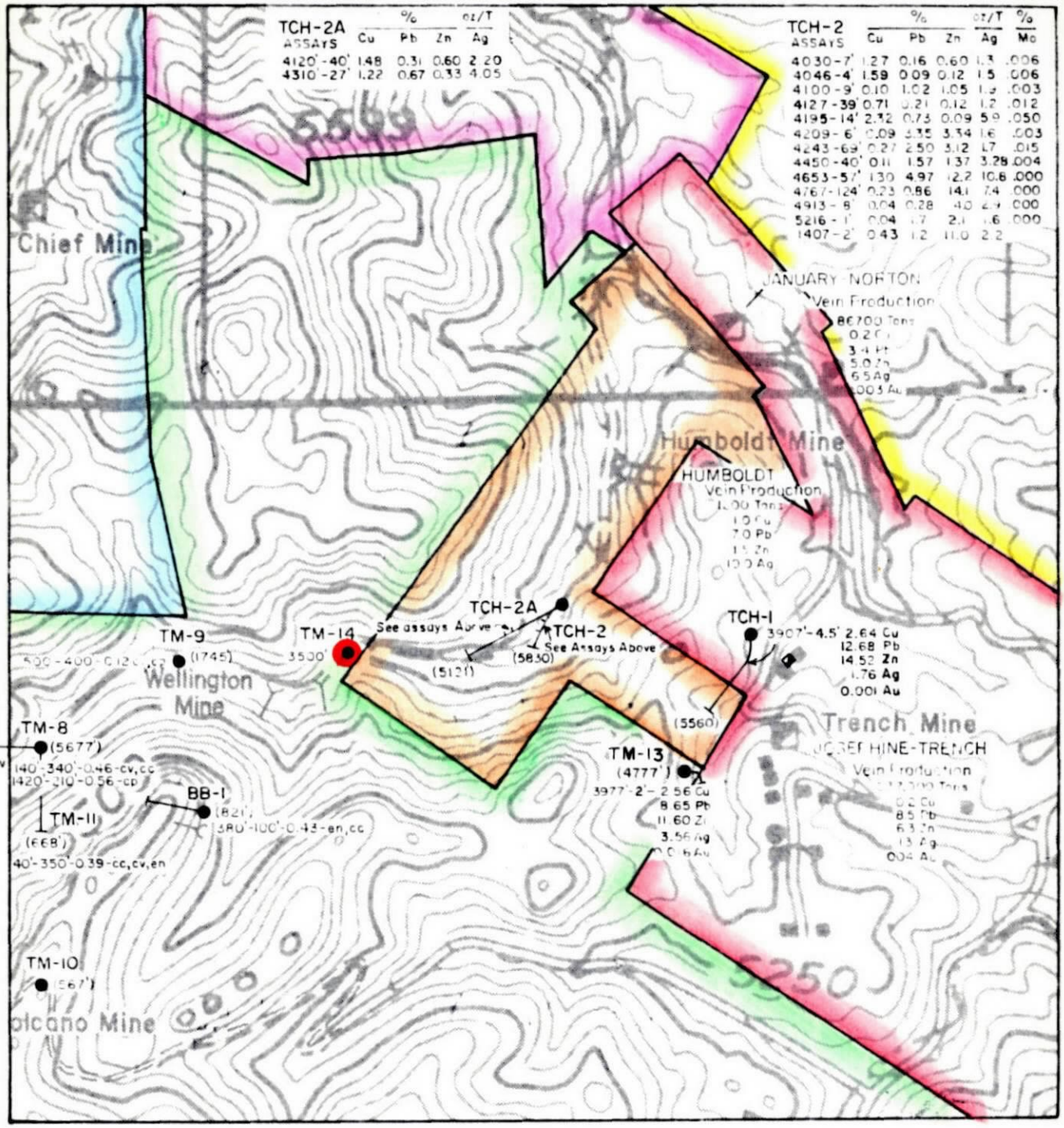
The quartz-sericite (and pyrite) is particularly strong around the IBX in TM-14. Pyrite ranges from 4-7% outside the IBX zone and immediate halo (8-12% py inside). Several tenths percent chalcopyrite--mostly disseminated--with traces of bornite and secondary covellite-chalcocite is common to about 3300' depth, but only traces were noted below. Trace to several tenths percent sphalerite are found in this year's drilling--possibly with a slight increase with depth. Rare molybdenite is mostly found in late white quartz veinlets.

In summary, little additional information was provided this year on when TM-14 will pass into the Paleozoic or even out of the QMP. The Paleozoic has been previously predicted after TCH-2/2A to be as deep as 4300-5000' depth. Deepening of TM-14 should be continued next year and again I strongly recommend that we save our dollars and drill a 2-year back-to-back assessment program which should give us enough money for 900-1000' deeper. If by the time we reach 4500' depth we have not hit the Paleozoic or other strongly encouraging mineralization or geology, we should consider abandoning, at least temporarily, TM-14 and do another drill out of TCH-2/2A to better define our known skarn/limestone replacement Ag-Zn-Pb-Cu intercepts.

As a reminder over the next several years, if funded, the University of Arizona Geosciences Dept. (under Titley and Davis) will be doing considerable geologic work in the Northern Patagonia Mountains including mapping, age-dating and structure-geomorphology in support of the planned study and deep drilling under Red Mountain. This work should be of direct benefit to continued exploration in the Patagonias and we should keep close track of what is being done and might even help guide parts of it.

F. R. Koutz

FRK:mek
Att: MVK 4048



EXPLANATION

- ASARCO INC. Trench Group
- ASARCO-Kerr McGee Thunder Mtn Joint Venture
- ASARCO-Anaconda 3R Joint Venture
- Mendoza-Humboldt Group (ASARCO INC.)
- Kerr-McGee-Red Mtn.
- Lichty-Argentor

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

⊙ Proposed drill hole

ASSAY DATA KEY

depth-length-%Cu-mineral

3860'-350'-0.59-cp

GEOLOGIC LEGEND

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

TO ACCOMPANY 3RD QUARTER REPORT
DATED 9-23-85
BY F.R. KOUTZ

DRILL MAP

TRENCH PROJECT

&

THUNDER MTN. PROJECT

PATAGONIA MTNS.

Santa Cruz County, Arizona

SCALE: 1" = 1000'

F.R.K Dec., 1981

MVK 4048

FILE

To: F. R. Kouty
from: JD Sell

Jan. 17, 1956

Precious Metal Review
Patagonia Mtns
Santa Cruz Co., AZ

Please place on your agenda a time slot to review the Patagonia Mountains for all the precious metal shows and formulate an exploration plan to exploit them.

James D. Sell

cc: WKenty

WLK concurred

ASARCO

Southwestern Exploration Division

To: JDSell
From: FRKoutz

1985-86 Assessment Work
Possibilities
Patagonia Mountains
Santa Cruz County, AZ

Jan. 23, 1986

SWED has 181 claims in the Patagonia Mountains: Thunder Mountain(93), 3-R(49), Ventura(32) and Trench (Mendosa-7). There are 240 Hardshell claims controlled by SWMD. D.F.Skidmore says that SWMD has not decided what to do for their assessment work and there are no plans to drop any HDS claims. Excess metallugical work on HDS was used to complete our 1984-85 assessment work when TM-14 drilling did not reach the required $18,100 expenditures. Perhaps additional HDS work this year or work for the benefit of Hardshell could be applied to other Patagonia claims. The followimg includes a number of Hardshell ideas but not enough to to reach $24,000 for HDS alone. HDS work might be best done by: metallurgical drilling/mining, start "deep" drilling below the Ag-MnOxide manto for a Ls-replacement ore body, additional metallugical or feasibility work.

do HDS 1. Finish detailed logging of Ventura DDH V-37, V-38, dispose of unnecessary core, write report (many figures done, assays completed, thin sections cut): 4-6 weeks. The galena-Au vein in V-36 plus Au-Ag shows on the west side of the Patagonias could be looked into. Note that there is a symmetrical weak Ag-Mn-±Au zone on the west side of the Patagonias to compare to the Hardshell-Mowry zone. The upper granitic portion of ASARCO deepening of DDH V-74-1 (1982-84) can be skeletonized and disposed of.

do HDS

2. Sept.1985 Au-assaying of the 1973 FTG Sunnyside Project-Patagonia Mountains geochem. samples ran up a $1084.80 bill (incl.$256 for repulverizing the pulps.) This bill, writing the report (1 day) and drafting (2 days) plus several days of low priority field examination of a few of the weak anomalies could be used for assessment work. TM-14 assays($178.53 Nov.20) plus DAM splitting time and thin sections ($46.50) can also be used for 1985-86 assessment work.

work only pre-Hardshell

3. Hermosa Area at Hardshell: write up 1981-84 sampling (including UG work) and drilling into a formal report with drafting. Two weeks plus drafting. (Now in monthly reports only.)

Hold off HDS

4. Hardshell drilling proposal for a moderate depth limestone replacement Ag-Pb-Zn sulfide deposit below the Ag-MnOx manto. Re-examine limestone core and chips from hole bottoms and select holes for DDH deepening. One week.

low priority jobs

5. Hardshell to Mowry belt. Examine Sharon Steel geochem data (@BLM) and areas east to southeast of American Peak. Sharon Steel drilling data/core may still be in N.M. New U of A paleomag.-dating M.S. Thesis on this area.

There are spotty pods of (10,000T @ about 5 opt Ag UG found in the 1940's by Ventures Ltd. in the Mowry Mine. Some of this data is in our files and I believe Lichty (of the Argentor Syndicate) has a copy of the old Ventures data. Exxon drilled (1983) a pyritized gabbro body at the west end of the distict (a Zonge geophysical anomaly) which may well have been responsible for the limestone replacement mineralization but then dropped their claims.

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6. There are a number of satellite mineralized zones east of Red Mountain in the North Saddle Mountain area which have minor Ag-Pb-Mn shows around them. The host is mostly the trachyandesite of Meadow Valley. This search might be extended into the Canello Hills and the Red Rock Distict

(although mostly spotty shows of CuOx here) using C. Kluth's U of A PhD structural interpretations.

low priority jobs.

7. The Lead Queen area about one mile north of Trench should be looked into (This is Kerr-McGee Red Mtn. ground). This is a NW-striking Pb-Ag±Cu-Zn Trench-type vein with a few 1000T production. There is potential for Ls-replacement mineralization beneath this area if the Paleozoic is faulted up to a reasonible depth beneath the Meadow Valley (Weiland Canyon-(JHC-1953)) Andesite here. One interpretation is the January-Norton fault zone is reverse N-side up which should bring the Paleozoics to shallower depth than beneath Trench.

Keep secret jobs.

8. Flux Mine Area. Although cerussite mineral specimen mining has been mentioned the legal-safety-liability costs may well be prohibitive. Some of the better areas could be reopened-if they have not already been secretly been done so- for a few thousand dollars. The legal ramifications of any such venture should be looked into soon.

I have previously pointed out a coincident N35E line-zone of mineralization (along 4 miles) including the Ventura breccia, 3-R Mine, Flux Mine, Exposed Reef Mine and the deep Red Mountain Cu-Mo IBX zone. This line could be continued several miles to the NE to the Elevation, Christmas Gift and Santa Cruz Mines and SW of Ventura to the Denver and Jarillas Mines. I suggest that this line of mineralization may represent the NW edge of the Patagonia Batholith at depth- a very good zone to prospect as is the east edge of the batholith along the Harshaw Creek Fault. Although the Flux-Exposed Reef Mines area has been mapped several times -most recently by JHC in the early 1950's and partially by FTG(1973) I believe this area deserves remapping at 1"=500' or less paying particular attention to alteration and NNE-NE qtz-ser-py veinlets and other features which might eventually lead to development of limestone replacement drill targets at moderate depths (1000-3000') if the Paleozoic extends this far to the NW. It may well have been in the immediate vicinity to provide the carbonate megabreccia blocks mineralized in the Flux Mine. The Flux produced 3x (@850,000T) the Zn-Pb-Ag-Cu tonnage compared to the Trench-January-Norton(in spite of not being next to the Chief-Sunnyside diatreme) and I suggest the potential for mineralization at depth is 3x that of Trench.

later jobs

9. Perhaps FTG could finish his write-up of the Sunnyside Porphyry Copper (3-R/TM) drilling from the middle 1970's. Some of the maps have already been produced. At present I do not think that TM-14 should be written up/ maps-sections revised or core thrown away until TM-14 is completed- or taken to the 4000-4500' depth range.

TM-14 should be written up. Jobs. & core revised jobs

10. The broad +1ppm USGS Ag anomaly in the S and SW Santa Ritas might be looked into although much (Salero Mine area) of this ground is in Baca Float #3 scheduled for subdivision or near the Mt. Wrightson Wilderness. I believe GWP did some work in the area- particularly around the Arizona-Pittsburg Mine. There are a number of small(?) Ag shows in the Mansfield Canyon area which might be looked into. The Greaterville Au area and areas to the W and NW south of the Sawmill Canyon Fault north of the Wilderness should also be looked into.

Hold off jobs

11. My partication in the March AGS Hardshell/Red Mountain Field Trip might also be charged for assessment work (prob.2-3 days).

Fleetwood R. Koutz

JDS

F.T. Graybeal
NY Office

2/25/86

Assessment Work - 1986
Patagonia Mtns

As per our telephone conversation today, I attach a portion of Fleets report on the area I believe he should work for the assessment year ending Aug 31, 1986.

As noted I needed to send two sheets so as to get both portions of the claim block on the ±N35°E line.

Your comments please.

James D Sell

Attachments
cc: FRKouty

low priority job

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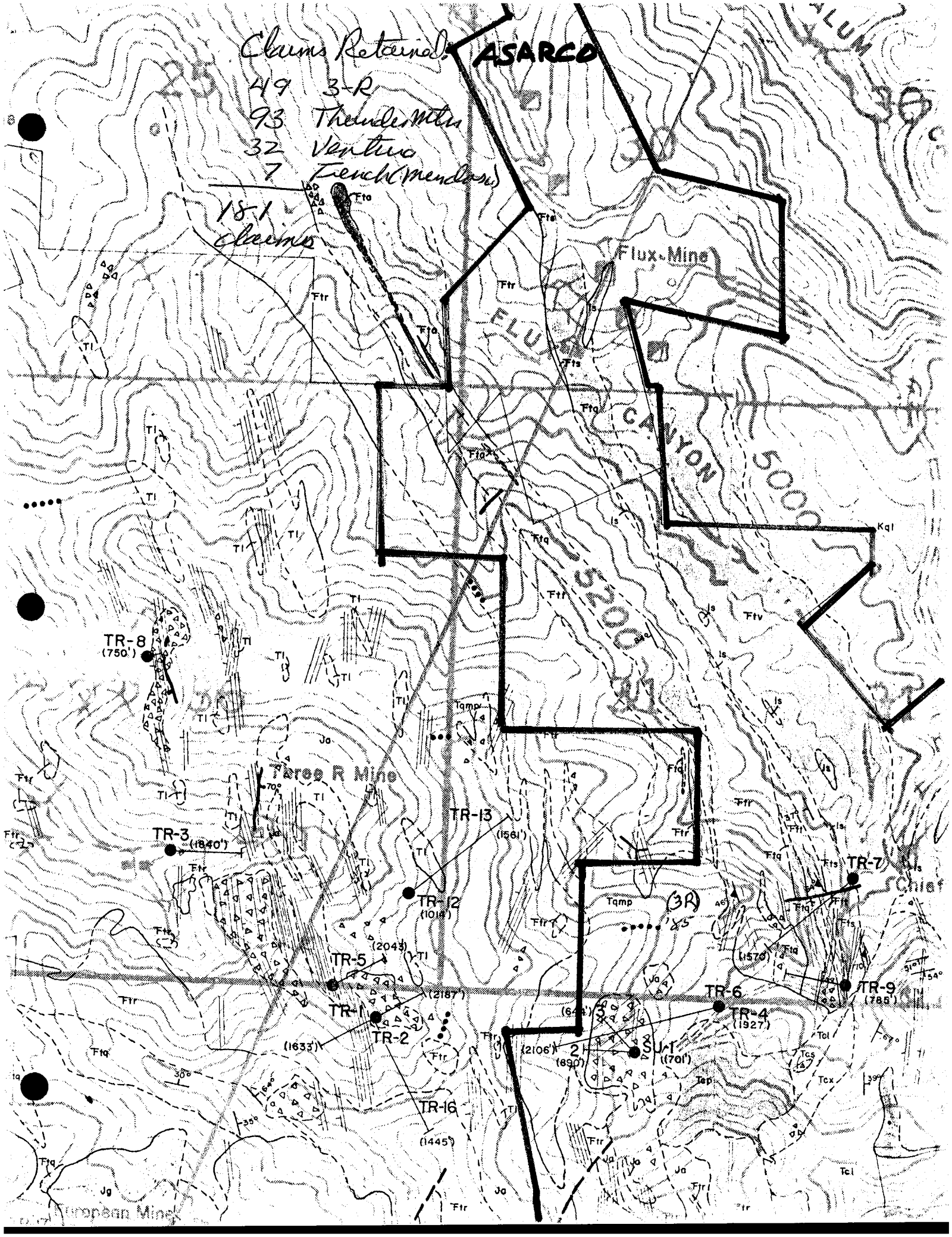
Claims Retained:
ASARCO
49 3-R
93 Thunder Mtn
32 Ventura
7 French (Mendocino)
18-1 claims
Flux Mine
FLUX CANYON
5000
5200
Three R Mine
European Mine
Chief
TR-1
TR-2
TR-3
TR-4
TR-5
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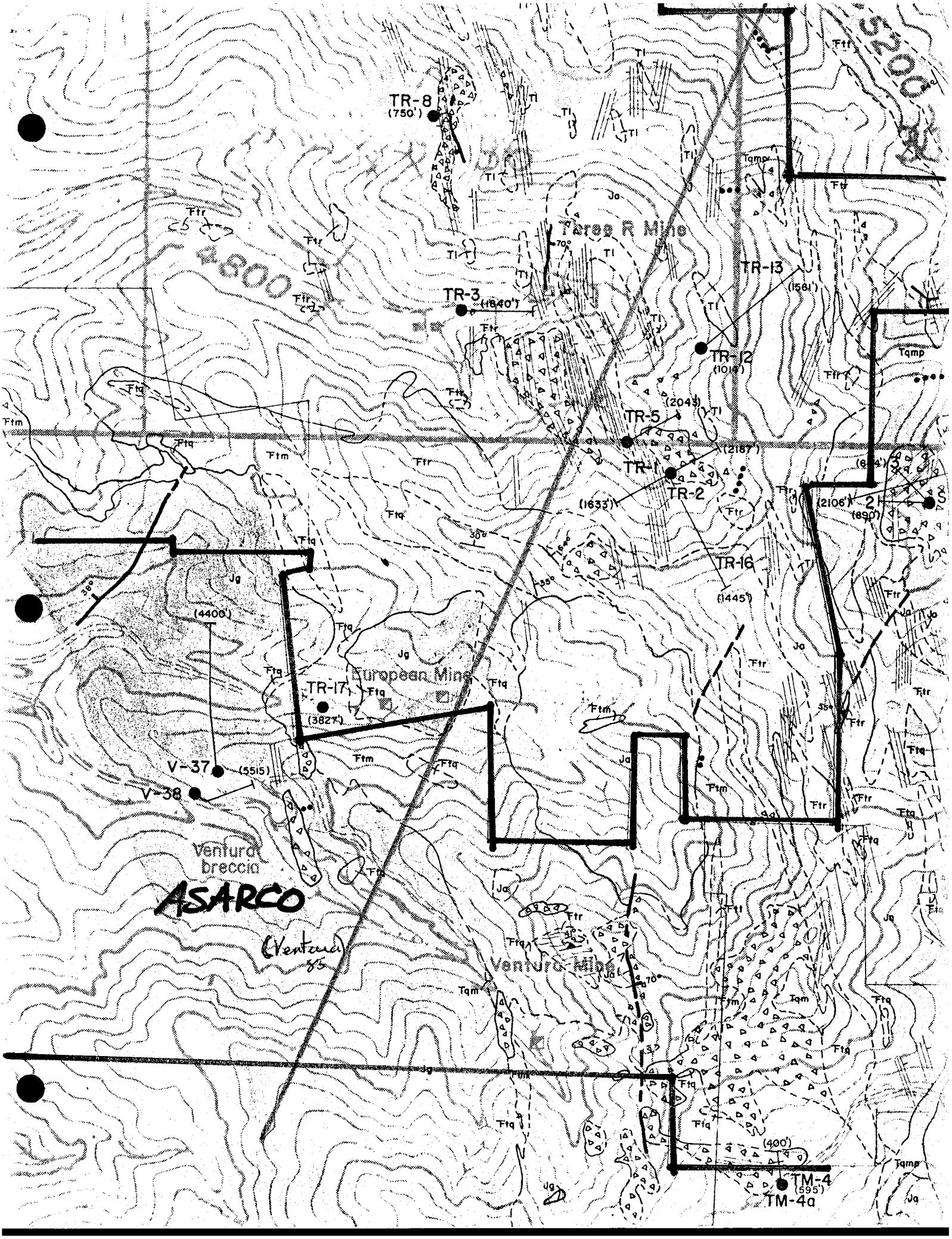
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Ventura breccia
ASARCO
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5300

F.T. Graybeal
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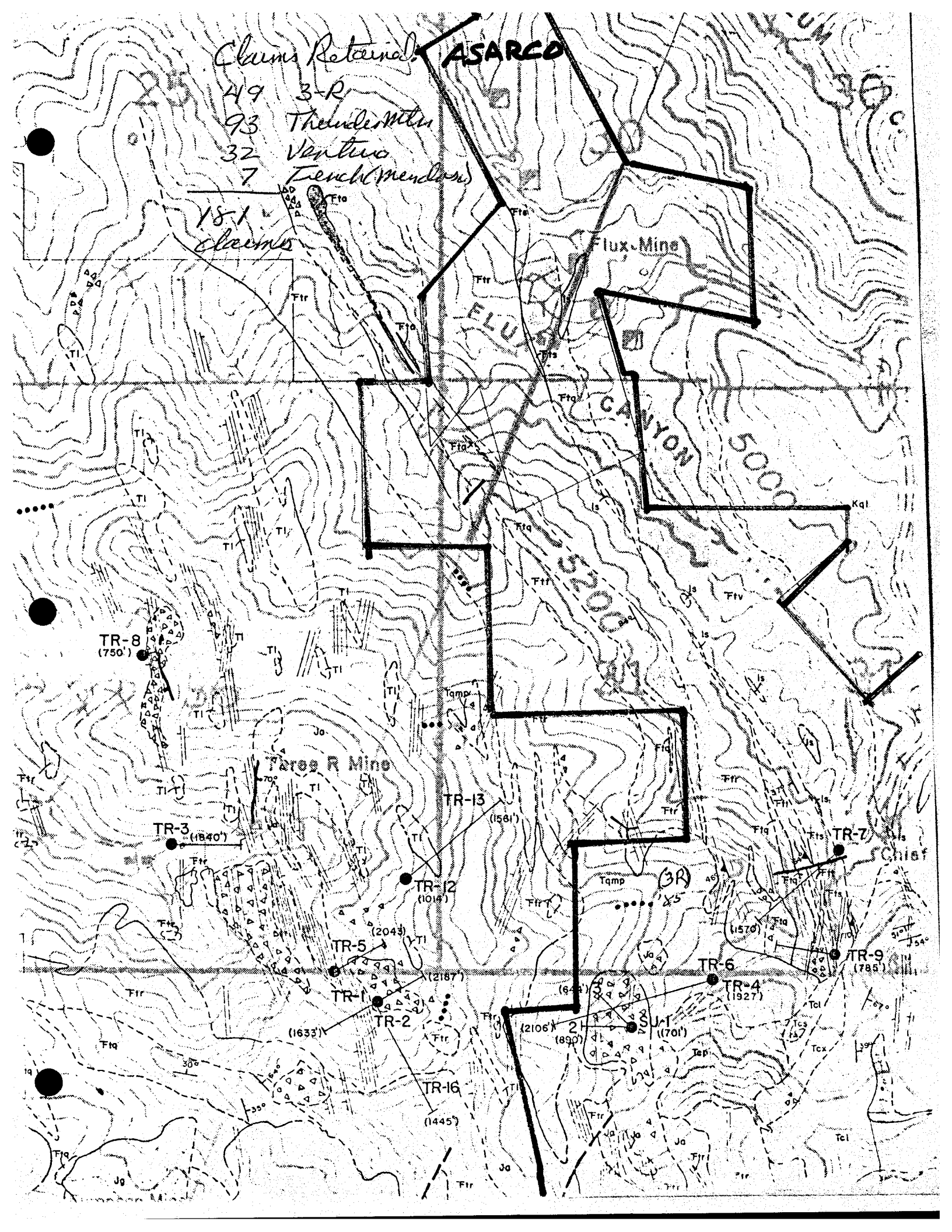
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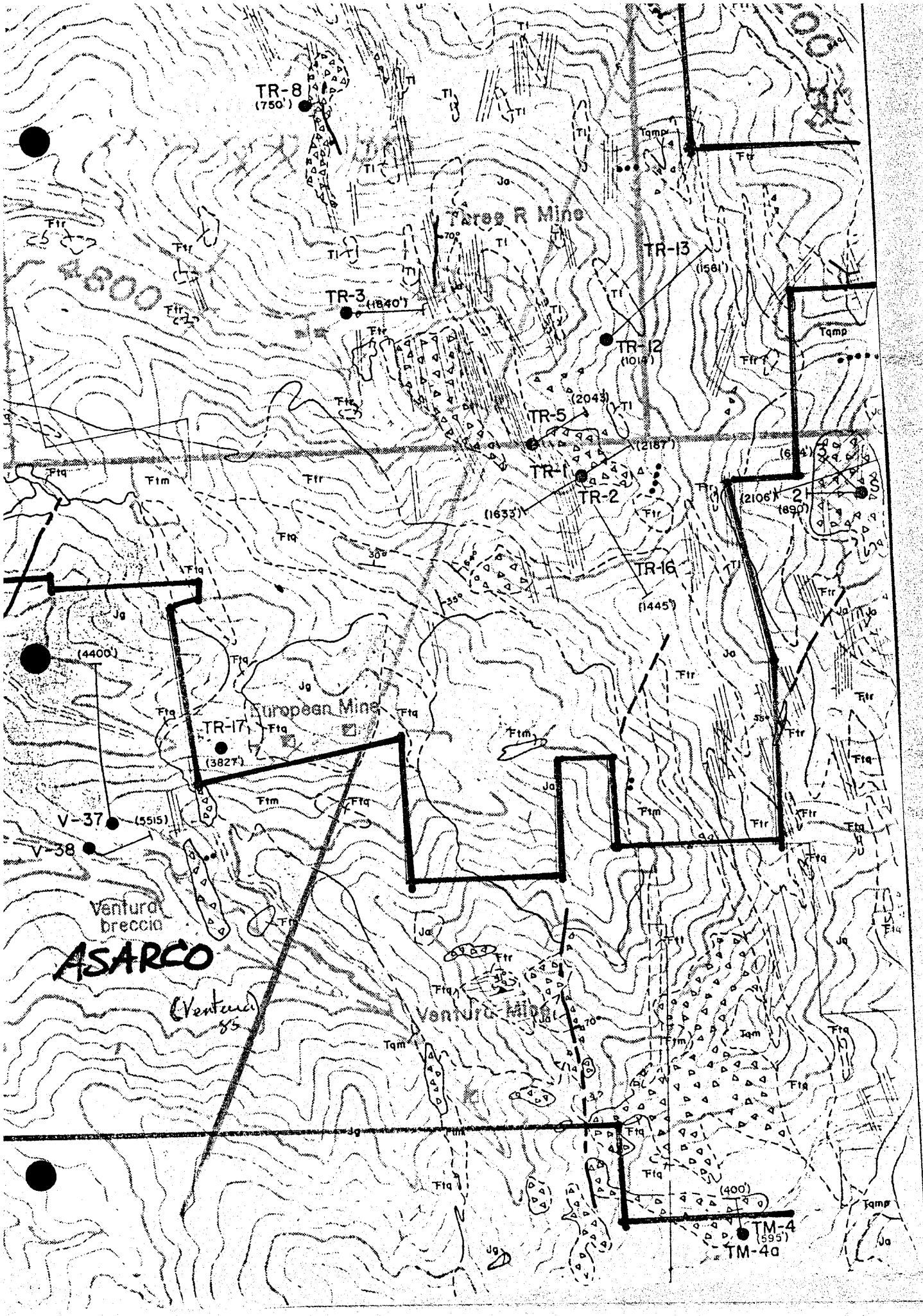
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JDS

ASARCO

Southwestern Exploration Division

July 21, 1986

To: F. T. Graybeal
New York Office

From: J. D. Sell

SWED Projects

I bring to your attention a typographic error in your Advisory Committee letter of May 19, 1986, Thunder Mountain Project, AZ (attached). The Three-R Project note should have been 49 claims instead of 97 claims including the Flux Mine. The Three-R has 37 retained claims (Boot) plus 12 Flux claims for the total 49 claims.

Also attached is a note saying that the Mendoza claims (Humbolt, et al) were to be included with the Hardshell claims and handled by the Mining Department. I talked with Dave Skidmore today and he confirms that the Mining Department has NOT performed the assessment work, nor recorded the same, for the Mendoza claim group at any time. SWED has performed the assessment work and recorded the same through September 1, 1986, by drilling and geological work and evaluation as part of the Thunder Mountain Project and general Patagonia District in general.

Do you agree that the 7 Mendoza claims belong to SWED and are separate from either the Three-R, Thunder Mountain, or Ventura Projects? My office file from previous managers has a file: "Hardshell-encl. Mendoza #0013, #0057" which contains the earlier Mendoza material, plus another file "Trench (& Humbolt), #0200" with the later assessment files, W.D. Gay file as attached, which followed J.R. Stringham's filing of last year. Mendoza, EA-0057, should be the correct file and Project for these seven claims, correct?

Also, since the first of the year, the Comptroller's Statement No. 8 continues to list our projects which have been terminated and returned to the optioned owners. These include:

Rawhide	EA-0041	($71,662 unexpended)
Chief Consolidated	EA-0198	($23,773 unexpended)
Godiva	EA-0362	($41,664 unexpended)
Hobo	EA-0368	($36 unexpended)

Mr. Robles, Accounting Tucson, informs me that notice of accounting termination should be initiated in New York. As you have letters indicating their termination in the past year or more, perhaps you could bring it to the attention of the Comptroller and remove the terminated projects from the Statements, if that is Asarco's present attitude.

James D. Sell

James D. Sell

JDS:mek
Atts.

cc: W. L. Kurtz

New York, May 19, 1986

TO: The Advisory Committee

Thunder Mountain Project,
Arizona

Thunder Mountain is a joint venture option with Kerr-McGee to earn a 50% interest in 93 claims covering a deep disseminated copper zone and a deep high grade Cu-Pb-Zn-Ag carbonate replacement zone. Assessment work is required to keep the claims in good standing. Work done on the Thunder Mountain block also covers assessment work on the adjoining Three R Project (97 claims including the Flux Mine) and Mendoza Project (7 claims). Anticipated work will involve deepening a drill hole to test the carbonate replacement.

Advisory Committee approval is requested for an expenditure of $130,000 to cover drilling, geologic studies, and administrative costs.

F. T. Graybeal

F. T. Graybeal

FTG:mr
Att.

3-R = 37 claims
Flux = 12 "
49 claims total in 3-R Project

Thunder Mtn: 93 K-M claims
+ 7 Mendoza-Humbolt (ASARCO) claims
100 claims total in block

ASARCO Incorporated

JUL 14 1986

SW Exploration

Re: MENDOZA claims (Humbolt et al)

Hereafter these claims will be included with the HARDSHELL claims, and handled by the Mining Dept. (entered into their document book).

PATAGONIA DOCUMENT BOOK

DOC. NO.	DIGEST OF LEASES, TITLES, ETC.
1-FF	Letter to Kerr-McGee stating that Asarco has fulfilled minimum expenditures ($100,000 required to continue the Operating Agreement beyond October 1, 1980. Yearly Expenditures.
1-G	Plat and exhibit of mining claims existing prior to 9/1978, in accordance with ARS 27-210 (Thunder Mountain).
	Amendment notices as filed October 22, 1980, with Santa Cruz County Recorder Doc. 288, pgs. 552-576. (Note: "Mendoza" claims will hereafter be included with Hardshell claims - and handled by Mining Department). Shedinos 7/21/84 says the Mining Dept has not to date recorded the assessment work on the "Mendoza" claims with the Hardshell claims. Exploration has been maintaining these 7 Mendoza claims.
1-H	Fourth Amendment to Kerr-McGee ASARCO Operating Agreement dated 9/1/72.
1-I	Gold Depository and Loan Company, Inc. Quit Claim to Kerr-McGee and Asarco unpatented mining claims in Harshaw Mining District, Santa Cruz Co., July 16, 1982.
1-J	Juan Chavez, Impossible Dream Ltd., Quit Claim Deed to Kerr-McGee Corporation and ASARCO Incorporated, Jointly, in unpatented mining claims in Harshaw Mining District, Santa Cruz County, AZ, March 2, 1983.
1-K	ASARCO Incorporated Quit Claim Deed to Kerr-McGee of unpatented mining claims, Orb 8, Orb 9, Orb 10, Calvin Coolidge, Abraham Lincoln, Bryan in the Harshaw Mining District, Santa Cruz County, AZ. Dated May 13, 1983.
	ASARCO Incorporated Quit Claim Deed to Kerr-McGee of unpatented mining claims, Welington, Lafayette, Copper Dyke, Warren Harding, Roosevelt, Orb #7 in the Harshaw Mining District, Santa Cruz County, AZ, June 13, 1983.
1-L	Surface Boundary Line Agreement by and between Argentor Mining Corp., ASARCO INc., and Kerr-McGee Corp., dated May 23, 1983.
1-M	Fifth Amendment, dated 7/1/83, to Kerr-McGee and Asarco Operating Agreement of 10/1/72 - "Initial Exploration Period" extended to 10/1/90 & Asarco is obligated to spend $1,000,000 between 12/1/77 and 10/1/90.
	Letter Agreement, dated 8/5/83, between Asarco & Kerr McGee - re purchase of lease of Manchester Property, N.J.
1-N	Sixth Amendment, dated 3/20/84, to Kerr-McGee and Asarco Operating Agreement of 10/1/72 - Orb #10 added to Exhibit A of Agreement.
1-O	Seventh Amendment, dated 6/25/85, to Kerr-McGee and Asarco Operating Agreement of 10/1/72 - claims to be excluded Exhibit C, claims to be retained Exhibit B, which replaces claims in Exhibit A to Agreement.

ASARCO

Exploration Department
Southwestern United States Division

CERTIFIED MAIL
RETURN RECEIPT

July 10, 1986

Mr. Dean Bibles
State Director
Bureau of Land Management
U.S. Dept. of the Interior
P.O. Box 16563
Phoenix, AZ 85011

Mining Claim Annual Recordation
Trench Group (7)
A MC 50226 thru 50232

Dear Sir:

In accordance with the Federal Land Policy and Management Act (43 CFR, Part 3833.2), enclosed is an exact reproduction of the affidavit of assessment work, with mining claim serial numbers, as recorded in the Santa Cruz County Recorder's office in Docket 427, Pages 23 and 24, for the assessment year ending September 1, 1986.

Please return acknowledgement in the enclosed envelope.

Very truly yours,

William D. Gay

William D. Gay
Land Engineer

WDG:mek
enc.

cc: R. L. Brown
H. E. Kelshaw (w/enc.)
A. J. Robles (w/enc.)
J. D. Sell (w/enc.)

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

MICROFILMED INDEXED

AFFIDAVIT OF LABOR PERFORMED AND IMPROVEMENTS MADE

STATE OF ARIZONA)
) ss
County of Pima)

William D. Gay, being first duly sworn, deposes and says that he is a citizen of the United States and more than twenty-one (21) years of age, and resides in Tucson, County of Pima, State of Arizona, and is personally acquainted with the mining claims situated in the Harshaw Mining District, Santa Cruz County, Arizona, the names and books and pages of record in the office of the County Recorder of Santa Cruz County, Arizona, and the Bureau of Land Management serial number of the Notices of Location whereof are as follows:

NAME OF CLAIM	RECORDING DATA BOOK	PAGE	BLM SERIAL NO.
South Humbolt	007	360	A MC 50226
" " Amended	380	682 and 683	"
Humbolt	007	358	A MC 50227
" Amended	380	684 and 685	"
Silver Leaf	007	364	A MC 50228
" " Amended	380	686 and 687	"
Good Luck #2	007	366	A MC 50229
" " " Amended	380	688 and 689	"
Indian Chief	007	368	A MC 50230
" " Amended	380	690 and 691	"
Monoca	007	362	A MC 50231
" Amended	380	692 and 693	"
Good Luck	4	300	A MC 50232
" " Amended	382	575 and 576	"

The above described unpatented lode mining claims are located in Section 32 of Township 22 South, Range 16 East, and Section 5 of Township 23 South, Range 16 East, G&SRB&M.

That all of said mining claims are owned by ASARCO Incorporated, the mailing address for which is P.O. Box 5747, Tucson, Arizona 85703; that between September 1, 1985 and June 15, 1986, in excess of $700.00 worth of geologic studies, evaluation and improvements were done and performed for the benefit of the described claims. The studies, evaluation, and improvements were performed by F.R. Koutz, T. Dalla Vista, and J.D. Sell, ASARCO Incorporated, Tucson, Arizona.

Said labor was performed and improvements made at the expense of ASARCO Incorporated for the benefit of each and all of said mining claims comprising said contiguous groups as part of a general plan of exploration, improvements and development, and they tend to explore, improve and develop each and all of said mining claims. The amount expended for and the value of said labor and improvements is more that One Hundred Dollars ($100.00) for each of the mining claims and at least said amount was allocated to each of the mining claims. Said expenditure was made in good faith for the purpose of exploring, improving and developing said contiguous groups of mining claims, and was intended as annual labor and improvements for each and all of the above-described unpatented lode mining claims for the assessment year ending at 12:00 o'clock Meridian, September 1, 1986.

ASARCO Incorporated

By W. D. Gay

STATE OF ARIZONA)
) ss
County of Pima)

The foregoing instrument was acknowledged before me this 25th day of June, 1986, by William D. Gay.

Kathleen Ekelugen
Notary Public

My Commission Expires:
My Commission Expires July 7 1988

FEE NO. 03468

STATE OF ARIZONA County of Santa Cruz — SS.
I do hereby certify that the within instrument was filed and recorded at the request of ASARCO Inc.
on JUL 03 '86 - 10 10 AM Docket No. 427 Page 23-24
Records of Santa Cruz County, Arizona.
WITNESS my hand and official seal the day and year first above written.

COUNTY RECORDER SANTA CRUZ COUNTY STATE OF ARIZONA

MARY LOU G. SAINZ, COUNTY RECORDER
By Margarita Vergara
Deputy

JDS

ASARCO

Southwestern Exploration Division

March 26, 1987

R.L. Brown/F.T. Graybeal
NYO

Claim Map
Patagonia Mountains
Santa Cruz Co., AZ

Attached is F.T. Graybeal's surface geology map with faint claim boundaries (uncolored), along with a colored outline map of the claim blocks held at present. These are:

Asarco - Humbolt (Trench)	7	claims	(red)
Asarco - 3R Project	49	"	(green)
Noranda - Ventura Project	32	"	(brown)
Kerr-McGee - Thunder Mt. Project	93	"	(orange)
	181	claims	

These outlines are also shown on the four smaller sheets (except for Humbolt). The shaded claims are the ones we retained in 1985 after the reduction from the larger block as shown on the sheets. The Asarco Humbolt stayed as the original seven claims with no reduction.

It is my understanding that Mr. Brown wanted to drop the entire package to a 150 claim block ($15,000/year assessment work costs) and do this by shaving off the additional claims from the Thunder Mountain group and at the same time revamp the Kerr-McGee option and eliminate the $50,000 per year work commitment, of which Asarco is in arrears.

As noted on the colored claim map we still need a corridor of claims to tie into the Ventura Project.

If Asarco has an interest in potential ore in the Bisbee Formation, as found in the TCH holes to the north, then I'd be reluctant to drop the east half of the OCCI group of the Thunder Mountain Project. (As noted on the detailed claim map of the OCCI area, this block also contains the American Annex, Big Jim, and Campsite claims.) Asarco would also lose the main road access by deleting the east portion.

Asarco has a waiver from Noranda on the $40,000 work commitment for the year ending August 31, 1987, but Asarco will need to delete the work requirement from the Noranda option at some time in the near future.

Thus, it appears to me, in order to hold some semblance around the known and possible mineral zones of the Patagonia Mountains, Asarco can only shave about 20 claims from the present outline. This would be the 9 western

claims at Ventura, the 6 TM claims west of the OCCI group, and the adjacent 5 OCCI claims on the west side of the OCCI group. This reduction would not drop the entire block to the 150 claim goal.

Your input to the problem would be appreciated.

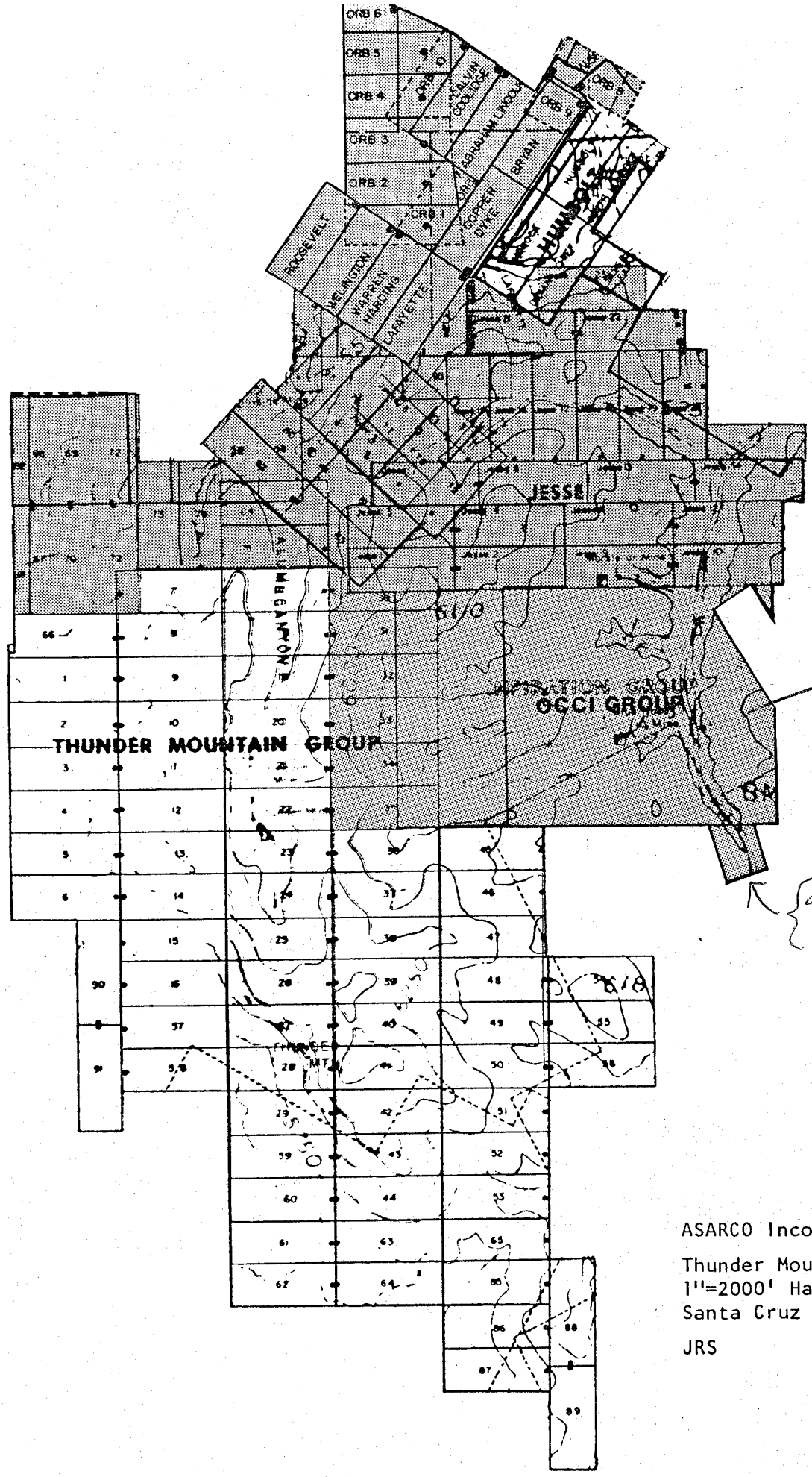
As Mr. Kurtz has noted, the dropping of the Ventura Project would meet the requirement of retaining a 150 claim block total.

James D. Sell

James D. Sell

JDS:mek
Atts.

cc: W.L. Kurtz (w/o atts)



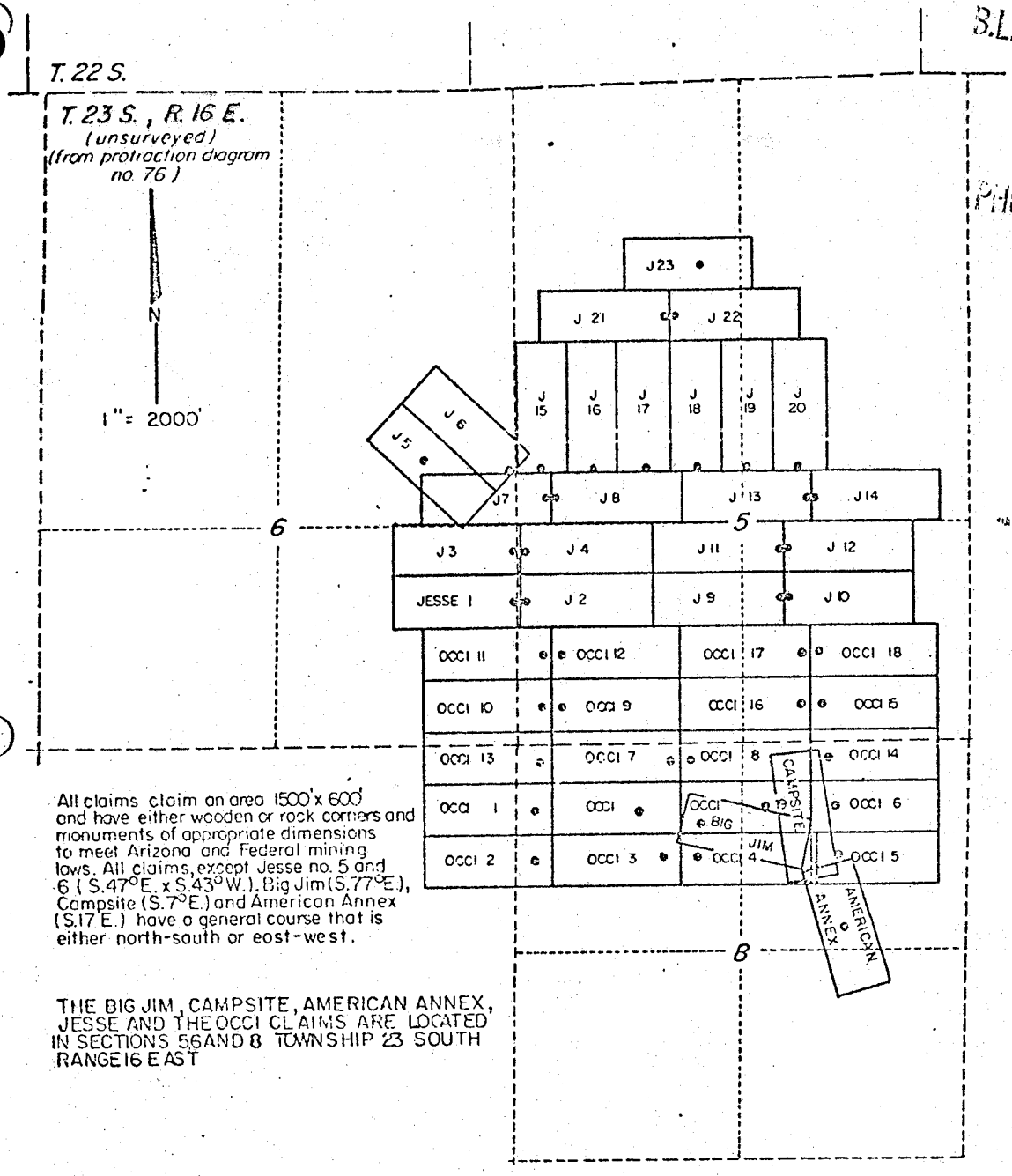
50-50 owned by ASARCO Ken-McGee from V. Hays. includes American Annex Big Jim Campsite

ASARCO Incorporated

Thunder Mountain Group
1"=2000' Harshaw Dist.
Santa Cruz Co.,Arizona

JRS mn6156 4/85

RECEIVED
B.L.M., ARIZONA STATE OFFICE
JUL 30 1979
10:00 A.M.
PHOENIX, ARIZONA



All claims claim an area 1500' x 600' and have either wooden or rock corners and monuments of appropriate dimensions to meet Arizona and Federal mining laws. All claims, except Jesse no. 5 and 6 (S.47°E. x S.43°W.), Big Jim (S.77°E.), Campsite (S.7°E.) and American Annex (S.17 E.) have a general course that is either north-south or east-west.

THE BIG JIM, CAMPSITE, AMERICAN ANNEX, JESSE AND THE OCCI CLAIMS ARE LOCATED IN SECTIONS 5 6 AND 8 TOWNSHIP 23 SOUTH RANGE 16 EAST

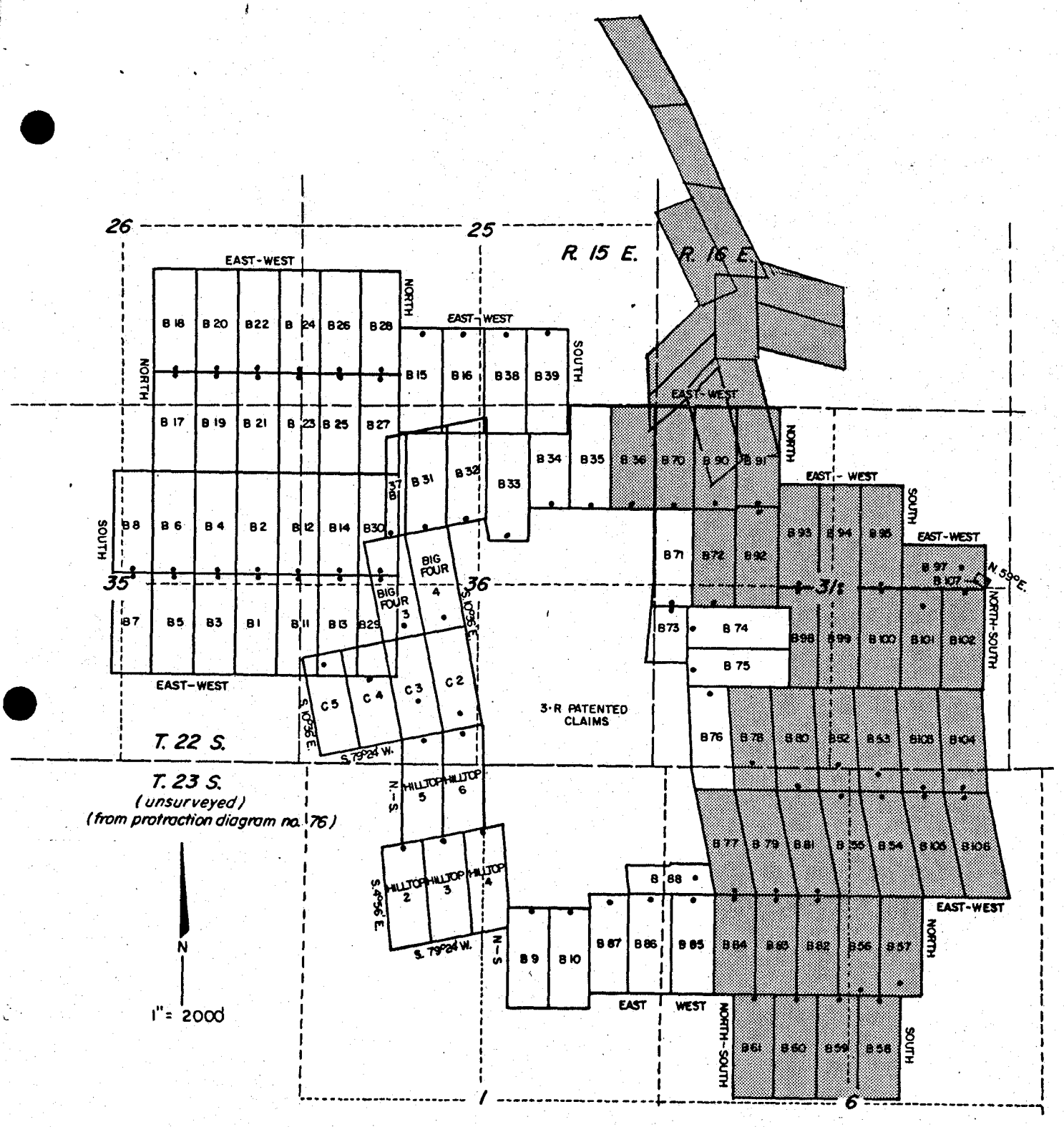
LODE CLAIM	ORIG. LOCATION NOTICE	/ DATE
JESSE NO. 9, 11-14, 19, 20	Kerr-McGee Corporation	/9-8-70
JESSE NO. 1-4, 6-8, 16-18	Oklahoma City, Ok.	/9-9-70
JESSE NO. 6, 21-23	"	/9-10-70
JESSE NO. 5	"	/9-29-70
OCCI	Inspiration Consolidated Copper Co.	/10-9-61
OCCI # 1, 2	P.O. Box 1321	/10-9-61
OCCI # 3-6	Claypool, Az 85532	/10-10-61
OCCI # 7-13	"	/10-11-61
OCCI # 14-18	"	/10-12-61
OCCI # 19	"	/1-18-62
BIG JIM	M. V. Hoy	/9-2-60
CAMPSITE	Sunnyside - Lochiel Star Route Box 205	/10-1-67
AMERICAN ANNEX	Patagonia, Az 85624	/10-1-67

OWNER
Kerr-McGee Corporation
Oklahoma City, Ok
ASARCO Incorporated
Tucson, Az. 85703

LODE CLAIMS IN
SANTA CRUZ CO.

ASARCO Incorporated
1150 NORTH 7TH AVENUE
TUCSON, ARIZONA 85703

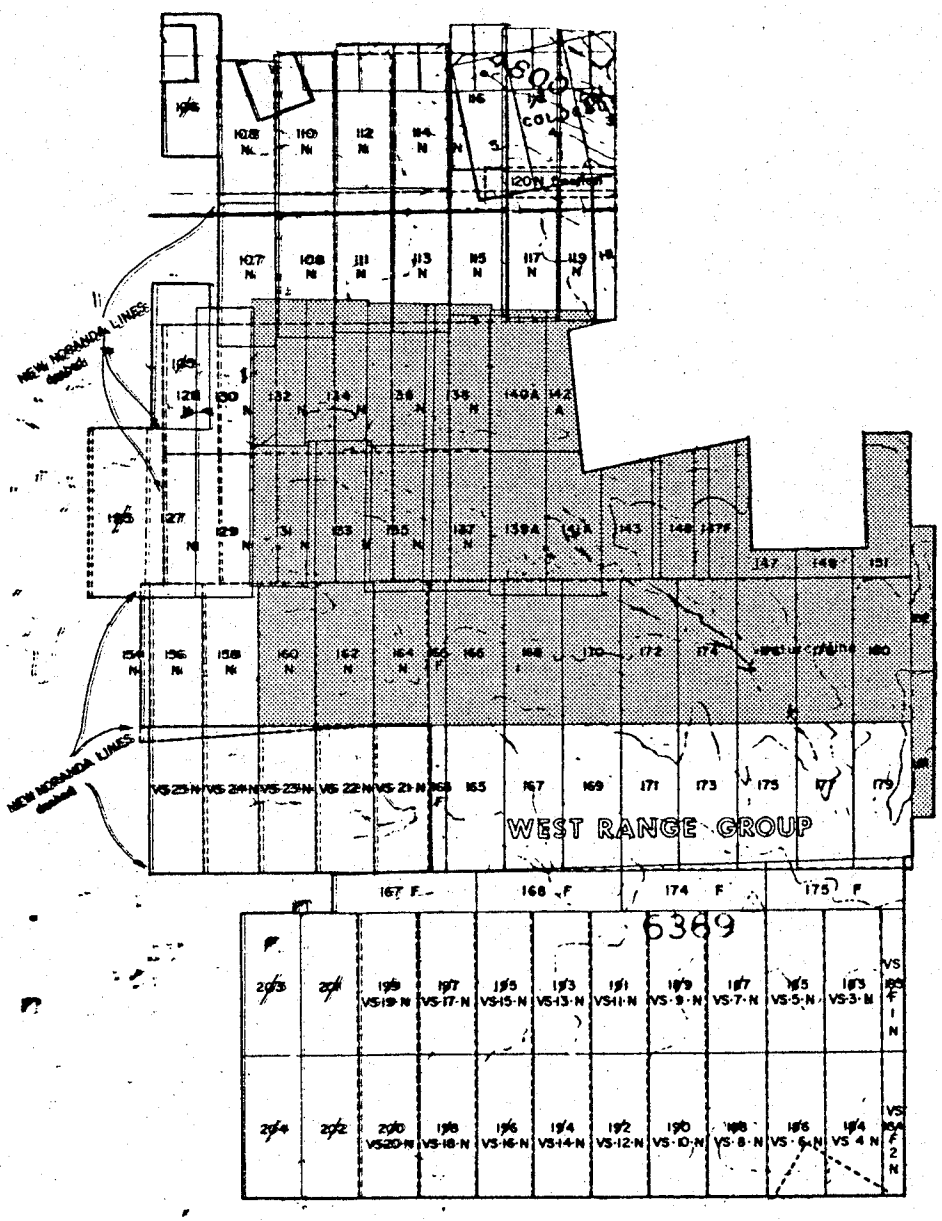
mn 5130r dam



ASARCO Incorporated

3-R Agreement Anaconda
1"=2000' Harshaw Dist.
Santa Cruz Co.,Arizona

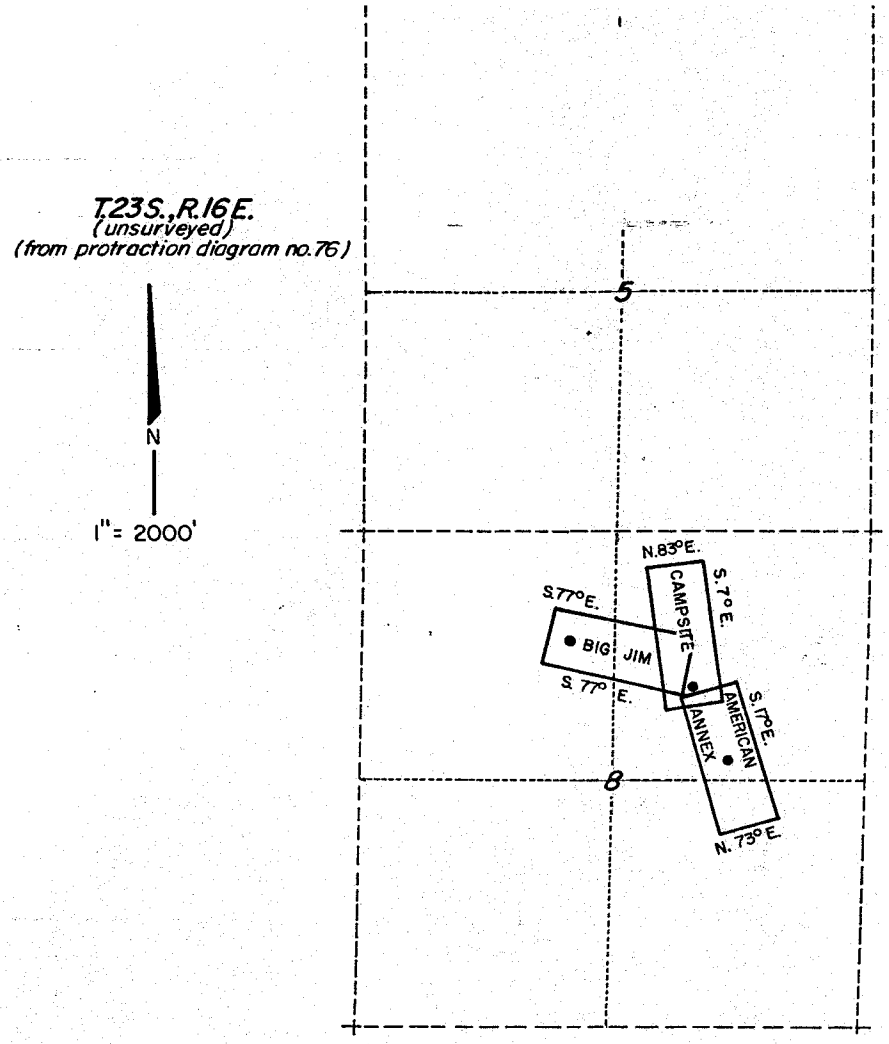
JRS mn6157 4/85



ASARCO Incorporated

West Range Group
1"=2000' Harshaw Dist.
Santa Cruz Co., Ariz.

JRS mn 6155 4/85



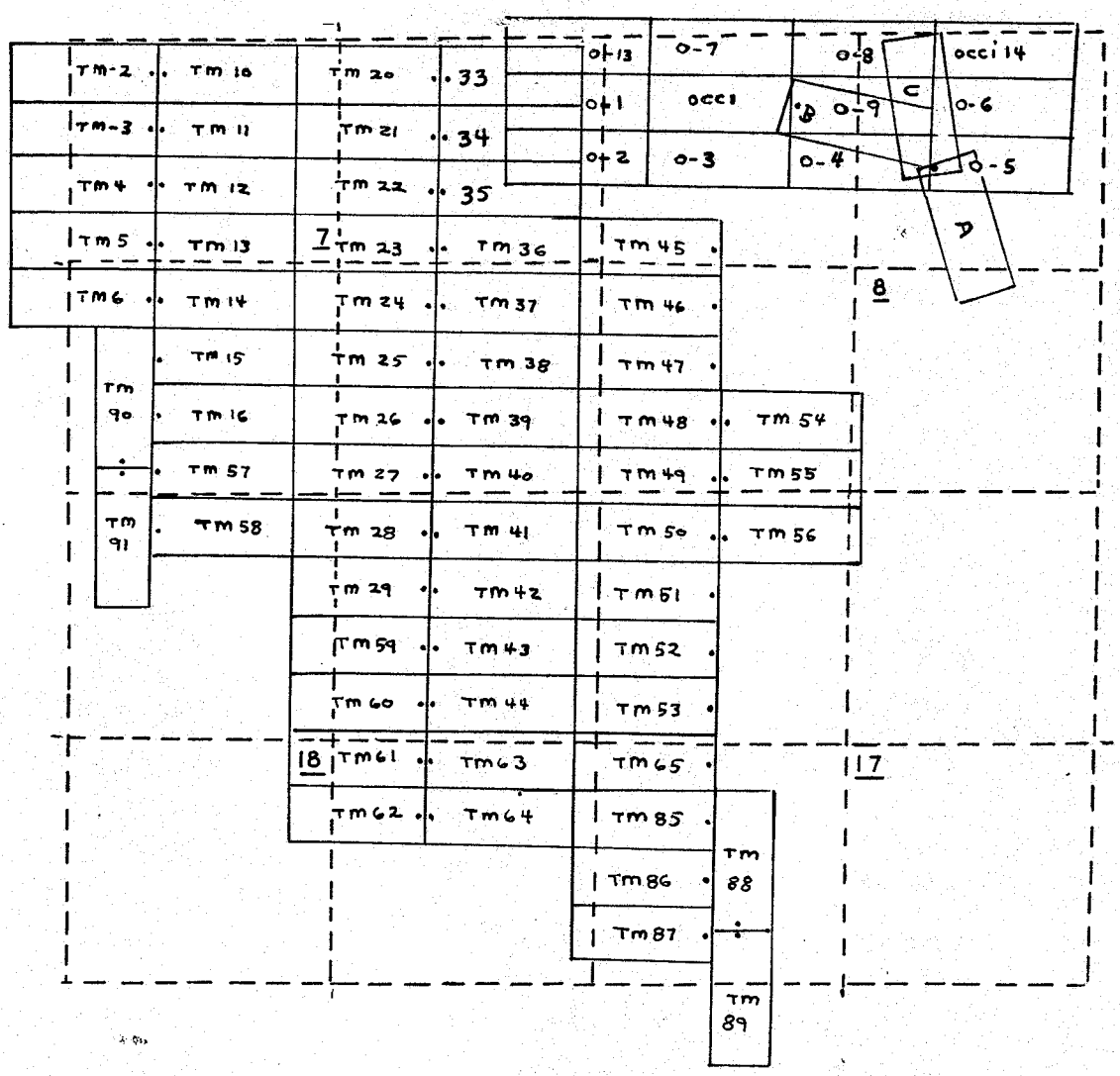
THE BIG JIM, CAMPSITE, AND AMERICAN ANNEX CLAIMS ARE LOCATED IN SECTION 8 OF TOWNSHIP 23 SOUTH, RANGE 16 EAST.

LODE CLAIM	ORIG. LOCATION NOTICE / DATE		OWNER
BIG JIM	M.V.Hay	/9-2-60	ASARCO Incorporated
CAMPSITE	Sunnyside-Lochiel Star Route Box 265	/10-1-67	P.O.Box 5747
AMERICAN ANNEX	Patagonia, Az 85624	/10-1-67	Tucson, Az 85703

LODE CLAIMS IN
SANTA CRUZ CO.

ASARCO Incorporated
1150 NORTH 7TH AVENUE
TUCSON, ARIZONA 85703

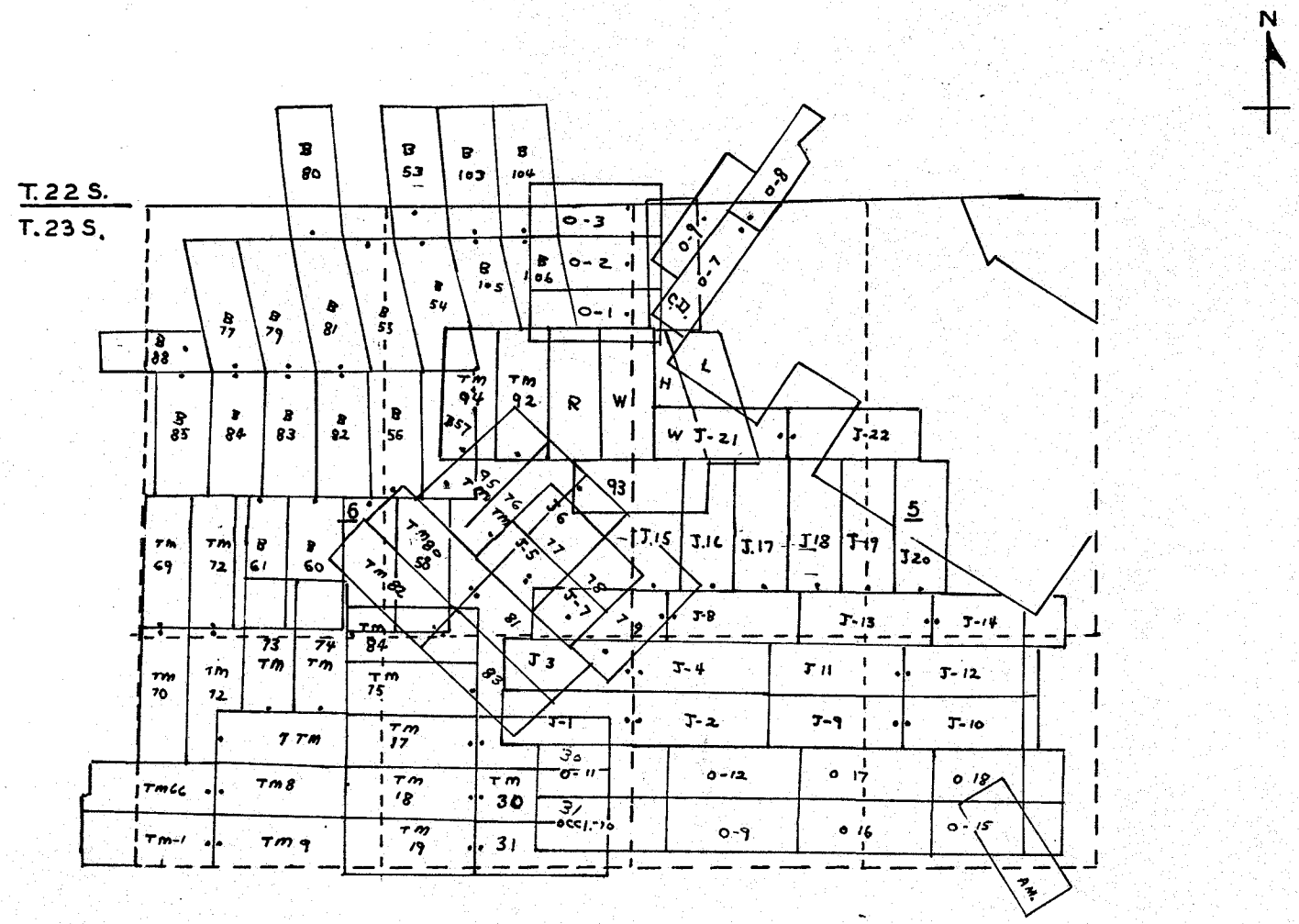
mn 5130 s dam



A. AMERICAN ANNEX, B. BIG JIM
C. CAMPSITE
THUNDER MOUNTAIN & OCCI CLAIMS _____ LOCATED IN THE ____ 1/4
OF SECTION _____ T. 23 S. R. 16 E. G.&S.R.B.& M.
SANTA CRUZ COUNTY, ARIZONA.

NOTE: FROM PROTRACTION DIAGRAM NO. 76

SCALE: 1" = 2000'



ORB, BOOT, ROOSEVELT, WELLINGTON, HARDING, WARREN, AMERICAN, JESSE,

& THUNDER MOUNTAIN CLAIMS _____ LOCATED IN THE _____ 1/4
OF SECTION _____ T. 23 S. - R. 16 E. G.&S.R.B.&M.
SANTA CRUZ COUNTY, ARIZONA

NOTE: FROM PROTRACTION DIAGRAM NO. 76

SCALE: 1" = 2000'

ASARCO Southwestern Exploration Division

JDS

Mary
Inform Sell
Copy went to Graybeal
9/1/87

September 1, 1987

To: J.D. Sell

From: F.R. Koutz

Annual Report
DDH TM-14 (3500-3599')
Thunder Mtn. Project (EA 0042)
Santa Cruz County, AZ

DDH TM-14 was deepened 99 feet to 3599' depth for assessment work for the 181 remaining Exploration Dept. claims in the Patagonia Mountains. Drilling problems forced reduction of the hole NX to BX and leaving 900 feet of NX rod (BX casing) in the hole with only about 15% of appropriated funds used for deepening. The hole continued in phyllically-altered Quartz Monzonite Porphyry containing an estimated X00 ppm sphalerite > chalcopyrite and 3-6% disseminated > veinlet controlled pyrite as it has since 2560' depth. No new information on depth to the Paleozoic sediments is indicated in this year's drilling.

Attached is the 1985 Operations/Geology Report on TM-14 for background. This hole is cased with 2613' of NC rods (Asarco owned), and was opened to 3500' depth NX from 1984 and 1985 (3075-3500') drilling. Joy Mfg. (R.A. Gardner, lead driller) started operations 6 July and by 8 July had reached TD @ 3500' and was washing out old settled cuttings/conditioning hole. On the second shift the rods began to seize up, bind and eventually became stuck, apparently up the hole from the bit. After a week of fishing for broken rods after numerous pulling attempts including a number of bbl. of diesel and old oil injected, the hole was converted to BX and drilled to 3599 feet with few problems. The NX rods were then cut @ 2600' depth 13 feet up inside the NC rods leaving us the reluctant owner of 900' of NX rods stuck between 2600 and 3500' depth. There should not be any significant problems re-entering this hole for deepening. I strongly suspect that the use of the more convenient, more expensive "E-Z Mud" rather than the conventional bentonite-based (+ Cellex-Dextrid) mud used previous to 1985 in all our deep drilling contributed to the stuck rods and the loss of NX drilling. What does Joy say about this? JDS

JDS note WK

The geology in this year's 99 feet of BX core was not significantly different than the 425' of NX core drilled in 1985. No significant changes with depth were noted in an hour's quick-logging for this year's core. Detailed logging, splitting a few intervals for character assay with thin section will await a reasonable batch of core.

The rock is Quartz Monzonite Porphyry to Monzonite Porphyry and has been (except for a 6' IBX zone @ 3100') since 2560'. The QMP is moderately to strongly phyllically altered with quartz-sericite-pyrite veinlets and sericite-disseminated pyrite flooding of QMP matrix. Feldspar phenocrysts have been altered to tan sericite-clay and biotite to tan sericite (?). A few ½-5' zones show aplitic-micrographic texture with greenish altered feldspar and pink K-feldspar-rich groundmass. Pyrite ranges from 3-6 and locally 8% probably averaging 5% with disseminated usually 2:1 or 3:1 to veinlet-controlled pyrite. Traces of chalcopyrite and grey-black sulfide (probably mostly sphalerite) both with traces of covellite tarnish probably amount to 500-1500 ppm Zn and 200-500 ppm Cu, are mostly disseminated and less than several 100 feet up the hole in general. Rare late milky quartz ± MoS_2 veinlets were noted. Fracturing and the amount of white chalky sericite-clay did decrease somewhat with depth in the 99 feet drilled. No calcite veinlets or any other potential indication of the Paleozoic were noted.

From the dip projected on the contact from DDHS TM-13/RH-1 to TCH-2 to TCH 2A, the Paleozoic could be as deep as 5100 feet depth in TM-14 (see Section Y-Y' (MVK 5334) - TCH 2, 2A reports). However, the shape of the QMP pluton is impossible to predict and may have completely cut out the Paleozoic. As stated in 1985, if by the time we have reached 4500 feet and have not hit the Paleozoic or other strongly encouraging mineralization or geology we should consider doing another TCH-2 drill out rather than continued deepening of TM-14 (or even an easterly drill-out of TM-14). This may be advisable even shallower in TM-14 or sooner since contractual requirements with Kerr-McGee have changed (?) not requiring us to drill on the TM side of the line with Mendoza/Humbolt/Trench. Again as in 1985, the back-to-back or "full-funding-to-finish" recommendation remains. Unfortunately our dire 1985 predictions of hole conditions/costly casing came true this year. I rather doubt that at present drilling rate we would ever reach 5100' BX.

with Agees.

F. R. Koutz

FRK:mek
Att: 1985 TM-14 memo

cc: W.L. Kurtz
F.T. Graybeal

ASARCO

Southwestern Exploration Division

October 1, 1985

F. T. Graybeal
New York Office

1985 Operations/Geology
Thunder Mt. Project (EA-0042)
Santa Cruz Co., AZ

Attached is F.R. Koutz's report on the drilling in TM-14 for this year's assessment work. The work also covered the 3-R and Ventura claims under control of Asarco's joint ventures.

I agree with Koutz on the double assessment work next year for the reasons stated. A secondary reason is that we have been able to drill the hole NX with only the first casing in the NC portion of the hole to 2613 feet. This last 900 feet of open hole is at present quite stable in the porphyry, but it is unlikely that another year of 500 feet of drilling will leave the open portion in good shape for reentry and a new set of costly casing may be necessary to ensure reentry. However, by continual drilling over two assessment years, we may be able to continue the hole to the depth that further decisions can be made as stated by Koutz.

James D. Sell

James D. Sell

JDS:mek
Att.

cc: W. L. Kurtz
F. R. Koutz

ASARCO

Southwestern Exploration Division

September 23, 1985

To: J. D. Sell

From: F. R. Koutz

1985 Operations/Geology
Thunder Mt. Project (EA-0042)
Santa Cruz Co., AZ

Operations

From July 29 to August 14, Joy Manufacturing (John Sanchez, driller) deepened DDH TM-14 425 feet (NX) from 3075-3500'. Minor problems were encountered getting back to bottom below the NX casing (2613') due to settled cuttings, bridges and rig in poor repair (disuse), but otherwise drilling (2 shifts) went well. D.A. Melhado handled all field supervision. The hole was left full of thick EZ-mud and capped for next re-entry. Costs are tabulated below. Although the cost of EZ-mud ($.94/ft.) was more than the Cellex-Dextrid - bentonite mud mixture used previously ($0.67/ft.-1984) it was more convenient for this short job but I don't think it works as well.

Item	Cost	Cost/Ft.
Drilling (NX)	$10,922.50	$25.70
Mobe & demobe	1,000.00	2.35
EZ-mud	400.68	.94
Water truck	304.50	.72
Re-entry	1,017.00	2.39
Misc.	73.35	.17
Road work	360.00	.85
	$14,078.03	$33.12

Administrative - property, geology and drafting salaries were added to make the required expenditures on the 181 claims in the revised Thunder Mt., 3-R, Ventura and Mendosa claim blocks assessed by this work. All State water and Forest Service permit work has been completed.

Geology

The core has been logged and ten intervals will be split for character assay. The hole was surveyed to 3050' depth in 1984 and was 33' N13E of the collar (1¼° from vertical and trending N71E) at that depth.

When we left TM-14 in 1984 the hole was in Quartz Monzonite Porphyry (QMP) after passing through the Chief lithic lapilli tuff and tuff breccia to 2155', the Quartz Feldspar Porphyry (QFP) from 2155 to about 2560' which is apparently intrusive into the QMP which continued to 3075'. The 425'

drilled this year continued in QMP to TD with the partial exception of an intrusive breccia (IBX) and associated intrusion breccia from 3094.5-3100'. The IBX zone included 20-30% fragments of Chief tuff, QFP, and Hardshell ash-flow breccias and tuffs. In DDH TCH-2/2A some 1000-1200' ENE the hole had passed into Hardshell ignibrites-hornfels by 3000' depth. TM-14 is passing through a thicker QMP section than TCH-2 either due to the attitude of the QMP body or nearness to the QMP source.

The QMP in TM-14 2560-3500' is much more strongly quartz-sericite-pyrite stockwork veinlet altered than the QMP in TCH-2. In addition a local micropegmatic micrographic-aplitic textured ground mass is more common in the deeper parts of TM-14 and is similar but considerably more fine-grained than that in the Jurassic Monzonite over the Ventura deposit some 2 miles to the SW.

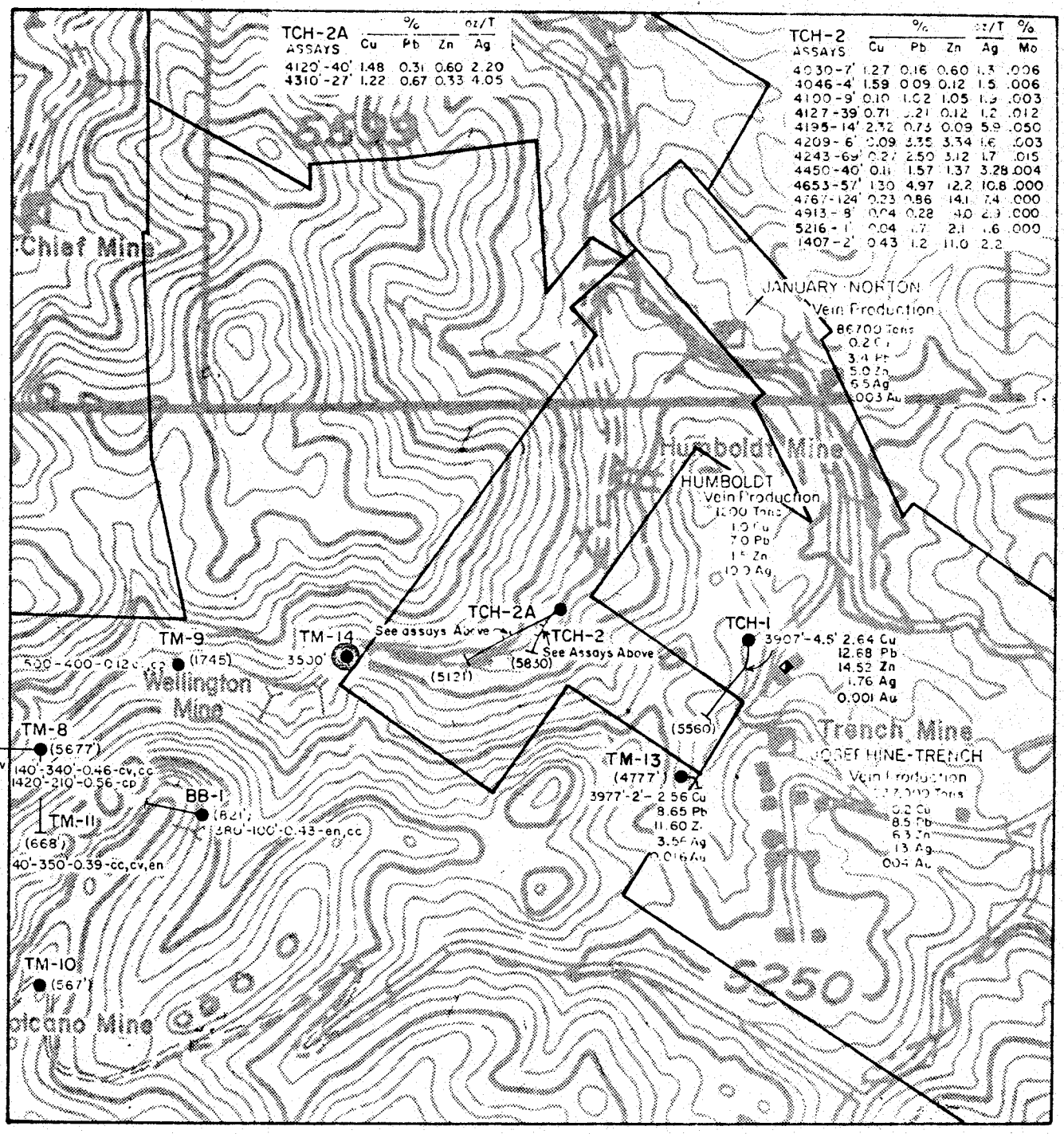
The quartz-sericite (and pyrite) is particularly strong around the IBX in TM-14. Pyrite ranges from 4-7% outside the IBX zone and immediate halo (8-12% py inside). Several tenths percent chalcopyrite--mostly disseminated--with traces of bornite and secondary covellite-chalcocite is common to about 3300' depth, but only traces were noted below. Trace to several tenths percent sphalerite are found in this year's drilling--possibly with a slight increase with depth. Rare molybdenite is mostly found in late white quartz veinlets.

In summary, little additional information was provided this year on when TM-14 will pass into the Paleozoic or even out of the QMP. The Paleozoic has been previously predicted after TCH-2/2A to be as deep as 4300-5000' depth. Deepening of TM-14 should be continued next year and again I strongly recommend that we save our dollars and drill a 2-year back-to-back assessment program which should give us enough money for 900-1000' deeper. If by the time we reach 4500' depth we have not hit the Paleozoic or other strongly encouraging mineralization or geology, we should consider abandoning, at least temporarily, TM-14 and do another drill out of TCH-2/2A to better define our known skarn/limestone replacement Ag-Zn-Pb-Cu intercepts.

As a reminder over the next several years, if funded, the University of Arizona Geosciences Dept. (under Titley and Davis) will be doing considerable geologic work in the Northern Patagonia Mountains including mapping, age-dating and structure-geomorphology in support of the planned study and deep drilling under Red Mountain. This work should be of direct benefit to continued exploration in the Patagonias and we should keep close track of what is being done and might even help guide parts of it.

F. R. Koutz

FRK:mek
Att: MVK 4048



EXPLANATION

- ASARCO INC. Trench Group
- ASARCO-Kerr McGee Thunder Mtn Joint Venture
- ASARCO-Anoconda 3R Joint Venture
- Mendoza-Humboldt Group (ASARCO INC.)
- Kerr-McGee-Red Mtn.
- Lichty-Argentor

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

⊙ Proposed drill hole

ASSAY DATA KEY

depth-length-%Cu-mineral

3860'-350'-0.59-cp

GEOLOGIC LEGEND

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

TO ACCOMPANY 3RD QUARTER REPORT
DATED 9-23-85
BY F.R. Kourz

DRILL MAP

TRENCH PROJECT & THUNDER MTN. PROJECT

PATAGONIA MTNS.

Santa Cruz County, Arizona

SCALE: 1" = 1000'

F.R.K Dec., 1981

MVK 4048

JDS

ASARCO

Exploration Department
Southwestern United States Division

April 20, 1989

See note on yellow sheet for new MGR for 1990

Mr. W.K. John
Manager - Mineral Lands
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, Oklahoma 73125

405/ 270-3326
→ Sr. Staff Landman

Thunder Mountain Project
Summary Thru Feb. 1, 1989
Santa Cruz County, AZ

Dear Mr. John:

As per Article 2(f) of the Eighth Amendment to the Operating Agreement, dated January 1, 1988, between Kerr-McGee Corporation and ASARCO Incorporated, I submit this Summary of Activities for the year 1988.

Quarterly Reports for 1988 have been submitted. As restated, the Asarco drill hole TM-14 was at a depth of 3599 feet, with the last 99 feet as open hole. It was anticipated to reenter the hole and continue to the target depth of 5100 feet.

Before the hole could be reentered, it was necessary to have a Forest Service archaeology permit for the TM-14 area. On July 27, 1988 the Forest Service approved the site area for continued drilling use.

TM-14 was reentered on August 15, 1988, and coring continued from 3599 feet to 4587 feet in weakly altered and mineralized intrusive. Asarco will sample and analyze sections of this core at some future time.

At the depth of 4587 feet, the BX core barrel/bit assemblage became stuck and the assemblage and ten feet of rods were lost. In reentering the hole to set a wedge to by-pass the abandoned barrel/bit, the wedge prematurely sheared at a depth of 4021 feet. While working to recover the sheared wedge assemblage, the drill string became separated at 1760 feet. Further work failed to reestablish the drill string and hole TM-14 was declared totally abandoned.

Sufficient work had been accomplished to satisfy the yearly assessment work for the years ending September 1, 1988, and September 1, 1989. Both of these Affidavits have been recorded with the County and with the BLM and confirming copies have been submitted to you.

Expenditures to the end of 1988 amounted to $493,705 credited against our commitment of $1,000,000.

Attached are maps showing the location of the Thunder Mountain Project and a topographic map showing the location of drill hole TM-14, and the previous drill holes within the map area.

Further evaluation of the Thunder Mountain Joint Venture area will be of the high-grade sections.

Sincerely,

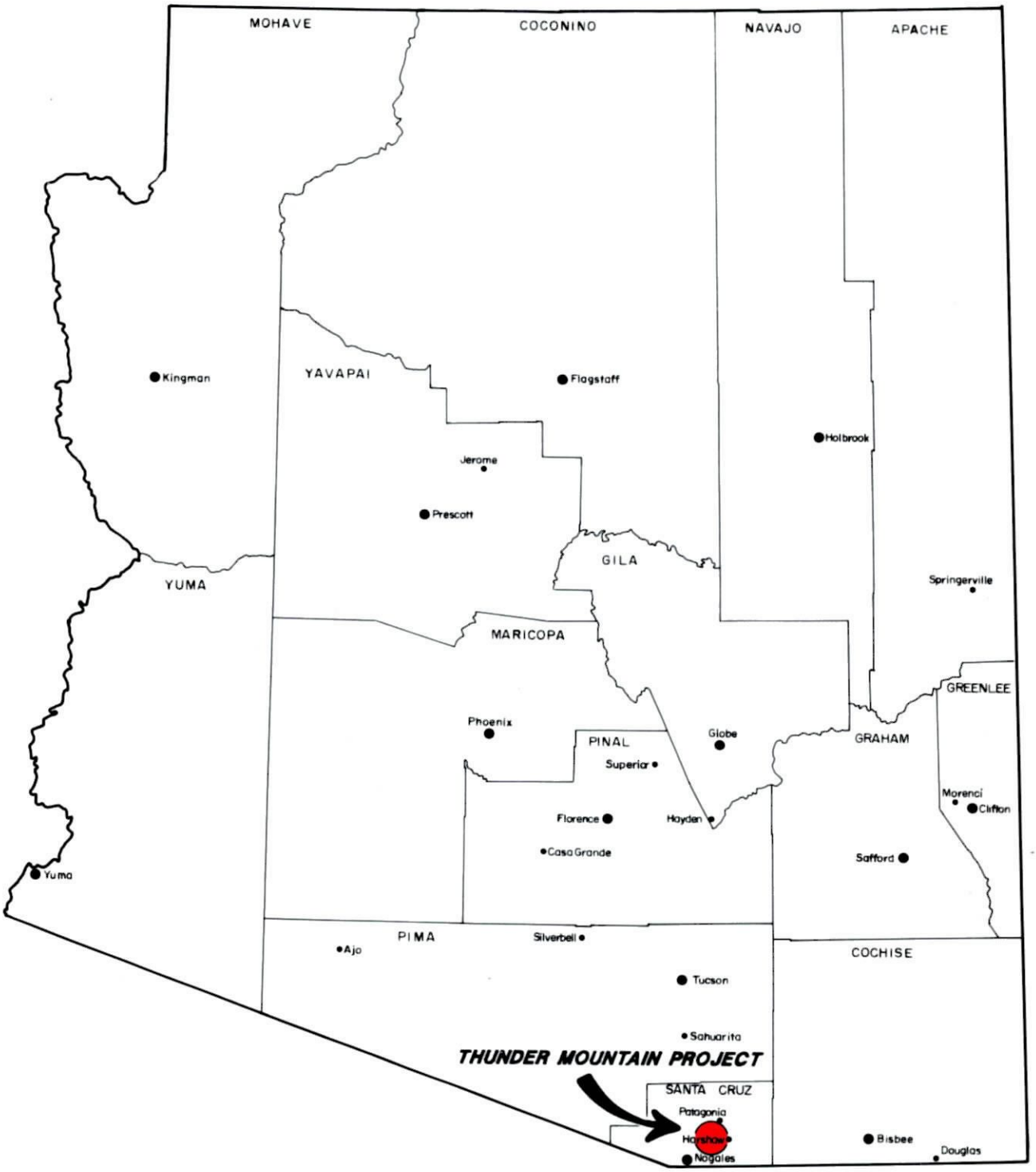
James D. Sell

James D. Sell

JDS:mek
Att.

cc: W.L. Kurtz
F.T. Graybeal

ATTACHMENT A



ASARCO Incorporated

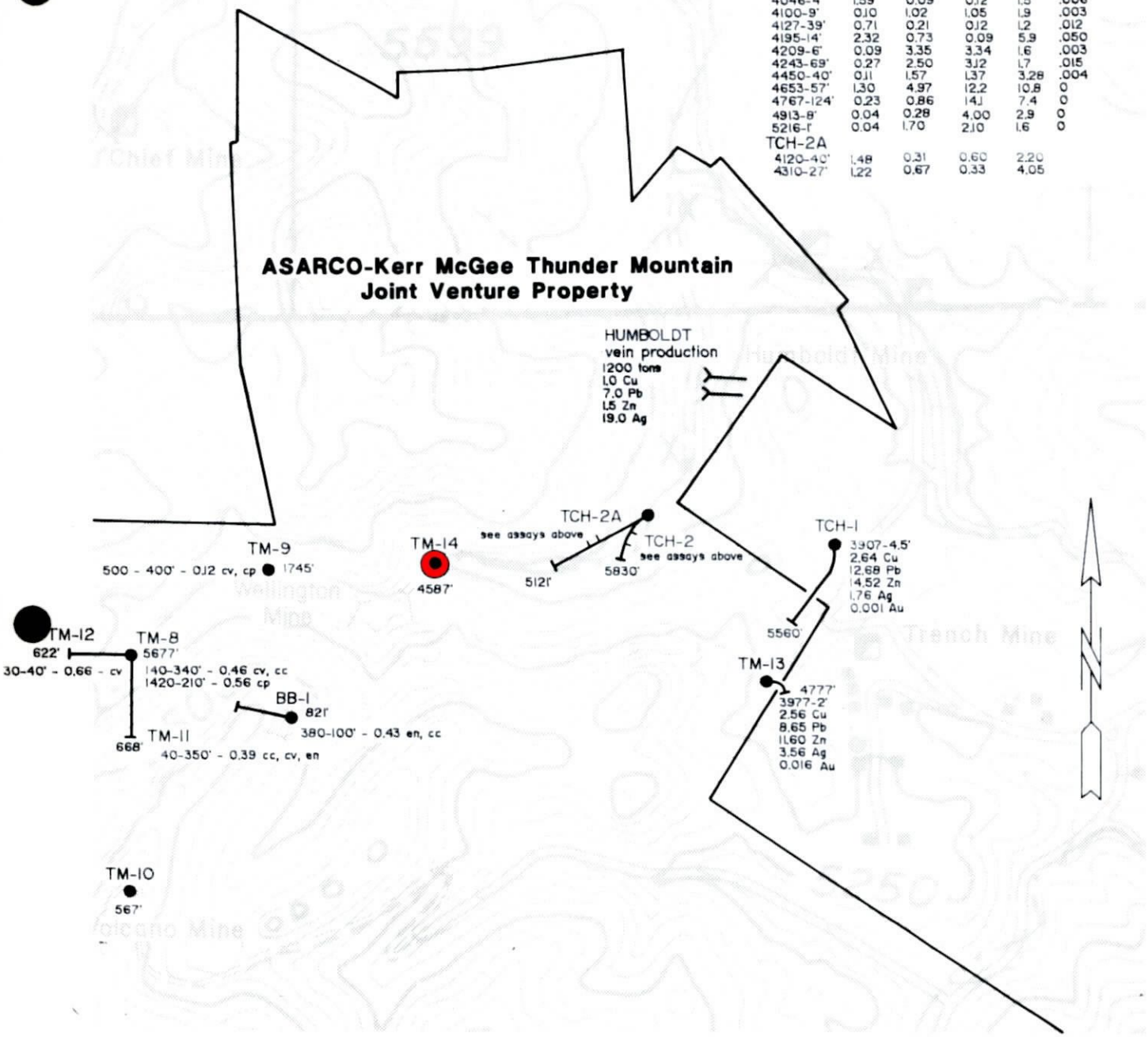
INDEX MAP

THUNDER MOUNTAIN PROJECT
SANTA CRUZ CO.,ARIZONA
J.D.S. 4-88

0 50
MILES

mn6599 JDS/dam tuc 4-88

TCH-2 ASSAYS	% Cu	% Pb	% Zn	opt Ag	% Mo
1407-2'	0.43	.20	1.0	2.2	-
4030-7'	1.27	0.16	0.60	1.3	.006
4046-4'	1.59	0.09	0.12	1.5	.006
4100-9'	0.10	1.02	1.05	1.9	.003
4127-39'	0.71	0.21	0.12	1.2	.012
4195-14'	2.32	0.73	0.09	5.9	.050
4209-6'	0.09	3.35	3.34	1.6	.003
4243-69'	0.27	2.50	3.12	1.7	.015
4450-40'	0.11	1.57	1.37	3.28	.004
4653-57'	1.30	4.97	12.2	10.8	0
4767-124'	0.23	0.86	14.1	7.4	0
4913-8'	0.04	0.28	4.00	2.9	0
5216-1'	0.04	1.70	2.10	1.6	0
TCH-2A					
4120-40'	1.48	0.31	0.60	2.20	
4310-27'	1.22	0.67	0.33	4.05	



EXPLANATION

821' BB-1 Drill hole showing depth

Proposed or deepened drill hole

ASSAY DATA KEY
depth - length - % Cu-mineral

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

ASARCO Incorporated
THUNDER MOUNTAIN PROJECT

DRILLING PROGRESS

PATAGONIA MOUNTAINS
SANTA CRUZ COUNTY, ARIZONA

0 1000'

mn6692 JDS/dam tuc 04-21-89

New man → for Yearly reports etc
Spring 1990 : cc to WIL John

L. A. Robbennolt 405/270-3975
Manager of Mineral Lands

Copy of Accounting Sheet last year.
Map of Lands surrounding.

FORM ME-3

MINE EXAMINATION & DEVELOPMENT EXPENSE
SOUTHWEST EXPLORATION DIVISION

PROJECT - Thunder Mountain Prospect MONTH - December 1988

DEPT./ COST CENTER (30-33)	EXP. NO. (34-36)	EXPLANATION (54-71)	MONTH (43-53)	YEAR	TO DATE
502	950	Option Payments	0	0	0
503	950	Bonus Payments on Mineral Land	0	0	0
504	950	Minimum Royalties Deductible	0	0	0
505	950	Minimum Royalties Non-Deductible	0	0	0
506	950	Mineral Property - Rental	0	0	0
507	950	Staking Claims	0	0	0
512	750	Underground Excavating	0	0	0
521	400	Drilling Supplies	0	0	0
521	750	Surface Drilling	6,881	44,985	44,985
522	750	Underground Drilling	0	0	0
530	400	Geologic Supplies and Expenses	0	0	0
540	750	Sampling, Assay, Lab.	0	0	0
550	750	Geophysics	0	0	0
570	750	Engineering	0	0	0
580	750	Construction - Temporary	0	0	0
581	750	Road Maintenance	0	0	0
590	750	Construction - Permanent	0	0	0
610	400	Field Camp Expense	0	0	0
620	100	Salaries - Geologic Admin.	0	3,360	3,360
620	130	Additional Compensation	0	0	0
620	150	Labor Wages - General	0	0	0
620	200	Overhead from General & Others	0	974	974
620	220	Social Security Tax	0	0	0
620	230	Group Life Insurance	0	0	0
620	240	Retirement Annuity	0	0	0
620	270	Savings Plan	0	0	0
620	300	Medical and Surgical	0	0	0
620	310	ASARCO Health Plan	0	0	0
620	320	ASARCO Dental Plan	0	0	0
620	330	ASARCO Vision Plan	0	0	0
620	350	Equipment Rental	0	0	0
620	390	Repairs and Maintenance	0	0	0
620	440	Office Supplies & Expenses	6	16	16
620	500	Telephone & Communications	0	0	0
620	530	Postage and Box Rent	0	0	0
620	550	Express and Freight	0	0	0
620	600	Travel Expense	0	0	0
620	601	Travel Expense - 80% Limit	0	211	211
620	680	Insurance	0	0	0
620	710	Memberships & Donations	0	0	0
620	720	Newspapers, Periodicals	0	0	0
620	750	Accounting	0	0	0
620	753	Legal Expense	0	0	0
620	754	Outside Professional Services	0	0	0
620	755	Permits	0	0	0
620	780	Fuel, Power, Water	0	0	0
620	790	Rent of Building and Grounds	0	0	0
620	800	Taxes - Sales, Property, Etc.	0	7	7
620	950	Environmental Expense	0	0	0
620	951	General Administration - Other	0	52	52
641	400	Automobile, Vehicle Expense	0	542	542
641	662	Depreciation - Automobile	0	0	0
509	660	Depreciation - Equipment	0	0	0
650	950	Partners' Share	0	0	0
		Total expenses through 12/31/87			635,953
		Total	6,887	50,147	686,100
		TOTAL AUTHORIZED			718,000
		UNEXPENDED BALANCE			31,900

AUTHORIZATION ASSIGNED BY N.Y.O.:

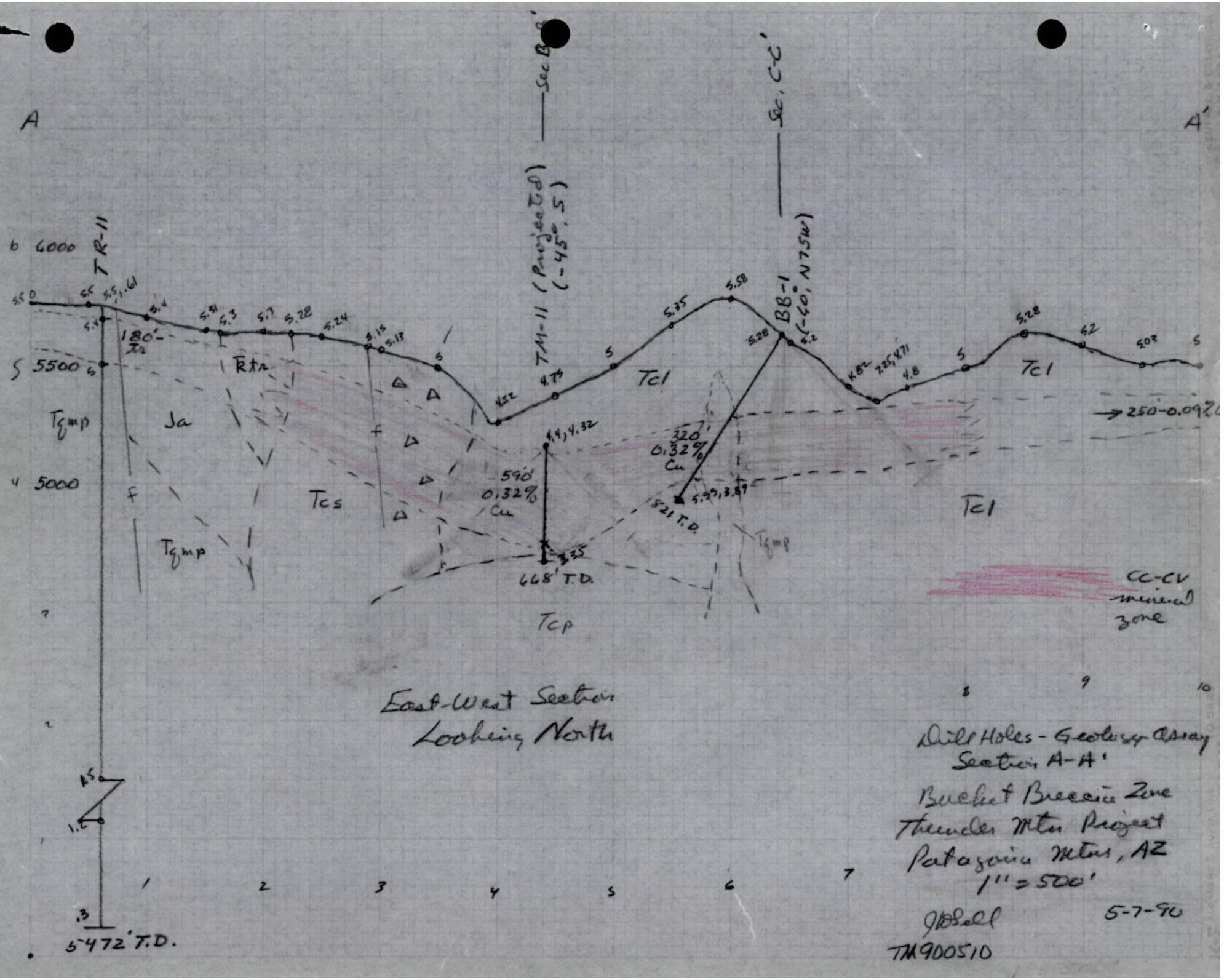
NUMBER	DATE	AMOUNT
0042-00/11		668,000
0042-12		20,000
0042-13	8/9/88	30,000

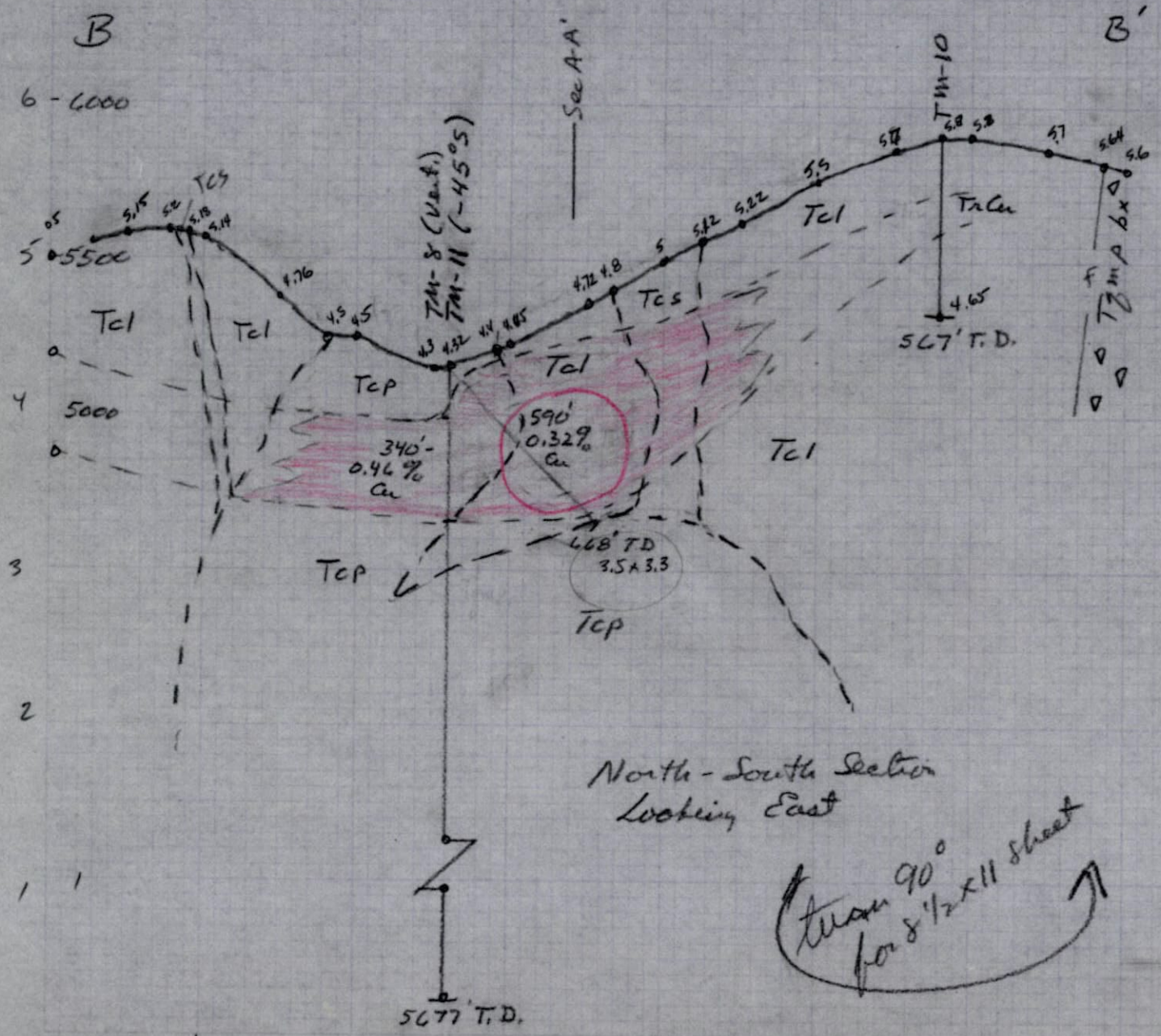
RJO'K RLB RJK ADC TES JDS CLS File - 2

ASARCO Incorporated

JAN 13 1989

SW Exploration


A
A'
Sec B-B'
Sec. C-C'
TR-11
TM-11 (Projected) (-45°, S)
BB-1 (-40°, N75W)
6000
5500
5000
180'
590' 0.32% Cu
320' 0.32% Cu
668' T.D.
521' T.D.
5472' T.D.
250'-0.092
Tqmp
Ja
Rtr
Tcs
Tcp
Tcl
CC-CV mineral zone
East-West Section
Looking North
Drill Holes - Geology & Assay
Section A-A'
Bucket Breccia Zone
Thunder Mtn Project
Patagonia Mtns, AZ
1" = 500'
5-7-90
TM900510

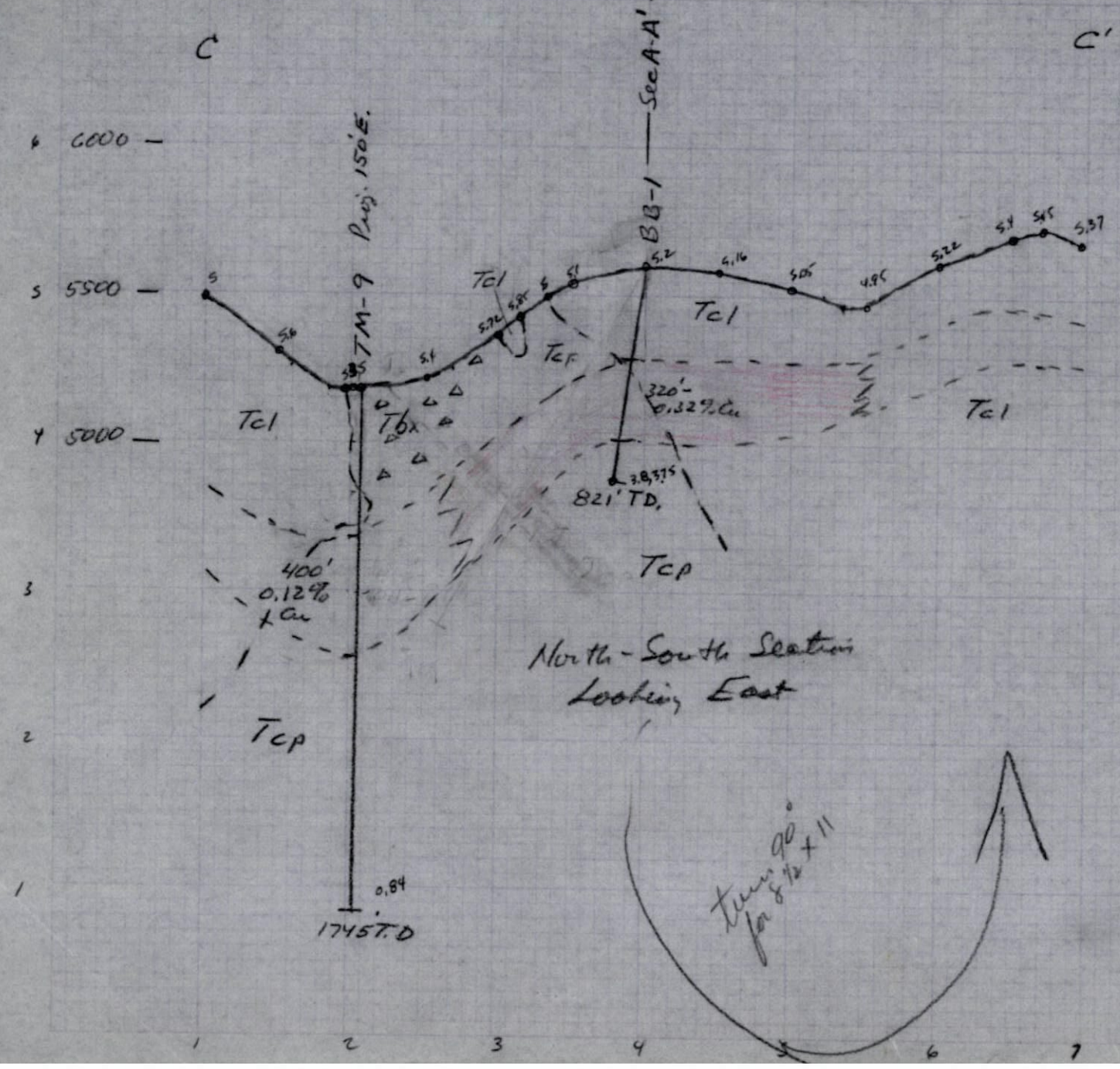


Oracle Hills-Geology-Discovery
Section B-B'
Bucket Breccia Zone
Thunder Mtn Project
Patagonia Mtns, AZ
1" = 500'

5-7-90

CC-CV
mineral
zone

TM 900511

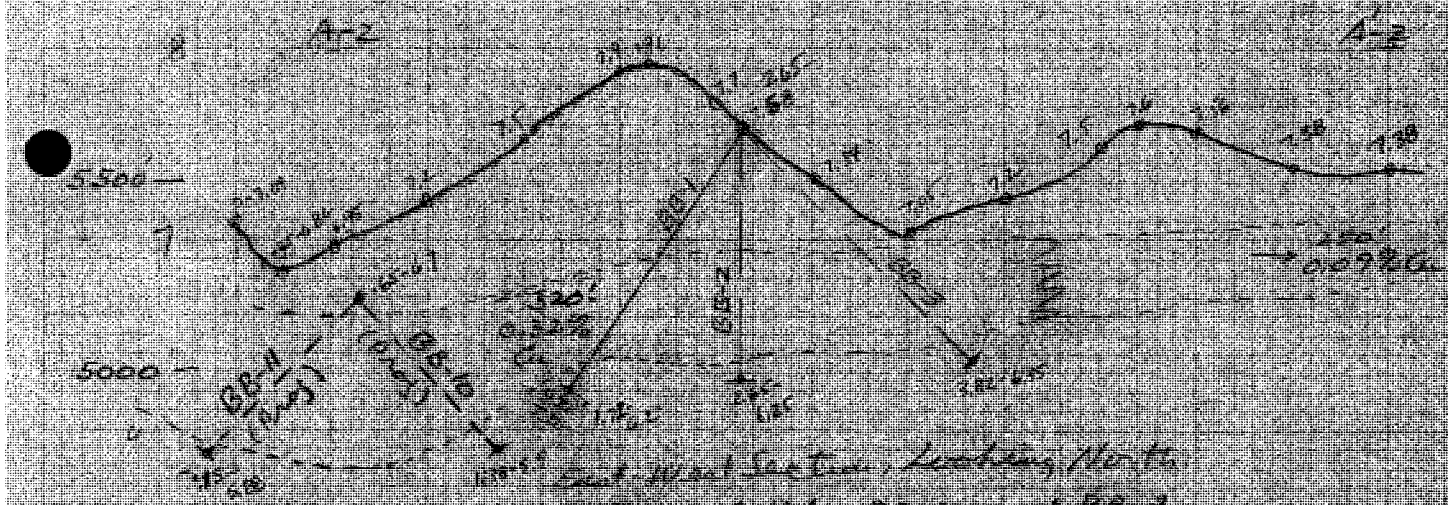


Drill Holes - Geology - Assay
Section C-C'
Bucket Breccia Zone
Thunder Mtn Project
Pataguania Mtns, AZ
1" = 500'

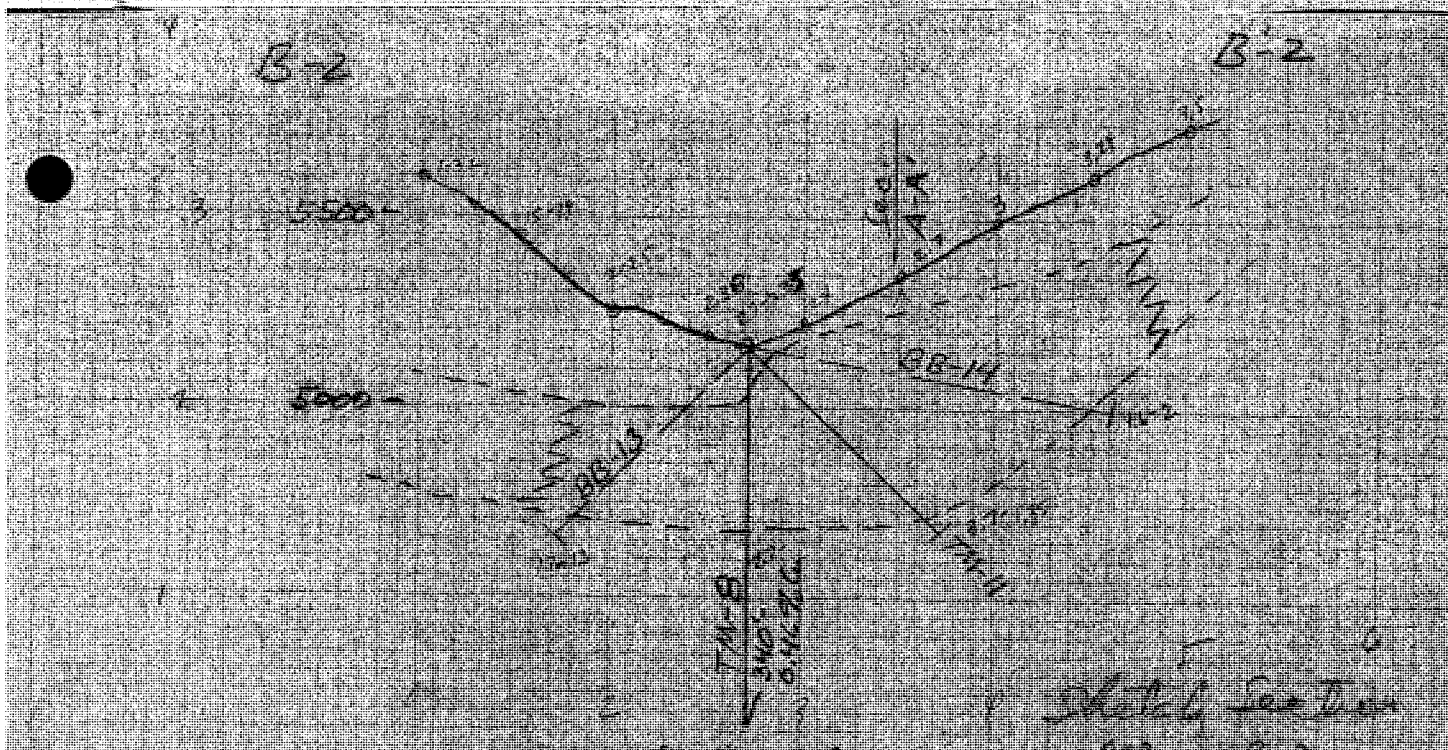
5-7-90

CC-CV mined zone

TM 900512



East-West Section, Looking North
Diamond Holes BB-2 and BB-3



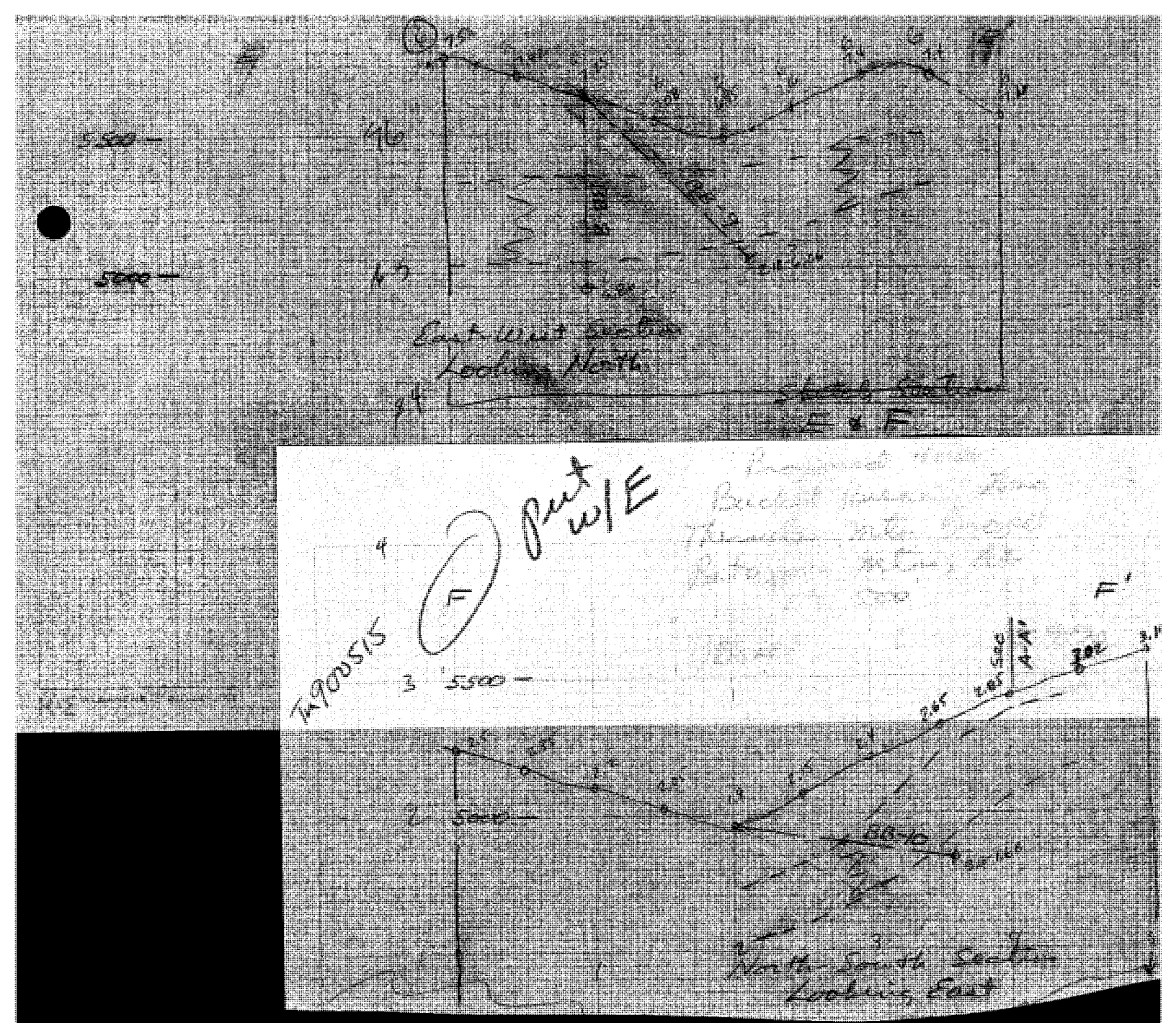
North-South Section
Looking East

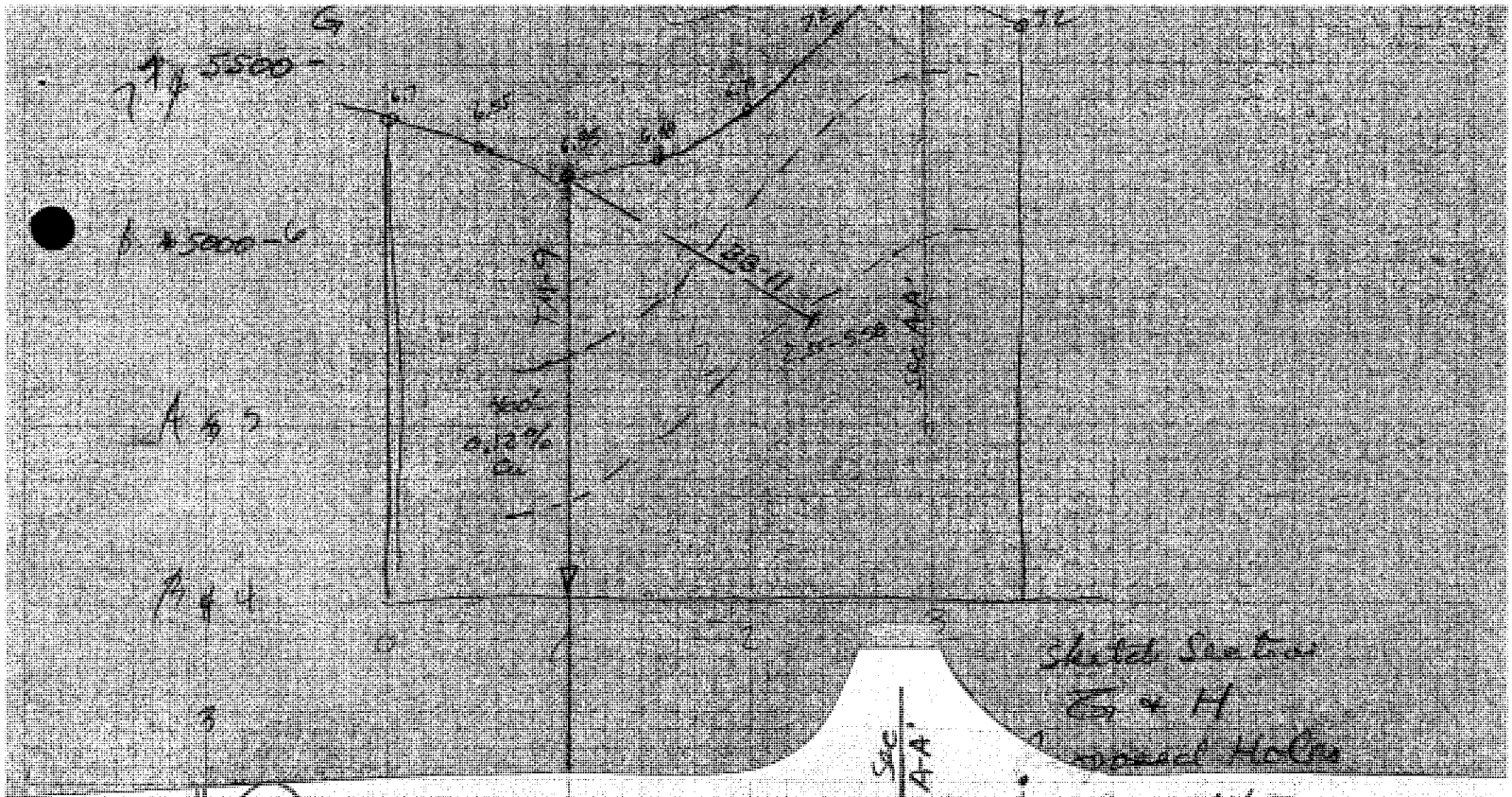
North-South Section
A'-2 = B-2

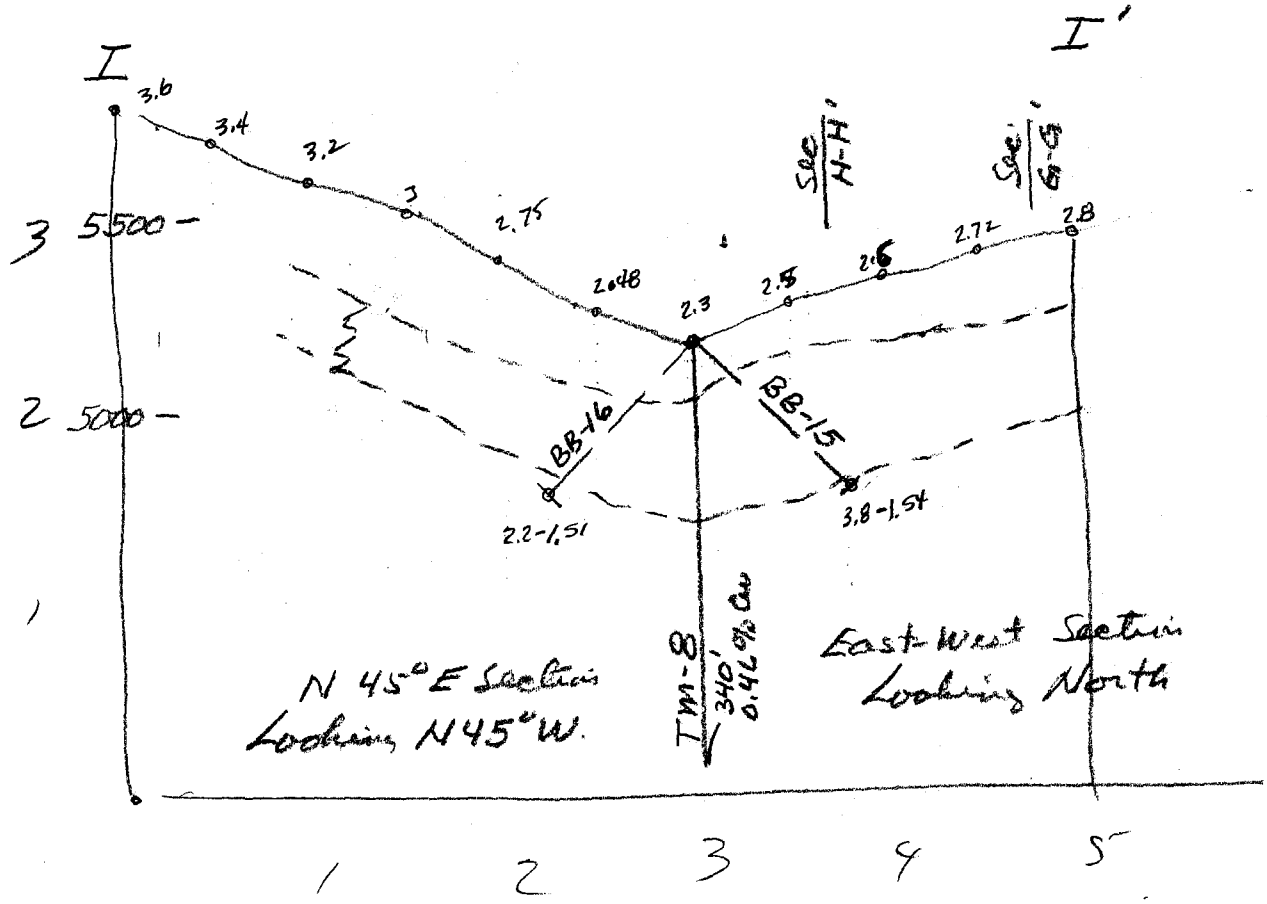
Diamond Holes
Cracker Powder Zone
Rocky Mtn. Project
Hallgarth Mine, AZ
1" = 500'

Plotter

5-9-78


5500
5000
East-West Section
Looking North
E & F
Put w/E
F
F'
TX900515
5500
5000
North-South Section
Looking East

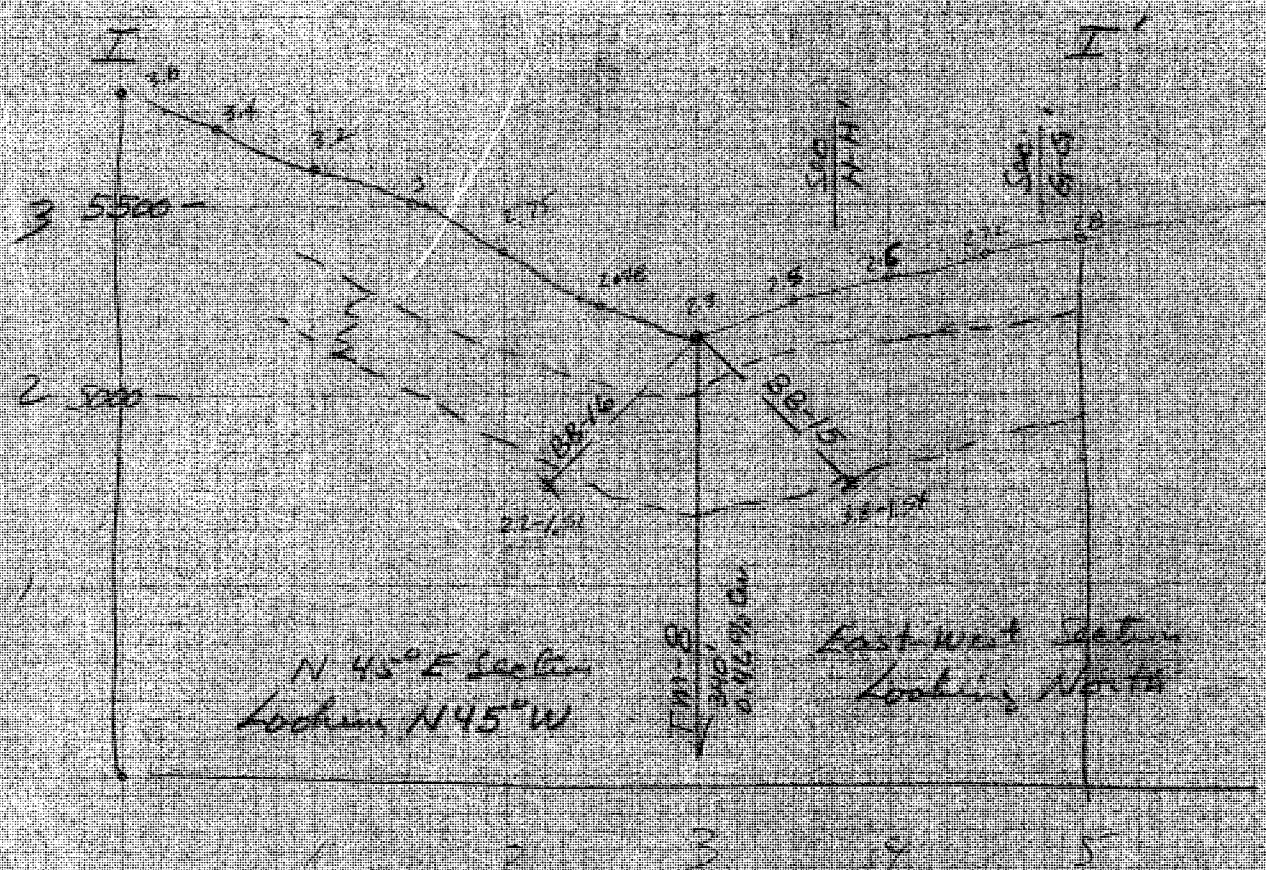

Sketch Section
G & H
H'
5500
5250'
5000
North South Section
Looking East
MAPOSIE



TM 900517

Sketch Section
I
Proposed Holes
Beulet Breccia Zone
Thunder Mountain Project
Patagonia Mtns, AZ
1" = 500'

5-9-90



Sketch Section
I
Proposed Holes
Bentlet Breccia Zone
Thunder Mountain Project
Patagonia Mtns, AZ
1" = 500

Fisher

5-9-90

JDS

ASARCO

EXPLORATION DEPARTMENT
SOUTHWESTERN UNITED STATES DIVISION

JAMES D. SELL
MANAGER

April 19, 1990

Mr. L.A. Robbennott
Manager of Mineral Lands
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, OK 73125

Thunder Mountain Project
Summary thru Feb. 1, 1990
Santa Cruz County, Arizona

Dear Mr. Robbennott:

As per Article 2 (f) of the Eighth Amendment to the Operating Agreement, dated January 1, 1988, between Kerr-McGee Corporation and ASARCO Incorporated, I submit this Summary of Activities for the year 1989.

No further activity was performed in drilling during the year. As mentioned in last year's Summary, the weakly altered and mineralized core from TM-14 is scheduled to be spot sampled and analyzed at some time.

Plans are being formulated to drill in the third quarter of 1990 to satisfy the yearly assessment work for the year ending August 31, 1990.

The Arizona Mine Inspector's Office is now examining claim blocks to evaluate the dangerous conditions which might exist, such as open shafts, non-posted tunnels, etc. Some owners of claims in the Patagonia Mountain district have been notified. As of this date, the claims within the Thunder Mountain Project have not been notified, but Asarco SWED has started its appraisal of the dangerous situations.

Sincerely,

James D. Sell

James D. Sell

JDS:mek

cc: F.T. Graybeal
W.L. Kurtz
W.D. Gay
W.K. John - Kerr-McGee

ASARCO INCORPORATED P.O. BOX 5747 TUCSON, AZ 85703
1150 NORTH 7TH AVENUE (602) 792-3010

JDS

ASARCO

Southwestern Exploration Division

August 9, 1990

R.L. Brown
New York Office

J.J. Malusa's Report
Patagonia Drilling
Santa Cruz County, AZ

Attached is Mr. Malusa's report on drill holes BB-2 and V-39 in the Patagonia Mountains. Assay results are pending.

James D. Sell

JDS:mek

James D. Sell

cc: W.L. Kurtz
J.J. Malusa

ASARCO

Southwestern Exploration Division

August 2, 1990

J.D. Sell

J.J. Malusa
Monthly Report
July 1990

Yarnell Project, Yavapai County, AZ - EA-0444

Completed reports pertaining to XRD work performed on green clay mineral and whole rock analysis of altered footwall granite. The green clay mineral was determined to be nontronite, an Fe rich montmorillonite. While the whole rock data suggests an introduction of potassium and a depletion in sodium in altered granite with respect to unaltered granite.

Thunder Mountain Project, Santa Cruz County, AZ - EA-0042

Arranged for road maintenance; excavation of mud pits and drilling supplies (i.e. wood blocks, marking pens, storage trailer and core boxes). Got drillers started on hole BB-2 which is located on the same drill site as TM-8. The hole is orientated S45°W34° and has been drilled to a depth of 446 feet as of July 31. So far the rock consists of a quartz feldspar porphyry that is highly sericitized with pyrite and chalcocite. Below 352 feet there is a different unit. This unit is a xenolithic quartz feldspar porphyry that contains less sericite and is more siliceous.

Ventura Project, Santa Cruz County, AZ - EA-0165

Same as Thunder Mountain project with the exception that drillers are working on hole V-39 which is located on the same drill site as V-1, 2, 3, & 4. The hole is vertical and has been drilled to a depth of 210' as of July 28th. So far rock encountered consist of a highly oxidized altered granodiorite down to 69 feet. From 69 to 81 feet there is an oxided andesite dike which is underlain by a brecciated zone (81 to 82 feet). From 82 to 210 the rock is vuggy unoxidized and contains up to 10% pyrite.

Expenditures for both drill holes BB-2 and V-39, as of July 25, and their locations are shown on the attachments.

	Field Days	Office Days	Expense Account	Vehicle Expense
July	12	8	$274.27	$700.00
YTD	60	80	$3,175.17	$2,413.00

John J. Malusa

JJM:mek

John J. Malusa

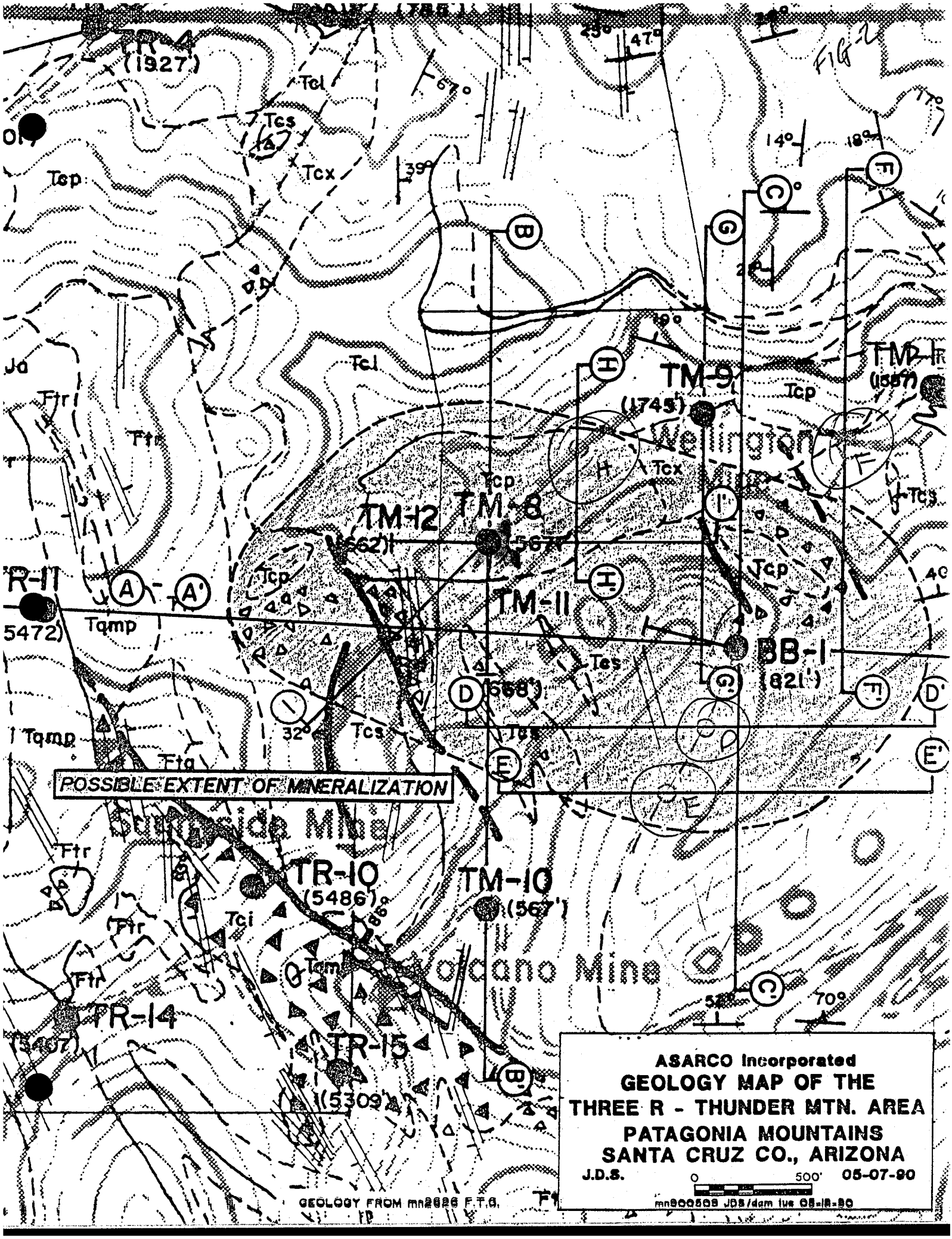
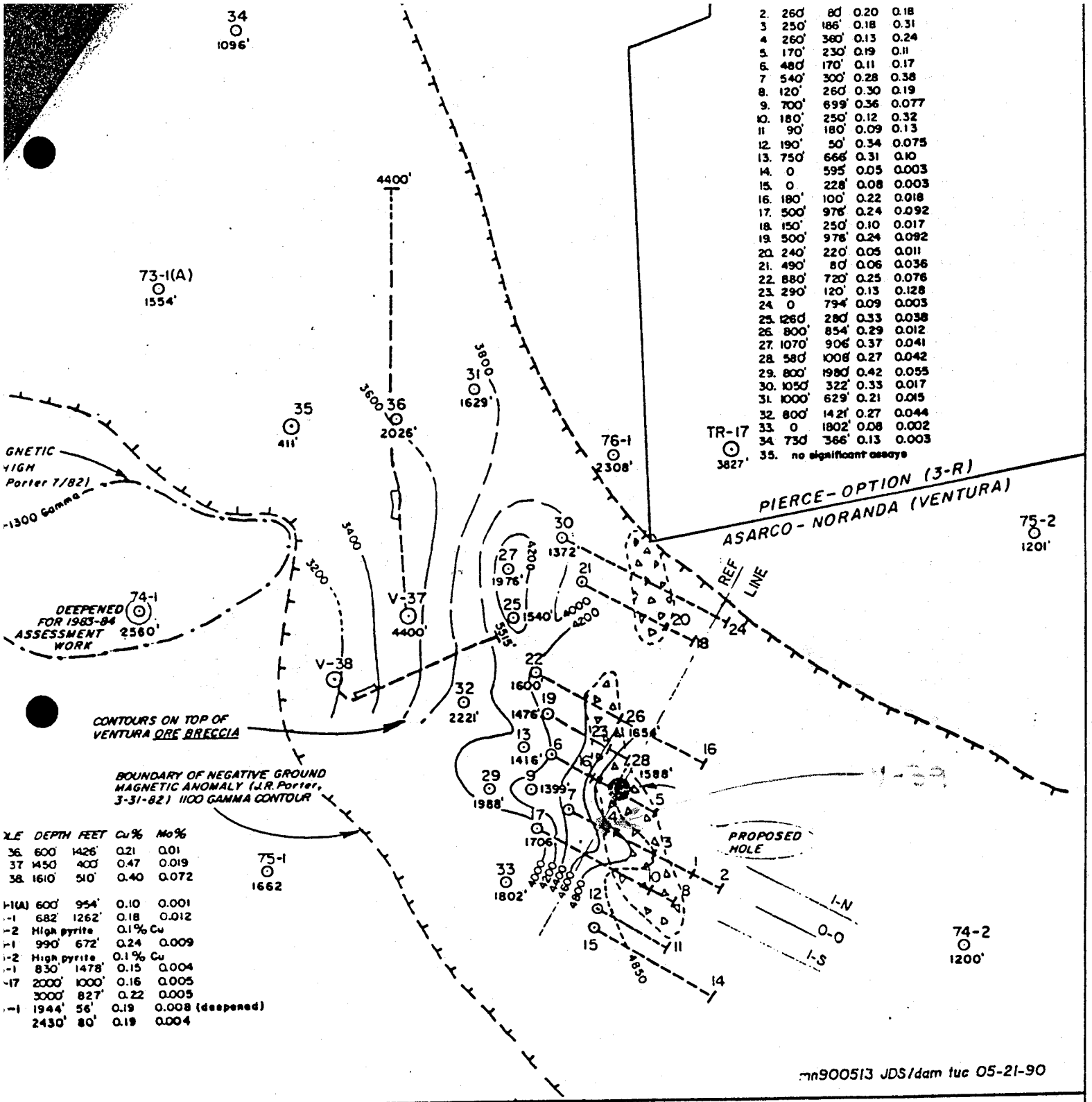


FIG 2
TR-4
(1927')
Tcl
Tcs
Tcx
Tcp
Ja
Ftr
Ftg
TM-9
(1745')
Wellington Mine
TM-12
TM-8
(562')
TR-11
(5472')
Tqmp
TM-11
BB-1
(821')
(568')
POSSIBLE EXTENT OF MINERALIZATION
Sunrise Mine
TR-10
(5486')
TM-10
(567')
Tci
Tqm
Volcano Mine
TR-14
TR-15
(5309')
ASARCO Incorporated
GEOLOGY MAP OF THE
THREE R - THUNDER MTN. AREA
PATAGONIA MOUNTAINS
SANTA CRUZ CO., ARIZONA
J.D.S.
0
500'
05-07-90
mn900509 JDS/dam tue 05-18-90
GEOLOGY FROM mn2626 F.T.G.



2.	260'	80'	0.20	0.18
3	250'	186'	0.18	0.31
4	260'	360'	0.13	0.24
5.	170'	230'	0.19	0.11
6.	480'	170'	0.11	0.17
7	540'	300'	0.28	0.38
8.	120'	260'	0.30	0.19
9.	700'	699'	0.36	0.077
10.	180'	250'	0.12	0.32
11	90'	180'	0.09	0.13
12.	190'	50'	0.34	0.075
13.	750'	666'	0.31	0.10
14.	0	595'	0.05	0.003
15.	0	228'	0.08	0.003
16.	180'	100'	0.22	0.018
17.	500'	976'	0.24	0.092
18.	150'	250'	0.10	0.017
19.	500'	976'	0.24	0.092
20.	240'	220'	0.05	0.011
21.	490'	80'	0.06	0.036
22.	880'	720'	0.25	0.076
23.	290'	120'	0.13	0.128
24.	0	794'	0.09	0.003
25.	1260'	280'	0.33	0.038
26.	800'	854'	0.29	0.012
27.	1070'	906'	0.37	0.041
28.	580'	1008'	0.27	0.042
29.	800'	1980'	0.42	0.055
30.	1050'	322'	0.33	0.017
31.	1000'	629'	0.21	0.015
32.	800'	1421'	0.27	0.044
33.	0	1802'	0.08	0.002
34.	730'	366'	0.13	0.003
35.	no significant assays			

LE	DEPTH	FEET	Cu%	Mo%
36.	600'	1426'	0.21	0.01
37	1450	400'	0.47	0.019
38.	1610'	510'	0.40	0.072
H(A)	600'	954'	0.10	0.001
-1	682'	1262'	0.18	0.012
-2	High pyrite		0.1% Cu	
-1	990'	672'	0.24	0.009
-2	High pyrite		0.1% Cu	
-1	830'	1478'	0.15	0.004
-17	2000'	1000'	0.16	0.005
	3000'	827'	0.22	0.005
-1	1944'	56'	0.19	0.008 (deepened)
	2430'	80'	0.19	0.004

NOTE: Unsurveyed area, topography flown for Noranda.

EXPLANATION

V-37 ⊙ 4400' — ASARCO Inc. drill hole showing total depth & (—▭—) mineral intercept

76-1 ⊙ 2308' — Noranda drill hole (V-prefix not shown)

2026' — West Range drill hole (V-prefix not shown)

Ventura breccias, surface expression

NORTH

DRILLING PROGRESS MAP

VENTURA PROJECT

Patagonia Mountains

SANTA CRUZ COUNTY, ARIZONA

SCALE: 1" = 400'

Feb. 1983

Rev. April 1984

ASARCO Southwestern Exploration Division

JDS

September 10, 1990

J.D. Sell

J.J. Malusa
Monthly Report
August 1990

Thunder Mountain Project, Santa Cruz County, Arizona - EA-0042

Hole BB-2

Finished drilling remainder of BB-2 (location plotted on last monthly report). Lithology since July 25th is as follows:

352-501	Tuffaceous Breccia
501-511.5	Agglomeratic Scoria
511.5-516.5 (BOH)	Breccia Chert

Artesian water flowing at a rate of 10 gallons/minute was encountered at 491 feet. Ore intercepts for BB-2 are as follows:

Interval (feet)	Thickness (feet)	Grade ~~(%)~~
60	40 - 100	0.60 % Cu
40	250 - 290	0.99 oz/t Ag

Down the hole surveying results are as follows:

Depth (feet)	Inclination & Bearing
15	33° S49°W
170	35° S49°W
330	37° S49°W
510	39° S50°W

Hole BB-3

Hole BB-3 began on August 13th and was completed on August 30th at a depth of 725 feet. The hole is located on the same drill site as BB-2 and is oriented dipping 45° due north. In general the lithology is as follows:

0-14	Overburden
14-555	Quartz feldspar porphyry
555-640	Fault Zone
640-725	Tuffaceous agglomerate

Artesian water flowing at a rate of 2 gallons/minute was encountered at 485 feet. No assay results are available as yet. However, surveying results are as follows:

Depth (feet)	Inclination & Bearing
*---	----
242	48°N
484	51°N 2°E
715	50°N 3°E

*No surface survey was performed due to difficulty with instrument.

Ventura Project, Santa Cruz County, Arizona - EA-0165

Drilling continued on hole V-39 (location plotted on previous monthly report) and is at a depth of 1000' as of Sept. 1. Lithology from 0 to 1000' is as follows:

0-20	Overburden
20-82	Granodiorite Oxidized Zone (i.e., bleached cap)
82-314	Granodiorite
314-325	Microdiorite Dike
325-443	Granodiorite
443-460	Brecciated
460-602	Granodiorite
602-668	Brecciated
668-795	Granodiorite
795-1000	Granodiorite Porphyry

Ore intercepts for V-39 are as follows:

Interval (feet)	Thickness (feet)	Grade (%)
170-190	20	1.00 Cu
260-310	50	0.83 Cu 0.37 Mo
330-360	30	0.38 Mo
440-510	70	0.56 Mo
490-520	30	0.67 Cu
540-590	50	0.99 Mo

Surveying results for hole V-39:

Depth (feet)	Inclination & Bearing
500	89° N27°E
1000	89° N47°E

Cost estimates are attached for July 26 through August 25 for both Ventura and Thunder Mountain.

Field Days		Office Days	Expense Account	Vehicle Expense
Aug.	16	7	$32.10	$487.50
YTD	76	87	$3207.27	$2900.50

John J. Malusa

JJM:mek

John J. Malusa

HOLE BB-3 PROJECT Thunder Mtn. EA-0042 26th July THRU 25th Aug, 19 90 CONTRACTOR CDL

DESCRIPTION: July — August

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
FEET DRILLED																																		
0 – 14 rotary																																		
14 – 500																			5	50	10	15	21			69	74	61	111	50	20	486	18 90	9185 40
500-540																															40	40	19 70	788 00

SUB TOTAL 9973 40

CEMENTING																	1		6	6	7	1										21	55 00	1150 00
CONDITIONING																																		
CASING																																		
Moving																																1	500 00	500 00
overburden/rotary																			3½													3½	60 00	210 00
stand-by																					6	9										15	50 00	750 00

SUB TOTAL 2610 00

MATERIALS																																		
cement															1	3	2		2													8	6 02	48 16
cal seal																			1													1	35 72	35 72
EZ Mud																											1					1	131 04	131 04
Truck expense																																600	0 25	150 00
JS Malusa																																7	90 00	630 00
logging																																2	250 00	500 00
road maint.	10	7																														17	87 25	1493 50

SUB TOTAL 2988 50

TRUCK RENTAL																X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	15	20	300 00
MILEAGE																																		
LOADS OF WATER																																		

SUB TOTAL 300 00

MISC.																																		
Per Diem																4	4		4	3	4	4	4			4	4	4	4	4	4	51	15 00	765 00

SUB TOTAL 765 00

$30 80/foot

TOTAL 16,636

mn 3031

HOLE BB-2 PROJECT Thunder Mtn. EA-0042 26th: July THRU 25th Aug., 1990 CONTRACTOR CDC

DESCRIPTION: July — August

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
FEET DRILLED																																		
162 - 500	64	60	66		50	44	45	7	7																							338	18.00	6388.00
500 - 516½									14			2	½																			16½	19.70	325.05
SUB TOTAL																																		6713.25
CEMENTING																																		
CONDITIONING																																		
CASING																																		
SUB TOTAL																																		
[redacted]																																		
cleaning mud tank		2½				2																										4½	50.00	225.00
Stand by (camera)													11	5																		16	50.00	800.00
Surveying													1	1½																		2½	55.00	137.50
EZ-mud						2																										2	131.04	262.08
Cement																																8	6.00	48.16
roadwork	7																															7	85.00	595.00
logging																																3 days	250.00	750.00
survey eq. rental																																½ month	700.00	700.00
JJ Malusa																																7	90.00	630.00
Truck expense																																600 miles	0.25	150.00
assays																																516½	196/foot	1016.43
SUB TOTAL																																		5314.17
TRUCK RENTAL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																	15	20.00	300.00
MILEAGE																																		
LOADS OF WATER																																		
SUB TOTAL																																		300.00
MISC.																																		
Per Diem	4	4	4		4	4	4	4	4			4	4	4	4																	48	15.00	720.00
SUB TOTAL																																		720.00

$36.80/foot

TOTAL 13,047

mn 3031

HOLE V-39 PROJECT Ventura 26th July THRU 25th Aug, 19 90 CONTRACTOR CBC

DESCRIPTION: July — Aug.

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
FEET DRILLED																																		
60 – 500	60	45	45		40	45	60	70	20			10	45																			440	17.40	7656.00
500 – 1000													15	47	71	42			35	50	35	54	51			30	35	45				500	18.20	9100.00
1000 – 1070																													5	30	35	70	19.20	1344.00

SUB TOTAL 18,100.00

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
CEMENTING	1																															1	55.00	55.00
CONDITIONING																																		
CASING																																		
Surveying																1														1		2	55.00	110.00

SUB TOTAL 165.00

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
MATERIALS																																		
50# mud		1																														1	5.17	5.17
E7 mud						1							1													1						3	131.04	393.12
surveying (eg. rent)																																1/2 month	700.00	700.00
logging																																3	250.00	750.00
assays (20-150)																																130	2.60	338.13
road maint.																			2.9													2.9	188.58	188.58
JS Maluxa																																7	90.00	630.00
Blazer miles																																723	0.25	180.75

SUB TOTAL 3185.75

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
TRUCK RENTAL	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	30	20.00	600.00
MILEAGE	20	20	20				20	20				20		20		20			20			20				20		20				240	0.75	180.00
LOADS OF WATER	1	1	1				1	1				1		1		1			1			1				1		1				12	6.75	81.00

SUB TOTAL 861.00

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
MISC.																																		
Per Diem	2	2	2		2	2	2	2	2			1	2	2	2	2			2	2	2	2	2			2	2	2	2	2	2	47	15.00	705.00

SUB TOTAL 705.00

$22.78/foot

TOTAL 23,016.75

ASARCO

Southwestern Exploration Division

September 21, 1990

J.D. Sell

J.J. Malusa
Monthly Report
August 1990

Thunder Mountain Project, Santa Cruz County, AZ - EA-0042

Hole BB-2

Finished drilling remainder of BB-2. Location is plotted on last month's report. A cross section showing bottom of hole is plotted on Attachment 1. The general lithology of BB-2 is as follows:

0- 12	Overburden
12-352	Quartz Feldspar Porphyry
352-501	Tuffaceous Breccia
501-511.5	Agglomeratic Scoria
511.5-516.5	(BoH) Breccia Chert

Artesian water flowing at a rate of 10 gallons/minute was encountered at 491 feet. Ore intercepts for BB-2 are as follows:

Interval(ft.)	Thickness(ft.)	Cu %	Ag (ppm)
40-500	460	0.25	6.10
40-100	60	0.59	2.50
250-290	40	0.28	33.251

No gold assays were above .006 opt.

Down the hole surveying results are as follows:

Depth (ft.)	Inclination & Bearing	
15	33°	S49°W
170	35°	S49°W
330	37°	S49°W
510	39°	S49°W

Hole BB-3

Hole BB-3 began on August 13th and was completed on August 30th at a depth of 725 feet. The hole is located on the same drill site as BB-2 and is oriented dipping 45° due north. A cross section showing the orientation and the bottom of the hole is plotted on Attachment 2. In general, the lithology of BB-3 is as follows:

0- 14	Overburden
14-555	Quartz Feldspar Porphyry
555-640	Fault Zone
640-725	Tuffaceous Agglomerate

Artesian water flowing at a rate of 2 gallons/minute was encountered at 485 feet. Ore intercepts for BB-3 are as follows:

Interval(ft.)	Thickness(ft.)	Cu %	Ag (opt)
14- 90	76	0.61	0.04
90-500	410	0.07	0.02
500-720	220	0.24	0.05
720-725	5	0.02	0.02

0.12 Cu
704 | 86,136

0.03 oz Ag
704 | 22,24

No gold assays were above .004 opt.

Surveying results for BB-3 are as follows:

Depth (ft.)	Inclination & Bearing
* --	----
242	48°N
484	51°N2°E
715	50°N3°E

* No surface survey was performed due to difficulty with instrument.

Ventura Project, Santa Cruz County, Arizona - EA-0165

Drilling continued on hole V-39 (location plotted on previous monthly report) and is at a depth of 1000' as of Sept. 1. A cross section (Attachment 3) is provided to show the present depth of hole with relation to previously drilled holes. Lithology from 0 to 1000' is as follows:

0- 20	Overburden
20- 82	Granodiorite Oxidized Zone (i.e. bleached cap)
82-314	Granodiorite
314-325	Microgranodiorite Dike
325-443	Granodiorite
443-460	Brecciated
460-602	Granodiorite
602-668	Brecciated
668-795	Granodiorite
795-1000	Granodiorite Porphyry

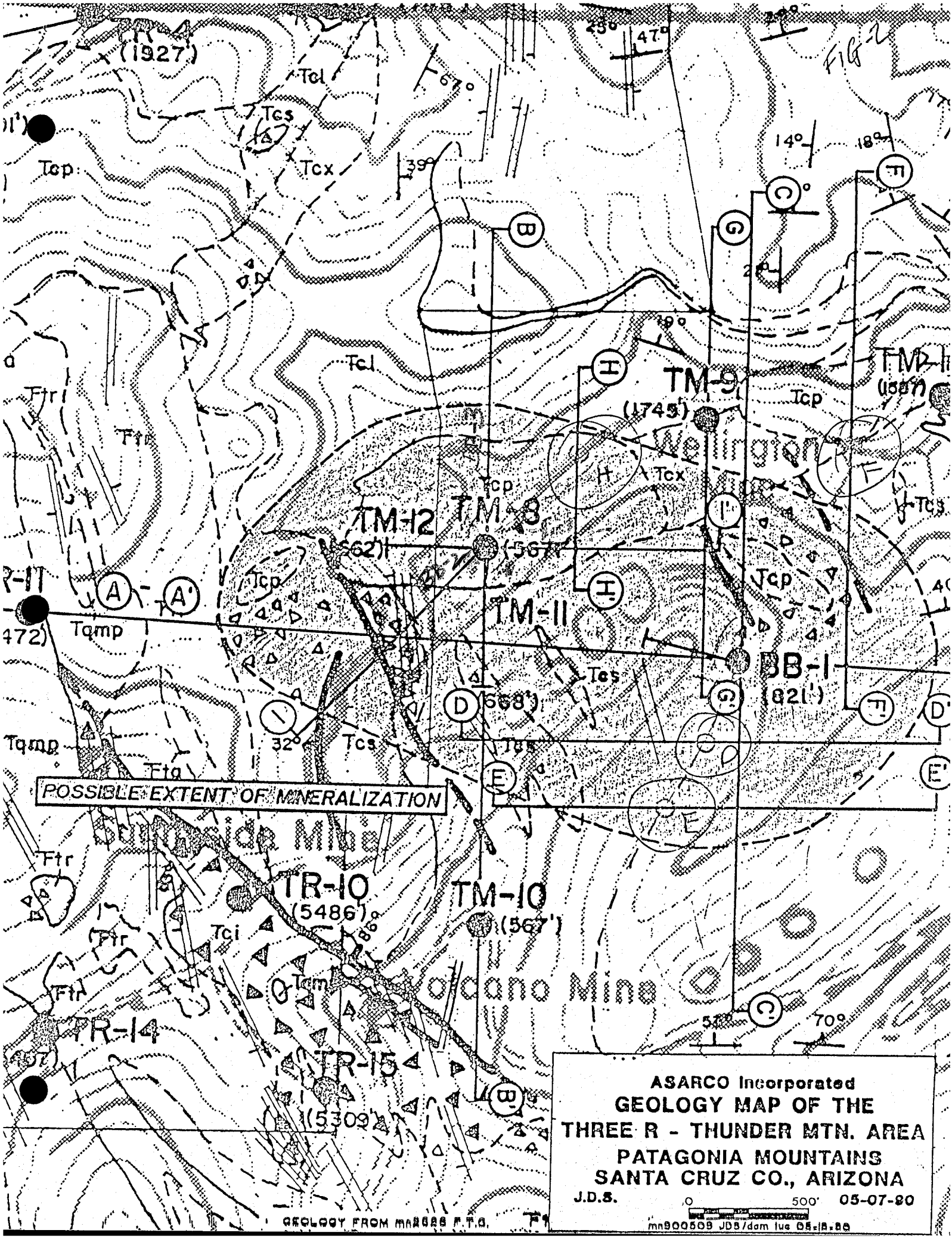


FIG 2
(1927')
Tcl
Tcs
Tcx
Tcp
Ftr
Ftr
Tcl
TM-9
(1745')
Wellington
Tcp
Tcx
TM-12
(562')
TM-8
(567')
Tcp
TM-11
Tcp
Tcs
BB-1
(821')
Tqmp
Tqmp
Tcs
Tcs
Tcs
Ftg
POSSIBLE EXTENT OF MINERALIZATION
Ftr
TR-10
(5486')
TM-10
(567')
Tci
Tcm
Volcano Mine
TR-14
TR-15
(5309')
ASARCO Incorporated
GEOLOGY MAP OF THE
THREE R - THUNDER MTN. AREA
PATAGONIA MOUNTAINS
SANTA CRUZ CO., ARIZONA
J.D.S.
0
500'
05-07-80
GEOLOGY FROM mn8688 F.T.G.
mn900509 JDS/dam lue 05-18-80

PROJECT [illegible] 26th July THRU 25th Aug. ,1990 CONTRACTOR [illegible]

SCRIPTION: July — August

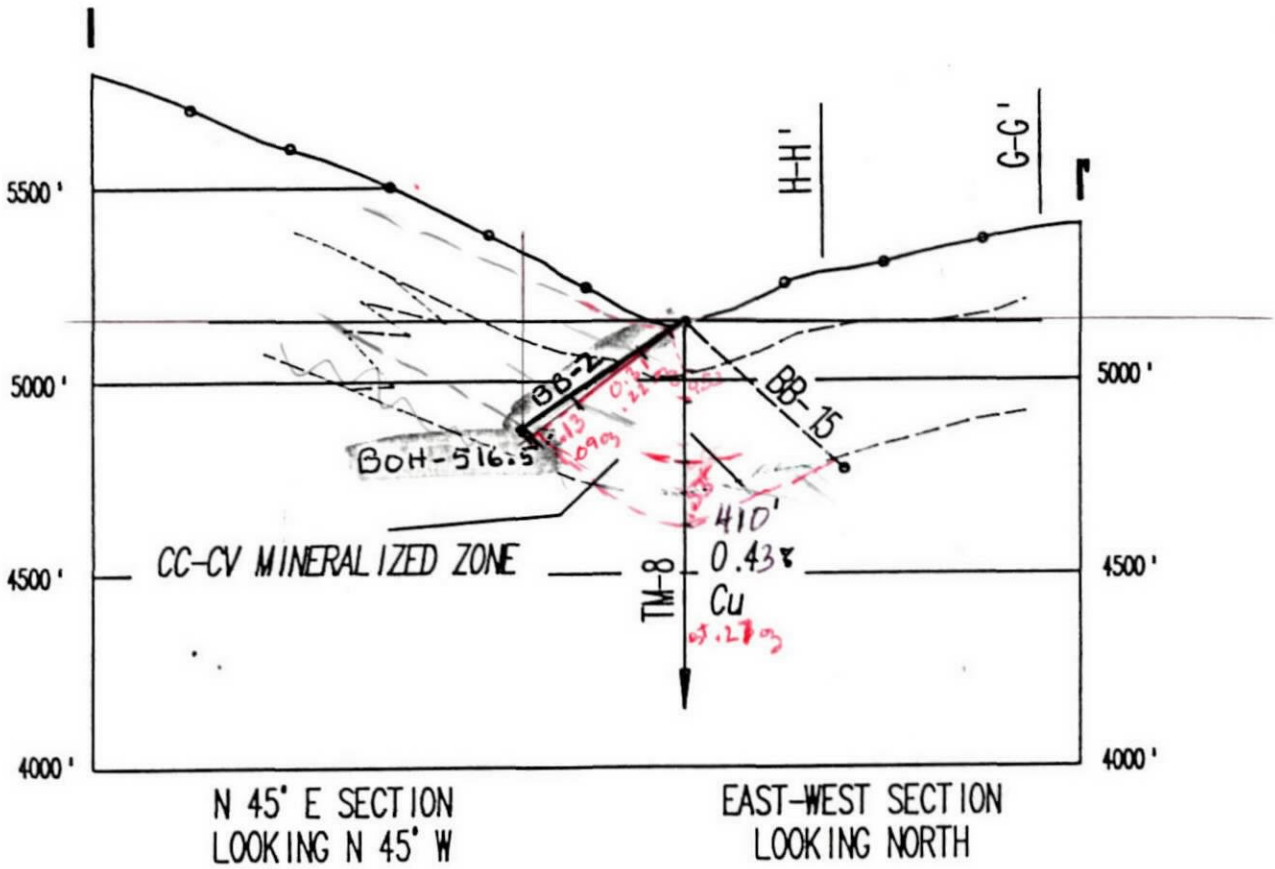
	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
ET DRILLED																																		
2 - 500	64	60	66		50	44	45	7	2																							338	18.00	6388.00
00 - 516½									14			2	½																			16½	19.70	325.05
SUB TOTAL																																		6713.25
ENTING																																		
ONITIONING																																		
SING																																		
SUB TOTAL																																		
[redacted]																																		
leaning mud tank		2½				2																										4½	50.00	225.00
Stand by (camera)													11	5																		16	50.00	800.00
surveying													1	1½																		2½	55.00	137.50
Z-mud						2																										7	131.00	262.00
Cement																																8	6.00	48.16
oadwork	7																															7	85.00	595.00
oarging																																3 days	250.00	750.00
ntry eq. rental																																½ month	700.00	700.00
15 Malusa																																7	90.00	630.00
Truck expense																																600 mile	0.25	150.00
assays																																516½	1.96/ft	1016.43
SUB TOTAL																																		5314.17
UCK RENTAL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																	15	20.00	300.00
EAGE																																		
ADS OF WATER																																		
SUB TOTAL																																		300.00
SC																																		
er Diem	4	4	4		4	4	4	4	4			4	4	4	4																	48	15.00	720.00
SUB TOTAL																																		720.00

$36.80/ft

TOTAL 13047

Attch. 1

FIGURE 10



PROPOSED DRILL HOLES BB-15, 16

ASARCO Incorporated

THUNDER MOUNTAIN PROJECT

PROPOSED DRILL HOLES

SKETCH SECTION I

BUCKET BRECCIA ZONE

PATAGONIA MTNS., AZ.

J.D.SELL **05-09-90**

0 250' 500'

mr900517 JDS/dcm tuc 05-22-90

DESCRIPTION: BB-3

July — August

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
FEET DRILLED																																		
0 - 14 rotary																																		
14 - 500																			5	50	10	15	21			69	74	61	111	50	20	486	18 90	9185 40
500-540																															40	40	19 70	788 00

SUB TOTAL 9973 40

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
CEMENTING																																		
CONDITIONING																	1		6	6	7	1										21	55 00	1150 00
DRILLING																																		
Reaming																																		
Underreamer/rotary																																1	500 00	500 00
Hourly																			3½													3½	60 00	210 00
																					6	9										15	50 00	750 00

SUB TOTAL 2610 00

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
MATERIALS																																		
Cement															1	3	2		2													8	6 02	48 16
Gel seal																			1													1	35 72	35 72
EZ Mud																											1					1	131 04	131 04
Truck expense																																600	0 25	150 00
SS Malusa																																7	90 00	630 00
Logging																																2	250 00	500 00
2nd maint.	10	7																														17	87 75	1493 51

SUB TOTAL 2988 51

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
TRUCK RENTAL																X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	15	20	300 00
MILEAGE																																		
GALLONS OF WATER																																		

SUB TOTAL 300 00

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
MISC.																																		
Per Diem																4	4		4	3	4	4	4			4	4	4	4	4	4	51	15 00	765 00

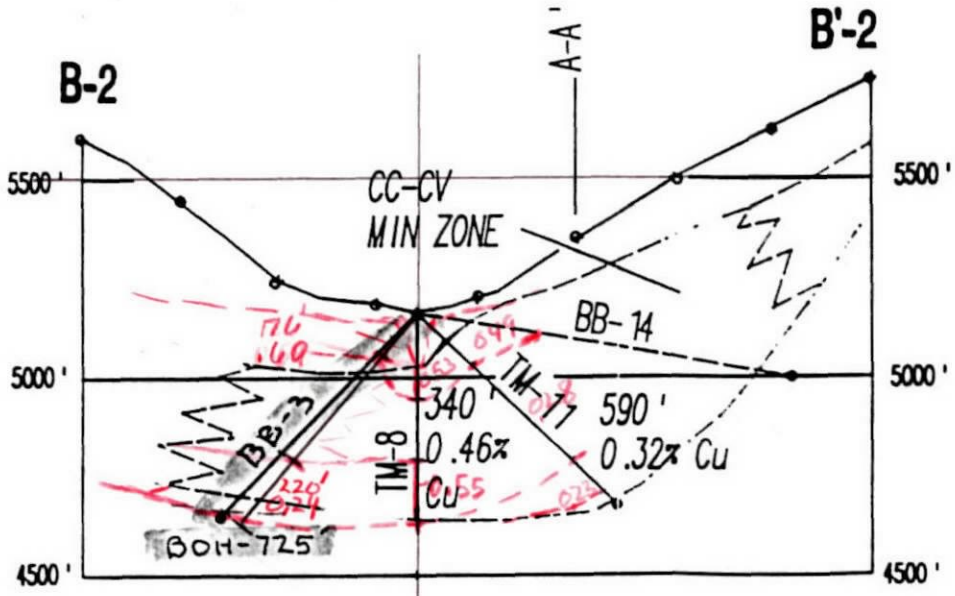
SUB TOTAL 765 00

$30 80/foot

TOTAL 16,636

mn 3031

Attch. 2



NORTH-SOUTH SECTION, LOOKING EAST

ASARCO Incorporated

THUNDER MOUNTAIN PROJECT

PROPOSED DRILL HOLES

SKETCH SECTIONS ~~A-2~~ & B-2

BUCKET BRECCIA ZONE

PATAGONIA MTNS., AZ.

J.D.BELL 05-09-90

0 250' 500'

mr900513 JDS/dcm t.u.c 05-21-90

JDS

ASARCO

Southwestern Exploration Division

October 4, 1990

J.D. Sell

J.J. Malusa
Monthly Report
September 1990

Thunder Mountain Project, Santa Cruz County, AZ - EA-0042

Hole BB-4

Hole BB-4 began on September 5 and was completed on September 25 at a depth of 797 feet. Surface casing was left on the upper 20 feet for possible reentry. The hole is located half way between holes TM-8 and TM-9 (see Attachment 1). A cross section showing the orientation and the depth of the hole is plotted on Attachment 2. The water table was inferred to be encountered at approximately 600 feet due to the driller's account of excess water filling the drill hole overnight. This was not an artesian well as the two previous holes were.

No assay results are available as yet; however, the general lithology of BB-4 is as follows:

0-5	Overburden
5-56	Quartz feldspar porphyry
56-60	Breccia Zone
60-189	Quartz feldspar porphyry
189-318	Tuffaceous volcanic agglomerate
318-647	Quartz feldspar porphyry
647-797	Gradational contact at about 647 feet with less altered rock below 647 feet. The less altered rock looks suspiciously similar to the Ventura granodiorite.
797	Bottom of hole.

Surveying results for BB-4 are as follows:

Depth (ft.)	Inclination & Bearing
15	90°
195	90°
395	90°
595	90°
795	89° N73°W

Ventura Project, Santa Cruz County, AZ - EA-0165

Drilling continued on hole V-39 (location plotted on July's monthly report) and is at a depth of 1695 feet as of October 1. A cross section (Attachment 3) is provided to show the present depth of the hole with relation to previously drilled holes. Lithology from 0-1695 feet is as follows:

0-20	Overburden
20-82	Granodiorite Oxidized Zone (i.e. bleached cap)
82-314	Granodiorite
314-325	Microgranodiorite Pike
325-443	Granodiorite
443-460	Bracciated
460-602	Granodiorite
602-668	Brecciated
668-795	Granodiorite
795-1018	Granodiorite porphyry
1018-1075	Highly siliceous granodiorite
1075-1160	Granodiorite porphyry
1160-1180	Granodiorite
1180-1420	Granodiorite porphyry
1420-1480	Granodiorite
1480-1530	Granodiorite porphyry
1530-1695	Granodiorite

Assays are available down to 1070 feet. With regard to the available information the ore intercepts for V-39 and V-4 (comparison hole) are as follows:

V-39 Interval (feet)	Thickness (feet)	% Cu	% Mo	V-4 Interval (feet)	Thickness (feet)	% Cu	% Mo
20-200	180	0.29	0.018	surf.-200	200	0.12	0.016
200-660	460	0.23	*0.262	200-610	410	0.28	0.224
660-710	50	0.22	0.008	610-703	43	0.10	0.005
710-1070	360	0.06	0.003				

*V-39 (550'-560') assay of 3.735% Mo was lowered to 1.0% Mo for the interval average due to its "questionably high value."

Survey results for V-39:

Depth (feet)	Inclination & Bearing
500	89° N27°E
1000	89° N47°E
1585	89° N47°E

Cost estimates are attached for August 26 thru September 25 for both Ventura and Thunder Mountain.

Field Days		Office Days	Expense Acct.	Vehicle Expense
Sept.	16	4	$247.09	$694.00
YTD	94	91	$3,454.36	$3,594.50

John J. Malusa

JJM:mek

cc: W.L. Kurtz

HOLE BB-3 PROJECT Thunder Mtn. 26th Aug. RU 25th Sept, 19 90 CONTRACTOR CBC

DESCRIPTION: Aug. Sept.

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
FEET DRILLED																																		
540 - 725		40	57	63	25																											185	19.70	3644.50

SUB TOTAL 3644.50

CEMENTING		3				2																										5	55.00	275.00
CONDITIONING																																		
CASING																																		
Surveying					2½	1½																										4	55.00	220.00

SUB TOTAL 495.00

MATERIALS																																		
cement		5			4	3																										12	6.02	72.24
Barite mud					10																											10		
ASSAYS																																725 ft	2.23/foot	1622.86

SUB TOTAL 1695.10

TRUCK RENTAL	X	X	X	X	X	X																										6	20.00	120.00
MILEAGE																																		
LOADS OF WATER																																		

SUB TOTAL 120.00

MISC.																																		
Per Diem		4	4	4	4	2																										24	15.00	315.00

SUB TOTAL 315.00

$33.88/foot

TOTAL $ 6269

mn 3031

HOLE BB-4 PROJECT Thunder Mtn. 26th Aug. THRU 25th Sept, 19 90 CONTRACTOR CBC

DESCRIPTION: Aug. Sept.

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
FEET DRILLED																																		
7-500													46	69		70	70	50	70	70			48									493	17.40	8578.20
500-797																							12	70	70	50	52	43				297	18.20	5405.40
SUB TOTAL																																		13,983.60

CEMENTING																																		
CONDITIONING																																		
CASING													1																			1	55.00	55.00
overburden drilling																															1½	1½	55.00	82.50
Surveying																																1	500.00	500.00
Moving																																		
SUB TOTAL																																		637.50

MATERIALS																																		
Cement											2	1																			4	7	5.13	36.19
EZ Mud													1																			1	131.04	131.04
Surveying rental																																½ month	1400.00 month	700.00
JJ Mousa																																12 days	93/day	1116.00
vehicle expense																																		185.00
ASSAYS																																		no results
Logging																																2 days	250.00/day	500.00
SUB TOTAL																																		2668.23

TRUCK RENTAL							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	25	20.00	500.00
MILEAGE																																		
LOADS OF WATER																																		
SUB TOTAL																																		500.00

MISC.																																		
Per Diem										4	3	3	4	4		4	4	4	4	4			4	4	4	4	4	4		2	3	67	15.00	1005.00
SUB TOTAL																																		1005.00

23.58/foot — without assay cost

TOTAL mn 3031 18794.33

HOLE V-39 PROJECT Ventura 26th Aug THRU 25th Sept, 1970 CONTRACTOR CBC

DESCRIPTION: Aug. — Sept.

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
FEET DRILLED																																		
1070 – 1500										35	53	27	7			36	27	38	41	31				30	50	50	5					430	19.20	8256
1500 – 1585																											45				40	85	20.50	1742.50

SUB TOTAL 9,998

CEMENTING																																		
CONDITIONING																				1½				2								3½	55.00	192.50
CASING																																		

SUB TOTAL 192.50

MATERIALS																																		
EZ mud										1						1								1			1					4	131.04	524.16
assays (150-1070)																																920	3.03	2788.23
logging (110-1520)																																1½	250.00	375.00
I5 Malusa																																7	93.00	651.00
vehicle																																80 miles	0.25	202.00
surveying (rental)																																½	1400.00	700.00

SUB TOTAL 5240.39

TRUCK RENTAL	X	X	X	X	X	X	X	X	X	X	/	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	30	20.00	600.00
MILEAGE										20						20			20					40	20		20				20	160	0.75	120.00
LOADS OF WATER										1						1			1					2	1		1				1	8	6.75	54.00

SUB TOTAL 774.00

MISC.																																		
Per Diem										2	2	2	2			2	2	2	2	2				2	2	2	2			1	2	29	15.00	435.00

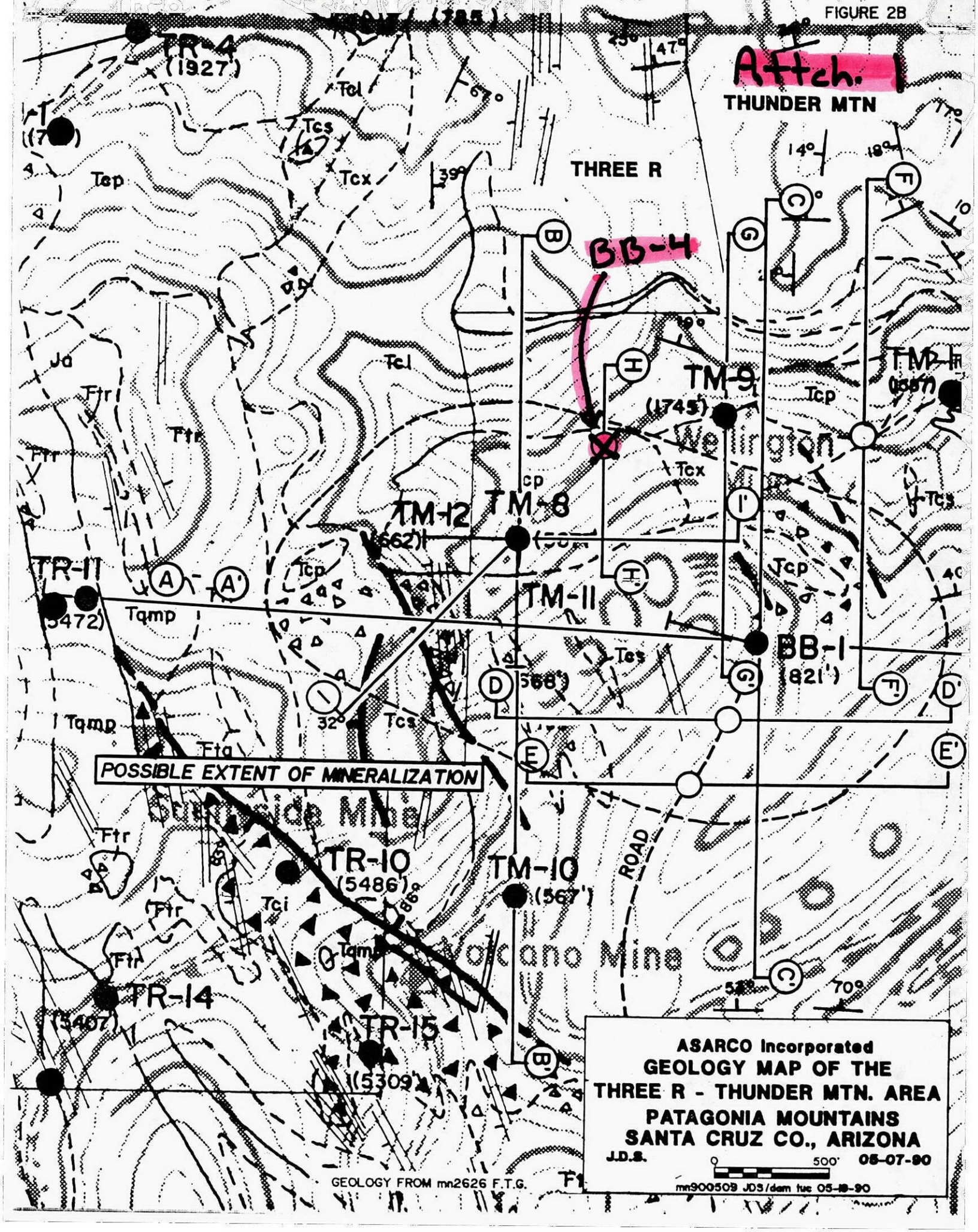
SUB TOTAL 435.00

// 32.31/foot

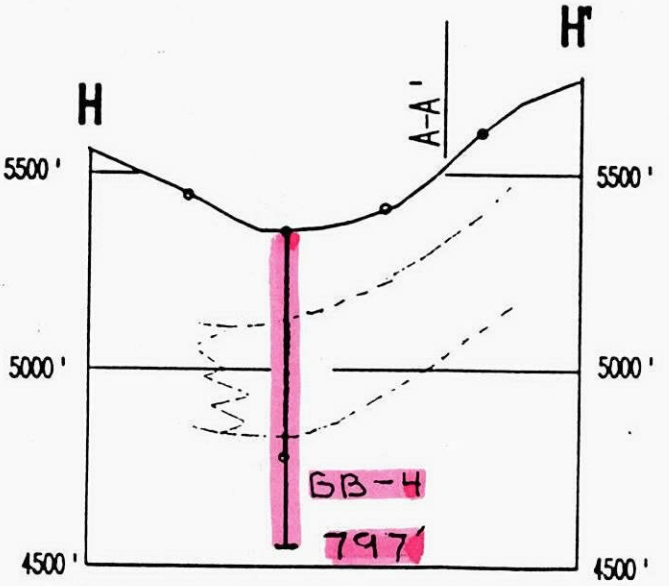
TOTAL 16,640

mn 3031

FIGURE 2B


Attch. 1
THUNDER MTN
THREE R
BB-4
TR-4
(1927')
TM-9
(1745')
TM-12
(562')
TM-8
TR-11
(5472)
TM-11
BB-1
(821')
(568')
POSSIBLE EXTENT OF MINERALIZATION
Sunnyside Mine
TR-10
(5486')
TM-10
(567')
ROAD
Volcano Mine
TR-14
(5407)
TR-15
(5309')
Tcl
Tcs
Tcx
Tcp
Tep
Ja
Ftr
Tqmp
Tqi
Tqa
ASARCO Incorporated
GEOLOGY MAP OF THE
THREE R - THUNDER MTN. AREA
PATAGONIA MOUNTAINS
SANTA CRUZ CO., ARIZONA
J.D.S.
0
500'
05-07-90
mn900509 JDS/dam fuc 05-18-90
GEOLOGY FROM mn2626 F.T.G.

Attch. 2



NORTH-SOUTH SECTION, LOOKING EAST
PROPOSED DRILL HOLE BB-12

ASARCO Incorporated
THUNDER MOUNTAIN PROJECT
PROPOSED DRILL HOLES

SKETCH SECTIONS G & H

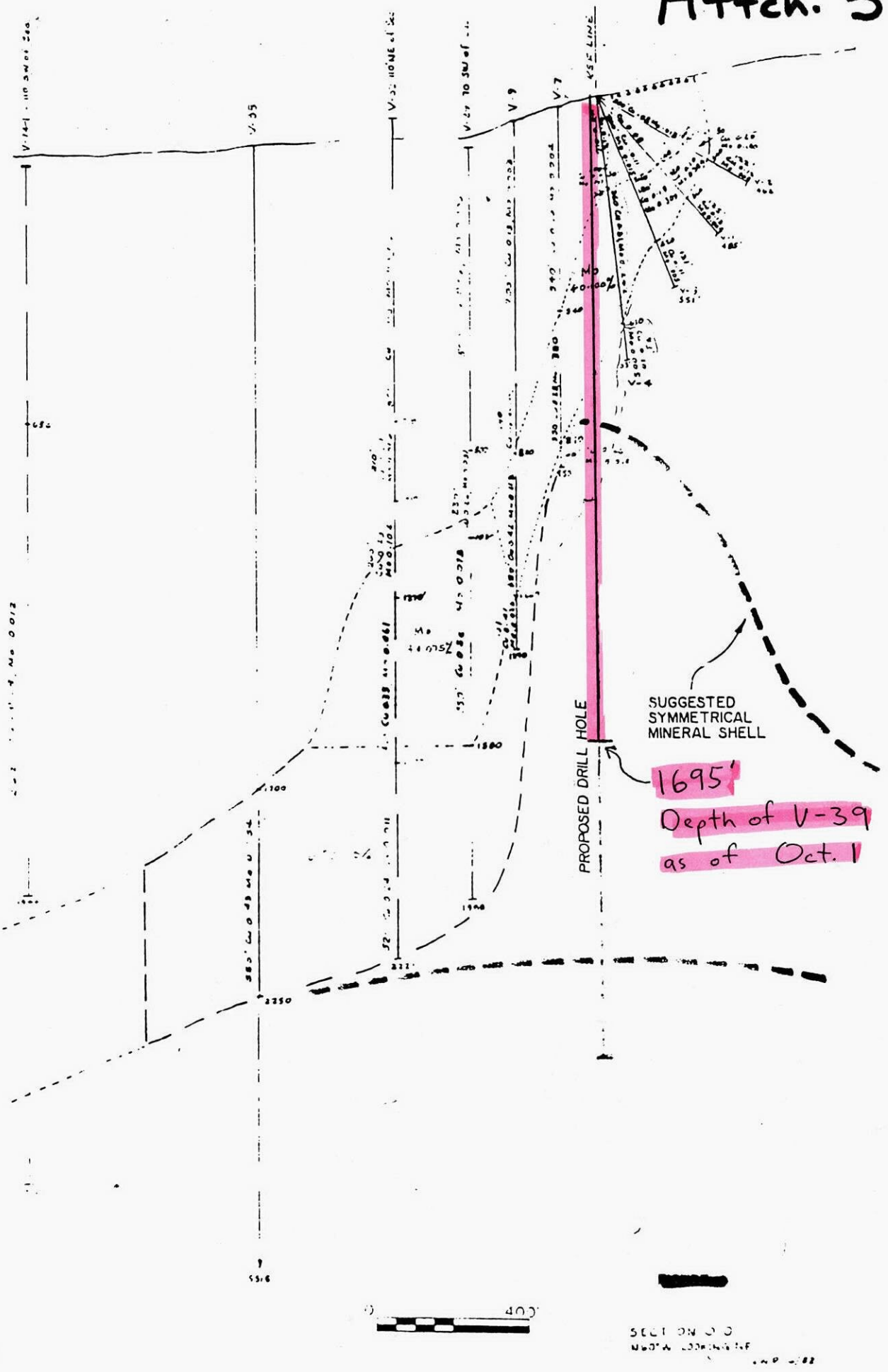
BUCKET BRECCIA ZONE
PATAGONIA MTNS., AZ.

