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James Doyle Sell Mining Collection

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Orcana Resources Limited
405-121 Richmond St. W.
Toronto, Ontario
M5H 2K1

Asarco
1150 North 7th Avenue
P.O. Box 5747
Tucson, Arizona 85703-0747

Attention: James D. Sell
Exploration Manager

JDS

# ORCANA RESOURCES LIMITED

SUITE 804 405 • 121 RICHMOND STREET WEST • TORONTO • ONTARIO • M5H 2K6 • TELEPHONE 416-947-0500 416-364-2015

November 7, 1991

Asarco Inc.
1150 North 7th Avenue
P.O. Box 5747
Tucson, Arizona
85703-0747

Attention: James D. Sell
Exploration Manager

Dear Jim

Re: Castle Copper Moly Deposit, Arizona, USA

I assume you were unable to convince Asarco with optioning the property. Orcana has decided to proceed with a drilling program early next year. We plan to evaluate the property in detail and, as a result, we would appreciate receiving the maps and PD drill logs that I left with you. I would appreciate if you could send them by courier as soon as possible.

After we complete our study I shall present you with a copy for your update. When we proceed with drilling please feel free to visit the site anytime.

Thank you for your interest in the property.

Yours very truly
ORCANA RESOURCES LIMITED

Raymond J. Mongeau
President

ASARCO Inc.

NOV 8 1991

SW Exploration

JD S

# ASARCO

**Exploration Department**
Southwestern United States Division
James D. Sell
Manager

April 23, 1991

Mr. Raymond J. Mongeau
Orcana Resources, Ltd.
121 Richmond St. West, Suite 405
Toronto, Ontario M5H 2K6
Canada

Castle Copper-Moly Deposit
Yavapai County, Arizona

Dear Ray:

Thank you for the note, map and cross section of April 18, 1991.

The best targets are certainly the enriched blanket areas in what may drill out as valley edges next to the fault with tilted fault blocks.

It will need some close drilling to find the trend but should be good going along trend.

I'll continue to work on it from this end and will be out of the office for the month of May before I can get back on it.

Sincerely,

James D. Sell

JDS:mek

cc: W.L. Kurtz

ASARCO Incorporated P.O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue FAX (602) 792-3934 Phone (602) 792-3010

JDS

TELECOPIER/FACSIMILE COVER LETTER

NAME OF SENDER: Raymond Mongeau

DATE: June 18 1991 TIME:

PLEASE DELIVER THE FOLLOWING 15 PAGES (INCLUDING THIS COVER LETTER) TO:

NAME: Jim Sell, Exploration Manager

TELECOPIER: (602)-923-9134 CITY:

FIRM: Asarco

COMMENTS:

IF YOU DO NOT RECEIVE ALL PAGES, PLEASE CALL BACK AS SOON AS POSSIBLE TO:

NAME: Maria

PHONE: (416) 364-2015

TELECOPIER NO: (416) 364-2178

incorporate

JUN 18 1991

exploration

ORCANA RESOURCES LIMITED

405 364-2015

SUITE ~~402~~ · 121 RICHMOND STREET WEST · TORONTO · ONTARIO · M5H 2K6 · TELEPHONE 416 ~~947-0500~~

ASARCO Incorporat

June 18, 1991

JUN 1 8 1991

SW Exploration

Asarco
1150 North 7th Avenue
P.O. Box 5747
Tucson, Arizona
85703-0747

Attention: James D. Sell
Exploration Manager

Dear Jim

Re: Castle Copper Moly Deposit, Yavapai County, Arizona

Further to my recent letter and reports with regard to the above property we had Mr. John Steers, a consulting geologist from Toronto complete an economic evaluation and sensitivity study on the deposit using a software package by Gemcan Services Inc. I'm enclosing a letter and an evaluation resume by Steers and two tables completed by myself utilizing his information. While we have had to make a number of assumptions as to its location, infrastructure, orebody dimensions and depth, type of mining method and smelter location, we have utilized this program to give us a feel for the economic viability of the project. I'm certain you have your own computer models to work from but, I thought that you may be interested in seeing the projected capital and operating costs for this bulk-type underground operation.

This program was developed in Canada so the numbers are all in Canadian dollars. The program is unable to provide for minimal precious metal credits. Therefore, we have provided gold and silver credits in the amount of $1.00 net per ton of ore processed in the return on the sale of the molybdenite concentrates (in a higher price for molybdenite). Further, the program assumes the ore to be a mixture of chalcopyrite and chalcocite whereas most of the ore is believed to be chalcocite. In this study we have used a conservative concentrate grade of 33% Cu.

The labour and materials which are based on 1986 Canadian costs have gone up since the program was written but a large part of this is offset by the fact that costs for labour and materials are much lower in the US than in Canada.

The data produced by this study was rather favourable as it resulted in a production cost of 64 cents Canadian (55 cents US) per pound of copper produced after smelting charges and Au + Ag credits are taken into consideration and on the basis of an in-situ reserve grade of 1.27% Cu. Also, we have been advised that this predominantly chalcocite ore will probably be amenable to leaching and solvent extraction and electrowinning.

If you have any questions or wish to obtain the details of this program please feel free to call. Hoping to hear from you shortly, I remain,

Yours very truly
**ORCANA RESOURCES LIMITED**

Raymond J. Mongeau
President

## TABLE A

### Castle Copper Molybdenum Property
### Yavapai County, Arizona, USA

### INFERRED ORE RESERVES AND GRADE

Ore Reserves in Place: 40,000,000 tonnes
Grade: - 1.27% Cu (see note 1 below)
- 0.05% $MoS_2$
- Minor Au + Ag Credits ($1.00 net/tonne of ore)

Ore Reserves Recoverable: 29,975,570 tonnes
Grade: - 1.17% Cu
- 0.014% $MoS_2$
- Minor Au + Ag Credits ($1.00 net/tonne of ore)

Dilution Factor: 7.1% Recovery Factor: 70%

Mill Recovery - Cu 93.89%
- $MoS_2$ - 28.86%

Grade of Concentrate: Cu - 33% (see note 3 below)
$MoS_2$ - 80%

NOTES:

1) The above indicated reserves are based on widely spaced drill holes only. We expect results of detail drilling to augment the in-situ copper grade to the 1.50% level. Also, based on a room and pillar mining method the unrecoverable pillars are most likely to be placed in the leaner portion of the orebody. Assuming that the average grade of rock left as pillars averages 0.65% then the mineable ores should average 1.48% Cu. If the reserve grade proves to be higher than 1.27% Cu and the pillars to consist of leaner material there's an excellent possibility of the mineable ores in place to average above 1.50% Cu.

2) The copper concentrate grade of 33.0% is conservative as it assumes the inclusion of a large amount of chalcopyrite. This does not appear to be the case.

TABLE B

## Castle Copper Molybdenum Property
## Yavapai County, Arizona, USA

### ECONOMIC EVALUATION AND SENSITIVITY ANALYSES

a) Ore Reserves in Place: 40,000,000 tons
In-Situ Grade: 1.27% Cu; copper price 1.30 Cdn ($1.13 US)
Concentrate Grade: 33.0% Cu

Total Pre-Production Capital Cost $128,776,338
Annual Revenue at the Mine Site $80,661,667
Annual Operating Cost $34,148,810
Annual Net Operating Profit before Taxes $46,512,857
Mining Rate per Day - 10,000 tonnes (2.6 million tonnes annually)
Milling Rate per Day - 7,123 tonnes
Mining Life - 12 years
Pre-production - 4 years
Payback - 3.6 years

Total Operating and Smelting Costs
per Pound of Copper Produced: Cdn$ - 0.64
US$ - 0.55

### SENSITIVITY ANALYSES

b) In-Situ Grade: 1.27% Cu (see above)

| Copper Price | | | |
|---|---|---|---|
| Cdn$ | US$ | IRR %[1] | NPV 12% |
| 1.30 | 1.13 | 13.28 | $15.57 million |

c) In-Situ Grade: 1.50% Cu

| Copper Price | | | |
|---|---|---|---|
| Cdn$ | US$ | IRR %[1] | NPV 12% |
| 1.30 | 1.13 | 20.97 | $63.85 million |

[1]Internal Rate of Return or Discounted Cash Flow Rate of Return before Taxes

**MEMO**

Date: June 10, 1991

To: Mr. R.J. Mongeau/Mr. J.A. Tait

From: J.E. Steers

Subject: Castle Cu-Mo Project, Arizona

As requested I have attempted some sensitivity analyses for the "base case geological model" constructed Sept. 26, 1990. At that time current copper prices and exchange rates were used and it was assumed that certain precious metals credits would be available. Since we did not have a good handle on the precious metal grades we added a very nominal dollar value to the then current $MoS_2$ price to provide for some precious metals credits. The base case should be considered as a type I estimate accurate to plus or minus 25-30% as we have insufficient information on the total tonnage likely to be available, the ultimate average grade, and the metallurgical characteristics of the potential "ore" to do a more refined evaluation. However the purpose of this exercise is to indicate that there are good geological and economic reasons to pursue additional exploration to obtain the data needed.

The program used to prepare these estimates is called Mine-Forecast, marketed by Gemcom Services Inc., designed and developed by Dr. J.B. Gammon who is now a very senior official with the Ontario Ministry of Natural Resources. The formulas used to derive such things as capital and operating costs, mine and plant sizing etc. are developed from curves and published by T. O'Hara, a very well known evaluator and consultant who spent much of his career with Hudson Bay Mining and Smelting. The program assumes that the mineralization being treated is chalcopyrite whereas in actuality most of the mineralization is chalcocite which would produce a superior grade concentrate, decrease shipping and smelting costs and yield a higher netback to the potential mine. It has been indicated that a chalcocite concentrate might be amenable to treatment on site in a low cost solvent extraction electro-winning plant. Although the construction of such a plant would add marginally to the capital costs the production of a premier grade copper on site would yield an improved netback through a premium copper price and the elimination of smelter and concentrate transportation charges. (Additional metallurgical testwork is required to confirm or deny this indication, and for this core is needed.)

The principal sensitivities on the potential economics of the prospect are, in no particular order, copper price, average grade of the deposit, discount rate used, and because of the long lead times and the effects of discounting capital costs and when they are incurred. The program assumes total capital costs incurred evenly over a 4 year preproduction period however they are likely to be heavier in years 3 & 4 than in years 1 & 2.

An examination of the base case indicates that at any discount rate equal to or greater than 6% mine life (12 years) is sufficient to provide positive net present value; therefore there is little reason to pursue exploration for more tonnage since the known mineralized volume will contain sufficient tonnage for the postulated 12 year mine life. Annual mining and processing costs are

estimated at $34,148,810 which when divided by the recovered copper per year (28,961 tonnes x 2204.6 lbs) yields a minesite cost of 53.48 cents Canadian per pound recovered at the smelter (transportation and smelting charges would add to this cost, however even this number is conservative since no credit is given for moly and P.M. credits.) Using precisely the same parameters as in the base case and changing the average grade to 1.5% (which certainly seems reasonable when the geological data is examined has the effect of reducing the mining and processing costs to about 44 cents Canadian a pound of recovered copper. The above illustrates why it is so important to perform additional drilling to establish the average grade and the metallurgical characteristics of the mineralization.

Respectfully submitted,

J.E. [illegible] Eng.

P-1

Grade: 1.27% Cu
Cu Concentrate Grade: 28.5% (cpy)
Copper Price: $1.30 Cdn (1.13 US.)

SECTION I - INTRODUCTION

This worksheet was prepared by: J. E. STEERS
The property being evaluated is known as: Castle Cu-Mo
Date that this worksheet was prepared: 11-JUN-1991
Metals present and prices chosen(Cdn.$!)

| | |
|---|---|
| Copper(Cdn$/ | $1.30 |
| Moly(Cdn$/lb | $6.05 |

Tonnage estimate: 40,000,000 Tonnes

Grade estimate:

| | | |
|---|---|---|
| Gold | | g/mt. |
| Silver | | g/mt. |
| Copper | 1.27 | % |
| Lead | | % |
| Zinc | | % |
| Moly | 0.05 | %MoS2 |

**********

SECTION II - MINING PARAMETERS:

| | |
|---|---|
| Average stoping width of the ore zone | 30.00 metres |
| General dip of the ore zone | 0 Degrees |
| Maximum depth below surface | 700 metres |
| Relatively competent rocks | 2 |
| ROOM AND PILLAR UNDERGROUND MINING CASE: | |
| Calculated dilution factor: | 7.1 % |
| Assumed recovery factor: | 70 % |
| Recoverable ore reserves: | 29,975,570 Tonnes |

With a grade of:

| Au | Ag gmt |
|---|---|
| 0.00 | 0.00 |
| Cu% | Pb% |
| 1.19 | 0.00 |
| Zn% | MoS2% |
| 0.00 | 0.04 |

| | |
|---|---|
| Calculated annual mine capacity: | 2,600,000 Tonnes/year |
| Hence mine lifetime is: | 12.0 Years |

**********

SECTION III - MILLING PARAMETERS Copper(+/-Au & Ag)- Molybdenite ores

COPPER CONCENTRATE:

| | |
|---|---|
| Calculated mill recovery: | 93.89 % for Cu. |
| Calculated mill recovery: | 100.00 % for Ag. |
| Calculated mill recovery: | 100.00 % for Au. |
| Assumed grade of Cu in the concentrate: | 28.50 %Cu |
| Calculated grade of Ag in the concentrate | 0.00 gms/tn.Ag |
| Calculated grade of Au in the concentrate | 0.00 gms/tn.Au |
| Recoverable metals per year - | 28,961 Tonnes of Cu |
| Recoverable metals per year - | 0 Grams of Ag |
| Recoverable metals per year - | 0 Grams of Au |

P-2

Tonnes of concentrate produced per year - 101,616 Tonnes

| | |
|---|---|
| NET SMELTER VALUE | $647.64 /Tonne |
| CONCENTRATE TRANSPORTATION COSTS: | |
| Rail freight distance: | 120 kms. |
| Road freight distance: | 60.00 kms. |
| Ocean Transport (Choice #): | 5 |
| Number of transfer points: | 1 |
| Transportation cost : | $33.79 /Tonne conc. |
| ANNUAL REVENUE AT THE MINE SITE: | $62,377,464 |
| MOLYBDENITE CONCENTRATE | |
| Calculated Mill Recovery: | 26.86 % for MoS2 |
| Assumed grade of MoS2 in concentrate: | 80 %MoS2 |
| Recoverable metals per year - | 307 tns of MoS2 |
| Tonnes of concentrate produced per year - | 383 tonnes |
| NET SMELTER VALUE | $10,670.26 /Tonne |
| CONCENTRATE TRANSPORTATION COSTS: | |
| Rail freight distance: | 120 kms. |
| Road freight distance: | 60.00 kms. |
| Ocean Transport (Choice #): | 5 |
| Number of transfer points: | 1 |
| Transportation cost : | $33.79 /Tonne conc. |
| ANNUAL REVENUE AT THE MINE SITE: | $4,075,247 |
| TOTAL ANNUAL REVENUE AT THE MINE SITE: | $66,483,710 |

**********

SECTION IV - ESTIMATION OF OPERATING COSTS

| | |
|---|---|
| Daily mined tonnage (5d/wk)- | 10000 Tns/day(Ore) |
| Daily milled tonnage (7d/wk) - | 7123 Tns/day |
| Mine operating costs: | |
| Labour Cost - (Room and Pillar) | $2.06 /Tonne |
| Supplies Cost - (Room and Pillar) | $3.61 /Tonne |
| Mill Operating Costs: | |
| Labour Cost | $1.70 /Tonne |
| Supplies Cost | $2.32 /Tonne |
| EMPLOYEES REQUIRED:- | |
| Operating Personell - (Mine): | |
| Room and Pillar Mining: | |
| Development | 21 |
| Stoping | 67 |
| Mine Service | 18 |
| Maintenance | 19 |
| Mine Staff | 24 |
| TOTAL | 149 |
| Operating Personell - (Mill) | |
| complex sulphide mills | 69 |
| Administration and Gnl. Services: | |
| Electrical Services | 9 |

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| | |
|---|---|
| Plant Serv. & Roads | 9 |
| Townsite | 9 |
| Gnl. Admin. | 15 |
| TOTAL EMPLOYEES REQUIRED: | 259 |
| Admin & Gnl Services -Operating Costs/dy. | |
| Electrical Services | $1,064 |
| Surface Plant Services | $861 |

| | |
|---|---|
| Camp Employees Wages | $782 |
| Fringe Benefits | $348 |
| Supplies | $1,079 |
| Camp Operating Cost | $3,521 |
| Gnl Admin Expenses | $1,565 |
| Electric Power | $14,745 |
| TOTAL | $24,565 |
| Admin & GnlServ Cost | $3.45 /Tonne(Ore) |
| TOTAL ANNUAL OPERATING COSTS: | $34,148,810 |

**********

SECTION V - PROCESS PLANT,CAPITAL COST ESTIMATION:

| | |
|---|---|
| Plant-Site Clearing and Mass Excavation | |
| Relatively flat site: | $1,065,704 |
| Concrete Foundations and detailed excavations | |
| Concrete slabs on compact gravel/sand: | $5,784,406 |
| Crushing Plant,Coarse Ore Storage | |
| and Conveyors: | $7,230,508 |
| Concentrator Building | |
| Mild climate: | $4,820,338 |
| Grinding Section and Fine Ore Storage | |
| Medium ores (70% -200#): | $11,628,327 |
| Flotation and/or Processing Section | |
| Flotation-complex base metal ores | $4,845,136 |
| Thickening and filtering Section | |
| Complex base metal ores | $1,606,779 |
| Concentrate Storage and Loading | $1,324,710 |
| CAPITAL COST OF PROCESS PLANT: | $36,981,198 |

**********

SECTION VI - MINE, CAPITAL COST ESTIMATION.

| | |
|---|---|
| UNDERGROUND MINE CASE | |
| Timbered shaft | |
| Area: | 34.3 sq.m |
| Cost of shaft sinking | $11,787,348 |
| Hoisting Plant sizing and Cost: | |
| Drum diameter | 4.9 metres |
| Hoisting Speed | 973.6 m/min |

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| | |
|---|---|
| Motor Horsepower | 7,643.8 HP |
| Area of Hoistroom | 1,225.2 sq.m |
| Headframe Height | 68.1 metres |
| Weight of structural steel | 2,242,977 Kg. |
| Cost of erecting Headframe complex | $8,043,160 |
| Cost of installing hoist | $926,909 |
| Cost of Hoistroom | $3,425,690 |
| Cost of Hoist Equipment | $5,751,634 |
| Preproduction Mine Development costs: | |
| Drifts,ramps,raises(as drifting equiv.) | 14,636 metres |
| Cost of Mine Development | $12,291,220 |
| Compressor capacity | 14,816 CFM |
| Compressor installation cost | $261,554 |
| Compressor purchase price | $1,444,769 |
| Equipment cost & installation | $14,509,722 |
| Cost of Maintenance Facilities | $2,665,288 |
| CAPITAL COST OF UNDERGROUND MINE | $61,107,292 |

**********

SECTION VII-PLANT UTILITIES AND GENERAL SERVICES,CAPITAL COST ESTIMATION

| | |
|---|---|
| Existing utility services | |
| Peak | 26,164 KW |
| Substation | $2,153,946 |
| Loc Dist. | $3,692,479 |
| Cost of power line extension: | $107,934 |
| Tailings Storage | $1,285,424 |
| Water Supply | |
| Reclaim water required | 1,251 GPM |
| Cost of reclaim water pumps | $389,475 |
| Cost of General Plant Services | $1,225,975 |
| Kms of road to be constructed | 10 |
| Cost of access road construction | $1,269,280 |
| Townsite/Accomodation costs | $1,962,293 |
| UTILITIES AND GENERAL SERVICES CAPITAL COST | $11,976,756 |

**********

SECTION - VIII PROJECT OVERHEAD COSTS

| | |
|---|---|
| Feasibility studies,design engineering and technical planning | $5,503,262 |
| Project supervision,contract management,expediting and general construction facilities,including camp costs: | $8,805,220 |
| Administration,accounting,legal and | |

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| | |
|---|---|
| pre-production employment of key operating staff: | $4,402,610 |
| TOTAL PROJECT OVERHEAD COSTS | $18,711,092 |

**********

SECTION IX - SUSTAINING CAPITAL COSTS

| | |
|---|---|
| Mill Sustaining capital cost | $187,826 /Year |
| Mine Sustaining Capital Cost | $5,618,538 /Year |
| TOTAL SUSTAINING CAPITAL COST | $5,806,365 |

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CASH FLOW DISTRIBUTION SUMMARY
Castle Cu-Mo

| YEAR #----> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ANN.REV---> | 0.00 | 0.00 | 0.00 | 0.00 | 66.45 | 66.45 | 66.45 | 66.45 | 66.45 | 66.45 | 66.45 | 66.45 | 66.45 |
| OP.COSTS--> | 0.00 | 0.00 | 0.00 | 0.00 | 34.15 | 34.15 | 34.15 | 34.15 | 34.15 | 34.15 | 34.15 | 34.15 | 34.15 |
| CAPITAL---> | 32.19 | 32.19 | 32.19 | 32.19 | 0.00 | 0.00 | | | | | | | |
| SUST.CAP--> | 0.00 | 0.00 | 0.00 | 0.00 | 5.81 | 5.81 | 5.81 | 5.81 | 5.81 | 5.81 | 5.81 | 5.81 | 5.81 |
| WORK.CAP--> | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| CASH FLOW-> | (32.19) | (32.19) | (32.19) | (32.19) | 26.50 | 26.50 | 26.50 | 26.50 | 26.50 | 26.50 | 26.50 | 26.50 | 26.50 |

| | |
|---|---|
| NPV@8%--> | $42.64 Million |
| NPV@10%-> | $23.13 Million |
| NPV@12%-> | $7.92 Million |
| NPV@14%-> | ($3.95)Million |
| NPV@16%-> | ($13.23)Million |
| NPV@18% | ($20.49) |
| DCFROR--> | 13.28 %(IRR) |

| 14 | 15 | 16 | 17 | 18 | 19 | 20 | TOTAL |
|---|---|---|---|---|---|---|---|
| 66.45 | 66.45 | 66.45 | 0.00 | 0.00 | 0.00 | 0.00 | 797.44 |
| 34.15 | 34.15 | 34.15 | 0.00 | 0.00 | 0.00 | 0.00 | 409.79 |
| | | | | | | | 128.78 |
| 5.81 | 5.81 | 5.81 | 0.00 | 0.00 | 0.00 | 0.00 | 69.68 |
| 0.00 | 0.00 | 8.54 | 0.00 | 0.00 | 0.00 | 0.00 | 8.54 |
| 26.50 | 26.50 | 35.04 | 0.00 | 0.00 | 0.00 | 0.00 | 197.74 |

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**********
SECTION X - SUMMARY
**********

| | |
|---|---|
| Property Name:..... | Castle Cu-Mo |
| Ore Type..... | Copper - Molybdenite ore |
| Mining Method used..... | Room and Pillar |
| Recoverable Ore Reserves..... | 29,975,570 Tonnes |
| Mining Rate (of ore) per day..... | 10,000 Tonnes |
| Milling Rate per day..... | 7,123 Tonnes |
| Mine Lifetime..... | 12.0 Years |
| Annual Revenue at the Minesite..... | $66,453,710 |
| Annual Operating Costs..... | $34,148,810 |
| Capital Cost of Mill..... | $36,981,198 |
| Capital Cost of Mine..... | $61,107,292 |
| Capital Cost of Utilities and Services..... | $11,976,756 |
| Project Overhead Costs..... | $18,711,092 |
| Working Capital Required (3 mos operating)... | $8,537,203 |
| Total Pre-Production Capital Cost..... | $128,776,338 |

Preproduction (yrs)..... 4

1A

Grade 1.50% Cu
Concentrate Grade : 33% Cu
Copper Price : $1.30 Cdn (1.13 US

**********
SECTION X - SUMMARY
**********

| | |
|---|---|
| Property Name:..... | Castle Cu-Mo |
| Ore Type..... | Copper - Molybdenite ore |
| Mining Method used..... | Room and Pillar |
| Recoverable Ore Reserves..... | 29,975,570 Tonnes |
| Mining Rate (of ore) per day..... | 10,000 Tonnes |
| Milling Rate per day..... | 7,123 Tonnes |
| Mine Lifetime..... | 12.0 Years |
| Annual Revenue at the Minesite..... | $80,661,667 |
| Annual Operating Costs..... | $34,148,810 |
| Capital Cost of Mill..... | $36,981,198 |
| Capital Cost of Mine..... | $61,107,292 |
| Capital Cost of Utilities and Services..... | $11,970,756 |
| Project Overhead Costs..... | $18,711,092 |
| Working Capital Required (3 mos operating)... | $8,537,203 |
| Total Pre-Production Capital Cost..... | $128,776,338 |
| Preproduction (yrs)..... | 4 |
| Payback (years)..... | 3.16 |
| Copper(Cdn$/LB)..... | $1.30 |
| Copper($US/Lb..... | $1.13 |
| In-situ Cu. grade | 1.50 % |

Concentrate grade 33% Cu.

CASH FLOW DISTRIBUTION SUMMARY
Castle Cu-Mo

| YEAR #----> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ANN.REV---> | 0.00 | 0.00 | 0.00 | 0.00 | 80.66 | 80.66 | 80.66 | 80.66 | 80.66 | 80.66 | 80.66 | 80.66 |
| OP.COSTS--> | 0.00 | 0.00 | 0.00 | 0.00 | 34.15 | 34.15 | 34.15 | 34.15 | 34.15 | 34.15 | 34.15 | 34.15 |
| CAPITAL---> | 32.19 | 32.19 | 32.19 | 32.19 | 0.00 | 0.00 | | | | | | |
| SUST.CAP--> | 0.00 | 0.00 | 0.00 | 0.00 | 5.81 | 5.81 | 5.81 | 5.81 | 5.81 | 5.81 | 5.81 | 5.81 |
| WORK.CAP--> | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| CASH FLOW-> | (32.19) | (32.19) | (32.19) | (32.19) | 40.71 | 40.71 | 40.71 | 40.71 | 40.71 | 40.71 | 40.71 | 40.71 |

NPV@8%--> $121.34 Million
NPV@10%-> $89.25 Million
NPV@12%-> $63.85 Million
NPV@14%-> $43.67 Million
NPV@16%-> $27.55 Million
NPV@18%-> $14.64
DCFROR--> 20.97 %(IRR)
Copper(Cdn$/LB)
$1.30

| 14 | 15 | 16 | 17 | 18 | 19 | 20 | TOTAL |
|---|---|---|---|---|---|---|---|
| 80.66 | 80.66 | 80.66 | 0.00 | 0.00 | 0.00 | 0.00 | 967.94 |
| 34.15 | 34.15 | 34.15 | 0.00 | 0.00 | 0.00 | 0.00 | 409.79 |
| | | | | | | | 128.78 |
| 5.81 | 5.81 | 5.81 | 0.00 | 0.00 | 0.00 | 0.00 | 69.68 |
| 0.00 | 0.00 | 8.54 | 0.00 | 0.00 | 0.00 | 0.00 | 8.54 |
| 40.71 | 40.71 | 43.24 | 0.00 | 0.00 | 0.00 | 0.00 | 368.24 |

JDS

ASARCO Incorporated

JUN 1 8 1991

SW Exploration

TELECOPIER/FACSIMILE COVER LETTER

NAME OF SENDER: Raymond Mangeau

DATE: June 18 1991 TIME:

PLEASE DELIVER THE FOLLOWING 15 PAGES (INCLUDING THIS COVER LETTER) TO:

NAME: Jim Sell, Exploration Manager

TELECOPIER: (602) 792-3934 CITY:

FIRM: Asarco

COMMENTS:

IF YOU DO NOT RECEIVE ALL PAGES, PLEASE CALL BACK AS SOON AS POSSIBLE TO:

NAME: Maria

PHONE: (416) 364-2015

TELECOPIER NO: (416) 364-2178

9/88 WLK for Lab → FILE

# ORCANA RESOURCES LIMITED

SUITE 405 · 121 RICHMOND STREET WEST · TORONTO · ONTARIO · M5H 2K8 · TELEPHONE 416-364-2015

June 18, 1991

Asarco
1150 North 7th Avenue
P.O. Box 5747
Tucson, Arizona
85703-0747

ASARCO Incorporated
JUN 18 1991
SW Exploration

Attention: James D. Sell
Exploration Manager

Dear Jim

Re: Castle Copper Moly Deposit, Yavapai County, Arizona

Further to my recent letter and reports with regard to the above property we had Mr. John Steers, a consulting geologist from Toronto complete an economic evaluation and sensitivity study on the deposit using a software package by Gemcan Services Inc. I'm enclosing a letter and an evaluation resume by Steers and two tables completed by myself utilizing his information. While we have had to make a number of assumptions as to its location, infrastructure, orebody dimensions and depth, type of mining method and smelter location, we have utilized this program to give us a feel for the economic viability of the project. I'm certain you have your own computer models to work from but, I thought that you may be interested in seeing the projected capital and operating costs for this bulk-type underground operation.