J.D.SELL 05-09-90

0 250' 500'

mr900516 JDS/dcm tuc 05-22-90

Attch. 3


V-35
V-9
V-7
Mo
40-100%
PROPOSED DRILL HOLE
SUGGESTED
SYMMETRICAL
MINERAL SHELL
1695'
Depth of V-39
as of Oct. 1
400'

JDS

ASARCO

Southwestern Exploration Division

October 4, 1990

J.D. Sell

J.J. Malusa
Quarterly Report
3rd Quarter 1990

EXPLORATION AUTHORIZATION

Yarnell Project, Yavapai County, AZ - EA-0444

Four days were spent researching and writing reports pertaining to the potassic alteration (determined through whole rock analysis) and the presence of nontronite (determined through XRD) at Yarnell.

Thunder Mountain Project, Santa Cruz County, AZ - EA-0042

Thirty-four days were spent on this project. Three core holes have been completed (hole numbers BB-2, 3 & 4). Hole BB-2 intercepted 460 ft. of 0.25% Cu and 0.18 opt Ag between 40 and 500 feet. Hole BB-3 intercepted 76 feet of 0.61% Cu between 14 and 90 feet. Hole BB-3 also intercepted 220 ft. of 0.24% Cu between 500 and 720 feet. Assay results for BB-4 are not available as of yet. Drilling has begun on another hole labelled BB-5.

Ventura Project, Santa Cruz County, AZ - EA-0165

Eighteen days were spent on this project. Drilling is continuing on a deep vertical hole labelled V-39 which is at a depth of 1695 feet as of October 1. Ore intercepts for V-39 include 180 feet of 0.29% Cu between 20 and 200 feet, and also 460 feet of 0.23% Cu and 0.262% Mo between 200 and 660 feet.

MISCELLANEOUS

Eight days were spent on general book work, truck maintenance and locating a new vehicle to purchase for the Exploration Department.

John J. Malusa

JJM:mek

John J. Malusa

cc: W.L. Kurtz

JDS

ASARCO

Southwestern Exploration Division

November 9, 1990

J.D. Sell

J.J. Malusa
Monthly Report
October 1990

Thunder Mtn. Project, Santa Cruz Co, AZ - EA-0042

Hole BB-4

Information pertaining to BB-4 is available on last month's report. However, the assay results were not available while writing that report; therefore, they are presented here.

Ore intercepts for BB-4 are as follows:

Interval (ft.)	Thickness (ft.)	Cu %	Ag (opt)
7 - 190	183	0.48	0.06
190 - 320	130	0.01	<0.01
320 - 550	230	0.25	<0.01
550 - 797	247	0.05	<0.01

No gold values exceeded 0.00X opt.

Hole BB-5

Hole BB-5 began on Sept. 28 and was completed on Oct. 27 at a final depth of 800 feet. The hole is located on the same drill site as TM-9 (see Figure 1) and is orientated due south, dipping 30° from horizontal. A cross section showing the orientation and depth of BB-5 is plotted on Attachment 1. No surveying results are available due to the driller accidently exposing the film to light; therefore, destroying the film. The water table was encountered 335 feet down the hole.

Ore intercepts for BB-5 are as follows:

Interval (ft.)	Thickness (ft.)	Cu %
230 - 310	80	0.15
690 - 780	90	0.10

Silver values averaged <0.01 opt and gold values averaged <0.002 opt for the entire hole.

The general lithology of BB-5 is as follows:

0 - 10	Overburden
10 - 107	Quartz feldspar porphyry
107 - 199	Intrusive breccia consisting of angular silicified fragments averaging 2 inches in size
199 - 228	Brecciated (shattered) chert
228 - 247	Intrusive breccia
247 - 257	Brecciated chert
257 - 8000	Intrusive breccia.

Ventrua Project, Santa Cruz Co., AZ - EA-0165

Drilling continued on hole V-39 (location plotted on July's monthly report) and was completed on October 29 at a final depth of 2470 feet. Surface casing was left on the upper 20 feet for possible reentry, but mainly due to the drillers not being able to pull the casing without spending a substantial amount of time and money. A cross section (Attachment 2) is provided to show the final depth of the hole with relation to previously drilled holes.

A general description of the lithology of V-39 is as follows:

0 - 20	Overburden
20 - 82	Granodiorite Oxidized Zone (i.e. bleached cap)
82 - 314	Granodiorite
314 - 325	Microgranodiorite Dike
325 - 443	Granodiorite
443 - 460	Brecciated
460 - 602	Granodiorite
602 - 668	Brecciated
668 - 795	Granodiorite
795 - 1018	Granodiorite porphyry
1018 - 1075	Highly siliceous granodiorite
1075 - 1160	Granodiorite porphyry

1160 - 1180	Granodiorite
1180 - 1370	Granodiorite porphyry
1370 - 1372.5	Andesite dike
1372.5 - 1420	Granodiorite porphyry
1420 - 1480	Granodiorite
1480 - 1530	Granodiorite porphyry
1530 - 2470	Granodiorite - below 1670 secondary biotite more noticeable and is sometimes altered to chlorite.

Water table is at approximately 120 feet.

Ore intercepts for V-39 are as follows:

V-39 Interval (ft.)	Thickness (feet)	% Cu	% Mo	Ag Intervals (feet)	Thickness (feet)	Ag (ppm)
20 - 200	180	0.29	0.018	20 - 200	180	1.0
200 - 660	460	0.23	*0.262	200 - 630	430	0.6
660 - 730	70	0.19	0.008	630 - 2470	1840	2.56
730 - 1190	460	0.05	0.002	ore zones within		
1190 - 1680	490	0.15	0.001	630 - 2470 interval include		
1680 - 1900	220	0.07	<0.001	630 - 770	140	2.24
1900 - 2160	260	0.17	0.002	830 - 900	70	0.97
2160 - 2290	130	0.27	<0.001	940 - 990	50	1.77
2290 - 2470	180	0.15	0.001	1070 - 1180	110	1.48
				1180 - 1380	200	9.28

* V-39 (550'-560') assay of 3.735% Mo was lowered to 1.0% Mo for the interval average due to its "questionably high value."

Survey results for V-39:

Depth (ft.)	Inclination & Bearing
500	89°N 27°E
1000	89°N 47°E
1585	89°N 47°E
2000	89°N 50°E
2470	89°N 52°E

Cost estimates are attached for September 26 through October 25 for Thunder Mountain and for September 26 through October 29 for Ventura. Four extra days were added to the Ventura estimate to finish the hole this month.

	Field Days	Office Days	Expense Acct.	Vehicle Expense
October	17	5	$546.56	$460.75
YTD	111	96	$4000.92	$4055.25

John J. Malusa

JJM:mek
Atts.

cc: W.L. Kurtz

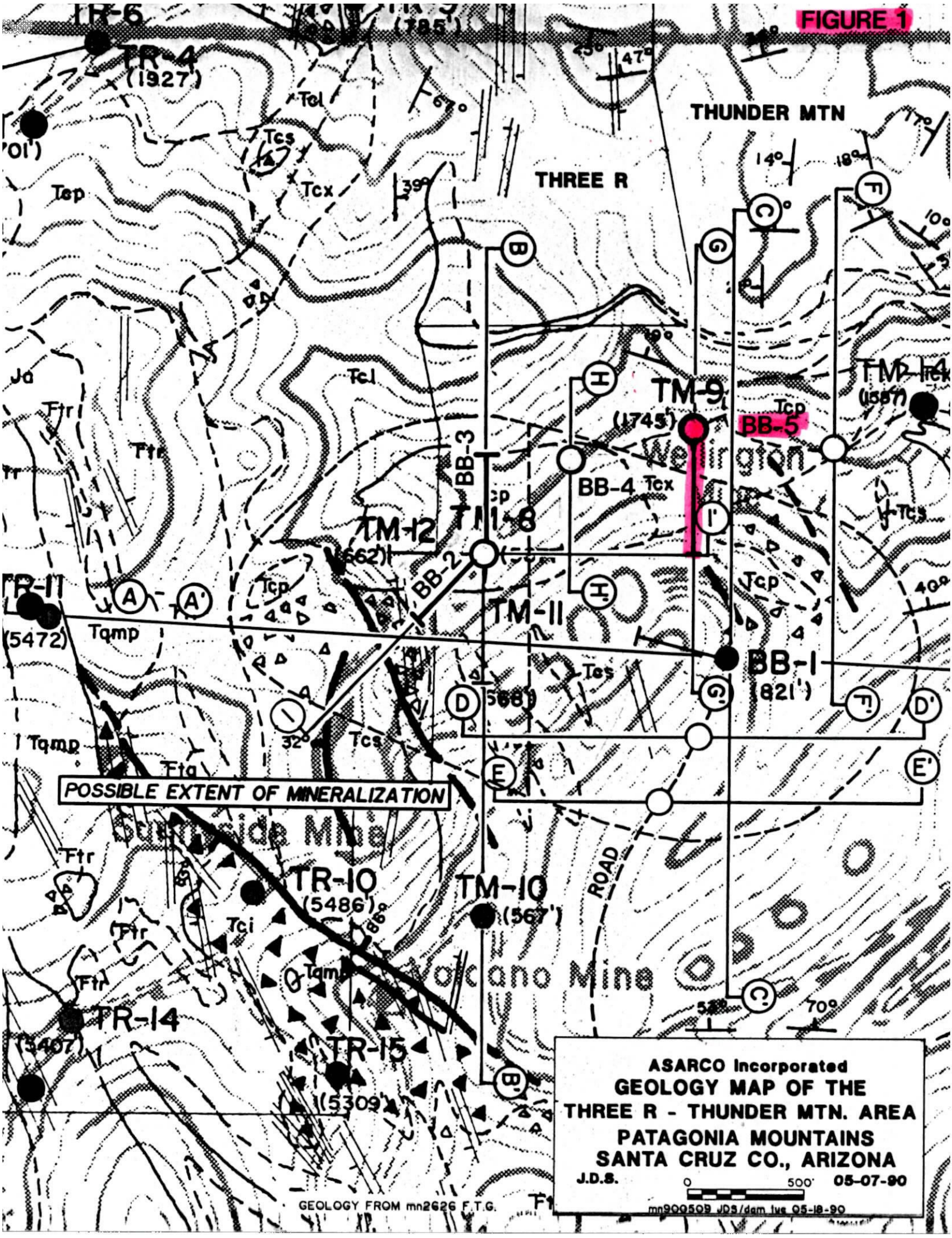
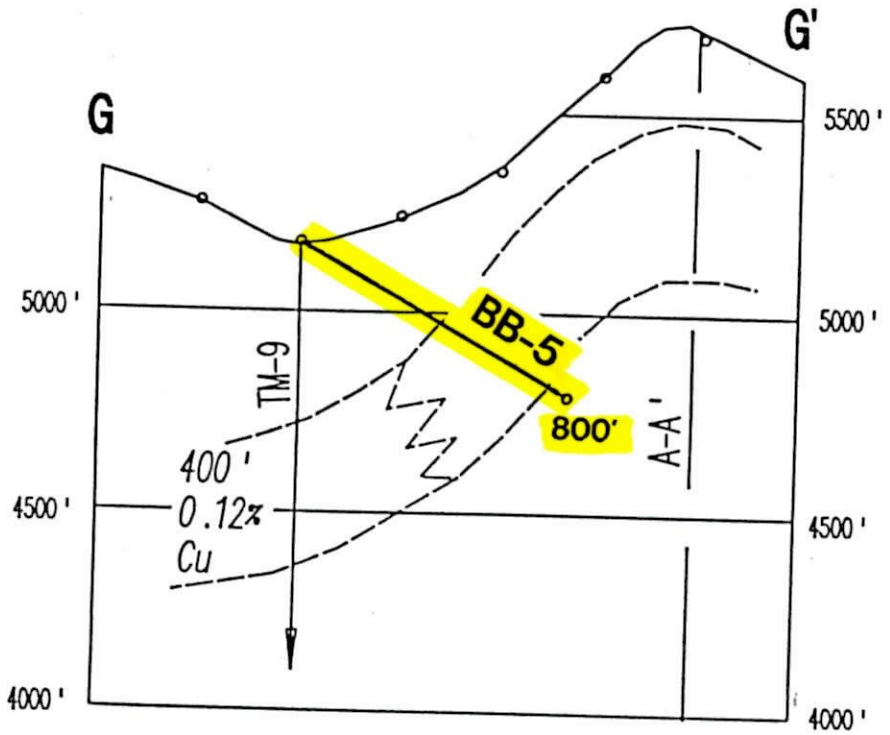


FIGURE 1
TR-6
TR-4
(1927')
THUNDER MTN
THREE R
Tcl
Tcs
Tcx
Tcp
Ja
Ftr
Ftc
TM-9
(1745')
BB-5
BB-4
BB-3
BB-2
BB-1
(821')
TM-12
TM-8
TM-11
TR-11
(5472')
Tqmp
POSSIBLE EXTENT OF MINERALIZATION
Sunnyside Mine
TR-10
(5486')
TM-10
(567')
ROAD
Volcano Mine
TR-14
(5407')
TR-15
(5309')
ASARCO Incorporated
GEOLOGY MAP OF THE
THREE R - THUNDER MTN. AREA
PATAGONIA MOUNTAINS
SANTA CRUZ CO., ARIZONA
J.D.S.
0
500'
05-07-90
GEOLOGY FROM mn2626 F.T.G.
mn900509 JDS/dam lvs 05-18-90

Attch. 1



ASARCO Incorporated

THUNDER MOUNTAIN PROJECT

PROPOSED DRILL HOLES

SKETCH SECTIONS G & H

BUCKET BRECCIA ZONE

PATAGONIA MTNS., AZ.

J.D.SELL 05-09-90

0 250 ' 500 '

mn9005 16 JDS/dcm tuc 05-22-90

Attach. 2

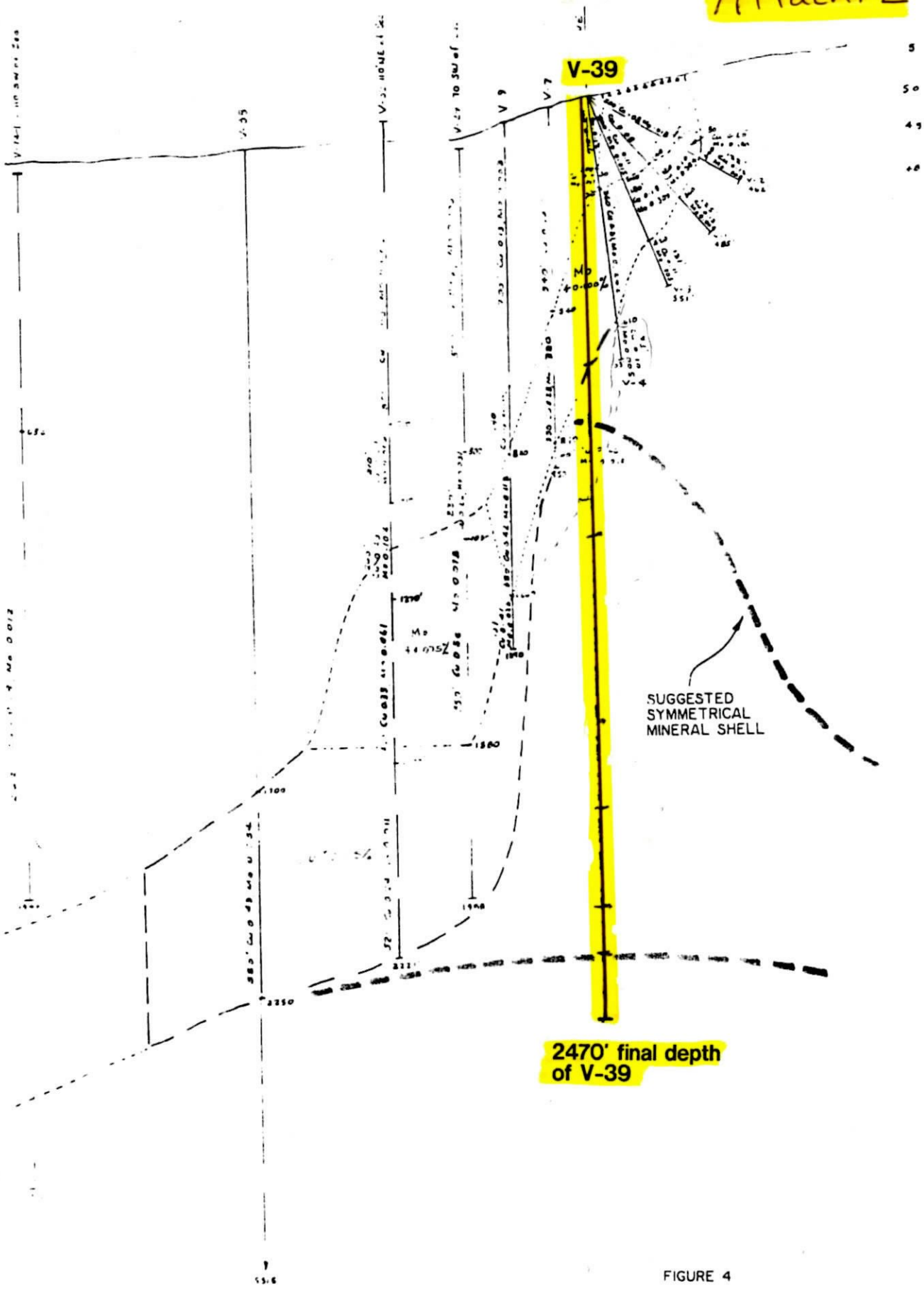


FIGURE 4

HOLE BB-5 PROJECT Thunder Mtn. 26th Sept. THRU 25th Oct., 19 90 CONTRACTOR CBC

DESCRIPTION: Sept. Oct.

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
FEET DRILLED																																		
0-10 overburden																																		
10-500							11	56	70	54	18	8		22	13	34	11	71			1	3	35	58	25							490	18 90	9261 00
500-767																									32	0		75	35	60	65	267	19 70	5259 90

SUB TOTAL 14520 90

CEMENTING	2										1½																					3½	55 00	192 50
CONDITIONING																																		
CASING							2																									2	55 00	110 00
overburden			4																													4	60 00	240 00
reaming							4½																									4½	55 00	247 50
clean mud tanks										2				2										1								5	55 00	275 00

SUB TOTAL 1065 00

MATERIALS																																		
cement	1	3																			1											5	5 00	25 00
EZ Mud								1																1								2	131 04	262 08
Dextrid								1																1								2	?	—
cal seal											1																					1	35 22	35 22
5 gal solubt oil															1																	1	?	—
logging (0-800)																																2	250 00	500 00
assaying (BB-4)																																797	1 60	1280 18
Malusa (supervision & room)																																		1193 16
vehicle expense																																1266	0 25	316 50
surveying (rental)																																½	1400 00	700 00
Moving																																1	500 00	500 00

SUB TOTAL 4813 49

TRUCK RENTAL																																1	600 00	600 00
MILEAGE																																		
LOADS OF WATER																																		

SUB TOTAL 600 00

MISC.																																		
Per Diem	4	4	3				4	4	4	4	4	4		4	4	4	4	4			4	4	4	4	4	4		4	4	4	4	95	15 00	1425 00

SUB TOTAL 1425 00

TOTAL 22,424 39

mn 3031

HOLE U-39 PROJECT Ventura 26th Sept. THRU 25th Oct. ,19 90 CONTRACTOR CBC

DESCRIPTION: Sept. Oct.

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
FEET DRILLED																																		
1585-2000	10	34	23	43			27	27	66	45	25			55	50	10																415	20.00	8507.50
2000-2457																50	70	55			38	32	5	25	19			24	57	44	38	457	22.50	10282.50

SUB TOTAL 18790.00

CEMENTING																																		
CONDITIONING																																		
CASING																																		
Surveying	1																	1														2	55.00	110.00
haul cuttings																												1				1	55.00	55.00

SUB TOTAL 165.00

MATERIALS																																		
5 Gal EZ mud									1		1				1							1			1				1	1		7	13.04	91.28
soda ash																1																1	26.84	26.84
50# cement																														1		1	5.17	5.17
logging (1520-2470)																																3½	250.00	875.00
assays (1070-1520)																																450	3.06	1379.50
JJ malus a																																8	93.00	744.00
Vehicle																																577	0.25	144.25
surveying (rental)																																½	1400.00	700.00

SUB TOTAL 4792.04

TRUCK RENTAL																																		600.00
MILEAGE		20					20	20	40	20				40	20	20	20				20	20			40				20	20	40	380	0.75	285.00
LOADS OF WATER		1					1	1	2	1				2	1	1	1				1	1			2				1	1	2	19	6.75	128.25

SUB TOTAL 1013.25

MISC.																																		
Per Diem	2	2	2	2			4	4	4	4	4			4	4	4	4	4			4	4	4	4	4			4	4	4	4	84	15.00	1260.00

SUB TOTAL 1260.00

TOTAL 26,020.29

mn 3031

HOLE U-39 PROJECT Ventura 26th Oct THRU 25th Nov, 19 90 CONTRACTOR CBC

DESCRIPTION: Oct. — Nov.

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
FEET DRILLED																																		
2457-2470	13																															13	22.50	292.50
SUB TOTAL																																		292.50
CEMENTING				1																												1	55.00	55.00
CONDITIONING																																		
CASING				½																												½	55.00	27.50
surveying	1																															1	55.00	55.00
SUB TOTAL																																		137.50
MATERIALS																																		
50# cement	4			2																												6	5.17	31.02
SUB TOTAL																																		31.02
TRUCK RENTAL																																		
MILEAGE																																		
LOADS OF WATER																																		
SUB TOTAL																																		
MISC.																																		
SUB TOTAL																																		

TOTAL 461.02

mn 3031

JDS

ASARCO

Southwestern Exploration Division

December 10, 1990

J.D. Sell

J.J. Malusa
Monthly Report
November 1990

Thunder Mountain Project, Santa Cruz County, AZ - EA-0042

Hole BB-6

Hole BB-6 began on October 31, 1990 and was completed November 21, 1990 at a final depth of 800 feet. The hole is located on the same drill site as BB-2 (see Figure 1). A cross section showing the orientation and depth of BB-6 is plotted on Attachment 1.

Surveying results for BB-6 are as follows:

Depth (ft.)	Inclination & Bearing
400	S88°E 48°
600	S88°E 50°
794	S87°E 52°

No 200 ft. or surface surveys due to camera problems.

Ore intercepts for BB-6 are as follows:

Interval (ft.)	Thickness (ft.)	Ag (oz/t)	Cu (%)
20 - 90	70	0.14	0.37
90 - 280	190	0.02	0.13
280 - 520	240	0.12	0.54
520 - 600	80	<0.01	0.10
600 - 760	160	0.02	0.23
760 - 800	40	<0.01	0.05

No gold values exceeded 0.00X opt except for 740 to 750 feet which had a value of 0.010 opt Au.

The general lithology of BB-6 is as follows:

0 - 20	Overburden
20 - 368	Quartz feldspar porphyry -- within this zone; 246 - 247.5 breccia zone, 290 - 319 multiple fault zones, 330 - 348 multiple faults and gouge zones, 360 - 368 heavy chalcocite/covellite/pyrite.
368 - 394	Intrusive Breccia - siliceous fragments in tuffaceous matrix.

394 - 397.5	Lapilli Tuff.
397.5 - 454	Intrusive Breccia - heavy covellite/Chalcocite/pyrite 440 - 450.
454 - 718	Quartz feldspar porphyry
718 - 800	Mixed intrusive breccia and quartz feldspar porphyry

Superior East Project, Pinal County, AZ - EA-0010

Hole A-16

The drill rig that was at Ventura was moved up to the Superior East Project on November 1st where it reentered a hole that was 2446 feet deep. By November 25th the hole was 2760 feet deep and continuing. The hole location is plotted on Figure 2. No cross section is available as of yet for this hole.

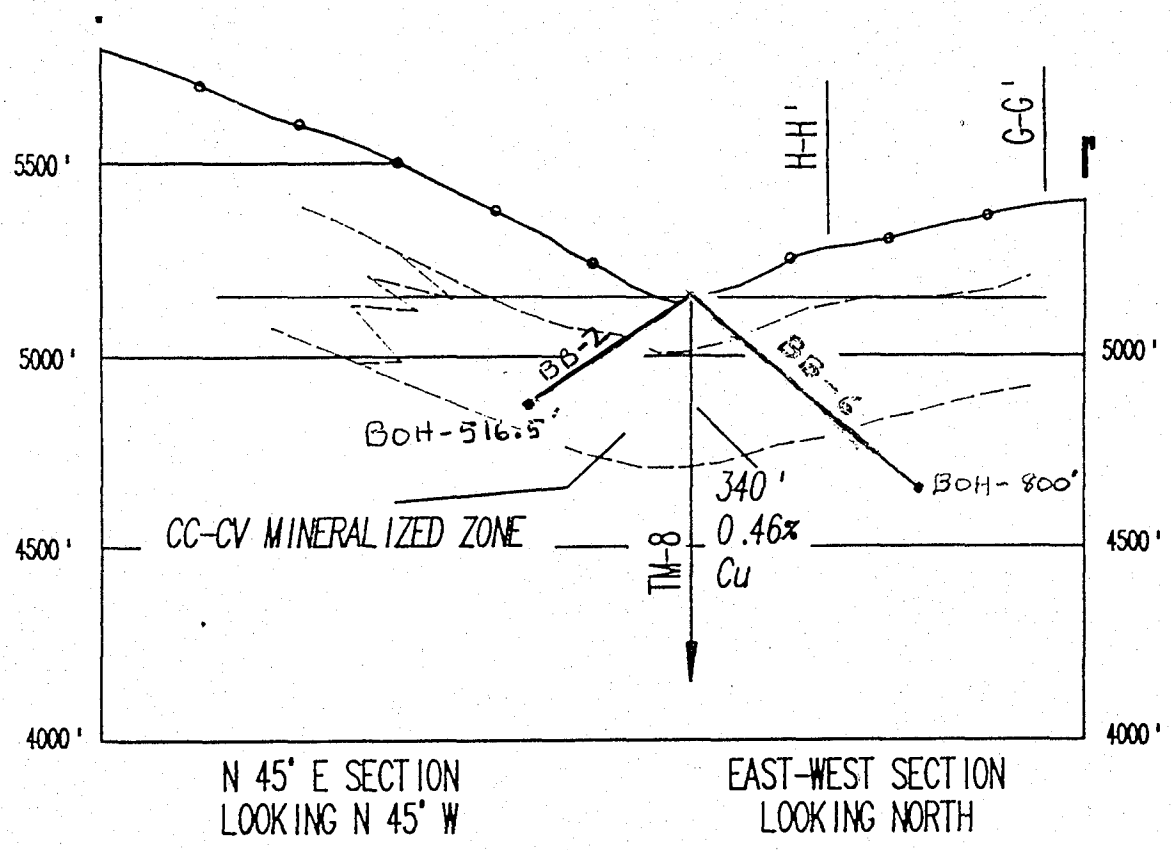
Cost estimates are attached for October 26, 1990 thru November 25, 1990 for both the Thunder Mountain and Superior East Projects.

	Field Days	Office Days	Expense Acct.	Vehicle Exp.
November	15	4	$43.65	$570.00
YTD	126	100	$4044.57	$4625.25

John J. Malusa

JJM:mek
Atts.

cc: W.L. Kurtz



PROPOSED DRILL HOLES BB-15, 16

ASARCO Incorporated

THUNDER MOUNTAIN PROJECT

PROPOSED DRILL HOLES

SKETCH SECTION I

BUCKET BRECCIA ZONE

PATAGONIA MTNS., AZ

J.D.SELL **05-09-90**

0 250' 500'

mn900517 JDS/dcm tuc 05-22-90

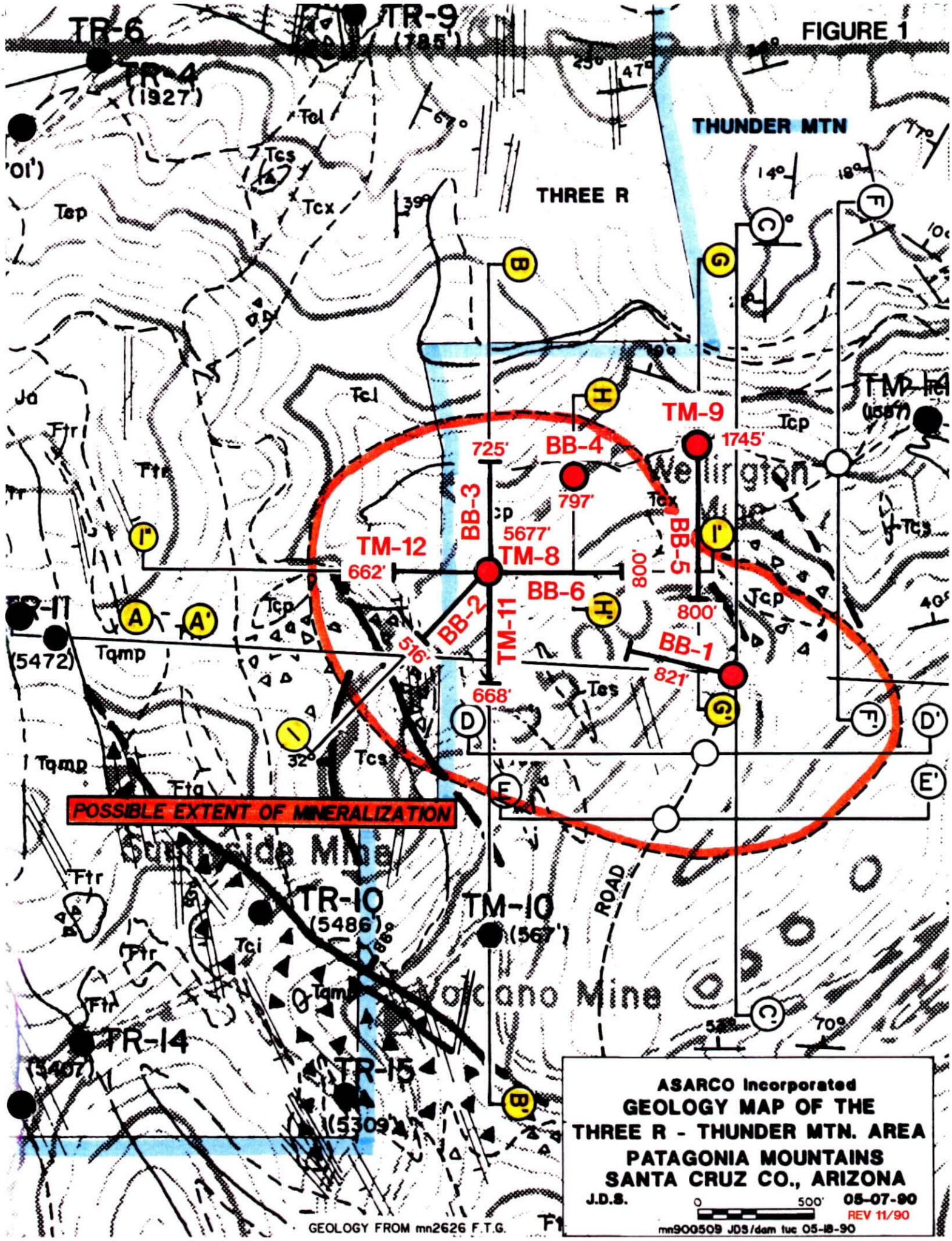
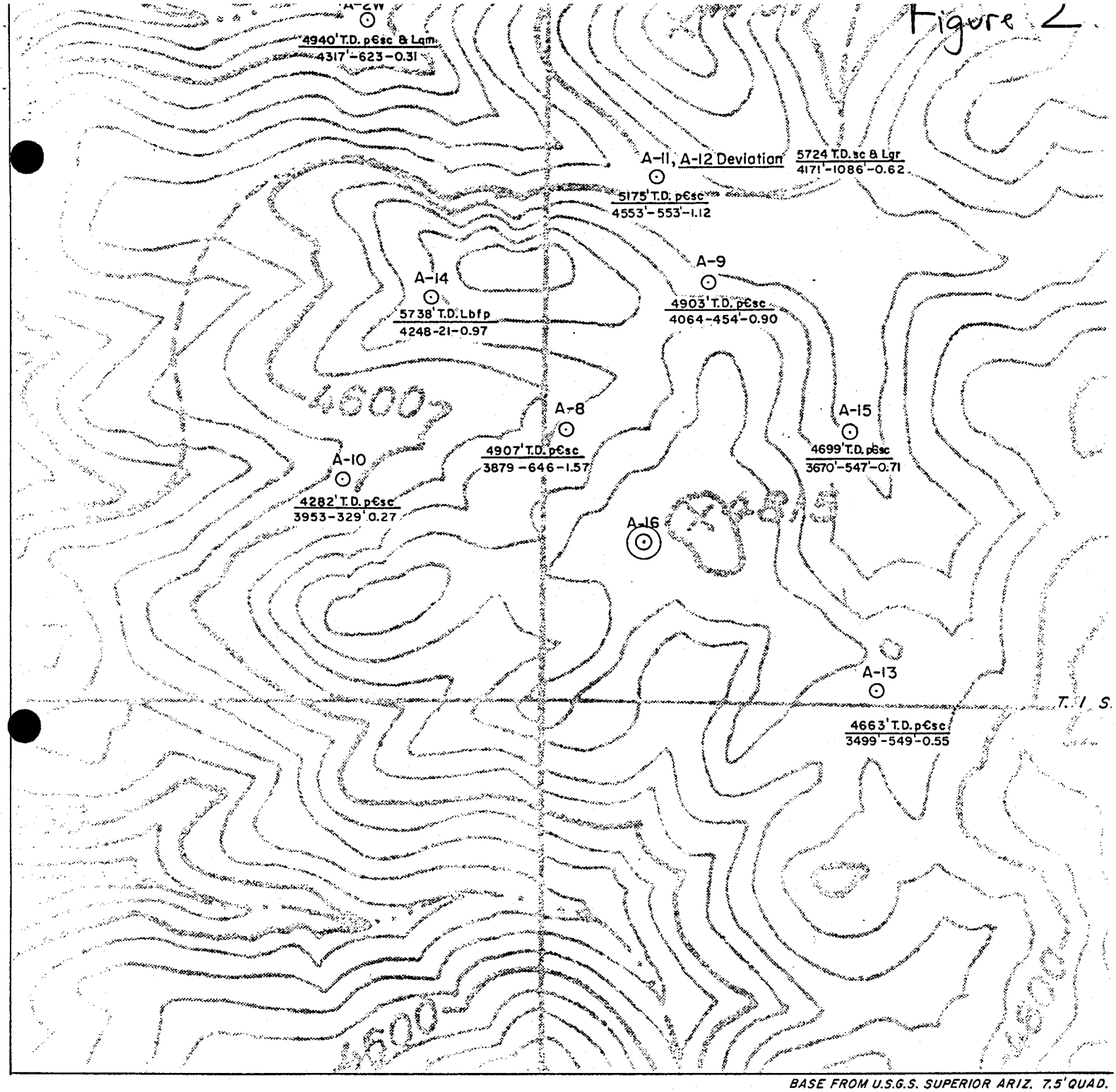


FIGURE 1
TR-6
TR-9
(785')
TR-4
(1927')
THUNDER MTN
THREE R
TM-9
1745'
BB-4
725'
797'
BB-3
5677'
TM-8
TM-12
662'
BB-6
800'
BB-5
800'
BB-2
516'
TM-11
668'
BB-1
821'
POSSIBLE EXTENT OF MINERALIZATION
Sunnyside Mine
TR-10
(5486')
TM-10
(567')
ROAD
Volcano Mine
TR-14
TR-15
(5309')
GEOLOGY FROM mn2626 F.T.G.
ASARCO Incorporated
GEOLOGY MAP OF THE
THREE R - THUNDER MTN. AREA
PATAGONIA MOUNTAINS
SANTA CRUZ CO., ARIZONA
J.D.S.
0
500'
05-07-90
REV 11/90
mn900509 JDS/dam tuc 05-18-90

Figure 2



BASE FROM U.S.G.S. SUPERIOR ARIZ. 7.5' QUAD.

N

EXPLANATION

POST-MINERAL ROCK UNIT

- Td-Dacite
- Tev-Early Volcanics
- Tw-Whitetail

PRE-MINERAL ROCK TYPE

- Lbx-Breccia
- Lbfp-Laramide Biotite Feldspar Porphyry
- Lqm-Quartz Monzonite
- Lgr-Granite
- p€sc-Schist

A-8 — ASARCO Hole & Designation

4907' T.D. p€sc / 3879-646-1.57 — Total Depth-Rock Type / Depth-Length-% Cu

⊕ — Proposed Drill Site

◎ — Drill Site

DRILLING PROGRESS MAP

SUPERIOR EAST PROJECT

PINAL COUNTY, ARIZONA

SCALE: 1" = 500'

J.D. Sell

HOLE A-16 PROJECT Superior East 26th Oct THRU 25th Nov, 19 90 CONTRACTOR CBC

DESCRIPTION: Oct. Nov.

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
FEET DRILLED																																		
2446 - 2500												4	22		28																	54	22.20	1198.80
2500 - 2760														.	5			40	35	34	36	15			14	45	36					260	24.40	6344.00

SUB TOTAL 7542.80

CEMENTING																																		
CONDITIONING																																		
CASING																																		

SUB TOTAL

MATERIALS																																		
mud seal											1																					1	18.90	18.90
EZ mud											1	1							1													3	131.04	393.12
1-55 gal sol oil															1																	1	30.18	30.18
Vehicle																																400	0.25	100.00
JJ Malusa																																2	93.00	186.00
Mobilization																																1	900.00	900.00

SUB TOTAL 1628.20

TRUCK RENTAL							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	25	20.00	500.00
MILEAGE																																		
LOADS OF WATER																																		

SUB TOTAL 500.00

MISC.																																		
Per Diem												4	4	4	4			4	4	4	4	4			4	4	4					12	15.00	180.00

SUB TOTAL 180.00

TOTAL 9851.00

mn 3031

HOLE BB-6 PROJECT Thunder Mtn. 26th Oct. THRU 25th Nov. 19 90 CONTRACTOR CBC

DESCRIPTION: Oct. — Nov.

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
FEET DRILLED																																		
0-20 Overburden																																		
20-500												18	66	105	70			69	68	58	26											480	18.90	9072.00
																					6	64	60		60	60	50					300	19.70	5910.00

SUB TOTAL 14982.00

CEMENTING									2		3																					5	55.00	275.00
CONDITIONING																																		
CASING						4			1			6																				11	55.00	605.00
Move																																1	500.00	500.00
Overburden								6	5		5																					16	60.00	960.00
Ream											5							1														6	55.00	330.00

SUB TOTAL 2670.00

MATERIALS																																		
Cement						1	3		4		3	1																				12	5.17	62.04
Dextrid											1																					1	87.19	87.19
mud seal																			1													1	?	—
plugging																				1												1	55.00	55.00
cleaned mud tanks															1½						1				1							3½	55.00	192.50

SUB TOTAL 396.73

TRUCK RENTAL																																1	600.00	600.00
MILEAGE																																0	0	
LOADS OF WATER																																0	0	

SUB TOTAL 600.00

MISC.																																		
Per Diem					3	4	4	4	2		4	4	4	4	4			4	4	4	4	4	4		4	4	4					69	15.00	1035.00

SUB TOTAL 1035.00

TOTAL 19,683.73

mn 3031

HOLE BB-5 PROJECT Thunder Mtn 26th Oct THRU 25th Nov, 1970 CONTRACTOR CBC

DESCRIPTION: Oct. Nov.

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
FEET DRILLED 767 – 800	33																															33	19.70	650.10
SUB TOTAL																																		650.10
CEMENTING CONDITIONING CASING																																		
SUB TOTAL																																		
MATERIALS																																		
SUB TOTAL																																		
TRUCK RENTAL MILEAGE LOADS OF WATER																																		
SUB TOTAL																																		
MISC. Per Diem	4			3																												7	15.00	105.00
SUB TOTAL																																		105.00

TOTAL 755.10

mn 3031

JDS

ASARCO

Southwestern Exploration Division

January 7, 1991

J.D. Sell

J.J. Malusa
Monthly Report
December 1990

Thunder Mtn. Project, Santa Cruz County, AZ - EA-0042

Hole BB-7

Hole BB-7 began on Nov. 29 and was completed December 21, 1990 at a final depth of 735 feet. The hole is located on the same drill site as BB-1 (see Figure 1). A cross section showing the orientation and depth of BB-7 is plotted on Figure 2.

No assay results are available as yet.

Surveying results for BB-7 are as follows:

Depth (ft.)	Inclination & Bearing
150	89° S 77° E
250	88° S 67° E
500	88° S 67° E
730	88° S 62° E

The general lithology of BB-7 is as follows:

0 - 12	Overburden.
12 - 27	Lapilli Tuft - fragments grit size to 10 mm. Red hematite and goethite filling open fractures.
27 - 32	Compacted Talc/Alunite layer.
32 - 41.5	Brecciated Chert - similar to bottom of BB-2, TM-11 and TM-12.
41.5 - 51	Fault gouge and breccia.
51 - 257	Rhyolite or Rhyodacite - massive siliceous (>60% silica) probably same unit logged as silica tuff in BB-1 (Graybeal, et al).
257 - 617.5	Lapilli Tuff.
617.5 - 635	Rhyolite/Rhyodacite.
635 - 735.5	Lapilli Tuff.

Superior East Project, Pinal County, AZ - EA-0010

Hole A-16

Drilling continued on hole A-16 (location plotted on November's monthly report) and is at an approximate depth of 3200 feet as of December 25th. The core is being logged on site and dumped until ore is intersected. A general lithological cross section is attached (Figure 3) to show the depth and orientation of the hole with respect to rock type.

Surveying results for A-16 are as follows:

Depth (ft.)	Inclination & Bearing
1050	89° S 64° W
1500	89° S 89° W
2000	89° S 59° W
2500	89° N 22° W
3000	90°

Cost estimates are attached for November 26 thru December 29, 1990 for Thunder Mountain. This concludes the 1990 drilling program (i.e., BB-2 thru BB-7) for Thunder Mountain.

Cost estimates are attached for November 26 thru December 14, 1990 for Superior East Hole A-16.

	Field Days	Office Days	Expense Acct.	Vehicle Exp.
Dec.	10	6	$72.17	$522.50
YTD	136	106	$4,116.24	$5,144.75

John J. Malusa

JJM:mek
Atts.

cc: W.L. Kurtz

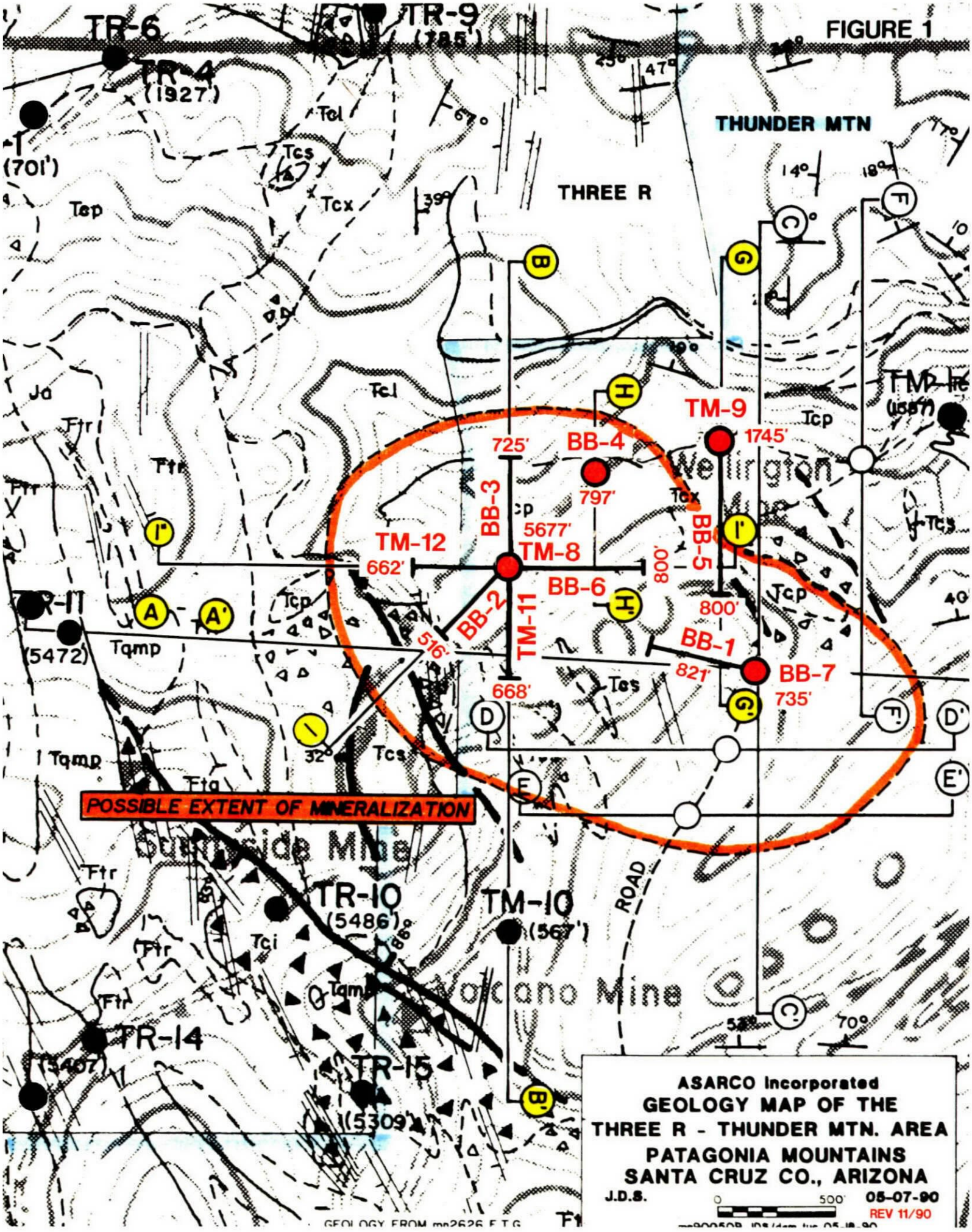
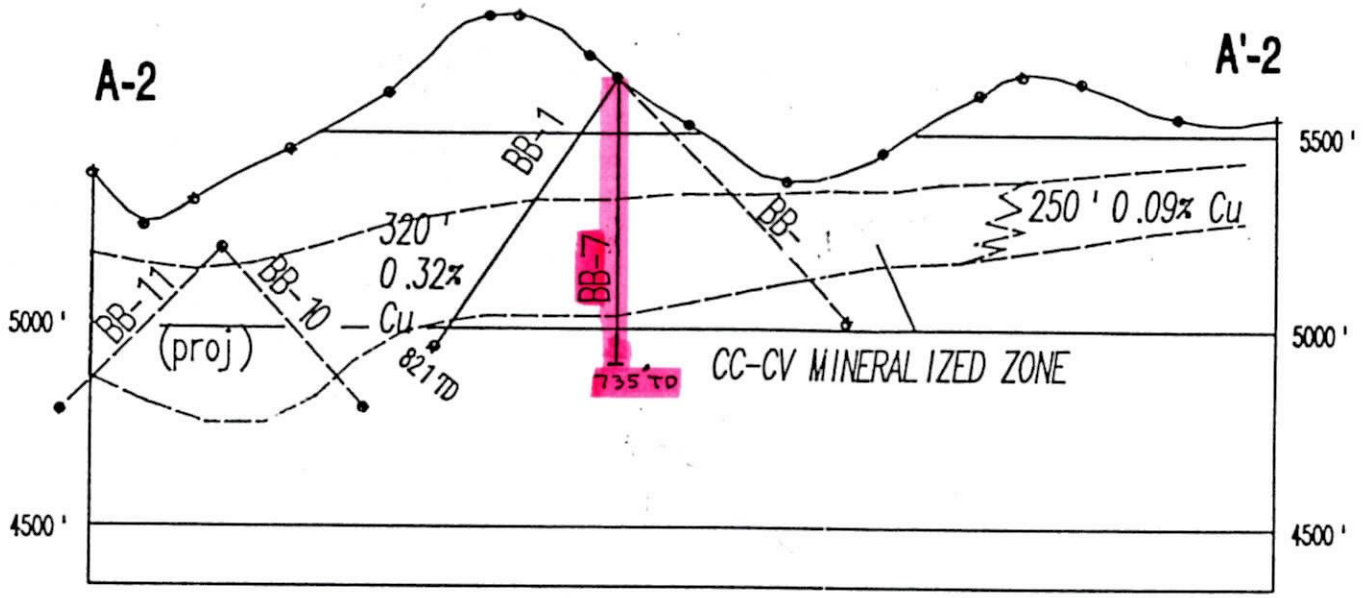


FIGURE 1
TR-6
TR-9
(785')
TR-4
(1927')
(701')
THUNDER MTN
THREE R
Tcl
Tcs
Tcx
Tcp
Ja
Ftr
Tqmp
Tqmp
Tcs
Tcp
Tcp
Tcx
Tcs
Tcs
Tcp
Tcp
Tcs
Tci
Tqmp
TM-9
1745'
BB-4
797'
725'
BB-3
5677'
TM-8
TM-12
662'
BB-6
800'
BB-5
800'
BB-2
516'
TM-11
668'
BB-1
821'
BB-7
735'
TR-11
(5472')
POSSIBLE EXTENT OF MINERALIZATION
Sunnyside Mine
TR-10
(5486')
TM-10
(567')
ROAD
Volcano Mine
TR-14
(5407')
TR-15
(5309')
ASARCO Incorporated
GEOLOGY MAP OF THE
THREE R - THUNDER MTN. AREA
PATAGONIA MOUNTAINS
SANTA CRUZ CO., ARIZONA
J.D.S.
0
500'
05-07-90
REV 11/90
GEOLOGY FROM mn2626 F.T.G.

Figure 2



EAST-WEST SECTION, LOOKING NORTH
PROPOSED DRILL HOLES BB2 AND BB-3

ASARCO Incorporated
THUNDER MOUNTAIN PROJECT
PROPOSED DRILL HOLES

SKETCH SECTIONS A-2

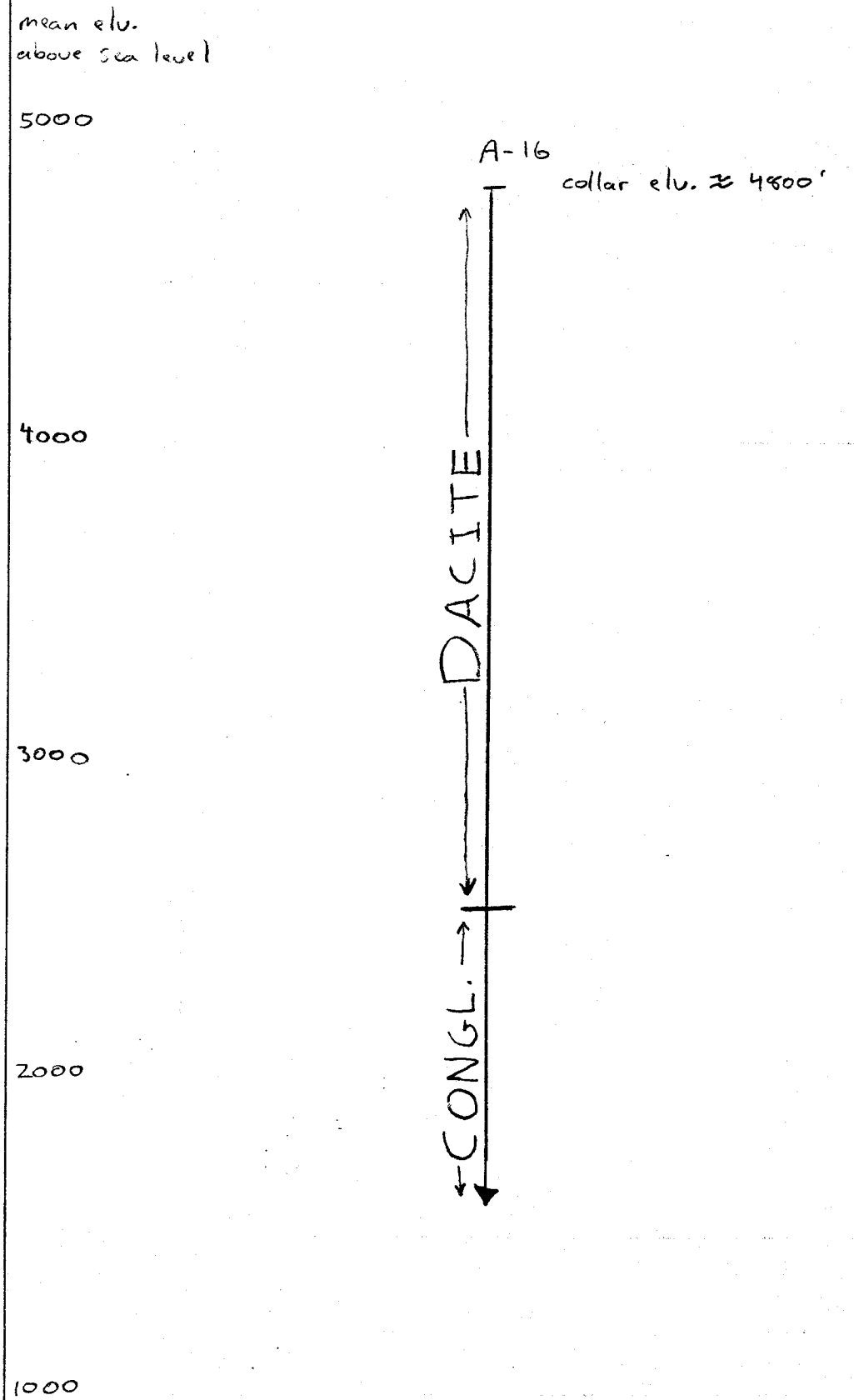
BUCKET BRECCIA ZONE
PATAGONIA MTNS., AZ.

J.D.SELL 05-09-90

0 250' 500'

mn900513 JDS/dcm tuc 05-21-90

Figure 3



AMPAD 22-141 50 SHEETS 22-142 100 SHEETS 22-144 200 SHEETS

HOLE BB-7 PROJECT Thunder Mtn. 26th Nov. THRU 25th Dec. 1990 CONTRACTOR CBC

DESCRIPTION: Nov. — Dec.

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
FEET DRILLED																																		
otary → 0-10½																																2 hours	60.00	120.00
NC → 10½-130							21½		5	12	3	20	11			28	19															119½	17.40	2079.30
NX → 130-500																	5	78	76	74	81		56									370	15.40	5698.00
NX → 500-735																							4	70	70	31	60					235	16.20	3807.00
																																	SUB TOTAL	11,704.30
CEMENTING										7	14	8	3																			32	55.00	1760.00
CONDITIONING																																		
CASING							1										2															3	55.00	165.00
Plugging										1½			1																			2½	55.00	137.50
																																	SUB TOTAL	2062.50
MATERIALS																																		
Cal Seal					1						2																					3	35.72	107.16
Cement					2					1	1	2																				6	6.02	36.12
Soda Ash							1																									1	26.84	26.84
EZ Mud										1																						1	131.04	131.04
Mud seal													1																			1	18.00	18.00
Delays																	2½															2½	55.00	137.50
Moving																																1	500.00	500.00
																																	SUB TOTAL	957.56
TRUCK RENTAL																																30	20.00	600.00
MILEAGE																																		
LOADS OF WATER									1	1	1	2	2			2	2			2			1									14	6.75	94.50
																																	SUB TOTAL	694.50
MISC.																																		
Per Diem					4	4	4		4	4	4	4	4			4	4	4	4	4	4		4	4	4	4	4					76	15.00	1140.00
																																	SUB TOTAL	1140.00

TOTAL 16,558.86

mn 3031

HOLE BB-7 PROJECT Thunder Mtn. 26th Dec THRU 25th Jan, 1990-91 CONTRACTOR CBC

DESCRIPTION: Dec — Jan

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
FEET DRILLED																																		
																																SUB TOTAL		
CEMENTING		1		1																												2	55.00	110.00
CONDITIONING																																		
CASING		2																														2	55.00	110.00
Surveying	1½	½																														3	55.00	165.00
																																SUB TOTAL		385.00
MATERIALS																																		
50# bagmud	3																															3	5.17	15.51
cement		2		1																												3	6.02	18.06
																																SUB TOTAL		33.57
TRUCK RENTAL																																		
MILEAGE																																		
LOADS OF WATER																																		
																																SUB TOTAL		
MISC.																																		
Per Diem	4	4	4	4																												16	15.00	240.00
																																SUB TOTAL		240.00

TOTAL 658.57

mn 3031

HOLE BB-6 PROJECT Thunder Mtn. 26th Nov THRU 25th Dec ,19 CONTRACTOR CBC

DESCRIPTION: Nov — Dec

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
FEET DRILLED																																		
SUB TOTAL																																		
CEMENTING		1																														1	55.00	55.00
CONDITIONING																																		
CASING		1																														1	55.00	55.00
Surveying	3	1																														4	55.00	220.00
Delays	2																															2	50.00	100.00
SUB TOTAL																																		430.00
MATERIALS																																		
50# Mud	3	2																														5	5.00	25.85
SUB TOTAL																																		25.85
TRUCK RENTAL																																		
MILEAGE																																		
LOADS OF WATER																																		
SUB TOTAL																																		
MISC.																																		
Per Diem	4	4	4	4																												16	15.00	240.00
SUB TOTAL																																		240.00

TOTAL 695.85

mn 3031

HOLE A-16 PROJECT Superior East 26th Nov THRU 25th Dec, 19 90 CONTRACTOR CBC

DESCRIPTION: Nov — Dec.

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
FEET DRILLED																																		
2760-3000	17		43	30	35				23		32	15				10	35															240	24.40	5856.00
3000-3060																				60												60	25.70	1542.00

SUB TOTAL 7398.00

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
CEMENTING																																		
CONDITIONING	1																															1	55.00	55.00
CASING																		11	14													25	55.00	1375.00
Surveying																	3	5														8	55.00	440.00

SUB TOTAL 1870.00

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
MATERIALS																																		
E-Z Mud									1								1															2	131.04	262.08

SUB TOTAL 262.08

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
TRUCK RENTAL																																1 month	600.00	600.00
MILEAGE																																		
LOADS OF WATER																																		

SUB TOTAL 600.00

	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL	PRICE	AMOUNT
MISC.																																		
Per Diem	4	4	4	4	4				4	2	4	2	2			4	4	4	4	4												54	15.00	810.00

SUB TOTAL 810.00

TOTAL 10,940.08

mn 3031

ASARCO

Southwestern Exploration Division

January 14, 1991

J.D. Sell

J.J. Malusa
Quarterly Report
4th Quarter 1990

EXPLORATION AUTHORIZATION

Yarnell Project, Yavapai County, AZ - EA-0444

Three and a half days spent finishing research and writing report pertaining to K-Ar dating of illite clay.

Superior East Project, Gila County, AZ - EA-0010

Three days spent supervising the reentry and continuation of drill hole A-16.

Thunder Mountain Project, Santa Cruz County, AZ - EA-0042

Thirty-three days were spent on this project. Three core holes were completed this quarter (BB-5, 6 & 7). Assay results for BB-4, 5 & 6 were obtained this quarter while results for BB-7 are yet to be received. Hole BB-4 intercepted 183 feet of 0.48% Cu and 0.06 opt Ag between 7 and 190 feet. Hole BB-5 intercepted 80 feet of 0.15% Cu between 230 and 310 feet. Hole BB-6 intercepted 70 feet of 0.37% Cu and 0.14 opt Ag between 20 and 90 feet. Hole BB-6 also intercepted 240 feet of 0.54% Cu and 0.12 opt Ag between 280 and 520 feet. These holes complete the Thunder Mountain drilling program for this year.

Ventura Project, Santa Cruz County, AZ - EA-0165

Fourteen days were spent on this project. Finished drilling deep vertical hole V-39 at a final depth of 2470 feet.

Miscellaneous

Three and a half days spent on general book work and truck maintenance.

JJM:mek

John J. Malusa

JDS

ASARCO

Southwestern Exploration Division

January 31, 1991

J.D. Sell

J.J. Malusa
Monthly Report
January 1991

GENERAL EXPLORATION

Reconnaissance of Cyclopic Mine and Gold Basin District in northwest Arizona. Truck maintenance and book work.

Superior East Project, Pinal County, AZ - EA-0010

Drilling continued on hole A-16 (location plotted on November's monthly report) and is at a depth of 4270 feet as of January 30, 1991.

Thunder Mountain Project, Santa Cruz County, AZ - EA-0042

Assay results from BB-7 were received and no ore was intercepted.

Road work and clean up was officially inspected and given approval by Duane Bennett, U.S. Forest Service.

Assay checks and hydrologic information was compiled and written.

Ventura Project, Santa Cruz County, AZ - EA-0165

Road work and site clean up officially approved by Duane Bennett, U.S. Forest Service.

Dixie Project, La Paz County, AZ - EA-04772

Mapping.

	Field Days	Office Days	Expense Acct.	Vehicle Exp.
January & YTD	13	10	$101.46	$400

John J. Malusa/mek

John J. Malusa

JJM:mek

cc: W.L. Kurtz

ASARCO

Southwestern Exploration Division

JDS

October 2, 1990

R.L. Brown
New York Office

Bucket Breccia Zone
Thunder Mountain Project
Santa Cruz County, AZ

Two drill holes have been completed (BB-2 and BB-3) and assayed in the area of the previous drill hole TM-8, TM-11 and TM-12 (Figure 1) in the Bucket Breccia zone of the Thunder Mountain Project, Santa Cruz County, Arizona.

Table 1 lists the five drill holes, their mineralized intercepts and the copper-silver values of the intercepts.

On Figure 1, the heavy dashed outline approximates the western third of the proposed extent of mineralization.

Based on a block 800 feet wide (E-W), and 1200 feet lone (N-S), this western block would contain 42 million tons at a grade of 0.27% copper and 0.20 ounces silver. Within this block the best upper part of the zone would contain 9 million tons of 0.51% copper and 0.22 ounces silver.

Drill hole BB-4 is completed, with assays pending, and is not included in the above mineral resource numbers.

Since drilling has started in late July, a total of $46,800 has been spent (including BB-4) out of the $250,000 which was approved June 21 for this project.

I believe the numbers to date justify continuing the project drilling as outlined in my request of June 8, 1990, and unless notified, the drilling will continue.

James D. Sell

James D. Sell

JDS:mek
Att.

cc: W.L. Kurtz

Table 1. Drill Holes, Mineralized Intercepts and Assay Values

Drill Hole	Bearing	Inclination	Mineralization From	Mineralization To	Mineralization Drill Length	Mineralization Est. Vertical Feet	Assay % Cu	Assay oz Ag	T.D. Feet	Sketch Sections		
BB-3	N2°E	-50°	14	90	76	65	0.60	0.04	725	B-2		
BB-3	N2°E	-50°	500	720	220	175	0.24	0.06	725	B-2		
BB-3	N2°E	-50°	14	720	706	560	0.12	0.03	725	B-2		
TM-8	--	Vert.	130	210	80	80	0.53	0.21c.*	5677	B-2	I-2	I-1
TM-8	--	Vert.	210	370	160	160	0.25	0.20c.	5677	B-2	I-2	I-1
TM-8	--	Vert.	370	540	170	170	0.55	0.31c.	5677	B-2	I-2	I-1
TM-8	--	Vert.	130	540	410	410	0.43	0.27c.	5677	B-2	I-2	I-1
TM-11	due S	-45°	40	180	140	130	0.49	0.31c.	668	B-2		
TM-11	due S	-45°	180	540	360	350	0.28	0.41c.	668	B-2		
TM-11	due S	-45°	540	630	90	90	0.23	0.20c.	668	B-2		
TM-11	due S	-45°	40	630	590	570	0.32	0.35c.	668	B-2		
TM-12	due W	-45°	10	100	90	90	0.41	0.21c.	620	I-2		
TM-12	due W	-45°	100	220	120	100	0.09	0.20c.	620	I-2		
TM-12	due W	-45°	220	570	350	310	0.27	0.20c.	620	I-2		
TM-12	due W	-45°	10	570	560	500	0.25	0.20c.	620	I-2		
BB-2	S49°W	-37°	40	140	100	90	0.47	0.07	517	I-1		
BB-2	S49°W	-37°	140	360	260	190	0.23	0.29	517	I-1		
BB-2	S49°W	-37°	360	500	140	130	0.13	0.09	517	I-1		
BB-2	S49°W	-37°	40	500	460	410	0.25	0.18	517	I-1		

*c. Estimate silver value from scattered individual and composite assays.

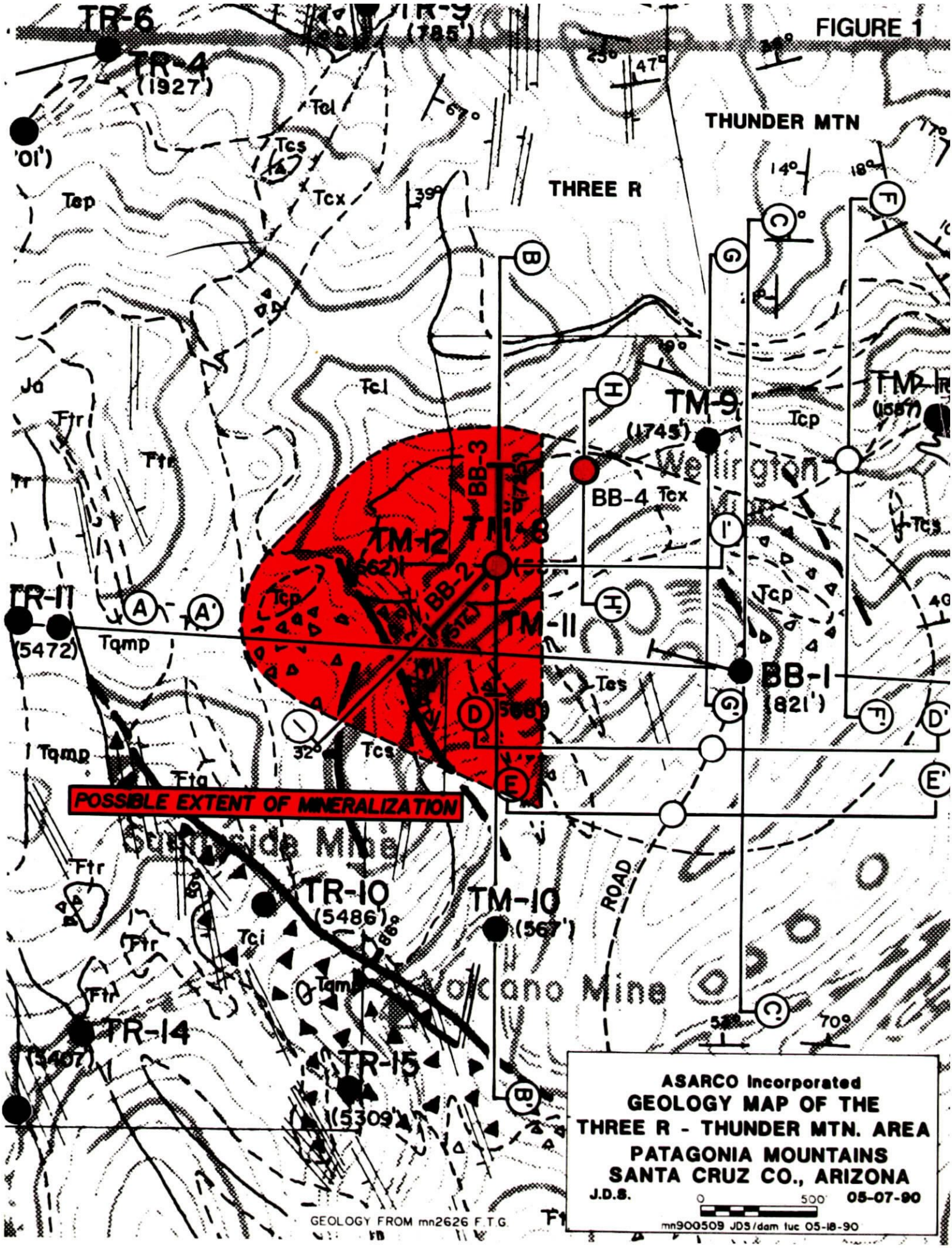


FIGURE 1
TR-6
TR-9
(785')
TR-4
(1927')
THUNDER MTN
THREE R
Tcl
Tcs
Tcx
Tcp
Ja
Ftr
Ftg
Tqmp
Tqm
Tci
TM-9
(1745')
BB-4
BB-3
BB-2
BB-1
(821')
TM-12
TM-8
TM-11
TR-11
(5472)
TR-10
(5486')
TM-10
(567')
TR-14
(5407)
TR-15
(5309')
POSSIBLE EXTENT OF MINERALIZATION
Sunnyside Mine
Volcano Mine
ROAD
ASARCO Incorporated
GEOLOGY MAP OF THE
THREE R - THUNDER MTN. AREA
PATAGONIA MOUNTAINS
SANTA CRUZ CO., ARIZONA
J.D.S.
0
500
05-07-90
mn900509 JDS/dam fuc 05-18-90
GEOLOGY FROM mn2626 F.T.G.

JDS

ASARCO

Southwestern Exploration Division

November 14, 1990

W.L. Kurtz

Results, Holes BB-2 thru BB-5
Bucket Breccia Zone
Thunder Mountain Project
Santa Cruz County, Arizona

Summary

As indicated by the summary table below the four new holes (BB-2 through BB-5) intercepted an overall vertical thickness averaging 555 feet at 0.22% copper and 0.07 opt silver versus the previous four holes (BB-1, TM-8, -11, -12) having 460 feet of 0.32% copper and an estimated 0.28 opt silver.

The loss of copper value is mainly in the lower part of the hole as shown by the comparison of the best upper zone vertical thickness-grade. The four new holes average 112 feet of 0.50% copper with 0.05 opt silver versus the previous four holes having 98 feet of 0.46% copper and estimated 0.27 opt silver.

Summary Table: Thickness-Grade, New Holes vs. Previous Holes

Drill Hole	Vertical Thickness Overall	Cu %	Ag opt	Vertical Thickness Upper Zone	Cu %	Ag opt
NEW						
BB-2	440'	0.25	0.18	80'	0.47	0.07
BB-3	~~626'~~ 460	0.18	0.04	76'	0.60	0.04
BB-4	600'	0.25	0.01	180'	0.47	0.04
BB-5	NA*	NA	NA	NA	NA	NA
Avg.	555'	0.22	0.07	112'	0.50	0.05
PREVIOUS						
BB-1	~~290'~~ 330	0.30	NA	100'	0.41	NA
TM-8	410'	0.43	0.23e*	80'	0.53	0.21e
TM-11	590' 570	0.32	0.35e	140'	0.49	0.33e
TM-12	540'	0.24	0.24e	70'	0.41	0.21e
Avg.	460'	0.32	0.28e	98'	0.46	0.27e

*NA Not available/not applicable.
*e Estimated value, opt silver, based on scattered assays or composited sample assay.

From the table, it is noted that with the drop in grade for the overall thickness, the potential recovery of the values is a critical question. A leach test will be conducted on the core rejects.

No present explanation can be given for the large difference in the silver assays for the new holes versus the previous holes. Some checks on rerunning pulps will be made to confirm the reliability, but standard checks have been submitted with the present samples and most indicate the standard value. It would appear that the 1970's values might be in error.

Using the present outline and the value in the upper zone, it might be expected that some 25 million tons at a grade of 0.48% copper would be in the zone which would have less than a 1 to 1 stripping ratio.

Figures 2 through 5 update the drill hole assay intervals and intercepts. Appendix Table 1 lists all the drilled holes and their intercepts/grade with the section location.

An additional ten holes are requested to test the bulk of the outline as now suggested (See Table 2 of the June 8, 1990 supplemental exploration authorization request report).

James D. Sell

James D.Sell

JDS:mek
Atts.

cc: R.L. Brown
F.T. Graybeal

APPENDIX A

Results: BB-2 thru BB-5
compared to previous holes
Bucket Breccia Zone
Thunder Mountain Project
Santa Cruz County, Arizona

Four new holes (BB-2 thru BB-5) have been drilled in the Bucket Breccia zone of mineralization based on five previous holes (BB-1, TM-8, TM-9, TM-11, TM-12).

Figure 1 is the plan map showing all the holes in the general area and the revised plan of possible extent of mineralization.

Hole BB-2, collared at the TM-8 site and drilled west, was drilled to confirm the values in the vertical hole TM-8 and bisected the hole TM-11, drilled south from TM-8, and hole TM-12, drilled west from TM-8.

Hole BB-2 (Section I-I') intercepted 320' (40'-360') of 0.30% copper compared to TM-8 (Section I-I') intercept of 240' (130'-370') of 0.34% copper, hole TM-11 (Section B'-2) intercept of 140' (40-180) of 0.49% copper, hole TM-12 (Section I'-I") intercept of 90' (10'-100') of 0.41% copper. In the holes, only TM-8 had a basal zone of mineralization which ran 0.55% copper over 170' (370'-540'). The other three holes ran less than half this amount of copper, or as in the case of BB-2, may not have penetrated the full zone of mineralization.

Drill hole BB-3 (Section B'-2), drilled north from TM-8, also found an upper zone of 76' at 0.60% copper (14'-90') versus TM-8 upper zone of 80' at 0.53% copper (130'-210'). The basal zone was half that amount of copper and similar to that found in TM-11, TM-12, and BB-2.

Drill hole BB-6 is presently being drilled east from TM-8 and may confirm the basal higher grade zone as found in TM-8, and add to the evolution of the intercepts in this area. The deep (130 feet) drop to the top of the zone in TM-8 compared to the other three holes collared at the same site is at present unexplained.

Drill hole BB-4 (Section H-H'), drilled vertically between hole TM-8 and TM-9, also found an upper zone of 180' (10'-190') at 0.47% copper. BB-4 also intercepted a basal zone of half this grade, similar to BB-3. This intercept confirms the lateral extent of the mineralization, but unfortunately, does not have a higher grade basal portion.

APPENDIX A

Drill hole TM-9, of low grade values, was used as one of the perimeter holes. Drill hole BB-5 was drilled south from the TM-9 site and intercepted a 570 foot zone of low grade mineraliztion, but failed to pick up the grade expected northward from hole BB-1.

Section G-G' plots holes TM-9, BB-5, and BB-1 and their intercepts.

A proposed hole was scheduled along Section F-F' (report of June 8, 1990) (Figure 1) as a long flattish hole to intercept the zone. This hole will not be drilled until the east end of the extent of mineralization is confirmed by holes out of the BB-1 site (Figure 1, Section A'-2).

Table 1 lists all the drill holes to date with the break down of the various grade intervals.

The overall lack of silver values in the new drilling versus the original holes in the area cannot be explained at this time, but it is probable that the earlier silver assays were on the high side.

James D. Sell

James D. Sell

APPENDIX

Table 1. Assay-footage in Drill Holes

Section	Drill Hole	Footage Interval	Core Footage	Estimated Vertical Thickness (feet)	Assay Cu %	Assay Ag opt
A'-2	BB-1	250-350	100	90	0.15	NA*
		350-490	140	100	0.41	NA
		490-740	250	190	0.24	NA
	Avg.	350-740	390	290	0.30	NA
B'-2	TM-8	130-210	80	80	0.53	0.21e*
		210-370	160	160	0.25	0.20e
		370-540	170	170	0.55	0.31e
	Avg.	130-540	410	410	0.43	0.23e
B'-2	TM-11	40-180	140	140	0.49	0.33e
		180-630	450	450	0.27	0.35e
	Avg.	40-630	590	590	0.32	0.35e
B'-2	BB-3	14-90	76	76	0.60	0.04
		90-500	410	350	0.07	0.03
		500-720	220	200	0.24	0.06
	Avg.	14-720	706	626	0.18	0.04
G-G'	TM-9	10-500	490	490	0.04	0.07e
		500-900	400	400	0.12	0.17e
G-G'	BB-5	230-310	80	80	0.15	<0.01
		310-800	490	620	0.04	<0.01
H-H'	BB-4	10-190	180	180	0.47	0.04
		190-390	200	200	0.07	0.08
		390-610	220	220	0.24	<0.01
	Avg.	10-610	600	600	0.25	0.01
I-I'	BB-2	40-140	100	80	0.47	0.07
		140-180	40	40	0.04	0.10
		180-360	180	180	0.27	0.33
		360-500	140	140	0.13	0.09
	Avg.	40-500	460	440	0.25	0.18

*NA Not avialable.
*e Estimate from scattered assays or composite values.

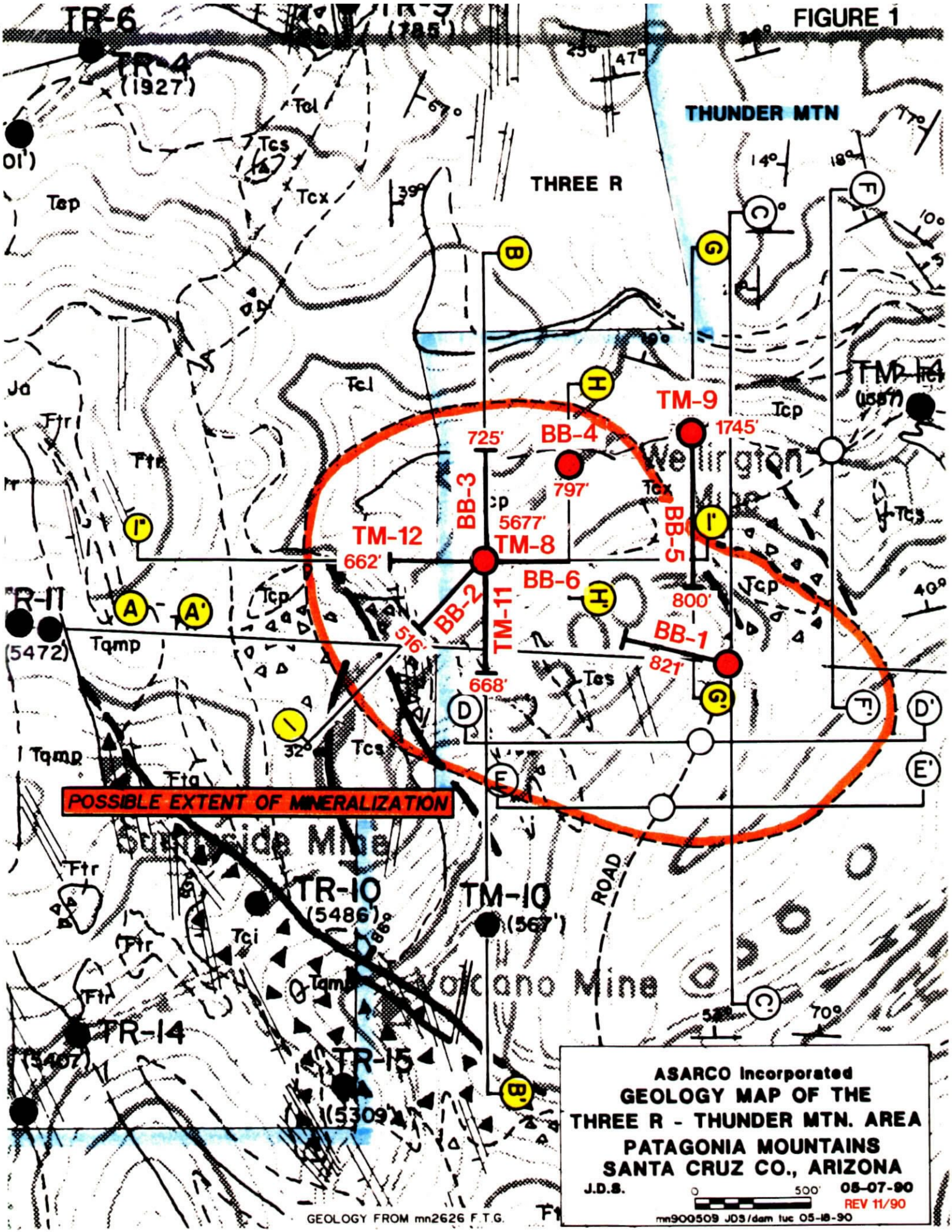
APPENDIX

Table 1. Assay-footage in Drill Holes (Continued)

Section	Drill Hole	Footage Interval	Core Footage	Estimated Vertical Thickness (feet)	Assay Cu %	Assay Ag opt
I-I'	TM-8	130-210	80	80	0.53	0.21e
		210-370	160	160	0.25	0.20e
		370-540	170	170	0.55	0.31e
	Avg.	130-540	410	410	0.43	0.23e
I-I'	TM-12	10-100	90	70	0.41	0.21e
		100-220	120	120	0.09	0.20e
		220-600	380	350	0.25	0.25e
	Avg.	10-600	590	540	0.24	0.24e

*NA Not available.
*e Estimate from scattered assays or composite values.

FIGURE 1

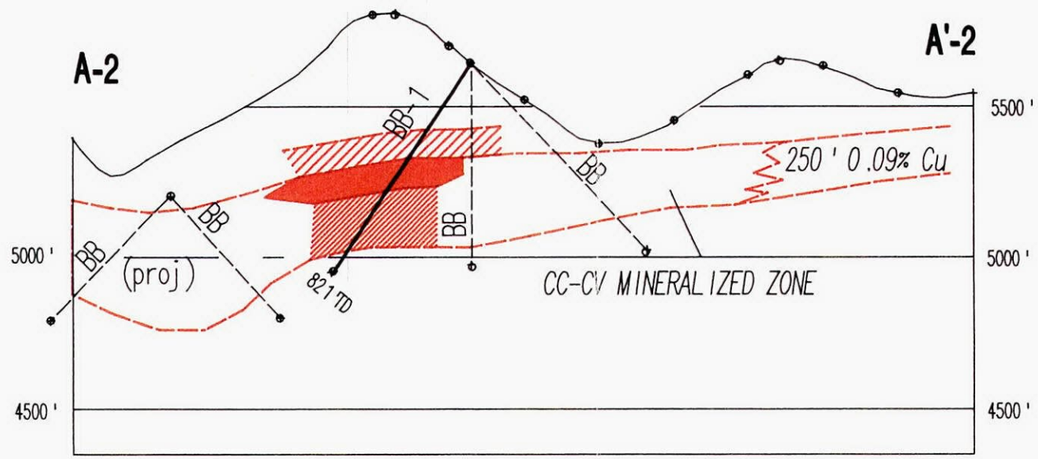


ASARCO Incorporated
GEOLOGY MAP OF THE
THREE R - THUNDER MTN. AREA
PATAGONIA MOUNTAINS
SANTA CRUZ CO., ARIZONA

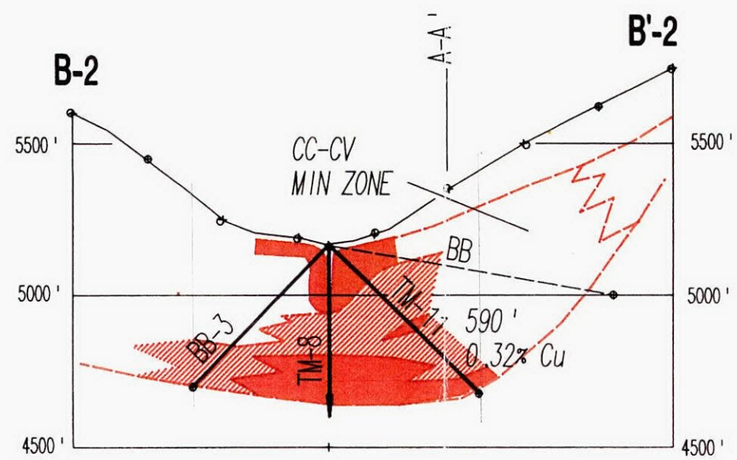
J.D.S. 0 500' 05-07-90
REV 11/90
mn900509 JDS/dam tuc 05-18-90

GEOLOGY FROM mn2626 F.T.G.

FIGURE 2



EAST-WEST SECTION, LOOKING NORTH
PROPOSED DRILL HOLES AND DRILL HOLE BB-1



NORTH-SOUTH SECTION, LOOKING EAST
PROPOSED DRILL HOLE AND DRILL HOLES
TM-8, TM-11 AND BB-3

EXPLANATION

- 0.10 - 0.19 % Cu
- 0.20 - 0.39 % Cu
- + 0.40 % Cu

ASARCO Incorporated

THUNDER MOUNTAIN PROJECT

PROPOSED DRILL HOLES

SKETCH SECTIONS A-2 & B-2

BUCKET BRECCIA ZONE

PATAGONIA MTNS., AZ.

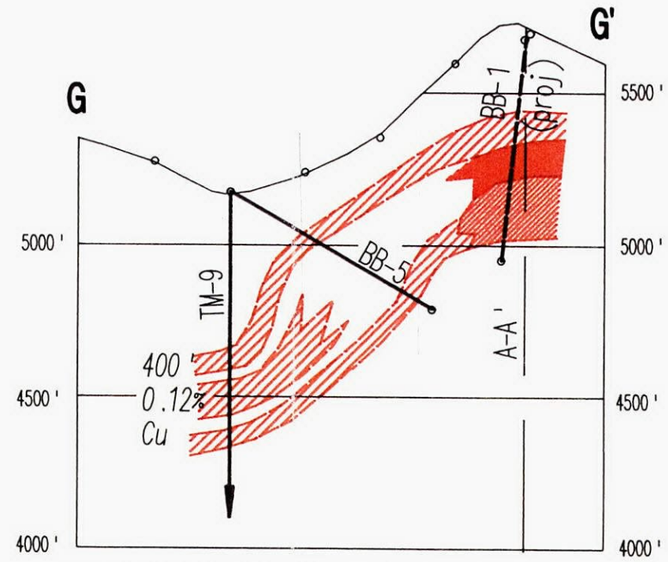
J.D.SELL **05-09-90**

REV. 11-90

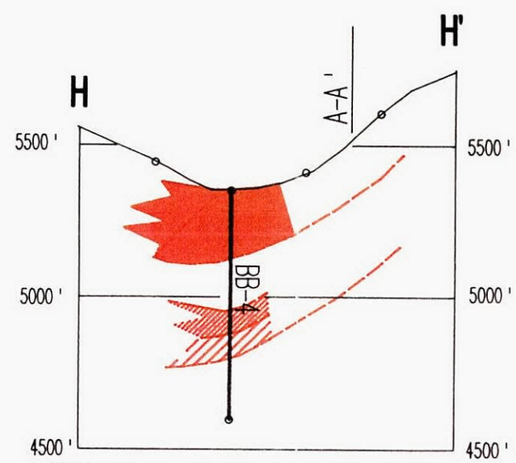
0 250 ' 500 '

mn TM901121 JDS/dam tuc 11-15-90

FIGURE 3



NORTH-SOUTH SECTION, LOOKING EAST
DRILL HOLES TM-9, BB-1, BB-5



NORTH-SOUTH SECTION, LOOKING EAST
DRILL HOLE BB-4

EXPLANATION

0.10 - 0.19 % Cu

0.20 - 0.39 % Cu

+ 0.40 % Cu

ASARCO Incorporated
THUNDER MOUNTAIN PROJECT
PROPOSED DRILL HOLES

SKETCH SECTIONS G & H

BUCKET BRECCIA ZONE
PATAGONIA MTNS., AZ.

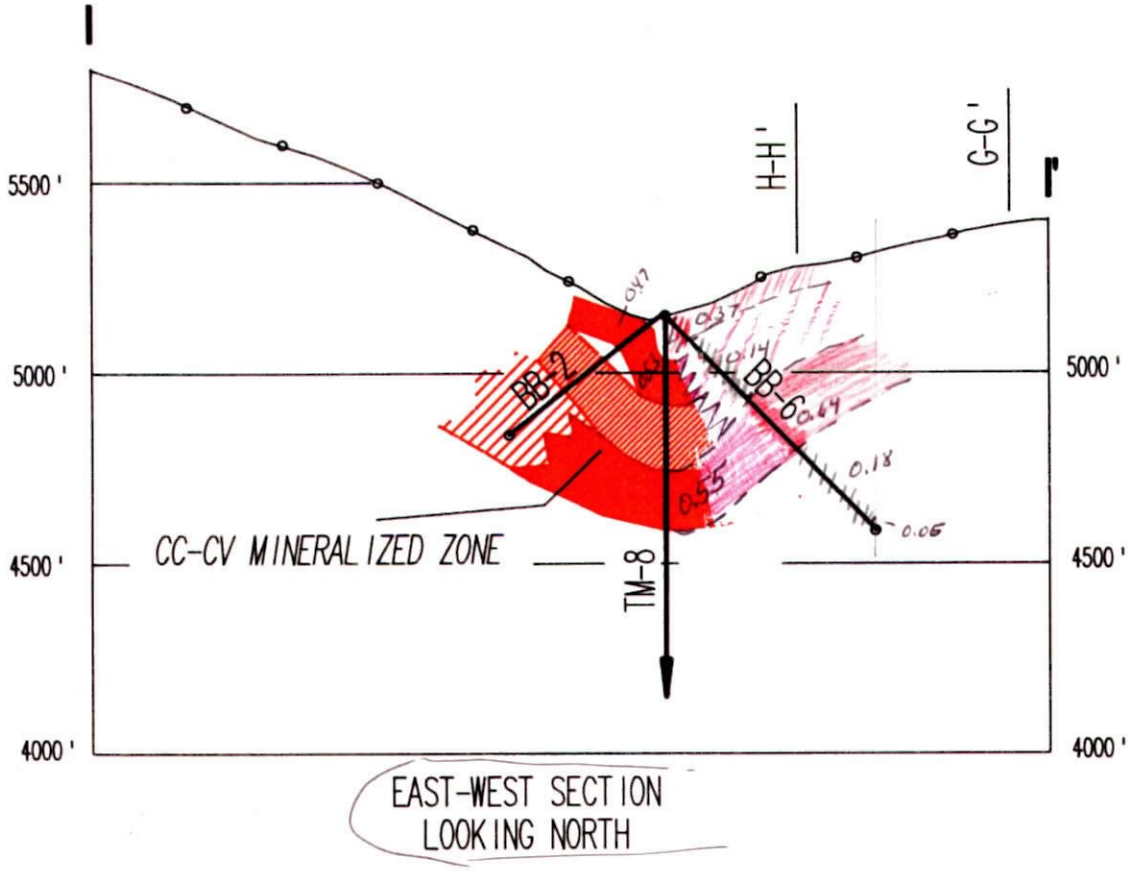
J.D.SELL

05-09-90
REV 11-90

0 250 ' 500 '

mn 901122 JDS/dam tuc 11-16-90

FUGURE 4



EAST-WEST SECTION
LOOKING NORTH

DRILL HOLES BB-2, BB-6, TM-8

EXPLANATION

0.10 - 0.19 % Cu

0.20 - 0.39 % Cu

+ 0.40 % Cu

ASARCO Incorporated

THUNDER MOUNTAIN PROJECT
PROPOSED DRILL HOLES

SKETCH SECTION I

BUCKET BRECCIA ZONE

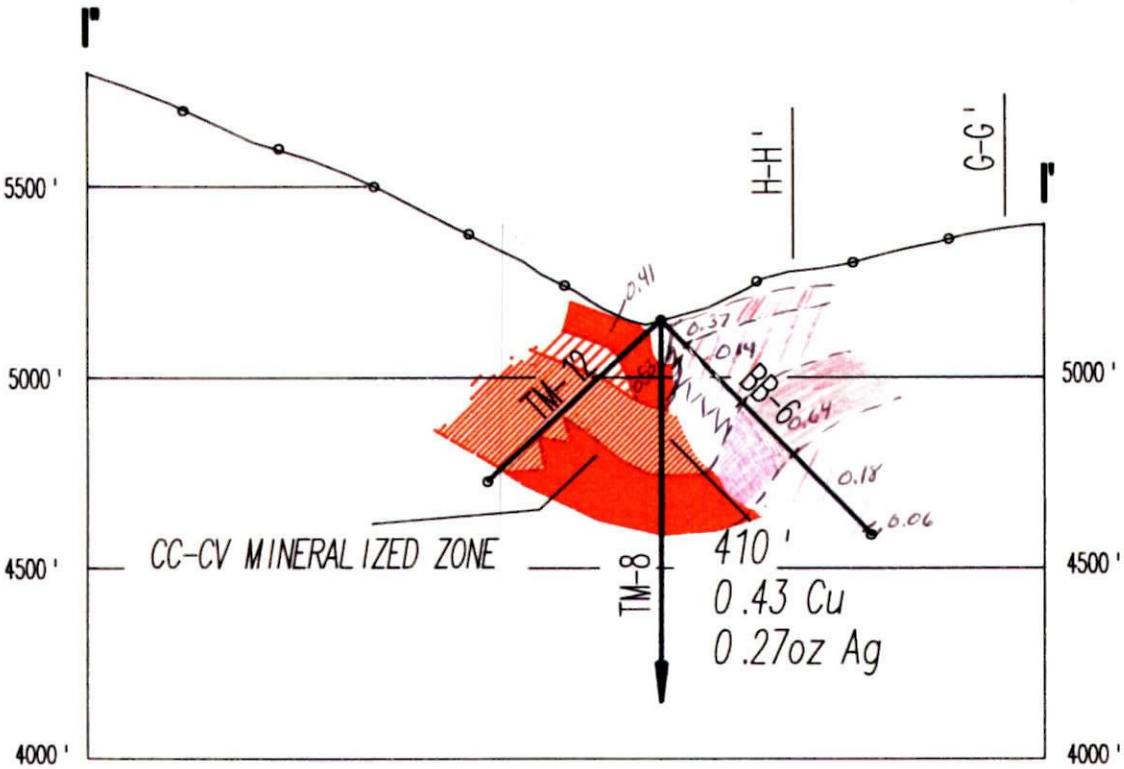
PATAGONIA MTNS., AZ.

J.D.SELL **05-09-90**
REV 11-90

0 250' 500'

mn 901123 JDS/dam tuc 11-16-90

FUGURE 5



EAST-WEST SECTION
LOOKING NORTH

DRILL HOLES TM-12, BB-6, TM-8

EXPLANATION

0.10 - 0.19 % Cu

0.20 - 0.39 % Cu

+ 0.40 % Cu

ASARCO Incorporated

THUNDER MOUNTAIN PROJECT
PROPOSED DRILL HOLES

SKETCH SECTION I'-I"

BUCKET BRECCIA ZONE
PATAGONIA MTNS., AZ.

J.D.SELL **05-09-90**
REV 11-90

0 250' 500'

mn 901124 JDS/dam tuc 11-16-90

Mr. R. L. Brown

Greater Patagonia Exploration
Patagonia Mountains
Santa Cruz County, AZ

Dear Sir:

You have requested that I up-date the past drilling activities and the exploration potential in the Patagonia Mountains, Santa Cruz County, AZ.

The ASARCO agreement with Ken-McGee calls for $100,000 work ~~program~~ program per year with approximately $375,000 yet to be expended by ASARCO to become a 50% vested owner. The Noranda agreement calls for $40,000 per year work committment, and approximately $200,000 remains to be spent for 51% ~~own~~ vested owner.

~~I will~~ Noranda continue ~~to pursue~~ to secure relief from the Noranda work committment.

Attachment A plots the ~~three~~ four main areas of continued exploration interest:

1. Ventura breccia and expanded lateral mineralization. This property is under the Noranda agreement. The central moly pipe extends from the surface to 1600 feet; present drilling suggest 13 million tons of 0.28% copper and 0.14% moly (Mo). The deeper, 1600'-2200', open-ended, tabular zone of copper mineralization is drill-indicated 31 million tons of 0.36% copper and 0.035% moly

In excess of fifty holes have been drilled in the area of Attachment A. Four major mineralized centers have been outlined with seven targets ranging from ~~[illegible]~~ near vertical breccia pipe mineralization to high-level, ~~ch~~ near surface, chalcocite zones, to deep primary chalcopyrite zones, to skarn-hosted massive sulfide pods, lenses, masses in deep carbonates.

Table 1 lists the zones outlined and a common theme is the relative low-grade (±0.40% or less copper) in both the high-level chalcocite zones and the deeper chalcopyrite zones, even ~~the carbonate hosted massive sulfide~~ though large tonnages are indicated. The carbonate-hosted massive sulfides ~~have~~ often have excellent Pb-Zn-Ag values but are deep and have erratic and scattered intercepts.

No drilling to date has outlined an area of sufficient grade and open-pit availability to propose a massive drilling program to confirm the grade and tonnage available. Available leach tests on the Bucket Breccia ~~mineralization~~ or chalcocite mineralization indicate low recoveries not suitable for heap-leach or in stirred tank procedures.

As a mineral resource, ~~the~~ the Ventero-~~Thunder Mountain~~ Sunnyside-Trench mineralized zones are subjective based on today's economic parameters and await future economics.

(Table 1-B)

The greater tonnage estimated is based on a few outlying holes indicating extended mineralization and the concept of mineralization also existing southeast of the pipe area and underlying the Ventura mine breccias and others to the southeast. ~~Table 1 for estimated data on the system.~~

2. Sunnyside deep zone at +2500 feet below the surface is part of the Kerr-McGee agreement. The Sunnyside zone has a ~~sparse drilling~~ geologic estimated reserve of 450 million tons of 0.34% copper and 0.012 moly. The larger, billion ton plus, (Table 1-B) estimated tonnage is based on the probable extent outward from known drilling and expansion northwestward under the known shallow zones and breccia pipe development. ~~Known~~. ~~Table V lists the data for this pyrite chalcocite mineralization.~~

Several shallow chalcocite zones are known which are upper-level expression of the deep chalcopyrite zone. A., The Sunnyside breccia and breccia pipe, and the B., Bucket breccia chalcocite.

A. The Sunnyside breccia pipe was one of the earliest AS ARCO drill projects in the Patagonia Mountains. This breccia pipe has a drill indicated 3 million tons of 0.48% copper surrounded by a zone of lesser grade which has been estimated at 35 million tons of 0.37%

copper. (Table 1-A).

B. The Bucket breccia shallow chalcocite zone has been the current drilling area and ten holes have cut this zone. ~~The mineral~~ Table 1-A lists the data on the zone. Mineralization essentially begins at the canyon bottom level and extends under the hillside. ~~in~~ A potential 30 million plus tons of 0.28% copper may exist in this zone. Attachment B plots the topography and the current drill holes in the Bucket Breccia zone, and the indicated grade contours of the total zone as ~~drill~~ indicated by drilling to date.

~~The zone has a total thickness (Table 1) of an average of 576 feet, and~~

Three representative cross-sections, A-A', B-B', and C-C' are also shown and exhibited in Attachments C-1, C-2, and C-3.

Table 1-A indicates the total zone ~~is and~~ has an average thickness of 574 feet. The total zone is best expressed as a three-layer zone with a higher grade (+0.40% copper) at the surface and at depth, separated by a zone of 0.2-0.4% copper. All is surrounded by a low-grade envelope of mineralization.

3. Three R (TR) shallow chalcocite zone was also one of the early drilling projects and at a grade of 0.35% copper (Table 1-A), the zone was ~~not considered worth to attempt to be~~

not of sufficient interest and was dropped many years ago. However, it is part of the overall mineralization in this portion of the Patagonia Mountains and undoubtedly is the high-level expression of a continued deep primary zone of the Sunnyside deep chalcopyrite zone presently held by ASARCO-Ken McGee.

4. Trench deep carbonate Pb-Zn Ag mineralization

This zone is within the ASARCO Mining Department lands and the ASARCO-Ken McGee exploration agreement

Only four holes penetrate the shaw-hosted Zone. The holes and intercepts of note are listed in Table 1-~~[illegible]~~ ~~[illegible]~~. ~~The no~~

The numerous intercepts range from knife-edge slips and 1" - 2" gouge-replaced zones to replacement zones up to 43' thick. Many of the intercepts are probably lenses and pods as usual in the type of shaw-hosted ~~[illegible]~~ mineralization ~~of this type~~.

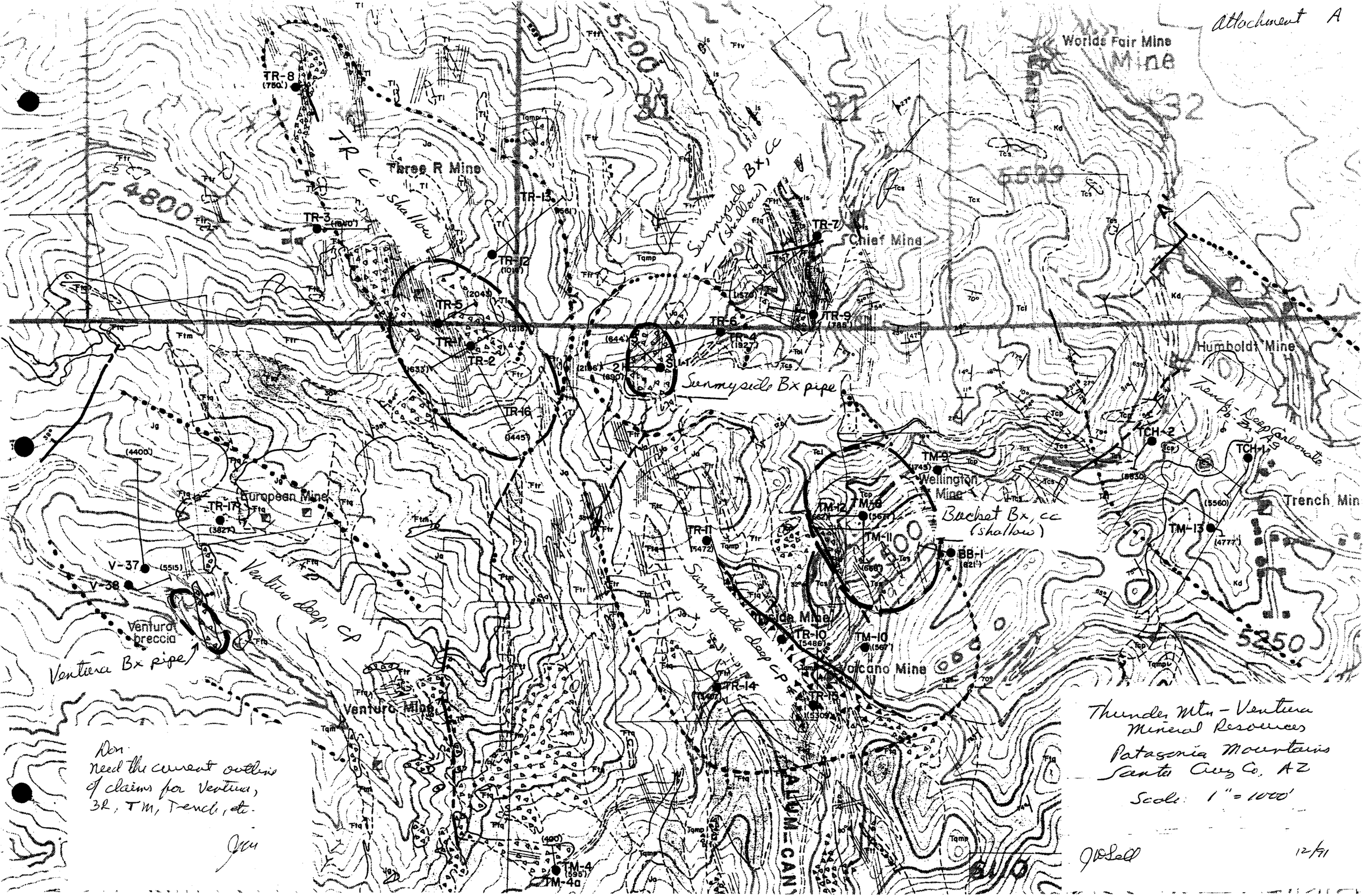
Structural complexities and the depth factor are obstacles to evaluation of the ~~the~~ shaw target zone

The ~~above~~ mineral zones at Ventura, ~~and~~ Sennepido, and Trench are within exploration agreement held with Noranda and Kerr-McGee.

To continue to fulfill the current work committment of $40,000 per year at Ventura, I will propose a hole southeast of the Ventura breccia pipe to test the extent of the deep, primary chalcopyrite mineralization in this direction.

To continue to fulfill the current work committment of $100,000 per year at the Thunder Mountain project with Kerr-McGee, I ~~will~~ have established four drill sites midway up the slope southeast of TM-8 at about the 5400' elevation (Attachment B). The rough, steep terrain at these sites suggest that helicopter-supported transport will be the means of placing the drill equipment. Costs are being ~~separated~~ obtained from various sources and the Forest Service has been requested to complete their survey for approval of the Plan of Operations.

Attachment A

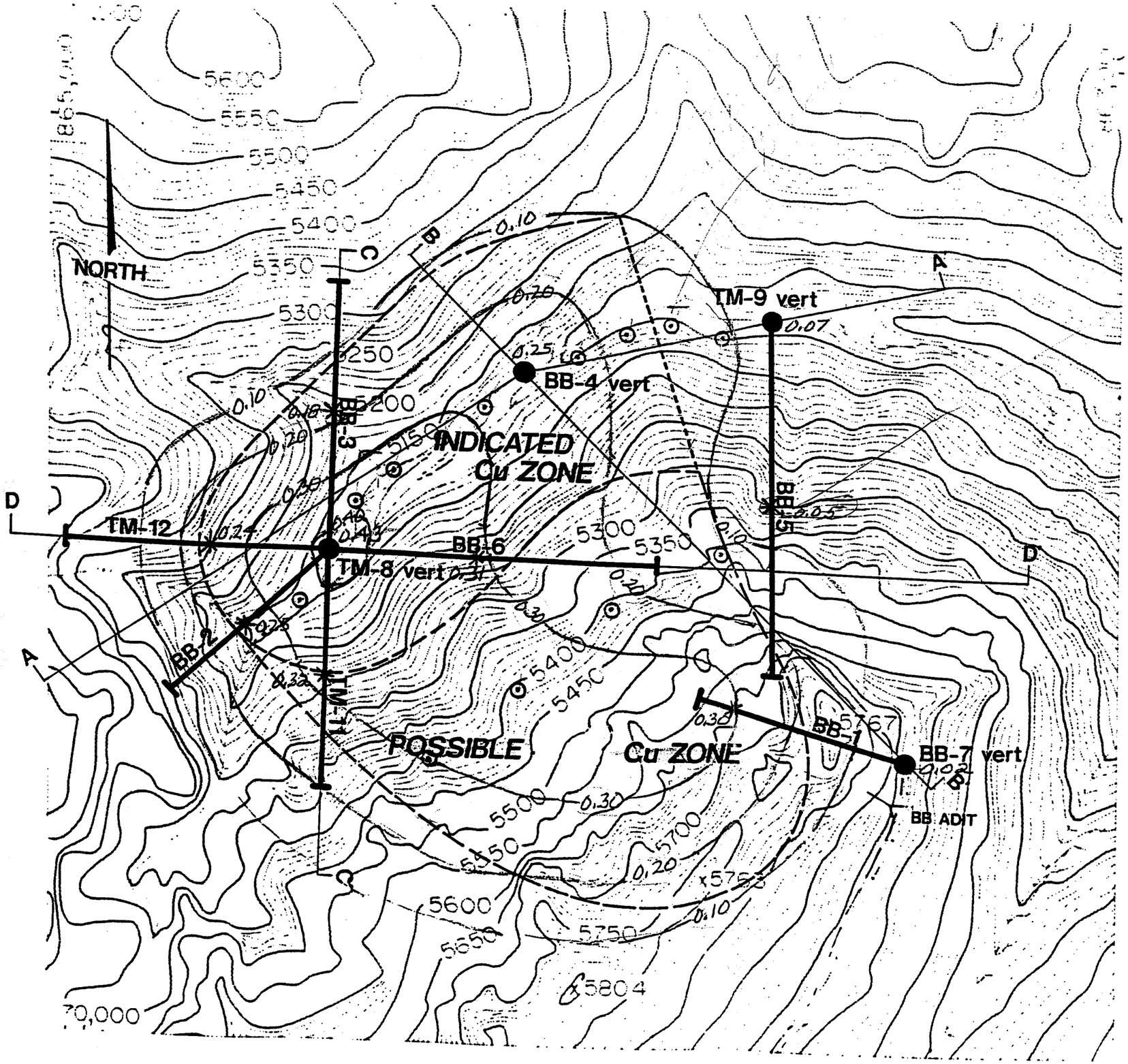


Don
Need the current outline of claims for Ventura, 3R, TM, Trench, etc.

JCH

Thunder Mtn - Ventura
Mineral Resources
Patagonia Mountains
Santa Cruz Co. AZ
Scale: 1" = 1000'

JWSell 12/91



Region revealed * and values at drill hole intersect

Total Zone
% Copper

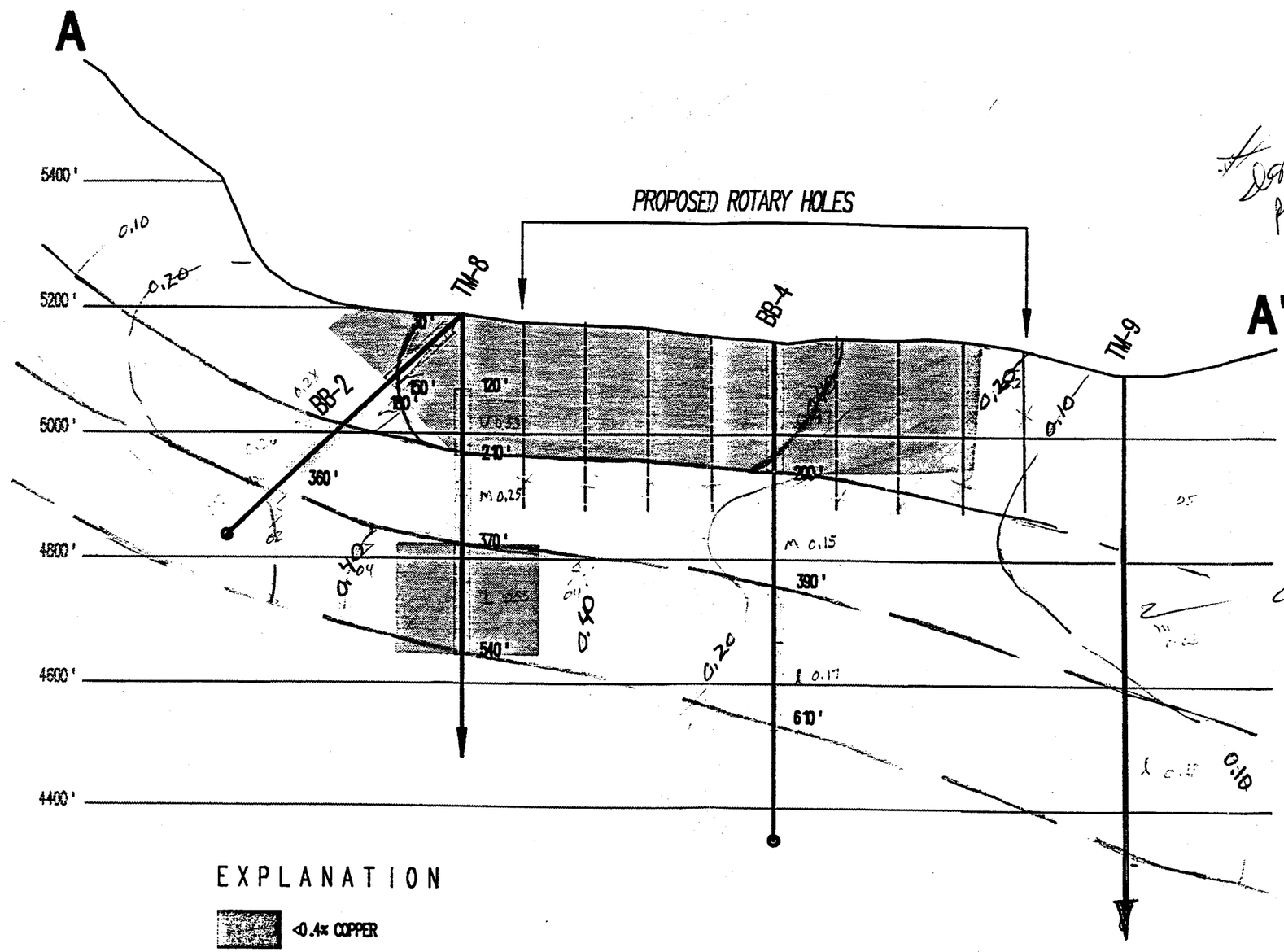
ASARCO Incorporated
THUNDER MOUNTAIN PROJECT

1990 BB-DRILLING MAP

SANTA CRUZ CO., ARIZONA

HJD 1"=200' 01/91

ATTACHMENT C-1



EXPLANATION

<0.4% COPPER

0.2-0.4% COPPER

0.1-0.2 Copper

ASARCO SOUTHWESTERN EXPLORATION

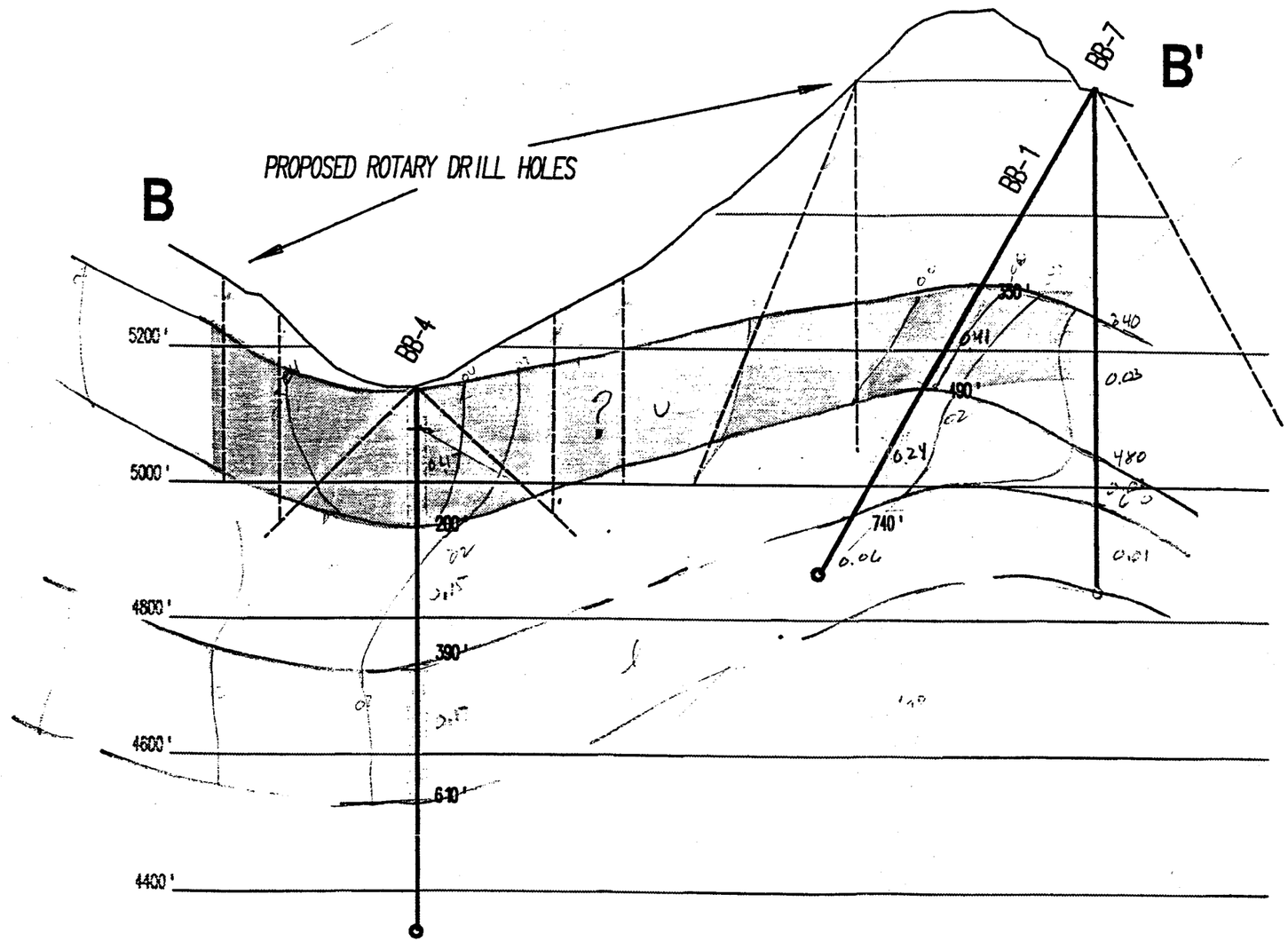
THUNDER MOUNTAIN PROJECT

SECTION A-A'

PATAGONIA MOUNTAINS, ARIZONA

H.J.D. 0 100' 200' 01-91

TM910110 HJD/DAM TUC 01/15/91



ignore dbbe pencil scribbles lots 45° 02 0.06 etc.

EXPLANATION

- <0.4% COPPER
- 0.2-0.4% COPPER
- 0.1-0.2% Copper

ASARCO SOUTHWESTERN EXPLORATION

THUNDER MOUNTAIN PROJECT

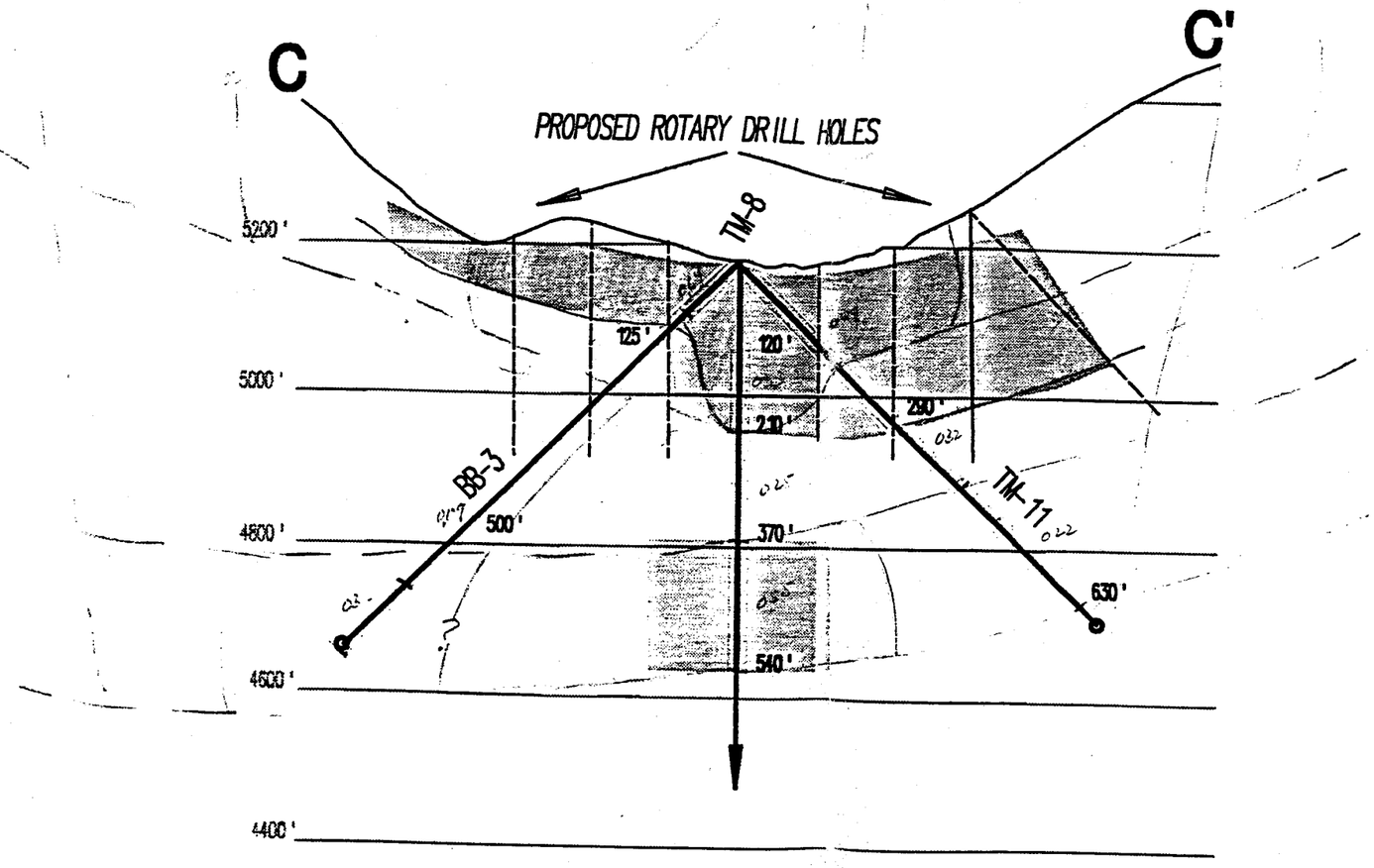
SECTION B-B'

PATAGONIA MOUNTAINS, ARIZONA

H.J.D. 0 100' 200' 01-91

mn TM910111 HJD/DAM TUC 01/15/91

ATTACHMENT C-3



EXPLANATION

<0.4% COPPER

0.2-0.4% COPPER

0.1-0.2% copper

ASARCO SOUTHWESTERN EXPLORATION

THUNDER MOUNTAIN PROJECT

SECTION C-C'

PATAGONIA MOUNTAINS, ARIZONA

H.J.D. 0 100' 200' 01-91

mn TM910112 HJD/DAM TUC 01/15/91

See Rept
Greater Patagonia Expl.
to RMS

Rehash:

Shallow Upper Zone - hi-level chalcocite

Zone	Depth to Top	Ave Thickness	Ave Grade	Ave Tons Est.
TR *	660	209	0.35 Cu	142,200,000
Sennyside BX (include pipe) **	361	170	0.37 Cu	34,600,000
Bucket BX	150	576	0.28 Cu	32,300,000
	1171/3 = 390'	955/3 = 318'	297.33/955 = 0.31 Cu	229,100,000

* Includes TR drilled zone of 81 million tons of 0.37 % Cu

** Sennyside Bx pipe

360'-600'
500' in diameter
3,000,000 tons at 0.48 % Cu.

Deep Zone - Chalcopyrite

Zone	Depth to Top	Ave Thickness	Ave Grade	Ave Tons, Est.
Sennyside	2960	2475	0.22 Cu	3,500,000,000
Ventura	1600	324	0.36 Cu	155,000,000

Ventura Bx pipe

Surface to 1600'
150'-400' in diameter
13,000,000 tons at 0.28 % Cu and 0.136 % Mo

Trench, deep carbonate Pb-Zn-Ag

4 drill intercepts from 3900' to 5000'
Numerous intercepts from 2' to 43' thick

best single interval:

Hole	Thickness	% Cu	% Pb	% Zn	oz Ag
TM-13	2'	2.56	8.65	11.40	3.56
TCH-1	4.5'	2.64	12.70	14.50	1.80
TCH-2	26'	1.83	6.29	15.06	14.93
TCH-2A	6'	0.69	1.65	0.24	9.04

The best ~~of~~ total of the holes is TCH-2 where ~~of~~ between the depths of 4030' to 4920', 15 intervals, totalling 350', ranging from 4' to 43' thick, averaged 23' thick, 0.58% Cu, 1.95% Pb 7.25% Zn, and 5.53 oz Ag.

Trench Deep Carbonate Zone

TM-13. 4777'

280 - 300 = 10' at 0.26% Cu (cut every 5', other ±0.01%)
in tuff bx. (chip)

3478' qtzite. 3801 dolomitic lms/marble.

		Depth	ft	Cu	Pb	Zn	Ag	Au
lms.		3890-3900	10	0.009%	0.42%	0.31%	0.09oz	tr
cut bx		3919-3925	6	0.025	0.24	0.24	0.26	0.002
cut bx		3925-3931	6	0.055	0.17	0.25	0.22	0.001
cut bx	17' at 0.35 Cu 1.16 Pb 1.54 Zn 0.90 Ag	3962-72	10	0.043	0.12	0.10	0.53	0.006
" "		3972-77	5	0.048	0.24	0.48	0.57	0.007
" "		3977-79	2	2.56	8.65	11.60	3.56	0.016
bx seep lms. gtzite (cilbx?)		3990-4000	10	0.32	0.08	0.79	0.06	tr

			ft	Cu	Pb	Zn	Ag	
		Josephine Vn 338-341 = 3' (1' true)		0.059	9.90	1.12	5.33	0.001
3747 ss-qtzite lm	TCH-1	lms 3907 - 3911.5 = 4.5		2.64	12.7	14.5	1.8	0.001
		seep marble 4840-4850 = 10'		0.03	0.53	0.48	0.04	<0.001
		seep ss 4800-4810 = 10'		0.04	0.26	0.27	tr	tr
		4810-4820 = 10'		0.02	0.15	0.15	0.07	tr
	TCH-2	4653 - 4710 = 57'		1.30	4.97	12.0	10.8	?
		4767 - 4891 = 124		0.23	0.86	14.0	7.4	?
		4195 - 4209 = 14'		2.32	0.73	0.09	5.9	

See next sheet

			ft	Cu	Pb	Zn	Ag	Au
	TCH-1	Josephine Vn 338-341	3' (1' true)	0.059	9.90	1.12	5.33	0.001
	marble.	4800-4810 = 10'		0.04	0.26	0.27	tr	tr
	seep-ss	4810-4820 = 10'		0.02	0.15	0.15	0.07	tr
	silicif	4820-4840 = 20'		0.004	0.02	0.005	tr	tr
	lms-seep.	4840-4850 = 10'		0.03	0.53	0.48	0.04	tr
		50/4 = 13'		0.02	0.20	0.18	tr	tr
	lm	3907-3911.5 = 4.5'		2.64	12.7	14.5	1.8	tr

4030-4037 7 1.27 0.18 0.60 tr 1.12
4037-4046 9 0.04 0.04 0.05 tr 0.09

TABLE 2

CALCULATED VS. ANALYZED COMPOSITE ASSAYS

DDH TCH-2 - Trench Project

Interval	Feet	Cu %	Pb %	Zn %	Au ppm	Ag oz/T	Mo ppm	Fe %	Mn %	S %	Bi ppm	Sb/As	CaO/MgO	SiO_2/Al_2O_3
4046 -4050	4	1.59	0.09	0.12	0.13	1.24	55							
		1.60	0.08	0.13	0.23	1.26	55	15.6	0.26	20.7	170	.006/.017	0.18/0.43	43.2/8.80
4127 -4166	39	0.71	0.21	0.12	< 0.02	0.91	118							
		0.75	0.21	0.21	< 0.02	0.74	100	15.1	1.52	2.8	100	.005/.005	9.00/0.97	49.2/3.70
4195 -4215	20	1.65	1.52	1.07	----	4.58	312							
		1.91	1.67	1.20	0.05	5.02	340	12.4	1.13	3.2	2200	.003/.005	21.90/0.97	33.6/3.50
4243 -4286	43	0.04	1.61	1.22	----	1.99	133							
		0.05	1.56	1.20	< 0.02	1.94	140	9.9	1.47	1.2	280	.002/.005	20.00/1.00	42.1/4.90
4286 -4312	26	0.63	4.04	6.26	----	1.22	138							
		0.63	3.75	6.05	< 0.02	1.18	180	6.1	1.14	4.5	70	.004/.005	11.90/1.20	50.7/6.30
4450 -4490	40	0.11	1.57	1.37	----	3.28	42							
		0.11	1.50	1.28	< 0.02	2.96	38	9.1	3.30	1.3	330	.004/.005	25.10/2.10	34.7/2.50
4653 -4679	26	1.83	6.29	15.06	< 0.04	14.93	< 2							
		1.79	5.40	14.20	0.05	14.30	< 2	6.3	0.96	10.0	1100	.002/.005	11.30/0.41	40.4/0.89
4683 -4710	27	0.97	4.38	11.01	< 0.02	8.42	< 2							
		0.81	4.10	10.60	< 0.02	7.92	4	4.8	1.20	6.8	580	.002/.002	23.80/0.88	30.2/1.40
4767 -4783	16	0.21	2.26	13.75	0.07	11.76	< 2+							
		0.21	2.18	12.90	0.09	11.78	4	8.8	1.26	10.7	970	<.001/.010	16.10/0.93	34.8/2.10
4785.6-4804	18.4	0.17	0.74	15.18	< 0.05	6.18	< 2							
		0.15	0.67	11.70	0.07	5.20	2	6.5	1.70	7.3	570	<.001/.004	23.60/1.80	27.7/2.50
4804 -4837	33	0.15	0.94	19.08	0.06	8.11	< 2							
		0.16	0.77	19.00	< 0.02	6.12	2	9.0	1.00	10.1	960	.002/.004	19.20/0.49	30.2/1.90
4849 -4882	33	0.15	0.66	11.60	< 0.09	5.38	< 2							
		0.15	0.85	18.40	< 0.06	7.34	2	5.7	0.86	10.6	1800	.001/.002	12.40/0.66	42.4/1.30
4882 -4891	9	1.36	1.82	25.00	0.16	17.98	< 2							
		1.32	1.79	25.80	0.15	17.56	< 2	6.2	1.11	15.3	1600	.002/.005	15.10/0.90	20.9/1.50
(El Paso)		1.40	1.80	25.80	0.17	19.20	4							

First row of each pair is weighted mean calculated composite from individual intervals (June-July 1981).
Second row of each pair is assay value of physically compositing each interval in proportion to its footage (September-October 1981)
All assays except last: Skyline Labs. All assays by AA except Ag by fire. Some AA Ag values used for calculation if fire value not available.

4913-4921 8 0.04 0.28 3.95 tr 2.30

15 intervals between 4030 & 4920 (890'), ranging from 4' to 48' thick

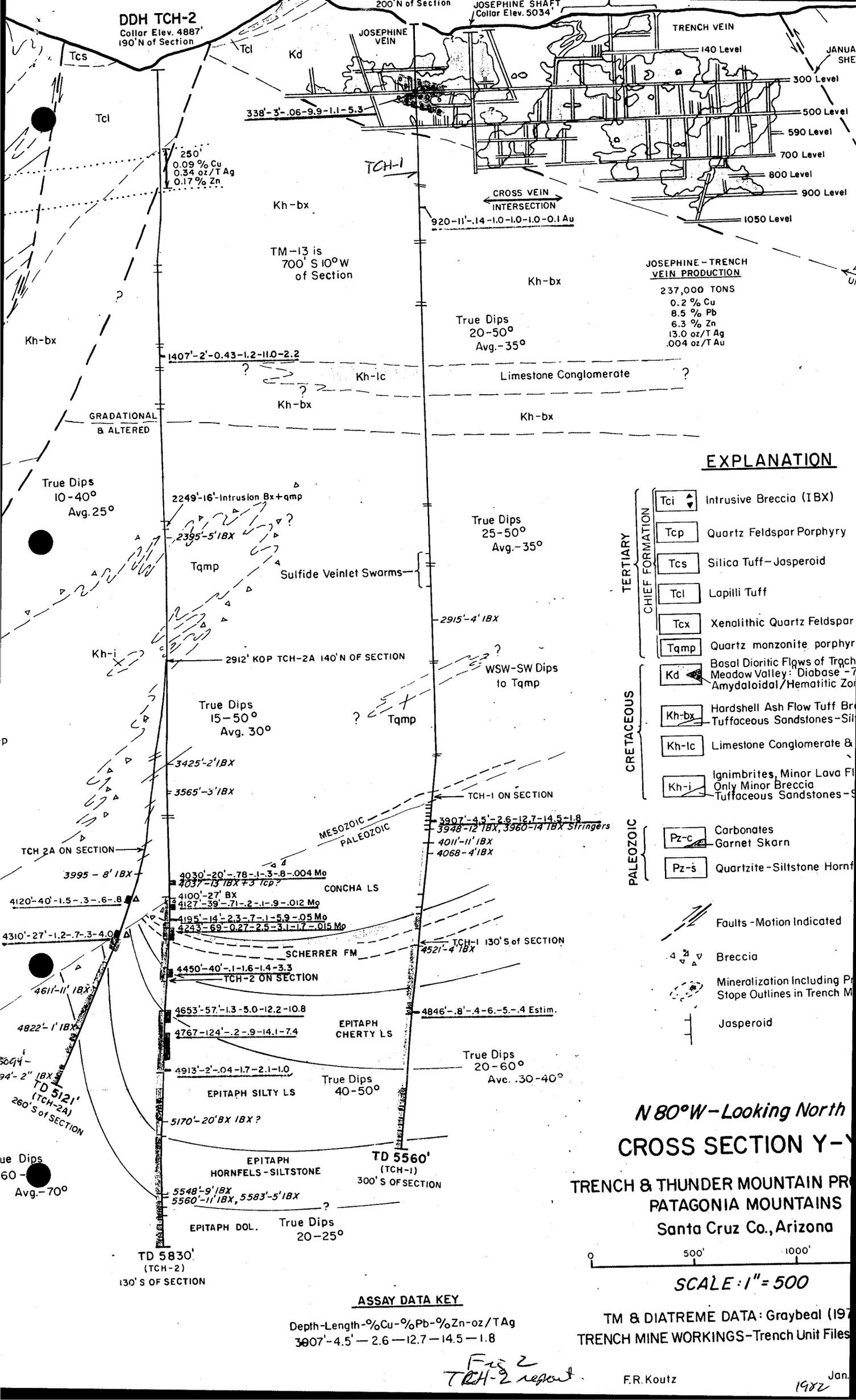
Ave $\frac{349.4}{15} = 23'$ $\frac{201.158}{349.4} = 0.58$ Cu., $\frac{680.276}{349.4} = 1.95$ Pb., $\frac{2532.962}{349.4} = 7.25$ Zn., tr Au., $\frac{1931.142}{349.4} = 5.53$ oz Ag

TCH-2	interval	thickness	Cu %	Pb %	Zn %	g/tg	g/cm
	4046-4050	4	1.59	0.09	0.12	1.24	tr
	4127-4166	39	0.71	0.21	0.12	0.91	tr
	41						

TCH-2A

	4300-4310 =	10'	0.15	0.18	0.30	0.26	tr
	4310-4316 =	6'	0.69	1.45	0.24	9.04	0.005
cole-siliceous	4316-4323 =	7'	0.38	0.08	0.24	0.58	tr
	4323-4328.6 =	5.6'	1.50	0.45	0.66	2.60	0.002
	4328.6-4329 =	0.4'	0.60	0.19	0.46	0.58	tr
	4329-4337 =	8'	2.20	0.64	0.23	4.52	0.002
	4337-4340 =	3'	0.22	0.06	0.13	0.38	tr
	4340-4350 =	10'	0.19	0.06	0.06	0.13	tr
	4350-4356 =	6'	0.18	0.11	0.05	0.67	tr
	composite 4310-4337 =	27'	1.22	0.67	0.33	bio 4.76	tr.
	4300-4356 =	56' =	$\frac{38.18}{56} = 0.68$	$\frac{21.416}{56} = 0.38$	$\frac{13.13}{56} = 0.23$	$\frac{118.32}{56} = 2.11$	tr

(in plan one interval of TCH-2 & TCH-2A separated by 500' ±)
(same in section, ± 500')


DDH TCH-2
Collar Elev. 4887'
190'N of Section
200'N of Section
JOSEPHINE SHAFT
Collar Elev. 5034'
JOSEPHINE VEIN
TRENCH VEIN
140 Level
300 Level
500 Level
590 Level
700 Level
800 Level
900 Level
1050 Level
Tcs
Tcl
Kd
338'-3'-.06-9.9-1.1-5.3
250'
0.09 % Cu
0.34 oz/T Ag
0.17 % Zn
TCH-1
CROSS VEIN
INTERSECTION
920-11'-.14-1.0-1.0-1.0-0.1 Au
Kh-bx
TM-13 is
700' S 10° W
of Section
JOSEPHINE-TRENCH
VEIN PRODUCTION
237,000 TONS
0.2 % Cu
8.5 % Pb
6.3 % Zn
13.0 oz/T Ag
.004 oz/T Au
True Dips
20-50°
Avg.-35°
1407'-2'-0.43-1.2-11.0-2.2
Kh-lc
Limestone Conglomerate
GRADATIONAL
& ALTERED
True Dips
10-40°
Avg. 25°
2249'-16'-Intrusion Bx+qmp
2395'-5'IBX
Tqmp
Sulfide Veinlet Swarms
True Dips
25-50°
Avg.-35°
2915'-4' IBX
Kh-i
2912' KOP TCH-2A 140'N OF SECTION
WSW-SW Dips
to Tqmp
True Dips
15-50°
Avg. 30°
3425'-2'IBX
3565'-3'IBX
TCH-1 ON SECTION
MESOZOIC
PALEOZOIC
3907'-4.5'-2.6-12.7-14.5-1.8
3948-12 IBX, 3960-14 IBX Stringers
4011'-11' IBX
4068-4'IBX
TCH 2A ON SECTION
3995 - 8' IBX
4030'-20'-.78-.1-.3-.8-.004 Mo
4037-13 IBX+3' Icp?
CONCHA LS
4120'-40'-1.5-.3-.6-.8
4100'-27' BX
4127'-39'-.71-.2-.1-.9-.012 Mo
4195'-14'-2.3-.7-.1-5.9-.05 Mo
4243'-69'-0.27-2.5-3.1-1.7-.015 Mo
4310'-27'-1.2-.7-.3-4.0
TCH-1 130'S of SECTION
4521'-4' IBX
SCHERRER FM
4450'-40'-.1-1.6-1.4-3.3
TCH-2 ON SECTION
4611'-11' IBX
4653'-57'-1.3-5.0-12.2-10.8
4846'-.8'-.4-6.-5.-.4 Estim.
4822'-1' IBX
4767-124'-.2-.9-14.1-7.4
EPITAPH
CHERTY LS
True Dips
20-60°
Ave. .30-40°
4913'-2'-.04-1.7-2.1-1.0
True Dips
40-50°
EPITAPH SILTY LS
TD 5121'
(TCH-2A)
260'S of SECTION
5170'-20'BX IBX?
EPITAPH
HORNFELS-SILTSTONE
TD 5560'
(TCH-1)
300'S OF SECTION
Avg.-70°
5548'-9'IBX
5560'-11' IBX, 5583'-5'IBX
EPITAPH DOL.
True Dips
20-25°
TD 5830'
(TCH-2)
130'S OF SECTION
EXPLANATION
TERTIARY
CHIEF FORMATION
Tci Intrusive Breccia (IBX)
Tcp Quartz Feldspar Porphyry
Tcs Silica Tuff-Jasperoid
Tcl Lapilli Tuff
Tcx Xenolithic Quartz Feldspar
Tqmp Quartz monzonite porphyr
CRETACEOUS
Kd Basal Dioritic Flows of Trach
Meadow Valley: Diabase -7
Amydaloidal/Hematitic Zo
Kh-bx Hardshell Ash Flow Tuff Br
Tuffaceous Sandstones-Sil
Kh-lc Limestone Conglomerate &
Kh-i Ignimbrites, Minor Lava Fl
Only Minor Breccia
Tuffaceous Sandstones-S
PALEOZOIC
Pz-c Carbonates
Garnet Skarn
Pz-s Quartzite-Siltstone Hornf
Faults-Motion Indicated
Breccia
Mineralization Including Pr
Stope Outlines in Trench M
Jasperoid
N 80°W-Looking North
CROSS SECTION Y-Y
TRENCH & THUNDER MOUNTAIN PR
PATAGONIA MOUNTAINS
Santa Cruz Co., Arizona
0
500'
1000'
SCALE: 1"=500
TM & DIATREME DATA: Graybeal (197
TRENCH MINE WORKINGS-Trench Unit Files
ASSAY DATA KEY
Depth-Length-%Cu-%Pb-%Zn-oz/TAg
3907'-4.5' — 2.6 — 12.7 — 14.5 — 1.8
Fig 2
TCH-2 report.
F.R. Koutz
Jan.
1982

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

March 13, 1973

Memorandum to: W. L. Kurtz

From: F. T. Graybeal

Deep Exploration Possibilities
at the Trench Mine,
Patagonia Mtns., Arizona.

SUMMARY AND RECOMMENDATIONS

Recent mapping indicates that the mineralized rhyolite agglomerates in the Hardshell area are older than the Chief formation. These agglomerates may underlie the diabase in the Trench area and, where cut by the downward projection of the Trench veins, may contain manto-type silver mineralization similar to the Hardshell deposit. I recommend that a detailed geologic study be made of this area to evaluate further the possibility of deep silver mineralization under the Trench mine.

DISCUSSION

Recent work in the Sunnyside area has been partly involved with the distribution of the Chief formation. This is a fine to coarse conglomeratic tuff which is well exposed on the ridges west of the Humboldt mine. Mapping of the Chief formation immediately west of the Trench mine has revealed that the Chief overlies a diabasic rock along a west-dipping unconformity as shown on the cross section on Figure 1. The presence of a northwesterly-elongate zone of manganese staining in the Chief which lies directly along strike of the Trench vein indicates that the Chief is premineral.

Mapping by S. R. Davis in the Hardshell area disclosed that a series of rhyolitic agglomerates and associated fine-grained sediments are the primary host for the silver mineralization found there. He feels that the dense massive nature of the upper agglomerates formed a barrier to further upward movement of the mineralizing fluids causing them to move laterally within the fine-grained sediments and resulting in the formation of a manto-shaped mineral deposit. These rhyolitic agglomerates have been correlated with the Chief formation by earlier workers and this name is still used.

Mapping by Davis and information from drill hole HDS-53 demonstrate that the rhyolite agglomerates are overlain by the diabase in the Hardshell area. This fact, in addition to some lithologic differences, leads me to suggest that the agglomerates in the Hardshell area are older than and, therefore, not equivalent to the Chief formation exposed west of the Trench mine.

Cross-sections of the Trench mine reveal that the Josephine shaft penetrated through the diabase and into an underlying rhyolite as shown on Figure 1. The dip of the diabase-rhyolite contact is shown on these sections to be easterly at 30-50°. According to J. H. Courtright, the Trench veins narrowed to thin, unproductive, quartz veins upon entering the rhyolite.

I believe it is reasonable to assume that the rhyolite under the diabase in the Trench area is the same formation as the rhyolite agglomerate which underlies the diabase in the Hardshell area as shown by the cross section on Figure 1. If this is so, then it is possible that a manto-like silver deposit may be present within and under the rhyolite in the Trench area. Although this mineralization would be deep and not amenable to open pit mining methods, the larger size, higher grade, and more widespread distribution of the original Trench veins as compared to the Hardshell veins suggests that deep mineralization under the Trench could be of substantially higher grade than in the Hardshell area. The Trench-January veins are part of a well-defined belt of silver mineralization 1000-2000 ft. wide and 12,000 ft. long which extends northwesterly from the Hardshell mine to the Worlds Fair mine.

RECOMMENDATIONS

The potential for high-grade, manto-like silver mineralization under the Trench area is sufficiently good to recommend a detailed study of the geology of this area. This study should include the following:

1) a comparison of the Chief formation and the rhyolite agglomerates at the Hardshell to validate them as two distinct formations;

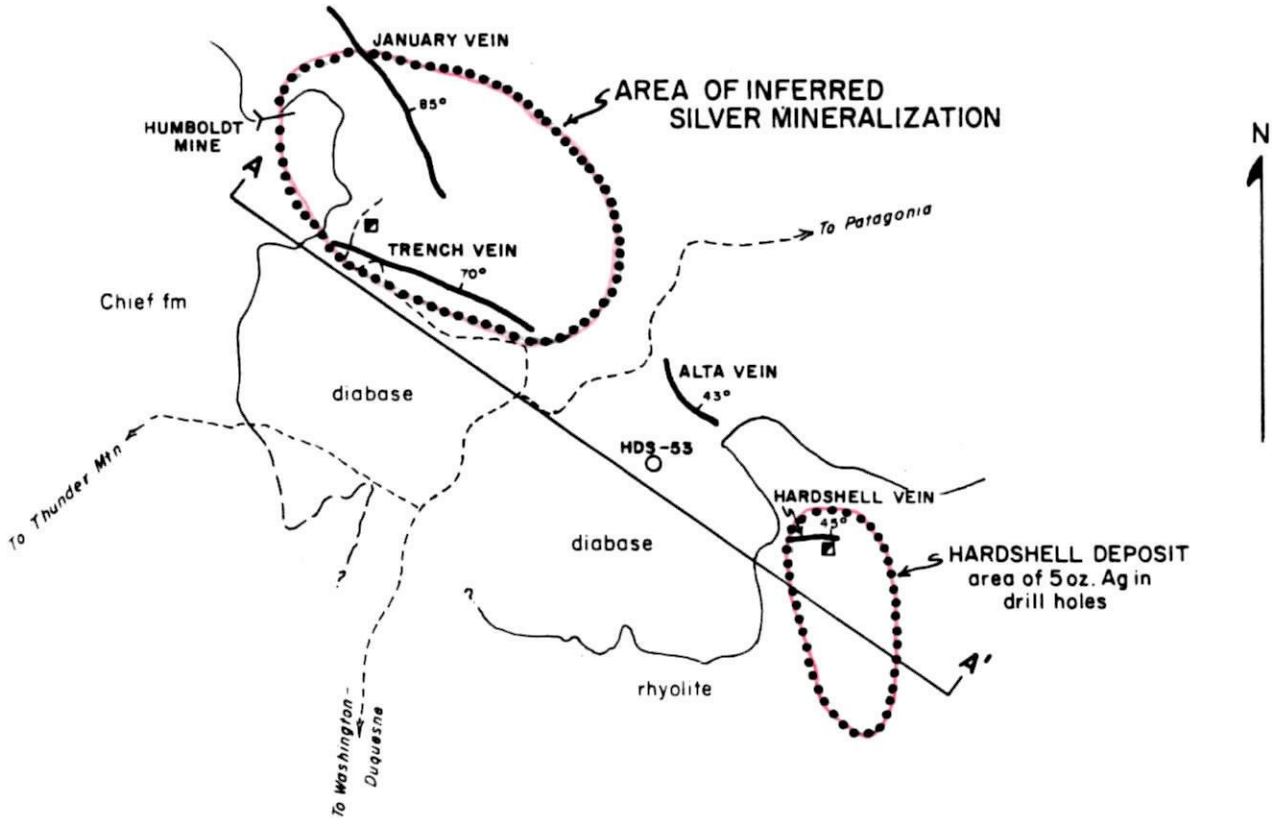
2) an examination of the extent of lateral stratigraphic changes within the Hardshell rhyolite agglomerates to determine both the thickness and rock type within the Trench area;

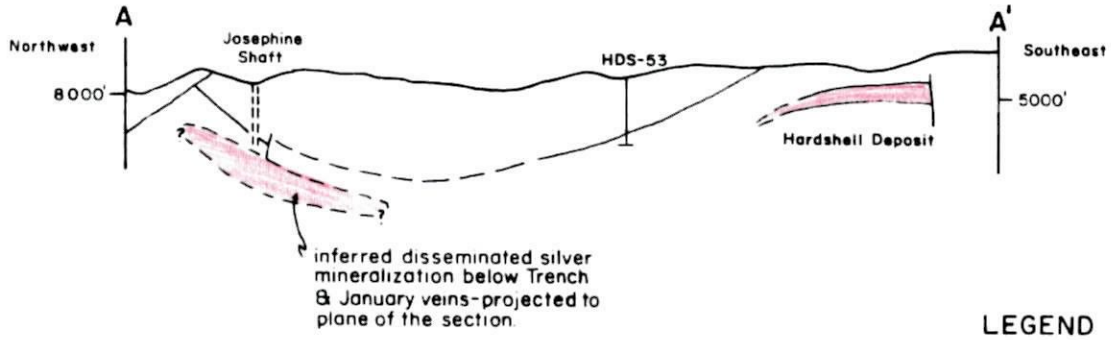
3) an examination of the Trench and Humboldt veins with respect to density, thickness, geochemistry, and productivity; some of this data is available in the Trench files.

The primary target within the Trench area appears to be on ground held by ASARCO and adjacent to ground held by Kerr-McGee, and Robinson-Mendoza as shown on Figure 1. Although the need for a study such as outlined above is not pressing, it should be completed as soon as convenient in order that an accurate evaluation of the adjoining properties can be made.

F. T. Graybeal

FTG:lb
Attachs.





LEGEND

- disseminated silver mineralization
- Chief formation
- diabase
- Jurassic (?) rhyolite agglomerate
- productive veins

SCALE

0 2000'

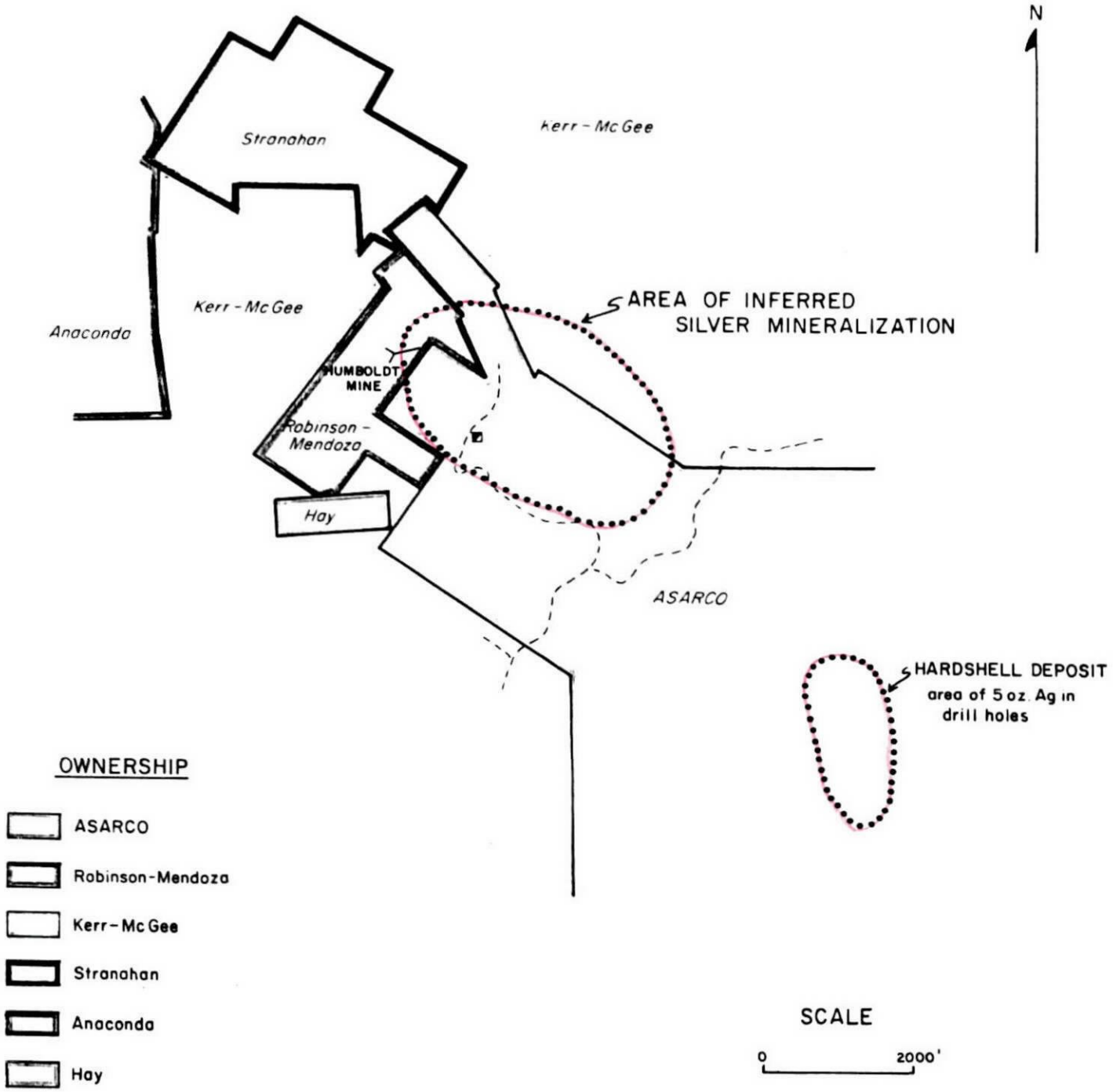
GEOLOGIC MAP AND SECTION

TRENCH-HARDSHELL AREA

PATAGONIA MTNS. SANTA CRUZ COUNTY, ARIZONA

F.T.G. Feb 1973

MVK - 2590



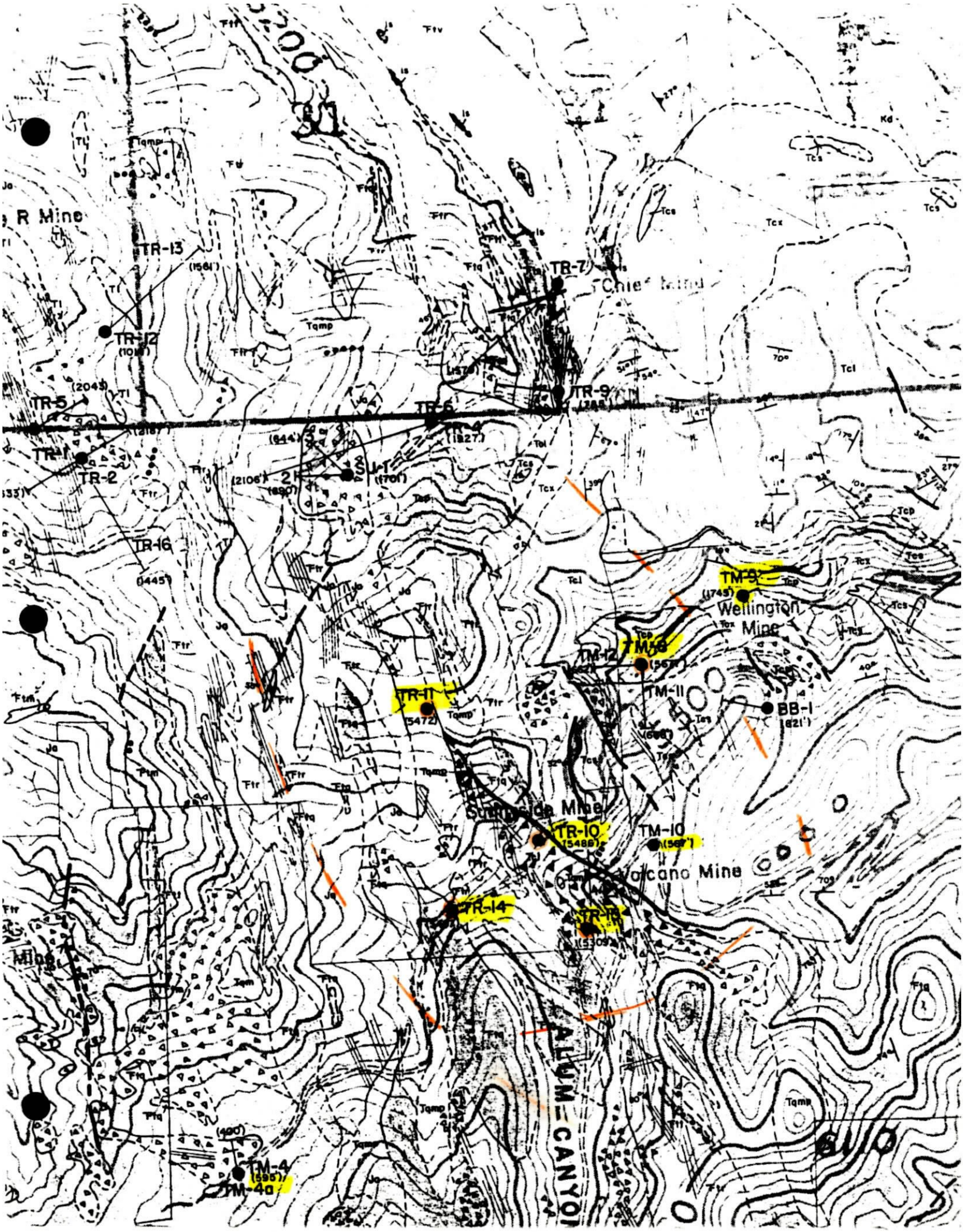
LAND STATUS

TRENCH-HUMBOLDT MINE AREA

PATAGONIA MTNS. SANTA CRUZ COUNTY, ARIZONA

F.T.G. Feb. 1973

MVK - 2591


R Mine
TR-13
(1561')
TR-12
(1018')
TR-5
(2043')
TR-1
(218')
TR-2
TR-16
(0445')
TR-7
TR-9
(1745')
TR-6
(1827')
(844')
(2106')
(1890')
(1701')
TM-9
(1745')
Wellington
Mine
TM-12
TM-8
(565')
TM-11
BB-1
(1621')
TR-11
(5472')
Sunnyside Mine
TR-10
(5488')
TM-10
(568')
Volcano Mine
TR-14
TR-15
(5309')
Mine
ATLUM CANYON
(400')
TM-4
(596')
TM-4a

Rehash SW Area: deep zone.

TD 5486 **TR-10**

3440 - 3800 = 360' = 6.25/36 = 0.17 Cu
3800 - 4710 = 910' = 36.95/91 = 0.41 Cu
4710 - 5486 = 776' = 15.40/77.6 = 0.20 Cu
} 1686' = = 0.31
3440 - 5486 = 2046' = 58.60/204.6 = 0.29 Cu

TD 5472 **TR-11**

1400 - 4800 = 3400' = 484/3400 = 0.14 Cu
4800 - 5472 = 672' = 249/672 = 0.37 Cu ←
1400 - 5472 = 4072' = 733/4072 = 0.18 Cu

T.D 5407 **TR-14**

4100 - 4500 = 400' = 0.45/4 = 0.11 Cu
4500 - 4590 = 90' = 1.44/9 = 0.16 Cu
4590 - 5020 = 430' = 19.27/43 = 0.45 Cu
5020 - 5407 = 387' = 10.60/38.7 = 0.27 Cu
} 817' = = 0.37
4100 - 5407 = 1307' = 35.81/130.7 = 0.27 Cu

TD 5309 **TR-15**

4550 - 5309 = 759' = 15.17/75.9 = 0.20 Cu

TD 5477 **TM-8**

1350 - 1650 = 300' = 14.74/30 = 0.49 Cu
1650 - 2710 = 1060 = 28.06/106 = 0.26 Cu
2710 - 3550 = 840 = 4.47/84 = 0.05 Cu
3550 - 5540 = 1990 = 43.29/199 = 0.22 Cu
1350 - 5540 = 4190 = 89.99/419 = 0.21 Cu

TM-4
TM-4A
TM-9
TM-10
} Not of sufficient depth to test deep zone

Rehash - Continued. SW Dog Zone.

Overall

TR-10	3400-5486 =	2046' = 586.0/2046	= 0.29 Cu
TR-11	1400-5472 =	4072' = 733/4072	= 0.18 Cu
TR-14	4100-5407 =	1307 = 358.1/1307	= 0.27 Cu
TR-15	4550-5309 =	759 = 151.7/759	= 0.20 Cu
TM-8	1350-5540 =	4190 = 899.9/4190	= 0.21 Cu

14,800/5 = 2960 ave top 12,374/5 = 2,728.7/12,374 = 0.22% Cu

= 2475' ave thickness ave grade

overall 4500' (open) long x 4000' wide x 2475' thick ÷ 12.5 = 3,500,000,000 tons at 0.22% Cu resource open ended

Internal:

TR-10	3800-5486 = 1686 =	523.5/1686 =	0.31 Cu
TR-11	4800-5472 = 672 =	249/672 =	0.37 Cu
TR-14	4550-5407 = 817 =	298.7/817 =	0.37 Cu
TR-15	4550-5309 = 759 =	151.7/759 =	0.20 Cu
TM-8	3550-5540 = 1990 =	432.9/1990 =	0.22 Cu *

5924/5 = 1455.8/5924 = 0.28 Cu

1185' ave Thickness

* TM-8 has bigger zone of:

1350-2710 = 1360 = 42.80/136 = 0.31 Cu

internal (open) 4500' x 4000' x 1185' ÷ 12.5 = 1,700,000,000 tons at 0.28% Cu

SW Area.

vertical TD. 5486

TR-10 log

110 - 160 = 50' = 3.13/5 = 0.63 % Cu
160 - 310 = 150 = 1.05/15 = 0.07 %
310 - 360 = 50' = 1.53/5 = 0.31 % Cu

110-360 = 250' = 15.71/25 = 0.23 % Cu

3440 - 3700 = 260' = 3.65/26 = 0.14 Cu
3700 - 3800 = 100' = 2.60/10 = 0.24 Cu

3440-3800 = 360' = 6.25/36 = 0.17

3800 - 3860 = 60' = 2.31/6 = 0.39 Cu
3860 - 4210 = 350' = 19.91/35 = 0.57 Cu

3800-4710 = 910' = 37.95/91 = 0.41 % Cu

4210 - 4710 = 500' = 14.73/50 = 0.29 Cu
4710 - 5486 = 776 = 15.40/77.6 = 0.20 Cu

3440-5486 = 2,046' = 58.60/204.6 = 0.29 % Cu

vertical 5407 TD

TR-14 log

140 - 190 = 50' = 2.48/5 = 0.50 % Cu
4500 - 4590 = 90' = 1.44/9 = 0.16 Cu
4590 - 5020 = 430' = 19.27/43 = 0.45 Cu
5020 - 5407 = 387 = 10.60/38.7 = 0.27 Cu

4500-5407 = 907 = 31.31/90.7 = 0.35 % Cu

vertical TD 5309

TR-15 log

40 - 110 = 70' = 0.87/8 = 0.11 Cu
4550 - 5309 = 759' = 15.17/75.9 = 0.20 % Cu

vertical TD 5472

TR-11 log

4800-5472 = 672' = 0.37 % Cu

base on geochem each 100', 10' sample per 100'

with 4300-4800 = 500' = 0.12 %, as above
with 3900 - 4300 = 400' = 0.06 %, as above
with 1400 - 3900 = 2500' = 0.16 %, as above

1400-4800 = 3400' = 4.84/34 = 0.14 Cu

continued, next sheet

[illegible]

SW Area Continued

-70° 595' TD — TM-4 log No assay above 0.05 Cu (only few assays).

-45° 400' TD — TM-4A log No assays.

vert. 5677' TD — TM-8 assay sheet 130 - 540 = 410' = 17.69/41 = 0.43 Cu

1350 - 1650 = 300' = 14.74/30 = 0.49 Cu

1650 - 2710 = 1060' = 28.06/106 = 0.26 Cu

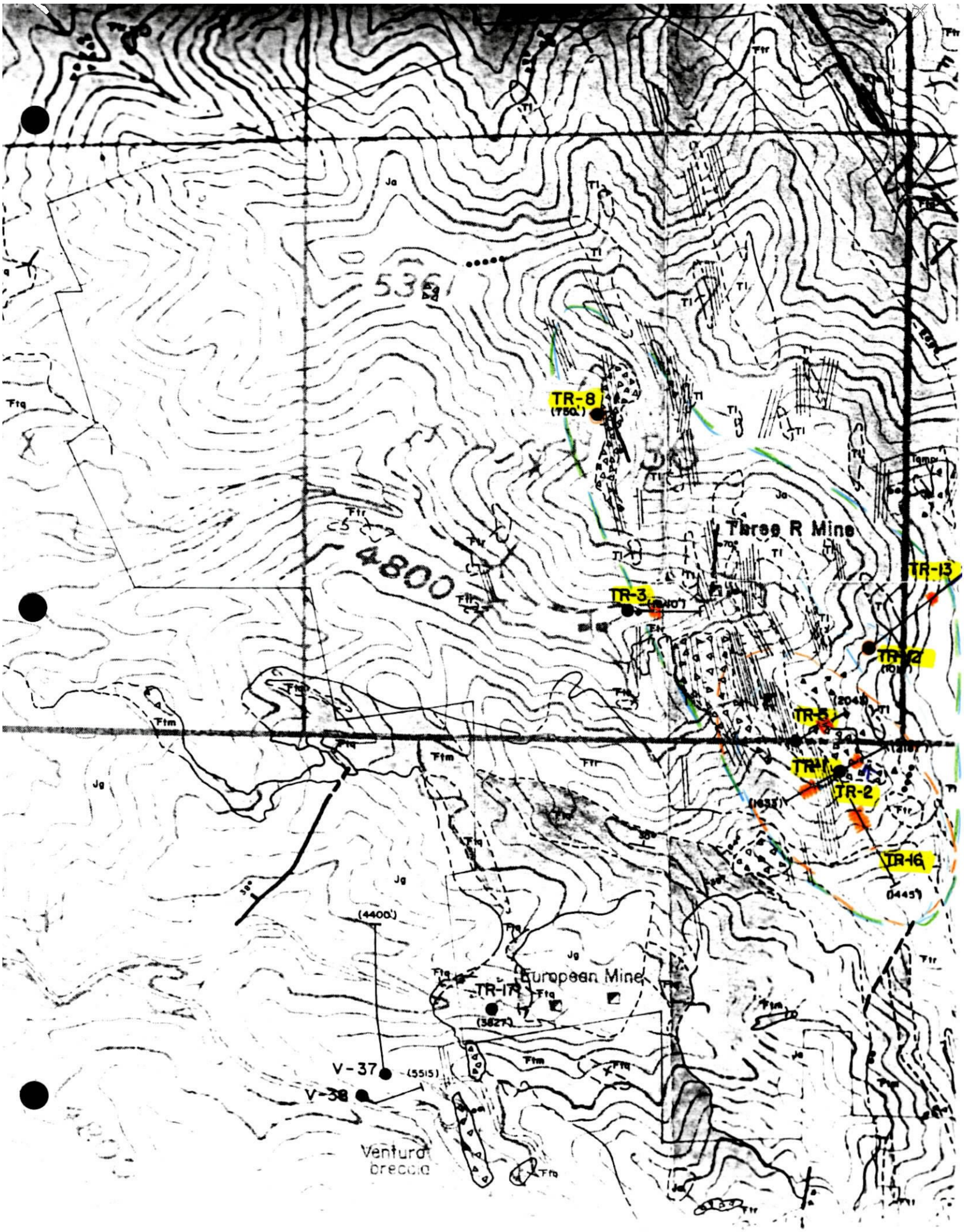
2710 - 3550 = 840' = 4.47/84 = 0.05 Cu

3550 - 5540 = 1990' = 43.29/199 = 0.22 Cu

1350 - 5540 = 4190 = 89.99/419 = 0.21 Cu

vert 567' TD — TM-10 No assay, 10' per 100', above 0.02% Cu (Not of sufficient depth to test the copper zone)

Vert. 1745' TD — TM-9 log 640 - 880 = 240' = 3.26/24 = 0.14 Cu


TR-8
(750')
Three R Mine
TR-13
TR-3
TR-12
TR-5
TR-1
TR-2
TR-16
(1445')
(4400')
European Mine
TR-17
(3627')
V-37
(5515')
V-38
Ventura
breccia
4800
Ja
Jg
Ftq
Ftm
Ftr
Tl

Rehash: 3-R Area

TD 1643 TR-1 (Vertical ≅) 750-1130 = 380' at 0.28 % Cu.

TD 2187 TR-2 (Vertical ≅) 645-1075 = 430' at 0.46 % Cu

T.D. 2043 TR-5 (vertical ≅) 830-1235 = 405' at 0.36 % Cu

TD 1840 TR-3 (vertical ≅) 580-735 = 155' at 0.12 % Cu

TR-8 Vertical 160-200 = 40' at 0.21 % Cu

TR-12 Vertical ~~470-560 = 90' at 0.17 % Cu~~
→ 890-920 = 30' at 0.41 % Cu

TD 1561 TR-13 (vertical ≅) 875-945 = 70' at 0.48 % Cu

TD 1445 TR-16 (vertical ≅) 555-715 = 160' at 0.35 % Cu
5285/8
= 660 ave to top

1670/8 = 209' ave at 578.9/1670 =
= 0.35 % Cu

5500 x 1400 x 209 ÷ 12.5 =
+ 0.5 x 4000 x 1000 x 209 ÷ 12.5 =
= 128,744,000
= 33,440,000
162,184,000 tons

Overall Greater Geol. Resource

Extend best: Using TR-1, -2-5, -16: 1375/4 = 344' ave @ 5061.0/1375 =
= 0.37 % Cu

2100 x 1400 x 344 ÷ 12.5 = 80,908,800 tons

All of this off of present ASARCO Property position.

~~TR-1~~

~~TR-2~~

TR-5 inch 400' of

vent = 380' - 0.28

5.66 / 20 = 0.28 Cu

-70°

Vent 750'-1130'

TR-1 log

800 - 1020 = 220' = 2.98 / 11 = 0.27 Cu

1020 - 1120 = 100' = 0.43 / 5 = 0.086 Cu

1120 - 1200 = 80' = 2.25 / 4 = 0.56 Cu

1200 - 1320 = 120' = 0.45 / 6 = 0.075 Cu

-77°

vent 645'-1075'

~~TR~~ TR-2 log

660 - 720 = 60' = 2.27 / 3 = 0.757

720 - 1020 = 300' = 1.64 / 15 = 0.109

1020 - 1100 = 80' = 6.11 / 4 = 1.53

1100 - 1200 = 100' = 0.87 / 5 = 0.17

10.02 / 22 = ~~0.45~~ = 0.46 Cu

440' of

vent 430' of 0.46 Cu

-75°

vent 60-1235

TR-5 log

860 - 920 = 60' = 3.80 / 3 = 1.27

920 - 1140 = 220' = 1.15 / 11 = 0.10

1140 - 1280 = 140' = 2.65 / 7 = 0.38

7.60 / 21 = 0.36 Cu

420' of

Vent 405' of 9

1280 - 1420 = 140' = 0.93 / 7 = 0.13

1420 - 1760 = 340' = 1.47 / 17 = 0.086

1760 - 1960 = 200' = 2.62 / 10 = 0.26

-70°

Vent

Vent

TR-3 TR-3 log 620 - 780 = 160' = 0.92 / 8 = 0.115 Cu

TR-8 TR8 log 160 - 200 = 40' = 0.41 / 2 = 0.21 Cu

TR-12 log 470 - 560 = 90' = 1.55 / 9 = 0.17 Cu

890 - 920 = 30' = 1.24 / 3 = 0.41 Cu

-44°

Vent 875-945

TR-13 log 500 - 590 = 90' = 1.61 / 9 = 0.18 Cu

1250 - 1350 = 100' = 4.84 / 10 = 0.48 Cu 70' vertical

-40°

Vent 555-715

TR-16 log 860 - 1000 = 140' = 3.96 / 14 = 0.28 Cu

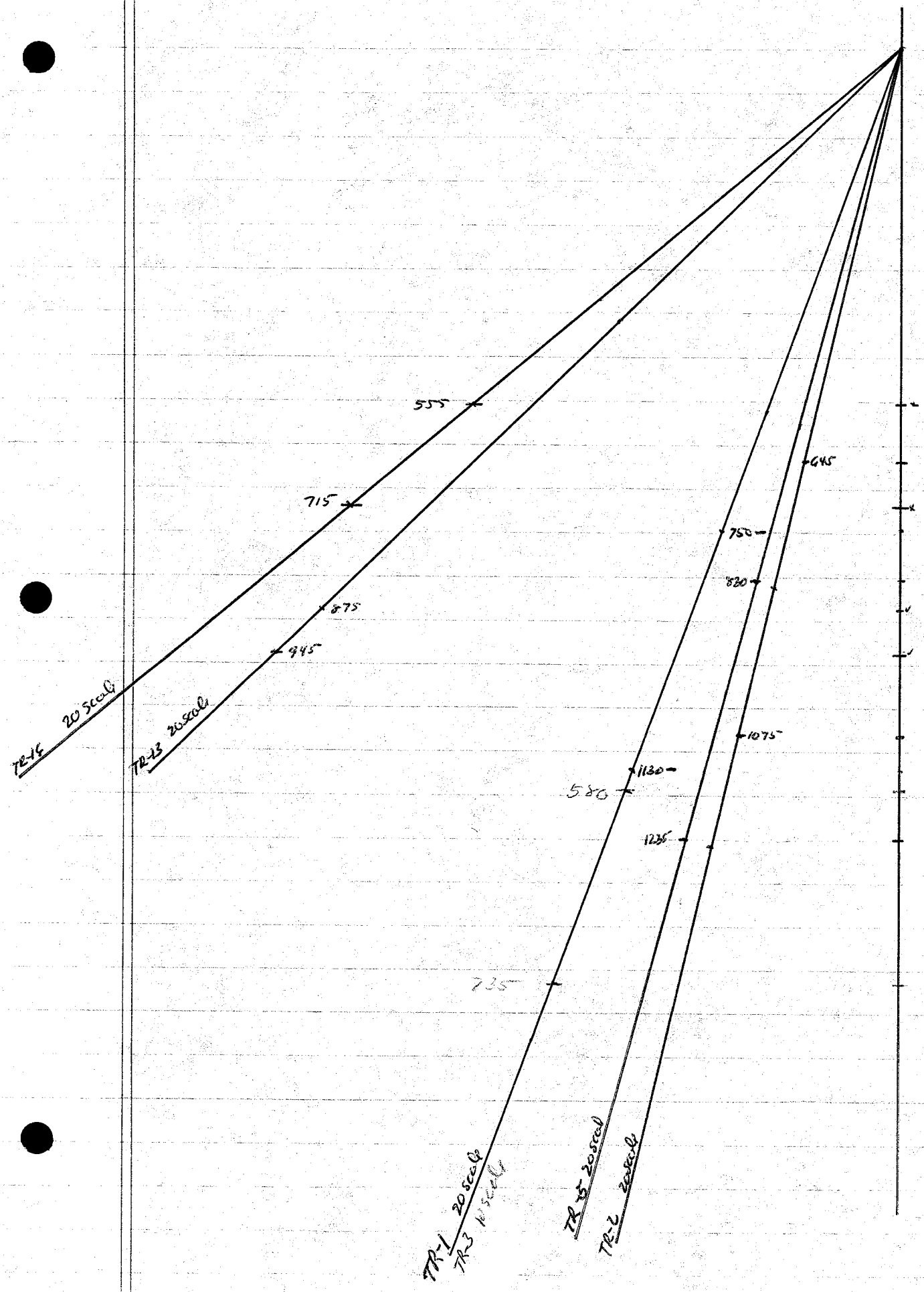
1000 - 1070 = 70' = 0.87 / 7 = 0.12 Cu

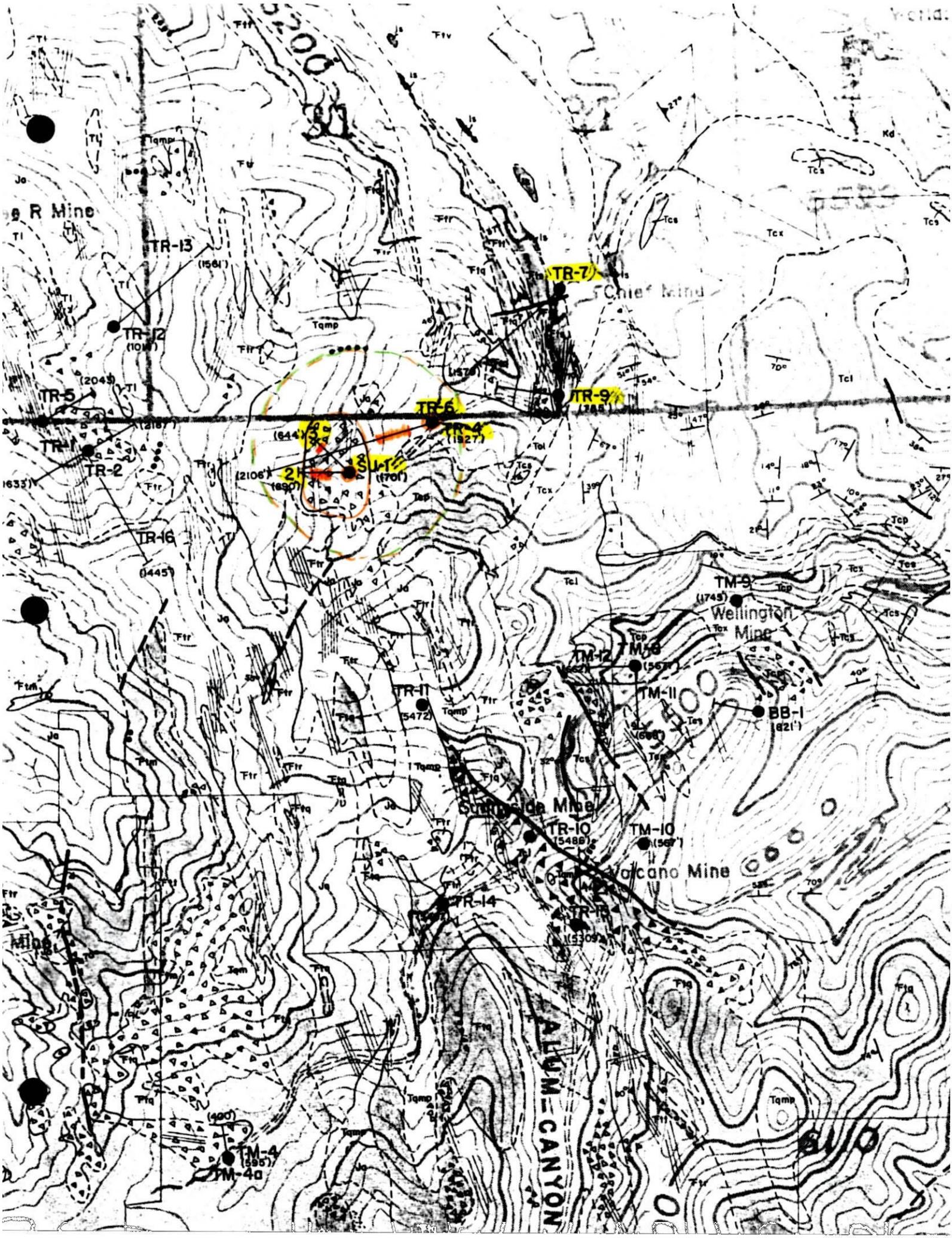
1070 - 1110 = 40' = 3.82 / 4 = 0.96 Cu

8.65 / 25 = 0.35 Cu

250' of

160' vertical


555
715
875
945
TR-15 20 scale
TR-13 20 scale
645
750
880
1075
1130
580
1235
735
TR-1 20 scale
TR-3 10 scale
TR-5 20 scale
TR-2 20 scale


TR-13
(1561')
TR-12
(1018')
TR-5
(2045')
TR-1
(1633')
TR-2
(2106')
TR-6
TR-4
(1327')
TR-7
TR-9
(1745')
SJ-1
(1701')
TR-16
(1445')
TM-9
(1745')
Wellington Mine
TM-12
TM-8
TM-11
BB-1
(821')
TR-11
(5472')
Scorpion Mine
TR-10
(5488')
TM-10
(567')
Volcano Mine
TR-14
TM-4
(595')
TM-4a
ALUM CANYON

Rehash Sunnyside Bx area

T.D 701 SU-1 vertical 353-600 = 247' of 0.18 % Cu

TD 890 -60 SU-2 (vertical ≅) 310-597 = 287' of 0.67 % Cu

TD 644 -650 SU-3 (vertical ≅) 323- 367 = 44' of 0.71 % Cu

TD 1927 TR-4 vertical 580-660 = 80' of 0.20 % Cu

TD 2106 -45 TR-6 (vertical ≅) 240-435 = 190' of 0.15 % Cu

1806/5 = 361 ave log

Greater Overall 848/5 = 170' ave @ 312.49/848 = 0.37 %

3.14 x (900) x (900) x 170 ÷ 12.5 = 34,690,000 tons of 0.37 % Cu

w/ bx pipe having 3.14 x 250 x 250 x 193 ÷ 12.5 = 3,000,000 tons @ 0.48 % Cu

(Rampt Pt = 2.7 mill @ 0.48 % Cu) Cu 267.99/558 = 0.48 % Cu

Sunnyside Bx

log
Vertical
TD ~~695~~ 701

SU-1 Vertical 0-353 -0.03 Cu, 0.14 Ag (353') cc,

347-340: 43' of 0.73 Cu. 353-701 TD 0.13 Cu, 0.13 Ag. (348') cc. eng.
(353-600) 247' 0.18 Cu, 0.13 Ag

log
-60°
TD 860'

SU-2 N 90° W, @ 60°

300-341 41' Tr Cu, 0.14 Ag

341-890 T.D. 549', 0.45 Cu, 0.14 Ag
(341-458) = 317' 0.67 Cu 0.13 Ag.

Inclined 340'-673' = 333' @ 0.67 Cu

Converted vertical 287' of 0.67 at 340' below surface collar

log
-50°
TD 444'

SU-3 N 45° W @ 50°

400-421 21' Tr Cu, 0.32 Ag

421-444 TD 219' 0.23 Cu, 0.25 Ag
(421-495) = 74' 0.42 Cu, 0.26 Ag.

inclined 421-480 = 59' of 0.71 C

Converted vertically: 44' of 0.71 Cu at 323 below collar

vertical
TD 1927

on edge
TR-4 log. 580-660 = 80' = 0.83/4 = 0.20 Cu

1360-1780 = 420 = 3.29/21 = 0.157 Cu

Bx pipe, cone-shaped, narrowing rapidly

Bergey Report

2.7 mill tons 0.48% Cu, 0.14 oz Ag. (enargite)

at depth of one chain 430', the pipe is elliptical 350 x 450'

-45°
TD 2104

TR-6 log 340-620 = 280' = 2.04/14 = 0.147 Cu = 0.15

1360-1520 = 160' = 1.14/8 = 0.14 Cu

converted vertically 240-435 = 190' @ 0.15 Cu

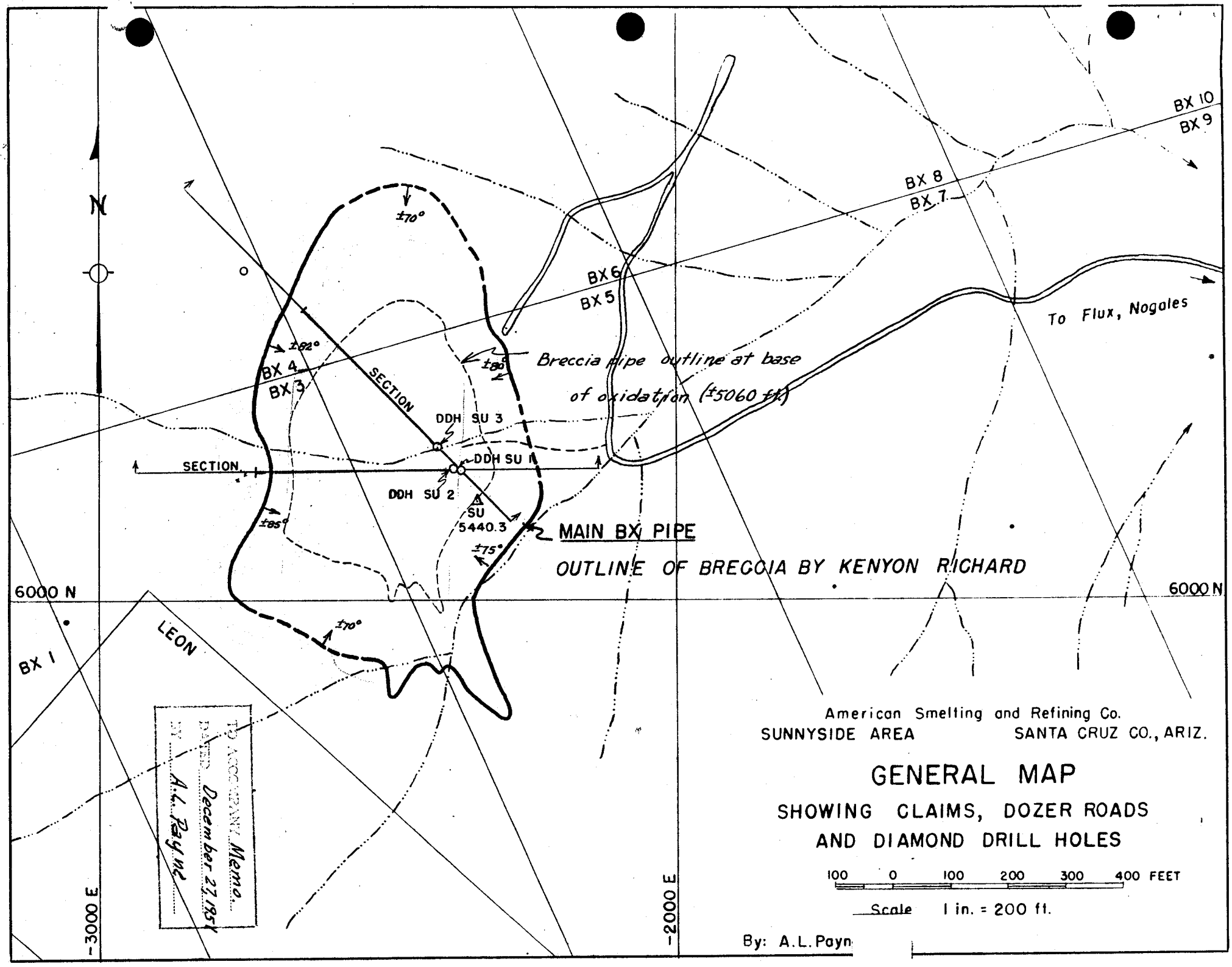
outside

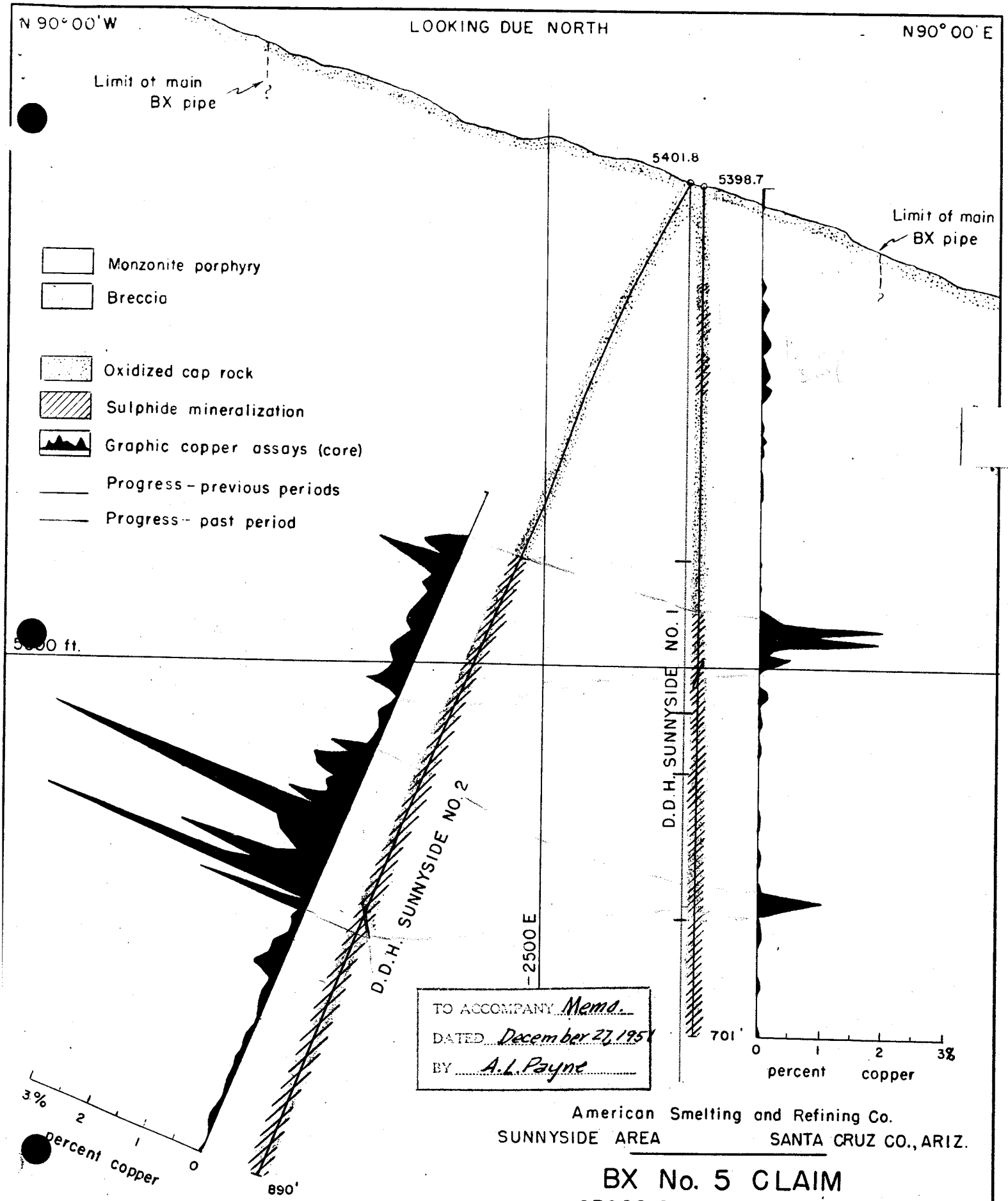
-50°
TD 1541

TR-7 log none above 0.05 !

-45°
TD 785

TR-9 log none, except 1 @ 0.09; above 0.05 !


N
BX 10
BX 9
BX 8
BX 7
BX 6
BX 5
BX 4
BX 3
BX 1
To Flux, Nogales
±70°
±62°
±80°
±85°
±75°
SECTION
SECTION
DDH SU 3
DDH SU 1
DDH SU 2
SU
5440.3
Breccia pipe outline at base
of oxidation (±5060 ft)
MAIN BX PIPE
OUTLINE OF BRECCIA BY KENYON RICHARD
6000 N
6000 N
LEON
-3000 E
-2000 E
TO ACCOMPANY Memo
DATED December 27, 1954
BY A.L. Payne
American Smelting and Refining Co.
SUNNYSIDE AREA
SANTA CRUZ CO., ARIZ.
GENERAL MAP
SHOWING CLAIMS, DOZER ROADS
AND DIAMOND DRILL HOLES
100 0 100 200 300 400 FEET
Scale 1 in. = 200 ft.
By: A.L. Payn



American Smelting and Refining Co.

SUNNYSIDE AREA SANTA CRUZ CO., ARIZ.

BX No. 5 CLAIM

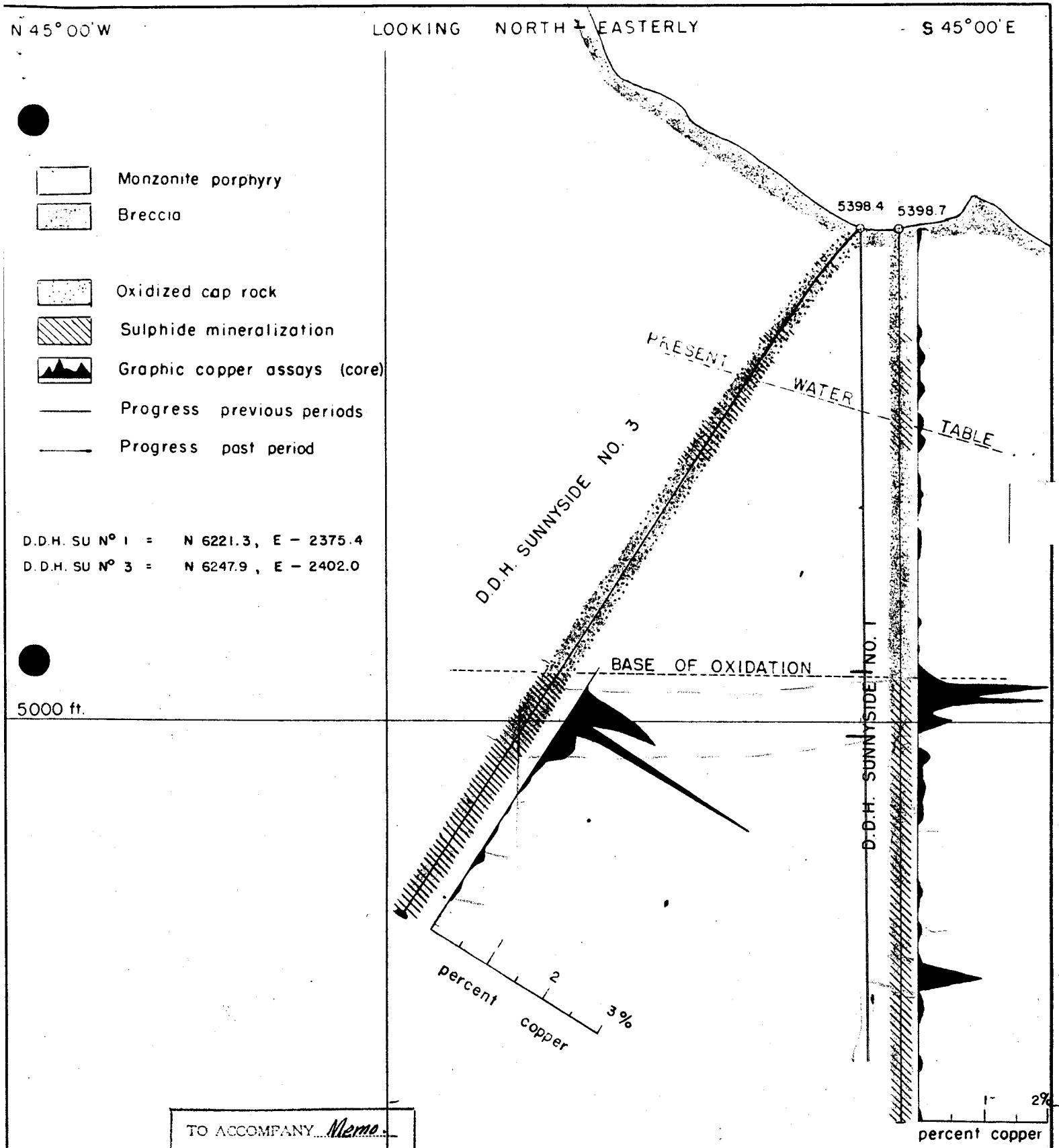
CROSS SECTION THROUGH SUNNYSIDE D.D.H. No. 1 & 2

Scale: 1 in. = 100 ft.

By: A.L. Payne

D.D.H. SU NO.1 = N 6221.3, E - 2375.4

D.D.H. SU NO.2 = N 6222.7, E - 2385.1



TO ACCOMPANY Memo.
DATED Dec. 27, 1951
BY A.L. Payne.

American Smelting and Refining Co.
SUNNYSIDE AREA SANTA CRUZ CO. ARIZ.

BX NO. 5 CLAIM.

CROSS SECTION THROUGH D.D.H.s SUNNYSIDE NO. 1 & 3

Scale: 1 in = 100 ft.

By: A.L. Payne

Su #1 — CORE

CORE SAMPLE LOG, D. D. H. Su No. 1

Footage From (ft.)	Footage To (ft.)	Interval (ft.)	Recovery %	Weight (lbs.)	Sp.G.	Hole Size	ASSAYS No.	Jacobs Control Ag oz.	Jacobs Control Cu %	El Paso Umpire Ag oz.	El Paso Umpire Cu %	
0.0	6.0	6.0	0.0	(3½" drive pipe cemented in place)								
6.0	10.0	4.0	20	2.13	2.25	NX	(23)	0.16	0.02	n.a.	n.a.	
10.0	15.0	5.0	67	12.38	2.19	NX	(24)	0.16	tr.	"	"	
15.0	21.0	6.0	67	8.94	2.19	NX	(25)	0.08	"	"	"	
21.0	31.0	10.0	72	19.00	2.30	NX	(26)	0.07	"	"	"	
31.0	40.0	9.0	111	18.19	2.25	NX	(27)	0.10	"	"	"	
40.0	46.0	6.0	98	19.31	2.25	NX	(28)	0.11	"	"	"	
46.0	51.0	5.0	82	12.31	2.40	NX	(29)	0.09	"	"	"	
51.0	56.0	5.0	82	13.00	2.40	NX	(30)	0.12	"	"	"	
56.0	66.0	10.0	53	17.06	2.32	NX	(31)	0.08	"	"	"	
66.0	71.0	5.0	80	13.31	2.20	NX	(32)	0.08	"	"	"	
71.0	76.0	5.0	80	12.00	2.20	NX	(33)	0.16	"	"	"	ox
76.0	81.0	5.0	105	22.31	2.63	NX	(34)	0.08	"	"	"	
81.0	86.0	5.0	105	20.06	2.63	NX	(35)	0.10	0.03	"	"	
86.0	91.0	5.0	94	11.56	2.48	BX	(8)	0.35	tr.	"	"	
91.0	96.0	5.0	94	12.19	2.48	BX	(9)	0.32	0.05	"	"	
96.0	101.0	5.0	85	9.25	2.31	BX	(10)	0.14	0.12	"	"	hanging surface
101.0	106.0	5.0	85	13.50	2.31	BX	(11)	0.45	0.06	"	"	
106.0	116.0	10.0	84	12.64	2.43	BX	(12)	0.08	tr.	"	"	
116.0	121.0	5.0	86	10.13	2.19	BX	(13)	0.29	0.08	"	"	
121.0	126.0	5.0	86	10.64	2.19	BX	(14)	0.18	0.14	"	"	
126.0	131.0	5.0	103	11.13	2.58	BX	(15)	0.16	0.10	1.195 / 16 = 0.0756	"	
131.0	136.0	5.0	103	8.13	2.58	BX	(16)	0.06	tr.	"	"	
136.0	141.0	5.0	75	8.25	2.79	BX	(17)	0.25	0.03	"	"	
141.0	146.0	5.0	75	9.25	2.79	BX	(18)	0.14	0.05	"	"	
146.0	151.0	5.0	94	9.69	2.28	BX	(19)	0.26	0.09	"	"	
151.0	156.0	5.0	94	8.88	2.28	BX	(20)	0.21	0.12	"	"	
156.0	161.0	5.0	98	10.06	2.27	BX	(21)	0.29	0.04	"	"	
161.0	166.0	5.0	98	15.50	2.27	BX	(22)	0.14	0.17	"	"	
166.0	171.0	5.0	103	11.56	2.44	BX	(36)	0.26	0.13	"	"	
171.0	176.0	5.0	103	12.06	2.44	BX	(37)	0.18	tr.	"	"	ox
176.0	181.0	5.0	95	3.50	2.40	BX	(38)	0.13	"	"	"	
181.0	186.0	5.0	95	4.75	2.40	BX	(39)	0.13	"	"	"	
186.0	190.0	4.0	58	4.50	2.37	BX	(40)	0.08	"	"	"	
190.0	196.0	6.0	65	7.25	2.12	BX	(41)	0.07	0.01	"	"	
196.0	201.0	5.0	50	5.94	2.01	BX	(42)	0.08	0.01	"	"	
201.0	203.0	2.0	60	2.64	2.63	BX	(43)	0.08	tr.	"	"	
203.0	208.0	5.0	96	10.69	2.28	BX	(44)	0.19	0.09	"	"	
208.0	213.0	5.0	96	8.31	2.28	BX	(45)	0.15	tr.	"	"	
213.0	219.0	6.0	60	6.88	2.40	BX	(46)	0.16	0.01	"	"	
219.0	224.0	5.0	91	8.13	2.33	BX	(47)	0.12	tr.	"	"	
224.0	229.0	5.0	91	10.06	2.33	BX	(48)	0.10	tr.	"	"	
229.0	234.0	5.0	95	9.00	2.28	BX	(49)	0.15	0.01	"	"	
234.0	239.0	5.0	95	12.13	2.28	BX	(50)	0.18	0.01	"	"	
239.0	249.0	10.0	39	6.00	2.33	BX	(51)	0.14	0.01	"	"	
249.0	259.0	10.0	34	5.25	2.25	BX	(52)	0.12	tr.	"	"	
259.0	268.0	9.0	62	10.00	2.33	BX	(53)	0.18	"	"	"	
268.0	278.0	10.0	90	17.19	2.68	BX	(69)	0.16	"	"	"	
278.0	288.0	10.0	27	4.88	2.25	BX	(72)	0.05	"	"	"	
288.0	300.0	12.0	42	11.38	2.50	BX	(70)	0.09	"	"	"	

CORE SAMPLE LOG, D. D. H. Su No. 1 — cont'd.

Footage From (ft.)	Footage To (ft.)	Interval (ft.)	Re-covery %	Weight (lbs.)	Sp.G	Hole Size	No.	ASSAYS Jacobs Control Ag oz.	ASSAYS Jacobs Control Cu %	ASSAYS El Paso Umpire Ag oz.	ASSAYS El Paso Umpire Cu %
300.0	306.0	6.0	20	2.56	2.40	BX	(71)	0.14	tr.	n.a.	n.a.
306.0	312.0	6.0	28	3.13	2.22	BX	(73)	0.09	0.01	"	"
312.0	315.0	3.0	70	3.00	2.48	BX	(74)	0.12	tr.	"	"
315.0	322.0	7.0	77	8.64	2.24	BX	(75)	0.12	tr.	"	"
322.0	330.0	8.0	58	6.25	2.30	BX	(76)	0.14	0.01	"	"
330.0	337.0	7.0	50	6.50	2.16	BX	(77)	0.15	0.01	"	"
337.0	343.0	6.0	0	(..... no core recovery.....)							
343.0	347.0	4.0	95	6.64	2.57	BX	(78)	0.13	tr.	"	"
347.0	355.0	8.0	86	16.25	2.74	BX	(79)	0.12	0.23	31.39	"
355.0	360.0	5.0	99	12.00	2.90	BX	(80)	0.18	0.35	43	"
360.0	365.0	5.0	99	11.50	2.90	BX	(81)	0.34	1.98	0.10	0.32
365.0	370.0	5.0	98	10.81	2.75	BX	(84)	0.19	0.81	0.40	2.22
370.0	375.0	5.0	98	11.00	2.75	BX	(85)	0.36	1.89	0.10	0.80
375.0	380.0	5.0	102	10.50	3.05	BX	(86)	0.12	0.25	0.30	2.06
380.0	385.0	5.0	102	13.00	3.05	BX	(87)	0.10	0.15	n.a.	n.a.
385.0	390.0	5.0	99	12.50	3.33	BX	(88)	0.16	0.48	0.10	0.45
390.0	395.0	5.0	99	12.50	3.33	BX	(89)	0.08	0.13	n.a.	n.a.
395.0	400.0	5.0	99	14.13	2.61	BX	(90)	0.05	tr.	"	"
400.0	405.0	5.0	99	10.69	2.61	BX	(91)	0.08	"	"	"
405.0	410.0	5.0	99	12.13	2.96	BX	(92)	0.09	"	"	"
410.0	415.0	5.0	99	13.25	2.96	BX	(106)	0.18	0.13	"	"
415.0	420.0	5.0	98	9.25	2.68	BX	(107)	0.11	0.07	"	"
420.0	425.0	5.0	98	12.13	2.68	BX	(108)	0.14	0.09	"	"
425.0	430.0	5.0	99	11.25	2.47	BX	(109)	0.10	tr.	"	"
430.0	435.0	5.0	99	13.0	2.47	BX	(110)	0.12	0.04	"	"
435.0	445.0	10.0	99	22.75	2.76	BX	(111)	0.12	0.05	"	"
445.0	455.0	10.0	99	24.38	2.74	BX	(112)	0.15	0.01	"	"
455.0	465.0	10.0	100	22.64	2.81	BX	(113)	0.12	0.01	"	"
465.0	475.0	10.0	100	24.38	2.70	BX	(114)	0.15	0.03	"	"
475.0	485.0	10.0	99	23.25	2.75	BX	(115)	0.08	tr.	"	"
485.0	495.0	10.0	99	18.00	2.83	BX	(116)	0.09	tr.	"	"
495.0	505.0	10.0	102	18.88	2.54	BX	(117)	0.06	"	"	"
505.0	515.0	10.0	95	21.19	2.68	BX	(118)	0.12	"	"	"
515.0	525.0	10.0	97	23.19	2.82	BX	(119)	0.13	0.03	"	"
525.0	535.0	10.0	94	23.81	2.82	BX	(120)	0.07	tr.	"	"
535.0	551.0	16.0	83	36.50	2.65	BX	(121)	0.08	0.01	"	"
551.0	561.0	10.0	100	19.0	2.54	BX	(122)	0.10	tr.	"	"
561.0	571.0	10.0	100	20.75	2.53	BX	(123)	0.13	"	"	"
571.0	581.0	10.0	97	23.25	2.68	BX	(124)	0.15	0.07	"	"
581.0	591.0	10.0	100	24.56	2.77	BX	(125)	0.21	1.00	0.10	0.97
591.0	610.0	10.0	100	24.06	2.81	BX	(126)	0.09	0.01	n.a.	n.a.
601.0	611.0	10.0	98	22.56	3.27	BX	(127)	0.14	0.05	"	"
611.0	621.0	10.0	99	20.94	2.69	BX	(128)	0.09	0.09	"	"

El Paso assays should probably be moved up one line

CORE SAMPLE LOG, D. D. H. Su No. 1 — cont'd.

Footage From (ft.)	To (ft.)	Interval (ft.)	Recovery %	Weight (lbs.)	Sp.G	Hole Size	No.	Ag oz.	Cu %	Ag oz.	Cu %
621.0	631.0	10.0	97	26.56	2.49	BX	(129)	0.13	0.01	n.a.	n.a.
631.0	641.0	10.0	101	22.69	3.17	BX	(130)	0.08	tr.	"	"
641.0	651.0	10.0	98	26.88	3.03	BX	(131)	0.07	tr.	"	"
651.0	661.0	10.0	98	16.50	2.95	AX	(132)	0.14	0.07	"	"
661.0	671.0	10.0	97	11.75	2.69	AX	(133)	0.10	tr.	"	"
671.0	681.0	10.0	97	15.50	2.42	AX	(134)	0.12	"	"	"
681.0	691.0	10.0	96	13.75	2.70	AX	(135)	0.10	"	"	"
691.0	701.0	10.0	98	13.75	2.61	AX	(136)	0.15	0.01	"	"
0.0	701.0	701.0	84.1%		2.55						

AVERAGE LENGTH OF DRILL RUN: 6.6 ft.

RECOVERIES:

Oxide Zone: 0.0' - 353.0' - 75.8%
Sulphide Zone: 353.0' - 701.0' - 95.0%
Over-all: 0.0' - 701.0' - 84.1%

(Note: A comparison of core recoveries for the various core bit sizes (NX, BX, AX) would be meaningless in this hole.)

SPECIFIC GRAVITIES:

Oxide Zone: 0.0 - 353.0' - 2.37
Sulphide Zone: 353.0' - 701.0' - 2.78
Over-All: 0.0' - 701.0' - 2.55

ASSAYS:

Oxide Zone: 0.0 - 353.0' - 0.14 Oz. Ag 0.03% Cu
Sulphide Zone: 353.0' - 390.0' - 0.23 oz. Ag 0.84% Cu
390.0 - 701.0' - 0.11 oz. Ag 0.05% Cu
353.0' - 701.0' - 0.12 oz. Ag 0.13% Cu
Over-All 0.0' - 701.0' - 0.13 oz. Ag 0.08% Cu
Sulphide within BX pipe (353.0-601.0) 0.13 oz. Ag 0.08% Cu

CORE SAMPLE LOG - D. D. H. No. 2

Footage From (ft.)	Footage To (ft.)	Interval (ft.)	Recovery %	Weight (lbs.)	Sp. G.	Hole Size	No.	ASSAYS Jacobs Control Ag. oz.	ASSAYS Jacobs Control Cu %	ASSAYS El Paso Umpire Ag oz.	ASSAYS El Paso Umpire Cu %
0.0	3.0	3.0	0	(3½" drive pipe cemented in place)							
3.0	7.0	4.0	95	10.06	2.53	NX	(210)	n.a.	n.a.	n.a.	n.a.
7.0	29.0	22.0	50	31.50	2.15	NX	(211)	"	"	"	"
29.0	34.0	5.0	76	11.06	2.24	NX	(212)	"	"	"	"
34.0	44.0	10.0	90	13.81	2.03	NX	(213)	"	"	"	"
44.0	64.0	20.0	95	73.94	2.17	NX	(214)	"	"	"	"
64.0	83.0	19.0	58	32.75	2.36	NX	(215	"	"	"	"
83.0	102.0	19.0	16	16.25	2.06	NX	(216)	"	"	"	"
102.0	118.0	16.0	40	11.25	2.17	NX	(217)	"	"	"	"
118.0	125.0	7.0	94	6.69	1.99	NX	(218)	"	"	"	"
125.0	135.0	10.0	27	16.75	1.96	NX	(219)	"	"	"	"
135.0	147.0	12.0	23	9.75	2.27	NX	(220)	"	"	"	"
147.0	153.0	6.0	35	4.75	2.34	BX	(221)	"	"	"	"
153.0	159.0	6.0	28	4.13	2.27	BX	(222)	"	"	"	"
159.0	165.0	6.0	63	9.00	2.42	BX	(223)	"	"	"	"
165.0	169.0	4.0	42	6.25	2.34	BX	(224)	"	"	"	"
169.0	174.0	5.0	46	7.13	2.05	BX	(225)	"	"	"	"
174.0	184.0	10.0	86	15.88	2.32	BX	(226)	"	"	"	"
184.0	190.0	6.0	80	7.00	2.05	BX	(227)	"	"	"	"
190.0	200.0	10.0	94	19.75	2.25	BX	(228)	"	"	"	"
200.0	208.0	8.0	76	11.81	2.02	BX	(229)	"	"	"	"
208.0	212.0	4.0	98	9.75	2.25	BX	(230)	"	"	"	"
212.0	218.0	6.0	118.	19.50	2.12	BX	(231)	"	"	"	"
218.0	224.0	6.0	83	12.25	1.67	BX	(232)	"	"	"	"
224.0	233.0	9.0	68	13.88	2.64	BX	(233)	"	"	"	"
233.0	237.0	4.0	45	4.56	2.68	BX	(234)	"	"	"	"
237.0	243.0	6.0	45	8.00	2.82	BX	(235)	"	"	"	"
243.0	248.0	5.0	16	4.00	2.07	BX	(236)	"	"	"	"
248.0	253.0	5.0	36	5.64	2.57	BX	(237)	"	"	"	"
253.0	256.0	3.0	40	3.75	2.39	BX	(238)	"	"	"	
256.0	266.0	10.0	28	4.88	2.51	BX	(239)	"	"	"	
266.0	272.0	6.0	85	13.00	1.96	BX	(240)	"	"	"	
272.0	278.0	6.0	75	10.75	1.89	BX	(241)	"	"	"	"
278.0	288.0	10.0	59	15.44	2.80	BX	(242)	"	"	"	"
288.0	300.0	12.0	47	11.25	1.99	BX	(243)	"	"	"	"
300.0	309.0	9.0	37	6.00	2.02	BX	(150)	0.14	tr.	"	"
309.0	315.0	6.0	77	9.00	1.94	BX	(151)	0.17	"	"	"
315.0	323.0	8.0	86	15.13	2.43	BX	(152)	0.10	"	"	"
323.0	329.0	6.0	75	8.50	2.43	BX	(153)	0.11	"	"	"
329.0	334.5	5.5	60	9.38	1.76	BX	(154)	0.16	"	"	"
334.5	340.0	5.5	91	11.38	1.86	BX	(155)	0.15	"	"	"
340.0	346.0	6.0	88	11.25	2.20	BX	(156)	0.18	0.26	"	"
346.0	353.0	7.0	100	25.25	2.23	BX	(157)	0.21	0.62	"	"
353.0	361.0	8.0	96	20.94	3.02	BX	(158)	0.09	0.15	"	"
361.0	367.0	6.0	100	20.13	2.19	BX	(159)	0.16	1.35		

CORE SAMPLE LOG — D. D. H. No. 2, cont'd.

Footage From (ft.)	Footage To (ft.)	Interval (ft.)	Recovery %	Weight (lbs.)	Sp.G.	Hole Size	No.	ASSAYS Jacobs Ag oz.	ASSAYS Jacobs Cu %	ASSAYS El Paso Umpire Ag oz.	ASSAYS El Paso Umpire Cu %
367.0	377.0	10.0	100	30.50	2.54	BX	(160)	0.09	0.24	n.a.	n.a.
377.0	387.0	10.0	87	26.13	2.26	BX	(161)	0.11	0.37	"	"
387.0	391.7	4.7	100	10.00	2.79	BX	(166)	0.09	0.21	"	"
391.7	401.7	10.0	98	13.25	3.15	AX	(167)	0.12	0.28	"	"
401.7	410.0	8.3	93	8.50	2.69	AX	(168)	0.08	0.35	52.987/137 = 0.387	"
410.0	420.0	10.0	99	16.00	2.76	AX	(169)	0.07	0.36	"	"
420.0	426.5	6.5	100	11.38	2.10	AX	(170)	0.11	0.22	"	"
426.5	436.5	10.0	99	15.50	2.72	AX	(171)	0.10	0.36	"	"
436.5	446.5	10.0	97	15.25	1.71	AX	(172)	0.10	0.42	"	"
446.5	456.5	10.0	99	15.25	2.93	AX	(173)	0.12	0.26	"	"
456.5	462.0	5.5	91	7.00	3.13	AX	(174)	0.15	0.33	"	"
462.0	472.0	10.0	94	15.06	2.46	AX	(175)	0.14	0.48	"	"
472.0	477.0	5.0	100	7.00	2.34	AX	(176)	0.12	0.59	"	"
477.0	479.0	2.0	100	3.75	2.95	AX	(177)	0.07	0.04	"	"
479.0	489.0	10.0	86	10.50	2.55	AX	(178)	0.06	0.06	"	"
489.0	499.0	10.0	100	14.25	3.06	AX	(179)	0.09	0.18	"	"
499.0	509.0	10.0	97	13.25	2.51	AX	(180)	0.12	0.06	5.68/52 = 0.11	"
509.0	519.0	10.0	88	11.13	2.82	AX	(181)	0.11	0.10	"	"
519.0	529.0	10.0	89	14.44	2.63	AX	(182)	0.15	0.16	"	"
529.0	535.0	6.0	62	5.50	2.59	AX	(183)	0.12	0.74	"	"
535.0	539.0	4.0	100	5.00	2.27	AX	(184)	0.08	0.29	"	"
539.0	548.0	9.0	61	5.88	1.74	AX	(185)	0.15	0.89	"	"
548.0	556.0	8.0	99	6.25	2.26	AX	(203)	0.18	0.76	"	"
556.0	560.0	4.0	100	5.69	2.42	AX	(204)	0.15	0.39	"	"
560.0	567.0	7.0	70	6.31	2.87	AX	(205)	0.09	0.51	"	"
567.0	577.0	10.0	87	11.50	2.88	AX	(206)	0.12	0.41	"	"
577.0	583.0	6.0	108	9.75	2.19	AX	(207)	0.14	1.07	164.99/144 = 1.146	"
583.0	589.0	6.0	95	7.50	2.77	AX	(208)	0.08	0.37	"	"
589.0	594.0	5.0	38	3.00	2.13	AX	(209)	0.45	5.19	n.d.	5.70
594.0	596.0	2.0	5	(too little core to prepare assay pulps) est 1.00							
596.0	609.0	13.0	63	11.31	2.65	AX	(250)	0.12	1.05	n.d.	1.31
609.0	619.0	10.0	99	13.31	2.75	AX	(251)	0.16	0.83	n.a.	n.a.
619.0	629.0	10.0	100	12.88	2.58	AX	(252)	0.13	0.42	n.a.	n.a.
629.0	638.0	9.0	98	11.50	2.62	AX	(253)	0.15	0.97	"	"
638.0	643.0	5.0	100	7.94	2.84	AX	(254)	0.14	2.51	n.d.	2.51
643.0	648.0	5.0	100	7.25	2.33	AX	(255)	0.13	1.33	n.d.	1.26
648.0	653.0	5.0	100	7.75	2.99	AX	(256)	0.12	1.95	n.d.	1.92
653.0	658.0	5.0	100	6.00	2.23	AX	(257)	0.18	4.86	n.d.	4.85
658.0	663.0	5.0	100	7.31	2.51	AX	(258)	0.15	0.12	n.a.	n.a.
663.0	668.0	5.0	100	7.19	2.71	AX	(259)	0.22	0.28	n.a.	n.a.
668.0	673.0	5.0	100	6.75	2.58	AX	(260)	0.17	1.87	n.d.	0.23
673.0	678.0	5.0	100	7.64	2.46	AX	(261)	0.12	0.14	n.a.	n.a.
678.0	683.0	5.0	100	6.75	2.67	AX	(262)	0.19	0.16	n.a.	n.a.
683.0	688.0	5.0	100	6.56	2.74	AX	(263)	0.15	0.13	"	"

223.657/333 = 0.679

13.45/55 = 0.244

CORE SAMPLE LOG — D. D. H. No. 2, cont'd.

Footage From (ft.)	Footage To (ft.)	Interval (ft.)	Recovery %	Weight (lbs.)	Sp.G.	Hole Size	No.	Jacobs Ag oz.	Jacobs Cu %	El Paso Control Umpire Ag oz.	El Paso Control Umpire Cu%
688.0	698.0	10.0	101	10.88	2.79	AX	(264)	0.12	0.11	n.a.	n.a.
698.0	708.0	10.0	102	14.75	2.62	AX	(265)	0.24	0.31	"	"
708.0	718.0	10.0	101	13.56	2.40	AX	(266)	0.13	0.29	"	"
718.0	728.0	10.0	102	14.00	2.63	AX	(267)	0.26	0.42	"	"
728.0	738.0	10.0	99	11.06	3.07	AX	(268)	0.13	0.10	"	"
738.0	748.0	10.0	102	14.13	2.49	AX	(269)	0.11	0.14	"	"
748.0	758.0	10.0	102	14.19	2.51	AX	(270)	0.17	0.07	"	"
758.0	768.0	10.0	102	13.94	2.65	AX	(271)	0.14	0.02	"	"
768.0	778.0	10.0	100	12.56	2.67	AX	(272)	0.15	0.04	"	"
778.0	788.0	10.0	101	13.00	2.40	AX	(273)	0.12	0.05	"	"
788.0	798.0	10.0	101	13.19	2.45	AX	(274)	0.17	0.02	"	"
798.0	802.0	4.0	45	5.38	2.91	AX	(275)	0.14	0.11	"	"
802.0	812.0	10.0	101	10.31	2.62	AX	(276)	0.07	0.05	"	"
812.0	821.0	9.0	101	11.81	2.33	AX	(277)	0.27	0.07	"	"
821.0	831.0	10.0	100	13.31	2.36	AX	(278)	0.19	0.06	"	"
831.0	841.0	10.0	98	12.64	2.66	AX	(279)	0.10	0.04	"	"
841.0	851.0	10.0	98	13.00	2.34	AX	(280)	0.15	0.12	"	"
851.0	861.0	10.0	101	12.81	2.58	AX	(281)	0.16	0.13	"	"
861.0	870.0	9.0	89	9.69	2.31	AX	(282)	0.21	0.02	"	"
870.0	880.0	10.0	96	12.13	2.53	AX	(283)	0.20	tr.	"	"
880.0	890.0	10.0	102	11.13	2.50	AX	(284)	0.25	0.06	"	"
0.0	890.0	890.0	81.3		2.43						

AVERAGE LENGTH OF DRILL RUN: 7.4 ft.

RECOVERIES:

Oxide zone: (0.0' - 341.0') 59.8%
Sulphide zone: (341.0' - 890.0') 94.5%
Over-all: (0.0' - 890.0') 81.3%
Sulphide zone - BX size (341.0-392.0') 94.9%
Sulphide zone - AX size (392.0' - 890.0') 94.5%

SPECIFIC GRAVITIES:

Oxide zone : (0.0' - 341.0') 2.21
Sulphide zone: (341.0' - 890.0') 2.56
Over-all: (0.0' - 890.0') 2.43

ASSAYS:

Oxide zone: (300.0' - 341.0') 0.14 oz. Ag tr. % Cu
Sulphide zone: (341.0' - 890.0') 0.14 oz. Ag 0.45 % Cu
Over-all (300.0' - 890.0') 0.14 oz. Ag 0.43 % Cu
Best 25± foot run (629.0' - 658.0') 0.14 oz. Ag. 2.14 % Cu
Best 50± " " (609.0' - 658.0') 0.15 oz. Ag 1.52 % Cu
Best 100± " " (577.0 - 678.0') 0.16 oz. Ag 1.36 % Cu
Sulphide within BX pipe (341.0 - 658.0) 0.13 oz. Ag 0.67 % Cu

CORE SAMPLE LOG - D. D. H. No. 3

Footages						Assays				
							Jacobs cont		El Paso	
from (ft)	to (ft)	interv. (ft)	rec. (%)	weight (lbs.)	Hole size	No.	Ag oz	Cu %	Ag oz	Cu %
0.0	10.0	10.0	63	29.56	4"	(285)	n.a.	n.a.	n.a.	n.a.
10.0	20.0	10.0	53	18.13	3.5"	(286)	"	"	"	"
20.0	30.0	10.0	80	34.19	3.5"	(287)	"	"	"	"
30.0	40.0	10.0	97	36.31	3.5"	(288)	"	"	"	"
40.0	50.0	10.0	67	27.94	3.5"	(289)	"	"	"	"
50.0	60.0	10.0	37	23.75	3.5"	(290)	"	"	"	"
60.0	70.0	10.0	80	35.38	3.5"	(291)	"	"	"	"
70.0	80.0	10.0	60	25.75	3.5"	(292)	"	"	"	"
80.0	90.0	10.0	43	16.25	3.5"	(293)	"	"	"	"
90.0	100.0	10.0	69	33.69	3.5"	(294)	"	"	"	"
100.0	110.0	10.0	73	24.31	3.5"	(295)	"	"	"	"
110.0	120.0	10.0	82	32.25	3.5"	(296)	"	"	"	"
120.0	130.0	10.0	81	33.64	3.5"	(297)	"	"	"	"
130.0	140.0	10.0	99	48.94	3.5"	(298)	"	"	"	"
140.0	150.0	10.0	82	46.00	3.5"	(299)	"	"	"	"
150.0	160.0	10.0	82	42.75	3.5"	(300)	"	"	"	"
160.0	170.0	10.0	90	47.00	3.5"	(301)	"	"	"	"
170.0	180.0	10.0	104	47.64	3.5"	(302)	"	"	"	"
180.0	190.0	10.0	95	51.50	3.5"	(303)	"	"	"	"
190.0	200.0	10.0	78	24.38	3.5"	(304)	"	"	"	"
200.0	210.0	10.0	85	46.13	3.5"	(305)	"	"	"	"
210.0	222.0	12.0	65	34.06	3.5"	(306)	"	"	"	"
222.0	230.0	8.0	100	35.25	NX	(307)	"	"	"	"
230.0	240.0	10.0	100	37.88	"	(308)	"	"	"	"
240.0	250.0	10.0	96	33.38	"	(309)	"	"	"	"
250.0	260.0	10.0	94	35.81	"	(310)	"	"	"	"
260.0	270.0	10.0	88	34.56	"	(311)	"	"	"	"
270.0	280.0	10.0	89	32.25	"	(312)	"	"	"	"
280.0	290.0	10.0	65	16.00	"	(313)	"	"	"	"
290.0	300.0	10.0	77	22.81	"	(314)	"	"	"	"
300.0	310.0	10.0	82	25.81	"	(315)	"	"	"	"
310.0	320.0	10.0	89	30.19	"	(316)	"	"	"	"
320.0	330.0	10.0	73	26.00	"	(317)	"	"	"	"
330.0	340.0	10.0	60	18.94	"	(318)	"	"	"	"
340.0	350.0	10.0	65	18.19	"	(319)	"	"	"	"
350.0	360.0	10.0	64	19.13	"	(320)	"	"	"	"
360.0	370.0	10.0	50	13.50	"	(321)	"	"	"	"
370.0	380.0	10.0	43	9.44	"	(322)	"	"	"	"
380.0	390.0	10.0	39	9.44	"	(323)	"	"	"	"
390.0	400.0	10.0	33	9.38	"	(324)	"	"	"	
400.0	410.0	10.0	83	24.00	"	(325)	0.31	tr.	"	
410.0	419.0	9.0	90	24.00	"	(326)	0.32	tr.	"	
419.0	421.0	2.0	60	5.44	"	(328)	0.35	tr.	"	"
421.0	428.0	7.0	50	8.81	"	(329)	0.29	1.05	"	"
428.0	434.4	6.3	95	27.25	"	(330)	0.35	1.43	"	"

footages from	to	inter.	% rec.	weight lbs.	Hole size	Assays No.	Jacobs Ag oz	Jacobs Cu %	El Paso Ag oz	El Paso Cu %
434.4	440.0	5.7	86	16.94	NX	(331)	0.23	0.91	"	"
440.0	447.0	7.0	99	28.25	"	(332)	0.27	0.37	"	"
447.0	449.0	2.0	100	7.88	"	(333)	0.39	3.31	"	"
449.0	452.0	3.0	100	11.06	"	(334)	0.33	0.56	"	"
452.0	462.0	10.0	100	38.56	"	(335)	0.25	0.27	"	"
462.0	470.0	8.0	100	38.64	"	(336)	0.27	0.37	"	"
470.0	480.0	10.0	100	42.81	"	(337)	0.15	0.35	"	"
480.0	490.0	10.0	100	43.38	"	(327)	0.29	0.13	"	"
490.0	500.0	10.0	100	43.06	"	(338)	0.31	0.06	"	"
500.0	511.0	11.0	91	22.69	BX	(339)	0.16	0.04	"	"
511.0	518.0	7.0	81	13.00	"	(340)	0.21	0.08	"	"
518.0	527.0	9.0	100	23.06	"	(341)	0.18	tr.	"	"
527.0	537.0	10.0	94	20.31	"	(342)	0.16	0.01	"	"
537.0	547.0	10.0	98	21.64	"	(343)	0.15	tr.	"	"
547.0	553.0	6.0	98	12.69	"	(344)	0.17	0.05	"	"
553.0	562.0	9.0	53	10.06	"	(345)	0.14	0.02	"	"
562.0	572.0	10.0	96	21.75	"	(346)	0.25	0.05	"	"
572.0	582.0	10.0	98	21.94	"	(347)	0.31	0.14	"	"
582.0	592.0	10.0	96	22.44	"	(348)	0.26	0.07	"	"
592.0	602.0	10.0	98	19.64	"	(349)	0.33	0.03	"	"
602.0	612.0	10.0	88	8.13	"	(350)	0.359	0.06	"	"
612.0	614.0	2.0	100	4.94	"	(351)	0.38	0.02	"	"
614.0	624.0	10.0	18	3.25	"	(352)	0.39	0.05	"	"
624.0	634.0	10.0	59	8.81	"	(353)	0.15	0.03	"	"
634.0	639.0	5.0	92	11.00	"	(354)	0.26	0.07	"	"
639.0	644.0	5.0	92	9.19	"	(355)	0.24	0.08	"	"
0.0	644.0	644.0	79.1%							

41,596 / 59 = 0.705

AVERAGE LENGTH OF DRILL RUN: 6.44 feet

RECOVERIES:

Oxide zone	0.0 to 421.0 ft.	74.6%
Sulphide zone	421.0 to 644.0 ft.	87.6%
Over-all	0.0 to 644.0 ft.	79.1%

ASSAYS:

		oz Ag	% Cu
Oxide zone	400.0 - 421.0 ft.	0.32	tr.
Sulphide zone	421.0 - 644.0 ft.	0.25	0.23
Over-all	400.0 - 644.0 ft.	0.25	0.21
Best 25 ft run	421.0 - 449.0 ft.	0.29	1.10
Sulphide within BX pipe	421.0 - 490.0 ft.	0.26	0.62

n.a. = not assayed

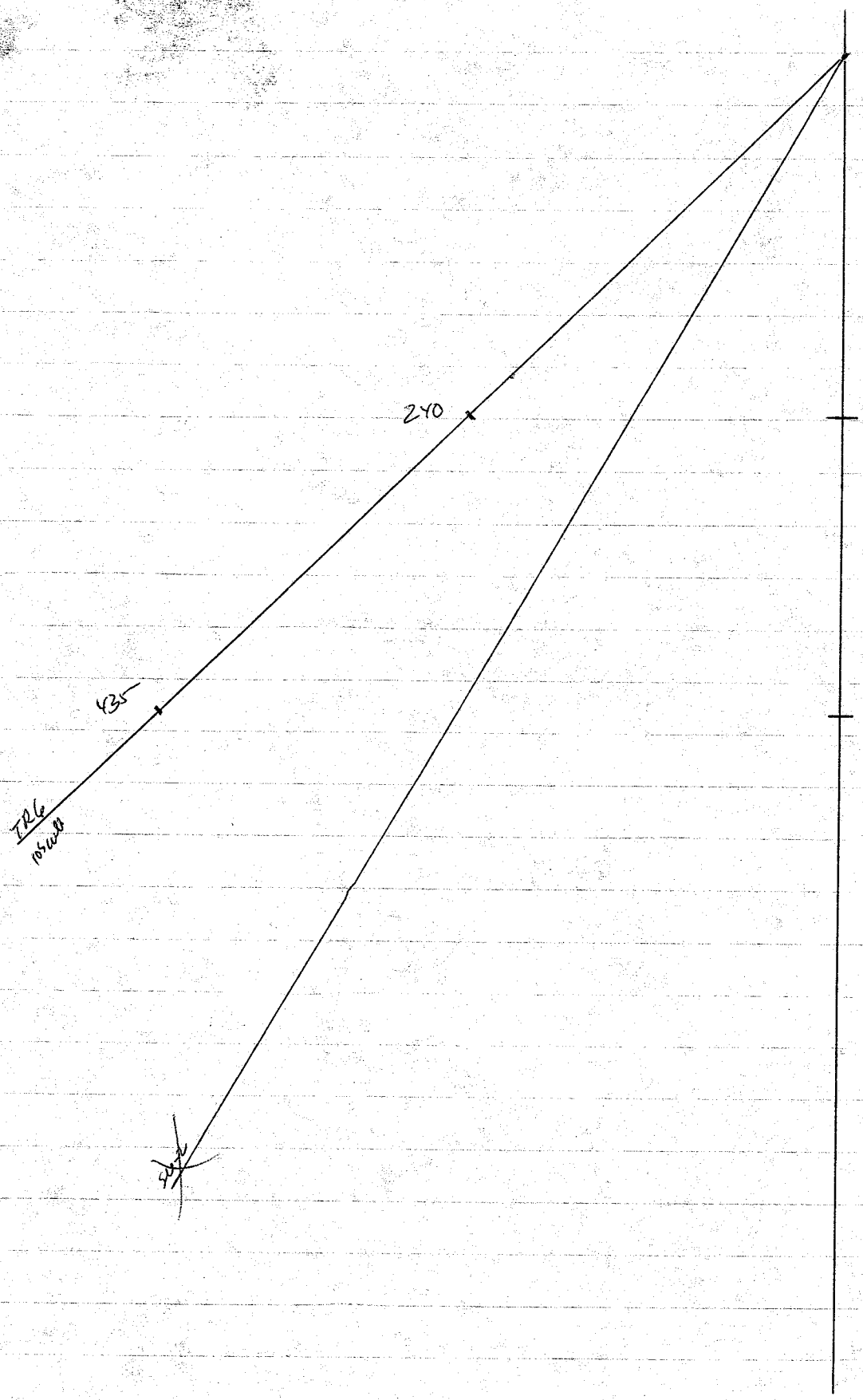
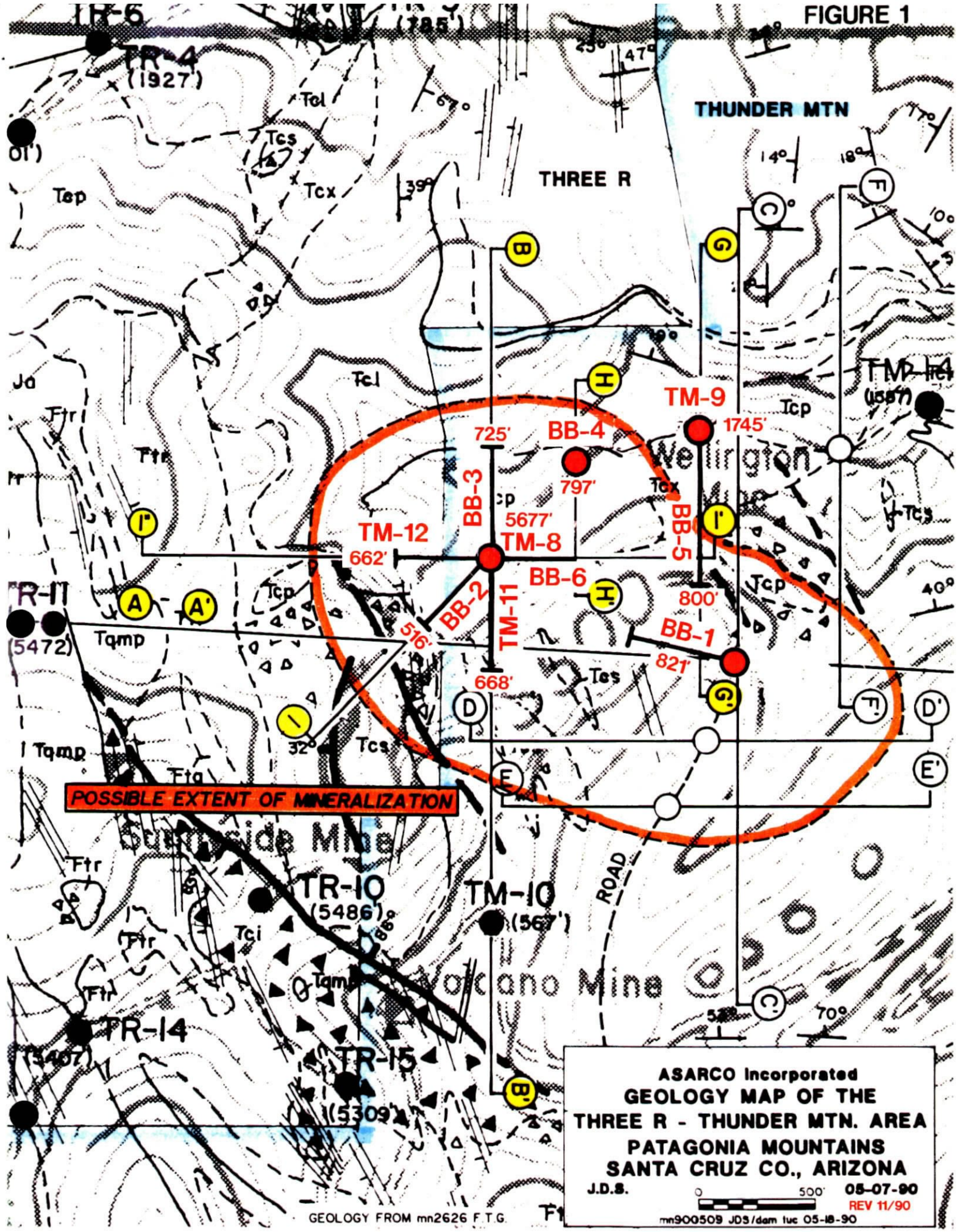

240
435
IRG
105W

FIGURE 1

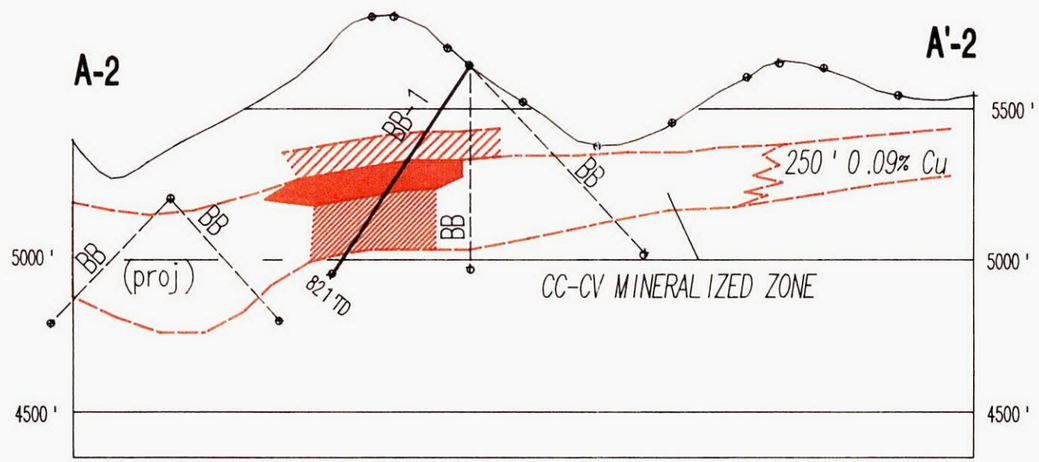


GEOLOGY FROM mn2626 F.T.G.

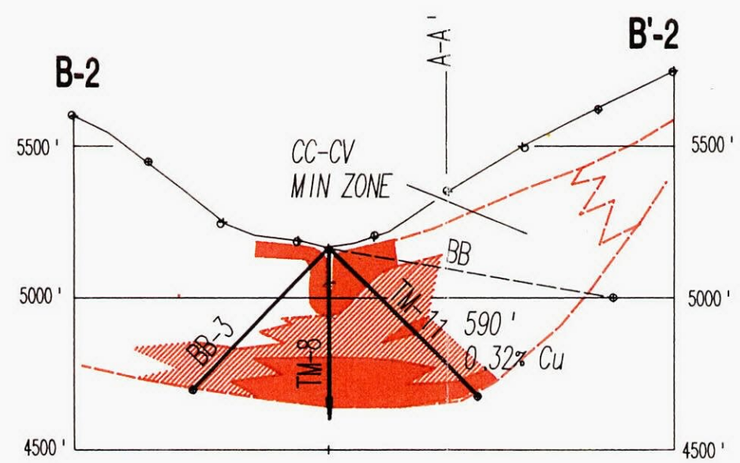
ASARCO Incorporated
GEOLOGY MAP OF THE
THREE R - THUNDER MTN. AREA
PATAGONIA MOUNTAINS
SANTA CRUZ CO., ARIZONA

J.D.S. 0 500' 05-07-90
REV 11/90
mn900509 JDS/dam tuc 05-18-90

FIGURE 2



EAST-WEST SECTION, LOOKING NORTH
PROPOSED DRILL HOLES AND DRILL HOLE BB-1



NORTH-SOUTH SECTION, LOOKING EAST
PROPOSED DRILL HOLE AND DRILL HOLES
TM-8, TM-11 AND BB-3

EXPLANATION

0.10 - 0.19 % Cu

0.20 - 0.39 % Cu

+ 0.40 % Cu

ASARCO Incorporated

THUNDER MOUNTAIN PROJECT

PROPOSED DRILL HOLES

SKETCH SECTIONS A-2 & B-2

BUCKET BRECCIA ZONE

PATAGONIA MTNS., AZ.

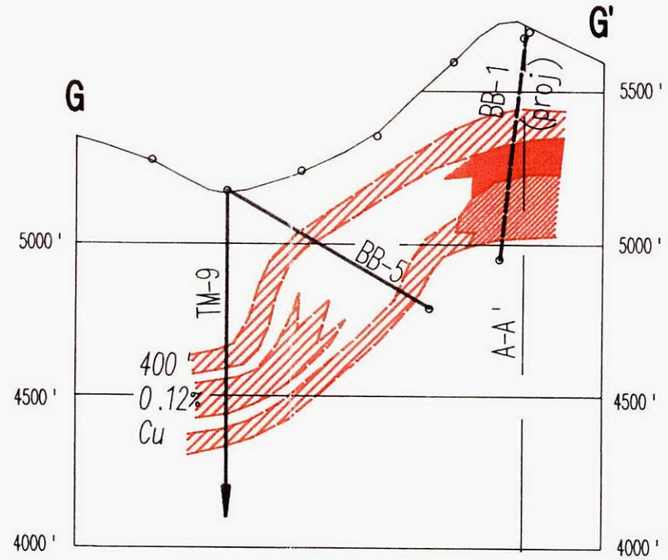
J.D.SELL 05-09-90

REV. 11-90

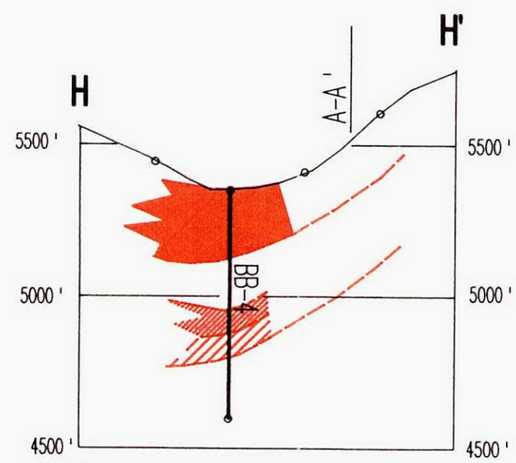
0 250 ' 500 '

mn TM901121 JDS/dam tuc 11-15-90

FIGURE 3



NORTH-SOUTH SECTION, LOOKING EAST
DRILL HOLES TM-9, BB-1, BB-5



NORTH-SOUTH SECTION, LOOKING EAST
DRILL HOLE BB-4

EXPLANATION

0.10 - 0.19 % Cu

0.20 - 0.39 % Cu

+ 0.40 % Cu

ASARCO Incorporated
THUNDER MOUNTAIN PROJECT
PROPOSED DRILL HOLES

SKETCH SECTIONS G & H

BUCKET BRECCIA ZONE
PATAGONIA MTNS., AZ.

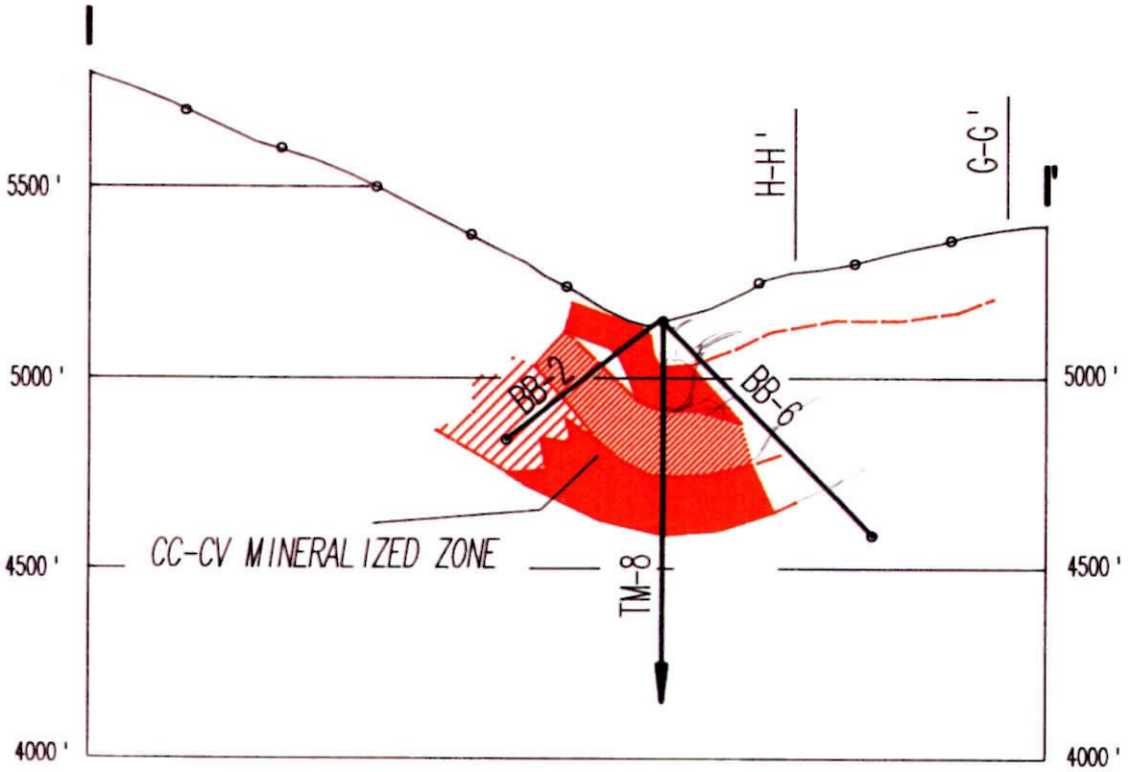
J.D.SELL

05-09-90
REV 11-90

0 250 ' 500 '

mn 901122 JDS/dam tuc 11-16-90

FUGURE 4



EAST-WEST SECTION
LOOKING NORTH

DRILL HOLES BB-2, BB-6, TM-8

EXPLANATION

0.10 - 0.19 % Cu

0.20 - 0.39 % Cu

+ 0.40 % Cu

ASARCO Incorporated

THUNDER MOUNTAIN PROJECT
PROPOSED DRILL HOLES

SKETCH SECTION I

BUCKET BRECCIA ZONE

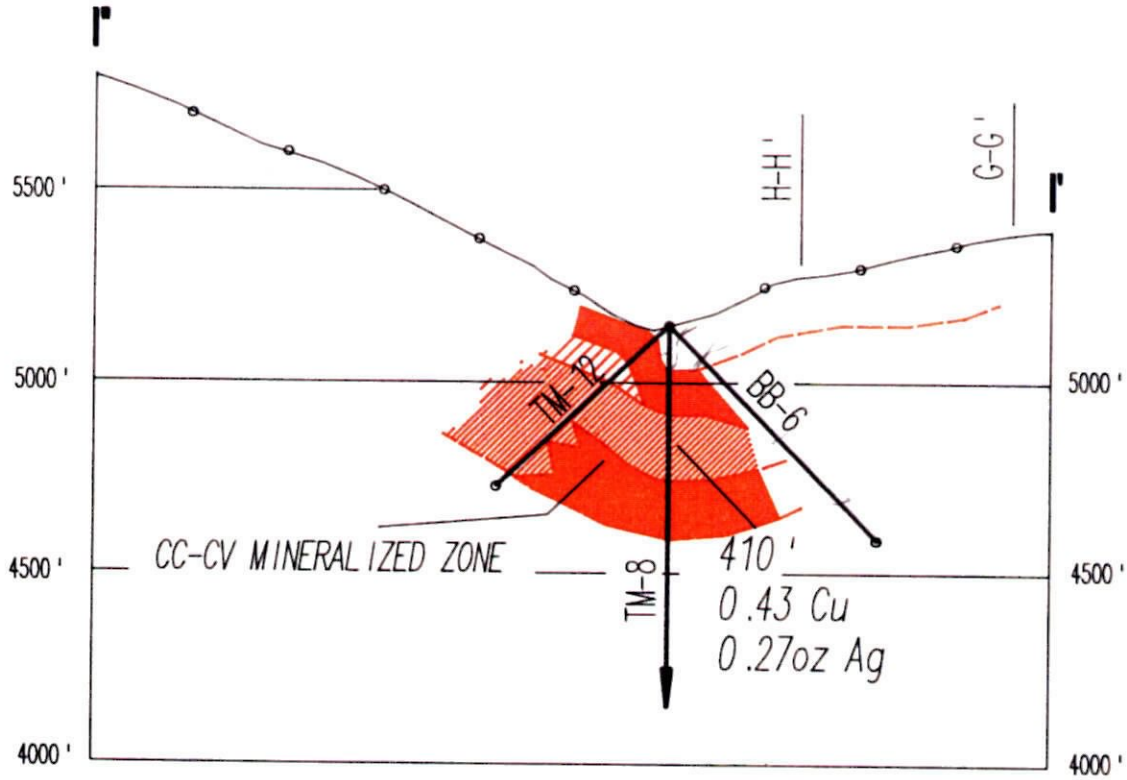
PATAGONIA MTNS., AZ.

J.D.SELL **05-09-90**
REV 11-90

0 250 ' 500 '

mn 901123 JDS/dam tuc 11-16-90

FUGURE 5



EAST-WEST SECTION
LOOKING NORTH

DRILL HOLES TM-12, BB-6, TM-8

EXPLANATION

0.10 - 0.19 % Cu

0.20 - 0.39 % Cu

+ 0.40 % Cu

ASARCO Incorporated

THUNDER MOUNTAIN PROJECT
PROPOSED DRILL HOLES

SKETCH SECTION I'-I"

BUCKET BRECCIA ZONE
PATAGONIA MTNS., AZ.

J.D.SELL **05-09-90**
REV 11-90

0 250' 500'

mn 901124 JDS/dam tuc 11-16-90

yearly report on TM ! Here

est 24,000 per 800' in SEA = $32.5*/ft
but.

BB-2 566
BB-3 725'
BB-4 797
BB-5 800
BB-6 800
BB-7 736
4374'

Jan-Dec 1990
101,220
24,726
125,946
= $28.8/ft

BB-2 0-142 = $7975 incl 500 mobility = $49.23/ft
= 7475 = $46.14/ft.

Mr. Harold W Holmberg
Director of Metal Exploration
~~Mr. L.A. Rothenrott~~
~~Manager of Mineral Land~~
Ken-McGee Corporation
PO Box 25861
Oklahoma City, OK 73125

Year 1989
what No 1990 report!

Jan 25, 1991 year 1991 on rigest bottleroll test gen. 20-40% ferric acid leach.
head assay 0.35 Cu 32 Fe

Cat ~~loader~~ Loader work $3000 + 1500 + 1500 $6000

Consultant $250/day x 2½ + 5½ + 2 + 1 + 1 + 2 + 2 + 1½ + 18 x 250 = $5000/mo

22 ($8435.24); 11 ($2217.80); 28 ($5[illegible],152); 33 ($6[illegible],175); 54 (1069.20)

Assays 79 Au/Ag/Cu = $1508; 13 (202.02); 57 (1137.15); 28 (558.60); 25 ($498.75

Survey eq (Boyle) ~~400~~ 1400/mo + 200 handling

CBC	BB-2	BB-3	BB-4	BB-5	BB-6	BB-7
	22,440.11 (9/7		18,811.34 (11/2)		766.86 (1/3)	1,028.85 (1/8)
	6,612.10 (8/3)		21,426.62 (10/4)		20,429.19 (12/10)	17,407.21 (1/3)

$108,982.28 ÷ 4374' = 24.92/ft.

Assays 350 @ $6,837 = 19.53 per sample Cu Au Ag prep.

= $20 ÷ 5' = $4/ft.

BB4 - Sect 7 - Sec 25

43,000 ft²/acre

20' wide disturbed zone

550' per 50' site

2400' + 1600' = 3000'
x 20
60,000

UDG est. road at (3000') = 90 days at 800/day = $72K

Blue Mountain (Potas cat man) est.

JDS

ASARCO

Southwestern Exploration Division

February 19, 1991

W.L. Kurtz

H.J. Downey's Report
Summary 1990 Drilling
Thunder Mountain Project
Santa Cruz County, AZ

I submit Mr. Downey's report on the 1990 drill results at the Thunder Mountain Project, Santa Cruz County, Arizona.

The drilling was successful in expanding the zone of shallow copper mineralization and confirming a lower zone of lesser overall grade.

Full logs of the drilling and individual assay logs are available in the files.

James D. Sell

James D. Sell

JDS:mek
Att.

cc: R.L. Brown
F.T. Graybeal
H.J. Downey (w/o att.)

MEMORANDUM

TO: James D. Sell
FROM: Harold Downey
DATE: February 7, 1991

SUBJECT: Summary of 1990 Thunder Mountain Drilling Project; Discussion of lithologic relationships, mineralization, ore grades and reserves; Recommendations

Core drilling of six holes at the Thunder Mountain project was completed December 21, 1990. The holes were designated BB-2 through BB-7, four of which were angled and two vertical. BB-2, BB-3, and BB-6 were located at the old TM-8, TM-11, TM-12 drill site. BB-4 was located approximately halfway between the above site and the site of TM-9, another earlier hole. BB-5 was drilled at a shallow angle (30) due south from TM-9 and BB-7 was drilled vertically from the old site of BB-1 on the ridge near the "Bucket Breccia" adit.

Lithologies

The rock units intercepted in the 1990 drilling were of volcanic origin as was expected from the earlier drilling. The various sequences are indicative of chaotic processes which could be expected in a diatreme environment. Many of the units are fragmentals, some are tuffaceous in appearance, others are seen as slump breccias and intrusive breccias. I would suggest the possibility of a caldera system here but at this writing I do not have background data of others who have worked the Patagonia Range to know if this is a valid assumption.

The predominant rock type is an intensely altered quartz feldspar porphyry which was found in all holes except BB-7 and the earlier hole BB-1 both of which are somewhat separated in distance laterally from the main focus of drilling. Thin section analyses by Sid Williams (report of 9/26/90) define the alteration assemblage as dominated by pyrophillite, with sericite, alunite and kaolinite subsidiary. Williams classified the unit as probably dacitic in origin, but also said this was difficult to determine because of the intense alteration. There may be a relationship with the rock found in BB-7 which I logged as Rhyodacite (others have called it Silica Tuff in BB-1) and the QFP although I did not note a porphyritic texture in the Rhyodacite.

Intrusive breccias are found at random intervals (without apparent continuity between holes) in all holes drilled this period. In addition to these breccias, tuffaceous agglomerates (lapilli tuffs) are also common. The distinguishing features between these units is mostly fragment size and angularity; the breccias contain fragments to 3" diameter which are generally angular whereas the tuffs have mostly grit to 1" fragments that are mostly subangular. Both of these units have a QFP matrix.

A unique siliceous rock is found near the bottom of BB-2, also at the bottom of TM-11 and TM-12. Fragments of brown chert (or very fine-grained quartzite) are bonded in a siliceous matrix so that total composition amounts to greater than 90% silica. I logged this unit as brecciated chert. The TM logs refer to it as silica breccia but descriptions match. The intercepts in the three holes form a plane which strikes N40W and dips 30° NE.

Mineralization

There is no obvious relationship of mineralization to lithology and although permeabilities caused by alteration may have been a factor in supergene enrichment, the overall intensity of the alteration has blurred such relationships, if they exist. Quartz/sulfide veining is stronger in and adjacent to some of the breccia zones (usually fault breccias) but not consistently. The entire volcanic system in this area is highly pyritic, however the period of copper sulfide emplacement was probably after the pyrite (Williams, 9/26/90). Williams describes a sequence of pyrite with occasional large grains of satellitic sphalerite followed by copper sulfides, the earliest of which were bornite and chalcocite which in turn has, in some places, altered to covellite. Other minerals reported in earlier drilling and in Williams report include the sulfosalts, enargite and terahedrite/tennantite. I did not identify either of these in my logging but some of the fine-grained black specks seen could well have been either or both. Certainly the anomalous silver values may represent the presence of tetrahedrite.

Ore Grades & Reserves

The 1990 drilling coupled with earlier work has defined copper mineralization with higher grade sections separated to "upper" and "lower" zones. Although some intercepts in the lower zone are of good grade (+0.5 % Cu), continuity is lacking. Although collared in the same general area, the angle holes fanned out from TM-8 show a zone of + 100 feet of vertical thickness averaging +0.4 % Cu beginning near surface. TM-8, a vertical hole, did not hit any appreciable values until a depth of 140'. The reason for this negative anomaly is unclear but may be due to the close association with the stream bed in the canyon bottom. BB-4, a vertical hole collared 500' easterly from the above holes, intercepted a solid first 200' of +0.4 % Cu.

Obviously, data points are meager and some fill-in work is necessary (refer to Recommendations & Attachments), however a reserve of 8 million tons of shallow mineralization at a grade of +0.4 % Cu is possible, located along the canyon bottom from 250' west of TM-8 to 250' east of BB-4 and 250' each side from the canyon bottom (block shown on Attachment "B"). This block would have practically nil stripping ratio (shallow overburden only); if it can be connected to the +0.4 % Cu zone found in BB-1, then reserves could be at least doubled and stripping ratio would still

be in the 1:1 range.

Recommendations

If on-going metallurgical testing is favorable and mining and environmental considerations are within ASARCO's parameters, then additional drilling will be necessay to confirm grade/tonnage figures. Because of the steep canyon walls, drilling off the road in the canyon bottom will be difficult. Initially, a line of vertical holes along this road spaced every 100' and drilled to a minimum depth of 300' should be considered. Inasmuch as future evaluation is mostly a sampling problem, these could be rotary drilled. Further angle drilling outward from the canyon bottom (road) could follow. In order to drill holes from locations on the canyon sides some ingenuity will be required but could be accomplished. Detailed drilling could conceivably encounter better grades and depth continuity and if such were the case, reserve figures could be increased substantially. Drilling off the access road to BB-1, BB-7, extending this road westerly and drilling from it, would be useful in determining the southern limits of mineralization found in BB-1 and also determining if the BB-1 mineralization is connected to the mineralized areas to the north and west.

Attachments:

"A" Summary of Logs of BB-2 through BB-7 Drill Holes

"B" Location Map Showing Drilled Areas, Reserve Block, and Recommended Drilling

"C-1" through "C-4 " Vertical Sections

1"=100' Scale Model of Drill Holes (in office only)

Harold J. Downey

Harold J. Downey

2/7/91

Date

Attachment "A"

Summary of Logs of BB-2 through BB-7 Drill Holes, Thunder Mountain Project, 1990

BB-2: Coord N: 1710,010, Coord E: 865,425, Elev: 5,170, Incl: -35
Bearing: S 45 W
12'-120': Quartz Feldspar Porphyry - white, soft, intensely altered, original texture nearly obliterated. Predominant alteration mineral is pyrophyllite, subordinate sericite, kaolinite, and alunite. 5%-8% disseminated pyrite grains and clusters sometimes rimmed with chalcocite/covellite. A few blebs of sphalerite 20'-30'. Breccia (QFP) 78'-88'.
120'-176.5': Lappili Tuff- Subangular fragments of dark grey siliceous volcanics, tan quartzite, and chert in QFP matrix. Sooty chalcocite associated with pyrite in matrix (short sections). Fault breccia 162'-165'.
176.5-183': Intrusive Breccia - Lapilli to block size angular fragments in QFP matrix.
183'-352': Quartz Feldspar Porphyry - similar to unit above 120', minor sulfide veining, mineralization mostly associated with disseminated pyrite, 3" of compacted gouge at 322'. Better Cu 262'-318'.
352'-501.5': Intrusive Breccia - Angular siliceous fragments in QFP matrix, pyrite fills voids and fractures, also pyrite veining, Cu decreasing with depth. Red hematite fracture filling 460'-510'.
501.5'-511.5': Agglomeritic Scoria - brown, pumiceous, vesicular fragments in ash matrix.
511.5'-516.5' (BOH): Brecciated Chert - Large angular fragments of brown/grey chert or very fine grained quartzite interlocked in siliceous matrix. Nil sulfides, red hematite coating fractures. Probably same unit as in bottoms of TM-11 & TM-12.

BB-2 Assays	Interval	Footage	Cu %	Ag opt
	40-140	100	0.47	0.07
	140-180	40	0.04	0.10
	180-360	180	0.27	0.33
	360-500	140	0.13	0.09

BB-3: Coord N: 171,010, Coord E: 865,425, Elev: 5170, Incl: -45 ,
Bearing: due North
14'-555': Quartz Feldspar Porphyry - White to light grey, intensely altered to pyrophillite, lesser sericite, kaolin. Minor pyrite veining to 110', then increasing to 160'. Multiple fault zones (gouge & breccia) 164'-184' and 217.5'-245'. Chalcocite/covellite mineralization rims pyrite grains, also with pyrite in hairline, random veinlets. Mineralization weak below 100'.
555'-640': Major Fault - Orientation is 15 to core axis. gougy and porous, sulfides oxidized to red hematite and goethite/jarosite limonites
640'-722': Intrusive Breccia - Angular fragments of grey/tan chert and dark grey silicified andesite in QFP matrix. Fragment size (to

BB-3 continued -
3") generally increasing with depth. Very fine grained disseminated pyrite, total 3%, with associated chalcocite/covellite.
722'-725' (BOH): Fault Breccia - Fragments of intrusive breccia in a red hematite/goethite gouge matrix.

BB-3 Assays	Interval	Footage	Cu %	Ag opt
	14-90	76	0.60	0.04
	90-500	410	0.07	0.03
	500-720	220	0.24	0.06

BB-4: Coord N: 171,400, Coord E: 865,850, Elev: 5140, Incl: -90

8'-189': Quartz Feldspar Porphyry - White to light grey, intensely altered, similar to QFP in other holes. Scattered lapilli size clasts - may be bordering on a lapilli tuff but clasts are only about 10% at most. Small breccia zones 15'-18' and 56'-60'. Clastic texture of the rock becomes more prominent below 90'- may be gradational change to lapilli tuff. Total sulfides 5%-7% disseminated and in veinlets. Chalcocite/covellite rimming and coating pyrite, traces of sphalerite filling a few cavities 87'-91.5'.
189'-318': Intrusive Breccia - Angular light brown chert and dark grey silicified volcanic fragments, also some QFP frags. in a light grey tuffaceous matrix (gritty tuff matrix). Sulfide content decreases.
318'-647': Quartz Feldspar Porphyry - Similar to QFP at top of hole. A few lapilli sized clasts of brown chert and grey volcanics. Very fine grained pyrite with associated chalcocite/covellite disseminated and in random veinlets. 8' discontinuous breccia zone at 388'(may be fault breccia). Cu mineralization generally better 440'-500' with good chalcocite/covellite section 430'-470'. Brecciated and gougy 502'-505'. Below 505' rock is less altered and more siliceous (not silica alteration).
647'-797 (BOH):Tongues of medium grained Quartz Diorite Porphyry may represent gradational contact. Pyrite only sulfide observed.

BB-4 Assays	Interval	Footage	Cu %	Ag opt
	10-190	180	0.47	0.04
	190-390	200	0.07	0.08
	390-610	220	0.24	<0.01

BB-5: Coord N: 171,550, Coord E: 866,300, Elev: 5,110, Incl: -30, Bearing: due South
10'-107': Quartz Feldspar Porphyry - White to light grey, intensely altered to pyrophyllite, sericite, kaolinite, originally an intermediate rock (dacite). 3 %-5 % sulfides disseminated, sparse hairline veining.
107'-199': Intrusive Breccia - Angular to subangular fragments of chert and silicified volcanics in QFP matrix. Less veining than in previous holes.

BB-5 continued -
199'-257': Alternating zones or layers of Brecciated Chert and Intrusive Breccia. Oxidized zone with red hematite and goethite staining along fractures 199'-228'. Contact 60 to core axis. 1" seam chalcopyrite, bornite, pyrite at 247'.
257'-800' (BOH): Intrusive Breccia - Same unit as 107'-199'. The section from 370'-450' contains multiple fault breccia and gouge zone but without lithological of mineralogical change.Alteration intensity decreases below 460'. Nil veining to 750' where 2 mm veinlets occur mostly 30 -40 to acore axis and continue to bottom of hole.

BB-5 Assays	Interval	Footage	Cu %	Ag opt
	10-'-230'	220	0.04	<0.01
	230'-310'	80	0.15	<0.01
	310'-800'	490	0.04	<0.01

BB-6: Coord N: 171,010, Coord E: 865,425, Elev: 5,170, Incl: -45
Bearing: due East
20'-368': Quartz Feldspar Porphyry - Intensely altered, originally a dacite ?. Granular pyrite blebs 1-5 mm, some coated or rimmed with chalcocite/ covellite, some sootiness as fracture coating. Nil veining to 105', then increasing. Fault ? (multiple gouge sections) 200'-219'. Heavy chalcocite/covellite/pyrite 360'-369'.
368'-454': Intrusive Breccia - Angular silicified fragments in QFP matrix. Probable fault breccia 382.5- 394. Short section of Lapilli Tuff 382'-394'.
454'-718': Quartz Feldspar Porphyry - Same as above 368'. Well mineralized sections with sooty chalcocite/pyrite blebs to 5 mm diameter. Cu mineralization decreases somewhat below 560'. Fault gouge and breccia 667'-674' & 685'-692'.
718'-800' (BOH): Mixed Intrusive Breccia and Quartz Feldspar Porphyry -Mostly breccia but with short (1'-5') sections of QFP. Contact zone 716'-718' is flow banded @ 30 to core axis.

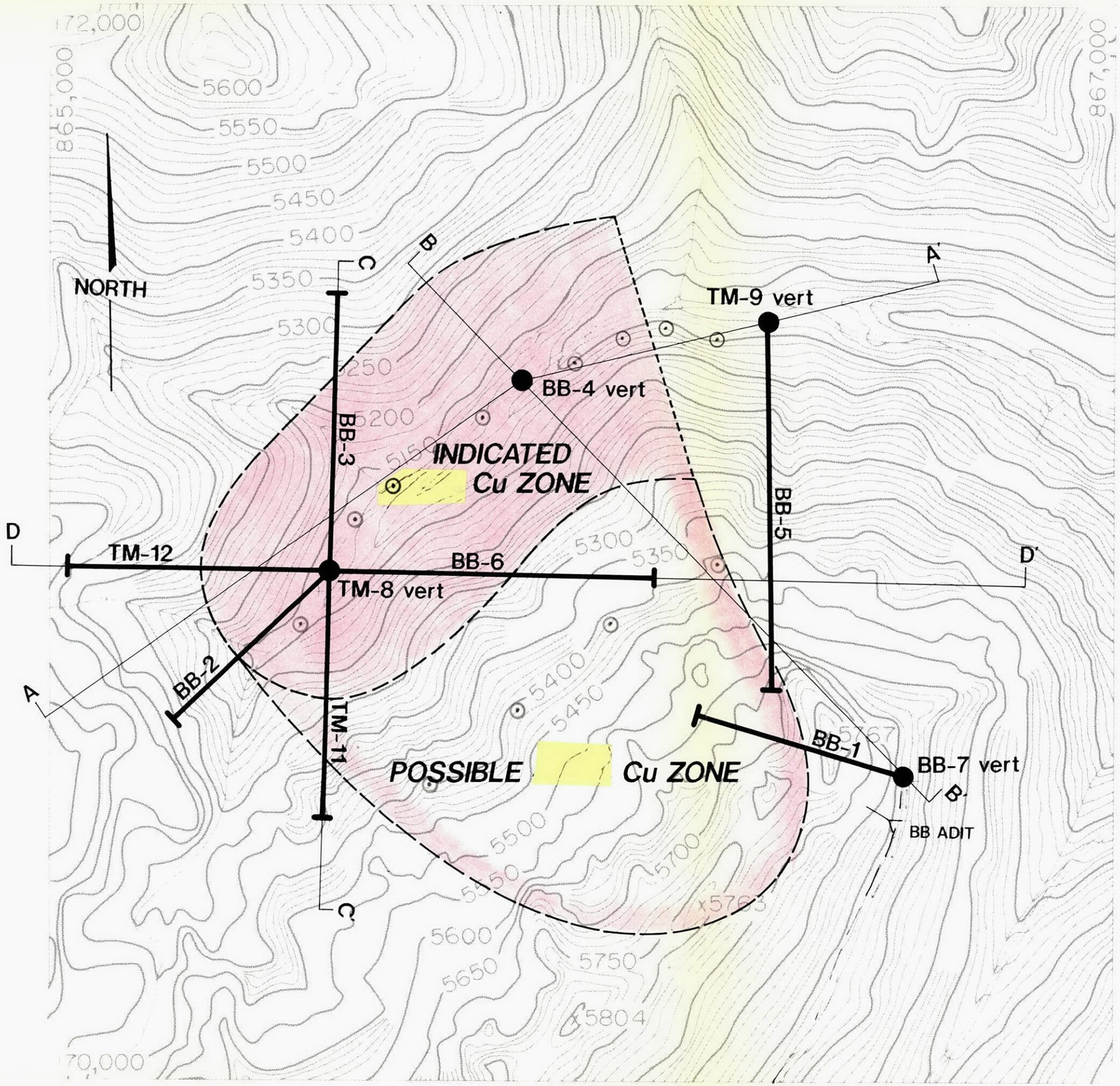
BB-6 Assays	Interval	Footage	Cu %	Ag opt
	20-90	70	0.37	0.14
	90-280	190	0.13	0.02
	280-520	240	0.54	0.12
	520-600	80 480	0.10	<0.01
	600-760	160	0.23	0.02
	760-800	40	0.05	<0.01

BB-7: Coord N: 170,700, Coord E: 866,550, Elev: 5,585, Incl: -90
12'-27': Lapilli Tuff - Light grey altered tuff with subangular fragments to 10 mm diameter.
Argillic alteration intense, also sericite/pyrophyllite? Red hematite and goethite fills some fractures.
27'-32': Compacted Talc (may contain alunite) - White, very soft, pure mixture without fragments.
32'-41.5': Brcciated Chert - Very siliceous grey chert (of fine

BB-7 continued -
grained quartzite) fragments in siliceous matrix, appearance similar to bottom of BB-2.
41.5'-51': Fault gouge & breccia.
51'-257: Rhyolite or Rhyodacite - Light to medium grey, very siliceous (not silica alteration) with numerous brccia and gouge zones. Fine grained pyrite disseminated and filling some fractures. Some thin alunite stringers. Sooty gouge 144'-156'.
257'-617.5': Lapilli Tuff - Appearance similar to unit at top of hole but with occasional fragments up to 2 cm diameter. Fine grained disseminated pyrite, only slight hairline veining. Occasional clasts to 10 mm are rich in pyrite (>25%). Alteration appears more sericitic below 460'. 1-3 mm pyrite/chalcocite veinlets more common 520'-580.
617.5'-635': Rhyodacite - Similar to unit 51'-257'. Contact @ 20 to core axis.
635'-735.5' (BOH): Lapilli Tuff - Fragment size generally smaller than in units higher in hole (grit size predominant).

BB-7 Assays	Interval	Footage	Cu %	Ag opt
	12-735	723	0.027	<0.01

Note: Dendritic black mineral noted in drill log from 480' - 630' as chalcocite? is probably a manganese mineral as indicated by very low Cu assays in that interval.



ASARCO Incorporated
THUNDER MOUNTAIN PROJECT

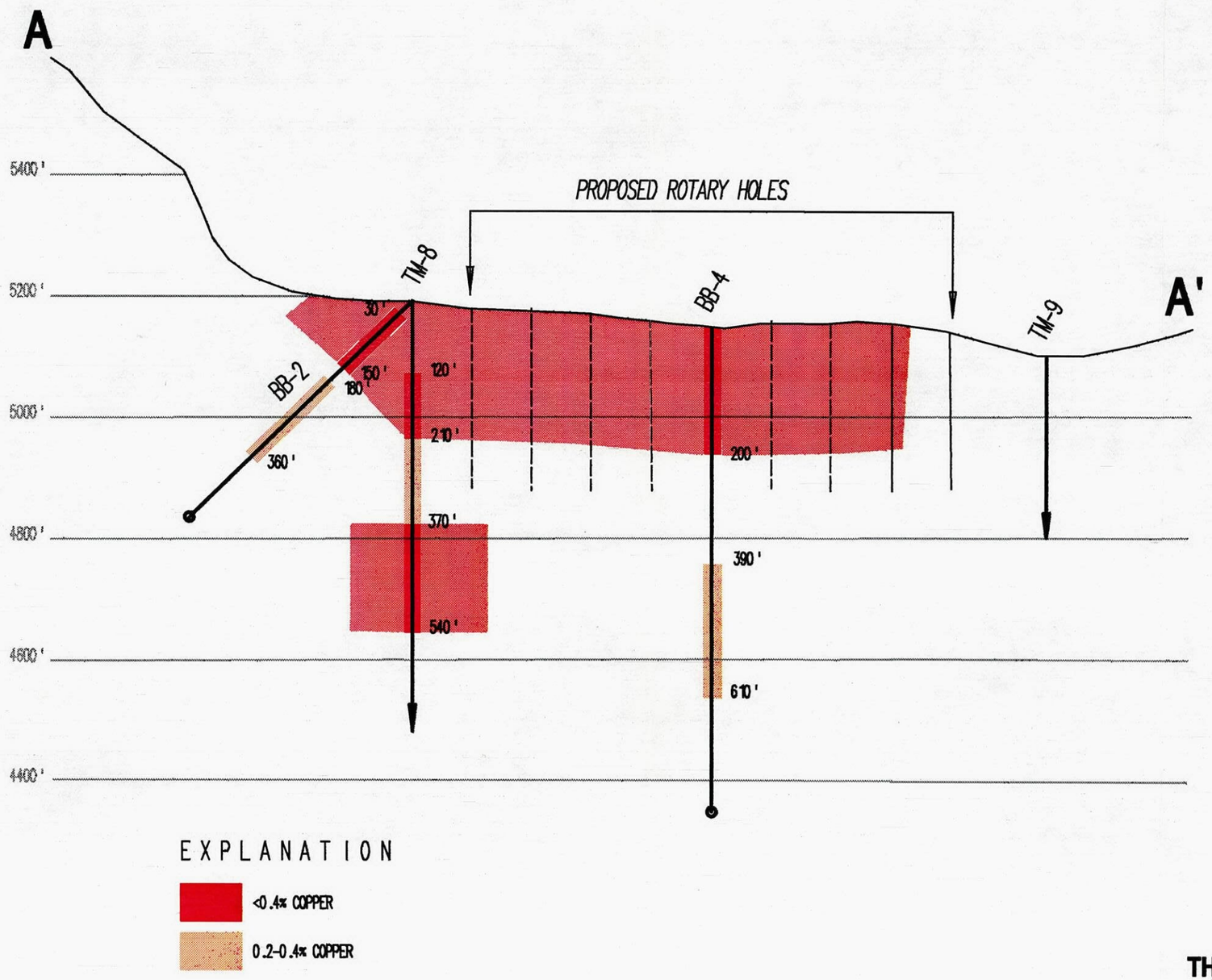
1990 BB-DRILLING MAP

SANTA CRUZ CO.. ARIZONA

HJD 1"=200' 01/91

mn TM910201 HJD/DAM TUC 02/04/91

ATTACHMENT C-1



ASARCO SOUTHWESTERN EXPLORATION

THUNDER MOUNTAIN PROJECT

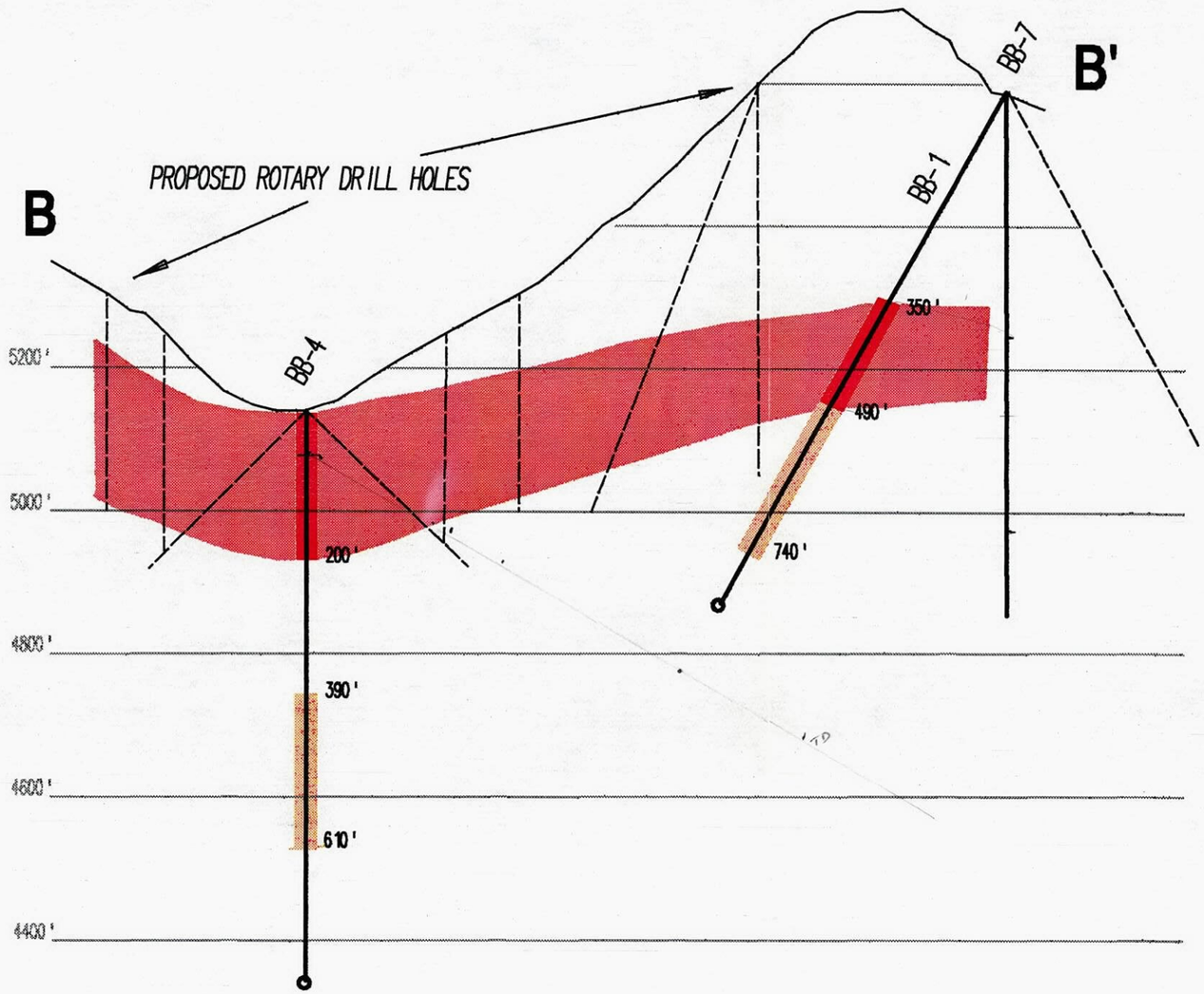
SECTION A-A'

PATAGONIA MOUNTAINS, ARIZONA

H.J.D. 0 100' 200' 01-91

mn TM910110 HJD/DAM TUC 01/15/91

ATTACHMENT C-2



EXPLANATION

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0.2-0.4% COPPER

ASARCO SOUTHWESTERN EXPLORATION

THUNDER MOUNTAIN PROJECT

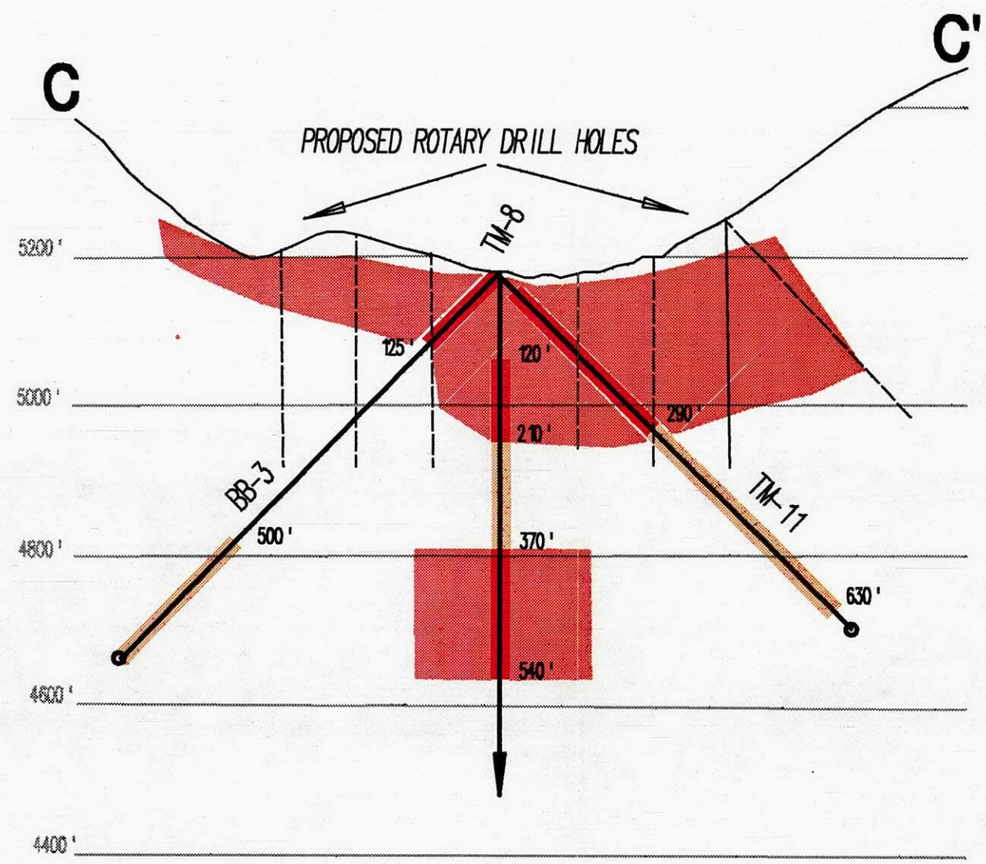
SECTION B-B'

PATAGONIA MOUNTAINS, ARIZONA

H.J.D. 0 100' 200' 01-91

mn TM910111 HJD/DAM TUC 01/15/91

ATTACHMENT C-3



EXPLANATION

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0.2-0.4% COPPER

ASARCO SOUTHWESTERN EXPLORATION

THUNDER MOUNTAIN PROJECT

SECTION C-C'

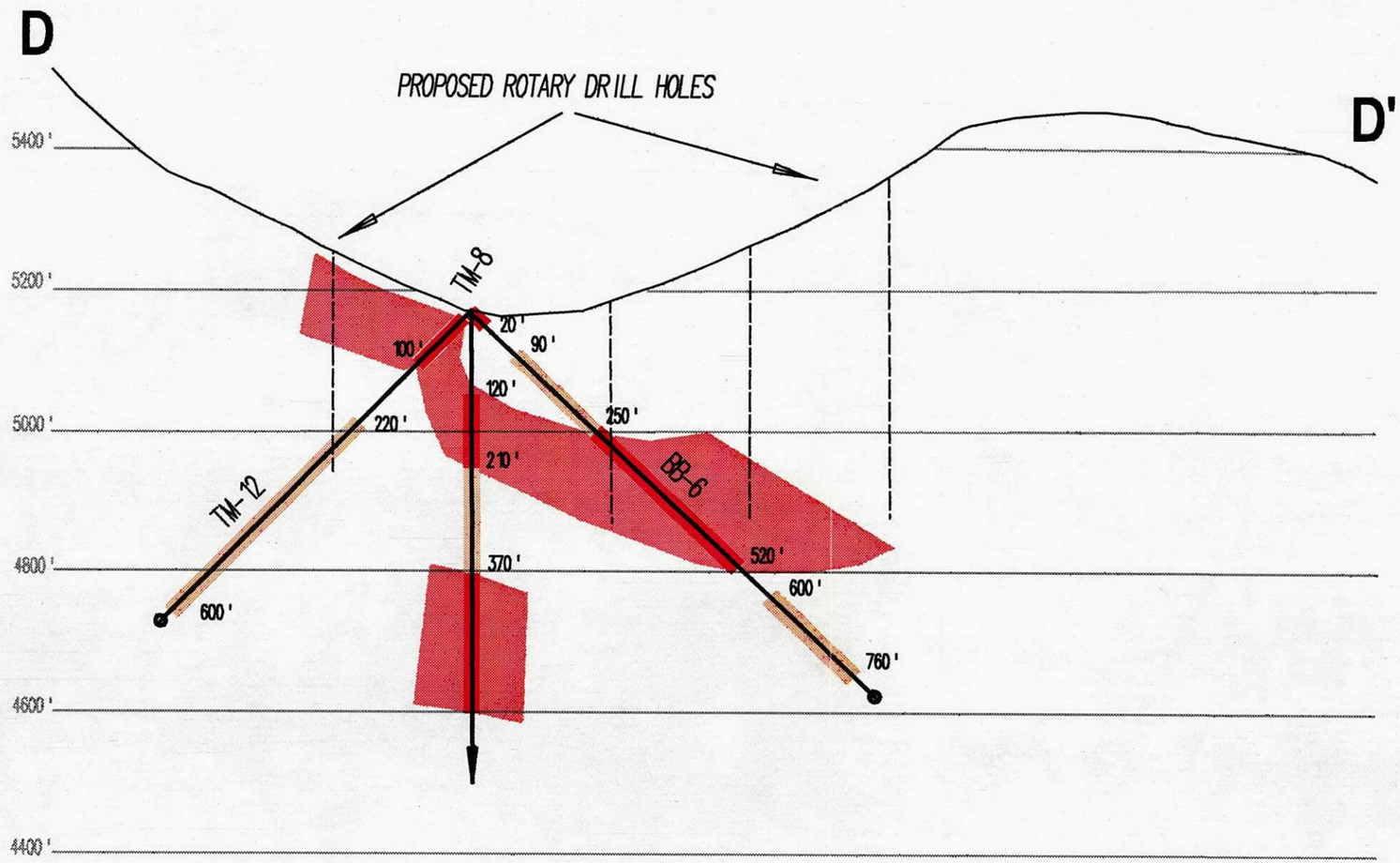
PATAGONIA MOUNTAINS, ARIZONA

H.J.D. 01-91

0 100' 200'

mn TM910112 HJD/DAM TUC 01/15/91

ATTACHMENT C-4



EXPLANATION

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0.2-0.4% COPPER

ASARCO SOUTHWESTERN EXPLORATION

THUNDER MOUNTAIN PROJECT

SECTION D-D'

PATAGONIA MOUNTAINS, ARIZONA

H.J.D. 0 100' 200' 01-91

mn TM910113 HJD/DAM TUC 01/15/91

JDS

ASARCO

Exploration Department
Southwestern United States Division
James D. Sell
Manager

April 11, 1991

Mr. W.K. John
Manager - Mineral Land
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, OK 73125

1990 Exploration Report
Thunder Mountain Project
(02-007-0000)
Patagonia Mountains
Santa Cruz County, AZ

Dear Mr. John:

As per Article 2(f) of the Eighth Amendment to the Operating Agreement, dated January 1, 1988, between Kerr-McGee Corporation and ASARCO Incorporated, I submit this Summary of Activities for the year 1990.

Three segments of work have been undertaken:

1. Completion of spot sampling and assaying the lower portion of drill hole TM-14. This has now been completed and the field log with assays for TM-14 is submitted as Attachment A.

2. A series of diamond drill core holes were placed in the zone of shallow mineralization penetrated by the K-M hole BB-1. The Bucket Breccia zone was penetrated by previous holes TM-8, TM-11, and TM-12. This past half year, drill holes BB-2 through BB-7 have been cored into the projected zone. Results to date are reported in Attachment B and C.

3. The Arizona State Mine Inspector ordered all mine workings in the Patagonia Mountains be secured and posted. On the Thunder Mountain claims openings were fenced with barbed wire and signs posted with warnings. A memo of June 22, 1990 informed Kerr-McGee of this compliance.

ASARCO Incorporated P.O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue FAX (602) 792-3934 Phone (602) 792-3010

Filing of the Assessment work for the year ending August 31, 1990 was completed on the Thunder Mountain block and confirmed copies sent to Kerr-McGee on October 15, 1990.

Total costs for the Thunder Mountain Project through December 31, 1990 are $584,320.

Sincerely,

James D. Sell

JDS:mek
Att.

cc: R.L. Brown (w/o att.)
F.T. Graybeal " "
W.L. Kurtz " "
W.D. Gay " "

ATTACHMENT A

GEOLOGIC LOG WITH ASSAYS - DRILL HOLE TM-14

⇒ Drilling by Joy MFG (Gardner + Sanchez, drillers) Joy-22HO (9103)
6¼" Rock Bit to 23' (cemented - hole straightened to 43')
4" casing 2-23' (21') - note cap is 2 feet below surface
NC core: 21-910' July 21 - Aug 6 1982

GEOLOGIC LOG

McPhar gamma ray spectrometer.
21-485': 35-50 K/counts (BKGD 35-40) - no correlation of 45-50 K cps
485-910: 35-50 K/counts (BKGD 30-40)
40-50 @ 855 + 504 + 635-665 (margin of QFP)
AT 70-80 @ 800-826 in lap. tuff

PROJECT Thunder Mountain
TCB elev. Collar elev. 4999.3? ground level
Trench unit grid Coord N. #9950
Coord E. #2050
Logged by F.R. Koutz ASARCO Aug. 1982
Date start July 19, 1982
HOLE NO. TM-14
Final depth 910' (TEMP T.D.)
Inclination 90° - 87-89° @ 880'
Page 1 of 2
Date finish Aug 6, 1982 (910')

Margin note	From	To	Int'vl Feet	Core Recovery	Assay Interval or Comment	Cu	Pb	Zn	Au AA	Ag AA	Mo	As
	0	21	21	Rock Bit 6¼"								
T.S. 38'	21	40	19	95	21-30	194	52	1700	<0.1	1.7	10	26
	40	60	20	98								
	60	80	↑	100	2"59 60-70 / 70-80	76 / 109		1960 / 1860		1.1 / 1.3		
@97 4"59-60 @70°	TS PC 80	100		↑	← 89' @30 80-90 / 90-100	82 / 159	275	1280 / 4100	<0.1	1.3 / 4.0	10	41
2"99 @30-40 T.S. 139		120		↓								
		140		100	120-130 / 130-140	175 / 140		3400 / 2900		4.7 / 2.3		
		160		99								
		160		99								
@30 4"59 197'	180	200		98	190-200	57	54	1560	<0.1	1.1	19	17
		220		100								
		240		↑	220-230 / 230-240	143 / 114		1500 / 2200		1.6 / 1.9		
		260			240-250 / 250-260	162 / 1110		2600 / 3500		3.0 / 7.7		
		280										
3"59 134 @40° 299'	280	300		↓	290-300	201	241	1240	<0.1	2.1	16	32
		320		100	TS-318							
		340		99								
		360		100								
		380		100	TS-372							
	380	400		98	390-400	203	60	2500	<0.1	2.2	12	3
		420		99								
		440		99								
		460		97								
		480		99								
500' T.S.	480	500		100	490-500	77	30	160	<0.1	1.5	38	9
		520		100								
→ 537-545 (CR+?)	MAF FAULT	540		95								
555-560° (+30°)		560		98	TS@558 558-560 / 560-570	133 / 518		240 / 1540		1.0 / 1.7		
		580		100								
	580	600		↑	590-600	94	18	1090	<0.1	1.6	15	21
617-626 Box spilled + homogenized		620		↓								
		640		100	634TS							
		660		99	651TS 640-650 / 650-660	66 / 73		— / —		1.0 / 0.9		
		680		99								
	680	700		100	690-700	79	18	93	<0.1	0.8	16	88
		720		↑	710TS							
		740			720-730 / 730-740	729 / 311				2.6 / 2.4		
		760			740-750 / 750-760	166 / 204				2.6 / 2.6		
		780			760-770 / 770-780	202 / 269				2.0 / 2.9		
	780	800			780-790 / 790-800	259 / 469	35	805	<0.1	2.8 / 6.4	15	9
		820			800-810 / 810-820	161 / 130				2.6 / 3.5		
		840	↓	↓	835TS 820-830 / 830-840	146 / 337				5.4 / 6.0		
	840	860	20'	100	840-850 / 850-860	420 / 270				2.6 / 3.7		

MINERALOGY AND STRUCTURE (Volume Percent)

To	Chalcopyrite	Chalcocite	Covellite	Galena	Sphalerite	Gray, S° or SS		Pyrite-Dissem.	Pyrite-Vein	Limonite	Hematite		Magnetite		Alunite	K-Feldspar	Qtz-Dissem./Vary	Qtz-Vein	Clay	Sericite	Chlorite	Epidote	Calcite	Gypsum	% Vugs-pore space	Av. Clast size	% Bx Matrix (f.g. ash)	Fx/Foot	Dip: Bedding/flow-layer	Sulfide veins # & per foot	Width (mm) sulfide vn / alter selv. + dissem grains	Fault - crushing - shearing	Detail
21	No sample taken — a few large boulders — bedrock at about 20 feet depth.																																
40	T	T?	T-	—	—	.5		1.5	T+	T+	—		—		—	—	2	—	25	20	—	—	—	—	2	4	20	1	25	<½ -30°	1-perv ½-2 diss	—	Wh. clay lapilli (loc.) Ten?
60	T-	T	T	T-	T+	.4		1.8	.2	T-	—		—		T	—	3	—	20	25	—	T	—	T	4	3	15	1	30	½ -30	2-perv(+) ½-2 diss	¼ft 1-5 mm clay 35	2" 10% S° (w/ Cv) @30° 35 @50'
80	.1	T1	.1	—	T-	.6		2.5	.4	T-	T-	← clasts			T1	—	6	T	15	22	T-	T	—	T	2	4	12	½	25	<½ -25	½-perv ½-2 diss.	Loc. sh-35 ¼"	Detail py+silica-py cv, cc, en? en pyr. Sl in vn.
100	T1	T	.1	T-	.1	1.0		2.0	.2	T-	T-		—		½	—	5	T	20	25	—	T-	—	T+	3	2-3	20	1	20	1 -30	½-perv ½-2 di	Loc 35 -54	Sorting better - sl in vn. Loc ½-inch sl vn
120	T-	T	.1	T-	.2	1.0		1.8	.3	T	—		—	Tr. black sil.	2	—	5	T	15	22	T-	T	—	T-	2	2+ 4-6	15	½	15	1 - 30 +70	½-2-perv ½-2	Loc 35 -54	1-2 mm ... well sorted.
140	T-	T+	T	—	.2	1.2		1.5	.2	T-	—		—	T-Mnox	3	—	6	T	15	20	T-	T+	—	T-	2	2-4	12	⅓	20	½ - 30 +60	½-1 perv ½-1	Loc none solid	Much S° pre-Bx. Sl/cp in clasts. Locally x'tals as well as lithics
160	T-	T	T	—	T+	.8		1.2	.1	T-	—		—		1	—	6	T+	15	20	—	T-	-	T-	2	2-4 +8	20	⅓	15	½ - 50 +30	½ - perv ½-1	—	
160	—	T-	T	—	.1	1.0		1.5	.2	T+	T	← w/ clasts Tr CaF2			3	—	7	¼	20	22	—	T	—	T	4	2-5	25	2	25	<½ -30	½-1 - perv <½-1	Loc. wk cr + 35-sh @	60° purple silica clasts common (w/ pyr) CaF2 (+) green is detrital
200	—	T	T-	—	.1	.8		1.2	.1	T-	—		—		2	—	5	¼	12	18	—	T-		—	4	2-6	20	1	30	<½ -30+ 60	½ - perv <½-1	Loc 35 +54	Clasts are fresher (less clay)
220	T-	T-	T-	T-	.2	1.0		1.2	.8	T	T-		—		2	—	5	½	18	22	T-?	T	—	T+	4	2-5	15	⅙	30	<½-1 30 +60	½-2-perv <½-2	Loc cr+ 31 @30°	Clast size incr + better round
240	—	T	T-	T-	.2	1.0	T En	1.2	.6	T-	—		—		3	—	5	¼	18	20	—	T-	—	T-	3	2-4	20	½	30	<½-2 40 +80	½-2 perv <½-1	Loc cr +35	253-262' -20% cr 35 yn zn
260	T-	T-	T	T	.2	1.5		1.5	.3	T-	T-		—		1	—	3	T	25	25	—	—	—	T+	4	2-3	30	⅕	35	<½-1 30+ 85	<½-1 perv <½-1	All wk cr ↙	
280	T-	T	T	—	.1	1.0		1.2	.1	T-	—	Tr-H FS			1	—	4	T	20	25	—	T-	—	T-	5	2-3	20	1	20	½ 85	<½-1 perv ½-2	Wk. loc. crush	Wide var. in sorting ~30% SS-seit
300	T	T-	T-	—	.2	1.0		1.5	.1	—	—		—		2	—	5	—	23	20	—	—	—	T+	4	1-3	30	⅙-½	20	<½-1 30	½-1 perv 4½-1	Loc wk cr	Loc. str. arg. clasts.
320	T-	—	T-	.1	.2	1.0		1.0	.1	T-	—		—		½	—	4	T-	20	25	—	T-	—	T	3	1-2	20	1	25	½-1 30 80	<½-3 perv <½-2	—	325' 3" 3'64 316-395' more f.g. grit-SS
340	T-	—	T-	—	T	.8		1.3	T	—	—		—		T	—	2	—	15	20	—	—	—	T	2	1-2	30	½	20	<½ -30	<½ -1	→	@700
360	T-	T	T	T-	.1	.8		1.2	.2	—	—		—		—	—	4	T	15	20	—	—	—	T-	2	2	30	½	?	½ 60 30	<½-1	T crush @30°	more crystals (qtz > FS) arrive
380	—	T-	T	T-	.2	.6	T Mus	1.0	.2	T-	T- CN Fx		—		T	—	8	½	13	18	—	—	—	T-	3	1-2	20	⅓	30?	<½ 60-70	½-2 ½-1 diss	T shear Fx	372.1' zone rounded-sub ∠ qtz Φ? XQFP? grades into tuff above + below
400	T-	T	T-	T-	T	.8	T Mo?	1.3	.1	T-	T-		—		—	—	7	½	12	20	—	—	—	—	5	2-3	25	½	20	<½ -20	<½-perv ½-1 diss	—	Incr in clast size
420	—	T-	T	—	T+	.8		1.5	.2	T	—		—		—	—	8	—	18	22	—	T	—	T	5	2-4	20	1	30	<½ 30	<½-2 ½-3 diss	All T → wk cr	5-10% purple qtz clasts sub-rounded.
440	—	T-	T	—	T	1.2		1.0	T	T-	—		—		—	—	6	—	20	18	—	T-	—	T-	6	2-5	15	3	35	<½ - 85	<½ perv ½-2 diss	Cr-424-30 432-33	@80°
460	—	T-	T-	—	T-	1.0		.8	.1	—	—		—		—	—	7	—	25	15	—	—	—	T+	6	2-4	30	2	30-45	<½ -30 to 60	<½-½ perv ½-1 diss	445-48 cr-sh @85°	All wk crush - mod. fractured in core ... Incr. in x'tals (rounded purple qtz)
480	—	T-	—	—	T+	.8		.8	T	T-	T-		—		T	—	8	T	23	18	—	—	—	—	4	2-4	20	1-3	25	½ 30 +75°	<½-1 perv ½-1 diss	Str cr @60° Str cr @60°	465.1' Hint of XQFP text. 480-82'
500	—	T-	—	—	T-	.6		1.0	T	T	T-		—		T	—	8	T+	18	15	—	—	—	—	2	2-3	15	1	25	<½ 30	<½-1 ½-1 diss	incr. clay	Str. cr. @60° 502-03 } local
520	T-	T-	T	T-	T	.7		1.2	.2	T	T-	T Mus?	—		½	T?	9	1	15	15	T-	—	—	—	2	2-4	15	1	30	<½-1 60 +30	½-1/10 ½-1 diss		4" cr. zn @ 514-20 + 30° } poorly consolid. + crushed
540	—	T-	T-	—	T-	1.0		2.0	.3	T-	—	T Jar.	—		—	—	5	1	30	25	—	—	—	T	5	2-3	40 Bx	1+ ∞	30	½-3 80 +30	½-1-perv ½-2 diss.	537-545 30% str cr + incr. clay	1 X: 533+60130° ⇒ 545-55: trans. zn ⇒ (silicif. lap. tuff → XQFP) ⇐
560	T-	T-	—	T	.1 vn	.8		2.0	.5	T-	1	← Afran py 555-57 +			½?	1?	30	5	20	15	—	—	—	1	4	2-3	30	2-3 ∞	60	<½-3 30 +60	⅛-1/5-10 ½-2 diss		Str. silic. fluid/breccia, purple (HDS? Bx)
580	T-	T	T-	T	.1	.6		2.5	1	—	T-		—		½?	3?	20	5	8	12	T-	—	—	1	2	10 Xeno	30 (vn)	1	40 fr.	1-4 30	<½-2/5-8 ½-2 diss	Loc. clay-vn zn	Loc. resorbed ... Φ in XQFP. Pyr. ... Φ in xeno + xeno. rims
600	T-	T-	T-	—	T	.6		2.5	1	—	T		—		3	2	20	7	6	15	2	2	—	2	3	30 Xeno	30	1	70	1-5 40, 60 30	½-5/1-20 ½-3 diss	white ... -crushed	590-600 2-8mm qtz pyr-alun-pyr vn @75-80° + cr, clay, hm.
620	—	—	T-	—	T	1.0		4	2	—	T-		—		5?	2?	25	8	5	18	2	2	—	4	½	40? xeno	20	½	40	<½-4 30 +60	<½-4/perv <½-1 diss	Str. flow text	@625 more phenocrysts below
640	—	T-?	—	—	—	.3		2½	½	—	T-		—	Sl, py, vn sil.	1?	8?	20	5	2 (mont?) 4	15	1	T?	—	1	Tr	—	—	⅓	35	1-5 30 +60	<½-2/perv ½-1 diss	wk mod flow text	Mostly Φ - minor xenol (620-640). Below 650 - mostly XQFP lapilli tuff (crystal-lithic)
660	T-	—	—	—	T-	.2		3	½	—	—		—		2	2?	22	5	3 (1-3 mont)	15	T	T?	—	1	¼	1-2 45	40	2	20	<½-2 30-50	½-¼/perv <½-1 diss	transition flow	640-50: str. fluid + xenol (% qtz Φ variable 0-8%)
680	T-	—	—	—	T-	.2		2	Tr	—	—		—		3	—	27	3	4	18	T-	½	—	2	1	2-4	30	1	20	<½ 30+60	½-¼ 1-5 <½-5 diss	T-wk cr. @80°	Str. silica flood + alteration ... Loc. so4-pyr-alun.
700	—	—	—	—	T-	.2		1.5	T	—	—		—		½	—	10	3	5	18	—	T	—	½	1	2-4	20	2	15?	<½-1 90 +40	½ 1-2 <½-1 diss	T cr. @90° + ... vns	Silica decr. w/depth. Some QFP clasts to 15mm; loc. welded affinity (HDS?)
720	—	—	—	—	T-	.3		1.5	T	T-	T-		—		T	—	15	1	8	20	—	T-?	—	T	½	2-4	20	1	10	<½ 20 +80	<½-1/1-20 <½-½ diss	Loc. wk Fx @70-80	699-705: Fx @70-80 w/ wk clay seams
740	—	T-	.1	—	T	.4		1.8	Tr	—	—		—	Tr Gr. cpx	—	—	10	½	10	20	—	T-?	—	½	1	2-5	30	1	20	<½ 60	<½-½ — <½-2 diss	wk loc cr @70	Cv. spec. of pyr. Some well-rounded frags - lithic-pyrite
760	-?	.1	T1	—	T	.3		2.0	T-	—	—		—		—	—	8	½	8	18	—	T-	—	½	1	2-4	30	1	15	<½ 60 +30	<½-perv <½-2 diss	wk loc cr @60°	Cc on py
780	F	.2	T	—	T-	.2		2.2	.3	—	T-		—		T+	—	7	½	7	16	—	—	—	T	¼	2-3	20	1	10	<½-1 60°	<½-1 perv <½-1	—	Loc. Q-S selv. on pyr stringer vn.
800	—	.2	T+	—	T-	.2		2.0	.5	—	—		—		—	—	12	2	7	20	—	—	—	T	½	2-4	20	1	15	½-2 60-30°	<½-1/1-5 ½-2 diss	—	
820	—	.1	T-	—	—	.2		1.5	.2	—	—		—		—	—	10	1	6	18	—	T?	—	T	½	1-3	40	1	15	<½-½ 160 20-30	<½-K stringer <½-½ diss	wk fluid 55	@811: 3-4" @60° local graded beds
840	T-	.2	T	—	T-	.3		1.8	.3	—	T-		—		—	—	10	1	7	18	—	—	—	T-	1	1-4	30	1	20	<½-½ 20	<½-½/1-5 <½-1 diss	—	@853' 1" py + and zn @60°. 852-55' wk fluid @60°
860	T-	T1	—	—	T-	.2		1.2	.5	—	—		—		—	—	7	1	9	20	—	—	—	T+	1	2-4	20	2-3	20	<½-2 30 +60°	<½-stringer <½-½ diss	wk cr @60°	

ROCK TYPE AND REMARKS

⇒ GENERAL REMARKS

⇒ 20 - 545': Chief Fm: lithic lapilli tuff to tuff breccia, usually with lithics >> crystals; considerable epiclastic component. Very poorly sorted in general but locally exhibits graded-bedding, x-beds, and slump structures at 15-50° ∡'s. Beds are much less sorted than TCH-2 (which was closer to the edge of the diatreme). TM-14 also shows better consolidation (more f.g. ash, or H cementing?) than TCH-2. Local zones in TM-14 of sandy to grit, more x'tal-rich texture. Clasts are sub-ang to well rounded and comprise 60-85% of the rock in the ½ - 8 mm size range. The ashy-gray matrix is now mostly clay + sericite. A wide variety of clasts are present - mostly aphanitic lapilli tuff but also several varieties of porphyry - both volcanic (vesicular) + QFP-types. Welded tuffs - or ribbon rock of the Middle tuff group variety are locally common. Silica pyrite, massive pyrite and other mineralized (mostly sl > py > gn > cv) clasts are locally common as is purple (amethystine) jasperoid. Some pyrite, silica and clay are present in reaction rims of clasts, some pyrite is detrital but most is disseminated in the ashy matrix. Argillic alteration (both clay + ser) decreases somewhat with depth (clasts less altered) while f.g. silica as flooding of clasts and matrix away from minor mineralized pyrite veinlets increases with depth with thicker Q-Ser-pyr. flooded selvages. Pyr and sl-gn is replaced by cv, cc and cn-H-fn? and honey-colored sl shows dark rims and Fx-fillings. Locally, especially in better-sorted zones with depth, x'tals are > lithics, even though subrounded: which may be similar to FTG's xenolithic QFP. - These zones are completely gradational with lithic > x'tal lapilli tuff & are minor. Faulting, usually at low angles is common along well argillized strata in the tuff. There is much less FeOx except for trace hem after S° and Fx and most FeOx noted is in oxidized clasts which are locally common even at depth.

⇒ 555 → 650': Partially fluidized zone of Qtz Felds. Porph with maj. xenoliths in lg. 60°, xenoliths + auto Bx fragments strongly resorbed by matrix - sev. periods of Bx. Some IBx + intrusive Bx zones but str. → v. str. Qtz + Q-S flooding destroys texture. Some silica flooded clasts amethystine. Minor late Bx + silica-pyr. flooding. Most pyrite is v.f.g. replaces Φ in xenoliths + etches swirly fluid zones + xenoliths. White mineral in fluid zones is alunite? but also possible Kfs? Local late white gypsum + clay. F.g. tan cal.-rpd.-mont? of some FS. Fabric to QFP - Bx at 30°.

⇒ 650 - 910' Chief Fm. lithic lapilli tuff to tuff Bx, as above but less variety in clasts which show wk. mod. Q-S-py. soak. - most clasts are porphyry but no welded tuff or silica-pyrite. Silica decreases w/ depth below QFP zone 710. Below ~708' - local clayey zones below with local cc > cv on pyr. Some local good Q-S selv. to pyrite stringer veins. Rock is denser + more consolidated and sorted that upper chief tuff. Bedding more indistinct but some good graded beds f-3'.

→ sericite & clay estimates could be low by 50%.

Zone 650-708' could be called xenolithic QFP.

(2)

GEOLOGIC LOG

PROJECT: Thunder Mtn. HOLE NO. 3-TM-14
Collar elev. ____ Final depth: 910' (Temp)
Coord N. ____ Inclination ____
Coord E. ____ Page 2 of ____
Logged by: F.R. Koutz (logged Aug 10, 19, 22)
Date start ____ Date finish ____

TEMP T.D. AUG 82 → (at 910')

89.3% 21-820' (core recovery note)

SKYLINE TAT 1323 Below 980 — ASSAY (All ppm, AAL)

DEPTH From (feet)	To	Int'vl	Core Recovery	Assay Interval or Comment	Cu	Pb	Zn	Au	Ag	Mo	As
860	880	20	100	860-870 / 870-880	369 / 134	—	—	—	8.7 / 2.5	—	—
880	900	20	100	880-890 / 890-900	285 / 58	21	1501	0.32	2.8 / 2.0	9	3
900	910	10	100	910TS; 900-910	183	—	—	—	4.8	—	—
910	920	10	100								
920	940	20									
	960										
	980			969-965 - Loc. Fluid.							
980	1000			991 C60°? str.; 980-1000; 1008TS	220	20	120	<.02	0.2	2.	
	1020										
	1040										
	1060										
	1080										
1080	1100			1090-1100	200	40	75	<.02	0.8	2.	
	1120										
	1140			1136TS							
	1160										
	1180										
1180	1200			1180-1200	160	10	85	<.02	<0.2	2.	
	1220										
	1240										
	1260		100	1241TS; 1240-1250	220	—	275	—	0.2	—	
	1260		95	6" INPUT?							
1280	1300		100	1290-1300	170	50	105	<.02	<0.2	2.	
	1320										
	1340		98	1331TS							
	1360			1340-50	85	—	100	—	0.2	—	
	1380										
1380	1400		98	1390-1400	300	50	120	<.02	<0.2	4.	
	1420			1414TS							
	1440										
	1460			1442TS; 1440-1450	100	—	230	—	0.2	—	
	1480										
1480	1500			1480-1500	36	35	110	<.02	<0.2	4.	
	1520										
	1540			1537TS							
	1560										
	1580										
1580	1600			1580-1600	280	60	1800	<.02	1.0	4.	
	1620										
	1640										
	1660			1646TS; 1640-1650	45	—	200	—	0.6	—	
	1680										
1680	1700	20		1690-1700	140	40	160	<.02	0.2	2.	

MINERALOGY AND STRUCTURE (Vol. %)

To	Chalcopyrite	Chalcocite	Covellite	Galena	Sphalerite	Grey S= or SS		Pyrite-Dissem	Pyrite-Vein	Limonite	Hematite		Magnetite
880	—	.2	T-	—	T-	.2		1.2	.2	—	T-		—
900	—	.2	T-	-	T+	.3		1.2	.2	—	T-		—
910	—	.1.2	T-	—	T-	.2		1.3	.1	—	—		—
920	—	.1	T-	—	T	.3		1.5	.1	—	—		—
940	—	T	—	—	T+	.5		2.0	.3	T	—		—
960	T	.1	T-	—	T	.4		1.8	.3	—	T		—
980	T	.1	T-	—	T+	.6		2.5	.5	—	T		—
1000	T	T+	T-	—	T	.8		2.5	1.0	—	T		—
1020	T	T-	—	—	T	.4		2.0	.2	—	T		—
1040	—	T-	—	—	T-	.3		2.2	.4	—	T-		—
1060	T	T	—	—	T	.2		2.5	.4	—	T		—
1080	T	T+	T-	—	.2	.3		2.5	.6	—	T		—
1100	—	T	—	—	T+	.3		2.0	.2	—	—		—
1120	T	T	T-	—	.2	.3		2.2	.2	—	T		—
1140	T	.1?	—	—	.5	.3		2.5	.1	—	T-		—
1160	—	T+	—	—	.2	.2		2.0	.3	—	T-		—
1180	—	T+	T-	—	.2	.3		4.0	.5	—	T-		—
1200	T	T	—	—	.3	.3	T mol.	3.0	.5	—	T-		—
1220	T+	T	—	—	.2	.2		4.5	1.0	—	—		—
1240	T	.1?	T-	—	.5	.3		5.0	1.3	—	T-		—
1260	T	.1	T	—	.4	.5		4	2	—	T		—
1280	T	.1	—	—	.3	.4	T mol.	5	3.5	—	1/8" frags		—
1300	—	T+	—	—	.2	.3		3.5	.8	—	T		—
1320	—	T	—	—	.1	.3		3	.3	—	T		—
1340	—	T+	—	—	.3	.5		3	.8	—	T		—
1360	T	T	—	—	.3	.6		3.5	1.5	—	T+		—
1380	—	T-	—	—	.2	.3		2.5	.3	—	T+		—
1400	—	—	—	—	.1	.8		2.5	.8	—	T		—
1420	T	—	—	—	.4	1.0		3.5	2	—	T		—
1440	—	T	—	—	.4	.6		4.0	1	—	T		—
1460	T	T+	T	—	.3?	.3	T mol.	4.5	1	—	T		—
1480	—	T-	—	—	.2	.2		4.5	.7	—	T-		—
1500	—	T-	—	—	.1	.2		4.0	1.5	—	T-		—
1520	—	T-	—	—	T	.2		4.0	1	—	T-		—
1540	—	—	—	—	T+	.2		3.0	.5	—	T-		—
1560	—	T-	—	—	T	.1		3.0	.2	—	T-		—
1580	T	T+	—	—	.3	.4		3.0	1.0	—	T-		—
1600	T-	T	—	—	.3	.5		3.0	1.0	—	T+		—
1620	T-	T	—	—	.5	.4		3.5	.8	—	—		—
1640	—	T	T+	—	.4	.5		4.0	.8	—	T-		—
1660	T-	T+	T-	—	.3	.4		4.5	.5	—	—		—
1680	T-	T	—	—	.3	.3		4.0	.5	—	—		—
1700	—	T+	—	—	.2	.2		3.5	.8	—	—		—

To	Cp x100 above bkgd (Au)	Alunite	K-feldspar	Qtz-Dissem (Lsr)	Qtz-VN	Clay	Sericite	Chlorite	Epidote	Calcite	Gypsum	% Vugs-space
880		—	—	7	1/2	7	15	—	T-	—	T-	1 1/2
900		—	—	7	1/2	9	16	—	T-	—	T-	2
910		—	—	8	T+	8	15	—	—	—	T-	1 1/2
920	10	—	—	10	T	10	18	—	—	—	—	2
940	10	—	—	10	T	10	20	—	—	—	—	2
960	5	T?	—	15	1/2	12	20	—	—	—	—	2
980	5	2?	—	18	2	15	30	—	—	—	—	3
1000	8	3	—	15	2	10	25	—	—	—	—	2
1020	12	2	—	18	T	10	22	—	—	—	T-	3
1040	5	1	—	15	T	10	22	—	—	—	—	2
1060	8	1	T?	13	1	13	25	—	—	—	—	2
1080	8	T	—	8	2	18	30	—	—	—	T	3
1100	5	—	—	8	1	14	25	—	—	—	—	2
1120	5	2?	—	10	1	14	22	—	—	—	T	4
1140	5	1	—	10	1	12	22	T?	—	—	—	2
1160	5	1	—	14	2	10	20	T	—	—	—	2
1180	8	1	T	15	3	8	22	—	—	—	—	3
1200	5	2	—	13	2	8	22	—	—	—	—	2
1220	8	1	—	10	2	12	25	—	—	—	—	2
1240	10	3	—	15	3	15	25	—	—	—	—	2
1260	8	1	—	12	1	15	30	—	—	—	—	2
1280	5	3	—	18	2	15	35	—	—	—	—	4
1300	8	1?	—	15	1	18	40	—	—	—	—	4
1320	8	T	—	10	1/2	10	25	—	—	—	—	2
1340	5	—	—	20	2	20	40	—	—	—	—	4
1360	5	T	—	10	3	20	40	—	—	—	—	4
1380	10	1?	—	15	1	10	20	—	—	—	—	2
1400	8	2	—	10	4	12	25	—	—	—	—	3
1420	8	4	—	18	3	15	30	—	—	—	—	3
1440	8	3	—	12	1	14	25	—	—	—	—	3
1460	8	1	—	16	1	10	20	—	—	—	—	1
1480	10	T	—	15	1	9	18	—	—	—	—	1/2
1500	8	1	—	12	2	10	20	—	—	—	—	1/2
1520	5	1	—	10	1	8	18	—	—	—	—	1/2
1540	10	—	—	10	1	8	18	—	—	—	—	1
1560	8	—	—	9	1/2	9	18	—	—	—	—	1
1580	8	1	—	12	2	8	20	—	—	—	—	1/2
1600	10	—	—	10	2	8	18	—	—	—	—	1
1620	8	1	—	10	2	9	20	—	—	—	—	1
1640	10	—	—	12	2	8	20	—	—	—	—	2
1660	8	—	—	12	1/2	8	18	—	—	—	—	2
1680	10	3?	T	12	1	7	18	—	—	—	—	1/2
1700	8	3	T	12	1	8	18	—	—	—	—	2

To	Av. clast size	% Bx Mat.	Fx/Foot	Dip-Bed/Flow Band	Sulfide vn # & ∠	Width (mm) Sulfide vn + Alter. selv. + Dissem size	Faults - Crushing - Shearing	DETAIL
880	1-3	20	1	20	<1/2 30	<1/2-6 strgrs; 1/2-2 diss.	Tr fluid - cc around py	Loc. purple-silica vn clasts
900	1-4	20	1	20?	<1/2 30± 60	1/2-2; <1/2-2 diss.	—	1-2mm - 8' Pvue @200 @885'; could be slow pyr. Refica flowrel-ed fig.
910	1-2	30	1	25	<1/2 30	<1/2-1/2 / Perv <1/2-2	—	many silica-pyr-clasts; Almosta GRIT.
920	2-3	25	1	25	<1/2 30-60	1/2 / Perv <1/2-2	—	Loc. purple silica clasts
940	2-4	30	1/2	20	1/2 60°	1/2-1 / Perv <1/2-2	—	
960	2-8	30	1/2	15	<1/2 60°	1/2 / Perv 1/2-2	—	Hem rims around some clasts / S= in mat; ∮ (QFP+MP+?) clasts / pre-Bx
980	2-3	35	1	25	<1/2-1 60°, 120° Fluid	1/2-2 / Perv 1/2-2	Loc. fluid zn (wk) 969-75'	— Re-Bx'd Bx in F11 zone
1000	1-4	30	1	35	1/2-1/2 60°, 40°	1/4-4 / Perv <1/2-2	Loc. shear.	
1020	1-3	25	1	20	1/2 30	<1/2 / Perv <1/2-2	wk on Fx in clay	Loc. silica-pyrite frags + ∮ frags - largely purple
1040	2-4	30	1/2	?	1/2 65	1/2-15 / Perv <1/2-2	wk shear on Fx	After frags of HOE(?) ... fluid; @1037: 1/2-1/2" pyr. vn @65°
1060	1-5	35	1	20	1/2 60, 40°	1/2-20 / Perv 1/2-3	wk fluid + shear.	close to 40° ... 1/2-3/4" pyr vn
1080	1-2	30	1	?	1/2-1 20-40°	1/2-2 crushed / <1/2-3 Perv	mod shearing clay py-vn	fewer +5mm clasts
1100	1-2	30	1	20	1/2 65	1/2 / Perv <1/2-1	—	fewer +5mm clasts
1120	1-3	25	1	35	1/2 35°, 70°	1/2-4 / Perv 1/2-1	Loc. shear in clay	Loc. graded beds - mod. ...; large clasts picked up below 1113
1140	1-3	30	2	20	1/2 40°	1/2 / Perv <1/2-2	wk shear on Fx	Loc. Re-Bx'd - Bx?; 1125-1138 pks S= ... py
1160	2-5	25	1	15	1/2-1 / 60°	1/2-1/2 / Perv <1/2-1	wk fluid 1156 8" @60°	1144-54 well sorted GRIT
1180	2-4	25	1	15	1/2-1 60°	1/2 / Perv <1/2-1	wk fluid mvmts.	Many ∮ clasts 1173-1182: Higher pyrite
1200	2-5	25	1	25	1/2-1 / 60°	1/2-2 / Perv <1/2-1	— →	@1190 @65° strong shear. 2" pyrite fragment - 1/4"
1220	2-4	20	2	20	<1/2-2 / 60-70	1/2-20 / Perv 1/2-2	Loc. fluid zones	1215' 1" v. str. shear py @70°
1240	2-4	30	1 1/2	20	1/2-2 / 60-70	1/2-4 / Perv <1/2-3	wh clay + sheared	1237-1243 - mod. ... fluid + ... py; local graded bedding
1260	2-4	35	2	15	1-2 / 70-80 splotches	1/2-5 / Perv <1/2-3	Loc. shear	@1260' 8" clay gg @30-60° - only wk shear ...
1280	2-5 graded	25	2	20	<1/2-2 / 40-70	1/2-200 / Perv <1/2-3	Loc. shear →	Loc ∮ + HOE Bx (rich ... pink frags); @1275: 6" pyr... ... Q-S ...
1300	1-5 graded	35	3	10	1/2-4 / 30, 60°	1/2-2 / Perv <1/2-2	Loc. shear + crush	Some graded beds ...; @1286-1' wh. rotten clay - wk fluid; 1293-1296: multiple shears + clays @60°; silica pyr clasts.
1320	1-4 graded	30	1	10	1/2-1 / 60-70°	<1/2-1 / Perv <1/2-2	Loc. mod shear.	1307': Strong - Py. clay - graded beds: Top of lower.
1340	1-4 graded	35	4	20	1/2-2 / 50-80°	1/2-3 / Perv <1/2-3	A FAULT zone	@1323: 1' crush @60°, 1324-1328' slickensided @50-70° (Re-Bx'd Bx)
1360	1-3	45	4-25?	20	1-8 / 60-70°	1/2-2 / Perv <1/2-2	crushed + shearing	1346-51 crushed + shear @70-60° + ca. 5° + Bx
1380	2-8	20	1	20	1/2-1 / 60-80°	1/2 Perv <1/2-1	wk shear-clay in Fx	+4 x" thk (Fe) lithic tuff in part; ∮ clasts: A coarse zone in lapilli tuff.
1400	1-6	30	2-8	25-60°	1/2-2 / 40-60°, Faults?	1/2-1 Perv <1/2-2	— crushed →	@1404 - 2" QTZ py vn (wk qtz) "stringer" @60-80°; 1395-1404: mod shear ... @60°-65° ...
1420	2-4	30	4	20-40, 40°	1-8 / 65-90	1/2-75 Perv <1/2-3	mod to str loc. shear	3" py vn @35° @1420' - fluid; 1410-15' - strong fluid: looks like XQFP (QTZ ∮) crystal
1440	2-4	25	1/5	15	1-2 / 10-20, 60°	1/2-2 Perv <1/2-2	loc mod. shear	1416-1433 - rotten - but only loc. shear, @30 + 60°
1460	1-2	25	1-2	15	1 / 60°	1/2-2 Perv <1/2-1	Loc. clay + shear	
1480	1-3	25	1	10	1/2-2 / 60-70	1/2-5 Perv <1/2-1	wk loc. shear	
1500	1-4	25	1/2	15	1/2-4 / 50-60	1/2-3 Perv <1/2-1	wk shear 1481'	Loc. Q-S-py vnlts.
1520	1-3	25	1	10	1/2-1/2 / 30°	1/2-8 Perv <1/2-1	wk sh. on Fx	1 1/2" py vn @30° @1516'
1540	1-2 graded	30	1	10	1/2-1/2 / 30°	1/2-1 Perv <1/2-2	wk sh. on Fx	1527 - rotten 1".
1560	2-4	25	1/2-2	15	1/2 / 30+60	1/2 Perv <1/2-1	wk. shear Fx	
1580	1-5 graded	20	1	10	1/2-2 / 20-40, 60	1/2-50 Perv <1/2-2	mod sh. on Fx	1586 3" py-qtz vn
1600	2-5	25	1	10	1/2-1 / 20-40, 60-70	1/2-2 Perv <1/2-1	wk shear on Fx	Loc. pink silica
1620	2-4	?	1 1/2	15	1/2-1/2 / 40	1/2-1 Perv <1/2-2	— →	Many lapilli (2-4mm) clasts sugared; Some ... silica py clasts; @1613 - 4" crush - clay zone
1640	2-4 graded	25	1	20	1/2-1 / 65-85	1/2-2 Perv <1/2-1	—	High grey silica; greenstone in some clasts
1660	2-4	30	1	15	1/2 / 70°	1/2-1/2 Perv	—	Many Mp clasts subrounded.
1680	2-5	20	1/8?	20	<1/2 / 60°	1/2 Perv <1/2-1	—	XQFP? - rock's ... clay matrix
1700	1-3	25	1	20	1/2 / 50-60°	1/2 Perv	—	graded bk ...

ROCK TYPE AND REMARKS

⇒ GENERAL REMARKS

✓ END 1982 - START 1983

CHIEF Fm.

⇒ 910-1705: lithic lapilli ± crystal tuff + tuff breccia, weakly bedded but with only minor graded bedding. Mostly aphanitic clasts but some silica-pyrite (jasperoid) and several varieties of porphyry (MP-QMP). Generally fewer vugs and better lithified with depth. The amount of faulting-shearing also increases with depth also the number of pyrite veinlets. Pyrite mostly disseminated. Ranges from 2-4 vol. % and generally increases with depth especially below 1160'. Only traces of cpy and cc-cov. were noted but probably SI averages several tenths percent - also generally increasing with depth. In the lower portion of the interval ME zones of white? has probably been logged in previous years (by PTG) as XQFP. Xenolithic quartz-feldspar porphyry almost like an intrusive but with distinct quartz crystals.

Note that some pyrite may be pre-Bx and detrital. Some silica + pyrite is Amethystine.

⇒ 1705-1954: lithic lapilli tuff (± qtz+Fs crystal tuff) to tuff Bx essentially as above 910-1705 - but generally better consolidated. Below 1873 amount of silica (qtz-ser-m-py) and pyrite veins + breccia (tectonic) matrix. SI replaces pyrite maybe cov or SI, CV, CC or even hem. (spec.)

better consol w/ depth

(3)

GEOLOGIC LOG

PROJECT: Thunder Mountain — HOLE NO. TM-14
Collar elev. ______ Final depth ______
Coord N. ______ Inclination ______
Coord E. ______ Page 3 of ______
Logged by F.R. Koutz
Date start ______ Date finish ______

MINERALOGY AND STRUCTURE (Vol %) / ASSAY (All ppm) / ROCK TYPE AND REMARKS

From	To	Int'vl	Core Recovery	Sample	Cu	Pb	Zn	Au	Ag	Mo	As	Chalcopyrite	Chalcocite	Covellite	Galena	Sphalerite	Gray Cu SS	Pyrite-Dissem	Pyrite-Vein	Hematite	Magnetite	Carbon. above base (AK)	Alunite	K-Alt	Quartz-Dissem/Jasp	Qtz Vein	Clay	Sericite	Chlorite	Epidote	Calcite	Gypsum	% Vugs	Av. clast size	% Bx Matrix	Fx/Foot	Dip	Sulph-Vein ∠ #	Width (mm) sulfide vn. + alter. selv.	Faults — Crushing — Shearing	Detail
1700	1720	20	100									—	T	—	—	T+	.2	2.8	.3	—	—	5	—	T	10	½	5	20	—	—	—	—	2	1-4	25	1	20	½ ~70°	½-3 ½-1 perv	=	Loc. AP-QAP clasts
	1740	↓										—	T+	—	—	.2	.3	2.5	1.0	—	—	0	T+	T	12	½	5	20	—	—	—	—	2	2-6	20	½	15	½-1 20-30	½-2 ½-2 perv	—	BK min. after py.
	1760											—	T-	—	—	.1	.2	2.5	.5	—	—	5	T	T+	15	1	7	22	—	—	—	—	2	2-4	20	½-1	15?	½ 20,40	½-1 perv ½-2	→	1½" IBx @ 40° @ 1741.5 - fluid + FS flow - Mostly ... clasts.
	1780											T+	T+	—	—	.2	.5	2.8	.2	T	—	8	2 (VFS)	1	18	½	8	22	—	—	—	—	1½	1-3	25	½	20	½ 30+	½ perv ½-2	wk slick on Fx	wk-silica flood. - many clear QTZ xenol. / cry translucent
1780	1800			1790-1800	125	40	180	<.02	0.2	4.		T	T	—	—	.2	.5	4.0	1.5	T	—	5	3	3	20	2	8	25	—	—	—	—	1	2-8	30	1	25	½-4 60-70°	½-100 perv ½-2	wk loc. fluid	1782: 4" pyrite-flooded wk fluid vn @ 70°, T gn cov
	1820			1805 T.S.; 1810	280 / 140	—	2300 / 2500	—	1.8 / 1.6	—		T+	.1	—	—	.8	.7	3.5	.3	—	—	8	5?	2	17	½	6	20	—	—	—	—	1	2-5	25	½-1	15	½ 20+ 65	½ ½-1 perv	—	v.x.s. clasts, fluidal matrix / 1803-06: vfg. bedded matrix - alunite?
	1840			1837 T.S.; 1830	185 / 280	—	2100 / 1800	—	2.4 / 1.6	—		T	.1?	T SN	—	.4	.5	3.0	.8	T	—	12	3	1	20	2	8	25	—	—	—	—	2	2-6	20	1	15	½ 30 +60°	½ perv ½-1	wk shear on Fx →	1835-37: I Bx - ... w/ frags ... QS flood, HOS? min. py, T+ dissem. ... + Bx
	1860			1850	460 / 450	—	500 / 1800	—	0.8 / 1.0	—		T	.2?	—	—	.8	.7	3.5	1.0	T	—	8	2	1	17	2	6	20	—	—	—	—	2	2-4	15	½	15?	½ 25 75	½-1 perv ½-1	—	Identity of Bi- min. ... assay (Cv ...?)
	1880			1870	480 / 85	—	280 / 80	—	0.4 / <0.2	—		T	.3	—	—	.8	.8	5.0	2	T-	—	5	2	1	30	5	5	25	—	—	—	—	½	1-3	35	1-4	?	½-2 30+ 75	½-3 perv ½-2	shear on Fx	Silicif. incr. strongly w/depth.
1880	1900			1890	80 / 80	— / 15	320 / 65	— / <.02	<0.2 / <0.2	— / 2.		T	.1	—	—	.3	.4	6.0	3	¼ ...	—	8	2	1	32	4	4	25	—	—	—	—	1½	1-3	30	1-2	20	½-3 20 60-75	½-10 perv ½-3	loc. shear ...	mud-sh silic. py dissem clay Fx
	1920		100									T	T	—	—	.2	.3	5.0	5	T+	0-2 po?	8	4?	2	35	5	4	25	—	—	—	—	2	1-5	30?	2	20	½-5 20-70°	½-30 perv ½-5	loc. shear	str. py vnlt; 1907-1914: ½-4": Fills Bx (...) 30+60°
	1940		98									—	T-	—	—	.2	.5	4.0	3	¼ ...	0.25 po?	8	3?	2	32	5	8	23	—	—	—	—	3	1-4	30	2-8	?	½-3 20-60°	½-30 perv ½-4	... SHP 60°	1919-1922: mx-min. in py, po? ... to 1" pyrite; Flt zone 1935-41
	1960		99	1940-50	35	—	50	—	<0.2	—		—	T	—	—	.1	.3	4.0	6	⅛	—	10	3	1	30	6	10	28	—	—	—	—	4	2-5	35	2-4	60° fluid	½-4 20+ 60-70	½-400 perv ½-5	All wk ...	Art silicif. clay, +gg / 1954-5?: FAULT; 50% pyrite / ... lapilli tuff
	1980		95									—	T+	.2	—	.3	1.0	4.5	4	T	—	8	3	4	35	10	15	30	—	—	—	—	5	?	15	5-8	30-60°	1-5 20-40°	½-20 perv ½-2	str. Bx ...	Str. fault 1965-67. vfg. silic. porcellaneous volc (Ash flow)
1980	2000		98	1988-2017 ... spalled + ...	25	20	550	<.02	<0.2	10		—	T	T	—	.1	.4	4	3	¼	—	5	3	5	30	6	12	30	—	—	—	—	4	5-8	40	3+	?	½-2 30+ 60-85	½-10 perv ½-2	Tectonic Bx-local	HOS Fx?-Bx? + ... clasts - Landslide Block? vfg felsic volc. - volc Bx
	2020		98									—	T-	T	—	.1	.5	3.5	4	/	±	8	2	4	28	8	10	28	—	—	—	—	2	4-8	50?	3+	?	½-4 30 60-85	½-15 perv ½-3	All wk Bx	HOS?- Ash flow tuff (tuff Bx?) f.g. QTZ Porph. ... volc.
	2040		100	TS 2023								—	.1	T	—	.2	.4	3.5	3	2	—	8	2	5	38	3	4	20	—	—	—	—	½	4-10	40	½-1	10	½-3 30 60-85°	½-150 perv ½-2	wk-mod. fluid. healed	@ 2030: 6" pyrite vn / wk fluid - 60-80° locally - mod fluid / 2030 graded ... lapilli tuff
	2060			2040-50	120	—	125	—	<0.2	—		T	.1	.2	—	.2	.5	3.0	.8	T+	—	8	2	4	30	1	4	23	T stks ... Fx				1	2-4	35	½	15	½ 30° 60-80°	½ perv ½-1	... Bx	2047-2054 f.g. volc: poss HOS Block in lapilli tuff.
	2080											—	T	T	.	.1	.4	3.5	.7	T	—	5	2?	2	25	1	4	20	T stks ...				2	1-4	25	½ ½	10	½ 35°	½ perv ½-1	T Bx	lapilli tuff w/ lcr. graded beds - well consolid.
2080	2100			TS 2096; 2090-2100	30	35	45	<.02	<0.2	2		T?	T-	T-	—	T	.2	3.0	.5	T-	—	8	1	1	23	½	4	20	—	—	—	—	2	1-2	20	1	15-30	½ 40°	½-4 perv ½-2	T slick in clay seam on Fx	lapilli tuff graded beds + clasts sub & to sub round
	2120											T	T-	T-	—	.1	.2	3.5	.3	T-	—	10	1	2	25	½	5	20	—	—	—	—	1	2-4	20	1	20	½ 60°	½ perv ½-1	—	lapilli tuff ... Fs xtls
	2140											T	T-	T-	—	T	.2	3.2	.3	—	—	8	T	3	30	½	4	18	T stks - Fx				1	1-2 +	35 MAT	½-1	20	½ 30+ 65	½-2 perv ½-1	T-crush	Transition zone (X QFP?) Lt. gy Qtz Fs φ (clasts 1-3mm ...) in ... gy lapilli tuff (QFP is xenol.-Bx frags) - some wk Q-S flood Bx zones.
	2160			2153 TS (2 p)								T	T+	.2	—	T	T	3.0	.3	T in vn	—	10	T	4?	20	1	3	15	—	—	—	—	½	1-3 φ	20-40	½-1	20-60	½ 30+ 60-70	½ ½ 1-4mm	Flow 30-50°	QFP (XQFP?) - Lt. gy, 5-15% round to sub round QTZ φ 1-4mm. Fs 2-6mm in f.g. grey ... even dissem. py + thin Q-S selv. - also variety - transition w/ more wh. Fs, grey ... matrix.
	2180											T	T-	.2	—	—	T-	2.5	.2	T-	—	8	—	2?	10	1	8	25	—	—	—	—	2	—	—	2-4	30?	½ 60-75	½ 1-2 ½-½	wk slicks on Fx	2168 + 2171 1-4" clay seams, little movement - some shear. - QFP - DK phase (no remaining mafics)
2180	2200			2190-2200	360	70	1000	<.02	0.6	<2.		T	T-	.2	—	—	T+	2.5	.2	—	—	8	—	2	12	2	6	20	—	—	—	—	½	—	—	½-4	—	½ 60-75	½ 1-4 ½-½	wk slicks on Fx	QFφ (QTZ to hexagonal will round 5-8%) ... Fs φ ... grey-φ
	2220											.1	T-	.1	—	T	T-	2.8	.3	—	—	8	—	4	12	2	8	22	—	—	—	—	¾	—	—	1-3	—	½-1 30 60-75	½-1 1-3 ½-½	slicks on Fx	2211: ¼-½" gg on Fx incl. clay, (10-15% QTZ φ)
	2240		100									T	—	.2	—	T	T	2.5	.5	—	—	10	—	4	18	4	8	25	—	—	—	—	½	—	—	2-10	50-70	½ 10-30 65-85	½-2 1-10 ½-1	slicks on most Fx	2224-25: 75-80° crush-sg.: loc. Q-S flood destroys φ text. QFφ
	2260		99	2250	490 / 450	—	370 / 3200	—	0.4 / 1.4	—		T+	—	.3	—	.4	.2	4.0	3.	—	—	12	—	1	15	5	12	35	—	—	—	—	3	—	5	½-12	60-80	½-5 20-40 65-80	½-70 5-100 ½-1	wk-mod crush	2246-55: ½-½" seam - clay - py vn @ 75-85°; 2255-61: 50-65% py infills w/ Bx ... and wh. phase QFP (intrusive, xeno. in Alt phase?)
	2280		100									T	—	.1	—	.1	.5	3.0	.5	—	—	12	—	2	20	3	10	28	—	—	—	—	½	—	2	1-5	50?	½-2 70-90	½ 5-100 ½-1	loc. wk flood 40-50°	2255-1-4" dissem. B? > py; 2265-2276 gg ... on Fx + wk ... - QFP.
2280	2300		100	2290-2300	700	15	500	<.02	0.4	<2.		T	—	.2	—	.1	.3	2.5	.4	—	—	10	—	3	15	4	7	23	—	—	—	—	1	—	—	1-2	60	½-1 50-70	½-2 10-30 ½-1	wk slicks on Fx	QFP - T volc(?) xenoliths
	2320		99									T	—	.2	—	.3	.2	2.3	.2	—	—	5	—	2	12	2	8	25	—	—	—	—	1	—	—	1-8+	—	½-1 60-80 30-40	½-½ 10-40 ½-1	wk slicks on Fx	2301-04: mod. → str. ... 70-90° - QFP -
	2340											T-	—	.1	—	.2	.3	2.5	.4	—	—	5	—	2	10	2	8	25	—	—	—	—	1½	—	—	1-4	—	½-1 70-80	½-½ 4-50 ½-½	wk slicks on Fx	QFP - subround-hex. QTZ eyes.
	2360			2360 TS; 2340-2350	830	—	1000	—	1.0	—		T	T	.1	—	.4	.4	2.5	.4	—	—	5	—	1	10	2	7	23	—	—	—	—	2	—	—	1-2	—	½-1 20 60-80	½-1 10-20 ½-1	wk slicks in clay	QFP
	2380											.1	—	.2	—	.4	.3	2.5	.5	—	—	3?	—	1	10	3	8	23	—	—	—	—	1	—	—	1-2	—	½-1 40-60	½-2 5-10 ½-1	wk slicks in Fx	QFP
2380	2400			2390-2400	590	25	930	<.02	1.0	<2.		.1	—	.1	—	.3	.3	2.8	.7	—	—	0	—	1	10	4	10	25	—	—	—	—	1½	—	—	1-3	—	½-2 40-60 80	½-2 5-10	wk slicks in clay on Fx →	2383-85 ½-½" clayey + wk crush - QFP - loc. 5-10mm FS (1-5%)
	2420											.1	T+	.4	—	.2	.2	2.5	.7	—	—	5	—	2	9	4	8	25	—	—	—	—	1½	—	—	1-2	—	½-1 20-60°	½-15 5-15 ½-1	wk slicks on Fx	QFP ½" py vn @ 50°
	2440											.1	—	.4	T	.2	.2	2.8	.5	—	—	3	—	1	9	2	8	23	—	—	—	—	1	—	—	½-1	—	½-1 50-60	½-10 5-20 ½-1	wk slicks on Fx	2428 ... clay-ser ... 1-50 vnlts. - fewer QTZ eyes in QFP
	2460			2440-60	35	—	1000	—	0.8	—		T	T+	.3	—	.3	.2	2.8	.7	—	—	3	—	1	10	4	7	23	—	—	—	—	1½	—	—	½-2	—	½-2 70-80	½-2 5-10 ½-1	wk slicks on shear Fx	QFP - back to normal 5-10% QTZ eyes.
	2480			2475 TS								—	—	T+	—	.1	.4	3.5	.5	—	—	5	—	T	15	5	10	25	—	—	—	—	2	—	—	1-2	—	½-1 20	½-3 5-20 ½-1	wk slicks on Fx	QFP-Q-S locally destroys text. / 2475-79: xeno. of volc. tuff? strong sericitic mat.
2480	2500			TS 2490-2500	200	50	185	<.02	<0.2	14.		T	T	T+	—	.2	.3	3.8	.7	—	—	5	—	2	13	5	8	23	—	—	—	—	2	—	90	1½	—	½-2 20-30 70-90	½-10 10-20 ½-1	→	2482-88: ¼-½" py vn @ 80-90° wk shear texture. @ ~2488: Bx (ign) Lt. φ (QFP) in dk gy QTZ eye-poor porphyry ± to 2510.
	2520											T-	—	T-	—	T	.5	4.0	.7	—	—	10	—	T	12	5	10	28	—	—	—	—	2	—	80	½-8	—	½-2 30-40 80-90	½-3 5-50 ½-1	str. slicks in clay - Fx	2515-2527 ¼-1" flt - py vn @ 70-80° (py below 2521) crushed. - Low QTZ eye φ
	2540	↓										—	T-	T+	—	.1	.4	4.5	2.	—	—	8	—	1	12	4	15	28	—	—	—	—	2	—	95	½-4	—	½-2 30-40 70-80	½-30 5-10 ½-1	→	Bx starts 2534.- Bx (ign) frags w/ diff. groundmass - fracturing - Low QTZ eye φ
	2560	20										—	T-	T	—	.1		3.5	1	—	—	8	—	1	10	3	10	25	—	—	—	—	1	—	—	1-2	—	½-1 50-70	½-15 10-10 ½-1	wk slicks in clay - Fx	½-¼" py vn 70-80° @ 2552 / ½" @ 2556 @ 70° py : ex Biot (1-5%) Heavy clay-SER.. v. few QTZ eyes: Bx texture becomes indistinct w/ depth

⇒ General comments

⇒ 1954-2054: Lapilli tuff breccia - locally well foot bed. - Contains landslide block of or Ash silica of vfg-fg felsic volcanic - volc. Bx (Ash flow?) Pervasive, partly healed crush, very strong dissem. pyrite + 50-90% pyrite replacement veins in tectonized volcanics. Note relict hematite in HOS frags. Local T cov, bn, cc + cpy.

⇒ 2054-2122: Lithic lapilli tuff - well consol. As above 1954. Silica, clay + sericite decrease. Good graded beds + often rounded lapilli.

⇒ 2122-2155: Transition zone wh. groundmass QFsφ intrudes lapilli tuff - itself is engulfed in dark-mod. gy QTZ Fs φ - transition below - wh. clasts in dark matrix.

⇒ 2155-2475: QTZ eye (rounded to hex) m. ... dk gy Fs porphyry, 5-15% QTZ - some variation in Fs size & %. More SER plus clay seam pyrite veinlets, local cov only ± slat... pyrite. This DMP shows no evidence of mafics.

⇒ 2475-2560 (gradational contacts): Zone of transition with xenoliths of QTZ eye QFP in QFP several varieties, engulfing phase has few or no QTZ eye phenocrysts - strong grey QTZ SER destroys & confuses Bx texture. Most clasts well rounded. It is unclear if these two intrusives are FTG's QFP being engulfed by DMP (opposite to previous sequence). Maybe just differentiation in a single pluton.

(4)

GEOLOGIC LOG

PROJECT [illegible] Mountain HOLE NO. [illegible]
Collar elev. ____ Final depth 3075' (1984)
Coord N. ____ Inclination ____
Coord E. ____ Page 4 of ____
Logged by F.R. Koutz
1985: 3075-3500' Date start ____ Date finish ____

From	To	Int'vl	Core Recovery		Cu	Pb	Zn	Au	Ag	Mo		Chalcopyrite	Chalcocite	Covellite		Sphalerite	Grey S on SS		Pyrite-Dissem	Pyrite-Vein		Hematite		Magnetite	CPS x100 above bkgd	Alunite	K-Feldspar	Qtz-Dissem + Mat	Qtz VN	Clay	Sericite	Chlorite	Epidote	Calcite	Gypsum	% Vugs space	Av clast size	% Bx matrix	Fx/Ft	Dip: Bxs-flow band	Sulphide vn/ft # + ∠	Width mm sulphides in + alt selv. + dissem size	Faults – crushing – shearing	Detail
2560	2580	20	100	-2570TS.								T	-	.1		.1	.2		3	2		T-		-	8	-	1	10	3	8	22	-	-	-	-	1	-	-	1	-	½-2 65-80	1-50 10-40 <½-2	wk shear in Fx	1-2" py: dissem. [illegible] 2573-77: Fs φ (Qtz in matrix but only 1-2% v. local Qtz eyes, 1-3mm Fs w/ wk rims, 1-3% ex-biot(?)) now tan clay (mont?)
2580	2600	↑	↑	2580-2600	380	95	130	<.02	<.2	6.		-	-	.2		.1	.3		3	1½		-		-	5	-	3?	8	3	6	18	-	-	-	-	½	-	-	1-2	-	½-1 70-80	1-60 10-30 <½-3	wk shear on Fx	2583-84 1-3" py vn @ 75-90°. Pyrite replaces mafics (½-2-3 mm) Fs φ (MP?-fresher than above)
	2620			-2614TS(N)								-	-	.1		.1?	.2		3	1½		-		-	3	-	3	8	4	8	20	-	-	-	-	½	-	-	½-2	-	½-3 75-90	½-8 10-40 <½-3	→	2600-2601: [illegible] mainly [illegible], wk tan stain in some Fs, more Fs: Rock "[illegible]" — @2613 NC→NX
	2640											T?	T	T+		T	.2		2.8	.5		-		-	8	-	1	7	3	6	23	-	-	-	-	½	-	-	½	-	½-4 50-60	½-2 4-10 <½-3	-	QMP-no Qtz eyes 1-6mm Fs (25-45%) — py replaces ex-Bot + Fs
	2660											T-	-	T		-	.5		3.5	2		-		-	8	-	1	10	5	8	25	-	-	-	-	½	-	-	2-10	-	½-2 50 70-85	½-20 5-50 <½-4	2648-50: Bx shear-	2644-46 ¼-½" py vn + Qtz-ser, 2660: 75-80° ¾" Qtz-py-ser vn (wk faults)
	2680											T	T	-		-	.2		3.5	3/4		-		-	10	-	1	11	4	5	22	-	-	T-	-	½	-	-	1-2	-	½-1 70-90	½-4 3-20 <½-3	wk slick; on Fx	
2680	2700			2690-2700	520	40	375	<.02	<.2	2.		T-	T	T+		T?	.2		3.2	½		-		-	10	T?	1	10	4	7	25	-	-	-	-	2 (local)	-	-	1-4	-	½-2 30 80	½-1 2-10 ½-3	wk slick; on Fx	
	2720											T	.1	.2		T	.2		3.7	.3		-		-	8	-	1	8	3	6	22	-	-	-	-	2	-	-	1-2	-	½-½ 30 60	½-½ 2-10 <½-2	wk slick; on Fx	
	2740			-2737S								-	-	T		T	.3		3.0	.3		-		-	3	-	1	8	3	7	20	-	-	-	-	1	-	-	¼-4	-	½-½ 60-70	½-1 5-20 <½-2	wk slick on Fx in sea	Includes a few f.g. φ (no Qtz eyes) with [illegible] xeno, /wk tan stain in Fs
	2760											-	-	-		T	.3		3.0	.6		-		-	5	-	2	12	5	6	22	-	-	-	-	1	-	-	⅓-3	-	½-2 30 60-80	½-2 10-30 ½-2	wk slicks in [illegible]	ser.
	2780											T	-	-		-	.2		3.0	.6		-		-	5	-	2	10	4	5	20	-	-	-	-	3 (local)	-	-	1-3	-	½-1 50-70	½-2 10-40 ½-2	-	
2780	2800			2790-2800	415	35	200	<.02	<.2	6.		T	-	-		T+	.2		3.5	.4		-		-	10	-	2	10	5	5	22	-	-	-	-	2	-	-	⅓-5	-	½-2 30-60	½-½ 5-20 ½-4	-	Q-S-py selv, more clear, more tan in Fs / 2788-2802: Sm. vert. ser Fx
	2820											.1	-	T+		T	.2		3.2	.8		-		-	10	-	2	8	6	6	25	-	-	-	-	1	-	-	½-2	-	½-2 20-30 70-80	½-50 5-40 <½-3	→	2806: 2"-70% matrix vn @55° ± vugs
	2840											.1	.1	.3		.1	.2		3.8	1		-		-	13	-	1	8	5	6	25	-	-	-	-	2	-	-	½-2	-	½-1 20-80 61-75	½-1 5-20 <½-2	-	
	2860			2850	700 / 220	-	340 / 670	-	0.6 / 0.2	-		2?	T+	.2		T	.3		4.0	1		-		-	8	-	1	10	5	5	25	-	-	-	-	2	-	-	⅓-1	-	½-4 40-60	½-1 5-30 <½-3	-	
	2880			2870	200 / 275	-	560 / 390	-	0.4 / <.2	-		.1	T+	.2		T	.2		4.0	1		-		-	10	-	1	10	6	6	25	-	-	-	-	1	-	-	½-1	-	½-7 50-70	½-1 5-30 <½-3	Foliation? yellow w/ Fx	
2880	2900			2890	600 / 335	50	600 / 700	<.02	<.2 / 0.4	<2.		.3	T	.3		T+	.2		3.8	3/4		-		-	5	-	1	12	5	5	27	-	-	-	-	2	-	-	⅓-1	-	½-2 30-50	½-1 5-30 <½-3	-	STR Q-S and selv. w/ tan stained Fs beyond (peaks)
	2920			2910	250 / 200	-	720 / 780	-	0.2 / <.2	-		.3	T	.2	Loc. py	-	.2		3.5	.6		-		-	8	-	2?	12	5	5	25	-	-	-	-	1	-	-	⅓-1	-	½-1 20-40 60-70	½-1 5-40 <½-2	-	
	2940			-2931TS.								.2	T	.1		-	.3		3.3	.5		-		-	5	-	1	10	5	5	25	-	-	-	-	1	-	-	⅓-1	-	½-1 30 75-90	½-1 5-30 <½-2	-	
	2960			2940-50	1050		880		0.2	-		.3	.4	.2		T?	.3		3.5	.7		-		-	10	-	1	12	4	4	25	-	-	-	-	1	-	-	½-1	-	½-1 20-30 70-80	½-1.5 5-40 <½-2	-	½" py-sp-cv VN @30° 2977.
	2980											.2	.1	.2		-	.2		3.0	1		-		-	8	-	1	10	4	4	23	-	-	-	-	1	-	-	1-2	-	½-1 10-20 50-60	½-10 5-30 <½-2	wk slicks on Fx	
2980	3000			-2995TS. 2990	150 / 150	85	600 / 600	<.02	<0.2 / <0.2	2		.2	.2	.1		-	.2		3.5	.8		-		-	3	-	1	10	5	4	25	-	-	-	-	1	-	-	½-1	-	½-1 20-30	½-3 5-30 <½-3	wk slicks on Fx	V. Strong Q-S selv 1-2/FT, loc. chalced Qtz
	3020			3018	380 / 125	-	600 / 550	-	<.02 / 0.2			.2	T+	.2	T bn	-	.2		3.2	.8		-		-	10	-	1	8	4	9	28	-	-	-	-	1	-	-	1-2	-	½-2 20-40 60	½-2 5-30 <½-3	-	@3002-2-6" chalcedonic Qtz-py stockwork @60°
	3040	↓										.1	T	.1		-	.2		3.8	.7		-		-	13	-	1	10	5	4	25	-	-	-	-	1	-	-	½-2	-	½-2 20-40	½-10 5-50 <½-2	-	Loc. 8-15mm. Fs.
	3060	20	↓									T	-	.1		T	.4		2.5	1.0		-		-	10	-	1	12	4	4	25	-	-	-	-	1½	-	-	⅓-2	-	½-3 / 70-90	½-1 5-30 <½-1	-	1½" py (70%) 65° VN + Qtz @3039'
3060	3075	15	100	-3071 TS 3060-3080	280	50	600	<.02	0.2	4		T	.2	.1		T	.3		3.5	1		-		-	10	-	½	12	6	6	35	-	-	-	-	2	-	-	1	-	<½-2 / 70-80 / 20-30	½-2 5-20 ½-2	-	Str chalky, [illegible] below 3068.
3075	3080	5	36	3075-79: core ground							1705457	T	T+	-		T	.2		4	.8		T-		-	8	-	-	15	8	10	40	-	-	-	-	1	-	-	1	-	½-2 / 60-70 10-20	½-1 10-20	-	
3080	3100	20	98	-3096 3117 / 3090-3100	590	60	445	<.02	1.0			.2	T	T	T bn	.1	.3		5	5	T-MoS2	T-		-	13	T?	3?	30	10	5	40	-	-	-	-	3	2cm	60	4	60 Ev	2-5 / 10-60 10-40	<½-1 (10) <½-2	wk shear 60-80°	
	3120	↑	100	3110 -3110TS	590 / 550	30 / 68	170 / 240	<.02 / <.02	1.0 / 2.0			.3	T	T	T bn	.1	.3		5	3	-	T		-	15	T?	3	35	12	6	35	-	-	-	-	5	4.5 cm	20	3	25+ 60	2-8 / [illegible]	½-5 (5-10) <½-4	Mod. loc. shear 60°	@3096: 4" 5% [illegible]
75°	3140		100	3124' 1' zone chalced vn to 1" / mostly [illegible]								.2	T	-		T+	.2		5	4		-		-	12	T	½	20	10	5	40	-	-	-	-	3	-	T (chalced)	2	-	2-10 / 10-20 60	½-4 (5-20) <½-1	Loc. 71° shear	Loc. f.g. sec. [illegible] Fs φ
	3160		100	vn @[illegible]								.3	T?	-		.1	.3		4	3	T-MoS2	T	Sm. Fluor?	-	10	-	1	15	8	5	35	-	-	-	-	2	-	-	½-2	-	2-6 / 20-30 60	½-1 (5-30) <½-1	-	
75°	3180		100	3168' 1-2" [illegible] / 3172-F5 [illegible] / -3160TS	1600 / 680	30 / 45	770 / 460	<.02 / <.02	1.0 / 0.6	-3170'		.4	T	T	T bn	.1	.4		4	1.5		-		-	5	-	5	12	10	4	30	-	-	-	-	½	-	-	½-1	-	2-3 / 60-80 90	½-1 (3-40) <½-1	-	3?% aplitic f.g. groundmass [illegible] NOT ALT. related
3180	3200		99	1" py vn @3184 60°	80	20	1100	<.02	0.8	-3190'		.1	-	-		.1	.2		3.5	.25		-		-	10	-	3	15	7	3	28	-	-	-	-	½	-	-	1-3	-	1-5 / 20 60-90	½-25 (5-20) <½-2	wk shear in py [illegible]	10% aplitic [illegible] matrix [illegible] through 3190
	3220		100	3200 30% py vn 2" @ 55°	710	35	780	<.02	1.2	-3210		.2	T	.2		T	.2		4	2		-		-	25 [illegible] 18	-	2	25	10	4	25	-	-	-	-	½	-	-	⅓-1	-	½-3 / 30-60	½-3 (5-20) <½-1	wk 83° Fx	Loc. [illegible] vn [illegible] to 2mm.
70°	3240		100	3226' 3" 50% py stringer vn @70°	950	80	1100	<.02	2.0	-3230		.2	-	T		T	.3		3.5	3	T+ MoS2	-		-	15	-	1	18	9	5	25	-	-	-	-	2 [illegible]	-	-	½-1	30° vn	½-2 / 50-80	½-50 (1-50) <½-2	wk shear 60 Fx	3238-40: 2' 3x 10-30% [illegible] / 10% aplitic matrix (with φ)
	3260		100									.1	-	T-		T	.2		3.5	1.5	T MoS2	-		-	10	-	1	18	10	4	25	-	-	-	-	½	-	-	1-4	-	½-2 / 20-30 60-80	<½-2 (5-70) <½-2	wk loc. shear	py in old biotites
60°	3280		100	3266' 1" py vn @60° / -TS 3272								.1	-	T-	T bn	T	.2		3.5	2	T MoS2	-		-	10	-	1	15	7	4	28	-	-	-	-	2	-	-	½-3	-	½-2 / 60-70	<½-20 (5-30) <½-2	-	wk tan alt between Q-S-py stockwork veinlets. 3274-76 [illegible] matrix [illegible]
3280	3300		100		490	110	1300	<.02	1.6	-3290		T	-	T+		T	.2		3.5	1		-		-	8	-	-	12	10	4	25	-	-	-	-	3	-	-	⅓-1	-	½-2 / 60-90	<½-1 (5-20) <½-1	Loc. open Fx	Loc. wh Qtz-calcite/[illegible] @60° Loc. tan stain between Q-S selv.
	3320		100									.1	-	T+		T+	.2		3.0	.8	T-MoS2	-		-	3	T?	-	10	10	6	25	-	-	-	-	1	-	-	⅓-1	-	½-2 / 70-80	<½-1 (5-80) <½-1	slicks in clay on Fx	
	3340		100	3334' ½" py vn @ 70°								.1	-	T+		T	.1		3.0	.8	T-MoS2	-		-	5	-	2	8	7	4	28	-	-	-	-	½	-	-	¼-1	-	½-3 / 60-85	<½-3 (5-30) <½-1	-	80% f.g. groundmass: aplitic [illegible] (30-50% [illegible]) φ
	3360		99	3356-58 1-3" 60% py vn 60-75° / -3342 TS.								T	-	T-		T	.1		4	6		-		-	5	-	2	12	12	3	23	-	-	T-	-	2	-	-	⅓-4	60±	½-4 / 60-90	1-30 (5-40) <½-2	Py vn sheeted	3354' 1-2" Bx in [illegible] py vn 60-80°, 50% aplitic groundmass
	3380	↓	100									T	-	T-		.2	.2		4	1		-		-	3	-	1	15	9	3	25	-	-	-	-	2	-	-	½-2	-	½-2 / 30 70	1-3 (5-30) <½-1	wk shear 70° Fx	
3380	3400	20	100									-	-	T-		.2	.2		3.5	1	T-MoS2	-		-	3	-	-	12	8	5	28	-	-	-	-	2	-	-	½-1	30°	1-3 / 60-90 70-90	½-2 (5-30) <½-1		Loc. tan stain plags between Qtz stockwork 3394' [illegible] Qtz [illegible] / wkly leached

ROCK TYPE AND REMARKS
⇒ GENERAL COMMENTS

⇒ 2560-3075: Quartz Monzonite Porphyry. Lt to med grey (mostly Qtz-ser flood) with local tan stain between strong Q-S-P selvages. Fe prob. from (contact) oxidized BOT 1-5%. Now sericite-clay (montmorillonite?) QFP has no mafics - only v. rare Qtz phenocrysts although some Qtz in groundmass. (30-70 AV) plag?) Fs 20-60%, 1-4mm with local up to 10 mm. A few minor zones with K-fs, igneous xenoliths (1-5%). Some Fs have [illegible] rims. Some KFs (1-2%) phenocryst, 2-3mm. Qtz-ser-py veinlets are generally not strong. Pyrite 2.5-4% dissem, mostly in former biotite sites + on FS rims. Local wk to strong cov. on py + cpy. Some py has pink-gold (cpy) tarnish [illegible]. Local chalcocite but never strong. Porosity from wk leaching of feldspar + some vuggy Qtz vn. Contact relationships above 2560' uncertain. Is this QMP of FTG Sunnyside [illegible]? If so above 2560 [illegible] to consist of [illegible] xenoliths of QFP. QMP = MP of [illegible] TCH-2 [illegible] about this interval. This may be a phase of QFP at depth. Assuming this is QMP-MP the hole should progress out of the unit within several 100 feet into HDS [illegible] or Flux Group [illegible] flows - volcanics using TCH-2 model. ∴ Deepen hole next year. K3075 1984 E.OH.

3075-3094.5' QMP as above. B-tinge [illegible] + py w/ depth

⇒ 3094.5-3110: IBX: 30-60% Q-S-py matrix w/ dissem py [illegible] + [illegible]; clasts [illegible] mostly QMP (some auto-Bx) but also 40% chilled [illegible] clasts, [illegible] possibly some QFP clasts, a few HDS Bx clasts. 10-20' Q-S halo.

⇒ 3110-3500: QMP→MP. Lt-m grey (Qtz-ser) with local tan stained plag between Q-S-py stockwork. Fx but now [illegible]. Local aplitic-[illegible] groundmass "somewhat" like txt (between Fs) of Jmonz over [illegible] Bx. Loc. py vn 1 Qtz-py-chalcedonic to 1-2" usually high ∠'s. Much of cpy in veinlets is cov. coatings, loc. cc/cov on py. T Qtz-MoS2-py (rare cpy) veinlets.
-A few zones below 3400 have less Q-S + almost fresh "MP" w/ green stained plags. Compared to TCH-2 should have gone into lower HDS [illegible] volcanics below ~3100-3200! Prob. thicker (apparent dip of MP dike?) MP. Hole needs to be deepened. Would guess that SI ≥ cpy: is this encouraging for LS [illegible] Depth? [illegible] may still be out from center.

GEOLOGIC LOG

PROJECT: Thunder Mountain   HOLE NO.: TM-14   Final depth: 3500 (4222)
Collar elev. ___ Coord N. ___ Coord E. ___ Inclination ___ Page 5 of ___
Logged by: F.R. Koutz, M. [illegible], H.G. Kirsis   Date start ___ Date finish ___

Depth, Core Recovery, Unit Notes and Assay (All ppm)

From	To	Int'vl (NX)	Core Recovery	Unit notes	Cu	Pb	Zn	Au	Ag	Mo
3400	3420	20	100	3416-41' relatively fresh						+3426.75
	3440	↑	99	3344 [illegible]						
3440	3460		100							
	3480	↓	100	3482- 1-2" @ 60°						
3480	3500	20	99	See 3 Sect. 3480-3500	385	240	1200	<.02	1.6	
3485	E.O.H.									
3500	3520	20	100							
3520	3540	20	100							
3540	3560	20	100							
3560	3580	20	100	Qtz vein & sulfide veinlets [illegible]						
3580	3600									
3600	3620	20	100	3600-3610 →	325	12	295	<.02	.9	
3620	3640	20	100							
3640	3660	20	100							
3660	3680	20	100	1" TKA vn @ 65° @ 3665						
3680	3700	20	100							
3700	3720	20	100	3700-3710 →	1800	85	730	<.02	2.2	
3720	3740	20	100							
3740	3760	20	100							
3760	3780	20	100							
3780	3800	20	100							
3800	3820	20	98%	3800-3810 →	550	80	465	<.02	1.4	
3820	3840	20	100							
3840	3860	20	100							
3860	3880	20	100							
3880	3900	20	100							
3900	3920	20	100	3900-3910 →	1400	160	680	<.02	2.6	
3920	3940	20	100							
3940	3960	20	100							
3960	3980	20	100							
3980	4000	20	100							
4000	4020	20	100	4000-4010 →	700	120	650	<.02	1.7	
4020	4040	20	100							
4040	4060	20	100							
4060	4080	20	100							
4080	4100	20	100							
4100	4120	20	100	4100-4110 →	1052	150	1600	<.02	2.5	
4120	4140	20	100							
4140	4160	20	100							
4160	4180	20	100							
4180	4200	20	100	[illegible]						
4200	4222	22	100	4200-4210 →	1150	70	750	<.02	2.0	

Mineralogy and Structure (Vol %)

From	Chalcopyrite	Chalcocite	Covellite	Sphalerite	Gray SS	Pyrite-veinlets	Pyrite-dissem	Hematite	Magnetite	K-feldspar	Qtz	Qtz Vn	Clay	Sericite	Fx/Ft	Sulfide Vn/Ft
3400	T	-	T-	.2	.2	4	1.5	-	-	2	12	7	8	35	1-10	2-3/3-60
	T-	T+	-	.2	.2	3.5	2	-	-	3	15	10	5	22	2-1	1-4/60-70
3440	-	-	T-	.1	.2	3	1.5	-	-	3	12	12	5	22	½-1	½-2/70-80
	T	-	T	.1	.2	3	1.5	-	-	2	12	10	3	20	½	½-2/30 70-80
3480	T-	-	T-	.2	.2	3.5	1	-	-	1	12	12	5	35	1-5	½-2/30 60-80
3500	T	-	T-	T-	T-	3	4	?	-	1	10	12	3	25	2-3	1-3, 5-70°
3520	T	-	?	? Vn		3	2	?	-	1	10	5	4	35	3/4	2, 60-80°
3540	T-	-	?	?T	?	3	1	?	-	1	10	5	4	30	2	2, 60-70°
3560	T+	-	?	-	-	6	2	-	-	1	18	2-3	2	30	1	2,4
3580	T	-	-	-	?	6	2	-	-	1	17	5	2	35	1	2-3 40-60
3600	T	-	-	-	-	4	4-5	-	-	1	10	1-2	2	30	1	5, 40-60
3620	T	-	-	-	-	4	3	-	-	1	[illegible]	1-2	2	30	2	2, 40-60°
3640	T	-	-	-	-	4	5	-	-	1	10	2-3	2	35-40	2	2 40-60°
3660	T	-	-	-	-	4.5	5	-	-	1	10	1	3	40	3-4	1, 60-80°
3680	T	-	-	-	-	3	3	-	-	1	10		4	35	1	1, 40-80°
3700	T	-	-	-	-	3	3			1	10		1	35-40	1-3	2-3 30-60°
3720	T	-	-	-	-	6	2	-	-		10		1-2	35-40	3	2, 30-60°
3740	T	.1	-	-	-	4	3-4	-	-	1	10	1	2	35-40	1-2	2 30-60
3760	T	.1	-	-	-	4	3	-	-	1	10	1	2	35	.5	2 [illegible]-60°
3780	T	.3	-	-	-	4	3	-	-	1	10	1	2	35	2	2-3, 30-60°
3800	T	.2	-	-	-	5	4	-	-	1	10	1	1	35	4	3 20-60°
3820	T	.2	-	-	-	3	3	-	-	1	10	1	1	35	4	2-3 20-90
3840	T	T+	-	-	-	2-3	2	-	-	1	10	1-2	2	35	3	2, 40-60°
3860	T	T+	-	-	-	2-3	2	-	-	1	10	1	1	35	2	3-20-60°
3880	T	T	-	-	-	3	4	-	-	1	10	1	1	30	2	2-3, 40-60°
3900	T	0.1	-	-	-	3	4	-	-	1	10	1	1	35	5-cut / C-core	2-3, 30-60
3920	T	T	-	-	-	2-3	3			1	10	5	1	35	5	3-3 50-90
3940	T	T	-	-	-	3	3	-	-	3	10	12	1	35	6-7	3-4 60-90
3960	T	T	-			2-3	3	-	-	1	10	2	1	35	4-5	3, 40-80
3980	T	T				2-3	3	-	-	1	10	1	1	35	2-4	2-3/40-70
4000	T-	T	-	T	-	3-4	2-3	-	-	1	10	1	1	35	1-2	3/20-70
4020	T-	.1	-	-	-	4	5	-	-	1	10	5	1	35	3-4	2 40-70
4040	T	0.1	-	-	-	<2	2	-		1	10	3	3	35	[illegible]	1-3/30-50
4060	T	0.1	-	-	-	3	3	-		1	10	1	2-3	35	4	1-3
4080	T	0.05	-	-	-	2	2	-		1-2	10	1	[illegible]	35+	2	2, 30-60
4100	T	T	-	-		2-3	1	Loc 3-4		1	10	1-5	2-3	35-40	3-4	1-4/35-60
4120	T	T	-	-	-	3	1			1	10	1	2-4	40	2	1/70°
4140	T	T		-		3	3	-		1	10	1-2	3.5	40	5	2/40-70°
4160	T	?		-	-	3	2			1	10	1	1	35	2	2-3/40-70
4180	T	2.1		-	-	3	2			1	10	2	1	35	3	3/40-60
4200	T	0.1		-	-	2-3	1-2			1	10	2	1	35	2-3	3/[illegible]

Rock Type and Remarks

Detail → Graphic comments

From	Remarks
3400	3418-24' [illegible] @ 70-75° 15% [illegible] / 20% aplitic groundmass
	70% aplitic groundmass.
3440	3452' [illegible] @ 70° / 30% aplitic groundmass
	30% aplitic groundmass / 30% aplitic.
3480	3475-3500: [illegible] @ 75° [illegible] (Fit 2068)
3500	Fine [illegible] [illegible] zone? None obvious.
3520	No faults
3540	3566 [illegible] 60° small 1' crushed zone
3560	Mod. [illegible] Py + [illegible] see vns as described.
3580	Tourmaline @ 3594'
3600	Vs [illegible] variable 2x to 10 mm in thickness.
3620	Vn selvages [illegible] intensity change in alt style?
3640	2" gouge 3663
3680	Alteration [illegible] mask sulfides
3700	[illegible] Py [illegible] surface [illegible]?
3820	[illegible] in veins
3900	3904-05, 1' [illegible] 30% Py n Vn. Small [illegible] @ 3904-06 [illegible] on fracs @ 3908
3920	Vert. 1" wide Qtz-Py Vn @ 3925'
3940	[illegible] 3950-53. 3952-55 [illegible]
3960	Loc varied [illegible]
4000	Apparent feldspar [illegible] to [illegible]. [illegible] over some intervals
4020	Qz Vn / Py - [illegible]
4040	4041-4046, 4052-4053 [illegible] Py. Sub [illegible] crushing
4060	Loc [illegible] Bx zone? [illegible] (Episodes & 21 mush)
4080	[illegible]
4100	[illegible] 4116-4124 [illegible] 10% Py [illegible]
4120	AA [illegible]
4160	Selvages [illegible]

(6)

GEOLOGIC LOG

PROJECT Indian Mtn HOLE NO. IM-1A
Collar elev. ____ Final depth 4580'
Coord N. ____ Inclination V.
Coord E. ____ Page 6 of ____
Logged by MAMILLOCK FR & HGRIMES
Date start ____ Date finish ____

DEPTH From	DEPTH To	Int'vl	Core Recovery	VULT NOTES	ASSAY Cu	Pb	Zn	Au	Ag	Mo
4220	4240	20	100							
4240	4260	20	100							
4260	4280	20	100							
4280	4300	20	100							
4300	4307.4	7.4	100	4300-4310→	670	80	840	<.02	1.6	
4307	4320	13	100							
4320	4340	20	100							
4340	4360	20	100							
4360	4380	20	100							
4380	4400	20	100							
4400	4420	20	100	4400-4410→	425	28	195	<.02	1.1	
4420	4440	20	100							
4440	4460	20	100							
4460	4480	20	100							
4480	4500	20	100							
4500	4520	20	100	SHEAR VEIN EST. CONTACT	1100	60	890	<.02	1.8	
4520	4540	20	100							
4540	4560	20	100	4550-4560→	1080	48	345	<.02	1.2	
4560	4580	20	100	4570-4580→	1500	65	780	<.02	2.0	

TD @ 4580'

MINERALOGY AND STRUCTURE

Lithologic Code	Contacts	Conditions	Fracture Dir.	Fracture Dip	Py Type	Py-Vol	Hematite	Magnetite	Cpy Type	Alunite	K-Feldspar	Sericite	Chlorite	Carbonate	Calcite	Gypsum	Vol %	Avg Grain Size	Bx Matrix	Bx Fragments	Bx Sizes	Veinlets Vol/ft	Veinlets Type	Veinlets Comments	Fault Gouge Comments
T	T	-	-	-	5	4	-	-	-	-	1	10	0	-	35	-	-	-	-	5	-	-	2-3	-	2.5/20
T	X3	-	-	-	4	4-5	-	-	-	-	1	10	-	-	35	-	-	-	-	1	-	-	5-3	1.5	34/60
T	X1	-	-	-	5	54	-	-	-	-	1	10	-	-	35	-	-	-	-	1	-	-	4	-	3/40-60
T	X	-	-	-	4-5	5	-	-	-	-	1	14	2	1	35	-	-	-	-	1	-	-	3	-	2-3/40-60
-	-	-	-	-	1	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	—
-	-	-	-	-	2	3	-	-	-	-	1-2	10-3	1-5	1	35	-	-	-	-	-	-	-	3	3	1-2/40-60
-	T	-	-	T, Py	2	4-5	-	-	-	-	2	10	1-2	<1	35	-	-	-	-	-	-	-	-	-	3/40-60
-	T	-	-	-	1-4	5-2	-	-	-	-	1-3	10	1	<1	35								2-3	-	2-3/40-60
2-3	T	-	-	-	3-2	4	-	-	-	-	1	12	2	1	33	-	-	-	-	-	-	-	1	-	3/20-60
T	T-3	-	-	-	3-4	3	-	-	-	-	1-2	0-12	<1	1	33	-	-	-	-	-	-	-	2-3	-	4-3/20-60 K-CLAYS
T	T	-	-	-	5	3	-	-	-	-	1	14	<1	1	35								1-2	-	4-3/20-60
T	T		-	-	2-4	3	-	-	-	-	1	14	<1	1	35	-	-	-	-	-	-	-	2		3-2/20-60 SOME 0-CLAY
T	T	-	-	-	4	3-4					1	14	<1	1	35	-	-	-	-	-	-	-	2	-	AA
	As		AS ABOVE		-		-				-	As ABOVE							-	-	-	-	2	-	As ABOVE
	As ABOVE				5-6	4	-	-	-	-	-	1													6-7/40-60
T	T				5	1	-	-	-	-	-	1	As ABOVE			-	-	-	-	-	-	-	1	-	3/40-60
T	T				5-7	3	-	-	-	-	-	-	As ABOVE			-	-	-	-	-	-	-	1-2		4-5/40-70
T	T				5-7	5							As ABOVE												
T	T	-	-	-	4-5	5							As ABOVE										3		As ABOVE

ROCK TYPE AND REMARKS

4229-4233 Y [illegible] Py [illegible] - 230'-mm/ft [illegible]
[illegible] ZONE 4232-34

STRONG PENETRATIVE DEFORMATION OF FABRIC/VEIN

16' Th Py VEIN @ 4280 w/ 42

INTENSE BX. COMPOSED OF FG MATRIX, ABOVE 80% - LARGE FRAG PIECES → [illegible] LATE SHOCK BRECCIA

FRAG THICK SATURATED [illegible]

FINE DATHO CLASTS [illegible]

ABU BOX STAINING - SUBSTITUTION PERVASIVE THROUGH MATRIX - IN SELVEDGES BLEACH OUT TOWARD ZONE

K-SPARS ON FRAC SURFACES [illegible]

Y ABU PUG SPOTS - HIGH [illegible]

4229-33 FG SMALL FRAG BRECCIA - CLAY [illegible]

STRONG - TYPICAL SERSPAT

FRAG CHALCOCITE [illegible]

[illegible] Py [illegible]

[illegible]

[illegible]

[illegible] VEIN - 4550-60

[illegible]

BUCKET BRECCIA ZONE ACTIVITIES

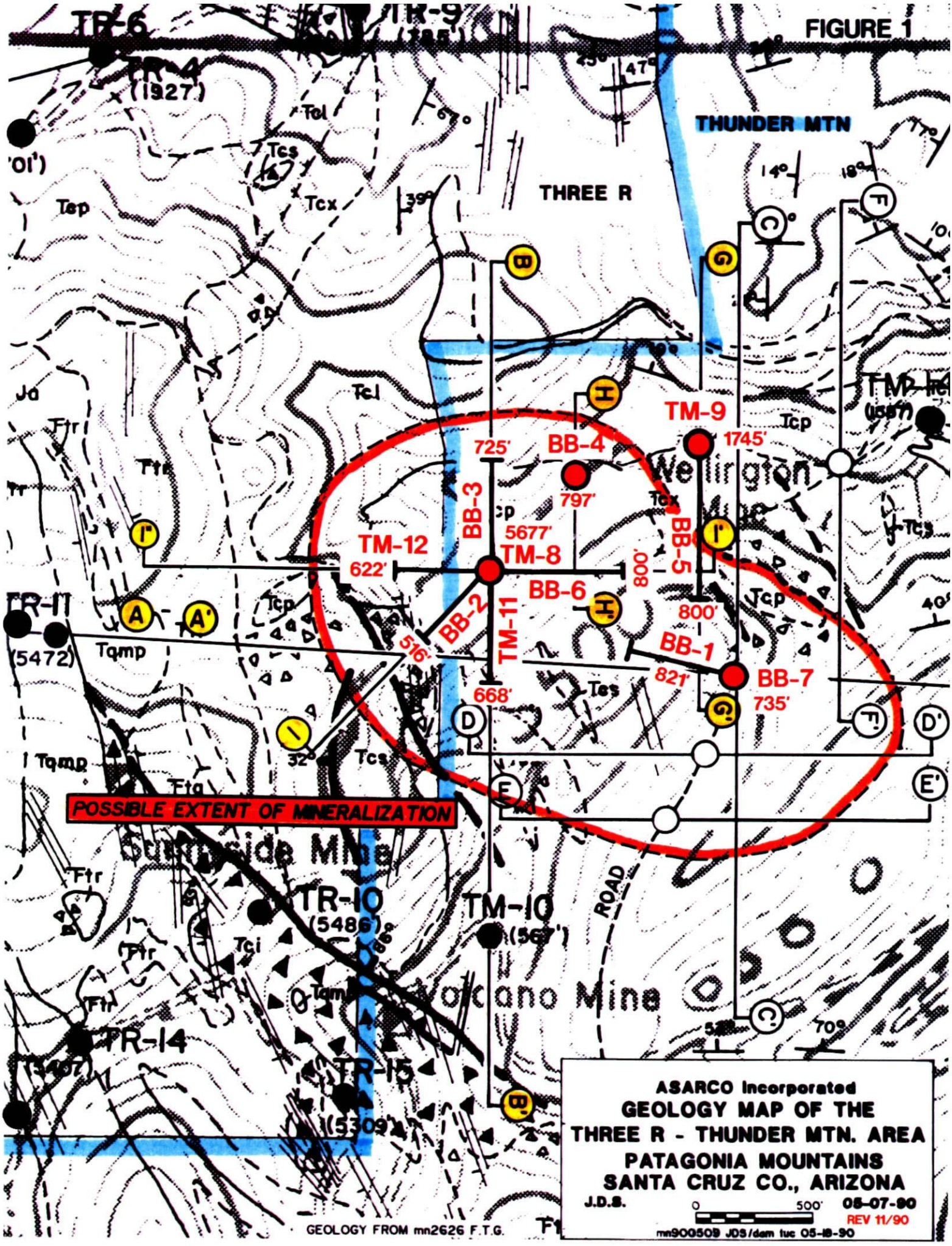
Attached Figure 1 is a portion of the Bucket Breccia area. Ten holes have now been drilled in the area to outline and determine the thickness/grade of the shallow level copper sulfide blanket. The holes are Bucket Breccia -1 (BB-1), TM-8, -11, -12, and BB-2 thru BB-7, shown in Figures 2 thru 5.