This program was developed in Canada so the numbers are all in Canadian dollars. The program is unable to provide for minimal precious metal credits. Therefore, we have provided gold and silver credits in the amount of $1.00 net per ton of ore processed in the return on the sale of the molybdenite concentrates (in a higher price for molybdenite). Further, the program assumes the ore to be a mixture of chalcopyrite and chalcocite whereas most of the ore is believed to be chalcocite. In this study we have used a conservative concentrate grade of 33% Cu.

The labour and materials which are based on 1986 Canadian costs have gone up since the program was written but a large part of this is offset by the fact that costs for labour and materials are much lower in the US than in Canada.

The data produced by this study was rather favourable as it resulted in a production cost of 64 cents Canadian (55 cents US) per pound of copper produced after smelting charges and Au + Ag credits are taken into consideration and on the basis of an in-situ reserve grade of 1.27% Cu. Also, we have been advised that this predominantly chalcocite ore will probably be amenable to leaching and solvent extraction and electrowinning.

If you have any questions or wish to obtain the details of this program please feel free to call. Hoping to hear from you shortly, I remain,

Yours very truly
**ORCANA RESOURCES LIMITED**

Raymond J. Mongeau
President

## TABLE A

**Castle Copper Molybdenum Property**
**Yavapai County, Arizona, USA**

**INFERRED ORE RESERVES AND GRADE**

Ore Reserves in Place: 40,000,000 tonnes
Grade: - 1.27% Cu (see note 1 below)
- 0.05% $MoS_2$
- Minor Au + Ag Credits ($1.00 net/tonne of ore)

Ore Reserves Recoverable: 29,975,570 tonnes
Grade: - 1.17% Cu
- 0.014% $MoS_2$
- Minor Au + Ag Credits ($1.00 net/tonne of ore)

Dilution Factor: 7.1% Recovery Factor: 70%

Mill Recovery - Cu 93.89%
- $MoS_2$ - 28.86%

Grade of Concentrate: Cu - 33% (see note 3 below)
$MoS_2$ - 80%

NOTES:

1) The above indicated reserves are based on widely spaced drill holes only. We expect results of detail drilling to augment the in-situ copper grade to the 1.50% level. Also, based on a room and pillar mining method the unrecoverable pillars are most likely to be placed in the leaner portion of the orebody. Assuming that the average grade of rock left as pillars averages 0.65% then the mineable ores should average 1.48% Cu. If the reserve grade proves to be higher than 1.27% Cu and the pillars to consist of leaner material there's an excellent possibility of the mineable ores in place to average above 1.50% Cu.

2) The copper concentrate grade of 33.0% is conservative as it assumes the inclusion of a large amount of chalcopyrite. This does not appear to be the case.

## TABLE B

### Castle Copper Molybdenum Property
### Yavapai County, Arizona, USA

### ECONOMIC EVALUATION AND SENSITIVITY ANALYSES

a) Ore Reserves in Place: 40,000,000 tons
In-Situ Grade: 1.27% Cu; copper price 1.30 Cdn ($1.13 US)
Concentrate Grade: 33.0% Cu

Total Pre-Production Capital Cost $128,776,338
Annual Revenue at the Mine Site $80,661,667
Annual Operating Cost $34,148,810
Annual Net Operating Profit before Taxes $46,512,857
Mining Rate per Day - 10,000 tonnes (2.6 million tonnes annually)
Milling Rate per Day - 7,123 tonnes
Mining Life - 12 years
Pre-production - 4 years
Payback - 3.6 years

Total Operating and Smelting Costs
per Pound of Copper Produced: Cdn$ - 0.64
US$ - 0.55

### SENSITIVITY ANALYSES

b) In-Situ Grade: 1.27% Cu (see above)

| Copper Price | | | |
|---|---|---|---|
| Cdn$ | US$ | IRR %[1] | NPV 12% |
| 1.30 | 1.13 | 13.28 | $15.57 million |

c) In-Situ Grade: 1.50% Cu

| Copper Price | | | |
|---|---|---|---|
| Cdn$ | US$ | IRR %[1] | NPV 12% |
| 1.30 | 1.13 | 20.97 | $63.85 million |

[1]Internal Rate of Return or Discounted Cash Flow Rate of Return before Taxes

# MEMO

Date: June 10, 1991

To: Mr. R.J. Mongeau/Mr. J.A. Tait

From: J.E. Steers

Subject: Castle Cu-Mo Project, Arizona

As requested I have attempted some sensitivity analyses for the "base case geological model" constructed Sept. 26, 1990. At that time current copper prices and exchange rates were used and it was assumed that certain precious metals credits would be available. Since we did not have a good handle on the precious metal grades we added a very nominal dollar value to the then current $MoS_2$ price to provide for some precious metals credits. The base case should be considered as a type I estimate accurate to plus or minus 25-30% as we have insufficient information on the total tonnage likely to be available, the ultimate average grade, and the metallurgical characteristics of the potential "ore" to do a more refined evaluation. However the purpose of this exercise is to indicate that there are good geological and economic reasons to pursue additional exploration to obtain the data needed.

The program used to prepare these estimates is called Mine-Forecast, marketed by Gemcom Services Inc., designed and developed by Dr. J.B. Gammon who is now a very senior official with the Ontario Ministry of Natural Resources. The formulas used to derive such things as capital and operating costs, mine and plant sizing etc. are developed from curves and published by T. O'Hara, a very well known evaluator and consultant who spent much of his career with Hudson Bay Mining and Smelting. The program assumes that the mineralization being treated is chalcopyrite whereas in actuality most of the mineralization is chalcocite which would produce a superior grade concentrate, decrease shipping and smelting costs and yield a higher netback to the potential mine. It has been indicated that a chalcocite concentrate might be amenable to treatment on site in a low cost solvent extraction electro-winning plant. Although the construction of such a plant would add marginally to the capital costs the production of a premier grade copper on site would yield an improved netback through a premium copper price and the elimination of smelter and concentrate transportation charges. (Additional metallurgical testwork is required to confirm or deny this indication, and for this core is needed.)

The principal sensitivities on the potential economics of the prospect are, in no particular order, copper price, average grade of the deposit, discount rate used, and because of the long lead times and the effects of discounting capital costs and when they are incurred. The program assumes total capital costs incurred evenly over a 4 year preproduction period however they are likely to be heavier in years 3 & 4 than in years 1 & 2.

An examination of the base case indicates that at any discount rate equal to or greater than 6% mine life (12 years) is sufficient to provide positive net present value; therefore there is little reason to pursue exploration for more tonnage since the known mineralized volume will contain sufficient tonnage for the postulated 12 year mine life. Annual mining and processing costs are

estimated at $34,148,810 which when divided by the recovered copper per year (28,961 tonnes x 2204.6 lbs) yields a minesite cost of 53.48 cents Canadian per pound recovered at the smelter (transportation and smelting charges would add to this cost, however even this number is conservative since no credit is given for moly and P.M. credits.) Using precisely the same parameters as in the base case and changing the average grade to 1.5% (which certainly seems reasonable when the geological data is examined has the effect of reducing the mining and processing costs to about 44 cents Canadian a pound of recovered copper. The above illustrates why it is so important to perform additional drilling to establish the average grade and the metallurgical characteristics of the mineralization.

Respectfully submitted,

J.E. Steens P.Eng.

JDS FILE

# ORCANA RESOURCES LIMITED

405 SUITE ~~904~~ • 121 RICHMOND STREET WEST • TORONTO • ONTARIO • M5H 2K6 • TELEPHONE 416-~~947-9500~~ 364-2015

February 26, 1991

ASARCO Incorporated
MAR 4 1991
SW Exploration

Asarco
1150 North 7th Avenue
P.O. Box 5747
Tucson, Arizona 85703-0747

Attention: James D. Sell
Manager
Exploration Department

Dear Jim

Thank you for your letter of January 14, 1991. I'm sorry for the long delay in getting to Arizona. Our syngenetic base-metal project in the Northeast United States is taking longer to put together than I originally thought.

I've arranged to pick up the Phelps Dodge drill data the week of March 18th, 1991. I would greatly appreciate meeting with you sometime that week if you are available. I shall call your office on March 18th from Arizona.

Yours very truly

ORCANA RESOURCES LIMITED

Raymond J. Mongeau

JDS

# ASARCO

**Exploration Department**
Southwestern United States Division

James D. Sell
Manager

January 24, 1991

Mr. Raymond J. Mongeau
President, Orcana Resources Ltd.
Suite 405
121 Richmond Street West
Toronto, Ontario
Canada M5H 2K1

Castle Copper-Moly
Yavapai County, AZ

Dear Ray:

Your letter and attachments of January 14, 1991 arrived today. Thank you.

It looks as if you have been working on this problem while enjoying the sunny climes of your vacation time.

No doubt the exploration potential is open and needs to be done to confirm the higher grade zone along the suggested structure.

I look forward to chatting with you when you get down this way.

Sincerely,

James D. Sell

James D. Sell

JDS:mek

cc: W.L. Kurtz

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

WLK → FILE JDS

Yavapai Co., AZ

# ORCANA RESOURCES LIMITED

SUITE ~~904~~ 405 • 121 RICHMOND STREET WEST • TORONTO • ONTARIO • M5H 2K6 • TELEPHONE 416-~~947-9500~~ 364-2015

January 14, 1991

Asarco Inc.
1150 North 7th Avenue
Tucson, Arizona 85703

ASARCO Incorporated
JAN 23 1991
SW Exploration

Attention: Jim D. Sell
Exploration Manager

Dear Mr. Sell

**Re: Castle Copper Molybdenum Deposit, Arizona, U.S.A.**

Further to my previous letter to you please find enclosed my thoughts regarding the possible origin and symmetry for this enriched supergene copper zone.

Utah logged copper mineralization within a strong fault zone (see hole UC-16), suggesting that copper migration did take place along northwest faults in the area.

A glance at the enclosed cross sections reveals that the west block, being the uplifted portion of the fault zone, carries extensive copper mineralization but its content is rather lean - no obvious enriched supergene zone is evident - it may at one time existed but, if so, it has since been destroyed by subsequent leaching.

The east block, which is the down throw portion of the fault zone, is characterized by an extensive and enriched secondary sulphide copper blanket with its greater thickness and higher grade appearing to lie along and near the fault zone, thinning rapidly to the east.

One suspects that the copper within the uplifted west block was extensively leached, thereafter migrating along the fault into the lower block where it rapidly precipitated upon reaching the water table.

No doubt, much drilling is needed to determine the grade and tonnage of this deposit.

Yours very truly
**ORCANA RESOURCES LIMITED**

RJ

**Raymond J. Mongeau**
**President**

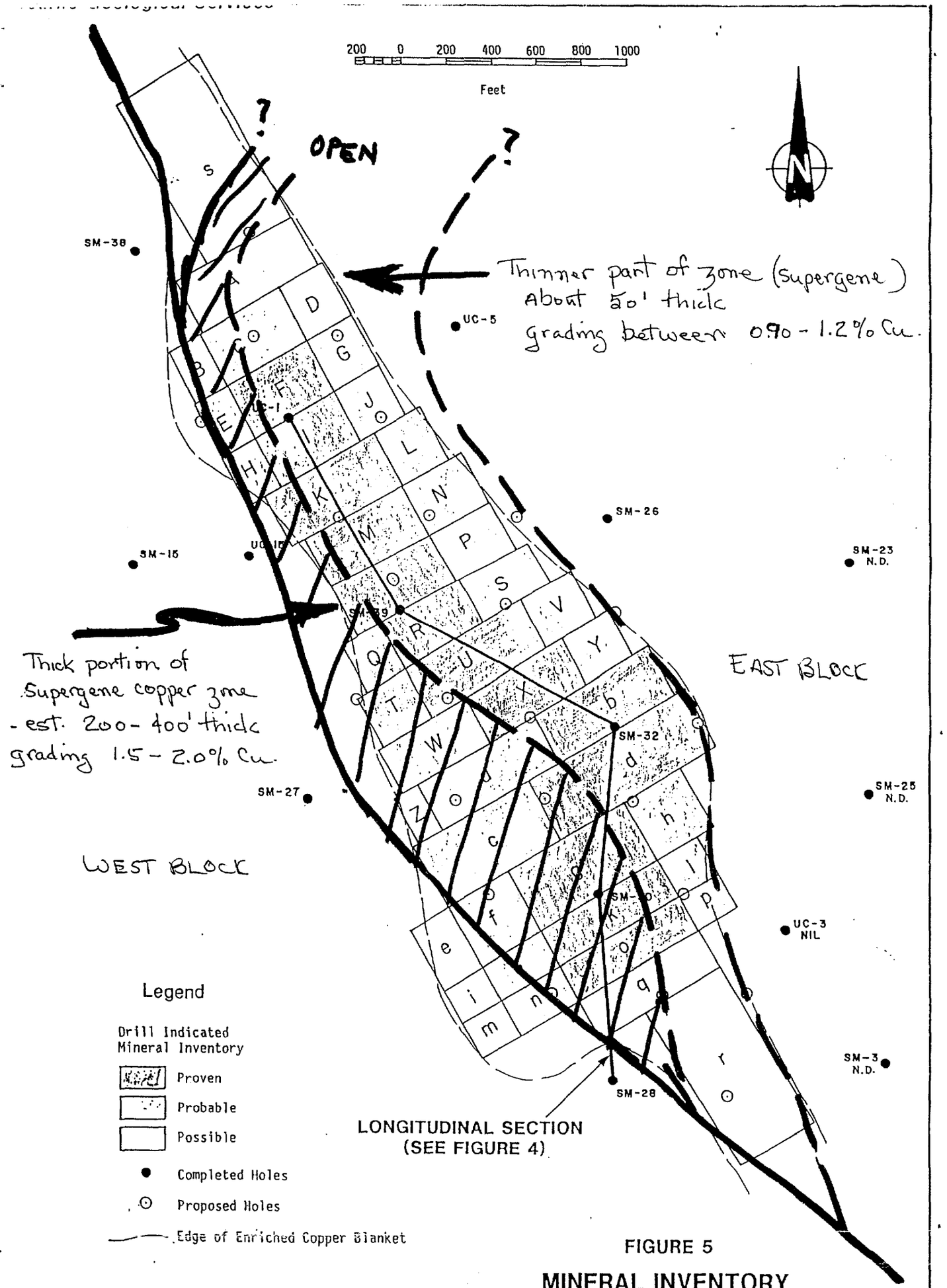



FIGURE 5

# MINERAL INVENTORY
# CASTLE COPPER-MOLYBDENUM DEPOSIT
# DIAMOND DRILL PLAN MAP AND LOCATION OF COPPER-MOLYBDENUM ZONE

YAVAPAI COUNTY, ARIZONA

LICENSED PROFESSIONAL ENGINEER
D. A. BOURNE
PROVINCE OF ONTARIO

August 27, 1990

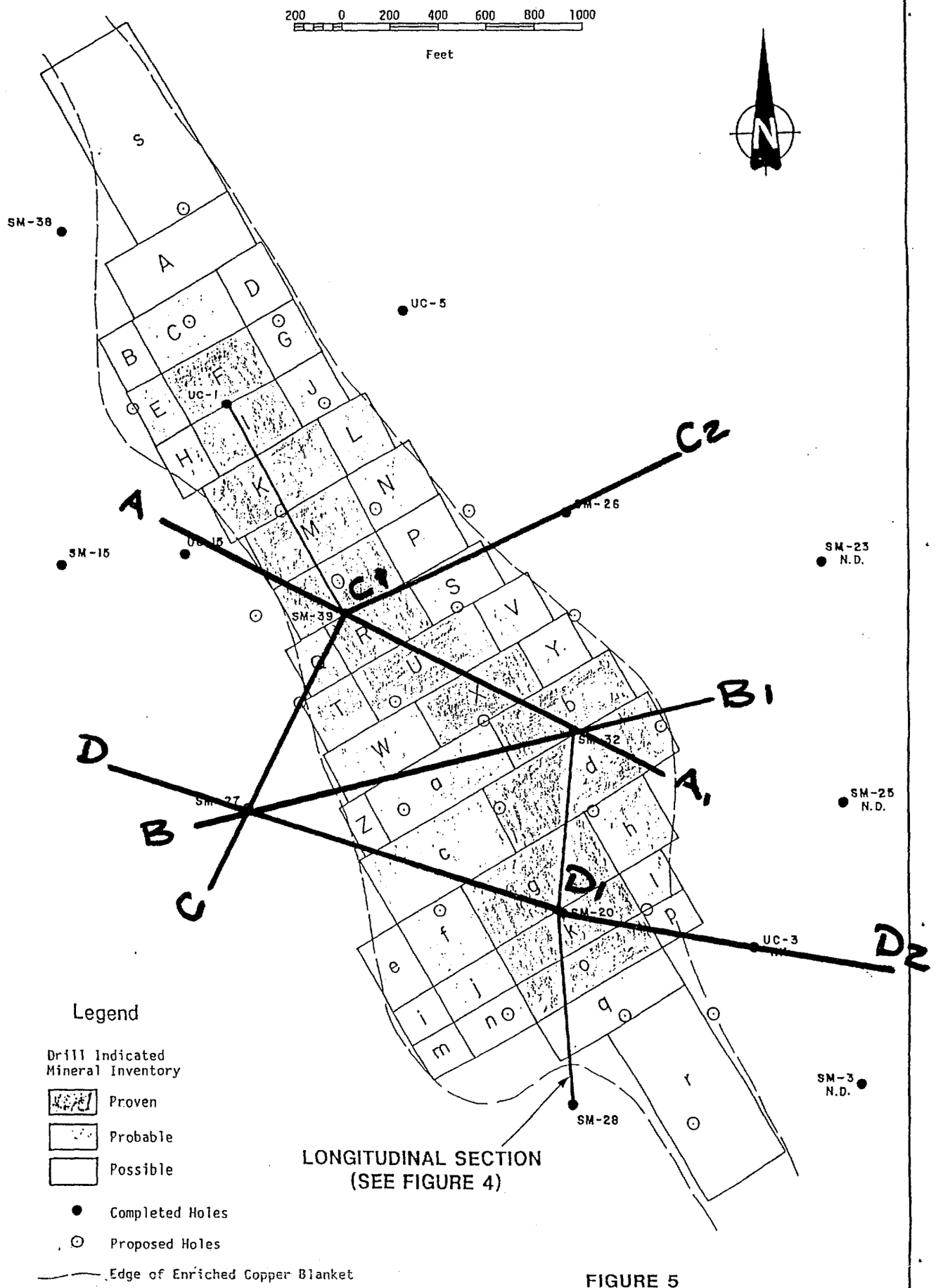



FIGURE 5

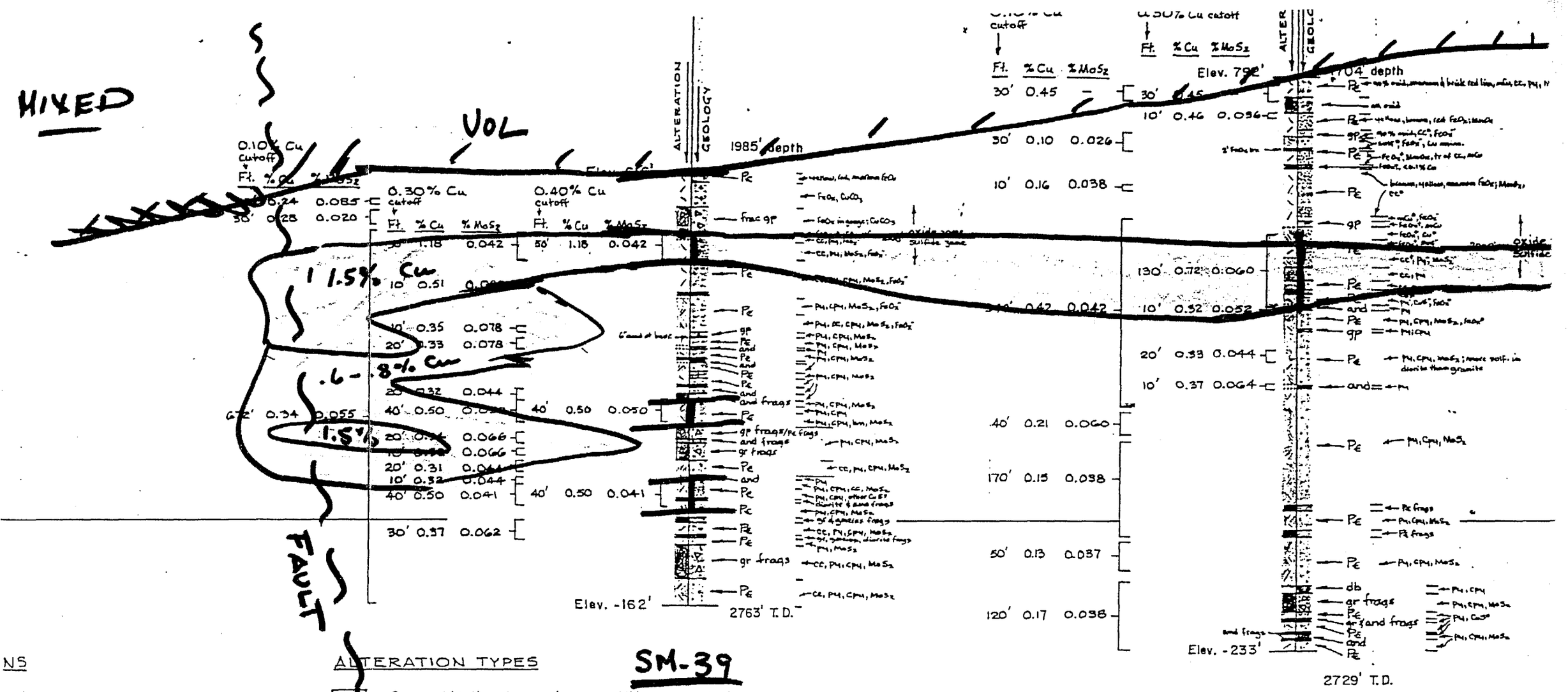
MINERAL INVENTORY
CASTLE COPPER-MOLYBDENUM DEPOSIT

# DIAMOND DRILL PLAN MAP AND LOCATION OF COPPER-MOLYBDENUM ZONE

YAVAPAI COUNTY, ARIZONA

LICENSED PROFESSIONAL ENGINEER
D. A. BOURNE
PROVINCE OF ONTARIO

August 27, 1990



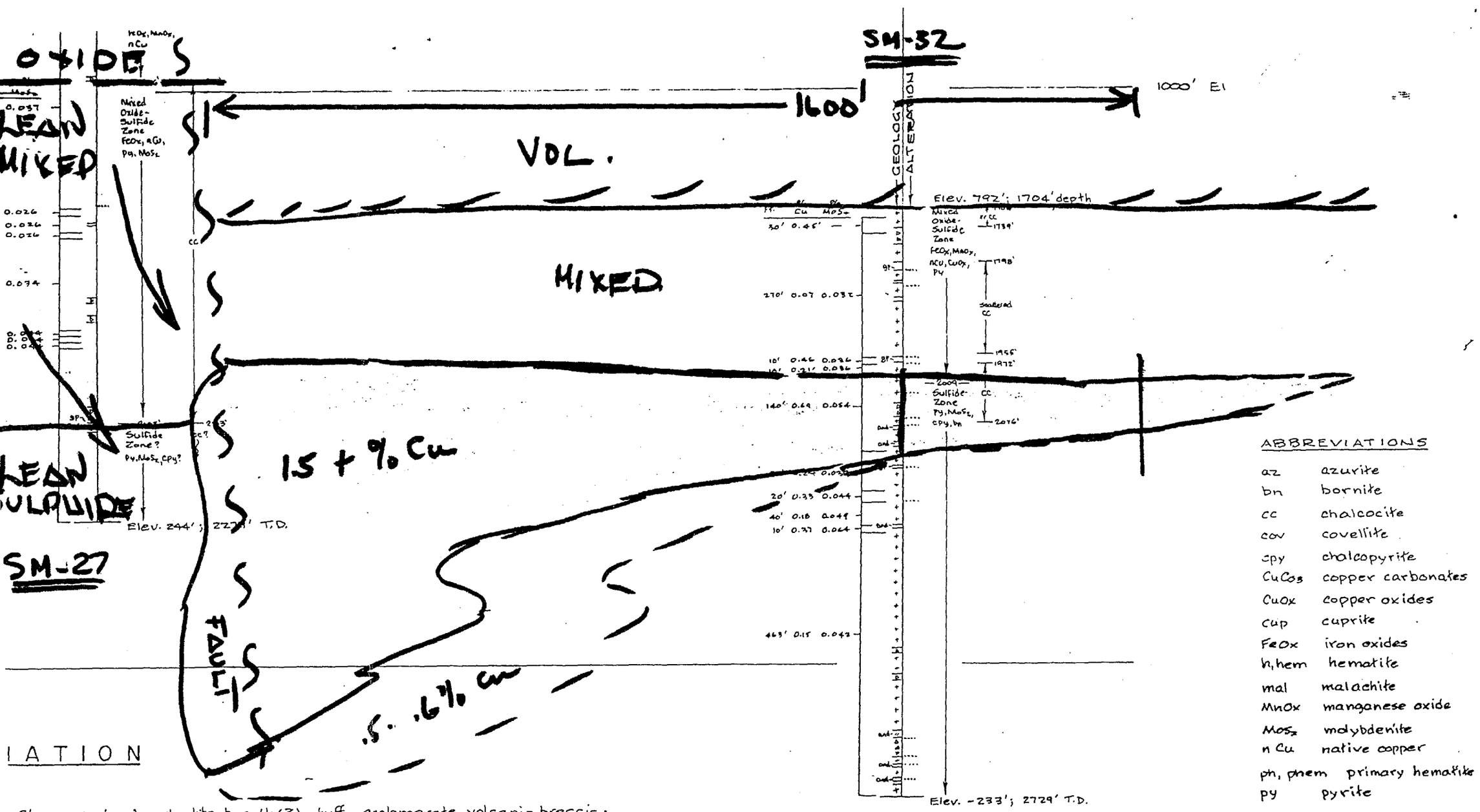

ALTERATION TYPES

- Clay-chlorite; in varying quantities. Includes some secondary biotite (especially in schist) and some secondary quartz.
- Sericite; quartz-sericite; quartz-sericite-clay. Usually includes clay & chlorite. Includes some silification in places.
- Silification.
- Quartz veinlets (locally accompanied by calcite).
  - weak to moderate
  - strong

SECTION A-A1

NS
rals
er
e
fides
e
bonates
des

UTAH
CR
LO
SHE
Yava




ABBREVIATIONS

| | |
|---|---|
| az | azurite |
| bn | bornite |
| cc | chalcocite |
| cov | covellite |
| cpy | chalcopyrite |
| $CuCo_3$ | copper carbonates |
| CuOx | copper oxides |
| cup | cuprite |
| FeOx | iron oxides |
| h, hem | hematite |
| mal | malachite |
| MnOx | manganese oxide |
| $MoS_2$ | molybdenite |
| n Cu | native copper |
| ph, phem | primary hematite |
| py | pyrite |

IATION

Flows: andesite, rhyolite, basalt (?), tuff, agglomerate, volcanic breccia;
omerate, sandstone (including lake deposits?); locally includes thin sequence of alluvium & talus
in age to Gila conglomerate?

-y; post-Bradshaw complex; age uncertain

phyry; post-Bradshaw complex; age
be fine grained equivalent of diabase?)