A review of the sections indicate an upper near surface zone of plus 0.4% copper, and often a deeper second zone of plus 0.4% copper, separated by a variable zone which ranges in grade from 0.39% copper down to below 0.10% copper.

Drilling has been terminated at this time. Review of the assay results and distribution will be undertaken as well as a 3 hole bottle roll test for soluble copper extration parameters, during the first quarter of 1991.

Individual drill hole logs and assays for BB-2 thru BB-7 are included as Attachment C.

FIGURE 1

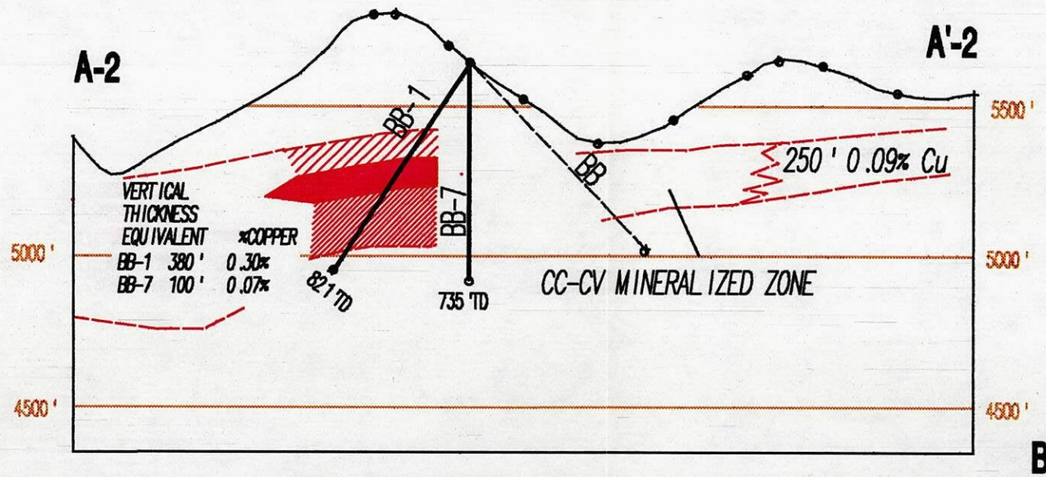


ASARCO Incorporated
GEOLOGY MAP OF THE
THREE R - THUNDER MTN. AREA
PATAGONIA MOUNTAINS
SANTA CRUZ CO., ARIZONA

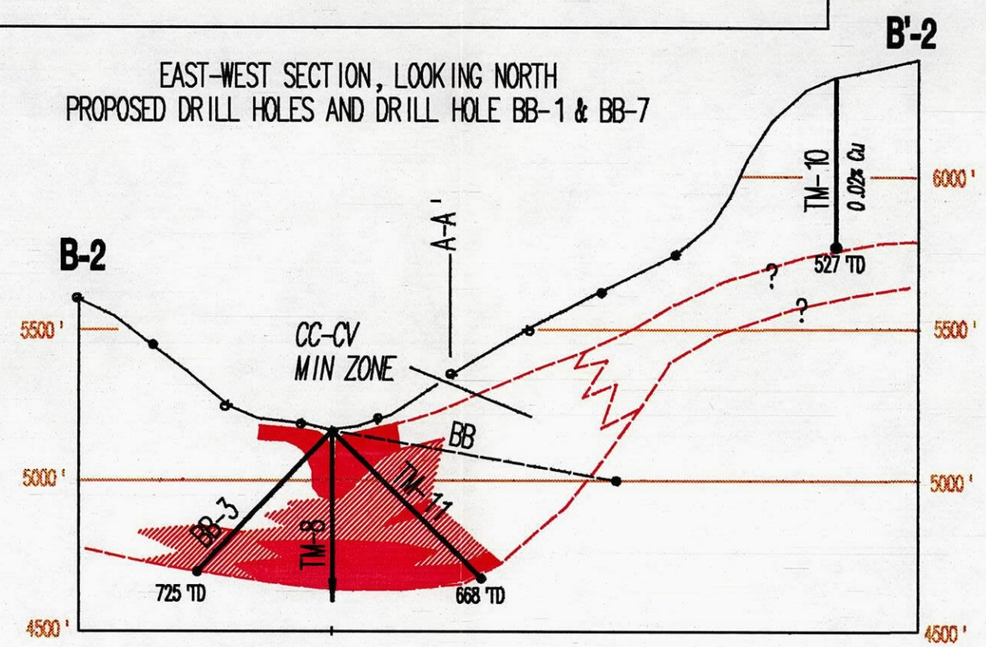
J.D.S. 0 500' 05-07-90
REV 11/90
mn900509 JDS/dam tuc 05-18-90

GEOLOGY FROM mn2626 F.T.G.

FIGURE 2



EAST-WEST SECTION, LOOKING NORTH
PROPOSED DRILL HOLES AND DRILL HOLE BB-1 & BB-7



VERTICAL
THICKNESS
EQUIVALENT %COPPER
BB-3 420' 0.18%
TM-8 410' 0.43%
TM-10 ABOVE ZONE
TM-11 570' 0.32%

NORTH-SOUTH SECTION, LOOKING EAST
PROPOSED DRILL HOLE AND DRILL HOLES
TM-8, TM-10, TM-11 AND BB-3

EXPLANATION

- 0.10 - 0.19 % Cu
- 0.20 - 0.39 % Cu
- + 0.40 % Cu

ASARCO Incorporated
THUNDER MOUNTAIN PROJECT
PROPOSED DRILL HOLES

SKETCH SECTIONS A-2 & B-2

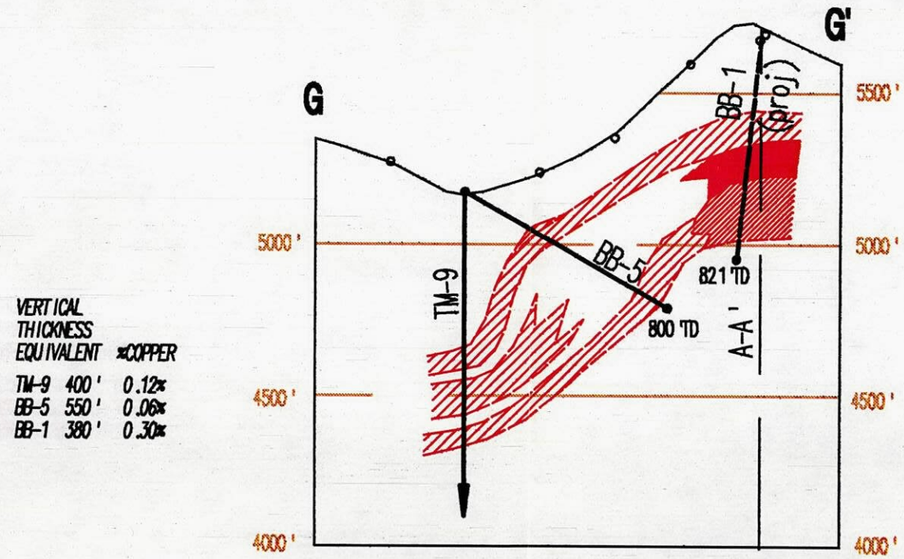
BUCKET BRECCIA ZONE
PATAGONIA MTNS., AZ.

J.D.SELL
05-09-90
REV. 11-90
REV. 01-91

0 250' 500'

mn TM901121 JDS/dam tuc 11-15-90
mn TM910104 JDS/DAM TUC 01-10-91

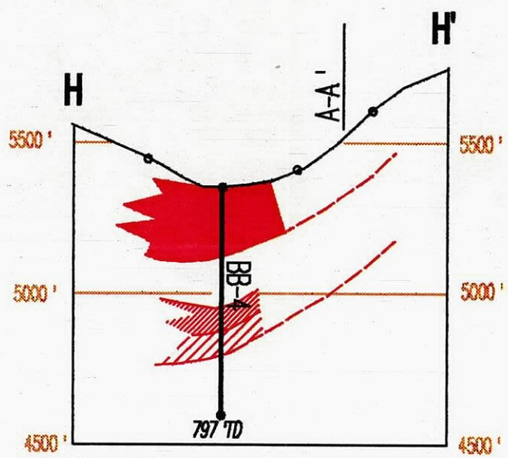
FIGURE 3



VERTICAL THICKNESS EQUIVALENT %COPPER

TM-9	400'	0.12%
BB-5	550'	0.06%
BB-1	380'	0.30%

NORTH-SOUTH SECTION, LOOKING EAST
DRILL HOLES TM-9, BB-1, BB-5



VERTICAL THICKNESS EQUIVALENT %COPPER

BB-4	600'	0.25%

NORTH-SOUTH SECTION, LOOKING EAST
DRILL HOLE BB-4

EXPLANATION

- 0.10 - 0.19 % Cu
- 0.20 - 0.39 % Cu
- + 0.40 % Cu

ASARCO Incorporated

THUNDER MOUNTAIN PROJECT
PROPOSED DRILL HOLES

SKETCH SECTIONS G & H

BUCKET BRECCIA ZONE
PATAGONIA MTNS., AZ.

J.D.SELL

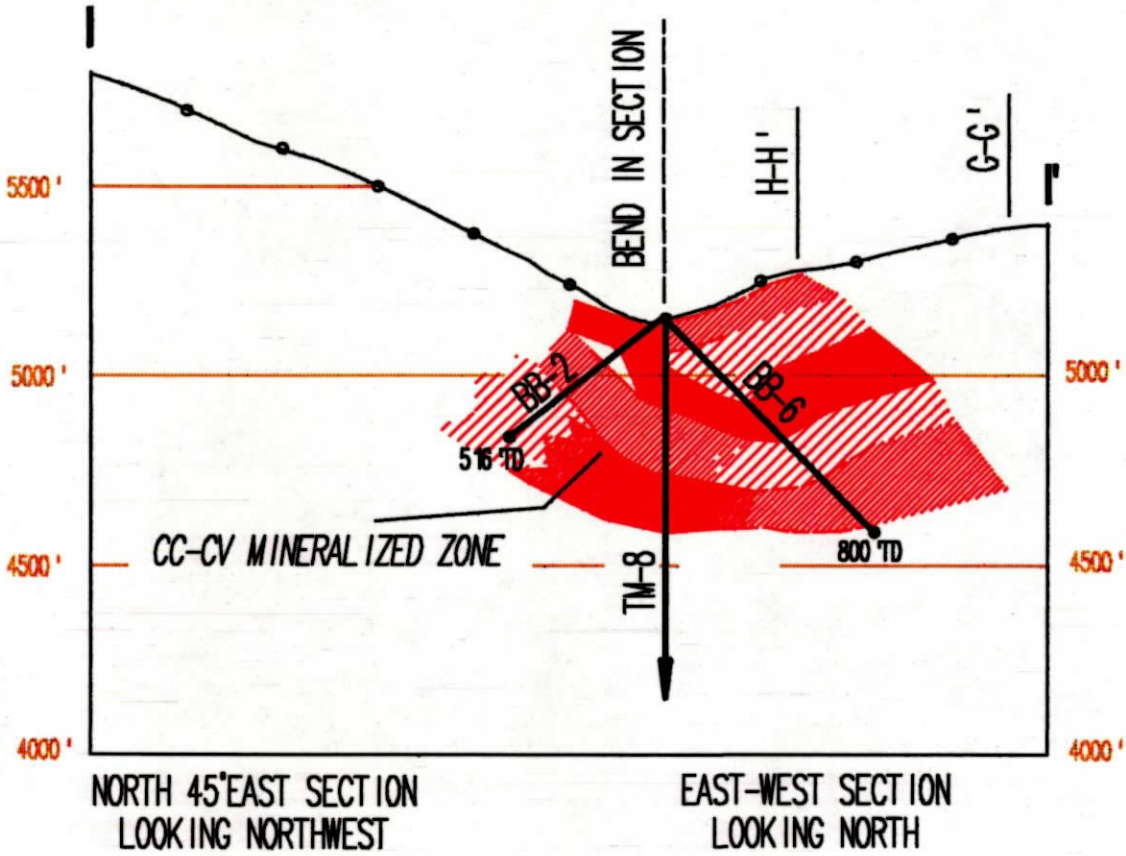
05-09-90
REV 11-90
REV. 01-91

0 250' 500'

mn TM901122 JDS/dam tuc 11-16-90
mn TM910105 JDS/DAM TUC 01-10-91

VERTICAL THICKNESS EQUIVALENT		%COPPER
BB-2	440'	0.25%
TM-8	410'	0.43%
BB-6	540'	0.37
	or 680'	0.31%

FIGURE 4



DRILL HOLES BB-2, BB-6, TM-8

EXPLANATION

0.10 - 0.19 % Cu

0.20 - 0.39 % Cu

+ 0.40 % Cu

ASARCO Incorporated

THUNDER MOUNTAIN PROJECT
PROPOSED DRILL HOLES

SKETCH SECTION I

BUCKET BRECCIA ZONE

PATAGONIA MTNS., AZ.

J.D.SELL

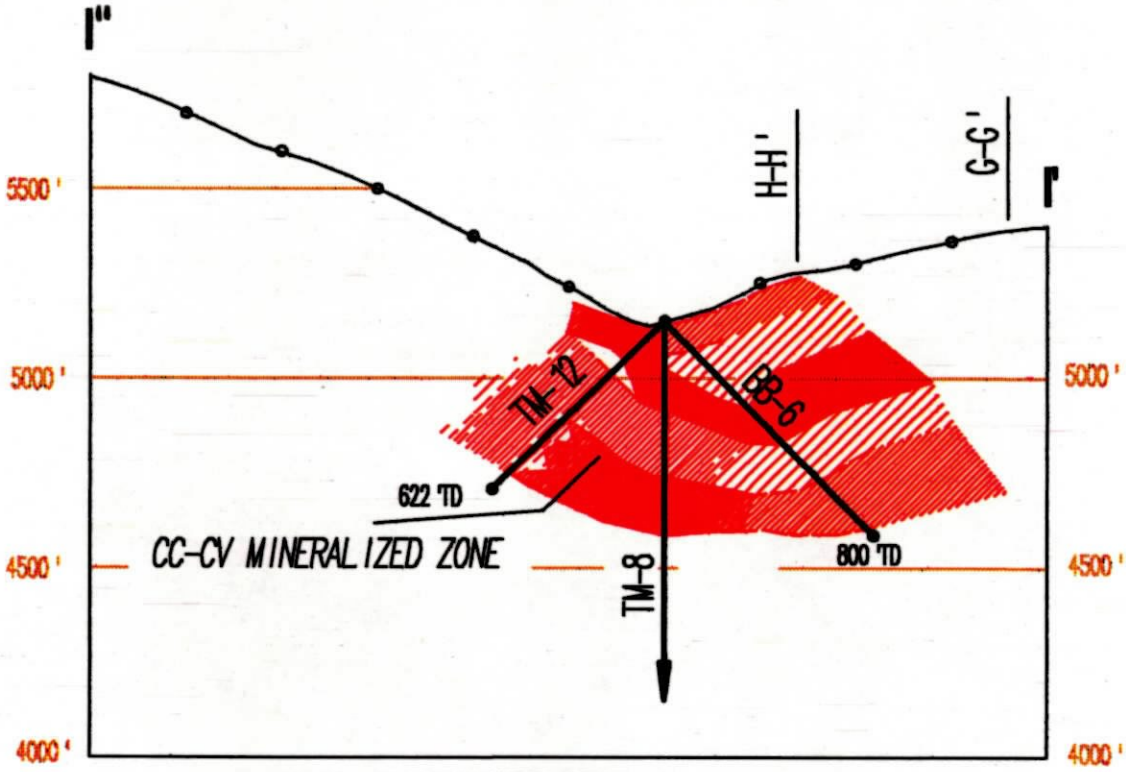
05-09-90
REV 11-90
REV. 01-91

0 250' 500'

mn 901123 JDS/dam tuc 11-16-90
mn TM910106 JDS/DAM TUC 01-10-91

FIGURE 5

VERTICAL THICKNESS EQUIVALENT		%COPPER
BB-12	540'	0.24%
TM-8	410'	0.43%
BB-6	540'	0.37
	or 680'	0.31%



EAST-WEST SECTION
LOOKING NORTH

DRILL HOLES TM-12, BB-6, TM-8

EXPLANATION

0.10 - 0.19 % Cu

0.20 - 0.39 % Cu

+ 0.40 % Cu

ASARCO Incorporated

THUNDER MOUNTAIN PROJECT

PROPOSED DRILL HOLES

SKETCH SECTION I'-I''

BUCKET BRECCIA ZONE

PATAGONIA MTNS., AZ.

J.D.SELL

05-09-90
REV 11-90
REV. 01-91

0 250' 500'

mn 901124 JDS/dam tuc 11-16-90
mn TM910107 JDS/DAM TUC 01-10-91

ATTACHMENT C

DRILL LOGS WITH ASSAYS - HOLE BB-2 THROUGH BB-7

NOTES: ORE MINERALS - ESTIMATED % METAL V = VEIN/FRACTURE FILLED D = DISSEMINATED
GANGUE MINERALS - PYRITE AS %
" " - SILICATE - SULFATE - CARBONATE ALTERATION AS %
" " FeOx MINERALS AS %
STRUCTURE: RQD = % OF GREATER THAN 5" CORE LENGTHS IN RUN

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN. HOLE NO. BB-2
Collar elev. 5145 Final depth 576.5
Coord N. 471,010 Coord E. 865,425
Inclination -35° S45W Page 1 of 2
Logged by H. DOWNEY
Date start 7/11/90 Date finish 8/3/90

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	ASSAY % Cu	ASSAY JABA Cu	ASSAY PPM Ag	ASSAY JABA OZ/T Ag	ASSAY PPM Au	ORE MINERALS CHALCOCITE	COVELLITE	BORNITE	MOLYBDENITE	STHALENITE	GALENA	GANGUE MINERALS PYRITE D	PYRITE V	GOETHITE	JAROSITE	RED HEMATITE	SERICITE	CHLORITE	QUARTZ MGN	QUARTZ DISS.	ALUNITE	CALCITE	STRUCTURE ∠ TO CORE AXIS OPEN FRACT/ FOLIATION	FAULTS	RQD %	ROCK TYPE and REMARKS
0	12	12	—	—	—	—	—	—																					ROCKBIT TO 12'
12	20	8	95	0.03	0.05	0.5		.012	.01D	01D	TR				3					60	10	2	10	5		1 @ 60		60	12 - QUARTZ FELDSPAR PORPHYRY: white, soft intensely altered porphyry
20	30	10	100	0.02	0.21	0.2		.014	.01D	01D	TR		0.05	TR	3					60	10	2	10	5		1 @ 55		70	originally 45% 3 mm. feldspar (phenocrysts?) obliterated by
30	40			0.04	0.05	0.5		.016	.01D	01D	TR				3	2				60	10	2	15	5		1 @ 60		80	pasty ground mass. Feldspars 20% altered to sericite and
40	50			0.48	0.22	0.9	0.4	.010	.05V	01D	TR				3	2				60	10	2	10	5		1 @ 60		70	probably some mafic minerals. Pyrite fragments throughout
50	60			0.58	0.23	5.0		.022	.1D .1V	.05	TR				3	2				60	10	2	10	5		2245		40	in cavities and filling open fractures or veinlets (not quartz veins)
60	70			0.51	0.34	4.0		.012	.1D .1V	.1D	TR				3	2				60	10	2	10	5		2 @ 60		50	Chalcocite coat and rims pyrite - covellite probably coating pyrite
70	80			0.72	0.40	2.7		.022	.3D .3V	.1D .1V	TR				5	3				60	10	2	15	5		1 @ 45		70	and filling pits. Sphalerite 1% - Q 27.5. Alunite also filling
80	90			0.82	0.39	1.8		.024	.3D .3V	.1D .1V	TR				5	3				60	10	2	15			2 @ 45		60	voids and fractures. No more minerals
90	100			0.51	0.40	1.1		.006	.3D .3V	.1D .1V	TR				5	2				60	10	2	15			1 @ 70		50	
100	110			0.22	0.29	1.8		.026	.15V	.1D	TR				4	2				60	10	2	15			1 @ 70		80	120 - QFP predominant but short sections of slate
110	120			0.19	0.20	2.1		.020	.1D .1V	.1D	TR				4	1				60	5	2	15			1 @ 45		70	- 116.5 (pasty eye tuff) with angular fragment 1-3 mm.
120	130			0.41	0.68	1.7		.030	.1D .1V	.1D	TR				4	1				60	5	2	15			1 @ 45		50	pasty shards, white volcanic tuff predominately
130	140			0.26	0.96	1.1		.026	.1D .05V	.1D	TR				4	1				60	5	2	15			1 @ 60		40	grey volcanics. 123-136; 155-158
140	150			0.04	0.54	2.0		.006	.1D .05V	.1D	TR				4	1				60	5	2	10			1 @ 70		50	
150	160			0.11	0.41	1.2		.036	.1D .05V	.1D	TR				4	1				60	5	2	10			1 @ 60		60	78-88 Breccia zone - Angular frags of QFP in volcanic
160	170			<.01	0.45	3.4		.016	.1D .05V	.1D	TR D				4	1				60	10	2	10			1-45	162-165	60	pyrite matrix - abundant rocky chalcopyrite associated
170	180			0.01	0.28	7.6		.016	.1D .05V	.1D	TR D				3	1				40	5	5	20			1-60		80	with pyrite in matrix
180	190			0.34	0.54	4.5		.012	.1D .05V	.1D	TR D				4	1				50	10	2	5			1-60		70	
190	200			0.22	0.47	7.3		.024	.1D .05V	.1D	TR D				4	1				60	10	2	10			<1-60		80	112-113 Short breccia zone not as mineralized as above
200	210			0.17	0.78	4.4	0.3	.040	.1D .05V	.1D	TR D				4	1				60	10	2	10			<1-45		80	162-165 Fault? breccia - rocky chalcopyrite/pyrite matrix
210	220			0.36	0.69	2.2		.006	.1D .05V	.1D	TR D				4	1				50	20	2	10			1-45		80	176.5-183.0 VOLCANIC AGGLOMERATE: Lapilli to blocks size (5 mm - 2
220	230			0.20	0.69	3.4		.020	.1D .05V	.1D	TR D				4	1				50	20	2	10			<1-60		80	angular mafic fragments grey volcanic, pyrite diff. throughout
230	240			0.20	0.52	3.0		.022	.1D .05V	.1D	TR D				5	1				50	20	2	10			<1-60		80	QFP matrix. Many pyrite inclusions.
240	250			0.15	0.78	4.9		.016	.1D .05D	.1D	TR D				5	1				50	20	2	10			<1-60		80	
250	260			0.33	0.82	14.0		.008	.1D .3V	.1D	TR D				5	1				50	20	2	10			1-60		80	183.0-352.3 QUARTZ FELDSPAR PORPHYRY: white, soft, intensely
260	270			0.21	0.82	60.0		.050	.3D .3V	.3D	TR D				5	2				50	20	2	10			1-70		80	silicified, pasty eye. Pyrite blebs 1-5 mm. disseminated
270	280			0.32	0.59	44.0		.070	.3D .3V	.3D	TR D				5	2				50	20	2	10			1-70		90	throughout. Many pasty veins with associated pyrite.
280	290			0.28	0.64	15.0		.030	.3D .3V	.3D	TR D				5	2				50	20	2	10			<1-80		90	Pyrite commonly rimmed with chalcocite/covellite.
290	300			0.25	0.83	7.8		.034	.3D .3V	.3D	TR D				5	2				50	20	2	10			1-45		80	Better copper section 262' - 318'
300	310			0.42	0.71	7.8		.040	.3D .3V	.3D	TR D				5	2				50	20	2	10			<1-80		90	
310	320			0.43	0.56	7.9		.030	.3D .3V	.1D	TR D				5	1				50	20	2	10			1-80		90	
320	330			0.20	0.89	4.5		.030	.3D .3V	.1D	TR D				4	1				50	20	2	10			1-60	322.0 322.5	90	322-322.5 3" gouge @ 45°
330	340			0.29	0.46	6.0		.012	.3D .3V	.1D	TR D				4	1				50	20	2	10			1-70		80	501.5 INTRUSIVE?
340	350			0.31	0.89	3.2		.014	.3D .3V	.1D	TR D				4	1				50	20	2	10			<1-60		90	352.3 - TUFFACEOUS BRECCIA: Angular to rounded volcanic or pyroclastic
350	360			0.26	0.82	2.7		.03	.3D .3V	.05D					4	1				30	10	3	15			<1-85		90	fragments in pasty eye tuff matrix. Predominantly
360	370			0.17	0.87	2.8		.02	.3D .3V	.05D					4	1				30	10	3	15			<1-70		90	fragments are dark grey to black andesite - some are similar to QFP
370	380			0.12	0.62	3.8		.04	.3D .1V	.05					4	1				30	10	3	15			1-70		90	sizes from 1 mm to 2" become larger and more abundant
380	390			0.09	0.64	1.6		.02	.2D .1V	.05D					4	1				35	10	3	15			<1-70		90	with depth. This unit may also be a volcanic flow or
390	400			0.20	0.89	6.6		.05	.3D .3V	.05D					4	2				25	10	3	10	1		<1-70		90	breccia (pyrite sphalerite 1% and trace lead). Fine grained
400	410			0.05	0.97	4.7		.06	.3D .3V	.05D					4	2				35	10	3	10	5		<1-70		90	bandings (see above) for QFP. Abundant fine grained
410	420			0.12	0.80	4.1		.08	.3D .3V	.05D					4	2				35	10	3	13			1-70		80	pyrite and fracture filling pyrite. Some chalcopyrite
420	430			0.14	0.63	3.8		.03	.3D .3V	.05D					4	2				35	10	3	10	3		<1-70		90	Pyrite is associated with quartz veinlets and

HM 2558 GM

GEOLOGIC LOG

PROJECT THUNDER MTN

PROJECT THUNDER MTN — HOLE NO. BB-2
Collar elev. 5145 — Final depth 516½
Coord N. 111,010 — Coord E. 865,425
Inclination -35° S 45 W — Page 2 of 2
Logged by
Date start 7/11/90 — Date finish 8/8/90

DEPTH from	DEPTH to	int'vl	% CORE RECOV.		ASSAY % Cu	ASSAY JABA Cu	ASSAY PPM Ag	ASSAY JABA OZ/T Ag	ASSAY PPM Au	ORE MINERALS: CHALCOCITE	COVELLITE	BORNITE						GANGUE MINERALS: PYRITE	PYRITE	COSTATITE	LIMONITE	RED HEMATITE			SERICITE	KAOLIN/CLAY	QUARTZ VEIN	QUARTZ DISS	FLUOR.							STRUCTURE (L = L TO CORE AXIS): BRGN FRACT/FT-L	FAULTS	RQD	ROCK TYPE and REMARKS
430	440	10	100		0.15	0.59	6.0		.06	.2 D .1 V	.05 D							4	2						35	10	3	15	1							<1-70		90	CONT. - TUFFACEOUS BRECCIA (AGGLOMERATE) Some fractures are
440	450				0.17	0.90	1.2		.03	.05 D .04 V	TR D							4	1						35	10	3	25	1							<1-70		90	filled with pyrite, rich black silica (chert) - also thin
450	460				0.13	0.55	1.0		.02	.05 D .05 V	TR D							3	1						35	10	3	25	1							<1-70		90	of white chert - 6" chert seam or seen at 404'. Fractures
460	470				0.03		0.5		.02	TR D TR V								3	TR			2			20	5	3	35								<1-60		90	red hematite below w/fine grained pyrite 421'-465'. Copper
470	480				0.14		0.4		.05	TR D TR V								2	TR			1			15		5	40								<1-60		90	decreasing after 430. NO SULFIDES BELOW 485 (A few cell
480	490				0.19		2.2		.19	TR D TR V								1	TR			1					5	80								1-60		80	after pyrite in oxidized zone 486 - 490)
490	500				0.10		2.9		.10	TR D TR V												1					5	50								1-45		80	-501.5 Brown AGGLOMERITIC SCORIA - open vesicles in ash
500	510				0.01		1.6		.10													1					5	70								2-45		50	511.5 matrix - whitish grey angular fragments to 1" dia. Well
510	516.5				0.01		1.2		.06																		5	90								3-45		25	defined contact @ 45° @ 511.5.
			BOTTOM		OF		HOLE		516.5																														-516.5 Gray BRECCIATED CHERT layer - Large angular fine
																																							grained recrystallized chert fragments interlayered w/
																																							angular cherty lapilli, agglomerate. Nil sulfides - red
																																							hematite coatings in places.

mn 2556 dm

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN — HOLE NO. BB-3
Collar elev. 5145 — Final depth ~~770~~ 725
Coord N. 171,010 — Coord E. 865,425
DUE NORTH Inclination -45° — Page 1 of 2
Logged by H. DOWNEY
Date start 8/8/90 — Date finish 9/4/90

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	ASSAY % Cu	ASSAY oz/T ~~Pt~~ Au	ASSAY oz/T ~~Pd~~ Ag	ORE MINERALS CHALCOCITE	COVELLITE	BORNITE	GANGUE MINERALS PYRITE-DISS	PYRITE-VEIN	SERICITE	ARGILLIC	QUARTZ-VEIN	QUARTZ-DISS	ALUNITE	STRUCTURE OPEN FRACS/FT. -<	FAULTS	RQD %	ROCK TYPE and REMARKS
0	14	14																		OVERBURDEN (ROCK 131F)
14	20	6	95	0.13	0.046	<0.01				2		60	10	1	10		1-70		60	14- QUARTZ FELDSPAR PORPHYRY - Light gray to white, soft intensely altered (sericite). Original texture destroyed by alteration. Originally 75% plagioclase? 10% quartz? low to nil mafics. 2-3% pyrite ½ mm-1 mm. Veins - finger sericite & chalcedonic running some of the pyrite.
20	30	10	100	0.55	<0.002	0.02		0.05D	0.05D	2		60	10	1	10		1-60		80	
30	40			0.80	<0.002	<0.01		0.05	0.05D	2		60	10	1	10		2-45 60		40	
40	50			0.51	<0.002	0.03		0.05D	0.05D	3		60	10	1	10		2-45		20	
50	60			1.30	<0.002	<0.01		0.05	0.05D	3		60	10	1	15		2-45		30	
60	70			0.62	<0.002	<0.01		0.05D	0.05D	3		60	10	1	10		1-60		60	
70	80			0.28	<.002	0.16		0.05D	0.1D	3		60	10	1	10		1-45		50	
80	90			0.44	<.002	0.08		TRD	0.05D	2		70	10	1	10		1-45		50	
90	100			0.06	<.002	<.01			0.05D	2		70	10	1	10		<1-45		80	
100	110			0.11	<.002	0.01			0.05D	2		70	10	1	10		<1-60		90	
110	120			0.10	<.002	0.01			0.05D 0.05✓	2	1	70	10	2	10		<1-70		80	1 mm veins @ 35° 110-120
120	130			0.18	<.002	0.05			0.05D 0.05✓	2	1	70	10	2	10		<1-70		90	Pyrite blebs increase in size (up to 4mm dia) slight
130	140			0.18	<.002	<.01			0.05D 0.05✓	2	1	80	10	2	20		<1-70		90	increase in pyrite veining 110-
140	150			0.07	<.002	<.01			0.05D 0.05✓	2	1	60	10	2	20		1-45		60	
150	160			0.01	<.002	<.01			0.05D 0.05✓	2	1	60	10	1	20		1-70		70	
160	170			0.05	<.002	<.01			0.1D	2		70	10	1	10		2-60	164-170?	20	Gouge zone - may be fault 164-170
170	180			0.01	<.002	<.01			0.1D	2		70	10	1	10		1-70		50	
180	190			0.08	<.002	0.03			0.1D	2		70	10	1	10		1-70	182-184	70	" " " " " 182-184
190	200			0.04	<.002	0.15			0.1D	2		70	10	1	10		1-60		60	
200	210			<.01	<.002	<.01			0.1D	3		70	10	1	10		1-60		70	
210	220			0.07	0.002	0.07			0.1D	3		60	20	1	10		1-60	217.5-219	60	217.5-219 FAULT BRECCIA Angular basalt gray fragments depth in gray volcanic - light gray chert in gouge matrix
220	230			0.12	<.002	0.10			0.1D	3		60	10	1	20		1-70	224-232	70	224-232 Tuffs - sections of breccia or agglomerate some fragments block size.
230	240			0.04	<.002	0.11			0.1D	3	1	60	20	2	10		1-70	238-240-	50	Gouge 238-240
240	250			0.06	<.002	0.01			0.1D	3		60	10	1	20		2-70		30	The pyrite seen throughout the hole and particularly at
250	260			0.09	<.002	0.05			0.1D	3	1	60	10	3	20		1-60		70	250-260. has definite peach-purple tinting suggesting
260	270			0.12	<.002	0.01			0.1D	3		60	10	1	20		1-70		60	fine grained barite intermixed - Covellite & pyrite may be altered from rock. Do some polished
270	280			0.07	<.002	<.01			0.1D	3		60	10	1	20		<1-70		80	sections for check.
280	290			0.07	<.002	0.04			0.1D	3		60	10	1	20		<1-70		80	
290	300			0.08	<.002	0.09			0.1D	3		60	10	1	20		1-70		70	
300	310			0.05	0.004	0.07			0.1D	3		60	10	1	20		1-70		50	
310	320			0.06	0.004	0.03			0.1D	3		60	10	1	20		1-80		50	
320	330			0.03	0.002	0.04			0.1D	3		60	10	1	20		1-80		50	
330	340			0.07	<.002	0.01		0.2D	0.1D	3		60	10	1	20		1-70		70	340-342 Pyrite oxidizes to brown FeOx - a few chalcocite blebs
340	350			0.06	<.002	<.01		0.2D	0.1D	3		60	10	1	20		1-60		60	
350	360			0.07	<.002	<.01		0.05D	0.1D	3		60	10	1	20		1-60	350-352 352-355	60	gouge sections 350-360
360	370			0.10	<.002	<.01		0.05D	0.1D	3		60	10	1	20		1-60		70	
370	380			0.04	<.002	0.02		0.05D	0.1D	3		50	20	1	20		1-45		60	
380	390			0.09	<.002	<.01		0.1D 0.05✓	0.1D	3	1	50	20	3	20		1-60		70	Slight increase in hydrothermal sulfide veinlets w/ chalcocite? / covellite below 380' (380-490)
390	400			0.05	<.002	<.01		0.1D 0.05✓	0.1D	3	1	50	20	3	20		<1-80		90	
400	410			0.06	<.002	0.02		0.1D 0.05✓	0.1D	3	1	50	20	3	20		<1-80		90	
410	420			0.03	<.002	<.01		0.1D 0.05✓	0.1D	3	1	50	20	3	20		1-60		60	
420	430			0.07	<.002	<.01		0.05D 0.05✓	0.1D	3	1	50	20	3	20		1-70		60	

mn 2565 dm

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN. HOLE NO. BB-3
Collar elev. 5145 Final depth 725'
Coord N. 171,010 Coord E. 865,425
Inclination -45° DUE NORTH Page 2 of 2
Logged by H. DOWNEY
Date start 8/8/90 Date finish 9/4/90

DEPTH from	DEPTH to	int'vl	% CORE RECOV.		ASSAY % Cu	ASSAY OZ/T Au	ASSAY OZ/T Ag	ORE MINERALS: CHALCOCITE	COVELLITE	BORNITE	HEMATITIC Cu Ox	GANGUE MINERALS: PYRITE-DISS	PYRITE-VEIN	SERICITE	APGILLIC	QUARTZ-VEIN	QUARTZ-DISS	ALUNITE	RED HEMATITE	GOETHITE	JAROSITE	STRUCTURE: OPEN FRACTS/FT-2	FAULTS	RQD %	ROCK TYPE and REMARKS
430	440	10	100		0.10	<.002	<.01	0.05D 0.05V	0.1D	TR D		3	1	50	20	3	20					1-60		70	CONT.- QUARTZ FELDSPAR PORPHYRY - Intensely altered
440	450				0.06	<.002	<.01	0.05D	0.1D	TR D		3	1	5	20	3	20					1-60		70	
450	460				0.10	0.002	<.01	0.05D	0.1D 0.05V	TR D		3	1	60	10	3	20					1-45		80	
460	470				0.05	0.002	<.01	0.05D	0.1D 0.05V	TR D		3	1	60	10	3	10					1-60		80	
470	480				0.07	<.002	<.01	0.05D	0.1D 0.05V	TR D		3	1	60	10	3	10					1-45		60	
480	490				0.08	<.002	<.01	0.05D	0.1D	TR D		3		70	10		10					1-45		60	Nil mining 471' - 555'
490	500				0.06	<.002	0.02	0.05D	0.05D			3		70	10		10					<1-45		80	
500	510				0.14	<.002	0.03	0.05D	0.05D			3		70	10		10					1-45		70	
510	520				0.20	<.002	<.01	0.05D	0.05D			3		70	10		10					1-60		50	
520	530				0.17	<.002	0.04	0.05D	0.05D			3		70	10		10					<1-45		80	
530	540				0.11	0.002	<.01	0.05D	0.05D			3		70	10		10					1-45		80	
540	550				0.05	<.002	<.01	0.05D	0.05D			3		70	10		10					1-45		70	
550	560				0.13	<.002	0.04	0.05D	TR D		0.1D	2		40	40		10	10	3			1-45	-555-	60	555-640 - Fault Zone - Gouge, porous, sulfides leached
560	570				0.39	<.002	0.13	0.05D	TR D		0.1D	2		40	40		10	10	3			2-15	↑	20	and oxidized to red hemat.t.. & limonite - trace
570	580				0.18	0.002	0.12	0.05D	TR D		0.1D	2		40	40		10	5	1			1-15		40	jarosite - grain of rock & fault is 15° to core
580	590				0.10	0.002	0.04	0.05D			0.2D			40	40		10	10	3			1-45		60	axis indicating a true width of 20'
590	600				0.02	0.004	<.01	0.05D			0.2D			40	40		10	10	3	TR		1-70	H	70	
600	610				0.18	0.004	0.06	0.05D			0.2D			40	40		10	10	3	TR		2-70	3	20	
610	620				0.30	<.002	0.02	0.05D			0.1D	2		50	30		10	2	2	TR		1-60	4	60	
620	630				0.33	<.002	0.02	0.05D	TR D		0.1D	2		50	30		10	2	1			1-70		70	
630	640				0.55	0.004	0.23	0.05D	TR D		0.1D	2		60	20		10	2	1	TR		2-15	↓	20	(INTRUSIVE BRECCIA)
640	650				0.40	<.002	0.08	0.1D	0.05D			3		50	10	2	20	5	5			1-60	640	80	640-722 TUFFACEOUS VOLCANIC AGGLOMERATE - Angular fragments
650	660				0.35	0.002	0.13	0.1D	0.05D			3		40	10	2	30					1-70		60	of grey-tan chert and dark grey silicified andesite
660	670				0.19	<.002	0.11	0.1D	0.05D			3		40	10	2	30					1-60		80	in quartz-feldspar matrix. Probably same unit as
670	680				0.30	<.002	<.01	0.1D	0.05D			3		30	10	2	40					1-60		80	found in lower sections of BB-2. Fragment sizes
680	690				0.36	0.002	0.11	0.1D	0.05D			3		30	10	2	40					1-60		70	increase with depth (begin @ 1-5 mm, increase
690	700				0.33	0.002	<.01	0.1D	0.05D			3		30	10	2	40					1-60		80	to 1" @ 665' to 2" from 690' to 722') Very fine
700	710				0.36	<.002	0.04	0.1D	0.05D			3		30	10	2	40					1-70		80	grained disseminated pyrite with trace covellite & bolsin
710	720				0.17	<.002	<.01	0.1D	0.05D			3		30	10	2	40					1-70		20	coatings.
720	725				0.02	<.002	0.02	0.05D	0.05D			3		30	10	2	40	5	3			2-45		20	722-725 FAULT BRECCIA - Angular fragments of aggregate in
BOTTOM OF HOLE-725																									hematite / limonite gouge matrix.

mn 2555.dm

ORE MINERALS – ESTIMATED % METAL
GANGUE MINERALS – PYRITE AS %
SILICATE – SULFATE CARBONATE AS %

V = VEIN/FRACTURE FILLED
D = DISSEMINATED

STRUCTURE: RQD = % OF GREATER THAN 5" CORE LENGTHS

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN
Collar elev. 5115
Coord N. 171,400
Inclination -90°
Logged by H. DOWNEY
Date start 9/5/90

HOLE NO. BR-4
Final depth 797
Coord E. 865,850
Page 1 of 2
Date finish 9/30/90

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	ASSAY % Cu	ASSAY oz/t Au	ASSAY oz/t Ag	ORE (ESTIMATES) MINERALS CHALCOCITE	COVELLITE	BORNITE	SPHALERITE	GANGUE MINERALS PYRITE-DISS	PYRITE-VEIN	SILICA-VEIN	SILICA-DISS	SERICITE	ARGILLIC	ALUNITE	STRUCTURE ∠ TO CORE AXIS OPEN FRACS/FT-2	FAULTS	% RQD	ROCK TYPE and REMARKS
0	8						—	—			—			1	1	1					OVERBURDEN – ROCK BIT TO 8'
8	20	12	100	0.43 0.59	0.004 0.008	0.02 0.17	0.1D	0.1D			3			15	40	30		1-70		50	8– QUARTZ FELDSPAR PORPHYRY – White to light gray –
20	30			0.83	2.002	0.08	0.1D	0.1D			3			15	40	30		1-70		60	Extensively altered to sericite giving appearance of a tuffaceous
30	40			0.38		<.01	0.1D	0.1D			3			15	40	30		1-70		70	volcanic rock (Quartz eye tuff) – scattered clasts mostly
40	50			0.29		0.08	0.1D	0.2D 0.1V			3	1	5	15	40	30		1-70		80	lapilli size but up to 1" of siliceous volcanics and chert –
50	60			0.58		0.06	0.1D	0.2D 0.1V			3	1	5	30	30	10		1-70		60	56-60 Breccia zone – silicified fragments in sericite/clay
60	70			0.59		<.01	0.1D	0.2D 0.1V			3	1	5	15	40	30		1-70		40	matrix (15-18)
70	80			0.18		<.01	0.1D	0.2D 0.1V			3	1	5	15	40	30		1-70		70	– Disseminated pyrite 3-5% 1-2% in. 1-3 mm,
80	90			0.24		<.01	0.1D	0.2D 0.1V	TR D		3	1	5	70	10	10		1-70		40	veins – chalcocite & covellite veins on pyrite – also
90	100			0.65		0.03	0.1D	0.2D 0.2V	TR D	TR D	3	1	5	15	40	30		1-70		80	covellite coating on pyrite – some in very fine
100	110			1.29		0.16	0.1D	0.3D 0.3V	TR D		3	1	5	15	40	30		1-70		80	grained appearing as black specks. Trace of
110	120			0.44		<.01	0.1D	0.2D 0.1V	TR D		3	1	5	15	40	30		<1-80		90	sphalerite falling a few centers 91-92
120	130			0.14		<.01	0.1D	0.3D 0.1V	TR D		3	1	5	15	40	30		1-80		80	Very pulverized 87-91.5
130	140			0.49		0.02	0.1D	0.2D 0.2V	TR D		3	1	5	15	40	30		1-45		60	– 92 Clastic texture of the rock becomes more predominant
140	150			0.39		<.01	0.05D	0.2D 0.1V	TR D		2	1	5	15	40	30		1-70		60	siliceous pebbles and chert fragments increase
150	160			0.41		<.01	0.05D	0.2D 0.1V			2	1	5	15	30	40		1-70		80	in quantity and size.
160	170			0.26	0.006	0.01	0.1V	0.2D 0.3V			2	2	5	15	30	40		1-45		30	Black specks (chalcocite?) decrease at 150
170	180			0.30	0.004	0.01	TR D	0.2D 0.05V			2	1	5	10	30	40		1-70		80	–189
180	190			0.34	0.002	<.01	TR D	0.2D 0.2V			2	1	5	10	30	45		2-70	Bouey 187-189	30	189 – 318 TUFFACEOUS VOLCANIC AGGLOMERATE – Angular
190	200			0.06	0.004			0.1D 0.1V			3	1	3	5	30	40		1-45		80	light brown fine to fine grained quartz, feldspar and
200	210			0.03	<.002			0.1D 0.05V			3	1	3	5	30	50		1-70		80	dark gray siliceous volcanics, lapilli to 2" dia.
210	220			0.03	0.002			0.1D 0.05V			3	1	3	5	30	50		<1-80		80	in light gray tuff core matrix (gritty tuff).
220	230			<.01	<.002			0.05D			2	1	3	5	30	50		<1-80		90	Rock
230	240			<.01	<.002			0.05D			2	1	3	5	30	50		<1-80		90	
240	250			<.01	<.002			0.05D 0.05V			2	1	3	5	30	50		1-80		90	
250	260			<.01	0.002			0.05D			2	1	3	5	30	50		<1-70		90	
260	270			<.01	<.002			0.05D			2	1	3	5	30	50		1-80		90	
270	280			<.01	<.002		TR D	0.05D			2	1	3	5	30	50		<1-80		90	
280	290			<.01	<.002		TR D	0.05D			2	1	3	5	30	50		<1-80		90	
290	300			<.01	<.002		TR D	0.05D			2	1	3	5	30	50		<1-80		90	
300	310			0.02	<.002		TR D	0.05D			2	1	3	5	30	50		<1-70		90	–318 Contact @ 60° to core axis
310	320			0.03	<.002		0.05D 0.05V	0.1D 0.05V			2	1	3	10	40	30		<1-80		90	318– QUARTZ FELDSPAR PORPHYRY – Similar to QFP above.
320	330			0.14	0.002		0.05D 0.05V	0.1D 0.05V			2	1	3	15	40	30		<1-70		90	A few lapilli size clasts of brown chert and black
330	340			0.09	0.002		0.05D 0.05V	0.1D 0.05V			2	1	3	15	40	30		<1-70		90	siliceous volcanics. Very fine grained pyrite and fine
340	350			0.19	0.004		0.05D 0.05V	0.1D 0.05V			2	1	3	15	40	30		<1-70		90	sq. chalcocite? covellite (may be only coating pyrite)
350	360			0.19	0.006		0.05D TR V	0.1D TR V			2	1	3	15	40	30		<1-80		90	Pale gray 1-3 mm veins – randomly oriented but
360	370			0.19	<.002		0.05D TR V	0.1D TR V			2	1	3	15	40	30		1-70		90	60° to axis dominant.
370	380			0.13	0.004		0.05D	0.1D			2	1	3	15	40	30		1-80		90	
380	390			0.19	<.002		0.05D	0.1D			2	1	3	15	40	30		1-70	388-?	90	Breccia zone (not continuous – may be fault zone)
390	400			0.62	<.002	0.02	0.05D TR V	0.1D TR V			2	3	5	10	40	30		<1-80	396	90	Indications of grain 35° to core axis.
400	410			0.02	0.008	0.01	0.05D TR V	0.1D TR V			2	3	5	10	40	30		1-80		80	Fresh pyrite veins (seams) more prominent
410	420			0.41	<.002	0.07	0.05D TR V	0.1D TR V			2	2	5	10	40	30		1-60		60	below 390'.
420	430			0.30	<.002	<.01	0.05D TR V	0.1D TR V			2	2	5	10	40	30		1-70		60	–CONT.

mo 2555 dm

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN. HOLE NO. BB-4
Collar elev. 5114 Final depth 797
Coord N. 171,400 Coord E. 865,850
Inclination -90° Page 2 of 2
Logged by H. DOWNEY
Date start 9/5/90 Date finish 9/30/90

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	ASSAY % Cu	ASSAY oz/t Au	ASSAY oz/t Ag	ORE MINERALS CHALCOCITE	COVELLITE	BORNITE	GANGUE MINERALS PYRITE-DISS	PYRITE-VEIN	SILICA-VEIN	SILICA-DISS	SERICITE	ARGILLIC	ALUNITE	STRUCTURE <-L TO CORE AXIS OPEN FRACS/FT-<	FAULTS	% RQD	ROCK TYPE and REMARKS
430	440		100	0.44	<.002	<.01	0.1 D 0.1 V	0.1 D 0.5 V	TR D	2	3	5	10	40	30		1-45		80	CONT. - QUARTZ FELDSPAR PORPHYRY
440	450			0.44	0.002		0.1 D 0.05 V	0.1 D 0.3 V	TR D	2	3	5	10	40	30		1-70		60	Covellite - chalcocite in pyrite veins - good correlation
450	460			0.34	0.006		0.05 D 0.05 V	0.1 D 0.2 V	TR D	2	3	5	10	40	30		1-45		70	430-470
460	470			0.35	0.006		0.05 D 0.05 V	0.1 D 0.3 V	TR D	2	3	5	10	40	30		1-70		70	
470	480			0.26	<.002		0.05 D 0.05 V	0.1 D 0.5 V	TR D	2	3	5	10	40	30		1-70		70	
480	490			0.12	<.002		0.05 D TR V	0.1 D 0.05 V	TR D	2	3	5	10	40	30		1-70		90	
490	500			0.28	0.002		0.05 D TR V	0.1 D 0.05 V	TR D	2	3	5	10	40	30		2-70		40	
500	510			0.19	0.002		0.05 D TR V	0.1 D TR V	TR D	2	2	10	10	20	20	2	2-60	502-505	30	Brecciated & gouggy 502-505 — grain in 30° to core axis
510	520			0.22	0.004	0.01	0.05 D TR V	0.1 D TR V	TR D	2	2	15	10	20	20	2	1-70		80	Below 505 rock is less altered (more siliceous)
520	530			0.20	0.002	<.01	0.05 D	0.1 D TR V	TR D	2	2	15	15	20	20	2	1-70		90	grey blue quartz veining from hairline stringers
530	540			0.13	0.004		TR D	0.1 D TR V	TR D	2	2	15	15	20	15		1-70		90	to 1/2", occasional fragment of brown quartzite
540	550			0.26	0.004			0.1 D TR V	TR D	2	2	15	15	20	15		1-70		80	up to 2" dia.
550	560			0.07	0.004			0.1 D 0.05 V	TR D	2	3	15	15	15	15		1-70		70	From 549 to 565 rock is brecciated (shattered)
560	570			0.07	<.002			0.1 D 0.05 V	TR D	2	3	15	15	15	15		1-60		70	with only slight displacement of fragments. Quartz,
570	580			0.10	0.006			0.1 D 0.05 V	TR D	2	3	15	15	30	15		1-70		70	pyrite fills interstices. Country rock more
580	590			0.17	0.004			0.2 D 0.1 V	0.05 D	2	3	15	15	30	20		1-70		80	silicified.
590	600			0.20	0.002			0.2 D 0.1 V	0.05 D	2	3	15	15	30	20		1-70		80	
600	610			0.10	0.002			0.1 D 0.1 V	0.05 D	2	3	10	15	20	30		1-70		70	
610	620			0.03	0.004			0.1 D 0.05 V	TR D	2	2	10	15	20	30		1-70		80	
620	630			0.08	0.002			0.1 D 0.05 V	TR D	2	3	10	20	30	20		1-70		80	
630	640			0.03	<.002			0.1 D 0.05 V		2	2	10	30	20	10		1-60		70	-647 Contact ?
640	650			0.09				0.05 D		2	2	10	30	20	10		2-70		40	647 - Tongues of medium grained grey QUARTZ
650	660			0.05				0.05 D		2	2	10	30	20	10		2-70		50	DIORITE PORPHYRY (or granodiorite) ~~irregular~~
660	670			0.02				0.05 D		2	2	10	30	20	10		2-70		50	gradational contact; Texture blurred by silicification
670	680			0.03				0.05 D		2	2	10	30	20	10		2-70		40	Pyrite only seen but may be some very fine
680	690			0.01				0.05 D		2	2	10	30	20	10		2-70		40	grained covellite
690	700			0.01				TR D		2	2	10	30	10	10		1-45		50	
700	710			0.05				TR D		2	2	10	30	10	10		2-70		30	
710	720			0.03				TR D		2	2	10	30	10	10		2-70		20	
720	730			0.02				TR D		2	4	10	30	10	10		1-70		50	
730	740			0.02				—		2	2	10	30	10	10		1-60		50	
740	750			0.01				—		2	2	10	30	10	10		1-70		60	
750	760			0.03				—		2	2	10	30	10	10		1-45		20	
760	770			0.04				—		2	3	10	30	10	10		3-20		15	
770	780			0.04				—		2	4	15	30	10	10		2-60		30	
780	790			0.01				—		2	4	15	30	10	10		3-70		10	
790	797			0.01				—		2	2	15	30	10	10		3-70		30	-797 BOH
797			BOTTOM OF HOLE 797																	

mn 2555 dm

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN. HOLE NO. BB-5
Collar elev. 5090 Final depth 800
Coord N. 171,550 Coord E. 366,300
Inclination -30° DUE SOUTH Page 1 of 2
Logged by H. DOWNEY
Date start 9/30/90 Date finish 10/27/90

DEPTH from	DEPTH to	int'vl	% CORE RECOV.		ASSAY % Cu	ASSAY oz/T Au	ASSAY oz/T Ag	ORE (ESTIMATES) MINERALS CHALCOCITE	COVELLITE	BORNITE	LIMONITE & Cu OX	CHALCO-WHITE	GANGUE & ALTERATION MINERALS PYRITE-DISS	PYRITE-VEIN	RED HEMATITE	GOETHITE	VARGSITE	SILICA-VEIN	SILICA-DISS	SERICITE	ARGILLIC-PROPYLITIC	ALUNITE	STRUCTURE OPEN FRACS/FT-2	FAULTS	% RQD	ROCK TYPE and REMARKS
0	10		—					—	—	—			—	—				—	—	—	—		—		—	OVERBURDEN - ROCK BIT
10	20		90		0.02	<.002	<.01	TR D	0.2 D 0.1 V	0.1 D			3	1				2	10	10	50		5-45		10	10-107 QUARTZ FELDSPAR PORPHYRY - White to light
20	30		85		0.02			TR D	0.2 D 0.1 V	0.1 D			3	1				2	10	10	50		10-45		5	gray - soft - intensely altered to sericite/pyrite
30	40		50		0.02			TR D	0.2 D 0.1 V	0.1 D			3	1				2	10	10	50		10-45		0	originally intermediate classification.
40	50		80		0.03			TR D	0.2 D 0.5 V	0.1 D			3	1	1			2	10	10	50		3-60		20	Sulfides from 3-5% dominantly disseminated -
50	60		95		0.04			0.05 D	0.2 D TR V	0.1 D			2	-				2	10	10	50		2-45		30	sparse veining - mostly hairline to 1 mm.
60	70		95		0.04			0.1 D	0.1 D TR V	0.1 D			2	-				2	10	10	50		10-45		0	
70	80		80		0.07			0.1 D	0.1 D TR V	0.1 D			2	1				2	10	10	50		10-45		0	
80	90		80		0.04			0.3 D	0.1 D TR V	0.1 D			3	1				1	10	10	50		10-45	89-100	0	Sulfides oxidized in fault zones.
90	100		100		0.01			0.2 D	TR D	TR D	0.3		0.05	-	2	10	3	1	5	5	60		3-60		15	Plane of faults in approx. 30° to core axis - The
100	110		100		0.02	0.004	0.03	0.1 D	TR D	TR D	0.3		0.05	-	2	10	3	1	5	5	60		3-45	103-107	30	107 - faults are probable contact with agglomeratic (intrusive
110	120				0.05	<.002	<.01	TR D	0.1 D	0.05 D			3	1				1	5	10	50		1-45		70	breccia) below
120	130				0.08	<.002		TR D	0.1 D	0.05 D			3	1				1	5	10	50		1-45		70	
130	140				0.10	0.002		TR D	0.1 D	0.05 D			3	1				1	5	10	50		1-45		70	INTRUSIVE BRECCIA - Same unit as found yesterday
140	150				0.13	<.002	0.03	TR D	0.1 D	0.05 D			3	1				1	5	10	50		<1-45		90	at depth in previous BB holes. Angular to
150	160				0.02		<.01	—	0.1 D	0.1 D			3	1				1	5	10	40		1-60		60	rounded silicified fragments up to 2" diameter
160	170				0.03			—	0.1 D	0.1 D			3	1				1	5	10	40		1-45		90	in QFP matrix. Less veining than in previous
170	180				0.06			—	0.1 D 0.05 V	0.1 D 0.1 D			3	2				1	5	10	40		1-45		80	holes.
180	190				0.01			—	0.1 D	0.1 D			3	1				1	5	10	40		1-70		70	
190	200				0.02			...	0.1 D	0.1 D			3	1	1	1		1	10	10	30		2-70		40	- 199 Shattered/chert-like 199-228 - Same unit as
200	210				0.02			—	-	-	0.1		2	-	1	1		10	70				5-60		10	199 - in bottom of BB-2. Hematite and goethite staining
210	220				0.03			-	-	-	0.1		2	-	1	1		10	70				5-60		0	along fracture - CONTACT 60° TO CORE AXIS -
220	230	-			0.06	0.004	0.05	—	-	-	0.1		2	-	1	1		10	70				5-60		10	- 228 Contact with INTRUSIVE BX - Same as 107-199
230	240				0.19	<.002	0.03	TR D	0.1 D	0.1 D			2	1				10	40	10	30		2-60		30	228 - 247 ENT. BX
240	250				0.25		<.01	0.05 D 0.1 V	TR V	0.1 D 0.1 V		0.2 D 0.1 V	2	1				10	30	10	30		1-70		50	247 - 257 BRECCIATED CHERT - 1" Seam chalcopyrite, bornite, sphalerite
250	260		85		0.24			0.05 D	0.05 D TR V	0.05 D 0.05 V			1	1				10	70	5	10		2-60		30	- Fault @ 30° to core axis @ 247'
260	270		80	MISS LATCH	0.12			0.05 D	0.05 D TR V	0.05 D			1	0.5				10	20	10	30		2-60	260-264	50	257 - INTRUSIVE BRECCIA - Same as 107-199.
270	280		95		0.08			0.05 D	0.1 D TR V	TR D			1	0.5				2	10	10	50		1-60		60	
280	290		100		0.13			0.05 D	0.1 D TR V	TR D			1	0.5				2	10	10	50		1-60		70	Sulfides are very fine grained disseminated below
290	300				0.12		0.03	0.05 D	0.1 D TR V	TR D			1	0.5				2	10	10	50		2-70		30	260. Minor veinlets up to 1/4" thick
300	310				0.10		<.01	0.05 D	0.1 D TR V	TR D			1	0.5				2	10	10	50		1-70		50	
310	320				0.05		<.01	0.05 D	0.1 D TR V	TR D			1	0.5				2	10	10	50		1-70		50	
320	330				0.06		0.01	0.05 D	0.1 D TR V	TR D			1	0.5	1	1		2	10	10	50		1-70		50	
330	340				0.03		<.01	0.05 D	0.2 D 0.1 V	TR D			1	0.5	1	1		2	10	10	50		2-45		20	
340	350				0.03			0.05 D 0.05 V	0.2 D 0.05 V	TR D			1	0.5	1	1		2	10	10	50		1-60		50	
350	360				0.07			0.05 D 0.05 V	0.2 D 0.05 V	TR D			1	0.5				2	10	10	50		2-60		20	
360	370				0.05			0.05 D 0.05 V	0.2 D 0.05 V	TR D			1	0.5				2	10	10	50		1-60		40	
370	380				0.04		0.05	0.05 D 0.05 V	0.1 D 0.05 V	0.05 D			1	1				2	10	10	50		3-60	376-378	10	3' Fault gouge
380	390				0.02		<.01	0.1 D 0.3 V	0.1 D 0.05 V	0.05 D			2	1				2	10	10	60		2-60	383-385	20	2' Fault breccia & gouge - sooty zone w/clumps of
390	400				0.01			0.05 D	0.05 D 0.05 V	0.05 D			2	1				2	5	10	50		1-70		40	massive fine grained pyrite
400	410				0.04			TR D	0.05 D 0.05 V	0.05 D			2	1				2	5	10	50		1-70		70	
410	420				0.01			TR D	0.05 D 0.05 V	0.05 D			2	1				2	5	10	50		1-70		50	
420	430				0.01			TR D	0.05 D 0.05 V	0.05 D			2	1				2	5	10	50		1-60		50	CONT. -

mn 2555 dm

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN. HOLE NO. B3-5
Collar elev. 5090 Final depth 800
Coord N. 171,550 Coord E. 866,300
Inclination -30° DIP SOUTH Page 2 of 2
Logged by H. DOWNEY
Date start 9/30/90 Date finish 10/27/90

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	ASSAY % Cu	ASSAY oz/T Au	ASSAY oz/T Ag	ORE MINERALS: CHALCOCITE	COVELLITE	BORNITE	CHALCOPYRITE	GANGUE & ALTERATION MINERALS: PYRITE-DISS	PYRITE-VEIN	RED HEMATITE	GOETHITE	JAROSITE	SILICA-VEIN	SILICA-DISS	SERICITE	PROPYLITIC	ALUNITE	STRUCTURE: OPEN FRACS/FT-L	FAULTS	% RQD	ROCK TYPE and REMARKS
430	440		100	<.01	<.002	<.01	TR D TR V	0.05 D 0.05 V	0.05 D		2	1				2	5	10	50		1-45		60	CONT. — INTRUSIVE BRECCIA - Siliceous clasts 2 mm - 2", mostly
440	450			0.01			TR D	0.05 D 0.05 V	TR D		1	1				2	5	10	60		2-45	443-447	10	angular, in QFP matrix. The section from 370' - 450
450	460			0.04			TR D	0.05 D 0.05 V	TR D		1	1				2	5	10	50		1-70		60	contains multiple fault breccia and gouge zones but
460	470			0.01			TR D	0.05 D TR V	TR D		1	1				2	5	5	40		1-70		70	without lithological or mineralogical change.
470	480			0.07			0.05 D 0.2 V	0.05 D 0.3 V	TR D		1	1				2	5	5	40		2-70		20	1" sooty chalcocite/covellite/quartz vein @ 475.2
480	490			0.01			TR D 0.05 V	0.05 D TR V	0.05 D		1	1				2	10	5	30		1-70		50	
490	500			0.02			TR D 0.05 V	0.05 D	0.05 D		1	0.5				2	10	5	30		1-45		50	Propylitic/clay alteration decreases below 460'
500	510			0.02			TR D 0.05 V	0.05 D	0.05 D	TR D	1	0.5				2	10	5	30		2-70		20	
510	520			<.01			0.05 D 0.1 V	0.05 D	0.05 D	TR D	1	0.5				2	10	5	30		2-60		30	Uraninite? coating fractures 519-520
520	530			0.01			TR D 0.05 V	0.05 D	0.05 D	TR D	1	0.5				2	10	5	30		1-70		40	
530	540			0.01			TR D	0.05 D	0.05 D	TR D	1	0.5				2	10	5	30		1-60		30	Nil veining
540	550			0.01				0.05 D	0.05 D	TR D	1	0.5				2	10	5	30		1-60		50	
550	560			<.01				0.05 D	0.05 D	TR D	1	0.5				2	10	5	30		1-20		30	
560	570			<.01				0.05 D	0.05 D	TR D	1	0.5				2	10	5	30		1-30		40	
570	580			0.01				0.05 D			1	0.5				2	10	5	30		1-60		60	
580	590			0.02				0.05 D			1	0.5				2	10	5	30		1-60		60	
590	600			0.04				0.05 D			1	TR				2	10	10	50		2-60		40	Multiple short, gouge, brecciated zones 590-660
600	610			0.05				0.05 D			1	TR				2	10	10	50		2-60		50	
610	620			0.03				0.05 D			1	TR				2	10	10	50		1-70		60	Only very minor hairline veins below 590
620	630			0.03				0.05 D			1	TR				2	10	10	50		2-70		50	
630	640			0.05			TR D	0.05 D			1					2	10	10	50		1-70		70	
640	650			0.07	0.002		0.2?	0.05 D			1					2	10	10	50		2-70		60	Gray sooty fractures 650-653
650	660			0.02	<.002		TR D	0.05 D			1					2	10	10	50		2-70		70	
660	670			0.03			TR D	0.05 D			1					2	10	10	30		1-70		80	
670	680			0.02		0.01	TR D	0.05 D			1					2	10	10	30		1-70		70	
680	690			0.03		<.01	0.2?	0.05 D			1	TR				2	10	10	30		2-70		50	Gray section 682-685
690	700			0.22			TR D	0.05 D			1	0.5				2	10	10	30		1-70		80	
700	710			0.04			TR D	0.05 D			1					2	10	10	30		1-70		70	
710	720			0.03			TR D	0.05 D			1					2	10	10	30		1-70		60	
720	730			0.07			TR	0.05 D			1					2	10	10	40		1-70		70	
730	740			0.15			TR D	0.05 D			1					2	10	10	40		1-70		70	
740	750			0.16			TR D	0.05 D			1	0.5				2	10	10	30		1-70		60	
750	760			0.04			TR D	0.05 D 0.1 V			1	1				5	10	10	30		1-70		80	Sulfide veining begins at 757 and continues to
760	770			0.11		0.01	TR D	0.05 D 0.1 D			1	1				5	10	10	30		1-70		70	bottom of hole. Veinlets average 1/8" thick 30°-45° to
770	780			0.08		0.01	0.05 D 0.05 V	0.05 D 0.2 V			1	1				5	10	10	30		1-80		90	core axis.
780	790			0.02		<.01	0.05 D 0.1 V	0.05 D 0.2 V			1	2				5	10	10	30		1-80		90	
790	800			0.03		0.02	0.05 D 0.1 V	0.05 D 0.2 V			1	2				5	10	10	30		1-70			
800			BOTTOM OF HOLE																					

mn 2556 dm

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN. HOLE NO. BB-6
Collar elev. 5145 Final depth 800'
Coord N 469,140 Coord E 857,530
Inclination -45° DUE EAST Page 1 of 2
Logged by H. DOWNEY
Date start 11/6/90 Date finish 11/26/90

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	ASSAY % Cu	ASSAY oz/T Au	ASSAY oz/T Ag	ORE (ESTIMATED) MINERALS CHALCOCITE	COVELLITE	BORNITE	GANGUE % MINERALS PYRITE-DISS.	PYRITE-VEIN	PYRRHOTITE	SERICITE	ARGILLIC	QUARTZ-VEIN	QUARTZ-DISS.	ALUNITE	STRUCTURE OPEN FRACS./FT.	FAULTS	% RQD	ROCK TYPE and REMARKS
0	20		—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	0-20 OVERBURDEN — NO CORE
20	30		95	0.81	0.002	0.36	0.05			3	1	60	10	5	1	10		3-45		15	20-368 QUARTZ FELDSPAR PORPHYRY — Intense alteration has obliterated most of the texture — originally 75% plagioclase? 10% quartz — 10% mafics. Major alteration mineral is pyrophyllite (white and pale green). Granular pyrite blebs 1-5 mm, some coated with covellite/chalcocite. Some fractures are sooty. Nil veining to 105' then increasing. Trace of fine grained disseminated barite throughout.
30	40		90	0.18	0.008	<.01	0.05D	0.05		3	1	60	10	5	1	10		2-60		30	
40	50		95	0.15	0.006	0.08	0.05D	0.05		3	1	60	10	5	1	10		2-60		30	
50	60		95	0.44	0.004	0.03	0.05D 0.05V	0.05D 0.05V		3	2	60	10	5	2	10		2-60		20	
60	70		90	0.30	0.002	0.06	0.05D	0.05D	TR D	3	1	60	10	5	1	5		2-60		30	
70	80		95	0.26	0.002	0.14	0.05D	0.1D	TR D	3	1	60	10	5	1	5		2-60		40	
80	90		95	0.46	0.004	0.31	0.05D	0.1D	TR D	3	1	50	10	5	1	5		2-60		40	
90	100		85	0.18	0.002	0.12	0.05D	0.1D	TR D	3	1	50	10	5	1	5		2-60		40	
100	110		95	0.19	0.002	0.05	0.05D 0.05V	0.1D 0.05V	TR D	4	2	50	10	5	3	5		1-45		50	
110	120		100	0.21	0.002	<.01	0.05D 0.1V	0.1D 0.1V		4	2	50	10	5	5	5		1-60		60	Moderate sulfide veining 105'-155' w/ chalcocite/covellite quartz/sulfide veinlets are irregular and stringy, probably low temperature filling fractures.
120	130		100	0.07	<.002	<.01	0.05D 0.1V	0.1D 0.1V		4	2	60	10	5	5	5		1-45		60	
130	140			0.08	0.002	<.01	0.05D 0.1V	0.1D 0.1V		4	2	60	10	5	5	5		2-60		60	
140	150			0.26	<.002	0.07	0.1D 0.2V	0.1D 0.1V		4	2	60	10	5	5	5		1-45		60	
150	160			0.13	0.002	<.01	0.1D 0.2V	0.1D 0.1V		4	2	60	10	5	5	5		1-45		70	
160	170			0.06	0.001	<.01	0.05D 0.05V	0.1D 0.05V		3	1	50	10	5	2	5		1-60		80	
170	180			0.14	<.002	<.01	0.05D 0.05V	0.1D 0.05V		3	1	50	10	5	1	5		1-60		70	
180	190			0.08	<.002	<.01	0.05D	0.1D 0.05V		3	1	50	10	5	1	5		1-60		70	
190	200			0.07	<.002	0.03	0.05D	0.1D 0.05V		3	1	50	10	5	1	5		1-60		60	
200	210			0.05	<.002	<.01	0.05D	0.1D 0.1V		3	1	40	10	20	1	5		2-60	200-204 Gouge 214-219 gouge	40	Fault zone? (multiple gouge veinlets) 200-219
210	220			0.16	<.002	<.01	0.05D	0.2D 0.1V		3	2	40	10	20	2	5		2-45		20	Covellite increases below 200'
220	230			0.23	<.002	0.09	0.05D	0.2D 0.1V		4	2	50	10	10	2	5		1-45		60	
230	240			0.12	0.002	<.01	0.05D	0.2D 0.1V		4	2	50	10	10	2	5		1-60		80	
240	250			0.14	<.002	<.01	0.1D 0.3V	0.2D 0.1V		4	3	40	10	20	2	5		1-45	245-247.5	40	Small (1.5') brecciated zone - probably fault breccia 245-247.5
250	260			0.08	<.002	<.01	0.1D 0.1V	0.2D 0.1V		4	2	50	10	10	2	5		2-60		30	occ. stringers and 1" seam filled with chalcocite/covellite
260	270			0.13	<.002	0.05	0.05D 0.1V	0.2D 0.1V		3	2	50	10	10	2	5		1-60		50	
270	280			0.15	<.002	<.01	0.05D 0.1V	0.2D 0.1V	V	4	2	50	10	10	2	5		2-60		50	
280	290			0.23	<.002	0.09	0.05D 0.1V	0.1D 0.1V		3	2	50	10	10	2	5		1-60		60	
290	300			0.15	<.002	0.02	0.05D 0.1V	0.1D 0.1V		3	2	50	10	10	2	5		1-60		60	
300	310			0.34	0.002	<.01	0.05D 0.1V	0.05D 0.1V		3	3	40	10	20	5	5		1-60	309-312	70	
310	320			0.18	<.002	<.01	0.1D 0.1V	0.05D 0.1V		3	3	40	10	10	5	5		1-60		70	Veining increases 310-330
320	330			0.31	0.002	<.01	0.1D 0.1V	0.05D 0.1V		3	3	40	10	10	5	5		2-60		60	
330	340			0.17	0.002	<.01	0.1D 0.05V	0.2D 0.1V		3	2	40	10	20	5	5		1-45	330-333 GOUGY	60	
340	350			0.52	<.002	0.06	0.1D 0.05V	0.2D 0.1V		3	2	30	10	20	5	5		2-60	340-348	40	
350	360			0.11	0.002	<.01	0.1D 0.05V	0.2D 0.1V		3	2	30	10	20	5	5		1-60		50	Heavy chalcocite/covellite/pyrite = 360-369
360	370			3.75	0.004	1.69	0.5D 0.7V	0.5D 0.15V		6	6	30	5	10	10	30		1-60		50	368-394 INTRUSIVE BRECCIA Angular altered fragments in tuffaceous matrix. Fragments range from lapilli/block size — light to dark grey color
370	380			0.45	<.002	<.01	0.1D 0.1V	0.1D 0.1V		6	3	20	5	10	10	30		1-70		70	
380	390			0.70	0.002	<.01	0.1D 0.2V	0.2D 0.2V		6	3	20	5	40	10	30		2-70	382.5-394	40	Probable fault breccia 382.5-394
390	400			1.03	<.002	0.27	0.2D 0.2V	0.1D 0.1V		6	3	20	5	40	10	30		1-70		70	
400	410			0.81	0.002	0.10	0.2D 0.2V	0.1D 0.1V		5	3	30	5	15	10			1-70		70	394-397.5 Short section of lapilli tuff.
410	420			0.67	0.006	0.15	0.2D 0.2V	0.1D 0.1V		5	4	10	5	40	10			1-70		70	397.5-454 INTRUSIVE BRECCIA - Same unit as above 394
420	430			0.41	<.002	0.04	0.2D 0.2V	0.1D 0.1V		5	4	10	5	40	10			1-70		70	
430	440			0.53	0.002	0.04	0.2D 0.2V	0.1D 0.1V		5	5	10	5	40	10			1-70		70	

mn 2555 dm

GEOLOGIC LOG

PROJECT _____

PROJECT Thunder Mtn. HOLE NO. BB-6
Collar elev. 5145 Final depth 800
Coord. N. 169,642 Coord. E. 857,530
Inclination -45° DIP EAST Page 2 of 2
Logged by H. DOWNEY
Date start 11/1/90 Date finish 11/26/90

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	ASSAY % Cu	ASSAY oz/T Au	ASSAY oz/T Ag	ORE (ESTIMATES) MINERALS CHALCOCITE	COVELLITE	BORNITE	GANGUE MINERALS PYRITE-DISS	PYRITE-VEIN	PYROPHILLITE	SERICITE	ARGILLIC	QUARTZ-VEIN	QUARTZ-DISS	BIOTITE	STRUCTURE OPEN FRACS/FT-<	FAULTS	% RQD	ROCK TYPE and REMARKS
440	450		100	1.00	0.002	0.34	0.7 D 0.7 V	0.2 D 0.3 V		5	7	20	5	10	20	20		1-70		70	CONT. — INTRUSIVE BRECCIA
450	460			0.23	0.002	<.01	0.3 D 0.5 V	0.2 D 0.1 V		5	7	40	10	10	10	10		2-70		20	454-718 QUARTZ FELDSPAR PORPHYRY - Similar to that from 368' Well mineralized sections with only chalcocite/pyrite blebs to 5 mm dia. Fine grained pyrite rimmed by covellite, pyrite veinlets from open fracture fillings and as prominent as in breccia.
460	470			0.17	<.002	<.01	0.3 D 0.2 V	0.2 D 0.1 V	TR TR	4	3	50	10	10	5	5		2-70		40	
470	480			0.30	0.002	0.03	0.3 D 0.2 V	0.2 D 0.1 V		4	2	50	10	10	5	5		1-70		70	
480	490			0.41	<.002	<.01	0.3 D 0.2 V	0.2 D 0.1 V		4	2	50	10	10	5	5		1-70		80	
490	500			0.15	<.002	<.01	0.3 D 0.1 V	0.2 D 0.1 V		4	2	50	10	10	5	5		1-70		80	
500	510			0.12	<.002	<.01	0.2 D 0.1 V	0.1 D 0.1 V		4	2	50	10	10	5	5		1-70		80	
510	520			0.24	<.002	<.01	0.3 D 0.2 V	0.1 D 0.1 V		4	3	50	10	10	5	5		1-70		70	
520	530			0.16	<.002	<.01	0.7 D 0.3 V	0.3 D 0.1 V		5	3	50	10	10	5	5		1-70		80	
530	540			0.11	<.002	<.01	0.5 D 0.2 V	0.2 D 0.05 V		4	3	50	10	10	5	5		1-70		70	
540	550			0.04	<.002	<.01	0.6 D 0.2 V	0.2 D 0.05 V		6	3	50	10	10	5	5		1-70		80	
550	560			0.11	<.002	<.01	0.6 D 0.2 V	0.2 D 0.05 V		6	3	50	10	10	5	5		1-60		60	Cu mineralization decreases below 560 particularly chalcocite blebs decrease in size and abundance ↑(560-630)↑
560	570			0.14	<.002	<.01	0.1 D 0.1 V	0.2 D TR V		4	2	40	10	10	3	5		1-60		70	
570	580			0.07	0.002	<.01	0.3 D TR V	0.2 D TR V		5	1	40	10	20	3	5		1-60		80	
580	590			0.12	<.002	<.01	0.1 D 0.1 V	0.3 D 0.1 V		5	2	40	10	20	3	5		1-70		80	
590	600			0.02	<.002	<.01	0.1 D 0.1 V	0.1 D 0.1 V		4	1	30	10	30	3	5		1-70		90	
600	610			0.25	0.002	<.01	0.05 D 0.05 V	0.1 D 0.1 V		4	2	30	10	30	3	5		1-70		80	
610	620			0.30	0.002	0.15	0.05 D 0.05 V	0.1 D TR V		4	1	30	10	30	3	5		1-70		80	
620	630			0.15	<.002	<.01	0.05 D TR V	0.1 D TR V		4	1	30	10	30	3	5		1-70		80	
630	640			0.05	<.002	<.01	0.1 D 0.05 V	0.2 D 0.05 V		5	1	40	10	20	3	5		1-70		90	
640	650			0.03	0.002	<.01	0.2 D 0.2 V	0.2 D 0.1 V		5	1	50	10	10	3	5		<1-70		90	
650	660			0.14	<.002	<.01	0.2 D 0.05 V	0.2 D TR V		5	1	50	10	10	3	5		<1-70		90	
660	670			0.26	<.002	<.01	0.2 D 0.05 V	0.2 D TR V		5	1	50	10	10	3	5		1-60	667-674	70	gouge
670	680			0.12	<.002	<.01	0.2 D 0.05 V	0.2 D TR V		5	1	50	10	10	3	5		1-60		40	
680	690			0.53	<.002	<.01	0.2 D 0.05 V	0.3 D TR V		5	1	50	10	10	3	5		2-60	685-690	30	Breccia - gouge
690	700			0.30	<.002	<.01	0.2 D 0.05 V	0.3 D TR V		5	1	50	10	10	3	5		1-45		30	
700	710			0.24	0.002	<.01	0.1 D 0.05 V	0.1 D TR V		5	1	50	10	10	3	5		1-70		80	
710	720			0.04	<.002	<.01	0.1 D 0.05 V	0.1 D TR V		4	1	50	10	10	3	5		1-70		80	718-800 MIXED INTRUSIVE BRECCIA & QFP - Mostly breccia but with short sections (1'-5') of QFP. Contact zone from 716 to 718 is short banded (~35° to core axis) Quartz/pyrite/chalcocite veining improves in breccia.
720	730			0.25	<.002	<.01	0.1 D 0.2 V	0.1 D 0.05 V		4	1	30	10	5	5	10	3	1-70		80	
730	740			0.21	0.002	<.01	0.1 D 0.2 V	0.1 D 0.05 V		5	2	30	10	5	5	10	3	1-70		80	
740	750			0.52	0.010	0.10	0.1 D 0.2 V	0.1 D 0.05 V		6	3	20	10	5	10	10	3	1-60		80	
750	760			0.23	<.002	<.01	0.1 D 0.2 V	0.1 D 0.05 V		4	3	20	10	5	5	10	3	1-70		90	
760	770			0.02	<.002	<.01	0.1 D 0.1 V	0.1 D 0.05 V		4	3	20	10	5	5	10	3	2-70		50	
770	780			0.01	<.002	<.01	0.1 D 0.1 V	TR D 0.05 V		4	3	20	10	5	5	10	3	2-70		60	
780	790			0.06	<.002	<.01	0.1 D 0.1 V	TR D 0.05 V		4	3	20	10	5	5	10		1-60		50	
790	800			0.13	<.002	<.01	0.1 D 0.1 V	TR D 0.05 V		4	2	20	10	5	5	10		2-70		60	

800' - BOTTOM OF HOLE

mn 2555 dm

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN. HOLE NO BB-7
Collar elev 5590 Final depth 735.5
Coord N 170,700 Coord E 866,550
Inclination -90 Page 1 of 2
Logged by H. DOWNEY
Date start 11/29/90 Date finish 12/21/90

NOTE: RQD FOR NX CORE IS % > 4" LENGTH PER 10' (NC IS 5")

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	CORE SIZE	ASSAY % Cu	ASSAY oz/T Au	ASSAY oz/T Ag	ORE: CHALCOCITE	ORE: COVELLITE	ORE: BORNITE	ORE: Cu PYRITE LIMONITE/TENORITE	MINERALS	GANGUE (%): PYRITE DISS	PYRITE-VEIN	RED HEMATITE	SECONDARY HEMATITE	JAROSITE	MINERALS: SILICA-VEIN	SILICA-DISS	PYROPHYLLITE	SERICITE	ARGILLIC	ALUNITE	STRUCTURE: OPEN FRACT. FT.	FAULTS	% RQD	ROCK TYPE and REMARKS
0	12		—		—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—		—	—	—	0-12 OVERBURDEN
12	20		100	NC	0.01	<.002	<.01				.05				1	5			5	25	25	25		4-60		15	12-27 LAPILLI TUFF - Light grey altered tuff with sub-
20	30		95		0.01	<.002	<.01				<.05	Limonite after ?			3	3			5	25	25	25		3-60		15	rounded volcanic fragments to 18 mm diameter. Rapid
30	40		30		0.01	0.010	0.78				0.35				5	2			90			5		5-70		0	alteration (sericite?) intense. Also pyrite/Pyrrhotite
40	50		50		0.01	0.004	0.26				0.05				5	2			40		10	40		gouge	41.5-51	0	Red hematite and gypsum in fracture filling.
50	60		95		0.01	<.002	0.03				0.05		.5				5		60		5	10		4-40		5	27-32 TALC - ALUNITE - White - very soft - pure mixture
60	70		90		0.05		<.01	TR					1				5		50		10	30	5	5-70	61-64	10	without fragments - may be suspected gouge.
70	80		98		0.16								1						60		5	10	5	5-60		0	32-41.5 BRECCIATED CHERT - Very siliceous grey chert (or very
80	90		100		0.09								1						60		5	10	3	3-60		40	fine grained quartzite) fragments in siliceous matrix.
90	100		95		0.06								1						60		5	10	3	2-60		70	Fragment edges are indistinct due to silicification
100	110		100		0.04								1						60		5	10	3	2-70		50	41.5-51 FAULT GOUGE & BRECCIA
110	120		50		0.11								1						30		10	50	3	gouge	110-117.5	20	
120	130		85		0.03								1	0.5					30		10	40	3	gouge	117.5-125	5	51-257 RHYOLITE OR RHYODACITE Light to medium grey
130	140		95	NX	0.06								1	0.5					30		10	40	3	4-70	-133.5	15	very siliceous (not silica stringers) with numerous
140	150		98		0.05						30%	0.3	2						60		5	10	3	3-70		5	breccia and gouge zones. Fine grained pyrite
150	160		100		0.06	0.002					30%	0.3	2						30		10	40	3	3-60	148-156	5	disseminated and filling some fractures. Some thin
160	170		100		0.01	<.002							1	0.5					60		5	10	3	1-80		80	alunite stringers. (NOTE: THIS UNIT WAS LOGGED
170	180		100		0.01	<.002							1	0.5					60		5	10	3	2-70		70	Sorty gouge 144-156 AS SILICA TUFF - LOG BB-6)
180	190		100		0.02	0.004							1	0.5					60		5	10	3	2-70		50	
190	200		100		0.02	0.002							1	0.5	1	5	3		30		10	40	3	3-80	196-205	20	Fault contact at 196' - 38° to core axis
200	210		85		0.03	0.002							1	0.5		5	3		30		10	40	3	4-70	205-210	15	Total fault intercept - 19'
210	220		100		0.03	0.002	0.11						2	1					50		10	10		2-80		50	
220	230				0.01	0.002	<.01	0.20					2	1					50		10	10		1-80		50	Very fine grained disseminated pyrite appearing at
230	240				0.02	<.002		0.051 0.20					2	1					60		10	10		2-70		10	210'. Chalcocite trace, some pyrite blebs from
240	250				0.02			0.10					2	1					30	5	10	40	3	3-80	238-248	10	220 - down. Contact indistinct
250	260				0.01			0.17					2	1					50	5	10	20		2-70		30	257-617.5 LAPILLI TUFF Appearance similar to unit at top of hole
260	270				0.01			0.05					2	1					20	10	10	40		3-80		10	but with rounded fragments up to 2 cm. Fine
270	280				0.01			TR D					3	0.5					10	10	10	40		2-80		20	grained disseminated pyrite. Only slight limonite staining.
280	290				0.01			TR D					3	0.5					10	10	10	40		2-80		30	Occasional clasts to 10 mm are rich in pyrite.
290	300				0.04			TR D					3	0.5					10	10	10	40		3-70		20	
300	310				0.01			TR D					3	0.5					10	10	10	40		2-80		60	
310	320				0.01			TR D					3	0.5					10	10	10	40		1-80		60	
320	330				0.02			TR D					3	0.5					10	10	10	40		1-80		70	
330	340				0.01			TR D					3	0.5					10	10	10	40		1-80		80	
340	350				0.03			TR D					3	0.5					10	10	10	40		1-80		70	
350	360				0.04			TR D					3	0.5					10	10	10	40		3-80		20	
360	370				0.01			TR D					2	0.5					10	10	10	40		1-80		90	
370	380				0.01			TR D					2	0.5					10	10	10	40	3	2-80		50	
380	390				0.02			TR D					2	0.5					10	10	10	40	3	1-70		60	
390	400				0.02			TR D					2	0.5					10	10	10	40	3	1-80		70	
400	410				0.03			TR D					2	0.5					10	10	10	40	3	1-80		80	
410	420				0.03								2	0.5					10	10	10	40	3	2-70		60	
420	430				0.04								2	0.5					10	10	10	40	3	1-70		70	CONT.

mn 2555 dm

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN. HOLE NO. BB-7
Collar elev. 5590 Final depth 735.5
Coord N: 170,700 Coord E. 846,550
Inclination -90° Page 2 of 2
Logged by H Bowen
Date start 11/29/90 Date finish 12/21/90

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	CORE SIZE	ASSAY % Cu	ASSAY oz/T Au	ASSAY oz/T Ag	ORE ESTIMATES MINERALS CHALCOCITE	COVELLITE	BORNITE	MALACHITE	GANGUE MINERALS PYRITE-DISS	PYRITE-VEIN	RED HEMATITE	GOETHITE	JAROSITE	SILICA-VEIN	SILICA-DISS	PROPYLITE	SERICITE	ARGILLIC	ALUNITE	STRUCTURE OPEN FRACT. FOOT	FAULTS	% RQD	ROCK TYPE and REMARKS
430	440		100	NX	0.04	<.002	<.01					2	0.5					10	10	10	40	3	1-70		80	430-617.5 LAPILLI TUFF - Alteration appears more sericitic
440	450				0.01							2	0.5					10	10	10	40	3	1-80		80	(less argillic) below 460
450	460				0.02							2	0.5					10	20	20	30	1	1-80		80	
460	470				0.03							2	0.5					10	20	30	20	1	1-80		80	
470	480				0.04							2	0.5					10	20	30	20	1	2-80		60	
480	490				0.02							2	0.5					10	20	30	20	1	1-70		60	Splotchy, lenticular clumps of sooty chalcocite ? 500-520
490	500				<.01			0.1D	TRD			3	0.5					10	20	30	20	1	3-70		20	- also fine grained chalcocite with sparse covellite, minor
500	510				0.02			0.3D	TRD	TRD	TRD	3	0.5					10	20	30	20	1	2-70		70	fine grained chalcopyrite (PROBABLY A MANGANESE MINERAL)
510	520				0.04			0.3D	TRD	TRD	TRD	3	0.5					10	20	30	30	1	1-70		80	
520	530				0.02			0.1D	TRD	TRD	TRD	3	1					10	20	30	10	1	2-70		50	1-3 mm. pyrite/chalcocite veinlets more common
530	540				0.02			0.1D 0.1V	TRD			3	1					10	20	30	10	1	1-80		70	520-580
540	550				0.05			0.1D 0.1V	TRD			3	1					10	20	30	10	1	1-80		90	
550	560				0.02			0.1D 0.2V	TRD			3	1					10	20	30	10		1-80		80	
560	570				0.01			0.1D 0.3V	TRD			3	1					10	20	30	10		1-80 1-45		60	
570	580				0.03			0.1D 0.7V	TRD			3	1					10	20	30	10		1-80		60	
580	590				0.05			0.1D 0.05V				3	0.5				5	10	20	30	10		1-80		80	
590	600				0.06			0.1D 0.05V				2	0.5				5	10	20	30	10		1-80		90	
600	610				0.08			0.1D 0.05V				2	0.5				5	10	20	30	10		1-80		70	
610	620				0.01			0.1D 0.05V				2	0.5				5	10	20	30	10		1-70	615.5-617.5	70	Fault gouge & breccia 615.5-617.5 - contact @ 20° to axis
620	630				<.01			0.1D 0.05V				2	0.5				5	50	10	10	5		1-70		80	617.5-635 RHYOLITE OR RHYODACITE (SILICA TUFF IN BB-1 & 2 TH LOGS)
630	640				<.01			0.1D				2	0.5				5	60	10	10	5		1-70	634-635	70	Similar to unit 51-257. Small (1') gouge seam @ 635
640	650				<.01			0.1D				2						10	20	30	10		2-70		30	635-735.5 LAPILLI TUFF contact with above unit probably is
650	660				<.01			0.1D				2						10	20	30	10		1-70		80	small fault. Fragment size generally smaller than
660	670				<.01			0.1D				2						10	20	30	10		1-70		80	units higher in hole (grit size predominant).
670	680				<.01			0.1D				2						10	20	30	10		1-80		90	
680	690				0.01			0.1D				2						10	20	30	10		1-60		80	
690	700				0.02			0.1D				2						10	20	30	10		1-80		70	
700	710				0.01			0.1D				2						10	20	30	10		1-80		80	
710	720				<.01			0.1D				2						10	20	30	10		2-70		50	
720	730				<.01			0.1D				2						10	20	30	10		2-70		60	
730	735.5				<.01			0.1D				2						10	20	30	10		1-80		60	
	735.5		BOTTOM OF HOLE																							

ASSAYS INDICATE THIS IS PROBABLY MANGANESE MINERALIZATION

mn 2558 dm

JDS

ASARCO

Southwestern Exploration Division

April 15, 1991

FILE NOTE

Paperwork
Thunder Mountain Project
Santa Cruz County, AZ

Mr. W.K. John, Manager-Mineral Land, Kerr-McGee Corporation will terminate on April 30, 1991.

After that date, address all correspondence and reports to:

Mr. Harold W. Holmberg
Director of Metal Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, OK 73125

Phone: 405/270-3820.

James D. Sell

JDS:mek

James D. Sell

cc: R.L. Brown
F.T. Graybeal
W.L. Kurtz
W.D. Gay

JDS

ASARCO

Southwestern Exploration Division

January 7, 1992

F.T. Graybeal
New York Office

Greater Patagonia Exploration
Patagonia Mountains
Santa Cruz County, Arizona

Mr. R.L. Brown requested an update of the past drilling activities, discoveries, and the exploration potential of the land held under exploration agreements with Noranda and Kerr-McGee.

No drilling to date has outlined an area of sufficient grade and open-pit availability to propose a rapid expenditure of funds to confirm the grade and tonnage available. Present leach tests on the high-level chalcocite in the Bucket Breccia blanket indicate moderate recoveries of values for heap leach or in situ methods of recovery of the copper values.

The Asarco agreement with Noranda (Venture Project) calls for $40,000 per year work commitment and approximately $200,000 remains to be spent for a 51% vested ownership.

Each year between 1986 and 1991 I have been able to secure a waiver of work requirement, year by year. Noranda is presently considering my proposal to amend the agreement to eliminate the $40,000/year work commitment or to a buy out of their interest. I should have a response during the first quarter of 1992.

The Asarco agreement with Kerr-McGee (Thunder Mountain Project) calls for $100,000 per year work commitment, with approximately $375,000 yet to be expended by Asarco for a 50% vested ownership. Mr. Brown negotiated the last amendment to the Kerr-McGee Thunder Mountain agreement which calls for $100,000 to be spent in 1992. I have no idea if Kerr-McGee might be receptive to a reduced work commitment or to a totally new operating agreement.

In excess of fifty holes have been drilled in the area shown in Attachment A. Four major mineralized centers have been outlined with seven targets identified ranging from near vertical breccia pipe mineralization, to high-level primary chalcocite blankets, to extensive deep primary chalcopyrite mineralization, to deep carbonate-hosted skarn mineralization of massive pyrite-lead-zinc-silver values in pods, lenses and variable massive beds.

Discussion of the four major mineralization zones and the seven target areas is detailed in the attached Addendum - Greater Patagonia Exploration, as is the recommended work for 1992.

The present claim block boundaries (Attachment A) show that the Three R shallow chalcocite zone (TR CC shallow) is no longer within the Asarco land or any of the agreement lands.

Table 1 lists the target zones of mineralization and a common theme is the relative low-grade (±0.40% copper or less) in both the high-level chalcocite blankets, and the deeper primary chalcopyrite mineralization. Moderate to large tonnage of mineralization is available from these mineral centers. The carbonate-hosted massive sulfide deposits have excellent Pb-Zn-Ag values. The target is deep and the values variable and in scattered intercepts.

Table 1 outlines the mineral resource of the Attachment A portion of the Patagonia Mountains. The large tonnage indicated is an asset to Asarco as a mineral producer, although to date the targets are insufficiently drilled out and present parameters indicate low economics. The agreements property position is adjacent to the Asarco Mining Department holdings at the Flux, Trench, and Hardshell mineral resource areas.

I recommend further exploration to fulfill the annual work commitments on the agreement lands and to continue to outline the mineral base.

As you are aware, Mr. Kurtz has long advocated, both verbally and in writing, that both joint venture projects in the Patagonia Mountains should be terminated. He believes the low grade and attendant poor metallurgy of the near surface copper mineralization renders the indicated deposits as uneconomic for the foreseeable future. He believes the Ventura moly-copper pipe is too small to be of interest and the deeper disseminated chalcopyrite mineralization too low grade to be economic. He expresses the same reservation on the deep base metal-silver skarn mineralization, in that drilling has indicated erratic grades and a structurally complex setting for mining considerations.

Asarco in the past has maintained a longer view on mineral assets. The expenditures needed for Asarco to be vested at 50% in the two project lands will not fully test any of the present targets, but at the time of vesting will provide outside funding contributions for further evaluation.

James D. Sell

James D. Sell

JDS:mek
Atts.

cc: W.L. Kurtz

Table 1. Mineral Resource of Thunder Mountain - Ventura - Trench Areas, Patagonia Mountains.

A. Shallow Upper Zones of hi-level chalcocite

Zone	Depth to Top, ft.	Average Thickness, ft.	Avg. Grade % Copper	Estimated Tonnage
TR*	660	209	0.35	162,200,000
Sunnyside Bx**	361	170	0.37	34,600,000
Bucket Bx	150	576	0.28	32,300,000
Average/Total	390	318	0.31	229,100,000

*Includes TR drilled, 4 hole area, of 81 million tons at average grade of 0.37% Cu, thickness of 345 feet.
**Includes Sunnyside breccia pipe, 4 hole area, of 3 million tons at average grade of 0.48% Cu, thickness of 240 feet.

B. Deep Zone of primary chalcopyrite

Zone	Depth Top, ft.	Average Thickness, ft.	Avg. Grade % Copper	Estimated Tonnage*
Sunnyside	2960	2475	0.22	3,500,000,000
Ventura**	1600	324	0.36	155,000,000
**Ventura Bx	Surface	1600	0.28 Cu, & 0.136 Mo	13,000,000

*Note: Drilling insufficient to outline total resource. Open beyond drilling used for this tabulation.
**Excluding the breccia pipe, the lateral mineralization has a drill indicated 31 million tons of 0.36% copper and 0.035% moly.

C. Deep Trench carbonate-hosted Pb-Zn-Ag

Insufficient drilling to outline any resource. Presently, 4 drill holes, with numerous intercepts ranging from 2' to 43' thick at depth from 3900' to 5000'.

Best Single Interval

Hole	Thickness	% Cu	% Pb	% Zn	oz. Ag
TM-13	2'	2.56	8.65	11.60	3.56
TCH-1	4.5'	2.64	12.70	14.50	1.80
TCH-2*	26'	1.83	6.29	15.06	14.93
TCH-2A	6'	0.69	1.65	0.24	9.04

*The best total hole is TCH-2; 15 intervals, totalling 349', between 4030' and 4920' range between 4' and 43' thick, averaging 23' thick, 0.58% cu, 1.95% Pb, 7.25% Zn, and 5.53 oz. Ag composited through the 349' of mineral. Trace of mineral is found throughout the remaining intervals of altered limestone (skarn).

Greater Patagonia Exploration
Patagonia Mountains
Santa Cruz County, Arizona

The present Ventura and Thunder Mountain Projects comprise the Greater Patagonia Exploration program of Asarco. In addition to SWED claims, we have Asarco Mining Department claims in the district and have exploration agreements with Noranda (Ventura Project), and Kerr-McGee (Thunder Mountain Project). Figure 1 locates the area in Santa Cruz County in southern Arizona.

Attachment A outlines the four major mineralization centers and the seven target areas of past and present exploration interest. They are:

1. Ventura breccia and expanded lateral mineralization. This property is under the Ventura Project with the Noranda agreement. The central moly breccia pipe extends from the surface to 1600 feet. Present drilling outlines 13 million tons of 0.28% copper and 0.14% moly (Mo) (Table 1-B). The deeper 1600'-2200', open-ended, tabular zone of primary chalcopyrite mineralization has a drill indicated reserve of 31 million tons of 0.36% copper and 0.035% moly.

   The greater tonnage estimate (Table 1-B) is based on a few indicative outlying holes indicating extended mineralization and the projection of mineralization to extend southeastward toward the Ventura Mine area.

2. Sunnyside deep target lies plus 2500 feet below the surface and is part of the Thunder Mountain Project with Kerr-McGee. The primary chalcopyrite mineralization of the Sunnyside target has a sparse drill intercept geologic estimated resource of 450 million tons of 0.34% copper and 0.012% moly. The larger, billion ton plus estimated tonnage, Table 1-B, is based on the projected extent outward from known drilling and expansion northwestward under the known shallow chalcocite zones and breccia pipe development.

   Attachment A outlines several shallow chalcocite zones which are upper-level expressions of the deep chalcopyrite mineralization. The two explored targets are, A, the Sunnyside breccia and breccia pipe, and B, the Bucket Breccia chalcocite blanket.

   A. The Sunnyside breccia pipe was one of the earliest Asarco exploration drill targets in the Patagonia Mountains. The breccia pipe (Table 1-A) has a 5 hole drill indicated tonnage of 3 million tons of 0.48% copper surrounded by an envelope of lesser grade which is estimated at 35 million tons of 0.37% copper.

   B. The Bucket Breccia shallow chalcocite blanket has been the current drilling area and ten holes have cut the zone of mineralization. Mineralization essentially begins at the surface of the canyon

bottom level and extends upward and under the adjacent hillsides. A potential of 30 million tons plus of 0.28% copper (Table 1-A), may exist in this target. Attachment B plots the topography, current drill holes, and the indicated copper grade contours of the total Bucket Breccia mineralization.

Three representative cross-sections, A-A', B-B', C-C' are shown on Attachment B and exhibited in Attachments C-1, C-2 and C-3.

The total blanket has an average thickness of 576 feet, and is best expressed as a three layer packet with a higher grade (+0.40 copper) at the surface and at depth, separated by a zone of 0.2-0.4 copper. All is surrounded by a low-grade envelope of mineralization.

3. Three R (TR) shallow chalcocite mineralization was also one of the early drill projects and at a grade of 0.35% (Table 1-A), the blanket was not of sufficient interest at the time and the property was returned to the owners with some unpatented claims retained over the Sunnyside breccia and tying into the Asarco Flux unit to the north.

   As shown on Attachment A, the TR mineralization is part of the system in the Patagonia Mountains and is the high-level chalcocite expression of the continued deep primary zone known as the Sunnyside deep primary chalcopyrite mineralization located in the Thunder Mountain project of Asarco-Kerr-McGee.

4. Trench deep carbonate Pb-Zn-Ag mineralization. This zone is within lands held by Asarco Mining Department and under the Asarco-Kerr-McGee exploration agreement.

   Only four holes penetrate the carbonate skarn-hosted mineralization.

   Table 1-C lists the holes and the best intercepts found. Numerous intercepts of 1"-2" gouge - replacement zones up to massive sulfide replacement lenses or beds 43 feet thick have been cut. The best representation of the skarn-hosted style of mineralization was found in hole TCH-2, Table 1-C, and the many intercepts represent slips, lenses, pods, and probable extensive beds of massive sulfides.

Future exploration on the mineral centers at Ventura, Sunnyside, and Trench will be on lands within the Exploration Agreements with Noranda and Kerr-McGee.

Greater Patagonia Exploration
Patagonia Mountains
Santa Cruz County, Arizona

To continue to fulfill the current work commitment of $40,000 per year at the Ventura project with Noranda, I will propose a hole southeast of the Ventura Breccia pipe (Attachment A), to test the extent and grade of mineralization in the southeast direction.

To continue to fulfill the current work commitment of $100,000 per year at the Thunder Mountain project with Kerr-McGee, I will propose four holes. These sites, Attachment B, have been flagged about midway up the slope from previous hole TM-8, and will lie along the 5400 foot elevation contour.

The rough, steep terrain at these sites suggest that helicopter-supported transport will be the means of placing the drill equipment. Costs are being obtained from contractors and the Forest Service has been requested to complete their survey for approval of the Plan of Operations.

James D. Sell

James D. Sell

JDS:mek
Att.

Table 1. Mineral Resource of Thunder Mountain - Ventura - Trench Areas, Patagonia Mountains.

A. Shallow Upper Zones of hi-level chalcocite

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Zone	Depth Top, ft.	Average Thickness, ft.	Avg. Grade % Copper	Estimated Tonnage*
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*Note: Drilling insufficient to outline total resource. Open beyond drilling used for this tabulation.
**Excluding the breccia pipe, the lateral mineralization has a drill indicated 31 million tons of 0.36% copper and 0.035% moly.

C. Deep Trench carbonate-hosted Pb-Zn-Ag

Insufficient drilling to outline any resource. Presently, 4 drill holes, with numerous intercepts ranging from 2' to 43' thick at depth from 3900' to 5000'.

Best Single Interval

Hole	Thickness	% Cu	% Pb	% Zn	oz. Ag
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TCH-1	4.5'	2.64	12.70	14.50	1.80
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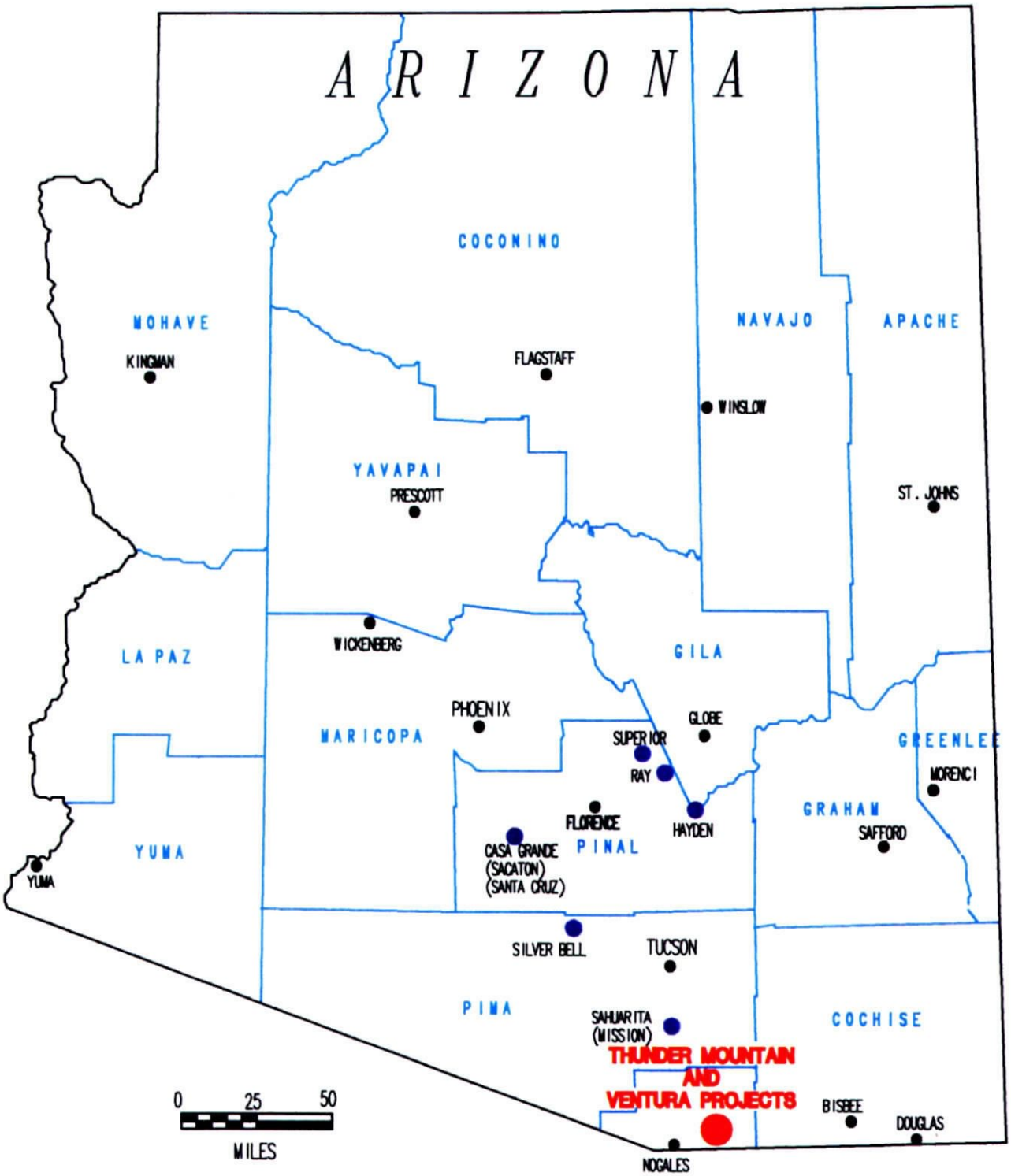
TCH-2A	6'	0.69	1.65	0.24	9.04

*The best total hole is TCH-2; 15 intervals, totalling 349', between 4030' and 4920' range between 4' and 43' thick, averaging 23' thick, 0.58% cu, 1.95% Pb, 7.25% Zn, and 5.53 oz. Ag composited through the 349' of mineral. Trace of mineral is found throughout the remaining intervals of altered limestone (skarn).

FIGURE 1

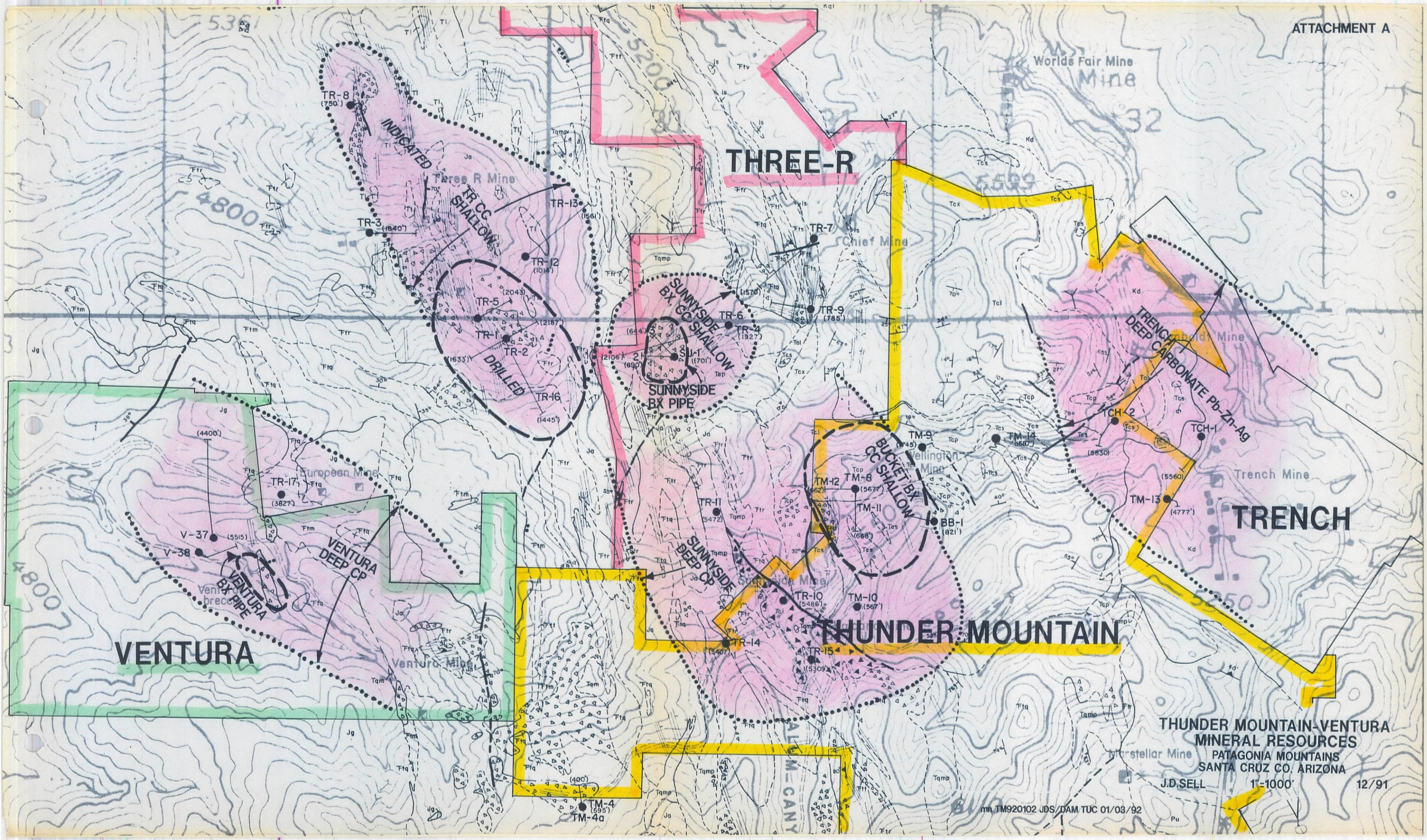


ASARCO SOUTHWESTERN EXPLORATION

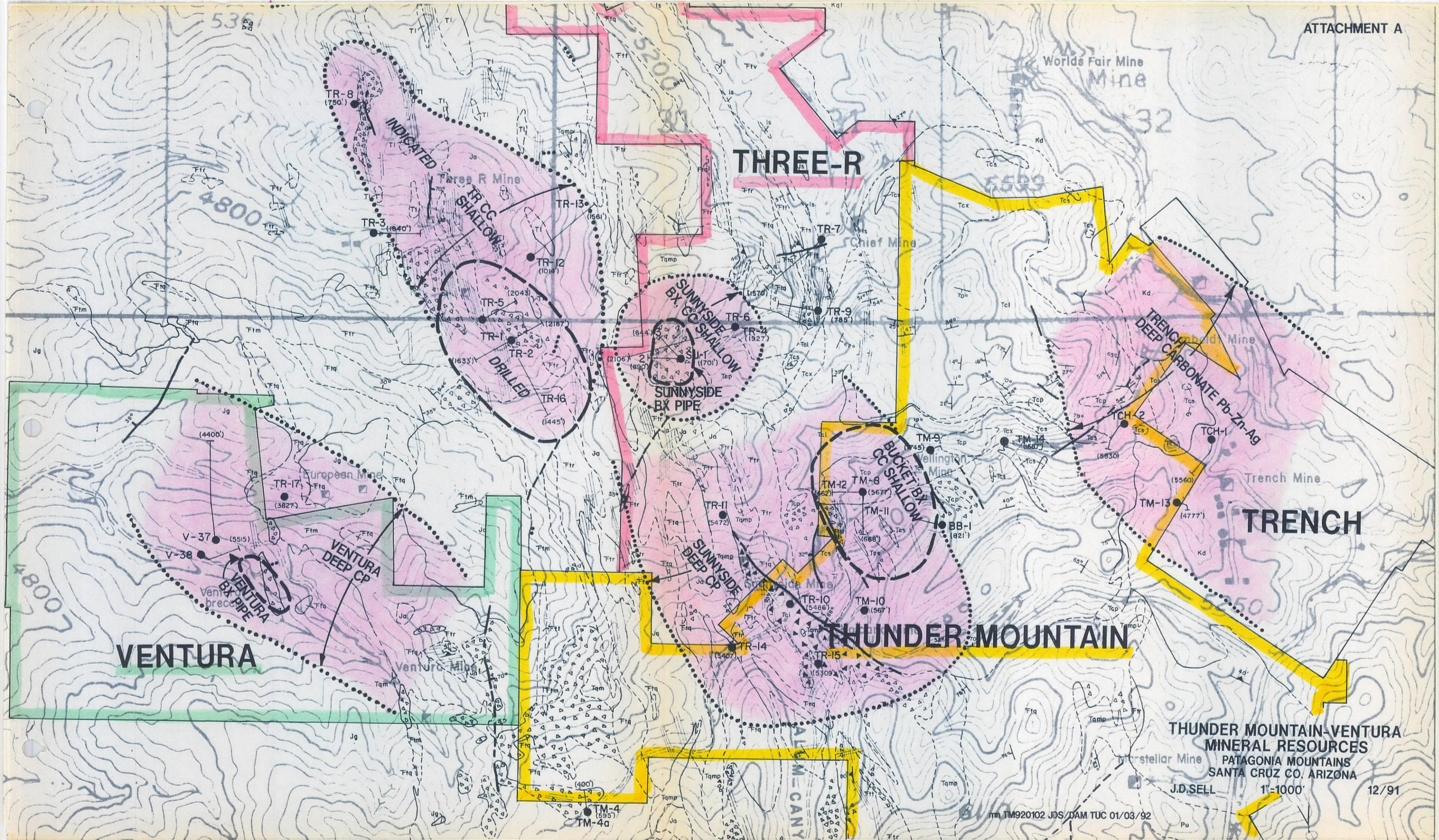
THUNDER MOUNTAIN AND VENTURA PROJECTS INDEX MAP

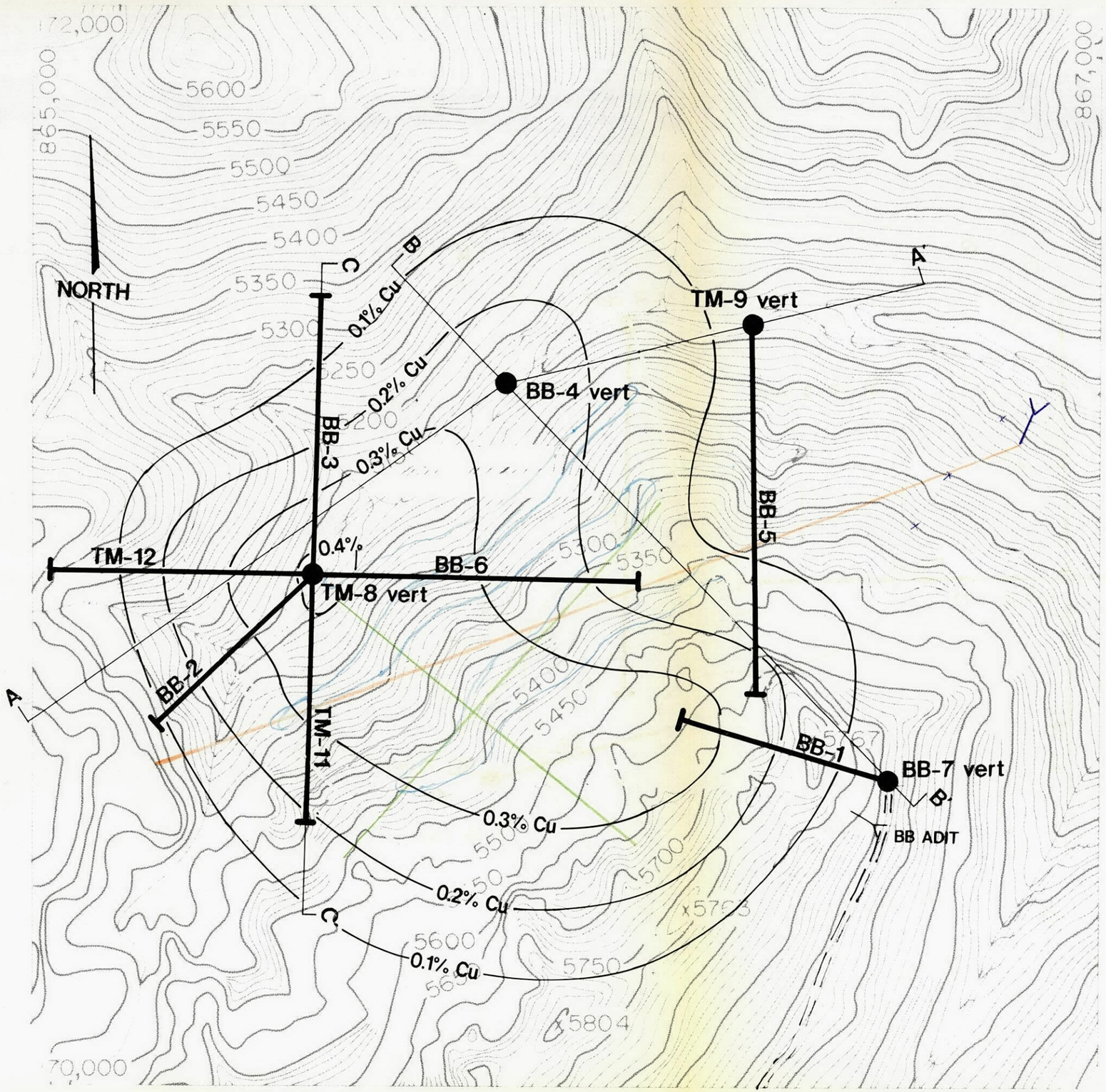
mn TM9201010 DAM/JDS TUC 01/03/92

ATTACHMENT A



ATTACHMENT A





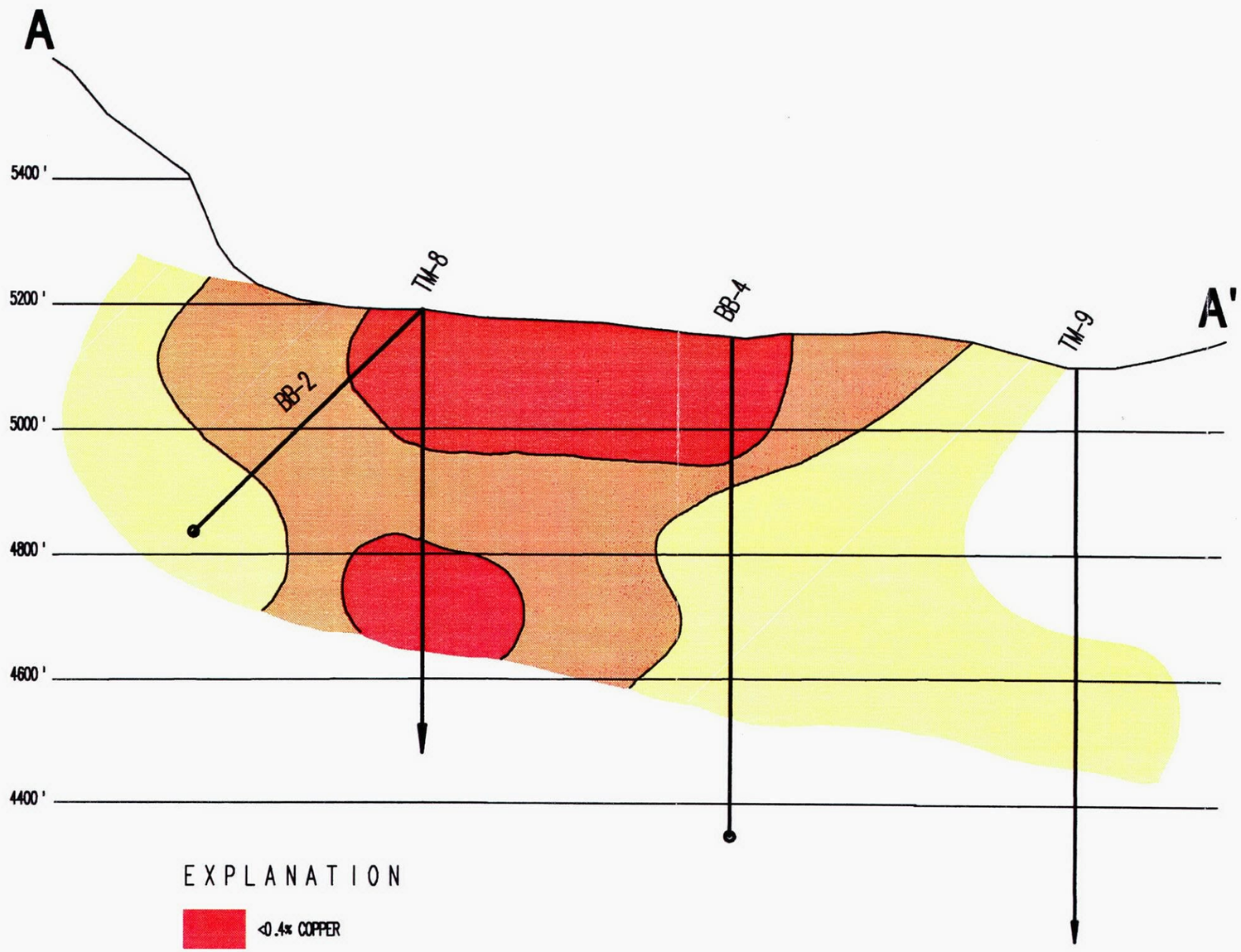
ASARCO Incorporated
THUNDER MOUNTAIN PROJECT

TOTAL ZONE % COPPER

SANTA CRUZ CO.. ARIZONA

J.D.S. 1"=200' 12-91

mn TM911205 JDS/DAM TUC 12/22/91



PLOT CHG:
SP9-119
SP10-166
SP11-194
SP14-7/.7

ASARCO SOUTHWESTERN EXPLORATION

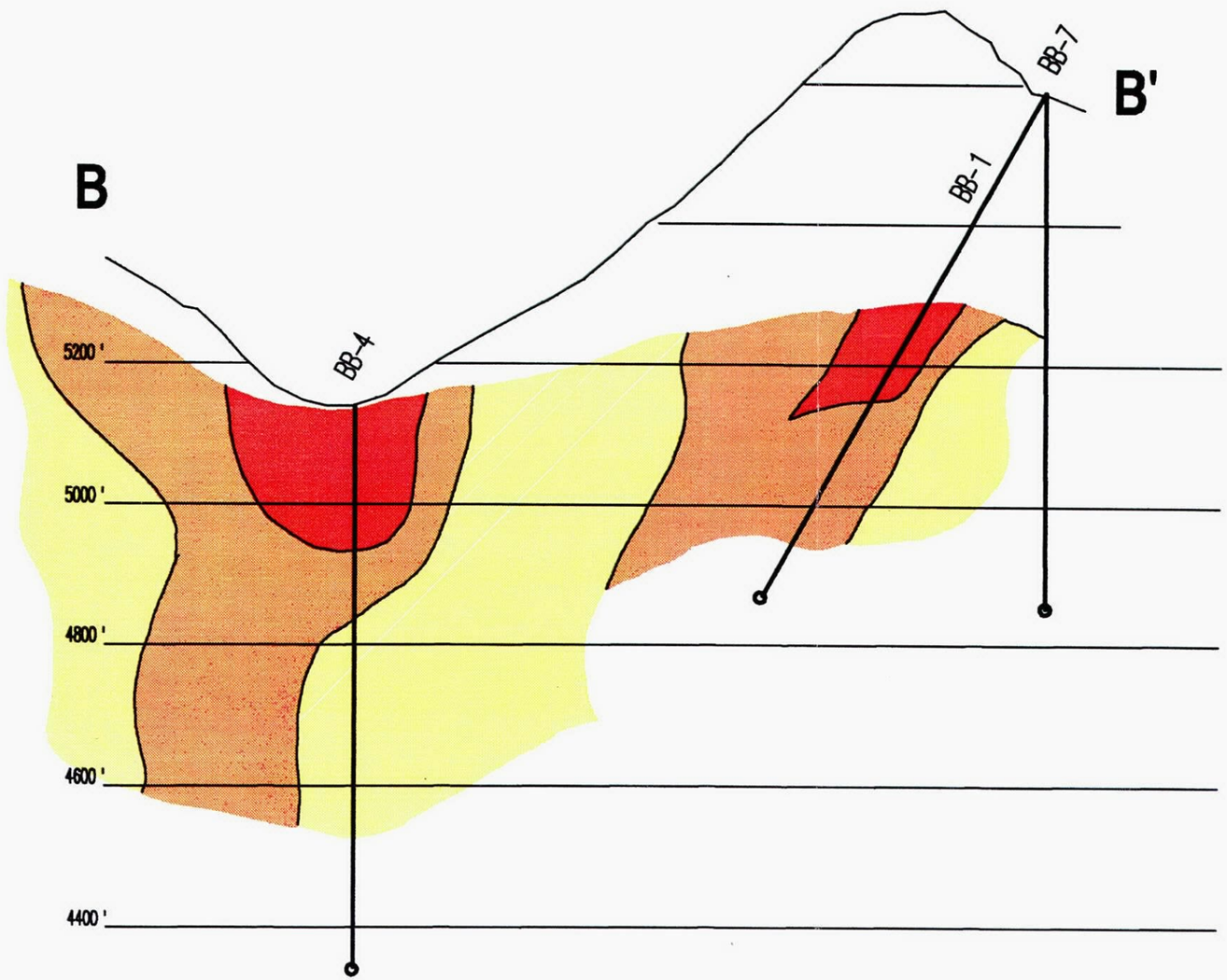
THUNDER MOUNTAIN PROJECT

SECTION A-A'

PATAGONIA MOUNTAINS, ARIZONA

J.J.S. 0 100' 200' 01-91

mn TM911202 JDS/DAM TUC 12/19/91



EXPLANATION

- <0.4% COPPER
- 0.2-0.4% COPPER
- 0.1-0.2% COPPER

ASARCO SOUTHWESTERN EXPLORATION

THUNDER MOUNTAIN PROJECT

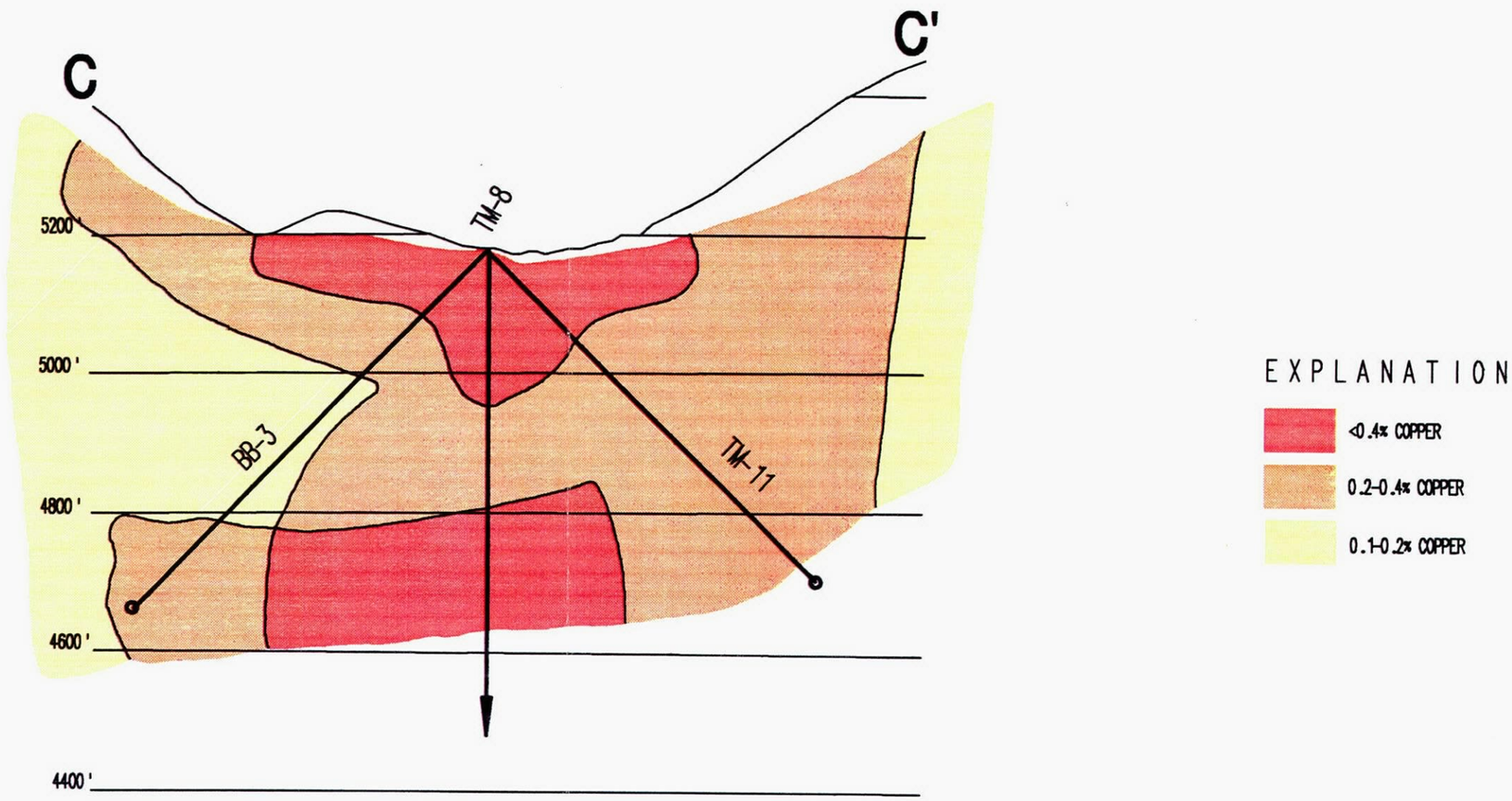
SECTION B-B'

PATAGONIA MOUNTAINS, ARIZONA

J.D.S. 0 100' 200' 01-91

mn TM911203 JDS/DAM TUC 12/19/91

PLOT CHG:
SP14-7/.7
SP9-119
SP10-166
SP11-194



ASARCO SOUTHWESTERN EXPLORATION

THUNDER MOUNTAIN PROJECT

SECTION C-C'

PATAGONIA MOUNTAINS, ARIZONA

J.D.S. 01-91

0 100' 200'

mn TM911204 JDS/DAM TUC 12/20/91

PLOT CHG:
SP14-7/.7
SP9-119
SP10-166
SP11-194

JDS

ASARCO

Exploration Department
Southwestern United States Division
James D. Sell
Manager

February 5, 1992

405/ 270-1313 ext 3802

Mr. Harold W. Holmberg
Director of Metal Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, OK 73125

Report on Activities - 1991
Thunder Mountain Project
Santa Cruz County, Arizona

Dear Mr. Holmberg:

The annual summary of activities for the year 1991 on the Thunder Mountain Project, Santa Cruz County, Arizona, is hereby submitted.

In the fourth quarter of 1990, six shallow holes were drilled in the chalcocite mineralization between holes TM-8 and BB-1. The zone penetrated averages 576 feet thick with an average grade of 0.28% copper. The low copper grade lead to a ferric-acid leach, bottle roll test to determine readily soluble copper value.

Final results were reported in early 1991 and of the four samples submitted, the head grade ranged from 0.25% copper to 0.37% copper, and averaged 0.34% copper. The percent copper extracted ranged from a low of 18% to a high of 42%, with an average of 27% recovered. These low values do not suggest that leaching might be a viable method for extracting copper from the zone.

A composite sample of the three holes, with an average grade of 0.33% copper, was selected to be used in an extended leach time (6 days) with an elevated ferric iron concentration. The result from this test indicated a 29% copper recovery -- still far below that which is believed to be of interest.

No further work was done in the project area for the remainder of 1991.

Preliminary thoughts have been generated for the 1992 year, but no plan has been formalized.

Sincerely,

James D. Sell /mek

James D. Sell

JDS:mek
cc: G.D. Van Voorhis
F.T. Graybeal
W.L. Kurtz
W.D. Gay

ASARCO Incorporated P.O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue FAX (602) 792-3934 Phone (602) 792-3010

WD 67

5/8/92

Mr. Harold W. Holmberg 405-270-1313
Director of ~~Mineral~~ Metal Exploration
Kerr-McGee Corporation
PO Box 25861
Oklahoma City, OK 73125

3802

[redacted]

I need his telephone #.

JAS

TM

1. Relief of WWC wol commitment
2. Claim in force validation by drilling.
3. Other?
4. Red Mtn Sale ? →,
5. TM Sale ? →,

Shallow cc 20 mill .69% 43 mill bx 1.17
W 136.47
E 44.53

is Ranch in package.

. Put package together on new (Final) agreement — They will listen!
Need update of drilling results. — assays, drillhole info, map.

Patagonia

1. Noranda is interested in Cu and wants to get on with program. Looks unlikely that we'll get out of work committment ("Schneider")

2. Holmberg says he'd like a summary report. OK? to release data of Jan 7. 1992 on "Greater Patagonia Expl." & leave off Ventura data ?

Holmberg says he'd like a FINAL amendment proposal that is workable. Seems stickey on let us out of work committment & vesting us since they would have to contribute from that point on.

JDS

ASARCO

Southwestern Exploration Division

June 1, 1992

G.D. Van Voorhis
Vice President of Exploration

Thunder Mountain Project
Patagonia Mountains
Santa Cruz County, AZ

Mr. H.W. Holmberg, Director of Metal Exploration, Kerr-McGee Corporation, has requested a summary report on the project area.

Mr. Holmberg requested the summary when I approached him to modify the agreement. He felt he needed to be aware of the various targets and their grade/depth parameters in order for him to lobby his organization on any new (and FINAL, as he says) amendment.

Kerr-McGee is aware of the holding costs for long-term future reserves and at Red Mountain they have retained only the patented group of claims over the deep mineral zone, and have released all the unpatented claims.

I have written a summary of the drilling results and interpretation for Mr. Holmberg. The preliminary copy is attached.

Please review and modify the summary and attachments for the final copy to be sent to Mr. Holmberg. I await your review.

James D. Sell

James D. Sell

JDS:mek
Attachments

cc: F.T. Graybeal (w/o maps)
W.L. Kurtz (" ")

ASARCO

Exploration Department
Southwestern United States Division
James D. Sell
Manager

PRELIMINARY COPY FOR REVIEW

Mr. Harold W. Holmberg
Director of Metal Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, OK 73125

Thunder Mtn. Project
Patagonia Mountains
Santa Cruz County, AZ

Dear Mr. Holmberg:

A summary of the drilling results, and interpretation is submitted. The Thunder Mountain Project comprises part of the Patagonia Exploration program of Asarco. In addition to SWED claims, the Asarco Mining Department has claims in the district. Figure 1 locates the area in Santa Cruz County in southern Arizona.

Attachment A outlines the two major mineralization centers and the four target areas of past and present exploration interest. They are:

1. Sunnyside deep target lies plus 3800 feet below the surface and is part of the Thunder Mountain Project. The primary chalcopyrite mineralization of the Sunnyside target has a sparse drill intercept geologic estimated resource of 650 million tons of 0.38% copper and 0.022% moly.

   Attachment A outlines several shallow chalcocite zones which are upper-level expressions of the deep chalcopyrite mineralization. The two explored targets are, A, the Sunnyside breccia and breccia pipe, and B, the Bucket Breccia chalcocite blanket.

   A. The Sunnyside breccia pipe was one of the earliest Asarco exploration drill targets in the Patagonia Mountains. The breccia pipe (Table 1-A) has a 5 hole drill indicated tonnage of 3 million tons of 0.48% copper surrounded by an envelope of lesser grade which is estimated at 35 million tons of 0.37% copper.

   B. The Bucket Breccia shallow chalcocite blanket has been the current drilling area and ten holes have cut the zone of mineralization. Mineralization essentially begins at the surface of the canyon bottom level and extends upward and under the adjacent hillsides. A potential

ASARCO Incorporated P.O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue FAX (602) 792-3934 Phone (602) 792-3010

of 30 million tons plus of 0.28% copper (Table 1-A), may exist in this target. Attachment B plots the topography, current drill holes, and the indicated copper grade contours of the total Bucket Breccia mineralization.

Three representative cross-sections, A-A', B-B', C-C' are shown on Attachment B and exhibited in Attachments C-1, C-2 and C-3.

The total blanket has an average thickness of 576 feet, and is best expressed as a three layer packet with a higher grade (+0.40 copper) at the surface and at depth, separated by a zone of 0.2-0.4 copper. All is surrounded by a low-grade envelope of mineralization.

2. Trench deep carbonate Pb-Zn-Ag mineralization. This zone is within lands held by Asarco Mining Department and under the Asarco-Kerr-McGee exploration agreement.

   Only four holes penetrate the carbonate skarn-hosted mineralization.

   Table 1-C lists the holes and the best intercepts found. Numerous intercepts of 1"-2" gouge - replacement zones up to massive sulfide replacement lenses or beds 43 feet thick have been cut. The best representation of the skarn-hosted style of mineralization was found in hole TCH-2, Table 1-C, and the many intercepts represent slips, lenses, pods, and probable extensive beds of massive sulfides.

Future exploration on the mineral centers at Thunder Mountain and part of Trench will be on lands within the Exploration Agreement with Kerr-McGee, as outlined on Attachment A.

James D. Sell

JDS:mek
Att. TM920102
91 1205 plan
91 1202 section
cc: G.D. Van Voorhis 1203 "
F.T. Graybeal 1204 "
W.L. Kurtz

Table 1. Mineral Resource of Thunder Mountain - Trench Areas, Patagonia Mountains.

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Sunnyside Bx*	361	170	0.37	34,600,000
Bucket Bx	150	576	0.28	32,300,000
Average/Total	256	373	0.30	66,900,000

*Includes Sunnyside breccia pipe, 4 hole area, of 3 million tons at average grade of 0.48% Cu, thickness of 240 feet.

B. Deep Zone of primary chalcopyrite

Zone	Depth Top, ft.	Average Thickness, ft.	Avg. Grade % Copper	Estimated Tonnage*
Sunnyside	3860	388	0.38	650,000,000

*Note: Drilling insufficient to outline total resource. Open beyond drilling used for this tabulation.

C. Deep Trench carbonate-hosted Pb-Zn-Ag

Insufficient drilling to outline any resource. Presently, 4 drill holes, with numerous intercepts ranging from 2' to 43' thick at depth from 3900' to 5000'.

Best Single Interval

Hole	Thickness	% Cu	% Pb	% Zn	oz. Ag
TM-13	2'	2.56	8.65	11.60	3.56
TCH-1	4.5'	2.64	12.70	14.50	1.80
TCH-2*	26'	1.83	6.29	15.06	14.93
TCH-2A	6'	0.69	1.65	0.24	9.04

*The best total hole is TCH-2; 15 intervals, totalling 349', between 4030' and 4920' range between 4' and 43' thick, averaging 23' thick, 0.58% Cu, 1.95% Pb, 7.25% Zn, and 5.53 oz. Ag composited through the 349' of mineral. Trace of mineral is found throughout the remaining intervals of altered limestone (skarn).

~~JDSell~~ — is FIY following up on this or are you? JDS

ASARCO

Exploration Department
G.D. Van Voorhis
Vice President

Fred is still working on the K-M side. We did get a waiver on the work commitment for 1992.

RECEIVED
JUN 8 1992
EXPLORATION DEPARTMENT

June 5, 1992

To: J.D. Sell

Re: Ventura Project, Arizona

As at Thunder Mountain, I do not want to spend anything above the minimum holding costs at Ventura for the foreseeable future. If Noranda does not agree with this, we should terminate the agreement with them.

Noranda has been making some drastic exploration cuts and I anticipate that they will be amenable to your proposal to cover holding costs.

GDV

G.D. Van Voorhis

GDv/lj

cc: F.T. Graybeal
W.L. Kurtz

ASARCO Incorporated 180 Maiden Lane New York, N.Y. 10038 (212) 510-2000
Telex:RCA 232378 Cable: MINEDEPART Fax: (212) 510-1978

June 9, 1992

Telecopier Message To:

RECEIVED
JUN 9 1992
EXPLORATION DEPARTMENT

Mr. W.L. Kurtz/J.D. Sell
Exploration Dept.
Tucson Office

Thunder Mtn.

Attached please find a draft which I propose be sent to Harold Holmberg at Kerr-McGee. This would replace the draft prepared by Jim Sell. The attached draft has several blanks which need numbers provided by the Tucson office. The location map provided by Mr. Sell with his draft was excellent. We also need a simplified geologic map with perhaps the quartz monzonite and the quartz feldspar porphyries collected into a single pattern with no other geology shown. The map should also contain an outline of the Thunder Mtn. group owned by Kerr-McGee and an outline of the Three R Group (no hyphen) owned by Asarco. I would not show any other claim ownership in the area.

On this simplified claim and geologic map I would outline the drill targets identified in my draft. The deep Sunnyside chalcopyrite target needs to be drawn so that it extends just beyond TM-8, TM-10, TR-15, TR-14, and TR-11, in a northwest ellipse. All drill holes should be shown on this map. The various targets should be labeled. The outline of the BX breccia is fine as shown on Mr. Sell's draft Attachment A. In addition the Flux Mine target should be identified with a single mine symbol and draw as an ellipse encompassing the Flux mine and extending southeasterly toward the Thunder Mtn. claim group. My guess is that a scale of 1 inch equals 2,000 ft. would allow all these features to be placed on an 8 1/2 x 11 inch map.

If there are any questions please call me and we can discuss them over the phone. I would like to get this going as fast as possible. Please advise whether this letter should go out on my letterhead or yours.

Very truly yours,

F.T. Graybeal

F.T. Graybeal

Enclosure

Asarco Incorporated

Fax # 212-510-1978

FAX COVER SHEET

Name: J.D. Sell & W.L. Kurtz

Location: Tucson Office

From: F.T. Graybeal

Department: Exploration Department N.Y. Office

You will receive 4 page (s) excluding this page. Please call Marie-Elaina Vesce at (212) 510-1873 if all pages are not received.

RECEIVED

JUN 9 1992

EXPLORATION DEPARTMENT

June 9, 1992

Telecopier Message To:

Mr. W.L. Kurtz/J.D. Sell
Exploration Dept.
Tucson Office

THREE R

RECEIVED
JUN 9 1992
EXPLORATION DEPARTMENT

Thunder Mtn.

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Very truly yours,

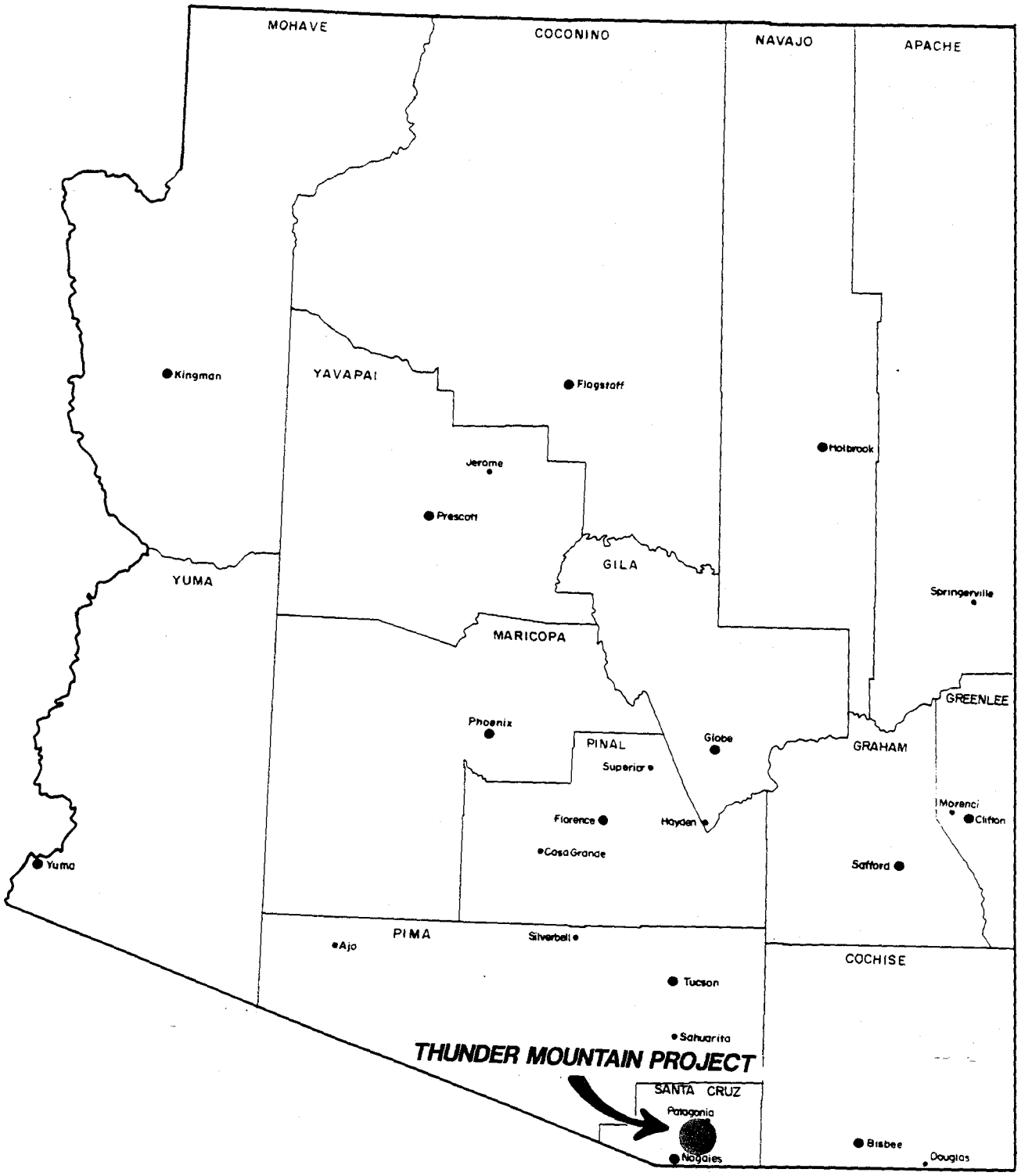
F.T. Graybeal

F.T. Graybeal

All NEW DDH

Enclosure

FIGURE 1

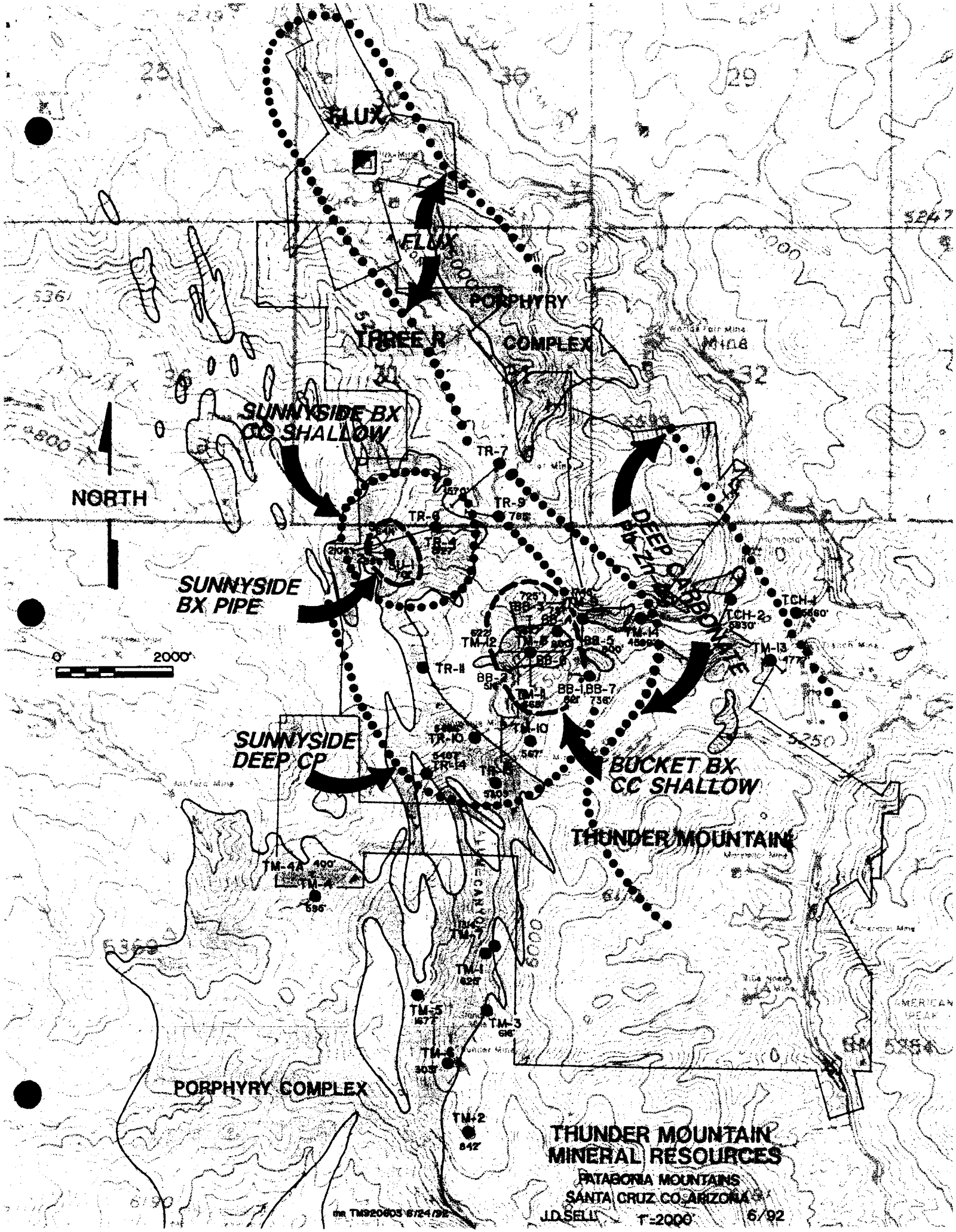


ASARCO Incorporated

INDEX MAP
THUNDER MOUNTAIN PROJECT
SANTA CRUZ CO., ARIZONA
J.D.S. **4-88**

0 50
MILES

mn6599 JDS/dam tuc 4-88


FLUX
FLUX
PORPHYRY
COMPLEX
THREE R
SUNNYSIDE BX
CC SHALLOW
NORTH
SUNNYSIDE
BX PIPE
0
2000'
DEEP CARBONATE
SUNNYSIDE
DEEP CP
BUCKET BX
CC SHALLOW
THUNDER MOUNTAIN
PORPHYRY COMPLEX
TR-7
TR-9
TR-6
TR-11
TR-10
TR-14
TM-12
TM-14
TM-13
TCH-1
TCH-2
BB-5
BB-1,BB-7
TM-10
TM-4A
TM-4
TM-7
TM-1
TM-5
TM-3
TM-2
THUNDER MOUNTAIN
MINERAL RESOURCES
PATAGONIA MOUNTAINS
SANTA CRUZ CO. ARIZONA
J.D.SELLI
1"=2000'
6/92

JDS

ASARCO

Exploration Department
Frederick T. Graybeal
Chief Geologist

June 9, 1992

Dr. Harold W. Holmberg
Director of Metal Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, OK 73125

DRAFT

THUNDER MTN. PROJECT
SANTA CRUZ COUNTY
ARIZONA

Dear Dr. Holmberg:

The Thunder Mtn. Project is a vertically-zoned porphyry copper system similar in some respects to the Red Mtn. property owned by Kerr-McGee. Thunder Mtn. is located at the north end of the Patagonia Mtns. about 60 miles south of Tucson, Arizona immediately south of Red Mtn. Thunder Mtn. is covered by 101 unpatented mining claims as shown on the attached map. Asarco negotiated an option to earn a 50 percent participating interest in a joint venture on the Thunder Mtn. Project in 1972. Since that time the original agreement has been amended 8 times reflecting the evolution in porphyry copper exploration objectives over the last 2 decades. ~~Over the same period of time Asarco has drilled 36,615 feet in 16 diamond drill holes within the existing claim group and spent $1,521,348. All drill core is stored in Tucson.~~ *

The current agreement requires that Asarco spend $100,000 per year until $1 million has been spent. Expenditures through May 31, 1992 which have been allowed as credit toward the $1 million are $627,316. If Asarco terminates before reaching the $1 million level a formula provides for partial Asarco ownership in Kerr-McGee Thunder Mtn. claims and partial Kerr-McGee ownership in Asarco Humboldt claims. (Note: no "d" on original claim notice)

Several mineralized zones exist on and adjacent to the Thunder Mtn. Project claim group and are shown on the attached simplified geologic map. None of these are viable at current metal prices, but might justify holding for the long term if costs could be kept to the minimum required by assessment work which is currently $ 10,100 for the Thunder Mountain group.

* Over the same period of time Asarco has drilled 23,016 feet in 13 holes at a cost of $856,713 on the Thunder Mountain claims, and 13,599 feet in 3 holes at a cost of $664,635 on the Humbolt Group for a total of 36,615 feet in 16 holes at a total expenditure of $1,521,348 within the present Thunder Mountain agreement lands.

Suggested Change

Thunder Mtn. Project

The Bucket Breccia zone contains shallow disseminated chalcocite mineralization centered in Alum Canyon and under the ridge to the east. Ten holes define roughly 30 million tons averaging 0.28% Cu with roughly 0.17 oz Ag, starting virtually at the surface. Most of the Bucket Breccia target is on the Thunder Mtn. claim group. Additional drilling might at best double the tonnage. The Sunnyside zone contains vein and disseminated chalcopyrite lying at a depth of roughly 3800 ft. Based on 5 deep drill holes this zone contains a minimum of 100 million tons averaging 0.51% Cu, 0.030% MoS_2 (0.018% Mo), and 0.17 oz Ag. Expansion of this zone is likely with more drilling. Roughly 20 % of this zone is on the Thunder Mtn. claim group. The Deep Carbonate zone lies under the northeastern portion of the Thunder Mtn. claim group and probably extends northwesterly under the Three R claim block toward the Flux Mine. Sulfide intersections in 4 holes at a depth of 4000 ft. near the base of the Mesozoic volcanic section vary from 4-40 ft. thick and average 1-2% Cu and 1-5 oz Ag. These are underlain by the Palezoic carbonate section with several intersections in retrograde-altered skarn; perhaps the most significant was in TCH-2 which cut 57 ft. averaging 1.3% Cu, 5.0% Pb, 12.2% Zn, and 10.8% Ag at a depth of 4653 ft. The carbonate mineralization appears limited to the southwest by the intrusion-hosted Sunnyside zone and to the northeast by altered, but relatively unmineralized carbonates in TCH-1 and TM-13. The Deep Carbonate intersections are interpreted to be near the top of the Palezoic section which is roughly 4000 ft. thick. The east-west width of the zone probably varies from one to several thousand feet and it may be 1-2 miles long.

The Three R claim group lies along the northwest side of the Thunder Mtn. claim group. The Three R group consists of 49 unpatented claims owned entirely by Asarco which contain several zones of mineralization shown on the attached simplified map. Portions of the Sunnyside, Bucket Breccia, and northwesterly extension of the Deep Carbonate zones mentioned above occur on the Three R group. In addition, 4 holes in the BX Breccia zone indicate roughly 3 million tons averaging 0.48% Cu as chalcocite which might be expanded with further drilling. Finally, the Flux mine at the north end of the claim group produced 1,100,000 tons ~~tons~~ between 1937-1965 averaging 5.10 %Pb, 9.80 %Zn and 3.30 oz Ag from a large exotic block of Palezoic limestone in the Mesozoic volcanic section. No exploration has been conducted at the Flux Mine since it closed in ~~1960~~. 1965.

Thunder Mtn. Project

None of the targets on the 2 claim blocks described above merit accelerated exploration at present, but an argument could be made to hold them for the long term if costs could be held to assessment work. With this in mind, Asarco proposes that the Three R and Thunder Mtn. claim groups be combined in a single joint venture owned 50% by Asarco and 50% by Kerr-McGee. Asarco would be manager of the joint venture. Annual work would be limited to that required to fulfill annual assessment (~$15,000) requirements until such time as both parties agreed to a more aggressive program.

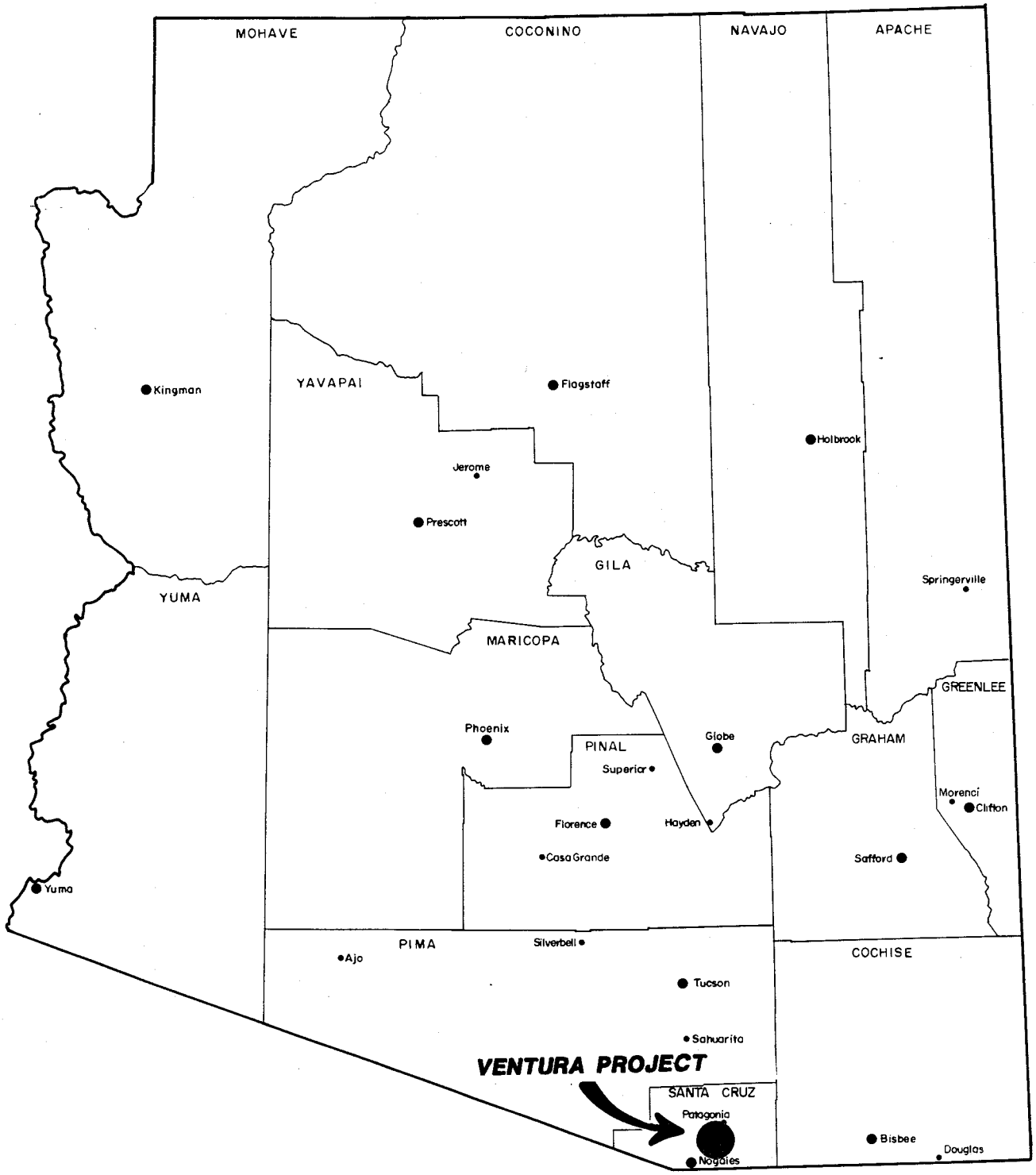
If the above proposal is of interest to Kerr-McGee please call me at 602-792-3010. We can arrange an examination of the drill core, logs, and other information at short notice if necessary.

Very truly yours,

F.T. Graybeal

FTG/mev

FIGURE 1



ASARCO Incorporated

INDEX MAP

VENTURA PROJECT

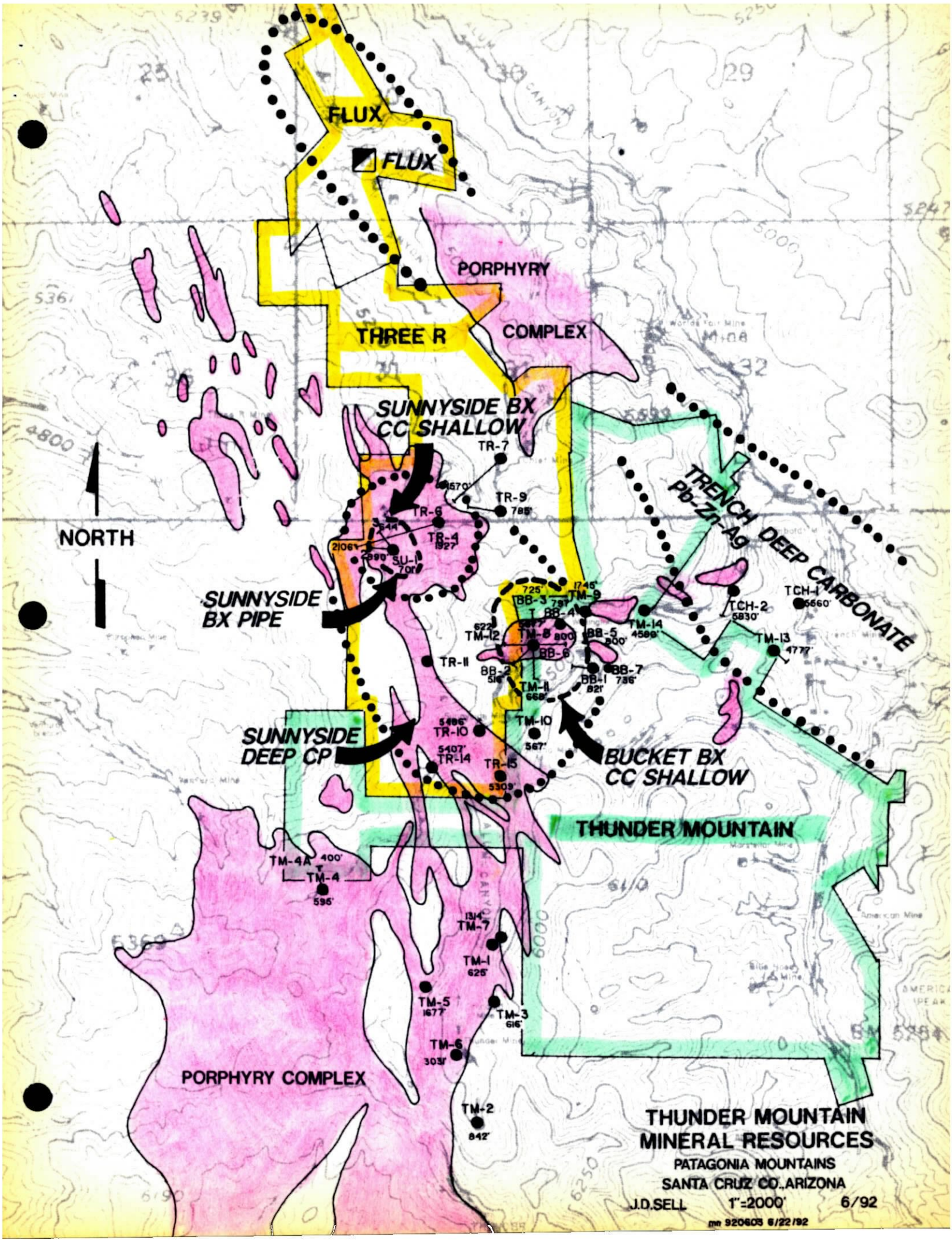
SANTA CRUZ CO.,ARIZONA

J.D.S. 4-88

0 50

MILES

mn6599 JDS/dam tuc 4-88


FLUX
FLUX
PORPHYRY
THREE R
COMPLEX
SUNNYSIDE BX
CC SHALLOW
TR-7
TR-9
785'
TR-6
TR-4
1927
SU-1
NORTH
SUNNYSIDE
BX PIPE
TRENCH DEEP CARBONATE
Pb-Zn-Ag
TCH-1
5660'
TCH-2
5830'
TM-13
4777'
TM-14
4589'
TM-9
1745'
BB-3
725'
BB-4
TM-12
TM-8
BB-5
BB-6
TR-11
BB-2
BB-7
736'
BB-1
821'
TM-11
TM-10
567'
TR-10
5486'
TR-14
5407'
TR-15
5309'
SUNNYSIDE
DEEP CP
BUCKET BX
CC SHALLOW
THUNDER MOUNTAIN
TM-4A
400'
TM-4
595'
TM-7
1314'
TM-1
625'
TM-5
1677'
TM-3
616'
TM-6
303'
PORPHYRY COMPLEX
TM-2
842'
THUNDER MOUNTAIN
MINERAL RESOURCES
PATAGONIA MOUNTAINS
SANTA CRUZ CO., ARIZONA
J.D.SELL
1"=2000'
6/92
mn 920603 6/22/92

Asarco Incorporated

Fax # 212-510-1978

FAX COVER SHEET

Name: J.D. Sell

Location: Tucson Office

From: F.T. Graybeal

Department: Exploration Department N.Y. Office

You will receive 2 page (s) excluding this page. Please call Marie-Elaina Vesce at (212) 510-1873 if all pages are not received.

RECEIVED
JUN 24 1992
EXPLORATION DEPARTMENT

To: JDSell
Tucson Office
by FAX

Thunder Mtn.

Thanks for the revisions and map re proposal to Kerr-McGee. I'll fix the text and send from here. Would you revise map as follows (see attached map):

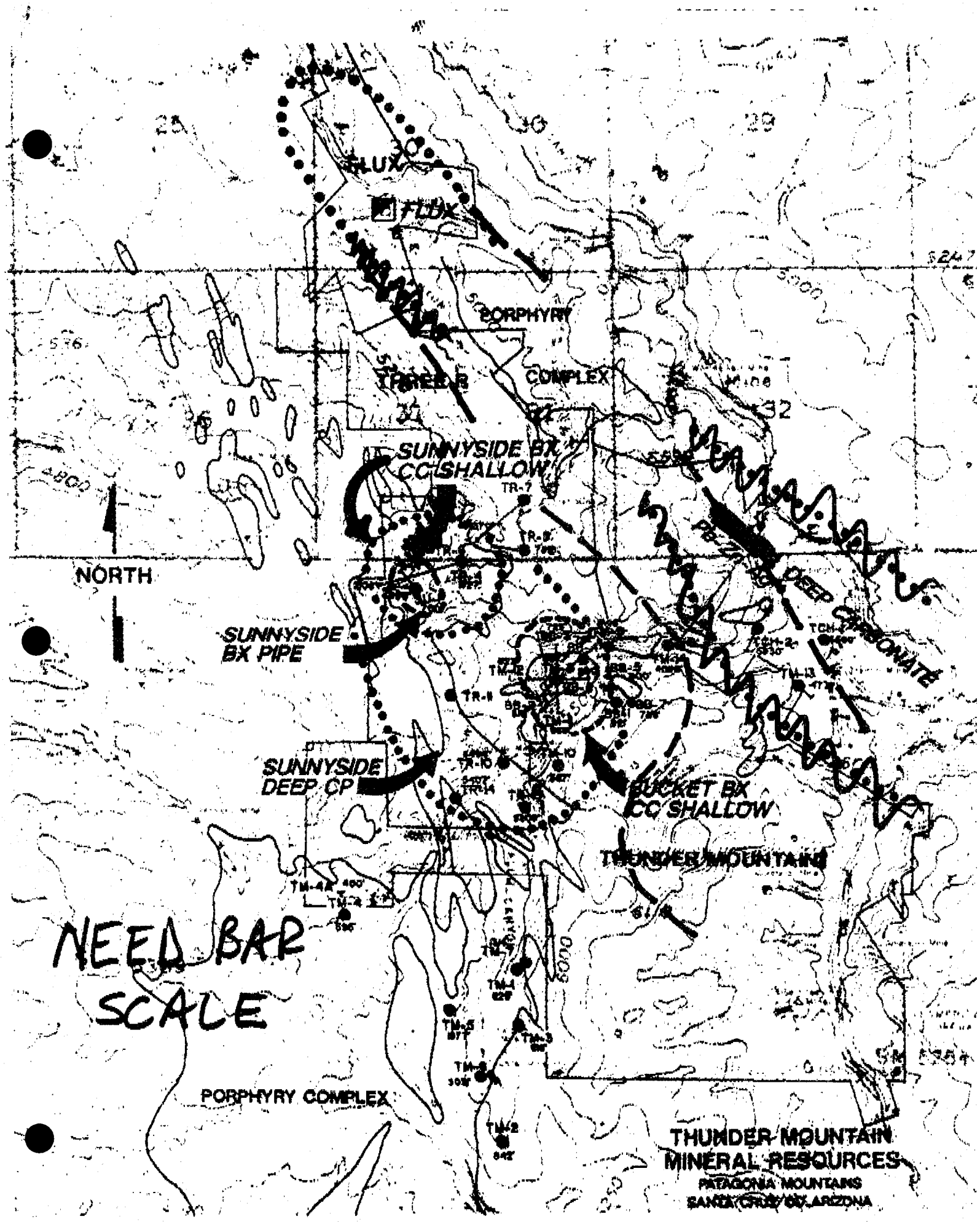
1.) change Fhx outline
2) change deep carbonate outline and leave off the word Trench
3.) revise Sunnyside Bx arrow to point at outer circle
4) map needs a bar scale.

Send me FAX of revise map. If OK send colored copies here (how will you color them?) and I'll send letter from NY.

FTG
6/24/92

Attach

RECEIVED
JUN 24 1992
EXPLORATION DEPARTMENT


FLUX
FLUX
PORPHYRY
COMPLEX
SUNNYSIDE BX
CC SHALLOW
TR-7
NORTH
SUNNYSIDE
BX PIPE
DEEP CARBONATE
SUNNYSIDE
DEEP CP
BUCKET BX
CC SHALLOW
THUNDER MOUNTAIN
NEED BAR
SCALE
PORPHYRY COMPLEX
THUNDER MOUNTAIN
MINERAL RESOURCES
PATAGONIA MOUNTAINS
SANTA CRUZ CO. ARIZONA

TOTAL P.06

To: JDSell
Tucson Office
by FAX

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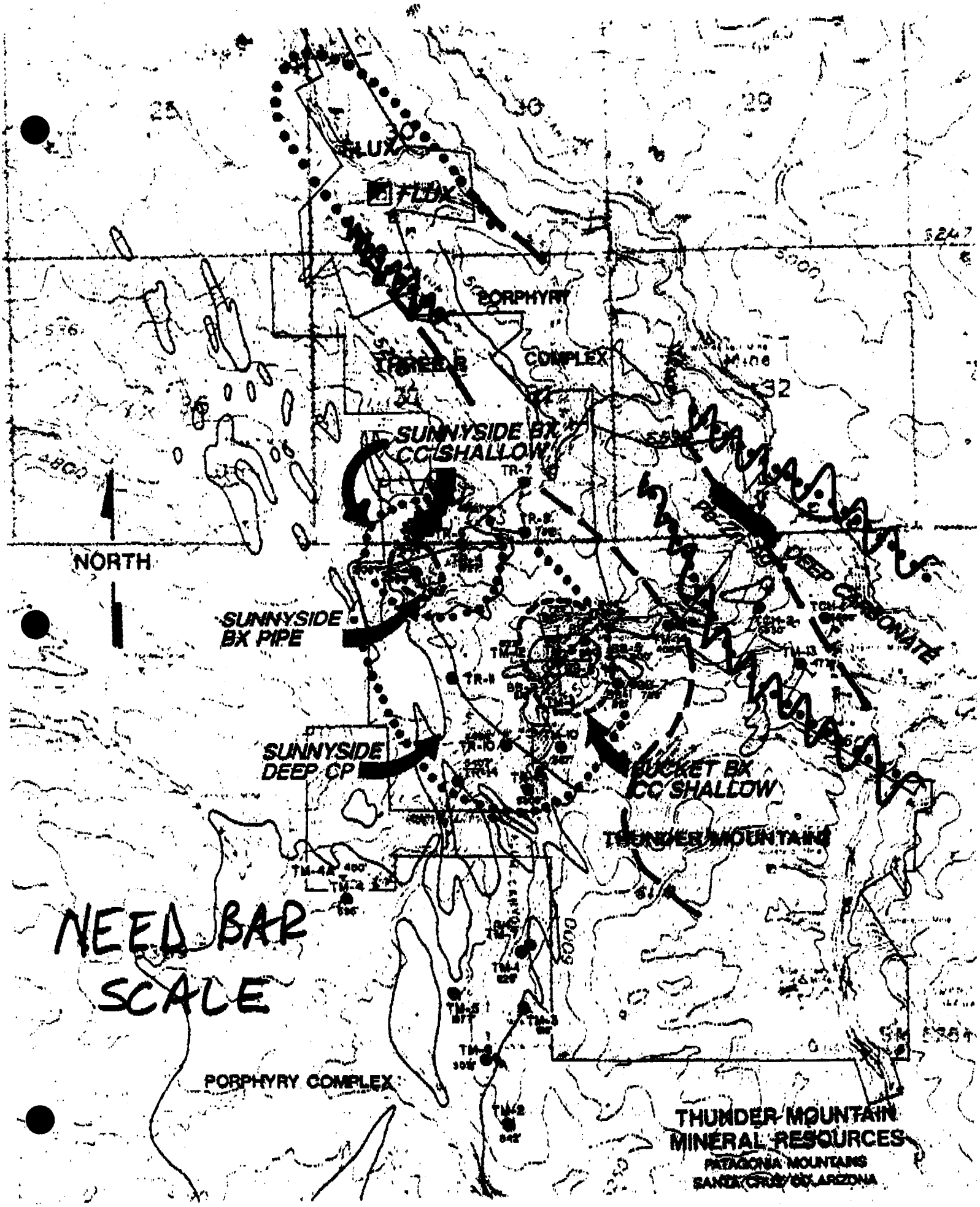
FLUX
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BX PIPE
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THUNDER MOUNTAINS
NEED BAR
SCALE
PORPHYRY COMPLEX
THUNDER MOUNTAIN
MINERAL RESOURCES
PATAGONIA MOUNTAINS
SANTA CRUZ CO. ARIZONA

Asarco Incorporated

Fax # 212-510-1978

FAX COVER SHEET

Name: J.D. Sell

Location: Tucson Office

From: F.T. Graybeal

Department: Exploration Department N.Y. Office

You will receive 2 page (s) excluding this page. Please call Marie-Elaina Vesce at (212) 510-1873 if all pages are not received.

RECEIVED
JUN 24 1992
EXPLORATION DEPARTMENT

ASARCO

JDS

Exploration Department
Frederick T. Graybeal
Chief Geologist

August 4, 1992

ASARCO Incorporate

AUG 11 1992

SW Exploration

Mr. J.D. Sell
Manager Southwestern Exploration Division
Tucson Office

Red Mountain Property
Arizona Santa Cruz Co

Dear Mr. Sell:

I have your note of July 27, 1992 in which you inquire about the possibility that Asarco might take an option on a claim group held by Jim Quinlan surrounding the patented claims held by Kerr-McGee at Red Mountain. This property is too deep and, given current chemical technology, not compatible with existing in situ capabilities to be attractive to Asarco. At such time as in situ techniques are able to extract copper from hypogene deposits at depths in excess of 1 mile or conventional mining at these depths becomes viable we might want to reconsider. At the present time I think we hold enough deep copper deposits in inventory to satisfy our current needs.

To be honest, no one in Asarco disagrees with the concept of holding resources with the future; rather we disagree on whether certain resources will ever be anything but a resource. Opportunities will continue to come and should be continually reviewed to test changing long term strategies. We will keep an open mind on this subject even though it is unlikely that any of us are going to prevail all the time with our own particular view.

Very truly yours,

F.T. Graybeal

F.T. Graybeal

FTG/mev

cc: W.L. Kurtz-Tucson Office

ASARCO Incorporated 180 Maiden Lane New York, N.Y. 10038 (212) 510-2000
Telex:RCA 232378 Cable: MINEDEPART Fax: (212) 510-1978

7/29/92

FROM: W. L. KURTZ

TO: F.T. Graybeal

Red Mtn. Claims

Without going to the files my recollection is that the bx-pipe was very limited and deep; and the grade of copper outside the pipe was low.

I am the man referred to by Sell as "no interest in holding resources for the future." This is not true, but is true for deep, low grade, copper sulfide reserves (resources).

cc: J.D. Sell

JDS

ASARCO

Southwestern Exploration Division

July 27, 1992

F.T. Graybeal
New York Office

Red Mountain Claims
Patagonia Mining District
Santa Cruz County, Arizona

You may have been aware that Kerr-McGee had patented some 34 claims at their Red Mountain Project, Santa Cruz County, Arizona, and had dropped all the unpatented ground.

Jim Quinlan, former Red Mountain Project geologist, had gone to K-M earlier this year and told Dr. Holmberg that he would stake some of the dropped claims.

Jim has done that, Figure 1, staking 2 "BP" claims on the south to cover a small hole left by K-M, and 8 "A" claims on the north and has BLM numbers. Figure 1 also shows the K-M patented claims outline.

Jim's reasoning for staking these claims in their relation to the others, is illustrated in attached Figures 2 and 3 which show the silicate alteration pattern and the chalcopyrite distribution.

No imagination is needed to suggest that the claims have, perhaps, up to ¼ the total mineral zone as outlined by K-M.

The breccia pipe area has an estimated one billion pounds of copper, the K-M total zone contains 2-3 billion pounds and the J.Q. ground may contain a billion pounds or more of copper.

Note: All figures are from the AGS 1981 symposium, Field Trip #8, which contains the 25 page paper by James J. Quinlan on the geology and silicate-sulfide zoning at Red Mountain.

Mr. Quinlan is interested in making a deal with Asarco and would be pleased to hear from you as to Asarco's interest, or lack of interest.

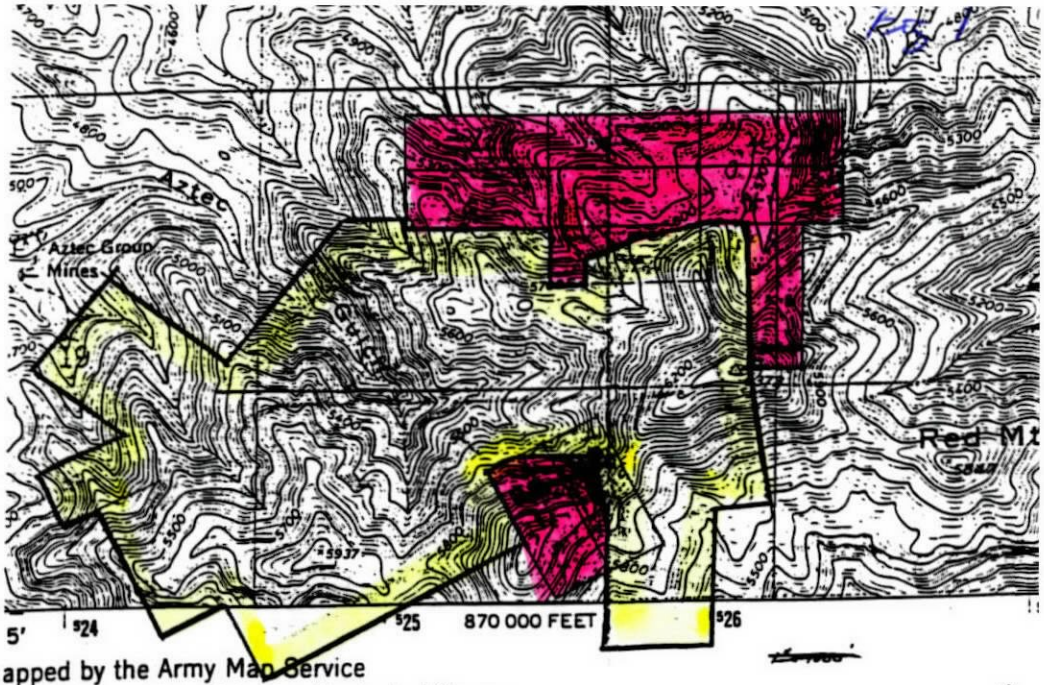
I realize that this submittal comes to SWED at a time when some in Asarco have no interest in holding resources for the future, but I bring it to your attention as another facet in our dealing with Kerr-McGee in the near future.

James D. Sell /mek

James D. Sell

JDS:mek
Attachments

cc: W.L. Kurtz



apped by the Army Map Service
dited and published by the Geological Survey

1" = 2000'

KM Patented Lode Claims

JQ Unpatented Lode Claims

7/92

JAMES J. QUINLAN
Mining Geologist

SPECIALIST:
Deposit Definition
and Ore Reserves

5626 E. Holmes St.
Tucson, Arizona 85711
(602) 747-4850

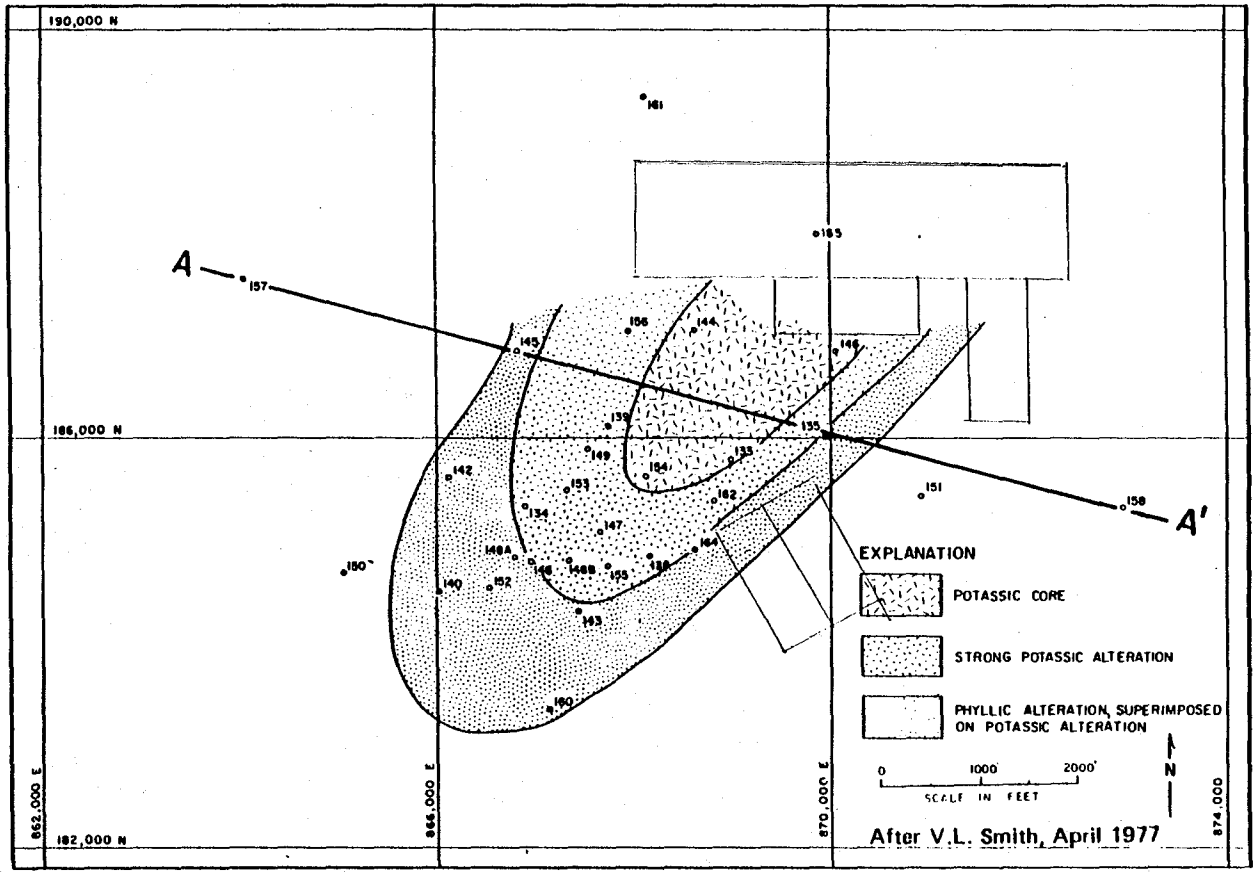


Fig. 5. Map showing silicate alteration between elevations 2,000' and 2,500' at Red Mountain, Arizona. Developed from petrographic study of thin sections from selected holes.