# SECTION B-B1

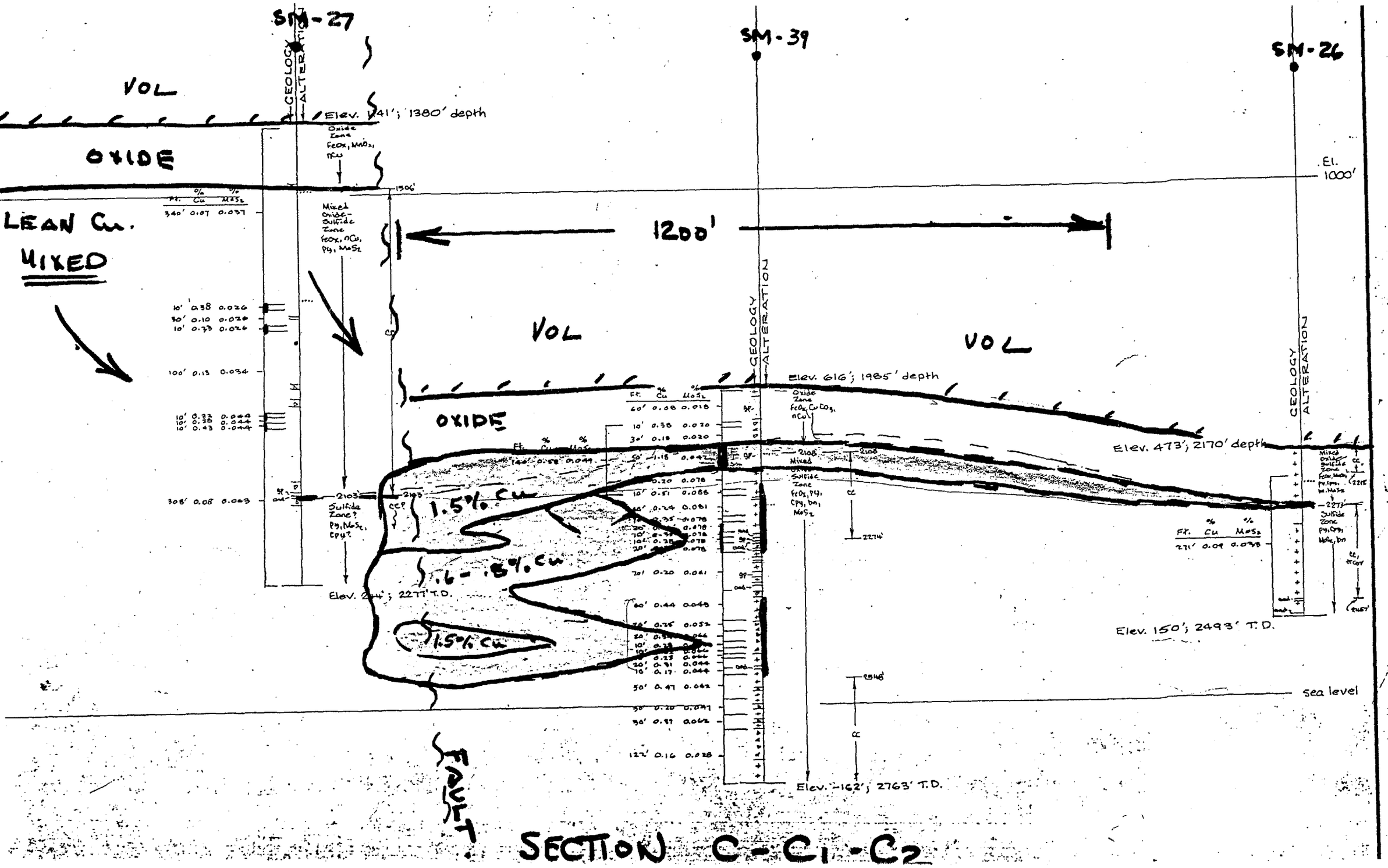
Drill hole nomenclature:
"R" rotary
"C" core
"SM" SM series; drilled by D.D. Corp.
1, 2, etc. hole number

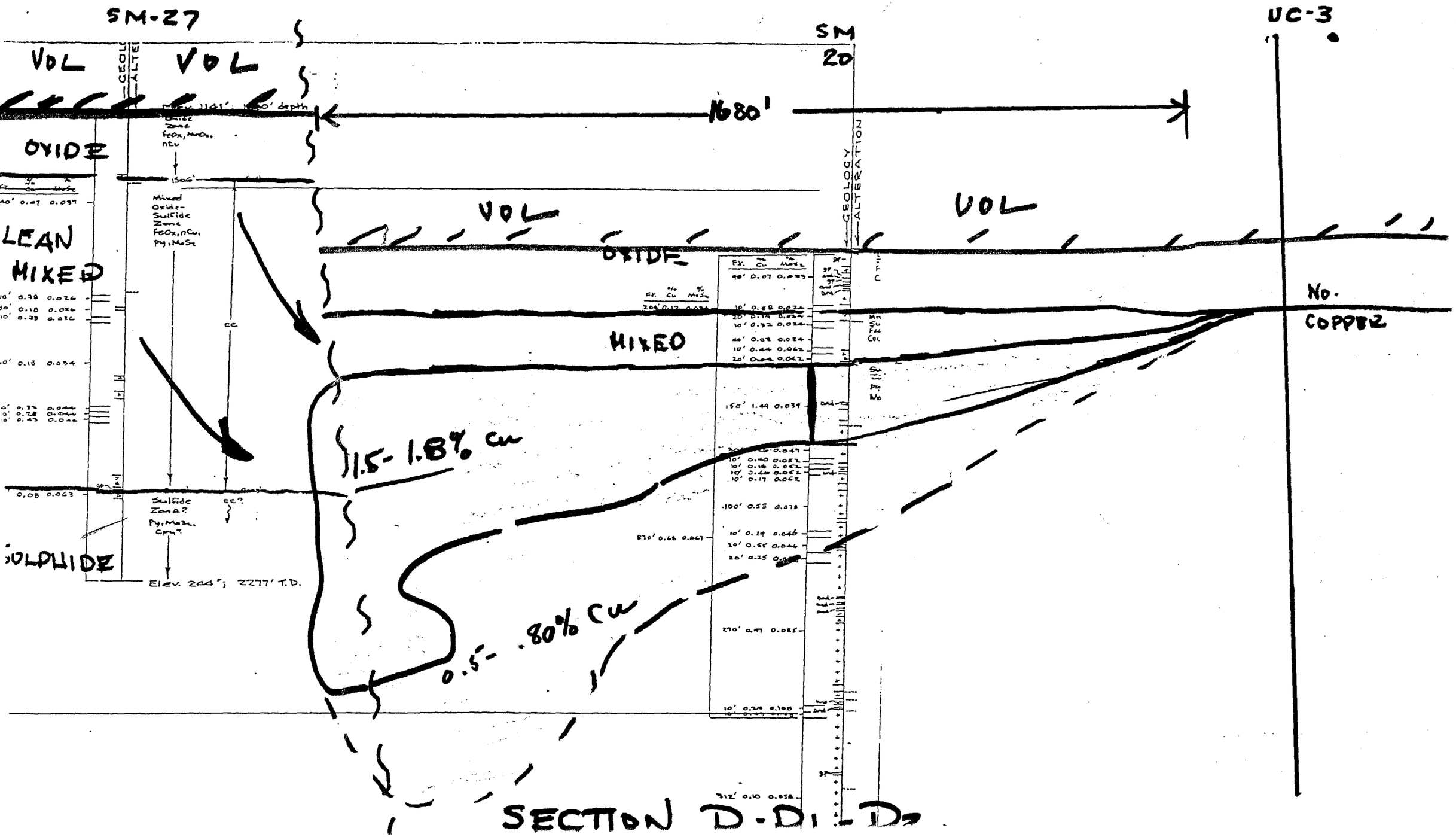
ALTERATION TYPES

clay-chlorite; in varying quantities; traces to no sericite

UTAH CONSTRUCTION & MINING CO.

CROSS SECTION


SM-27
SM-39
SM-26
GEOLOGY
ALTERATION
VOL
OXIDE
Elev. 1041'; 1380' depth
Oxide Zone FeOx, MnOx, nCu
El. 1000'
LEAN Cu.
MIXED
1200'
Mixed Oxide-Sulfide Zone FeOx, nCu, Py, MoS2
VOL
VOL
Elev. 616'; 1985' depth
OXIDE
Oxide Zone FeOx, CuCO3, nCu
Elev. 473'; 2170' depth
Mixed Oxide-Sulfide Zone FeOx, Py, Cpy, bn, MoS2
Sulfide Zone? Py, MoS2, Cpy?
1.5% Cu
.6-.8% Cu
1.5% Cu
Elev. 244'; 2277' T.D.
Elev. 150'; 2493' T.D.
sea level
Elev. -162'; 2763' T.D.
FAULT
SECTION C-C1-C2


SM-27
SM 20
UC-3
VOL
VOL
VOL
VOL
OXIDE
OXIDE
LEAN
MIXED
MIXED
SULPHIDE
GEOLOGY
ALTERATION
1680'
Mixed Oxide-Sulfide Zone FeOx, nCu, Py, MoSe
Sulfide Zone? Py, MoSe, Cpy?
Elev. 244'; 2277' T.D.
1.5-1.8% Cu
0.5-.80% Cu
No. COPPER
SECTION D-D1-D2

JDS

**ASARCO**

Southwestern Exploration Division

December 18, 1990

S.A. Anzalone
Tucson Office

Castle Cu-Mo Deposit
(Sheep Mountain Project)
Humbug District
Sec. 10, et al, T8N, R1W
Yavapai County, Arizona

Dear Sal:

I bring to your attention the old Sheep Mountain Project drilled by Phelps Dodge, Kennecott and Utah International, and now controlled by Orcana Resources.

Additional holes will be needed to define the high grade (plus 1.25% copper) zone, but the data available may be of interest as to your determining any interest of Asarco in such a mineral resource.

James D. Sell

James D. Sell

JDS:mek
Att.

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

JDS — I'm not interested BUT you can work on NY, if you want,
haven't talked to NY, but will send copy by SAA
JDS

**ASARCO**

Southwestern Exploration Division

December 17, 1990

W.L. Kurtz

Castle Cu-Mo Deposit
(Sheep Mountain Project)
Humbug District
Sec. 10, et al, T8N, R1W
Yavapai County, AZ

In the early 1980's, H.G. Kreis gathered data on the Sheep Mountain Prospect where PD, Kennecott and Utah had drilled copper-moly mineralization starting around 2000 feet in depth below and through a volcanic cap. At that time, the Asarco mood was to "save it for a rainy day."

Hank, in his report of April 25, 1984, suggested an enriched chalcocite zone on the east side of a weakly mineralized stock, and being part of a chalcopyrite ring which horseshoed around the stock.

Recently, Orcana Resources Ltd. sent out a flyer (to probably all copper companies) suggesting the enriched chalcocite zone might contain 40 million tons grading 1.27% copper, 0.047% molybdenite with low gold-silver values. Below this blanket is some 60-100 million tons grading 0.50-0.65% copper with 0.06 molybdenite before going into low grade mineralization.

I then called Orcana Resources Ltd., Toronto, phone 416-364-2015, and talked to Mr. Raymond J. Mongeau (President), who has worked for Asarco with Bob Gray.

The renamed Castle copper-moly deposit packet arrived 12/13/90, and the interesting concept is that the enriched chalcocite zone is located along the Cow Creek fault.

Some of the Utah cross-sections sent along, suggest some subparallel faults which also contain intercepts of similar grade, but the zones were not followed up on the wide-spaced drilling.

Orcana Resources staked the ground after the previous owner died and the claims were allowed to lapse. Orcana is open for a proposal. They hope, however, to secure an offer which will repay them for the staking, their report time, etc., and do the five recommended initial drill holes in the supergene zone. For this you would own 20% of Orcana Resources. In going ahead with a program to outline reserves, etc., earning up to 50% of project, and since you'd own 20% of Orcana, you'd be the top dog on the totem pole.

JDS

**ASARCO**

**Southwestern Exploration Division**

December 17, 1990

W.L. Kurtz

Castle Cu-Mo Deposit
(Sheep Mountain Project)
Humbug District
Sec. 10, et al, T8N, R1W
Yavapai County, AZ

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They have verbal clearance with PD that they'll get all the PD drill hole info, something that Kreis and Utah were unable to do.

I attach the Orcana summary of the area as they see it.

Much low grade has been drilled and additional hi-grade may be found in structural zones as postulated.

Is this the "rainy" day for Asarco.

James D. Sell

James D. Sell

JDS:mek
Attachment

cc: R.L. Brown

Attachment A

SUMMARY (D. A. Bourne, Consulting Geologist, Aug. 27, 1990.)

The Castle Copper-Molybdenum Property consists of 141 unpatented lode mining claims covering approximately 2,500 acres located in the Sheep Mountain East area about 50 miles northwest of Phoenix in south central Arizona, U.S.A. The property was acquired to cover a zone of enriched copper-molybdenum mineralization within and adjacent to a composite stock of Laramide (?) age which forms part of an extremely large mineralized system covering 3 or 4 square miles in aereal extent. Excess smelting capacity is available within trucking distance for custom treatment of copper concentrates.

The oldest rocks of the area are biotite schists of the Yavapai Series of Precambrian age cut by foliated granite alaskite and diorite of the Bradshaw complex also Precambrian in age. Intrusive into these rocks is the Sheep Mountain Stock, a composite body of Laramide (?) age which forms a slightly elongated dome measuring 3,400 feet by 2,300 feet whose long axis strikes N45° W and plunges 50° northwest. The copper-molybdenum mineralization on the Castle property appears to be related to this stock. Unconformably overlying the Precambrian and Laramide (?) rocks is a series of mid-Tertiary volcanic flows and pyroclastics from 1,500 to 2,200 feet thick which cover the entire Sheep Mountain East area. Post-mineral andesite dykes which are probable feeders for the overlying lavas cut both the Precambrian and Laramide (?) rocks along the eastern margin of the stock.

The mineral system at Sheep Mountain East is an extremely large one with significant sulphide mineralization having been identified over 3 or 4 square miles although the better copper-molybdenum appears to be located within or adjacent to the Sheep Mountain Stock. Hypogene sulphide mineralization

consists principally of pyrite with lesser chalcopyrite and molybdenite. Minor amounts of galena, sphalerite, magnetite and specularite are present locally.