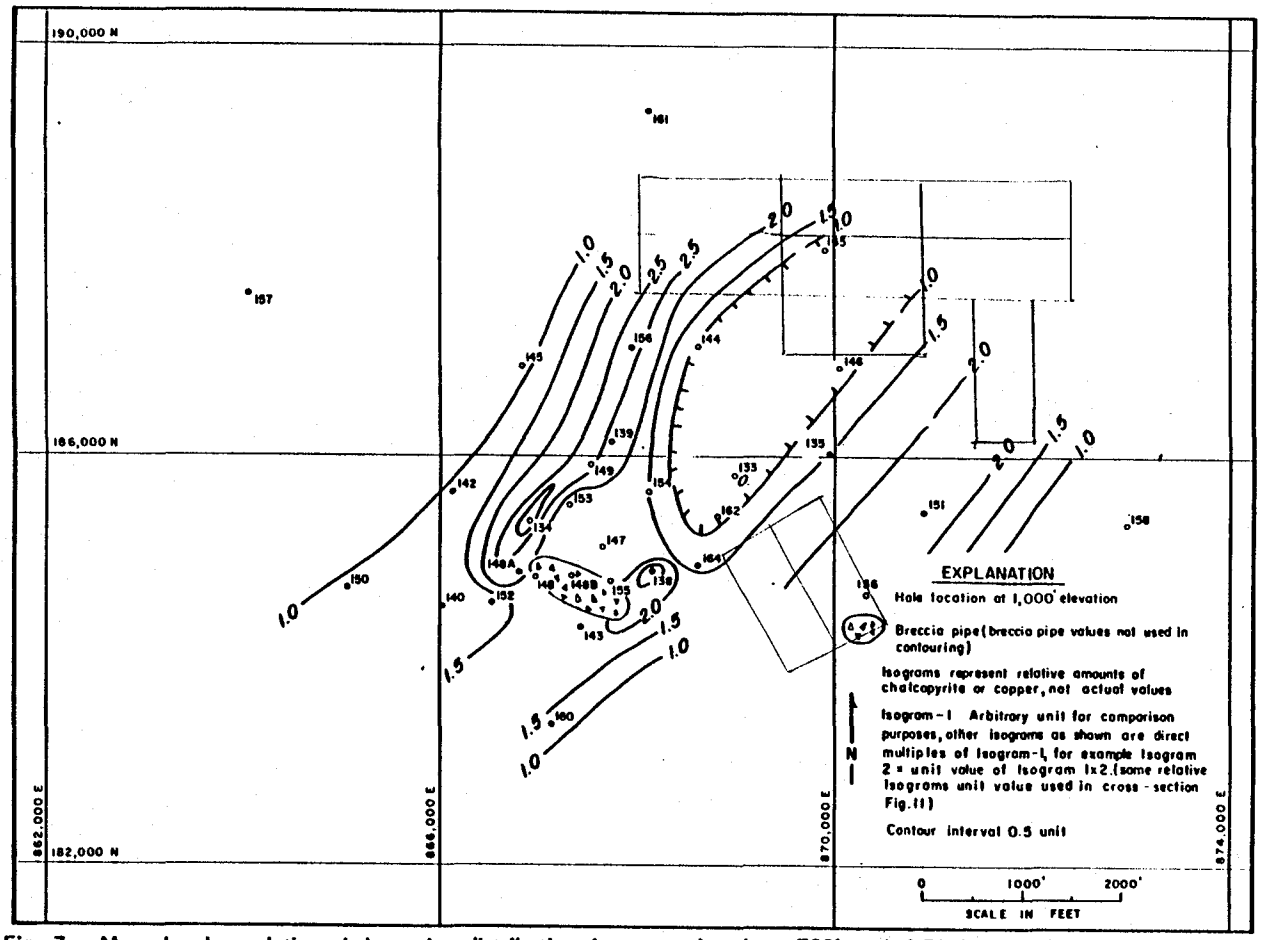


Fig. 7. Map showing relative chalcopyrite distribution between elevations 500' and 1,500' at Red Mountain, Arizona.

FIG 3
20

ASARCO

Exploration Department
Frederick T. Graybeal
Chief Geologist

ASARCO Incorporated

NOV 19 1992

SW Exploration

November 13, 1992

Dr. Harold W. Holmberg
Director - Metals Exploration
Kerr McGee Corporation
Kerr McGee Center
Oklahoma City, Oklahoma 73125

Thunder Mtn. Project
Arizona

Dear Harold:

If the terms proposed in your August 6, 1992 letter and your kind offer to rewrite the Joint Venture Agreement still hold, I would be pleased to proceed on that basis. If there are questions regarding expenditures I suggest someone contact Jim Sell, Asarco Manager of Southwestern Exploration in Tucson (602-792-3010). Alternatively call me or sent me a draft and I can fill in the blanks.

My rather hectic schedule will continue. Between November 16 and the end of the year I will be in my office only the week of December 14. After that I may be in New York only in the week of January 4 until February 1.

Best regards,

Very truly yours

Fred Graybeal

F.T. Graybeal

FTG/lj

cc: J. Sell/w att. ✓

ASARCO Incorporated 180 Maiden Lane New York, N.Y. 10038 (212) 510-2000
Telex:RCA 232378 Cable: MINEDEPART Fax: (212) 510-1978

KERR-McGEE CORPORATION
KERR-McGEE CENTER • OKLAHOMA CITY, OKLAHOMA 73125

RECEIVED
AUG 10 1992
EXPLORATION DEPT

MINERALS EXPLORATION DIVISION
H. W. HOLMBERG
DIRECTOR - METALS EXPLORATION

August 6, 1992

F. T. Graybeal
Chief Geologist
ASARCO Incorporated
180 Maiden Lane
New York, New York 10038

Dear Fred:

It was a pleasure talking with you and pursuing ways to preserve existing property interests at Thunder Mtn., Arizona. As I stated, Kerr-McGee will entertain ASARCO's proposal to reduce annual obligations on said project but it is not our desire to create a spending obligation for ourselves in the process. Alternatively, I propose the following terms for your consideration.

1) Exhibit A of said Agreement will be amended to reflect the addition of ASARCO's Three R claims.

2) Initial Exploration Period will be redefined as terminating on October 1, 2002.

3) In order for ASARCO to earn their proportionate share, they must satisfy the existing obligation to spend $1,000,000. The remaining unsatisfied expenditure as of December 31 of each year will be inflated by the CPI for that year until such time that the annual earn-in is satisfied.

4) The ultimate ownership, should ASARCO satisfy the earn-in on October 1, 2002, will be 55% ASARCO - 45% Kerr-McGee. Until such date, should ASARCO satisfy the earn-in early, the relationship will be 50% ASARCO - 50% Kerr-McGee.

5) Early termination prior to satisfaction of the earn-in obligation will be handled as provided for in Paragraph 3 of Amendment 8. That is, each party earns into the others' property holding on a proportional basis as dictated by spending.

We also suggest that a new Joint Exploration Agreement be drafted to replace the old Operating Agreement since so much time has passed since the original Agreement was entered into and since numerous revisions have transpired or are proposed.

If these proposed terms are satisfactory to ASARCO, please advise and we will initiate preparation of said Agreement for your review. We will require a listing of claims to be incorporated into the Agreement.

Sincerely,

KERR-McGEE CORPORATION
Minerals Exploration Division

Harold W. Holmberg

Harold W. Holmberg
Director - Metals Exploration

HWH:jh

c: G. D. Christiansen
J. P. Jones

URGENT!

JDS

June 30, 1993

Jim:
Attached is a letter of termination to Kerr-McGee.

Mr. Holmberg ~~sa~~ thinks we owe him something on the summary report of ~~operations~~ exploration operations. I think the only thing he might not have is the data on the BB-8 & BB-9 holes drilled in 1992.

Fred ask me to have you call ~~Mr~~ Mr. Holmberg and see ~~wed~~ what he wants and give him anything he needs.

Mr. Holmberg will, after he has received the geological data, ~~call~~ contact ~~Cam~~ Marco. Please have Mr. ~~Hol~~ Holmberg respond to Mike Lee with a copy to Pat Maley

An Ex. Employee
Bill Gay

Thanks Jim hope this Thunder Mtn deals get put to bed soon.

Final Report:
Release: Tom Wolfe, Perry-Off.
cc: Pat Maley
Gil Malcolm in site

ASARCO

Exploration Department
Frederick T. Graybeal
Chief Geologist

May 28, 1993

VIA FACSIMILE AND FEDERAL EXPRESS
Facsimile Number 405-270-3123

Mr. Harold Holmberg MT 2604
Kerr-McGee Corporation
Minerals Exploration Division
Kerr-McGee Center
123 Robert S. Kerr Avenue
Oklahoma City, OK 73102

Re: Operating Agreement dated October 1, 1972 (as amended) Thunder Mountain Project Santa Cruz County, Arizona (Your designation 02-007-0000)

Gentlemen:

In accordance with the Operating Agreement dated October 1, 1972, as amended from time to time to and including the Eighth Amendment effective January 1, 1988, ASARCO Incorporated hereby gives notice of termination of the Operating Agreement as amended, in its entirety.

ASARCO Incorporated hereby notifies Kerr-McGee Corporation that ASARCO has not done annual assessment work for the assessment year commencing September 1, 1992; and has not made work program expenditures for exploration or development on the subject lands during the years commencing October 1, 1991 and October 1, 1992, and has not paid federal rentals on any of the Subject Land due August 31, 1993.

Within thirty days from date hereof, ASARCO will furnish to Kerr-McGee with a summary report of exploration operations, if any, conducted on the Subject Lands since the last annual report thereof.

ASARCO Incorporated 180 Maiden Lane New York, N.Y. 10038 (212) 510-2000
Telex:RCA 232378 Cable: MINEDEPART Fax: (212) 510-1978

ASARCO will upon request cooperate in executing additional documents, if reasonably necessary, to document the termination of the Operating Agreement as amended.

Sincerely,

F. T. Graybeal

F. T. Graybeal

FTG:dlc

cc: W. D. Gay - Tucson Office

ASARCO

Exploration Department
Frederick T. Graybeal
Chief Geologist

May 28, 1993

VIA FACSIMILE AND FEDERAL EXPRESS
Facsimile Number 405-270-3123

Mr. Harold Holmberg MT 2604
Kerr-McGee Corporation
Minerals Exploration Division
Kerr-McGee Center
123 Robert S. Kerr Avenue
Oklahoma City, OK 73102

Humbolt-Mendoza Claims
Thunder Mountain Project, Arizona

Dear Mr. Holmberg:

The Humbolt-Mendoza group of about 7 claims was held by Asarco for many years having been purchased from a local prospector named Joe Mendoza. These claims were made part of the project as part of the Eighth Amendment.

You should know that if you decide to retain these claims they carry a 2.5% NSR payable to Mr. Mendoza at production. Mr. William Gay in Asarco's Tucson Office can provide you with the details.

Very truly yours,

F. T. Graybeal

F. T. Graybeal

FTG:dlc

cc: W. D. Gay - Tucson Office

ASARCO Incorporated 180 Maiden Lane New York, N.Y. 10038 (212) 510-2000
Telex:RCA 232378 Cable: MINEDEPART Fax: (212) 510-1978

JDS

ASARCO

Exploration Department
Frederick T. Graybeal
Chief Geologist

June 29, 1992

ASARCO Incorporated
JUL 6 1992
SW Exploration

Dr. Harold W. Holmberg
Director of Metal Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, OK 73125

THUNDER MTN. PROJECT
SANTA CRUZ COUNTY
ARIZONA

Dear Dr. Holmberg:

The Thunder Mtn. Project is a vertically-zoned porphyry copper system similar in some respects to the Red Mtn. property owned by Kerr-McGee. Thunder Mtn. is located at the north end of the Patagonia Mtns. about 60 miles south of Tucson, Arizona immediately south of Red Mtn. Thunder Mtn. is covered by 101 unpatented mining claims outlined in green on the attached map. Asarco negotiated an option to earn a 50 percent participating interest in a joint venture on the Thunder Mtn. Project in 1972. Since that time the original agreement has been amended 8 times reflecting the evolution in porphyry copper exploration objectives over the last 2 decades. Over the same period of time Asarco has drilled 23,016 feet in 13 holes at a cost of $856,713 on the Thunder Mountain claims, and 13,599 feet in 3 holes at a cost of $664,635 on the Humbolt Group for a total of 36,615 feet in 16 holes at a total expenditure of $1,521,348 within the present Thunder Mountain agreement lands.

The current agreement requires that Asarco spend $100,000 per year until $1 million has been spent. Expenditures through May 31, 1992 which have been allowed as credit toward the $1 million are $627,316. If Asarco terminates before reaching the $1 million level a formula provides for partial Asarco ownership in Kerr-McGee Thunder Mtn. claims and partial Kerr-McGee ownership in Asarco Humbolt claims.

Several mineralized zones exist on and adjacent to the Thunder Mtn. Project claim group and are shown on the attached simplified geologic map. None of these are viable at current metal prices, but might justify holding for the long term if costs could be kept to the minimum required by assessment work which is currently $10,100 for the Thunder Mtn. group.

The Bucket Breccia zone contains shallow disseminated chalcocite mineralization centered in Alum Canyon and under the ridge to the east. Ten holes define roughly 30 million tons averaging 0.28% Cu with roughly 0.17 oz Ag, starting virtually at the surface. Most of the Bucket Breccia target is on the Thunder Mtn. claim group. Additional drilling might at best double the tonnage. The Sunnyside deep chalcopyrite zone contains vein and disseminated chalcopyrite lying at a depth of roughly 3800 ft. Based on 5 deep drill holes (TM-8, TR-10, 11, 14, and 15) this zone contains a minimum of 100 million tons averaging 0.51% Cu, 0.030% MoS_2 (0.018% Mo), and 0.17 oz Ag. Expansion of this zone is likely with more drilling. Roughly 20% of this zone is on the Thunder Mtn. claim group. The Deep Carbonate zone lies under the northeastern portion of the Thunder Mtn. claim group and probably extends northwesterly under the Three R claim block toward the Flux Mine. Sulfide intersections in 4 holes at a depth of 4000 ft. near the base of the Mesozoic volcanic section vary from 4-40 ft. thick and average 1-2% Cu and 1-5 oz Ag. These are underlain by the Paleozoic carbonate section with several intersections in retrograde-altered skarn; perhaps the most significant was in TCH-2 which cut 57 ft. averaging 1.3% Cu, 5.0% Pb, 12.2% Zn, and 10.8% Ag at a depth of 4653 ft. The carbonate mineralization appears limited to the southwest by the intrusion-hosted Sunnyside zone and to the northeast by altered, but relatively unmineralized carbonates in TCH-1 and TM-13. The Deep Carbonate intersections are interpreted to be near the top of the Palezoic section which is roughly 4000 ft. thick. The east-west width of the zone probably varies from one to several thousand feet and it may be 1-2 miles long.

The Three R claim group lies along the northwest side of the Thunder Mtn. claim group and is outlined in yellow on the attached map. The Three R group consists of 49 unpatented claims owned entirely by Asarco which contain several zones of mineralization. Portions of the Sunnyside, Bucket Breccia, and northwesterly extension of the Deep Carbonate zones mentioned above occur on the Three R group. In addition, 4 holes in the BX Breccia zone indicate roughly 3 million tons averaging 0.48% Cu as chalcocite which might be expanded with further drilling. Finally, the Flux mine at the north end of the claim group produced 1,100,000 tons averaging 5.1% Pb, 9.8% Zn and 3.3 oz Ag from a large exotic block of Palezoic limestone in the Mesozoic volcanic section. No exploration has been conducted at the Flux Mine since it closed in 1965.

Thunder Mtn. Project

None of the targets on the 2 claim blocks described above merit accelerated exploration at present, but an argument could be made to hold them for the long term if costs could be held to assessment work. With this in mind, Asarco proposes that the Three R and Thunder Mtn. claim groups be combined in a single joint venture owned 50% by Asarco and 50% by Kerr-McGee. Asarco would be manager of the joint venture. Annual work would be limited to that required to fulfill annual assessment requirements ($15,000) until such time as both parties agreed to a more aggressive program. If we are unable to reduce costs to assessment work levels, we will have to withdraw from the Thunder Mtn. agreement.

If the above proposal is of interest to Kerr-McGee please call me at 212-510-1871. We can arrange an examination of the drill core, logs, and other information at short notice if necessary.

Very truly yours,

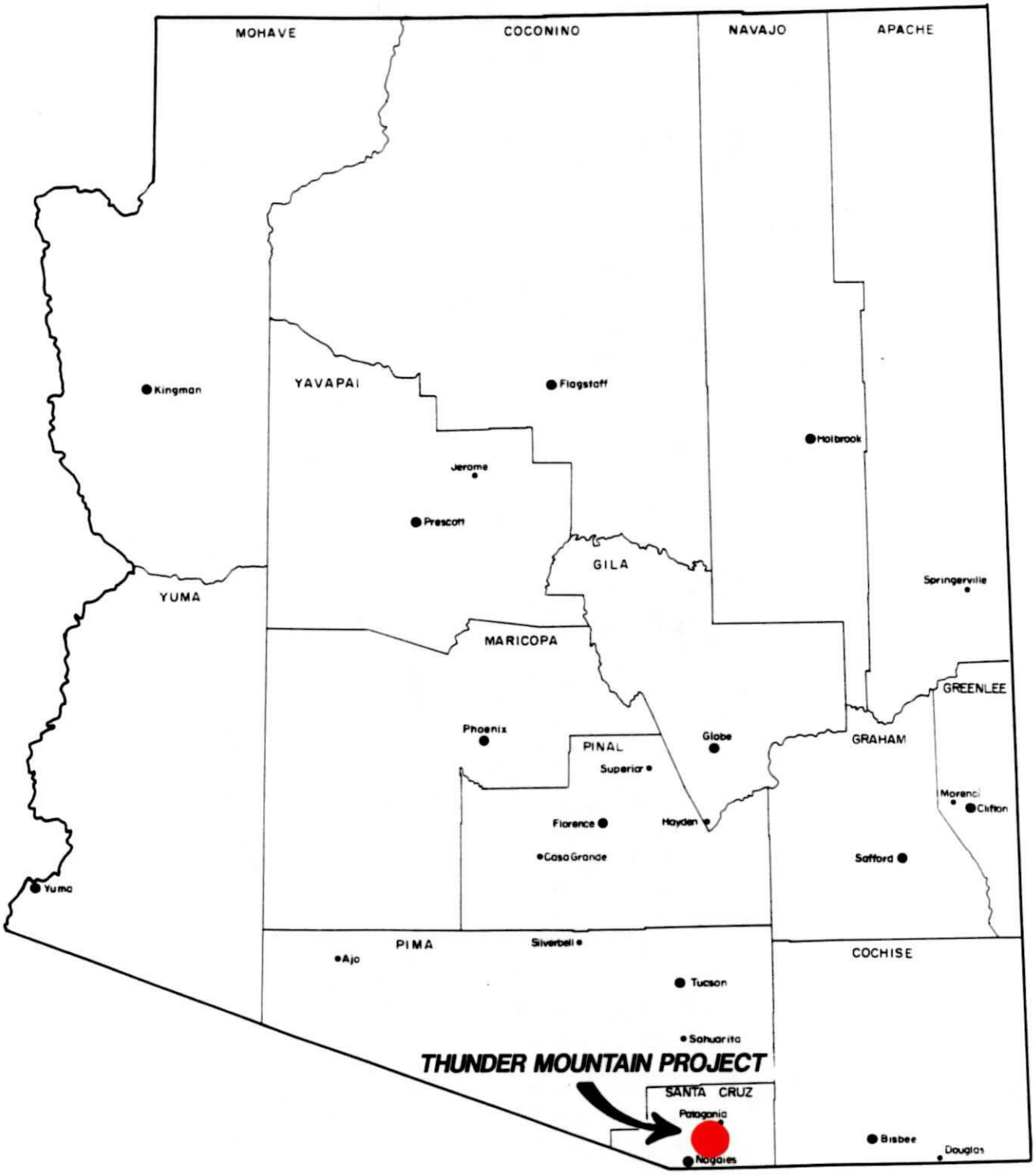
F.T. Graybeal

F.T. Graybeal

Attachments

FTG/mev
cc: JDSell w/attachments

FIGURE 1



ASARCO Incorporated

INDEX MAP

THUNDER MOUNTAIN PROJECT

SANTA CRUZ CO.,ARIZONA

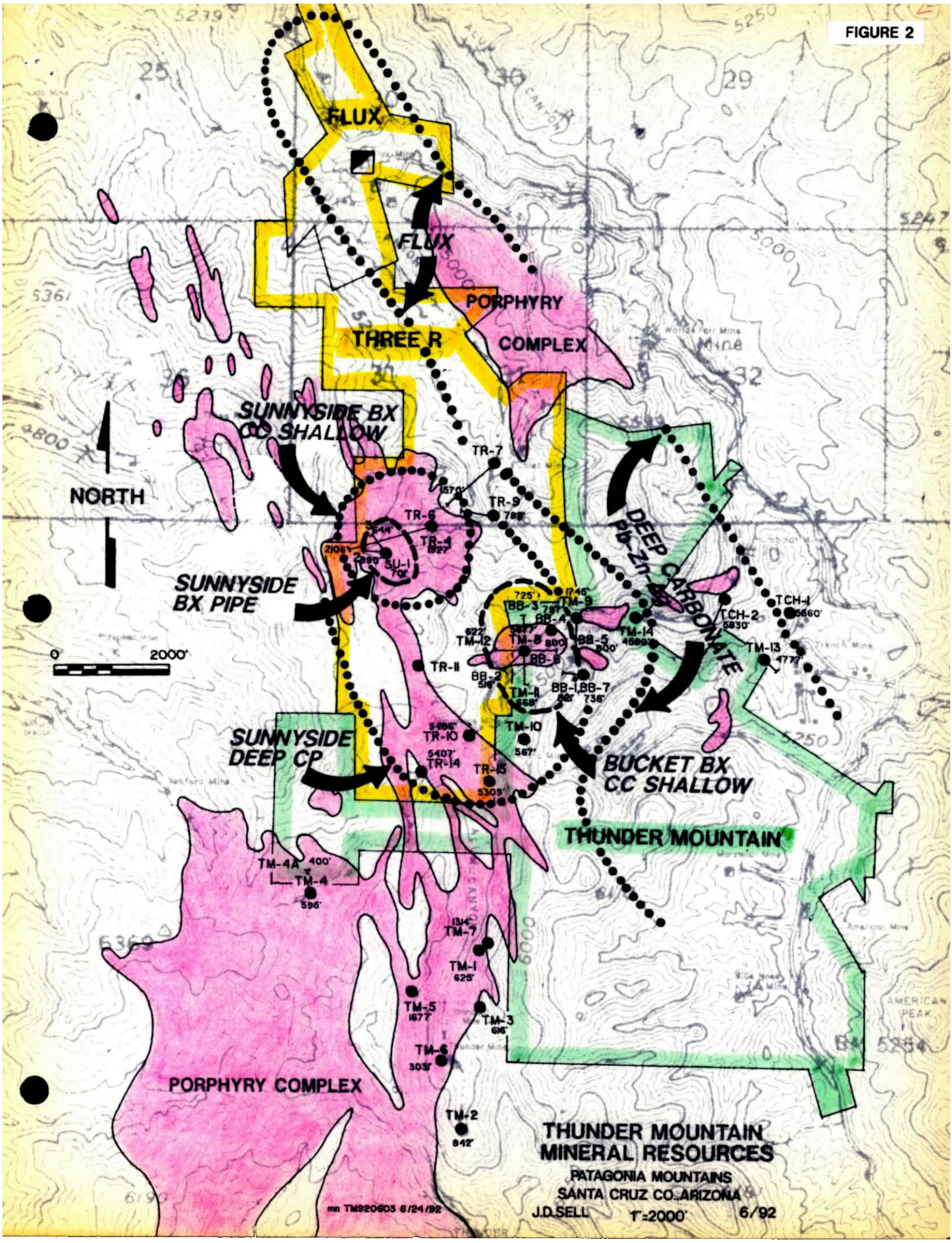
J.D.S. 4-88

0 50

MILES

mn6599 JDS/dam tuc 4-88

FIGURE 2


FLUX
FLUX
PORPHYRY
COMPLEX
THREE R
SUNNYSIDE BX
CC SHALLOW
NORTH
SUNNYSIDE
BX PIPE
0
2000'
SUNNYSIDE
DEEP CP
DEEP CARBONATE
Pb-Zn-Ag
BUCKET BX
CC SHALLOW
THUNDER MOUNTAIN
PORPHYRY COMPLEX
TR-7
TR-9
TR-6
TR-4
SU-1
TR-11
TR-10
TR-14
TR-15
TM-9
TM-8
TM-12
TM-11
TM-10
TM-14
TM-13
TCH-1
TCH-2
BB-1
BB-2
BB-3
BB-4
BB-5
BB-6
BB-7
TM-4A
TM-4
TM-7
TM-1
TM-5
TM-3
TM-6
TM-2
AMERICAN PEAK
THUNDER MOUNTAIN
MINERAL RESOURCES
PATAGONIA MOUNTAINS
SANTA CRUZ CO., ARIZONA
J.D.SELL
1"=2000'
6/92
mn TM920603 6/24/92

JDS

FILE NOTE March 4, 1993

Report - Assays
DDH's BB-8 and BB-9
Thunder Mountain Project
Santa Cruz County, AZ

Attached is the report on the two drill holes BB-8 and BB-9, drilled for assessment work in late 1992.

The holes were placed to further test the copper-silver high level blanket of the Bucket Breccia Zone.

The loss of surface values, especially in BB-9, is probably due to the flushing of values by surface waters from the side drainage into the main canyon.

Complete assays are also attached.

Synopsis of the assay intervals is listed in Table 1.

Table 1. Synopsis of Cu-Ag Values

Drill Hole	Depth	Feet	% Cu	ppm Ag
BB-8	0-130	130	0.11	3.8
	130-290	160	0.41	8.3
	290-500	210	0.13	3.5
	500-600	100	0.06	1.8
	0-600	600	0.19	4.6

Table 1 Continued

Drill Hole	Depth	Feet	% Cu	ppm Ag
BB-9	10-150	140	0.08	2.2
	150-310	160	0.14	2.8
	310-410	100	0.21	2.9
	410-510	100	0.15	3.5
	10-510	500	0.14	2.8

340 0.14 3.0

Jeanette Sell

cc: FT Greenhead, NYC

SKYLINE LABS, INC.
1775 W. Sahuaro Dr. • P.O. Box 50106
Tucson, Arizona 85703
(602) 622-4836

Complete

REPORT OF ANALYSIS

JOB NO. TAJ 748
November 18, 1992
PROJECT: THUNDER MOUNTAIN
BB-8 0-90, BB-9 (13-150)
BB-9 (250-310)

ASARCO INCORPORATED
Attn: Mr. James D. Sell
Southwestern Exploration
P.O. Box 5747
Tucson, AZ 85703

Analysis of 28 Drill Core Samples

ITEM	SAMPLE NUMBER	Au (ppm)	Ag (ppm)	Cu (%)
1	BB-8 00-10	.04	3.8	.07
2	BB-8 10-20	.03	1.1	.14
3	BB-8 20-30	.03	.9	.06
4	BB-8 30-40	.02	1.0	.07
5	BB-8 40-50	.02	1.0	.14
6	BB-8 50-60	.03	2.8	.07
7	BB-8 60-70 *	<.02	7.8	.23
8	BB-8 70-80	.02	1.6	.05
9	BB-8 80-90	.02	4.1	.12

0-130 = 130'
= 1.44/13 = 0.11%

See Nov. 5 continuation TAJ 744

0-130 = 130'
49.49/13 = 3.8
ppm Ag

Charles E. Thompson
Arizona Registered Assayer No. 9427

William L. Lehmbeck
Arizona Registered Assayer No. 9425

James A. Martin
Arizona Registered Assayer No. 11122

SKYLINE LABS, INC.
1775 W. Sahuaro Dr. • P.O. Box 50106
Tucson, Arizona 85703
(602) 622-4836

REPORT OF ANALYSIS

JOB NO. TAJ 744
November 5, 1992
PROJECT: THUNDER MTN.
BB-8 (90-320)

ASARCO INCORPORATED
Attn: Mr. Jim Sell
Southwestern Exploration
P.O. Box 5747
Tucson, AZ 85703

Analysis of 23 Drill Core Samples

ITEM	SAMPLE NUMBER	Au (ppm)	Ag (ppm)	Cu (%)
1	BB-8 90-100	<.02	4.8	.11
2	BB-8 100-110	<.02	8.4	.20
3	BB-8 110-120	.02	8.9	.13
4	BB-8 120-130	.04	4.1	.07
5	BB-8 130-140	.03	7.5	.32
6	BB-8 140-150	.02	5.3	.17
7	BB-8 150-160	.02	6.4	.38
8	BB-8 160-170	<.02	10.0	.27
9	BB-8 170-180	.02	16.0	.51
10	BB-8 180-190	<.02	7.6	.56
11	BB-8 190-200	<.02	5.8	.27
12	BB-8 200-210	.03	18.0	1.35
13	BB-8 210-220	<.02	8.3	.09
14	BB-8 220-230	<.02	7.6	.11
15	BB-8 230-240	<.02	5.3	.12
16	BB-8 240-250	<.02	8.9	.10
17	BB-8 250-260	<.02	5.7	.25
18	BB-8 260-270	<.02	4.2	.26
19	BB-8 270-280	<.02	4.7	.53
20	BB-8 280-290	<.02	12.0	1.22

130-210=80'
=3.83/8=0.48%Cu

160
.40

130-290=160'
=6.51/16=0.41

210-290=80'
=2.68/8=0.34%

210-320=110'
=3.20/11=0.29%

130-210=80'
=74.6/8=
=9.4 ppm Ag

210-320=110'
=68.1/11=
=6.2 ppm Ag

130-290=160'
=133.3/16=
=8.3 ppm Ag

Charles E. Thompson
Arizona Registered Assayer No. 9427

William L. Lehmbeck
Arizona Registered Assayer No. 9425

James A. Martin
Arizona Registered Assayer No. 11122

SKYLINE LABS, INC.
1775 W. Sahuaro Dr. • P.O. Box 50106
Tucson, Arizona 85703
(602) 622-4836

JOB NO. TAJ 744
November 5, 1992

ITEM	SAMPLE NUMBER	Au (ppm)	Ag (ppm)	Cu (%)
21	BB-8 290-300	<.02	3.4	.20
22	BB-8 300-310	.04	4.2	.11
23	BB-8 310-320	<.02	3.8	.21

cc: Mr. Harold Downey
1803 E. 10th Steet
Tucson, AZ 85719

Continued TAJ 749
1/22/93

REGISTERED ASSAYER
CERTIFICATE NO. 9425
WILLIAM L. LEHMBECK
ARIZONA U.S.A.

William L. Lehmbeck
Manager
11/5/92

JDS

SKYLINE LABS, INC.
1775 W. Sahuaro Dr. • P.O. Box 50106
Tucson, Arizona 85703
(602) 622-4836

ASARCO Incorporated

JAN 25 1993

SW Exploration

REPORT OF ANALYSIS

JOB NO. TAJ 749
January 22, 1993
PROJECT: THUNDER MTN.
BB-8 (60-70), (320-600)

ASARCO INCORPORATED
Attn: Mr. Jim Sell
Southwestern Exploration
P.O. Box 5747
Tucson, AZ 85703

Analysis of 29 Drill Core Samples

ITEM	SAMPLE NUMBER	Au (ppm)	Ag (ppm)	Cu (ppm)
1				
2	BB-8 320-330	.04	4.4	1900.
3	BB-8 330-340	<.02	3.6	900.
4	BB-8 340-350	<.02	1.8	1250.
5	BB-8 350-360	.02	2.8	1700.
6	BB-8 360-370	<.02	2.9	750.
7	BB-8 370-380	<.02	2.9	720.
8	BB-8 380-390	<.02	2.2	610.
9	BB-8 390-400	<.02	3.1	1250.
10	BB-8 400-410	<.02	8.2	2000.
11	BB-8 410-420	<.02	4.1	1150.
12	BB-8 420-430	<.02	3.8	185.
13	BB-8 430-440	<.02	2.5	850.
14	BB-8 440-450	<.02	4.3	900.
15	BB-8 450-460	<.02	4.2	2050.
16	BB-8 460-470	<.02	1.6	1300.
17	BB-8 470-480	.04	3.8	1700.
18	BB-8 480-490	<.02	.9	385.
19	BB-8 490-500	<.02	5.4	1450.
20	BB-8 500-510	<.02	1.9	305.

290-500 = 210'
= 2,625/21 = 0.13% Cu

=210'
=7309/21 = 3.5 ppm Ag

Charles E. Thompson
Arizona Registered Assayer No. 9427

William L. Lehmbeck
Arizona Registered Assayer No. 9425

James A. Martin
Arizona Registered Assayer No. 11122

SKYLINE LABS, INC.
1775 W. Sahuaro Dr. • P.O. Box 50106
Tucson, Arizona 85703
(602) 622-4836

JOB NO. TAJ 749
January 22, 1993

ITEM	SAMPLE NUMBER	Au (ppm)	Ag (ppm)	Cu (ppm)	
21	BB-8 510-520	<.02	4.4	550.	500-600 = 100'
22	BB-8 520-530	<.02	2.9	800.	
23	BB-8 530-540	<.02	3.7	495.	= 0.558/10 = 0.06 % Cu
24	BB-8 540-550	<.02	1.3	280.	
25	BB-8 550-560	<.02	1.4	750.	= 10
26	BB-8 560-570	<.02	.9	580.	= 18.17/10 = 1.8 ppm Ag
27	BB-8 570-580	<.02	1.4	660.	
28	BB-8 580-590	<.02	.8	680.	
29	BB-8 590-600	<.02	1.0	530.	

cc: Mr. Harold Downey
1803 E. 10th Steet
Tucson, AZ 85719

Total 0 - 600' = 600'
= 11.153/60 = 0.19 % Cu
= 600'
= 274.05/60 = 4.4 ppm Ag

William L. Lehmbeck
Manager

1/22/93

JD

SKYLINE LABS, INC.
1775 W. Sahuaro Dr. • P.O. Box 50106
Tucson, Arizona 85703
(602) 622-4836

Complete

REPORT OF ANALYSIS

JOB NO. TAJ 748
November 18, 1992
PROJECT: THUNDER MOUNTAIN
BB-8 0-90, BB-9 (13-150)
BB-9 (250-310)

ASARCO INCORPORATED
Attn: Mr. James D. Sell
Southwestern Exploration
P.O. Box 5747
Tucson, AZ 85703

Analysis of 28 Drill Core Samples

ITEM	SAMPLE NUMBER	Au (ppm)	Ag (ppm)	Cu (%)	
10	BB-9 13-20	.02	1.6	.16	
11	BB-9 20-30	.02	1.9	.04	
12	BB-9 30-40	.02	3.2	.11	10-150=140'
13	BB-9 40-50	.02	1.9	.17	=1.17/14=0.08% Cu
14	BB-9 50-60	.04	1.8	.07	
15	BB-9 60-70	.02	2.5	.07	
16	BB-9 70-80	.02	.4	.01	10-150=140' =30.9/14=2.2 Ag
17	BB-9 80-90	.02	3.9	.04	
18	BB-9 90-100	.02	5.5	.31	
19	BB-9 100-110	.02	1.5	.02	
20	BB-9 110-120	<.02	1.7	.04	

ASARCO Incorporated
NOV 19 1992
SW Exploration

Charles E. Thompson
Arizona Registered Assayer No. 9427

William L. Lehmbeck
Arizona Registered Assayer No. 9425

James A. Martin
Arizona Registered Assayer No. 11122

SKYLINE LABS, INC.
1775 W. Sahuaro Dr. • P.O. Box 50106
Tucson, Arizona 85703
(602) 622-4836

JOB NO. TAJ 748
November 18, 1992

ITEM	SAMPLE NUMBER	Au (ppm)	Ag (ppm)	Cu (%)	
21	BB-9 120-130	<.02	1.4	.01	
22	BB-9 130-140	.02	1.8	.08	
23	BB-9 140-150	<.02	1.8	.04	
1	BB-9 150-160	.02	2.1	.08	
2	BB-9 160-170	.08	2.2	.10	
3	BB-9 170-180	.02	2.7	.29	
4	BB-9 180-190	<.02	<.1	.16	150-310 = 160'
5	BB-9 190-200	<.02	4.5	.09	= 2.24/16 = 0.14 C
6	BB-9 200-210	<.02	3.6	.19	
7	BB-9 210-220	<.02	3.5	.07	= 160'
8	BB-9 220-230	<.02	5.2	.08	= 45.3/16 = 2.8
9	BB-9 230-240	<.02	7.0	.08	ppm
10	BB-9 240-250	.03	5.7	.50	
24	BB-9 250-260	<.02	1.4	.08	
25	BB-9 260-270	<.02	1.1	.08	
26	BB-9 270-280	<.02	1.4	.08	
27	BB-9 280-290	.05	1.6	.26	
28	BB-9 290-300	<.02	1.4	.07	
29	BB-9 300-310	<.02	1.8	.05	

*NOTE: Sample not received.

cc: Mr. Harold Downey
1803 E. 10th Steet
Tucson, AZ 85719

Continued

Charles E. Thompson
Arizona Registered Assayer No. 9427

William L. Lehmbeck
Arizona Registered Assayer No. 9425

James A. Martin
Arizona Registered Assayer No. 111

Arizona Registered Assayer No. 9427

Arizona Registered Assayer No. 9425

Arizona Registered Assayer No. 11122

JDS

SKYLINE LABS, INC.

1775 W. Sahuaro Dr. • P.O. Box 50106
Tucson, Arizona 85703
(602) 622-4836

REPORT OF ANALYSIS

JOB NO. TAJ 747
November 12, 1992
PROJECT: THUNDER MTN.
BB-9 (310-510)
PAGE 1 OF 1

ASARCO INCORPORATED
Attn: Mr. James D. Sell
Southwestern Exploration
P.O. Box 5747
Tucson, AZ 85703

Analysis of 20 Drill Core Samples

ITEM	SAMPLE NUMBER	Au (ppm)	Ag (ppm)	Cu (%)
1	BB-9 310-320	.03	2.0	.17
2	BB-9 320-330	<.02	2.8	.24
3	BB-9 330-340	<.02	3.0	.25
4	BB-9 340-350	.03	2.5	.16
5	BB-9 350-360	<.02	3.7	.33
6	BB-9 360-370	<.02	3.6	.22
7	BB-9 370-380	<.02	1.9	.09
8	BB-9 380-390	<.02	3.5	.17
9	BB-9 390-400	<.02	2.5	.20
10	BB-9 400-410	<.02	3.1	.22
11	BB-9 410-420	.03	2.2	.04
12	BB-9 420-430	<.02	2.4	.07
13	BB-9 430-440	<.02	3.5	.09
14	BB-9 440-450	<.02	4.9	.43
15	BB-9 450-460	<.02	4.1	.06
16	BB-9 460-470	<.02	4.9	.08
17	BB-9 470-480	<.02	2.1	.13
18	BB-9 480-490	<.02	1.5	.14
19	BB-9 490-500	<.02	5.3	.08
20	BB-9 500-510	<.02	4.4	.40

310-410=100'
=2.05/10=0.21%Cu

310-410=100'
=28.6/10=2.9 ppm A

410-510=100'
=1.52/10=0.15%Cu

410-510=100'
=35.3/10=3.5ppm A

cc: Mr. Harold Downey
1803 E. 10th Steet
Tucson, AZ 85719

ASARCO Incorporated
NOV 13 1992
SW Exploration

REGISTERED ASSAYER CERTIFICATE No. 9425 WILLIAM L. LEHMBECK ARIZONA U.S.A.

William L. Lehmbeck
Manager

Charles E. Thompson
Arizona Registered Assayer No. 9427

William L. Lehmbeck
Arizona Registered Assayer No. 9425

James A. Martin
Arizona Registered Assayer No. 11122

JDS

MEMORANDUM

To: James D. Sell

From: Harold Downey

Date: February 1, 1993

Subject: Thunder Mountain Project; Summary of Drill Holes BB-8 and BB-9, Discussion and Recommendations.

Two diamond drill holes, BB-8 and BB-9, were drilled in August of 1992 for purposes of assessment work and to help further delineate zones of mineralization encountered in previous work. Each hole was drilled vertically to a depth of 600 feet in the canyon bottom along the main access road on which most of the earlier drilling was done. BB-8 was collared 100 feet northeasterly from the area of several holes drilled in 1990 (BB-2, BB-3, BB-6). BB-9 was located another 100 feet northeasterly from # 8 (refer to attached location map).

Summary of holes as follows:

BB-8: Coord N: 1710,100, Coord E: 865,485, Elev: 5140, Inclination: -90

0 - 600: Quartz Feldspar Porphyry, intensely altered to pyrophyllite/sericite/kaolin to 310. Very sparse quartz veining. Disseminated pyrite blebs to 3 mm dia. estimated at 3%-5%. Minor fine grained disseminated chalcopyrite. Some of the pyrite is coated blue/black (covellite/chalcocite). Probable small fault 300-301, rock is less altered and mineralized below 310. Short sections of lapilli welded tuff 372.5 - 373 and 442 - 444.

Mineralization: The only section of copper mineralization above 0.2% copper (except for scattered 10 foot runs) occurs from 130 to 290 (160 feet) which averaged 0.407% Cu and 8.3 ppm Ag.

BB-9: Coord N: 1710,170, Coord E: 865,555, Elev: 5125 Inclination: -90

0-600: Quartz Feldspar Porphyry, intensely altered, pyrophillite dominannt alteration mineral. Compacted gray volcanic mud 66-67.5. Pyrite 3%-5% in clumps and fine grained disseminated. Copper mineralization generally weak with less visible covellite than in other holes in area. Chalcocite is seen coating pyrite and some sooty chalcocite is found in a few fractures and small slips.

Mineralization: The best apparent zone of mineralization (by visual estimate) occurs from 325 to 460. This estimate is confirmed by an assay run of 100 feet of .205 % Cu from 310 to 410. Only 3 ten foot runs assayed in the 0.4% to 0.5% range and these were too scattered to help in making any significant footages which would average greater than 0.2% Cu.

Discussion:

Results of this period of drilling are disappointing inasmuch as my Memorandum to James Sell dated February 7, 1991 recommended drilling along the road in a pattern similar to that which was partially completed by drilling BB-8 and BB-9. It was hoped that a continuous near-surface zone of +0.4% Cu could be proven in the area between vertical hole TM-8 and BB-4 (refer to attached map and vertical section A-A`). I now have some reservations regarding drilling vertical holes along this road which closely follows the stream bed at the bottom of a canyon possibly created by faulting. The vertical hole, TM-8, did not hit appreciable mineralization until a depth of 140 feet while angle holes drilled from the same location were quite successful in cutting +0.4% Cu. The reason for the "negative anomaly" of TM-8 has been previously discussed on page 2, under Ore Grades & Reserves, my memo to Sell, 2/7/91. If in fact, chalcocite/covellite enrichment was either not formed or flushed away by certain hydrogeological processes associated with steep faulting, vertical drilling may not be giving a true test of mineralization, or at best, an erratic one.

Recommendations:

If ASARCO elects to continue with this project, a better determination of mineral continuity and extent must be made. It follows therefore, that angle drilling outward from the canyon bottom is warranted; also drilling in the southern area near BB-1 could be undertaken (Recommendations, memo Downey to Sell, 2/7/91).

References and Attachments:

Summary Report; Sell to Kurtz, 11/14/90

Memorandum; Downey to Sell, 2/7/91 - Sell to Kurtz, 2/19/91

Drill Logs; BB-8, BB-9.

Location Map updated from map 2/7/91

Vertical Section A-A` updated from 2/7/91

Vertical Sections B-B` through D-D` from 2/7/91

Harold J. Downey

Harold J. Downey

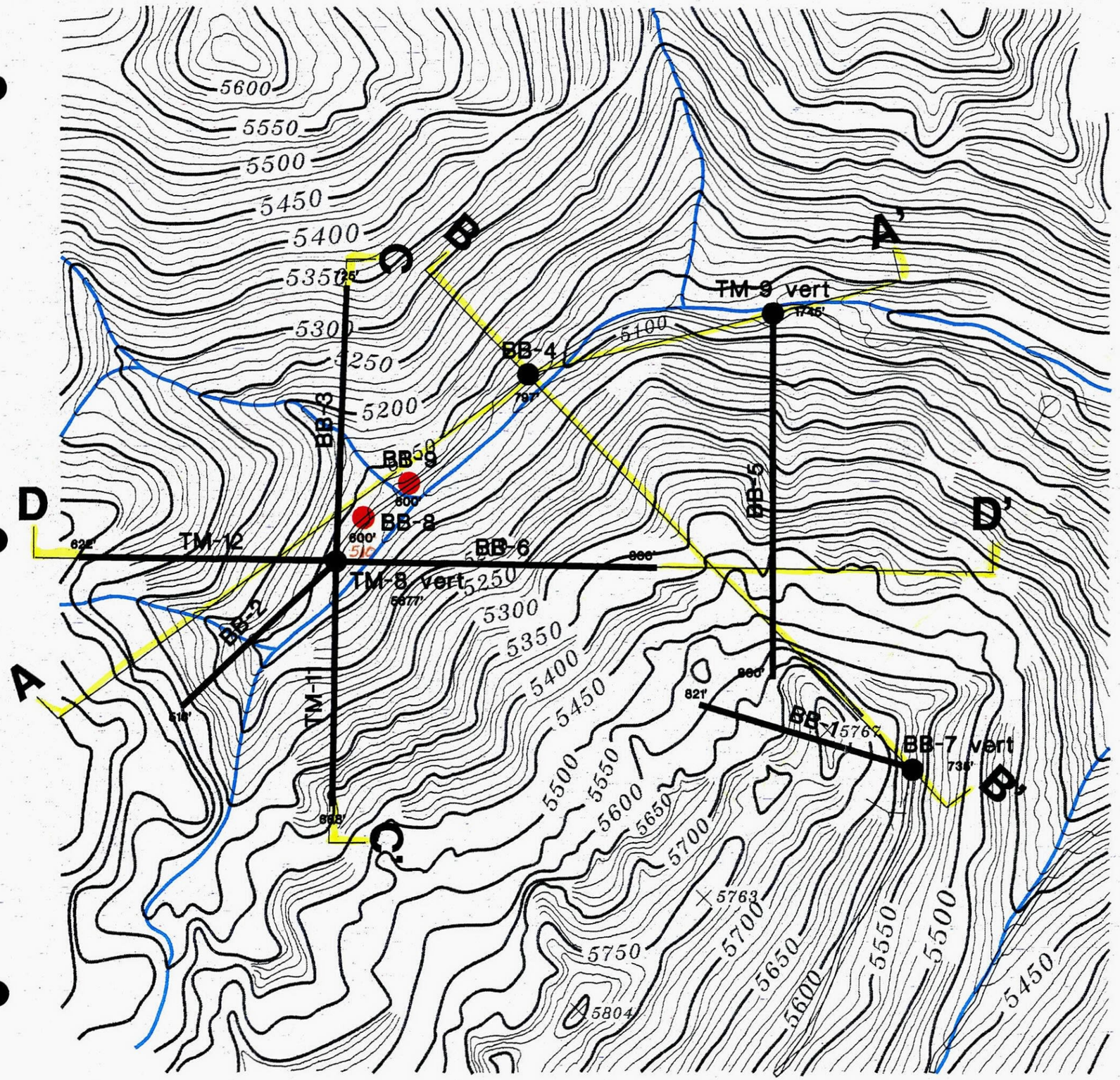
2/1/93

Date

ASARCO WESTERN USA EXPLORATION

THUNDER MOUNTAIN PROJECT
INDEX MAP
SANTA CRUZ CO., ARIZONA

mn TM921204 TUC 12/11/92



ASARCO WESTERN USA EXPLORATION

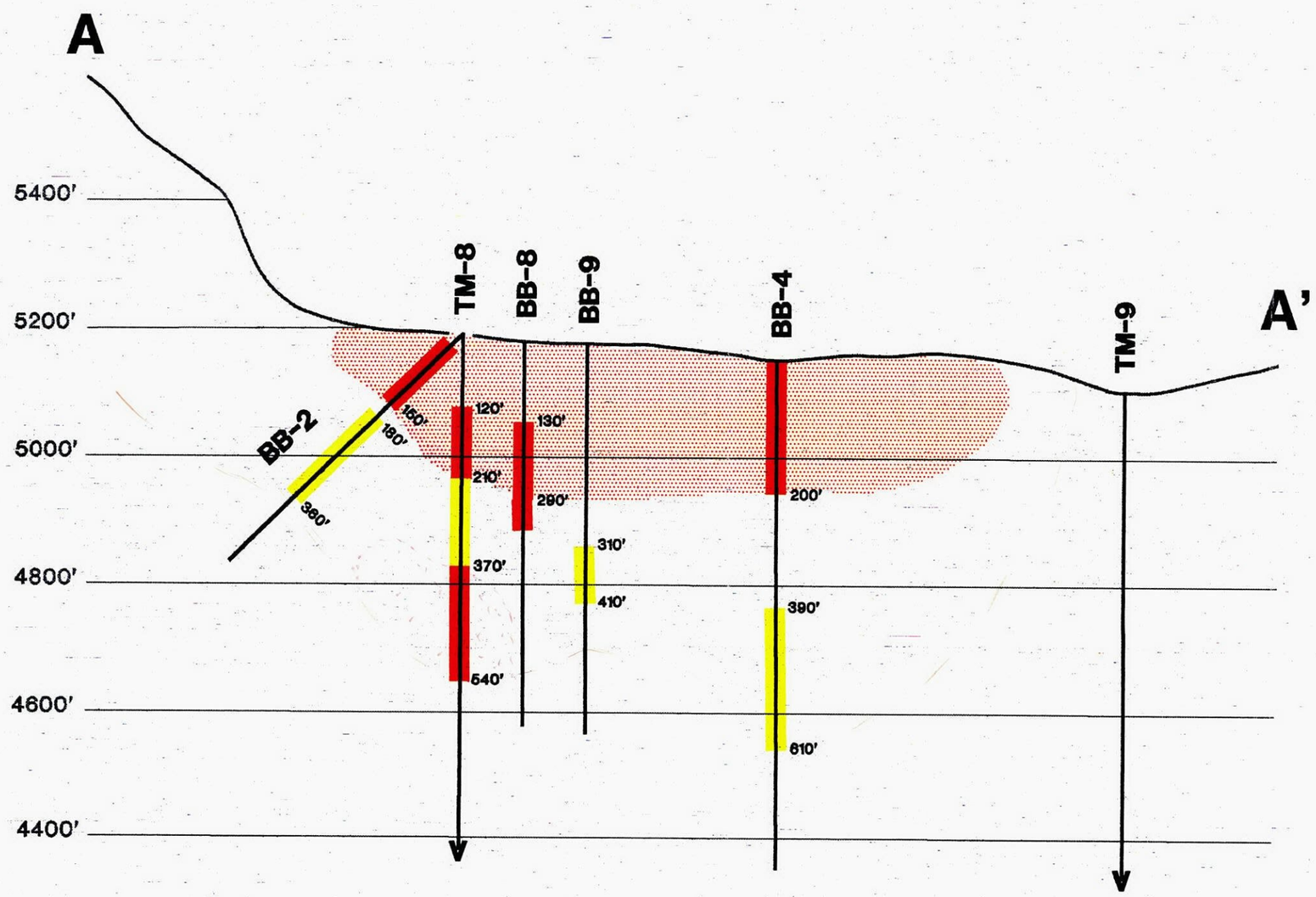
THUNDER MOUNTAIN PROJEC

1992 BB-DRILLING

SANTA CRUZ CO., ARIZONA

0 200' 400'

Map number TM921202 TUC 12/11/92

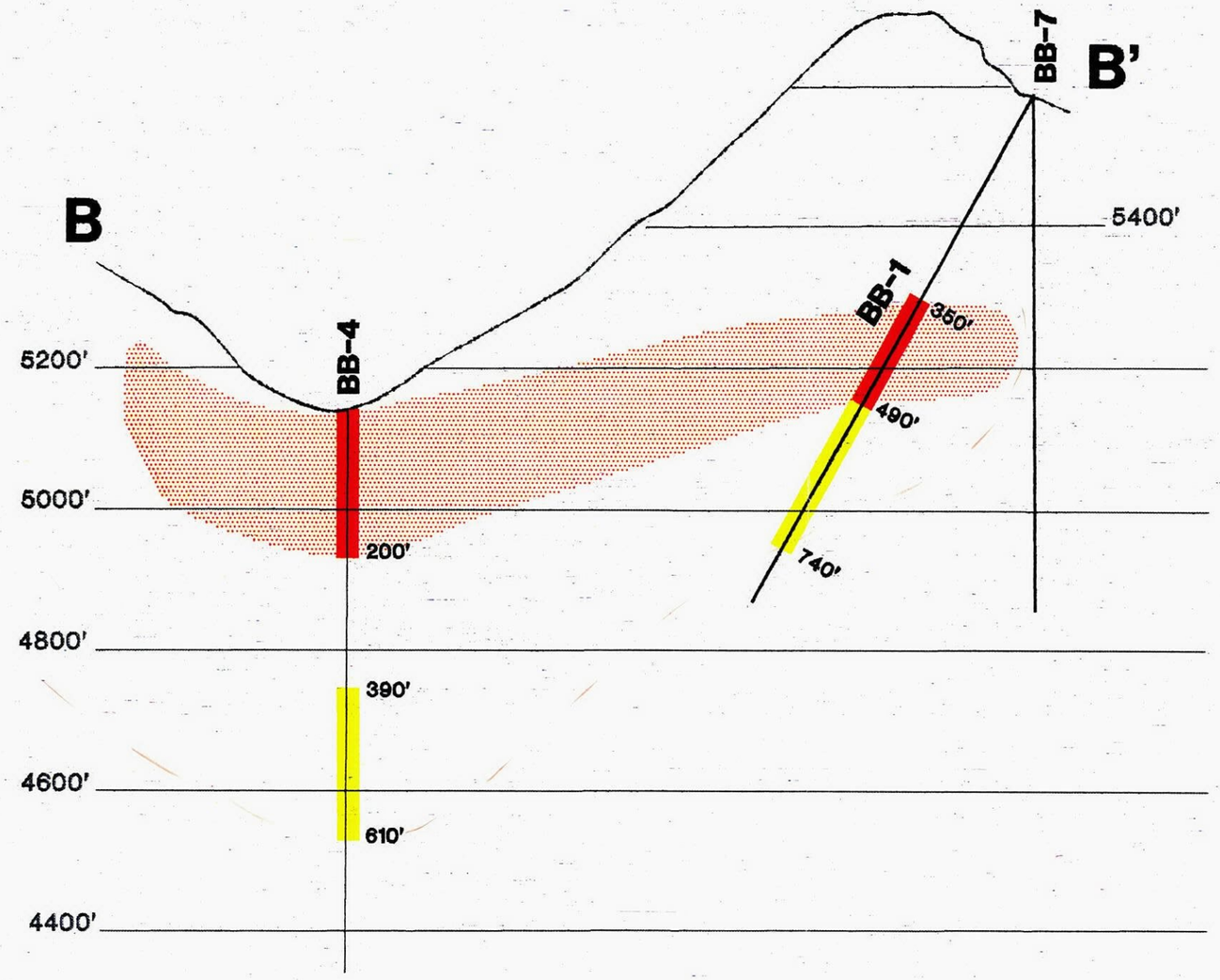


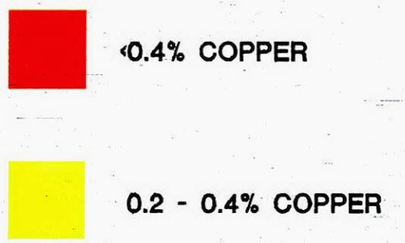
ASARCO WESTERN USA EXPLORATION

THUNDER MOUNTAIN PROJECT
SECTION A-A'
SANTA CRUZ CO., ARIZONA

0 200' 400'

mn TM921208 TUC 12/11/92



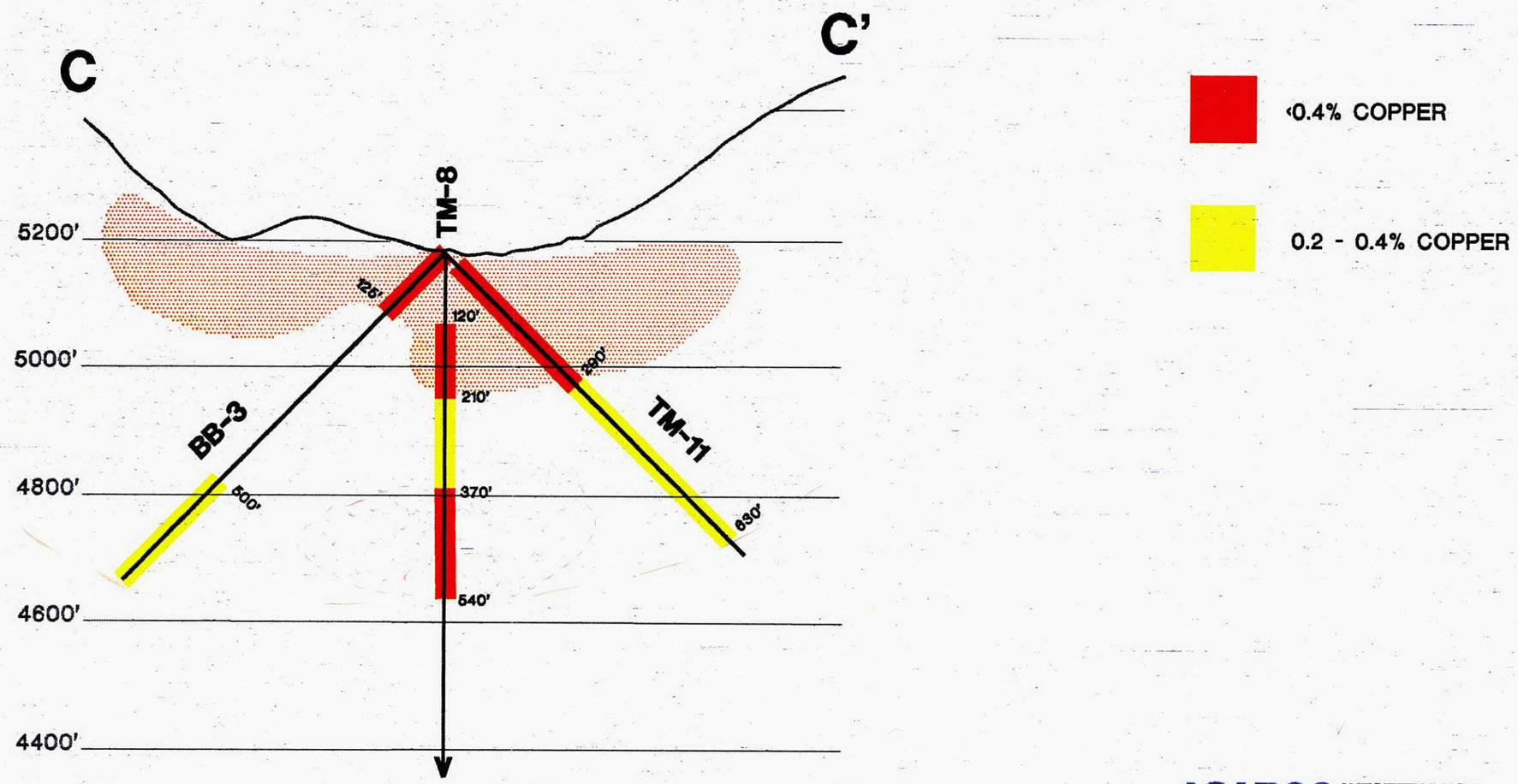


ASARCO WESTERN USA EXPLORATION

THUNDER MOUNTAIN PROJECT
SECTION B-B'
SANTA CRUZ CO., ARIZONA

0 200' 400'

mn TM921225 TUC 12/17/92

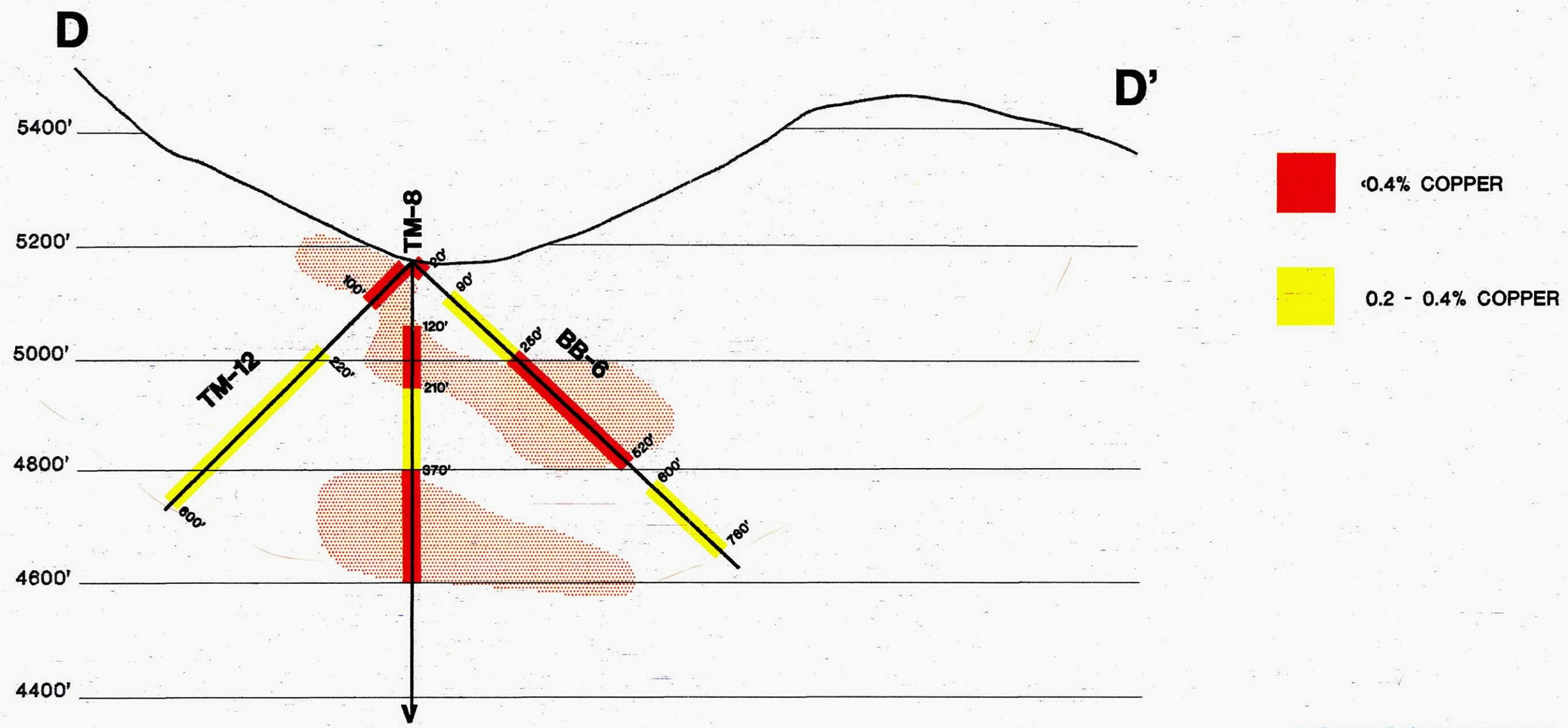


ASARCO WESTERN USA EXPLORATION

THUNDER MOUNTAIN PROJECT
SECTION C-C'
SANTA CRUZ CO., ARIZONA

0 200' 400'

mn TM921210 TUC 12/11/92



ASARCO WESTERN USA EXPLORATION

THUNDER MOUNTAIN PROJECT
SECTION D-D'
SANTA CRUZ CO., ARIZONA

0 200' 400'

mn TM921211 TUC 12/11/92

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN. HOLE NO. BB-8
Collar elev. 5,140 Final depth 600'
Coord N. 1,710,100 Coord E. 865,485
Inclination 5,140 Page 1 of 2
Logged by H. J. DOWNEY
Date start 8/2/92 Date finish 8/8/92

NOTE: % RQD = % PIECES > 4" LONG IN 10' RUN

DEPTH from	DEPTH to	% CORE RECOV	ASSAY % Cu	ASSAY O.P.T. Au	ASSAY O.P.T. Ag		ORE % EST MINERALS: CHALCOCITE	COVELLITE	CHALCOPYRITE	SPHALERITE	ENARGITE	GANGUE & ALTERATION MINERALS: PYRITE-VEIN	PYRITE-DISS	GOETHITE	LIMONITE	HEMATITE	QUARTZ-VEIN	QUARTZ-DISS	PYROPHYLLITE	SERICITE	ARGILLIC	ALUNITE	STRUCTURE: FAULTS	FRACS. PER FT	% RQD	ROCK TYPE and REMARKS
0	8	NO CORE	—	—	—																				
8	10	95	.07	.04	3.8		Tr	Tr	0.1		0.1 ?	1					5	30	5	10			3	50	8 – QUARTZ FELDSPAR PORPHYRY – light gray, intensely
10	20	98	.14	.03	1.1		Tr	Tr	0.1			1					5	30	5	10			2	85	altered giving rock a tuffaceous appearance – could
20	30	100	.06	.03	.9		Tr	Tr	0.1			1					5	30	5	10			2	90	be called a quartz eye tuff – pyrophyllite and
30	40		.07	.02	1.0		Tr	Tr	0.1			1					5	30	5	20			2	85	kaolin predominant. Nil quartz veining. Disseminated
40	50		.14	.02	1.0		Tr	0.1	0.1			2					5	30	5	20			1	85	pyrite blebs to 3 mm dia with minor associated
50	60		.07	.03	2.8		Tr	0.1	0.1			2					5	30	5	20			1	95	chalcopyrite. Trace bornite and some pyrite grains
60	70		.23	<.02	7.8		0.1	0.1	0.1	0.1		1 2					5	30	5	20			1	90	are coated blue/black (covellite/chalcocite?). Fine
70	80		.05	.02	1.6		0.1		0.1			2					3	30	5	20			1	95	grained black disseminated mineral may be enargite
80	90		.12	.02	4.1		0.1		0.1			2					3	30	5	20			2	90	(Russ Corn communication)
90	100		.11	<.02	4.8		0.1	0.2	0.1			3					3	30	5	20			1	90	Chalcopyrite increases below 180. Strong
100	110		.20	<.02	8.4		0.1	0.2	0.2			3					3	40	5	20			3	70	CPY 200–210
110	120		.13	.02	8.9		0.1	0.2	0.2			3					3	40	5	20			2	70	
120	130		.07	.04	4.1		0.1	0.2	0.2			3					3	40	5	20			1	95	
130	140		.32	.03	7.5	130-150=20'	0.1	0.1	0.1			.5 3				Tr	3	40	5	20			1	90	
140	150		.17	.02	5.3	=0.47/2=0.235	0.1	0.1	0.1			.5 3				Tr	3	40	5	20	3		1	95	
150	160		.38	.02	6.4		0.1	0.1	0.2			.5 5				Tr	5	40	5	20	3		1	90	
160	170		.27	<.02	10.0		0.1	0.1	0.2			.5 5				Tr	5	40	5	20	1		1	95	
170	180		.51	.02	16.0	150-180=60'	0.1	0.1	0.2			.5 5				Tr	5	40	5	20	1		1	95	
180	190		.56	<.02	7.6	=3.34/6=0.56	0.2	0.1	0.3			5					3	50	10	20	1		2	75	
190	200		.27	<.02	5.8		0.2	0.1	0.4			5					3	50	10	20	1		1	90	
200	210		1.35	.03	18.0		0.2	0.1	0.5			.5 5				Tr	3	50	10	20	1		1	90	
210	220		.09	<.02	8.3		0.2	0.1	0.4			.5 5				Tr	3	50	10	20	1		1	90	
220	230		.11	<.02	7.6	210-250=40'	0.2	0.1	0.3			5					3	40	10	20	Tr		1	95	
230	240		.12	<.02	5.3	=0.42/4=0.11	0.2	0.1	0.3			7					3	50	10	20	Tr		< 1	95	
240	250		.10	<.02	8.9		0.2	0.1	0.3			7					3	50	10	20	Tr		< 1	95	
250	260		.25	<.02	5.7		0.2	0.1	0.3			5					3	50	10	20	Tr		1	90	
260	270		.26	<.02	4.2	250-300=50'	0.3	0.1	0.3			5					3	50	10	20	Tr		1	90	
270	280		.53	<.02	4.7	=2.94/5=0.59	0.3	0.1	0.3			.5 5				.5	3	50	10	30	Tr		1	90	
280	290		1.22	<.02	12.0	130-300=170 feet = CT 17/17=2.37% Cu	0.3	0.1	0.3			.5 5				.5	3	50	10	30	Tr		< 1	95	
290	300		.20	<.02	3.4		0.1	0.1	0.1			3					3	40	10	20	1	?	1	90	Gouge 300–301 May be small fault
300	310		.11	.04	4.2		0.1	0.1	0.1			3					3	40	10	20	1		1	90	
310	320		.21	<.02	3.8		0.1	0.05	0.1			3					3	30	10	20			1	85	Rock is less altered and mineralized below 310
320	330		.19	.04	4.4		0.1	0.05	0.1			3					3	30	10	20			< 1	95	
330	340		.09	<.02	3.6		0.1	0.05	0.1			.5 3				.5	3	30	10	20			1	80	Angular altered feldspars up to 5 mm dia 340–347
340	350		.13	<.02	1.8		0.1	0.05	0.1			.5 3				.5	3	30	10	20			1	90	
350	360		.17	.02	2.8		0.1	0.05	0.1			3					3	30	10	20			2	80	
360	370		.08	<.02	2.9		0.1	0.05	0.1			3					3	30	10	20			1	85	
370	380		.07	<.02	2.9		0.1	0.05	0.1			.5 3					3	20	10	10			1	95	6" Lapilli Tuff 372.5 – 373
380	390		.06	<.02	2.2		0.05	Tr	0.1			2					3	20	10	10			1	95	(Tuffaceous Lapilli Agglomerate)
390	400		.13	<.02	3.1		0.05	Tr	0.1			2					3	20	10	10			1	90	also at 382'–383'
400	410		.20	<.02	8.2		0.05	Tr	0.1			2					3	20	10	10			1	95	
410	420		.12	<.02	4.1		0.05	Tr	0.1			2					3	20	10	10			1	90	

mn 2555 (2/2)

GEOLOGIC LOG

THUNDER MOUNTAIN

PROJECT THUNDER MIN. HOLE NO. BB-8
Coord N/S ____ Total depth 600'
Coord N ____ Coord E ____
Inclination ____ Page 2 of 2
Logged by H.J. DOWNEY
Date start ____ Date finish ____

DEPTH FROM	TO	% CORE RECOVERY	% Cu	PPM Au	PPM Ag	CHALCOCITE	COVELLITE	CHALCOPYRITE	SPHALERITE	ENARGITE	PYRITE-VEIN	PYRITE-DISS	QUARTZ-VEIN	QUARTZ-DISS	PYROPHYLLITE	SERICITE	ARGILLIC	ALUNITE	FAULTS	FRACS PER FT	% RQD	ROCK TYPE and REMARKS
420	430	99-100	.02	<.02	3.8	0.05	Tr	0.1				2		3	20	10				1	95	QUARTZ FELDSPAR PORPHYRY
430	440		.09	<.02	2.5	0.05	Tr	0.1				2		3	20	10	10			1	90	Tuffaceous Lapilli Agglomerate 442-444
440	450		.09	<.02	4.3	0.05	Tr	0.1				2		3	20	10	10			1	95	
450	460		.21	<.02	4.2	0.05		0.05				2		3	20		20			1	95	Alteration appears more argillic 450 - 600
460	470		.13	<.02	1.6	0.05		0.05				3		3	20		20			1	95	
470	480		.19	.04	3.8	0.05		0.05				3		3	20		20			2	90	Pyrite dominant to 600'
480	490		.04	<.02	0.9	0.05		0.05				4		3	20		20			1	90	
490	500		.15	<.02	5.4	0.05		0.05			.5	4		3	20		20			1	90	
500	510		.03	<.02	1.9	0.05		0.05			.5	5		3	20		30			1	95	
510	520		.06	<.02	4.4	0.05		0.05			.5	5		3	20		30			1	90	
520	530		.08	<.02	2.9	0.05		0.05			.5	5		3	20		30			1	90	
530	540		.05	<.02	3.7	0.05		Tr			.5	5		3	20		30			1	90	
540	550		.03	<.02	1.3	0.05		Tr				5		3	20		30			2	85	
550	560		.08	<.02	1.4	0.05		Tr				5		3	20		30			1	90	
560	570		.06	<.02	0.9	0.05		Tr				5		3	20		30			2	85	
570	580		.07	<.02	1.4	0.05		Tr			.5	5		3	20		30			1	90	
580	590		.07	<.02	0.8	0.05		Tr			.5	5		3	20		30			2	80	
590	600		.05	<.02	1.0	0.05		Tr				5		3	20		30			1	90	
BOH - 600'																						BOH

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN — HOLE NO. RB-9
Collar elev. ____ — Final depth 600'
Coord N. 1710,170 — Coord E. 865,555
Inclination 5,130 — Page 1 of 2
Logged by H.N. DOWNEY
Date start ____ — Date finish ____

% RQD = % PIECES >4" LONG IN 10' RUN

DEPTH from	DEPTH to	DIV	% CORE RECOVERY	ASSAY Cu	ASSAY Au	ASSAY Ag	ORE MINERALS (EST.) CHALCOCITE	COVELLITE	CHALCOPYRITE	SPHALERITE	ENARGITE	GANGUE & ALTERATION MINERALS PYRITE-VEIN	PYRITE-DISS.	GRAPHITE	LIMONITE	HEMATITE	QUARTZ-VEIN	QUARTZ-DISS.	PYROPHYLLITE	SERICITE	ARGILLIC	ALUNITE	STRUCTURE FAULTS	FRACS PER FT.	% RQD	ROCK TYPE and REMARKS
0	13		—	—	—	—																				OVERBURDEN — NO CORE
13	20		95	.16	.02	1.6	Tr				Tr	3		3			3	3	0	1	0	20		2	60	13-21 QUARTZ FELDSPAR PORPHYRY - Soft white to light gray
20	30		95	.04	.02	1.9	Tr				?	3		3			3	3	0	1	0	20		1	80	
30	40		99-100	.11	.02	3.2	Tr		0.05			3					3	3	0	1	0	20		1	90	vuggy/, zones to 85' - Extremely altered to pyrophillite?
40	50			.17	.02	1.9	Tr	Tr	0.05			5					3	3	0	1	0	20	3	2	85	
50	60			.07	.04	1.8	.05	Tr	0.05			5					3	4	0	1	0	20	3	1	90	Compacted gray volcanic mud 66-67.5 (Alunite rich?)
60	70			.07	.02	2.5	.05	Tr	0.05			5					3	4	0	1	0	20	10	1	90	
70	80			.01	.02	.4	0.1	Tr	0.05			5					3	4	0	1	0	20	3	2	80	sericite, kaolin with some alunite? layering, limonite
80	90			.04	.02	3.9	0.1	0.1	0.1			5					3	4	0	2	0	10	2	1	90	72'-82' -82
90	100			.31	.02	5.5	0.1	0.2	0.1			5					5	3	0	2	0	10		1	95	after pyrite to 30'. Pyrite 3%-5% in clumps &
100	110			.02	.02	1.5	0.2	0.2	0.1			5					10	3	0	2	0	10		1	95	fine grained disseminated. Traces of chalcopyrite
110	120			.04	<.02	1.7	0.2	0.2	0.1			5					10	3	0	2	0	10		1	95	
120	130			.01	<.02	1.4	0.2	0.1	0.1			5					10	3	0	2	0	10		1	95	and fine grained black specks (chalcocite?) sparsely
130	140			.08	.02	1.8	0.2	0.1	0.1			5					10	3	0	2	0	10		1	90	
140	150			.09	<.02	1.8	0.2	0.1	0.1			5					10	3	0	2	0	10		1	90	disseminated throughout. Very little covellite compared
150	160			.08	.02	2.1	0.2	0.1	0.05			5	7				10	3	0	2	0	10		1	95	
160	170			.10	.08	2.2	0.3	0.1	0.05			5	7				10	3	0	2	0	10		1	95	to other holes in area (to 82' where covellite coats
170	180			.29	.02	2.7	0.3	0.05	0.05			5	7				10	3	0	2	0	10		1	95	
180	190			.16	<.02	<.1	0.2	0.05	0.05				7				5	3	0	2	0	10		1	95	pyrite). Probable fault from 72'-82'. Below 82'
190	200			.09	<.02	4.5	0.2	0.05	0.05				7				5	3	0	2	0	10		1	95	
200	210			.19	<.02	3.6	0.3	0.1	0.05				7				5	3	0	2	0	10		1	90	feldspar phenocrysts to 5 mm dia are more
210	220			.07	<.02	3.5	0.3	0.1	0.05				7				5	3	0	2	0	10		1	95	
220	230			.08	<.02	5.2	0.3	0.1	0.05				7				5	3	0	2	0	10		1	95	prominent. Sooty chalcocite in fractures 165'-180'
230	240			.08	<.02	7.0	0.3	0.05	0.05			5	7				5	3	0	2	0	10		1	90	
240	250			.30	.03	5.7	0.4	0.05	0.05			5	7				5	3	0	2	0	10	3	1	90	
250	260			.08	<.02	1.4	0.2	Tr	Tr			5	5				5	3	0	2	0	10	3	1	95	Pyrite blebs are larger 203'-240
260	270			.08	<.02	1.1	0.2	0.05	0.05			5	5				5	3	0	2	0	10	3	1	95	
270	280			.08	<.02	1.4	0.3	0.05	0.05			5	5				5	4	0	2	0	10		1	95	
280	290			.26	.05	1.6	0.2	0.05	0.05			5	5				5	4	0	2	0	10		1	95	
290	300			.07	<.02	1.4	0.2	0.05	0.05			5	7				5	4	0	2	0	10		1	95	Chalcocite improves below 325'. Fine grained
300	310			.05	<.02	1.8	0.2	0.05	0.05			5	7				5	4	0	2	0	10		1	95	disseminated and sooty fracture coatings and
310	320			.17	.03	2.0	0.3	0.05	0.05			5	7				5	4	0	2	0	10		1	90	seams. (325-440)
320	330			.24	<.02	2.8	0.4	0.05	0.05			5	7				5	4	0	2	0	10		1	90	
330	340			.25	<.02	3.0	0.4	0.1	0.05			5	10				5	4	0	2	0	10		1	90	
340	350			.16	.03	2.5	0.4	0.1	0.05			5	10				5	4	0	2	0	10		1	90	
350	360			.33	<.02	3.7	0.4	0.1	0.05			5	10				5	4	0	2	0	10		1	90	
360	370			.22	<.02	3.6	0.3	0.1	0.05			5	7				5	4	0	2	0	10		1	95	Vuggy section 330-360
370	380			.09	<.02	1.9	0.3	0.1	0.05			5	7				5	4	0	2	0	10		1	95	
380	390			.17	<.02	3.5	0.3	0.1	0.05				7				5	4	0	2	0	10		1	90	
390	400			.20	<.02	2.5	0.3	0.1	0.05				7				5	4	0	2	0	10		1	90	Rock is less altered 410-460
400	410			.22	<.02	3.1	0.3	0.1	0.05				7				5	2	0	1	0	10		1	90	
410	420			.04	.03	2.2	0.3	0.1	0.05				7				5	2	0	1	0	10		1	95	
420	430			.07	<.02	2.4	0.3	0.1	0.05				7				5	2	0	1	0	10		1	90	

mn 2565 dm

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN. HOLE NO. BB-9
Collar elev. ____ Final depth ____
Coord N. ____ Coord E. ____
Inclination ____ Page 2 of 2
Logged by H.N.D.
Date start ____ Date finish ____

DEPTH from	DEPTH to	% CORE RECOVERY	ASSAY Cu	ASSAY Au	ASSAY Ag	ORE MINERALS: CHALCOCITE	COVELLITE	CHALCOPYRITE	SPHALERITE	ENARGITE	GANGUE & ALTERATION MINERALS: PYRITE-VEIN	PYRITE-DISS	GOETHITE	LIMONITE	HEMATITE	QUARTZ-VEIN	QUARTZ-DISS	PHYLLITE	SERICITE	ARGILLIC	ADVANCED ARGILLIC	STRUCTURE: FAULTS	FRACS PER FT.	W/P RQD	ROCK TYPE and REMARKS
430	440	100	.09	<.02	3.5	0.3	0.1	0.05			7					5	20	10	10				1	95	— QUARTZ FELDSPAR PORPHYRY (continues to BOH)
440	450		.43	<.02	4.9	0.3	0.1	0.05			7					5	20	10	10				1	90	
450	460		.06	<.02	4.1	0.3	0.1	0.05			7					5	20	10	10				1	95	
460	470		.08	<.02	4.9	0.2	0.1	0.05			7					5	30	20	10				1	95	
470	480		.13	<.02	2.1	0.2	0.1	0.05			10					5	30	20	10				1	90	
480	490		.14	<.02	1.5	0.2	0.1	0.05			7					5	30	20	10				1	90	
490	500		.08	<.02	5.3	0.2	0.1	0.1			7					5	30	20	10				1	90	
500	510		.40	<.02	4.4	0.4	0.1	0.1			10					5	40	20	10			6"	2	85	Small fault? (gouge w/chalcocite) 504-504.5
510	520					0.2	0.1	0.1			7					5	30	20	10				1	95	Chalcocite decreases - chalcopyrite increases slightly
520	530					0.2	Tr	0.1			7					5	20	10	10				1	95	below 510 (510-600)
530	540					0.1	Tr	0.1			7					5	30	10	10				1	95	
540	550					0.1		0.1			5					5	30	20	10				1	95	
550	560					0.1		0.1			5					5	30	20	10				1	95	
560	570					0.1		0.1			5					5	30	20	10				1	95	
570	580					0.1		0.1			5					5	30	20	10				1	95	
580	590					0.1		0.1			5					5	30	20	10				1	95	
590	600					0.1		0.1			5					5	30	20	10				1	95	
	BOH	600'																							BOH

mn 2555 dm

7/13

Dr. Harold W. Holmberg
Director of Metal Exploration
Kerr-McGee Corporation
PO Box 25861
Oklahoma City, OK 73125

Thunder Mountain Project
Santa Cruz County, AZ

Dear Dr. Holmberg:

I submit this packet of information on the drill holes ~~of~~ in the Thunder Mountain Project, Santa Cruz County, Arizona. The location of the project area is shown on Figure 1.

Figure 2, the Thunder Mountain Mineral Resources, is taken from Dr. Graybeal's June 29, 1992, report to you, and shows the drill holes within the Thunder Mountain Project. The drill holes include TM-8 through TM-14, TCH-1, through TCH-2A, and BB-1 through BB-9. (See Appendix for drill logs/assays of the drill holes).

Three target zones were indicated by the drilling (Figure 2). 1) The deep Sunnyside chalcopyrite zone, 2) the shallow, upper-level chalcocite zones in breccia above the Sunnyside zone, and indicated by the Sunnyside breccia pipe, and the Bucket breccia, and 3), the Deep Carbonate of Pb-Zn-Ag in sediments.

As noted, much of the Sunnyside Deep ~~[illegible]~~

chalcopyrite zone and the shallow chalcocite of the Sunnyside Breccia is not within the Thunder Mountain Project lands.

~~23,046~~ ~~The~~ A total of ~~18 holes~~ ~~37,725~~ 38,541 feet of drilling in 19 holes have been completed in the present agreement lands. (Table 1).

34,915
4,000
590
37,725

Table 1. Drill Hole Numbers and Depths.

	Hole Number	Depth, feet.	Best Intercept Drilled-Length, % Cu, Pm Ag	Remarks, Remarks
log	TM-8	5477	370-540 = 170' at 0.55 and 0.31 e*	
log	TM-9	1745	500-900 = 400' at 0.12 and 0.17 e	
log	TM-10	567	190-400 = 210' at 0.02 and 0.25 e	
3 log	TM-11	668	40-180 = 140' @ 0.49 and 0.33 e	
log	TM-12	622	10-100 = 90' @ 0.41 and 0.21 e	
log	TM-13	4777	3977-3979 = 2' @ 2.56 and 3.56 ounces.	
log	TM-14	4580	3700-3710 = 10' @ 0.15 and 2.2	
log	TCH-1	5560	3907-3911.5 = 4.5' @ 2.64 and 1.80 ounces	
log	TCH-2	5830	4030-4209 ≅ 25.~~2~~ @ 1.90 and 3.90 ounces.	
Graphic Log	TCH-2A	2209	4120-4140 = 20' ~~2~~ at ~~0.64~~ 1.48 and ~~9.10 ounces~~ 2.29 ounces.	
log	BB-1	821	350-490 = 140' at 0.41 and NA* (drilled by KM)	
log	BB-2	517	40-140 = 100' at 0.47 and 0.07	
log	BB-3	725	14-90 = 76' at 0.60 and 0.04	
log	BB-4	797	10-190 = 180' at 0.47 and 0.04	
log	BB-5	800	230-310 = 80' at 0.15 and tr	
log	BB-6	800	340-450 = 110' @ 0.91 and 0.25 ounces.	
log	BB-7	734	340-490 = 150' @ 0.03 and 0.17 e	
log	BB-8	600'	130-290 = 160' @ 0.41 and 0.3	
log	BB-9	510	310-410 = 100' @ 0.21 and 2.9	

38,541

*e, estimated from scattered assays or composite values

*NA, Not Available

The Sunnyside deep target (Figure 2) lies plus 2500 feet below the surface. The primary chalcopyrite mineralization of the Sunnyside target has a sparse drill intercept geologic estimated resource of 450 million tons of 0.34% copper, 0.012% moly, and ~~two~~ minor gold-silver credits. A larger, ~~two~~ billion ton plus estimated tonnage can be inferred lying between 3000 & 5500 feet below the surface, ~~or 2475 feet of intercept~~ averaging 0.22% copper, and is based on the projected extent outward from known drilling and expansion northwestward under the known shallow chalcocite zones and breccia pipe development.

The Bucket breccia ~~pipe~~ shallow chalcocite blanket (Figure 2) has been the current drilling area and twelve holes have been placed in the mineralization. (Figure 3) The chalcocite essentially begins at the surface of the Afton canyon bottom level, and ~~extends~~ eastward and under the adjacent hillside, ~~(Figure 3)~~ as shown in Figures 4 thru 7. A potential of plus 30 million tons of plus 0.28% copper may exist in this target zone.

The Deep Carbonate Pb-Zn-Ag zone ~~(Figure 2)~~ has four holes which penetrate into the carbonate skarn-hosted mineralization (Figure 2) ~~(Figure 2)~~. The holes were TM-13, TCH-1, TCH-2, and TCH-2A. Table 2 lists the various intercepts of interest in the four holes. ~~the~~ the ~~estimates~~ ~~probably~~ dip ~~steeply~~ moderately ~~at 50°~~; at ~~best, the drill hole~~ It is likely that the drill hole intercepts are longer (thicker) than the undivided beds cut. This is shown

Table 2. Intercepts/assays of drill carbonate mineralization

Hole No	Interval-Footage	% Cu	% Pb	% Zn	oz/T Silver
TM-13	3977-3979 = 2'	2.54	8.45	11.40	3.56
TCH-1	3907-3911.5 = 4.5'	2.64	12.68	14.52	1.74
	1407-1409 = 7'	0.43	1.18	10.95	2.16
TCH-2	4030-4037 = 7'	1.27	0.18	0.40	1.42
	4046-4050 = 4'	1.59	0.09	0.12	~~1.24~~ 1.24
	4100-4109 = 9'	0.10	1.02	1.05	~~1.36~~ 1.36
	4127-4166 = 39'	0.71	0.21	0.12	~~1.20~~ 0.91
	4195-4209 = 14'	2.32	0.73	0.09	5.86
	4209-4215 = 6'	0.09	3.35	3.34	1.40
	4243-4312 = 69'	0.27	2.50	3.12	1.68
	4450-4490 = 40'	0.11	1.57	1.37	~~3.28~~ 3.35
	4653-4710 = 57'	1.30	4.97	12.20	10.82
	4767-4891 = 124'	0.23	0.86	14.10	7.36
	4913-4921 = 8'	0.04	0.28	3.95	2.30
	5214-5217 = 1'	0.04	1.70	2.08	1.44
	/				
TCH-2A	4120-4160 = 40'	1.50	0.30	0.60	0.80
	4310-4337 = 27'	1.20	0.70	0.30	~~0.40~~ 4.0

on Figure 8. Drill hole TM-14 was terminated at the depth of 4500 feet and did not penetrate to the carbonate horizon, and as noted in Table 1, the best intercept in TM-14 was from 3700-3710 feet, or 10 feet of 0.15% copper and 2.2 ppm silver.

James D. Sell

Addendum A.

List of Attachments

Tables 1 + 2

FIGURE

1. Index Map – Thunder Mountain Project
2. Plan Map – Thunder Mountain Mineral Resources
3. Plan Map – BB Drill Holes/Section Locations
4. Section A-A' – BB Drill Holes/Assay groups
5. Section B-B' – BB " " / " "
6. Section C-C' – BB " " " "
7. Section D-D' – BB " " " "
8. Cross Section Y-Y – Trench (TCH) drill holes/assay groups

Attachment

Drill Logs with assays of TM-8, -9, -10, -11, -12, -13, and -14.

Drill Logs with assays of TCH-1, TCH-2, and TCH-2A

Drill Logs with assays BB-1, -2, -3, -4, -5, -6, -7, -8, -9.

FEDERAL EXPRESS

7/14/93

Mr. Harold W. Holmberg
Kerr-McGee Corporation
Director of Metal Exploration
Kerr-McGee Center
123 Robert S. Kerr Avenue
Oklahoma City, OK 73102

Summary Report
Thunder Mountain Project
Santa Cruz County, AZ

Dear Mr. Holmberg:

As outlined in the May 28, 1993 letter to you from Dr. Graybeal, I submit this report and map packet on the targets and drill holes in the Thunder Mountain Project, Santa Cruz County, Arizona.

The location of the project area is shown on Figure 1.

Figure 2 is an overview of the entire Thunder Mountain mineral resource area and contains the drill holes within and outside the Thunder Mountain Project. Only a few of the Bucket Breccia (BB-) drill holes are shown in the cluster of the BB drill holes.

The drill holes include TM-8 through TM-14, TCH-1 through TCH-2A, and BB-1 through BB-9. Logs and assays for the

drill holes are in the Attachments to this short report.

Three target zones were indicated by the drilling (Figure 2):

1). The deep Sunnyside chalcopyrite zone.

2). The shallow, upper-level chalcocite zones in breccias above the deep Sunnyside zone, and drilled as the Sunnyside breccia pipe, and the Bucket Breccia target.

3) The deep carbonate of Pb-Zn-Ag in sediments.

As noted, from the land position boundaries, much of the Sunnyside deep chalcopyrite zone and the shallow chalcocite zone of the Sunnyside Breccia is not within the Thunder Mountain Project boundaries.

A total of 38,541 feet of drilling in 19 holes has been completed in the present agreement lands (Table 1 in Attachments).

The Sunnyside deep target (Figure 2) lies plus 2500 feet below the surface of the ground. The primary disseminated/fracture controlled mineralization of the Sunnyside target has a sparce drill intercept geologic estimated resource of 450 million tons of around 0.34% copper and 0.012% moly, with minor gold-silver credits. A larger, three

billion plus, estimated tonnage, can be inferred lying between 3000 and 5500 feet below the surface, averaging around 0.22% copper, and is based on the projected extend outward from the known drilling and expansion northward under the known shallow chalcocite zones and breccia pipe development.

The shallow Bucket Breccia chalcocite blanket (Figure 2) has been the current drilling area. Twelve holes have cut the shallow mineralization (Figure 3). The chalcocite essentially surfaces at the canyon bottom of Alum Creek and extends upward and under the adjacent hillsides, as shown in Figures 4 through 7.

A potential of plus 30 million tons of plus 0.28% copper may exist in this target zone.

The deep Carbonate Pb-Zn-Ag zones is indicated by four holes which penetrate into the carbonate skarn-hosted mineralization (Figure 2). The holes were TM-13, TCH-1, TCH-2, and TCH-3. Table 2, attachment list, is a synopsis of the various mineral intercepts in the four holes.

Figure 8 is a cross section (Y-Y') east-west through the TCH-holes and indicate the complexity of the target area. Drill hole TM-14 was proposed to test the ~~zone~~ carbonate zone

at depth but due to drilling problems, the hole was terminated at 4580 feet prior to a carbonate intercept.

Further details of the complex geology, alteration, mineralization and assays are contained on the individual drill hole log sheets, attachments.

Contact me for any other information you need for the evaluation.

Sincerely.

Ernesto Lee

Attachments

cc. FTGrayhead (letter only).

List of Attachments

Table

1. Drill Hole Numbers, Depth and Best Intercept
2. Intercepts / assays of deep carbonate mineralization

Figure

1. Index Map - Thunder Mountain Project
2. Plan Map - Thunder Mountain Resources
3. Plan Map - Bucket Breccia (BB-) Drill Holes and Cross-Section Locations.
4. Section A-A' — BB Drill Holes / Assay group
5. Section B-B' — BB Drill Holes / Assay group
6. Section C-C' — BB Drill Holes / Assay group
7. Section D-D' — BB Drill Holes / Assay group
8. Section V-V' — Trench (TCH) Drill Holes / Assay group.

Attachments

TM- Drill Logs with Assays. Holes TM-8, -9, -10, -11, -12, -13, and TM-14.

TCH- Drill Logs with Assays. Holes TCH-1, TCH-2, and TCH-2A.

BB- Drill Logs with Assays. Holes BB-1, -2, -3, -4, -5, -6, -7, -8, and BB-9.

Table 1. Drill Hole Number, Depth and Best Intercept.

Hole No.	Depth, feet	Best Intercept Interval	Feet	% Cu	ppm Ag
TM-8	5677	370-540	170	0.55	0.31e*
TM-9	1745	500-900	400	0.12	0.17e
TM-10	567	190-400	210	0.02	0.25e
TM-11	648	40-180	140	0.49	0.33e
TM-12	622	10-100	90	0.41	0.21e
TM-13	4777	3977-3979	2	2.56	3.56 ounces
TM-14	4580	3700-3710	10	0.15	2.2
TCH-1	5560	3907-3911.5	4.5	2.64	1.76
TCH-2	5830	4030-4209	25**	1.90	3.90 ounces
TCH-2A	2209	4120-4140	20	1.48	2.20 ounces
BB-1	821	350-490	140	0.41	—
BB-2	517	40-140	100	0.60	0.04
BB-3	725	14-90	76	0.60	0.04
BB-4	797	10-190	180	0.47	0.04
BB-5	800	230-310	80	0.15	tr
BB-6	800	340-450	110	0.91	8.50
BB-7	736	340-490	150	0.03	0.17e
BB-8	400	130-290	160	0.41	8.30
BB-9	510	310-410	100	0.21	2.90
	38,541 feet				

*e estimated from scattered assays or composite values

** selected intervals from total intercept length.

Table 2. Intercept/Assays – Deep Carbonate Mineralization

Hole No	Interval	Footage	% Cu	% Pb	% Zn	g/T Ag
TM-13	3977-3979	2	2.56	8.65	11.60	3.56
space						
TCH-1	3907-3911.5	4.5	2.44	12.68	14.52	1.76
space						
	4844-4847	1	0.40	6.00	5.00	0.40
TCH-2	1407-1409	2	0.43	1.18	10.95	2.14
	4030-4037	7	1.27	0.18	0.60	1.12
	4046-4050	4	1.59	0.09	0.12	1.24
	4100-4109	9	0.10	1.02	1.05	1.36
	4127-4166	39	0.71	0.21	0.12	0.91
	4195-4209	14	2.32	0.73	0.09	5.86
	4209-4215	6	0.09	3.35	3.34	1.60
	4243-4312	69	0.27	2.50	3.12	1.68
	4450-4490	40	0.11	1.57	1.37	3.35
	4653-4710	57	1.30	4.97	12.20	10.82
	4767-4891	124	0.23	0.86	14.10	7.36
	4913-4921	8	0.04	0.28	3.95	2.30
	5216-5217	1	0.04	1.70	2.08	1.64
TCH-2A	4120-4160	40	1.50	0.30	0.60	0.80
	4310-4337	27	1.20	0.70	0.30	4.00

ASARCO

Exploration Department

TELECOPIER

DATE: 7/14/93

TO: FAX: 405-270-3123

NAME: Mr. Harold W. Holmberg
Kerr-McGee Corporation

LOCATION: Oklahoma City, OK

FROM: James D. Sell

MESSAGE:

The attached Summary Report on the Thunder Mountain Project with Figures and Attachments will be sent to you by Federal Express (next day delivery, 7/16/93), tomorrow.

cc: F.T. Graybeal (FAX)

You will receive 6 page(s) of copy including this sheet.
If you do not receive all pages, please call: 602-792-3010 Ext. 324

This transmission X will ____ will not be confirmed by mail.

ASARCO Incorporated P.O. Box 5747 Tucson, Az 85703
1150 North 7th Avenue FAX (602) 792-3934 Phone (602) 792-3010

ASARCO

FEDERAL EXPRESS

Exploration Department
Southwestern United States Division
James D. Sell
Manager

July 14, 1993

Mr. Harold W. Holmberg
Director of Metal Exploration
Kerr-McGee Corporation
Kerr-McGee Center
123 Robert S. Kerr Avenue
Oklahoma City, OK 73102

Summary Report
Thunder Mountain Project
Santa Cruz County, Arizona

Dear Mr. Holmberg:

As outlined in the May 28, 1993 letter to you from Dr. Graybeal, I submit this report and map packet on the targets and drill holes in the Thunder Mountain Project, Santa Cruz County, Arizona.

The location of the project area is shown on Figure 1.

Figure 2 is an overview of the entire Thunder Mountain resource area and contains the drill holes within and outside the Thunder Mountain Project. Only a few of the Bucket Breccia (BB-) drill holes are shown in the cluster of the BB drill holes.

The drill holes include TM-8 through TM-14, TCH-1 through TCH-2A, and BB-1 through BB-9. Logs and assays for the drill holes are in the Attachments to this short report.

Three target zones were indicated by the drilling (Figure 2):

1. The deep Sunnyside chalcopyrite zone.
2. The shallow, upper-level chalcocite zones in breccias above the deep Sunnyside zone, and drilled as the Sunnyside breccia pipe, and the Bucket Breccia target.
3. The deep carbonate of Pb-Zn-Ag in sediments.

As noted, from the land position boundaries, much of the Sunnyside deep chalcopyrite zone and the shallow chalcocite zone of the Sunnyside Breccia is not within the Thunder Mountain Project boundaries.

ASARCO Incorporated P.O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue FAX (602) 792-3934 Phone (602) 792-3010

Summary Report - Thunder Mountain Project

A total of 38,541 feet of drilling in 19 holes has been completed in the present agreement lands (Table 1 in Attachments).

The Sunnyside deep target (Figure 2) lies plus 2500 feet below the surface of the ground. The primary disseminated/fracture controlled mineralization of the Sunnyside target has a sparse drill intercept geologic estimated resource of 450 million tons of around 0.34% copper and 0.012% moly, with minor gold-silver credits. A larger, three billion plus, estimated tonnage, can be inferred, lying between 3000 and 5500 feet below the surface, averaging around 0.22% copper, and is based on the projected extent outward from the known drilling and expansion northward under the known shallow chalcocite zones and breccia pipe development.

The shallow Bucket Breccia chalcocite blanket (Figure 2) has been the current drilling area. Twelve holes have cut the shallow mineralization (Figure 3). The chalcocite essentially surfaces at the canyon bottom of Alum Creek and extends upward and under the adjacent hillsides, as shown in Figures 4 through 7.

A potential of plus 30 million tons of plus 0.28% copper may exist in this target zone.

The deep Carbonate Pb-Zn-Ag zone is indicated by four holes which penetrate into the carbonate skarn-hosted mineralization (Figure 2). The holes were TM-13, TCH-1, TCH-2, and TCH-2A. Table 2, Attachment list, is a synopsis of the various mineral intercepts in the four holes.

Figure 8 is a cross section (Y-Y') east-west through the TCH-holes and indicates the complexity of the target area. Drill hole TM-14 was proposed to test the carbonate zone at depth, but due to drilling problems the hole was terminated at 4580 feet prior to a carbonate intercept.

Further details of the complex geology, alteration, mineralization and assays are contained on the individual drill hole log sheets, Attachments.

Contact me for any other information you need for the evaluation.

Sincerely,

James D. Sell

James D. Sell

JDS:mek
Attachments

cc: F.T. Graybeal (w/o atts.)

LIST OF ATTACHMENTS

Table

1. Drill Hole Numbers, Depth and Best Intercept
2. Intercepts/Assays of deep carbonate mineralization

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Attachments

TM - Drill Logs with Assays. Holes TM 8, -9, -10, -11, -12, -13, and TM-14
TCH - Drill Logs with Assays. Holes TCH-1, TCH-2, and TCH-2A
BB - Drill Logs with Assays. Holes BB-1, -2, -3, -4, -5, -6, -7, -8, and BB-9

Table 1. Drill Hole Numbers, Depth and Best Intercept

Hole No.	Depth, Feet	Best Intercept Interval	Feet	% Cu	ppm Ag
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TM-13	4,777	3977-3979	2	2.56	3.56 ounces
TM-14	4,580	3700-3710	10	0.15	2.2
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BB-3	725	14-90	76	0.60	0.04
BB-4	797	10-190	180	0.47	0.04
BB-5	800	230-310	80	0.15	tr
BB-6	800	340-450	110	0.91	8.50
BB-7	736	340-490	150	0.03	0.17e
BB-8	600	130-290	160	0.41	8.30
BB-9	510	310-410	100	0.21	2.90
	38,541 feet				

*e estimated from scattered assays or composite values

** selected intervals from total intercept length

Table 2. Intercept/Assays - Deep Carbonate Mineralization

Hole No.	Interval	Footage	% Cu	% Pb	% Zn	oz/T Ag
TM-13	3977-3979	2	2.56	8.65	11.60	3.56
TCH-1	3907-3911.5	4.5	2.64	12.68	14.52	1.76
	4846-4847	1	0.40	6.00	5.00	0.40
TCH-2	1407-1409	2	0.43	1.18	10.95	2.16
	4030-4037	7	1.27	0.18	0.60	1.12
	4046-4050	4	1.59	0.09	0.12	1.24
	4100-4109	9	0.10	1.02	1.05	1.36
	4127-4166	39	0.71	0.21	0.12	0.91
	4195-4209	14	2.32	0.73	0.09	5.86
	4209-4215	6	0.09	3.35	3.34	1.60
	4243-4312	69	0.27	2.50	3.12	1.68
	4450-4490	40	0.11	1.57	1.37	3.35
	4653-4710	57	1.30	4.97	12.20	10.82
	4767-4891	124	0.23	0.86	14.10	7.36
	4913-4921	8	0.04	0.28	3.95	2.30
	5216-5217	1	0.04	1.70	2.08	1.64
TCH-2A	4120-4160	40	1.50	0.30	0.60	0.80
	4310-4337	27	1.20	0.70	0.30	4.00

FIGURE 1

ASARCO WESTERN USA EXPLORATION

THUNDER MOUNTAIN PROJECT
INDEX MAP
SANTA CRUZ CO., ARIZONA

mn TM921204 TUC 12/11/92

FIGURE 2

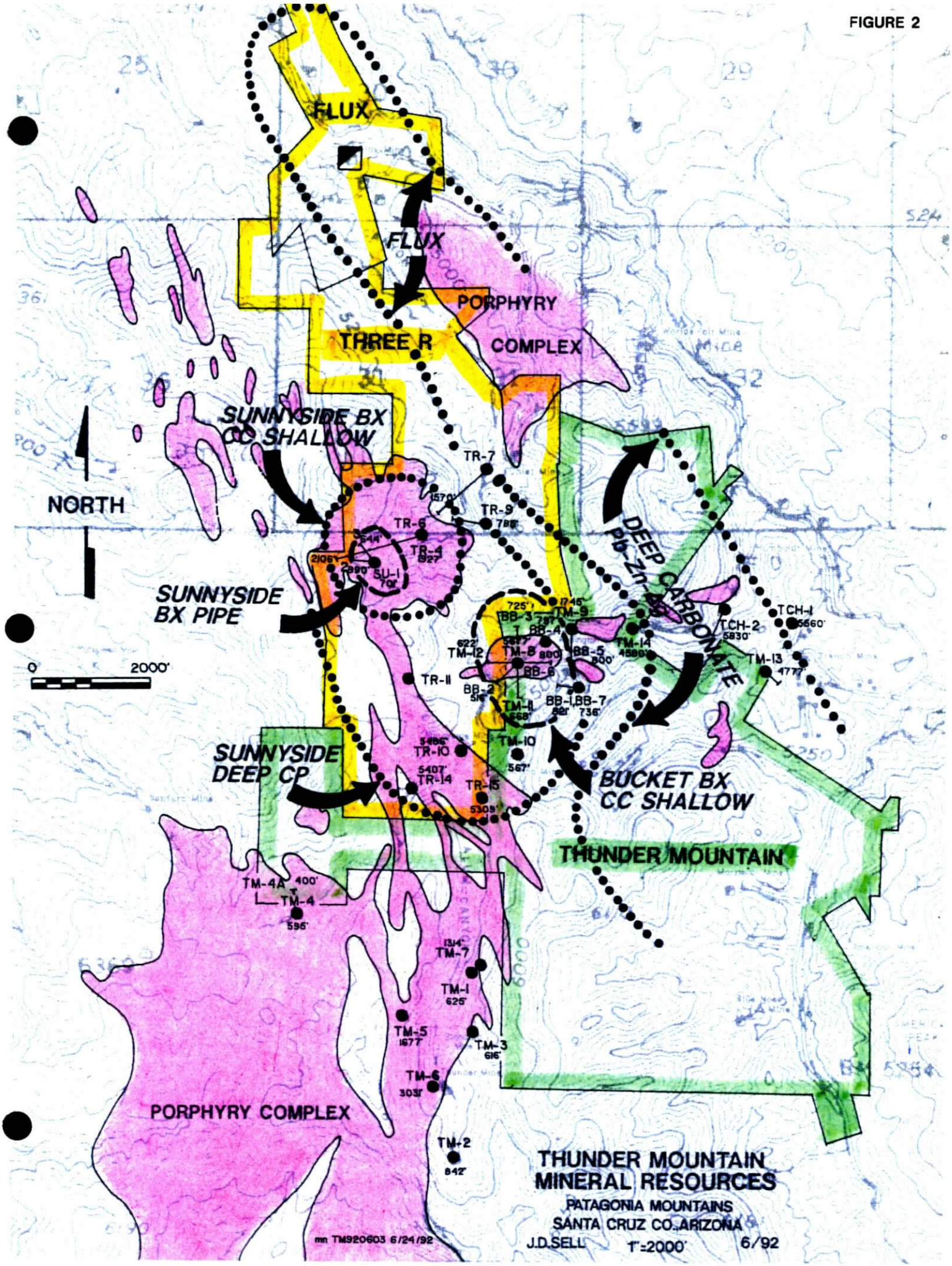
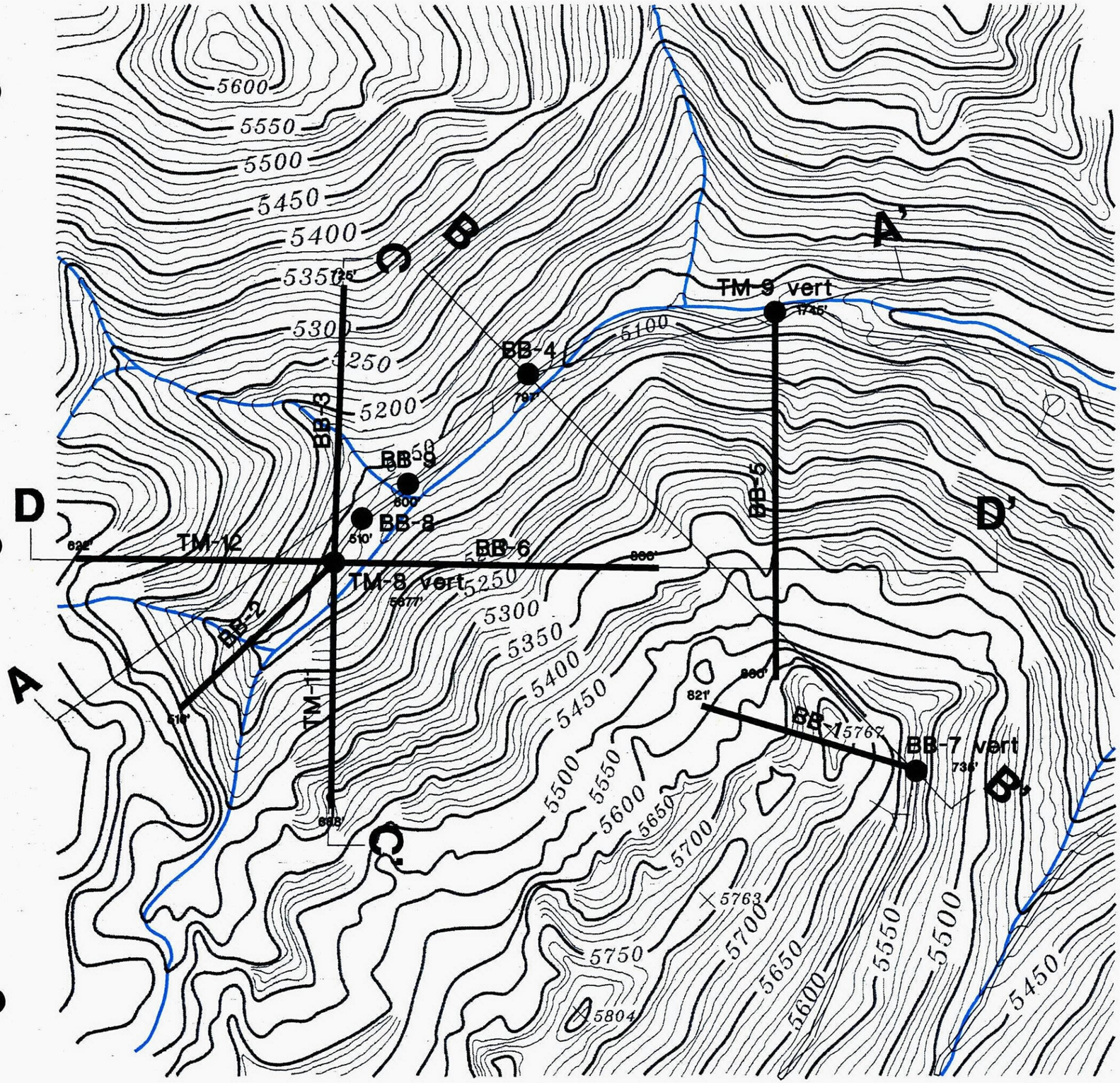

FLUX
FLUX
PORPHYRY
THREE R
COMPLEX
SUNNYSIDE BX
CC SHALLOW
NORTH
SUNNYSIDE
BX PIPE
0
2000'
SUNNYSIDE
DEEP CP
DEEP CARBONATE
Pb-Zn-Ag
BUCKET BX
CC SHALLOW
THUNDER MOUNTAIN
PORPHYRY COMPLEX
TR-7
TR-9
TR-6
TR-4
SU-1
TM-9
BB-3
BB-4
TM-12
TM-8
BB-5
BB-6
TM-14
TCH-1
TCH-2
TM-13
TR-11
BB-2
TM-11
BB-1
BB-7
TM-10
TR-10
TR-14
TR-15
TM-4A
TM-4
TM-7
TM-1
TM-5
TM-3
TM-6
TM-2
THUNDER MOUNTAIN
MINERAL RESOURCES
PATAGONIA MOUNTAINS
SANTA CRUZ CO. ARIZONA
J.D.SELL
1"=2000'
6/92
mn TM920603 6/24/92

FIGURE 3



ASARCO WESTERN USA EXPLORATION

THUNDER MOUNTAIN PROJECT

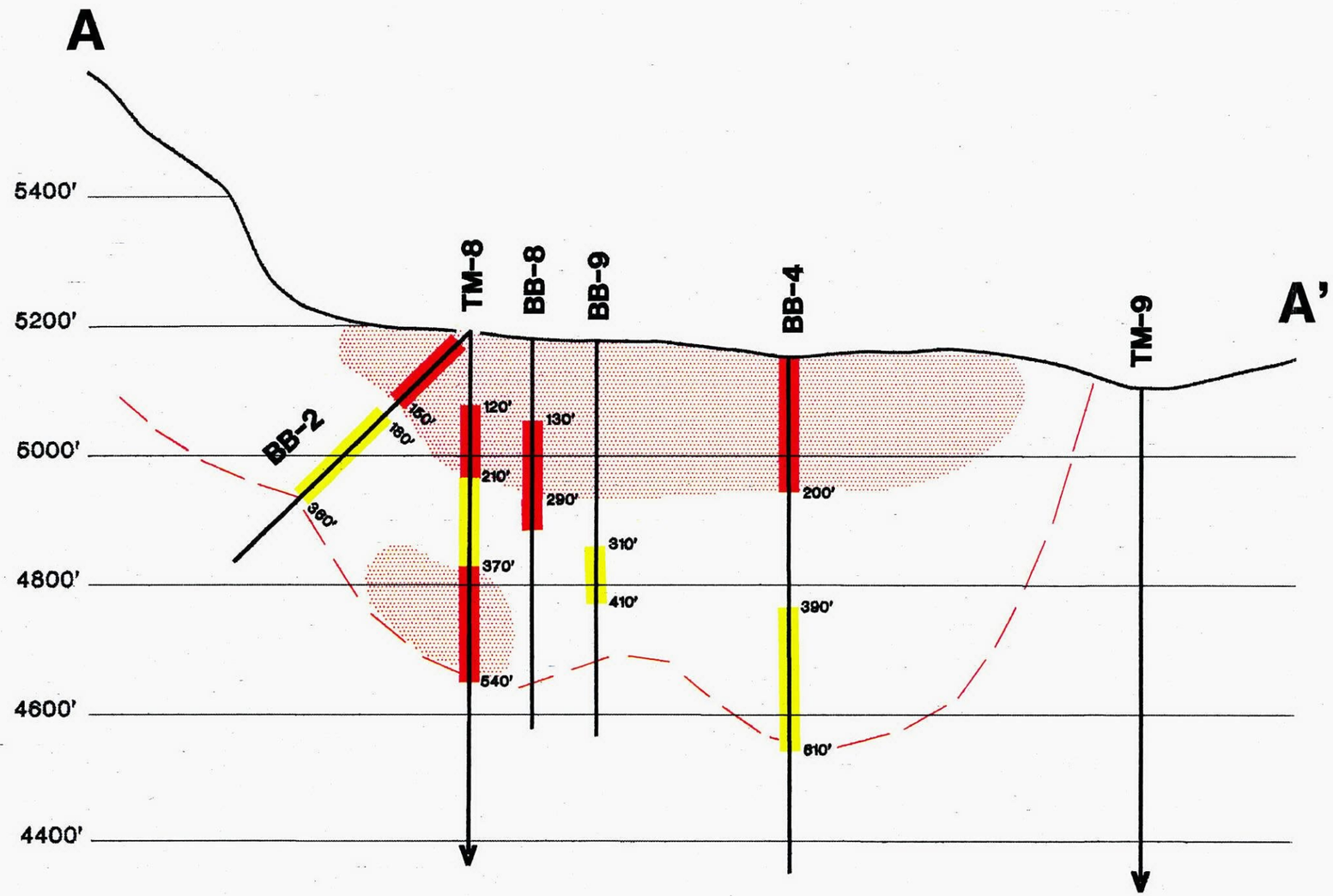
BB-DRILLING

SANTA CRUZ CO., ARIZONA

0 200' 400'

Map number TM921202 TUC 12/11/92

FIGURE 4



<0.4% COPPER

0.2 - 0.4% COPPER

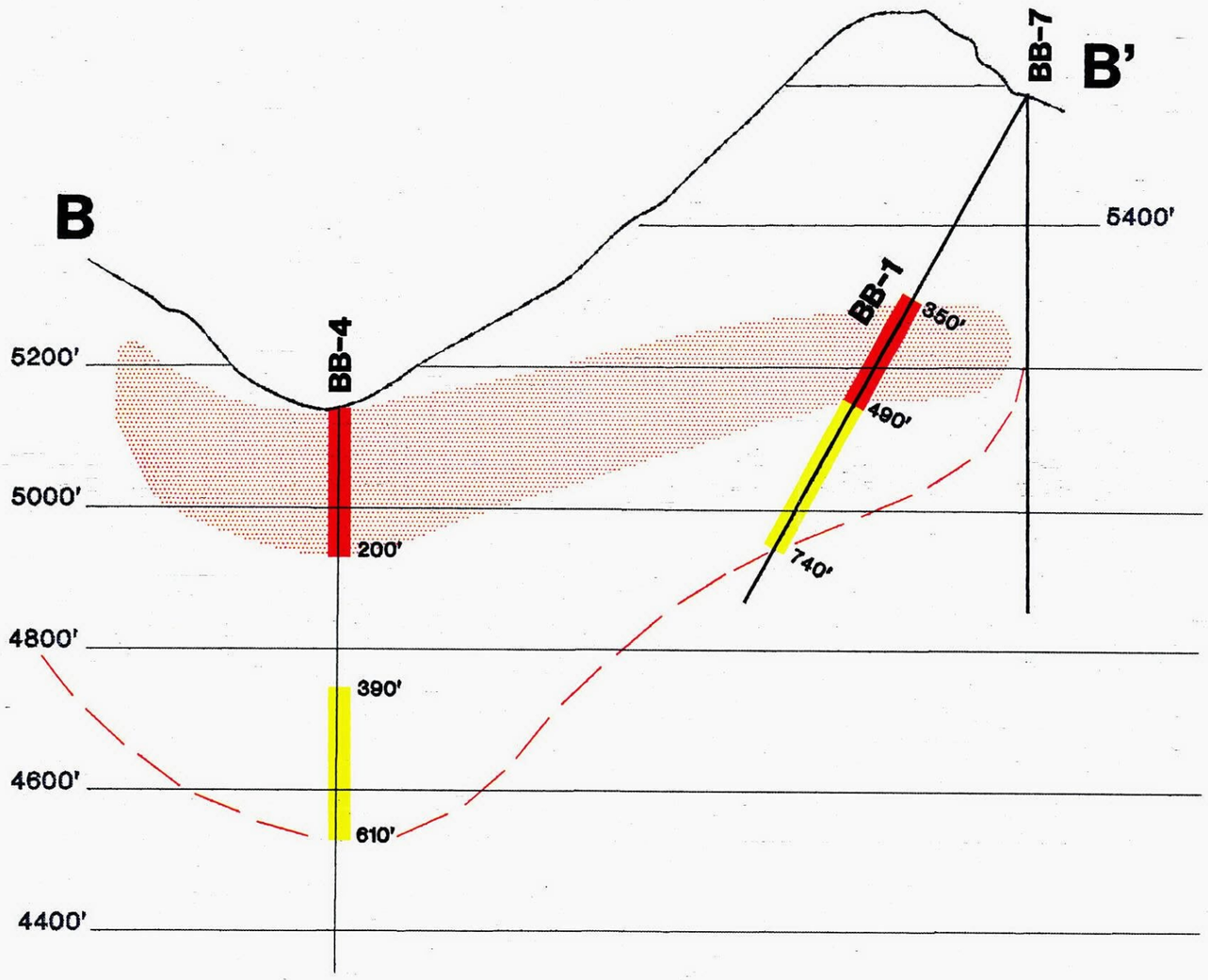
ASARCO WESTERN USA EXPLORATION

THUNDER MOUNTAIN PROJECT
SECTION A-A'
SANTA CRUZ CO., ARIZONA

0 200' 400'

mn TM921208 TUC 12/11/92

FIGURE 5



<0.4% COPPER

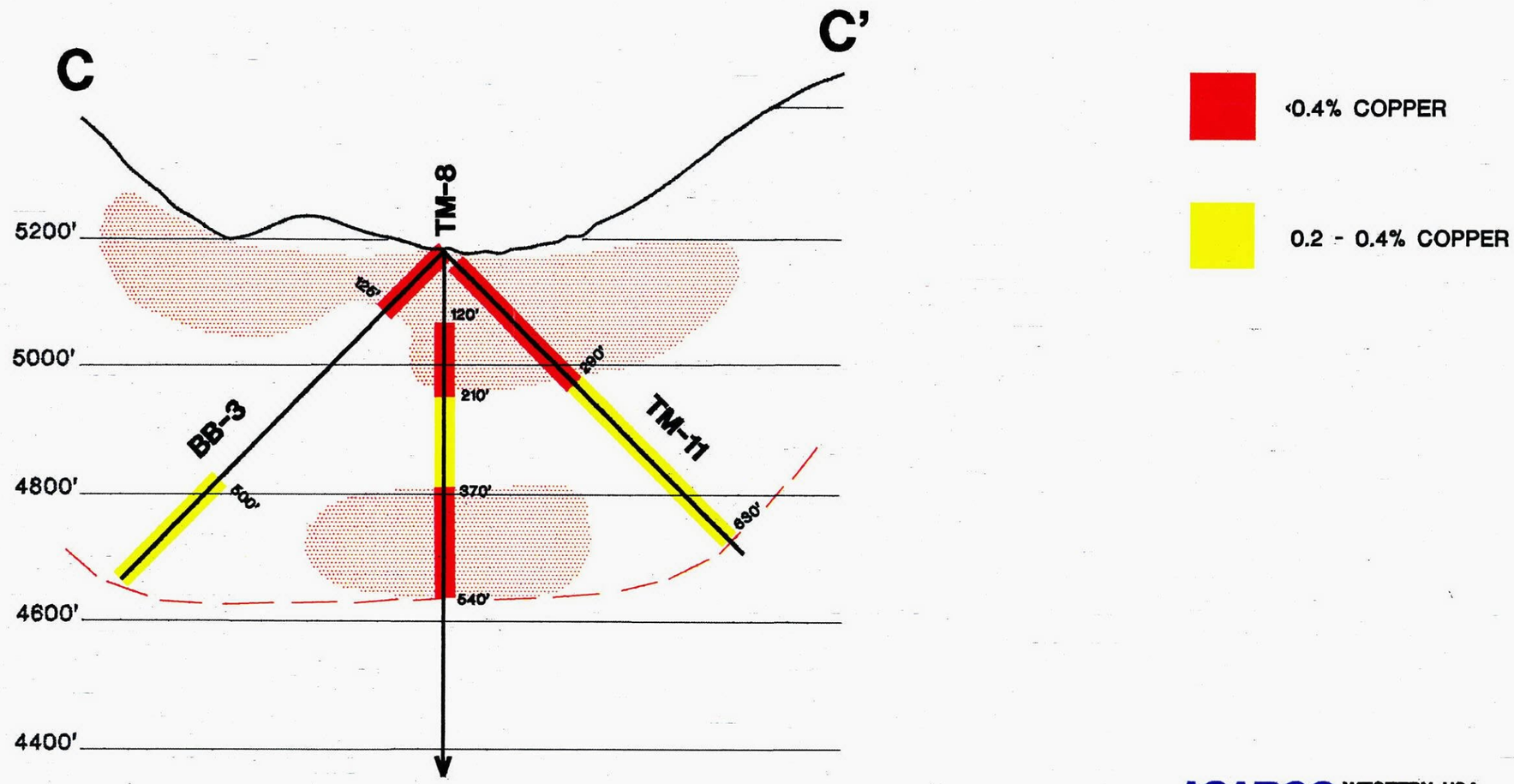
0.2 - 0.4% COPPER

ASARCO WESTERN USA EXPLORATION

THUNDER MOUNTAIN PROJECT
SECTION B-B'
SANTA CRUZ CO., ARIZONA

0 200' 400'

mn TM921225 TUC 12/17/92



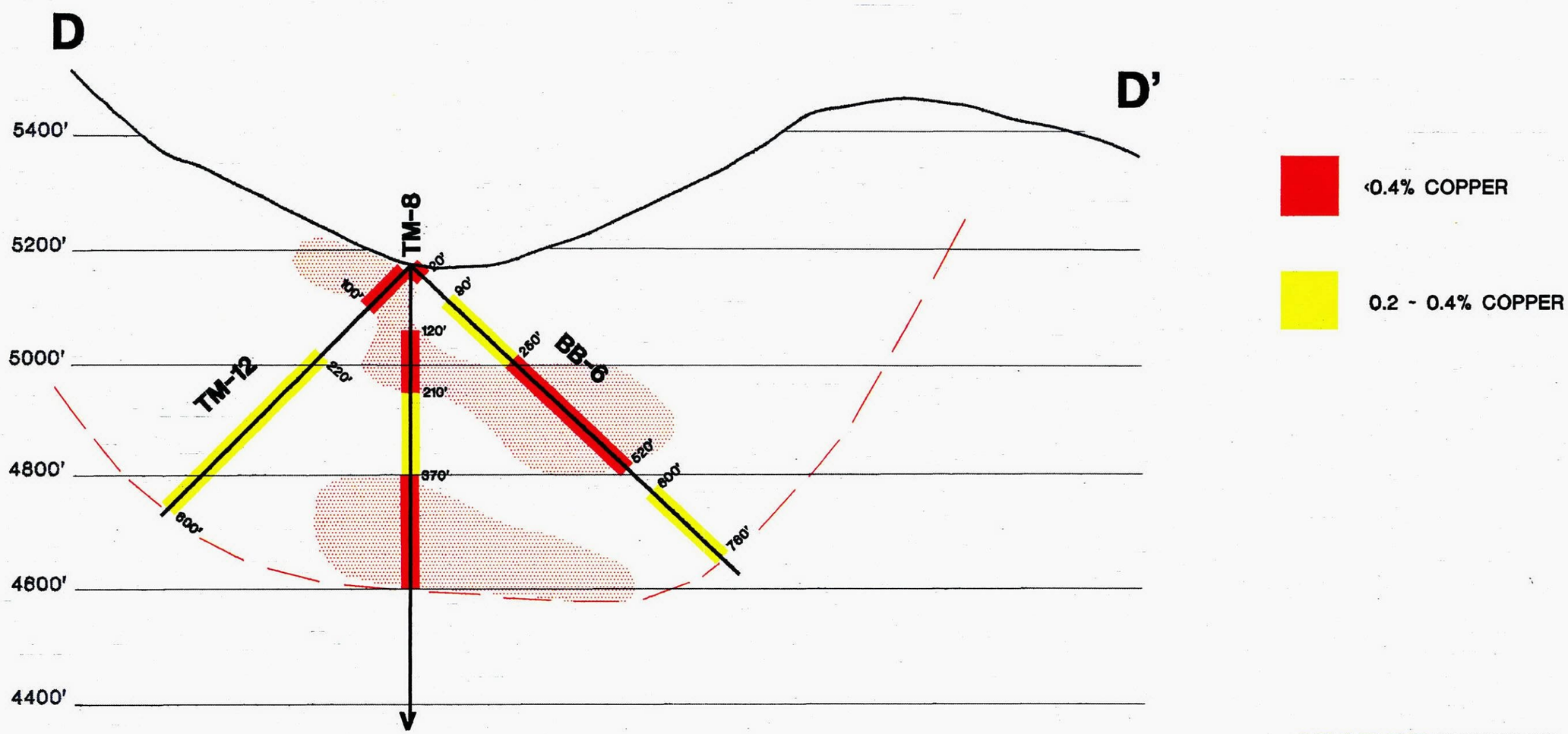
ASARCO WESTERN USA EXPLORATION

THUNDER MOUNTAIN PROJECT
SECTION C-C'
SANTA CRUZ CO., ARIZONA

0 200' 400'

mn TM921210 TUC 12/11/92

FIGURE 7



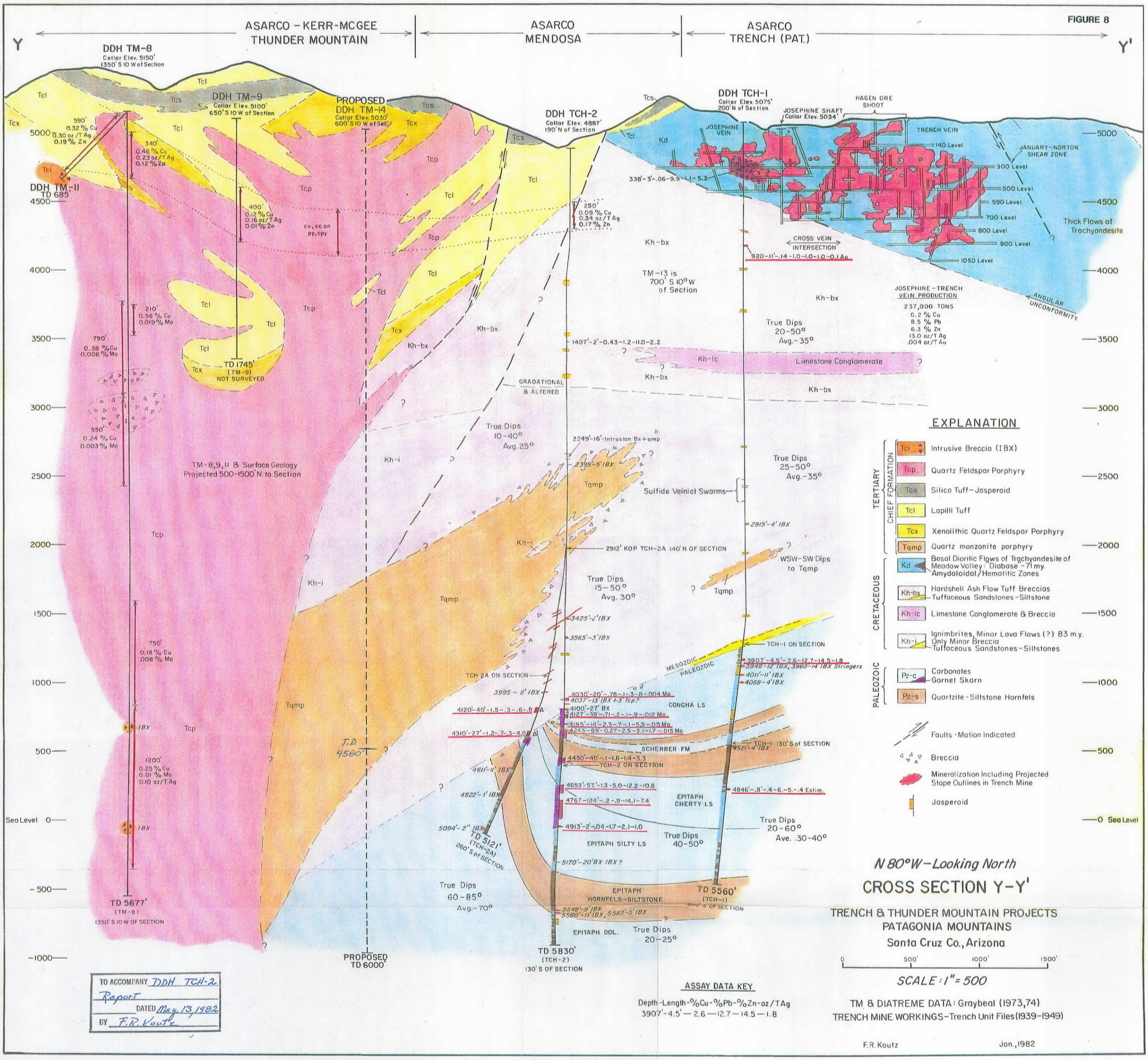
ASARCO WESTERN USA EXPLORATION

THUNDER MOUNTAIN PROJECT
SECTION D-D'
SANTA CRUZ CO., ARIZONA

0 200' 400'

mn TM921211 TUC 12/11/92

FIGURE 8


Y
Y'
ASARCO - KERR-MCGEE THUNDER MOUNTAIN
ASARCO MENDOSA
ASARCO TRENCH (PAT.)
DDH TM-8
Collar Elev. 5150'
1350' S 10 W of Section
DDH TM-9
Collar Elev. 5100'
650' S 10 W of Section
PROPOSED DDH TM-14
Collar Elev. 5030'
600' S 10 W of Sec.
DDH TCH-2
Collar Elev. 4887'
190' N of Section
DDH TCH-1
Collar Elev. 5075'
200' N of Section
JOSEPHINE SHAFT
Collar Elev. 5034'
HAGEN ORE SHOOT
JOSEPHINE VEIN
TRENCH VEIN
JANUARY-NORTON SHEAR ZONE
140 Level
300 Level
500 Level
590 Level
700 Level
800 Level
900 Level
1050 Level
Thick Flows of Trachyandesite
ANGULAR UNCONFORMITY
CROSS VEIN INTERSECTION
920-11'-.14-1.0-1.0-1.0-0.1 Au
JOSEPHINE-TRENCH VEIN PRODUCTION
237,000 TONS
0.2 % Cu
8.5 % Pb
6.3 % Zn
13.0 oz/T Ag
.004 oz/T Au
DDH TM-11
TD 685'
590' 0.32 % Cu 0.30 oz/T Ag 0.19 % Zn
340' 0.46 % Cu 0.23 oz/T Ag 0.12 % Zn
400' 0.12 % Cu 0.16 oz/T Ag 0.01 % Zn
cv, cc on py, cpy
250' 0.09 % Cu 0.34 oz/T Ag 0.17 % Zn
210' 0.56 % Cu 0.019 % Mo
790' 0.38 % Cu 0.006 % Mo
550' 0.24 % Cu 0.003 % Mo
750' 0.18 % Cu .008 % Mo
1200' 0.25 % Cu 0.01 % Mo 0.10 oz/T Ag
TD 1745' (TM-9) NOT SURVEYED
TM-13 is 700' S 10° W of Section
338'-3'-.06-9.9-1.1-5.3
1407'-2'-0.43-1.2-11.0-2.2
GRADATIONAL & ALTERED
True Dips 10-40° Avg. 25°
True Dips 20-50° Avg.-35°
True Dips 25-50° Avg.-35°
True Dips 15-50° Avg. 30°
True Dips 60-85° Avg.-70°
True Dips 20-60° Ave. .30-40°
True Dips 40-50°
True Dips 20-25°
2249'-16'-Intrusion Bx+qmp
2395'-5' IBX
Sulfide Veinlet Swarms
2915'-4' IBX
2912' KOP TCH-2A 140' N OF SECTION
WSW-SW Dips to Tqmp
3425'-2' IBX
3565'-3' IBX
TCH-1 ON SECTION
TCH 2A ON SECTION
3995 - 8' IBX
4120'-40'-1.5-.3-.6-.8
4310'-27'-1.2-.7-.3-4.0
4611'-11' IBX
4822'-1' IBX
5094'-2" IBX
TD 5121' (TCH-2A) 260' S of SECTION
5170'-20' BX IBX ?
T.D. 4580'
MESOZOIC
PALEOZOIC
CONCHA LS
SCHERRER FM
EPITAPH CHERTY LS
EPITAPH SILTY LS
EPITAPH HORNFELS-SILTSTONE
EPITAPH DOL.
4030'-20'-.78-.1-.3-.8-.004 Mo
4037'-13' (BX+3' Tcp?
4100'-27' BX
4127'-39'-.71-.2-.1-.9-.012 Mo
4195'-14'-2.3-.7-.1-5.9-.05 Mo
4243'-69-0.27-2.5-3.1-1.7-.015 Mo
4450'-40'-.1-1.6-1.4-3.3
TCH-2 ON SECTION
4653'-57'-1.3-5.0-12.2-10.8
4767-124'-.2-.9-14.1-7.4
4913'-2'-.04-1.7-2.1-1.0
5548'-9' IBX
5560'-11' IBX, 5583'-5' IBX
3907'-4.5'-2.6-12.7-14.5-1.8
3948-12' IBX, 3960-14' IBX Stringers
4011'-11' IBX
4068-4' IBX
TCH-1 130' S of SECTION
4521'-4' IBX
4846'-.8'-.4-6.-5.-.4 Estim.
TD 5677' (TM-8) 1350' S 10 W OF SECTION
PROPOSED TD 6000'
TD 5830' (TCH-2) 130' S OF SECTION
TD 5560' (TCH-1) 300' S OF SECTION
TM-8,9,11 & Surface Geology Projected 500-1500' N to Section
Kh-bx
Kh-lc
Kh-i
Limestone Conglomerate
Tqmp
Tcp
Tcl
Tcs
Tcx
Kd
EXPLANATION
TERTIARY
CHIEF FORMATION
Tci Intrusive Breccia (IBX)
Tcp Quartz Feldspar Porphyry
Tcs Silica Tuff-Jasperoid
Tcl Lapilli Tuff
Tcx Xenolithic Quartz Feldspar Porphyry
Tqmp Quartz monzonite porphyry
CRETACEOUS
Kd Basal Dioritic Flows of Trachyandesite of Meadow Valley: Diabase - 71 m.y. Amydaloidal/Hematitic Zones
Kh-bx Hardshell Ash Flow Tuff Breccias Tuffaceous Sandstones-Siltstone
Kh-lc Limestone Conglomerate & Breccia
Kh-i Ignimbrites, Minor Lava Flows (?) 83 m.y. Only Minor Breccia Tuffaceous Sandstones-Siltstones
PALEOZOIC
Pz-c Carbonates Garnet Skarn
Pz-s Quartzite-Siltstone Hornfels
Faults - Motion Indicated
Breccia
Mineralization Including Projected Stope Outlines in Trench Mine
Jasperoid
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
Sea Level 0
-500
-1000
N 80° W - Looking North
CROSS SECTION Y-Y'
TRENCH & THUNDER MOUNTAIN PROJECTS
PATAGONIA MOUNTAINS
Santa Cruz Co., Arizona
0 500' 1000' 1500'
SCALE: 1" = 500
TM & DIATREME DATA: Graybeal (1973,74)
TRENCH MINE WORKINGS - Trench Unit Files (1939-1949)
F.R. Koutz
Jan., 1982
ASSAY DATA KEY
Depth-Length-%Cu-%Pb-%Zn-oz/TAg
3907'-4.5' — 2.6 — 12.7 — 14.5 — 1.8
TO ACCOMPANY DDH TCH-2 Report
DATED May 13, 1982
BY F.R. Koutz
MVK-5334

LOGGING NOTES:
1.) ore minerals: gives % Cu (or Zn) in each mineral, estimated where assay not available; left blank where no ore minerals seen
2.) gangue minerals: vol. % present; only alteration minerals logged
3.) sulfide veins: number present, range of dips

GEOLOGIC LOG

PROJECT ASARCO – THUNDER MTN (Kerr-McGee option)
Patagonia Mtns, Santa Cruz County, Arizona

PROJECT ASARCO - Thunder Mtn
Collar elev. 5175
Coord N.
Inclination vertical
Logged by FTGraybeal
Date start 8/6/73

HOLE NO. TM-8
Final depth 5677
Coord E.
Page 1 of 14
Date finish 4/16/74

DEPTH from	DEPTH to	int'vl	% CORE RECOV.		ASSAY % Cu			MoS_2	Au oz	Ag oz	ORE MINERALS chalcocite	covellite					sphalerite	galena	GANGUE MINERALS pyrite-diss	pyrite-vn	limonite	hematite	clay	sericite	quartz-diss	quartz-vn	alunite	STRUCTURE sulfide veins	faults	breccia	ROCK TYPE and REMARKS
	0	10	10	–		–	–	–	–	–	–	–							–	–	–	–	–	–	–	–	–	–	–	–	Rockbit
NC →		20	all 10 except EOH	above 90% except where noted	.04						.03	.01							3				5	50	5		2				10: QUARTZ FELDSPAR PORPHYRY: white, soft, mass.; st. mgr diss. sericite,
		30			.01							.01					tr		4					40	10		5			22	minor buff pods alun (?); py is med. gr uniform diss, as small xtls in vugs,
		40			.01							.01							4					35	10		5			weak	and rims on siliceous masses. Prob. wk bx throughout and vugs filled w v.fgr
		50			.01							.01							4					30	15		5				gy banded silica in irreg. shaped masses to 2"; possib 1% tab 1" vugs
		60			.01							.01					tr		6					40	10		5				55: XENOLITHIC QUARTZ FELDSPAR PORPHYRY: wht-lt gy, mass.; 10-70%
		70			.01							.01						tr	6					45	10		5				ang-subrnd clasts qmp, silica tuf, por volc. in irreg. matrix of qtz feld por
		80			.01							.01					tr		6					45	10		2				Pervas. med-cgr ser diss and in mass 1-3" pods. Py is uniform diss, cgr
		90			.02							.02							6					55	5		2				Qtz in tiny crystals in vugs. Sphal-galena in pods to 1/2" and assoc. w
90	100				.01			.002	.013	.20		.01					tr		5					50	5		(?)				py, mostly in vug-like masses. Minor gougy zones, but no obvious faults
		110			.01							.01					.5		5					40	5						Tr dk gy, vitreous, acicular min in vugs. Ser is coarser where pseudmor @ feldsp.
		120			.02							.02					.5	tr	5					45	5						Breccia continues from 22-55' as weak pervas. vugginess, vugs to 1/2" mostly
		130			.03							.03					.5		6					50	5				126-		filled w. ser-qn-sl-py-qtz xtls, minor vfgr gy silica. Coarseness of sericite
		140			.20			composite 100-200'			.03	.17					tr		5					60	2				138 (?)		is notable
		150			.59				.004	.21	.09	.50							5					50	3	tr	tr				
		160			.37						.07	.30							5					60	1						
		170			.99	70'					.19	.80						tr	4	1				60	3			3-70°		163	163: QUARTZ FELDSPAR PORPHYRY: lt gy, mass; 10% qtz eyes, 40% euh feld
		180			.69	@					.09	.60							3	2				50		tr		3: 50-70°			phena, both alt + set in fgr matrix. Alt is perv. ser, gen. cgr in feld, med-
		190			.51	0.58					.11	.40							4	tr				50				2: 10, 80°			fgr. elsewhere Tr 1/16" discont fgr gy silica vns w no suls; minor irreg masses
190	200				.42			.001	.010	.14	.12	.30							4	tr				50	tr						of vfgr gy silica. Py is med-cgr is dissem, replaces feld phena, and in rare
		210			.47						.07	.40							4					50							veins 1/16-1/4" to 185'; discont. of veins sugg. zone is grad w overly breccia
		220			.25						.05	.20							4					50			2		4@212'		Cov (?) is close assoc. w. py. Alun (?) is med gr pink repl of feldspar phena
		230			.23						.03	.20							3	tr				50			1				Rare bleached (ser?) veins w. nil suls. Rare xenoliths. Cov: commonly rims py
		240			.26						.06	.20							4					50			1				Very rare sooty (?) bluish-blk cc-cov (??) as coating on pyrite grains.
		250			.14			composite 200-300'			.04	.10							4					50							Possib. that all dk sulfide is cc, but dull sooty aspect is mostly absent, mineral
		260			.08				.003	.12	.04	.04					.5		4					50	7		1				has metallic luster + may inherit py fracture. Bluish cast may be more
		270			.12						.02	.10							4	tr				50	2		tr	1-80°			abund. w. incr. depth. Poss sulfide ratios in higher grade rock are
		280			.09						.04	.05							5	tr				50			1				cov-30, cc-30, en-40
		290			.24	160'					.04	.20							5					50							
290	300			340'	.27	@		.001	.008	.07	.07	.20							5					50							
		310		@	.58	0.25					.08	.50					.5		5					50	2		2				
		320		0.46 Cu	.49						.09	.40							5					50			tr				
		330			.14						.04	.10							5					60			tr				
		340		0.005 Au	.43			composite 300-400'			.03	.40							5					60					331		331-380: shear zone; soft, pervasively crushed, no well-defined breccia
		350		0.23 Ag	.36				.008	.28	.06	.30							4					60							or gouge.
		360			.23						.03	.20					tr		4					60			2		shear zone		
		370			.15						.05	.10							4					60							
		380			.61						.11	.50					tr		4					60					380		
		390			1.02						.07	.95							4	1				60				3: 50°			
390	400				.38	110'		.0003	.007	.25	.08	.30							4					60			2 (?)				
		410			.70	@					.05	.65							4					55	1						400: sericite becomes noticeably finer grained toward bottom of
		420			.56	0.68					.06	.50							4					55							higher grade Cu section
		430			.77						.07	.70							4					60							

GEOLOGIC LOG

PROJECT ASARCO - THUNDER MTN
Patagonia Mtns, Ariz

PROJECT ASARCO - Thunder Mtn
Collar elev. 5175
Coord N.
Inclination vertical
Logged by FTG
Date start 8/6/73

HOLE NO. TM-8
Final depth 5677
Coord E.
Page 2 of 14
Date finish 4/16/74

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	ASSAY % Cu	ASSAY % MoS_2	ASSAY oz. Au	ASSAY oz. Ag	ORE MINERALS chalcocite	covellite	sphalerite	GANGUE MINERALS pyrite-diss	pyrite-vn	limonite	hematite	clay	sericite	quartz-diss	quartz-vn	alunite	STRUCTURE sulfide veins	faults	breccia	ROCK TYPE and REMARKS
430	440	10		1.22				.22	1.00		4					60							
	450			.27	composite 400-500'			.02	.25		4					60							449-475: wkly shattered zone, looks like both bx and stkwk, slight incr in sulfide content
	460			.88		.003	.31	.03	.85		4					60							
	470		100	.45				.05	.40		5	tr				60							
	480		60	.62				.02	.60		4					60							
	490		20	.27					.27		4					50			1			480 (wk	480: XENOLITHIC QUARTZ FELDSPAR PORPHYRY: rubbly-mass; 10-60% subang 1" silica tuff clasts, apparently in qtz feld. por matrix, often gritty; entire rock looks brecciated after consolid. Pervas ser. alt. Py is med-cgr dissem, and v. fgr where assoc w. silica tuff
490	500		95	.37		.007	.008	.18	.37	tr	3					35			1				
	510			.07					.07		3					40						517	
	520			.23					.23		4					45							
	530			.77				.07	.70		4					50							517: QUARTZ FELDSPAR PORPHYRY: as above, st alt, contact brkn, wk shatter
	540			.21					.21		4					60							537: XENOLITHIC QUARTZ FELDSPAR PORPHYRY: rubbly-mass; 20-70% subang ¼-3" silica tuff clasts in qtz. feld por matrix - often gritty; clasts in swarms, not uniform distrib, Py is cgr
	550			.02					.02		6					40							
	560			.07					.07		5					40							
	570			.15					.15		4					45							568: QUARTZ FELDSPAR PORPHYRY: wht-lt gy, mass; feld. pheno pseudomorphs to 1" long euh, average ⅛" long. Pervas med gr. ser alt. Py is med gr, unif. diss; tr enar. Rare silica tuff inclusions. Rare sericite veins to ¼"
	580			.09					.09		4					50							
	590			.03					.03	tr	4					50							
590	600			.12		.001	.006	.25	.12		4	tr				50				2:60°			Pass. irreg. tr cc.
	610								tr		4	tr				50							
	620								tr		4	tr				50							
	630								tr		4	tr				50							
	640								tr		4					50							
	650								tr		4					50							
	660							tr	tr		4					50							
	670								tr	tr	3	1				50				3:10-40°			
	680								tr		3					50							672-675: pebble dike; 15% ang. clasts + ¼" in gritty matrix, pre-min, sim to qtz feld por
	690								tr		3	tr				50							
690	700			.06		.001	.004	.21	.06		4					50							
	710								tr		3					50							
	720								tr		4					50			2				
	730								tr		4					50							
	740								tr		4	tr				50				2: 80°			
	750								tr		4					50			4				
	760								tr		4	tr				50				1: 80°			
	770								tr		4	tr				50			2	2: 80°			
	780								tr		3	1				50				1: 80°			
	790								tr		3					50							
790	800			.03		.001	.005	.05	.03		4	tr				50			?	1: 80°			
	810								tr		3					50							
	820								tr		3				?	50							
	830								tr		3					50							823-873: zone w. several 1-3" gouge zones, wk ¼" flt zones w crushed py, and generally more rubbly and pervasive weak shearing
	840								tr		3					50							
	850								tr		4					50							
	860								tr		3					50							

mn 2555 dam

GEOLOGIC LOG

PROJECT ASARCO - THUNDER MTN
Patagonia Mtns., Ariz

PROJECT ASARCO - Thunder Mtn
Collar elev. 5175
Coord N.
Inclination vertical
Logged by FTG
Date start 8/6/73

HOLE NO. TM-8
Final depth 5677
Coord E.
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Date finish 4/16/74

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	ASSAY % Cu	ASSAY % MoS2	ASSAY oz. Au	ASSAY oz Ag	ORE MINERALS chalcocite	covellite	chalcopyrite	sphalerite	GANGUE MINERALS pyrite-diss	pyrite-vn	clay	sericite	quartz-diss	quartz-vn	alunite	STRUCTURE sulfide veins	faults	ROCK TYPE and REMARKS
860	870	10							tr			3		(?)	50						
	880											3			50						
	890								tr			4			60						
890	900			.06		.001	.003	.12		.06		5			50						
	910											4			50			tr (?)			900: alunite logged as lt pink dots to 1/8" replacing some
	920											4			50			tr			feldspar pseudomorphs.
	930											4			50			tr			
	940							tr	tr	(?)		4			50			tr			
	950											4			50			1			
	960								tr			4			50			1			
	970								tr			4			50			1			
	980								1			4	1		50			tr	1: 80°		
	990								tr			4	tr		50						
990	1000			.07		.001	.002	.03		.07		4			50						
	1010			.13						.13		5	tr		50			tr	1: 60°		
	1020			.13						.13		6			50			tr			
	1030			.13						.13		5			50			tr			
	1040			.08						.08		4	1		50			tr	2: 10, 80°		1030: pyrite veins 1/32" - 1/4", aver 1/16" wide, often discont sulfide
	1050			.08						.08		6	tr		50			2	2: 70°		along vein surface, attitude variable; rarely a bleach-looking
	1060			.09					(?)	.09		4			45			2			selvage is present (poss. incr sericite ?), rare qtz (?) -ser veins
	1070			.11					tr	.11		4	2		45	tr		2	4: 70°		to 1/16" w nil-tr pyrite. Total sulfide content in veins is small
	1080			.10						.10		4	tr		45			2	3: 40-70°		Pyrite appears to coarsen with depth and in zones of
	1090			.06						.06		4	tr		45	tr		2	5: 40-60°		increased abundance.
1090	1100			.02		.0002	.001	.01		.02		4	tr		45			2	1: 20°		Traces of covellite logged as v.f.gr black mineral - identif. is
	1110			.08						.08		4	tr		45			2	2: 45		uncertain
	1120			.08						.08		4	tr		45	tr		1			Black pyritic veins prob due to slight post-mineral movement
	1130			.14						.14		4	1		45	tr		1	3: 30°		and resultant crushing of sulfides.
	1140			.15						.15		4	1		45	tr			2: 40-70°		
	1150			.06						.06		5			45						1143-1146: wk movement on veins (?) formed wk. bx w ang masses
	1160			.21					tr	.21	(?)	4	1		45	tr			5: 50-70°		of py to 1/2"
	1170			.10						.10		4	tr		45	tr		tr	3: 40°		
	1180			.37					tr	.37		5	1		45			tr	2: 70°		
	1190			.12						.12		4	1		45			tr	2: 70		
1190	1200			.14		.0005	.001	.10		.14	tr	4	1		45			tr			1200: Alteration appears to become finer grained with increasing
	1210			.10						.10		4	tr		50			tr	2: 50-70		depth from 1200', although change is gradual and not
	1220			.15						.15		5		(?)	40			1			clear cut. Abundance of clay below this point is uncertain,
	1230			.06						.06		5			40			1			but some may be present
	1240			.10						.10		5			40			1			
	1250			.09						.09		5			40			1			
	1260			.09						.09		4			45			1			
	1270			.06						.06		4	tr		45			1			
	1280			.07						.07		4			45			1			
	1290			.06						.06		4			45			2			

mn 2555 dm

GEOLOGIC LOG

PROJECT ASARCO - THUNDER MTN
Patagonia Mtns., Ariz

PROJECT ASARCO - Thunder Mtn. HOLE NO. TM-8
Collar elev. 5175 Final depth 5677
Coord N. Coord E.
Inclination vertical Page 4 of 14
Logged by FTG
Date start 8/6/73 Date finish 4/16/74

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	ASSAY % Cu			% MoS_2	oz Au	oz. Ag	ORE MINERALS covellite	chalcopyrite	molybdenite	sphalerite	GANGUE MINERALS pyrite-diss	pyrite-vein	hematite	clay	sericite	quartz-diss	quartz-vein	alunite	barite	STRUCTURE sulfide veins	faults	ROCK TYPE and REMARKS
1290	1300	10		.09			.002	.001	.01	.09				3			(?)	45			2				
	1310			.09						.09				4	tr			45			1		4:30-45°		
	1320			.14						.14				4	tr			45			1		2:20-70°		
	1330			.22						.22				4				45			1				
	1340			.09			composite 1300-1400'			.09				4				45							
	1350			.09			.003	.004	.17	.09	tr			4	1			45					4:20-70°		
	1360			.13						.12	.01		tr	4	tr			45					1: 70°		1350: First definite occurrence of f.gr uniform diss chalcopyrite
	1370			.27						.12	.15			5				45							
	1380			.48						.08	.40			6				45							
	1390			.35						.05	.30			5				50						brkn	
1390	1400			.24			.004	.001	.01	.04	.20			6				50							1390: disseminated pyrite begins to show moderate tendency to
	1410			.28						.08	.20			6	tr			50					2:50°		occur as rims around altered feldsparphenocrysts. Sulfide
	1420			.45						.05	.40			5	tr			50					2:20-40°		veins still without obvious selvage; some veins are more like linear
	1430			.51						.06	.45			5	tr			50					2: 80°		shattered zones (no rotate of frags) + sometimes have minor f.gr. qtz
	1440			.54			composite 1400-1500'			.04	.50			5	tr			50					1: 40°		Veins often sharply terminated against other veins or barren fract.
	1450			.43			.020	.004	.21	.13	.30			6				50							Some suls. logged as dissem still in angular pods up to 1/4" across -
	1460			.50						.10	.40			6				50							suggesting pervasive but very weak pre-mineral ox
	1470			.40						.05	.35			6	1			50	S(?)				2:70°		1460: slight granular texture to alteration suggests (?) - silicif(?)
	1480			.52						.07	.45			6				45	S(?)						
	1490			.50							.50	tr		6	tr			45	S(?)				2:75°		1484-1487: xenolithic zone; 50% frags; nature of matrix unclear, wk flow(?)
1490	1500			.53			.029	.002	.09	.03	.50			5	1			50					1:30		structure @ 30°
	1510			.72						.22	.50	tr		6				50							Below about 1500 ft. the feldspar phenocryst pseudomorphs become
	1520			.45	210'					.20	.25	tr		7				50							progressively destroyed so that evidence of former porphyritic
	1530			.43	@					.13	.30			5				50				tr			texture is difficult to recognize. Molybdenite present, but is dissem,
	1540			.48	0.56	Cu				.18	.30	tr		5	1			50					2:70°		very f.gr. Veins to 1/8" thick w mass py-cpy, diffuse selvage of mass
	1550			.40	0.032	MoS_2	composite 1500-1600'			.10	.30			5	1			50					2:30-50°		gray ser. w. heavy diss py 1/8-1/4" thick, grad. w. white, st ser alt
	1560			.93	0.004	Au	.048	.005	.25	.43	.50	tr		5	2			50	1				2:70°		1550: where both are abundant cov(?) occurs as rims around some cpy; cov
	1570			.33	0.24	Ag				.13	.20	tr		5	1			50					2:30°		most abund in weakly vuggy mass py veins
	1580			.26						.11	.15	tr		5	2			50	2				3:40-80°	1573 shear zone 1584	
	1590			.71						.06	.60	tr		5				50							Occasional nearly barren joints @ 30-70° throughout - estimate
1590	1600			.54			.028	.001	.09	.04	.50	tr		5	1			50					2: 70°		5-10 per 10 ft. interval
	1610			1.36						.20	.90	tr		7				50							
	1620			.65						.05	.40	tr		5	1			50					5:50-80°		
	1630			.56						.05	.40			4	tr			50					4:20-60°		
	1640			.37						.07	.30	tr		4	1			50					2:70°		
	1650			.55			composite 1600-1700'			.05	.35	tr		5	1			50					1:70		
NX →	1660			.34			.012	.003	.26	.04	.30	tr		5	tr			50					2:40		
	1670			.32						.07	.20			5		tr		50	2						Distribution of dissem suls. very uneven where more abundant. Some
	1680			.25						.05	.20			4		tr		50							diss py looks weakly vuggy - minute cavities due to hydrother. leach(?)
	1690			.35						.05	.30			4		1		40							
1690	1700			.29			.004	.001	.12	.04	.25			4		1		40							
	1710			.27						.03	.24			4		2		45							
	1720			.36						.06	.30			4		2		45	2						

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GEOLOGIC LOG

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Patagonia Mtns, Ariz.

PROJECT ASARCO - Thunder Mtn
Collar elev. 5175
Coord N.
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Date start 8/6/73

HOLE NO. TM-8
Final depth 5677
Coord E.
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Date finish 4/16/74

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	% Cu	MoS2 %	Au oz	Ag oz	covellite (ORE MINERALS)	chalcopyrite	molybdenite	sphalerite	pyrite-diss (GANGUE MINERALS)	pyrite-vein	hematite	clay	sericite	quartz-diss	quartz-vein	alunite	barite	sulfide veins (STRUCTURE)	faults	breccia	ROCK TYPE and REMARKS
1720	1730	10		.29					.29			6	tr			50								
	1740			.37				tr	.37			5	tr	tr		50								
	1750			.29	composite 1700-1800'				.29			4	tr			50								
	1760			.36	.003	tr	.25	.06	.30			5	1			50		1			5:30-70°			1750. Vague banding @ 60-70° (seen only when core is wet) defined by 1/8"
	1770			.23				.03	.20			5	tr			50								layers of 100% f gr material - a flow structure
	1780			.19				.04	.15			5	1			50					2:70°			
	1790			.15					.15			2	tr	3		50								1780-1790: zone of strong hydrothermal (?) oxidation of pyrite-cpy to hematite
1790	1800			.33	.001	.001	.06	.08	.25			5	tr			50					2:70°	1798		1798-1834. very weak shearing - rock is wkly vuggy along shears, dk gy
	1810			.20				.05	.15			4	tr			50						very wk		specks to 1850 are probably crushed pyrite grains.
	1820			.30				.05	.25			3				50						shearing @40-70°		
	1830			.51				.11	.40			4				50								
	1840			.21				.01	.20			4	1			50					1:30°	1834		
	1850			.16	composite: 1800-1900'			.06	.10			4				50								
	1860			.15	.002	tr	.14	.08	.07			6				50								
	1870			.12				.06	.06			6	tr			50					2:30°			
	1880			.17				.08	.09			5				50								
	1890			.26				.13	.13			5				50								1888: QUARTZ FELDSPAR PORPHYRY BRECCIA: mass. w brkn sections, lt-dk gy.
1890	1900			.26	.003	.001	.01	.06	.20			6				50	2		2					Orig. brecciation healed, then rock rebrecciated (?) 1914-1990'. Alteration is
	1910			.25				.05	.20			6				50			1					very strong, obscures nature of matrix; mostly very f gr sericite w wk (?)
	1920			.36				.16	.20			6				50			3				1914	silicif (?) of matrix, alunite (?) in veins and rounded-ang. pods to 1/2"
	1930			.25				.10	.15			7				50	1		5				weak,	Pyrite is irreg dissem and in massive-angular pods to 3" across -
	1940			.41				.06	.35			6				50	1		2				few vugs,	shape of py-alun masses suggest filling of former vugs. Cpy and
	1950			.24	composite: 1900-2000'			.04	.20			5				50	1		1				mostly	covellite (?) very irreg dissem. w cov. rims rarely around py. Frags are rare
	1960			.32	.003	.001	.09	.02	.30			6				50			3				healed	volc and qtz feld por(?). Suggestion that sulfides more strongly dissem in
	1970			.31				.06	.25			6				50			2					matrix around frags. All sulfides are med-c.gr.
	1980			.31				.10	.21			8				50	2		4					
	1990			.36				.16	.20			7				50	4		2				1990	1990: QUARTZ FELDSPAR PORPHYRY: lt gy, very dense, wkly brkn; vague qtz eyes,
1990	2000			.22	.002	.001	.03	.15	.07		1	6	2			40	5	2	1		3:70°			tr-nil remains of pseudom. @ feldspar pheno. Alteration prob pervasive sericite,
	2010			.21				.15	.06		tr	7				40	5	4	2					very f.gr. Sulfides irreg dissem, often abundant in bands dipping @ ~70°
	2020			.15				.05	.10			6				40	2	3	1					Qtz veins are whitish, v.f gr w sharp borders. Mod flat joints w. tr py
	2030			.15				.05	.10			5	1			40	2	1			3:40-70°			
	2040			.33				.10	.23			5	1			40	5	2			3:70°			2031: QUARTZ FELDSPAR PORPHYRY BRECCIA: mass. w brkn sections, no vugs now; var
	2050			.71	composite: 2000-2100'			.11	.60			5	tr			40	5	3	5			brkn.		whitish-gray. Angular qtz feld por frags 1/2"-6' cemented by f gr darker
	2060			.35	.004	tr	.29	.05	.30			4				40	3	1	1			2046-2057		gray siliceous material often w well-devel parallel banding. Soft clay-like
	2070			.25					.25			6				40	5							massive alunite (?) also cements frags. Minor foreign rocks (<1%) sugg. rock
	2080			.41				.06	.35			5	tr			40	5	2			1:75°			not intrusive bx. Fine gr sericite alt pervasive, rare light pinkish coloration adj to
	2090			.31					.31			5				40	7			tr				some veins, rock appears weakly silicified throughout. Pyrite is dissem and in
2090	2100			.20	.003	.002	.16		.20			5	tr			40	3	1			1:70°			massive pods 2-3". Cpy dissem and is more abundant in matrix of bx and
	2110			.54					.54			5				40	5		2					as discont. rims on some frags. Breccia was prob wkly vuggy when formed and
	2120			.41					.41			5				45	3		3					was intramineraliz - thus veins terminate at matrix, but uncrushed sulfides
	2130			.43				.03	.40			7				45	6	2	2					rim frags. Cov. is decreasing. Rare 1/2" f gr qtz veins. Traces yellow,
	2140			.24	composite: 2100-2200'				.24			5	tr			40	6	2		tr				vitreous mineral (barite?). Sulfides in matrix material generally coarse-
	2150			.24	.004	.001	.26		.24			8	tr			40	5	1		2	2:70°			grained. Quartz eyes mostly < 1/8", < 5% of rock, feldspars completely gone

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GEOLOGIC LOG

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Patagonia Mtns., Ariz.

PROJECT ASARCO - Thunder Mtn
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HOLE NO. TM-8
Final depth 5677
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Date finish 4/16/74

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	% Cu	ASSAY % MoS_2	Au oz	Ag oz	covellite	chalcopyrite	molybdenite	sphalerite	pyrite-diss	pyrite-vein	clay	sericite	quartz-diss	quartz-vein	alunite	barite	sulfide veins	faults	ROCK TYPE and REMARKS
2150	2160	10		.51					.51			6			45	5		2	1			2150: fibrous, radiating light pink mineral occas present – barite (?)
	2170			.31					.31			4			45	5		1	tr			
	2180			.33					.33			7			50	2			tr			
	2190			.29					.29			6			50	2		1	tr			
2190	2200			.19	.005	.005	.32		.19			7	1		50	5			tr	2:70°		
	2210			.32					.32			4	1	5	40	5	2			1:70°		2200: quartz veins are often irreg, discontinuous; may occur between fragments; are mostly post-breccia.
	2220			.25					.25			5		5	40	5	5					
	2230			.38					.38			5	1	5	45	5	6			1:60°		Alteration mineralogy obscured by pervasive crushing of the
	2240			.26					.26			6		6	45	7			tr			rock, amount of introduced dissem quartz mostly a guess.
	2250			.33				tr	.33		tr	6		4	40	10	5					
	2260			.38					.38	tr		6		2	40	15	5					
	2270			.20					.20	tr		7			40	10	1					2250: MoS_2 is med-fgr, diss + along qtz veins
	2280			.23					.23	tr		6			50	10	2					
	2290			.15					.15			4	1		50	5	2			6:20-70°		
2290	2300			.19	.007	.001	.11		.19			5	tr	2	50	5	7					
	2310			.15					.15		tr	4		2	50	5	2				brkn.	
	2320			.19					.19			4	1	2	50	7	5			2:40°	2315-2318	
	2330			.27					.27			4	1	4	40	10	4			1:70°		
	2340			.20					.20	tr		6	tr	1	40	6	7			3:40-70°		
	2350			.17					.17			4	1	1	50	2	3			2:50-70°		
	2360			.26					.26			4	1	3	50		2			2:50-70		
	2370			.16					.16	tr		5			50		4					2365: QUARTZ FELDSPAR PORPHYRY: lt. gy-white; massive-irreg brkn; texture
	2380			.17					.17	tr		4	2		50		3			7:40-70		obscured by alt. but scarcity of qtz eyes and vague shape - small size
	2390			.18					.18			4	2		50		2			6:40-70		of remnant feldspar pheno sugg rhyolite por (Thunder Mtn. group)
2390	2400			.30	.008	.002	.07		.30			4	2		50		6			4:40-70°		Rock is pervasively altered to fgr sericite (?) w short wkly silicified
	2410			.21					.21			3	2		40	6	2			4:20-50°		zones Variable amount qtz veins 1/8-1" thick w/wo sulfides; qtz is
	2420			.16					.16			3	3		45	4	6			7:50-70		lt gy, granular. Pyrite w minor chalcopyrite both diss and in 1/32-3"
	2430			.24					.24			4	2		40	15	5			4:50-70°		veins w no selvage Irreg py in wkly brkn zones Rock is wkly
	2440			.32				tr	.32	tr		4	2	tr	50	5	7			6:30-70°		crushed throughout All veins tend to vary widely in strike - sugg of
	2450			.55					.55			4	1	1	50	2	8			2:40°		local stockwork
	2460			.28					.28			4	1		50		10			2:70°		
	2470		70	.44					.44			3	3		50		8			5:50-70		
	2480		60	.47					.47			3	2	tr	50		8			6:10-80	brkn.	
	2490			.22					.22			5	2	1	40	10	8			6:20-70	2485-2488	
2490	2500			.32	.004	.003	.16	tr	.32			5	2	3	50	5	6			4:60-80		
	2510			.27					.27			5	2	2	40	15	6			4:40-70	2500-2502	
	2520			.15					.15			5	1		45	10	7			5:40-70		
	2530			.32					.32			4	1		50	5	8			3:70°		
	2540			.14					.14			4	1		50	7	5			6:40-70°		
	2550			.17					.17	tr		4	1	1	50	5	5			3:50°		
	2560			.13					.13			4	1		50	3	6			4:30-70°		
	2570			.12					.12			5		3	60		2					
	2580			.21					.21			4		1	50		tr					

mn 2555 dm

GEOLOGIC LOG

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Patagonia Mtns., Ariz.

PROJECT ASARCO - Thunder Mtn. HOLE NO. TM-8
Collar elev. 5175 Final depth 5677
Coord N. Coord E.
Inclination vertical Page 7 of 14
Logged by F.T.G.
Date start 8/6/73 Date finish 4/16/74

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	% Cu	ASSAY % MoS_2	ASSAY oz Au	ASSAY oz Ag	ORE MINERALS: covellite	chalcopyrite	molybdenite	sphalerite	GANGUE MINERALS: pyrite-diss	pyrite-vein	clay	sericite	quartz-diss	quartz-vein	STRUCTURE: sulfide veins	faults	ROCK TYPE and REMARKS
2580	2590	10		.23					.23			3	1		50	5	3	3:70°	2584-2589	
2590	2600			.32	.011	.003	.16		.32	tr		4	tr		50	10	1	2:70		
	2610			.31					.31	tr		4	tr		40	20	2	4:20-70°		2600: pervasive silicif. accomp. by drop in % vein sulfides, vein qtz,
	2620			.22				.05	.17	tr		4			40	20	2			and by incr (?) in cpx.; silicif. zones irreg. distrib, gradational
	2630			.15					.15	tr		4			50	15	5			w. unsilicif. rock. Silicif. zones often shattered w. py. in
	2640			.10					.10	.02		4	1	2	50	5	8	3:70°		resulting stockwork
	2650			.14					.14	tr		5	tr	tr	50	5	8	2:70°		
	2660			.34					.34			5	tr	1	50		7	4 40-85°		2657: 1/8" py-cpy veins @ 85° cut all alt, bx, and qtz. veins
	2670			.18				tr	.18	tr		5	tr	1	40	15	4	1:20°		
	2680			.09					.09			6	tr		50	10	7			
	2690			.15					.15			6	tr		50	10	5	3:20-90°		
2690	2700			.16	.013	.001	.06		.16			5	tr		50	7	5	3:20-80		
	2710			.37					.37			4	tr		45	15	3	2:60-80°		2710 1/4" cpy-sl vein @ 60°
	2720			.06					.06			3	1		50	5	6	3:20-60°		
	2730			.10					.10	tr		4	2	1	50	5	7	8:20-90°		2730-2800: 0-20% subrounded-ang 1/4-1" xenoliths, mostly silica tuff
	2740			.07					.07	tr		4	2	2	50	5	5	4:50-70°		
	2750			.01					.01			4	2	1	40	15	1	5:20-70°		
	2760			.03					.03	tr		5	1	1	30	30	2	1:60		
	2770			.05					.05			4	tr	3	50	10	2	1:20	2761	2761-2806: rock is variably broken w several 6"-1' gouge zones
	2780			.07					.07	tr		4	tr	1	40	10	5	2:40	see	
	2790			.06								6	1	2	60	5	5	7:10-80	notes	
2790	2806			.05	.017	tr	.12			tr		5	1	2	55	5	3	5:30-70		
	2810			.06					.06			4	tr	2	50	5	2	1:70	2806	
	2820			.05								4	1		50		2	6:20-70°		
	2830			.04								3	tr		50		2	4:40-70°		
	2840			.10					.10	tr		4	tr		40	10		2:35°		2830-3020: qtz feld por is weakly xenolithic throughout, average
	2850			.16					.16			4	tr	1	45	5		2:40		<5% subrnd-ang gray fragments silica tuff, rhy por
	2860			.07								5	tr		40	10	2	3.20-50		
	2870			.08					.08			5	1	1	40	5		4:20-90		
	2880			.01								4	2	1	40	2	6	4:20-70		
	2890			.02								4	tr	1	50		2	2:20-40		
2890	2900			.04	.014	tr	.03					4	tr		50	5		2:75°	fault	
	2910			.02						tr		4			50		1		2901-2906	
	2920			.02						Tr		5			45	10	1			
	2930			.01						.04		4			40	10	2			
	2940			.01						.02		4	tr		40	10	2	1:70		
	2950			.03						.04		4	tr		45	5	2	2:20		
	2960			.07						tr		4	tr	1	50	5	2			
	2970			.03								3		2	50	5				
	2980			.06						tr		4		1	50	2			2979-2984	
	2990			.06						tr		4	tr		50	5		1:70°		
2990	3000			.06	.008	tr	.01					4	tr	2	45	10		1:45		
	3010			.07					.07	tr		4	tr		45	10	4	2:50°		

mn 2555 rm

GEOLOGIC LOG

PROJECT ASARCO - THUNDER MTN
Patagonia Mtns., Ariz

PROJECT ASARCO - Thunder Mtn
Collar elev. 5175
Coord N.
Inclination vertical
Logged by F.T.G
Date start 8/6/73

HOLE NO. TM-8
Final depth 5677
Coord E.
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Date finish 4/16/74

DEPTH from	DEPTH to	int'vl	% CORE RECOV.		% Cu			ASSAY % MoS_2	oz Au	oz Ag	ORE MINERALS: black sulfide	covellite	chalcopyrite		molybdenite				GANGUE MINERALS: pyrite - diss	pyrite - vein		clay	sericite	quartz - diss	quartz - vein							STRUCTURE: sulfide veins	faults	ROCK TYPE and REMARKS
3010	3020	10			.04										.01				4				40	15									brkn: 3019-	
	3030				.03										tr				4				40	15									3332	
	3040				.06										.02				4	1			40	15	2						1:60°		brkn: 3046-	
	3050				.06										tr				4				40	15	3								3053	
	3060				.03														5				40	15	2								Vert joints 3054-	
	3070				.02														4	1			40	10	3						4:20-70°		3061	
	3080				.03										tr				4				40	15									brkn: 3074-	
	3090				.26										tr				4				40	15	4								3096	
3090	3100				.10			.012	tr	.08					tr				4	tr			40	15	2						3:40-70			
	3110				.02								.02		tr				4				45	15	3									
	3120				.06														4				40	20	6									
	3130				.01										.01				4	tr			40	20	2						2:20-70°			3120. sulfide veins include discontinuous, short, stockwork-like
	3140				.16								.16		.02				4	tr		2	40	20	3						2:70°			veins which have in part been offset along other veins
	3150				.06										tr				6	1		2	45	15	2						8:20-80°			and by barren joints. MoS_2 shows increasing tendency
	3160				.17								.17		tr				4	1			45	15	4						7:40-70			to assoc. w. qtz veins w. incr. depth.
	3170				.07							tr							4	tr		1	40	15	5						3:50-70°			Offsets on stockwork locally sufficient to open small
	3180				.08								.08						4	1		1	45	10	3						6:40-70°			vugs which were filled w. qtz & py pods to 1/4". Overall
	3190				.03														5	1		4	50	10	2						1:35°			thickness of py veins decr downward. Material logged
3190	3200				.14			.018	tr	.11					.03				4	1		2	50	10	3						4:20-70			as clay is soft whitish material as clots in veins
	3210				.29								.29		.03				4	tr			50	7	4						3:70°			3200. quartz eyes become much more obvious w. incr. depth, rock
	3220				.04										.02				4	1		2	50	7	3						1:45			becomes more dense - hard to tell at times % of
	3230				.01										.01				4	tr		3	50	5	5									introduced silica. Feldspar ghosts badly corroded
	3240				.01										tr				4	1		1	50	8	2						1:55°			
	3250				.02										.01				4				40	10	4									
	3260				.05								.05		.01				4				40	5	5						2:40-70			
	3270				.10								.10		tr				3	tr		2	40	10	5						1:80			
	3280				.04														3	tr		1	35	10	3						2:70°			
	3290				.04														3				35	15	2							brkn:		
3290	3300				.02			.012	tr	.06									3	1			35	15	4						3:50-70°	3295-3298		3300-3450: small fissures along qtz veins are common.
	3310		80		.08								.08						3				40	15	2							brkn		
	3320				.06								.06						3				45	10	2							3309-3321		
	3330				.05										tr				3				45	10	2									
	3340				.07										tr				3				50	5	2									
	3350				.14							tr	.14		tr				3	tr			50	5	2						1:80°			
	3360				.06							tr	.06		tr				3	tr			50	10	1						1:75°			
	3370				.05										tr				3	2			40	20	2						2:50-70			
	3380				.06										tr				3			2	50	5	2									
	3390				.04										tr				3			3	50	5	2									
3390	3400				.02			.005	tr	.01			.02		tr				3	1			45	15	1						5:60-V			
BX →	3410				.06										tr				3	tr			45	15	1						2:20-70			
	3420				.06								.06						3				45	10	1									
	3430		15		.01								.01						3				40	15										
	3440				.01														3	tr			30	30							3:25°			

mn 2555 dm

GEOLOGIC LOG

PROJECT ASARCO - THUNDER MTN
Patagonia Mtns, Ariz

PROJECT ASARCO - Thunder Mtn
Collar elev. 5175
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Logged by F.T. Graybeal
Date start 8/6/73

HOLE NO. TM-8
Final depth 5677
Coord E.
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Date finish 4/16/74

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	% Cu	ASSAY % MoS2	oz. Au	oz Ag	ORE MINERALS black sulfide	covellite (?)	chalcopyrite	molybdenite	sphalerite	GANGUE MINERALS pyrite - diss	pyrite - vein	clay	sericite	quartz - diss	quartz - vein	STRUCTURE sulfide veins	faults	ROCK TYPE and REMARKS
3440	3450	10		.03									3	tr	2	35	25	2	2: 30-70°		
	3460			.01									2		2	40	20	2			
	3470			.01									2	1	2	40	20	2	2: 70°		Vague zone of pervasive silicif appears to post-date(?) the
	3480			.07									2	tr	1	35	25	2	4: 30-70	3480	quartz veins. Rare wkly shattered zones w increased py
	3490			.01									4	1	1	30	35	3	4: 40-70		Rock is uniform grey color w no indication of feldspar
3490	3500			.06		.002	.003	.07		.06			3		1	30	35	2			ghosts over most of the core
	3510			.05						.05			3	tr	1	40	30	2			
	3520			.06						.06			4	1	2	40	25	3	6: 30-60°		
	3530			.05						.05			6	1	3	40	25	1	2: 50-70°		
	3540			.16						.16			5	1	3	40	25	1	3: 20-60°		
	3550			.06						.06			3		1	40	25	4		pervas. wkly.	
	3560		70	.21						.21			3	1	2	40	25	3	4: 20-80°	brkn.	
	3570			.23						.23	tr		3	2	3	40	30	4	9: 30-70°	zone	
	3580			.21						.21			3	1	2	35	30	2	4: 50-70°		
	3590			.16						.16	tr		3		2	40	30	2			
3590	3600			.13		.010	.001	.03		.13	tr		3	1	2	40	30	4	3: 50-70°		
	3610			.14						.14	tr		3	tr	2	40	30	2	3: 70°		3600. Pyrite veins become consistently present. Veins contain med-cgr py
	3620		70	.12						.12	tr		3	tr	2	30	30	2	4: 50-70°		w rare assoc cpy, possib tr tenn(?), alteration selvages are absent,
	3630			.36						.36	tr		3	1	1	30	30	4	3: 40-60°		py veins often cut older qtz. veins. Veins vary 1/64 - 1/2" thick,
	3640		70	.20						.20	tr		3	1	1	35	25	3	5: 20-70°		mostly 1/16" thick, strikes + dips variable
	3650			.11						.11	tr		3	1	2	35	25	3	4: 20-80°		Quartz veins 1/16-1/8" thick, no alt selvage, generally barren
	3660		40	.23						.23	tr		2	1	2	35	25	3	2: 70°	3660	
	3670			.20						.20	CS		3	1	2	40	25	3	5: 30-70°		
	3680			.18						.18	tr		3	1	2	40	20	2	6: 30-80°		
	3690			.12						.12			2	1	2	40	15	2	5: 30-60°		
3690	3700			.16		.004	.001	.16	tr	.16			2	tr	2	45	15	1	3: 20-70°		
	3710			.19						.19		tr(?)	3	1	2	50	10	1	4: 50-70°		
	3720			.14						.14			3	1	2	50	15	2	8: 20-70		
	3730			.17					.02	.15			2	2	1	45	10	2	11: 30-70°		
	3740			.18						.18			2	2	1	45	10	5	15: 30-70		
	3750			.24						.24			3	2	1	45	10	3	14: 30-70°		
	3760			.20						.20			3	1	1	45	10	2	5: 40-80°		
	3770			.19						.19			2	2	1	50	5	2	7: 30-70°		
	3780			.21					tr	.21			2	2	1	50	5	1	12: 40-70°		
	3790			.17						.17	tr		2	2	1	40	15	1	12: 40-80°		
3790	3800			.10		.009	.001	.10	tr	.10	tr		2	2	1	40	15	2	8: 40-80°		
	3810			.09						.09			2	2	1	45	10	2	7: 40-60°		
	3820			.09						.09	tr		2	2	2	45	10	2	8: 40-70°		
	3830			.10						.10	tr		2	1	2	45	10	2	5: 20-70°		
	3840			.15					tr	.15	tr		2	2	4	50	10	1	7: 40-70°		
	3850			.14						.14	tr		3	2	3	45	15	1	7: 40-70°		
	3860			.13						.13	tr		3	1	2	45	10	4	6: 20-80°		
	3870			.30						.30	tr		4	2	2	45	15	1	8: 10-70°		

GEOLOGIC LOG

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PROJECT ASARCO - Thunder Mtn
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HOLE NO. TM-8
Final depth 5677
Coord E.
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Date finish 4/16/74

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	% Cu	ASSAY % MoS_2	oz. Au	oz. Ag	ORE MINERALS: black sulfide	covellite	chalcopyrite	bornite	molybdenite	sphalerite	tetrahedrite (?)	GANGUE MINERALS: pyrite-diss	pyrite-vein	clay	sericite	quartz-diss	quartz-vein	barite	STRUCTURE: sulfide veins	faults	ROCK TYPE and REMARKS
3870	3880	10		.25						.25		tr			3	1	2	45	10	1		4:40-70°		
	3890			.19						.19		tr			3	1	1	45	15	2		4:50-70°		
3890	3900		50	.12	.013	.001	.23			.12		tr			3	tr	1	55	5	tr		2(?):50°		
	3910			.20						.20		tr			3	2	1	50	5	5		8:60-90°		
	3920		75	.20						.20		.05			3	3	1	50	5	3		5:20-70°		
	3930		70	.19						.19		tr			2	2	tr	50	5	2		6:50-80°		3927: texture of rock changes from feldspar-qtz porphyritic to a more sugary textured rock with less obvious remnant phenocrysts; alteration continues very strong but sericite appears to become finer-grained; pyrite veins thinner — change may be either magmatic or hydrothermal
	3940			.14						.14		tr			3	1		50	10	2		8:10-80		
	3950			.22						.22		tr			3	1		50	10	2		4:40-70		
	3960			.17				tr		.17		tr			3	1		50	10	1		5:60-80°		
	3970			.18				tr		.18		tr			3	1		50	10			7:40-80°		
	3980			.12						.12		tr			3	tr		50	10	1		1:70°		
	3990			.17						.17		tr			3	tr	tr	50	10	1				
3990	4000			.25	.016	.002	.07			.25		tr			3	1		50	10	1		3:20-70°		
	4010			.16						.16		tr			4	1		50	15	1		9:50-70°		4002: texture of rock change: to coarse gr feldspar-porphyritic rock with highly variable % phenocrysts — mostly due to intense alteration; texture resembles qtz monz por except for presence of quartz eyes. Very fine-gr cpy more abund in this rock especially where clay-rich zones present
	4020			.16						.16		tr			3	1		50	10	1		2:20-70		
	4030			.19						.19		tr			3	1		50	5	1		4:70°		
	4040			.15						.15					3	1		50	5	3		6:10-70°		
	4050			.22						.22		tr			3	2	1	50	5	3		11:40-70°		
	4060			.18						.18		.05			3	1	2	50	6	4		6:50-70°		
	4070			.14				tr		.14		tr	tr		3	2	1	50	5	2		8:50-70°		4060: approximate first appearance of alteration selvages (gray) on pyrite veins; are up to 1" wide, usually more uniform gray than rest of rock, prob mass sericite, not always present. Vuggy qtz vns w cpy - moly also become more abundant and cpy appears more abund along veins. Sulfides usually less than 1/16" thick along veins, qtz veins (both early-barren and vuggy - mineralized types) generally less than 1/4" thick. Faintly pinkish mineral on some qtz veins
	4080			.24						.24		tr			3	1	1	50	5	1		7:10-80°		
	4090			.19				tr		.19		tr			3	1	1	50	5	3		7:10-70°		
4090	4100			.21	.017	.002	.11			.21		tr			3	1	1	50	5	4		6:40-70°		
	4110			.18				tr		.18		tr			3	2	3	50	2	4		14:10-80°		
	4120			.13				tr		.13		tr			3	1	1	50	5	2		3:20-70°		
	4130			.20				tr		.20		tr	tr		2	2	2	50	5	3		11:50-70°		
	4140			.17						.17		tr			3	2	2	50	5	4		5:50-70°		
	4150			.20						.20		tr			3	2	3	50	5	2		5:50-70°		
	4160			.14						.14		tr	tr		3	2	1	55		3		4:20-70		
	4170			.14						.14		tr			3	2	1	55		3		8:30-60°		
	4180			.23						.23		tr			3	2	1	55		3		4:20-70°		
	4190			.18						.18		tr			3	2	1	50	5	3		8:30-80		
4190	4200			.25	.005	.001	.17			.25					3	1	2	50	1	2		6:20-70°		
	4210			.23						.23					3	1	3	50		2		6:40-60°		
	4220			.13						.13		tr			3	2	2	50		2		9:20-50°		
	4230			.18						.18		tr			3	2	2	50		2		12:20-50°		
	4240			.14						.14		tr			3	2	3	50		2		9:20-80°		
	4250			.13						.13		tr			3	1	2	55		3	tr	11:40-60°		
	4260			.15						.15		tr			3	1	1	55		2	tr	9:20-70		
	4270			.14						.14	tr	tr			3	1		55		2	tr	10:50-70		
	4280			.10						.10		tr			4	1	1	55		2	tr	10:20-70		
	4290			.11						.11		tr			3	1	1	55		2	tr	5:20-70		
4290	4300			.30	.018	.002	.07			.25	.05	tr		tr	4	1	2	55		2	tr	4:20-50		4296.5: dissem bn adj to py aggregate

mp 2555 dm

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HOLE NO. TM-8
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DEPTH from	DEPTH to	int'vl	% CORE RECOV.	% Cu	ASSAY % MoS_2	oz Au	oz Ag	ORE MINERALS black sulfide	covellite	chalcopyrite	bornite	molybdenite	GANGUE MINERALS pyrite - diss	pyrite - vein	hematite	clay (?)	sericite	quartz - diss	quartz - vn	barite	serpentine	STRUCTURE sulfide veins	faults	ROCK TYPE and REMARKS
4300	4310	10		.27						.27		tr	5	tr		2	SS		2	tr		3:20-70		4400: fine grained diss cpy abundant, assoc w very pervasive alteration;
	4320			.29						.29		tr	5	tr		3	SS		2	tr		4:20-70		rock too badly altered to recognize texture; erratic clay
	4330			.27						.27		tr	4	2		3	SS		2			10:20-60		(or alunite) clots to 1/4" may fill very weak bx vugs (?), cpy
	4340			.24						.24			2	1		3	60		2			2:50°		often assoc w. clay clots, less commonly along quartz or
	4350			.22						.22		tr	3	1		1	60		2			3:50°		sulfide veins.
	4360			.33						.30	.03	tr	3	1		1	SS	3	2			5:40-60°		
	4370			.24						.24		tr	3	1			SS	5	2			5:20-70°		
	4380			.27						.27	tr	tr	3	tr		1	50	5	1			3:30°		
	4390			.30						.30		tr	4	1		1	50	5	1			8:40-70°		
4390	4400			.22		.012	.003	.12		.22			4	1		3	50	10	1	tr		8:20-80°		
	4410			.16						.16			4	1		3	50	10	1	1		6:30-50°		
	4420			.24						.24		tr	4	1		2	50	10	1	tr		5:20-50°	4415	4414: INTRUSIVE BRECCIA (?): identity of rock very uncertain due to intense
	4430			.16						.16			4	2		4	50	10	1			4:60-80°	brkn	alteration - could be a strongly healed pre-mineral faultzone Locally
	4440			.10						.10		tr	5	2		2	50	10	1			5:70-90°	likely sheared zone	5% 1/2" rounded white qtz frags, vague sugg of qtz feldspar frag.
	4450		75	.28						.28			3	2		1	45	15	1			5:70°		Coincides with fault-shear zone which is both pre-(py along broken
	4460			.17						.17			5	1		2	55	5	1			6:40-70°	4451	zones) and post- (py crushed along shears) mineral
	4470			.19						.19			5	1		5	50	10	1	tr		6:30-70		4465: QUARTZ FELDSPAR PORPHYRY: lt gray, massive - rubbly - brkn, rare qtz
	4480			.26						.26		tr	5	1		5	50	15	2			8:20-80		eyes visible, rare wht qtz pods sugg. some xenoliths present, but
	4490			.11						.11		tr	5	2		1	45	20	2			12:10-60°		alteration generally to severe to identify rock with certainty. Clearly
4490	4500			.20		.014	.002	.06		.20		tr	4	2		1	50	10	2			13:10-70		porphyritic zones alternate with intense alteration - particularly silicif.
	4510			.25						.25			5	1		1	45	15	1			12:20-50°		Rock has rare 1/4" angular vugs - sugg wk brecciation Alteration is
	4520			.24						.24			4	1		1	50	2	3	tr		10:10-40°		pervasive, f gr, sericite and irregular silicified zones which are gradational
	4530			.18						.18			4	1		2	50	10	3	tr		6:20-50°		w. sericitic zones, silicif is f-med gr qtz (not same as silica tuff) which
	4540			.20						.20			4	1		3	50	10	4			5:20-50°		totally destroys igneous texture. Qtz veins 1/8-1", sometimes wkly vuggy,
	4550			.34						.34		tr	4	2		2	50	10	4	2		7:20-40		usually with minor sulfides. Mineralization is mostly similar to
	4560			.23						.23		tr	4	1		2	50	5	4	tr		5:20-50		above with 1/32-1/2" py veins, and f-gr-c.gr dissem pyrite. Chalcopyrite
	4570			.29						.29			5	1		2	50	10	4	tr		6:20-70		occurs as f-gr. dissem grains, often assoc w white clots (kaolinite ?)
	4580			.26						.26		tr	3	1		2	50	10	2	tr		4:20-50		Cpy becomes more abundant in veins at 4520'. Barite is pinkish.
	4590			.17				.08		.17			5	1		1	50	10	3			9:10-70°		Minor greenish clay, dk gy sericite. Flat dipping (10-20°) veins predominate
4590	4600			.22		.029	.010	.10		.22			4	1		1	50	10	3			5:10-70°		below about 4600'. Vein cpy occurs mostly on these flat veins,
	4610			.24				.19		.24		tr	4	tr		1	55	10	5	1		6:20-40°		vein surfaces very rough, irregular, obscure on surface of core
	4620			.30					tr	.30		tr	4	tr		1	55	10	5	1		5:10-30°		
	4630			.27						.27			4	1			60	2	2	1		6:10-40°		
	4640			.28						.28			4	tr		1	60		2	1		5:10-70°		
	4650			.59	20@					.59			3	tr			60		2			4:10-30°		4650-4730: aspect of alteration changes where serpentine is
	4660			.41	0.50					.41			3	tr		1	60		2	1	tr	5:10-50°		present, serp. occurs as clots and along flat qtz-cpy veins. Serp
	4670			.28						.28			3	tr	1	1	60		6		tr	6:10-V		absent where pervasive silicif is absent, pyrite veins with prominent
	4680			.29						.29			3	1	1	tr	60		4	tr	2	7:10-80		dk gy sericite selvages are common. Occasional (0-4/10' interval)
	4690			.17						.17			3	tr	tr		60		4	tr	1	7:10-70		post-mineral slip surfaces smear sulfides, dips 40-70°
4690	4700			.23		.011	.004	.16		.23			3	1			60	2	5		tr	7:20-80		
	4710			.27						.27			3	tr			60		5	2	2	5:20-60		
	4720			.26						.26		tr	4	tr			55	5	5	1	tr	5:10-50		
	4730			.27						.27		tr	4	tr	1		55	5	7		1	3:10-40		

GEOLOGIC LOG

PROJECT ASARCO - THUNDER MTN
Patagonia Mtns., Ariz.