The drill indicated copper-molybdenum mineral inventory identified to date on the Castle property occurs in a north-westerly striking zone measuring 5,500 feet in length by 1,100 feet wide and has been intersected in 4 holes drilled by previous operators. The drill-indicated mineral inventory as calculated by the writer is summarized as follows:

| | TONS | % CU | TXCU | % $MoS_2$ | TX$MoS_2$ |
|---|---|---|---|---|---|
| PROVEN | 15,002,232 | 1.17 | 17,562,298 | 0.047 | 701,261 |
| PROBABLE | 14,070,869 | 1.17 | 16,459,752 | 0.047 | 655,998 |
| SUB TOTAL | 29,073,101 | 1.17 | 34,022,050 | 0.047 | 1,357,259 |
| POSSIBLE | 10,361,383 | 1.55 | 16,032,858 | 0.037 | 383,806 |
| TOTALS | 39,434,484 | 1.27 | 50,054,908 | 0.044 | 1,741,065 |

It is assumed that the intersections of supergene enriched copper-molybdenum mineralization used in the calculations represent a tabular body continuous between drill holes rather than a complex of enriched shear zones or channels.

The writer recommends a program of fill-in rotary/core drilling to further define the mineral inventory position coupled with metallurgical test work on drill core in order to bring the Castle property to the prefeasibility stage. The proposed program is divided into two parts, the total cost of which is estimated at $2,022,500 U.S.

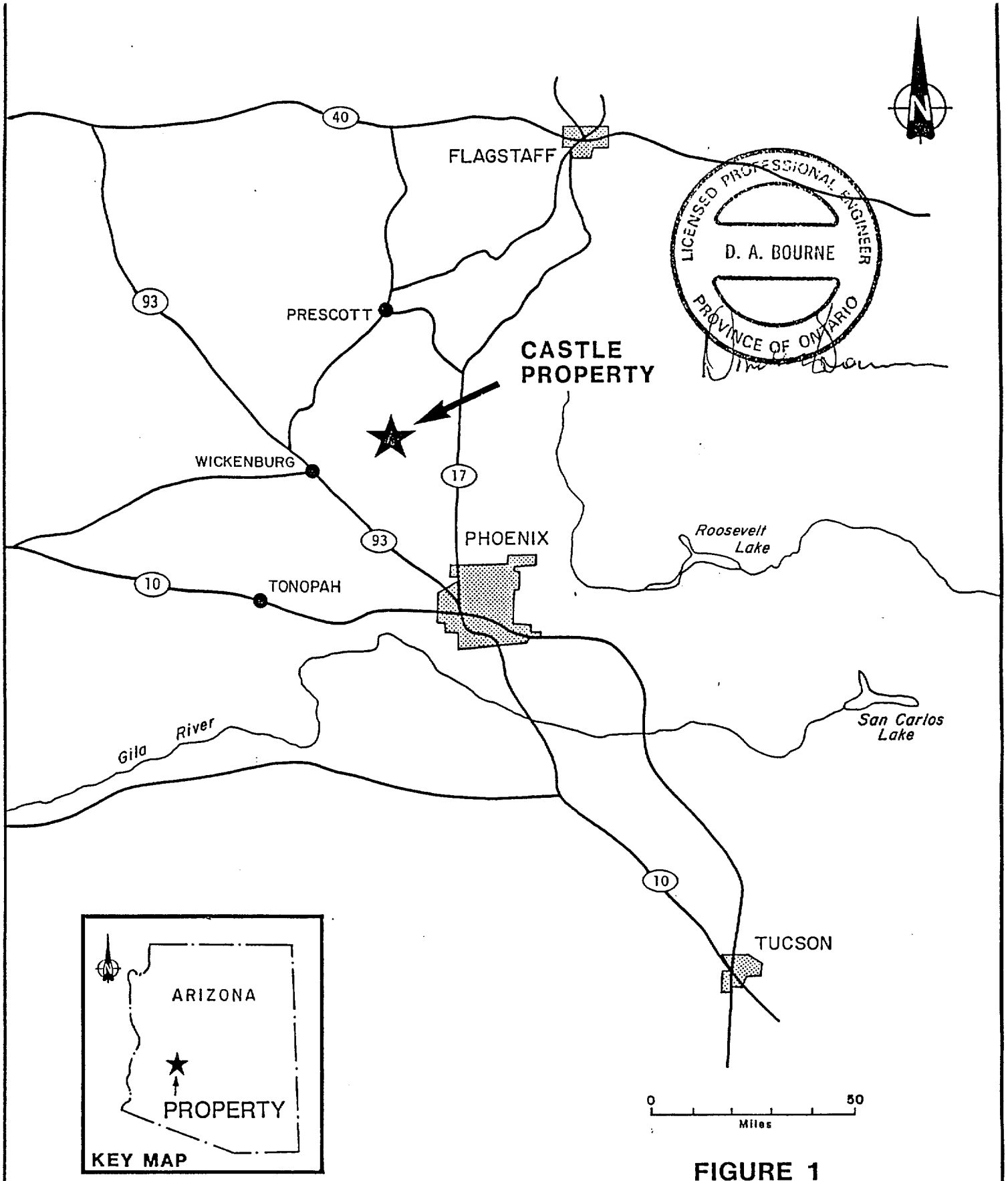



**FIGURE 1**

# LOCATION MAP
# CASTLE PROPERTY

**YAVAPAI COUNTY, ARIZONA, U.S.A.**

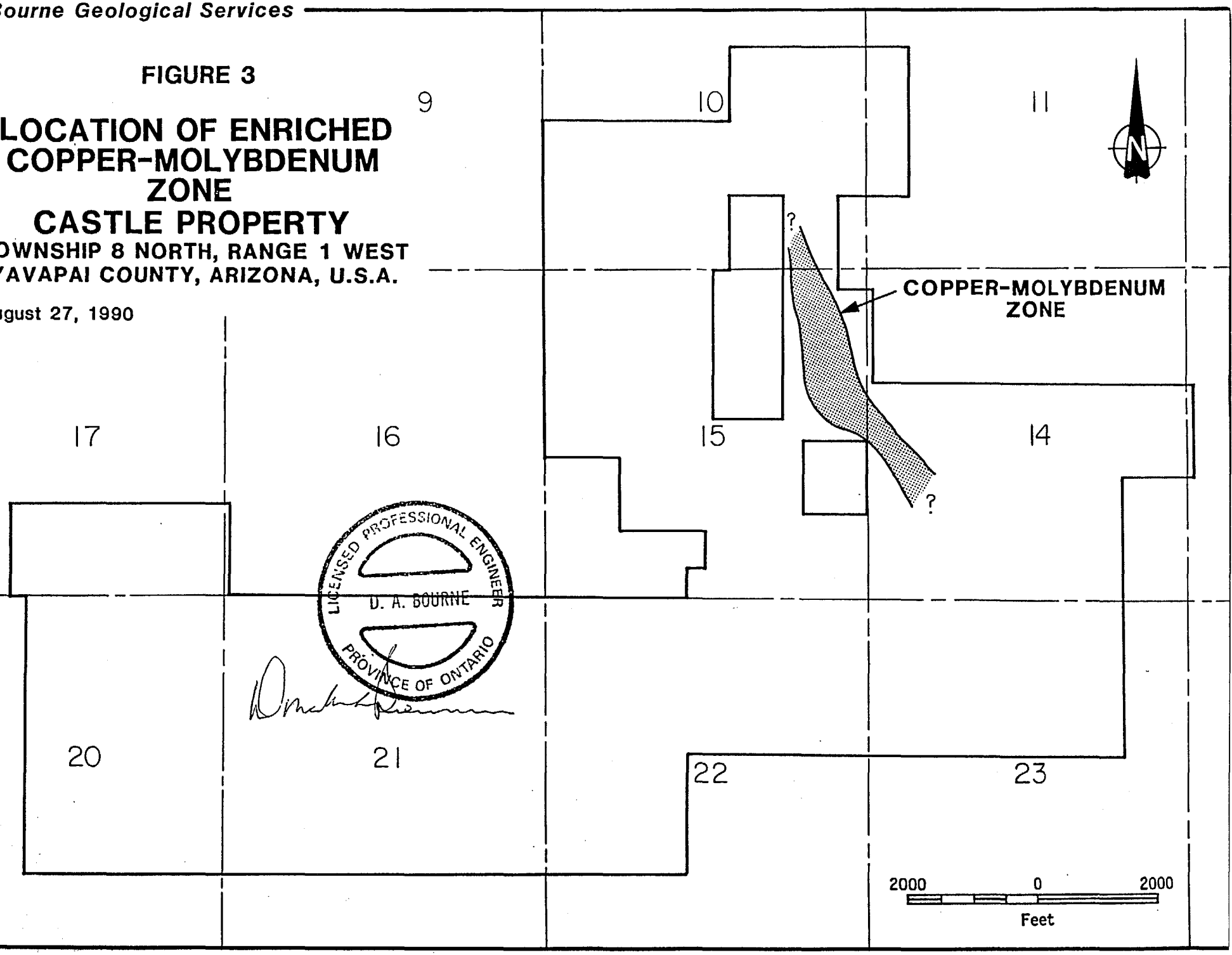
August 27, 1990

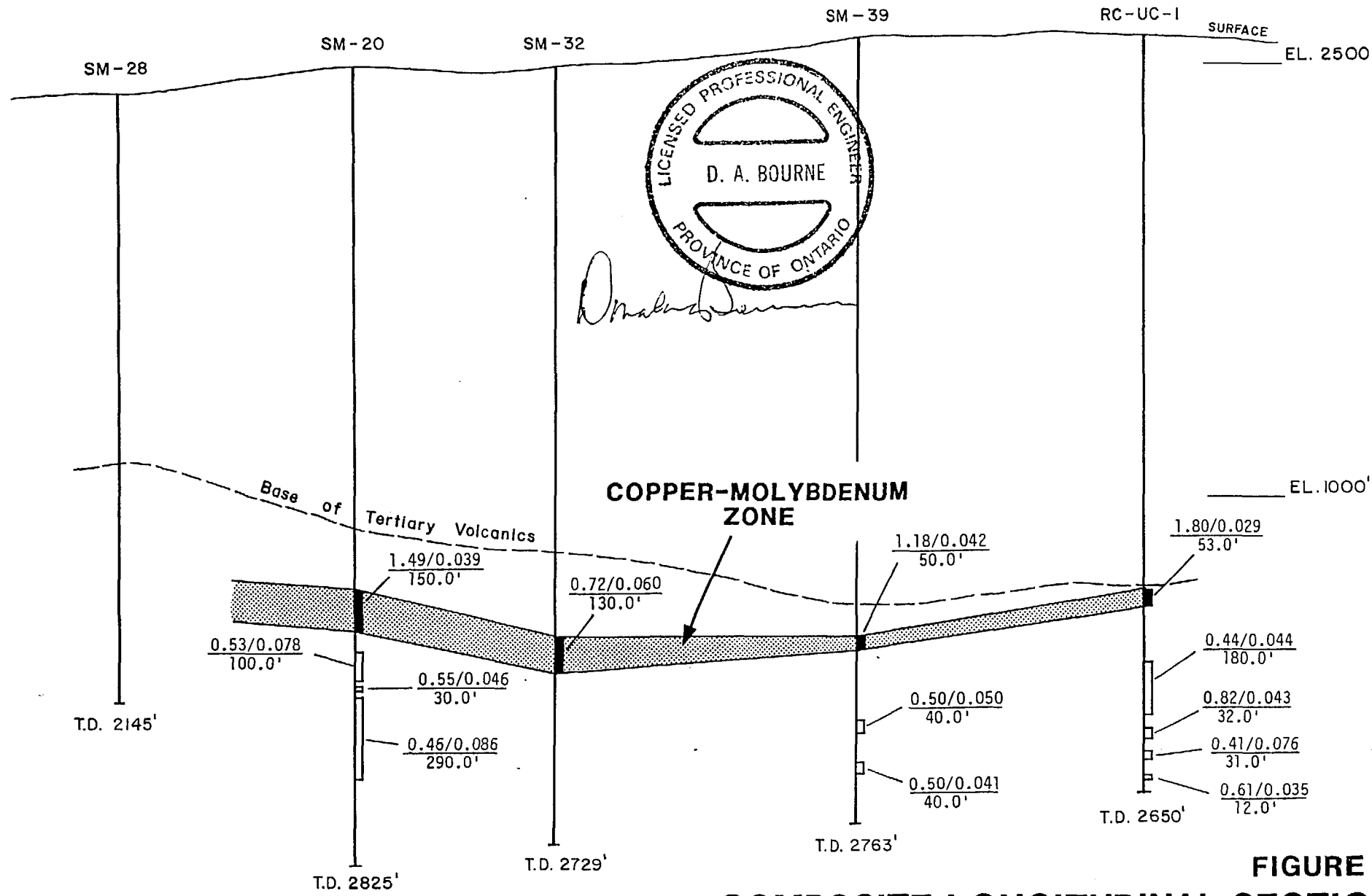
FIGURE 3

# LOCATION OF ENRICHED COPPER-MOLYBDENUM ZONE CASTLE PROPERTY

TOWNSHIP 8 NORTH, RANGE 1 WEST
YAVAPAI COUNTY, ARIZONA, U.S.A.