PROJECT ASARCO - Thunder Mtn
Collar elev. 5175
Coord N.
Inclination vertical
Logged by FTG
Date start 8/6/73

HOLE NO. TM-8
Final depth 5677
Coord E.
Page 12 of 14
Date finish 4/16/74

DEPTH from	DEPTH to	int'vl	% CORE RECOV.		% Cu			ASSAY % MoS2	oz Au	oz Ag		ORE MINERALS chalcopyrite	bornite	molybdenite				GANGUE MINERALS pyrite-diss	pyrite-vein	hematite	clay	sericite	quartz-diss	quartz-vein	barite	chlorite	orthoclase						STRUCTURE sulfide veins	faults	breccia	ROCK TYPE and REMARKS
4730	4740	10			.29							.29		tr				4	tr		2	60		5									4:10-30°			
	4750				.36							.36		tr				4	1		4	50	15	5	1								9:10-60°			
	4760				.33							.33		tr				4	1		2	55	5	3									8:10-50			4750: several 2-10 ft xenolithic (?) zones could be intrusive breccia
	4770				.33							.33		tr				4	tr		1	55	5	2	1								4:10-40°			
	4780				.29							.29		tr				4	tr		1	55	2	4	tr								3:10-20°			
	4790				.29							.29		tr				4	tr		1	60	2	5	2								3:50-70°			
4790	4800				.27			.011	.001	.09		.27		tr				4	tr		1	60	5	4	tr								5:60°			
	4810				.24							.24						5	1		1	50	10	3	tr								8:5-70°			
	4820				.36							.36		tr				5	tr		1	50	10	2	1								4:10-60°			
	4830				.37							.37	tr	tr				5	tr		1	50	10	2	tr								5:20-70°			
	4840				.26							.26						4	tr		1	55	5	5	tr								3:40-70°			4836: FELDSPAR PORPHYRY: greenish, brittle, 5-15% pseudom of tabular feldspar
	4850				.14							.14		tr				4	tr		tr	60		8									3:20-60°			pheno in greenish matrix, 1-3" silicified zones - veins? Uniform texture
	4860				.05							.05						4	tr		tr	50	5	4	tr								5:10-80°			4851: INTRUSIVE (?) BRECCIA: grayish, brittle, irreg dissem silicif, clasts of greenish por
	4870				.13							.13		tr				4	tr			60		5	1								4:10-70°			4860: FELDSPAR PORPHYRY: greenish to n 4880 then white - lt gx; greenish color in
	4880				.15							.15						4	tr			60		5	1	tr							2:10-50°			matrix, feld pheno yellowish - wht, greenish min (serp, montmor ?) borders
	4890				.09							.09						4	tr			60		5	1	tr							5:20-50°			⅛-1" qtz-ser-py (cpy) veins. Alteration is st sericite, uniform diss py
4890	4900				.03			.008	.001	.09		.03						6	tr			45	15	3	tr	tr							5:20-50°			4892: INTRUSIVE BRECCIA: gray, irreg silicif, chlor (serp? mont ?) assoc w py.
	4910				.08							.08						4	1			55	3	4		1							8:10-70°			4903: FELDSPAR PORPHYRY: grayish with yellowish cast to altered feldspars and often
	4920				.09							.09						4	tr			50	5	4		2							3:5-70°			a pervasive greenish cast to entire rock or in patches. Rare possibility
	4930				.12							.12						3	tr	tr		50		3		tr							4:50-70°			of quartz phenocrysts. Pseudom after feld pheno mostly < ⅛" long, irregular
	4940				.25							.25						3	2	tr		50	5	1		tr							6:20-80°			shape, 10-20% of rock. Alteration is pervasive - sericite (?) - with spotty
	4950				.23							.23						3	tr	tr		55		1	tr	tr							6:10-70			silicified zones assoc w py veins. Veins mostly < 1/16" thick, but have
	4960				.27							.27		tr				3	tr	tr		50	5	2	1	tr							1:20°			assoc thick (1-2") grayish (qtz-ser?) selvage. Red hem-lim assoc w py
	4970				.25							.25						3	tr	tr		50	8	1		1							5:20-50°			veins. Greenish color due to chlorite (?) very finely dissem and in
	4980				.36							.36						4	tr	tr		50	15			1							5:20-50°			coarser aggregates assoc w sulfide veins. Overall number of veins and
	4990				.31							.31		tr				3	tr	tr		50	10			1							3:20-50°			abundance of sulfides in veins decreases w depth.
4990	5000				.24			.013	tr	.08		.24						4	1	tr		50	10	3		tr							6:10-50°			Abundance of qtz phenocrysts (?) increases w depth.
	5010				.17							.17						4	tr			50	10	2									7:10-50°			
	5020				.19							.19						3	1	tr		50	2			tr							5:10-70°			
	5030				.16							.16						3	tr			50	4	1		1							3:40-70°			
	5040				.22							.22		tr				3	tr	1		50	5	2		1							2:10-40			
	5050				.23							.23						4	tr			40	20	3		1							3:5,70°			
	5060				.25							.25						4	tr	tr		50	10			tr							1:10°			
	5070				.13							.13						3	tr			50	10			1							3:20-50°			5068: H greenish, greasy-lustered patches to 1-6" become common - a
	5080				.24							.24						3	tr	tr		50	5			3							2:10,70°			colorless serp (?); talc (?), form 10-30% of rock
	5090				.16							.16		tr				3	tr	tr		50		tr		1							1:50°			
5090	5100				.17			.012	tr	.08		.17		tr				3	1	1		50		2		1							5:50-70°	5105-5111		
	5110				.25							.25		tr				4	1	tr		50	5	4		4							3:70°			5105-5111: flt bx offsets 1/10" py-cpy vein
	5120				.34							.34						2	tr	tr		50	3	1		2							3:20-40°			
	5130				.29							.29		tr				2	tr	1		45	10			4							2:20-40°		5127	5127: INTRUSIVE BRECCIA: unclear, bx is roughly coincident w increase in dissem
	5140				.10							.10						2		tr		40	20		tr	1										qtz, however some silicif zones occur as frags. Matrix of bx 5-10% filled
	5150				.35							.35						3	tr			40	20			8							2:20,70°			w greenish chlorite (??) material. No vugs. Vague buff-pink 5150-
	5160				.08							.08						4	tr			40	20			6		5					2:70°			5160 is 2nd kspar (?)

mn 2555 dm

GEOLOGIC LOG

PROJECT ASARCO - THUNDER MTN
Patagonia Mtns. Ariz

PROJECT ASARCO - Thunder Mtn — HOLE NO. TM-8
Collar elev. 5175 — Final depth 5677
Coord N. — Coord E.
Inclination vertical — Page 13 of 14
Logged by F.T.G.
Date start 8/6/73 — Date finish 4/16/74

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	% Cu	ASSAY % MoS_2	oz Au	oz Ag	ORE MINERALS: black sulfide	chalcopyrite	bornite	molybdenite	sphalerite	GANGUE MINERALS: pyrite-diss	pyrite-vein	hematite	clay	sericite	quartz-diss	quartz-vein	barite	chlorite	orthoclase	biotite	STRUCTURE: sulfide veins	fault	breccia	ROCK TYPE and REMARKS
5160	5170	10		.34					.34				3	tr	tr		40	20	1		3						
	5180			.34					.34		tr		2		tr		40	20		1	2	2					
	5190			.33					.33		tr		3				40	20		1	2				broken zones		
5190	5200			.51	.041	.001	.15		.51		tr		3				35	25	1	tr	5	5					
	5210			.43					.43				3	tr	tr		45	15	1	tr	5	5		2:50°	1' @ 5210		
	5220			.73					.73				3	1			50	10	2	tr	6	tr		4:70°			5212: QUARTZ(?) FELDSPAR PORPHYRY(?): alteration masks texture but with
	5230			.29					.29		tr		3	tr			50	10	2		6	1		4:50-70°	1' @ 5222		increasing depth texture shows rare vague similarity to quartz monzonite-
	5240			.31					.31		tr		2	tr	tr		50	5	3		5	2		2:30,50°	6' @ 5228		granodiorite por(?). Alteration is highly variable from greenish-yellowish
	5250			.23					.23		tr		3	1			50	5	3		5			4:30-50°	2' @ 5246		sericite alt of feldspars, grayish ser in matrix to weakr(20-40(?)%)
	5260			.22					.22				3	1	tr		50	5	4		4	1		4:10-40°	2' @ 5255		sericite mixed with variable 2ndary orthoclase which locally (6"-2') reaches
	5270			.28					.28				3	tr	1		50	3	2		5	3		3:20-40°			20%. Irreg mixed with both types is locally abundant (to 5-7%) chlorite(?)
	5280			.37					.37			tr	2	tr	1		50		2		2	2		2:40°			dissem, in chloritic veins, + in py veins. 2nd kspar assoc w edge of
	5290			.41					.41				2	tr	1		40	15	2	tr	1			2:40°			thin py or qtz veins or as vague irreg sized pinkish zones to 6" long
5290	5300		70	.24	.031	.001	.16		.24				3	tr	1		45	10	2		1	tr		3:20°	9' @ 5293		dissem. in rock. Pyrite veins start @ n 1/32", increase @ 5300 to
	5310			.16					.16				2	2	2		40	10	4		1	9		5:20-50°			occas 1/4" thick. Chalcopyrite is dissem, in cpy veins, and in flat py-
	5320			.27					.27				2	2	1		40	10	3		1	4		6:10-70°			qtz-cpy veins. Qtz vns (mineraliz or barren) up to 1/4", silicif irreg
	5330			.20					.20				2	tr	1		45	10	4		3	2		4:10-40°			distrib., may be rock silica(?). Hem only on py or cpy veins, preferentially
	5340			.33					.33				2	tr	tr		45	10	4		2	3		4:10-20°			oxidizes cpy in vein @ 5261. Broken zones post-mineral. Texture of
	5350			.32					.32				2	tr			50	5	3	tr	5	3		5:10-60°			alteration is coarsely variable - grain size, distribution, and color
	5360			.22					.22		tr		3	tr			40	5	3		4	7		1:20°			
	5370			.30					.30		tr		2	tr	tr		40	5	3		5	5		5:10-50°			
	5380			.19					.19				2				40	5	2		3	5					
	5390			.23					.23				2	tr	tr		40		3		5	7		1:10°			
5390	5400			.21	.017	tr	.20		.21		tr		2	tr			35		3		5	7		2:15°			
	5410			.21					.21		tr		2	tr			35		4		6	5		3:10-30°			
	5420			.12					.12		tr		2	tr	tr		40	5	2		2	5		2:85°			5410: pyrite occurs both dissem, in visible veins, and as discontinuous
	5430			.23					.23				3				30		4		2	8					coatings along joints - latter not included in veins. Erratic
	5440			.22					.22		tr		3	1			30		3		3	10	tr	6:10-85°			silicif occurs as vague halos along sulfide veins. Quartz veins
	5450			.20					.20		tr		2	tr			35	5	3		3	4		1:30°	5' @ 5349		variable, tend to be more abundant where 2nd kspar more abund,
	5460			.24					.24		tr		2				40	5	4		2	10					are 1/8-1" thick, dip 10-90°, 75% are barren or w traces of
	5470			.39					.39				2	tr	tr		30	5	2		3	7		2:30°			MoS_2. Zones w. more abund ser. considerably softer. Zones
	5480			.38					.38				2	tr			45		3	tr	5	5		2:70-V			w. dark greenish sericite(?) 5480-5491, contain considerably
	5490			.36					.36				2	tr			45		2		7	1		2:20°			reduced qtz veins, kspar. Med gr qtz often occurs in irregular
5490	5500			.32	.020	tr	.06		.32		tr		2	tr			50		4		1	10		2:10,70°			1/8-1/2" dots - not a bx filling. Alt. quartz med-c grained,
	5510			.13					.13		tr		2				40		5	tr	2	12					alteration texture is coarsely variable w. clots of qtz, chlor,
	5520			.14				tr	.14		tr		3				50	5	2		1	7					and kspar as well as pervasive uniform finer-gr. sericite
	5530			.18					.18		tr		3				45	5	3		4						
	5540			.19				tr	.19		tr		3				40	5	4		5	2					
	5550			.11					.11				3	tr			40	3	1		2	2		4:5-40°			5544: grad change over 1 ft to uniform f gr grayish rock; unclear
	5560			.03					.03				2				40					tr					if this is a rock type or just alteration change (prefer latter)
	5570			.01					.01				2				40				tr	1					Coarse gr hydrothermal qtz disappears, py content may drop, cpy
	5580			.01					.01				2				40				1	tr					obviously falls. Color becomes lt yel-pinkish w incr depth; 2nd
	5590			.02					.02		tr	tr	2				40				1						kspar often abund assoc w 1/16" veins as filling and selvage

mo 2555 dm

GEOLOGIC LOG

PROJECT ASARCO - THUNDER MTN.
Patagonia Mtns., Ariz.

PROJECT ASARCO - Thunder Mtn
Collar elev. 5175
Coord N.
Inclination vertical
Logged by F.T.G.
Date start 8/6/73

HOLE NO. TM-8
Final depth 5677
Coord E.
Page 14 of 14
Date finish 4/16/74

DEPTH from	DEPTH to	int'vl	% CORE RECOV.		% Cu			% MoS2	oz. Au	oz. Ag	ORE MINERALS: black sulfide		chalcopyrite	bornite	molybdenite	sphalerite			GANGUE MINERALS: pyrite - diss	pyrite - vein	hematite	clay	sericite	quartz - diss	quartz - vein		barite	chlorite	orthoclase					STRUCTURE: sulfide veins	fault	breccia	ROCK TYPE and REMARKS
5590	5600	10			.01			.001	tr	.13			.01						2				40	tr				1									Greenish zones accentuated by dk. greasy green color of altered feldspars.
	5610				.02						tr		.02						2				40	tr				1	6								
	5620				.03								.03						2				40	1	tr			1	4								
	5630				.04								.04		tr				3	tr			40	5	1				7					2:20,70°			5630: pyrite shows some tendency to follow thin, steep breaks in the rock; probably very weak shearing. Also py veins have prom. gray selvage which cuts light colored matrix. Several thin (1/16") qtz-or veins w. 1" gray selvage but no assoc sulfides.
	5640				.01								.01						3				30	5					20								
	5650				.02								.02		tr				3				40	2					7								
	5660				.04								.04						2	tr			40	5					5					2:40,70°			
	5670				.02								.02						2				30	5	1				5								
	5677	7			.05								.05						3	tr			30	5	1				7					1:30°			
	EOH.																																				

NOTES:

1) drill contractor - Joy Mfg. Co

2) drill hole survey (at 4925')
   a) at 4925' bottom of hole was 38' - N18E from collar and drifting toward collar
   b) temperatures
      1400' - 94° F
      4925' - 142° F

3) assaying by American Analytical
   a) checks by Skyline, Southwestern confirm higher grade Cu intervals
   b) samples labeled M8 - 20 etc., the last number is the depth at the bottom of a 10 ft. sample

mn 2555 dm

LOGGING NOTES:
1) ore minerals: gives % Cu in each mineral, estimated where assay not available; left blank where no ore minerals seen
2) gangue minerals: vol. % present, only alteration minerals were logged
3) sulfide veins: number present, range of dips

GEOLOGIC LOG

PROJECT ASARCO - THUNDER MTN. (Kerr-McGee option)
Patagonia Mtns., Santa Cruz Cty., Ariz.

PROJECT ASARCO - Thunder Mtn HOLE NO. TM-9
Collar elev. 5100 Final depth 1745
Coord N. Coord E.
Inclination vertical Page 1 of 5
Logged by F.T. Graybeal
Date start 8/10/74 Date finish 10/15/74

DEPTH from	to	int'vl	% CORE RECOV	% Cu	ppm Mo	oz/ton Au	oz/ton Ag	covellite	chalcocite	evargite	molybdenite	pyrite-diss	pyrite-vein	limonite	hematite	clay	sericite	quartz-diss	quartz-vein	alunite	↳ may be kaolinite	sulfide veins	faults	ROCK TYPE and REMARKS
NX → 0	10	10	—																					Rockbit
	20		+90	.04				.03	.01			3		tr		5	40							10: LAPILLI TUFF: white near surface, becoming lt gy w incr. depth, massive. Estimate 40-70% subrnd-ang lapilli, mostly reddish + gray and prob mostly volcanic - some show vague par text. Up to 5% qtz xenocrysts, tr feldspar. Lapilli mostly ≤ ½" dia. Alteration is pervasive sericite w 1-6" weakly silicif zones. Pyrite is med gr, uniform dissem Cov-cc dissem in near surface zone
	30			.07					.07			4				5	40	5						
	40			.11					.11			4				2	40							
	50			.03								4				3	40						brkn 40-45'	
	60			.02								4					35							
	70			.02								4					35							
	80			.04					.04			4	tr				35	3				2:10-70°		
	90			.02					.02			4				5	35						89-96'	
90	100			.01	20-100': 9		.10					5	tr				40					1:40°	@80°	
	110			.01								3					45							
	120			.02								3					45							
	130			.02								3					45							
	140			.12					.12			3				10	50						135'	135-174: fault zone: estimate 50% frags - 50% soft gouge, strong crushing of py indic. fault is post-min; possibly some cc enrichment in fault. Dip roughly 75°
	150			.15					.15			3	tr			25	50					2:30°		
	160			.08					.08			3				25	50							
	170			.08					.08			4				25	50							
	180			.07					.07	tr(?)		4	1	1		5	40	10	tr			2:70°	174'	177: QUARTZ FELDSPAR PORPHYRY: light gray, massive. Contact at 4" limonite zone is weakly silicif, dips @ 60°. Estimate 10-15% altered feld. pheno, 1-2% round qtz pheno. Rock is strongly sericitized and silicified(?). Alunite logged as irreg wht compact vein filling Pyrite is dissem and in granular, vein-like zones w. no alt selvage w diffuse borders to 1" wide. Black sulfide is chalcocite(?). Dark hairline cracks may be veins or crushed sulfides along microfaults. Many veins appear to define weakly shattered zones
	190			.06					.06			3	1				35	10		4		4:20-50°		
190	200			.05	100-200': 10	.001	.06		.05			3	3				45	5		1		5:40-70°		
	210			.03					.03			4	2				45					2:50-70°		
	220			.02					.02			3	1				45					3:20-80°	brkn 218-220	
	230			.03					.03			4	2				45			tr		3:70°		
	240			.03					.03			2	tr				45			1			brkn 230-232	
	250			.01								2	2				50					3:70-V		
	260			.01								3	tr				55		tr				259-260	259: INTRUSIVE BRECCIA: med gy, compact, clasts of volc, qtz feld por to ½", 50% matrix; upper cont 70°, lower cont grad, vague flow struct on up cont; often clayey
	270			.01								3	tr			20	50					1:75°		
	280			.02								2	tr				60		tr	tr		3:30-70°		269: LAPILLI TUFF: light gy, massive, compact, estimate 40-75% volc, ign, sed clasts to 1"; matrix is med gr, equigran arkosic-looking. Alteration uniform strong - prob sericite, pyrite is uniform dissem and in vague, sometimes offset veins to ⅛" wide w minor qtz, blackening of vein sulfides indicates later crushing due to slight movement
	290			.21								3	tr				60		tr			3:40-70°		
290	300			.01	200-300': 13	tr	.01					2	tr				60		tr			3:40-80°		
	310			.01								2	tr				60					3:40-V		
	320			.01							tr	2	2				50		tr			5:30-80°		
	330			.01								tr	1				50					5:20-70°		
	340			.01								1	1				50		tr	tr		3:20-70°		
	350			.01								1			tr		50							
	360	35		.03								1	tr				50							
	370			.04								2	tr				50						367-368	
	380			.06								2	1				50					4:30-70°		
	390			.02								2					50			tr				
390	400			.02	300-400': 20	.002	.09					2					50							
	410			.04								tr	tr		2		45					2:50°		400: finely-dissem hematite is hydrothermal oxidation of earlier sulfides, rock retains light gray color w. local greenish cast
	420			.02								1			2		45							
	430			.01								2	tr				45					1:70°		

mn 2555 am

GEOLOGIC LOG

PROJECT ASARCO - THUNDER MTN.
Patagonia Mtns, Ariz

PROJECT ASARCO - Thunder Mtn
Collar elev. 5100
Coord N.
Inclination vertical
Logged by F.T.G
Date start 8/10/74

HOLE NO. TM-9
Final depth 1745
Coord E.
Page 2 of 5
Date finish 10/15/74

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	% Cu	ASSAY ppm Mo	oz. Au	oz. Ag	ORE MINERALS: covellite	chalcocite	chalcopyrite	enargite	molybdenite	GANGUE MINERALS: pyrite-diss	pyrite-vein	hematite	clay	sericite	quartz-diss	quartz-vein	alunite	STRUCTURE: sulfide veins	faults	ROCK TYPE and REMARKS
430	440	10		.05				.05					3	tr	tr		45				1:75		
	450			.08				.08					tr	tr	3		50				2:20 30°		
	460			.03								tr			3		50						
	470			.13									tr		3		50						
	480			.06											3		50						
	490			.03									3		1		50						
490	500			.03	400-500':	20	.002	.11					2	1			50				3:40-80°		
	510			.09				.07		.02			2				50						500: covellite is very fine gr, both dissem and in veins. Some veins
	520			.13				.13					1	tr	1		50				1:30°		are 1/64" hairline cracks in core w. irreg attitude. Cov mostly
	530			.08				.08					2	tr			50						occurs as coating on py. Traces cpy w. more abund cov.
	540			.11				.07		.04			2	tr			50	S					All sulfides are med - fine gr.
	550			.12				.12					3				50						Core may become slightly whiter and softer with 1st appear.
	560			.19				.19					2	tr			50				3:40-70 brkn 558-561		of covellite
	570			.14				.14					2	tr			50				3:40-80°		Veins are 1/64 - 1/8" thick, both straight and wavy, often w diffuse
	580			.11				.10		.01			1		2		50				570		borders and no alt. selvage - no contained quartz.
	590			.08				.07		.01			2				60						570-610: pervasively crushed zone; core soft; obvious faults absent
590	600			.04	500-600':	40	.002	.19					3	tr			60				2:45°		
	610			.02								tr	2	tr			50			3	2:40 80° 610		606: (QUARTZ) FELDSPAR PORPHYRY: whitish, massive, igneous text destroyed
	620			.03						.03			2	1			50				5:15-30°		by alt. but vague ghosts of feldspar visible, tr-nil visible qtz. eyes.
	630			.05				.05					3	1			50				5:20-70°		Rock appears weakly + irreg shattered - pre-mineral. Alteration is
	640			.08				.08					3	tr			50				5:40-70		pervasive intense but very fine-gr sericite (?). Mineraliz is f gr
	650			.12				.12					4	1			50				6:40-70		dissem py-cov-cpy; sulfides also in 1/64-1/2" veins w no alt
	660			.06				.04		.02		tr	3	1			60	tr			4:20-80		selvage and in irreg heavy dissem-mass zones, 1-6" where rock
	670			.10				.07		.03		Tr	4	1			60	tr			3:40-V		was previously broken. Moly is med gr both in rare qtz-py veins
	680			.08				.08				tr	3	tr			60				3:20-70 brkn		and dissem w no assoc qtz.
	690			.12				.11		.01			4	tr			60				1:70 675-684		
690	700			.13	600-700':	62	.003	.15	.13				3	tr			60				2:70°		
	710			.84				.80		.04			4	tr			60	5			4:20-50		709: SILICIFIED BRECCIA: dense, gray, extremely hard; silicification very f gr.
	720			.25				.25					6	tr			20	40			1:40°		Py dissem + in irreg pods. Cut by qtz feld por - silicif is pre-por.
	730			.03				.03					5				10	40					Possib. silicif lapilli tuff
	740			.13				.13					3	tr		tr	30	40			2:15, 70		
	750			.15				.15					3				50		1		2:70°		740: (QUARTZ) FELDSPAR PORPHYRY: whitish, massive, vague feldspar ghosts; no
	760			.09									3	tr			50						visible qtz. eyes. Alt. is pervas. v.f gr. sericite. Py is dissem
	770			.10									3	tr			50				1:70		f + c gr, and in rare hairline fractures; fractures occur throughout
	780			.06									3	tr			45						core and it tends to break easily to many angular fragments.
	790			.04						.04			3				50				787		787-803 fault zone w mixed st qg and unbroken zones, no slicks.
790	800		70	.04	700-800':	17	.001	.18					3	1		15	50				2:70		Py veins are 1/16 - 1/2" and are often crushed due to post-mineral
	810			.07				.07				tr	1	tr	4		50				2:75° 803		move. Cov-cpy mostly assoc w. py veins. Rock contains 1-5%
	820			.11				.10		.01			3	1			50				5:70-V		xenoliths to 1/2" - is similar to xeno qtz. feld por.
	830			.01				.01					4	1	1		50				2:30		
	840			.16				.15		.01			5	2			50				5:20-70		
	850			.19				.19					4	tr			50				3:20-70		
	860			.09									3	1			60				6:30-V		

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GEOLOGIC LOG

PROJECT ASARCO - THUNDER MTN
Patagonia Mtns, Ariz

PROJECT ASARCO - Thunder Mtn
HOLE NO. TM-9
Collar elev. 5100
Final depth 1745
Coord N.
Coord E.
Inclination vertical
Page 3 of 5
Logged by F.T.G.
Date start 8/10/74
Date finish 10/15/74

DEPTH from	to	int'vl	% CORE RECOV.	% Cu	ASSAY ppm Mo	oz Au	oz Ag	ORE MINERALS covellite	black sulfide (?)	chalcopyrite	enargite	molybdenite	GANGUE MINERALS pyrite-diss	pyrite-vein	hematite	clay	sericite	quartz-diss	quartz-vein	alunite	STRUCTURE sulfide veins	faults	ROCK TYPE and REMARKS
860	870	10		.14				.14					2	tr			45		1		3:70-80°		
	880			.15				.15					3	2			50				3:40-70°		875: weak but pervasive stockwork fracturing ends; rock massive
	890			.02									3	3			40	5			12:40-V		below 875', but rock type is similar
890	900			.11	800-900': 28	.001	.14	.10		.01			2	1			45				6:40-70		900: (QUARTZ) FELDSPAR PORPHYRY: light gray, massive; 5-20% anhedral
	910			.01								tr	2	1			50				4:40-70		feldspar ghosts, poss tr. qtz eyes. Contact w. xenolithic phase is
	920			.06				.06				tr	1	1			50				17:60-V		grad. Alteration is very fine gr., prob sericite. Py both dissem
	930			.01								tr	2	1			40				7:20-V	939-	and in 1/32-1/4" veins w. sharp borders and no alt. selvage.
	940			.07						.07		tr	2	1			40				11:70-V	942	Moly in hairline cracks not assoc w. silica; mod py also in hairline
	950			.05								tr	2	tr			40				6:50-70		fractures. Qtz veins are very fine gr., brown w. no sulfs
	960			.05						.05			2	1			40	tr			6:40-80		Igneous texture is locally very poorly preserved
	970			.01									3	1			40	2			9:40-80		
	980			.07									3	tr			30	4			5:20-70		
	990			.06									3	tr			30		1		4:10-40		
990	1000			.03	900-1000': 44	.001	.05						3	1			35		1		8:40-V		
	1010			.08				.04		.04			3	tr			35				4:20-70		
	1020			.04				.04					3	tr			35		1		5:20-50		
	1030			.07				.07					2	tr			35		1		3:20-80°		
	1040			.02									3	1			35		1		3:20-50		
	1050			.01									3	tr			25	10	1		5:20-80		
	1060			.01								tr	4	tr			35	5			5:40-60		
	1070			tr									4	1			35	5			7:20-70		
	1080			.01									4	1			35	5			6:40-70	broken	
	1090			.01				.01					3	1			35				14:40-70	1085-	
1090	1100			.01	1000-1100': 36	tr	.09						3	tr			40	tr			4:20-70	1095	1100: LAPILLI TUFF (?): massive, lt gray. Texture has med-gr granular aspect
	1110			tr									3	tr			40				6:40-80		but is obscured by alteration. 5-10% zones w. lapilli + 1/8", 5-10%
	1120			.01									3	2			35				6:20-80		whitish 1/32-1/16" clasts may be feldspar and give a weak igneous
	1130			.01									3	1		10	35			tr	5:10-50	1125-	aspect to the rock. Rare zones w. flat zones of varying grain size are
	1140			.01									3	tr		10	35				4:10-30	1136	bedding (?). Alteration is pervas., f gr, mixed ser. and silicif (?).
	1150			.01									3	tr			25	15			3:10-80		Dissem py occas. in zones w. 10-15% sulfides - mostly 2-3%
	1160			.01									3	tr			40				2:20,70°	1153-60	
	1170			.01									2	1			35	5	tr		7:20-80°	1166-67	
	1180			.01								tr	3				35	tr					
	1190			.01									5	tr			45				3:20-V	1183-'87	
1190	1200			.01	1100-1200' 16		.02						4	tr			35	5			3:20-40		1195: QUARTZ FELDSPAR PORPHYRY-(?) dense, mass, lt gray. Estim 5-10% qtz
	1210			.01									4				35	5					phenos (?), vague remnants of feldspar phenos (?); no lapilli. Slight
	1220			.01									4	tr			35	5			2:40,70°		granular texture not typical - identification uncertain
	1230			.01									5	tr			45	5			3:20-60	1228-	1228-1237: possib pre-mineral fault w. 5-7% diss py and med-cgr ser
	1240			.01					.01				4				40					1237	
	1250			tr					tr				3	1			40				4:20-50		
	1260			.01					.01				3	3			50	5			2:20-70	1259-	
	1270		60	tr									2	tr		tr	50				1:60°	1270	
	1280			tr									3	1			35	5			4:20-70		
	1290			.01									3	tr			35	5	tr	tr (?)	4:50-70°		

GEOLOGIC LOG

PROJECT ASARCO - THUNDER MTN
Patagonia Mtns, Ariz

PROJECT ASARCO - Thunder Mtn — HOLE NO. TM-9
Collar elev. 5100 — Final depth 1745
Coord N. — Coord E.
Inclination vertical — Page 4 of 5
Logged by F.T.G.
Date start 8/10/74 — Date finish 10/15/74

DEPTH from	to	interval	% CORE RECOV	ASSAY % Cu	ppm Cu	ppm Mo	oz Ag	ORE MINERALS covellite	black sulfide	chalcopyrite	enargite	molybdenite	GANGUE MINERALS pyrite-diss	pyrite-vein	hematite	clay	sericite	quartz-diss	quartz-vein	alunite	barite (?)	STRUCTURE sulfide veins	faults	breccia	ROCK TYPE and REMARKS
1290	1300	10		tr	1200-1300'	23	.01						4	tr		10	40		1			2:20,70	1294-		
	1310			.01									3	1			30	10				2:20°	1301		1300: LAPILLI TUFF (?): lt gray, brkn-massive, texture is vague but 1-10% lapilli
	1320			tr									4	1		5	40	5				2:20°	1312-17 @70° 1319-1327		are dissem in a med gr, equigran., gritty-clastic (?) matrix similar to
	1330			.01									5				30	10		tr			1326-29		typical tuff. Alteration uniformly intense w lt gray sericitic zones
	1340			tr									3				40	10							alternating w 3-6 ft. dk gray zone of mod strength silicification. Silicified
	1350			tr				tr					3	1			30	15		tr		3:20-30°			zones contain heavily dissem py (to 10%) and py veins w diffuse or
	1360			tr									3			10	30	15			tr		1350-55 @ 80°		sharp border and no alteration selvage
	1370			tr								tr	5	2			30	20				6:20-30°			1319-1327: pre-min brecciation w 0.5% vugs w alunite - chalcedonic qtz
	1380			.02									3	tr			40	10				4:30-50°	brkn-gray:		1371: TUFF BRECCIA (?): gray, dense, mostly brkn. Vague continuity of coarse-grained
	1390			.01					.01				6			2	40	15					1387-		rock over 1-3 ft. suggest change in rock types, in addition vague
1390	1400			.01	1300-1400'	12	.09		.01				6	tr		10	30	25				3:60-V	1396		coarser, brecciated textures - now silicified - are visible; breccia is
	1410			.01					.01				6				40	10		S			1408-		massive, no vugs. Distrib of pyrite is highly irregular, more abundant
	1420		65	.01					.01			tr	3			10	30	15		tr			1417 @ 80°		in f gr. silicified rock. Veins up to 1" wide w diffuse border. Py med gr
	1430			.01					.01			tr	4	3			30	20				4:10-20	1426		fault zones are mixed gouge (20%) and strongly broken (80%) zones,
BX at 1442' →	1440			.01					.01			.05	4	2		10	30	20		tr		2:20°			dips prob steep
	1450		35		54	16	.01		tr			.05	3	1 (?)			50	10				(?)	brkn-gray		1426-1455: mixed flt-brkn zone is post-mineral
	1460								tr			tr	3	2			35	10		3		1:75°	1455		1450: (?) LAPILLI TUFF: lt gy, massive-brkn, textures show clear 10-30% subang
	1470		60						tr				3				30	20					1450-61 1462		lapilli in f gr siliceous matrix. Alt is mostly pervasive silicif w assoc
	1480		45						tr				3	1			30	20				2:20-70°	1476		ser. Sulfides are mostly dissem + highly irreg. w 1-8" zones of 50%
	1490								tr				5	tr			30	20				1:75°	brkn 1498-1502		diss. py - some sugg of vein-like distrib, but all logged diss, all med gr.
1490	1500								tr				3	2			30	20				3:20-45°			1496: (?) XENOLITHIC QUARTZ FELDSPAR PORPHYRY (?): lt gy, brkn-massive, texture:
	1510												7	tr			30	20		S		1:70°			vague w possib. feld. pheno qtzt mixed w. lapilli. Rock strongly silicified
	1520												4	1			30	25				4:40-70°			with mineraliz. similar to lapilli tuff @ 1450-1496'.
	1530												7	1			40	10				3:40-80			1525: QUARTZ FELDSPAR PORPHYRY: whitish, mass-brkn. Good por text w 2% qtz
	1540												5	tr			50			2		3:20-40			10% feld. pheno, all < 1/8". Rock pervac alt to sericite. Py is uniform
	1550				52	3	.03						4	2			45	5		1		3:20-80			diss; often replaces feld pheno. Alun. is pinkish vein material - cuts py.
	1560		30										3	tr			40	10		3		2:40°	1550		1542-1548 is pervas. shattery, becomes incr brkn below 1548'
	1570		40										3				40	10		3			stg brkn gy lost (?)		1568: LAPILLI TUFF: med gy, dense, mass. Texture typical w 10-40% subang-subrnd
	1580		75							tr			5	tr			40	15		2		2:40-70°			lapilli in whitish-gy matrix. Alt is pervasive silicif w assoc ser as
	1590									tr			4	tr	tr		35	15		tr		2:50°	1588		dissem and whitish specks. Pyrite mostly uniform dissem, med gr with a
1590	1600									tr			3	tr			30	10				3:50-70°	brkn-gray:		heavy dissem zone 1675-83.
	1610		60							tr			3				30	10		tr			1603-		
	1620									tr			4	tr			35	10		tr		3:20-70°	1614		
	1630									tr			6	1			35	10		tr		5:10-70			
	1640									tr			3	tr			35	10				3:10-20°			
	1650				249	12	.09			tr			3	tr			30	15				3:10-80			
	1660									tr			3	tr			30	20				2:30°			
	1670									tr			5	tr			30	20		tr		2:30°			
	1680		80										6	1			20	30				1:70°			
	1690												8	tr			25	25				1:45°			
1690	1700												6	1			25	25				3:55-70			
	1710		75										5	1			35	15				1:60°			1706-1745: silicif ends abruptly; well defined py veins appear, often w
	1720												5	1		tr	40	5				7:45-70			dense hydrother oxid to hematite lapilli of and por (?), rhy, silicif easily seen.

mr: 2555.dm

GEOLOGIC LOG

PROJECT ASARCO - THUNDER MTN
Patagonia Mtns, Ariz.

PROJECT ASARCO - Thunder Mtn
HOLE NO. TM-9
Collar elev. 5100
Final depth 1745
Coord N.
Coord E.
Inclination vertical
Page 5 of 5
Logged by F.T.G.
Date start 8/10/74
Date finish 10/15/74

DEPTH from	DEPTH to	% CORE RECOV.	ASSAY ppm Cu	ASSAY ppm Mo	ASSAY oz Ag	ORE MINERALS: black sulfide	GANGUE MINERALS: pyrite-diss	pyrite-vein	hematite	sericite	quartz-diss	quartz-vein	alunite	STRUCTURE: sulfide veins	ROCK TYPE and REMARKS
1720	1730		362	5	.06		5	tr		40				4:50-70	
	1740		↓				4	1	1	40				7:40-70	
	1745						4	tr	tr	40				3:20-70	
E.O.H.															

NOTES:

1) drill contractor - Joy Mfg Co
   a) hole caving and generally in bad condition

2) no hole survey

3) assaying and geochemistry by American Analytical
   a) sample number on assay sheets is the depth at the bottom of a 10 ft sample

mn 2555 dam

GEOLOGIC LOG

PROJECT Thunder Mtn. (Kerr-McGee), Patagonia Mtns, Ariz.

PROJECT THUNDER MTN. HOLE NO. TM-10
Collar elev. 5845 Final depth 567'
Coord N. Coord E.
Inclination vertical Page 1 of 1
Logged by F.T. Graybeal
Date start 7/24/76 Date finish 8/27/76

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	Assay Interval	ASSAY % Cu	% MoS_2	% Pb	% Zn	oz. Au	oz Ag	ORE MINERALS enargite	GANGUE MINERALS (vol. %) pyrite-diss	pyrite-vein	hematite	clay	sericite	quartz-diss	quartz-vein	alunite	STRUCTURE sulfide veins	faults	ROCK TYPE and REMARKS
0	8	8																				ROCKBIT
8	20	12										tr		5	20	50	10		10		brkn	8. INTRUSIVE BRECCIA: mass-brkn; reddish-gy-wht. Est. 30% clasts size/type like
	40	20												3	10	30	50		5			tuff but highly variable texture w sharp contacts at textural changes
	60	↓									tr	2		3	5	40	20		5			suggests intrusive emplacement. Also presence of rounded clasts of massive
	80	↓										3		3	5	60	5		5			qtz-py only seen to date in intrusive bx. Rock varies from highly siliceous
80	100			90-100	.01	.002	.02	.01	.002	.09		7		2	4	60	10		10			intervals to compact-massive- but soft zones. Sulfide zones up to 10' long, py
	120											3		tr	2	40			2			is f.gr., dissem. Alt. is ser-clay-alun or silicif; everywhere pervasive
	140											3		tr		40	5		2			113: TUFFACEOUS ARKOSE: mass, gy w brkn hematitic zones; 10% clasts set in med gr
	160											3		tr		40	5					granular matrix. High % equigran. matrix with slight bedding(?) @ 40° sugg
	180											tr		15		50	5				brkn: 171-182'	epiclastic origin. Py is f-med gr, uniform diss. Pervasive ser alt
180	200			190-200	.02	.002	.02	tr	.003	.16				10		50	8					160-182: brkn, oxidiz. zone w. 40% lapilli; strong hem. stain, lapilli tuff bed
	220													tr		40	25					Clastic zone below 182' has hypogene(?) oxidiz of suls, no transport hem, is
	240													tr		5	90				brkn 220-227	increasingly silicified to 241'
	260													4		30	50		5			241: LAPILLI TUFF: mod brkn; poros; pervasively leached. Overall grayish w pervas + joint-
	280													4		30	50		5			controlled hem. stain. Est 40% ang-subrnd lapilli. Silicification is pervasive
280	300			290-300	.02	.005	.02	tr	.006	.33				5		20	70		1			in matrix and lapilli. Fractures @ 60-80° common 290-320. 5" incl of
	320													5		20	70		1			typical qmp at 328'. Scattered clasts to 6" in deeper portions of section
	340										tr	2		2		30	40		1			
	360													8		20	70		1			345-365: 10% ¼-1" cavities, poss. former inclusions of massive fgr py
	380													8		20	70		1			
380	400			390-400	.02	.003	.02	tr	.005	.25				4		20	70		1			
	420											tr		2		20	70		1			
	440													2	5	50	30		1		brkn 446-445 459-567	
	460													3	3	2	90		1			459-567: rock is broken with several zones containing no rock pieces over
	480		85											4		2	90		1			1" long, rock is moderately (5-15%?) poros due to leach of mass.
480	500		85	490-500	.01	.003	.01	.01	.003	.19				4		2	90		1			sul. clasts (?) Spotty clasts of massive gray silica suggest 2 periods
	520													5		5	90		1			of silicif or intra-silicif age of lapilli tuff.
	540													3		5	90		1			
	560	20												4		5	90		1			
560	567	7												10	5	5	75		1			notes,
	EOH.																					1.) assaying by American Analytical
																						2.) hole drilled by Longyear
																						3.) hole not surveyed or cased

mn 2555 dm

LOGGING NOTES :

1) ORE MINERALS : GIVES % CU (OR ZN-PB-AG) IN EACH MINERAL, ESTIM WHERE ASSAY NOT AVAILABLE, LEFT BLANK WHERE NO ORE MINERALS SEEN.

2) GANGUE MINERALS : VOL % PRESENT: ONLY ALTERATION MINERALS LOGGED.

3) SULFIDE VEINS: NUMBER PRESENT. RANGE OF DIPS.

GEOLOGIC LOG

PROJECT ASARCO-THUNDER MTN (KERR-McGEE OPTION)

PATAGONIA MTNS, SANTA CRUZ CO., ARIZONA

PROJECT ASARCO – THUNDER MTN. HOLE NO. TM-11

COLLAR EL. 5175 FINAL DEPTH 668

AZIMUTH -45° SOUTH DIP -45° DEG. PAGE 1 OF 2

LOGGED BY S. R. DAVIS

DATE 8/2/77 DATE 8/24/77

DEPTH FROM	DEPTH TO	INTERVAL	RECOVERY	% Cu	oz Ag	oz Au	% Mo	% Pb	% Zn	ORE MINERALS: CHALCOCITE	COVELLITE	CHALCOPYRITE	ENARGITE ?	GANGUE MINERALS: SPHALERITE	GALENA	PYRITE-DISS	PYRITE-VN	LIMONITE	HEMATITE	CLAY	SERICITE	QUARTZ-DISS	QUARTZ-VN	ALUNITE	SULFIDE VEINS	FAULTS	BRECCIA
5	10	5	45	.01							.01							Tr	1								
10	20	10	65	.04									.04			4	Tr			5	45	5		2			
	30	"	+90	.03							.01		.02	.1		5	.5			2	40	10		1	1-50°	36-41	
	40	ALL	ABOVE	.13										Tr		4	2			1	45	10		5	3:<15°		
	50	10'	90%	.59	.40	.002	.0004	.09	.21	.09	.20		.20	.3	Tr	3	1				35	8		2	1-1rr.		
	60	EXCEPT	EXCEPT	.41						.11	.20		.10	.2		3					40	10	Tr	3			
	70	TOP AND	WHERE	.31							.06		.25			4	Tr				45	10		2			
	80	EOH	NOTED	.51						.06	.15		.30	.2		4	Tr				50	8		2			
	90			.70							.20		.50	.4	Tr	3					50	10		1			
90	100			.47	.26	.001	.0002	.12	.42	.07	.20		.20	.5	.1	3				1	50	10	Tr	1	1-1rr	100	
	110			.41							.11		.30	.2		4					55	8	Tr	2		110	
	120			.62							.12		.50	.1	Tr	3	Tr				60	5	Tr	1			
	130			.51									.51			3					55	5		1			
	140			.52							.06		.45	.1		4					60	4		2			
	150			.54							.10		.44	.2		3	Tr				50	5		1			
	160			.26							.10		.16	.2		2					50	3		Tr			
	170			.42							.10		.32	.3	Tr	3	1			1	60	1			1-50°	170	
	180			.57							.35	.15	.07	.3	Tr	4	Tr			Tr	55					SZ	
	190			.28							.25	.03		.1	Tr	3	Tr			Tr	55			?		190	
190	200			.14	.27	.002	.0003	.03	.10		.10	.04		Tr		2				1	55						
	210			.21							.18	.03		.1		4				1	60			2		205 SZ 207	
	220			.32							.20	.12		.2	.1	4				1	60				1-45°		
	230			.33	.31	.001	.0004	.05	.17		.10	.05	.18	.3	.1	4	1			Tr	60			3	1-30°		
	240			.52							.20	.28	.10	.4	Tr	3	Tr			1	55						
	250			.26							.20	.06		.1		2	Tr			2	60	2	Tr	2		247-250	
	260			.59							.59			.1		5				1	55			1			
	270			.34							.30		.04	.1		5				2	60			2		264	
	280			.26							.20		.06	.2		3				2	60						
	290			.28							.15		.13	.1		3				4	60	5				285	
290	300			.34	.27	.003	.0007	.05	.02		.24		.10	Tr		4				6	40	3				298	
	310			.20							.20			.1		3	Tr			2	30	2				305	308
	320			.19							.19			.2		3				2	45	4				317	
	330			.21							.21			.1		4				1	60	6					
	340			.11							.04		.07	.3		5					60	2					
	350			.28									.28	.3		5	Tr				60						
	360			.12									.12	.3	Tr	5					60						
	370			.50	1.39	.002	.0004	.09	.28		.07	.05	.38	.4	.1	5	1				45	12			1-88°		
	380			.62							.15		.47	.4	.1	6	Tr			Tr	55	2		?			
	390			.75							.16	.09	.50	.4	Tr	5					60						
390	400			.25	.07	.003	.0024	.05	.11			.08	.17	.1		4					35	5					
	410			.30								.10	.20	.2		4					40	3					
	420			.11									.11	.1		2					45						
	430			.21							.06		.15	.2		4				1	45						

5-11 5: BRECCIA : No REC 0-5, THEN SILICEOUS EL OF MAX VOL & TUFF FRAG'S W/LOC VUGGY – TUFFACEOUS MATR (A BOULDER?). MINOR HEM & TR CLAY, POSS ← DISS PYR.

11 : XENOLITHIC QUARTZ FELDSPAR PORPHYRY : WHT TO LT GRY, MASS TO [illegible] VUGGY, FG – MG PO W/CONSTIC RTS AS [illegible]. RESORBED EYES & SANI EUHEDRAL (ALT – LATE STAGE) CRYSTALS. CONTAINS 10 TO 15 % APLITIC TO TUFFACEOUS XENOLITHS &/OR DIKELETS. BOTH MATRIX & XENO'S ARE [illegible] ALTERED TO SER W/LOC MOD CLAY – ALUNITE. PYR OCCURS AS MG DISS & SUL VNLTS. A TR OF BLADED, DARK STEELY GRY METALLIC, POSSIBLY EN OCCURS IN KAO [illegible]

42 : QUARTZ FELDSPAR PORPHYRY : WHT TO PALE GRNISH GRY, MASS FG – MG PO W/8-10% RESORB QTZ EYES & 30-40 % MG to CG FELD PHENOS. SER [illegible], MAINLY VFG WHT W/LESSER MG PALE GRN SELECT REPL MG FELD PHENOS. SOME LOC CLAY (KAO) & ALUN AS FRAC FILLING & FREE REPL OF VCG FELD PHENO'S (EST 3% ≥ 1 CM) WHERE ALUN IS NOTICEABLY PINK. PYR DOM SUL W/WIDESPREAD SPH & EN(?) INTERGROWTHS AND COV/CC COATINGS INDIC CONTEMP & LATER DEPOSITION. PYR COM VFG TO MG DISS'S, SPH – EN? AS FG DISS'S, BOTH AS MG TO CG VNLT – VUG FILLING LOCALLY AS AT 92 & 147. RARE COV – CC COMMON ONLY AS THIN SUL & FRAC COATINGS – VENLETS. TR OF LOC VFG BLADED GRY MET (AG) ; OR EN?) AS ABOVE.

170-190 & 205-207: MOD SHEAR AT ± 45-60°. ~1 ft. gouge @ 190.

174 :) ST DEF CPY W/ANOM COV (BOTH IRRG & PLATY COV).

200-243 : INCR CG SUL'S AFTER FELD. QTZ EYES DECREASING TO 4-6%.

220-240: VNLTS – DIKELETS(?) OF VFG QTZOSE INTR? OR ALUN FLOOD [illegible], CONSID ALUN IN FELD SITES & GOUGE OF FAULTS (PART CRUSHED [illegible])

276 : XENOLITHIC QUARTZ FELDSPAR PORPHYRY : MATRIX AS ABOVE W/ ±10% FG, DENSE, CHERTY FRAG'S & 50% QTZ FELD PO FRAG'S, BAL QFP [illegible] GM. FEW GRN SER MASSES – FELD/MAFIC, WK SILIC OF GM.

298-308 : VUGGY BX ZONE COMPR OF ± 40% FG CHERTY FRAG'S, 60% QFP FRAG'S IN A SER GM. MINOR WHT TO LT BRN CLAY.

318 : LAPILLI TUFF : WHT TO LT GRY W/SOFT PUMICEOUS MATRIX COMPOSED & W/[illegible] OF FRAG'S OF HIGHLY PURIFIED PUMICEOUS ORIG. FRAGS VARY FROM MIN TO 80% & SELDOM EXCEED 3 CM. SOME VUGS & SOLUTION CHANN'S OPEN, OTHERS FILLED W/ [illegible] – SHREDDY MG TO CG PYR & SPH. BEDDING [illegible] VARIES FROM 45-60°. RK IS ALT TO WHERE RECOG IS DIFF, BUT SOME IRREG INTR BY QFP OR [illegible]. SELECT. SER IS INTENSE & LOC SIL FLOODING COMMON. SUL'S MAINLY FG – MG DISS [illegible] W/ [illegible] COV.

318-324 & 361-368: LITHIC FREE FG UNITS W/ANOM SIL, MAY BE TUFF OR FG INTR.

392 : LAPILLI TUFF : SEE DESC ON PAGE 2

DRILL LOG

PROJECT: ASARCO – THUNDER MTN (KERR McGEE OPTION)
PATAGONIA MTNS., SANTA CRUZ Co., ARIZONA

PROJECT: ASARCO – THUNDER MTN HOLE: TM-11
COLLAR ELEV: 5175 DATE: 622
COORD N: COORD E:
INCLINATION: –45° SOUTH FOOT 2 OF 2
LOGGED BY: S.R. DAVIS
DATE STARTED: 8/2/77 DATE FINISHED: 8/24/77

		% Cu	oz Ag	oz Au	% Mo	% Pb	% Zn	Chalcocite	Covellite	Chalcopyrite	Enargite ?	Tennantite - Tetrahedr. ?	Sphalerite	Galena	Pyrite-Diss	Pyrite-Vn	Limonite	Hematite	Clay	Sericite	Quartz-Diss	Quartz-Vn	Alunite	Sulfide Veins	Faults Breccia	TYPE AND REMARKS
430	440	.20							.05		.15		.2		5				50						439	392 : LAPILLI TUFF : WHT TO LT GRY, PUNKY MATRIX W/ LOC ALIGNED PUMICE
	450	.19									.19		.2		4				3	50	1		?			FRAGMENTS & FEW FG BEDDED HORIZONS AT 393-405, AVE ATT 60-65°.
	460	.15									.15		.2		3				5	35	3					LAPILLI – LITHIC FRAGS VARY FROM 30-70%, MOST ANGULAR TO SUB RNDD
	470	.26									.26		.1		2				1	40						VFG TO FG VOLC/SEDIM ROCK W/ ORIG SILIC PRECEDING STRONG FELS.
	480	.37									.37		.1		3	Tr			1	30					479	MOST FRAG'S LIGHT GRAY TO PALE LAVENDER & 1 TO 3 CM. W/ V. RARE
	490	.19									.19		Tr		3					50						SPECIMENS TO 6 CM. SUL'S DOM FG TO VFG PYR W/ LOCALLY LG ELONG
490	500	.17	.01	.001	.0010	.04	.03				.17		.1		3				1	45					494	SUL MASSES-PODS IN PUMICE SITES & VUGS. MINOR CPY & RARE
	510	.29									.29		.2		4				?	45	1	Tr	1		ALT 60°	GALENA ASSOC W/ AND AS OVERGROWTHS TO PYR. COV & POSS FG EN (?)
	520	.21							.06		.15		.2		4				3	40	2		3		52 W/ GCE	ONLY CU SUL'S, COV AS PYR COATINGS & RARE VNLTS, EN (?) AS FG
	530	.19							.04		.15		.1		3	Tr			2	45	Tr	Tr	2		@ ±8/10°	DISS IN CLAY (KAOL) & ALUN OF FRAG & FELS SITES. ALT ESS AS STR
	540	.31							.11		.20		.2		4				1	40	3		1		533	WHAT SER IN GM, MINOR SILICA FLOODING & LOC CG GRN SER (500-530)
	550	.16							.06	.05	.04		.1		3					35	5		Tr			REPL PHENO'S & PUM FRAGS. SEVER SOLUTION VUGS & CAVITIES TRUNCAT,
	560	.10							.06		.04		Tr		3				1	35	2		Tr			MOST ≤ 2 CM. 460-487 LITHIC POOR, SG TUFF ZONE.
	570	.09							.06		.03		.1		4				Tr	40			1			567-572 : XQFP OR IRREG INTRUDED LAP TUFF FRAGS AS
	580	.05	.20	.002	.0005	.21	.56				.05		.2	Tr	3				Tr	40	3		Tr		582	ABOVE, BUT MATRIX DEF QFP W/ ±4% RESORB QTZ EYES &
	590	.18									.18		.2		4				1	45	1		2			OPV CG SER AFT FELS & MAFICS.
590	600	.20	.19	.002	.0006	.04	.05				.20		.1		4				1	40	2		1		599	
	610	.32							.08		.15	.09	.2		4	Tr		2	2	35	3		Tr			609 : QUARTZ FELDSPAR PORPHYRY : LOC SOMEWHAT PEROLITIC (≤ 1 CM)
	620	.47							.07			.40	.1		4	1		4	1	20	15				1-50°		BUT NEVER OVER 30%, NO TUFF SHARDS & NO FOLIATION-BDDNG.
	630	.51										.51			3	Tr	1	2	1	15	55					625	ALT PERV SER & INCR SIL FLOODING & CLAY. SUL'S SIM TO ABOVE, TR-5% HEM.
	640	.02											.02				1	Tr		5	25						Tr BRN METALLIC - TENN.-TETR?
	650 NX	.01											.01				Tr	Tr	Tr	?	90						625 : TRANSITION BRECCIA : INITIALLY BXTD QFP AS ABOVE, THEN BECOMING
	660 START BX	.04											.04				Tr	1		?	42						SILICA FRAG RICH & FINALLY SIL BX. ALT AS SER RESTRICTED TO MATRIX
	668-TD	.02	.03	.001	.0070	.07	.02						.02				Tr	1	Tr	2	43					663	& DECR W/ DEPTH. SIL FLOODING/REPL INCR W/ DEPTH. SUL'S DEC OXID BEL
																											600, TOT OXID BELOW 620 W/ DOM HEM & LESS JAROSITE AS RESIDUALS
																											TRANSP FeOx (ORIG SULS IN MATR & PO FRAG'S, NOT SIL FRAGS).
																											632 : SILICA BRECCIA : FRAG'S OF 70-80% FG SIL, 20-30% SILIC PO, PERV
																											& INTENSELY SILICIFIED, NO EVIDENCE OF ANY PREEXIST SULS & ONLY
																											MINOR FeOx INDIC. SIL PREDATES SUL MIN. FEW VUGGY ZONES, BUT
																											LESS OPEN SPACE THAN ABOVE, MINOR VARICOLORED CLAY – SEDIMENT
																											IN SOME VUGS. ROCK RESEMBLES A DK CHERT W/ EX TEXT DESTROYED.
																											668.5 EOH : EXTREMELY HARD DRILLING & HIGH ARTESIAN FLOW, EST AT
																											75 GPM FROM 632-654 INCR TO >100 GPM BELOW 654.

NOTES: 1) DRILL CONTRACTOR: JOY MFG. Co.

2) NO DRILL HOLE SURVEY.

3) ASSAYING BY AMERICAN ANALYTICAL.

LOGGING NOTES:

1) ORE MINERALS: GIVES % Cu (OR Zn-Pb-As) IN EACH MINERAL, ESTIMATED WHERE ASSAY NOT AVAIL. LEFT BLANK WHERE NO ORE MINERALS SEEN.

2) GANGUE MINERALS: VOL % PRESENT, ONLY ALTERATION MINERALS LOGGED.

3) SULFIDE VEINS: NUMBER PRESENT, RANGE OF DIPS.

GEOLOGIC LOG

PROJECT ASARCO - THUNDER MTN (KERR McGEE OPTION)
PATAGONIA MTNS, SANTA CRUZ Co, ARIZONA

PROJECT THUNDER MOUNTAIN
Collar elev. 5175
Coord N.
Inclination -45° WEST
Logged by S. R. DAVIS
Date start 8/27/77

HOLE NO. TM-12
Final depth 622
Coord E.
Page 1 of 2
Date finish 9/7/77

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	ASSAY % Cu	ASSAY oz Ag	ASSAY oz Au	ASSAY % Mo	ASSAY % Pb	ASSAY % Zn	ORE MINERALS: Covellite	Chalcocite	Sphalerite	Galena	GANGUE MINERALS: Pyrite-Diss	Pyrite-Vn	Limonite	Hematite	Clay	Sericite	Quartz-Diss	Quartz-Vn	Alunite	Epi-Clinoz.?	Gray-Blk Sub-metallic	STRUCTURE: Sulfide Veins	Faults	Breccia	ROCK TYPE and REMARKS
2	10	8'	70	.03						.03				2		3	1	10	45									0 - 8: BOULDERS - ALLUVIUM: MIXED POORLY CONSOLIDATED ALLUVIAL MATTER
	20	NC	90	.18						.18			.1	4		1		2	55			Tr					6"@12'	W/Fg VOLCANIC, SILICA BX & GRANITIC FRAG'S, MINOR PYR, MOD LIM.
	30	@16	~~START NX CORE~~ +90	.18						.18			Tr	5	Tr			1	55	4	1							8: QUARTZ FELDSPAR PORPHYRY: WHT TO PALE GRN, MASS, Fg to Mg PO.
	40	ALL	ABOVE	.51						.51			.2	6	Tr			1	60	3	1				1@40°	52 36-39		INITIALLY SOFT & PUNKY, BECOMING MORE DENSE W/INCR DEPTH. PRIMARY
	50	10'	90%	.49						.49			.1	6	Tr			2	60	2	Tr				1@22°		3"@42'	QTZ EYES EST @ 5-8%, RARE SMALL CHERT XENO'S. PERV STR SER ALT ALL
	60	EXCEPT	EXCEPT	.70						.70			Tr	6	1			2	60	3	Tr	Tr			3@31-62°	60		Fg - WHT TO 16' WHERE MG PALE GRN SER COMMONLY REPL'S FELD
	70	TOP &	WHERE	.95						.95				6	1			3	55	3	1	2			2 - 1tr.			PHENO'S, TR CALCITE IN VEIN/VUGS AT 45 & 52. PYR ESSENT Vfg to
	80	EOH	NOTED	.28						.28				4	1			2	60	1		2			1 - 1tr.	76?		Fg CUBIC EUH DISS'S TO 33 WHERE ADD'L Mg PUL & SPH IN FELD
	90			.14						.10	.04			4	Tr			1	60	1		1				52 85-88		SITES ARE COMMON. FEW PYR-SPH VNLTS 30-120 AVE ± 3MM, MOST < 8MM.
90	100			.27	.21	.002	.0008	.05	.08	.27				3	1			?	60	2		Tr					7"@93'	94-98: SHAT ZONE W/SEV V THIN SUL VNLTS W 1:1 PYR:SPH RATIO.
	110			.07						.07				3	Tr				60	3	2							100 - ? DECR IN GRN SER (NIL BELOW 130') AND UNIQUE HABIT TO
	120			.17						.17			Tr	3	Tr				55	3	2							Mg PYR; OCCURS AS A RIM TO FELD PHENO'S WHICH HAVE
	130			.11	.05	Tr.	.0004	.28	.46	.11			.2	4	Tr				60	2								PER! ALT'D TO SER-KAO CENTERS (W/MOD PINK-BUFF ALUN.)
	140			.10						.10			.1	4	Tr				55	3								
	150			.07						.07			.1	4	Tr				55	4								
	160			.05						.05	?			2					50	3		Tr						164: LAPILLI TUFF: OR XENOLITHIC QUARTZ FELDSPAR PORPHYRY: Fg to
	170			.16						.16			Tr	2					60	1		1						Mg WHT TO PALE PINK ROCK W/MINOR LITHIC MATTER MAINLY SMALL (≤1CM)
	180			.08						.08			.1	3					55	2				Tr				THE PUM'S FRAG'S - SHARDS & QTZ CRYSTALS. PERV, STR, WHT Fg SER ALT
	190			.04						.04	?		Tr	3					50			1		.5	1@70°			W/FEW THIN ZONES - STREAKS OF SILIC. FELDS & MINOR ALUN AS ABOVE. SUL'S OCCUR
190	200			.09	.34	.003	.0005	.04	.19	.09			.2	Tr	4			1	45					.1				AS Fg DISS OF PYR & SPH, BOTH LOC COATED BY COV W/RARE Fg DISS COV & TR CC ALSO NOTED
	210			.04						.04					5	Tr		1	50	1				Tr				200: QUARTZ FELDSPAR PORPHYRY: GRADATIONAL W/ABOVE; WHT TO PALE GRY,
	220			.04						.04	?		Tr		4			3	35	5		?		Tr				MASS Fg PO A B TO 164. ALT CONTINUES AS STR WHT Fg SER W/
	230			.58						.50	.08			Tr	4	1		2	50	4					7"@228			INCREASING (AVE ±8%) SILICA FLOODING. PYR MORE TYPIC Mg & LESS EUH
	240			.18						.12	.06		Tr		4	1		1	50	3					2@20°			THAN ABOVE, BUT STILL COMMONLY RIMMING FELD SITES & RARE FRAG'S.
	250			.50						.50			Tr		3	Tr		10	45	8								COV & CC SLI INCR FROM ABOVE, CC NOT OBSERVED BELOW 240.
	260			.12						.12			.2	Tr	4	Tr		1	50	6				Tr	1@50°			228 - 228.7: DISS & PODDY MG TO CG PYR (7-8%) & COV (5-6%)
	270			.07						.07			.1		4	Tr			55	8			.5	1	2@60°			IN CLAY ALTERED ZONE/GOUGE.
	280			.21	.02	Tr.	.0005	.07	.12	.21					4	1			55	6			2	2	3@75°			238 - 249: XENOLITH(?) OF LAPILLI TUFF W/±20% SMALL (≤3 CM)
	290			.38						.38			Tr		4				60	4				Tr		287-290		ANG TO SUB-ANG FRY CHERTY FRAG'S. Fg TUFFAC APPEAR W/FAINT
290	300			.27	.19	.001	.0007	.03	.09	.27			Tr		5				60	5						297		BEDDING, GRADE INTO QFP.
	310			.24						.24					5	Tr			55	7						305-307		245 - 248: SEVERAL VEINS & FRAG'S FILLED W/WHITE CLAY?, PROB KAO.
	320			.08						.08			.1		4				55	8				Tr				250: QTZ AS RESORBED EYES & SEC EUH CRYSTALS INCREASE TO 8-10%
	330			.21						.21					3	1			55	8					1@80°	333-		BELOW 250, SUL'S (MAINLY PYR) BECOMING MORE SHREDDY &
	340			.45						.45					4	Tr			65	2				Tr		338		FAVORING RIMMING FELD'S, ESP SO BELOW 280.
	350			.10						.10			Tr		3	Tr			60	4					1@70°			326-382: QFP LOCALLY WKLY XENOLITHIC, FRAG'S COMMONLY Fg CHERTY
	360			.16	.03	Tr	.0005	.07	.25	.16			.1		3	Tr			55	8				.5				
	370			.23						.23			.1		4	Tr			50	10								
	380			.87						.80	.07		.1		3	Tr			55	8								
	390			.26						.26			.2		2	Tr			30	10							382	382: BRECCIA: SILICEOUS, DENSE CHERT BX; FRAG'S OF SILIC Fg VOL & CLASTIC
390	400			.13	.21	.003	.0037	.08	.12	.13			Tr		1				8	10								(TRIASSIC?) ROCKS IN A MATRIX OF COMMIN CHERT & POSS Fg QFP. FRAG'S
	410			.13						.13			.2		2	Tr			20	8					1@60°			DOM 1-4 CM W/OCC SPEC'S ≥ 5 CM, FRAG:MATRIX RATIO EST @ 80:20.
	420			.30	.78	.004	.0024	.16	.39	.30			.3		2	2			25	10					3@±45°			ALT PRINCIP MOD-STR SER & SIL, W/SER RESTRICTED TO THE MATRIX-GM AND
	430			.06						.06			.2	Tr	2	1			10	12					1@70°		433	PROPORTIONAL TO VOLUME THEREOF. SUL'S PRINCIP Fg SHREDDY PYR (±3%) IN —

mn 2555 dm

GEOLOGIC LOG

PROJECT ASARCO - THUNDER MTN (KERR McGEE OPTION)
PATAGONIA MTNS, SANTA CRUZ Co., ARIZONA

PROJECT ASARCO-THUNDER MTN. HOLE NO. TM-12
Collar elev. 5175 Final depth 622
Coord N. Coord E.
Inclination -45° WEST Page 2 of 2
Logged by S. R. DAVIS
Date start 8/27/77 Date finish 9/7/77

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	% Cu	oz Ag	oz Au	% Mo	% Pb	% Zn	ORE MINERALS: Covellite	Chalcocite					Sphalerite	Galena	GANGUE MINERALS: Pyrite-Diss	Pyrite-Vn	Limonite	Hematite		Clay	Sericite	Quartz-Diss	Quartz-Vn		Alunite	Arsenopyr.? Gry-Blk Sub-Metallic					Sulfide Veins	Faults	Breccia	ROCK TYPE and REMARKS
430	440			.37						.37						Tr		4	1					40	8									THIN 2@60°		*433	CONT.-- MATRIX & ON HAIRLINE FRAC'S THROUGH MATRIX & FRAG'S, FEW Mg-Cg PYR-SPH &
	450			.41						.41						Tr		4	1					50	6									2@40°			COV MASSES OBVIOUSLY FILLING VOIDS. 408-415 THIN QFP DIKE w/MIN QFP PERV of GM.
	460			.38						.30	.08					Tr		4	1					45	4			1						THIN-3-IRR			433: QUARTZ FELDSPAR PORPHYRY: WHT TO LT GRY, MASS, fg TO Mg PO AS ABOVE.
	470			.31						.31						.2		4	1					50	10									V THIN ±8:1rr			LOCALLY vfg XENOLITHIC (433-468 & 495-498), COMMONLY ≤ 1cm FRAG'S OF SIL
	480			.31	.23					.31						Tr		3	2					55	4	1			Tr	.2				3@70-90°			fg VOL/SED OR QTZ (RARE XENO'S AS ABOVE @ 538-581). ALT CONSISTS OF MOD-
	490			.20						.20						Tr		4	2					50	8				Tr					3@70-80°			STR SER TO 514 WHERE PREVIOUSLY MOD SIL FLOODING BECOMES INTENSE
490	500			.36	.01	.002	.0010	.06	.11	.36						Tr		3	2					45	12	1				Tr				V THIN ±10:1rr			AT THE EXPENSE OF SER. BELOW 514 ROCK BECOMES A DENSE, Fg SILIC-
	510			.28	.51	.006	.0020	.08	.14	.28						.1		3	2					35	15	1			Tr	2				5@70-90°			EOUS MASS w/PRESERVED QTZ EYES THE ONLY RECOGNIZEABLE TEXTURE.
	520			.07						.07						.2	Tr	4	Tr		Tr		Tr	10	45	2			.2					V THIN 1@60°			SUBHEDRAL fg DISS PYR w/COMMON V THIN COV COATING & FEW THIN
	530			.29	.02	Tr	.0037	.05	.42	.27	.02					.1	Tr	5	Tr					8	42	1			Tr	1							VNLTS OF SIMILAR COMPOSITION ARE MAIN MINER. TR SPH AND
	540			.19						.19								4	1				Tr	8	40	1				.4				V THIN 3:1rr			GALENA ALSO NOTED. POSSIBLE ASPY; WHITE MET-SUL 480-540.
	550			.22						.22								3	1				Tr	10	40					.2				1@70°			520-560: PYR MORE MG-CG SHREDDY-BLOTCHY w/RIMMED FELD'S &
	560			.17						.17								3	2				Tr	10	38			?		1				3@45-60°			LOCAL BLOTCHES-PODS OF GRY, MALODORED & ACRID TASTING
	570			.29						.27	.02					.1		4	1		Tr		Tr	5	50	Tr		Tr		.2				V THIN 7:1rr			MIN IN AND ADJ TO FRACTURES, ESS A GRY-BLK SUB-MET.
	580			.33	.03					.20	.13							4	1		Tr		Tr	8	48	3		3		.2				V THIN 5 ±20-30			
	590			.11						.11						Tr		4	Tr		Tr		1	40	10	1			Tr	.1				V THIN 4:1rr			581: LAPILLI TUFF: WHT TO GRY WKLY FRAG LITHIC TUFF, FRAG SUITE AS BEFORE, RARE
590	600			.11	.26					.11						.2		3	2		Tr		3	25	15	2		?		.1				V THIN 15+:1rr		599	45-60° BEDDING/SORTING. FRAG'S VAL @ 5-25%. SUL MIN SIMILAR TO ABOVE.
	610			.02																5	2		2	5	85												599: SILICA BRECCIA: PERVASIVELY SILICIFIED BRECCIA (COLLAPSE-INFILL?), GRY
	620			.03	.04	.004	.0053	.02	.01							.03				.5	1		2	2	90												TO TAN, DENSE CHERTY ROCK w/RARE QTZ XTAL LINED OPEN VUGS &
	622	TD		N.A.																Tr	1		Tr	1	92											622	FRAC'S. FRAG'S VARY FROM <1 TO >10 CM & COMPRISE ± 75% OF TOTAL
																																					ROCK. BOTH FRAG'S & BX MATRIX ARE COMMONLY SO THOROUGHLY
																																					SILICIFIED THAT ORIG TEXT NOT PRESERVED. RARE POSSIBLE REMNANT
																																					BEDDING AT 60-70°. FEW VERY SMALL PODS OF REMNANT CLAY-SER
																																					w/MINOR HEM & LIM, STRONGLY OVERCAST BY INTENSE SILICIFICATION.
																																					MINERALIZATION ESS HEM & MIN LIM, IN PART RESIDUAL AFTER
																																					FINELY DISS PYR (MAINLY IN MATRIX FROM 599 TO 605), BALANCE
																																					TRANSPORTED.
																																					609-610: ZONE OF V STR (15-20%) BLACK SPECULAR HEM
																																					IN BX MATRIX, BRINGS 10 FT INTERVAL TO 2% HEM.
																																					622: EOH

NOTES: 1) DRILL CONTRACTOR: JOY MFG. Co.
2) NO DRILL HOLE SURVEY
3) ASSAYING BY AMERICAN ANALYTICAL

mn 2555 dm

GEOLOGIC LOG

PROJECT _____

PROJECT: THUNDER MTN. HOLE NO. TM-13
Collar elev. 5175 ft First depth 4777 ft
Coord N. _____ Coord E. _____
Inclination: vertical Page 1 of 6
Logged: F.T. Graybeal
Location: See note p.6 Date: _____

DEPTH From	DEPTH To	DEPTH Interval	% CORE RECOVERY	ASSAY ppm Cu	ppm Mo	ppm Pb	ppm Zn	oz Au	oz Ag	ORE MINERALS: galena	fine-gr. gray sulfide	GANGUE MINERALS: Pyrite-diss	Pyrite-vein	Limonite	Hematite	Quartz-diss	Quartz-vein	Clay	Sericite	Epidote	Chlorite	Albite ?	Calcite	STRUCTURE: Sulfide Veins	Faults
0	10	10																							
10	20	10										tr		3	tr		tr		10	8	8				
20	40	20										tr		3	1		tr		10	10	8				
	60		40-50	219		323	697	tr	0.01			tr	tr	3	1		tr		10	8	6				
	80											tr	tr	3	1		1		10	8	6				
80	100		90-100	213	1	792	1349	tr	0.03	tr		2	tr	3	1		tr		20	8	6			3:80-80°	91-93
	120											2	tr	2	1		tr		10	8	6	tr			106-107
	140		140-150	212		137	383		0.09			4	tr	tr	1				10	8	6	tr			127-128
	160											6	tr		2			10?	40	1	tr				151-160 brkn 161-171
	180											4	tr		1		tr		15	10	6				
180	200		190-200	294	1	230	624	tr	0.07	tr		3	tr		1		2		10	10	7				
	220									tr		14	tr		2		1	10	30	5	2				208 ↓ 236
	240		240-250	98		209	262		0.20			3			tr		tr		45						
	260											6	tr		tr		tr	5	50						
	280										tr	4	tr		tr	10			50						
280	300		290-300	26% 1349	6	426	836	.007	1.21		tr	5			tr				60						286-287
	320										tr	5				5			60						
	340		340-350	153		234	389		0.05		tr	5							60						
	360										tr	4					tr		50						
	380										tr	4				5	1		40	1					
380	400		390-400	155	2	250	422	tr	0.04		tr	4	1			10	1	?	20					1-70°	
	420											4			tr	10			10	7	3				
	440		440-450	168		173	398		0.01			4			tr	5			5	7	3				
	460											4				10			5	8	3				
	480										tr	3				10	tr		15	4	2				
480	500		490-500	148	1	472	532	tr	0.06			5							60						489-491
	520											5							50						
	540		540-550	102		362	907		0.01	2%		4							50					1-30°	525: 6" @ 30° 533-537 @ 50° 541-588 many small faults
	560											4							50						
	580											5							60						
580	600		590-600	125	1	248	736	tr	0.09			4				10			30	1					
	620											4				10			30						
	640		640-650	82		48	133		0.18			6						?	60						
	660											5							60						646-649 651-653 655-658
	680											5							60						
680	700		690-700	81	1	54	172	tr	0.14			5							60						695-696 @ 40° 718-726 brkn
	720											5							60						
	740		740-750	112		66	361		0.06			5				10			60						735-740
	760											5							60						
	780											5							60						760-762 brkn 785-799 brkn
780	800		790-800	94	1	71	350	tr	0.05			5							60						
	820											5							30	tr					
	840		840-850	285		750	867		0.01			5							50	tr					831-833 gg-bx

Rockbit

10: DIABASE: medium greenish, variably broken; medium-grained, equigranular w. 50-60% wht.-grn plag? prob variably sericitized, 25% altered mafic + magnetite (1-3%), 15% light pinkish orthoclase matrix, not obviously porphyritic but plag is tabular; texture very uniform, no flow banding. Epidote is 20% in 1/16" replacement veins, 70% as vein envelopes dissem mostly as replacement of plag. Chlorite repl. mafics only, rare chlorite(?) or serpentine veins. Hematite as oxdiz. of mafics; limonite from oxdiz. py, py is f.gr. dissem. in/along epid vns. Whitish, vuggy qtz vns to 1/8" cut + offset epid vns. Texture not obviously diabase but Trench area terminology is used. Most veins 50-80°
89: 3 - 1/16 - 1/8" galena veins w lt gy altered envelope
91-93: fault; gouge, 65°, 5-10% dissem py in and near fault, may be pre-min flt.
151-160: fault; 50% db - 50% gg, pervasive clay-ser-diss py, no epid, prob pre-min
198-204: fine-grained diabase zone w 7-8% diss py, grad up/down to med gr db

217: TUFF BRECCIA: light gray color due to strong sericite alteration, color becomes highly variable in gray-brown-greenish where sericite weaker and epidote is present. Texture highly variable, volcaniclastic. Nature of rock obscured at diabase contact due to strong gouge fault zone. Overall rock contains 50% 1/4"-10' angular volcanic clasts set in variable gritty to pseudo-porphyritic matrix. Abundant coarsely porphyritic latite(?) 217-300 ft in 5-20' zones may be clasts or intrusions. Remainder of clasts are variety of siliceous volcanic rocks w no free qtz which are often strongly flow banded and porphyritic; no diabase or plutonic clasts. Alteration is sericitic which varies inversely with propylitic as noted at left. Pyrite is dissem. Propylitic rock hard-dense, prob. siliceous, clasts dominated by red-brn latite(?) for. Matrix carries ~5-10% quartz clasts.

481: BEDDED TUFF: medium-fine gr. poorly bedded(?) tuff; bedding @ 20°, bottomed on gouge fault 489-491 @ 45°

491: PORPHYRITIC LAPILLI TUFF: gray, similar to tuff breccia but fragments smaller, less abundant varying 1/4-2" and up to 25% of rock; matrix contains less clastic, foreign-looking grit and more feldspar grains which may be phenocrysts and rock is variably layered w flow(?)-lines @ 20-30°. Alteration pervasive but textures well-preserve.
539: 3" zone of roughly 50% galena in 1/8-1" massive galena veins @ 30°
541-588: 14-15 gouge 3"-2' fault zones mostly 40-70°. Matrix is latite porphyry?

575: TUFF BRECCIA: variable color due to alteration, clasts angular generally 1/4-2", similar to 217-481 except porphyritic latite absent, clasts smaller; nearly a lapilli tuff

615: WHITE TUFF BRECCIA: light gy-white, strongly altered, 30-60% ang. clasts; 10-30% are sandstone.

648: SANDSTONE: whitish, prob. depositional because clasts absent in lower rock

654: PORPHYRITIC LAPILLI TUFF: similar to 491-575, basal contact gradational

694: TUFF BRECCIA: similar to above; abundant flow-banded clasts; pervasive f.gr. sericite-pyrite, no veins

757: WHITE TUFF BRECCIA: whitish, fragments smaller than Tuff Bx and rock is nearer a lapilli tuff, name is descriptive, 5-15% clasts of sandstone/qtzt, similar in places to Tuff Bx

782: LATITE PORPHYRY: very similar to matrix in Por. Lap. Tuff 491-575. Gray w. 5-15% whitish [illegible] small anhed. feldspar pheno. Flow layering mostly 15-25°, erratic distub. Pervasive ser-py

GEOLOGIC LOG

PROJECT _____

PROJECT THUNDER MTN. HOLE NO. TM-13
Collar elev. 5175 ft. Final depth 4777 ft
Coord N. _____ Coord E. _____
Inclination vertical Page 2 of 6
Logged by F.T.G
Date start See note p.6 Date finish _____

DEPTH from	DEPTH to	DRILL	% CORE RECOV	ASSAY PPM Cu	PPM Mo	PPM Pb	PPM Zn	OZ. Au	OZ Ag	ORE: galena	ORE: fine-gr gray sulfide	GANGUE: Pyrite-diss	GANGUE: Pyrite-vein	GANGUE: Hematite	GANGUE: Quartz-diss	GANGUE: Quartz-vein	GANGUE: Clay	GANGUE: Sericite	GANGUE: Epidote	GANGUE: Chlorite	GANGUE: Calcite	STRUCTURE: Sulfide Veins	STRUCTURE: Breccia	STRUCTURE: Faults	ROCK TYPE and REMARKS
840	860	20										5				3		70						837-841: brkn	821-837: latite por texture coarser, more strongly flow banded, texture more variable
	880											5				tr		60						845-849 gg	
880	900		890-900	167	1	432	540	tr	0.08			6						70						856-861: gg 60°	837: PORPHYRITIC RHYOLITE: white, massive, no flow structure; 1-5% anhed feld pheno in
	920											5						40						865-870: brkn gg	f gr possibly devitrified matrix; no clasts. Textures obscured by pervasive clay-
	940		940-950	137		131	648		0.19			6						60						901-904: 50° 930-933: brkn	sericite. Possibly tuffaceous
	960		960-970	103	27	465	1110	.001	0.16		tr	8						30					940-950: yellowish bx	963-977 @ 50°	889: LATITE PORPHYRY: gray, rather coarse, variable texture to 914 ft, then more
	980											15						50							uniform porphyritic, 5% 1/8-1/2" elongate whitish masses (pumice?), pervas ser-py.
980	1000		990-1000	134	13	276	738	.001	0.19			6			5			40							936-945 ft texture coarser, pumice masses to 1".
	1020											5			5			40							945: SANDSTONE BRECCIA: 945-963 ft is reddish sandstone clasts (30-70%) cut by sulfide-
	1040		1040-1050	68		157	839		0.04			7	tr					70				1-70°		1036-1052: brkn-sl gg	rich, variably banded intrusive (fluidized) grit; 963-977 is intense gouge fault breccia
	1060											6						60							@ ~50° w. interior bx zone 967-971 of very high S.G rock, 977-984 ft is gray
	1080											6						60						1076: 1 @ 70°	weakly bx sandst w intense sericite-pyrite (20% and all f.gr. dissem)
1080	1100		1090-1100	71	2	313	655	.001	0.13			6						60						1083-1109: brk, gg	984: TUFF BRECCIA: dense, 10-50% ang clasts to 6" in gritty matrix; feldspar xenocrysts in
	1120											5						50						1098-1103 1.6 ft	matrix similar to feldspar in latite por. Spotty probable Lat. Por. clasts up to 2 ft
	1140		1140-1150	119		62	166		0.06			5						50							long. Several blocks 2-15 ft of fine gr. porphyritic(?) tuff - rock type obscured by
	1160											5						50							strong sericite alteration with up to 10% diss. py. Reduced abundance flow banded
	1180										tr	5						50							clasts, incr in porphyritic and fine-gr tuffaceous/sediment clasts compared to Tuff
1180	1200		1190-1200	101	1	110	222	tr.	0.09			5						50							Bx higher in hole. Alteration is pervasive uniform sericite-dissem py, no
	1220									tr		6	tr					60							sulfide veins. Numerous 1"-1' gougy zones 1036-1103 ft, remainder of rock
	1240		1240-1250	154		112	312		0.21			5						50				2:70°			variably broken
	1260											5						50							1209: tr galena in 1/16" veins.
	1280											6						60							
1280	1300		1290-1300	224	14	431	741	tr	0.19		tr	5						60							
	1320											6						60							1307: FLOW BANDED PUMICEOUS RHYOLITE: gray, 1/4-1" pumice(?) clasts (all thick) form
	1340		1340-1350	81		188	631		0.08			6						60							20-30% of rock; foreign clasts not abundant; may be ash flow tuff, layering at
	1360										tr	5						50						1341-1349: brk-gg @ 70°	20°; lower part grades into unlayered pumiceous, faulted tuff breccia
	1380											5						50							1359: SILICEOUS PORPHYRY: gray, siliceous w 5-10% anhed feld pheno, 5% pumice clasts
1380	1400		1390-1400	99	1	159	387	tr.	0.05			6						60							1382: TUFF BRECCIA: each tuff breccia is internally quite variable and different from others.
	1420											6						60						1407-1415: brkn	This unit contains several clast varieties which include fine-grained clastic rocks,
	1440		1440-1450	88		716	1007		0.11			6						60						1439-1477: sl gg ff	tuffaceous sediments, and fine-grained volcanic rocks which look similar due to
	1460									tr		7						60							pervasive, strong sericite alteration and dissem. fine-gr pyrite and to st. faulting.
	1480									tr		8	tr			tr		70				2:75°		1477-1498: brkn-gg	1439-1477: strong fault zone; 50% gouge-breccia gen 60-75°; assoc py vns
1480	1500		1490-1500	81	1	390	542	tr	0.10			7						60							1498-1503: strong fault gouge-breccia zone, broken to 1512
	1520											6						50							1512-1514: strong fault breccia, minor gouge
	1540		1540-1550	123		57	120		0.22			6						50		tr				1544-1551: brkn, gg	1540-1589: rock is variably to strongly broken throughout w spotty 1/4" gg zones
	1560											5						50		tr				1554-1558: brkn	Rare flow banded zones. Below 1520 a dark gray por volc. w 2-10% anhed pheno
	1580		1590-1600	198	16	87	103	.001	0.21			5						50		tr				1583-1586: brkn	to 1/8" becomes more abund. as clasts. At 1530 ft traces of calcite appear as coatings
1580	1600											5				tr		50		tr				1608-1610: brkn	along fractures and as weak dissem replacement of feld pheno and rare pumice clasts
	1620		1640-1650	79		203	168		0.23			5						50		tr				1622-1633: brkn	1612-1629: mostly contin. block of dark gy por volc.
	1640											6						50		tr					1629-1671: tuff bx has mixed dk gy por, light felsite, and spotty flow band clasts
	1660											7						50		1					1641-1652: strongly crushed zone, but rock largely intact - only minor gg-bx.
	1680											5						30		3					1671: LIMESTONE CONGLOMERATE: 1/4"-2' blocks med gr white marble form 10-70% of rock
1680	1700		1690-1700	90	41	209	220	.002	0.26			5						50		3				1684-87: brkn, gg	w. remainder 1/4-1" gy volc. clasts in gritty matrix; pervasive diss py.

GEOLOGIC LOG

PROJECT _____

PROJECT THUNDER MTN
Collar elev. 5171 ft
Coord N. _____
Inclination vertical
Logged by F.T.G.
Date start See note p.6

HOLE NO. TM-13
Final depth 4777 ft
Coord E. _____
Page 3 of 6
Date finish _____

DEPTH from	DEPTH to	int'vl	% CORE RECO.	ASSAY PPM Cu	PPM Mo	PPM Pb	PPM Zn	OZ. Au	OZ Ag	ORE MINERALS galena	fine-gr gray sulfide	sphalerite	GANGUE MINERALS Pyrite-diss	Pyrite-vein	Hematite	Quartz-diss	Quartz-vein	Clay	Sericite	Epidote	Chlorite	Calcite	Serpentine	Garnet	tourmaline	STRUCTURE Sulfide Veins	Breccia	Faults	ROCK TYPE and REMARKS
1700	1720	20											5						50			3							1689: PUMICEOUS PORPHYRITIC LAPILLI TUFF: 5% feld pheno; 5-10% pumice, 5-25% clast (rare mb)
	1740			1740-1750	11		101	27		0.33	tr		6						30			3	2						1729: LIMESTONE: generally white with irreg clots of lt.grn serpentine and thin gray
	1760												4									10	5						swirly-linear streaks of diss py. Entirely recrl. to fine-cgr marble; textural variations
	1780											?	3						5			2	15	5		1777-1794: sh gg-bx w 75°			marked by white-pale brn-lt.gy color changes, some healed internal bx; rare 1/8" vugs w
1780	1800			1790-1800	32	2	156	180	tr	0.26			5						50			3	2	tr					qtz. crystals 1756-1770 fl pervasive serpentine-green garnet (?), other lime silicates
	1820												6						50			5				1806-1815: brkn-gg @ 45-75°			1774-1777: lime silicates 1777-1794: strong fault zone, broken-gougy throughout
	1840			1840-1850	104		132	88		0.20			6						60			4							1777: TUFF BRECCIA: fragment size quite variable includes fine-gr volc, dk.gy flow-banded pa
	1860												6						50			2				1831-1841: sh gg			volc, minor white marble throughout; prob. some calcitic alt. of lapilli; py is uniform
	1880			1890-1900	112	5	136	200	.002	0.25			7						50			2				1849-1852: sh gg			f.gr.-dissem. 1831-1841 is virtually 100% gougy fault zone. Certain fragments
1880	1900												7						50			2				1886-1926: variably brkn-gg			more abundant in specific zones, incomplete mixing. Occas. up to 10% diss py in
	1920												6						50			2							matrix. Pervasive alt/min throughout. Fragments sharply defined
	1940			1940-1950	94		98	32		0.20			6						50			tr							1908: FLOW LAYERED PORPHYRITIC LAPILLI TUFF: grayish, 5-15% anhed 1/8" feld pheno,
	1960												6						50			tr				1946-2000: brkn, no gg			flow layering erratic-vague @ 5-20°, clasts small, vague por or flow band volc, tr mb.
	1980												5						50			tr							2000-2040: Tuff breccia zone with clasts dominantly brownish fine gr rhyolite?
1980	2000			1990-2000	116	1	97	29	.001	0.21			4						40	tr		tr							Sericitic alteration weakens around 1980 ft w. spotty f gr diss chlor generally
	2020												3	tr					40	tr	tr	tr							present. Calcite largely confined to joints and rare small pumice(?) clasts. Color
	2040			2040-2050	117		91	31		0.11			3	tr					40	tr	tr	tr							becomes gray-purplish w. white pheno and minor mottling due to bleached spots assoc.
	2060												3						50		1	tr				2053-2059: brkn-gg			w. pyrite; 2 fl. reddish, f.gr arkosic clast @ 2146
	2080										tr	tr	4	tr		tr			50		1	tr					1:70°		2073: 1" qtz-gn-py-sl-chlor-ser-hem vein
2080	2100			2090-2100	125	5	202	389	.001	0.15			4						40		1	tr				2082-2091: brkn			Calcite only logged where occurs as alteration product or vein in non-carbonate rocks
	2120												4						40		1	tr							
	2140			2140-2150	100		73	102		0.12			4	tr					30		1	tr							2130: erratic broken zones, rock perhaps more brittle where sericite alteration weaker
	2160												4						30		1	tr							
	2180			2190-2200	148	2	70	108	tr	0.13			3						30		1	tr							
2180	2200												3						40		1	tr				2206-2232: brkn-gg			2206-2232: Strongly broken, locally gougy fault zone, cavity 2206-2210
	2220												3			tr			30		1	tr							2215: FLOW BANDED RHYOLITE: alternating 1/8-1/2 gray-brown and cream colored flow layers
	2240			2240-2250	125		97	63		0.06			3						30		tr	1				2232-2239: sh gg-bx			@ 40-70°, bottomed by strong 7 ft fault zone.
	2260												3						30		2	1							2239: SPHERULITIC-PORPHYRITIC LATITE: variably colored purplish-white due to alteration.
	2280												4						40	tr	tr	tr				2286-2288: brkn			Texture variable also due to alteration. Spherulitic texture erratic throughout, spotty
2280	2300			2290-2300	159	2	84	41	tr	0.04			4						50		tr	1							layering 2260-2270 due to flattened pumice @ 10°, minor tuff bx; clasts mostly absent
	2320												4						50		2	1							Texture obscured by pervasive sericite-pyrite. Basal contact @ 75°. Diss/vn. calcite
	2340			2340-2350	130		75	61		0.06			3						30		1	1							2333: INTRUSIVE RHYOLITE: gray; flow layering 75-90°, rare tiny white pheno(?), layers <1/16"
	2360												4						40			1							2341: FELDSPATHIC PORPHYRITIC FLOW: 20-50% diffuse, white, anhedral, blocky-elongate
	2380												3						30			1							feldspar or pumice mostly less than 1/8" in gray matrix. Unclear if tuffaceous/devitrified
2380	2400			2390-2400	139	1	67	54	tr	0.08			5						20		tr	1							matrix. Texture obscured by alteration. Virtually no foreign clasts. Wk layering 10-20°
	2420												5						30		tr	1							2372-2380: spherulitic zone?
	2440			2440-2450	165		88	176		0.09			4						30		tr				tr				2380: QUARTZ LATITE: f.g., weak flow text, siliceous, vague wk circular agg. of diss py
	2460												4						30		tr					2448-2461: brkn			2430: SPHERULITIC RHYOLITE TUFF: light-gy to white, strongly spher. text weakens w. depth;
	2480												4						30		1								below 2450 ft. wk flow layer @ 20-40° parallel to wk flattened pumice
2480	2500			2490-2500	186	2	87	109	tr	0.11			3						20		1								
	2520												3						20		1	tr				2501-2505: brkn-gg			2505: LATITE PORPHYRY BRECCIA: generally dark colored w. light flow banded clasts to 12"
	2540			2540-2550	85		174	153		0.31			3						20		1	1							set in darker matrix, clasts of mixed lithology, breccia-lapilli tuff zones mixed w.
	2560												3						20		1	1				2540-2555: brkn-gg			dark gray porphyritic flow to breccia w. 1/16" feld. pheno in dark matrix. Unit variable

GEOLOGIC LOG

PROJECT _____

PROJECT THUNDER MTN — HOLE NO. TM-13
Collar elev. 5175 ft — Final depth 4777 ft
Coord N. _____ — Coord E. _____
Inclination vertical — Page 4 of 6
Logged by F.T.G.
Date start See note p.6 — Date finish _____

DEPTH from	DEPTH to	% CORE RECOVERY	ASSAY PPM Cu	PPM Mo	PPM Pb	PPM Zn	OZ Au	OZ Ag	ORE MINERALS: galena	fine gr. gray sulfide	sphalerite	chalcopyrite	GANGUE MINERALS: Pyrite-diss	Pyrite-vein	Hematite	Quartz-diss	Quartz-vein	Clay	Sericite	Epidote	Chlorite	Albite %	Calcite	Serpentine	Garnet	Tourmaline	STRUCTURE: Sulfide Veins	Breccia	Faults	ROCK TYPE AND REMARKS
2560	2580												3						20		tr		tr							but characterized by dense, siliceous aspect, variable breccia-porphyry to 2630 then
2580	2600		2590-2600	174	2	314	827	tr.	0.18				3						20		tr		tr							dk gy por. with variable alteration bleaching and flow banding 10-30° Pervasive
	2620												3			tr			20		tr		2							weak, diss. py-bleaching throughout
	2640		2630-2640	275	2	311	1370	.002	0.27		tr	tr	tr	3	tr		tr		20		tr		tr				8:40-60°			2635: 1/8" cpy-sl-hem veins common w grayish envelopes in overall
	2660		2640-2650	456		725	27% >2000		0.12		tr	1	tr	3	tr		tr		20		1		tr				12:40-60°			greenish alteration. Traces galena. Veins mostly 40-60° Chlor-py-
	2680											tr	1	4	tr		tr		30		tr		tr				4:40-60°			ser. veins mostly 60°-V.
2680	2700		2690-2700	457	2	494	1863	tr.	0.16	tr		tr	1	5	tr		tr		40		tr						8:40-60°	2688: 1' @ 50°		2688: zone of white flow banded clasts in a matrix of flow-banded and
	2720									tr		tr	tr	5	tr		tr		40		tr						4:40-60°			porphyritic rock which grades into variably porphyritic-flow banded rock
	2740		2740-2750	559		570	925		0.11	tr		tr	tr	4	tr		tr		30		1						4:40-70°			above, variably pinkish, dk-lt gy, cream, white reflects bleach due to alteration
	2760									tr		tr	tr	4	tr		tr		30		1						6:40-70°			Breccia-lapilli tuff zones mostly absent below 2700 ft. Local intricate, intense
	2780									tr		tr	tr	4	tr		tr		30		1						6:40-70			flow banding mostly 10-30°
2780	2800		2790-2800	369	1	343	514	tr.	0.09	tr				3	tr		tr		30		1						2:80°			
	2820									tr		tr		4	tr				20		1						2:80°			
	2840		2840-2850	188		85	62		0.37					4	tr				30		1		tr					2839-2843: brkn		Calcite mostly on veins.
	2860											tr	tr	3					20		1		tr							
	2880													3	tr				30	tr	1	tr	tr				1:80°			2880: Minor py-epid veins w. pink (kspar?, albite?) envelope outside
2880	2900		2890-2900	408	1	156	205	tr	0.23			tr	tr	4	tr				20	tr	1	tr	tr				7:40-70			sericite envelope
	2920													3	tr				20		1	tr	tr				4:40-70			2900: FLOW BANDED LATITE PORPHYRY: similar to above, dense, siliceous
	2940		2940-2950	214		193	271		0.13					2	tr		tr		10		1		tr							(alt vs magmatic unclear), med-light gray-brown mottled by zones of
	2960										tr		tr	2	tr				10		1	1	tr				1:30	2960.6' @ 70°		bleaching and other alteration, flow banding marked by 1/16-1/8 wavy alternating
	2980										tr			2	tr		tr		10		1	2					1:20			darker/lighter layers - not everywhere well developed - varies 10-45° dip, 10%
2980	3000		2990-3000	210	1	141	175	.001	0.13		tr			2					10	1	2	3								small whitish subhed feld pheno. Chlorite on joints w. diss py and in feld pheno
	3020													3					10	2	2	4								Albite is flesh alt in small pods and as outer margin of bleach envelop. on py vein
	3040		3040-3050	212		83	73		0.09		tr			2					5	1	1	1	tr							Epid diss and in veins. Tr. cal. in thin veins. Subs. +chlor. often confined/distrib
	3060									?	tr			3					5	1	1	1	tr							along flow layers. Cpy confined to thin py vns all < 1/8"
	3080											tr		2					5		1		tr				1:20			
3080	3100		3090-3100	197	3	80	59	.002	0.18					2			5		5	tr	1	5	tr							3098-3132: variable strong bleaching, possible fragments of more mafic? rock
	3120													2			5		10	tr	1	5	tr	?				3129-3135: brkn		in variably siliceous, more porphyritic and less flow banded rock
	3140		3140-3150	202		203	118		0.22					2					10	tr	1	1	tr							3132: TRACHYANDESITE POR: rock type uncertain, local wk. flow band in alt rock locally
	3160													3					10	tr	2		tr							dark gy w 20% subhed wht feld pheno. Spotty inclusions of lot por
	3180													3				2	10	1	2	1			?			3167-3172: brkn		3168-3191: trachy bx w incl of feldspathic rock in flow band trachy and irreg
3180	3200		3190-3200	367	1	234	247	.003	0.31					2					20	1	1	1								qtz pods, alt stronger in trachy
	3220												tr	2					20		1		1							3191-3243: pob trachy por. w up to 40% small wht feld pheno in dk. matrix
	3240		3240-3250	318		192	349		0.33			tr		2			tr		25		1		1					3233-3239: alt ftr @ 80°		locally flow banded, locally variable textures
	3260											1	1	2	1			20	20	tr	tr						2:20°			3243: MIXED QTZT-FELDSPATHIC VOLC: may be zones of siliceous alt. Several py-cpy vns, qu-sl stwk
	3280											tr		2				20	10		tr		tr							1/2" py-cpy vn @ 20° @ 3258'
3280	3300		3290-3300	230	1	150	213	tr.	0.23			tr		3				20	10		tr		tr	?						3261: SILICEOUS PORPHYRITIC VOLCANIC ROCK: vague small wht. feld pheno in lt gy very fine gr
	3320											tr		3				20	10		1	?	tr	?						siliceous rock - could represent pervasive silicification; spotty less siliceous mottled
	3340		3340-3350	167		81	54		0.16			tr		3				20	10		1		tr	?						zones. Spotty (<1%) greasy green spots might be serpentine.
BX → 3261	3360											tr		3				10	10		1		tr	?						3367: could be rock type change or reduced silicification
	3380											tr		3					10		3	1	tr	?						Although textures variable, probably same rock type. Bleaching is pervasive,
3380	3400		3390-3400	163	4	79	63	.001	0.23			tr		3				5	10		2	3	tr	?						silicification variable - both types of alteration obscure rock textures.
	3420											tr		3				10	15		1		tr	?						

mr. 2555 cr.

(2)

GEOLOGIC LOG

PROJECT: TRENCH — HOLE NO. TCH-1
Collar elev. ____ Final depth: 5560
Coord N. ____ Inclination ____
Coord E. ____ Page 2 of 9
Logged by: F.R. KOUTZ
Date start ____ Date fin. ____

MINERALIZATION AND STRUCTURE

From	To	Ft	%	TS	Comment or Assay Interval	Cu ppm	Pb ppm	Zn ppm	Au oz/T	Ag oz/T	Mo ppm	Chalcopyr. / Covellite / Galena / Sphalerite	Grey S= or SS	Pyrite-Dissem. / Pyrite-Vein	Limonite / Hematite / Specularite / Magnetite	Biotite / K-feldspar / Qtz-Dissem. / Qtz-Vein / Clay / Sericite / Chlorite / Epidote / Calcite / Gypsum / % Vugs	% Bx Mat	Fx/Foot	Dip: Flow Banding	Sulfide Vn. #/Ft	Width: mm S-vn + alt selv. / Width dissem S=	Faults / Crushing / Shearing	Remarks
860	880	20	100									— — — T-	.6	5 ½	T- T- — —	— 5 1 10 15 4 2 T — T	T	2	30?	2: 60	½/1-3 ½mm dissem.	slick on chl in Fx	← hem rich MAT
880	900	↑	↑		890-900	152	197	580	T	0.03	9	— — — T-	.3	5 1	T- T — —	T 8 2 8 20 5 1 — — T	80	2	40?	3: 60-80 vfg	½ dissem / dissem	clay on Fx	913-915: QTZ-py-sl ± gn ± Rhod. vn @ 20-40° -20% S= : pyr to 1cm. 911-913 - gg + Broken
	920				-910-920	1175	0.61%	0.47%	—	0.63	7	— T .1 .5	.5	6 5	T- T- — —	2 10 8 10 20 2 T+ — — 2	70	5	35	2: 20-30 +70	most ½/1-3	mod loc. cr + SiO2	927-931 (1-5% sl > py > gn : vnlt stringer veins):
	940			TS 945	-920-931 -931-940	1420 641	1.04% 0.51%	1.01% 0.33%	0.010 —	1.00 0.75	6 5	— T- .2 1.0	1.0	6 2	T- T- — —	5 10 5 15 25 T — — — ¼	20	5	40	3: 80-90	½-3/stringers	mod loc. CRT	ox + SiO2
	960											T- — T .1	.6	5 ½	— — — —	2 10 1 12 20 T ½? Fg — — ¼	30	3	30?	2: 60-80	½/1-5 perv.	loc. gg to 1cm @ 70°	← most of Rock Q-S-Flooded. - large frags to 10cm.
	980											— — T T+	.5	4 ½	T- — — —	1 10 1 12 20 — T — — ¼	70	2	35	2: 60-80	½/1-3	wk cr.-Bx	← local 1-2' fg sdy-Ashy TUFF.
980	1000				990-1000	80	300	1001	T	0.03	7	— — T- Tr	.5	4 ½	T- — — —	.2 8 1 10 20 3 ¼ — T T	80	4	40	2: 60-80	½/1-5 ½-1mm dissem pyr	wh. clay on Fx	Chl is pre Q-S-py flood
	1020				1013-1018	101	120	231	—	0.15	5	— — T .2	.5	5 ½	T- — — —	2 10 2 18 28 1 T — — T+	30	8	35	3: 20+60	½/1-8	40°	→ 1013-1017 v. str. clay gg + dissem sl+py
	1040											— — T T	.3	4 ½	T- — — —	2 8 1 30 95 T T- — — T	70	10	35	4: 20+60	½/1-5+ perv.		→ 1035-39: massive clay-SER (white) low density; only weakly sheared @ 65°
	1060											— T- T .1	.3	5 ½	— — — —	2 10 2 12 20 — — — — T	60	2	40	1: 30+70	½/perv	1-2mm wh. clay on Fx	
	1080			TS 1071								— — T- T+ Tcc	.3	3½ ½	— — — —	1 8 2 12 20 — — — T+ ¼	80	1	30	1: 30+70	½/perv. ¼-1mm dissem pyr	—	1068-71 + 76-80 vfg sdy tuff. 1071 1" @ 25° stringer vn - Amystine QTZ + fg py + sl.
1080	1100				1090-1100	600	600	500	T	0.04	4	T+ T- T- T Tcc	.3	4 ½	T- — — —	1 8 1 15 20 1 T+ T- T+ T	40	2	40	2: 30+70	½/perv	wh. clay on Fx	
↓																							
1100	1120											T- — — T Tcc	.5	3 1	T- T- — —	½ 6 ½ 10 18 2 ½ — — T	80	8	30?	4: 30+60 F0	¼-1/1-perv	wk-mod crush	→ 1106-09 STR. CR @ 30° ; Max Frag Size = 1cm
	1140											T — — T —	.7	3 2	T — — —	T 10 2 8(str.) 15 2 ½ — — T	40	3	40	6: ALL & +60	¼-1/½-perv ½-1 grains	mod crush	← stringer vnlts Around cr. frags.
	1160			TS 1151								T- — — T- —	.4	2½ ½	T+ — — —	4 10 3 6 13 1 T+ — — T+	20	2	?	2: ALL ¼	½/1-4	wk cr. 30-49	
	1180											T- T- — T- —	.5	2 ½	¼ — — —	5 6 2 12(gr) 18 2 T- — — T	10	5	40	2: ALL ¼	½/perv	loc. wk cr. @ 60°	
1180	1200			1195 TS	1190-1200	100	800	800	T	0.04	3	— — — — —	.2	2 ¼	T 1 — —	? 3 T 10 20 T — — T T-	95	3	50	1: 70°	½/— ½-1 grains	wh. clay on Fx	
	1220											T- T T .1 —	.5	1½ T	— 15 — —	— 10 3 12 20 — — — T+ T+	98	4	?	1: ALL ¼	½/—	wh. clay on Fx	1208-1212: purple jasp Bx + Q. vn.
	1240				1222-31 1231-40	74 65	166 36	220 63	0.02 0.15	.003 .005	6 9	T — T? .2?	.8	3 ½	T — — —	— 50 5 20(wh.) 15 — — — T? 6	15	20	—	3: ALL ¼	½/perv.	white clay in vugs	1222-1248 jasp Bx
	1260											T- — — T	.5	3 ¼	T- T- — —	— 70 2 10 10 2 T- — — 2	5	1 to 10	—	3: ALL ¼	½/perv ¼mm grain	wk-str loc crush	
	1280				1270-1280	916	166	1430	0.027	0.37	10	T- T- T- .2	.8	4 1	T- — — —	— 75 5 10 5 T — — — 2	4	8	—	5: ALL & Around Frags	½-1 perv	loc str. crush	
1280 (1294 sample clay)	1300				1290-1300	200	500	400	T	0.04	3	— — — T	.4	3½ ½	T- — — —	— 70 3 8(wh) 15 T — — — 1	40	3	—	2: ALL & surround frags	1/2-2	wh. clay in Fx	
(1320' Bit torn up)	1320											— — — T	.8	3 1	T- — — —	T? 30 1 6 20 ¼ — — — ¼	20	3	20?	2: ALL & 50-70	½-1/perv	loc. v. late crush @ 60	1-4"
(sample spherulites?)	1340			TS 1345								— — — T-	.7	3½ 2	T — — —	Host Rx frags → 3? 35 2 12 23 ½ — — — ½	10	1	?	3: ALL & 50-80°	½-3/perv.	wh. clay in MAT.	
	1360											— — — —	.5	4 1	T- — — —	— 20 1 15 20 T — — — 1	10	½-10	?	2: 60-90	½-1/perv.	wh. clay + SiO2 in Fx	QTZite mostly 1350-68
	1380											— — — T-	.5	4 1	— — — —	— 15 3 12 18 — — — — T	1	½	15	4: 10-20 60-70	½/1-4 +perv.	—	fiame grade into Q-S-(py) VN
1380	1400				1390-1400	100	400	300	T	0.08	2	— — — — Tcc?	.7	4 ½	¼ ← in Fs sites	— 5 2 15(most) 15 1 — — — T-	—	1	30-80	2: 20-30 60-80	½/1-40 = Q-S ½-1 py grains	—	
	1420			T.S. [illegible] 1413								— — — —	.5	3 ½	¼ — — —	Host Rx → 2 8 2 17 15 3 — — — T	95	2	40?	3: 20-30 70-80	½/1-50: Q-S	wh. clay on Fx	.8-2cm QTZ VN @ 50° 1413
	1440			TS 1433								T- — — —	.2	2½ ½	⅛ in MAT T- T+	→ 15 6 2 10 12 5 ¼ — — T-	98	1	35	2: 20-40 70	½/1-10 Q-S	tan clay on Fx	← Epid + MGT! + Kfs + chl.
	1460											— — — —	.2	3 ¼	¼ — T- T-	15 7 2 8 10 5 T+ — — T-	97	2	10	1: 20-40 80	½/1-10 Q-S ½-1 pyr	tan clay on Fx	← T MnCO3? in Fs 1-3mm w/chl-pyr.
	1480											T — — —	.5	3½ ½	⅛ T- — T-	3 7 3 10(most) 15 1 — — — T-	98	2	20	5: 10-40 +60-80	½/1-5 Q-S ½	—	
1480	1500				1490-1500	401	81	332	T	0.01	32	.1 — — T-	.2	2 ¼	⅛ — — T+	T but 10 6 4 7 15 5 T — — T-	98	3	?	8: ALL &	½/1-8 Q-S ½ pyr.	str crush 1487-88	yellow clay on Fx : DK green chl try Repl. Biot-MGT
	1520											T+ — — T-	.2	2 ½	T+ — T- T+	.5 15 6 5 6 12 7 T .3 pink — T-	99	1	25	5: 10-20 60-80	½/1-5 Q-S	wk ... 1502-04	Dissem. pink stained xtals : Rhodoch?
	1540			TS 1531								T — — —	.3	1½ ¼	⅛ T — .3	.3 15 5 2 6 10 8 T+ .3 pink — T-	97	1	20	2: 10-20 70-80	½/1-3 Q-S ¼ pyr.	yellow clay on Fx	
	1560			TS 1543	1550-1560	99	104	390	—	0.19	8	T — — —	.3	3 ½	T — — T	— 5 10 1 12 10 6 3 1.0 pink — T-	50	1	25?	5: 10-40 60-80	½/1-3 Q-S	3" gg @ 40° 1567	
	1580				1560-70 1570-80 1580-1590	230 317 243	144 2200 1890	580 610 410	— — —	0.20 0.21 0.15	3 9 9	.2 T+ .1 .2	.5	3½ ½	F — — —	T 2 10 3 12 12 8 2 .3 pink — T-	60	1	40	4: 10-50 80	½/1-2 Q-S	chl on Fx	
1580	1600			TS 1598	1590-1600	343	0.27%	547	0.001	0.21	25	.2 T+ .3 .2	.8	4 1	— — — —	— 5 12 4 8(green) 15 10 1 1.0 pink — ½	40	2	40	8: 70-80	½-1/1-6 Q-S	pyr tcbl on Fx	
1600	1620	20	100		1600-1620	102	1660	0.29%	—	0.20	5	.2 T+ .1 .2	.6	4 ½	— — — T-	.3 4 10 4 7 15 10 1 2 — ½	70	1	50	3: 60-80	½/1-3 Q-S ¼ pyr	sh in calc vn	½-1" calc. vn @ 80-90° 1609-11 (+chl)

T pink (calcite); 80° ← strong flow (volc)

ROCK TYPE AND REMARKS

⇒ 900-1046: Strong clay + Q-S-py has destroyed much of texture of Hos Rhyol. Bx (the amount of recryst. QTZ + SER. to clay maybe more than logged here). Most of pyrite to 1108 (+Beyond) is v.fg. + weakly crushed + looks grey: most of grey S= is f.g. pyr. Note more Cu as cpy below about 1100. Overall text. of Hos Rhyol Bx (welded TUFF Bx) has not varied much to 1108 - just amount of clay + SER.

⇒ There is a surprising amount of f.g. sl + gn in the core!

Some of material logged as chl-epid. maybe DK green montmorillon or FeSO4 after pyr - all is vfg.

1108-43: welded lapilli tuff: maybe would be tuff agglom. @ Hos. No "Ribbon" frags + frags small + str. chl is not overprinted by Q-S-P. Dirty m. grey w/ green mont + chl.

⇒ 1143-1180: f.g. tuff w/ local intraml Bx - few exotic frags: ϕ 1-3mm. : Strong Q-S ! weak weld.

⇒ 1180-1222 → Volc. SS, grains ~ ½-1mm, v. ¼'ed floating in clay-SER MAT., local ¼'ed frags to 1cm, some frags jaspeoid, / local clay + SiO2 vns., local jaspeoid Bx. All locally oxid to hem. in MATRIX. Rx is v. porous. 1222-1248 jasp Bx - Lt gy → wk purple, white clay-SER in & vugs (old Bx frags?) - some of white "clay" is v. hard + may be ALUNITE ←

⇒ 1246-1290 - Hi jasp. continues w/ fewer vugs + some relict gy jasp. Bx : SiO2 still high. Below 1290 but relict text. usual visible - Above 1290 much of Bx text. destroyed.

⇒ 1290-1368: f.g. Bx - Ashy TUFF - some sandy zones to 8': Much of Bx has low MAT % + sub-¼ to sub-round frags 1-20mm. loc. spherulites(?) in MAT: pie section - cog-wheel Fs or alunite ?? minor local 1-2 zones w/ Eutax. struct.; v. few exotic frags

⇒ 1368 → welded tuff - only a few local Bx frags : A few frags are actually interveinlet (Q-S) blocks. Q-S dies w/ depth below ~1420. Was a x'tal welded tuff : 10-20% 1-3mm Fs in MATRIX, Q-S gives way to Lt. yellow tan mont in Fs (in interveinlet blocks) to "fresh" welded tuff w/ rel. Eutaxitic text. still visible - w/ chl. after MAFICS + Tr epid + MGT ← to 1543

⇒ 1543-1603: Breccia (Volc) with purple QTZite + DK purple Rhyol? Frags. Frags 0.1-2cm in Lt purple (Lavender) MATRIX vFg.; welded Frags - A few m-xg granitic's. Tr Biot now mostly Chl + Pyr which fills Fx + etch fragments. Some Pheno + rims of bright pink rhombohedral min - prob. MnCO3 but no fizz. Local dissem + stringer vnlts of cpy + sl + gn with pyrite. 1603-1632: Gradational into next unit with Lt. Lavender grey flooded patches - locally around chloritized fragments (Lavender flooding prob f.g. silica - but not logged as such) if so MAT = SiO2

GEOLOGIC LOG

PROJECT _____

PROJECT THUNDER MTN — HOLE NO. TM-13
Collar elev. 5175 ft — Final depth 4777 ft
Coord N. ____ — Coord E. ____
Inclination vertical — Page 5 of 6
Logged by F. T. G
Date start See note p.6 — Date finish ____

ASSAY NOTES:
1) All Au-Ag by fire assay
2) Cu-Mo-Pb-Zn by geochem techniques except where values written in % analysis by standard assay

DEPTH from	DEPTH to	int'vl	% CORE RECOV	ASSAY - see notes above	ppm Cu	ppm Mo	ppm Pb	ppm Zn	oz Au	oz Ag	ORE: galena	ORE: fine grained gray sulfide	ORE: sphalerite	ORE: chalcopyrite	GANGUE MINERALS: Pyrite - diss	Pyrite - vein	Hematite	Quartz - diss	Quartz - vein	Clay	Sericite	Epidote	Chlorite	Albite	Calcite	Serpentine	Garnet	Tourmaline	Fluorite?	Silicates	STRUCTURE: Sulfide Veins	Breccia	Faults	ROCK TYPE and REMARKS
3420	3440	20		3440-3450	156		66	41		0.24		tr			2			5		10		1		tr	tr								3423-3456' brkn	
	3460											tr			2			5		10		1		tr	tr									Serpentine possibly montmorillonite ? Occurs in greasy green clots up to 1/4"
	3480											tr			2			5		10		1		tr	tr									long. Not obviously pseudomorphous after a specific igneous texture
3480	3500			3490-3500	160	3	78	42	.001	0.26		tr			2			5	2	10		1		tr	tr									
	3520											tr			2			15		10		1			tr									Qtz vn zones actually vuggy veins
	3540			3540-3550	110		61	48		0.15		tr			2			20		10					tr									
	3560											tr			2			20	1	10					tr									
	3580											tr			2			10		10					tr									
3580	3600			3590-3600	86	3	74	86	.002	0.26		tr			2			10		20					z									
	3620											tr			2			5		20					3									Basal part of volcanic section marked by several softer zones - originally more
	3640			3640-3650	91		127	130		0.21		tr			2			10		10					1									clay rich ? which could be silty beds Serp/mont. stops at 3678 ft
	3660										1	tr			2			15		10					1									
	3680										tr	tr			2			?		5					1									3678: QUARTZITE: could be silicified arkose or volcanic. Monotonous light gray with
3680	3700			3690-3700	122	4	147	120	tr	0.18	1	tr	tr		2			10		5														wispy white features - often vein-like but very thin. Appears to be very fine grained
	3720										1		1		2			10		2	5													galena - sphalerite dissem throughout. Spotty greenish areas clay ? Assume
	3740			3740-3750	289		.26%	2.05%		0.14	1		1		2			10		2	5											3721-3746': broken	rock is sediment, but I have also logged some silicification
	3760		3741-43 = 50%								4		4		6			10		5	10													3741-3744 10-70% pyrite-galena-sphalerite in gougy fault? in qtzite
	3780										1		1		2			5		2	10													3755-3756: massive pyrite-sphalerite-galena, assoc silicif very fine gr, sharp
3780	3800		3787-3800 =40%	3790-3800	209	84	.42%	.41%	tr	0.14	tr		tr		4			10			10				1		tr					3782-3801: brk-gy	contacts, suls-silica
	3820										tr		tr		2			30							2		tr							3782-3801: irreg dk grn, clay rich zone - siltstone bed?
	3840			3840-3850	116		516	864		0.12	tr		tr		2			70	tr						7									3801: DOLOMITIC? LMS: irreg. pale buff-lt gray, possib. some siltstone component, grades from 5-10%
	3860										tr		tr		2			30	1					30	3			tr				3852-3861 brkn	calcite to marbelized lms pods so likely strong silicification also Bedding @ 30° Less
	3880		3880-3890 =40%								1	tr	tr		1			20	1					40	5							3869-3900: brkn-gy	silicif zones of mb. gen. contain 5-10% streaks/irreg pods serpentine. Zones of crushed-bx
3880	3900		3890-3896 = 60%	3890-3900	94	46	.42%	.31%	tr	0.09	1	1	tr		2			40	2					30	15									serp. show increased gn-sl-py-gray f.g. sul. Suls either diss or in bx matrix
	3920			3919-3925	250	75	.24%	.26%	.002	.26	1		1		2			5	3					50	30									3896-3919: gy lms. cut by wht cal vns, brecciated, then healed by pervas. serpentine?
	3940			3925-3931	550	36	1720	.25%	.001	.22	2		2		2			20	1		25			25	10									3919-3931: Intrusive breccia: frags. por and sed rock ang + round in siliceous-gritty
	3960			3962-72	434	52	1160	1020	.006	.53	tr		tr		1			50		?				20	20									matrix, suls mostly dissem in matrix, spotty dk gy qtz in former vugs, intense
	3980			3972-77 3977-79	680 2.56%	79 2	.24% 8.65%	.48% 1.60%	.007 .016	.57 3.56	5	2	5	1	3			20	10	25				20	2									silicif of upper + lower contacts for 1-2 ft., overall 6% diss py-gn-sl
3980	4000			3990-4000	.32%	34	832	.79%	tr	.06	tr		tr		1			10						60	20							3985-01: gougy ft	Dense f.g. silicif. 3940-43, 3950-52, gen. weakly bx-vuggy, very low suls
	4020										tr		tr		1			10						60	20							4009-26: brkn-gy	Brecciated-healed serp ends at 3953. Silicif. could be chert or hydrother qtz.
	4040			4040-4050	10		111	305		0.02	tr		tr		1			2		tr	5			85	5									3962-3981: Intrusive breccia: light colored rounded clasts in darker gy f.gr. gritty-clayey
	4060												tr		tr			5		tr				90										matrix, variable sulfides; 3977-3979 several pods massive py-gn-sl-minor
	4080												tr		tr					tr				95										cpy. Bx unsilicif, % matrix varies widely
4080	4100			4090-4100	10	10	108	176	tr	0.02					tr			tr		1				95									3981-4027: Brecciated-healed serpentinized lms, later strongly faulted-gougy; rare
	4120														2			10		1				80	5	?							thin black gritty, flow banded zones may be fluidized grit
	4140			4140-4150	9		94	25		0.11					tr					tr				95									4027: MARBLE: white, med gr; rare thin clay partings and chert. Irreg. med-dk gy cut by wht mb.
	4160														tr					tr				95					tr				Spotty wk vuggy zones w. cal crystals. Overall texture somewhat poros - incipient sanding - in
	4180														tr					tr				95	1								both white and gray zones, no unrexl lms remains. Intrus. bx 4055-56', 4070-71, 4074-76'
4180	4200			4190-4200	40	8	118	82	.001	0.14					1			5						80	5	?			?				St. sanding 4172-75' Spotty pale brn clay (talc-serp?) vns to 1/4", 4245 bed dips 45°
	4220														tr					2				80									4180-4203: Poros dk gy marble w spotty serp-qtz-py and local 3" vugs w. cgr calcite
	4240			4240-4250	9		103	11		0.07					tr									80	2								4217-20, 4234-41: quartzite beds; contacts partly grad
	4260														tr									80	4				5				4258-79: brownish zone, abund fibrous mineral, grades downward into irreg sanded
	4280														2					5				60	5	tr			15				mb, with mixed zones banded brn serp?, yellow gar (minor), bed dip 25-35°

mn 2555 cm

③

GEOLOGIC LOG

PROJECT: TRENCH
HOLE NO.: TCH-1
Page 3 of 9
Logged by: F.R. KOUTZ

From	To	Length	Rec.	Comment on Assay Interval	Interval	Cu ppm	Pb ppm	Zn ppm	Au oz/T	Ag oz/T	Mo ppm
1620	1640	20	100								
	1660	↑	↑								
	1680				1680-1690	449	1250	780	—	0.15	8
1680	1700				1690-1700	168	0.21%	0.38%	T	0.06	11
	1720				1700-1710	110	1410	0.24%	—	0.16	
	1740										
	1760										
	1780										
1780	1800				1790-1800	80	178	274	T	0.03	17
	1820										
	1840										
	1860				1860-1870	87	1260	450	—	0.14	
	1880				1870-1880	154	690	149	—	0.16	
1880	1900			TS 1881	1890-1900	53	212	432	T	0.03	23
	1920										
	1940										
	1960										
	1980			TS 1972	1980-1990	197	318	670	—	0.15	7
1980	2000				1990-2000	96	685	860	T	0.07	11
	2020										
	2040										
	2060			TS 2051							
	2080				2050-2090	68	42	240	.004	0.06	9
2080	2100				2090-2100	444	72	366	T	0.03	19
	2120										
	2140										
	2160										
	2180				2180-82						
2180	2200				2190-2200	65	158	216	T	0.05	20
	2220										
	2240			TS 2230							
	2260										
	2280										
2280	2300				2290-2300	68	44	77	T	0.03	20
	2320			2304 TS							
	2340										
	2360										
	2380										
2380	2400				2390-2400	75	107	99	T	0.04	24
	2420										
	2440										
	2460	↓	V								
2460	2480	20	100								

MINERALOGY AND STRUCTURE

To	Chalcopyr.	Covellite	Galena	Sphalerite	Greys =	Pyrite-Diss.	Pyrite-Vn	Limonite	Hematite	Specularite	Magnetite	Rhodochrosite
1640	T	—	T	T+	.5	2	½	T-	—	—	—	T-
1660	T+	—	—	.1	.8	7	1	—	(HM)	—	—	—
1680	T	—	T	.1	.8	5	1	—	—	—	T+	T-
1700	T	T-	.3	.5 T cc?	1.0	3	½	—	—	T-?	—	T-
1720	T-	—	T+	.2 T+ cc	.8	2	½	—	—	—	—	—
1740	—	—	T-	T	.5	2	½	—	—	—	—	T-
1760	T-	—	T+	T+	.3	3½	½	—	T+	—	—	—
1780	T-	—	T-	T	.3	2	½	—	—	—	—	—
1800	—	—	T-	T	.2	2	¼	—	—	—	—	—
1820	—	—	—	T-	.3	2	½	—	—	—	—	—
1840	T+	—	T	T+	.2	2	½	—	—	—	—	—
1860	—	—	—	—	.2	½	½	—	—	—	T	—
1880	T+	—	.1	.2	.5	3	½	—	T-	—	—	—
1900	T-	—	T+	.1	.5	2	½	—	T-	—	T	T-
1920	.1	—	T-	.1	.7	2	½	—	T-	—	—	—
1940	T	—	T-	.1	.5	2	½	—	—	—	T-	T-
1960	—	—	T-	T	.3	2½	1	—	—	—	—	—
1980	—	—	—	T	.3	2	1	—	—	—	T-	—
2000	T	—	T+	.1	.3	2	1	—	2	—	—	T-
2020	—	—	T+	.1	.3	2	1½	—	—	—	—	—
2040	T-	—	—	T-	.2	1½	1	T-	—	—	—	—
2060	T-	—	—	—	.2	1	½	—	T-	—	—	3? pink Kfs
2080	T-	—	—	—	.2	2	1	—	T-	—	—	1?
2100	.1	—	—	T-	.1	1½	1	T-	—	—	T-	? pink Fs
2120	T+	—	—	—	.1	½	1	—	—	—	¼	— pink Fs
2140	T-	—	—	—	.2	1	1	—	—	—	¼	— pink Fs
2160	—	—	—	—	.2	1½	1	—	—	—	T-	—
2180	—	—	—	—	.3	1	1	—	T-	—	T-	—
2200	.1	—	—	.2	.3	2	8	—	—	—	—	—
2220	T-	—	—	T-	.2	1	½	—	—	—	—	—
2240	—	—	—	—	—	1	½	—	—	—	T+	—
2260	—	—	—	—	—	1	½	—	—	—	T	—
2280	—	—	—	—	.2	2	1	—	—	—	T	—
2300	—	—	—	—	.1	2	1	—	T-	—	¼	—
2320	T+	—	—	—	.1	2	1	—	—	—	½	—
2340	T	—	—	T-	.2	2	1	—	—	—	½	— ? pink Fs
2360	T+	—	—	—	.3	2	2	—	T	—	—	—
2380	.1	—	—	T-	.2	2	1	—	½	—	T	? pink Fs
2400	T-	—	—	—	.1	1½	½	—	—	—	T+	— pink Fs
2420	—	—	—	—	—	1	½	—	—	—	—	—
2440	—	—	—	—	.2	1	½	T-	T-	—	—	—
2460	T	—	—	—	.1	1½	½	—	—	—	T-	—
2480	T-	—	—	—	.2	1	½	—	—	—	—	—

To	Biotite	K-Feldspar	Qtz-Dissem.	Qtz-Vein	Clay	Sericite	Chlorite	Epidote	Calcite	Gypsum
1640	—	T	10	1	5 (wh)	12	12	T	2	?
1660	—	3	12	T	8 (1 vn)	10	15	T	3	—
1680	—	5	8	2	15 (gr)	10	25	5	4	?
1700	—	2	7	2	13	12	8	1	3	—
1720	—	T	6	1	15 (gr)	10	15	—	5	—
1740	—	—	8	1	8	12	10	T	15	T+
1760	?	—	6	1	10	12	15	—	20	½
1780	—	—	6	1	8	12	8	—	12	½
1800	—	—	5	1	15	18	4	—	4	1?
1820	—	T-	5	1	12	18	7	—	2	T
1840	—	2	7	2	10	30	2	—	T+	—
1860	—	4	5	½	7	20	3	T	T-	—
1880	—	5	15	2	6	18	2	—	—	—
1900	T?	10	12	4	3	12	4	½	—	—
1920	—	8	15	3	3	15	2	T	—	—
1940	?	4	15	3	4	12	4	T	—	—
1960	—	2	8	2	6 (gr)	15	6	2	—	—
1980	—	8	8	1	4 gr	12	6	5	—	—
2000	—	3	15	2	3	8	8	2	—	—
2020	—	2	10	4	4	18	3	T+	—	—
2040	?	5	10	5	2	12	5	½	—	—
2060	—	8	8	2	1	10	4	½	—	—
2080	—	8	7	3	1	12	6	T	—	—
2100	—	12	7	2	1	10	6	1	—	—
2120	?	10	6	1	1	8	8	2	T-	—
2140	—	8	5	1	½	10	7	3	T Fx	—
2160	—	7	4	3	1	12	7	2	T-	—
2180	—	7	6	5	½	10	7	1	T-	—
2200	—	3	5	5	1	12	6	1	T-	—
2220	—	2	6	5	½	12	3	¼	T-	—
2240	—	3	6	5	½	9	4	¼	T-	—
2260	—	2	4	4	T+	8	3	¼	T	—
2280	—	3	7	3	1	12	5	1	—	—
2300	—	½	3	1	1	10	5	1½	—	—
2320	—	½	3	½	½	6	4	2	T	—
2340	—	½	3	2	T+	5	2	3	T	—
2360	—	10	5	3	1	8	5	2	—	—
2380	—	8	6	4	2	10	7	2	—	—
2400	—	10	8	3	2	7	4	2	T-	—
2420	—	2	10	2	1	12	3	⅛	—	—
2440	—	5	8	1	5	15	2	T	—	—
2460	—	2	8	1	3	12	3	T	—	—
2480	—	3	10	1	½	10	4	T+	T-	—

To	% Vugs	% Bx Mat	Fx/Foot	Dip-Flow Band	Sulfide Veins # & %	Width mm / S = Vn Alt Selvage / Width Diss	Faults / Crushing / Shearing	Notes
1640	T	20	2	30 70	2: All &	½/1-30-S ½ pyr	1629-8" wh. clay gg	calcite @60, + ¼"@30to50° @1631
1660	¼	80	2	30°	20: All & vfg.	½/1-2 Q-S ½/1	—	+calc in Fx + many areas
1680	T+	20	1	30 60	15: All &	½-1/1-5 mont	—	calc in late Fx
1700	½	30	3	?	3: 50-70	½-4/1-10 Q-S	loc. wh. clay on Fx	2-4mm gn>sl vn @ 60° @1685
1720	1	30	4	—	3: 30-80	½-1/1-5 Q-S	Loc. mod sh. in gr. clay	DK green-clay-chl IN MATRIX
1740	½	25	2	—	2: 40-80	½/1-3 Q-S	cone ts crumby around clasts.	
1760	½	20	2	?	2: All &	½/1-3 Q-S	wk. crush	
1780	¼/	15	4	35	2: 50-70	½/1-3 Q-S	crush 1764-69	
1800	T+	10	3	—	1: 70-80	½/1-3 Q-S	white clay on Fx	
1820	T	15	2	40?	2: 40-70	½-15/1-10 Q-S	wh. clay on Fx	3¼" py,sl,cpy vn @ 50° @1805', 3mm gn, qtz, sl, cpy vn @20° @ 1823
1840	—	95	1	35	1: 20-50	½-8/1-5 Q-S	loc. wk sheens	5mm qtz, sl, py, cpy, gn vn @ 40° @ 1830', 8mm qtz>>cpy>sl>gn vn @40° @1872'
1860	—	98	½	30	1: 20-40	½/1-3 + ½ pyr penv	—	6cm qtz>gn>sl vr @1860 @ 50°
1880	T-	93	1	35	5: All &	½-15/1-5 ½ pyr-diss.	—	12cm qtz>>gn>sl>cpy±MoS_2 vn @35° @1868
1900	T-	95	1	25	4: 10-30 70	½-2/1-20 Q-S+Kfs	—	1886-1891: DK MAT: vitrophyre?
1920	—	90	1	30	5: 10-30 50-70	½-1/1-40 Q-S+Kfs	wk loc. mineraliz Bx	1905-06 ½-2" Q-S-pyr.+cpy DK stringer vns @60°
1940	T-	97	2	35	4: 10-40 50-80	½-1/1-30 Q-S+Kfs	1"gg-cpy-sl py vn 30° ← 1931	1928-31: DK purple MAT - well welded
1960	T-	80	2	25	2: 20-50	½/1-30 Q-S+mont.	—	
1980	—	75	4	?	4: All &	½/1-40 Q+S+Ep+Kfs	V. brittle rock	1984: 5mm. sl+cpy+gn vn @ 85° + stringers
2000	—	86	2	—	4: 30-90	½-5/1-20 Q+S/chl+Kfs	Brittle	1991-2001: f→mg. qtzite: well sorted but volc components: wk hem flooded + pyr + chl.
2020	T+	98	2	20 40	5: 70-80	½-2/1-10 Q-S	wh. clay on Fx	
2040	T-	98	1	20 40	2: 60-70	½-1/1-20 Q-S	chl-mont on Fx	
2060	—	100	1	40	1: 60+ 20-30	½/1-20 Q-S	v. good Eutax. struct.	
2080	—	—	½	35	½: 60-70 20-40	½-1/1-20 Q-S	v. good Eutax.	← Most Fx ⊥ to flow band
2100	—	99	1	40	½: 60-70	½/1-10 Q-S	—	
2120	—	—	½	40	2: 60-70	½/1-3 Q-S	—	Degree of welding increases↓
2140	T-	97	½	35	1: 30-40 +70	½/1-5 Q-S	—	
2160	—	—	½	35	1: 30-40 +60	½/1-6 Q-S+Kfs	—	
2180	—	—	1	35	1: 30-80 +20	½/1-3 Q-S	Hi ∠ Fx ⊥ flow	Incipient Ribbon Rock; Hem-stained Kfs around 1-3mm qtz flame.
2200	—	—	1	40	3: 30-40 +65	½-+/1-20 Q-S	wk sama cru 2" flow?	2181-82: 1' VN w/ 70-90% pyr, tr cpy, sl @60-70°: Bx w/ qtz-chl, @~45° to flow band
2220	—	—	1	30	1: 30-40 +70	½/1-30 Q-S	—	Amount of "Bleaching" (Q-S?) decreases below 2234: Pink + DK purple matrix below
2240	—	—	2	35	2: 20-40 60-70°	½-1/1-30 Q-S	— →	1cm qtz vn + 3cm chl-qtz-pyr. stringers @60° ⊥ flow @ 2230'
2260	—	—	½	40	2: 20-50 70	½/1-10 Q-S+Kfs	—	
2280	—	—	1	35	3: 20-40 60-70	½/1-5 +pear.	—	2278-88' fg weakly banded + bleached (Q-S-mont.)
2300	—	—	2	30	2: 70-90 30	½/1-3	—	
2320	—	—	1	20	2: 30+60	½-1/1-10 Q-S+chl+Kfs	—	
2340	—	—	1	15	2: 70-90	½/1-10 Q-S-chl	—	
2360	—	—	2	40	6: 50-60	½-1/1-5 +pear.	1cm qtz @80 @2348'	
2380	¼	20	2	0-90	2: 50-60	½/1-2 +pear	—	
2400	T	5	1	0 90	3: 20-50	½/1-10	—	
2420	T	2	4	30°	4: 70-90	½/1-pear Q-S	wk cr. @30 +60° 2412	-2416
2440	T+	—	3	20°	2: 70-90	½/1-pear Q-S	2433-38 str cr + sg	: Fault zone
2460	T	98	5	40-70	3: 60-80	½/pear Q-S	Loc mod. cr-clay	on Fx
2480	—	95	2	50-60	2: 60-70	½/pear Q-S	chl on Fx	

ROCK TYPE AND REMARKS

⇒1632-55 v.fg. Lt gy Ash w/ minor DK + Red flame + fragments of gy in Lt purple - v. Hard to distinguish Bx frags .1-2cm. - A few exotic x.g. welded tuffs to 10cm: Soaked w/ Fs py

⇒1655-68 DK purple well welded Tuff, 10-20% phenos 1-3mm. cut by calc + chl-py-mont stringer vnlts (+cc)

⇒1668-83: Granite (?) + welded tuff frags 1 to 50cm in chl+clay (olive) MAT + dissem. pyr.

⇒1683-1805 Breccia-Volcanic with carbonate, siltstone, quartzite + a wide variety of volcanic clasts, Ls sub-round-subang, local str chl + mont + ? (Dieps?) in matrix - pyr + sl + gn dissem around + in clasts. All of core soaked in $CO_3^=$, most clasts ¼-2 inches but some 1½' - largest marble clast: 6". Fractures are ragged + core is crumbly. Contacts gradational.

"Ls cgl" →

⇒1805-1991: Lithic Ash-flow tuff Bx: Mostly fg. frags 2-20mm. with v. high matrix %. Local str. Q-S alt. But some rock is relatively fresh + shows good Eutax. struct.: Densely welded zones have Kfs + ep + chl + tr mag. 1863-1991. Distinct dk purple to black volcanic lithics with weaken (?) qtz-ser.; chl. + pyr. + epid. on Fx

⇒2001 → Welded tuff with good Eutaxitic struct (Flow Banding), 5-15% 2-5mm Fs: when "fresh" m→dk purple banded w/ chlorite + mgt ± pyrite after mafics. Later Q-S-py ± Kfs + local pervasive "bleaching" has destroyed most of color to Lt. gy. Much of Q-S veining is 60°-90° ⊥ to flow banding. With depth the amount of welding increases with qtz bands surrounded by purple (hem) Kfs selvage forming "Ribbon Rock" type flow banding. Pink fs may be Mn-rich: rhombic cleavage - but prob. not rhodochrosite to 2278

⇒ 2278-2351 Lava flow: Flow Banded: 2288-2339 = DK purple to black 15-20% 2-5mm Fs w/ flow ~20-30°. Ep + pyr + chl alt around Fx + of Fs. - some wk Kfs selvages. MAT. prob. Kfs rich 2339-44: str. Kfs flood + many Q-S-chl-py vn. 2344-47: Mottled w/o Bx w/ spherulitic - Kfs matrix. 47-48: 30% spherulites to 1cm 2348-51. v.fg. siltstone or tuff - bleached.

⇒2351-2403 welded tuff, locally internally brecciated + healed (while hot) 2373-96 DK MATRIX with strong Kfs flood. Local fg + bleached zones at margin.

⇒2403-2486 flow banded volc.: some Eutax zones but most appear to be flow-banded lava. Most well alt to Q-S-py (but low pyr.) Earlier chl + Kfs + epid, a few volc bx zones. Suggest an overall Ash Flow tuff.

(4)

GEOLOGIC LOG

PROJECT	TRENCH	HOLE NO.	TCH-1
Collar elev.		Final depth	
Coord. N		Inclination	
Coord. E		Page	4 of 9
Logged by	KOUTZ		
Date started		Date finished	

MINERALOGY AND STRUCTURE

From	To	Col.	Col.	Comment on Assay Interv.	Cu ppm	Pb ppm	Zn ppm	Au oz/T	Ag oz/T	Mo ppm	Chalcopyrite	Galena	Sphalerite	Gray S=	Pyrite-Dissem.	Pyrite-Vn	Limonite	Hematite	Magnetite
2480	2500	20	100	2490-2500	260	127	196	T	0.06	11	T-	–	–	.2	1	1	–	T+	–
	2520	↑	98%								T-	–	–	.1	1½	1	–	T-	¼
	2540		100								–	–	–	–	2	1	–	T-	½
	2560		↑								–	–	–	.1	½	1	–	T-	½
	2580										–	–	–	.1	1	1	–	–	¾
2580	2600		TS 2600	2590-2600	67	44	100	0.001	0.15	23	T+	–	T	.3	½	1½	–	¼	1
	2620			Lost 80%, Circ. @ 2622							T-	–	–	.2	3	2	–	T	¼
	2640										–	–	–	.2	½	2	T	F(T)	½
	2660		↓	2640-50, 2650-60							T+	–	.1	.5	4	3	T	–	2
	2680		100	2682-84 Lost H2O press.							T-	T-	T-	.5	3	1½	T-	–	–
2680	2700		95%	2690-2700	96	128	181	0.001	0.12	24	T-	T-	T-	.5	2	1½	Tr	–	T
	2720		100								–	T-	F(T)	.3	½	1	–	F(T)	1
	2740		TS 2730								–	–	–	.2	½	1½	–	T	1
	2760		↑								–	–	–	.2	1	1½	–	T	1½
	2780										T-	–	–	.2	½	1	–	T-	½
2780	2800			2790-2800	90	63	96	T	T	34	T-	–	–	.1	1	1½	–	T-	¼
	2820										T-	T-	T	.3	1½	1½	–	T-	T-
	2840										–	–	–	.2	1½	1	–	T-	– (Tr MnCO3)
	2860										T-	–	T-	.2	1	2	–	–	–
	2880										–	–	T-	.2	1	1	–	–	–
2880	2900			2890-2900	97	52	31	T	T	32	F(T)	–	T-	.3	1	1	T-	–	T-
	2920			2900-2915 / 2915-2919 / 2919-2930	100 / 805 / 72	22 / 128 / 16	46 / 136 / 38	– / – / –	0.10 / 0.10 / 0.13	46 / 136 / 8	T (T+ cov)	T-	T (Tr MoS2)	.3	2	1	–	T- (T spec.)	–
	↙																		
2920	2940										–	–	–	.2	1	½	–	–	–
	2960										T-	–	–	.1	1	1	–	T+	T+
	2980										T	–	–	.2	1	1	–	½	T
2980	3000		TS 2994	2990-3000	61	28	27	T	T	28	T-	–	–	–	½	1	–	T+	T-
	3020										T-	–	–	–	½	½	–	T-	T
	3040										T-	–	–	.2	2	1	–	T-	T
	3060										T-	–	–	.2	1½	2	–	T-	T+
	3080										T-	–	–	.2	1	1	–	T-	T
3080	3100			2090-3100	82	66	60	T	T	33	–	–	–	.2	½	½	–	T-	T-
	3120										T-	–	–	.1	1	1	–	–	F(T)
	3140		3130 TS								T?	–	–	.3	1½	3	–	T	¼ in lava
	3160										–	–	–	.2	1	1	–	T-	½
	3180										T-	–	–	.1	1	½	–	–	½
3188 40-55° – 3180	3200			3190-3200	66	27	99	.001	0.07	22	T+	–	T-	.2	1½	2	–	T-	¼
	3220		3214 TS	3200-3210 / 3210-3220	224 / 282	280 / 125	652 / 224	–	0.19 / 0.13	17 / 16	.2	F(T)	T-	.2	3	1½	–	T-	T-
3230 40° →	3240		✓								T	–	T-	.5	2	1	–	T-	–
	3260		100								–	–	–	.4	½	½	–	–	–
3278 30° –	3280		99	3271-76	115	1070	3400	–	.21	12	.1	.2	.2	.8	3	1	T-	T-	– (2+ MnCO3)
3280	3300	↓	98	3290-3300, xno-3214	83	21	36	T	T	37	T-	T	T-	.5	2	1½	T-	F(T)	T (T MnCO3)
3300	3320	20	90	3312-24	91	315	510		0.17	11	.1	.2	.2	1.0	2	1	T-	–	– (3 MnCO3)
				3317 T.S.															

From	To	K-Feldspar	Qtz-Dissem.	Qtz-Vein	Clay	Sericite	Chlorite	Epidote	Calcite	[unheaded]	% Vugs	% Bx Matrix	Fx / Foot (open)	Dip-Flow Band	Sulfide Veinlets # ∠	Width mm S= vn + alt selvage - size dissem. S=	Faults — Crushing — Shearing	[Notes]
2480	2500	–	7	1	1	12	5	2	T-		T	98	5	25	2: 60-65	½-2/1-10 ½ dissem	mon slt gg @ 70-85	
	2520	1	5	½	1	7	6	3	T-		T-	–	4	30	4: 30-70	½/1-5 ½-1 Diss.	mont on Fx	
	2540	3	4	T+	1	5	6	5	T-		–	–	1	40	2: 40-60	½/1-5 Q-S+Kfs	—	
	2560	4	4	1	1	5	5	4	T-		–	–	1	35	2: 50-70	½/1-5 Q-S+Kfs	—	
	2580	4	4	½	2 (mont)	4	4	3	T-		T+	–	1	40?	4: 20-40, 50-80	½/1-6 Q-S+Kfs <½ Diss.	—	
2580	2600	4	4	1	2	4	4	2	T		–	98	2	40	3: 20-50, 60-80	½/1-6 Q-S-Kfs [illegible]	—	2584' 8mm chl-Hem-py-sl-pyrrh @60°
	2620	2	5	½	3	5	5	1	½		–	–	2	35	4: 20-40, 70-80	½/1-perv. ½-1 Diss	calc + clay on Fx	
	2640	3	7	1	4 (mont)	7	4	3	T+		T	–	4	40?	6: 20-50, 75	½-1/1-perv.	2634-41 well Fx	← 1-3mm gg + clay on Fx
	2660	10	5	3	8 (mont)	10	3	6	T		T+	98	4	40?	6: 10-30, 60-80	½-8/2-perv 1-2 Diss	1-3mm gg + clay on Fx	2664-5: 1cm vn @80°: Py(mass) ⇒ sl > Kfs > chl.
	2680	½	6	1	8	18	3	1	T-		–	–	7	60?	10: 20-50	½-10/2-10 2½-1 dissem	1-2mm clay on Fx	
2680	2700	1	3	1	8	15	3	2	T+		½	95 (tectonic)	20	?	120: 80-70	½-1/1-perv ½ diss	1-4mm clay on Fx	Semi-Rotten: core ground locally.
	2720	1	?	1	¼	2	1	9	¼		T	–	1	?	8: 10-30, 60-75	½/1-5	clay, calc on Fx	Massive Epidote 2712.5-14.
	2740	1	?	1	½	3	½	3	½		T	–	1	40?	7: 10-40, 70-80	½-1/1-30	Hem, clay, calc on Fx	Ep. vn @ 40-45°
	2760	½	?	½	½	2	1	4	½	Tr gyp.	T	–	1	30	4: 10-40, 70-80	½/1-10	calc-clay on Fx	Ep. vn @ 50 cut by pyr vn @ 60 cut by calc vn @ 80
	2780	12	10+	1	1	4	3	2	½	T gyp.	T	–	2	30	5: 10-40, 70-80	½/1-50 ½ Diss.	chl-pyr on Fx	
2780	2800	8	10?	½	2	5	4	4	¼	–	T-	97	2	35	2: 10-40, 60-70	½-1/1-30	wk tectonic Bx zones	2794-2800: Filled w/ chl + pyr.
	2820	3	12	1	2	10	4	1	F(T)	–	T-	99	2	40	3: 10-50, 60	½/1-perv ½ diss	wk. tect. Bx 2807.	
	2840	15	10	½	½	7	3	T+	–		–	–	1	20-40	1: 60-80	½-4/1-perv ½ diss	chl, pyr on Fx	IF Eutaxitic struct assumed to strike E-W then many of pyr vn strike NW @70°
	2860	10	10	1	½	8	4	T	–		–	–	1	40-50	3: 60-80, +80	½-1/1-perv	chl, pyr on Fx	local good Eutax. text to 2850
	2880	10	10	2	2	10	3	T+	T- Fx		T-	–	3	35	2: 70-80	½/1-perv	calc-chl-pyr on Fx	
2880	2900	6	8	1	2	7	3	½	T Fx		T-	–	5	40	2: 70-80, +80	½/1-perv.	clay on Fx	82-88' str. crush @80°
	2920	6	8	1	4 (mont)	8	4	½	T Fx		T-	30	2	35	4: 60-80, +80	½/1-5	clay, calc. on Fx	
2920	2940	5	4	1	1	6	3	2	T+ Fx		T-	–	2	30	2: 70-80	½/1-5 ½ dissem	clay, calc on Fx	
	2960	8	4	2	½	4	4	1	¼ Fx		T+	95	1	35	2: 60-90	½/1-3 ½ dissem.	calc on Fx	4-8mm calc, qtz, chl, hem. on @ 70°W, N20W° if dip Eutax is to N.
	2980	6	5	2	1	3	3	½	2		1	98	2	35	2: 50-70, +85	½/1-4	calc-qtz pyr-hem on Fx	
2980	3000	4	5	2	½	3	2	½	1		1	98	1	35	2: 60-90	½/1-3	chl+pyr +hem on Fx	2954-83 1-5mm Fx filled w/ calc, qtz @70-80°
	3020	4	8	2	1	4	3	T+	T+		T	98	½	25	1: 60-90	½/1-2	clay + chl + calc on Fx	
	3040	5	9	2	3	5	3	½	2		2	99	2	20-25	2: 70	½/1-5 <½ dissem.	clay + calc on Fx	3029-32 3-30mm wh. clay + calc vn @70-80°
	3060	5	10	2	1	3	4	½	½		T	95	½	35	4: 50-70, +85	½/1-3	cal. on Fx w/ clay	Lt. pink flame to 6", 85° FI & C Hsets 2+-6" reverse 3046-48
	3080	7	10	2	1	4	3	¼	T+		T	98	2	35	3: 60-90	½/1-3	clay, calc on Fx	
3080	3100	8	8	1	4 (mont)	6	3	1	T		½	100	3	35	2: 60+, 80-90	½/1-3	str clay on 80-90° Fx 1-5mm.	
	3120	9	8	1	2	5	2	1	T		T+	–	5	30	2: 60-80	½/1-2	str Fx 3100-3105 + crushed.	
	3140	10	10	2	1	8	4	1½	¼		–	–	3	35	4: 60-80	½-1/1-perv	clay on Fx Q-S	3125-3132: Arkosic, grit zone, partially welded x-bedded @25-35° (Prob. Base surge)
	3160	5	6	½	1	7	3	½	¼		T-	–	1	20-40	2: 70-90	½/1-3	clay, calc. on Fx	AT 3188 IF strike of volc is E-W
	3180	4	4	½	2	8	4	1½	2		1	–	2	20	2: 30-50, 70-80	½/1-3+ ½ diss	calc druse on Fx	+ dip to N: then MP dips SW
3180	3200	6	6	1	3	10	7	1	1		T+	–	2	20	2: 20-40, +80	½/1-perv	calc + clay on Fx	@3204 1cm qtz + chl + py + gn vn @60°
	3220	8	5	2	3	15	8	4	1		–	–	1	–	4: 10-30, +60	½-1/1-20 +perv.	calc on Fx	
	3240	7	20	3	3	18	5	2	2		½	–	1	20?	4: 20, +60-70	½-1/1-perv	calc in Fx	
	3260	–	30?	1	1	20?	1	T	7		2	5	2	–	1: 80-90	½/perv	3244-50: cockade Bx-vn w/ calc + T.	
	3280	1?	40	5	5	20	1	T	5		1	2	3	70?	5: 30-40, +90	½-4/perv	str crush @ 90°, 69-75'	3275: 3-4mm gn + sl stringer @50°
3280	3300	2	15	5	6	12	2	½	6		1	4	2-20	70?	6: 60-90	½-1/perv	str. crush @ 80-90°, 3284-90 vn with calc.	
3300	3320	5	15	10	5 (↑mont)	20	4	T	10		5	10	1?	?	4: 80-90, 20-4?	½-3/2-perv.	→ 3318-24 calcite cockade Bx-vn zone @80-90°	

LITHOLOGY AND REMARKS

⇒ 2486 to ~2615. Med. purple to grey lava flow ~5% Fs pheno 2-4mm. ~wk-mod flow 25-40°, wk→mod. chl ± Kfs ± epid. + pyr. along Fx + mottled dissem. clots. Later minor Q-S flooding; mont(?) + calc on Fx. Dissem. MGT in matrix of volc. Lower contact gradational, more f.g., % Fs phenos decrease + mod → str. dissem pyr + chl + epid.

⇒ 2615-2698 transition zone well altered. "mega-mottled" with epid + py + Kfs ± chl./unalt MGT between veinlets locally strongly augmented. 2627-37: f.g. Quartzite on volc. "Arkose" (MGT → hem) Host rock 2621-27 similar to below 2700 as prob. was the zone up to 2615. (now soaked green 2615-2621)

← similar to V-37-38 Hornfels: cf. Mt. Wrightson fm - Flux Grp??

⇒ 2698-2767: Dk grey to black (v.f.g. red hem in matrix as BKGD color - only obvious with hand lens) siltstone-hornfels, brittle, bedding and mineral contact obscure but contains magnetite. F.g. veinlets of pyrite ± epid ± chl + calc with local minor Qtz-S ± Kfs halo + local splotches of massive epidote. Mont, calc, py, chl on Fx. Q-S? bleached at margins. 2767-70: Kfs + pyr.-chl-epidote blebs in flow below.

⇒ 2767-2807: m.-dk grey lava flow with good lineation of feldspars (~10% 1-? mm). Fs partially chl + epid. Late pyr + ep. + chl vn common with Q-S on Kfs halo. Local Bx (tectonic). 2' spherulites 2-1.5cm to Qtz lithophysae 1-2cm 2802-04. 2804-08 transitional Lt. gy hornfels with local Bx.

⇒ 2807-2915 Welded tuff, strongly welded, Eutax text locally obscure, Dk gray with red & black flame, 5-15% Fs phenocr., 2-4mm, str. chl on vnlts, local pyr ± epid + Kfs.

⇐ 2915-19 IBx, both contacts 60-70° but almost concordant with Eutax. ~30% matrix, frags 1-30mm, 10mm. Many frags are volc, but some are quartzite + some are equigranular ign. Rx. Tr cpy, cov., spec on MoS2 (clasts sub ang - sub round). Min in IBx mostly dissem pyr.

⇒ 2919-3132: Ash flow tuff: cooling unit; prob continues above to 2807 w/o IBx. Well welded, brittle + vitric ~2940-3095: Dk gy → BK → Red, 10-15% Fs pheno 2-4mm + Kfs, qtz, chl-epid. Rx rims. Margins show good honey, red + black eutaxitic texture + less overgrowth on Fs. Local large fragments (Kfs rich) logged as Bx frags. Upper zones of unit locally poorly welded and prob. air-fall tuff although well indurated. Grit at bottom prob. base surge. Low pyr content overall, only T cpy on stain. Alt. chl ≥ epid. + Kfs + calc. + qtz, late clay vnlts + qtz + calcite.

(gen. note: If E-W strike = Eutax. text then most Fx NW @ 60-80 N dip, some ENE, 70-80°S strike)

⇒ 3132-88: Lava flow: Dk gy - v. Dk purple 10-20% pheno with lineation 20-40°, minor mgt in grndmass. Pyr + chl + ep. + mont Fx. Upper contact 6" jasperoid-sing(?); 3180-85: mottled w/ epidote patches. 3185-88, v.f.g. + strong Q-S + local wk spherulites.

⇒ 3188-3230 (40-50°): Intrusive(?) Monz. porphyry: 15-25% wh → Lt. green Fs, 3x5mm, in f.g. gy pink grndmass, loc str. chl. in grndmass, loc. perv. Q-S flood., early epid.-chl.-pyr., T dissem cpy + cov(?), local sl + gn + py in qtz veins.

⇒ 3230-3278: v.f.g. Lt. gy (bleached) siltstone or well altered as below, str calc flooding and veining. Rx texture is mottled but a few phenos can be noted.

→ 3318-24 calcite cockade Bx-vn zone @80-90°; 2-3% pyr, sl gn in wall rock, late rhodochrosite + [illegible] mineral (gy, polygonal [illegible] ?)

(5)

GEOLOGIC LOG

Project: TRENCH | Hole No.: TCH-1 | Page 5 of 9 | Logged by: F. R. Koutz

30-40 cps: 3708-4306: higher values in purple rhyol. (BKG: 30-35)

Depth / Assay

From	To	Feet	Rec. %	Comment or Assay Interval	Cu ppm	Pb ppm	Zn ppm	Au oz/T	Ag oz/T	Mo ppm	% Fe/Mn	Margin
3320	3340	20	98	TS 3329								
	3360		100 ↑									
	3380											
3380	3400			3390-3400	81	288	98	T	0.07	36		
	3420			-3418 Nx-Bx								NX-BX
	3440			3627- Lost 80% circ.								
	3460											
	3480											
3480	3500			3490-3500	91	38	23	T	T	41		
	3520											
	3540											
	3560											
	3580											
3580	3600		3591 TS	3590-3600	76	14	51	0.001	0.01	36		
	3620											
	3640											
	3660											
	3680											
3680	3700			3690-3700	84	44	22	0.001	0.05	40		
	3720											
	3740		TS-3721									
	3760			3740-50	74	34	75	0.001	0.01	16		3771 Lost circ.
				3750-60	100	138	72	T	T	22		
	3780		TS-3772	3760-3770	58	28	34	T	T	10		
				3770-3780	63	32	31	T	T	16		
3780	3800	20	TS-3790	3780-90	45	34	39	0.001	0.08	10		Logging interval change →
				3790-3800	61	60	75	T	T	23		
3800	3810	10	3802 TS		54	1002	170	T	0.03	12		
	3820				123	1110	160	0.001	0.08	28		60°; 3814' Lost circ.
	3830				60	150	193	T	0.03	7		
	3840		TS-3821		274	300	388	0.001	0.09	18		
	3850				36	166	130	T	0.01	3		
	3860				60	172	83	T	0.08	4		
	3870				42	90	37	T	0.03	10		
	3880				25	140	82	T	T	7		
	3890				123	156	455	0.001	0.08	11	%	
3880	3900		TS-3893		62	101	166	T	0.04	11	Fe/Mn	
	3910			3900-07	73	167	301	.001	0.06	1	3.6/1.48	S= 3907
				3907-08	1.36%	2.16%	3.20%	.001	0.94	6		
	3920		TS-3911.5	3908-09.5	3.60%	17.60%	21.60%	.001	1.95	2	9.4/1.8	3911.5
			TS 3919	3909.5-11.5	2.56%	14.24%	14.88%	.001	2.00	3	7.6/2.8	
	3930			3911.5-3920	201	850	810	.001	0.05	2	4.1/0.6	
	3940			[3909.5-11.5: 5350 ppm As, 475 ppm Sb, 80 ppm Bi]								
	3950											
	3960			3949-3959:	584	454	460	.001	0.07	11	4.1/0.6	
	3970		↓		86	85	207	T	0.04	17		
	3980		TS 3974		70	103	104	T	0.04	18		
3980	3990	10	100		73	124	185	T	T	16		

Mineralogy and Structure (sulfides, oxides, silicates)

To	Chalcopyrite	Covellite	Galena	Sphalerite	Grey S=	K/S-Flood	Pyrite-Dissem	Pyrite-VN	% Sulfide Ox	Limonite	Hematite	Specularite	Magnetite	Garnet	Serp.-Talc	Wollastonite	Graphite
3340	T	–	.1	.2	1.0 (T+ molyb)	20	2	1½	T-	T-	T	–	T	–	–	–	–
3360	T-	–	–	–	.3	2	1½	1	–	–	T	–	T+	–	–	–	–
3380	–	–	–	–	.3	3	1	1	–	–	–	–	T	–	–	–	–
3400	–	–	–	–	.3	6	2	1	–	–	T-	–	T	–	–	–	–
3420	–	–	–	–	.2	3	1	1	–	–	–	–	T-	–	–	–	–
3440	–	–	–	–	–	3	½	½	–	–	T-	–	T-?	–	–	–	–
3460	–	–	–	–	.1	5	1	½	–	–	–	–	T	–	–	–	–
3480	–	–	–	–	.3	3	½	½	–	–	–	–	T-	–	–	–	–
3500	–	–	–	–	.1	2	1	½	–	–	–	–	¼	–	–	–	–
3520	–	–	–	–	–	6+	1	½	–	–	T	–	T+	–	–	–	–
3540	–	T	Tr	T+	.3	8	1	2	–	–	–	–	T+	–	–	–	–
3560	–	–	–	T-	.2	5	1	2	–	–	–	–	–	–	–	–	–
3580	T-	–	T-	T-	2.0 (T- molyb)	5	2	3	–	–	–	–	–	–	–	–	–
3600	–	–	–	–	.3	8	1	½	–	–	T	–	T-	–	–	–	–
3620	–	–	–	–	.2	5	1½	1½	–	–	–	–	T+	–	–	–	–
3640	T-	–	–	–	.1	6	2	1	–	–	T-	–	½	–	–	–	–
3660	–	–	–	–	–	5	2	½	–	–	–	–	½	–	–	–	–
3680	–	–	–	–	T	4	1½	½	–	–	T+	–	¼	–	–	–	–
3700	–	–	–	–	T	5	2	½	–	–	–	–	T	–	–	–	–
3720	–	–	–	–	T	4	1½	½	–	–	–	–	T+	–	–	–	–
3740	–		–	–	T-	3	1.5	½	–	–	–	–	½	–	–	–	–
3760	–		–	–	Tr	2	1.0	¼	–	–	–	–	T+	–	T	–	–
3780	–		–	–	–	–	¼	½	5	1	2	–	T	–	T	–	–
3800	–		–	–	T-	T?	1.0	½	5	½	3	–	–	–	T Fx	–	–
3810	–		–	–	T-	–	2.0	¼	3	½	2	–	–	–	T Fx	–	–
3820	T-		T+	T-	T	1-2	2.0	¼	2	½	1	–	–	–	1	–	–
3830	–		–	–	T	–	¼	½	T	–	T	–	–	–	1	–	T
3840	–		–	–	T-	–	.2	.4	20	T	2	T	–	T?	2	–	T
3850	–		–	–	Tr	–	.4	.1	10	T	½	T-	–	–	1	–	T-
3860	–		T-	–	T	–	.4	.1	T+	T-	T+	–	–	–	½	–	T
3870	–		T-	T-	T	–	.5	.1	T	T	–	–	–	–	1	2	–
3880	–		.1	T	T+	–	.3	.1	T	–	T	–	–	–	2	10	–
3890	Tr		.3	.1	T+	–	.4	.1	T-	T-	T-	–	–	–	T	30	T
3900	–		–	–	T-	–	.3	T	1	T+	–	–	–	1-2?	1	40	–
3910	2		8	8	–	–	.5	3.	T-	T-	–	–	–	–	T-	85	–
3920	1		3	3	–	–	.3	1.	T-	T-	–	–	–	¼	T-	30	–
3930	–		T-	–	T-	–	.4	–	T-	T-	–	–	–	T?	5	30	–
3940	–		–	–	T-	–	.3	.1	T-	T-	–	–	–	T?	T-	10	–
3950	T		T-	T-	T+	T	.4	–	T-	T-	–	–	–	1?	5	10	T-
3960	.5	T-	T-	T-	.3	2	5	T	3	T+	½	T?	T-	–	5	T	–
3970	T	T-	–	–	T	T-	1	T	T	–	T+	–	–	T+	1	T	–
3980	T	–	–	–	T	T-	2	T-	T-	–	T-	–	–	T+	1	1	–
3990	–	–	–	–	T	–	¼	–	T	–	T-	–	–	T-	½	1	–

Mineralogy and Structure (gangue, structure)

To	Jasperoid-F.g. Qtz	Qtz-VN	Clay	Sericite	Chlorite	Epidote	Calcite	Cal. Grain Size	% Sanding-Vugs	% Banded, Zebra	Fx/Foot	Dip: Bedding, Flow-Band	Sulfide + Calc Veins # ∡	Width mm: Sulfide VN + Alt Fr. Selvage	Faults, Crushing, Shearing	Remarks
3340	8	10	5	10	4	T	3	<½-1	3	–	6	60	3: 10-40, 70	½-1/1-10	mod-str. crush	3339, 1' vuggy qtz-calc-mont(?) vn @ 70°
3360	7	1	2	8	3	½	½	<½	½	90	2	40, 60	4: 20-50, 70	½/1-5	calc on Fx w/ clay	3345-47: Qtzite: m.g. w/ dissem pyr.
3380	10	1	1	5	3	1	¼	<½	T+	80	1	40, 55	2: 40-70	½/1-5	1-2" crush zone @ 70	3372'
3400	7	2	1	6	3	1	T+	<½	T	90	3	40, 60	3: 30-60	½-1/1-perv	calc-clay on Fx	← gradational contact: STR purple below
3420	8	1	1	4	3	1	¼	<½	T-	98	1	40	2: 60-70	½/1-5	calc-clay on Fx	
3440	7	1	1	3	2	1½	½	<½	–	95	1	40	2: 60-80	½/1-5	calc-clay on Fx	
3460	6	2	2	4	3	3	1	<½-1	2	90	½-3	35	2: 40-70	½/1-5	calc-clay on Fx	1cm calc vn @ 85-90° 3458-57 (open)
3480	4	1	2	5	4	2	2	<½-1	1	80	½-8	45	1: 40-70, +85	½/1-5	calc fill Fx	3480-3538: core v. brittle: DK BK groundmass
3500	5	½	1	4	3	2	1	<½	T	90	½-2	40	2: 70-90	½/1-5, <½-1 dissem	calc on Fx	
3520	8	2	1	5	3	3	1	<½	T	95	⅓-5	40	3: 60-80	½/1-4, <½-1 dissem	–	good Kfs selv. around pyr + chl-epid. vnlts; ↙ pyr + chl post gn
3540	8	3	1	4	3	3	½	<½	T	95	⅓-3	40	3: 50-80	½-4/1-5	loc wk crush.	4mm qtz > gn > sl = py vn @ 60 w/ 3-5mm Kfs selv. @ 3527
3560	7	2	2	7	4	1	1	<½	T+	70	10	40	4: 40-70	½-1/1-5	chl + calc on Fx	
3580	8	2	4	9	5	1	1	<½	½	20	8-30	35	5: 20-30, 50-70	½-1/1-5 + perv.	str calc + py 3571-73	@ 3573 5-4cm 80% pyr vn @ 50°: Fl+?s @ 3573 + pyr stringers
3600	5	4	6	7	3	1	½	<½	½	10	3	–	3: all ∡	½-1/1-10	1-2" chl + py @ 50-3586	
3620	6	3	1	5	3	½	¼	<½	T	90	2	60	4: 50-90	½/1-5	bright green chl on Fx	
3640	5	4	3	3	5	2	2	<½	2	70	3	45	2: 50-90	½/1-5	str. 85-90° Fx + calc vn.	
3660	4	4	1	2	4	3	1	<½	½	95	1	35	2: 40-60, +85	½/1-3 to +40	chl-calc on Fx	2-4mm qtz vn @ 85
3680	3	4	½	3	2	3	¼	<½	¼	98	⅓	30	3: 60+80	½/1-3	chl-qtz calc on Fx	
3700	3	2	½	2	2	2	¼	<½	T	98	1	35	2: 60-70, 90	½/1-8	chl + qtz on Fx	
3720	2	3	½	2	2	2	½	<½	2	95	1	40	2: 60-70 per foot	½/1-3	qtz-calc on Fx	
3740	T	½	T+	2	¼	2	1	<1	T	95		45	per 10' +30: 60-80	<1/1-3	–	
3760	–	¼	1+	3	2	1	1	<1	¼	40		30, 50	+30: 50-80	<1/1-3	4" Bx + qtz @ 3758 @ 60°	
3780	T	T+	1	1	3	T	T+	–	T-	5		40?	+20: 30-60-80	<1/<1	–	
3800	–	T-	1	1	3	½?	3+	<½	T-	3-wk		35	+20: 30-80	<1/<1	–	↙ LOGGING INTERVAL CHANGE
3810	–	–	1	2	2	T+	3?	<½	T	3-wk		35	+20: 60-80	<1/<1	–	
3820	–	–	1	1	2	T-	30	1	T-	–		40	5: 20-60	1-2/1-3	wk. shin gr clay @ 38??	Dissem. gn stringers in grey-green chl + clay ? 3816.5. SS is well x'tal & has almost aphitic text: maybe anthosite-mottled.
3830	3	–	3	–	1	1	95	1-2	1-2	15		30-60	3: 20-80	1-2/–	wk sh. in clay-chl.	
3840	T+	–	2	–	3	T	70	½	¼	80		70, 90	3: 60-80	1-2/–	wk sh in clay-chl.	py → hem w/ chl. 3831-32: mottled Rx ≈ φ?? -calc, chl flooded wk Bx.
3850	2	–	1	–	1	T	93	1	1	50		30-40	3: 60-80		pyr. stringers in chloritized partings + mottled tan silica	
3860	30	–	1	–	1	–	65	1-2	½	30		30, 60	3: 30-70	<1/–	wk Bx + healing in jasp. + marble	
3870	45	–	1	–	1	–	50	1-2	1	10		60	1-2, 30-80	<1/–	Bx in jasp.	
3880	3	–	1	–	1-	–	75	2	1	5		60	3: 30-80	<1/–	wk sh in clay	Tan argillite @ 3875-76?
3890	20	T	½	–	T	–	45	1-2	1	7		40, 60	1: 70	4/1	Bx in jasp.	4mm gn, sl, cpy, py vn @ 70 3882 in jasp
3900	40	–	1	–	T+	–	15	1	3	15		40	3: 60-70	<1/–	jasp-wo Bx	
3910	20	–	1	–	T-	–	20	½-2	2	50		40-30	1 lower @ 60°	3-4'	wk Bx in jasp.	3900-3906: 85 Wo, 10 Jasp, 5 calc; 06-07 80 Jasp, 5 Wo, 15 calc; jasp w/ 10 S=; 08-11.5: 40-60% S=; rest calc + jasp.
3920	5	T+	½	–	T-	T	50	½	1	10		10-40	1 "	"	wk Bx in jasp	11.5-20: 3 jasp + mixed f.g. calc + Wo. S= weakly banded 20-40°, 1-8mm grains.
3930	25	½	1	–	–	–	35	1-5	3	20		20	–	–	wk Bx in jasp.	3920-27 Wo >> jasp > serp (tan) 27-34 = jasp (purple)
3940	60	–	1	–	T+	–	25	½	1	10		20, 30	1-3 ~	<1/–	wk Bx in jasp	
3950	70	T	1	2	3	–	10	½-1	1	10		20, 30	1 ~	<1/–	wk Bx in jasp	IBx @ 3949: v. sharp contact @ 30°, also 3" chl IBx @ 40° upper, 10° lower. @ 3948;
3960	15	¼	3	20	15	–	5	<½	½	80		20, 60	–	–	mod well banded	IBx to 3959.7 (50° upper contact). Local over cpy, pyr.
3970	80	T+	3	T+	1	–	10	<½	1	20		20, 40	–	–	mod-str Bx in jasp.	3" IBx @ 3960.5 (50% chl matrix), 3" IBx frag in jasp @ 3968'
3980	80	2	1	1	5	–	5	½-2	3	40		20, 40	–	–	mod Bx in jasp.	3973-74: 1' IBx: cut by 80° 1-4mm qtz veins (drusy)
3990	90	3	¼	T	½	–	7	1	1	10		20, 40	–	–	str cc-Bx in jasp.	str qtz + calc vn @ 85° ½-3mm (druse)

Description

⇒ 3278-3400: f.g. volcanic, well altered, with dark grey → BK groundmass if weakly altered; 5-10% Fs phenocrysts which increase in size w/ depth. Upper part flinty, calc-clay-qtz vns + alt. Multiple zones @ 3303 (8" @ 30°), 3324-35 (1" @ 85-90°) of Lt pink bleaching with DK red rims (Kfs?). Brecciated veins filled with qtz + calc - with weak grey S=. Local blebs of chl + cp + pyr in Fs + mafic sites.

⇒ 3400-3573 v.f.g. volcanic as above ~5% pheno 2-3mm, + locally overgrown - mod Kfs flood around qtz-epid-chl ± pyr. vn (prob. lava flow)

⇒ 3573-3586: m.g. sandstone with 1-5% Fs (now clay): Lt gy w/ chl on Fx with pyr; well silicif. 1' around 4cm pyr. vn.

3586-3595: qtz clots to 1-2cm in volc (~20%) 10-20% pink Kfs splotches, 1-5% epid, vnlt pyr-chl stringers - bottom top of flow: lithophysae - amygdaloids? (has vn qtz, spherulites?)

⇒ 3643-3720: fair eutaxitic struct. (1-3mm fiame): grades into "flow" above and below. Internal 3816.5-3586 maybe cooling unit

3586-3747 Flow banded rhyolite (?): 40-55° pink to purple: DK purple-gy around plag. x'ls 2-4mm. Locally bleached white to Lt. pink around 1-10mm epidote clots (// to flow). Qtz-calcite-pyr. vn @ 60-70 w/ acute ∡ to flow banding. Lower contact @ 3747 30+60°. Pink flooding prob. Kfs, increases 3731-47, Fe mat in matrix. 3747-58. Grey Fs φ pheno 1-4mm. Appears transitional to qtzite below or bleached rhyol.

⇒ 3747-3816.5: Sandstone-qtzite. Medium to DK gy w/ local / maroon tint. Local ∡ar to rounded grains 1-5mm, 1-3% a few to 1cm, maybe former Ls. SS is prob. of volc. derivation similar to HOS f.g. clastic unit. Silicif. or qtzite character incr. w/ depth. Local clots calc. w/ epidote + chl? + 1-2mm pyr. cubes. Harder character is prob. v.f.g. intergranular calcite. Local pink flooding near base of unit + along epidote-calcite Fx.

⇒ 3816.5-3907: Rex'tal Ls w/ local purple jasperoid + bottom massive wollastonite (1-5mm needles), local sheared chloritic clay-serp-talc zones w/ dissem S=. Locally weakly banded marble. All + test for calcite. Jasperoid is a Bx in part + cut by late calc. + Wo. Upper part of dissem S= is oxid. to hem. Some flowage in marble.

: Sulfide is replacement of marble, jasp. + Wo: a few local calc-qtz vn are post S=

⇒ IBx: ~10% f.g. ign. frags, rest qtzite > f.g. marble matrix chloritized ≈ 5% dissem py - some cpy. Locally some ign frags to hem - prob. pre-

(Veins; IBx f.g. frags ~5% of Bx mat)

IBx: (primarily chl + S=): frags ½-1cm, to 6cm, 10-40% matrix to IBx, STR purple jasp halo.

⑥ WITH UV LIGHT: Wo FLUOR. LT. Yellow
: Late calcite: ORANGE (ASSOC. w/ S=)
Soluble oil + LOST circ. material SOAKS CORE - circumf. + permeable zones,

Scintil.: BK 25-30 x100 cps - 4193-4603
30-40 @ 4597 (w/ F.g. S=)

GEOLOGIC LOG

TALC-SERP?

PROJECT TRENCH HOLE NO. TCH-1
Collar elev. ____ Final depth ____
Coord. N ____ Inclination ____
Coord. E ____ Page 6 of 9
Logged by FR KOUTZ
Date start ____ Date finish ____

From	To	Intv.	Core Recovery	Comment or Assay Interval	Cu ppm	Pb ppm	Zn ppm	Au oz/T	Ag oz/T	Mo ppm	Chalcopyrite	Galena	Sphalerite	Molybdenite	Grey S= or SS	Pyr.-Dissem.	Pyr.-Vein	Limonite	Hematite	Specularite	Magnetite	Garnet	Serp-Talc	Wollastonite	Graphite	Jasperoid	Qtz-Vein	Clay	Sericite	Chlorite	Epidote	Calcite	Cal. Gr. Size	% Sanding-Vugs	% Banded	Bx Matrix %	Dip: Bedding Flow-Band	Sulfide Veins # + ∠	Width mm Sulfide Vn + Alt. Selv.	Faults Crushing Shearing	Rock Type and Remarks	Rock Type and Remarks (cont.)
3990	4000	10	100		56	62	104	0.001	0.07	25	T-	-	-		T-	.2	-	-	-	-	-	-	1/4	1/2	-	80	3	1	-	1/2	-	15	2	3	10	8	-	—	—	JASP-Bx	JASP Bx w/ MARBLE MATRIX + calc. (druzy) VN.	
4000	4010	↑	↑	4006-09	103	1260	231	T	0.02	10	T+	.1	.1		T-	.5	-	T-	-	-	-	-	T	1	T-	55	1/2	1	1/2	2	-	40	1/2-2	2	10	15	30?	—	—	WK-mod Bx IN JASP.	STR Bx 4006-09 (IBX) ~5% IGN., DISSEM S= w/ Chl. IN MAT.	MARBLE 4009-11
	4020			4011-19	262	500	858	T	0.04	35	.5	.2	.3		1	3	-	T-	T-	-	-	-	1/4	2	T	50	T	1	1/2	3	-	25	1	1/2	5	20	~40	—	1/2-2cm Bx Frags	STR Bx	Bx-IBx 4011-4022 ~1% IGN Frags 1-20% MATRIX (PART IGN)	⇒ 4031-4068: MARBLE OR MARBLE Bx: 1-5% JASP.
	4030			4019-4030	102	203	180	T	T	16	T+	T+	.1		.3	1/2	-	-	-	T?	-	-	1/4	1	-	60	1	T	T	1	-	30	1-3	1/2	5	5	-	30% Bx	1/4-3cm Bx Frags	Local mod Bx	4022-31 jasp + jasp + marble Bx.	1-3 Wo, some of jasp could be wh. chert, 1-3mm calc. with
	4040										T-	T+	T+		.1	.2	-	T-	T-	T?	-	-	T+	1	-	5	-	1	-	1	-	93	1/4-2	1/4	20	5	-	Local - MARBLE Bx		Local WK Bx		dissem. py + En? ... , T sl, sn. Dip ~25-35? - flowage up
	4050			4040-50	19	100	13	0.001	T	6	-	-	-		T+	T	-	-	-	-	-	-	3	3	T	2	-	1	-	1	-	93	1-2	2	50	10	20	—	—	HEALED Bx IN MARBLE	⇒ IBX; 4068-72: contacts ≈60°: 30% sus & ign. Frags.	to 60°. 1/2-4cm clast size, 1-3 vugs w/ calc. druse
	4060			4050-60	48	300	1990	T	T	11	T-	T-	.3	—	T+	.2	-	-	-	T+?	-	-	1	1	T+	2	-	1/2	-	1/2	-	95	2	T	50	80?	-	1 @ 50 4057	2-4mm/-		Biot Q.M. + 4mm grains (wk Biot Rextal) + QTZ (sec), MoS_2-cpy VN	V. Mottled texture, S= in clay, ser-serp-chl AREAS
	4070			4066-68	413	65	86	T	T	15	.3	.1	.2	T-	.1	.4	.1	-	-	T-?	-	1/2	2	1	T	8	-	1	1	1	-	90	1/2-3	3	15	20	30	—	—	IBX	(Looks Part Bx) 1-3% Dissem cpy, py, in IGN Frags. Dissem. py +	
	4080			4068-72 4072-80	1830 1920	143 160	500 510	T T	0.03 T	140 4	.5	.1	.2	T	.3	.8	.1	T-	-	T-?	-	T+	1	-	T-	8	2	1	3	2	T? Act.	85	1-3	5	25	15	50?	~5: Act. 3 in Bx	1mm/4mm		v.f.g. gy S= in Bx MATRIX, WK SANDING IN MARBLE Below	⇒ 4072. → MARBLE: grains 1/2-3mm, wk sanding - splits Around grains
	4090										-	-	-	-	T-	.1	-	-	-	T-?	-	-	1/2	T	T-	1	-	-	-	T+	-	98	2	5	10	-	80/70	—	WK. FLOWAGE IN MARBLE 70-80°	←	mod. sanding	Locally vuggy + druzy - Local 1-5% JASP. (v. light purple) + Wo -
4090	4100				10	32	29	0.002	T	9	-	-	-		T-	T+	-	-	-	-	-	T-	1	T	T-	T	-	1/4	-	1/4	T? Act.	96	2	5	5	-	80/70	calc VN 1-2 @ 80-90° (Healed)				PATCHES - Locally to 30% mottled serp - chl. MATERIAL - Lt olive
	4110										-	-	-		T-	.1	-	-	-	-	-	-	1	2	T-	1	-	2?	-	1	-	93	1-2	3	15	-	40/80	—	—	WK FLOWAGE IN mottled ZN	4108-17: mottled MARBLE + Tr Dissem pyr + gy S=	green-TAN (some DK green): Local wK Bx + Healed in MARBLE.
	4120										-	T-	-		.1	.2	T-	-	-	-	-	-	3	4	T	1	-	1	-	3	?	85	1/2-1	1	50	-	60/80	—	—	—	IN DK green whisps.	Lt. green whispy, ANASTOMOSING shows malleable flowage.
	4130										-	-	-		T-	.2	.1	-	-	-	-	T?	1	1	T	2	-	1/2	-	2	-	92	1	2	10	-	30-60	5: 80-90 stringers	1/2-1/-1	—	4126-32: mottled green.	V. WK Dissem. S= IN SERP. MATERIAL + IN MARBLE. There ARE
	4140										-	T-	T-		T	.1	-	T+	-	-	-	1?	2	1	T	3	-	T?	-	3	T? Act.	90	1-5	4	30	20	30/80	—	—		← 4135-39 vuggy + mottled wK Bx	1-15' ZONES of 98+ % pure MARBLE until 4381
4140	4150				14	122	101	0.001	T	19	T-	-	-		T	.1	-	T	-	-	-	T?	8	1	-	3	-	T	-	2	T Act.	85	1/2-2	3	30	-	30/80	~3 calc VN 80	1-2mm/-	—	4147-49 mottled w/ SERP: m. olive gr.	Vuggy ZONES, Esp. in Wollastonite contain Fg. S= (Py >> gy S=)
	4160										-	-	-		T-	T	-	T-	-	-	-	-	2	T	-	1/2	-	T	-	1	-	95	1	4	10	-	-					+ ARE Strongly leached w/ Residual jarosite STAIN
	4170										-	-	-		T-	T	-	-	-	-	-	-	1	-	T-	T	-	-	-	T-	-	98	1-3	5	-	-	-	1-2mm 80-90 calc. VN + DRUSE			— Locally weakly FRIABLE MARBLE (mod. Sanding)	
	4180										-	-	-		T-	T-	-	-	-	-	-	-	1/2	-	T-	T	-	-	-	-	-	98	2-3	4	-	-	-	TR Stylolites IN SERP.	—	TR Bx + healing IN MARBLE		
	4190										-	T-	-		T	.1	-	-	-	-	-	T?	4	-	T-	1/2	-	-	-	T-	T? Act.	93	1-2	3	20	-	-	—	—	TR Bx + heal	4189-93: mottled SERP (DK ol) + MARBLE	↓ ALT (JASP + Wo) INCREASES Below
4190	4200				19	108	50	0.001	T	8	-	-	-		T-	T+	-	-	-	-	-	-	5	2	T+	T	-	-	-	T-	-	85	1-2	3	30	-	-	—	—	—	: @4198 1/2-1cm DK gy calc. (2-4mm) VN w/ Wo Rim. incipient Zebra?	
	4210										-	-	-		T-	T-	-	-	-	-	-	-	1/2	2	T	1	-	-	-	T-	-	96	2	4	5	-	25	—	—	—	Local DK. calc Knots to 1cm.	
	4220										-	-	-		-	-	-	-	-	-	-	-	T	5	T	-	-	-	-	-	-	95	1-2	3	2	-	-	—	—	—		
	4230										-	-	-		T-	-	-	-	-	-	-	-	T	4	T	-	-	-	-	-	-	95	2	3	2	-	30/40	—	—	—	@4228: Wo stained Lt. Bl-gr. from Dissem gy S=	
	4240										-	-	-		.1	.2	-	T-	-	-	-	-	T	3	T	-	-	-	-	-	-	96	1-2	6	-	-	-	—	—	—	mod sanding @ 4240: Discs 2-4cm thick.	
4240	4250				18	126	93	0.001	0.02	3	-	-	-		T+	.1	-	T-	-	-	-	-	.3	1	T	-	-	T?	-	-	-	98	1-3	3	-	-	-	3 @ 80-90 calc w/ TAN stain	.1-.2mm	—	S= w/ DK gy calc xtals (DISSEM) TAN: siderite of calc. mineral grains: TAN called Limon.	
	4260										-	-	-		.1	.2	-	T-	-	-	-	-	.4	1	T-	-	-	T?	-	-	-	96	2-5	8	-	-	10/80	—	—	—	(SALT + pepper Text) Sanded Discs @ 4256 + 1' @ 5258 + 4mm calc druse	
	4270										-	-	-		.1	.4	-	-	-	-	-	T+	1	4	T-	T	-	T	-	1/2	-	90	1/2-1	2	20	-	80	- Dissem pyr to 2mm most <1/2mm - some BK.			Loc. DK gn + TAN calc-silic (?); some QTZ SAND?	
	4280										-	-	-		.1	.3	-	T+	-	-	-	T+	4	2	T	5	-	-	-	1?	-	83	1/2-1	1	80	10	60/80	—	INCIPIENT Bx From VNS (calc		JASP = purple + heavy VN w/ calc.	
	4290										-	-	-		T	.1	-	T-	-	-	-	-	1	3	T-	30	T	T-	-	T	-	65	1/2-1	2	50	20	60/80	1/2-5/cm	1/2-4mm calc VN	—	JASP = purple: spider-WEB VN by calc.	
4290	4300				17	93	59	0.001	0.002	7	-	-	-		T-	.1	-	T-	-	-	-	-	1/2	20	-	10	-	T	-	-	-	60	1/2-2	2	20	-	-	Local Wo Rosettes to 2cm			JASP: gy (Lt) S= in JASP. Wo between JASP + MARBLE	
	4310										-	-	-		T	.3	-	T-	-	-	-	-	T	5	T-	30	-	T-	-	-	-	65	1/2-2	3	20	-	20/30	Wo to 2cm. Rosettes		wk Bx IN JASP.	JASP is Purple: DK green jasp has vFg. S=	
	4320										-	-	-		T+	.1	-	T	-	-	-	-	T	10	T+	15	-	T-	-	-	-	70	1	2	10	-	30	—	—	—	DK gy x.g. @ 4318 may have been Horn corals: Lt. JAROS? FLOOD. / S= (leached?)	
	4330										-	-	-		.1	.3	-	T-	-	-	-	-	T-	10	-	60	1	T-	-	-	-	30	1-2	3	10	-	20/40	—	—	WK Bx IN JASP.	Purp. JASP. w/ Dissem S=: clear needles (QTZ, calc or Wo in vugs)	
	4340										-	-	-		.1	.4	-	1/4	-	-	-	-	T	15	-	75	2	T	-	-	-	10	2	4	30	5	20/50	Vugs in Wo to .8cm w/ Wo DRUSE + Tr S= ; w/ JAR FLOOD			S= <1/4mm. A few py cubes on Fx in Purp. JASP.	
4340	4350		4355 Sample	4340-50	40	70	143	<0.001	<0.01	1	-	-	-		.1	.5?	-	1/4	-	-	-	-	T	10	-	85	1	T+	-	-	-	3	1	3	60	20	-	—	—	Bx Frags 2-20mm	Vugs in Wo contained S=??	
	4360			4350-60	32	98	144	<0.001	<0.01	1	T-	-	-		.2 *	.2	-	1/4	-	-	-	-	T-	5	T-	50	T+	T	-	-	-	75	1-2	1	50	15	-	*gy-Bl S=? on Fx w/ pyr @ 4365-57 cc? - MoS_2 - NOT SPEC. (SOFT)			4347-57 JASP-Wo Bx: DK gy-BK vFg. MATRIX smells like FLINT	⇒ GRADES INTO QTZite @ 4391-4410 to 4462
60°~	4370										-	-	-		.1 *	.1	-	T+	-	-	-	-	T-	15	-	3	-	T-	-	-	-	80	1	2	10	-	-	—	—	WK SH @ 60° @ 4369	~	Below 2410 v.F.g. QTZite w/ calc in Fx (1/4-1mm) Banded
	4380										T-	T-?	-		.1	.3	-	T-	-	-	-	-	1	3	-	-	-	T-	-	-	-	95	1	2	-	-	20/30	—	—	—		1-2mm 25-40° (Bedding?): v. wK. Bleach selv. Around
	4390										T-	-	-		.1	.3	-	1/4	-	-	-	-	1/2	3	-	2	-	-	-	-	-	80	<1/2	4	-	-	20/40	—	—	—	~4391 MARBLE grades into f.g. QTZite	Fx - some QTZ Looks like ARKOSE - Kfs?? Flooding
4390	4400				31	96	76	<0.001	0.01	1	T-	.1?	.1?		.2	.5	-	T-	-	-	-	-	T	2	-	?	-	-	-	-	-	40	<1/2	1/2	-	-	35	3 @ 60°	<1mm diss.	—	vFg QTZite 91-95	(Lt. pink) .1-.5% Dissem pyr. + Local blebs
	4410	↓	↓								-	.1	T+		.3	.4	T-	1/4	-	-	-	-	T+	5	-	30?	1	-	-	-	-	60	1/2-1	3	-	-	35	<1/2-1mm py-dissem.		4406-09 gy Wk Bx	Some 1 gy Fib. S=? @ 4407 w/ pyr. Look like STIBNITE?? Jasp is gy & v. Difficult to Disting from vFg QTZite	SN + Sl + pyr Assoc. w/ Late calc. VN
4410	4420	10	100								-	-	-		.1	.3	.1	T-	-	-	-	-	-	T-	-	?	T-	-	-	-	-	3 (↑ Late VN)	-	-	-	-	30	1 @ 80°	1-2mm / 1-2mm	—	QTZITE (VF.g)	

⑦

GEOLOGIC LOG

PROJECT TRENCH — HOLE NO. TCH-1

Collar elev. ____ Final depth ____

Coord N. ____ Inclination ____

Coord E. ____ Page 7 of 9

Logged by FRKOUTZ

Date start ____ Date finish ____

Assay (Geochem.)

From	To	Int'l	Core Rec.	Assay Interval	Cu ppm	Pb ppm	Zn ppm	Au oz/T	Ag oz/T	Mo ppm
4420	4430	10	100							
	4440	↑	↑							
4440	4450				36	29	30	<0.001	<0.01	2
	4460									
	4470									
	4480									
	4490									
4490	4500				24	140	169	0.001	T	14
	4510		TS 4503							
	4520									
	4530			4521-26	1365	216	575	T	T	15
	4540									
4540	4550				32	182	157	0.001	0.03	10
	4560									
	4570									
	4580									
	4590									
4590	4600				28	132	68	<0.001	<0.01	<1
	4610									
	4620									
	4630									
	4640									
4640	4650				32	76	602	<0.001	<0.01	5
	4660									
	4670									
	4680									
	4690									
4690	4700				51	108	539	<0.001	0.04	2
	4710									
	4720									
	4730									
	4740									
4740	4750				38	48	127	<0.001	<0.01	2
	4760									
	4770									
	4780									
	4790									
4790	4800				76	143	382	<0.001	<0.01	1
	4810				445	.26%	0.27%	T	T	4
	4820			4817 TS sample	209	1542	1460	T	0.07	1
	4830				41	24	61	T	T	<1
	4840				31	310	44	T	T	2
4840	4850	10	↓	4846 T.S.	320	0.53%	0.48%	<0.001	0.04	<1

Mineralogy and Structure

To	Chalcopyrite	Galena	Sphalerite	Grey S= or SS	Pyr Dissem	Pyr-Vein	Limonite	Hematite	Specularite	Magnetite	Garnet	Serp-Talc	Wollastonite	Graphite	Jasperoid	Qtz-Vein	Clay	Chlorite	Epidote	Calcite
4430	–	?	?	2	.5	T-	T-	T	–	–	T+	T+	–	–		–	–	–		2
4440	–	–	–	.1	.4	T-	T-	T	–	–	T-	1	–	–	V.F.g. QTzite	–	–	–		1
4450	–	–	–	T+	.3	.1	–	T-	–	–	–	½	–	–		–	T-	–		T
4460	–	–	–	T+	.2	.2	–	T-	–	–	–	½	–	–		–	T-	–		2
4470	–	.1	.1	T+	.3	T	–	–	–	–	2	2	3?	–	5	–	T+	–		30
4480	T-	.2	.1	.2	.8	T	T+	–	–	–	3?	1	2?	5	2	–	–	1	T?	70
4490	–	–	–	T+	.3	–	–	–	–	–	1	2	–	2	T-	–	–	½	–	93
4500	–	–	–	–	T-	–	–	–	–	–	–	2	–	3	–	–	T	T	–	95
4510	–	T	–	.1	.4	–	.2	–	–	–	–	30?←	–	–	–	–	?	1	T+?	65
4520	–	–	–	T-	.2	–	–	–	–	–	T+	10	?	T+	2	–	?	½	T?	85
4530	.3 Tr Bn	–	– Tr MoS_2	T-	.5	–	T-	T-	–	–	–	20	–	T+	T+	2	–	4	1	45
4540	T+	–	–	.1	.7	T-	T-	–	–	–	–	2	–	T+	T+	–	T	1	T-	85
4550	T+	T	–	T+	.4	–	T+	–	–	–	–	½	10?	T-	20	–	Tr	T	–	60
4560	–	–	–	T	.5	–	T+	–	–	–	–	T	3	–	10?	–	T	–	–	85
4570	–	–	–	T	.5	–	T-	–	–	–	–	T	T	–	30?	–	1	–	–	40
4580	–	–	–	T+	.6	–	T+	–	–	–	–	T-	–	–	20?	–	1	–	–	5
4590	–	–	–	T+	.5	–	–	–	–	–	–	T+	–	–	5	–	½	–	–	2
4600	T-	T+	–	T+	.3	–	T-	–	–	–	–	T-	–	–	–	–	½	–	–	2
4610	–	T+	–	.1	.8	–	T-	T-	–	–	T-	T+	–	T-	–	–	1	–	–	3
4620	–	T-	T-	.1	.5	–	T-	–	–	–	–	T	½	–	–	–	1	–	–	3
4630	–	–	–	T-	.3	T-	–	–	–	–	T-	2	–	2	–	–	1	T-	–	45
4640	–	–	.1	T+	.3	–	T-	–	–	–	T-	3	–	T-	2	–	2	T-	T?	10
4650	–	–	T	T	.2	–	T-	–	–	–	1?	4	–	¼	–	–	3	–	–	20
4660	–	–	T-	T	.2	–	T-	–	–	–	–	5	–	T+	2	–	8	T-	–	40
4670	–	–	–	T-	.2	–	T-	–	–	–	–	4	–	1	2	–	5	–	–	60
4680	–	–	–	T-	.3	–	1	–	–	–	–	2	–	½	2	–	5	–	–	30
4690	–	–	–	T-	.4	–	¼	–	–	–	–	1	–	–	T+	–	5	–	–	40
4700	–	–	–	T+	.2	–	T-	–	–	–	–	½	–	–	3	–	2	–	–	15
4710	–	–	–	T-	.2	–	T-	–	–	–	–	T-	–	–	T	–	1	–	–	10
4720	–	–	–	T-	.3	–	T-	–	–	–	–	T-	–	T-	3?	–	1	–	–	10
4730	–	T-	–	.1	.2	–	¼	–	–	–	–	5	–	–	1	–	5	–	T?	15
4740	–	T	–	.2	.4	–	¼	T-	–	–	–	½	–	–	–	–	1	–	–	8
4750	–	–	–	.1	.2	–	T+	–	–	–	–	½	–	–	–	–	1	T+	–	3
4760	–	–	–	T	.2	–	T-	–	–	–	–	½	–	–	–	–	1	T+	T-	5
4770	–	–	–	T	.2	–	T-	–	–	–	–	T+	–	–	–	T-	1	T-	–	5
4780	–	–	–	T	.2	T	–	–	–	–	–	T+	–	–	–	–	2	T+	–	5
4790	–	–	–	T+	.2	T	T-	–	–	–	–	T+	–	T-	T-	–	2	T+	T-	15
4800	–	–	–	T-	.1	T-	–	–	–	–	–	T-	–	–	T-	–	1	T-	–	15
4810	–	–	–	.3	.5	.2	.1	–	–	–	–	½	–	2?	5	T	2	T	–	20
4820	T-	T+	T-	.7	.2	–	T	–	–	–	–	3	T?	T	2	–	5	T-	–	30
4830	–	–	–	T	.1	–	T-	–	–	–	T?	1	?	T-	10	–	10?	–	–	5
4840	T-	T+	T-	.1	.3	–	T-	–	–	–	1?	3	1?	T-	3	–	10?	–	–	70
4850	T+	.5	1.0	.2	.3	–	T-	–	–	–	2?	8	3?	–	1	–	2	–	–	80

Structure, Rock Type and Remarks

To	Cal. Gr. Size	% Sanding-WSS	% Banded	Bx Matrix %	Dip. Bedding Flow-Band	Sulfide Veins # + *	Width mm S= Vn / Alt. Selv.	Faults / Crushing / Shearing	Rock Type and Remarks
4430	–	T-	60	–	30	1mm late calc vn		—	v.F.g. QTzite: 50% Lt. Pink ArKose -½ mm grains (maybe KFs flooded) Dissem S=: gy S= w/ pyr.
4440	–	–	10	–	35	1/60	1mm calc.	—	QTzite, 5% ArKose
4450	–	–	30	–	30-40	—	—	—	⇒ to 4462 QTzite
4460	–	–	10	–	35	2@40 1@80	⅛-1mm/calc.	—	
4470	½-1	¼	60	–	35	3@75 2@80 (cal)	⅛-3: Stringers 1-2	Loc wk Bx	~10% BK Re'xtal LS Mottled LS maybe Mg Because less Alt. Red S Rx
4480	½-1	T+	40	–	10-20	cal vn @ 10-20 + 60-70	1-2mm.	—	DK. gy-BK + white Banded LS 4477-82 ("schist") REST Mottled LS.
4490	<¼	T-	30	–	10-30	cal vn (+10) 30 + 60°	1-2mm.		v.Fg LS.
4500	½	T-	40	–	20-30	cal vn (+8) 20-30 + 60	1-2mm	–	30% BK Re'xtal Banded
4510	<¼	–	5	–	–	—	—	—	Mottled v.F.g. SERP or Talc or clayey LS. Dissem yellow stain Around Diss Pyr.
4520	½-2	T+	10	–	25	+20 cal vn	1-2mm	—	Diss. Pyr in green whispy Talc?
4530	½-2	T-	25	30/50	–	+10 cal vn: 80-90	1-3mm	Bx-wk crush.	4521-26 IBX, well Round to Sub Round. .2-5cm Frags 5-10% IGN. (QM w/ Pre Bx Q-S vn, Diss cpy, Tr Bn; Qtz-MoS_2 vn), 60-80° contacts, Sharp.
4540	½-4	T-	20	5	20-30	5 py: 70-80	¼mm sh. on Fx w/SERP	WK Bx	WK-mod cr. @ 75-80° 26-32: MARBLE + SERP.-wkly Bx.
4550	½-1	T	5	–	30?	cal vn 20+60	1-3mm	—	Jasp. is partially purple.
4560	½	T	2	–	Band 45	—	—	—	clusters of Dissem S=: jAsp? is grey.
4570	¼	–	30	–	45-50	Dissem. almost Bedded S= clusters @ 45°	cal vn @ 60°		3% purple, REST Grey jasp. After V.F.g. QTzite ⇒ ↓ Grades into QTzite ≈ 4555, v. F.g. ½-¼mm bedding Dip 15-30° Dissem. S=
4580	–	–	10	–	40	—	—	—	clusters along laminae, Locally Tr. Lt. pink hue, locally v. F.g. "Aplitic" or Arkosic
4590	–	–	5	–	35	+5 calc vn	½-1mm.	—	grades over 1-2' to BK MARBLE (Banded) @ 4626
4600	–	–	10	–	10-25	—	—	—	Pyr. Repl. "bedding"
4610	–	–	5	–	20	1-4mm calc-vn @80-90° (2-3)		—	
4620	–	T	3	–	20-30	1-cal vn @ 60	3mm	—	4626-4630 BK MARBLE
4630	½	–	50	Loc 1	35-40	Banded @ 50°	1" sheen talc @ 35°		4630
4640	–	–	70	–	30	5 @ 40-60°	1-2mm calc	—	Calc. QTzite much of gy S= is v.F.g. pyr.
4650	<¼	–	90	–	20-40	← Strong Band = ? Bedding			Pink, Tan & Lt. ol. green Banded (siltstone) weakly crushed
4660	<¼	T	80	–	20-40		@ 4656 wk sh in clay seap 40°		
4670	<¼	½	40	–	35	1-2 cal seap vn	2-3mm wk. slicks (vein?)		BK. MARBLE Banded @ 4668-72
4680	¼	1	20	–	30-40			—	Clayey Cr. zone 4673. 4673-83 QTzite, 83-85 mottled limey QTzite
4690	<¼	1	50	–	35°	5 calc vn @ 60, 30-50	1-2mm	—	⇒ 4688 ⇒ QTzite w/ 5-20% calc., Local 1' limey zones, much of QTZ mod → well Rounded + cemented w/ calc + SiO_2
4700	–	½	30	–	35	+5 calc vn @ 70-85	1mm	—	jasp(?) is med. gy. Maybe some Fs grains in QTzite? QTzite is whole Fx
4710	–	T+	20	–	20-40	+10 cal vn @ 30-40 + 60-80	1-3mm	—	
4720	–	T+	30	–	30	+5 calc vn @ 10-20 + 80-90° 1mm.	wk Fx 80-90		⇒ 4688 – 4818 mostly f.g. QTzite –
4730	–	T+	20	–	35	Dissem, 1-2mm calc vn @ 30° in clayey zn →			4726-29 clayey-SERP zone "Limonite" is Jarosite + $FeSO_4$? stain SILTSTONE, Local 1' MARBLE ZONES
4740	–	T+	30	–	–	—	—	—	@ 4734 Tr. or. Stilbite? selv to calc. vn Around Dissem pyr.
4750	–	T	10	–	30	1-2mm Fx @ 60° (8)	—	—	Chl. selv. 1-2 mm Around serp-chl. Dissem. py on lam Fx
4760	–	T-	10	–	35	—	–	–	
4770	–	½	10	–	35	2-4mm Fx calc dause filled 70-90° 4767		–	
4780	–	T-	10	–	10-30	↑ +10 / Ft ¼-½mm. calc-filled Fx 10-30, 70-80			
4790	–	T-	20	–	10-30				
4800	–	T-	40	3	20-40	↓			4803-04 5-15% BK Bx(?) MATRIX (crushed S=, carbon)
4810	–	3	60	8	80	crush ~ 60-90°	1-3mm.	4807-4812 mod-str crush (Not Min)	@80-90°: mostly cr. QTZ + S= (py) Locally vuggy + filled w/calc dause
4820	½	1	20	3	40	—	—	–	⇒ 4818 Lt. gy-gr limey clay-SILTSTONE (could be calc-silicates (Fg))
4830	–	T-	5	–	35	4/10: 1-2mm calc. vn w/ Tr. [illegible] S=		—	
4840	–	–	20	½	30-40	—	—	Tr. cr.	Local. Tr. selenite? on Fx - Muscov.?
4850	<½	T	80	T-	20	Stringers	—	Tr cr	⇒ 4846-77: 0.8' 5-10% S= sl > gn > py > cpy: .1-.5 Dissem Py, gn, sl. Elsewhere in granular MARBLE

(8)

GEOLOGIC LOG

PROJECT: TRENCH | HOLE NO. TCH-1
Collar elev. ______ | Final depth ______
Coord. N ______ | Inclination ______
Coord. E ______ | Page 8 of 9
Logged: F.R. Koutz
Date start ______ | Date finish ______

Depth, Assay, Sulfides and Oxides

From	To	Length	Rec. %	Cu ppm	Pb ppm	Zn ppm	Au oz/T	Ag oz/T	Mo ppm	Chalcopyrite	Galena	Sphalerite	Grey S= or SS	Pyr. Dissem.	Pyr. - Vein	Limonite	Hematite	Specularite	Magnetite
4850	4860	10	100							T-	.1	.1	.1	.3	-	T-	-		-
	4870	↑	↑							-	T-	T-	.1	.3	-	-	-		-
	4880									-	T	T	.1	.2	-	T-	-		-
	4890									-	-	-	T-	.3	-	-	-		-
4890	4900			44	65	92	<0.001	0.01	2	-	-	-	T	.2	-	-	-		-
	4910									-	-	-	.1	.2		-	-		-
	4920									-	-	-	.1	.2		-	-		-
	4930									-	-	-	.1	.2		-	-		-
	4940									-	-	-	.1	.3	.1	-	-		-
4940	4950			147	113	98	<0.001	<0.01	2	-	T-	T	.1	.3	-	-	-		-
	4960									-	-	T	.1	.2	-	T-	-		-
	4970									-	-	.1	T+	.1	-	T-	-		-
	4980									-	-	T-	T	.1	-	-	-		-
	4990									-	-	-	T-	.1	-	T-	-		-
4990	5000			11	105	78	<0.001	<0.01	NIL	-	-	-	T-	T+	-	-	-		-
	5010									-	-	-	-	T	-	-	-		-
	5020									-	-	-	-	-	-	T+	T-		-
	5030									-	-	-	-	.1-	-	T-	-		-
	5040									T-	-	-	-	.1	-	T-	-		-
5040	5050			8	107	27	<0.001	<0.01	3	-	-	-	-	.1	-	T-	-		-
	5060									-	-	-	-	T+	-	-	-		-
	5070									-	-	-	-	T-	-	-	-		-
	5080									-	-	T+	-	T+	-	-	-		-
	5090									T?	-	T-	-	.2	-	T-	-		-
5090	5100			26	70	36	<0.001	<0.01	2	-	-	T-	.2	.6	T-	T-	-		-
	5110									-	-	-	.1	.2	T-	-	-		-
	5120									-	-	-	T	.2	-	T-	-		-
	5130									-	-	-	.1	.4	T-	T-	-		-
	5140									-	-	-	-	.1-	-	-	-		-
5140	5150			10	97	27	<0.001	<0.01	2	-	-	-	T	.1	-	-	-		-
	5160									-	-	-	T+	.3	-	-	-		-
	5170									-	-	-	T-	.3	-	T-	-		-
	5180									-	-	-	T-	.1	T-	-	-		-
	5190									-	-	-	-	.1	-	-	-		-
5190	5200			26	41	28	<0.001	<0.01	3	-	-	-	T+	.2	-	-	-	T-	-
	5210									-	-	-	-	.1	-	-	-	-	-
	5220									-	-	-	-	.1	-	-	-	-	-
	5230									-	-	-	-	.1	-	T-	-	-	-
	5240									-	-	-	-	.2	-	T-	-	-	-
5240	5250			24	72	36	<0.001	<0.01	NIL	-	-	-	T	.2	-	T-	-	-	-
	5260									-	-	-	T-	.1	T	-	-	-	-
	5270	↓	↓							-	-	-	T-	.1	T	-	-	-	-
5270	5280	10	100							-	-	-	-	.1	T	-	-	-	-

Mineralogy and Structure (silicates, calcite, texture)

To	Garnet	Serp.-Talc	Wollastonite	Graphite	Jasperoid	Qtz-Vein	Clay	Chlorite	Epidote	Calcite	Calc. Gr. Size	% Sanding-Vug	% Banded	Bx Matrix %	Dip: Bedding/Flow Band
4860	2	3	-	1?	2	-	5	-	-	20	½	1	60	2	35
4870	1?	3	1?	T-	1	-	3	-	-	20	¼	½	30	1	30/40
4880	1?	1	-	2	2	-	1	-	-	40	½-1	T	60	T	35
4890	-	1	-	3	-	-	-	-	-	93	½	-	55	T	40/60
4900	-	2	-	T	1	-	3	-	-	50	½-1	T	20	-	20
4910	1	1-2	T?	T	T	-	2	-	-	70	½	T-	50	-	20/30
4920	-	T	-	5	1	-	T	-	-	95	½-2	T	95	3	0/90
4930	-	Tr	-	4	T+	-	T	-	-	95	½-1	T-	95	4	20/60
4940	-	T+	-	3	T	-	T	-	-	94	½-1	T-	90	3	20/60
4950	-	T	-	4	-	-	T	-	-	95	½-1	T-	95	3	20/50
4960	-	3	-	2	T-	-	2	-	-	96	½-1	T-	15	T	-
4970	-	1	T	½	-	-	1	T?	-	96	½-2	½	5	T	-
4980	-	1	T+	1	-	-	½	T-	-	95	½-2	1	20	1	30/70
4990	-	T+	2	½	-	-	1	-	-	96	1-3	3	10	-	20/40
5000	-	T	1	T+	1	-	½	-	-	98	1-3	3	10	-	30/50
5010	-	½	3	T-	½	-	1	-	-	95	1-3	5+	15	-	60/80
5020	-	T+	3	-	1	-	T	-	-	95	2-4	4	5	-	-
5030	-	T-	2	-	T+	-	T	-	-	96	1-3	2	10	-	-
5040	-	1	1	½	½	-	½	-	-	95	½-2	3	20	3	20/40
5050	-	1	2	½	T	-	T+	-	-	95	½-2	2	50	1	-
5060	-	1	4	1	T+	-	½	-	-	93	½-2	1	40	-	20/40
5070	-	2	3	½	5	-	T+	-	-	90	½-1	½	60	-	20/40
5080	-	½	2	T+	½	-	T-	-	-	95	1-3	1	20	2	35
5090	-	½	1	T-	-	-	½	-	-	96	½-3	2	10	-	35
5100	-	4	1	-	3	-	3	1?	?	80	½-1	½	80	15	10/20
5110	-	1	½	T-	35?	-	T-	-	-	60	½	T	50	1	10/30
5120	-	1	T	-	10	-	T	T-	-	86	1-2	¼	20	T+	20/50
5130	-	2	T	2	10	-	2	-	-	85	½-2	2	70	T-	30/40
5140	-	½	T	3	1	-	T	-	-	95	½-1	½	80	3	40/60
5150	-	T+	T+	T-	-	-	T	-	-	78	½-1	½	30	T	-
5160	T?	T+	T	½	T+	-	T	-	-	85	½	T+	40	-	15/30
5170	-	2	T	½	2	-	T+	-	-	80	¼-½	T+	70	5	10/30
5180	-	3	T	1	T	-	T+	-	-	75	½-1	T	70	1	10/40
5190	-	1	1	T+	8	-	½	-	-	85	1	1	50	1	35
5200	-	½	T	-	2	-	1	-	-	60	¼-½	T-	60	-	20/40
5210	T?	2	T-	½	8	-	1	-	-	80	½-1	T	80	-	10/30
5220	-	T-	T+	1	-	-	T	-	-	96	1-2	½	60	T	30
5230	-	T	1?	T	-	-	½	T	T-	96	1	½	5	-	-
5240	T?	½	2	¼	3	-	½	-	-	93	1	T	20	-	30/50
5250	-	1	½	T-	10	-	1	-	-	85	½	T+	10	-	40
5260	T?	2	½	T+	2	-	½	-	-	90	½	T	15	-	30/40
5270	-	4	T-	2	1	-	½	-	-	92	½	T	85	-	40
5280	-	6	-	2	2	-	1	-	-	90	½	1	80	-	10/40

Veins, Faults and Remarks

To	Sulfide Veins / # /ft / Width mm / S= Vn	Tact-Selv.	Faults - Crushing - Smearing	Remarks
4860	S= stringers @4856 ~5%; ½-2 stringers		Tr cr.	⇒ to 4874. Limey siltstone → Quartzite: Lt. gy with local mottled green dissem. S=, esp. in green-brown whispy stringers:
4870			Tr cr. calc. fills Fx. vksl 72-74	Locally clayey. % calc.-silicates uncertain.
4880	—	—		@ ~4874 Black banded f.g. marble starts. mod → str bleached black (graphite?) to 4879. S= in recryst. x.g. bands in marble: a v. weak zebra texture, to 4889.
4890	1-2 mm. calc vn	—	—	
4900	1-2 mm. +10 calc. vn @ 30-50°		—	⇒ 4889-4909. silty f.g. marble-Ls w/ local Qtzite: Lt.g, with local mottling (calc-silicates)
4910	—	—	—	⇒ 4909-4950: Black Ls-marble: wk → mod. banded. Local network
4920	Late 80-90° calc. vn to 8mm.		moderate flowage wk. Bx (4920-4950)	of BK graph. 1-2 mm. surrounding 1-3mm. blebs of grey calc. - Late calc. vn
4930	— ; 1/0 calc. vn/Fx 1-8mm all ∠			← Several periods of banding, calcite vn; up to 1cm (m-x.g. white). Pyr. conc. in dark → black bands. Microfaults
4940	4937 ~ stringer py vn			Local. Bleached + calc. silic. 4939-40; in core offset calc. vnlts 1-10mm.
4950	—	—		
4960	→ 4957-60 1-4mm 80-90° clay-calc-sheer	→ 3mm S1 vn (honey) @60° @ 4961.		← "clay" is papery + pure white prob. polygorskite (XRD sample); ⇒ 4950-4985: f → m.g. marble v. wk banding. Dk gray to black. (much weaker
4970	~ serp-chl. whisps 1mm. (local)			banding than above. Local wk. faulting of late calc vn (1-10mm offset)
4980	Local 1-5mm. offsets on 1-2mm calc. vn.		Tr crush	
4990	—	—	—	@ 4985: 0.8' sanded-clayey zone; ⇒ 4985-5040. - m → x.g. marble: mod sanding, local Wo? + clay: mottled black
5000	—	—	—	@ 4993-97, local drusy (1-3mm) lined vugs 80-90° + 1cm.! Some of Wo + Jasp.
5010	whispy serp. + Wo vn. 1-4mm @ 50-80°			5002-06: 80-90° open cavity + 1cm @ edge of core; is pink + light pink stain on Wo (surface of core)
5020	Local sanded vises 0-15° to core: prob. drilling artifact			(oxidized!)
5030	—	—	—	
5040	—	—	—	⇒ 5040-5093: mixed black (f.g) + rextal white (m.g.) marble: BK is < ½mm grain size
5050	1-6/ft 1-4mm calc vn: all ∠		—	white is ½-2mm. Late wh. calc. vn cuts all but is not noticeable in white marble
5060	1-5/ft 1-2mm. calc vn @ 60-90°		—	← local clots + knots of white calc in BK. Bleaching of BK → white calc. + rextal along late calc, no + serp-chl.
5070	—	—	—	vnlts in black marble: more Wo(?) fibres in white marble.
5080	calc + Wo vn 1-3mm 60-90	—	Tr crush	After 5074 completely bleached + recryst. - 5093.; ⇒ 5093-98: Chlorite-serp mudstone? Limey ~2% S= (py?
5090	1-2/ft 80-90° 1-2mm calc - Wo? vn	—		1885-86: calc. sand + clay? Lt. green (Wox stain ~½-2% pyr. 5089-90. gy S=)
5100	Loc. sh. in gr. clay.	—	Loc. wk Bx	Local clots in BK Ls-marble; ⇒ 5098-5126: f.g. silty limestone (marble) Lt. gy. with some
5110	—	—	—	5107-11: Qtzite v. Lt. purple jasperoid 40-50° bands (beds?); sandy zones. Local 1-2' zones of m → x.g. marble .2-.4%
5120	—	—	—	← zone v.x.g. calc. (gy) vn to 4mm grain size 5117-20; Dissem. S=: usually in calc. silic. zones (bands)
5130	Local stringers of dissem pyr.		—	← 5125 4": soft gritty (not gg) limey sand with 3% dissem pyr @35°; ⇒ 5126: f.g. Bl. + wh. well banded marble (zebra
5140	Local calc. vn to 6mm. 60-90°	wk. cr. 1-5mm offset.		← Local knots + clots (5%) to 4mm.; like: v. BK sh.-banded with wh. m.g calc. @ 40-50°. Several periods
5150	—	—	—	of x.c. banding. BK bands ¼-3mm. (to 5141')
5160	—	—	—	
5170	stringers of dissem pyr. ½-2mm grains			5164-68 BK banded marble w/ 8%- knots + clots of calc.; ⇒ 5141-5290. Bleached rextal marble f → m.g., Local x.g. zones
5180	—	—	—	60% BK. banded w/ knots + clots; Local 1-6' zones with relict black banding, Local v.f.g
5190	3 calc. vn 2-3mm 30-40°	—	—	Local rosettes = ?? [illegible] horn coral; Limey siltstone w/ wk calc silicates + dissem S=. All cut by
5200	T grey S=? on Fx: some is specularite			← limey v.f.g siltstone 5190-96; Late calc vn with local Wo: 1-5% knots + clots - most visible
5210	—	—	—	← 5214-18: grey banded m.g. w/ clots (jasperoid is grey); in BK. banded.
5220	20-40 calc vn. 1-3mm. @30-40°		—	
5230	5227-30 1-4mm @75-85 white polygorskite vn: white fibres - paper-like			
5240	—	—	—	
5250	—	—	—	
5260	1mm sh. w/ pyr + graph. @ 40-60°			
5270	—	3% clots of calcite	—	5261-5286 more or less all BK banded w/ wk-mod bleaching + rextal.
5280	bands ¼-4 mm	8% clots	—	

(9)

GEOLOGIC LOG

PROJECT: TRENCH
Coord. elev: 5075.25
Coord. N:
Coord. E:
Logged by: F.R. KOUTZ
Date start:

HOLE NO.: TCH-1
Final depth: 5560
Inclination:
Page 9 of 9
Date finish:

DEPTH From	DEPTH To	Recovery		ALL-AARL Cu ppm	Pb ppm	Zn ppm	Au oz/T	Ag oz/T	Mo ppm	CHALCOPYRITE	GALENA / SPHALERITE	GREY SULFOSALTS	PYRITE-DISSEM / PYRITE-VEIN	LIMONITE	HEMATITE	MAGNETITE	GARNET	SERP-TALC	WOLLASTONITE	GRAPHITE	JASPEROID	QTZ-VEIN	CLAY	GYPSUM ?	CHLORITE	ACTINOLITE	CALCITE	CAL. RECRYSTL	% SPARRY VEIN	% BANDED	BX MATRIX %	BEDDING DIP	SULFIDE VEINS #	*	WIDTH (mm) S = VN	HAT SEAL	FAULTS CRUSHING SHEARING	ROCK TYPE & REMARKS
5280	5280	10	75-5284 100							–	–	T-	.1	–	T-	–	–	6	T	½	10	–	1		–	80	½	1	80	–	10 30	Bands ¼-2mm. BK		–		20% BK Banded. Local tourmaline tourmalines? Local Leopard Frog Green Wkly SERP (similar to Ficaro MM. w/o MAGN.)
5290	5300			26	98	44	<0.001	<0.01	2	–	– –	.1	.3	–	– –	–	–	T-	–	40	–	T		–	30	½	–	30	–	15	STRINGERS - w/ DISSEM. PYR.		–		5290-5300: v. Fg. siltstone - limey siltstone
	5310									–	T –	.1	.2	–	– –	–	T?	½	–	½	T	–	½		–	95	½-½	T	60	–	35	T-60° Scoli. VN 1-2 mm.		–		
	5320									–	– –	T-	.1	–	– –	–	–	½	–	T+	–	–	T		T-	T?	95	½-2	1	20	–	10 20			–		⇒ 5270-5361 MARBLE - Pastel LS, Bleached white from Black & banded. Local zones of siltstone + Banded Calc-silicate
	5330									–	– –	T-	.2	–	– –	–	–	½	–	T	5	–	T		–	–	80	½	T	40	5	10 30	Py 1-2mm DISSEM IN calc-silic ? ZONES	Local wk	–		5327-28 v. Fg. Qtzite - s. Hstone
	5340									–	– –	T-	.1	–	– –	–	–	T+	–	–	5	–	T-		–	–	30	–	–	10	1.	–	–	Bx INDISTINCT	–		5331-39: v. Fg. Qtzite - SILTSTONE
	5350									–	– –	T	.2	.1	T-	–	–	T-	–	T+	8	–	T		–	–	90	½-2	T+	30	–	25	1mm @ 30° Py. (2) Fr.		–		~3' BLACK Banded - NO KNOTS
	5360									–	– –	T-	.3	–	T+	–	–	T	–	T-	8	–	T		–	–	85	½-1	T+	10	–	15	–	–	–		
	5370									T-	– –	.3	.8	.4	T-	–	–	1?	2	2	–	15	–	1		T	–	20	½	¼	80	–	25	DISSEM Py to 3mm. clots to 1cm.		–		⇒ 5361 Banded v. Fg. SILTSTONE - limey siltstone, Bands 1-5mm. w/ Trace pink in lighter colored Bands - maybe Calc - to 5395
	5380									–	– –	.2	1.2	T+	¼	–	–	-?	1	1	–	10?	–	2	T	T?	–	15	½	3	95	2	40	DISSEM Py to 3mm		–		Silicates. Local DISSEM Py. (Pink colored MATERIAL could be Rhodonite - wk ⇒ Lt Pink (non-calc.-Dol) = 10% GLOME
	5390		-5383 TS							–	– –	T+	.4	T-	T-	–	–	–	1	2?	–	-?	–	1	3	–	–	10	–	2	80	1	30	–	–	–		@ 5385: 4" v. Light (Low ρ) x tals (MASSIVE) - maybe Gypsum (?ρ,v): other 80-90° VN (1-4mm). (Local OXID + fracking)
5390	5400			28	100	70	<0.001	<0.01	2	–	– –	T+	.4	–	T-	–	–	–	1	1?	T+	5?	–	T+	1	–	–	60	1	T	30	–	30	–	–	–		⇒ 5395 BLACK Banded MARBLE Locally bleached to white MARBLE
	5410									–	– –	T	.3	T-	– –	–	–	4	–	1	–	–	T-	T?	–	–	90	½-1	T	95	–	30 60	–	–	–		15% KNOTS + clots calcite — Local Lt green SERP
	5420									–	– –	T	.3	.1	– –	–	–	7	2	1	3?	–	2	T	1?	T?	60	¼	¼	70	–	40	1mm @ 90° Py. 1-2	–	–		-5415-18: S. Hstone in calc. silicates mottled; 3% KNOTS
	5430									–	– –	T-	.2	–	– –	–	–	15	T	2	2	–	1	–	–	?	75	½-1	T	90	–	10 50	3/pm + BLACK CR PYR.? w/ SERP selv. 1-10mm	–		5% KNOTS of Calcite. Local strong in SERP?
	5440									–	T+ T	.1	.4	–	T+	–	–	3	–	½	3?	–	2	–	–	–	60	½	1	80	–	30	DISSEM. PYR. STRINGERS WK Iron Stain.	–		-5435-38: Gy Banded SILTSTONE
5440	5450			20	119	55	<0.001	<0.01	2	–	– –	T+	.2	–	– –	–	–	5	–	T+	–	–	1	T	–	–	93	1-2	T+	30	–	–	–	–	–		1% KNOTS
	5460									–	– –	T	.4	–	T-	–	–	1	–	T-	3	–	1	T	–	–	75	1-2	T	30	–	20	DISSEM. PYR STRINGERS				5452-54: Limey Banded SILTSTONE; 3% KNOTS in BK Banded.
	5470									–	– –	T-	.2	–	– –	–	–	T	–	T	2?	–	T	T-	–	–	88	1-4	T+	10	–	30	–	–	–		white MARBLE.
	5480									–	– –	T+	.3	.1	– –	–	–	2	–	1	2	–	T	½	–	–	93	1-3	T+	60	T	30 40	1@90° WK Sil. in calc w. Gyp. 1mm Py. + Gyp.	@20+30			
	5490									–	– –	T	.3	–	T-	–	–	2	3	–	T+	1	–	1	2	–	–	70	½-2	¼	20	½	35			wk. mod. strong in gyp-calc w/ 30-60°		
5490	5500			11	82	45	<0.001	T	2	–	– –	T-	.2	–	– –	–	–	2	–	T+	–	–	3	1	–	–	93	½-1	T+	40	T	40			–		5485-87: mottled Pink + grey limey siltstone — Ls to 5505
	5510									T-	– –	T+	.6	T-	T-	–	–	4	–	T-	–	–	4	2?	–	–	55	½-1	T	85	20	35	STRINGERS of PYR. 1mm @ 30-60°		–		5500-5507 wk Bx @ 30°. ⇒ 5505
	5520									–	– –	T-	.4	T	– –	–	–	1	5	–	–	7	–	2	T	–	T?	5	–	–	100	2	20	L20 mm @ 90° @75-90° @5507		–		
	5530									–	– T+	T-	.3	–	T+	–	–	–	5	–	–	–	–	2	1	–	–	20	½	2	60	–	20	–	–	–		m.g. MARBLE 5517-18; 5520-22 vugs, v.g. Dol? (wk Fizz + Neg ALIZ tests)
	5540									–	– –	T-	.3	–	– –	–	–	2	4	–	–	5	–	3	1-2	T?	–	5	–	T	85	–	15	3/1-3 mm. wkly to Calc gyp VN (5537-38)		–		
	5550			35	142	14	T	0.19	2	–	– –	T-	.3	–	T-	–	–	2?	3	–	–	1	–	1	1	T?	–	5	–	2	85	–	15	Calc gyp VN @ 10-80		–		- SANDSTONE - SILTSTONE ; Gyp-calc clause on Fx.
5550	5560	10	100							–	– –	T-	.3	T-	T-	–	–	2	1	–	–	–	–	1	1	T?	–	3	–	T	90	–	10 20	Local calc-gyp VN 10-30° (w/5, 1-2mm)		–		v. Fg. SANDSTONE.
TOTAL DEPTH																																						

⇒ 5505-5560: Limey or Dolomitic SILTSTONE w/ Loc. v. Fg. Qtzite; Banded some pink from Calc silicates. colors Lt. Gy → Brown mottled. DISSEM or Stringer pyr. - Local green SERP (Leopard) Local DISSEM gyp + gyp-calc VN. (Loc.)

NOTE: MINERAL ESTIMATES NOT CHANGED from original Logging AFTER Assays Returned.

(1)

Drilling by Joy MFG (R.A. Gardner) - 22HD (#9103)
0-21' 6¼" Rock Bit - 4" Csg 3/16/81
21-2502 NC (Rods left in hole after TCH-24 - (Jan 82))
2502-4280 NX
4280-5830' BX
T.D.

GEOLOGIC LOG

PROJECT TRENCH - USGS -
TRENCH UNIT COORD. 1981 SURVEY BY F. BAKER
Collar elev. 4888.55 Top of Platform / 4887.72 Top of 4" Csg
Coord N. 5360.13
Coord E. 3516.40
Logged by F.R. KOUTZ, 1981
Date start March 13 1981
HOLE NO. TCH-2
Final depth 5830' BX
Inclination 90* SEE SURVEY
Page 1 of 10
Date finish AUG 8 1981

Depth, recovery and assays

From	To	Interv.	Core Recovery	Comment or Assay Interval	AAML Cu %	AAML Pb ppm	AAML Zn ppm	Au oz/T	Ag oz/T	AAML Mo ppm	Ag ppm / Skyline Ag oz (Fire)
0	21	21	—								↓
21	40	19	100	21-30	0.03	114	244	.002	0.17	32	
40	60	20	↑								
60	80	↑									
80	100			TS 094' 90-100	0.01	18	199	.001	0.10	22	
	120										
	140										
	160										
	180										
180	200			190-200	0.01	14	224	.001	0.07	17	
	220			TS 212							
	240										
	260										
	280										
280	300			290-300	0.03	13	330	.001	0.14	10	
	320										
	340			TS 334							
	360		↓								
	380		100	360-370 / 370-380	0.01 / 0.01		700 / 800		0.09 / 0.40		
380	400		97	380-390 / 390-400	0.01 / 0.52	476	1300 / 3200	0.002	0.29 / 0.85	16	6.8 / .92 oz
	420		100	400-410 / 410-420	0.03 / 0.10		500 / 900		0.76 / 0.08		2.2 / 1.0
	440		99	420-430 / 430-440	0.02 / 0.03		100 / 300		0.10 / 0.49		.6
	460		100	440-450 / 450-460	0.03 / 0.02		300 / 100		0.60 / 0.09		— / .4
	480		100	TS 467' 460-470 / 470-480	0.04 / 0.02		200 / 500		0.35 / 0.60		—
480	500		100	XRD 500' 480-490 / 490-500	0.03 / 0.15	296	800 / 5900	.008	0.57 / 0.88	3	.6 / .74 oz
	520		99	500-510 / 510-520	0.03 / 0.07		4700 / 2300		0.14 / 0.17		1.6
	540		98	520-30 / 530-40	<0.01 / 0.08		1100 / 1200		0.09 / 0.16		—
	560		99	540-50 / 550-560	0.01 / 0.07		500 / 600		0.33 / 0.13		—
	580		100	560-570 / 570-580	0.02 / 0.03		1000 / 1000		0.13 / 0.11		2.0 / 1.0
580	600		99	580-590 / 590-600	0.07 / 0.31	39	700 / 2400	.001	0.12 / 0.20	3	— / 6.4
	620		100	600-610 / 610-620	0.32 / 0.09		3900 / 7400		0.66 / 0.37		0.50 oz / 11.0
	640		100	620-630 / 630-640	0.04 / 0.17		1700 / 600		0.20 / 0.15		4.2 / 2.4
	660		100	640-650 / 650-60	0.01 / <0.01		100 / 900		0.14 / 0.83		.2 / .2
	680		99	660-70 / 670-80	0.01 / 0.07		200 / 1300		0.10 / 0.11		—
680	700		96	680-690 / 690-700	0.09 / 0.04	70	1700 / 1060	.001	0.12 / 0.09	6	— / 2.0
	720		100	700-710 / 710-720	0.02 / 0.04		400 / 900		0.08 / 0.10		2.0 / —
	740		100	720-730 / 730-40	0.03 / 0.04		2800 / 900		0.20 / 0.09		—
764 circulation loss	760		100	TS-751 740-50 / 750-60	0.01 / <0.01		500 / 100		0.05 / 0.07		—
	780		100	760-770 / 770-780	<0.01 / <0.01		100 / 100		0.04 / 0.03		—
780	800		99	780-790 / 790-800	0.17 / 0.02	28	800 / 840	.003	0.09 / 0.32	10	.6
	820		100	800-810 / 810-820	<0.01 / <0.01		100 / 100		0.05 / 0.02		.2
	840	↓	100								
840	860	20	100								

Vertical note beside the Skyline column, 380–640: "950' @ 0.09 Cu, 0.17 Zn, 0.34 oz Ag"

Mineralogy and structure (Volume %)

To	Chalcopyrite	Covellite/cc	Galena	Sphalerite	Grey S= or SS	Pyrite-Dissem.	Pyrite Vein	Limonite	Hematite	Specularite	Magnetite		Alunite	K-Feldspar	Qtz-Dissem.-Jasper	Qtz-Vein	Clay	Sericite	Chlorite	Epidote	Calcite	Gypsum	% Vugs
21	—	—	—	—	1.0	.5	—	2	1	—	—			—	—	—	10	15	1	—	?	—	—
40	—	T-?	—	—	1.5	.8	T-	T-	T	—	—	T MnOx		—	1	—	12	18	T?	—	—	—	3 f.g.
60	T?	T-	—	—	1.5	1.5	F	T-	T	T?	—	T MnOx	T+? Alun.	T	2	T	15	20	—	—	—	—	4
80	—	?	—	—	2.0	1.5	T	—	T-	T	—	T+ MnOx		—	3	T+	15	18	T-	—	—	—	4
100	—	—	—	—	2.5	2	T	T	T-	T	—	T+ MnOx	T Alun.	—	3	T	12	18	T?	—	—	—	3
120	—	—	—	—	2.5	2	T+	T-	—	T	—			—	3	—	12	16	—	—	—	—	2
140	T-	T-?	—	—	1.5	2	1/2	1/4	—	T-	—	T MnOx		1	2	1/2	18	20	—	—	—	—	3 f.g.
160	T-	—	—	—	2.0	2	1/2	1/2	T	T-	—			—	4	1/2	20	18	T	—	—	—	4
180	—	T-	—	—	1.5	1.5	1/4	1/4	F	—	—			—	2	1/2	20	16	—	—	—	—	3
200	—	—	—	—	1.5	1.5	1/4	1/2	T	—	—			—	3	1/2	18	18	T?	—	—	—	3
220	—	—	—	—	2.0	1.8	1/2	1/4	T+	—	—			—	5	1/2	15	15	—	—	—	—	3
240	—	T-	—	—	1.8	2	1/2	1/2	T+	—	—			—	4	1/2	20	18	—	—	—	—	3
260	—	T-	—	—	1.5	2	1/2	1/2	T	—	—			1/4	4	1	20	15	1	T. Biot.		—	2
280	T-	T-	—	—	1.3	2 1/2	1/2	1/4	—	—	—			—	5	1	18	15	T+	—	—	—	2
300	—	T-?	—	—	1.0	2 1/2	1/4	3/4 ← stain of Fs	—	—	—			—	5	1/2	12 mud	15	T	—	—	—	2
320	—	—	—	—	0.8	2.5	1/4	1	T-	—	T-?			T	6	1/2	12 tan	14	T+	—	—	—	1 1/2
340	—	—	—	—	0.5	2.0	1/4	1	T-	—	F			T	8	1	10	12	T+	—	—	—	2
360	—	T	—	—	0.5	2.0	1/4	3/4	T	—	—			1/4	8	1	10	12	T	—	—	—	4
380	—	T-	—	—	1.0	1.5	T+	T+	—	—	—			—	3	T+	18	20	—	—	—	—	2
400	T+	cc .2	—	T? ←	2.0 - 10 En	2 1/2	1/2	T	1/4	T+	—		T Alunite?	T	5	1	25	15	—	—	—	—	5-
420	.1	cv? .1	—	?	2.0	1 1/2	1 1/2	T	T+	T	—			—	5	3	18	20	—	—	—	—	2
440	T	cv T+	—	—	1.3	2 1/2	1 1/2	—	1/2	—	—		1/2 Alun. in vn.	—	20	5	25	20	—	—	—	—	4
460	.1	.1	—	—	1.5	2	1 1/2	—	1/4	T-	—		1/2 vn Alun.	—	25	7	15	30	—	—	—	T-	2
480	T+	T+	—	—	2.0	1/2	1 1/2	—	T+	—	—		T pink clay 1? Alun.	T+	20	5	15	30	—	—	—	T-	1
500	T-	Tcc	—	—	2.0	1/2	3	—	T-	—	—		T+ Alun. + CaF_2 - green	—	22	8	15	28	—	—	—	—	3
520	T-	Tcc	—	—	1.5	3	1	—	—	—	—			—	10	5	25	45	—	—	—	—	1
540	F	.1	—	T-	1.5	2	2	—	T-	—	—		T Alun.	—	15	7	20	35	—	—	—	—	1
560	T	.2	—	—	1.5	2	1/2	—	T-	—	—			—	13	7	22	38	—	—	—	—	2
580	T	.6	—	—	1.2	1 1/2	1	—	T-	—	—		2 Alun?	—	15	8	18	30	—	—	—	—	1
600	F	.8	—	—	1.5	2	3	—	—	—	—			—	10	6	20	40	—	—	—	—	1
620	.1?	1.5	—	T?	2.0	2	2	—	—	—	—			—	12	8	15	30	—	—	—	—	2
640	T	1.0	—	—	1.2	2	1	—	T-	—	—			—	10	6	15	30	—	—	—	—	1
660	—	.4	—	—	1.0	2	1	—	—	—	—			—	10	5	12	26	—	—	—	—	2
680	—	.2	—	—	1.0	1.5	1	—	—	—	—			—	8	5	18	30	—	—	—	—	1
700	F	.2	—	—	1.0	2	1	—	—	—	—			T-	7	6	22	35	—	—	—	—	2
720	T-	.4	—	—	.8	2	1	—	—	—	—			—	8	5	18	30	—	—	—	—	1
740	—	.5	—	—	1.2	2.5	1	—						—	8	5	15	28	T-	—	—	—	2
760	T-	1.5	—	—	2.0	3	1 1/2	—	—	—	—		1 Alun?	—	10	7	12	25	—	—	—	—	2
780	—	1.0	—	—	1.2	2 1/2	1	—	—	—	—		3 Alun?	—	10	6	13	25	—	—	—	—	2
800	T	1.3	—	—	1.0	2	1 1/2	—	—	—	—		T Alun.	—	10	8	15	25	—	—	—	—	2
820	—	.1	—	—	.5	1 1/2	1	—	T-	—	—			—	12	4	10	20	—	—	—	—	1/2
840	T	T-	—	—	.3	1 1/2	3/4	—	T-	—	—			—	10	5	10	20	—	—	—	—	1
860	T	T-	—	—	.8	1 1/2	1/2	—	—	—	—		T Alun.?	—	13	5	12	22	—	—	—	—	3

Structure and detail

To	Av. clast size	% Bx Matrix	Fx/Foot	Dip: Bedding/Flow-Band	Sulfide Veins #/Ft	Width mm Sulfide vn/Alt Selv. + Dissem. grains	Faults, Crushing, Shearing	Detail
21	— mm	—	—	—	—	—	—	Rock Bit: Vials; Oxidiz. (Partial) to ~10': Bedrock Rep't 15-20' Solid at 20' JAR = Goeth > hem.
40	8	60	1	10/30	<1/2 Bk rims on clasts	<1/2-1 diss	—	CHIEF FORMATION
60	10-2	75	1	30-+50	Bk rims on clasts	part detrital <1/2-1	53': 4" clay + crush: no ∻ + gg on Fx	
80	1-2 + 5-8	75	1/2	40/70	—	<1/2-1	@ 65' 4" gg @ 75-85°	2-4' Beds: Alt x.g. ss, Grit + lapilli tuff
100	1-3 + 8	80	1	40/70	Al stringers in clasts	<1/2-2	@ 83' 3" gg + cr @ 30°	90-133: Dk gy Grit with fewer clasts
120	2-4	85	1/2-1	60/80 @ 50°	—	<1/2-2	119-120: 1/2" gg @ 80	Note: many of lithic
140	2-4 5-12	65	1	40	<1/2 stringers in clasts	<1/2-2	134-139 V. clayey + wk crush.	lapilli show several
160	2-5	70	1	30	<1/2 string. in clasts	<1/2-2	160, 6" clay + mud cr.	generations of reworking
180	2-8	60	4	35	<1/2 string. in clasts	<1/2-2 dissem	165-175 periodic	crush-clay zones
200	2-5	55	3	20/40	string. in clasts	<1/2-1	187-195 crumbly	197-234: mostly ss-Grit, thin 1-8"
220	2-4	75	1/2	40	<1/2-1 string. in clasts	<1/2-1	—	interbeds of 5-10mm clasts.
240	1-2 4-6	70	1/2	40/60	<1/2 strings.	<1/2-1	@ 230' 3" ss + gg @ 25°	: some clasts have weakly altered cores (chl)
260	4-8	50	1	30	<1/2 string	<1/2-1 diss-det.	235-244 + gg (1-2")	Locally v. soft clay-sh. @ 75°, 241-43'). Below 250' + better consolid., less clay below 268'
280	4-10	40	2	35	<1/2 string. in clasts	<1/2-1	266-68 - mud cr - gg zone @ 35°	: loc. purple SiO_2 clasts + mat. pyr.
300	2-4	40	1	30	Bk rims on clasts	<1/2-1	—	
320	4-10	35	1/2	15	<1/2-1 string in clasts	<1/2-1 dissem.	—	locally 1-5% xtal pheno.
340	4-10	30	1/2	35	<1/2-1 string in clasts	<1/2-1 dissem	wk-gg + sh @ 335 @ 30	~5% of clasts purple SiO_2
360	2-4 + 20	25	1	20	<1/2 vein, <1/2-2 string	<1/2-1	—	Distinct + post consolid pyr vn + xtal growth in vugs in larger clasts
380	2-4	80	2	40	<1/2 vein	<1/2-1	Loc. sh. @ 40-60	Tuff very ashy 380-394 ~6" core lost (ss ~394-395)
400	4-5 / 22-35	80 / 35	5	30	3: 50-70	1/2-5/3-10, <1/2-1 diss	Str. gg + sh. 394-96	Contact ~ 394.5 - no ∻ (35°?)
420	4-10	25	2	25	2/60-70	1-4/2-5, 1/2-1 diss.	Loc. sh. @ 30°	cc?-cv on cpy/pyr: minor dull-greasy gy En or atn??
440	15-20	30?	20	20	5: 10-25 +60-80	1/2-2/1-10, 1-2 diss.	Str. cr + sh. 423-430 (30-90°)	clay; f.g. Ashy tuff 418-431: v. wk relict Bx text.
460	2-30	30	1-15	20/40	3: w/sin Bx mat +60°	1/2-2/1-5	Loc. post SiO_2 cr + brecc.	Str. SiO_2 + vuggy partially leached vn (+hem)
480	4-30+	50	2	20?	2: 60-90	1/2-2/1-10 + peav.	White clay on Fx.	
500	15-15	40	3	35	3: 10-40 60-90	1/2-5/1-peav, 1/2-2 diss.	wk cr. wh. clay on Fx	⇒ HVY S= zone 496-500' ~30°
520	5-8	70	+20	?	5: All ∻ 10-30	1/2-5/1-peav, 1/2-3 diss.	V. str. clay + sh - v. crumbly	
540	10	75	+15	40 Eutax.	2: 30+ 60-70	1/2-3/1-peav, 1/2-1 diss	V. str. clay-crumbly	
560	5-15	70	13 +15	50 Eutax	2: 30 50-80	1/2-3/1-per, 1/2-2 diss.	56-63' - crumbly clay-gg	
580	5-15	70	2	30/40	4: 30 60-80	1/2-1/1-peav, 1/2-2 diss	70° sh @ 563-gg	⇒ (XRD: 565: ALUNITE)
600	10?	80	+25	50	5: 30 + 60	1/2-1/1-peav, 1/2-2 diss.	587-606 + wh. clay	V. str gg (local) (60 + 30°) + Bx py-cv stringers - 30°
620	5-20	80	3	35	6: 30+ 60-90	1/2-3/peav	Loc. sh! cr. @ 60-70°	
640	5-20	70	2	?	2: 50-65	1/2-3/pmv	Loc. sh @ 20 + 60°	
660	5-10	80	2	30/50	2: 50-90	1/2-1/peav, <1/2-2 diss	645-48' str cr. @ 60° w/ gg - white clay	⇒ (illite + Kaolin: XRD 646')
680	5-10	60	5	30	3: 30+ 50-70	1/2-1/peav, 1/2-1 diss	675-680: mostly clay + gg - plastic - crumbly	
700	5-15	40	+20	?	2: 30+ 50-70	1/2-1/pmv, diss 1/2	687-696 gg + clay plastic + crumbly	
720	5-20	60	4	30/50	4: 30-40 70-80	1/2-1/peav, diss 1/2-1	All T-wk crush + white clay	Sooty cov on Fx Much of cov/pyr
740	5-20	30	15	60	5: All ∻	1/2-1/peav, <1/2-2 diss	All wk-mod cr. + gg between Bx.	in vuggy Fx + phenocrysts in Bx clasts
760	5-30	35	3	30/50	6: 30-60 All ∻	1/2-2/peav, <1/2-1 diss.	wh. clay vn in Fx	Some cv in pumice(?) ± Qtz xtls: some/
780	5-30	40	1/2-5	45	2: 60 All ∻	1/2-1/peav, <1/2-2 diss	Crushed - 778-80	Bx + gg Rhyol Bx not well welded,
800	5-30	35	3	60	4: 50-90 20-30	1/2-1/1-peav, <1/2-1 diss.	v. wk cr. wh. clay on Fx	
820	5-15 450	20	2	?	1: 60-70	1/2/1-peav, <1/2-1 diss	v. wk cr. 800-813	Loc. Qtz druse in vugs
840	4-100	30	2	?	1: 60-70	1/2/1-peav, 1/2 diss	—	large Bx clasts: to 6"
860	10-30 +100	30	11-5	40?	1: 70	1/2/1-peav, 1/2 diss	849-56: wk crush Fx	Qtz druse + silica vn @ 846': 5 mm Qtz xtals - faint purple.

Rock type and remarks

⇒ GENERAL REMARKS

⇒ 20-394.5: Sandy to Gritty, porous, lithic lapilli tuff to tuff breccia, very poorly sorted but locally exhibits graded bedding, x-beds + slump struct (10-70°). Clasts are sub-∻ to well rounded. And make up 10-80% of unit with an ashy grey matrix. Most of the clasts are volcanic in origin but minor SiO_2-pyr clasts, sometimes Lt Lavender are not uncommon. A few QMP clasts can also be identified as can detrital Fs + Qtz xtals but much of core is so argillically altered to identify clasts. Locally tuff is weakly silicified + is usually only crumbly along well-sorted zones. Clay + sericite zones have been locally sheared and some core was plastic when removed from core bbl. Tuff has several % identifiable pyr, some as detrital grains but much of the grey color is undoubtibly due to v.f.g. dissem. pyr. Pyrite is locally oxidiz to jarosite-goethite which stains clays and locally a few % of clasts are oxidiz to hemat. Apparently previous to fm. of tuffs. Only trace local form. of pyr. to cpy-cv colors but only heavy cov-cc is in last few feet of tuff. This tuff is part of the tuffaring facies of FTG's Sunnyside diatreme. No sign of the Trachyandesite (db) was noted. Relative to clay vs sericite uncertain.

⇒ 394.5-431: Hausdell Rhyol. Tuff Bx: well alt. to argillic minerals (incl. ser). Dissem + Q-S vn pyr >> cpy with local late, spotty En? + cc-cv, many of vugs are silicif + contain Qtz druse, S= + late hem + white clay.

431-500' - Strong gy Q-S, locally destroys Bx txt, local thin alunite? vns + with pyr. Most vn Q-S-py w/wk selv., late wh. clay, loc. hem in vuggy veins. Most of Fs + Frags to white clay or SER.

⇒ 500-529: Str - mod. argillic alt + mod crush. Some of core poured from core bbl.

⇒ 500-801 - Handshell Tuff Bx - A welded tuff - local relict Eutax. struct - clasts mostly welded tuffs where identifiable. Some zones have only minor Bx frags. V. strongly argillic altered! Q-S-py (grey) flooding with local silicif. + later white clay overprint. Locally well faulted, crumbly + sheared in BRKN - argillic zones cov >> cc or pyr >> cpy. Some vuggy veins with Qtz stringers + dense crumpy + later hem. Only trace En(?) noted but much grey S= is unidentifiable. This is part of FTG's "Hypogene" covellite blanket as in TH-8 + 9; But has all ear-marks of supergene cv except capping. Hem. may indicate high T oxid/enrich. Amount of clay + cc/py dies out below ≈ 801: Bx fragments are more distinct (e.g. can note "Ribbon Rock") Below 801.

SKYLINE checked Cu+Zn with all Ag checks - SEE GEN. FILES   ↑ CHECK ASSAYS (SKYLINE)   ↑ see SM-5 magnetometer estimates by J.M. Wood.

(2)

GEOLOGIC LOG

width selv. = ¢ vn to margin.

PROJECT: TRENCH — HOLE NO.: TCH-2
Collar elev: ___ — Final depth: ___
Coord N.: ___ — Inclination: ___
Coord E.: ___ — Page 2 of 10
Logged by: F.R. KOUTZ
Date start: ___ — Date finish: ___

– = Not requested

Depth and Assay (AARL)

From	To	Interv	Core Recovery	Comment on Assay Interval	Cu %	Pb ppm	Zn ppm	Au oz/T	Ag oz/T	Mo ppm
860	880	20	100							
880	900	↑	100	890-900	0.01	13	239	.001	0.10	8
	920		100							
	940		98	920-930 / 930-940	0.03 / 0.01	– / –	882 / 335	–	0.14 / 0.04	–
	960		100							
	980		↑	923TS.						
980	1000			980-1000	0.01	9	194	.001	0.11	10
	1020									
	1040		↓							
	1060		100							
	1080		99							
1080	1100		99	1090-1100	0.01	10	520	.002	0.09	7
	1120		99							
	1140		97	TS-1138'						
	1160		100							
	1180		↑							
1180	1200			1190-1200	0.01	139	1920	.004	0.33	4
	1220		↓							
	1240		100							
1241' XRD wh. clay	1260		99	1240-50 / 1250-60	0.068 / 0.060	–	1310 / 10400	–	0.27 / 0.82	–
	1280		100	TS-1287						
1280	1300		↑	1290-1300	0.08	260	1230	.001	0.10	6
1294 XRD white clay	1320									
	1340									
	1360									
	1380									
1380	1400		↓	1390-1400	0.03	390	1830	.002	0.29	4
	1420		100 2'	1400-07 / 1407-09	1050 ppm / 0.43%	– / 1.18%	0.27 / 10.95%	– / –	0.18 / 2.16	–
	1440		99	1409-20 / 1420-30	137 / 580	392 / –	0.25 / 0.33	– / –	0.29 / 0.23	=
	1460		100	1430-40 / 1440-50	232 / 0.37	– / –	160 / 0.35	– / –	0.14 / 0.34	=
	1480		↑							
1480	1500		↓	TS-1480 1490-1500	0.03	112	730	.001	0.07	10
	1520		100							
	1540		99							
	1560		98	1540-50 / 1550-60 NOT SPLIT						
	1580		100							
1580	1600		↑	1590-1600	0.01	42	220	.001	0.24	8
	1620			1606-XRD SILKY SER.						
	1640									
	1660									
	1680									
1680	1700	↓	↓	1690-1700	0.01	11	124	.004	0.33	3
1700	1720	20	100							

Mineralogy and Structure — Sulfides and Oxides (mostly f.g. pyrite →)

To	Chalcopyrite	Covellite	Galena	Sphalerite	Grey S= in SS	Pyrite-Dissem.	Pyrite-Vein	Yellow-Brown Fe ox	Hematite	Specularite	Magnetite	Alunite
880	–	–	–	T-	.3	1½	½		T-	–	–	–
900	–	T cv/cc	–	T-	.5	1½	½		–	–	–	T
920	–	T cv	–	–	.6	1½	½		T-	–	–	–
940	–	T+	–	–	1.0	3	1		–	–	–	T
960	–	T-	–	T-	.7	2	1		–	–	–	–
980	–	–	–	–	.2	1	¼		–	–	–	–
1000	–	–	–	–	T	1.5	¼		–	–	–	–
1020	–	T-	–	–	.3	1.5	¼		–	–	–	–
1040	–	–	–	–	.2	2.0	½		–	–	–	–
1060	–	–	–	–	.3	2.0	½		–	–	–	–
1080	–	–	–	–	.5	2.0	½	T jar	–	–	–	–
1100	–	–	–	T- DK	.6	1.5	1		–	–	–	–
1120	–	–	–	T- honey +BK	.4	1.5	¾		–	–	–	–
1140	–	T	–	T	.5	1.0	1.5 in Fs		–	–	–	–
1160	–	–	–	.1	.8	2.0	1	T+	–	–	–	–
1180	–	–	–	.1	.6	2.5	1	1	–	–	–	–
1200	–	–	–	.1+	.8	2	1½	3	–	–	–	–
1220	–	–	–	.1	.8	2	1½	3	–	–	T-?	–
1240	–	–	–	T	.4	1.5	1	T-	–	–	–	–
1260	T-	.1? tcc	–	.2?	1.0	2.0	2	F	–	–	–	–
1280	–	–	–	H	.7	1.5	1	2	–	–	–	–
1300	T	T cc cv	–	T	.8	1.5	25	3	T-	–	–	–
1320	–	–	–	–	1.0	4	1.0	3	T-	–	–	–
1340	–	–	–	.1	.8	2	¾	2	–	–	–	–
1360	–	.2	–	.1?	1.0	1½	½	½	–	–	–	–
1380	mw	.1	–	.2	.8	4	1.5	3	–	–	–	–
1400	–	.1	–	.3	1.0	3	1.5	½	–	–	–	–
1420	T+	.2	T+	2.0	2.0	5	3	1	–	–	–	–
1440	T	.3	–	T+?	1.8	4	½	T+	–	–	–	–
1460	T	.4	–	T+	1.5	2½	3	2	T-	–	–	–
1480	–	T-	–	T+	.8	3	1	½	–	–	–	–
1500	–	T-	–	.1	.8	2	¾	T-	–	–	–	–
1520	–	T	–	TH	.6	1½	¾	–	–	–	–	–
1540	–	T-	–	T-	.3	1½	1	T+	–	–	–	–
1560	T-	T	–	.1	2.0	4	2	T-	–	–	–	–
1580	–	–	–	T	.8	3½	2	T-	–	–	–	–
1600	T	–	–	–	.6	2½	1	F	–	–	–	–
1620	T	T+	–	–	.3	1½	¾	T-	–	–	–	–
1640	–	–	–	T-	.3	2	1	¼	–	–	–	–
1660	–	.1	–	T	.4	1½	1½	T	–	–	–	–
1680	–	–	–	T+	.5	1½	2	½	–	–	–	–
1700	–	T-	–	T+	1.0	1½	2	T+	–	–	–	–
1720	–	–	–	–	.8	1½	1½	½	–	–	T-	–

Mineralogy and Structure — Alteration

To	K-feldspar	Qtz-Dissem.	Qtz-Vein	Clay	Sericite	Chlorite	Epidote	Calcite	Gypsum	% Vugs
880	1	10	3	10	20	–	–	–	–	½
900	–	12	4	10	20	–	–	–	–	1½
920	–	15	5	12	22	–	–	–	–	1
940	–	8	3	25	25	–	–	–	T-	2
960	T+	10	3	18	25	T-?	–	–	–	1
980	–	20	5	3	5	–	–	–	–	T+
1000	T+	25	3	4	5	–	–	–	–	F
1020	–	23	4	5	8	–	–	–	–	T+
1040	–	23	5	8	10	–	–	–	–	T+
1060	–	20	5	10	12	–	–	–	–	T
1080	–	15	4	12	15	–	–	–	–	¼
1100	–	12	5	8	15	–	–	–	–	T
1120	–	8	3	12	15	–	–	–	–	T+
1140	–	7	4	10	18	T+	T-	–	–	T
1160	–	8	3	10	15	T-	–	–	–	T+
1180	–	8	5	12 tan	17	–	–	–	–	1
1200	–	6	5	15 faint green	15	T?	–	–	–	T-
1220	–	6	4	15	12	2	T-	–	–	T-
1240	2	15	6	6	10	T	–	–	–	–
1260	2	5	5	25	20	–	–	–	–	1
1280	–	8	3	12	15	3	–	–	–	T+
1300	–	8	6	12	15	2	–	–	T-	½
1320	–	7	4	10	18	3	–	–	–	T
1340	–	4	2	12	16	1	–	–	–	½
1360	–	18	3	3	5	–	–	–	–	4
1380	–	12	2	6	8	T+	–	–	–	T+
1400	–	5	2	10	12	T-	–	–	–	T+
1420	–	8	4	12	15	–	–	–	–	¼
1440	T-	5	3	15	18	T-	–	–	–	½
1460	–	4	2	20	18	–	–	–	–	½
1480	–	5	2	8	10	–	–	–	–	½
1500	T+	12	5	8	10	–	–	–	–	1
1520	1	10	4	7	11	–	–	–	–	½
1540	1?	15	8	8	15	–	–	–	–	1
1560	3?	15	8	10	18	–	–	–	–	1
1580	1	15	10	5	12	–	–	–	–	T
1600	–	10	7	8	15	–	–	–	–	T+
1620	–	16	3	10	18	–	–	–	–	2
1640	–	15	3	7	12	–	–	–	–	T
1660	–	5	2	12	18	–	–	–	–	¼
1680	–	8	5	8	14	–	–	–	–	T+
1700	–	10	10	5	15	–	–	–	–	T-
1720	–	10	8	5	12	–	–	–	–	¼

Mineralogy and Structure — Texture, Structure and Detail

To	Av. clast size	% Bx Matrix	Fx/Foot	Dip Flow Band	Sulfide Fn #/Fx + ∠	Width mm Sulfide vn / Alt. selv. + Dissem. S= grains	Faults, Crushing, Shearing	Detail
880	many ¼"	30	1	?	1: 70-90	¼/1-Perv ½-1 Diss.	Loc. wk sh + white clay @ 60°+30°.	Relict Kfs + Hem in frags.
900	5-50	40	1	30	1: 30+60	¼/1-Perv ½ Diss.	wh. clay on Fx	3½" @30 @881 vug + Qtz dense
920	5-50	50	2	?	2: 60-70	½-1/1-Perv ¼ Diss.	CRT bleach incr. w/ depth.	
940	?	Tect. 10-70	+20	?	4: All @ +60	½-1/1-Perv 2½ Diss.	925-31: Bx+gg @60° - crushed S= + "fluid" : Local chalced. Qtz.	
960	?	?	2/10	?	2: 60+ All ?	½-1/Perv <½-2 Diss	935-44 ~70% is mod-str cr.	- A few Qtzite (f.g.) patches.
980	2	98	2	35	1: 85	¼/Perv ½-1	4" gg @60° + cr S= @962'	@979 ½-1" gg+Bx @85°
1000	Fs↓	46	3	25	1: 60+85	¼/Perv-2 ½-1 Diss	wh. clay on 85° Fx	(5-10% 1-3mm Fs frags)
1020	4	95	2	20	1: 60	½/Perv. ½-1 Diss.	T wh. clay on Fx	
1040	3-4	90	2	20?	2: 60-80	½/Perv ½-1 Diss.	wh. clay, py on Fx	
1060	4-5	80	2	35	2: 50-80	½/Perv ¼-1	wh. clay on Fx	
1080	4	75	1-8	35	2: 50-80	½/Perv. ½-1	Loc. mod sh. 60-80° + gg	
1100	3 Fs	90	4	45	5: 10-20 60-80	½/3-Perv ¼ Diss	70° sh+gg ½" @ 1086'	
1120	10?	30	10	?	4: 80-90 50-60	½/2-Perv ¼ Diss.	mod sh + cr 1115-1127	Below ~1105: Fragment ghosts noticeable
1140	5?	20	1-10	40	6: 70-90+	¼-1/1-5+ ¼ Diss Perv.	white-dy clay on Fx	1133-34 f.g. Hawtels @ 60° (clast?)
1160	5-15	20	4-5	20	3: 60-85	½-1/1-10 ½-1 Diss	Loc. wk cr. @60-90 1151-	1155: @1131 Q-S (py) vn w/ orka tan (mont?) of Fs 1st noticeable -
1180	5-10	70?	3	20?	4: 50-80	½-1/1-20 ½-2 Diss	clay, Qtz on Fx	wk ½-1cm. spherul.? 1165-66, Vuggy, Hi py zone 1171-75
1200	ghost 5-10	?	3	?	5: 50-80	½-2/1-8 ← Q-S Mont: perv	—	Loc. dk green clay in Fs., Bx frags to 6" locally distinct; all frags and flow band also.
1220	4-10	30	2	40 Eutax	2: 65-85	½-2/1-5 Q-S ½-1 Diss.	1211, sh, Q-S @75 ½-1"	1186-1216: gr. clay in Fs., Good Eutax struc 1214-20.
1240	5-15	70	1	45	2: 60-70	½/1-Perv. ½ Dissem.	Loc. sht fluidiz. zones -30-60	→ XRD: 1249: wh. clay, "Kaolinite - 1Md" ⇐
1260	10?	?	+30	60-70	5: 60-90 All ?	½-20/Perv. 1-5 Diss.	1250-1253: str. gg+Bx +S=,	1255-59, mod-str gg+Bx @60°
1280	10-20	30?	5	40	4: 60-80	½-1/1-5 ½-1 Diss.	wk. loc. cr horiz. shales: tan clay on Fx.	
1300	10-30	35	4	30	5: 60+90	½-8/1-20 ¼-2 Diss.	1287-1293 - ¼-1½" Qtz-pyr., Feox chl. vn @ 90 + stringers	
1320	5-15?	70?	4	?	3: 60-90	¼/1-30 <½-1 Diss	Yellow clay on Fx	1299-03: str: SiO2 flood. 1303-04 str clay gg+Bx no S=
1340	2-6	80?	6	?	4: 60-90	½/1-Perv ½-1 Diss	1-4mm - Yellow → wh. clay on Fx + local mod crush.	
1360	2-4	95	3-20	?	1: 30 60-80	¼/Perv ¼ Diss.	1342: 5" crush-gg @ 30°	
1380	2-5	85	½-15	20?	7: 30-70	½-1/2-10 ½-2 Diss.	1368-70 mod crush. 60-90°	1368-1382: str diss + vn pyr + late Feox on Fx.
1400	1-3	99	5	60	6: All ?	½-1/Perv ½-1	Diss. S= on Fx	
1420	5-10	40	3	20	6: 20-30 50-90	2½-3+/Perv 2½-5 Diss	Local wk cr. -	1.6' 60% S: pyr>>sl 1407.3-1408.3 @ ~30°
1440	5-15	Tect 5-80 +15	60	80	5: 60-70	2½-2/Perv 3½-2	crushed	1424-56: more or less all wk-strong bleach + Bx + crush + gg
1460	5-15	10-60 +20	60		6: 50-80 20-30	2½-2/Perv. 2½-2	crushed	wk. gr. to ox stain after cov 1436-41
1480	5-10	50	2	20	2: 20-30 50-70	2½-1/1-15 Q-S 2½-1 Diss.	-wht yellow clay on Fx	1463-67: Eutax. struct.
1500	2-7	80	3	15	1: 10-20 70	2½/1-Perv 2½-1	"Lithophys?" spherul.?	1478-90: clasts repl. by Qtz - vuggy with druse, str Q-S flood.
1520	8?	?	3-8	20	3: 10-40 80-90	2½/1-Perv 2½-1	Qtz-wh. clay on Fx	1508: cov-cc/py on 70° Fxs, 1-3mm.
1540	20-30	?	8	15	2: 60-90	2½-1/1-10 2½-1	wk cr. - All ?	str. Qtz flood from Fx into matrix - stockwork
1560	10-30	Tect 20	10	20	8: All 4	½-5 stringers	mod. cr: 30-70°	1553: 2 cm Qtz vn @70° + 1' crush + gg above.
1580	20?	?	2	20	3: 10-30 60-80	½-1/1-10 ½-2 Diss.	wh. clay on Fx	
1600	10-30	20?	2	20	3: 10-30 40-60	½-1/1-5 2½-1 Diss.	blebby-Qtz vn	1583-89: Qtzite blank or flood.
1620	?	?	2-5	20	2: 60-70	½-1/1-Perv ¼-1	Loc. wh. clay on Fx	1603-08: v. crumbly sdy + gg silky sericite
1640	10-20	?	2	30	2: 40-60	½-2/1-5 +Perv.	tan clay on Fx	1616-1629 - Relict - banding (Eutax.?) in Qtzite; 1629-34: anhedral Qtzite. ; Qtzite
1660	?	?	10	25	4: 60-80	½/1-10 +Perv.	1646-49 - strong cr - gg + sdy/leached	1657-59: chalky clay
1680	?	?	3	40?	3: 60-90	½/1-8	Loc. wk-mod cr.	wk relict Eutax. 1676-80
1700	10-30?	?	4	40	6: 10-70	½/1-5 2½-1 Diss.	T. wh. clay on Fx	Mottled with Q-S-py vn
1720	?	?	2	45?	8: 75-90	½-1/1-8 2½-1	Yellow clay on Fx	

Rock Type and Remarks

⇒ GENERAL

⇒ 801 - HOS - Rhyol Bx as above but less clay, clasts more visible, only T cov/cc on pyr. to 962. Local silicif. zones some with Qtz druse. Clay + Breccia gradually incr. below about 914 with str Bx + clay flood. Much of clay is prob. sericite. From 914-962 Bx text. is v. weak to missing in part from str Q-S + clay flooding.

⇒ 960 - 1008 m.-f.g. QUARTZite, medium grey, locally some Fs fragments, some Qtz grains sub-rounded with Qtz cement, % Fs incr. below 1000'. Loc. wk bedding. A few patches of detrital Bx frags.

⇒ 1008 - 1074 (gradational upper + lower contacts) Porphyry (Bx), zones of 5-10% white clay-altered pheno 3-5mm. Equant, but also sub Bx frags in Quartzite matrix + zones of 1-2' Qtzite: Fs increase w/ depth. Maybe a xtal lithic tuff. Most pyr. dissem but local stringer veins.

⇒ 1074 - 1226: Flow Banded porphyry 10-30% Fs + frags 0.4-0.8mm., with weak relict ghosts of clasts, clasts ≈ matrix, contacts gradational - a few local Qtzite beds, local relict Eutax. struct., esp. near bottom. Dissem. pyr. - some locally to goeth. Q-S selv. with perv. mont. of Fs clear in lower portion.

⇒ 1226 - 1250, mottled, silicif. zone with local Qtz. + matrix with "fluidized" fragments, late sh. @ 60-90., weak spherulites

⇒ 1250 - 1260: Bx-gg-crush. zone; str S=: str. bleach + clay: much of material as below ↓

⇒ XRD: 1294' wh. clay = Kaolinite + illite ⇐

⇒ 1260 - 1342: HOS Rhyol TUFF Bx but alt. usually destroys text. 5-30% phenos 2-5mm locally visible: some longer clasts. Relatively hvy clay + ser alt. + Yellow (Fe ox stained mont?) zones + veins. Well Fx + crushed locally.

1303-32: str yellow-brown Feox.

⇒ 1342 - 68 Quartzite as (960-1008), sandy + leached to 1348 with cv on Fx, str. crush 52-54 (60-80°), sharp contact @ 57', locally 5-20% Fs 2-4mm. (maybe arkose). 57-60: ϕ on Fs frags. Qtzite 60-62 / 62-68: mottled by ϕ on 30% Fs frags.

⇒ 1368 - 1428: Mostly well bleached, + crushed f.g. tuff: weak relict ghosts of longer clasts but most destroyed by alt. Hi pyr. %

⇒ 1478: f.g. ϕ (HOS Rhyol Bx with clasts only visible as ghosts): fairly strongly silicified with local "Quartzite" (prob. H Qtz). Relatively high pyr. content mostly dissem but w/ Qtz vein. Milky Qtz blobs + stringers locally, local strong crush. Weak local relict Eutax struct. to 1740 (gradational below)

1606 - Sericite = silky "clay" - By "XRD"

(3)

GEOLOGIC LOG

PROJECT: TRENCH
HOLE NO.: TCH-2
Collar elev.:
Final depth:
Coord. N.:
Inclination:
Coord. E.:
Page 3 of 10
Logged by: F. R. KOUTZ
Date start:
Date finish:

MINERALOGY AND STRUCTURE / ASSAY AARL

From	To	Int'l	Rec. %	Comment or Assay Interval	Cu %	Pb ppm	Zn ppm	Au oz/T	Ag oz/T	Mo ppm	Chalcopyrite	Covellite	Galena	Sphalerite	Grey S= or SS	Pyrite-Dissem	Pyrite-Vein	Yellow-Brown Fe Ox	Hematite	Specularite	Magnetite	Alunite	Pink CO3	Biotite	K-Feldspar	Qtz-Dissem	Qtz-Vein	Clay	Sericite	Chlorite	Epidote	Calcite	Gypsum	% Vugs	Av. Clast Size	% Bx Matrix	Fx/Foot (min)	Dip: Flow Band	Sulfide Vn. #/F +∡	Width: mm Sulf Vn/Alt. Selvage + Dissem. S= Trains	Faults – Crushing – Shearing	Detail
1720	1740	20	100								–	–	–	T	.7	1½	2	½	T-	–	–	–			–	5	3	8	12	–	–	–	–	¼	?	?	3	30?	8: 10-30, 50-80	½/1-10 1pcav	1723-27: WK CR @ 60°	1-2mm Yellow clay on Fx
	1760										T-	T-	–	T-	.6	2	1	T	–	–	–	–			–	12	8	5	15	–	–	–	–	T	?	?	1-5	25?	8: 20-40, 70-80	½-1/1-10 ½-1 Diss.	Loc. wk Sh @ 65°	1658-60: Q-S-(py) stringers @ 90°
	1780										–	T-	–	T-	.5	2	1	T-	–	–	–	–			T	10	7	3	15	T-	–	–	–	T-	–	–	2	15	8: 50-70, 20-30	½/1-5(10) 1pcav	T. wh. clay on Fx	& weak ghost Eutax.
1780	1800			1790-1800	0.01	54	172	.003	0.09	7	–	–	–	–	.4	½	1	T	–	–	–	–			T+	8	7	3½ (mont)	13	T-	–	–	–	–	No clasts noted		1	10	4: 10-30, 50-70	½/1-3 ½-1 Diss	—	~5% lithics or phenos – (Yellow mont) Eutax Bands ≤3mm.
(XRD sample 1857')	1820										–	–	–	–	.3	1½	1½	¼	–	–	–	–			2	10	5	5	12	–	–	–	–	–	–	–	1	5	1: 50-70, 10-30	½-4/1-20 ½-1 Diss.	—	3-5mm py vn @ 60° @1815 Eutax. Bands 1-5mm.
	1840										–	–	–	–	.2	1?	1½	½	T-	–	–	–			–	12	6	6	12	1	–	–	–	–	–	–	1	10	2: 80-90, 10-30	½/1-20 ½-1 Diss.	—	Welding & Q-S Flood incr. w/ depth
	1860										–	–	–	–	.3	1½	2	1	T-	–	–	–			3	13	5	5	12	T-	–	–	–	–	1-4 phenos.	–	1	15-25	1: 10-30, 80	½/1-10 ½-1 Diss	T. Yellow clay on Fx	⇐ XRD: Montmorillonite – (1857') ⇐
	1880										–	T-	–	T-	.4	1½	1½	1	T-	–	–	–			2	13	5	6	11	–	–	–	–	F	–	–	1	15	2: 60-70	½/1-5 ½-1 Diss	T. Yellow clay on Fx	1-2" string vn @ 20° @1895: py>sl.
1880	1900			TS-1900 1890-1900	0.03	90	740	.001	0.10	8	–	T-	–	T+	.5	1½	1½	¼	–	–	–	–			1	13	5	6	12	–	–	–	–	–	–	95	2	10-40	2: 10-30, 70-80	½-1/1-10	wh. clay on Fx	~5% phenos -10% 1-4mm.
	1920										–	T-	–	T+	.3	1½	1	T+	–	–	–	–			–	14	3	5	12	–	–	–	Groundmass →	–	–	94	1	5-15	1: 50-60	½/1-5 ½-1 Diss.	gy. clay on Fx	Much of Yellow Stain on outside of core only (Mud stain)
	1940										–	–	–	T-	.4	1	1	¼	–	–	–	–			–	12	3	6	12	–	–	–	–	–	Fs	95	1-4	10-30	2: 10-20, 50-90	½/1-5 ½-¼ Diss	WK CR-Fx 1933-40	1934: 2": ca-gy @ 55°
	1960		100								T-	T-	–	T+	.5	1½	¾	T+	–	–	–	–			–	10	4	8	15	–	–	–	–	T-	2-4	94	2	10-20	2: 10-20, 50-60	½/T-10 ½-1 Diss.	1-2mm clay on Fx	A few Bx Frags to 2cm.
	1980		99								–	T	–	T-	.4	1½	1	T	–	–	–	–			–	10	4	8	15	–	–	–	–	T	2-4	95	4	10	2: 10-20, 50-80	½/1-10 ½-1 Diss	1-4mm clay on Fx	strong Eutax. Struct last @ 1965
1980	2000		100	1980-2000	0.01	74	590	.001	0.06	8	–	T-	–	T	.3	1½	1	T	–	–	T-	–			T+	12	4	7	13	T-	–	–	–	T-	2Fs-5	93	3	10	2: 10-20, 60-80	½/1-8 ½-1 Diss.	1-2mm wh. clay on Fx	
	2020		100	TS2010							–	–	–	T-	.2	¾	1½	¼	–	–	T+	–			T	6	3	5	10	2	T-	–	–	–	2-4 Fs	95	2	40	2: 50-60	½/1-3 ½-1 Diss	—	1995-2015 BK MATRIX (w/ Tr MGT)
	2040		99								T	–	–	T	.3	2½	2	¼	–	–	T-	–			–	10	4	6	12	1	–	–	–	T-	2-4	96	1-8	?	3: 30, 50-70	½-1/1-Pcav ½-1 Dissem.	2018-22 Bleached, Sdy,	Bx + c crushed. (30°)
	2060		100	2040-50 2050-60	0.01 0.027	– –	381 821	– –	0.10 0.04	– –	T-	T-	–	.1	.5	1½	2½	¼	–	–	–	–			–	11	5	7	14	T	–	–	–	T-	2-4	95	2	20	2: 70, 60-80	½-2/1-Pcav ½-2 Dissem.	Tr Tan clay on Fx	2044-50: 1-10mm, Qtz stringers @ 70° ± sl dissem
	2080			2070-80	0.01	–	430	–	0.05	–	.1	T-	–	.2	.3	1½	2½	½	–	–	–	–			–	10	6	8	12	2	–	–	–	T-	2-4	98	2	20-40	2: 30, 60-80	½-2/1-Pcav ½-1 Dissem.	2067': 2" gg @ 30°	2072-75' Dissem cpy ≤ py w/ Forest gr. Chl.
2080	2100			2080-2090 2090-2100	0.01 0.10	– 180	510 740	.001 .005	0.07 0.20	– 8	.2	T-	–	.2	.5	1½	2	¼	–	–	–	–	Tr MnO3		–	9	4	9	12	2	–	–	–	T	2-4	95	3	20	6: 70, 50-80	½-1/1-Pcav ½-1 Diss.	1-2mm clay on Fx	2: 8-15mm py. vn @ 40-50° @2082'; V. WK Eutax? text.
	2120			2100-2110	0.013	–	292	.001	0.04	–	.2	T+	–	.2	.8	1½	2	T	–	–	–	–			2	12	5	7	12	2	–	–	–	T+	2-4	94	2	20?	6: 20-40, 70-90	½-1/1-Pcav ½-1 Diss	1-2mm clay on Fx	2105-2110: Reticular NETs of Q-S-py vn. 1-2mm.
	2140			TS 2134 IBx 2130-40	0.013	–	889	0.001	0.07	14	T+	T-	–	.2	.8	2	2½	¼	–	–	–	–			–	14	4	5	15	T	–	–	–	T-	2-4	98	2	20	10: 10-40, 60-80	½-2/1-Pcav ½-2 Diss	→	@2139 ½-4" IBx (w/ Rounded QMP clast) + 2142-43.5 IBX @ 20-90° gy-gr MAT. ~20% Sub Round clasts: S= must py (T sl)
	2160			2140-50	0.026	–	410	0.001	0.02	21	T-	–	–	.2	1.0	1½	2½	½	–	–	–	–			–	10	4	7	14	T-	–	–	–	T-	2-5 Fs	95	2	20?	5: 10-30, 50-80	½-2/1-Pcav ½-1 Diss	1-2mm clay on silky Ser on Fx	
	2180										T-	–	–	.1	.7	1½	2	¼	–	–	–	–			–	10	6	5	12	–	–	–	–	T	2-4 Fs	98	2	40-60	8: 10-30, 60-80	½-1/1-Pcav ½-1 Diss	1-2mm clay + Ser on Fx	STR. Banding 2177-79: Q-S Bands 1-2mm: Eutax. or Flow (JHC: Ribbon Rx)
2180	2200			2190-2200	0.03	370	860	.002	0.37	40	T-	T-	–	.2	.6	2	1½	¼	–	–	–	–			–	5	2	10	15	–	–	–	–	1	¼-F	20 Tect	+30	?	4: Acc ∡	½-1/Pcav ½-1	2191-99 STR CR + Bx	2193-95 Bx NO S=
	2220										–	–	–	.1	.4	1½	1½	¼	–	–	–	–			–	5	2	9	14	–	–	–	–	½	¼-5	30 Tect	3-20	?	5: 10-30, 60-80	½/1-10 ½-1	Locally STR. Bx + Fluid – 40-60°	Eg 2216-17: Some pseudoBx From Q-S stockwork
	2240			2239-49	0.017	490	1490	.001	0.09	–	–	–	–	.2	.3	1½	2	¼	–	–	–	–			–	8	3	5	12	–	–	–	–	T+	2-4 Fs	–	2-8	25?	6: 10-30, 60	½-1/1-10 ½-1 1pcav	2237-38': STR. Bx + gg @ 50-80°	: ALL WK CRUSH.
TS-2253 Sil'g-MP	2260			2249-56 2256-65	0.077 0.029	1180 3300	15400 10900	.001 .001	0.41 0.26	– –	.2	.1	T+	2.0	.5	2	2	T+	–	–	–	–			–	18	5	8	15	–	–	–	–	3.0	5-100	30	2-5	30?	8: 10-40, +65	½-2/1-Pcav ½-3 Diss	Loc Bx in clay 2249-55	
vol. φ TS-2272	2280			2265-75 2275-81	0.006 0.022	302 2700	700 5000	.001 0.01	0.05 0.14	– 5	T	T-	T-	.4	.5	1½	2	¼	–	–	–	–			–	8	2	7	10	–	–	–	–	T+	2-5 Fs	96	1-10	60-90?	8: 70-90, 20-40	½-1/1-3 ½-1 Diss	6" CR-gg @ 60° 2277"	WEAK Eutax? @ 85-90 @ 2271-73', sl: 1-4mm stringers 70-90° 2277-79
2280	2300			2281-90 2290-2300	0.015 0.04	2500 0.42%	3700 1.04%	.002 .003	0.17 0.34	6 10	.1	T-	.2	.7	.3	1½	1½	T+	–	–	–	–			–	12	5	5	10	–	–	–	–	¼	IBx 20-40	20X 20	3	65	4: 60-70, 30	½-1/1-5 ½-1 Diss	wh clay on Fx	IBx-Intrus Bx + sl + SiO2 Stringers, 2295-2300 (70-85°), 3" AP @ 2291, 30°
	2320		100	2300-2310 2310-2320	0.012 0.006	620 215	780 344	.001 –	0.06 0.04	7 	T	T-	T-	.3	.5	2	2	½	T-	–	T-	–			–	10	5	7	10	1	–	–	–	T+	–	–	3-5	75	5: 60-85, 10-80	½-2/1-5 ½-1 Diss.	2302-06 Qtz-sl py	1-2mm Stringers + crush @ 70-85°; 2311-2317: CONTACT ZONE 60-90° (int + out) MP: φ vol.
TS2354	2340		99	2320-2330 2330-2340	0.006 0.007	195 150	604 453	– –	0.07 0.05	– –	T	–	T-	.2	.8	2½	2	2	T+	T-	–	–			–	6	3	15	18	T	–	–	–	¼	–	–	3-30	30	3: 30-60	½-2/1-Pcav ½-1	2334-40 + 2342-45 shattered, crushed.	2317-2323 (30°) MP-45 Below But strong goeth. Flood
	2360		100	2340-2350	0.013	225	807	–	0.06	–	T+	T-	T-	.2	.3	2½	1½	2	T-	–	½	–		2	5	12	2	10	15	5	T+	T-	–	T+	–	–	2-10	50	5: 10-30, 80-90	½-1/1-Pcav ½ Diss	—	2323-2334: Volc. φ As Above: Str. SiO2 + Goeth Flood
	2380										–	–	–	.1?	.5	1	¾	T+	T-	T	2	–		2	15	3	1 (mont)	10	8	12	½	T Fx	–	T	–	–	2	30-50	1: 30-60	½-1/1-3 ½-1 Diss.	Tan clay on Fx –	2334-2340: well shattered, crushed + oxid. MP: @ 80-90° (v. str py + goeth)
2380	2400			2390-2400	0.01	80	290	.004	0.14	7	–	–	–	T-	.3	1½	½	1	T-	T	T+	–		½	8	5	½	12	7	14	½	T Fx	–	T-	–	–	2	FS 40	2: 60-70	½/1-5 ½-1 Diss.	1" gg @ 2385' @ 55°	2340-2356: Vol. φ (6" MP @ 30-40° @ 2346): oxid to 2346: silic. + Kfs flood of Fs + Q-S-Rims, Eutax Relict AT 50°
	2420										–	–	–	–	.3	1	T+	1½	T-	T	1½	–		½	10	3	½	10	5	14	1	¼ Fx	–	T-	–	–	2	Fs? 80?	1/2: 60-80	½/1-3 ½-½ Diss	1-2mm Yellow clay on Fx	@2431 @ 30° 1cm Qtz-py>sl
	2440			2430-40 2440-42	0.012 0.40	431 1580	1480 4100	– –	0.11 0.38	– –	–	–	T-	.1	.5	2	1	1	T-	–	¼	–		1	3	8	2	5	10	10	½	T+	–	¼	–	–	1	–	2: 10-30, 60-80	½-5/5-30 ½-2 Diss	2440-41.3 + stringers	½-3" py>sl vn @ 60-70° (cpy + gg)
	2460			2442-50	0.013	310	350	–	0.05	–	.1	–	T-	.8	.3	2	5	1	–	–	T+	–	T MnO3	2	3	10	4	8	13	8	T	T-	–	¼	–	–	½	–	2: 60-70	½-75/10-100 ½-1 Diss.	2444-47 mod cr. 70-90°	2428-54: Banded Loc Q-S Flood. / Alt incr Below 2380'
TS2493	2480										–	–	–	–	.5	1½	½	¼	F	–	T-	–	T MnO3	T	5	8	½	10	15	8	T-	F	–	T+	–	–	1	–	1: 50-60	½/1-5 ½-1 Diss	Tr calc + Qtz on some Fx	
2480	2500			2490-2500	0.01	43	211	.001	0.08	11	–	–	–	–	.3	2	1	T+	–	–	–	–		–	3	8	1	12	15	7	T-	¼ Fx	–	T+	–	–	2	–	2: 60, 80-90	½-1/1-5 ½-1 Diss	Tan clay on Fx	⅛" gg @ 50° @ 2512
	2520										–	–	–	–	.3	1½	1	¼	T-	T-	–	–		–	1	8	½	10	15	4	T-	T+ Fx	–	¼	–	–	2	–	1: 60-70, +90	½/1-Pcav ½-1 Diss	2505-09 1-4mm open	calc-clay Filled Fx @ 90°
	2540										T-	–	T-?	T-	.2	¾	½	¼	–	–	–	–		T+	3	5	½	8	13	5	–	–	–	T-	–	–	1	65?	2: 40-50, 85-90	½-1/1-10 ½-½ Diss	Tan clay on Fx: horiz. slicks;	Local 1-4mm BK Q-S-S=-chl vn @ 60°
	2560		100								T-	T-	T-	.1	.4	½	¾	Tr	¼	–	–	–		–	1	7	3	8	15	5	–	–	–	1	–	–	1-5	65?	2: 60-90	½-2/1-20 ½-1 Diss	Str. Fx 54-60° @ 75-90°	– Vuggy, SiO2 Boxwk ts= them.-altns= @ 2543, 6" @ 60° SiO2 Flood 10 ss, py, sl, cv.
2560	2580	20	99								.1?	T-	–	T	.3	½	1	Tr	¼	–	–	–		–	–	4	3	10	16	6	T+	–	–	1	–	–	3-10	45?	3: 80, 70-90	½-8/1-30 ½ Diss	2576: 1' Bx + gg @ 70°	2575-76: wk-mod crush. 2561-64: Shattered @ 60 + 85°: SiO2 Boxwk, py, hem.

REMARKS

⇒ GENERAL

⇒ 1740 – Ash flow tuff: Eutaxitic Struct picks up Below 1780, Generally shallow to 1785 Dip to Banding, No evidence of Bx Frags but 5-15% phenocrysts – sub ⅔ Kfs 1-4mm, Local wk-mod Q-S veining + SiO2 flood: only dissem pyr. in center of most Q-S selv., Many Fs are weakly stained with Yellow FeOx beyond Q-S selv. (prob montmorillonite). Amount of Fx + gg is much less than above

⇒ 1985-2249 f.g. porphyry w/ Flow Banding of Fs 1985-95 Strong Q-S Flood, 1995-2015: BK MATRIX: – maybe vitrophyric Dissem MGT in MATRIX, Late Goeth. stain w/ clay in Fs + on Fx Below crushed zone 2018-22 grades into Q-S Flooded Lt. Matrix φ with ~5% 2-4mm. Fs + DK. 1-4mm Q-S vein cores (10-20% Fs in BK. MAT φ).

60°-85° CONTACTS

⇒ 2249-65: Intrusion Bx: QMP Frags or Dykes 3" @ 2251, 4" 2253 (@ 60° I), 5" @ 30° 2263; 2259-61 volcanic φ block. Brecciated with 10-30% Matrix, Matrix is QMP, v.f.g. porcellaneous SiO2 to 3", Rock Flour, clay-sericite + Rimming Frags: V. BK sphalerite: clayey 49-56, Hard silicif. Beyond. Biot. in MP rex'tal + chalky Fs. 30% of Bx is Volc? φ as Below

⇒ 2265-2311, Grey Porphyry 5-10% 2-6mm Fs phenos white (clay + ser), f.g. matrix w/ Ts Hint of Eutax. Banding @ 60-90° (1-2mm), Dissem Pyr, sl in Fs, Could be intrusive But cut by MP. Could also be chilled border phase of MP???

⇒ 2356-2744 Monz. Porphyry (Prob QMP of Sunnyside) 20-40% 2-5mm (some to 10mm) zoned plag, 10-15% Biot (chl) 1-4mm. in Kfs Rich Groundmass, Fs Partially Argillized Esp. on Rim (Rim often Kfs Rich) Biot recryst + chloritized, Local str. Goeth stain in Fs, Pyr Dissem in Mafics Replaces MGT pyrite-chl-Kfs-vein + QSPy veins with Q-S selv, + Bleach to usually narrow widths, MGT w/ mafics blebs to 2mm.

④

GEOLOGIC LOG

PROJECT: TRENCH
HOLE NO.: TCH-2
Collar elev.:
Final depth:
Coord. N:
Inclination:
Coord. E:
Page 4 of 10
Logged by: F. R. KOUTZ
Date start:
Date finish:

Does drilling mud contribute to calc. fizz (Yes!)

DEPTH AND ASSAY (AARL)

From	To	Interval	Recovery %	Comment or Assay Interval	Cu %	Pb ppm	Zn ppm	Au oz/T	Ag oz/T	Mo ppm
2660	2600	.20	100	2590-2600	0.01	45	40	.001	0.05	12
TS 2620	2620	↑	↑							
	2640									
	2660									
	2680									
2693 - TS. 2680	2700			2690-2700	0.02	36	108	.001	0.09	9
	2720									
	2740									
	2760									
	2780									
2780	2800			2790-2800	0.01	40	110	.001	0.09	11
	2820									
	2840									
XRD 2857 gr. clay	2860			2840-50	0.018	–	109	–	0.04	–
	2880			2860-70 / 2870-80	0.025 / 0.032	– / –	155 / 80	– / –	0.06 / 0.03	– / –
2880	2900	TS 2895		2890-2900	0.01	68	256	.001	0.06	9
	2920									
	2940									
	2960									
	2980									
2980	3000			2990-3000	0.02	90	1500	.001	0.05	11
	3020									
	3040									
TS 3052	3060									
	3080									
3080	3100			3090-3100	0.04	92	214	.001	0.21	9
	3120									
	3140									
	3160									
	3180									
3180	3200			3190-3200	0.02	43	74	.002	0.08	11
	3220									
	3240									
	3260									
	3280	TS 3263	MGT Bands							
3280	3300			3290-3300	0.04	560	1280	.001	0.10	8
	3320									
	3340									
	3360	3344 XRD	100							
	3380		99							
3380	3400		100	3390-3400	0.02	258	760	.001	0.12	9
	3420									
3420	3440	20	100							

TS 3440

MINERALOGY AND STRUCTURE

To	Chalcopyrite	Covellite	Galena	Sphalerite	Grey S° or SS	Pyrite-Dissem.	Pyrite-Vein	Yellow-Brown FeOx	Hematite	Specularite	Magnetite	Rhodochrosite
2600	–	–	–	–	.2	1/2	1/2	T+	T-	–	T-	
2620	–	–	–	–	.3	1	3/4	T-	–	–	–	
2640	–	–	–	–	.1	1/4	1/4	T-	T	T-	1/2	
2660	–	–	–	–	.2	T+	1/2	T-	T-	–	2	
2680	–	–	–	–	–	T-	T+	T-	–	–	3	
2700	T-	–	–	–	.1	T-	.2	–	T-	–	3	
2720	–	–	–	–	.3	3/4	1/2	T-	T-	–	1	
2740	T-	–	–	–	.2	1	3/4	T-	T-	–	3/4	
2760	T-	–	–	–	.3	.6	.7	–	T-	–	1/2	
2780	–	–	–	–	.2	.7	.5	–	T-	T+	T-	
2800	–	–	–	–	.1	.4	.2	–	T-	T-	1	
2820	–	–	–	–	.3	.6	.5	T-	T-	T-	1	
2840	1	–	–	–	.2	1	1/2	T-	T+	T	1/4	T rod(?)
2860	.2	–	–	T-	.3	1	1/2	–	1/4	T	–	
2880	.2	–	–	.2	.5	3	.2	T-	T-	–	–	
2900	–	–	–	–	.1	.2	.3	–	T	T	2-3	
2920	–	–	–	–	.1	.6	.2	–	–	–	1	
2940	T-	–	–	–	.3	.4	.2	–	–	–	3/4	T $MnCO_3$
2960	–	–	–	–	.1	.4	.2	–	T-	–	1	
2980	–	–	–	T-	.2	.8	.4	–	–	–	1	
3000	T-	–	–	.2	.5	1.	1.	T Fx	–	–	–	
3020	T- Fx	–	–	T	.3	1	1 1/4	T Fx	–	–	–	
3040	T-	–	–	T+	.3	3/4	1 1/4	–	–	–	T+	
3060	–	–	–	–	.2	1	1	–	–	–	–	
3080	T-	–	–	T+	.2	3/4	1 1/4	–	–	–	–	
3100	T-	–	–	T-	.3	1 1/4	2	–	–	–	1/4	
3120	T-	–	–	T-	.3	1	2	–	T+	–	3/4	
3140	–	–	–	–	.3	1 1/2	3	–	T+	–	3/4	
3160	T-	–	–	T-	.5	2 1/2	2	–	1/2	–	1/2	
3180	T-	–	–	T-	.4	1 1/2	1 1/2	–	3/4	–	1	
3200	T-	–	–	–	.5	4	2 1/2	–	T	–	3	
3220	.1	T-	–	T	.4	1 1/2	2	–	1/4	–	3	
3240	T+	T-	T-	T	.5	2	3	–	1/4	–	1	
3260	.1	T-	T-	.1	.6	1 1/2	2	–	T	–	5	
3280	T-	–	–	T	.5	1 1/2	2	–	T+	–	4	v. silicif
3300	T+	T-	T	.2	.3	3/4	2	–	T-	–	1 1/2	
3320	T	–	T	.2	.5	1	2 1/2	–	–	–	–	
3340	–	–	T-	.2	1.0	3	2	–	–	–	–	
3360	T-	–	T-	T	1.2	2	3	1/2 Goeth	–	T-	–	T+ $MnCO_3$
3380	–	T-	T-	.1	.8	1 1/2	1 1/2	–	–	–	–	
3400	T-	–	T-	.1	.8	1 1/4	2	T-	–	–	–	
3420	T- VN	–	T- VN	.2 VN + DISS	.7	1	2	T jar.	–	–	–	
3440	T-	T-	T-	.1	1.0	1 1/2	2	–	–	–	–	

To	Biotite	K-feldspar	Qtz-Dissem	Qtz-Vein	Clay (mostly Mont.)	Sericite	Chlorite	Epidote	Calcite	Gypsum	% Vugs	Av clast size	% Bx matrix	Fx/Foot (open)	Dip: Flow Band	Sulfide veining #/Ft + ∡	Width mm: Sulf. vn/Alt. Selv. + Dissem S° grains	Faults / Crushing / Shearing
2600	2	4	4	2	5	12	8	1	–	–	T-	–	–	1	–	2: 30, 60, 85	≤1/2-1/1-5, ≤1/2 DISS	TR hem + tan clay on Fx
2620	T-	3	5	1/2	3	10	10	1	T	–	T+	–	–	1	80?	2: 70	≤1/2-1/1-3, ≤1/2 DISS	Loc 1-4mm Fx @ 75-85° grey clay + calc.
2640	1?	5	3	1/2	8	8	15	2	F	–	T-	–	–	1/2-5	–	1: 75-85	≤1/2/1-2, ≤1/2 DISS	wk cr. @ 60 + 90°; 2626-8: clay + calc. on Fx
2660	5	10	3	T	5	4	18	2	7	–	T-	–	–	2	–	1: 20, 60-70	1/2/1-2, ≤1/2 DISS	1-2mm clay + chl. on Fx
2680	5	15 +VN	2	1/4	3	2	14	3	1/4	–	T-	–	–	1/2	–	1/2: 70, +30	≤1/2/1-4 Kfs, ≤1/2 DISS + chl	Chl + calc on Fx 1-2mm
2700	4	18	4	1/2	5	3	15	2 +VN	1/4	–	–	–	–	1	–	1/2: 30 +70	≤1/2/1-5 Kfs, ≤1/2 DISS	—
2720	2	8	5	1	7	5	13	1	8	–	2	–	–	2	–	2: 70-90	≤1/2/1-3, ≤1/2 DISS	2708-13 ~5% QTZ, 1/2-3/4" calc vn + gyp? @ 80-90°
2740	Rextal 4	5	3	1/4	5	5	15	3	1	–	1	–	–	2	40	2: 30 + 60, +80	≤1/2-1/1-3, ≤1/2 DISS	→
2760	1	10	8	1/2	7	8	8	2	1	–	1/4	10-15	20	3	70-90	2: 60-90	1/2-1/1-3, ≤1/2 DISS	Clay in vugs, Fx
2780	2	10	7	1/2	6	5	6	1	1/2	–	F	20-30?	90	1	70	1: 60-80	≤1/2/1-3, ≤1/2-1 DISS	—
2800	3	7	4	T	8	2	15	1	3 SOAK	–	–	–	–	1	75	2: 30 + 70	1/2/1-3, ≤1/2-3 DISS	CALC. soaked
2820	2	10	3	T	10	2	16	2	3	–	T	–	–	2	–	1: 30 +, 70-80	≤1/2-1/1-3, ≤1/2 DISS	calc in Fs + groundmass
2840	2	10	4	2	7	3	12	2	2	–	1/2	20-30	15	1/2-3	10-40	2: 10-30, +70	≤1/2-1/1-5, ≤1/2-2 DISS	Bx (volc?) 2832-37, STR. calc in MAT. (no Lscgl)
2860	–	4	5	5	20	10	10	2	4	–	1	30-100	20	3	30	3: 60-80	≤1/2-1/1-10, ≤1/2-1 DISS	wk crush.
2880	–	8	10	5	12	8	12	1	3	–	1 (10 SiO_2)	30-40	15	3	40?	2: 20-30, +ALL	≤1/2-10/1-prev, ≤1/2-3	wkly calc. soaked
2900	2	10	3	T	8↔10?	15	3	3	–	–	T-	–	–	1	30?	1/2: 20, 60-90	≤1/2-1/1-3, ≤1/2 DISS	calc. soaked in Fs
2920	1	9	4	T+	7	10	15	3	4	–	–	–	–	1/2	60	1/2: 30, 80-90	≤1/2/1-10, ≤1/2-1 DISS	calc-chl on Fx
2940	T	10	3	1/4	8	10	14	2	3	–	1/4	–	–	1	–	1/2: 60-80	≤1/2/1-5, ≤1/2-1 DISS	chl-calc in stringers
2960	2	8	8?	1/4	8	12	16	2	2	–	–	–	–	1/3	–	1: 20-30, 50-60	≤1/2/1-2, ≤1/2 DISS	chl on Fx
2980	1	15	20	1	5	8	10	3	2	–	1	mottled ?	?	1	?	2: 20-30, 60-80	1/2/1-5, ≤1/2-1 DISS	chl-calc, clay on Fx
3000	–	5?	30	2	7	10	6	1/2	1/2	–	2	30-60?	30	2	60	2: 20-30, 70-80	1-5/1-prev, ≤1/2-4	open qtz lined vugs @ 60-90°
3020	–	8	25	3	4	7	4	3?	1/4 Fx	–	1/4	30-50	?10	2	?	2: 60-85	≤1/2-1/1-prev, ≤1/2 DISS	—
3040	–	3	15	3	2	6?	7	1?	1/4	–	T	–	–	3	10°	2: 20, 60-80	≤1/2/1-5, ≤1/2 DISS	—
3060	–	3	10	1	3	5	4	1/2?	T+	–	T-	–	–	1	10-25	2: 20, 80-90	≤1/2-2/1-prev, ≤1/2 DISS	—
3080	–	5	8	1	2 mgt	4	3	2	T	–	–	–	–	1/2	20	1: 20, +60	≤1/2/1-5, ≤1/2 DISS	—
3100	–	6	5	2	4?	3	3	2	T-	–	T+	–	–	2	10	3: 10-30, 60-90	≤1/2-2/1-5, ≤1/2-1	—
3120	–	8	3	1	2	1	8	4	–	–	T+	–	–	1	40	5: 50-70, 10-20	≤1/2/1-5, ≤1/2	open qtz vn-stringers 3-4mm 75-90° 3102-08
3140	–	4	2	1	2	2	10?	5	T	–	T-	–	–	1	30	5-40: 20-40, 70-90	≤1/2-1/1-5, ≤1/2-1 DISS	open qtz vn-lining 80-90 + 60 3139-43
3160	–	–	2	1	1	?5	15	8	1/4	–	T-	–	–	1/2	30	5-20: 30-70	≤1/2-1/1-3, ≤1/2-1 DISS	—
3180	–	5	QTZITE	1	T+	?3	10	5	1/2	–	–	–	–	1/2	30	5-10: 10-30, 70-80	≤1/2-5/1-5, ≤1/2-1 DISS	3-2mm calc on Fx
3200	–	2		T	T	2	8	4	1/4	–	–	–	–	2	–	6: 70-90, ALL 5	≤1/2-3/1-3, ≤1/2-1 DISS	—
3220	–	2	Qtz 1/2	T	T	3	6	5	1/4	–	–	–	–	1	–	5: 30-40, 60-70	≤1/2-1/1-4, ≤1/2 DISS	1/2 mm calc on Fx
3240	–	1	Qtz 1/2	2	2	4	8	5	1/2	–	2	–	–	3	30?	4: 30-40, 60-70	≤1/2-20/1-30, ≤1/2-1/2 DISS	calc, qtz on Fx, vugs
3260	–	3	Qtz 1/2	3	2	1	8	7	1/2	–	T	–	–	2	30?	6: 30-50, 70-90	≤1/2-2/1-20, ≤1/2-1 DISS	few mm movement across MGT filled Fx
3280	–	2	Qtz 1/2	4	T	1	8	8	1/4	–	T	–	–	1	40	4: 60-80	≤1/2-1/1-5, ≤1/2 DISS	calc-clay on Fx
3300	–	3	5	2	3 green	8	4	2	T+	–	T	–	–	4	30	2: 30, 70-90	≤1/2-2/1-20, ≤1/2-1 DISS	—
3320	–	1	6	3	3	8	T+	–	–	–	T-	–	–	1	15	2: 10-30	≤1/2-2/1-20, ≤1/2-1 DISS	—
3340	–	4	8	4	3	10	T+	–	–	–	T-	–	–	2	20	4: 20-60	≤1/2-2/1-prev, ≤1/2-2 DISS	33-crush 3337-38
3360	–	1	15	5	3	12	T-	–	–	–	1/2	+50	5	2	30	5: 30-70	1/2-30/5-prev, ≤1/2-3 DISS	Qtz druse on Fx
3380	–	2	6	2	5	8	1?	–	–	–	2	–	1	1-10	35	2: 30-60	1/2-2/1-30, ≤1/2-1 DISS	3360-66 BRKN + clay on Fx
3400	–	4	7	1	6 green	6	–	–	–	–	–	–	–	2	20	2: 20-50, +70	≤1/2-3/1-10, ≤1/2-1 DISS	v.f.g. qtz druse on Fx
3420	–	5	6	2	8	10	–	–	–	–	T+	–	–	1	20	2: 70, 20-30	≤1/2-3+/1-15, ≤1/2-1 DISS	v.f.g. qtz druse on Fx
3440	–	6	7	2	6	12	T?	–	–	–	±IBX	–	–	1/2	20	5: 20-40, +85	≤1/2-2/1-20, ≤1/2-2 DISS	1-2 BK cr. S2 Rim to IBX?

↑ ALL SM-5 MAGNETOMETER ESTIMATES BY J.M. WOOD.

ROCK TYPE AND REMARKS

DETAIL

To	Detail
2680	Kfs VN Selv. + Flood.
2700	Kfs Repl. plag; clay along Fx: chl + Kfs + ep. ± calc ± mgt ± pyr vn.
2740	STR Fx, VN @ 85 + 60: 2726-27 calc + clay.
2820	2828-30: Diss. Red Hem. in groundmass.
2840	@ 2835 @ 60° 8" chl, qtz, py >> cpy stringers
2940	4" + 9" qtzite, gy, f.g. @ 2925-27 xenolith.
2960	55-60' f.g. + dk green chilled margin? (Fs "Blue" + Fresh)
2980	10" Kfs flood at contact
3020	Stockwork SiO_2 ALT-Flood (mottling gives appearance of Bx
3040	Definite ghosts of Eutax. struct 1st noticed at ± 3033'
3080–3100	Little Banding Below 3145'
3160	3146-65' med. grey HNFLS, STR ALT: epid, pyr, chl (diss)
3200	Black f.g. Qtzite
3240	20 mm py, sl, cpy (qtz) vn @ 35° 3231 +, 2: 5 + 8 mm qtz-pyr (cpy) vn @ 30°
3260	1-5 mm MGT Fx 80-90° 3251-3273 (stringers); @ 3245: 20mm py, sl vuggy vn @ 60°
3280	1-8 mm calc vn + stringers (1-5 mm spacing) 3276-80 60 + 85°
3300	local 1-2 mm sl + cpy vn @ 30 + 5-8 mm Q-S selv. [3322-70' strong Lt gy Q-S Flood, bleach.]
3320	Fan of pyr. VN 3331-42 (20/Ft)
3340	3/4-2" pyr vn 3339 @ 50, 3330-32 qtz blebs 1-2cm w/Kfs rims (spherulites?)
3360	3347-50° M. gy silica (+fg) w/ loc. Bx, dissem pyr, goeth + Red Brown blades (xal) = HUEBNERITE (Fe, Mn) WO_4 By XRD (3349') (wolframite)
3380	green clay-SER. blebs of phenos + Eutax Banding picks up Below 3390'
3420	2-4mm qtz-py-sl vn @ 70 @ 3402'; Local 1-5% pink phenos: 3400-3490'
3440	3425-27: 3" DK gy "fluid" IBX? 1-4 mm well rounded clasts + v. str Q-S-py ALT + Tsl. (@ 75°)

⇒ GENERAL

From 2500 → most of groundmass gy - Lt. green. Q-S-flood + Chl + Mont?? to ~2625

2655 → gy-pink groundmass - Relict Bio - MGT plag Lt. BLUE (fresh?)

⇒ 2744-2753.5 (60°, 45° horiz. slicks) Rhyol + Rhyol. Bx: Prob volc. + not Dike. 1-2 mm ghost phenos, Lt. gy groundmass, 3-5% chl, calc. soaked (but no Ls cgl.) ⇒ 2753.5-2757: MP -

⇒ 2757-75: Rhyol. Bx (Tr ghost + Eutax. clasts) Flow @ 70-90° (70°, 90°) ← contacts indistinct.

⇒ 2775-2832: QMP: clay alt Fs: Dissem chl + chl after Biot. Calc. soaked, pyr very spotty.

⇒ 2832-41 (40°, 70°): Bx + Rhyol. Kfs flood in Rhyol. (2836-41), str. calc + SiO_2 + chl + pyr. in Bx.

2841-44 QMP (70° lower cont.) Kfs flooded, + ep. + chl around mafics + pyr.

⇒ 2857: XRD: GREEN clay = illite + Kaolinite ⇐

⇒ 2844-2872: QMP (str. bleach 46-68') with xenoliths of volc + volc. (~7' total) 56-58: clay ALT Rhyol. volc.

⇒ 2872-2880 (40°): Bx: Rhyol., SiO_2 + Kfs flooded, part of Bx is volc., str pyr.

⇒ 2880-2972 (40°): MP (on QAP) "Salt + Pepper" texture from dissem chl + Kfs flooding: many of Fs to Lt gr. clay or SER + calc. soaked (swell). Very low sulfide content. Hardness incr. to contact.

⇒ 2972: f.g. grey, mottled green porphyry (volcanic) well silicif. 30-50 below contact with almost all struct. destroyed, but relict phenos 1-4 mm visible. Core very solid with a few local SiO_2-lined Fx.

⇒ 3087: Grades into black → grey groundmass with Lt. green selv. around Fx, + Eutax. band. (Kfs, epid, chl + pyr) make up lighter olive green bands which locally become pervasive. To black groundmass (with MGT.) incr. below 3113, Fs die out below 3116 + Rock is dk to med. gy + gr. mottled hornfels with epid, pyr, chl. units. (local Hem. oxid) Hornfels is v. brittle + locally was prob a f.g. sandstone.

⇒ At 3288: flow banded Lt gy - dk gy mottled porphyry similar to above 3113, very sandy textured. - could be volc. sandstone: Lt. gr mottling along Fx + on flow band-bedding, below 3310 less "sdy" (mixture of clay-ALT + unalt-granular groundmass) more v.f.g. groundmass with Kfs-SiO_2 flood.

(5)

3940-4100 30-50 x100 cps (30-40 x100 BKGD)
4020-28 50-60 x100 cps

GEOLOGIC LOG

PROJECT TRENCH HOLE NO. TCH-2
Collar ele. ____ Final depth ____
Coord N. ____ Inclination ____
Coord E. ____
Logged by F.R. KOUTZ
Date start ____ Date finish ____

← Samples (T.S, P.S, XRD)

Samples	From	To	Intvl	% Rec	Comment or Assay Interval	Cu %	Pb ppm	Zn ppm	Au oz/T	Ag oz/T	Mo ppm	Comp. Assay
	3440	3460	20	100								
		3480	↓	↓								
	3480	3500			3490-3500	0.02	110	380	.001	0.08	10	
		3520										
TS 3538		3540										
		3560										
TS 3567 I:BX		3580			3560-3570	0.035	85	110	—	0.04	—	
	3580	3600			3590-3600	0.02	63	93	.001	0.12	11	
		3620										
		3640										
		3660										
		3680										
TS 3682	3680	3700			3680-3700	0.01	39	160	.001	0.06	28	
		3720			3700-3710	0.005	—	305	—	0.06	—	
		3740										
		3760										
		3780										
	3780	3800			3790-3800	0.02	34	179	.001	0.05	18	
		3820										
		3840										
		3860										
		3880										
TS 3883	3880	3900			3890-3900	0.01	56	190	.001	0.06	22	
		3920										
		3940										
3952		3960			3960-70	0.003	140	820	=	=	6	
		3980	↓		3970-80	0.0015	75	300			4	
3992	3980	4000	20		3980-3990 / 3990-4000	0.02 / 0.16	300 / 1950	900 / 2900	<.0006 / .002	0.05 / 0.23	8 / 14	
	4000	4010	10			0.026	475	1400	—	—	8	
		4020	10			0.014	320	920	—	—	18	
4027		4030	10			0.0012	145	620	—	—	10	
	4030	4037	7			1.27	1800	6000	.0012	1.12	60	
4039-4041	4037	4046	6		<30050* 4038-41 QFP!!	0.04	400	500	<.0006	0.09	16	
4050	4046	4050	4			1.59	900	1200	.0038	1.24	55	↕
4060	4050	4060	10	↓		0.06	600	600	—	—	24	
	4060	4070	10	100		0.012	235	325	—	—	10	
	4070	4080	10	95	(No Assays)	—	—	—	—	—	—	
	4080	4090	10	65		0.0005	145	250	—	—	20	
	4090	4100	10	75		0.001	295	490	—	—	46	
4100	4100	4109	9	75	2.5' lost 4101-05	0.10	10200	10500	<.0006	1.36	26	
1'99 4114-15	4109	4116	7	86	1' lost 4109	0.01	1000	1100	<.0006	0.30	30	
4125	4116	4127	11	45	4123-27'-3' lost 4116-22-3' lost	0.032	550	800	<.0006	0.4?	18	
	4127	4136	9	90	1' lost 4127	0.97	1500	1100	<.0006	0.64	38	↑

↑ Composite assay by Skyline — see page 10, this log. (AARL + Skyline +3960)

Mineralogy and Structure

To	Chalcopyrite	Covellite	Galena	Sphalerite	Molybdenite	Grey S= or SS	Pink CO3 (rhodo)	Pyrite-Dissem.	Pyrite-Vein	% S= Oxidiz.	Limonite	Hematite	Specularite	Magnetite	Garnet	Serp.-Talc	Wollastonite
3460	T	—	T-	.1	—	1.0		1½	2	—	—	—	—	—	—	—	—
3480	T-	—	T-	.2	—	1.5		2½	2	—	—	—	—	—	—	—	—
3500	—	—	—	T-	—	.5		1½	2	—	—	—	—	—	—	—	—
3520	—	—	—	T-	—	.3		1½	1½	T-	T- (Goeth)	—	—	—	—	—	—
3540	—	—	—	.1	T- Fx	.5		1	1½	—	—	—	—	—	—	—	—
3560	T	—	—	.2	—	.3		1	1½	—	—	—	—	—	—	—	—
3580	.1	—	.1	.3	—	.5		2	1½	—	—	—	—	—	—	—	—
3600	—	—	—	—	—	.4	T	1	1½	—	—	—	—	—	—	—	—
3620	T-	—	—	T+	—	.5	—	1	1	—	—	—	—	—	—	—	—
3640	—	—	—	?	—	1	—	1	2	—	—	—	—	—	—	—	—
3660	—	—	—	T-	—	.4	T+	½	1	—	—	—	—	—	—	—	—
3680	—	—	—	.1	—	.6	½	1½	1	—	—	—	—	—	—	—	—
3700	—	—	—	T-	—	.8	½	½	¾	—	—	—	—	—	—	—	—
3720	T-	—	—	.3	—	.8	T+	¾	1	—	—	T-	—	—	—	—	—
3740	—	—	—	T+	—	.8	T+	½	1	—	—	—	—	—	—	—	—
3760	—	—	—	.1	—	2	T+	2	2	—	—	—	—	—	—	—	—
3780	—	T cc?	—	T-	—	.6	T-	½	1	—	—	—	—	—	—	—	—
3800	—	—	—	—	—	.4	T+	½	1	—	—	—	—	—	—	—	—
3820	T-	—	T-	.1	—	.6	T-	½	¾	—	T-	—	—	—	—	—	—
3840	—	—	—	T-	—	.5	¼	¾	½	—	—	T-	—	—	—	—	—
3860	—	—	—	—	—	.4	T-	1	½	2?	Jar-1 stain	—	—	—	—	—	—
3880	—	—	—	—	—	.3	T-	¾	¼	—	—	—	—	—	—	—	—
3900	T-	—	—	T-	—	.3	—	1	¼	—	—	—	—	—	—	—	—
3920	—	—	—	—	—	.5	—	1	¼	—	T-	—	—	—	—	—	—
3940					—	.3	—	1¼	¼	—	—	—	—	—	—	—	—
3960	T+	T-	—	—	F	T-		1	T-	0	—	—	—	—	—	—	—
3980	T-	T cc	T-	—	T-	T		1.5	Tr	0	—	—	—	—	—	—	—
4000	.1	T+ cc	.3	.4	T	T+		1	1	0	—	—	—	—	—	—	—
4010	T+	T-	T+	.1	T	T		1.5	1	0	—	—	—	—	—	—	—
4020	T-	—	F	T	—	T		1	½	T	—	T-	—	—	—	—	—
4030	T-	—	—	T	—	T		1.5	1	T	—	T-	—	—	—	—	—
4037	1?	.1	T+	.2	—	.3		5	15	—	—	—	—	—	—	—	—
4046	.2	.1	T-	T-	T	.1		2	1.5	—	—	—	—	—	—	—	—
4050	.2	T	.2	.3	—	.3		8	15	T	F	T-	—	—	—	—	—
4060	.4	T-	T	.1	T?	.1		1	2	—	—	—	—	—	—	—	—
4070	.1	T? cc	T	T	—	.1		1.5	1	T	T-	—	—	—	—	—	—
4080	.1	T-	T	T+	—	.1		1.5	.5	—	—	—	—	—	—	—	—
4090	T	T+	T-	T	—	T		1.0	.5	T	T	—	—	—	—	—	—
4100	.1	.1 cc	T	T+	—	.2		2	1	¼	⅛	⅛	—	—	—	—	—
4109	.3	T	.8	.3	—	.5		1.5	1	5	½	2	1	—	T	10	—
4116	.2	T	.4	.6	—	2.0		2.0	.5	20	½	3	.3	—	10	16	—
4127	—	—	.2	.2	—	1		1.5	.5	5	.3	.1	—	—	T	10	—
4136	2.0	.1	—	T?	—	—		2	.5	30	.1	8	T	—	15	5	—

To	K-spar	Jasperoid (F.g. SiO2)	Qtz-Vein	Clay	Sericite	Chlorite	Epidote	Calcite	Cal. Gr. Size	% Sanding Vugs	% Banded	Bx Matrix %	Dip of Beds/Flow Band	Sulfide Veins # + ∠	Fx/Foot (open)	Width mm sulfide vn + alt. selv. or S= grain size	Faults — Crushing — Shearing
3460	5	7	2	4	10	—	—	—	—	T-	80	—	15	5:20-40 +60	½	1-3/5-20 ½-1 diss	→
3480	7	6	3	2	12	—	—	—	—	¼	40	—	20	5:20-40 +60	1	½-3/5-Prov ½-1 diss	Qtz druse on Fx: Esp 90°
3500	7	6	2	3	10	—	—	—	—	T+	30	—	20 +90	4:20-40 +75	3	½-5/5-Prov ½-1 diss	—
3520	6	4	1	5	9	T-?	—	—	—	—	50	—	30	2:10-40	1	½-2/5-Prov ½-1	—
3540	7	4	1	5 (gray clay?)	8	T?	—	—	—	1	70	—	?Alt 60	2:60	1	½-1+/1-5 ½-1 diss	v. wk cre 60-70 23-26'
3560	8	5	1	5	6	T?	—	—	—	T-	60	—	40 60	3:50-70	1	½-3/1-3 ½-1 diss	—
3580	6	4	1½	3	10	1	T-	T+ Fs+Fx	—	T+	30	25 IBX	40	1:30+70	½	½-8/1-5 ½-1 diss	→
3600	5	4	1	4	7	1	—	T+	<½	T	30	—	40	1:60-90	2	½-1/1-3 ½-1 diss	calc on Fx
3620	5	3	1	4	7	1	—	T	<½	T	80	—	30	2:30-40 +70	2	½-4+/1-3 ½-1 diss	—
3640	7	2	½	5	10	T	—	T-	<½	¼	95	IBX? 40	30	2:30-40 60+	1	½-1+/1-2 ½ diss	↗
3660	5	5	1	7	15	T+	—	—	—	¼	98	98	30 50	2:60-70	1	½-1 1-5 ½-1 diss	Qtz druse in vugs-Fx
3680	1	10	2	8	15	—	—	T-	<½	¼	50	98	15	3:60	½-3	½/1-2 ½-1 diss	MnCO3 in vug trace
3700	—	20	4	4	12?	1	T-	T-	<½	½	10	—	—	3:70-80	2	½-1/1-2 ½ diss	—
3720	10	14	2	2	10	1?	—	T Fx	<½	T-	30	—	30?	2:30-40 +70	2	½-3+/1-10 ½-1 diss	T. cr w/ Qtz vn fill
3740	10	8	2	2	8	T	—	—	—	T	10	—	20	3:10-20 85	2	½-2/1-3 ½-1 diss	Dk S= + MnCO3 on Fx
3760	12	10	3	2	7	T+	—	—	—	T-	5	3 (Pyr)	?	3-30 30-50°	2	½-2/1-5 ½-4 diss	MnCO3 + BK S= on Fx
3780	8	8	1	2	6	½	—	T-	<½	T-	3	—	—	4:30	3	½-1/1-10 ½-1 diss	MnCO3 + BK S= on Fx
3800	10	12	2	2	8	1	—	—	—	T	10	97	40?	3:20-40 85	2	½-2/1-3 ½ diss	MnCO3 + Qtz druse on Fx
3820	15	12	3	1	5	2	T-	—	—	T+	—	98	—	4:20 75-80	3	½-½/1-10 ½-1 diss	Chl on Fx → 8"
3840	10	13	4	1	6	3	½	F	<½	1	—	99	—	3:20-40 60-90	¾	½-1/1-5 ½-2 diss	chl + Qtz + MnCO3 on Fx
3860	8	10	2	5	10	4	1	T	<½	T	70	20	25	5:60-70 30	3	½/1-5 ½-1 diss	chl + calc on Fx
3880	6	12	1	4	10	2	T+	—	—	T-	80	—	35	3:50-80	4	½-1/1-10 ½-1 diss	—
3900	4	15	1	3	12	2	3	—	—	—	60	—	20	2:30 60-90	3	½/1-5 ½-1 diss	wh-yellow clay on Fx
3920	10	10	2	2	8	1	2	—	—	T-	80	—	25	1:75-90	1	½-1/1-5 ½-diss	—
3940	20	14	2	3	8	2	1	T w/cit	<½	T-	30	—	25	3:↑ per foot	2	½-1/1-5 ½-1 diss	3932-33 crumbled
3960	3	25	1	5	10	1	T+	—	—	—	10	20	15	3 ALL ∠ per 10 Ft	3	1mm	wk cr + sh.
3980	5	30	3	3	12	½	½	—	—	T+	15	20	30	+30 10-30 60-90		1mm	Tr-wk cr
4000	3	35	3	5	15	½	¾	—	—	T+	5	3	20	10:80-90		.5-3/1-5	Tr cr
4010	5	35	3	3	15	½	½	—	—	T+	20	—	20	15:60-80		.5-2/1-3	Tr cr.
4020	3	35	1	2	20	½	1	—	—	T	5	—	25	20: ALL ∠		.5-1/1-10	Tr cr.
4030	5	40	2	1	15	½	1+	—	—	T	5	3	15	15 20-30 60-80		.5-2/1-10	Tr cr
4037	15	40	5	3	20	4	½	—	—	T+	—	25	—	+40 ALL ∠		1-10/1-20	wk cr-Bx
4046	5	30	3	2	15	2	T	—	—	½	10	30	20 60	15 ALL ∠		.5-8/1-5	mod-str Bx-flow
4050	12	35	5	2	20	2	T	—	—	1	—	15	—	+50 ALL ∠		1-8/1-5	mod cr. — Bx
4060	10	30	5	3	15	5	½	—	—	2	—	3	—	+15 70-80 20-30		.5-2/1-3	Loc. mod cr @ 80-90
4070	8	20	2	2	18	4	1	—	—	½	—	1	—	+20 70-80 10-30		.5-1/1-5	Loc. wk. cr.-Bx
4080	12	15	3	4	20	2	½	—	—	2+	—	1	—	+10 60-80		.5-3/1-10	Loc. str. cr.
4090	8	12	2	5	20	2	T+	T-	—	5+	—	1	—	+8 60+ 90		.5-1/1-5	Loc. str. cr.
4100	8	10	2	8	15	8	1+	T Fx	—	10+	—	3	—	+10 30 60-90		.5-2/1-5	Loc. str. crush
4109	—	5	1	5	3	5	1	1	vFg w	10	80	5	20 60	whispy dissem stringers		.1-5	mod crush -Bx to flow
4116	—	3	T	15	2	8	T+	3	vFg w	15	85	5	20 80	whispy stringers		.1-.3	mod cr. + flow
4127	—	—	—	30	2	5	—	10	Diss	5	60	2	20 80	whispy		.1-5 diss w/chl. blebs	mod-str cr. + flow
4136	—	15	1	3	—	5	—	5	Late druse	15	80	2	30 20	Dissem blebs		.1-5 blebs-leached	mod flow

Rock Type and Remarks

To	Detail	General comment ⇒
3460	1" Qtz, pyr, sl +Kfs stringer "fluid" @60° @3442	⇒ con't from 3288 welded tuff -
3480	3466-88: Dk gy MAT, pink Kfs 2-5mm (5%), Q-S-flood?- Diss gy S= (Qtz druse in Fx)	3-15% 1-4mm Fs, locally some are pink,
3500		If weakly altered matrix is Dk gy; Lt green
3520	@3523 @60-80°, 1' crush + leached, recemented by v.f.g. SiO2 druse	mottling (mont or ser) follows Eutax struct.
3540	⇒ 3560-3620: local Dk gy groundmass "fresh"	+ Fx + diss pyr on vn.; local str Q-S-py.
3560	3mm sl>>cpy vn 3554 @65°, slicks horiz. ✓ 1-8mm stringers @20° sl>gn>cpy=pyr. @3565	w/ QS flood + py sl + cpy ton vns (# incr. with depth)
3580	→ 3565-67.5 IBX: 10-300 contacts: QMP-QFP? clasts, subround-sub ∠, Fg, chl, dis pyr, Tsl	
3600	Kfs flood in 1-3mm Eutax. band; 8mm Qtz, py, sl, Kfs vn @35 3606.	
3620	3637-41: 4-20mm fluid-Bx vn 60-80°: Bker S= mat., well round frags	
3640	Eutax. text. strong, 3622-68'	
3660		⇒ 3670-77: v.f.g. Lt→med gy Qtzite, mottled, Bk sl? Tr on Fx, T py. on Fx
3680		⇒ 3683-91: mottled Lt. tan-gy Qtzite 1-4mm. Qtz druse filled Fx
3700	⇒ 3677-83 Silicif.-gritty welded tuff as above 3670, but 1-5mm. ovoid fragments;	3691-3700: strongly silicif-mottling tuff?
3720	35mm pyr stringers @50° w/ 50-80mm Kfs selv. 1-5?-sl in selv.	⇒ 3700 → 3840 v.f.g. Lt. cream-mottled Lt greenish gray TUFF, prob
3740		v. Kfs ric; -local pink patches, 1-5% local 1-3mm phenos but
3760	~3748: @50°, 50mm BK S= (cr, py) "fluidized" stream	size enhanced by alt rim. Stockwork-Fx alt + pyr vns locally
3780	4342-50: str. Fx 1-4mm, BK pyr. filled.	give a Bx appearance but no evidence of +5mm fragments
3800		Many Fx filled with BK S= (sl or crushed py), locally chl?; lines
3820	3816: mottled tan + cream silg + vuggy S= @60°	Fx, local ghosts of banding (welding) but alt also follows
3840	3830: 3" vuggy Bx + chl + pyr.	dip of Fx. Prob. air-fall, v. weakly welded f.g. TUFF
3860	3844-44: Jar. stain in clay: 3840-46 mottled Bx, chl + pyr.	⇒ 3846-3886: Prob. welded tuff - faint Eutax text. with Lt. green
3880		Ser (or mont) + chl banding along 5-10% 1-3mm pheno (now pyr-chl-ep.)
3900		Groundmass: Dk-Lt gy.
3920	3920-25 str Kfs groundmass	⇒ 3886-3940 - f.g. tuff as above 3846: some elong. of Fs-pheno-chl-epi-Kfs
3940	F.g. Qtz in Q-S flood. Below ↓	pyrite clots. Gradational to unit below with incr. in ALTER: Esp chl + wh. ser (direct). ←
3960	30% Bx: Brecciated flow or flow Bx	⇒ 3940-4037: Rhyol-Latite? Ash Flow, local flow Bx zones (Esp 3940-60)
3980	10% Bx	wk ⇒ strong f.g. SiO2 flood ± Kfs ± seric. Loc sl-py ± gn ± cpy ± Q-S
4000	vn stringers @ 80-90° 3990-4002 (Q-S, sl, py, gn, cpy)	vn. Tr cc/cov on pyr/cpy. Rock weakly crushed + vn w/ drusy qtz.
4010		All mafics now chl-pye-Epid. 4010-4020 more phenocr. clusters.
4020	Epid. + chl + pyr in phenocr + py-Q-S vn.	
4030	Epid-chl pyr ± Kfs in vn.	↓ Rest of 4037-46 interval is IBX
4037	Kfs flood 4036-37. py + chl + ser ± cpy ± Qtz stockwork vn.	w/ mg. QMP frags to 8cm; frags similar to TR-13, TCH-1 QMP frags.
4046	← 4038-41: Intrus φ 40 phenocr. 5-10mm max mostly 1-3mm plag+Kfs. gy silicif. mat of wk Kfs flood only T-Biot. Rest of mafics to chl+py+Epid. (including QMP)	
4050	-IBX? -Bx: Rock types uncertain but include φ, volcanics ≈ above 4037, QMP + Kfs flooded frags, blebs + vnlts of pyr>>cpy in Qtz-ser Kfs mat.	
4060	[Volcanic flow Bx: v.f.g. silic. + Kfs + chl. flooded matrix (similar to above 4037)	↖ knsh. @60° @4050; sh. S=, pyrom.?-Rhodon.? on Fx
4070	4050-4100: Local 1-2' str. Kfs flood; loc. mod chl + epid. of phenocr + mafics.	2cm Kfs-pyr-Qtz vn @30° @4062
4080	→ crushing incr. below 4083 w/ up to 10% ∠ vgs: core looks like cemented crushed gravel - locally gravel by drilling.	
4090	- some of Bx-cr post Q-S; strong. chl-epi-pyr starts @5100	
4100	- vuggy Bx recemented by SiO2, Tr late calc.	↓ ↓ PZ section starts
4109	Mottled gr + tan banded skarn - S= folded	4100-4127: Mixed Bx zone of garnet
4116	Garn-Diop? skarn	skarn + volcanic frags - vuggy + gravelly: strong
4127	Low dens./leached calc-silic. ss-siltst.: 4123-27: Groundcore - local volc-flow (cave?) or Bx / crumbly	Oxid. to Hem.
4136	4127 → Leached. +0x10/2. (part) Garn/Diops. skarn "sandy"-vuggy - strong Hem. late blue-Qtz + calc. druse + flood.	

GEOLOGIC LOG

PROJECT: TRENCH
HOLE NO.: TCH-2
Collar elev.:
Final depth:
Coord N.:
Inclination:
Coord E.:
Page 6 of 10
Logged by: F.R. KOUTZ
Date start:
Date finish:

* El Paso check assays on these intervals - see Gen. Files 24 Jul 81 ↓

PS + T.S ↓

Margin	From	To	Intvl	Recovery	Comment + Assay Interval	Cu %	Pb %	Zn %	Au oz/T	Ag oz/T (Fire Assay Ag above 6 oz/T)	Mo ppm	Comp. Assay
	4136	4146	10	95		0.15	.0225	.072	<0.0006	0.18	50	As/Sb
4155 -	4146	4156	10	98		0.98	.23	.15	<0.0006	0.74	310	40/12 ppm
	4156	4166	10	95		0.76	.42	.14	<0.0006	2.06	65 ↓	
	4166	4175	9	100		0.02	.04	.04	<0.0006	0.32	10	
4170 -	4175	4185	10	100		0.32	.105	.067	<.0006	0.96	8	
4193 -	4185	4195	10	98		0.10	.24	.050	<.0006	1.68	55	
	4195	4201	6	100		0.50	.53	.056	<.0006	3.66	465 ↑	As/Sb 20/10 ppm
	4201	4205	4	100	→	6.50	1.01	.13	.0018	10.46	265	
	4205	4209	4	100		0.87	.75	.08	.0009	4.56	800	
	4209	4215	6	99		0.09	3.35	3.34	.0012	1.60	26 ↓	
> 4223 -	4215	4225	10	100		0.0005	.0265	.0320	—	<.006	2	
	4225	4233	8	↑		0.0005	.0190	.0275	—	<.006	10	%
	4233	4243	10			.0005	.0265	.0285	—	<.006	10	WO3
	4243	4249	6	↓		.0395	.85	.52	—	0.27	16 ↑	.02
	4249	4260	11	100		.02	.59	.24	—	3.68	450	.088
4263 -	4260	4270	10	100		0.03	3.15	2.70	.0012	1.76	18	.023
NX →	4270	4280	10	100		0.11	2.21	1.46	.0018	2.40	10	.012
BX	4280	4290	10	↑	4280-86	0.01	0.71	0.88	—	0.29	65 ↓	
					* 4286-90	0.21	4.10	7.10	<.0006	1.06	110 ↑	
	4290	4296	6			0.31	4.95	6.45	.0015	0.88	100	
	4296	4300	4			0.10	0.42	0.29	—	0.25	740	
	4300	4302	2	↓		1.50	8.00	13.5	.0012	3.12	170	
	4302	4312	10	100	*	1.05	3.95	6.75	.0009	1.34	8 ↓	
4316 -	4312	4320	8	↑		0.014	0.097	0.145	-	.006	2	
	4320	4330	10			0.0195	0.45	1.04	-	0.12	4	
	4330	4340	10			0.003	0.018	0.03	-	<.006	4	
	4340	4350	↑		ALL NOT SPLIT ↓	0.0005	0.0075	0.0195	.0012	<0.006	4	
	4350	4360										
	4360	4370										
4376 -	4370	4380										
	4380	4390										
	4390	4400			SPLIT	0.001	0.0155	0.018	.0012	0.006	18	
	4400	4410										
	4410	4420										
	4420	4430										
	4430	4440										%
>	4440	4450			SPLIT ↓	.0005	.0622	.086	—	—	10	WO3
	4450	4460			*	0.16	1.46	0.76	<.0006	4.10	160 ↑	0.42
4463 -	4460	4470			PS 4463	0.25	1.87	3.58	<.0006	3.21	2	.001
4479 -	4470	4480				<.01	0.68	0.59	—	1.00	2	.001
	4480	4490				.01	2.28	0.56	—	5.10	2	.003
	4490	4500	↓			.019	0.54	0.20	—	0.94	8 ↓	—
4502 -	4500	4510	10	↓		.0275	0.37	0.44	—	-	6	
	4510	4520	10	100		.004	0.15	.045	—	-	10	
	21	32										

MINERALOGY AND STRUCTURE

From	To	Chalcopyrite	Covellite	Galena	Sphalerite	Grey S= or SS	Pyrite-Dissem	Pyrite-Vein	% S= Oxidiz.	Limonite	Hematite	Specularite	Magnetite	Garnet	Serp-Talc + Diop	Wollastonite	Graphite	Jasperoid F-G SiO2	QTZ-Vein	Clay	Gypsum	Chlorite	Epidote	Calcite (10^3)	Cal Gr Size	% Shading-Vugs	% Banded	Bx-Matrix %	Dip-Beds-Flow Band
4136	4146	.5	T	—	T?	T	3	.5	70	1	10	—	—	60	10	—	—	10	5	2	—	5	—	3	F-G drusy	15	30	3	20/90
4146	4156	3	.3	T	.5	.5	3	2 blebs	40	T	8	—	—	60	10	—	—	3	2	1	—	3	—	15	<1	5	5	5	60
4156	4166	4	.2	.2 +Arg	T	.3	2	5	50	T	9	—	—	55	8	—	—	5	1	1	—	2	—	5	Dru?	8	20	10	30
4166	4175	.5	T	.1	.2	—	1.5	.5	70	T	10	—	—	40	3	—	—	15	5	—	—	3	—	15	to 3mm	5	80	1	30/50
4175	4185	.3	—	.1	T	—	1.0	.5	80	½	7	—	—	20	35 Diop.	—	—	15	3	—	—	10	—	12	to 3mm	3	100	2	10/40
4185	4195	.5	T	.1	.1	T	1.5	.5	50	T	8	—	—	25	40 Diop	—	—	10	6	2	—	5	—	20	3	6	60	5	20/40
4195	4201	.8	T	T	T+	T	.5	.5	5	T	2	—	—	25	40 Di	—	—	1	3	—	—	8	—	20	1-2	½	5	—	30
4201	4205	8	.2cv .3bn	—	.3	.8	.8	T	5	T	3	—	—	40	30	—	—	10	2	—	—	2	—	10	1	T	10	—	30
4205	4209	1.5	.1	.2	.4	.2	.6	.2	8	T	3	—	—	30	30	—	—	10	1	—	—	5	—	15	1	T	20	1	20/40
4209	4215	.5	.1	1.5	1.0	.5	.5	.1	1	T	1	—	—	10	10 Diop. 30 grcly	—		1	—	10	—	10	—	20	½	2	90	20	20/60
4215	4225	—	—	—	—	T	.1	—	—	—	—	—	—	—	3	—	—	T	—	3	2	1	—	20	VFg	T	—	—	—
4225	4233	—	—	.1	T+	T	T	—	—	T	—	—	—	3	5	?	T	3	T	3	1	1	—	25	VFg	T	20	—	20
4233	4243	—	—	—	—	T	T	—	—	T	—	—	—	1	5	?	T	2	T	2	2	2	—	40	to 1mm	T+	25	—	60
4243	4249	—	—	.3	.5	T+	.1	—	3	—	T+	—	—	2	80	—	—	2	1	5	1	15	—	30	VFg	T	70	3	60/80
4249	4260	2	—	.5	.8	T+	.5	.1	85	1	8	—	—	25	30	—	—	5	1	2	—	5	—	25	VFg	T+	—	—	50/70
4260	4270	.3	T	5	2	—	1	—	T	T	T	—	—	20	30	—	T	2	—	2	—	5	—	30	VFg	T	30	5	30/60
4270	4280	.2	—	4	6	—	2	—	T	—	T-	—	—	60	20	—	—	—	1	—	—	2	—	10	.5/1	—	20	1	30/50
4280 (4280-86)	4290	.1	—	.5	.3	—	.2	—	20	T	3	—	—	15	30	—	—	—	—	5	—	5	—	30	VFg	T	80	—	15
(4286-90)		.3	T	7	6	—	.5	—	T	—	T	—	—	10	40	—	—	—	1	6	—	6	—	25	VFg	T	80	—	30/60
4290	4296	.1	—	8	6	.5	.8	—	1	T	T	—	—	10	40	—	—	—	1	7	—	8	—	35	VFg	T	80	3	30/60
4296	4300	T	—	.5	.3	—	1.0	—	85	T	10	T	—	40	20	—	—	T	1	2	—	2	—	20	VFg	T	20	1	25 Bed
4300	4302	2	.3	15	3	—	4	—	3	T	½	—	—	10	40	—	—	T	1	5	1	10	—	20	VFg	1	80	2	10/30
4302	4312	2	.3	10	5	1	2	—	T	—	T	—	—	15	40	—	—	5	1	5	3	8	—	20	VFg	1	85	1	30/50
4312	4320	—	—	.2	.2	T	.3	—	T	T	—	—	—	3	5	—	T	3	1	3	3	1	—	20	.3/1	T	10	T	10/40
4320	4330	T	T	.3	.3	T	.1	—	T	T	—	—	—	1	3	—	T-	2	1	5	1	½	—	50	to 2mm	.5	20	1	10/20
4330	4340	—	—	T	T	T	—	—	T	T	—	—	—	T	2	—	T	3	T+	7	2	.3	—	60	to 2mm	.5	30	2	10/30
4340	4350	—	—	T-	T-	T	T	—	—	—	—	—	—	—	½	—	T+	4	1	2	T+	T+	—	30	VFg	T	20	3	50/80
4350	4360	—	—	—	—	T-	—	—	—	—	—	—	—	—	T+	—	T-	1	1	1	T+	T+	—	20	VFg	T	20	3	30/50
4360	4370	—	—	—	—	T-	T-	—	—	—	—	—	—	—	3	—	T-	1	1	8	T+	.5	—	40	VFg	.5	30	5	20/30
4370	4380	—	—	—	—	T-	T	—	—	—	—	—	—	—	4	—	T	20	3	10	T	1	—	10	VFg	1	30	5	10/40
4380	4390	—	—	—	—	T-	T	—	—	—	—	—	—	—	2	—	T-	15	1	4	3	.3	—	20	to 1mm	1	10	3	10
4390	4400	—	—	T+	T	T	T	—	—	—	—	—	—	—	1	—	T	8	1	1	3	.5	—	25	VFg	T+	5	2	40
4400	4410	—	—	.1	T	T	.1	—	—	—	—	—	—	—	2	—	T	10	1	4	1	.5	—	30	VFg	1	30	1	30
4410	4420	—	—	T	—	T	.2	—	—	—	—	—	—	—	4	—	T+	5	T	3	1	T	—	40	VFg	½	30	2	40
4420	4430	—	—	T-	—	T-	T	—	—	—	—	—	—	—	½	—	T	15	1	2	T	T+	—	50	VFg	T+	60	2	20/60
4430	4440	—	—	T	—	T-	T-	—	—	—	—	—	—	T-	1	—	T-	10	1	2	1	T	—	40	.5/60	T	25	2	40
4440	4450	T+	—	.1	.1	T+	T+	T	—	—	T	—	—	T-	1	—	T+	50	1	1	3	1	—	30	.5/2.0	½	20	4	20/60
4450	4460	.3	T-	2	1	.3?	.3	.1	10	T	3	T	—	20	25 Di	—	—	5	2	—	T	5?	—	15	.5/2.0	T	15	2	30
4460	4470	.5	—	3	7	.5	.5	.2	1	T	½	—	—	35	15 Dio	—	—	5	1	—	—	5	—	10	1	T+	40	5	40/50
4470	4480	—	—	1	1	T	.3	.1	3	—	1	—	—	10	5	5	T	2	1	T	3	3	—	10	.5	½	30	10	30/60
4480	4490	T	T+	5	1	T	.3	.2	2	—	½	—	—	20	8	15	T	5	1	T	1	2	—	15	.5/2	¾	60	3	30/50
4490	4500	T	T-	1	.5	T	.8	.2	2	—	½	—	—	15	12	1	—	2	1	T	2	2	—	20	1	¼	70	5	30
4500	4510	T	—	.5	.8	T	.5	T	8	—	¾	—	—	50	16	3	—	3	5	T	3	T	—	10	1-2	½	30	5	20/30
4510	4520	—	—	.3	T	—	.5	.2	1	—	T+	—	—	60	10 (Talc Serp)	2	T	1	T+	T	1	T	—	30	.5	T	10	T	10/20

From	To	Sulfide Veins #∡	Width mm Sulfide VN + Alt Selv or S= gr. size	Faults — Crushing — Shearing	Rock Type and Remarks (← Detail)
4136	4146	+10 20/90	.1-2. whisp .2-5 blebs	mod CR -Bx +Sh on Fx	Vuggy-leached-oxidiz. Garn. skarn - prob. hydrogarn in part + diops.? - Dk gr. clayey material: S= (SiO2) boxwork - vugs to 2cm.
4146	4156	+5 60/70	.1-2 whisps blebs to 3cm	wk-mod "flow"	
4156	4166	3 30/40	.2-5D.-zone blebs to 2cm	wk cr-flow	cs?-Ang/Gn: gn boxwork SiO2 +Tr? Po w/py-cpy
4166	4175	Hem +20 20/50	.5-1 vn .2-1 blebs	wk-flow diff	Pink frcs? in late blue SiO2 flood - post oxid.; +k.s. white calc. fills some vugs.
4175	4185	+100 10/40	.5-1 vn .5-2 blebs	band	Tr paly gonk? on SiO2-Fx: Dk gr. mod soft calc silic >garn.
4185	4195	+20 Hem 20/40	.5-1 vn .5-2 blebs	wk fabric	Hvy oxid. stops @ 4193
4195	4201	whispy all ∡	blebs cpy to 2cm.	wk fold late calc vn	Garn-diop.-calc. skarn ← No probably Moly
4201	4205	blebs not width of core	cpy blebs to 10cm.	Tr sheen	Massive cpy blebs, Tr bn-cv, +? gy. Tn-En-Asp? - Tr Rhodon?
4205	4209	+6 VN,	VN to 2mm blebs to 10mm	Tr fold of cal VN	Hydro.-garn-diops.-qtz-oxidiz.
4209	4215	whisps 20-90°	VN 5mm blebs 5mm	mod-str crush-sh	Sh but not fit. ∡ ≈ 50° ← Trans.-skarn zone - "grcky" + S= (4209-4215) - Hematite (oxid) decrease.
4215	4225	—	wk bleach 1-5mm from x.g. calc. Fx	Tr sh.	
4225	4233	whisps 20-40°	.5-1mm	loc. wk sh.	
4233	4243	—	.5-1 S=	Sh @ 30+60°	Calc-sltstone. (Dol? but + Aliz. test)
4243	4249	—	.5-1 S=	mod sh 60-90	4246-48 - calc. sandstone - wh. // S= strings (48-49) 43-48 mottled-sh.-sdy-calc. sltst.: gr. "soap"
4249	4260	whisp + blebs	.5-2 S= Now Hem	wk sh e 60°	Oxidiz. Diop? - Garn. skarn.
4260	4270	+100 30-60° whispy	.5-2 vn .5-3 blebs	wk-mod sh	64-67 Low S=: Calc.-mottled-gr siltstone - garn Diop? - skarn: 2-4mm dissem gn around 4270
4270	4280	whispy dissem	.6-3 blebs	Tr sh. @ 60°	sl darken w/time (rim); gn post sl 71-78 Almost mass garn + S=: Rextal calc light pink
4280 (4280-86)	4290	whispy	.5-2	wk sh.	Serp-siltstone
(4286-90)			.5-30mm	wk sh	Dissem whispy stringers of S=
4290	4296	whispy	blebs + strngs .5-30mm	mod sh @ 60-85	4292-94 (low S=)
4296	4300	whispy 30 Hem vn 60	.5-2 Hem.	Tr crush	Oxidiz. garn. skarn: garn zone - light rims - slicks on Hem+calc. Fx
4300	4302	whisp-mass 10/30	1-20	wk-mod sh. @ 80	0.5' mass gn>>py>cpy>sl>cv @4301
4302	4312	wh.spy 30-50	gn s.2c .5-5mm	wk sh e 60-70	∡ 40° cpy post gn-sl 0.5'-50% S= gn>sl>cpy @4310'. Lt pink matrix (not $CO_3^{=}$?) - gyp.
4312	4320	whispy @4312	stringers .3-.5	Tr sh.	
4320	4330	whispy 10-40	stringers .3-1	mod sh. in argillic	4227-35 m.g. marble; D.C. S= stringers @4225
4330	4340	—	blebs .3-1 chl.	wk sh 50-80 in Arg.	
4340	4350	—	stringer .3 blebs	—	
4350	4360	calc. vn "Bx mat" to 3mm.			
4360	4370	—	—	loc mod sh-Dr?	4369-71: mod. sh. in lt. gr arg. @ 50
4370	4380	—	pyr xtal 1-2mm in arg	shearing arg.	4376-77.5: 1-10mm. wide qtz druse lined vug @ 70-85° (Jasp-wk 4375-78)
4380	4390	—	—	wk. sh in arg.	Diop blebs in calc. 4383 ~6"
4390	4400	30-80 stringers	0.5mm blebs.	sh in arg	1" sh. in arg. @60° @ 4393'
4400	4410	60-80 string.	.5 blebs	sh in arg	
4410	4420	—	.5 xtals pyr	sh. & Bx in arg 4415	Prob. $CO_3^{=}$ Dol > Cal
4420	4430	—	—	—	sl + gn stringers in lt. green arg. @ 4440+4441 - maybe core
4430	4440	—	—	wk sh wk Arg+	(wk-mod. jasp: wh-lt. gy 4444-4450: mottled, 5% calc. vns.: mottled)
4440	4450	1-2 vn gn	.5mm vn e 4440	1-2" e 4440+41	
4450	4460	10 20-30 +60	.5-3 1-5mm blebs	—	Min. is dissem. around late calc vn
4460	4470	20-10/60	.5-3 1-4 blebs	wk sh e 4470 - local	Bx to 4473: sh ∡ 30-60°
4470	4480	8 10-60	.5-3 stringers	mod sh - Bx	4473 - 4485: tan sdy Dol.? cut by calc. vn
4480	4490	20 10/80	.5-2 1-4 blebs	wk sh. 30-80	gn post cpy
4490	4500	5 20/50	.5-2 1-2 blebs.	wk Bx 4499-4501	
4500	4510	20 20-90	.5-1 stringers	↗	4501-03 qtz-calc. flood + sl + gn + py VFg stringers + blebs 4506-4516 garn. (40-80% gr. VFg)
4510	4520	—	.5-1 blebs	—	gn-sl-pyr vn on Fx @ 4519. 4515-4520: v.f.g. Ls? - wk garn.

Rock Type and Remarks (⇒ General):

⇒ 4127-4210: Garn.-Diops(?) ± Al.-Actinol.? skarn: sandy textured, oxidiz. + leached to hem. Local SiO2 boxwork after S= + late blue SiO2 + x.g. calcite (post garn) - prob. origin S= ≈ 4195-4215.

‖ 4215 → white (bleached v.f.g. calcareous sandstone) - 1-2mm late calc. + gyp. veins → 4243

4243-4270: spotty Scheelite

⇒ 4260 → 4312: gn-sl-cpy garnet + gr-calc-silic. ore! skarn.

⇒ | 4312 to 4450: Locally gypsiferous bleached wh. sandy siltstone (calcareous) - vfg sandstone. Local cal, gyp + qtz vns to 1cm, sometimes dusty qtz. Local .1-1' zones of lt. gr. clayey mudstone - usually sheared. Locally mottled lt. gr. sandstone - zones 1-5' of white orthoqtzite. Prob. local mod. Dol in this interval. Local f-mg. marble zones. Jasp. logged when vfg → fg silicification.

→ C 4459: 10% 2-10mm scheelite blebs over ~0.8' w/ calc, sl, cpy in diop-garn skarn there.

⇒ 4450-4520 Garn. > Diops skarn w/ Dk green sandy patches, local Bx + flowage, late calc. vn.: local mod. st Hem on Fx + flowl. - local sdy Dol + calc marble zones. 4513-4525 is transitional. Most S= blebby/with late calcite. Core has a strong mottled appearance and a few Bx zones may have 5-10% igneous component but too alt/oxid to determine.

(7) 4445--5000 : 35-40 x100 cps : BKGD ≈ 35-40 / scintillometer counts
4911-25 40-55 cps x100

GEOLOGIC LOG

PROJECT TRENCH
HOLE NO. TCH-2
Collar elev
Final depth
Coord. N
Inclination
Coord. E
Page 7 of 10
Logged by FR Koutz
Date start
Date finish

* El Paso check assays

PS + T.S ↓

Depth and Assays

Assay header note: Skyline +0.5 oz/T Ag → fire assay AA

Margin	From	To	Intv.	% >	Comment or Assay Interval	Cu %	Pb ppm	Zn ppm	Au oz/T	Ag oz/T	Mo ppm	Comp.
	4520	4532	12	100		0.059	0.42	0.125	—	1.12	<2	
	4532	4540	8	↑							↑	
	4540	4550	10									
4559 –	4550	4560										
	4560	4570										
	4570	4580										
	4580	4590										
	4590	4600	10			0.011	0.55	0.21	<.0006	1.30		
	4600	4604	4									
	4604	4612	8			0.0365	0.22	0.38	—	0.29		
	4612	4620	8									
	4620	4630	10									
	4630	4640	10									
	4640	4648	8									
	4648	4653	5			0.001	0.043	0.057	—	.006		
–	4653	4656	3			1.56	6.65	17.6	.0024	18.18		↑
4664 –	4656	4662	6			1.35	3.96	13.7	.0012	14.04		
	4662	4666	4		*	3.65	10.8	26.8	.0018	33.86		
	4666	4670	4			1.13	5.75	12.8	.0012	8.60		
	4670	4679	9			1.70	5.95	10.9	<.0006	8.84		↓
gn+sl 4686 –	4679	4687	4 / 4		4679-4683 / 4683-4687	0.034 / 0.70	0.43 / 7.40	0.93 / 5.55	.0018 / <.0006	0.32 / 11.40		↑
	4687	4690	3			2.19	9.35	27.1	.0009	11.92		
	4690	4692	2			0.01	1.22	7.0	<.0006	3.30		
	4692	4696	4		*	2.36	8.05	21.0	<.0006	8.54		
4698 –	4696	4702	6			0.35	3.68	14.3	<.0006	16.5		
	4702	4710	8		→	0.04	0.49	1.24	<.0006	0.80	<2	↓
	4710	4720	10			0.0035	0.13	0.0475	—	—	16	
	4720	4730	10			0.0085	0.17	0.51	—	—	8	
	4730	4740	10			0.002	0.105	0.42	—	—	6	
	4740	4750	10			0.001	0.009	0.0265	—	—	50	
	4750	4755	5			0.003	0.0035	0.0145	<.0006	0.023	90	
4758 –	4755	4760	5			0.14	0.22	1.87	<.0006	1.80	65	
	4760	4767	7			0.002	0.027	0.057	<.0006	0.07	18	
4767 –	4767	4771	4		*	0.18	5.70	16.0	.003	25.7	4	↑
4770 – 4779 –	4771	4783	12			0.22	1.12	13.0	.0018	7.12	<2	↓
	4783	4785.6	2.6		*	.0045	0.062	0.50	<.0006	0.35		
4786 –	4785.6	4791	5.4			0.42	1.74	28.2	.0021	11.98		↑
	4791	4800	9			0.08	0.48	13.8	.0012	5.16		
	4800	4804	4		*	0.02	0.06	0.70	<.0006	0.66		✕
	4804	4812	8			0.25	1.82	18.2	.0029	14.66		
	4812	4822	10			0.13	0.70	15.5	.0021	5.98		
4822 –	4822	4828	6	↓	*	0.12	0.53	25.3	.0015	5.34		
	4828	4837	9	10>		0.12	0.67	19.7	.0012	6.52	<2	↓

Mineralogy and Structure

From	To	Chalcopyrite	Covellite	Galena	Sphalerite	Grey S= or SS	Pyr.-Dissem	Pyr.-Vein	% S= Oxid	Limonite	Hematite	Specularite	Magnetite	Garnet	Serp-Talc	Wollastonite	Graphite	Jasperoid F.g. SiO2	Qtz-Vein-xg	Clay	Gypsum	Chlorite	Diopside	Calcite
4520	4532	.1	—	1	.3	T	1	.3	T+	—	T	—	—	2	10 Serp	8	½	1	3	T	2	2	2	70
4532	4540	—	—	—	—	T=	.2	—	—	—	—	—	—	—	2	T	¼	T	—	T	T	—	—	93
4540	4550	—	—	—	—	T-	.1	—	—	—	—	—	—	—	2	—	¾	—	—	T+	¼	—	—	95
4550	4560	—	—	—	—	T-	.2	—	—	—	—	—	—	—	T	—	1	—	—	T+	T	—	—	93
4560	4570	—	—	—	T	T	.2	T	—	—	—	—	—	T	1	—	¾	T	—	T	T	—	—	90
4570	4580	—	—	—	T	T	.3	—	T-	—	—	—	—	—	8	—	¼	2	—	T	T+	T	—	80
4580	4590	—	—	—	—	T	.1	—	—	—	—	—	—	—	1	—	½	T	—	—	T	—	—	95
4590	4600	—	—	1.0	.5	T+	.2	—	—	—	—	—	—	2	2	1	T+	T+	T-	T	T	T-	—	95
4600	4604	—	—	—	—	T-	.1	—	—	—	—	—	—	—	T	T-	T+	—	—	T+	—	—	—	98
4604	4612	.1	—	.5	.8	T-	.2	T	—	—	—	—	—	3	—	—	T	T	T	T-	T	—	T-	95
4612	4620	—	—	T-	T-	T-	.1	—	—	—	—	—	—	—	3	—	¾	—	—	T	—	—	—	93
4620	4630	—	—	—	—	T-	.1	—	—	—	—	—	—	—	1	—	1	—	—	—	—	—	—	90
4630	4640	—	—	—	—	T-	T	—	—	—	—	—	—	—	1	—	T	—	—	20	3	—	—	70
4640	4648	—	—	—	T-	T-	T+	—	—	—	—	—	—	3	T	—	T-	T-	—	1	½	1	T+	95
4648	4653	—	—	T-	T-	T-	T-	—	—	—	—	—	—	3	T	—	—	—	—	—	1?	2	1?	90
4653	4656	3	T	7	20	½	1	.2	—	—	—	—	—	10	1	—	—	1	3	7	—	3	5	40
4656	4662	3	T-	5	15	½?	.5	—	—	—	—	—	—	25	1	—	—	T	5	3	—	3	C?	55
4662	4666	6	.2?	11	30	1	.3	—	—	—	—	—	—	10	—	—	—	—	5	3	—	3	10	40
4666	4670	2	T	6	13	½	.3	—	—	—	—	—	—	15	1	—	—	—	10	5	—	5	15	30
4670	4679	3	T+	6	11	1	.5	—	—	—	—	—	—	10	1	—	—	—	15	8	—	5	20	30
4679	4687	T / 1.5	T / .2	1 / 8	1 / 7	T / T+	T / T	— / —	— / 1	— / —	— / 1	— / —	— / —	3 / 2	— / —	— / —	— / —	— / 1	T / 25	T / 1	2 / 1	3 / 3	5 / 5	85 / 30
4687	4690	5	T	10	30	½	1	T	—	—	—	—	—	20	1	—	—	1	15	1	T	3	8	30
4690	4692	—	—	1.5	8	T	T	—	—	—	—	—	—	3	1	—	—	—	3	T	1	5	7	70
4692	4696	5	T	8	21	½	½	—	—	—	—	—	—	5	2	—	—	—	10	1	T	3	6	30
4696	4702	7	T+	4	15	.3	.3	—	T+	—	T+	—	—	10	1	—	—	—	15	2	T	3	6	50
4702	4710	.2	—	.5	1.2	½	T	—	—	—	—	—	—	1	T	1	—	—	T	3	5?	1	1	85
4710	4720	—	—	T	T-	T-	.3	T	10	—	2	—	—	90	—	—	—	—	T	—	—	—	1	8
4720	4730	T	T+	2	5	T-	.5	T	20	—	3	—	—	40	1	1	—	—	—	2	7	1	1	40
4730	4740	T	T-	.1	.4	T-	.3	—	10	—	1	—	—	20	2	—	—	2	1	3	T	1	5	60
4740	4750	—	—	—	—	T	T-	—	90	—	8	—	—	60	—	—	—	1	—	3	—	3	10	20
4750	4755	—	—	—	—	T	.3	—	70	—	2	—	—	90	—	—	—	—	T	T	T	T	½	5
4755	4760	.3	T-	.4	2	T	.1	—	5	—	½	—	—	20	5	—	—	T	1	2	T?	3	5	10
4760	4767	—	—	—	—	T-	.2	—	T	—	T	—	—	70	2	—	—	—	T	3	5?	1	1	80
4767	4771	.4	T	6	16	½	2	T+	T-	—	T-	—	—	10	3	—	—	T	3	2	2	15	10	20
4771	4783	4	T	1.5	13	½	3	¼	T	—	T	—	—	40	2	—	—	T	4	1	1	10	5	20
4783	4785.6	—	—	T	.6	T	T-	—	—	—	—	—	—	1	2	?	—	—	—	5	5?	3	1	90
4785.6	4791	.5	.2	1.7	28	½	1	—	T-	—	T-	—	—	25	—	—	—	2	8	1	1?	5	5	30
4791	4800	T	T+	.5	14	T+	.5	—	T	—	T	—	—	50	1	—	—	1	5	1	T?	5	8	30
4800	4804	—	T-	—	.8	T	.5	—	T	—	T	—	—	90	—	—	—	T	1	—	T-	3	5	2
4804	4812	.4	.1	1.8	18	¼	2	T	3	—	1	—	—	90	—	—	—	—	3	10	—	20	3	15
4812	4822	.2	T	.7	16	½	2	T	1	—	¼	—	—	25	—	—	—	2	15	½	—	30	5	10
4822	4828	.1	.1	.5	25	1	½	T	T	—	T+	T-	—	35	—	—	—	3	20	1	—	10	2	15
4828	4837	.1	T+	.7	20	1	½	—	½	—	T+	¼	—	15	—	—	—	3	40	1	—	5	2	10

Structure, Detail and General Remarks

From	To	Cal. Gr Size	% Sanding-Vug	% Banded	Bx-Mat %	Dip Beds/Band/Flow	Sulfide Veins # + ∡	Width mm Sulfide Vn + Alt. Selv. or S= gr. size	Faults	Crushing	Shearing	Detail	General
4520	4532	1-3	2	30	½	30/60	5 - 60-90	.5-1 mm stringers	wk			4520-22 calc-qtz-serp-gn stringers: Tr pyr. on late gyp-calc vn.	⇒ 4520–4653. Fg. BK→DKgy→wh Ls + Rextal Ls.
4532	4540	.5/3	T	10	—	70/80	—	.5 Pyr. grains		—		Rxtal Ls.-wh.	Locally BK+wh. zebra Banded + wk Knots + clots. Local Serp zones w/
4540	4550	.5/1	T	50	—	30/80	— CAL VN 30-60 + 85			—		Rxtal Ls-BK→wh. wk zebra + Knots calc.	Banding @ Hi ∡'s. Local sandy ± Dol? zones, only Trace or
4550	4560	<.5	—	60	.5	60/90	wk Band 60-90°			—		Fg. Rextal Ls-BK→DKgy w/ calc. clots; some sdy patches.	stringer S=. Tr vFg pyr. cubes in graphite whisps.
4560	4570	<.5/1	T	80	1	70/90	wk-mod. 75-90°	Band @ 1-3 mm width		—		Bleach incr. w/ depth.	
4570	4580	<.5	T	70	1	70/90	—	<.5 pyr.	80-90 Band in serp.			VFg Ls w/ wk Rextal + serp	
4580	4590	<.5/1	T-	20	—	80/90	—		wk 80-90 Band in graph.			Fg MARBLE-white	
4590	4600	.5/3	T	10	—	70/90	5 - 75-90	.5-2 blebs		—		gn-sl stringers 4598-99.5 (gn in stringers)	
4600	4604	<.5/1	T	3	—	85	1- 85	<.5		—		Fg. Ls-MARBLE-wh.	
4604	4612	<.5/1	T	3	—	30/85	120 ALL ∡	<.5-1 blebs + stringers				sdy MARBLE-wh	
4612	4620	<.5/1	T-	80	—	20	Serp Band 1-10 cm.	+ diff		—		BK+wh. Rextal Ls.	
4620	4630	<.5	T-	90	1	40/55	← original dip??			—		V.Fg zebra. Rextal / silty Ls. ↙ 4633-34: DK.gr-gy vFg sanded	
4630	4640	<.5/1	2	40	3	40/90	Gyp? on sh in clay.		30-60 in clay			4636-39: Lt.gr. clayey-vuggy zones - sheared but not MAJ Flt.?	
4640	4648	<.5/4	2	10	1	30/90	—	—		—		Lt.gr. garn? blebs 1-2mm in x.g. MARBLE	
4648	4653	2-/6	3	20	2	40/70	Gr. St. in 1-10mm	calc. blebs		—		x.g. MARBLE	
4653	4656	2-/4	1	80	—	30/60	30-60	1-5 mm. cpy, sl, gn Equally dissem.		—		Some cpy "coated" w/ sl or cpy filling vugs?	⇒ 4653–4679: Massive sulfides sl > gn > cpy >> pyr
4656	4662	1-/5	1	20	—	20/70	20-70 wk	3-5 mm 1-10 range		—		Sl darken toward rim of grains + coated by gn + ?: late calc + qtz vn.	Dissem. in garn-Diops? Skarn > marble with strong x.g. qtz
4662	4666	1-/3	1	40	—	20/30	20-40	3-6 mm ~4		—		Irreg. Dist. of cpy: late calc. + qtz vn. / Matrix: gr. clay-Diops?	intergrown w/ S=. Sulfides are 1-4 mm. + distinct dissem.
4666	4670	1-3	1	30	—	20/60	wk Band 20-60	1-5 mm blebs		—		Sev. stages late calc. vn	grains
4670	4679	1-3	½	70	—	10/40		Most 1-5 mm, some cpy + gn to 2cm.		—		S= post garn, gn + cpy vug + irreg. Dist.	
4679	4687	3-4 / 1-3	1 / 2	20 / 30	— / —	30 / 30	— / —	1 mm / 1-10 mm		— / —		Str qtz. 4685-87: 1-5 mm qtz xtals.-vuggy	⇒ 4679-83 m-DK.g MARBLE w/ minor S= stringers + gr. blebs (garn?)
4687	4690	1-2	3	30	—	30	—	<.5-3 cpy to 10		—			⇒ 4683-4702: Massive sulfides. sl > gn > cpy >> py > cv-ss?
4690	4692	1-5	1	80	—	20/40	—	<.5-2		—		MARBLE + diss + Band gr-clay Diop + S= + pink calc.	Qtz-x.g. Flooded between S= + calc.-silic. grains.: Mostly
4692	4696	1-3	2	30	—	20/50	—	.5-3 mm blebs		—		Late qtz vn. (post S=) - also late calc vn. -30+60°	Diops? - garn skarn + marble but much qtz.
4696	4702	1-2	2	10	—	20/50	—	.5-4 S= blebs	Tr shear post S=			S= in DK gr. clay-Diops?	
4702	4710	1-/10	3	5	—	30/80	—	<.5-2 + 10 cpy @ 70-80°					⇒ 4702-10 - Gypsif. MARBLE v.l.s. w/ gy xxg calc + m.g. gr. garn?
4710	4720	1-/5	1	3	—	—	—	—		—			⇒ 4710-25: Massive ol. green garnet - Local x.g. calc + S= + late hem. flood.
4720	4730	1-3	1	15	—	50/80	60-80°	1-2 mm	wk sh			4725-31: Gypsif. marble: tan→greenish str. hem 4721-25	
4730	4740	<.5	T	30	—	20/30	—	.5-1 mm		—			⇒ 4730-4762 v.Fg silty Ls - now mostly massive garnet - locally "sdy" txt. garn,
4740	4750	1-5	3	20	—	70/80	—	—		—		4747-4762 v. str. garnet	Local str. hem staining after S=. DK gr material maybe Diops-clay?
4750	4755	1-6	2	—	—	—	Cal. vn @ 30+60°						
4755	4760	<.5/3	1	30	30	—	—	<.5-2 grains	wk-mod Bx			4755-56: stringer sl 4755-59: Bx-wk→mod. w/ dissem S=: maybe some ign. material (IBx): green alt. mins + calc.	
4760	4767	1	3	20	—	60	—	<.5-1 grain	wk sh in gyp			4762-67 mottled white-pinkish-gypsif. Ls. - clayey: "eyes" of x.g. grey calc.	
4767	4771	1	1	30	2	60	— 30+60	<.5-4 blebs	wk shear			← wk Bx: possible ign. frags? with HVY chlorite	⇒ 4762-83 Massive sulfides sl >> gn > py > cpy with garnet (green) + local
4771	4783	<.5/1	½	20	—	60	— 20+60	<.5-4		—		vHVY S= 4771-73, 4779-83.	chl, diops?, purple qtz - pink calc.: DK rim to sl. Note higher pyr than above
4783	4785.6	2-/6	1	5	—	50	—	—		—			← gypsif.? Dolom. MARBLE: wh. w/ Lt. tan + greenish stain on CO3= xtals.
4785.6	4791	1-4	1	20	—	60	50-70	<.5-4		—			⇒ 4785.6-4800 Massive sulfides sl >> gn > py = cpy ≥ cv with gr. garnet. : only wk
4791	4800	1-5	½	30	—	60	— 50/90	<.5-3		—		v. DK sl.	Banding with granular txt. sl, calc. qtz. DK rims + Fx fillings (<1mm) to sl.
4800	4804	T	T	5	—	70	70-80	<.5-1		—		← Massive gr. garnet w/ dissem sl > py + late calc vn.	
4804	4812	1-5	1	20	—	60	50-80	1-4 blebs		—		gn post sl, cpy, pyr.: MnOx on Fx	⇒ 4804-4837 Massive sl >> gn = py > cpy > cv + massive garn on chl-Diops?
4812	4822	1-2	3	30	—	35	—	<1-4		—			strong qtz flooding-vuggy; late calc. vn + Fx fill. Late hem on Fx + vn.
4822	4828	<.5/1	3	20	—	20	60-80	1-15 blebs sl		—			sl. v. DARK in part by dark material on Fx + clay.
4828	4837	<.5	5	15	—	80	—	1-5 sl		—		4828-35: x.g. drusy wl. qtz between sl grains	

(8)

GEOLOGIC LOG

PROJECT: TRENCH
HOLE NO.: TCH-2
Collar elev.:
Final depth:
Coord N.:
Inclination:
Coord E.:

Logged by: FR KOUTZ
Date start:
Date finish:

Ps + Ts ↓

* El Paso Check Assays

SKYLINE (Ag = AA) If Ag > 0.50 oz/T = Fire

Depth and Assay

Margin	From	To	Intv	Core Recovery	Assay interval + comment	Cu %	Pb %	Zn %	Au oz/T	Ag oz/T	Mo ppm	Comp.
	4837	4849	12	100		0.002	0.19	0.63	<.0006	0.19	<2	
	4849	4854	5	↑		0.09	0.68	11.2	.0024	4.96	↑	↑
	4854	4860	6			0.07	0.66	14.2	.0024	5.16		
	4860	4869	2		4860-62	0.01	0.80	5.2	.002	5.62		
			7		4862-69 *	0.12	1.06	14.2	.0053	9.10		
4870	4869	4877	8			0.40	0.58	16.0	.0032	5.66		
	4877	4882	5			.003	0.185	0.75	<.0006	0.32	↓	
	4882	4891	9		*	1.36	1.82	25.0	.0047	17.98	<2	↓
4889	4891	4899	8			0.01	0.06	0.66	<.0006	0.72	14	
	4899	4913	14			0.01	0.02	0.19	<.0006	0.35	16	
	4913	4921	8			0.04	0.28	3.95	.0015	2.30	<2	
	4921	4929	8			0.01	0.02	0.26	<.0006	0.35	6	
	4929	4939	10			.0005	.0085	0.058	↑	0.07	65	
	4939	4949	10			.0005	.018	0.155	↓	0.12	44	
→	4949	4959	10	↓		.0005	.0085	0.044	<.0006	0.06	8 ←	
	4959	4970	11	100	→	ppm 5	ppm 5	ppm 270	ppm —	ppm	ppm	
	4970	4982	12	97		5	45	610	—	—	<2	
	4982	4991	9	100		30	1700	4400	—	—	<2	
4999	4991	5001	10	↑		85	930	4000	ppm <.02	ppm 5.6	2	
5001	5001	5010	9			15	550	1250	—	0.8	2	
	5010	5020	10			15	830	550	—	—	2	
	5020	5030	10			5	50	70	—	—	<2.	
5030	5030	5040	10			5	335	500	—	—	2.	
5033	5040	5050	10			5	90	225	—	<.2	4	
	5050	5060	10		—							
	5060	5070	10									
	5070	5080	10									
5080	5080	5091	11									
	5091	5100	9		—	5	60	70	<.02	0.2	16	
5108	5100	5110	10									
	5110	5120	↑	↓								
5123	5120	5130		100								
	5130	5140		95								
5140	5140	5150		98	5148-50 →	65	7300	3300	<.02	10.0	<2.	
	5150	5160	↓	35								
	5160	5170	10	95								
	5170	5179	9	12								
5182	5179	5190	11	90	5179-85 → / 5185-90 →	10 / 15	720 / 2800	450 / 840	<.02 / <.02	0.4 / 1.6	2. / 4.	
	5190	5200	10	100		5	75	265	<.02	.2	<2.	
	5200	5210	10	98								
	5210	5217	7	100	5216-17 →	ppm 380	1.77%	2.08%	.06	1.64 oz/T	14	
	5217	5227	10	100								
5239	5227	5239	12	100								
	5239	5251	12	100								

← ppm →

Mineralogy and Structure

From	To	Chalcopyrite	Covellite	Galena	Sphalerite	Molybdenite	Grey S= on SS	Pyr.-Dissem	Pyr-Vein	% S= Oxid.	Limonite	Hematite	Specularite	Magnetite
4837	4849	—	—	.2	.6		T-	T-	—	T-	—	T-	—	—
4849	4854	T	T	.7	11		1/4	.8	—	T	—	T	—	—
4854	4860	T	T-	.7	14		1/4	.3	—	2	—	1/4	—	—
4860	4869	T	T	.8	5		T	.8	—	T	—	T	—	—
		.1	T+	1	14		1/4	1.0	T+	T	—	T	—	—
4869	4877	.7	.1	.6	16		1/2	2	.3	T-	—	T-	—	—
4877	4882	—	—	.2	.8		T-	T	—	—	—	—	—	—
4882	4891	.3	.2	1.8	25		1/2	4	1/2	T+	—	T+	—	—
4891	4899	—	—	T	.7		T	1.5	T	T-	—	T-	—	—
4899	4913	—	—	—	.2		—	3	T+	—	—	—	—	—
4913	4921	T	—	.2	4		T+	1	T-	T	—	T	—	—
4921	4929	—	—	—	.3		—	1.5	T	—	—	—	—	—
4929	4939	—	—	—	T		—	T+	—	—	—	—	—	—
4939	4949		—	—	.2		T	.3	T-	—	—	—	—	—
4949	4959	—	—	—	T		—	.2	—	—	—	—	—	—
4959	4970	—	T-	—	T		T	.1	T	—	—	—	—	—
4970	4982	—	T-	T-?	T	—	T	.2	T	—	—	—	—	—
4982	4991	—	T-	—	T	T+	T	.4	.1	?	.3	—	—	—
4991	5001	T+	T	T+	.2	T	.1	.5	.1	1	.5	.5	T?	—
5001	5010	T-	T-	T	.2	T?	.1	.2	T+	T-	.2	T	T?	—
5010	5020	—	—	T	.1	—	T+	.1	T-	—	—	—	—	—
5020	5030	—	—	T-	T-	—	T-	T+	—	—	—	—	—	—
5030	5040	—	—	T+	.1	—	T	T	—	—	—	—	—	—
5040	5050	T-	—	—	T	—	T-	.2	T	—	—	—	—	—
5050	5060	—	—	T-	T-	—	T-	.2	—	—	—	—	—	—
5060	5070	—	—	—	T-	—	T-	T	—	—	—	—	T-	—
5070	5080	—	—	—	T	—	T	T+	—	—	—	—	T?	—
5080	5091	—	—	—	T-	—	T-	T-	—	—	—	—	—	—
5091	5100	—	—	—	T	—	T-	.3	T-	T	T-	—	—	—
5100	5110	—	—	—	T-	—	T	.6	.1	T-	T-	—	—	—
5110	5120	—	—	—	—	—	T	.2	T-	—	—	—	—	—
5120	5130	—	—	—	—	—	T	.5	T-	—	—	—	—	—
5130	5140	—	—	—	T-	—	T	.2	T-	—	—	—	—	—
5140	5150	T-	—	T	.1	—	.1	.2	—	—	—	—	—	—
5150	5160	—	—	—	T	—	T	.2	—	T	T	—	—	—
5160	5170	—	—	—	T	—	T	.1	—	—	—	—	—	—
5170	5179	T?	—	—	—	—	T	.5	—	T+	T+	—	—	—
5179	5190	T+	T?	T	.3?	—	3	2	.3	T	T	—	—	—
5190	5200	—	—	—	—	—	T	.3	—	—	—	—	—	—
5200	5210	—	—	—	—	—	T	.3	T-	—	—	—	—	—
5210	5217	T-	—	.1	.5	—	T+	.2	T	T-	T-	—	—	—
5217	5227	—	—	T-	.1	—	T	.3	—	—	—	—	—	—
5227	5239	—	—	T	T+	—	T	.1	—	—	—	—	—	—
5239	5251	—	—	—	T-	—	T	.4	—	—	—	—	—	—

From	To	Garnet	Serp.-Talc	Wollastonite	Graphite	Jasperoid f.g. SiO2	Qtz-Vein	Clay	Gypsum	Chlorite	Diopside	Calcite	Cal. Gr. Size	% Shattering-Vugs	% Banded	Bx-Mat. %	Dir. Beds Band Flow
4837	4849	T-	—	?	T-	—	T	1	8?	1/4	—	90	<.5-4	1/2	80	—	85
4849	4854	20	1	—	—	3	5	2	1?	15	3	50	1-4	1	90	—	80-90
4854	4860	35	3	—	—	1	3	2	—	20	3	25	1-3	2	30	—	30
4860	4869	5	5	—	—	T	1	5	2?	10	3	70	1-2	1	20	—	20
		20	3	—	—	T	2	5	1	25	2	30	1-3	1	40	—	30
4869	4877	15	2	—	—	T	1	3	1	30	8	30	1-3	1	30	—	70-80
4877	4882	10	T	?	—	—	—	5	5	1	—	75	<.5-2	1/2	5	—	75
4882	4891	15	T	—	—	1	2	1	1	15	3	30	1-4	1/6	40	—	30-50
4891	4899	30	3	—	—	3	1	3	—	25	3	30	<.5-2	1/4	10	—	35
4899	4913	70	T	—	—	T	T	1	—	10	1?	15	<.5-2	T+	5	—	30
4913	4921	60	1	—	—	T	1/2	1	—	15	2?	15	<.5-2	T+	10	—	20
4921	4929	80	—	—	—	T	—	1	—	10	T	10	<.5-1	T	20	—	75
4929	4939	10	2	—	—	—	—	3	1?	5	?	85	<.5	T	90	—	85
4939	4949	5	2	—	—	T	—	3	1	8	?	85	<.5	T-	70	—	70-80
4949	4959	2	4	—	—	—	—	5	T+	5	?	90	<.5	—	30	—	35
4959	4970	2	4	—	—	3	—	5	3	3	—	85	<.5-1	T+	30	—	30
4970	4982	—	8	—	T+	2	—	5	5	2	—	70	<.5-2	1/2	60	T	40-60
4982	4991	—	15	—	?.3	1	—	5	5	2	—	60	<.5-4	1/2	50	1/2	20-50
4991	5001	5	15	—	T	3	T	5	1	15	2?	70	<.5-2	1	70	5/30	20-40
5001	5010	T	4	—	—	2	—	6	2	1	—	60	<.5	T-	30	T	30
5010	5020	1	3	—	T	T	—	5	1	1	—	90	1-5	2	70	1	40
5020	5030	T+	2	—	T	—	—	2	3	T	—	95	1-6	2	20	—	40
5030	5040	1	2	T? or gyp	—	—	—	1	25	1?	—?	65	1-6	1	40	T	20-40
5040	5050	T	1	1 on gyp	T	30?	—	2	3	T	—	60	<.5-1	1	60	—	20-40
5050	5060	T	4	T?	T	1?	—	4	T	T	—	50	<.5-1	T+	30	—	20-40
5060	5070	—	1	?	—	?	—	1	1	1	—	20	<.5	2	15	—	30
5070	5080	T-	2	?	—	?	—	2	2	1	—	40	<.5-1	1	20	3	20
5080	5091	T	3	1-3 ? or gyp	T	1	—	2	3	T	—	90	<.5-1	3	20	2	20
5091	5100	—	1	—	T+	?	—	1	T	1	—	10	<.5	1/2	25	2	25
5100	5110	—	3?	1?	—	T	?	1	T+	1	?	5	<.5	T+	60	1-2	30-60
5110	5120	T+	3	—	T	?	—	2	1/2	1	?	3	<.5	1/2	70	3	30-60
5120	5130	—	20	—	T+	?	1	2	1/2	2	?	10	<.5	T	85	1	60
5130	5140	5?	75	—	2	3	—	3	1	1	?	15	1-2	T	60	1	30-60
5140	5150	—	40	—	3	3	—	5	1	?	?	40	.5-1	T	75	3	50-80
5150	5160	—	5	—	2	20	—	15	1	T	?	20	.5-1	+5	10	5	30
5160	5170	—	7	—	4	5	T+	1	1/2	T	?	80	.5-2	1	85	1/2	10-50
5170	5179	—?	2	—	—	90?	3	T	T	—	—	T	—	8+	5	?	—
5179	5190	5	2	—	T	50	3	20	—	—	—	15	<.5	5+	20	20/60	30
5190	5200	T	5	—	4	1	—	1	T	T	—	85	<.5-2	2	90	3	25-30
5200	5210	T	3	—	6	5	—	1	T	T	—	80	<.5-1	1	80	3	10-35
5210	5217	3	10	—	3	3	—	5	T+	?	?	70	<.5-1	1	70	1	20
5217	5227	T	4	—	T	2	—	1	3	T	?	80	<.5-2	T	30	1	10-25
5227	5239	T	6	—	1	1	—	2	1	—	—	85	<.5-1	T	40	T	10-30
5239	5251	?	5	—	1	2	—	3	1/2	T	?	70	.5	T	80	T	10-20

↖ "CARBONATE"

From	To	Sulfide Veins # + ≠	Width - mm sulfide vnt amt selv. or S= gr. size	Faults / Crushing / Shearing	Interval Comment
4837	4849	—	1mm S= blebs	shear 85-90°	95?-S= @ 4837 + 4848-49
4849	4854	80-90	1-5 sl	vert band calc-chl-sl	
4854	4860	—	1-3 sl	—	
4860	4869	20	<.5-1	=	4861-62: Dol. Ls-MARBLE: chl Around sl grains.
		20-30	<.5-4		
4869	4877	25	1-3	—	
4877	4882	—	1	—	← gypsif. Rextal TAN Ls-(Dol?), Local gr GARN. + tan blebs & veins.
4882	4891	30+50	<.5-5 blebs	wk. sh. ∈ 65 + hem.	
4891	4899	30	<.5-2	—	← VFg > GARN + f.g. Ls: late calc x.g.
4899	4913	—	<.5-1 blebs & layr	—	
4913	4921	—	<.5-2 blebs	—	
4921	4929	pyr. 20-30	<.5-1 blebs	—	
4929	4939	—	<.5-2	wk vert. shear	
4939	4949	—	<.5-1	wk vert sh.	
4949	4959	40	<.5-1	wk horiz slicks	4958-59 pseudo porphyritic text (1-3mm blebs-like in greenish chloritic Ls.)
4959	4970	—	<.5	wk-slicks in gyp	Local 1-5 Qtzite or chert?
4970	4982	10 all ≠	<.5	slicks in gyp on fx	Dol. Ls?-Rx to HCl is weak
4982	4991	grains on fx	.5-1	slicks in gyp-serp	Tr MoS2!
4991	5001	+30 all ≠ gr on fx	.5-2 blebs	≠ 20-30	20+30° slicks in serp @ 5000 = ↓H?
5001	5010	+10 30+70	<.5-1	wk. sh. in late calc + gyp	← V. STRONG BLEACH in Dol. Ls?
5010	5020	+5 30-50	<.5-1	Flow in ks. MARBLE	mostly MARBLE
5020	5030	—	<.5-.5 grain	Flow in v.g. MARBLE	Loc. "Birdseye" struct of gyp in MARBLE
5030	5040	—	<.5-1 grain	—	5032-36 mottled "Birdseye" gyp w/ serp + sl dots!
5040	5050	5 30-40	<.5-1 grains	—	5048-50 v.f.g. Qtzite or jasp. (gy)
5050	5060	—	<.5 grain	—	5052-56 VFg Qtzite (gy) w/ Diss py + gy S= DOTS
5060	5070	—	—	—	v.f.g. limey Qtzite
5070	5080	—	<.5-1 grains	wk sh. in gyp on fx	5070-77 Qtzite, 77-80 f.g. MARBLE
5080	5091		<.5 gr.	wk sh. on fx.	silty Dol? Ls.-MARBLE (f.g.)
5091	5100	—	<.5-1 gr. pyr	Loc. wk Bx thread-y/cal	v.f.g. Qtzite > siltstone: DK gy
5100	5110	8% 2" S= stringers 60°	<.5-2 pyr	Local Bx of Qtzite	v.f.g. Qtzite > Hornfels: DK gy
5110	5120	—	<.5-1	Loc. wk Bx - chert	v.f.g. Hornfels - Qtzite. Bx-chert? @ 5121.
5120	5130	4mm ≠ stringers	<.5-1	Loc wk Bx + chert	5120-27 v.f.g. Hornfels-Qtzite, 5127-37 massive serp > Hornfels.
5130	5140	—	<.5-1	20+60 shear - Local	Mass Serp + DK. Dol. MARBLE > Dol. MARBLE
5140	5150	stringers 5148-50	<.5-2	Loc. sh. 50-70	Loc. wh. clay vn @ 60°. Dol-cal MARBLE + serp. - S= 5148-50 pyr + graphite
5150	5160	stringers	.5-1	Bx + clay	v.f.g. Qtzite - jasp. w/ clay zones; core ground
5160	5170	—	.5-1	Bx-Qtzite 5166-70	Bk + wh. Banded MARBLE to silty; ← Horiz slicks; Brecciated Qtzite - shattered beyond
5170	5179		.5-1		Bx + sheared - shattered + ground Qtzite or jasp. - vuggy: pyr oxid partially in vugs
5179	5190	Band + flow 20-30 + 80°	.5-2	v. str. Bx fluidized	Shattered - Brecciated silica + clay +> pyr.
5190	5200	—	.5-1 w/ graph.	Local str. flow + sh. + slicks in graphite - serp.	Black + wh. Banded m.g. MARBLE
5200	5210	—	.5-1	Local SiO2 + pyr @ 5201	Black + white Banded MARBLE. f.g. zebra/calc vn x.c. @ 70-80° + 20-40°
5210	5217	Stringers	.5-2 grains	wk flow	zebra Ls marble to 5213 - serp + bleach incr. w/ depth - Dissem. S= + jasp. + garn? 5216-17
5217	5227	Dissem.	<.5-1 grains	wk flow	90% bleached MARBLE + gyp + dol.
5227	5239	Dissem	<.5-1 gr.	horiz slicks on fx w/ gyp	50% bleached MARBLE w/ local silty zones
5239	5251	Diss.	<.5-2 pyr.	Strong shear @ 50° @ 5251 1-2" + serp.	f.g. 60% bleach. silty Ls-Dol. - f.g. MARBLE ←

Rock Type and Remarks — General Comment

← sheared gypsif. fn. Rextal Ls-MARBLE - Late gray calc vn.