August 27, 1990






LICENSED PROFESSIONAL ENGINEER
D. A. BOURNE
PROVINCE OF ONTARIO

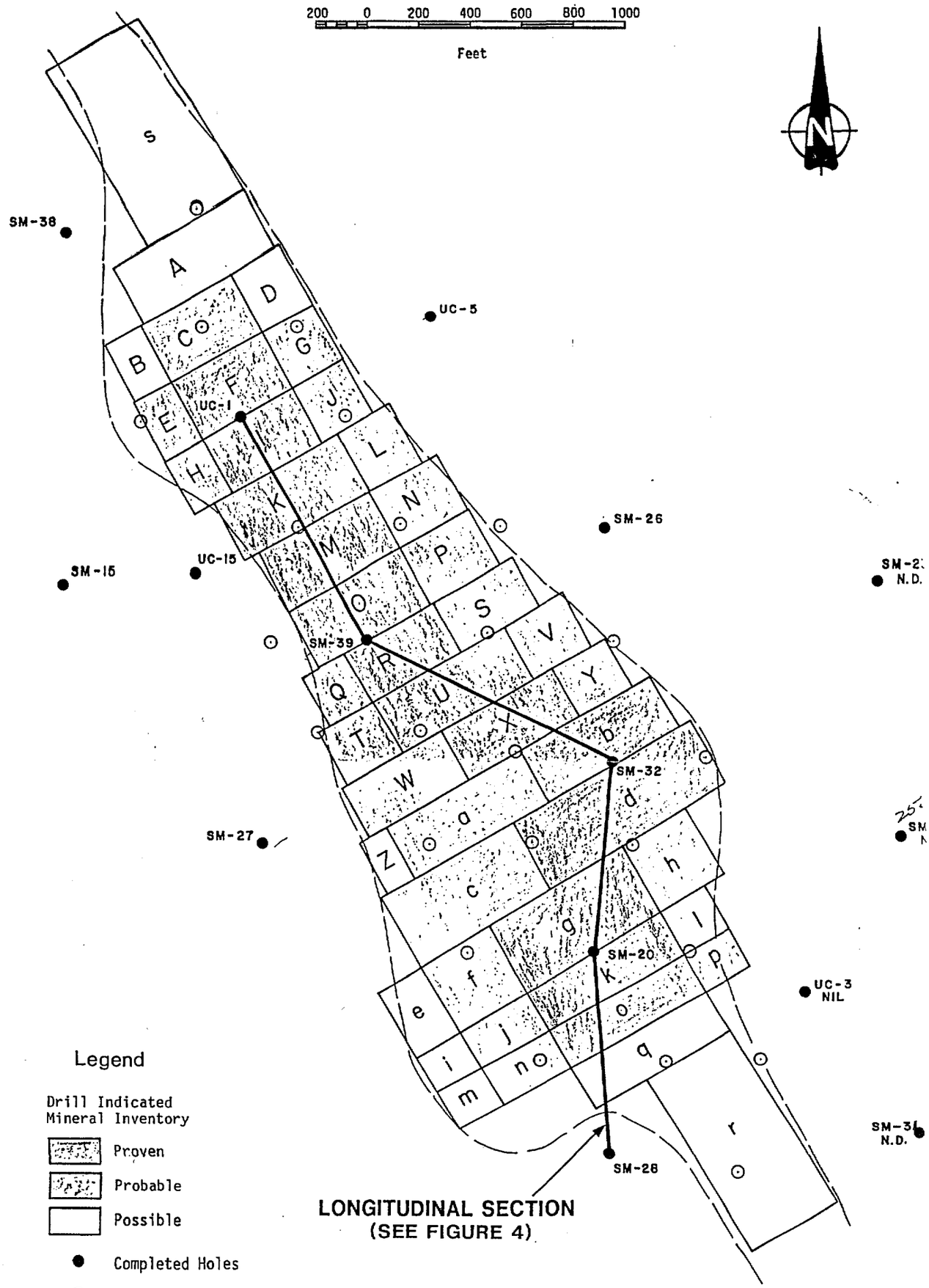
Mineralized Intersection

1.18/0.042 / 50.0' — %Cu/%$MoS_2$ / length (feet)

250 0 250 500
Feet

# FIGURE 4
# COMPOSITE LONGITUDINAL SECTION COPPER-MOLYBDENUM ZONE CASTLE PROPERTY
## YAVAPAI COUNTY, ARIZONA, U.S.A.

August 27, 1990




Legend

Drill Indicated
Mineral Inventory

- Proven
- Probable
- Possible

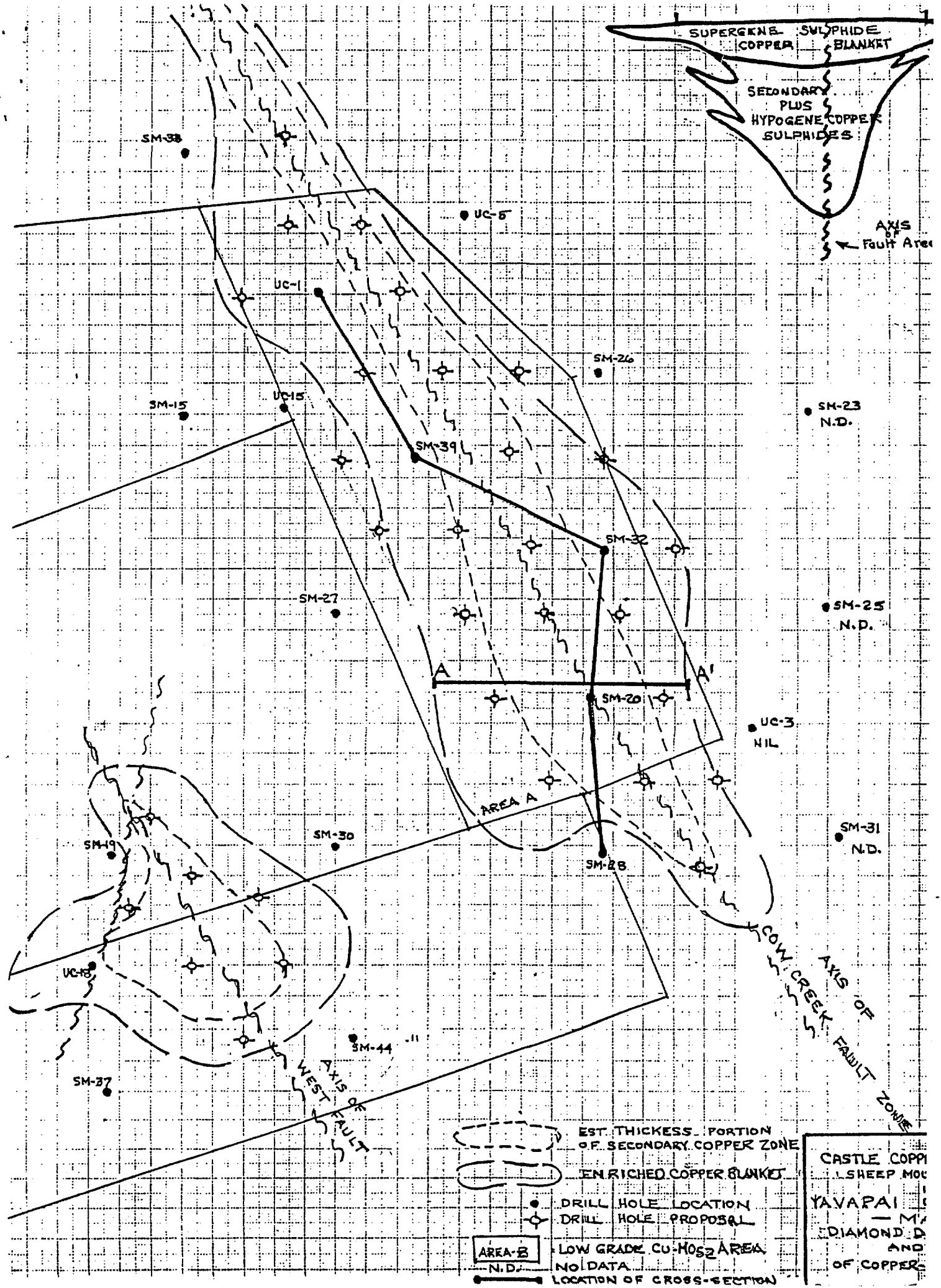
- Completed Holes
- Proposed Holes
- Edge of Enriched Copper Blanket

LICENSED PROFESSIONAL ENGINEER
D. A. BOURNE
PROVINCE OF ONTARIO

FIGURE 5

MINERAL INVENTORY
CASTLE COPPER-MOLYBDENUM DEPOS
DIAMOND DRILL PLAN MAP
AND LOCATION OF
COPPER-MOLYBDENUM ZONE
YAVAPAI COUNTY, ARIZONA

August 27, 199


SUPERGENE COPPER
SULPHIDE BLANKET
SECONDARY PLUS HYPOGENE COPPER SULPHIDES
AXIS OF Fault Area
SM-38
UC-5
UC-1
SM-26
SM-23
N.D.
SM-15
UC-15
SM-39
SM-32
SM-27
SM-25
N.D.
A
A'
SM-20
UC-3
NIL
AREA A
SM-31
N.D.
SM-19
SM-30
SM-28
UC-18
SM-44
SM-37
AXIS OF WEST FAULT
COW CREEK FAULT ZONE
AXIS OF
EST. THICKESS. PORTION OF SECONDARY COPPER ZONE
ENRICHED COPPER BLANKET
DRILL HOLE LOCATION
DRILL HOLE PROPOSAL
AREA-B
LOW GRADE Cu-MoS2 AREA
N.D.
NO DATA
LOCATION OF CROSS-SECTION
CASTLE COPP
SHEEP MOU
YAVAPAI
DIAMOND D
AND
OF COPPER

ORCANA RESOURCES LIMITED

SUITE ~~904~~ 405 • 121 RICHMOND STREET WEST • TORONTO • ONTARIO • M5H 2K6 • TELEPHONE 416-~~947-9500~~ 364-2015

April 18, 1991

ASARCO Incorporated

APR 23 1991

SW Exploration

Asarco
1150 North 7th Avenue
P.O. Box 5747
Tucson, Arizona 85703-0747

Attention: James D. Sell
Exploration Manager

Dear Jim

Re: Castle Copper Moly Deposit, Arizona, USA

Please find enclosed a vertical cross section (holes SM-26, 39, 27, 22 and 9) and a plan showing the trace of this cross section as well as two exploration targets for locating similar supergene copper blankets. Hole SM-22 appears to be too far north of the main hypogene copper zone as shown on the map. Note that Phelps Dodge holes SM-13 and 29, assays of which you have in your possession, appear to be within the main copper hypogene zone and partially enriched. As one gets closer to the Ash Creek fault the copper sulphide enrichment should improve - a distance of over 2000 feet. This zone could be as large or larger than that zone discovered along the Cow Creek fault.

Yours very truly

ORCANA RESOURCES LIMITED

Raymond J. Mongeau
President

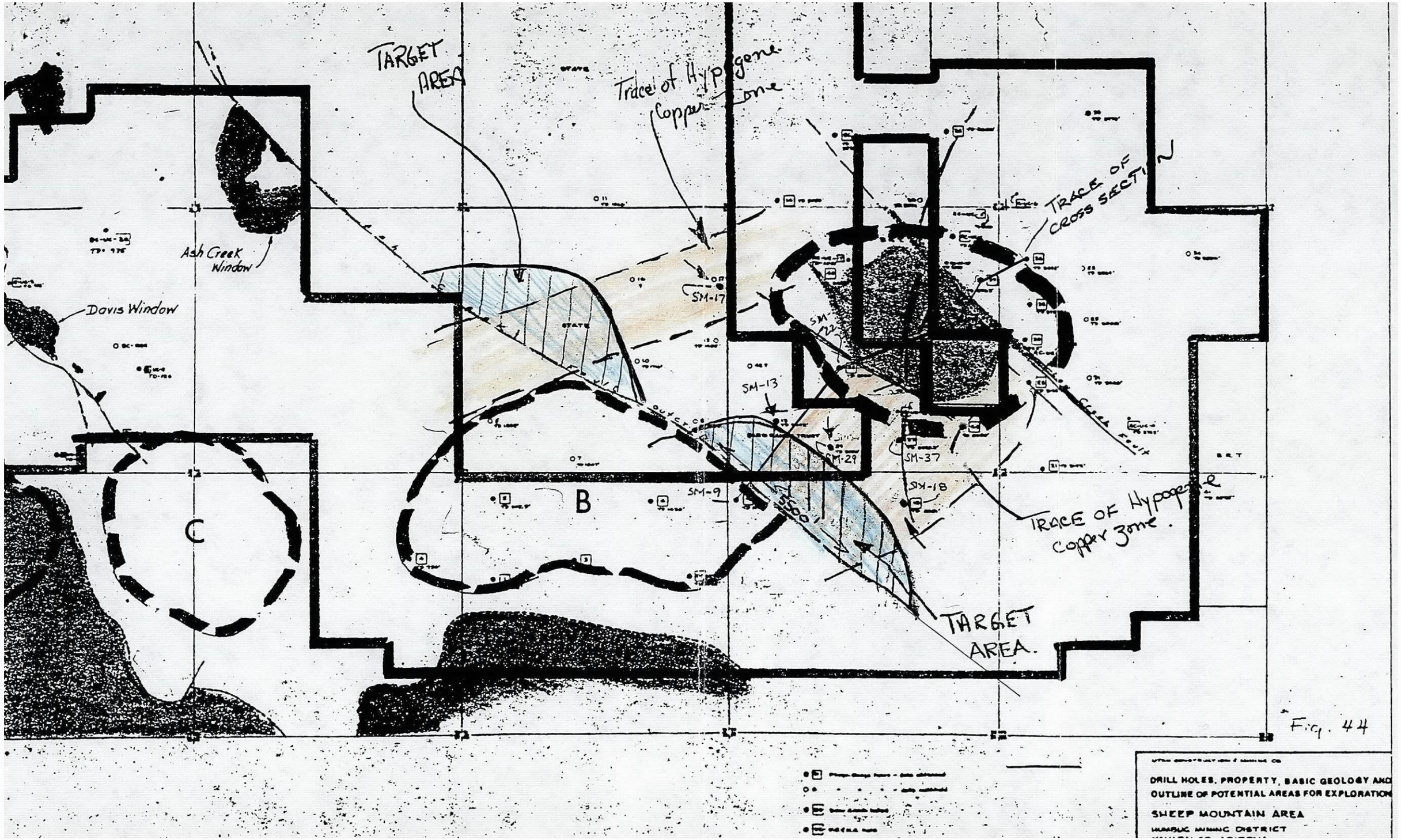

TARGET AREA
Trace of Hypogene Copper Zone
TRACE OF CROSS SECTION
Ash Creek Window
Davis Window
SM-17
SM-22
SM-13
SM-29
SM-37
SM-18
SM-9
B
C
TRACE OF Hypogene Copper Zone.
TARGET AREA.
DRILL HOLES, PROPERTY, BASIC GEOLOGY AND OUTLINE OF POTENTIAL AREAS FOR EXPLORATION
SHEEP MOUNTAIN AREA
HUMBUG MINING DISTRICT

Fig. 44

Sheep Mtn
Yavapai Co. AZ

# ORCANA RESOURCES LIMITED

3642015

SUITE ~~904~~ 405 • 121 RICHMOND STREET WEST • TORONTO • ONTARIO • M5H 2K6 • TELEPHONE 416-~~947-9500~~

November 19, 1990

Asarco Inc.
1150 North 7th Avenue
P.O. Box 5747
Tucson, Arizona 85703

ASARCO Incorporated
DEC 3 1990
SW Exploration

Attention: J.D. Sell, Manager

Dear Mr. Sell

We wish to present you an attractive exploration and development package consisting of a large supergene enriched copper blanket deposit averaging about 100 ft. in thickness within a large copper-molybdenum system located about 50 miles northwest of Phoenix, Arizona.