⇒ 4849-4877 MASSIVE sulfide Sl >> gn ≥ py > cpy, Locally Banded with GARN, chl. Diops ± QTZ + calcite (x.g.), short dirty TAN Rextal Ls on Dol. intervals

⇒ 4882-4891. MASSIVE sulfide Sl >> gn = cpy w/ garn + chl. + x.g. calcite - Bands with Dissem cpy; Late calc vn. + late vuggy or c. - sl.

⇒ 4891-4929 MASSIVE v.f.g. ⇒ m.g. GARN. Replacing Ls; Ls is f.g. + poorly Rextal - Late calc matrix to dissem. sl + pyr. m.g. (1-2mm). DK chl (?) post garn. Late calc vn. 70-90°

⇒ 4929-82: f.g. Dol.? Ls - silty (wk Rx to ALIZARIN) mottled with Lt. green chl? - or clay Local v.f.g. garn. - Diops?; Chlorite. Late pyrite on Fx. STR BLEACH to wk. 4929-4936, 4948-51. wk horiz slicks in gyp. + calc. 4962-75

⇒ 4982-5010: Mineralized (wkly) zone + Bx: Dol.? Ls + gyp; bleached + mottled w/ tan stain (Esp 4982-4996), Dissem. sl + py ≥ gn ≥ cpy >> cv + Tr MoS2? (or soft gy-metallic). @ 4996 to 5001 wk → str Bx mottled w/ gr. chl?, brecciated garn, local S= in matrix (~5-30% MAT) + late calc. + gyp healing Bx: V. similar to IBx above in TCH-2 + TCH-1 + TM-3 but no evidence of igneous fragments + will prob. have no Anom. out into wall rx. Good S= are 75' above, How far lateral?

⇒ 5010-5091: silty Dol(?) MARBLE - Ls with a few Qtzite beds. % Dol uncertain. MARBLE locally "Birdseye" w/ clots of gyp (f.g.) or locally fibr. which may be Wo. Whisps. Local stringers of S= grains py > sl >> gn. Bleached white color (from gyp) except for Lt. gy Qtzite contrasts w/ Darker CO3= Below (+ graphite?) (+ DK. Qtzite).

⇒ 5091-5170: v.f.g. Qtzite or silty Hornfels w/ Local serp + m.g. BK-Banded MARBLE in lower part - Local pyr >> sl ±? stringers + dissem. blebs in Hornfels. - A few clayey - vuggy - silicified zones at base with poor recovery. Local probable chert in section.

⇒ 5170-5180: massive vuggy + shattered silica plus strong clay rich Bx 5170-79 All SiO2 79-90; (good recovery 85-90) clayey - crushed sheared - Qtzite - Ls w/ blebs pyr + gy-BK S= w/ gr. serp blebs. Locally has φ text. w/ SiO2 matrix + clay + f.g. calc. "phenocrysts" ≡ Bx - silicified - vuggy zone prob. a fault

⇒ 5190-5251: dk gy + wh thinly laminated - zebra MARBLE w/ Local bleaching Local f.g. silty zones, f.g. pyr. w/ graphite + f. → m.g. S=: py ≥ sl ± gn ± gy S= Dissem. + in stringer zones. S= usually assoc. w/ bleaching + serp.

GEOLOGIC LOG

PROJECT: TRENCH — HOLE NO. TCH-2
Collar elev. ____ Final depth ____
Coord. N. ____ Inclination ____
Coord. E. ____
Logged by: FR KOUTZ
Date start ____ Date finish ____

MINERALS AND STRUCTURE

Mineral/structure columns (in order): Chalcopyrite, Cov., Galena, Sphalerite, Molybdenite, Grey S= or SS, Pyr.-Dissem, Pyr. Vein, % S= Oxid., Limonite, Hematite, Specularite, Magnetite, Garnet, Serp.-Talc, Wollaston., Graphite, Saccharoidal f.g. SiO_2, Qtz-Vein, Clay, Gypsum, Chlorite, Diopside, Calcite*, Cal-Gr.-Size, % Sandy Layers, % Banded, Bx-Mat %, Dip-Beds/Flow, Sulfide Veins, # + ∠, Width-mm Sulfide VN, Tact Sulf or S= gr. size, Faults / Crushing / Shearing

Margin	From	To	Intvl	Rec. %	Assay interval or comment	Cu ppm	Pb ppm	Zn ppm	Au ppm	Ag ppm	Mo ppm	Minerals and structure (columns in order)	Interval comment
5260	5251	5261	10	99								— — T- T+ T ·2 — — — — — — — 1? 2 — T+ 1 — 2 1 2 3? 40 <.5 — 10 — 20 Stringers <.5-1 Streaked in serp-chl	@ 5261 Limey f.g. QTzite > siltstone
	5261	5270	9	100								— — — T- T ·2 — — — — — — — — 3 — T — — — 5 T T? 2 50 <.5 — 40 — 20 — <.5-1 grains —	wh.-Lt gr. mottled silt + sdy Ls. - QTZITE.
	5270	5280	10	↑								— — — T? T ·2 — 5 ·1 T — — ? 2 — T- 2 — 5 T T 5 60 <.5 — 90 ½ 10/20 — <.5-1 gr. Tr Bx @ 5270	finely lamin. silty Ls-Dol → QTzite
5290	5280	5290	10									— — — T- T ·2 — 2 T T — — ? 1 — T 1 — 3 T+ T 2 70 <.5/1 T 90 T 15 — <.5-1 gr. Local vn + Bx @ 20-30°	f.g. lam. silty Ls > QTzite : Lt Brown-gr. incr. w/ depth = Dol?
5300	5290	5300	10			→ <5	<5	25	<.02	0.2	<2	— — — — T T — 5? — T Tr MnOx — T — T+ — — 3 T? T ? 70 <.5 T f.g. 60 — 15 — .5 gr. Loc. calc. vn.	f.g. lamin. Lt Brown sdy Dol? - QTzite w/ late w/ calc vn. Tr dissem. Hem + Mn ox
	5300	5310	10									— — — — T — — 90? — ½ + Tr MnOx — T — T — — 3 T? T ? 70 <.5 T 40 — 10/20 — .5 Hem pseudom. after pyr. —	SAME AS 5280-90. PYR → Hem ! + Rx for calc w/ ALIZ.
5318	5310	5320	10	↓								— — — T? T T- — 30 — T+ — — — T — T — — 4 T T+ ? 60 <.5 T 60 35/— 10/25 Dissem. + on Fx <.5-.5 Sharp → walls	2" Bx vn @ 70° 5318; 30-40% MAT Lt gr. chloritic - NO IGN. FRAGS?
	5320	5330	10	100								— — — — T- T- — 60 — T+ + Tr MnOx — T+ — T T — 2 T- T ? 45 <.5 T 50 1 20 Dissem on Fx pyr → Hem <.5 Loc. Bx-vn filled w/ gr. clay	liney QTzite > sdy Ls : SS incr. w/ depth. gr. "clay" on serp-gyp VN.
	5330	5340	10	99								— — — — T- T — 70 — T+ — — — ½ — — — — 4 T+ T+ ? 40 <.5 T+ 80 ½ 30 Diss + on Fx pyr → Hem <.5 grains -Loc Bx along calc. Fx	liney laminated QTzite (vFg) - Loc Bx @ 5335 - 6" 5-10% MAT.
	5340	5350	10	99		→ <5	5.	275	<.02	<.2	2	— — — — T- T — 20 — T — — — 4 — — — — 5 ½ 3 ? 35 <.5 ¼ 70 2 20 — <.5 Loc. chl + clay Bx MAT.	liney QTzite mottled gr. clay (chl?) ZONES
	5350	5360	10	100								— — — T- T ·3 — 5 — T+ — — — 8* — — T — 3 ½ 5* ? 65 <.5 T 90 4 15/30 In chl. = pyr. <.5-1 wk. sh. in chl-serp.	Lt. green mottled Ls > QTzite : * gr. color = chlor/+ serp. (Diops?)
5360	5360	5370	10	100								— — — — T- ·1 — T — T — — — 10 — — T — 4 T 7 ? 70 <.5 T 95 6 15/40 In gr. clay <.5-.5 gr. wk sh. + Bx in gr. material	Lt. gr. mottled wk. Bx, sdy Ls.
	5370	5380	10	↑								— — — — T- T — 80 — ·1 + Tr MnOx — 5 — — T+ — 3 T- 3 — 45 <.5 T 40 3 20 — <.5 Tr sh. in gr. clay	Lt. gr. QTzite; liney w/ wk Band from var. in % gr. clay-serp.
	5380	5390	10									— — — — T- T — 30 — T+ — — — 8 — — T — — 5 T 5 — 45 <.5 T 90 10 20/60 — <.5-.5 wk sh. in gr. clay	Lt gr. mottled QTzite, liney - 1-3% late calc. vn.
5391, 5400	5390	5400	10			→ <5	15	950	<.02	<.2	2	— — — T T- T — 10 — T — — — 5 — — 5 T- 3 T 10 ? 60 <.5 T+ 95 20 30 — <.5-.5 mod. Bx-sh. in gr. clay	Sdy Ls. - QTzite; 5395-5400: Bx of v.f.g. SiO_2 w/ chl. MAT.
	5400	5410										— T- — — T- ·2 — 10 — T — — — 4 — — 6 T- 4 T- 8 ? 50 <.5 T- 80 8 25 Pyr. in gr.-chl. <.5-.5 -wk-mod. Bx-sh.	Sdy Ls - QTzite : mottled Lt. gr.
	5410	5420										— — — — T- ·1 — 5 — T- — — — 4 — — 6 — 3 T- 10 ? 40 <.5 T- 60 10 30 Pyr. in gr. chl .5 wk sh. - Bx in gr. chl	sdy Ls - v.F.g QTzite : more QTz w/ depth.
	5420	5430		100								— — — — T ·2 — 10 — T- — — — 3 — — 5 — 4 T- 7 ? 50 <.5 T- 40 4 20 — <.5 wk. sh in gr. clay	v. F.g. QTzite - sdy Ls.
5434	5430	5440		99	5429-5434	15	160	940	<.02	.2	4	— — — T- T- ·4 — 3 — T- — — — 4 — — 7 T- 3 T 12 ? 35 <.5 T 30 8 15 Pyr. in gr. chl. wk-mod Bx sh in gr. clay.	v. F.g QTz - liney ss w/ Loc. Bx in clay : 5435-40: QTzite
>	5440	5450		100								— — — — T- ·2 — T — T- — — — 4 — — 2 — 4 T- 1 — 30 <.5 T- 10 2 10 — <.5-1 grains Tr Bx-sh in Fx	vFg liney QTzite cut by calc vn (5%)
	5450	5460		↑								— — — T- T- ·2 — — — — — — ? 5 Tr Epid. T- T — 3 T 5 — 45 <.5 — 80 T 5/15 — <.5-1 grains pyr. —	v.f.g liney siltst. > QTzite, local chl. Banded.
5467	5460	5470										— — — — T ·2 — 7 — T- — — ? 2 Tr Ep T- 3 — 2 T- 3 — 45 <.5 — 80 3 10 — .5 grains wk sh. in calc fill. Fx	v.f.g. liney siltst - Hornfels > QTzite Local pink + gr. Blotches.
	5470	5480		100								— — — — T ·2 — 20 — T+ — — ? 2 Tr Ep. T 3 — 1 T 2 — 30 <.5 — 85 1 15 — .5 grain S	f.g. liney siltst. - mottled Lt. purple + green.
	5480	5490		98								— — — — T- ·1 — 70 — ·1 — — — 3 Tr Ep. — 1 — ¼ T 4 —? 10 <.5 — 95 1 10 <.5 gr. pyr → hem —	f.g. siltst. - Hornfels - Lt purple > gr. Also Banding 30-40° in purple Bx
	5490	5500		100								— — — — T- T+ — 90 — ·2 — — — 2 ½ Ep — T — T+ T+ 3 — 15 <.5 T- 90 1 10 — <.5 —	DK gy f.g. Banded siltstone - Hornfels
5501	5500	5510		↑		→ <5	<5	10	<.02	.2	<2	— — — — T- T — 90 — ·1 — — ? 2 T Ep — — — T T+ 4 ? 15 <.5 — 85 1 15 — <.5 —	siltst. - Hornf.
	5510	5520				<5	<5	5	—	—	2	— — — — T ·1 — 70 — ·1 — — ? 3 — — — — 1 ¼ 4 ? 12 <.5 — 80 3 10 20+20-50° calc vns <.5 gr. wk sh. in cal-gyp vn.	silts. Hornfels : more green mottled But purple-gy > gr.
	5520	5530				<5	<5	5	—	—	8	— T- — T- T+ ·5 — 10 — T+ — — ? 2 3 Epid — 1 — 3 ½ T+ — 10 <.5 T 80 3 20/40 Dissem. <.5-1 pyr.-gr. —	Bleached siltst. - Hornfels.
5531	5530	5540	10			5	10	10	—	—	2	— T- — T- T+ ·5 — 5 — T- — — — 1 1 Epid — 4 — 5 1 T- — 5 <.5 T+ 70 3 20 Dissem. <.5-.5 pyr. wk sh. on Fx	Bleached siltst. - Hornfel - QTzite
∠ 65-70°	5540	5548	8			10	35	90	<.02	·2	4	— — — — — T+ ·6 — T — T- — — 2 T Ep — 3 — 7 2 T- — 10 <.5 T 60 2 20 Dissem. stringers <.5-1 pyr. wk. sh. post pyr - on Fx	Bleached QTzite - Hornfels - Tr Loc Bx
5553- GRAD. →	5548	5557	9			280	330	430	<.02	2.2	140 IBX	·1 T T+ T ·05 T+ 1.0 ·2 T — T ·2-·4 Biot — 1 Ep — 2 1 4 1 3 — 40 <.5/1 ½ 30 20/40 30/50 Flow <.5-2 S= Most Bx Frag. & % sub ∠	← IBX : Ls + Hornfels Frags : MAX 2" ¼ AV. : MAT % VAR.
∠ 90°+70°	5557	5560.5	3.5			35	340	115	—	1.0	20	T- — — T- T+ T ·4 T — — — T Biot — — Tr Ep — T — 5 T 1 T 60 <.5 — 10 5 15 — <.5-1 S= Loc. wk. Bx	← silty Ls - Bleached, w/ T S= in calc vn - Loc. Bx
∠ 40°	5560.5	5571	10.5			300	195	455	<.02	1.0	90 IBX	·2 T T ·1 ·08 T ·8 ·1 — — — ·3-·6 Biot T T+ Ep — 2 1 6 T+ 3 — 35 <.5 T 60 20/60 20/80 Flow ← mostly Hi ∠ <.5-1 S= Most Frag sub ∠	← IBX : Ls + Hornf Frags ¼-1" AV (small than above). 5-20? % IGN-MATERIAL - Mostly in MAT. : Most Frags ARE sub ∠ : But EQUI-GRAN. Q-FS Rock to 2" - well Round.
5572.5, 5584	5571	5583	12		← 70-80°	65	25	140	<.02	.2	8	·1 T T- T+ T- T ·5 ·1 5 — ½ T — 1 2 T? Ep? — 3 — 4 T 4 ? 55 <.5 T 80 3 15 60-90° <.5 vn .5-1 grains 1-5% Loc. Bx MAT	← silty Ls (vf.g) - Hornfels w/ Local garn.
70-90°	5583	5588	5	↓		800	165	360	<.02	1.6	170 IBX	T — T- T- T T ·5 ·1 T — T ·3-·5 Biot — 1 T ep. — 4 1 2 T+ 8 — 60 <.5 T+ 70 5/20 ~/50 Hi ∠ zone of Bx → <.5-1 gr. contacts 70-90°	← IBX : IGN. Frag & An Pink Kfs + cpy, MoS_2, Py, Biot : Less clay more Chl. than above + tighter w/ less MATRIX
	5588	5601	13	100		80	30	240	—	.6	2	— — — T- — T- ·3 — — — — 2? 5 T? ep — 3 — 3 T- 5 — 60 <.5 T- 60 4 30 — .5-2 cubes pyr. wk. sh. in chl.	← SILTY limestone - Hornfels. Loc. Epid? on Garn on Fx - Local wk. Bx w/ 5-10% MAT. : NO IGN. NOTED.
5 →	5601	5610	9	99								— T- T+ T+ T? T ·3 — — — — — 1? 2 T ep. — 5 T 2 T 2 — 35 <.5 T- 30 1 20 Dissem. <.5-2 pyr + S= wk. crush-Fx	5603-10: f.g. QTzite
5	5610	5620	10	78	2' loss 5612-15 + 19-20							— T- T+ ·1 — T ·4 — — — — 2? 5 — — 20? — 5 1 3 — 25 <.5 1 50 ½ 20 Dissem. stringers <.5-2 pyr + S= wk cr + sh.	5615-23 vFg. gy QTzite - Hornfels - calc blebs + VNS.
5	5620	5631	11	99								— T T- T+ — T ·3 — — — T? — 2? 3 — T 30? — 7 1 2 — 15 <.5/2 3 30 10 15 Dissem. stringers <.5-1 pyr 20° Mod.-Loc. crush.	5627-29 vf.g. gy. QTzite 23-27: Chalky crush Fg Ls - Hornfels. Rest mg. MARBLE
5	5631	5641	10	95								— T- — T+ — T ·2 — — — — T? 3 — T+ 50? — 2 T+ 1 — 15 <.5/2 4 20 2 25 Dissem. stringers .5-1 pyr + S= 15-30° -wk crush.	5631-33; 36-41(43) vf.g. QTzite w/ calc. in 1-3mm Fx - all ∠, REST mg. MARBLE
5	5641	5651	10	75	2' loss 5641-43 ← FAULT							— — — T- — T ·2 — — — — T- 7 — 1 60 1 5 T 1 — 25 <.5/1 10 40 30 20/30 Stringers 15/30 <.5-1 pyr. - str. crush.	43-46: Bx-SiO_2 w/ calc recement - bleached + leached. 46-56: f-mg. salt+pepper MARBLE w/ Hornfels Bands.
5	5651	5662	11	98								— — — — — T ·3 — — — — T+ 2 T ep? 1 40 1 3 T 1 — 55 .5/1 1 60 5 20 Blebs .5-1 pyr. wk crush 5661	56-62: vf.g. gy QTzite
	5662	5679	17	100								— T- — — — T- ·2 on po? — — — — — 5 — 3 3 — 1 — T+ — 85 .5/1 T 90 ½ 15 Blebs in graphite .5-2 pyr + carb. wk sh. in serp.	m.g MARBLE salt+pepper w/ Graph. - Loc. serp plus calc. clots, vns.

ROCK TYPE AND REMARKS

⇒ BULK INTERVAL — GENERAL COMMENT —

⇒ 5251 - 5348: v.f.g. limey QTzite, locally silty : % of sd + slt vs $CO_3^=$ varies w/ depth. Almost all has + react. to HCl + scratches steel. Some of $CO_3^=$ may be Dol. Late calc. vn. (white)

[⇒ 5288 → 5310 : Lt. Tan color From oxid. pyr → Hem. + MnOx v.f.g dissem.] Color Lt green to tan. - Oxid. dues to incr. perm. of sdy zones (+ look on Fx + in gyp-serp). Some of sandyness may be due to v.f.g. dissem. calc silicates.

⇒ 5348 - 5435 : mixed mottled green limey, silty v. F.g. QTzite > sdy-silty Ls (F.g.) : green material now prob. mostly chl ± serp. + most pyr is in gr. MATRIX. Locally text. is Bx w/ gr. matrix where QTz is v. F.g or jasperoid. ; more finely laminated where more limey. Some of pyr. is oxid. to hem., Esp. in more sdy. zones. As above part of "sand" maybe f.g. hard calc-silicates. Original Rock was prob. muddy siltstone - sandstone (zone is similar to much of TM-13)

⇒ 5435 - 5471 : v. f.g. mottled limey silts > QTz >> silty-sdy-Ls - mottled gr. w/ Loc. orange or grey (not as much chl. as above) Dissem pyr. : sdy Beds 1-2' are gradational with more limey Beds. Grtly feel as a whole. Gradational - interbedded contact with Lt. purple QTzite below

⇒ 5471 - 5548 : Hornfels : v.f.g. locally limey siltstone - QTzite sdy text. maybe in part from hard calc-silicates. Mottled Lt purple - DK gy to green, gr. zones contain more pyr - DK. gy zones partially oxid. Bleaching (+ % late calc > gyp vn) starts about 5518 + incr. w/ depth. incr. pyr + epid. + clay + CO_3 in whiter zones. wk sheen on pyr on Fx.

→ only 5-15% "IGN" material noted. - EQUIGRAN. Q-FS Rock - well Round w/ thin Biot - MoS_2 - cpy - pyr ± bn-cv? - ~1% Biot in MAT. / Frags Larger Below 5555. - IBx is later than MARBLE on Hornfels (cuts Frags : MAT: $CO_3^=$ Rich)

⇒ 5588 → 5641 : Mostly mixed, interbedded f.g. gy QTzite + f.x.g. MARBLE + limey Hornfels. - Possible Local Former chert : Loc. pyr + S= stringers + blebs, esp. in serp + carbon. areas.

(10)

PALEOZOIC FORMATIONAL/MEMBER BREAKDOWN: ALSO ARE CaO, MgO, SiO_2, Al_2O_3 ASSAYS EVERY 50' FOR PZ.

4100-4215: Cowhig "Ls"
4215-4450: Schenora Fm.
4450-4653: Epitaph - cherty Ls member
4653-4929: " silty Ls "
4929-5251: " silty Ls ?? (Manns. time?)
5251-5548: " HORNFELS SILTSTONE member
5548-5830 TD. " DOLOMITE MEMBER

GEOLOGIC LOG

PROJECT: TRENCH
Collar elev: 4888' USGS
Course: —
Dip: —
Logged by: F.R. KOUTZ : 3940-5830 logged as drilled June-AUG
21-3940' logged OCT 81 (FRK)

HOLE NO: TCH-2
Final depth: 5830' (BX)
Inclination: SEE Mullen-Haven Survey.
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T.S

DEPTH FROM	DEPTH TO	Assay Interval	% RECOVERY	Assay Interval or Comment	Cu ppm	Pb ppm	Zn ppm	Au ppm	Ag ppm	Mo ppm	CHALCOPYRITE	GALENA	SPHALERITE	Molybdenite	GEOL. S² OR S.S	PYR.-DISSEM. (Tr.-W)	2.5² OXIDIZ.	HEMATITE	SPECULARITE	MAGNETITE	GARNET	SERP.-TALC	WOLLASTON.	GRAPHITE	Fe-Mg-Mn-Ca CARB. QTZ-VEIN	CLAY	GYPSUM	CHLORITE	DIOPSIDE *	CALCITE *	CH. GR. SIZE	% Sphalerite Vugs	% Bleached	Bx Matrix %	Dip-Brec. Frags	SULFIDE VEINS # * *	WD TH - MM	SULFIDE VN TRUE SELV	OR S² grs. size	FAULTS CRUSHING	SHEARING	INTERVAL COMMENT
5679	5696	17	98	5682-83	25	10000	920	.03	12.0	2	T	.3	.2	-	T+	.2	T -	T-	-	-	T	1	-	T+	10	-	1	1	T+	-	8	<.5	T	10	2	20	Y/orisem (8-30°) Y/T-Pyy>>1 @ 5280'S.	Exc. WK Sphl. vn				limy zone 82-84, bleached & chalky 79-82, v.f.g. wh. QTzite; mottled tan 93-96
5686	5708	12	100	5696-5708	<5	25	40	<.02	<.2	8	—	-	-	-	T-	T -	-	-	-	-	20	-	2	-	-	T	T	T-	-	75	.5/2	T	70	T	10/40	Grnodite flecks - tan & pepm. Tr pyrite	Tr Sph.				STR. Local mass gr. Scap. Talc zones 03-07. Mg. MARBLE REST.
5708	5719	11	100								—	-	-	-	T-	T+	- -	—	T?	-	T	3	-	2	3	-	1	T	T	-	80	.5/2	2	80	T+	30/30	Py JARRIS IN SERP Stringers - 1mm	Stringers in gr Scap 2m, with Ca-crush-wh. Sh				JASP.-QTzite Bleached & Vuggy w/calc. 08-10; REST Mg. white-lily MARBLE
5719	5728	9	99								—	-	-	-	Tt	.1	← —	-	?	-	-	T+	-	T-	8	T	1	T	F	-	10	<.5	T	5	3	20	Py gray Sph Fe in bleached QTzite					Bleached wh. f.g. QTzite w/ loc. calc. vn.
5728	5737	9	100		—	T-?	T	-	T		—	-	-	-	T-	.1	- -	-	? T	-	-	6	-	2	1	-	1	T+	T+	-	90	.5/1	T-	85	T	10/30	PY>>Py S² blebs Assoc. w/graph.	Fleks.				Zebroid f.g. MARBLE - mottled sy+wh. : S² staing. @ 5737 & 20°
5737	5751	14	97	5737-5751:	<5	195	70	—	.2	6	—	-	T	-	T	.3	- -	-	T?	-	-	2	-	T+	10	T	3	1+	T	-	15	1	1	30	3	25	Py on Ba + calc vn. w Qtzite	@ 38-44 y				Bleach. f.g. wh. QTzite (to 44-46)
5751	5765	14	98		—	-	T?	-	T		—	-	T	-	T	.3	- T	T-	- -	-	T+	2	-	1	20	T	1	T	T	-	65	<.5/1	T	40	1/4	35	Py stringers + blebs to 3mm.					mg. MARBLE w/loc. Scap. 54-58; v.f.g. Silicif φ? on Arkose-cgl. (1-4mm. blebs of Pyr.)
5765	5783	18	98	% of Bx 20-85° 60°	—	-	-	-	T-		—	-	-	-	T-	.1	- ?	T-	- -	-	-	T+	-	10	T	2	2	T	-	5	<.5	1	20	8	20	Py gray, on Fe 1-2mm.					f.g. → mg wh. → tan QTzite w/ loc. STR. CR + Bx w/calc. cement
5783	5798	15	99		—	T?	F?	T?	T		—	.2	possibly PO w/graph.	-	-	- -	-	-	-	-	-	3	-	2	15	-	T	T	T+	-	60	<.5/1	1	70	5	25	Py. 1-3y ≤ 1mm. blebs of graph.					Mottled BIT → mg. Zebroid MARBLE w/ loc. Scap. 88-92.5 v.f.g. Silicif Qtz-silt. Hsf. Bleached. weak φ TEXT.
5798	5808	10	99	5798-5808	<5	10	40	—	<.2	6	—	-	-	-	T	.2	- -	-	-	-	-	2	-	2	5	-	1	T+	T	-	50	<.5/1	1/2	50	3	20	Py in stringers in Scap. zone S.S					98-04: wh. Bleach. f.g. QTzite. 04-08: DK.gy. ZEB. f.g. MARBLE
5808	5820	12	99	5808-5820	10	50	530	—	<.2	30	—	-	-	-	T	.5	- T+	T	- -	-	-	3	-	2	1	-	T+	T	T	-	70	<.5/1	T	60	1	10	<.5 Pyr. Dissem.	—				08-12: Tan-Red QTz. w/v.f.g. Dissem. pyr. + local 1-4mm bleached vn.: 12-20: DK.gy. MARBLE w/wk Zebroid tx.t. + Scap. splotches.
5820	5830	10	100	5820-5830	<5	5	50	<.02	<.2	2	—	-	-	-	T	.2	- -	-	T?	-	T	2	-	1	-	-	T+	1/4	T-	-	90	<.5/2	T	70	T	10/30	1-3 Dy cell. 80°+30° w/ <.5 Py + 2-10mm selv.	—				Bleach. v.f.g. MARBLE w/ lw. Scap. bleach. STARTS ~ 5817, Loc. DK.gy. v.f.g. calc. vn w/ dissem. Pyr. - bleach selv. Beyond.

TOTAL DEPTH →

THESE ESTIMATES NOT MODIFIED AFTER ASSAYS WERE OBTAINED.

MINERALOGY AND STRUCTURE

— GENERAL COMMENT —

5641-5830 Intenbedded f→mg. gy to bleached wh. MARBLE w/loc. wk. Zebroid tx.t. + SERP-TALC. ZONES And f→mg. QTzite (some siltstone) locally better called Jasperoid. QTz. Locally strongly crushed & Broken w/calc. vn. healing. Core Loss mostly in QTzite ZONES Because of caving between runs. Loc. dissem. Pyr or Po(?) Assoc. w/graph. - Ta other sulfides w/Pyr - usually in Scap. ZONES. THIS ZONE of QTzite + MARBLE should be distinctive in PZ!

COMPOSITE ASSAYS OF INTERVALS ↑ NOTED ABOVE (oct 7, 81 Skyline) WEIGHTED MEANS of SKYLINE INDIVIDUAL INTERVALS USED FOR PREVIOUS MONTHLY/QUARTERLY REPORTS

					Cu%	Pb%	Zn%	As ppm	Ag oz/T FIRE	Mo ppm	Fe%	Mn %	Sr %	Sb ppm	As ppm	Bi ppm	Ca%	Mg%	SiO_2%	Al_2O_3%	W ppm	V ppm	Ti %	Cd ppm	Co ppm	
4046	4050	4	100	IBX?	1.60	0.08	0.13	0.23	1.26	55	15.6	.26	.207	.06	.07	170	.18	.43	73.2	8.8	<50	20	.2	50	50	Tl 100 ppm Ag + 200 Ba
4127	4166	37	95		0.75	0.21	0.21	<.02	0.74	100	15.1	1.52	2.8	.09	.05	100	9.0	.97	49.2	3.7	100	30	.05	<50	20	
4195	4215	20	99+		1.91	1.67	1.20	0.05	5.02	340	12.4	1.13	3.2	.03	.05	2200	21.9	.97	32.6	3.5	200	30	.07	50	20	
4243	4286	43	100		0.05	1.56	1.20	<.02	1.84	140	9.9	1.57	1.2	0.02	.00	250	20.	1.0	42.1	4.9	700	50	.2	70	7	
4286	4312	26			0.63	3.75	6.05	<.02	1.18	180	6.1	1.14	4.5	0.04	.05	70	11.9	1.2	50.7	6.3	150	50	.2	50	50	
4450	4490	40			0.11	1.50	1.28	<.02	2.96	38	9.1	3.3	1.3	.04	.05	370	25.1	2.1	34.7	2.5	200	70	.07	50	15	
4653	4679	26			1.79	5.40	14.20	0.05	14.30	42	6.3	.86	10.0	0.02	.02	1100	11.3	.41	40.4	.89	70	15	.015	100	100	
4683	4710	27			0.81	4.10	10.60	<.02	7.92	4	4.8	1.26	8.0	0.02	.04	560	23.8	.88	30.2	1.4	70	30	.05	700	70	
4767	4783	16			0.21	2.18	12.90	0.09	11.78	4	8.8	1.26	10.7	0.01	.01	970	16.1	.93	34.2	2.1	<50	20	.1	100	150	
4785.6	4804	18.4			0.15	0.67	11.70	0.07	5.20	2	6.5	1.77	3.5	.01	.04	570	23.6	1.8	37.7	2.5	100	30	.05	150	200	
4804	4837	33			0.16	0.77	19.00	<.02	6.12	2	9.0	1.0	1.01	.002	.04	960	19.2	.49	30.2	1.9	<50	20	.05	150	200	
4849	4882	33			0.15	0.85	18.40	0.06	7.34	2	5.7	.86	1.06	.00	.02	1800	12.4	.66	40.4	1.3	<50	20	.1	700	100	
4882	4891	9	100		1.32	1.79	25.80	0.15	17.56	<2	6.2	1.11	15.3	.02	.05	1600	15.1	.90	20.9	1.5	<50	20	.02	200	30	
																		%			Wm	Bm	%	ppm		

(1)

GEOLOGIC LOG

PROJECT: TRENCH | HOLE NO.: TCH-2 (A)
Collar elev: 1977' (2912' down TCH-2) | Final depth: 5121' (from TCH-2 collar)
Coord N.: 5311' (Trench Grid) | Inclination: from vertical 20°, S60°W
Coord E.: 3454' | Page 1 of 5
Logged by: S.A. Catlin
Date start: 8/31/81 | Date finish: 1/15/82

Depth and Assay

Ft. in drill hole From	To	Int'vl	% Core Recovery	Comment, dip + bearing or Assay Interval	Cu ppm	Pb ppm	Zn ppm	Au oz/T	Ag oz/T	Mo ppm	thin section
1 SEPT → 2912	2943	31	0								
2943	2945	2	100	NX							2945
2945	3022	77	0								
3022	3023	1	100	NX							
3023	3122	99	0								
3122	3123	1	100	NX							3122
3122	3261	139	0								
3261	3270	9	100	NX							
16 SEPT → 3270	3290	20		↓							
3290	3300	10		split all	115	120	680	<.001	.01	2	
3300	3320	20									3307
	3340										
	3360			split 3340-3350	165	90	305	N/R	.01	<2	
	3380										
3380	3400			split 3396-3400	55	45	145	<.001	.006	<2	
	3420										
	3440										
	3460			split 3440-3450	235	285	990	N/R	.05	2	3446
	3480										
3480	3500			split 3490-3500	390	215	470	<.001	.03	<2	
	3520										
	3540										
	3560			split 3540-3550	290	175	630	N/R	.04	2	
	3580										3561
3580	3600			split 3570-3600	340	125	570	<.001	.02	2	
	3620										
	3640										
	3660			split 3640-3650	5	<5	130	N/R	<.006	<2	
	3680			split 3670-3680	980	830	1550	<.001	.13	2	PS 3674
3680	3700			split 3690-3700	10	35	270	<.001	<.006	<2	3699
	3720										
	3740										
	3760			split 3740-3750	20	5	95	N/R	<.006	<2	
	3780										
3780	3800			split 3790-3800	5	5	275	<.001	<.006	2	
	3820	20									
3820	3840	20									3825
	3860			split 3840-3849	10	80	65	N/R	.006	<2	
	3880										
	3900			split 3890-3900	9	5	45	<.001	<.006	<2	3900
	3920	20									

Mineralogy and Structure

From	To	Chalcopyrite	Covellite	Galena	Sphalerite	Molybdenite	Grey S= or SS	Pyrite-Dissem	Pyrite-Vn	% S= oxidiz	Limonite	Hematite	Specularite	Magnetite	Garnet	Serp.-Talc	Wollastonite	K-spar-total	Jasperoid (f.s. s2)	Qtz-vein	Clay	Sericite	Chlorite	Epidote	Carbonate	CG = grain size mm	% Standing vugs	% Banded	Bx-matrix %	Dip Bnds / Flow Bnds	Sulfide veins # & ∠ per foot	width mm sulfide + alt envelope / total width of selv. (or S= grain size)	Faults, crushing	Shearing
2912	2943																																	
2943	2945	T	-	-	-	-	-	2	.2	-	-	-	-	T+	-	T+	-	15	-	-		(fine) 1.0	8	1	-	na	-	-	na	na	2/30°	<1/-	—	
2945	3022																																	
3022	3023	-	-	-	-	-	-	.1	.3	-	-	-	-	-	-	-	-	30	-	1	.3	2	1	-	-	na	-	-	na	na	15/50-80°	1-4/0-5	—	
3023	3122																																	
3122	3123	-	-	-	-	T+	-	1.	1.	-	-	-	-	.5	-	-	-	5?	-	.3	T	2	8	7	-	na	-	-	na	na	5/20-90°	1-2/1.6	—	
3122	3261																																	
3261	3270	T	-	-	-	T	-	.5	.7	T	T	T	-	-	-	T	-	15	-	1	-	15	2	4	-	na	T	-	na	na	20/most 30-60°	1-10/1-15	2" vuggy at 3264'	
3270	3290	T+	-	-	-	-	-	.2	.4	-	-	-	-	-	-	T	-	10?	-	8	T	15	1	1	-	na	-	-	na	na	5/most 30-60°	1-4/to 40	—	
3290	3300	-	-	-	-	-	-	.1	.3	T	T	T	-	-	-	-	-	8?	-	5	T	12	1	1	-	na	-	flow 30	na	45	4/most 30-60	1-2/0-70	—	
3300	3320	-	-	-	-	-	Mo? T	.2	.3	-	-	-	-	-	-	-	-	12	-	2	-	15	2	1	-	na	-	-	25	na	5/50-60	1-10/0-35	shear at 3302	
	3340	-	-	-	-	T	T	.2	.4	T	T	T	-	-	-	-	-	15	-	2	-	10	.5	1.5	-	na	-	flow 30	na	25°	5/20-60°	1-2/0-30	—	
	3360	T	-	-	-	-	T	.1	.2	-	-	-	-	-	-	-	-	18	-	2	T	6	1.5	1	-	na	T	flow 25	na	30°	3/15-90°	1-2/1-10	—	
	3380	-	-	-	-	T	T	.2	.3	T	T	T	-	-	-	-	-	15	-	3	.1	8	2	1.5	-	na	-	flow 30	na	30-35°	4/20-80°	1-3/1-10	—	
3380	3400	-	-	-	-	-	T	.1	.2	-	-	-	-	-	-	-	-	25	-	1.5	-	10	1	1.5	-	na	-	flow 20	70	40-45°	7/0-60° 80-90°	1-2/1-35	4' IBX	
	3420	-	-	-	-	-	Mo? T	.1	.3	T	T	T	-	-	-	-	-	20-25	-	2	-	12	1	1	-	na	-	flow 10	na	10-20°	4/20-60°	1-4/1-35	—	
	3440	-	?	-	-	?	.4	.3	.5	T	T	T	-	-	-	-	-	30	-	2.5	.3	12	.5	.5	-	na	T	flow 20	na	30°	4/most 20-40°	1-5/1-30	—	
	3460	-	?	-	-	?	.3	.3	.3	-	-	-	-	-	-	-	-	25	-	.4	.4	12	.5	3	-	na	-	flow 40	na	30-35°	4/30-75°	1-3/1-7	—	
	3480	.1	-	-	-	T	T	.2	.5	-	-	-	-	-	-	T	-	35-40	-	2	.5	10	.5	4	-	na	T	flow 20	60	30-35	5/15-80°	1-4/1-40	IBX 3473, bx 3474	
3480	3500	T	-	-	-	?	T	.2	.4	T	T	-	-	-	-	-	-	30	-	3	T	10	.5	4	-	na	-	flow 80	na	40°	5/all ∠'s	1-5/1-40	—	
	3520	T	-	-	-	?	T	.2	.5	-	T	T	-	-	-	-	-	25	-	3	1	8	1	25	-	na	-	flow 50	60	40°	3/20-75°	1-25/2-150	IBX 3501	
	3540	-	-	-	-	-	T	.2	.2	-	-	-	-	-	-	.1	-	20-25	-	.8	.5	6	1.5	1.5	-	na	T	flow 10	40	40°	3/most 30-60°	1-2/1-30	gouge 3529, IBX 3539	
	3560	T	-	-	-	-	T	.2	.2	-	-	-	-	.3	-	.3	-	20-25	-	1.5	1.5	11	2	1.5	-	na	.5	flow 20	75	40°	4/most 20-60°	1-4/2-40	bx 3552, gouge bx 3553-3557.5	
	3580	T+	-	-	-	?	Mo? T	.3	.5	-	-	-	-	T	-	T	-	20-25	-	1	.2	8	1.5	1.5	-	na	T	flow 10	na	45°	5/0-60° 90°	1-5/2-15	—	
3580	3600	T	-	-	-	-	T	.2	.1	-	-	-	-	-	-	-	-	25	-	.5	.2	6	.5	1	-	na	T	flow 15	5	40-45	3/0-60°	1-2/1-15	IBX 3595-3598.5	
	3620	-	-	-	-	-	T	.1	.1	-	-	-	-	-	-	-	-	25	-	.5	2	8	1	1.5	-	na	T	flow 30	na	45°	3/45-85°	1-4/0-2	—	
	3640	-	-	-	-	-	T?	.1	.1	-	-	-	-	-	-	-	-	20-25	-	.3	1	5	1	1	-	na	-	flow 30	na	45°	2/25-70°	1-2/0-2	—	
	3660	-	-	-	-	?	Mo? T	.1	.1	-	-	-	-	-	-	-	-	25	-	.3	1	7	1	1.5	-	na	T	flow 10	70	35-45°	2/20° 60-90°	1-2/0-10	1" IBX at 60°, 3651'	
	3680	.3	-	-	-	T	Mo? T+	.3	.5	-	-	-	-	-	-	-	-	30-35	-	.3	2.5	10	.5	1	-	na	-	flow T	50	40°	3/most 60-70°	1-10/0-20	2" IBX at 60°, 3676	
3680	3700	-	-	-	-	-	-	.2	.2	-	-	-	-	-	-	-	-	25	-	.3	1	7	1.5	2	-	na	T	flow 20	30	45°	3/20-60°	1/0-12	structure bx 3685.5	
	3720	-	-	-	-	-	T	.2	.1	-	-	-	-	-	-	T	-	35	-	.3	1	8	1.5	1.5	-	na	.3	flow 10	na	30-40°	3/5-15° 60-70°	1-2/0-20	—	
	3740	-	-	-	-	-	T	.2	.2	-	-	-	-	-	-	-	-	25	-	.4	T	8	2	1.5	-	na	T	flow 10	na	40°	3/30-60° 80-90°	1/0-8	—	
	3760	-	-	-	-	-	-	.2	.3	-	-	-	-	-	-	-	-	25	-	.2	.2	7	1.5	3	-	na	-	flow 10	na	30°	4/40-60° 85-90°	1-3/1-12	—	
	3780	-	-	-	-	-	.1	.2	.2	-	-	-	-	-	-	-	-	25-30	-	.2	.2	6	1.8	1	-	na	-	flow T	na	30°	4/most 60-90°	1-3/1-15	broken up at 3773'	
3780	3800	-	-	-	-	T?	T	.2	.3	-	T	T	-	-	-	-	-	25-30	-	.5	.5	5	.5	1	-	na	.3	-	30	na	3/most 50-90°	1/1-15	3" IBX at 60°, 3786'	
	3820	-	-	-	T+	?	T	.6	.3	-	T	T	-	-	-	4	-	20	-	.3	.2	7	2	1.5	-	na	.5	-	70	na	4/45-90°	1-4/1-15	IBX at 90°, 3806'	
3820	3840	T	-	-	-	-	T	1.2	.3	.1	.1	.1	-	-	-	-	-	20-25	-	.5	.2	8	1	2	T	<½	-	-	na	na	4/40-60° 80-90°	1-3/1-3	—	
	3860	-	-	-	-	-	T	1.2	.5	T	T	-	-	-	-	-	-	25	-	.3	.7	7	1	3	-	na	-	-	20	na	4/40-90°	1-10/1-5	IBX at 3859-3860	
	3880	-	-	-	-	-	-	.9	.5	T	T	T	-	-	-	T	-	25	-	.2	.5	6	1	2	T	<½	-	-	na	na	5/40-90°	1-6/1-15	shears 3860-3862	
	3900	-	-	-	-	-	T	.2	.3	-	-	-	-	-	-	T+	-	25-30	-	.2	.3	9	.7	.5	-	na	-	-	na	na	4/60-90°	1-2/1-10	—	
	3920	-	-	-	-	-	T	.2	.3	-	-	-	-	-	-	.1	-	25-30	-	.3	.5	8	.6	.4	-	na	.2	-	50	na	5/most 60-90°	1-5/0-5	bx at 3920'	

Rock Type and Remarks

From	To	Rock type and remarks
2912	2943	Navi-Drill: vials with rock flour only
2943	2945	SPOT CORE — Porphyritic ig. rock, intermediate (monzonite porphyry?); K-spar hard, plag. soft
2945	3022	Navi-Drill
3022	3023	SPOT CORE — Felsic igneous rock, fine grained except for a few phenos (rhyolite porphyry?) qtz sericite py. veinlets
3023	3122	Navi-Drill
3122	3123	SPOT CORE — Fine grd intermediate ig rock(?) (andesite?), strong ep-py-chlor. & fracture controlled
3122	3261	Navi-Drill
3261	3270	SPOT CORE — Pink, gray, green fine grd ig. rock (some porphyry) (latite?), strong qtz-ser-py-ep (& K-spar) alteration
3270	3290	(CONTINUOUS CORE ↓) Latite, some porphyry, strong qtz-ser-py
3290	3300	latite or dacite, qtz-ser-py alteration, quartz selvages
3300	3320	latite-dacite to 3310; more felsic, less phenos, lithics below that; flow bx at 3310-3311
	3340	latite porphyry, variable texture ⟹ 3261-3380' latite to dacite, some porph, qtz-ser-py alt
	3360	latite porphyry, assorted veinlets (qtz-ser in selvages to py veins), some ep-chlor. alt.
	3380	latite to dacite porphyry
3380	3400	latite porphyry → 3394-3396' (3389-3391') bx, probably intrusive, most clasts
	3420	latite porphyry — (or all?) volcanic, maybe 1 or 2 intrusive,
	3440	latite porphyry, S= could be chalcocite — clasts show pre-bx alteration, 5 fracs/foot at 30-60°
	3460	latite porphyry, S= could be chalcocite (or moly?)
	3480	latite porphyry, some 2° K-spar → 3473' 2" wide IBX cutting core at 70°;
3480	3500	latite porphyry, some 2° K-spar, qtz selvages — most clasts volcanic, some intrusive (?)
	3520	latite porphyry, alteration patchy, variable in type — or sulfide; 1-3" 2° Kspar selvage;
	3540	latite porphyry (or a bit more mafic?) — a second thin IBX dike just below;
	3560	latite porphyry, few phenos 3557-3560 — below that 8" fault bx.
	3580	3560-3564 fine grd intermed. ig rock; rest latite porphyry → 3501' 3" wide IBX at 80°, like above
3580	3600	latite porphyry, not highly alt'd — some pre- and post-bx sulfide
	3620	latite porphyry → 3595-3598.5' IBX, rounded clasts to 6 cm,
	3640	latite to dacite porphyry, some 2° K-spar — intrusive porphyrys (?), extrusive rocks
	3660	latite porphyry, some 2° K-spar — as clasts; some pre-bx sulfide
	3680	latite porphyry, 2° Kspar - strong fracturing → 3675' strong py-cpy, thin (.5") IBX, 2° Kspar
3680	3700	(structure bx 3685.5 - now altered, healed) latite porphyry; variable in color, texture; 2° K-spar ⟹ 3380-3811.5' latite porphyry, tan
	3720	latite porphyry, variable color and texture, some 2° K-spar — to light green, flow banded at 40°;
	3740	latite and latite porphyry, variable color, some 2° K-spar — propylitic, some phyllic alt, IBX's
	3760	latite or dacite porphyry, some 2° K-spar — scattered through, 3-4 fracs/foot, all angles
	3780	latite or dacite porphyry, good 2° K-spar
3780	3800	latite porphyry, lighter colored deeper down, alteration, rhyolite(?) some white spotted texture at about 3799'
	3820	to 3811.5' like above: rhyolite or latite porphyry, few phenos
		3811.5' to 3820' spots of rhyolite (few phenos) mixed with
		latite or dacite porphyry with 30% blocky plag. phenos to 1 cm. flow contact?
3820	3840	latite to dacite porphyry, blocky plag. phenos, rhyolite spots top 2'
	3860	latite porphyry, strong propylitic alteration
	3880	latite and latite porphyry, minor stilbite (?) in cracks (may be clay)
	3900	latite porphyry (only 5-10% phenos) → 3920' 1' of breccia, probably not
	3920	latite porphyry — IBX, clasts angular, local

(2)

GEOLOGIC LOG

PROJECT: TRENCH — HOLE NO. TCH-2(A)
Collar elev. 2912' down TCH-2 — Final depth 5121'
Coord. N. 5311' — Inclination from vert. 20°, S60°W
Coord. E. 3454 — Page 2 of 5
Logged by S. A. Catlin
Date start 8/31/81 — Date finish 1/15/82

see page 5 for composite (4120–4160)

see page 5 for composite (4310–4340)

Depth and Assay

From	To	Int.	% Rec.	comment, dip + bearing or assay interval	Cu ppm	Pb ppm	Zn ppm	Au oz/ton	Ag oz/ton	Mo ppm	thin section
3920	3940	20	100	NX core							
	3960	↓	↓	split 3940-3950	10	20	1300	N/R	<.006	<2	
	3980	↓	↓								
3980	4000	↓	↓	split 3990-4000	15	70	180	<.001	.006	2	3987
	4020	↓	↓								
	4040	↓	↓								
	4060	↓	↓	split 4040-4050	30	100	245	N/R	.02	<2	
	4080	↓	↓								4069
4080	4100	20	100	split 4090-4100	30	65	285	<.001	.006	<2	
4100	4120	20	100								
4120	4130	10	100	split all	1.58%	2300	2200	.0052	fire 2.44	28	PS 4121
4130	4140	10	100	split all	assay 2.48%	2600	3600	.0052	fire 2.74	4	PS 4130
4140	4150	10	100	split all	1.14%	5300	1.61%	<.001	fire 2.08	60	4147
4150	4160	10	100	split all	7000	2200	2200	.001	fire 1.54	38	
4160	4180	20	100								
4180	4200	↓	↓	split 4190-4200	55	125	335	<.001	.006	2	
	4220	↓	↓								
	4240	↓	↓								4221
	4260	↓	↓	split 4240-4250	50	75	195	N/R	.006	<2	
	4280	↓	↓								4261
4280	4300	20	100	split 4290-4300	135	235	520	<.001	.04	2	
4300	4310	10	100	split all	1500	1800	3000	<.001	.26	4	
				split 4310-4316	6900	1.65%	2400	.005	10.8 fire 9.04	28	
				split 4316-4323	3800	770	2400	<.001	.58	4	
4310	4320	10	100	split 4323-4328.6	1.50%	4500	6600	.002	2.9 fire 2.60	65	PS 4313
				split 4328.6-4329	6000	1900	4600	<.001	.583	2	4319
4320	4340	20	100	split 4329-4337	2.20%	6400	2300	.002	3.4 fire 4.52	10	4320
				split 4337-4340	2200	550	1300	<.001	.38	<5	
4340	4360	20	100	split 4340-4350	1900	550	610	N/R	.13	20	4355
				split 4350-4356	1800	1100	460	.001	.67	235	
4360	4380	20	100								
	4400	↓	↓	split 4390-4400	285	395	660	<.001	.02	24	
	4420	↓	↓								
	4440	20	100	split 4420-4430	1900	120	260	<.001	.076	46	bornite .1; PS 4427
4440	4460	20	100	split 4440-4450	475	55	365	N/R	.006	42	4441

Mineralogy and Structure (mineralogy)

From	To	Chalcopyrite	Covellite	Galena	Sphalerite	Molybdenite	Gray S= or SS	Pyrite dissem	Pyrite vein	% S= oxid'd	Limonite	Hematite	Specularite	Magnetite	Garnet	Serp.-Talc	Wollastonite	K-spar total	Jasperoid fine grd SiO2	Quartz-vein	clay	Sericite	Chlorite	Epidote
3920	3940	—	—	—	—	—	T	.3	.3	—	—	—	—	—	—	—	—	25-30	—	.1	1	9	.3	.5
	3960	—	—	—	—	—	T	.5	.2	—	—	—	—	—	—	—	—	25	—	.2	.8	5	.5	.5
	3980	—	—	—	—	—	T	.7	.3	—	—	—	—	—	—	T+	—	30	—	.5	1	8	.5	.3
3980	4000	—	—	—	—	—	T	.4	.2	—	T	T—	—	—	—	—	—	15	15	1	.2	6	.3	.2
	4020	—	—	—	—	—	T	.3	.2	—	—	—	—	—	—	T	—	30-35?	—	.2	.4	2?	.3	.1
	4040	—	—	—	—	—	T	.2	.2	—	—	—	—	—	—	—	—	30-35?	—	.3	.2	3	.1	.2
	4060	—	—	—	—	—	—	.2	.2	—	—	—	—	—	—	—	—	30	—	.5	.3	3	.1	.4
	4080	—	—	—	—	—	T	.2	.3	—	—	—	—	—	—	T	—	30	—	.2	1	3	.1	.3
4080	4100	—	—	—	—	—	T	.3	.2	—	—	—	—	—	—	T+	—	30	—	.5	.5	3	.2	.2
4100	4120	—	—	—	—	—	T	.2	.3	—	—	—	—	—	—	T	—	30	—	.6	2	4	.5	.4
4120	4130	.1	—	—	—	—	.1	40	.2	—	—	—	—	—	—	T	—	10	—	.3	4	20	5	.1
4130	4140	.1	—	—	—	?	T+	50	.2	T	T	T—	—	—	—	T	—	5	—	.2	.2	16	4	.1
4140	4150	.1	—	?	.8	—	T+	12	1	T	T	T—	—	—	—	5	—	2	—	2	4	15	10	.3
4150	4160	T—	—	—	.2	—	T	10	.5	—	—	—	—	—	—	1	—	5-10	—	.5	2	10	8	.3
4160	4180	—	—	—	—	—	T—	.2	.2	—	—	—	—	—	—	—	—	30	—	.4	.5	2?	.3	.4
4180	4200	—	—	—	—	—	T	.2	.2	—	—	—	—	—	—	—	—	30-35	—	.2	1.5	3	.7	.3
	4220	—	—	—	—	—	T	.2	.2	—	—	—	—	—	—	T	—	30	—	.2	2	3	.5	.4
	4240	—	—	—	—	—	—	.2	.2	—	—	—	—	—	—	T	—	30	—	.4	2	3	.3	.3
	4260	—	—	—	—	—	T	.3	.5	—	—	—	—	—	—	T	—	30	—	.2	2	3	.2	.2
	4280	—	—	—	—	—	T—	.1	.3	—	—	—	—	—	—	—	—	30	—	.2	.4	4	.4	.2
4280	4300	—	—	—	?	—	T+	.1	.2	—	—	—	—	—	—	—	—	30	—	.4	.6	5	.2	.1
4300	4310	—	—	—	.1?	—	T	.7	.4	—	—	—	—	—	—	T	—	15-20	—	.5	1	9	3	.2
4310	4320	T+	T?	—	.2	—	T	10	.2	T?	.4	.4	.2	—	10	T	—	1	—	.2	.2	1	6	.5
4320	4340	T+	—	—	T	—	T	10	T	?	.5	.5	T	—	6	T	—	2	—	T	2	4	6	.5
4340	4360	.2	—	—	.1	—	T+	5	T	?	1	1	—	—	18	T	—	T?	—	T	T	T	3	.5
4360	4380	—	—	—	—	—	T?	.1	.1	T	.3	.3	.3	—	8	.5	—	—	—	T	—	T—	.5	.5
	4400	T	—	—	—	—	T—	.2	.1	—	.1	.1	.3	—	15-20	.5	—	—	—	T	T	T?	3	.5
	4420	T—	—	—	—	—	—	.2	T	—	.1	.1	.3	—	6	.5	—	?	—	T	T	T?	1	1
	4440	.2	T	—	—	—	T+	.2	T	—	.1	.1	.2	—	25-40	T	—	?	.2	—	—	T	.5	.6
4440	4460	T	—	—	—	—	T	.2	.1	—	.3	.3	.1	—	8	.5	—	T?	—	.4	1	T+	4	T

Mineralogy and Structure (structure) — Rock Type and Remarks

From	To	Carbonate	matrix grain size CO3= (mm)	% sanding vugs	% banded	Bx. matrix %	Dip of beds, flow banding	S= veins # (per foot) and ∡	width (mm) S= vein / alt. selvage (total) or (S= grain size)	Faults, Crushing, Shearing	Rock type and remarks
3920	3940	—	na	T	—	50	na	6/all ∡'s	½-1/0-4	bx at 3920	latite porphyry, 5-10% phenos only
	3960	—	na	T	—	25	na	3/60-90°	1-3/0-5	fault bx at 3942 and 3945	latite porphyry, strange pink mineral in spaces as balls
	3980	—	na	T	—	70	na	3/all ∡'s	1-2/0-8	broken 3968-73; trace IBX 3966	latite porphyry, patchy alt. 3978-79 (after bx.?), pink min. again
3980	4000	—	na	T	—	15	na	3/many 70-90°	1-2/0-3	IBX 3994' on	latite porphyry, silicified 3986 to 3994'
	4020	—	na	—	—	15	na	2-3/most 60-90°	½-2/0-1	IBX to 4003'	latite (few phenos), may have crossed fault at IBX
	4040	—	na	—	—	na	na	2-3/90° 60-90°	1-5/0-10	—	latite - nondescript, tan colored, few phenos
	4060	—	na	—	—	na	na	2-3/most 60-85°	½-4/0-5	—	latite, minor latite porphyry at bottom, tan colored
	4080	—	na	—	—	70	na	3/most 50-90°	1-4/0-5	trace bx (IBX?) 4066	latite and latite porphyry
4080	4100	—	na	—	—	60	na	2-3/most 60-90°	1-3/0-12	¼" bx at 4907 (IBX?); gouge at 4094'	latite (few pheno's.)
4100	4120	—	na	—	—	75	na	2-3/most ~60°	1-4/0-10	1" IBX at 55, 4117.5'; gouge zone 4110-4111'	latite and latite porphyry
4120	4130	—	na	—	—	60	na	2/all ∡'s	½-1/0-3	¼" bx's at 4121'	probable latite porphyry, gougy, heavily alt'd. to py-ser-chlor
4130	4140	—	na	—	—	na	na	1/all ∡'s	1-2/0-2	all gougy	gougy latite or latite porphyry, heavy py-ser-chlor
4140	4150	—	na	.5	—	na	na	<1/all ∡'s	2-10/0-10	all gougy	gougy latite porphyry, heavy py-ser-chlor-serp^t in spherules; pink mineral in vugs (Kspar?, replaced by clay?) - some odd dark sulfide xls in vugs
4150	4160	—	na	—	—	na	na	3/all ∡'s	1-3/0-10	gougy to 4157'	latite porphyry (just 3-5% phenos), gougy upper part w/ strong py-ser-chlor
4160	4180	—	na	—	—	na	na	2/10° 60-70°	1-4/0-8	—	latite porphyry (just 5% phenos)
4180	4200	—	na	T	—	na	na	2-3/20-30 60-80	1-10/1-15	—	latite porphyry (about 5% phenos), some 2° K-spar, phenos rotten
	4220	—	na	T	—	na	na	2-3/all ∡'s esp. 65-80	1-2/0-15	fractured up at 4210	latite and latite porphyry, strange pink phase in vugs, some 2° Kspar,
	4240	—	na	T	—	20	na	3/all ∡'s	1-4/0-12	bx at 4236'	latite porphyry, fresher deeper
	4260	—	na	T	—	30	na	3/all ∡'s	1-8/0-15	bx's at 4251 and 53	latite porphyry, some feldspars rotten (to clay-sericite some talc or serp.)
	4280	—	na	T	—	15	na	2/all ∡'s	½-1/0-3	crush bx at 4278'	latite porphyry, not highly altered - whole rock sample
4280	4300	—	na	.3	—	20	na	3-4/all ∡'s	1-4/1-15	2-3" IBX at 60°, 4293; broken 4294-4298	latite porphyry, strange pink phase in vugs, some gray sulfide (may be sphalerite); some 2° Kspar as selvages to pyrite veins
4300	4310	T	<½	T	—	na	na	4-5/most 30-65	1-6/1-20	—	latite porphyry, strongly alt'd 4304-4310 to chlor-py
4310	4320	15	<½	T	—	na	na	0-1/40-50°	1-5/0-2	—	green hornfels, some marble; patchy-veined texture; hematite probably from Fe-silicate breakdown
4320	4340	10	<½	3	—	30	na	0-1/all ∡'s	½-1/0	gougy-bx 4324-4332	green hornfels, some porous gougy (with ser-chlor), 6" latite porphyry (dike?) at 4329', hem after silicate?
4340	4360	15	<½-2	—	—	na	na	near 0	1 or 2 5 cm veins /0-10	vein-fault at 4344?	calc-silicate hornfels, patchy sulfides and calcite, hem after silicate, calcite-sulfide patches (veins? replacement veins?)
4360	4380	30	most <½	—	5	na	30°	0-1/0-60°	1-5/0-2	—	calc-silicate hornfels-marble; after calcareous siltstone? talc-calcite in fractures
	4400	50	½-1	—	15	na	10-30°	near 0	1-3/0-2	gougy 4398-4399	calc-silicate hornfels-marble; some silty (?)
	4420	60-65	<½	—	—	20	na	0-1/most near 90°	½-1/0-1	gouge-bx at 4403'	calc-silicate hornfels-marble, 2% coarse (to 5mm) calcite in veins
	4440	35-40	<½	—	—	na	na	0-1/some 40-60°	1-30/0-10	—	calc-silicate hornfels-marble, strong garnet; Cu-sulfide patches-veins, inc'ing bornite; trace chalcedony in fractures
4440	4460	25-30	<½	T	—	30	na	0-1/all ∡'s	½-2/0-1	sheared, broken 4442-4448; gouge-bx 4457-4460'	calc-silicate hornfels, some silty; much broken up; calcite veins 2% with grains ½-1 mm

→ 3994-4003' IBX, rounded clasts to 5" of intrusive and extrusive ig. rocks; sulfide pieces, pre-bx. sulfide common

⇒ 3811.5-3875' latite porphyry (20 to 25% plag. phenos); propylitic alteration; may be intrusive but more likely flow rock

⇒ 4121-4157' gougy latite and latite porphyry; strong py-chlor-ser-serp alt; some chalcopy.-sphal.

⇒ 3875-4121', 4157'-4310' latite porphyry (only 5% phenos mainly plag.); minor phyllic-propylitic alt., some clay and K-spar alt.; tan to light green color; scattered structural and intrusive bx's; not flow banded, about 3 fractures/foot, all angles

⇒ 4310-4363' green hornfels, w/ .4 to 1% hematite after Ca-Fe silicates; patchy calcite and sulfides

(3)

GEOLOGIC LOG

PROJECT: TRENCH — HOLE NO. TCH - 2(A)
Collar elev. 2912' down TCH-2 — Final depth 5121'
Coord N. 5311' — Inclination from vert. 20°, S60°W
Coord E. 3454' — Page 3 of 5
Logged by S.A. Catlin
Date start 8/31/81 — Date finish 1/15/82

Depth and Assay

From	To	Intvl	% Core Recov.	comment, dip + bearing or assay interval	Cu ppm	Pb ppm	Zn ppm	Au oz/ton	Ag oz/ton	Mo ppm	thin section
4460	4480	20	100								
	4500	20	100	split 4490-4500	105	1000	950	<.001	.02	2	
4500	4520	20	100								4503
4520	4540	20	100								
	4560	20	100	split 4540-4550	120	1550	3600	N/R	.093	12	
	4580	20	85								
	4600	20	90	split 4590-4600	15	15	220	<.001	<.006	6	4592
4600	4620	20	100								
4620	4640	20	100								4620
4640	4660	20	100	split 4640-4650	45	2800	8500	N/R	.20	6	
4660	4680	20	100								
4680	4700	20	95	split 4690-4700	5	100	335	<.001	<.006	<2	4694
4700	4720	20	100								
4720	4740	20	100								
4740	4760	20	100	split 4740-4750	35	160	305	N/R	.006	2	4749
4760	4780	20	100								
4780	4800	20	100	split 4790-4800	55	145	385	<.001	.006	<2	
4800	4820	20	100								
4820	4830	10	100	split all	710	1100	2200	<.001	fire 1.10	42	
4830	4840	10	100	split all	455	1250	3600	<.001	.27	30	4832
4840	4860	20	100	split 4840-4850	75	445	1200	<.001	.029	8	
4860	4879	19	100								4871

Mineralogy and Structure

From	To	Chalcopyrite	Covellite	Galena	Sphalerite	Molybdenite	Gray S= or SS	Pyrite dissem'd	Pyrite vein	% S= oxidized	Limonite	Hematite	Specularite	Magnetite	Garnet	Serp-Talc	Wollastonite	K-spar total	Jaspereoid fine grid SiO2	Qtz. vein	clay	Sericite	Chlorite	Epidote	Carbonate	matrix CO3= grain size mm	% sanding, vugs	% banded	Bx. matrix %	dip of bedding, banding
4460	4480	T	-	-	-	-	T?	.1	T	-	.1	.1	-	-	2?	.5	—	—	—	.2	1	.5	3	T	15	<½	T	3	30	10-20°
	4500	-	-	-	.1+	-	T (sphal?)	.1	T	-	T	T	?	-	-	.5	-	T?	-	.5	1	.5	2-3	T	1	<½	.4	shear 10	40	40-60°
4500	4520	-	-	-	T?	?	T+	.1	.1	-	-	-	-	-	-	.5	-	T? (in siltstone?)	-	.4	3	5?	1.5	T	3	<½	.3	7	na	near 90°
4520	4540	-	-	-	T?	-	T+	.1	.1	-	-	-	-	-	-	.3	-	T?	-	.3	2	4?	4	T	1	<½	.1	35	na	70-90°
	4560	-	-	-	.1	-	T	T	T	-	-	-	-	-	-	.3	-	T?	-	.4	2	3-4	5	T	T	<½	.4	5	na	80-90
	4580	-	-	-	T?	-	T	.1	-	-	-	-	-	-	-	.3?	-	T?	1	.2	3	2	5	T?	T	<½	3 to 15	5	30	75-85
	4600	-	-	-	-	-	T	T	T	-	-	-	-	-	T?	.2?	-	T?	-	.5	2	2	5	T+	1	<½	1 to 10	15	na	60-90°
4600	4620	T	-	-	T	-	T	.1+	T	-	T	T	-	-	T	.3	-	3	T	.4	2-3	4	12	.3	T	<½	.1	T	20	?
4620	4640	T	-	?	T	-	T	.1	T	-	T	T	-	-	T	.5	-	.5	-	.3	2	2	12	.2	35	½-1	.2	25	20	60-70°
4640	4660	-	-	-	.1	-	—	.1	T	-	T	T	-	-	T+	1	-	-	-	.2	2	.5	10	T	85	½	.1	45	na	60-70°
4660	4680	-	-	-	T+	-	T	T	-	-	T	T	-	-	2?	1	-	-	2	.2	2-3	2	15	T	40	most ½-2	T+	5	v. low	60°
4680	4700	-	-	-	-	-	-	T	-	-	T	T	T	-	T	.5	-	T? (in siltstone)	-	.2	3	2	5	T	1	<½	1 to 5	T	na	70°
4700	4720	-	-	-	-	-	T-	T	T	-	T	T	.1	-	-	.6	-	T?	-	.2	4	2	5	T	2	<½	.3	15	na	60-70°
4720	4740	-	-	-	-	-	-	.1	T	-	.1	.1	T	-	-	.4	-	T?	-	.2	2	1-2	4	T	1-2	<½	.2	15	na	60-70°
4740	4760	-	-	-	-	-	-	.1	T	-	T	T	-	-	-	.4	-	T?	-	.2	2	1-2	3-4	T	T	<½	.4	20	na	60-70°
4760	4780	-	-	-	-	-	-	T+	T	-	T	T	-	-	-	.3	-	T?	-	.2	2	1-2	5	T	T	<½	.5	15	50-65	40-70
4780	4800	-	-	-	-	-	-	T	T-	-	-	-	-	-	-	.3	-	T?	-	.2	2	2	4	T	1	<½	.4	20	15	60-70°
4800	4820	-	-	?	.2	-	T+	.1	T-	-	-	-	-	-	-	1	-	T?	T	.2	2	1	2-3	T	5	<½	.4	10	na	60-70°
4820	4830	.2	-	T	.2	-	T	.2	T	-	4	4	2	-	6	.5	-	-	T	.8	1	1	7	T	20	<½	.2	-	25	na
4830	4840	.1	-	-	T+	-	T	.1	-	-	3	3	1	-	20	.5	-	-	-	.3	1	1	5	.5	35	<½	.2	-	na	na
4840	4860	-	-	-	.1	-	T+	T	-	-	T	T	T	-	2	2	-	-	-	.4	1	1	3	T	70	<½	.1	T (shear?)	na	70-90°
4860	4879	T-	-	-	T+	-	T	T	T	T	T	T-	-	-	7	6	-	-	-	.4	.4	.5	.2	T	80	<½	-	15 (shear?)	na	45-65°

Veins, Faults and Rock Type

From	To	S= veins # per foot / ∡'s	width (mm) S= vein / selvage (total) or (S= grain size)	Faults, Crushing, Shearing	Rock Type and Remarks
4460	4480	near 0	½-1/0-1	gouge bx 4462-4469 and 4479-4480	hornfels- to 4469' calcareous + green; 4469-80 tan + silty, noncalcareous
	4500	0-1/all ∡s	1-3/0-6	gouge-bx-sheared at 4483, 4485, and 4487-4491'	tan, silty hornfels, low calcite; several sheared, broken zones w/ chlorite, sericite?, clay? part calcite
4500	4520	1/most 50-90°	1-3/0-2	gougy 4501-4502, 4511', elsewhere	tan siltstone-hornfels, light-med. green soft zones, qtz. xls in vugs, chlorite in shears
4520	4540	1-2/most 40-70°	1-2/0-3	broken 4522-4524	tan-green siltstone-hornfels, soft alt'd patches (clay, chlor-ser, calcite)
	4560	0-1/near 60°	1-2/0-2	scattered broken zones	siltstone-hornfels, tan mottled with green alt. (chlor.-clay), qtz. xls in vugs
	4580	na	na	broken 4566-4567', bx. 4575-4580	vuggy siltstone-hornfels, tan with green alt.; bx. 4575-80', some exotic fragments, incl'ing ig. clasts
	4600	0-1/most 60°	1/0-2	scattered broken zones	tan to green siltstone-hornfels; soft, vuggy alt'd spots; some qtz. xls, pink calcite in veins
4600	4620	0-1/all ∡'s	1-2/0-3	gouge 4600-4602, 1BX 4612 on	tan to green siltstone-hornfels, chlorite patches, stringers
4620	4640	0-1/all ∡'s	½-1/0-2	1BX to 4622', gouge 4632', various other broken zones	tan to green siltstone-hornfels to 4632', esp. (fault there?), calc-silicate marble 4632' on
4640	4660	0-1/most 40-60°	1-4/1-8	gougy 4647-4648, most of 4649-4658'	tan marble w/ gouge-shear zones alt'd to chlorite-clay
4660	4680	na	na	gougy 4666.5-4668' at 4671, 4674-4676, 4679'	calc-silicate hornfels-marble; silty 4675-80'; minor purple jasperoid 4666'; 4" coarse (to 5mm) clear mica w/calcite at 4670.5'
4680	4700	na	na	gougy 4681-4685	tan-green siltstone-hornfels, much broken, bleached along fractures
4700	4720	near 0/80°	½/0	scattered broken zones	tan-green siltstone-hornfels, broken, alteration patchy
4720	4740	near 0/all ∡s	½/0-1	gougy 4721-4722, 4732-4734'	tan-green siltstone-hornfels, broken (but less so than above)
4740	4760	near 0/30-60°	½-1/0-1	gouge 4759-4760	tan green siltstone-hornfels, bleached along fractures, alt. patchy
4760	4780	near 0/40-60°	½/0-1	1" 1BX at 35; 4764'	tan-green siltstone-hornfels; bx. zones; strange pink mineral in vugs; stringy, patchy alt.
4780	4800	near 0/30-60°	½-3/0-4	bx. most of 4776-4780, bx 4780-4781', other minor broken zones	tan-green siltstone-hornfels
4800	4820	near 0/steep	1-2/0-1	gouge at 4802', 4810-4812'	tan green siltstone-hornfels, some calcareous, patches of sphal ≥ py
4820	4830	near 0/all ∡'s	1-2/0-1	bx 4820-4824'	bx'd skarn-hornfels to 4824'; 4824' on is calcite-chlorite-hematite (from silicate breakdown) skarn; scattered mineralization
4830	4840	na	na	gougy spots	skarn, patchy in nature; garnet-calcite-chlorite-hematite (abundant; hematite from silicate breakdown)
4840	4860	near 0/all ∡'s	1-3/0-6	gougy 4842-4844, 4850.5-4852.5	tan to light-med. green hornfels-marble (marble with silty sections?), veined by calcite-serp-talc-gypsum(?)
4860	4879	near 0/most 60°	1-2/0-2	all veined, sheared	tan to light green marble, strongly veined by serp.-talc-calcite ± gypsum(?); trace clear mica 4879'

Summary remarks

⇒ 4363-4469' calc-silicate hornfels-marble, strong garnet-calcite diopside(?), .4 hematite after silicate; low Mg, low silt; probable primary ls.

⇒ 4610-4622' 1BX - angular to rounded clasts 5 cm and smaller of skarn-hornfels, intrusive ig. rock, possible extrusive ig. rock, and sulfides; clasts sericite-py. alt'd; matrix has strong chlorite.

⇒ 4469 to 4632' tan siltstone-hornfels with green alt. patches and stringers (chlorite-clay ± ser ± calcite ± talc-serp); many broken gougy zones (alt'd); sparse py-sphal-cpy dissem'd; few sulfide-bearing fractures; porous, vuggy; some 1BX; some banding, mainly at 60-90°

⇒ 4632-4675' tan-green hornfels-marble; broken-gougy zones common; minor sulfide (pyrite very low); sulfide veins rare; some banding at 60-70°; strong chlorite-calcite-clay

⇒ 4675-4820' tan-green siltstone-hornfels; gougy zones common; very low sulfide, few sulfide veins; clay-ser-chlor alt. common, esp. of gouge zones; banded (bedded?) at 60-70°

⇒ 4820-4840' skarn hornfels; abundant garnet calcite-chlorite-hematite (hem. from silicate breakdown?), scattered cpy-sphal-py

⇒ 4840-4879' tan to green marble (some silty), strongly veined by serp.-talc-calcite ± gypsum(?), minor sphalerite, trace pyrite only

(4)

GEOLOGIC LOG

PROJECT: TRENCH — HOLE NO.: TCH-2(A)
Collar elev.: 2912' down TCH-2 — Final depth: 5121'
Coord N.: 5311' — Inclination: 20° from vert., S60°W
Coord E.: 3454' — Page 4 of 5
Logged by: S. A. Catlin
Date begun: 8/31/81 — Date finished: 1/15/82

Depth, recovery, comments and assay

From	To	Interval	% Recovery	Comment (dip + bearing or assay interval)	Cu ppm	Pb ppm	Zn ppm	Au oz/ton	Ag oz/ton	Mo ppm	Thin section
4879	4890	11									4889.5
	4879-81	(2)	100								
	4881-82	(1)	0	cave material - reground							
start AX	4882-86	(4)	25								
	4886-88	(2)	50?	2 feet of rubble - some core, some cave							
	4888-90	(2)	50?	2 feet of rubble - some core, some cave							
4890	4900	10	100	split all	5	590	225	<.001	<.006	<2	4899
4900	4920	20	100								
4920	4930	10	100	5" of cave at 4920 and at 4923.7							
4930	4940	10	100	split 4932-4937	70	410	720	<.001	.02	60	4930
4940	4950	10	100	split all	80	165	2000	<.001	.06	30	
4950	4970	20	100								
4970	4990	20	100	split 4978-4985	40	55	105	<.001	<.006	<2	4973
				and 4985-4990	15	420	2000	<.001	.029	<2	4987
4990	5000	10	100	split all	5	30	175	<.001	<.006	<2	
5000	5010	10	100	split 5010-5014 →	390	590	770	<.001	.13	<2	
5010	5020	10	100	5014-5020 →	1150	610	3100	<.001	.20	42	
5020	5030	10									
	5020-22	(2)	75	2 feet of loose rubble - some cave?							
	5022-23.5	(1.5)	50	1.5 feet of loose rubble - some caved material							
	5023.5-24	(.5)	50	4" of loose rubble - some cave?							
	5024-25	(1)	40	6" of loose rubble - some cave?							
	5025-26	(1)	80	1 foot of broken pieces							
	5026-27	(1)	60	10" of broken pieces							
	5027-30	(3)	100	3 feet plus of broken pieces							
5030	5040	10	100								
	5030-32	(2)	80	2 feet of broken pieces							
	5032-33	(1)	80	10" of loose rubble							
	5033-34	(1)	50	10" of loose rubble - reground							
	5034-35	(1)	90	1 foot of broken pieces							
	5035-38	(3)	100	3 feet of broken pieces							
	5038-40	(2)	70?	interval 5038-43' has 4.5" rubble, cave(?)							
5040	5050	10		split 5040-5047 →	35	20	380	<.001	.006	32	5049
	5040-43	(3)	70?	5047-5050 (see above) →	600	2500	6400	<.001	.85	2	
	5043-45	(2)	50	2 feet of loose rubble, caved material							
	5045-46	(1)	65	1 foot of broken pieces							
	5046-47	(1)	60	1 foot of broken pieces							

Mineralogy and structure

Interval	chalcopyrite	covellite	galena	sphalerite	molybdenite	gray S=	pyrite disseminated	pyrite vein	% S= oxidized	limonite	hematite	specularite	magnetite	garnet	serp-talc	wollastonite	K-spar total (probable secondary)	jasperoid fine gr. SiO2	qtz. vein	clay	sericite	chlorite	epidote	carbonate	matrix CO3= / grain size mm	% sanding vugs	% banded	Bx matrix	dip of bedding banding	S= veins # per foot / ∠'s	width (mm) S= vein / selvage (total)	faults crushing shearing
4879-4890	-	-	-	-	-	T-	T	-	-	T	T	-	-	-	70	-	-	-	-	-	T	T	-	20	<½	?	10	na	65-70	na	na	all broken; reground in spots
4890-4900	-	-	T	.2	-	T+	T	T	-	.2	.2	-	-	-	25	-	-	-	-	-	-	-	-	70	½-1	-	10	na	60-70	3/45-65	½-1/0-12	slicks on some talc veins
4900-4920	T-	-	-	.1?	-	T+	T	T-	-	T-	T-	-	-	-	20	-	-	-	-	T	-	T	-	75	½-2	-	20	na	60-70	0-1/45-70	½-1/0-1	broken 4913-4915
4920-4930	-	-	-	-	-	T-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	?	-	40	<½	-	15	na	60	near 0/60	½/0	caved at 4920 and 4923.7
4930-4940	.1	-	-	.3	-	T	T	.1	-	-	-	-	-	8	5	-	-	-	-	T	-	T	T	20	½-2	-	-	na	na	near 0/40-50	1-3/0	—
4940-4950	.1	-	T-	.4	-	T+	T	-	-	-	-	-	-	.5	2	-	-	-	-	T	.5 (coarse)	T	T-	50	¼-2	-	-	na	na	na	na	—
4950-4970	-	-	-	.1	-	T+	T	T-	-	-	-	-	-	T	25	-	-	-	-	T	-	T	-	70	½-1	-	15	na	60-70	near 0/60	½-1/0-1	broken, sheared 4950-54
4970-4990	T-	-	-	.4	-	T+	T	-	-	-	-	-	-	-	18	-	-	-	-	3	.1 (coarse)	.2	-	55	½-2	-	-	na	na	na	na	—
4990-5000	-	-	-	.1	-	T+	T	T-	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-	90	1	-	-	na	na	near 0/varies	½-1/0-1	—
5000-5010	-	-	-	.1	-	T	T	-	-	-	-	-	-	-	10	-	-	-	-	1	T	-	-	50	1	-	5	na	60-70	na	na	broken at 5006'
5010-5020	.5	-	-	.1	-	T+	.3	-	-	T	T	-	-	-	40	-	- (maybe some detrital)	-	-	.3	1 (coarse)	T?	-	35	½-1	T (shear?)	10	na	45-70	na	na	broken at 5020'
5020-5030	-	-	-	-	-	T-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	.5	<½	?	-	na	na	na	na	all broken up
5030-5040	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	- (maybe some detrital)	-	-	5	2	-	-	.8	<½	T?	-	na	na	na	na	all broken
5040-5050	.1	-	-	.4	-	T+	T	-	-	-	-	-	-	-	2	-	-	-	-	10	1	-	-	30	1	50?	-	na	na	na	na	broken, gougy to 5048'

Rock type and remarks

Interval	Rock type and remarks
4879-4890	tan marble, some silty, strong talc content; maybe gypsum too; 4879-81' more calcitic, 4882-86' more talcy, 4886-88' more silty; all cut by talc-serpentine veins (± gypsum?), all 11' broken, has cave material, poor recovery; darker brown near bottom
4890-4900	white to tan to lime-green talc-serpentine marble, talc-serp veins, wispy S= stringers also some hematite in stringers
4900-4920	white to tan to light green talc-serp. marble, talc serp veins
4920-4930	light gray talcy marble with hard siltstone (qtzite?) layers, silty at 4922', 4924', 4926-30'.
4930-4940	light gray siltstone with interbedded marble (4936-37') and garnet skarn (4931-32'), talc-calcite veins
4940-4950	tan to light green silty marble 4940-46, tan siltstone qtzite 4946-50', sphal > cpy = py in marble, also coarse white mica in veins in marble
4950-4970	tan to gray to yellow-green talc-serp. marble; talc-serp-calcite veins
4970-4990	light gray to yellow-green to near black serp. marble 4970-85; serp-bearing siltstone 4985-90'; mica at 4988'-89
4990-5000	white to light gray to yellow-green serp. marble
5000-5010	gray and yellow-green serp. marble with silty layer 5004-08'
5010-5020	white to gray serp. marble 5010-14; dark green serpentinite 5014-18'; mica marble 5018-19; siltstone qtzite 5019-20'; dissemd. cpy > py > sphal
5020-5030	light olive green siltstone-qtzite; talc-serp veins and patches scattered through
5030-5040	light olive green siltstone; mica veins, patches throughout; minor serpentine
5040-5050	clayey, broken siltstone 5040-45; hard gray siltstone 5045-47; tan, serp-bearing marble 5047-50 - has mica and also sphal > cpy > py disseminated

⇒ 4879-4922' like 4840-79' logged earlier: white to tan to green talc-serp-gypsum?) marble, veined by same minerals (talc-serp-gyp-calcite); minor dissemd. S=, little is pyrite; minor silty component

⇒ 4922-5081' white to gray to tan to light green serpentine marble with siltstone interbeds of a few inches to 28 feet (5019-5047'); disseminated sulfides sphal > cpy > py; scattered clear mica veins, patches; badly broken, gougy in spots - clay bearing there;

(5)

GEOLOGIC LOG

PROJECT: TRENCH — HOLE NO.: TCH-2(A)
Collar elev.: 2912' down TCH2 — Final depth: 5121' from vert.
Coord. N: 5311 — Inclination: 20°, S60°W
Coord. E: 3454 — Page: 5 of 5
Logged by: S.A. Catlin
Date: 8/31/81 — Completed: 1/15/82

DEPTH From	To	Int.	% Rec.	Comment dip + bearing or assay interval	ASSAY Cu ppm	Pb ppm	Zn ppm	Au oz/ton	Ag oz/ton	Mo ppm	thin section	MINERALOGY AND STRUCTURE: chalcopyrite	covellite	galena	sphalerite	molybdenum	gray ST or ☐	pyrite (disseminated)	pyrite (veinlets) % sulfide	% oxidized	limonite	hematite	specularite	magnetite	garnet	serpentine	wollastonite	K-spar total	K-spar secondary	qtz vein	clay	sericite	chlorite	epidote	carbonate	matrix CO3	grain size (mm)	% leached	% vuggy	bx matrix %	dip of bedding, banding	ST veins %	AS	width (mm)	ST very	salvage (rqd)	ST jrnl SIZE	faults	crushing	shearing	TEXTURE AND REMARKS
	5047.50	(3)	100																																																
5050	5060	10	100	split 5050-5055 → 5055-5060 →	495	335	1.0%	<.001	.093	12		.2	-	-	2	-	T	T	-	-	-	-	-	-	5	-	-	-	-	-	T	-	-	90	1.2	-	20	na	70-80	na		na		—					tan-gray marble with some serpentine, disseminated ST's sphal > cpy > py;
					40	425	520	<.001	.006	<2																																									
5060	5065	5	100									-	-	-	T	-	T+	-	-	-	-	-	-	-	20	-	-	-	-	-	T?	-	75	1	-	20	na	shear? 60-70°	na		na		—					serpentine marble; gray with green mottling
5065	5070	5										-	-	-	T	-	—	.1	-	-	-	-	-	-	1	-	-	-	-	-	coarse 1?	-	-	1	<½	?	-	na	na	na		na		all broken, rubbly					gray to light olive green siltstone-qtzite; coarse white mica around 5070'
	5065-68	(3)	55	2 feet of broken pieces																																															
	5068-70	(2)	30	interval 5068-5071 has 1.5 feet of loose rubble-caved material																																															
5070	5078	8										-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	.5	coarse 2?	-	-	T	<½	?	-	na	na	na		na		all broken					gray siltstone with minor talc-serp in veins, scattered; low or no ST; coarse white mica 5070-71'; pink colored at 5078 (may be a stain - a drilling chemical?)
	5070-71	(1)	30	interval 5068-5071 has 1.5 feet of loose rubble-caved material																																															
	5071-73	(2)	20	10" of loose rubble - cave (?)																																															
	5073-75	(2)	40	1.5 feet of loose rubble, pieces, caved material																																															
	5075-76	(1)	90	1 foot of broken pieces																																															
	5076-78	(2)	90	almost 2 feet of broken pieces																																															
5078	5090	12		split 5081-5086	340	1000	2700	<.001	.105	4		T	-	-	.5	-	.2	.2	T	-	-	-	-	-	2	2	-	2	T	T	coarse .8	.1	.1	40	<½	past ?	-	na	na	<1/40-50	1.2/0-1		all broken					gray siltstone 5078-81; serpentine-mica-sulfide marble with some wollastonite -jasperoid (purple-hued) 5081-86; hornfels with calcite, wollastonite, silica (may be a siltstone?), white-colored 5086-91'
	5078-81	(3)	15	14" of loose rubble, pieces																																															
	5081-84	(3)	100	3' of broken pieces, good core																																															
	5084-86	(2)	80	2' of broken pieces, rubble, core, some reground																																															
	5086-87	(1)	100	16" of broken pieces, core																																															
	5087-89	(2)	20	10" of broken pieces, rubble																																															
	5089-90	(1)	35	12" of broken pieces for interval 5089-91																																															
5090	5100	10		split all	55	100	580	<.001	.02	34		T	-	-	T+	-	T+	-	-	-	-	-	-	-	1	8	-	20	.1	.3	coarse 1.5	.2	-	60	½	?	-	60	na	<1/all ½-1	½-1/0-3		all broken					mica marble 5091-94; chert-jasperoid 5094-96; mica-wollastonite marble with jasperoid (pink-gray) spots 5096-5100 one piece of reground IBX in rubble at 5094'
	5090-91	(1)	35	12" of broken pieces for interval 5089-91																																															
	5091-94	(3)	90	3' of broken pieces, good core							5094																																								
	5094-95	(1)	40	10" of broken pieces, rubble							5095																																								
	5095-98	(3)	95	3' of broken pieces, good core							5098																																								
	5098-100	(2)	85	2' 8" of broken pieces for interval 5098-5101																																															
5100	5112	12										-	-	-	-	-	T	T	T	-	-	-	-	-	80	-	12	.1	.1	coarse T	.2	.1	5	<½	-	-	? low	na	<1/steep ½/0		all broken					white rock with some calcite, strong wollastonite and secondary silica; possibly some primary chert (as at 5112') 5107-5112 may be brecciated
	5100-101	(1)	85	2' 8" of broken pieces for interval 5098-5101																																															
	5101-04	(3)	100	3' of broken core																																															
	5104-05	(1)	100	14" of broken core																																															
	5105-07	(2)	60	14" of broken core																																															
	5107-12	(5)	45	2' 4" of broken pieces																																															
5112	5121	9		split all	5	130	55	<.001	.006	2		-	-	-	-	-	-	-	T	T	-	-	-	-	T?	4	2	-	80	T	T	-	.8	.1	10	½	-	-	na	na	<1/all ½-1	½/0		scattered shears with chlorite					mixed marble and high-silica rock (chert or jasperoid); light green-gray colored; fractures with chlorite-calcite
	5112-17	(5)	30	2' of broken pieces, rubble																																															
	5117-19	(2)	35	13" of broken pieces, rubble																																															
	5119-21	(2)	65	18" of broken pieces																																															

composites:

4120	4160	40'	100	1.48%	3100	6000	fire 2.20	
4310	4337	27'	100	1.22%	6700	3300	A.A. 4.05	4.76 fire

Assay notes:
1.) – means nil
2.) all data from Kerr-McGee assay logs.

GEOLOGIC LOG

PROJECT KERR-McGEE THUNDER MTN
Patagonia Mtns., Ariz

PROJECT Kerr McGee - T.M.
HOLE NO. RR-1
Collar elev. ____
Final depth 821
Coord N. ____
Coord E. ____
Inclination N75°W @ -60°
Page 1 of 1
Logged by FTG
Date start 11/26/65
Date finish 1/20/66

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	Pb, Zn, Au, Ag assay interval	ASSAY Cu	Pb	Zn	MoS_2	Au oz.	Ag oz.	ORE: chalcocite	ORE: enargite	GANGUE MINERALS: pyrite-diss	pyrite-vein	limonite	hematite	clay	sericite	quartz-diss	quartz-vein	alunite	STRUCTURE: sulfide veins	faults	breccia	ROCK TYPE and REMARKS
0	7	7																							0-7: Rockbit
7	20	13							–	tr					3	1	15	15			5				7: LAPILLI TUFF: white, compact; clasts <½" dia, subrnd; perv. alt. w. alun. in veins.
	40	20							.002	.30			tr		1	3									24: SILICA TUFF: gray, dense; very siliceous w 60-80% silica; contacts broken but look
	60								tr	.14			tr		1	1	tr								sharp - prob. not hydrother. silicif.; silica very f.gr.; vague ghosts of ang. frags
	80								tr	.26			1		1	3	tr								throughout; spotty small vugs sugg very wk bx.; transp lim-hem on joints,
80	100				.05				tr	.12			1		1	4	tr								mixed w. spotty med. gr. diss. py.; 95-122 ft. has indig maroon-blk lim
	120				.06				.010	.10			tr		1	6	tr								
	140								.025	.08					3	2	20	5			3				128: LAPILLI TUFF: white, compact; nature of frags unclear - <1", subrnd; 128-135' resembles
	160				.16				tr	.06	.12	.04	tr	2	1	1	20	20			5	4(?):30°			vitrophyre; alt is pervas. f.gr. ser(?), py assoc w. alun. vns; cc coats py.
	180				.35				.002	.06			1	tr		1	5	40			5				177: SILICA TUFF: gray, brkn; 60-80% v. f.gr silica; occas. vague frag outlines,
180	200								.005	.20					1	1									wk, irreg vugs; contacts brkn but prob. sharp.
	220								tr	.09					1	1		tr							
	240				.01				–	.07			tr		1	1		5			1				238: LAPILLI TUFF: lt.gy, compact; clasts < ½" dia, ang-subrnd, form 40-80%,
	260				.11						.08	.03	1		2		20	5			4				include silica tuff, qtzt(?), qtz. mz por., por. volc. Poss. bedd 320-340 ft
	280				.20						.12	.08	2		2		15	5			5			270	@ 5° to core. Alt is pervasive but texture clearly visible. Py uniform dissem
280	300			251-300	.30	.008	.003		tr	.14	.25	.05	2		3		15	5			7				w cc. coat. Irreg 1"-4' completely leached intervals to 374'. Alunite in
	320				.05						.05		1		4		15	5			6			very weak	⅛" vns and irreg masses to 1" dia - sugg. pervas., v. wk brecciation (<1% vugs)
	340				.08						.08		1		5		10	10			4				
	360				.21						.10	.11	2		4		10	10			4				
	380			300-380	.22	.004	.002		–	.08	.17	.05	2		4		5	15			3			375	379: rapid change to strong, pervasive sericite alteration, no obvious incr. in
380	400				.93						.20	.73	3					50			1				qtz; lapilli text. mostly destroyed, rock is soft. Py is med-c.gr; dissem;
	420			380-410	.24	.004	.01		–	.18		.24	3					60							enar in contact w. and often rims pyrite; cc absent. Strength of
	440				.16							.16	2					60							alt grad. weakens. w. depth
	460			410-450	.23	.002	.003		tr	.04		.23	3					40							
	480				.60							.60	3					50							
480	500			450-490	.36	.002	.01		–	tr		.36	2					40			1				
	520				.08							.08	2					40			1				520: rare angular qtz. crystals appear irregularly - indicate transition to
	540			490-530	.32	.002	.005		–	tr	tr	.32	4		1			40			3				qtz eye lapilli tuff and qtz feld. por; q.f. por sugg. by rare zones w.
	560				.22							.22	4					40			2				tabular aggreg. of med-c.gr sericite
	580				.25							.25	3		tr			35			1				
580	600			530-590	.28	.005	.008		–	.04		.28	3					35							
	620				.22							.22	3					45							
	640				.36							.36	3					45							
	660				.34							.34	3					60							
	680				.22							.22	3					40							
680	700			590-700	.30				–	.10		.30	4					50							
	720				.10						.05	.05	3		1	1		50			3				
	740				.14							.14	3					50			5				
	760				.04							.04	2					35			1				
	780				.13							.13	2					40							
780	800				.05						.03	.02	1		2	1		30							787-821: lapilli tuff is completely leached w. lt brn-blk lim
	821	21		780-821	—				tr	tr					4			35							

mn 2555 dm

NOTES: ORE MINERALS - ESTIMATED % METAL V = VEIN/FRACTURE FILLED D = DISSEMINATED
GANGUE MINERALS - PYRITE AS %
" " - SILICATE - SULFATE - CARBONATE ALTERATION AS %
" " FeOx MINERALS AS %
STRUCTURE: RQD = % OF GREATER THAN 5" CORE LENGTHS IN RUN

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN. HOLE NO. BB-2
Collar elev. 5145 Final depth 516.5
Coord N. 171,010 Coord E. 865,425
Inclination -35° S45W Page 1 of 2
Logged by H. DOWNEY
Date start 7/11/90 Date finish 8/8/90

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	ASSAY % Cu	ASSAY JABA Cu	ASSAY PPM Ag	ASSAY JABA OZ/T Ag	ASSAY PPM Au	ORE MINERALS CHALCOCITE	COVELLITE	BORNITE	MOLYBDENITE	STHALENITE	GALENA	GANGUE MINERALS PYRITE D	PYRITE V	GOETHITE	JAROSITE	RED HEMATITE	SERICITE	KAOLINITE	QUARTZ VEIN	QUARTZ DISS.	ALUNITE	CALCITE	STRUCTURE OPEN FRACT/FT @ ∠ (∠ = ∠ TO CORE AXIS)	FAULTS	RQD %	ROCK TYPE and REMARKS
0	12	12	—	—	—	—	—	—																					ROCKBIT TO 12'
12	20	8	95	0.03	0.05	0.5		.012	.01 D	.01 D	TR D				3					60	10	2	10	5		1 @ 60°		60	12 - QUARTZ FELDSPAR PORPHYRY: White, soft intensely altered porphyry - groundmass 75% 3 mm. feldspar (plagioclase?) phenocrysts in quartz, ground mass. Feldspar 90% altered to sericite and probably some argillic minerals. Pyrite disseminated throughout and
20	30	10	100	0.02	0.21	0.2		.014	.01 D	.01 D	TR		0.05	TR	3					60	10	2	10	5		1 @ 60°		70	
30	40			0.04	0.05	0.5		.016	.01 D	.01 D	TR				3	2				60	10	2	15	5		1 @ 60°		80	
40	50			0.48	0.22	0.9	0.4	.010	.05 D .05 V	.01 D	TR				3	2				60	10	2	10	5		1 @ 60°		70	
50	60			0.58	0.23	5.0		.026	.1 D .1 V	.05	TR				3	2				60	10	2	10	5		2 @ 45		40	in cavities and billowy open fractures as veinlets (not quartz veins)
60	70			0.51	0.34	4.0		.012	.1 D .1 V	.1 D	TR				3	2				60	10	2	10	5		2 @ 60		50	Chalcocite coats and lines pyrite - covellite probably coating pyrite
70	80			0.72	0.40	2.7		.022	.3 D .1 V	.1 D .1 V	TR				5	3				60	10	2	15	5		1 @ 45		70	and molybdenite? Sphalerite blebs @ 27.5. Alunite/kaolin filling
80	90			0.82	0.39	1.8		.024	.3 D .1 V	.1 D .1 V	TR				5	3				60	10	2	15			2 @ 45		60	voids and fractures. No mafic minerals
90	100			0.51	0.40	1.1		.006	.3 D .3 V	.1 D .3	TR				5	2				60	10	2	15			1 @ 70		50	
100	110			0.22	0.29	1.8		.026	.1 D .05 V	.1 D	TR				4	2				60	10	2	15			1 @ 70		80	120 - QFP predominant but short sections are clastic
110	120			0.19	0.20	2.1		.020	.1 D .05 V	.1 D	TR				4	1				60	5	2	15			1 @ 45		70	- 176.5 (quartz eye tuff) with angular fragment 1-3 mm.
120	130			0.41	0.67	1.7		.030	.1 D .05 V	.1 D	TR				4	1				60	5	2	15			1 @ 45		50	quartz shards, white volcanic tuff, occasionally
130	140			0.26	0.96	1.1		.026	.1 D .05 V	.1 D	TR				4	1				60	5	2	15			1 @ 60		60	grey volcanics. 123-136, 155-158 -
140	150			0.04	0.54	2.0		.006	.1 D .05 V	.1 D	TR				4	1				60	5	2	10			1 @ 70		50	
150	160			0.11	0.41	1.2		.036	.1 D .05 V	.1 D	TR				4	1				60	5	2	10			1 @ 60		60	78-88 Breccia zone - Angular frags of QFP in siliceous
160	170			<.01	0.45	3.4		.012	.1 D .05 V	.1 D	TR D				4	1				60	10	2	10			1 - 45	162-165	60	pyritic matrix - abundant sooty chalcocite associated
170	180			<.01	0.28	7.6		.016	.1 D .05 V	.1 D	TR D				3	1				40	5	5	20			<1 - 60		80	with pyrite in matrix
180	190			0.34	0.54	4.5		.012	.1 D .05 V	.1 D	TR D				4	1				50	10	2	5			1 - 60		70	
190	200			0.22	0.49	7.3		.024	.1 D .05 V	.1 D	TR D				4	1				60	10	2	10			<1 - 60		80	112-113 Short breccia zone not as mineralized as above
200	210			0.14	0.78	4.4	0.3	.040	.1 D .05 V	.1 D	TR D				4	1				60	10	2	10			<1 - 45		80	162-165 Fault? breccia - sooty chalcocite? pyrite filling voids & fractures
210	220			0.36	0.69	2.2		.006	.1 D .05 V	.1 D	TR D				4	1				50	20	2	10			1 - 45		80	176.5 - 183.0 VOLCANIC AGGLOMERATE: Lapilli to block size (5mm. - 2")
220	230			0.20	0.69	3.4		.020	.1 D .05 V	.1 D	TR D				4	1				50	20	2	10			<1 - 60		80	angular & rounded fragments grey andesite, pebble tuff, lithic tuff in
230	240			0.20	0.52	3.0		.022	.1 D .05 V	.1 D	TR D				5	1				50	20	2	10			<1 - 60		80	QFP matrix. Minor pyrite disseminated.
240	250			0.15	0.98	4.9		.016	.1 D .05 D	.1 D	TR D				5	1				50	20	2	10			<1 - 60		80	
250	260			0.33	0.82	14.0		.008	.1 D .1 V	.1 D	TR D				5	1				50	20	2	10			1 - 60		80	183.0 - 352.3 QUARTZ FELDSPAR PORPHYRY: White, soft, intensely
260	270			0.21	0.92	60.0		.050	.3 D .3 V	.3 D	TR D				5	2				50	20	2	10			1 - 70		80	sericitized quartz eyes. Pyrite blebs 1-5 mm. disseminated
270	280			0.32	0.59	44.0		.070	.3 D .3 V	.3 D	TR D				5	2				50	20	2	10			1 - 70		90	throughout. Minor quartz veining with associated pyrite.
280	290			0.28	0.64	15.0		.030	.4 D .2 V	.3 D	TR D				5	2				50	20	2	10			<1 - 80		90	Pyrite commonly rimmed with chalcocite/covellite.
290	300			0.25	0.83	7.8		.034	.4 D .2 V	.3 D	TR D				5	2				50	20	2	10			1 - 45		80	Better copper section 262' - 318'
300	310			0.42	0.71	7.8		.040	.3 D .1 V	.3 D	TR D				5	2				50	20	2	10			<1 - 80		90	
310	320			0.43	0.56	7.9		.030	.2 D .05 V	.1 D	TR D				5	1				50	20	2	10			1 - 80		90	
320	330			0.20	0.89	4.5		.030	.2 D .05 V	.1 D	TR D				4	1				50	20	2	10			1 - 60	322.0 322.3	90	322-322.5 3" gouge @ 45°
330	340			0.29	0.46	6.0		.012	.2 D .05 V	.1 D	TR D				4	1				50	20	2	10			1 - 70		80	501.5 INTRUSIVE?
340	350			0.31	0.89	3.2		.014	.3 D .05 V	.1 D	TR D				4	1				50	20	2	10			<1 - 70		90	352.3 - TUFFACEOUS BRECCIA: Angular to rounded volcanic & crystalline
350	360			0.26	0.82	2.7		.03	.3 D .2 V	.05 D					4	1				30	10	3	15			<1 - 45		90	fragments in quartz eye tuff matrix. Predominant frags
360	370			0.17	0.87	2.8		.02	.3 D .1 V	.05 D					4	1				30	10	3	15			<1 - 70		90	are dark grey to black andesite - some are porphyritic - frag
370	380			0.12	0.62	3.8		.04	.3 D .1 V	.05 D					4	1				30	10	3	15			1 - 70		90	sizes from 1 mm to 2" become larger and more common
380	390			0.09	0.64	1.6		.02	.2 D .1 V	.05 D					4	1				25	10	3	15			<1 - 70		90	with depth. This unit may also be a volcanic flow
390	400			0.20	0.89	6.6		.05	.2 D .1 V	.05 D					4	2				25	10	3	10	1		<1 - 70		90	breccia (lapilli agglomerate) but lacks distinctive flow-
400	410			0.05	0.97	4.7		.06	.2 D .1 V	.05 D					4	2				25	10	3	10	5		<1 - 70		90	banding. Less altered than QFP. Abundant disseminated
410	420			0.12	0.80	4.1		.05	.2 D .1 V	.05 D					4	2				35	10	3	10	3		1 - 70		80	pyrite and fracture filling pyrite seams. Chalcocite rimming
420	430	↓	↓	0.14	0.63	3.8		.03	.2 D .1 V	.05 D					4	2				35	10	3	10	3		<1 - 70		90	pyrite and associated with pyrite in seams & veinlets cover-

mn 2555 dm

TRIM LINE TRIM LINE

GEOLOGIC LOG

PROJECT THUNDER MTN

PROJECT THUNDER MTN. HOLE NO. BB-2
Collar elev. 5145 Final depth 516 1/2
Coord N. 111,010 Coord E. 865,425
Inclination -35° S 45° W Page 2 of 2
Logged by
Date start 7/11/90 Date finish 8/8/90

DEPTH from	DEPTH to	int'vl	% CORE RECOV.		ASSAY % Cu	ASSAY JABA Cu	ASSAY PPM Ag	ASSAY JABA oz/T Ag	ASSAY PPM Au	ORE MINERALS: CHALCOCITE	COVELLITE	BORNITE	GANGUE MINERALS: PYRITE D	PYRITE V	GEOTHITE	JAROSITE	RED HEMATITE	SERICITE	KAOLIN/ILLITE	QUARTZ VEIN	QUARTZ DISS	ALUNITE	STRUCTURE (∠ = ∠ TO CORE AXIS): OPEN FRACT/FT-∠	FAULTS	RQD	ROCK TYPE and REMARKS
430	440	10	100		0.15	0.59	6.0		.06	.2 D .1 V	.05 D		4	2				35	10	3	15	1	<1-70		90	CONT. - TUFFACEOUS BRECCIA (AGGLOMERATE) Some fractures are
440	450				0.17	0.90	1.2		.03	.05 D .05 V	TR D		4	1				35	10	3	25	1	<1-70		90	filled with pyrite, rich black silica (chert) - also discovered
450	460				0.13	0.55	1.0		.02	.05 D .05 V	TR D		3	1				35	10	3	25	1	<1-70		90	a white alunite - 6" alunite seam or seen at 404'. Forming
460	470				0.03		0.5		.02	TR D TR V			3	TR		2		20	5	3	35		<1-60		90	red hematite blebs w/fine grained pyrite 461'-465'. Copper
470	480				0.14		0.4		.05	TR D TR V			2	TR		1		10		5	40		<1-60		90	decreasing after 430. NO SULFIDES BELOW 485 (A few cents
480	490				0.19		2.2		.19	TR D TR V			1	TR		1				5	50		1-60		80	after pyrite in oxidized zone 486 - 490)
490	500				0.10		2.9		.10	TR D TR V						1				5	50		1-45		80	-501.5 Brown AGGLOMERITIC SCORIA - open vesicular in ash
500	510				0.01		1.6		.10							1				5	70		2-45		50	511.5 matrix - siliceous grey angular fragments to 1" dia. Well
510	516.5				0.01		1.2		.06											5	70		3-45		25	defined contact @ 45° @ 511.5.
			BOTTOM	OF	HOLE		516.5																			-516.5 Grey BRECCIATED CHERT layer - Large angular fine grained very siliceous chert fragments interlayed w/ angular cherty lapilli agglomerate. Nil sulfides - red hematite coatings on voids.

TRIM LINE

TRIM LINE

mn 2555 dm

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN
Collar elev. 5145
Coord N. 171,010
DUE NORTH Inclination -45°
Logged by H. DOWNEY
Date start 8/8/90

HOLE NO. BB-3
Final depth ~~[illegible]~~ 725
Coord E. 865,425
Page 1 of 2
Date finish 9/4/90

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	ASSAY % Cu	ASSAY oz/T Au	ASSAY oz/T Ag	ORE: CHALCOCITE	ORE: COVELLITE	ORE: BORNITE	GANGUE MINERALS: PYRITE-DISS	PYRITE-VEIN	SERICITE	ARGILLIC	QUARTZ-VEIN	QUARTZ-DISS	ALUNITE	STRUCTURE: OPEN FRACTS/FT. - ∠	FAULTS	RQD %	ROCK TYPE and REMARKS
0	14	14																		OVERBURDEN (ROCK BIT)
14	20	6	95	0.13	0.046	<0.01				2		60	10	1	10		1-70		60	14- QUARTZ FELDSPAR PORPHYRY - Light grey to white, salt
20	30	10	100	0.55	<0.002	0.02	0.05D	0.05D		2		60	10	1	10		1-60		80	intensely altered (sericite). Original texture distinctly
30	40			0.80	<0.002	<0.01	0.05	0.05D		2		60	10	1	10		2-45-60		40	alteration. Originally 75% P/feldspar? 10% quartz -
40	50			0.51	0.002	0.03	0.05D	0.05D		3		60	10	1	10		2-45		20	lost to sil. mafics. 2-3% pyrite ½ mm - 1 mm
50	60			1.30	<0.002	<0.01	0.05	0.05D		3		60	10	1	10		2-45		30	blebs - trace covellite & chalcocite staining some
60	70			0.62	<0.002	<0.01	0.05D	0.05D		3		60	10	1	10		1-60		60	of the pyrite.
70	80			0.28	<.002	0.16	0.05D	0.1D	TR D	3		60	10	1	10		1-45		50	
80	90			0.44	<.002	0.08	TR D	0.05D	TR D	2		70	10	1	10		1-45		50	
90	100			0.06	<.002	<.01		0.05D	TR D	2		70	10	1	10		<1-45		80	
100	110			0.11	<.002	0.01		0.05D	TR D	2		70	10	1	10		<1-60		90	
110	120			0.10	<.002	0.01		0.05D 0.05V	TR D	2	1	70	10	2	10		<1-70		80	1 mm veins @ 35° 110-120
120	130			0.18	<.002	0.05		0.05D 0.05V	TR D	2	1	70	10	2	10		<1-70		90	Pyrite blebs increase in size (up to 4mm dia) slight
130	140			0.18	<.002	<.01		0.05D 0.05V	TR D	2	1	60	10	2	20		<1-70		90	increase in pyrite veining 110-
140	150			0.07	<.002	<.01		0.05D 0.05V	TR D	2	1	60	10	2	20		1-45		60	
150	160			0.01	<.002	<.01		0.05D 0.05V	TR D	2	1	60	10	1	20		1-70		70	
160	170			0.05	<.002	<.01		0.1 D	TR D	2		70	10	1	10		2-60	164-170?	20	Gouge zone - may be fault 164-170
170	180			0.01	<.002	<.01		0.1 D	TR D	2		70	10	1	10		1-70		50	
180	190			0.08	<.002	0.03		0.1 D	TR D	2		70	10	1	10		1-70	182-184?	70	" " " " " 182-184
190	200			0.04	<.002	0.15		0.1 D	TR D	2		70	10	1	10		1-60		60	
200	210			<.01	<.002	<.01		0.1 D	TR D	3		70	10	1	10		1-60		70	
210	220			0.07	0.002	0.07		0.1 D	TR D	3		60	20	1	10		1-60	217.5-219	60	217.5-219 FAULT BRECCIA Angular lapilli size fragments - dark
220	230			0.12	<.002	0.10		0.1 D	TR D	3		60	10	1	20		1-70	224-232	70	grey volcanics - light grey clay gouge matrix.
230	240			0.04	<.002	0.11		0.1 D	TR D	3	1	60	20	2	10		1-70	238-245	50	224-232 Ditto - sections of breccia or agglomerate - some frags are
240	250			0.06	<.002	0.01		0.1 D	TR D	3		60	10	1	20		2-70		30	gouge 238-245 block size.
250	260			0.09	<.002	0.05		0.1 D	0.1 D	3	1	60	10	3	20		1-60		70	The pyrite seen throughout the hole and particularly at
260	270			0.12	<.002	0.01		0.1 D	0.1 D	3		60	10	1	20		1-70		60	250-260 has definite peacock - purple coating suggesting
270	280			0.07	<.002	<.01		0.1 D	TR D	3		60	10	1	20		<1-70		80	fine grained bornite intermixed. Covellite coatings
280	290			0.07	<.002	0.04		0.1 D	TR D	3		60	10	1	20		<1-70		80	may be alteration of bornite. Do some polished
290	300			0.08	<.002	0.09		0.1 D	TR D	3		60	10	1	20		1-70		70	sections for check.
300	310			0.05	0.004	0.07		0.1 D	TR D	3		60	10	1	20		1-70		50	
310	320			0.06	0.004	0.03		0.1 D	TR D	3		60	10	1	20		1-80		50	
320	330			0.03	0.002	0.04		0.1 D	TR D	3		60	10	1	20		1-80		50	
330	340			0.07	<.002	0.01	0.2 D	0.1 D	TR D	3		60	10	1	20		1-70		70	340-342 Pyrite oxidized to brown FeOx - a few chalcocite blebs.
340	350			0.06	<.002	<.01	0.2 D	0.1 D	TR D	3		60	10	1	20		1-60		60	
350	360			0.07	<.002	<.01	0.05 D	0.1 D	TR D	3		60	10	1	20		1-60	250-394 352-365	60	gouge sections 350-360
360	370			0.10	<.002	<.01	0.05 D	0.1 D	TR D	3		60	10	1	20		1-60		70	
370	380			0.04	<.002	0.02	0.05 D	0.1 D	TR D	3		50	20	1	20		1-45		60	
380	390			0.09	<.002	<.01	0.1 D 0.05V	0.1 D	TR D	3	1	50	20	3	20		1-60		70	Slight increase in bigger sulfide veins w/
390	400			0.05	<.002	<.01	0.1 D 0.05V	0.1 D	TR D	3	1	50	20	3	20		<1-80		90	chalcocite?/covellite below 380' (380-490)
400	410			0.06	<.002	0.02	0.1 D 0.05V	0.1 D	TR D	3	1	50	20	3	20		<1-80		90	
410	420			0.03	<.002	<.01	0.1 D 0.05V	0.1 D	TR D	3	1	50	20	3	20		1-60		60	
420	430			0.07	<.002	<.01	0.05 0.05V	0.1 D	TR D	3	1	50	20	3	20		1-70		60	

mn 2555 dm

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN. HOLE NO. BB-3
Collar elev. 5145 Final depth 725
Coord N 171,010 Coord E 865,425
Inclination -45° DUE NORTH Page 2 of 7
Logged by H. DOWNEY
Date start 8/8/90 Date finish 9/4/90

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	ASSAY % Cu	ASSAY OZ/T Au	ASSAY OZ/T Ag	ORE MINERALS: CHALCOCITE	COVELLITE	BORNITE	HEMATITIC Cu Ox	GANGUE MINERALS: PYRITE-DISS	PYRITE-VEIN	SERICITE	ARGILLIC	QUARTZ-VEIN	QUARTZ-DISS	ALUNITE	RED HEMATITE	GOETHITE	JAROSITE	STRUCTURE: OPEN FRACTS FT-L	FAULTS	RQD %	ROCK TYPE and REMARKS
430	440	10	100	0.10	<.002	<.01	0.05D 0.05V	0.1D	TRD		3	1	50	20	3	20					1-60		70	CONT.- QUARTZ FELDSPAR PORPHYRY - Intensely altered
440	450			0.06	<.002	<.01	0.05D	0.1D	TRD		3	1	5	20	3	20					1-60		70	
450	460			0.10	0.002	<.01	0.05D	0.1D 0.05V	TRD		3	1	60	10	3	20					1-45		80	
460	470			0.05	0.002	<.01	0.05D	0.1D 0.05V	TRD		3	1	60	10	3	10					1-60		80	
470	480			0.07	<.002	<.01	0.05D	0.1D 0.05V	TRD		3	1	60	10	3	10					1-45		60	
480	490			0.08	<.002	<01	0.05D	0.1D	TRD		3		70	10		10					1-45		60	Nil mining 491' - 555'
490	500			0.06	<.002	0.02	0.05D	0.05D			3		70	10		10					<1-45		80	
500	510			0.14	<.002	0.03	0.05D	0.05D			3		70	10		10					1-45		70	
510	520			0.20	<.002	<.01	0.05D	0.05D			3		70	10		10					1-60		50	
520	530			0.17	<.002	0.04	0.05D	0.05D			3		70	10		10					<1-45		80	
530	540			0.11	0.002	<.01	0.05D	0.05D			3		70	10		10					1-45		80	
540	550			0.05	<.002	<.01	0.05D	0.05D			3		70	10		10					1-45		70	
550	560			0.13	<.002	0.04	0.05D	TRD		0.1D	2		40	40		10		10	3		1-45	555	60	555-640 - Fault Zone - Gouge, porous, sulfides leached and oxidized to red hematite & limonite - trace jarosite - grain of rock & fault in 15° to core axis indicating a true width of 20'
560	570			0.39	<.002	0.13	0.05D	TRD		0.1D	2		40	40		10		10	3		2-15		20	
570	580			0.18	0.002	0.12	0.05D	TRD		0.1D			40	40		10		5	1		1-15		40	
580	590			0.10	0.002	0.04	0.05D			0.2D			40	40		10		10	3		1-45		60	
590	600			0.02	0.004	<.01	0.05D			0.2D			40	40		10		10	3	TR	1-70	FAULT	70	
600	610			0.18	0.004	0.06	0.05D			0.2D			40	40		10		10	3	TR	2-70		20	
610	620			0.30	<.002	0.02	0.05D			0.1D	2		50	30		10		2	2	TR	1-60		60	
620	630			0.33	<.002	0.02	0.05D	TRD		0.1D	2		50	30		10		2	1		1-70		70	
630	640			0.55	0.004	0.23	0.05D	TRD		0.1D	2		60	20		10		2	1	TR	2-15	640	20	(INTRUSIVE BRECCIA)
640	650			0.40	<.002	0.08	0.1D	0.05D			3		50	10	2	20		5	5		1-60		80	640-722 TUFFACEOUS VOLCANIC AGGLOMERATE - Angular fragments of grey-tan chert and dark grey silicified andesite? in quartz-feldspar matrix. Probably same unit as found in lower sections of BB-2. Fragment size increase with depth (begin @ 1-5 mm., increase to 1" @ 665' to 2" from 690' to 722'). Very fine grained disseminated pyrite with traces covellite & chalcocite coating.
650	660			0.35	0.002	0.13	0.1D	0.05D			3		40	10	2	30					1-70		60	
660	670			0.19	<.002	0.11	0.1D	0.05D			3		40	10	2	30					1-60		80	
670	680			0.30	<.002	<.01	0.1D	0.05D			3		30	10	2	40					1-60		80	
680	690			0.36	0.002	0.11	0.1D	0.05D			3		30	10	2	40					1-60		70	
690	700			0.33	0.002	<.01	0.1D	0.05D			3		30	10	2	40					1-60		80	
700	710			0.36	<.002	0.04	0.1D	0.05D			3		30	10	2	40					1-70		80	
710	720			0.19	<.002	<.01	0.1D	0.05D			3		30	10	2	40					1-70		20	
720	725			0.02	<.002	0.02	0.05D	0.05D			3		30	10	2	40		5	3		2-45		20	722-725 FAULT BRECCIA - Angular fragments of agglomerate in hematite / limonite gouge matrix.
BOTTOM OF HOLE-725'																								

mn 2555 dm

ORE MINERALS - ESTIMATED % METAL
GANGUE MINERALS - PYRITE AS %
SILICATE - SULFATE - CARBONATE AS %

V = VEIN/FRACTURE FILLED
D = DISSEMINATED

STRUCTURE : RQD = % OF GREATER THAN 5" CORE LENGTHS IN RUN

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN
Collar elev. 5115
Coord N. 171,400
Inclination -90°
Logged by H. DOWNEY
Date start 9/5/90

HOLE NO. BR-4
Final depth 797
Coord E. 865,850
Page 1 of 2
Date finish 9/30/90

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	ASSAY % Cu	ASSAY oz/T Au	ASSAY oz/T Ag	CHALCOCITE	COVELLITE	BORNITE	SPHALERITE	PYRITE-DISS.	PYRITE-VEIN	SILICA-VEIN	SILICA-DISS.	SERICITE	ARGILLIC	ALUNITE	STRUCTURE OPEN FRACS. FT-∠	STRUCTURE FAULTS ∠ TO CORE AXIS	% RQD	ROCK TYPE and REMARKS
0	8						—	—													OVERBURDEN - ROCK BIT TO 8'
8	20	12	100	0.43 0.59	0.004 0.008	0.62 0.17	0.1D	0.1D			3			15	40	30		1-70		50	8— QUARTZ FELDSPAR PORPHYRY - White to light grey - Intensely altered to sericite giving appearance of a tuffaceous
20	30			0.83	<.002	0.08	0.1D	0.1D			3			15	40	30		1-70		60	volcanic rock (Quartz eye tuff) - scattered clasts - mostly
30	40			0.38		<.01	0.1D	0.1D			3			15	40	30		1-70		70	lapilli size but up to 1" of siliceous volcanics and chert
40	50			0.29		0.08	0.1D	0.2D 0.1V			3	1	5	15	40	30		1-70		80	
50	60			0.58		0.06	0.1D	0.2D 0.1V			3	1	5	30	30	10		1-70		60	56-60 Breccia zone - silicified fragments in sericite/clay
60	70			0.59		<.01	0.1D	0.2D 0.1V			3	1	5	15	40	30		1-70		40	matrix (also 15-18)
70	80			0.18		<.01	0.1D	0.2D 0.1V			3	1	5	15	40	30		1-70		70	— disseminated pyrite 3-5% 1-2% in. 1-3 mm,
80	90			0.24		<.01	0.1D	0.2D 0.1V	TR D		3	1	5	70	10	10		1-70		40	veins - chalcocite & covellite sims on pyrite - also
90	100			0.65		0.03	0.1D	0.2D 0.2V	TR D	TR D	3	1	5	15	40	30		1-70		80	covellite coating on pyrite - some is very fine
100	110			1.29		0.16	0.1D	0.3D 0.2V	TR D		3	1	5	15	40	30		1-70		80	grained appearing as black specks. Trace of
110	120			0.44		<.01	0.1D	0.2D 0.1V	TR D		3	1	5	15	40	30		<1-80		90	sphalerite filling a few cavities 91-92
120	130			0.14		<.01	0.1D	0.3D 0.1V	TR D		3	1	5	15	40	30		1-80		80	Very silicified 87-91.5
130	140			0.49		0.02	0.1D	0.2D 0.2V	TR D		3	1	5	15	40	30		1-45		60	— 92 Clastic texture of the rock becomes more predominant -
140	150			0.39		<.01	0.05D	0.2D 0.1V	TR D		2	1	5	15	40	30		1-70		60	siliceous volcanic and chert fragments increase
150	160			0.41		<.01	0.05D	0.2D 0.1V			2	1	5	15	30	40		1-70		80	in quantity and size.
160	170			0.26	0.006	0.01	0.1V	0.2D c.3V			2	2	5	15	30	40		1-45		30	Black specks (chalcocite?) decrease at 150.
170	180			0.30	0.004	0.01	TR D	0.2D 0.05V			2	1	5	10	30	40		1-70		80	—189
180	190			0.34	0.002	<.01	TR D	0.2D 0.2V			2	1	5	10	30	40		2-70	GOUGY 187-189	30	189— 318 TUFFACEOUS VOLCANIC AGGLOMERATE - Angular
190	200			0.06	0.004			0.1D 0.1V			3	1	3	5	30	40		1-45		80	light brown chert or fine grained quartzite, medium to
200	210			0.03	<.002			0.1D 0.05V			3	1	3	5	30	50		1-70		80	dark grey siliceous volcanics lapilli to 2" dia.
210	220			0.03	0.002			0.1D 0.05V			3	1	3	5	30	50		<1-80		80	in light grey tuffaceous matrix (gritty tuff).
220	230			<.01	<.002			0.05D			2	1	3	5	30	50		<1-80		90	Rock
230	240			<.01	<.002			0.05D			2	1	3	5	30	50		<1-80		90	
240	250			<.01	<.002			0.05D 0.05V			2	1	3	5	30	50		1-80		90	
250	260			<.01	0.002			0.05D			2	1	3	5	30	50		<1-70		90	
260	270			<.01	<.002			0.05D			2	1	3	5	30	50		1-80		90	
270	280			<.01	<.002		TR D	0.05D			2	1	3	5	30	50		<1-80		90	
280	290			<.01	<.002		TR D	0.05D			2	1	3	5	30	50		<1-80		90	
290	300			<.01	<.002		TR D	0.05D			2	1	3	5	30	50		<1-80		90	
300	310			0.02	<.002		TR D	0.05D			2	1	3	5	30	50		<1-70		90	—318 Contact @ 60° to core axis
310	320			0.03	<.002		0.05D 0.05V	0.1D 0.05V			2	1	3	10	40	30		<1-60		90	318— QUARTZ FELDSPAR PORPHYRY - Similar to QFP above.
320	330			0.14	0.002		0.05D 0.05V	0.1D 0.05V			2	1	3	15	40	30		<1-70		90	A few lapilli size clasts of brown chert and black
330	340			0.09	0.002		0.05D 0.05D	0.1D 0.05V			2	1	3	15	40	30		<1-70		90	siliceous volcanics. Very fine grained pyrite and fine
340	350			0.19	0.004		0.05D 0.05D	0.1D 0.05V			2	1	3	15	40	30		<1-70		90	gr. chalcocite?/covellite (may be only coating pyrite)
350	360			0.19	0.006		0.05D TR V	0.1D TR V			2	1	3	15	40	30		<1-80		90	Dark grey 1-3 mm veinlets randomly oriented but
360	370			0.19	<.002		0.05D TR V	0.1D TR V			2	1	3	15	40	30		1-70		90	60° to axis dominant.
370	380			0.13	0.004		0.05D	0.1D			2	1	3	15	40	30		1-80		90	
380	390			0.19	<.002		0.05D	0.1D			2	1	3	15	40	30		1-70	388-?	90	Breccia zone (not continuous) - may be fault breccia
390	400			0.62	<.002	0.02	0.05D TR V	0.1D TR V			2	3	5	10	40	30		<1-80	396	90	Indications of grain 30° to core axis.
400	410			0.02	0.008	0.01	0.05D TR V	0.1D TR V			2	3	5	10	40	30		1-80		80	Fresh pyrite veins (seams) more prominant
410	420			0.41	<.002	0.07	0.05D	0.1D TR V			2	2	5	10	40	30		1-60		60	below 390'.
420	430			0.30	<.002	<.01	0.05D	0.1D TR V			2	2	5	10	40	30		1-70		60	—CONT.

mn 2555 dam

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MIN. HOLE NO. BB-4
Collar elev. 5114 Final depth 797
Coord N. 171,400 Coord E. 865,850
Inclination -90° Page 2 of 2
Logged by H. DOWNEY
Date start 9/5/90 Date finish 9/30/90

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	ASSAY % Cu	ASSAY oz/T Au	ASSAY oz/T Ag	ORE MINERALS CHALCOCITE	COVELLITE	BORNITE	GANGUE MINERALS PYRITE-DISS.	PYRITE-VEIN	SILICA-VEIN	SILICA-DISS	SERICITE	ARGILLIC	ALUNITE	STRUCTURE < ~ ∠ TO CORE AXIS OPEN FRACS/FT ~ ∠	FAULTS	% RQD	ROCK TYPE and REMARKS
430	440		100	0.44	<.002	<.01	0.1 D 0.1 V	0.1D 0.5V	TR D	2	3	5	10	40	30		1-45		80	CONT. - QUARTZ FELDSPAR PORPHYRY
440	450			0.44	0.002		0.1 D 0.05V	0.1 D 0.3V	TR D	2	3	5	10	40	30		1-70		60	Covellite - chalcocite in pyrite veins - good concentration
450	460			0.34	0.006		0.05 D 0.05 V	0.1 D 0.2 V	TR D	2	3	5	10	40	30		1-45		70	430-470
460	470			0.35	0.006		0.05 D 0.05 V	0.1 D 0.3 V	TR D	2	3	5	10	40	30		1-70		70	
470	480			0.26	<.002		0.05 D 0.05 V	0.1 D 0.1 V	TR D	2	3	5	10	40	30		1-70		70	
480	490			0.12	<.002		0.05D TR V	0.1 D 0.05 V	TR D	2	3	5	10	40	30		1-70		90	
490	500			0.28	0.002		0.05 D TR V	0.1 D 0.05 V	TR D	2	3	5	10	40	30		2-70		40	
500	510			0.19	0.002		0.05 D TR V	0.1 D TR V	TR D	2	2	10	10	30	20	2	2-60	502-505	30	Brecciated & gouggy 502-505 — grain in 30° to core axis
510	520			0.22	0.004	0.01	0.05 D TR V	0.1 D TR V	TR D	2	2	15	10	20	20	2	1-70		80	Below 505 rock is less altered (more siliceous)
520	530			0.20	0.002	<.01	0.05 D	0.1 D TR V	TR D	2	2	15	15	20	20	2	1-70		90	grey blue quartz veining from hairline stringers
530	540			0.13	0.004		TR D	0.1 D TR V	TR D	2	2	15	15	20	15		1-70		90	to ½". Occasional fragment of brown quartzite
540	550			0.26	0.004			0.1 D TR V	TR D	2	2	15	40	15	15		1-70		80	up to 2" dia.
550	560			0.07	0.004			0.1 D 0.05 V	TR D	2	3	15	40	15	15		1-70		70	From 549 to 565 rock is brecciated (shattered)
560	570			0.07	<.002			0.1 D 0.05V	TR D	2	3	15	40	15	15		1-60		70	with only slight displacement of fragments. Quartz
570	580			0.10	0.006			0.1 D 0.05 V	TR D	2	3	15	30	15	15		1-70		70	pyrite fills interstices. Country rock more
580	590			0.17	0.004			0.2 D 0.1 V	0.05 D	2	3	15	30	20	15		1-70		80	silicified.
590	600			0.20	0.002			0.2 D 0.1 V	0.05 D	2	3	15	30	20	15		1-70		80	
600	610			0.10	0.002			0.1 D 0.1 V	0.05 D	2	3	10	20	30	15		1-70		70	
610	620			0.03	0.004			0.1 D 0.05 V	TR D	2	2	10	20	30	15		1-70		80	
620	630			0.08	0.002			0.1 D 0.05 V	TR D	2	3	10	20	30	20		1-70		80	
630	640			0.03	<.002			0.1 D 0.05 V		2	2	10	30	20	10		1-60		70	-647 Contact ?
640	650			0.09				0.05 D		2	2	10	30	20	10		2-70		40	647 - Tongues of medium grained, grey QUARTZ
650	660			0.05				0.05 D		2	2	10	30	20	10		2-70		50	DIORITE PORPHYRY (or granodiorite) ? may represent
660	670			0.02				0.05 D		2	2	10	30	20	10		2-70		50	gradational contact. Texture blurred by silicification
670	680			0.03				0.05 D		2	2	10	30	20	10		2-70		40	Pyrite only seen but may be some very fine
680	690			0.01				0.05 D		2	2	10	30	20	10		2-70		40	grained covellite
690	700			0.01				TR D		2	2	10	30	10	10		1-45		50	
700	710			0.05				TR D		2	2	10	30	10	10		2-70		30	
710	720			0.03				TR D		2	2	10	30	10	10		2-70		20	
720	730			0.02				TR D		2	4	10	30	10	10		1-70		50	
730	740			0.02				—		2	2	10	30	10	10		1-60		50	
740	750			0.01				—		2	2	10	30	10	10		1-70		60	
750	760			0.03				—		2	2	10	30	10	10		2-45		20	
760	770			0.04				—		2	3	10	30	10	10		3-20		15	
770	780			0.04				—		2	4	15	30	10	10		2-60		30	
780	790			0.01				—		2	4	15	30	10	10		3-70		10	
790	797			0.01				—		2	2	15	30	10	10		3-70		30	-797 1301+
797			BOTTOM OF HOLE 797'																	

mn 2555 dm

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN. HOLE NO. BB-5
Collar elev. 5090 Final depth 800
Coord N 171,550 Coord E 866,300
Inclination -30° DUE SOUTH Page 1 of 2
Logged by H. DOWNEY
Date start 9/30/90 Date finish 10/27/90

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	ASSAY % Cu	ASSAY oz/T Au	ASSAY oz/T Ag	ORE (ESTIMATES) MINERALS: CHALCOCITE	COVELLITE	BORNITE	LIMONITIC Cu Ox	CHALCOPYRITE	GANGUE & ALTERATION MINERALS: PYRITE-DISS	PYRITE-VEIN	RED HEMATITE	GOETHITE	JAROSITE	SILICA-VEIN	SILICA-DISS	SERICITE	ARGILLIC-PROPYLITIC	ALUNITE	STRUCTURE: OPEN FRACS/FT-2	FAULTS	% RQD	ROCK TYPE and REMARKS
0	10		—				—	—	—			—	—				—	—	—	—		—		—	OVERBURDEN - ROCK BIT
10	20		90	0.02	<.002	<.01	TR D	0.2 D 0.1 V	0.1 D			3	1				2	10	10	50		5-45		10	10-107 QUARTZ FELDSPAR PORPHYRY - White to light
20	30		85	0.02			TR D	0.2 D 0.1 V	0.1 D			3	1				2	10	10	50		10-45		5	grey - soft - intensely altered to pyrophyllite/sericite
30	40		50	0.02			TR D	0.2 D 0.1 V	0.1 D			3	1				2	10	10	50		10-45		0	originally intermediate classification.
40	50		80	0.03			TR D	0.2 D 0.05 V	0.1 D			3	1	1			2	10	10	50		3-60		20	Sulfides run 3-5% dominantly disseminated -
50	60		95	0.04			0.05 D	0.2 D TR V	0.1 D			2	—				2	10	10	50		2-45		30	sparse veining - mostly hairline to 1 mm.
60	70		95	0.04			0.1 D	0.1 D TR V	0.1 D			2	—				2	10	10	50		10-45		0	
70	80		80	0.07			0.1 D	0.1 D TR V	0.1 D			2	1				2	10	10	50		10-45		0	
80	90		80	0.04			0.3 D	0.1 D TR V	0.1 D			3	1				1	10	10	60		10-45	89-100	0	Sulfides oxidized in fault zones.
90	100		100	0.01			0.2 D	TR D	TR D	0.3		0.05	—	2	10	3	1	5	5	60		3-60		15	Grain of faults is approx. 30° to core axis - The
100	110		100	0.02	0.004	0.03	0.1 D	TR D	TR D	0.3		0.05	—	2	10	3	1	5	5	60		3-45	103-107	30	107 - faults are probable contact with agglomeratic (intrusive
110	120			0.05	<.002	<.01	TR D	0.1 D	0.05 D			3	1				1	5	10	50		1-45		70	breccia) below
120	130			0.08	<.002		TR D	0.1 D	0.05 D			3	1				1	5	10	50		1-45		70	
130	140			0.10	0.002		TR D	0.1 D	0.05 D			3	1				1	5	10	50		1-45		70	INTRUSIVE BRECCIA - Same unit as found generally
140	150			0.13	<.002	0.03	TR D	0.1 D	0.05 D			3	1				1	5	10	50		<1-45		90	at depth in previous BB holes. Angular to
150	160			0.06		<.01	—	0.1 D	0.1 D			3	1				1	5	10	40		1-60		60	rounded silicified fragments up to 2" diameter
160	170			0.03			—	0.1 D	0.1 D			3	1				1	5	10	40		1-45		90	in QFP matrix. Less veining than in previous
170	180			0.06			—	0.1 D 0.05 V	0.1 D 0.1 V			3	2				1	5	10	40		1-45		80	holes.
180	190			0.01			—	0.1 D	0.1 D			3	1				1	5	10	40		1-70		70	
190	200			0.02			—	0.1 D	0.1 D			3	1	1	1		1	10	10	30		2-70		40	- 199 Shattered/chert-like 199-228 - Same unit as
200	210			0.02			—	-	-	0.1		2	-	1	1		10	70				5-60		10	199 - in bottom of BB-2. Hematite and goethite staining
210	220			0.03			-	-	-	0.1		2	-	1	1		10	70				5-60		0	along fractures CONTACT 60° TO CORE AXIS
220	230			0.06	0.004	0.05	—	-	-	0.1		2	-	1	1		10	70				5-60		10	- 228 Contact with INTRUSIVE BX - Same as 107-199
230	240			0.19	<.002	0.03	TR D	0.1 D	0.1 D			2	1				10	40	10	30		2-60		30	228 - 247 INT. BX
240	250			0.25		<.01	0.05 D 0.1 V	TR V	0.1 D 0.1 V		0.2 D 0.1 V	2	1				10	30	10	30		1-70		50	247 - 257 - BRECCIATED CHERT - 1" Seam chalcopyrite bornite, pyrite @ 247'
250	260		85	0.24			0.05 D	0.05 D TR V	0.05 D 0.05 V			1	1				10	70	5	10		2-60		30	Fault @ 30° to core axis
260	270		80	0.12			0.05 D	0.05 D TR V	0.05 D			1	0.5				10	20	10	30		2-60	260-267	50	257 - INTRUSIVE BRECCIA - Same as 107-199.
270	280		95	0.08			0.05 D	0.1 D TR V	TR D			1	0.5				2	10	10	50		1-60		60	
280	290		100	0.13			0.05 D	0.1 D TR V	TR D			1	0.5				2	10	10	50		1-60		70	Sulfides are very fine grained disseminated below
290	300			0.12		0.03	0.05 D	0.1 D TR V	TR D			1	0.5				2	10	10	50		2-70		30	260. Minor veinlets up to 1/4" thick
300	310			0.10		<.01	0.05 D	0.1 D TR V	TR D			1	0.5				2	10	10	50		1-70		50	
310	320			0.05		<.01	0.05 D	0.1 D TR V	TR D			1	0.5				2	10	10	50		1-70		50	
320	330			0.06		0.01	0.05 D	0.1 D TR V	TR D			1	0.5	1	1		2	10	10	50		1-70		50	
330	340			0.03		<.01	0.05 D	0.2 D 0.1 V	TR D			1	0.5	1	1		2	10	10	50		2-45		20	
340	350			0.03			0.05 D 0.05 V	0.2 D 0.05 V	TR D			1	0.5	1	1		2	10	10	50		1-60		50	
350	360			0.07			0.05 D 0.05 V	0.2 D 0.05 V	TR D			1	0.5				2	10	10	50		2-60		20	
360	370			0.05			0.05 D 0.05 V	0.2 D 0.05 V	TR D			1	0.5				2	10	10	50		1-60		40	
370	380			0.04		0.05	0.05 D 0.05 V	0.1 D 0.05 V	0.05 D			1	1				2	10	10	50		3-60	376-379	10	3' Fault gouge
380	390			0.02		<.01	0.1 D 0.3 V	0.1 D 0.05 V	0.05 D			2	1				2	10	10	60		2-60	383-385	20	2' Fault breccia & gouge - sooty zone w/clumps of
390	400			0.01			0.05 D	0.05 D 0.05 V	0.05 D			2	1				2	5	10	50		1-70		40	massive fine grained pyrite
400	410			0.04			TR D	0.05 D 0.05 V	0.05 D			2	1				2	5	10	50		1-70		70	
410	420			0.01			TR D	0.05 D 0.05 V	0.05 D			2	1				2	5	10	50		1-70		50	
420	430			0.01			TR D	0.05 D 0.05 V	0.05 D			2	1				2	5	10	50		1-60		50	CONT. -

mn 2555 dm

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN. HOLE NO. BB-5
Collar elev. 5090 Final depth 800
Coord N 171,550 Coord E 866,300
Inclination -30° DUE SOUTH Page 2 of 2
Logged by H. DOWNEY
Date start 9/30/90 Date finish 10/27/90

DEPTH from	DEPTH to	int'vl	% CORE RECOV.	ASSAY o/o Cu	ASSAY oz/T Au	ASSAY oz/T Ag	ORE: CHALCOCITE	ORE: COVELLITE	ORE: BORNITE	ORE: CHALCOPYRITE	GANGUE & ALTERATION MINERALS: PYRITE-DISS	PYRITE-VEIN	RED HEMATITE	GOETHITE	JAROSITE	SILICA-VEIN	SILICA-DISS	SERICITE	ARGILLIC/PYROPHYLLITE	ALUNITE	STRUCTURE: OPEN FRACS. FT-L	FAULTS	o/o RQD	ROCK TYPE and REMARKS
430	440		100	<.01	<.002	<.01	TR D TR V	0.05 D 0.05 V	0.05 D		2	1				2	5	10	50		1-45		60	CONT. — INTRUSIVE BRECCIA - Siliceous clasts 2 mm - 2", mostly
440	450			0.01			TR D	0.05 D 0.05 V	TR D		1	1				2	5	10	60		2-45	443-447	10	angular, in QFP matrix. The section from 370' - 450
450	460			0.04			TR D	0.05 D 0.05 V	TR D		1	1				2	5	10	50		1-70		60	contains multiple fault breccia and gouge zones but
460	470			0.01			TR D	0.05 D TR V	TR D		1	1				2	5	5	40		1-70		70	without lithological or mineralogical change
470	480			0.07			0.05 D 0.2 V	0.05 D 0.3 V	TR D		1	1				2	5	5	40		2-70		20	1" sooty chalcocite/covellite/pyrite vein @ 475.2
480	490			0.01			TR D 0.05 V	0.05 D TR V	0.05 D		1	1				2	10	5	30		1-70		50	
490	500			0.02			TR D 0.05 V	0.05 D	0.05 D		1	0.5				2	10	5	30		1-45		50	Pyrophyllite/clay alteration decreases below 460'
500	510			0.02			TR D 0.05 V	0.05 D	0.05 D	TR D	1	0.5				2	10	5	30		2-70		20	
510	520			<.01			0.05 D 0.1 V	0.05 D	0.05 D	TR D	1	0.5				2	10	5	30		2-60		30	Chalcocite ? coating fractures 519-520
520	530			0.01			TR D 0.05 V	0.05 D	0.05 D	TR D	1	0.5				2	10	5	30		1-70		40	
530	540			0.01			TR D	0.05 D	0.05 D	TR D	1	0.5				2	10	5	30		1-60		30	Nil veining
540	550			0.01				0.05 D	0.05 D	TR D	1	0.5				2	10	5	30		1-60		50	
550	560			<.01				0.05 D	0.05 D	TR D	1	0.5				2	10	5	30		1-20		30	
560	570			<.01				0.05 D	0.05 D	TR D	1	0.5				2	10	5	30		1-30		40	
570	580			0.01				0.05 D			1	0.5				2	10	5	30		1-60		60	
580	590			0.02				0.05 D			1	0.5				2	10	5	30		1-60		60	
590	600			0.04				0.05 D			1	TR				2	10	10	50		2-60		40	Multiple short, gouge, brecciated zones 590-660
600	610			0.05				0.05 D			1	TR				2	10	10	50		2-60		50	
610	620			0.03				0.05 D			1	TR				2	10	10	50		1-70		60	Only very minor hairline veins below 590
620	630			0.03				0.05 D			1	TR				2	10	10	50		2-70		50	
630	640			0.05			TR D	0.05 D			1					2	10	10	50		1-70		70	
640	650			0.07	0.002		0.2 ?	0.05 D			1					2	10	10	50		2-70		60	Grey sooty fracture 650-653
650	660			0.02	<.002		TR D	0.05 D			1					2	10	10	50		2-70		70	
660	670			0.03			TR D	0.05 D			1					2	10	10	30		1-70		80	
670	680			0.02		0.01	TR D	0.05 D			1					2	10	10	30		1-70		70	
680	690			0.03		<.01	0.2 ?	0.05 D			1	TR				2	10	10	30		2-70		50	Grey section 682-685
690	700			0.22			TR D	0.05 D			1	0.5				2	10	10	30		1-70		80	
700	710			0.04			TR D	0.05 D			1					2	10	10	30		1-70		70	
710	720			0.03			TR D	0.05 D			1					2	10	10	30		1-70		60	
720	730			0.07			TR	0.05 D			1					2	10	10	40		1-70		70	
730	740			0.15			TR D	0.05 D			1					2	10	10	40		1-70		70	
740	750			0.16			TR D	0.05 D			1	0.5				2	10	10	30		1-70		60	
750	760			0.04			TR D	0.05 D 0.1 V			1	1				5	10	10	30		1-70		80	Sulfide veining begins at 757 and continues to
760	770			0.11		0.01	TR D	0.05 D 0.1 D			1	1				5	10	10	30		1-70		70	bottom of hole. Veinlets average 1/8" thick 30°-45° to
770	780			0.08		0.01	0.05 D 0.05 V	0.05 D 0.2 V			1	1				5	10	10	30		1-80		90	core axis.
780	790			0.02		<.01	0.05 D 0.1 V	0.05 D 0.2 V			1	2				5	10	10	30		1-80		90	
790	800			0.03		0.02	0.05 D 0.1 V	0.05 D 0.2 V			1	2				5	10	10	30		1-70			
800			BOTTOM	OF	HOLE																			

mn 2555 dm

THUNDER MTN. BB-6
5145 800'
169,640 857,530
-45° DUE EAST 1 2
H. DOWNEY
11/1/90 11/26/90

THUNDER MOUNTAIN

			% Cu	oz/T Au	oz/T Ag	CHALCOCITE (ESTIMATED)	COVELLITE (ESTIMATED)	BORNITE (ESTIMATED)	PYRITE-DISS. (%)	PYRITE-VEIN (%)	PYROPHYLLITE (%)	SERICITE (%)	ARGILLIC (%)	QUARTZ-VEIN (%)	QUARTZ-DISS (%)	ALUNITE (%)	OPEN FRACS./FT.-<	FAULTS	% RQD	
0	20	—	—	—	—												—	—	—	0-20 OVERBURDEN — NO CORE
20	30	95	0.81	0.002	0.36	0.05D			3	1	60	10	5	1	10		3-45		15	20-368 QUARTZ FELDSPAR PORPHYRY — Intense alteration ← White to light grey
30	40	90	0.18	0.008	<.01	0.05D	0.05D		3	1	60	10	5	1	10		2-60		30	has obliterated most of the texture - originally
40	50	95	0.15	0.006	0.08	0.05D	0.05		3	1	60	10	5	1	10		2-60		30	75% plagioclase? 10% quartz - 10% mafics.
50	60	95	0.44	0.004	0.03	0.05D	0.05D		3	2	60	10	5	2	10		2-60		20	Major alteration mineral is pyrophyllite (Williams
60	70	90	0.30	0.002	0.06	0.05V	0.05V		3	1	60	10	5	1	5		2-60		30	analyses). Granular pyrite blebs 1-5 mm., some
70	80	95	0.26	0.002	0.14	0.05D	0.05D	TR D	3	1	60	10	5	1	5		2-60		40	coated with covellite/chalcocite. Some fractures are
80	90	95	0.46	0.004	0.31	0.05D	0.1D	TR D	3	1	50	10	5	1	5		2-60		40	sooty. Nil veining to 105' then increasing. Traces
90	100	85	0.18	0.002	0.12	0.05D	0.1D	TR D	3	1	50	10	5	1	5		2-60		40	of fine grained disseminated bornite throughout.
100	110	95	0.19	0.002	0.05	0.05D	0.1D	TR D	4	2	50	10	5	3	5		1-45		50	
110	120	100	0.21	0.002	<.01	0.05D	0.1D		4	2	50	10	5	5	5		1-60		60	Moderate sulfide veining 105'-155' w/chalcocite/covellite
120	130	100	0.07	<.002	<.01	0.1V	0.1V		4	2	60	10	5	5	5		1-45		60	Quartz/sulfide veinlets are irregular and stringy, probably
130	140		0.08	0.002	<.01	0.05D	0.1D		4	2	60	10	5	5	5		2-60		60	low temperature filling fractures.
140	150		0.26	<.002	0.07	0.1 V	0.1V		4	2	60	10	5	5	5		1-45		60	
150	160		0.13	0.002	<.01	0.1D	0.1D		4	2	60	10	5	5	5		1-45		70	
160	170		0.06	0.006	<.01	0.2V	0.1V		3	1	50	10	5	2	5		1-60		80	
170	180		0.14	<.002	<.01	0.1D	0.1D		3	1	50	10	5	1	5		1-60		70	
180	190		0.08	<.002	<.01	0.05D	0.1D		3	1	50	10	5	1	5		1-60		70	
190	200		0.07	<.002	0.03	0.05V	0.05V		3	1	50	10	5	1	5		1-60		60	
200	210		0.05	<.002	<.01	0.05D	0.1D		3	1	40	10	20	1	5		2-60	200-204? gouge 214-219 gouge	40	Fault zone? (multiple gouge sections) 200-219
210	220		0.16	<.002	<.01	0.05D	0.2D		3	2	40	10	20	2	5		2-45		20	Covellite increases below 200'
220	230		0.23	<.002	0.09	0.05D	0.2D		4	2	50	10	10	2	5		1-45		60	
230	240		0.12	0.002	<.01	0.1D	0.2D		4	2	50	10	10	2	5		1-60		80	
240	250		0.14	<.002	<.01	0.3V	0.1V		4	3	40	10	20	2	5		1-45	246-247.5	40	Small (1.5') brecciated zone - probably fault breccia @ 15° to
250	260		0.08	<.002	<.01	0.1D	0.2D		4	2	50	10	10	2	5		2-60		30	axis. Stringers and 1" seam filled with chalcocite/covellite.
260	270		0.13	<.002	0.05	0.1V	0.1V		3	2	50	10	10	2	5		1-60		50	
270	280		0.15	<.002	<.01	0.05D	0.2D		4	2	50	10	10	2	5		2-60		50	
280	290		0.23	<.002	0.09	0.05V	0.1V	V	3	2	50	10	10	2	5		1-60		60	
290	300		0.15	<.002	0.02	0.05D	0.1D		3	2	50	10	10	2	5		1-60		60	
300	310		0.34	0.002	<.01	0.05V	0.1V		3	2	40	10	20	5	5		1-60	309-312	70	
310	320		0.18	<.002	<.01	0.05D	0.1V		3	3	40	10	10	5	5		1-60		70	Veining increase 310-330
320	330		0.31	0.002	<.01	0.1V	0.1V		3	3	40	10	10	5	5		2-60		60	
330	340		0.17	0.002	<.01	0.05D	0.1V		3	2	40	10	20	5	5		1-45	330-332 GOUGY	60	
340	350		0.52	<.002	0.06	0.1D	0.2D		3	2	30	10	20	5	5		2-60	34-38	40	
350	360		0.11	0.002	<.01	0.05V	0.1V		3	2	30	10	20	5	5		1-60		50	Heavy chalcocite/covellite/pyrite — 360-369
360	370		3.75	0.004	1.69	0.5D	0.5D		6	6	30	5	10	10	30		1-60		50	368-394 INTRUSIVE BRECCIA. Angular silicified fragments
370	380		0.45	<.002	<.01	0.1V	0.1V		6	3	20	5	10	10	30		1-70		70	in tuffaceous matrix. Fragments range from
380	390		0.70	0.002	<.01	0.1D	0.1D		6	3	20	5	40	10	30		2-70	382.5-394	40	lapilli to block size - light to dark grey color
390	400		1.03	<.002	0.27	0.6D	0.2D		6	3	20	5	40	10	30		1-70		70	Probable fault breccia 382.5-394
400	410		0.81	0.002	0.10	0.2D	0.1D		5	3	30	5	15	10			1-70		70	394-397.5 Short section of lapilli tuff.
410	420		0.69	0.006	0.15	0.2V	0.1V		5	4	10	5	40	10			1-70		70	397.5-454 INTRUSIVE BRECCIA - Same unit as above 394.
420	430		0.41	<.002	0.04	0.2D	0.1D		5	4	10	5	40	10			1-70		70	
430	440		0.53	0.002	0.04	0.2V	0.1V		5	5	10	5	40	10			1-70		70	

GEOLOGIC LOG

PROJECT _____

PROJECT Thunder Mtn. | HOLE NO. BB-6
Collar Elev. 5145 | Final Depth 800
Coord N. 169,640 | Coord E. 857,530
Inclination -45° DUE EAST | Page 2 of 2
Logged by H. DOWNEY
Date Start 11/1/90 | Date Finish 11/26/90

DEPTH FROM	DEPTH TO	% CORE RECOVERY	ASSAY % Cu	OZ/T Au	OZ/T Ag	ORE (ESTIMATES) CHALCOCITE	COVELLITE	BORNITE	MINERALS	GANGUE PYRITE-DISS	PYRITE-VEIN	MINERALS PYROPHILLITE	SERICITE	ARGILLIC	QUARTZ-VEIN	QUARTZ-DISS	ALUNITE	STRUCTURE OPEN FRACS/FT-<	FAULTS	% RQD	ROCK TYPE AND REMARKS	
440	450	100	1.00	0.002	0.34	0.7D	0.2D			5	7	20	5	10	20	20		1-70		70	CONT. —	INTRUSIVE BRECCIA
450	460		0.23	0.002	<.01	0.7V	0.3V			5	7	40	10	10	10	10		2-70		20	454 – 718	QUARTZ FELDSPAR PORPHYRY – Similar to that above 368'. Well mineralized section with sooty chalcocite/
460	470		0.17	<.002	<.01	0.3D	0.2D			4	3	50	10	10	5	5		2-70		40		pyrite blebs to 5 mm dia. Fine grained pyrite
470	480		0.30	0.002	0.03	0.2V	0.1V	TR		4	2	50	10	10	5	5		1-70		70		stringers by covellite. Pyrite veins result from
480	490		0.41	<.002	<.01	0.3D	0.2D	TR		4	2	50	10	10	5	5		1-70		80		open fracture filling; not as prominent as in
490	500		0.15	<.002	<.01	0.2V	0.1V			4	2	50	10	10	5	5		1-70		80		breccia.
500	510		0.12	<.002	<.01	0.3D	0.2D			4	2	50	10	10	5	5		1-70		80		
510	520		0.24	<.002	<.01	0.1V	0.1V			4	3	50	10	10	5	5		1-70		70		
520	530		0.16	<.002	<.01	0.2D	0.1D			5	3	50	10	10	5	5		1-70		80		
530	540		0.11	<.002	<.01	0.2V	0.1V			4	3	50	10	10	5	5		1-70		70		
540	550		0.04	<.002	<.01	0.7D	0.3D			6	3	50	10	10	5	5		1-70		80		
550	560		0.11	<.002	<.01	0.3D	0.2D			6	3	50	10	10	5	5		1-60		60		Cu mineralization decreases below 560 particularly
560	570		0.14	<.002	<.01	0.2V	0.1V			4	2	40	10	10	3	5		1-60		70		chalcocite blebs decrease in size and abundance.
570	580		0.07	0.002	<.01	0.2V	0.05V			5	1	40	10	20	3	5		1-60		80		↑(560-630)↑
580	590		0.12	<.002	<.01	0.6D	0.2D			5	2	40	10	20	3	5		1-70		80		
590	600		0.02	<.002	<.01	0.2V	0.05V			4	1	30	10	30	3	5		1-70		90		
600	610		0.25	0.002	<.01	0.6D	0.2D			4	2	30	10	30	3	5		1-70		80		
610	620		0.36	0.002	0.15	0.2V	0.05V			4	1	30	10	30	3	5		1-70		80		
620	630		0.15	<.002	<.01	0.1D	0.1D			4	1	30	10	30	3	5		1-70		80		
630	640		0.05	<.002	<.01	0.1D	0.2D			5	1	40	10	20	3	5		1-70		90		
640	650		0.03	0.002	<.01	0.2D	0.2D			5	1	50	10	10	3	5		<1-70		90		
650	660		0.14	<.002	<.01	0.2D	0.2D			5	1	50	10	10	3	5		<1-70		90		
660	670		0.26	<.002	<.01	0.2D	0.2D			5	1	50	10	10	3	5		1-60	667-674	70	gouge	
670	680		0.12	<.002	<.01	0.2D	0.2D			5	1	50	10	10	3	5		1-60		40		
680	690		0.53	<.002	<.01	0.2D	0.3D			5	1	50	10	10	3	5		2-60	685-692	30	Breccia – gouge	
690	700		0.30	<.002	<.01	0.2D	0.3D			5	1	50	10	10	3	5		1-45		30		
700	710		0.24	0.002	<.01	0.1D	0.1D			5	1	50	10	10	3	5		1-70		80		
710	720		0.04	<.002	<.01	0.1D	0.1D			4	1	50	10	10	3	5		1-70		80	718-800	MIXED INTRUSIVE BRECCIA & QFP – Mostly breccia but
720	730		0.25	<.002	<.01	0.1D	0.1D			4	1	30	10	5	5	10	3	1-70		80		with short sections (1'-5') of QFP. Contact zone
730	740		0.21	0.002	<.01	0.2V	0.05V			5	2	20	10	5	5	10	3	1-70		80		from 716 to 718 is slow banded @ 30° to core axis.
740	750		0.52	0.010	0.10	0.1D	0.1D			6	3	20	10	5	10	10	3	1-60		80		Quartz/pyrite/chalcocite veining improves in breccia
750	760		0.23	<.002	<.01	0.2V	0.05V			4	3	20	10	5	5	10	3	1-70		90		
760	770		0.02	<.002	<.01	0.1D	0.1D			4	3	20	10	5	5	10	3	2-70		50		
770	780		0.01	<.002	<.01	0.1V	0.05V			4	3	20	10	5	5	10	3	2-70		60		
780	790		0.06	<.002	<.01	0.1D	TR D			4	3	20	10	5	5	10		1-60		50		
790	800		0.13	<.002	<.01	0.1V	0.05V			4	2	20	10	5	5	10		2-70		60		

800' – BOTTOM OF HOLE

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN. HOLE NO. BB-7
SURF. ELEV. 5590 FINAL DEPTH 735.5
COORD. N 170,700 COORD. E 866,550
HOLE DIRECTION -90° PAGE 1 of 2
LOGGED BY H. DOWNEY
DATE 11/29/90 COMPLETED 12/21/90

NOTE: RQD FOR NX CORE IS % > 4" ~~LENGTH~~ PER 10' (NC IS 5")

From	To	Recovery	Core Size	% Cu	oz/T Au	oz/T Ag	Chalcocite	Covellite	Bornite	Cu Pitch Limonite/Tenorite	Pyrite-Diss	Pyrite-Vein	Red Hematite	Goethite/Jarosite	Silica-Vein	Silica-Diss	Pyrophillite	Sericite	Argillic	Alunite	Open Fracs ∠	Faults ∠	% RQD	Description
0	12	—		—	—	—															—	—	—	0-12 OVERBURDEN
12	20	100	NC	0.01	<.002	<.01				.05			1	5		5	25	25	25		4-60		15	12-27 LAPILLI TUFF - Light grey altered tuff with sub-rounded volcanic fragments to 10 mm diameter. Argillic alteration (kaolin/illite?) intense. Also sericite/pyrophillite? Red hematite and goethite as fracture filling.
20	30	95		0.01	<.002	<.01				0.05			3	3		5	35	25	35	5' 100% TALC/ALUNITE	3-60		15	
30	40	80		0.01	0.010	0.18				0.05			5	2		90			5		5-70		0	
40	50	50		0.01	0.004	0.26				0.05			5	2		40	10	40			gouge 41.5-51		0	
50	60	95		0.01	<.002	0.03				0.05	.5			5		60	5	10			4-60		5	27-32 TALC - ALUNITE - White - very soft - pure mixture without fragments - may be compacted gouge.
60	70	90		0.05		<.01	TR				1			5		50	10	30	5		5-70	61-64	10	
70	80	90		0.16							1					60	5	10	5		5-60		0	32-41.5 BRECCIATED CHERT - Very siliceous grey chert (or very fine grained quartzite) fragments in siliceous matrix. Fragment edges are indistinct due to re-silicification.
80	90	100		0.09							1					60	5	10	3		3-60		40	
90	100	95		0.06							1					60	5	10	3		2-60		70	
100	110	100		0.04							1					60	5	10	3		2-70		50	41.5-51 FAULT GOUGE & BRECCIA
110	120	50		0.11							1					30	10	50	3		gouge 110-117.5		20	
120	130	85		0.03							1	.05				30	10	40	3		gouge 119.5-		5	51-257 RHYOLITE OR RHYODACITE - Light to medium grey very siliceous (not silica alteration) with numerous breccia and gouge zones. Fine grained pyrite disseminated and filling some fractures. Some thin alunite stringers. (NOTE: THIS UNIT WAS LOGGED AS SILICA TUFF - LOG BB-1)
130	140	95	NX	0.06							1	0.5				30	10	40	3		4-70 - 133.5		15	
140	150	98		0.05			gouge 0.3				2					60	5	10	3		3-70		5	
150	160	100		0.06	0.002		gouge 0.3				2					30	10	40	3		3-60 144-156		5	Sooty gouge 144-156
160	170	100		0.01	<.002						1	0.5				60	5	10	3	?	1-80		80	
170	180	100		0.01	<.002						1	0.5				60	5	10	3		2-70		70	
180	190	100		0.02	0.004						1	0.5				60	5	10	3		2-70		50	
190	200	100		0.06	0.002						1	0.5	1	5 3		30	10	40	3		3-80 196-		20	Fault contact at 196' - 30° to core axis
200	210	85		0.03	0.002						1	0.5		5 3		30	10	40	3		4-70 - 205 208-215		15	Total fault intercept - 19'
210	220	100		0.03	0.002	0.11					2	1				50	10	10			2-80		50	
220	230			0.01	0.002	<.01	0.2 D				2	1				50	10	10			1-80		50	Very fine grained disseminated pyrite increasing at 210'. Chalcocite from some pyrite blebs from 220 - down. Contact indistinct
230	240			0.02	<.002		0.05 V				2	1				50	10	10			3-70		10	
240	250			0.02			0.2 D				2	1				30	5	10	40	3	3-80 239-248		10	
250	260			0.01			0.1 D				2	1				50	5	10	20		2-70		30	257-617.5 LAPILLI TUFF Appearance similar to unit at top of hole but with occasional fragments up to 2 cm. Fine grained disseminated pyrite. Only slight hairline veining. Occasional clasts to 10 mm are rich in pyrite.
260	270			0.01			0.1 D				2	1				20	10	10	40		3-80		10	
270	280			0.01			0.05 D				3	0.5				10	10	10	40		2-80		20	
280	290			0.01			TR D				3	0.5				10	10	10	40		2-80		30	
290	300			0.04			TR D				3	0.5				10	10	10	40		3-70		20	
300	310			0.01			TR D				3	0.5				10	10	10	40		2-80		60	
310	320			0.01			TR D				3	0.5				10	10	10	40		1-80		60	
320	330			0.02			TR D				3	0.5				10	10	10	40		1-80		70	
330	340			0.01			TR D				3	0.5				10	10	10	40		1-80		80	
340	350			0.03			TR D				3	0.5				10	10	10	40		1-80		70	
350	360			0.04			TR D				2	0.5				10	10	10	40		3-80		20	
360	370			0.01							2	0.5				10	10	10	40		1-80		90	
370	380			0.01							2	0.5				10	10	10	40	3	2-80		50	
380	390			0.02							2	0.5				10	10	10	40	3	1-70		60	
390	400			0.02							2	0.5				10	10	10	40	3	1-80		70	
400	410			0.03			TR D				2	0.5				10	10	10	40	3	1-80		80	
410	420			0.03							2	0.5				10	10	10	40	3	2-70		60	
420	430			0.04							2	0.5				10	10	10	40	3	1-70		70	CONT.

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT: THUNDER MTN.
ELEV: 5590
N: 170,700
DIP: -90°
LOGGED BY: H Downey
DATE: 11/29/90

HOLE NO: BB-7
DATE BEGUN: 23.5.5
COORD E: 866,550
PAGE: 2 of 2
DATE: 12/21/90

FROM	TO	CORE SIZE	% Cu	oz/T Au	oz/T Ag	ORE ESTIMATES MINERALS: CHALCOCITE	COVELLITE	BORNITE	CHALCOPYRITE	GANGUE MINERALS: PYRITE-DISS	PYRITE-VEIN	RED HEMATITE	GOETHITE	JAROSITE	SILICA-VEIN	SILICA-DISS	PYROPHYLLITE	SERICITE	ARGILLIC	ALUNITE	OPEN FRACS / FOOT-L	FAULTS	% RQD	
430	440	10 D	NX	0.04	<.002	<.01					2	0.5				10	10	10	40	3	1-70		80	430-617.5 LAPILLI TUFF - Alteration appears more sericitic (less argillic) below 460
440	450			0.01							2	0.5				10	10	10	40	3	1-80		80	
450	460			0.02							2	0.5				10	20	20	30	1	1-80		80	
460	470			0.03							2	0.5				10	20	30	20	1	1-80		80	
470	480			0.04							2	0.5				10	20	30	20	1	2-80		60	
480	490			0.02							2	0.5				10	20	30	20	1	1-70		60	
490	500			<.01		0.1 D	TRD				3	0.5				10	20	30	20	1	3-70		20	Splotchy, dendritic clumps of sooty chalcocite ? 500-520 - also fine grained chalcocite with sparse covellite, very fine grained chalcopyrite (PROBABLY A MANGANESE MINERAL)
500	510			0.02		0.3 D	TRD	TRD	TRD		3	0.5				10	20	30	20	1	2-70		70	
510	520			0.04		0.2 D	TRD	TRD	TRD	ASSAYS	3	0.5				10	20	30	20	1	1-70		80	
520	530			0.02		0.1 D	TRD	TRD	TRD	INDICATE THIS	3	1				10	20	30	10	1	2-70		50	1-3 mm. pyrite/chalcocite veinlets more common 520-580
530	540			0.02		0.1 D	TRD			IS PROBABLY	3	1				10	20	30	10	1	1-80		70	
540	550			0.05		0.1 D	0.1 V	TRD		MANGANESE	3	1				10	20	30	10	1	1-80		90	
550	560			0.02		0.1 D	0.2 V	TRD		MINERALIZATION	3	1				10	20	30	10		1-80		80	
560	570			0.01		0.1 D	0.7 V	TRD			3	1				10	20	30	10		1-80 / 1-45		60	
570	580			0.03		0.1 D	0.2 V	TRD			3	1				10	20	30	10		1-80		60	
580	590			0.05		0.1 D	0.05 V				3	0.5			5	10	20	30	10		1-80		80	
590	600			0.06		0.1 D	0.05 V				2	0.5			5	10	20	30	10		1-80		90	
600	610			0.08		0.1 D	0.05 V				2	0.5			5	10	20	30	10		1-80		70	
610	620			0.01		0.1 D	0.05 V				2	0.5			5	10	20	30	10		1-70 615.5-617.5		70	Fault gouge & breccia 615.5-617.5 - contact @ 20° to axis
620	630			<.01		0.1 D	0.05 V				2	0.5			5	5	10	10	5		1-70		80	617.5-635 RHYOLITE OR RHYODACITE (SILICA TUFF IN BB-1 & TM LOGS) Similar to unit 51-257. Small (1') gouge section @ 635
630	640			<.01		0.1 D					2	0.5			5	5	10	10	5		1-70 634-635		70	
640	650			<.01		0.1 D					2					10	20	30	10		2-70		30	635-735.5 LAPILLI TUFF contact with above unit probably a small fault. Fragment size generally smaller than units higher in hole (grit size predominant).
650	660			<.01		0.1 D					2					10	20	30	10		1-70		80	
660	670			<.01		0.1 D					2					10	20	30	10		1-70		80	
670	680			<.01		0.1 D					2					10	20	30	10		1-80		90	
680	690			0.01		0.1 D					2					10	20	30	10		1-60		80	
690	700			0.02		0.1 D					2					10	20	30	10		1-80		70	
700	710			0.01		0.1 D					2					10	20	30	10		1-80		80	
710	720			<.01		0.1 D					2					10	20	30	10		2-70		50	
720	730			<.01		0.1 D					2					10	20	30	10		2-70		60	
730	735.5			<.01		0.1 D					2					10	20	30	10		1-80		60	
	735.5	BOTTOM	OF	HOLE																				

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

HOLE: THUNDER MTN. | HOLE NO. TB-8
COORD. NORTH: 5,140 | DEPTH: 600'
COORD. EAST: 1710,100 | DATE: 865,485
ELEV. ORIGIN: 5,140 | PAGE: 1 OF 2
LOGGED BY: H. J. DOWNEY
DATE: 8/2/92 | 8/8/92

NOTE: % RQD = % PIECES > 4" LONG IN 10' RUN

From	To	Recovery	% Cu	OPT Au	OPT Ag	% EST MINERALS: CHALCOCITE	COVELLITE	CHALCOPYRITE	SPHALERITE	ENARGITE	GANGUE & ALTERATION MINERALS: PYRITE-VEIN	PYRITE-DISS	GOETHITE	LIMONITE	HEMATITE	QUARTZ-VEIN	QUARTZ-DISS	PYROPHYLLITE	SERICITE	ARGILLIC	ALUNITE	FAULTS	FRACS. PER FT	% RQD
0	8	NO CORE	—	—	—																			
8	10	95	.07	.04	3.8	Tr	Tr	0.1		0.1 ?		1					5	30	5	10			3	50
10	20	98	.14	.03	1.1	Tr	Tr	0.1				1					5	30	5	10			2	85
20	30	100	.06	.03	.9	Tr	Tr	0.1				1					5	30	5	10			2	90
30	40		.07	.02	1.0	Tr	Tr	0.1				1					5	30	5	20			2	85
40	50		.14	.02	1.0	Tr	0.1	0.1				2					5	30	5	20			1	85
50	60		.07	.03	2.8	Tr	0.1	0.1				2					5	30	5	20			1	95
60	70		.23	<.02	7.8	0.1	0.1	0.1	0.1		1	2					5	30	5	20			1	90
70	80		.05	.02	1.6	0.1		0.1				2					3	30	5	20			1	95
80	90		.12	.02	4.1	0.1		0.1				2					3	30	5	20			2	90
90	100		.11	<.02	4.8	0.1	0.2	0.1				3					3	30	5	20			1	90
100	110		.20	<.02	8.4	0.1	0.2	0.2				3					3	40	5	20			3	70
110	120		.13	.02	8.9	0.1	0.2	0.2				3					3	40	5	20			2	70
120	130		.07	.04	4.1	0.1	0.2	0.2				3					3	40	5	20			1	95
130	140		.32	.03	7.5	0.1	0.1	0.1			.5	3				Tr	3	40	5	20			1	90
140	150		.17	.02	5.3	0.1	0.1	0.1			.5	3				Tr	3	40	5	20	3		1	95
150	160		.38	.02	6.4	0.1	0.1	0.2			.5	5				Tr	5	40	5	20	3		1	90
160	170		.27	<.02	10.0	0.1	0.1	0.2			.5	5				Tr	5	40	5	20	1		1	95
170	180		.51	.02	16.0	0.1	0.1	0.2			.5	5				Tr	5	40	5	20	1		1	95
180	190		.56	<.02	7.6	0.2	0.1	0.3				5					3	50	10	20	1		2	75
190	200		.27	<.02	5.8	0.2	0.1	0.4				5					3	50	10	20	1		1	90
200	210		1.35	.03	18.0	0.2	0.1	0.5			.5	5				Tr	3	50	10	20	1		1	90
210	220		.09	<.02	8.3	0.2	0.1	0.4			.5	5				Tr	3	50	10	20	1		1	90
220	230		.11	<.02	7.6	0.2	0.1	0.3				5					3	40	10	20	Tr		1	95
230	240		.12	<.02	5.3	0.2	0.1	0.3				7					3	50	10	20	Tr		<1	95
240	250		.10	<.02	8.9	0.2	0.1	0.3				7					3	50	10	20	Tr		<1	95
250	260		.25	<.02	5.7	0.2	0.1	0.3				5					3	50	10	20	Tr		1	90
260	270		.26	<.02	4.2	0.3	0.1	0.3				5					3	50	10	20	Tr		1	90
270	280		.53	<.02	4.7	0.3	0.1	0.3			.5	5				.5	3	50	10	30	Tr		1	90
280	290		1.22	<.02	12.0	0.3	0.1	0.3			.5	5				.5	3	50	10	30	Tr		<1	95
290	300		.20	<.02	3.4	0.1	0.1	0.1				3					3	40	10	20	1	?	1	90
300	310		.11	.04	4.2	0.1	0.1	0.1				3					3	40	10	20	1		1	90
310	320		.21	<.02	3.8	0.1	0.05	0.1				3					3	30	10	20			1	85
320	330		.19	.04	4.4	0.1	0.05	0.1				3					3	30	10	20			<1	95
330	340		.09	<.02	3.6	0.1	0.05	0.1			.5	3				.5	3	30	10	20			1	80
340	350		.13	<.02	1.8	0.1	0.05	0.1			.5	3				.5	3	30	10	20			1	90
350	360		.17	.02	2.8	0.1	0.05	0.1				3					3	30	10	20			2	80
360	370		.08	<.02	2.9	0.1	0.05	0.1				3					3	30	10	20			1	85
370	380		.07	<.02	2.9	0.1	0.05	0.1			.5	3					3	20	10	10			1	95
380	390		.06	<.02	2.2	0.05	Tr	0.1				2					3	20	10	10			1	95
390	400		.13	<.02	3.1	0.05	Tr	0.1				2					3	20	10	10			1	90
400	410		.20	<.02	8.2	0.05	Tr	0.1				2					3	20	10	10			1	95
410	420		.12	<.02	4.1	0.05	Tr	0.1				2					3	20	10	10			1	90

8 – QUARTZ FELDSPAR PORPHYRY – Light gray, intensely altered giving rock a tuffaceous appearance – could be called a quartz eye tuff – pyrophyllite and kaolin predominant. Nil quartz veining. Disseminated pyrite blebs to 3 mm dia with minor associated chalcopyrite. Trace bornite and some pyrite grains are coated blue/black (covellite/chalcocite). Fine grained black disseminated mineral may be enargite (Russ Corn communication)

Chalcopyrite increases below 180. Strong cpy 200-210

gouge 300-301 May be small fault

Rock is less altered and mineralized below 310

Angular altered feldspars up to 5 mm dia 340-347

6" Lapilli Tuff 372.5 - 373 (Tuffaceous Lapilli Agglomerate) also at 382' - 383'

THUNDER MOUNTAIN

THUNDER MTN. BB-8

600'

2

H.J. DOWNEY

			% Cu	PPM Au	PPM Ag	CHALCOCITE	COVELLITE	CHALCOPYRITE	SPHALERITE	ENARGITE	PYRITE-VEIN	PYRITE-DISS	QUARTZ-VEIN	QUARTZ-DISS	PYROPHYLLITE	SERICITE	ARGILLIC	ALUNITE	FAULTS	FRACS PER FT.	% RQD
420	430	99-100	.02	<.02	3.8	0.05	Tr	0.1				2		3	2	0	10			1	95
430	440		.09	<.02	2.5	0.05	Tr	0.1				2		3	2	0	10	10		1	90
440	450		.09	<.02	4.3	0.05	Tr	0.1				2		3	2	0	10	10		1	95
450	460		.21	<.02	4.2	0.05		0.05				2		3	2	0	20			1	95
460	470		.13	<.02	1.6	0.05		0.05				3		3	2	0	20			1	95
470	480		.17	.04	3.8	0.05		0.05				3		3	2	0	20			2	90
480	490		.04	<.02	0.9	0.05		0.05				4		3	2	0	20			1	90
490	500		.15	<.02	5.4	0.05		0.05			.5	4		3	2	0	20			1	90
500	510		.03	<.02	1.9	0.05		0.05			.5	5		3	2	0	30			1	95
510	520		.06	<.02	4.4	0.05		0.05			.5	5		3	2	0	30			1	90
520	530		.08	<.02	2.9	0.05		0.05			.5	5		3	2	0	30			1	90
530	540		.05	<.02	3.7	0.05		Tr			.5	5		3	2	0	30			1	90
540	550		.03	<.02	1.3	0.05		Tr				5		3	2	0	30			2	85
550	560		.08	<.02	1.4	0.05		Tr				5		3	2	0	30			1	90
560	570		.06	<.02	0.9	0.05		Tr				5		3	2	0	30			2	85
570	580		.07	<.02	1.4	0.05		Tr			.5	5		3	2	0	30			1	90
580	590		.07	<.02	0.8	0.05		Tr			.5	5		3	2	0	30			2	80
590	600		.05	<.02	1.0	0.05		Tr				5		3	2	0	30			1	90

BOH - 600'

QUARTZ FELDSPAR PORPHYRY

Tuffaceous Lapilli Agglomerate 442-444

Alteration appears more argillic 450 - 600

Pyrite dominant to 600'

BOH

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN — HOLE BB-9
NORTHING 5,125 — DEPTH 600'
EASTING 1710,170 — ELEVATION 865,555
ELEVATION 5,130 — PAGE 1 OF 2
LOGGED H.V. DOWNEY — DATE 8/23/92 — 8/29/92

% RQD = % PIECES >4" LONG IN 10' RUN

From	To	% RQD	% Cu	Au (OPT)	Ag	ORE MINERALS (EST.) Chalcocite	Covellite	Chalcopyrite	Sphalerite	Enargite	GANGUE & ALTERATION MINERALS Pyrite-vein	Pyrite-diss.	Goethite	Limonite	Hematite	Quartz-vein	Quartz-diss.	Pyrophyllite	Sericite	Argillic	Alunite	Faults	Fracs per ft.	% RQD	Notes
0	13	—	—	—	—																				OVERBURDEN — NO CORE
13	20	95	.16	.02	3.6	Tr				Tr		3	3			3	3	0	1	0	20		2	60	13– QUARTZ FELDSPAR PORPHYRY – Soft white to light gray –
20	30	95	.04	.02	1.9	Tr				?		3	3			3	3	0	1	0	20		1	80	
30	40	99-100	.11	.02	3.2	Tr		0.05				3				3	3	0	1	0	20		1	90	rugged/porous to 85' – Extremely altered to pyrophillite,
40	50		.17	.02	1.9	Tr	Tr	0.05				5				3	3	0	1	0	20	3	2	85	
50	60		.07	.04	1.8	.05	Tr	0.05				5				3	4	0	1	0	20	3	1	90	Compacted gray volcanic mud 66-67.5 (Alunite rich?)
60	70		.07	.02	2.5	.05	Tr	0.05				5				3	4	0	1	0	20	10	1	90	
70	80		.01	.02	.4	0.1	Tr	0.05				5				3	4	0	1	0	20	3	2	80	sericite, kaolin with some alunite? layering, Limonite
80	90		.04	.02	3.9	0.1	0.1	0.1				5				3	4	0	2	0	10	2	72'-82' 1	90	-82
90	100		.31	.02	5.5	0.1	0.2	0.1				5				5	3	0	2	0	10		1	95	after pyrite to 30'. Pyrite 3%-5% in clumps &
100	110		.02	.02	1.5	0.2	0.2	0.1				5				10	3	0	2	0	10		1	95	fine grained disseminated. Traces of chalcopyrite
110	120		.04	<.02	1.7	0.2	0.2	0.1				5				10	3	0	2	0	10		1	95	and fine grained black specks (chalcocite?) sparsely
120	130		.01	<.02	1.4	0.2	0.1	0.1				5				10	3	0	2	0	10		1	95	disseminated throughout. Very little covellite compared
130	140		.08	.02	1.8	0.2	0.1	0.1				5				10	3	0	2	0	10		1	90	to other holes in area (to 82' where covellite coats
140	150		.04	<.02	1.8	0.2	0.1	0.1				5				10	3	0	2	0	10		1	90	pyrite). Probable fault from 72'-82'. Below 82'
150	160		.08	.02	2.1	0.2	0.1	0.05			.5	7				10	3	0	2	0	10		1	95	feldspar phenocrysts to 5 mm dia are more
160	170		.10	.08	2.2	0.3	0.1	0.05			.5	7				10	3	0	2	0	10		1	95	prominent. Sooty chalcocite in fractures 165'-180'
170	180		.29	.02	2.7	0.3	0.05	0.05			.5	7				10	3	0	2	0	10		1	95	
180	190		.16	<.02	<.1	0.2	0.05	0.05				7				5	3	0	2	0	10		1	95	Pyrite blebs are larger 203'-240
190	200		.09	<.02	4.5	0.2	0.05	0.05				7				5	3	0	2	0	10		1	95	
200	210		.19	<.02	3.6	0.3	0.1	0.05				7				5	3	0	2	0	10		1	90	
210	220		.07	<.02	3.5	0.3	0.1	0.05				7				5	3	0	2	0	10		1	95	
220	230		.08	<.02	5.2	0.3	0.1	0.05				7				5	3	0	2	0	10		1	95	
230	240		.08	<.02	7.0	0.3	0.05	0.05			.5	7				5	3	0	2	0	10		1	90	
240	250		.50	.03	5.7	0.4	0.05	0.05			.5	7				5	3	0	2	0	10	3	1	90	
250	260		.08	<.02	1.4	0.2	Tr	Tr			.5	5				5	3	0	2	0	10	3	1	95	
260	270		.08	<.02	1.1	0.2	0.05	0.05			.5	5				5	3	0	2	0	10	3	1	95	
270	280		.08	<.02	1.4	0.3	0.05	0.05			.5	5				5	4	0	2	0	10		1	95	
280	290		.26	.05	1.6	0.2	0.05	0.05			.5	5				5	4	0	2	0	10		1	95	
290	300		.07	<.02	1.4	0.2	0.05	0.05			.5	7				5	4	0	2	0	10		1	95	Chalcocite improves below 325'. Fine grained
300	310		.05	<.02	1.8	0.2	0.05	0.05			.5	7				5	4	0	2	0	10		1	95	disseminated and sooty fracture coatings and
310	320		.17	.03	2.0	0.3	0.05	0.05			.5	7				5	4	0	2	0	10		1	90	seams. (325-440)
320	330		.24	<.02	2.8	0.4	0.05	0.05			.5	7				5	4	0	2	0	10		1	90	
330	340		.25	<.02	3.0	0.4	0.1	0.05			.5	10				5	4	0	2	0	10		1	90	
340	350		.16	.03	2.5	0.4	0.1	0.05			.5	10				5	4	0	2	0	10		1	90	
350	360		.33	<.02	3.7	0.4	0.1	0.05			.5	10				5	4	0	2	0	10		1	90	
360	370		.22	<.02	3.6	0.3	0.1	0.05			.5	7				5	4	0	2	0	10		1	95	Vuggy section 330-360
370	380		.09	<.02	1.9	0.3	0.1	0.05			.5	7				5	4	0	2	0	10		1	95	
380	390		.17	<.02	3.5	0.3	0.1	0.05				7				5	4	0	2	0	10		1	90	
390	400		.20	<.02	2.5	0.3	0.1	0.05				7				5	4	0	2	0	10		1	90	Rock is less altered 410-460
400	410		.22	<.02	3.1	0.3	0.1	0.05				7				5	2	0	1	0	10		1	90	
410	420		.04	.03	2.2	0.3	0.1	0.05				7				5	2	0	1	0	10		1	95	
420	430		.07	<.02	2.4	0.3	0.1	0.05				7				5	2	0	1	0	10		1	90	

GEOLOGIC LOG

PROJECT THUNDER MOUNTAIN

PROJECT THUNDER MTN. HOLE NO. BB-9
DATE STARTED
DATE F.
INCLINATION
LOGGED BY HND
DATE
PAGE 2 OF 2

			% Cu	OPT Au	OPT Ag	ORE: CHALCOCITE	COVELLITE	CHALCOPYRITE	MINERALS: SPHALERITE	ENARGITE	GANGUE & ALTERATION MINERALS: PYRITE-VEIN	PYRITE-DSS	GOETHITE	LIMONITE	HEMATITE	QUARTZ-VEIN	QUARTZ-DSS	PYROPHILLITE	SERICITE	ARGILLIC	ALUNITE	FAULTS	FRACS. PER FT.	% RQD	
430	440	100	.09	<.02	3.5	0.3	0.1	0.05			7					5	20	10	10			1	95	— QUARTZ FELDSPAR PORPHYRY (continues to BOH)
440	450		.43	<.02	4.9	0.3	0.1	0.05			7					5	20	10	10			1	90	
450	460		.06	<.02	4.1	0.3	0.1	0.05			7					5	20	10	10			1	95	
460	470		.08	<.02	4.9	0.2	0.1	0.05			7					5	30	20	10			1	95	
470	480		.13	<.02	2.1	0.2	0.1	0.05			10					5	30	20	10			1	90	
480	490		.14	<.02	1.5	0.2	0.1	0.05			7					5	30	20	10			1	90	
490	500		.08	<.02	5.3	0.2	0.1	0.1			7					5	30	20	10			1	90	
500	510		.40	<.02	4.4	0.4	0.1	0.1			10					5	40	20	10		6"	2	85	small fault? (gouge w/chalcocite) 504-504.5
510	520					0.2	0.1	0.1			7					5	30	20	10			1	95	Chalcocite decreases - chalcopyrite increases slightly
520	530					0.2	Tr	0.1			7					5	20	10	10			1	95	below 510. (510-600)
530	540					0.1	Tr	0.1			7					5	40	10	10			1	95	
540	550					0.1		0.1			5					5	30	20	10			1	95	
550	560					0.1		0.1			5					5	30	20	10			1	95	
560	570					0.1		0.1			5					5	30	20	10			1	95	
570	580					0.1		0.1			5					5	30	20	10			1	95	
580	590					0.1		0.1			5					5	30	20	10			1	95	
590	600					0.1		0.1			5					5	30	20	10			1	95	
BOH	600'																							BOH