The enriched copper sulphide blanket has inferred ore reserves estimated at 40 million tons grading 1.27% copper, 0.047% molybdenite and carrying very low values in gold and silver. These reserves are based on the results of widely spaced vertical drill holes. Fill-in drilling along a fault zone should augment the copper grade. An additional 60 - 100 million tons grading 0.50 - 0.65% Cu. and 0.06% $M_0S_2$ exist below this blanket. Other favourable exploration targets to locate similar enriched copper zones within the widespread hypogene copper-molybdenum mineralization are known to exist as well.

The copper blanket is at a depth of 2200 feet and is amenable only to underground mining. An underground bulk mining method probably similar to that utilized by Magma Copper at its large underground San Manuel Mine near Tuscon, Arizona is envisioned. This mine processes 45,000 tons of ore per day at an average grade of 0.65% Cu. and presently generates a healthy cash flow. Its operating cost per ton is estimated at $6.50 - 7.00 US per ton.

John Steers Consulting Ltd. conducted a quick economic evaluation of the copper blanket zone only and returned positive results. The blanket zone is made up largely of chalcocite and therefore, would lend itself to higher grade concentrates.

In addition to the above there exist known favourable porphyry copper targets of shallow origin further to the west which also require immediate attention.

If you wish to pursue this further I would only be too pleased to send you more details on the project or to meet with you.

Yours very truly
ORCANA RESOURCES LIMITED

per _____
John G. Tait, Q.C.

JGT:mg

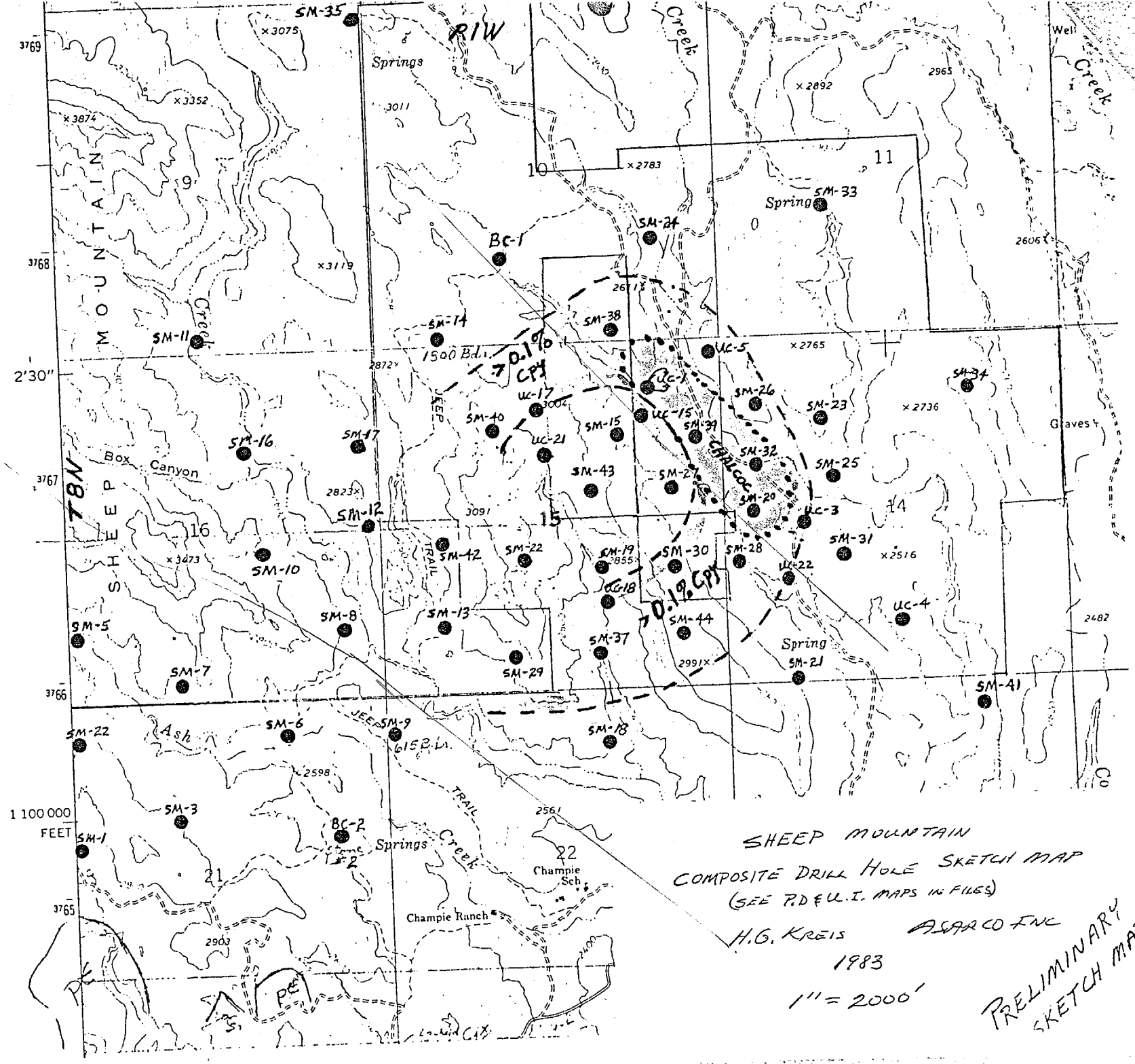
Ray Morris (worked for Bob Gray) Sheep Mtn Deposit

# KEEP THIS ON TOP

**Subject:** SHEEP MOUNTAIN PROJECT (PHELPS-DODGE)
Humbug Dist.
Yavapai Co., AZ

Sec. 10, 11, 14, 15, 20-23, T8N, R1W
Columbia 7-1/2' Quad
Prescott AMS

See: South Bradshaw Area Mines


SHEEP MOUNTAIN
COMPOSITE DRILL HOLE SKETCH MAP
(SEE P.D & U.I. MAPS IN FILES)
H.G. KREIS
ASARCO INC
1983
1" = 2000'
PRELIMINARY SKETCH MAP
R1W
T8N
SHEEP MOUNTAIN
Box Canyon
Ash Creek
Springs Creek
Champie Ranch
Champie Sch
Graves Co
JEEP TRAIL
1500 Bd.
615 B.D.
0.1% CPY
0.1% CPY
CHALCOC
SM-35
SM-33
SM-24
BC-1
SM-14
SM-38
SM-11
UC-5
UC-1
SM-26
SM-23
SM-34
UC-17
SM-40
SM-15
UC-15
SM-39
SM-32
SM-25
SM-16
SM-17
UC-21
SM-43
SM-27
SM-20
UC-3
SM-12
SM-42
SM-22
SM-19
SM-30
SM-28
SM-31
UC-22
SM-10
UC-18
SM-44
UC-4
SM-5
SM-8
SM-13
SM-37
SM-21
SM-7
SM-29
SM-41
SM-22
SM-6
SM-9
SM-18
SM-3
BC-2
SM-1
3769
3768
3767
3766
3765
2'30"
1 100 000 FEET

In ASARCO FILES

Greg Mills

| ~~Hole~~ Hole | ~~Log~~ Geol Log | Assay | ~~Assay~~ Hole | Log | Assay | ~~Hole~~ Hole | ~~Log~~ Log | ~~Assay~~ Assay | Hole | Log | Assay |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SM-1 | ✓ | ✗ | SM-27 | ✓ | ✗ | UC-1 | ✓ | ✓ | | | |
| -2 | ✓ | ✗ | -28 | ✓ | ✗ | -2 | ✓ | ✓ | | | |
| -3 | ✓ | ✗ | -29 | ✓ | ✓ | -3 | ✓ | | | | |
| -4 | ✓ | ✗ | - | | | - | | | | | |
| -5 | ✓ | ✓ | -31 | ✓ | ✓ | -5 | ✓ | ✗ | | | |
| -6 | ✓ | ✗ | -32 | ✓ | ✗ | - | | | | | |
| -7 | ✓ | ✓ | -33 | ✓ | ✓ | - | | | | | |
| -8 | ✓ | ✓ | -34 | ✓ Pm | | - | | | | | |
| -9 | ✓ | ✗ | -35 | ✓ Pm ✓ | | - | | | | | |
| -10 | ✓ | ✓ | -36 | Not drilled | | - | | | | | |
| -11 | ✓ | ✓ | -37 | ✓ | ✗ | - | | | | | |
| -12 | ✓ | ✓ | - | | | - | | | | | |
| -13 | ✓ | ✓ | -39 | ✓ | ✗ | - | | | | | |
| -14 | ✓ | ✗ | -40 | ✓ | ✗ | - | | | | | |
| - | | | -41 | Pm ✓ | | -15 | ✓ | ✓ | | | |
| - | | | -42 | ✓ | ✓ | -16 | ✓ | ✓ | | | |
| - | | | -43 | ✓ | ✓ | -17 | ✓ | ✓ | | | |
| -18 | ✓ | ✗ | SM-44 | ✓ | ✗ | -18 | ✓ | ✓ | | | |
| -19 | ✓ | ✗ | | | | -19 | ✓ | ✓ | | | |
| -20 | ✓ | ✗ | | | | -20 | ✓ | ✓ | | | |
| -21 | ✓ | ✗ | | | | -21 | ✓ | ✓ | | | |
| -22 | ✓ | ✗ | | | | -22 | ✓ | ✓ | | | |
| -23 | ✓ | ✓ | | | | | | | | | |
| -24 | ✓ | ✗ | | | | | | | | | |
| -25 | ✓ | | | | | | | | | | |
| -26 | ✓ | ✗ | | | | | | | | | |

du Oracana Material 12/15/90

| Hole | Geol Log | Assay | Hole | Log | Assay | Hole | Log | Assay |
|---|---|---|---|---|---|---|---|---|
| SM | | | SM-27 | | | UC-1 | ✓ | ✓ |
| - | | | - | | | | | |
| - | | | - | | | | | |
| - | | | - | | | | | |
| - | | | - | | | | | |
| - | | | -32 | ✓ | ✓ | | | |
| - | | | - | | | | | |
| - | | | - | | | | | |
| - | | | - | | | | | |
| - | | | - | | | | | |
| - | | | -37 | ✓ | ✓ | | | |
| - | | | - | | | | | |
| - | | | -39 | ✓ | ✓ | | | |
| - | | | | | | | | |
| - | | | | | | | | |
| - | | | | | | | | |
| - | | | | | | | | |
| - | | | | | | | | |
| - | | | | | | | | |
| SM-20 | ✓ | ✓ | | | | | | |
| - | | | | | | | | |
| - | | | | | | | | |
| - | | | | | | | | |
| - | | | | | | | | |
| - | | | | | | | | |
| 26 | ✓ | ✓ | | | | | | |

# REPORT ON
# GEOLOGY AND MINERAL INVENTORY
# CASTLE COPPER-MOLYBDENUM PROPERTY
# SHEEP MOUNTAIN EAST AREA
# HUMBUG MINING DISTRICT
# YAVAPAI COUNTY, ARIZONA
# U.S.A.

FOR

ORCANA RESOURCES LIMITED
TORONTO, ONTARIO
CANADA

LICENSED PROFESSIONAL ENGINEER
D. A. BOURNE
PROVINCE OF ONTARIO

SCARBOROUGH, ONTARIO
AUGUST 27, 1990

DONALD A. BOURNE, P.ENG.
CONSULTING GEOLOGIST

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SUMMARY

The Castle Copper-Molybdenum Property consists of 141 unpatented lode mining claims covering approximately 2,500 acres located in the Sheep Mountain East area about 50 miles northwest of Phoenix in south central Arizona, U.S.A. The property was acquired to cover a zone of enriched copper-molybdenum mineralization within and adjacent to a composite stock of Laramide (?) age which forms part of an extremely large mineralized system covering 3 or 4 square miles in aereal extent. Excess smelting capacity is available within trucking distance for custom treatment of copper concentrates.

The oldest rocks of the area are biotite schists of the Yavapai Series of Precambrian age cut by foliated granite alaskite and diorite of the Bradshaw complex also Precambrian in age. Intrusive into these rocks is the Sheep Mountain Stock, a composite body of Laramide (?) age which forms a slightly elongated dome measuring 3,400 feet by 2,300 feet whose long axis strikes N45° W and plunges 50° northwest. The copper-molybdenum mineralization on the Castle property appears to be related to this stock. Unconformably overlying the Precambrian and Laramide (?) rocks is a series of mid-Tertiary volcanic flows and pyroclastics from 1,500 to 2,200 feet thick which cover the entire Sheep Mountain East area. Post-mineral andesite dykes which are probable feeders for the overlying lavas cut both the Precambrian and Laramide (?) rocks along the eastern margin of the stock.

The mineral system at Sheep Mountain East is an extremely large one with significant sulphide mineralization having been identified over 3 or 4 square miles although the better copper-molybdenum appears to be located within or adjacent to the Sheep Mountain Stock. Hypogene sulphide mineralization

consists principally of pyrite with lesser chalcopyrite and molybdenite. Minor amounts of galena, sphalerite, magnetite and specularite are present locally.

The drill indicated copper-molybdenum mineral inventory identified to date on the Castle property occurs in a north-westerly striking zone measuring 5,500 feet in length by 1,100 feet wide and has been intersected in 4 holes drilled by previous operators. The drill-indicated mineral inventory as calculated by the writer is summarized as follows:

| | TONS | % CU | TXCU | % $MoS_2$ | TX$MoS_2$ |
|---|---|---|---|---|---|
| PROVEN | 15,002,232 | 1.17 | 17,562,298 | 0.047 | 701,261 |
| PROBABLE | 14,070,869 | 1.17 | 16,459,752 | 0.047 | 655,998 |
| SUB TOTAL | 29,073,101 | 1.17 | 34,022,050 | 0.047 | 1,357,259 |
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| TOTALS | 39,434,484 | 1.27 | 50,054,908 | 0.044 | 1,741,065 |

It is assumed that the intersections of supergene enriched copper-molybdenum mineralization used in the calculations represent a tabular body continuous between drill holes rather than a complex of enriched shear zones or channels.

The writer recommends a program of fill-in rotary/core drilling to further define the mineral inventory position coupled with metallurgical test work on drill core in order to bring the Castle property to the prefeasibility stage. The proposed program is divided into two parts, the total cost of which is estimated at $2,022,500 U.S.

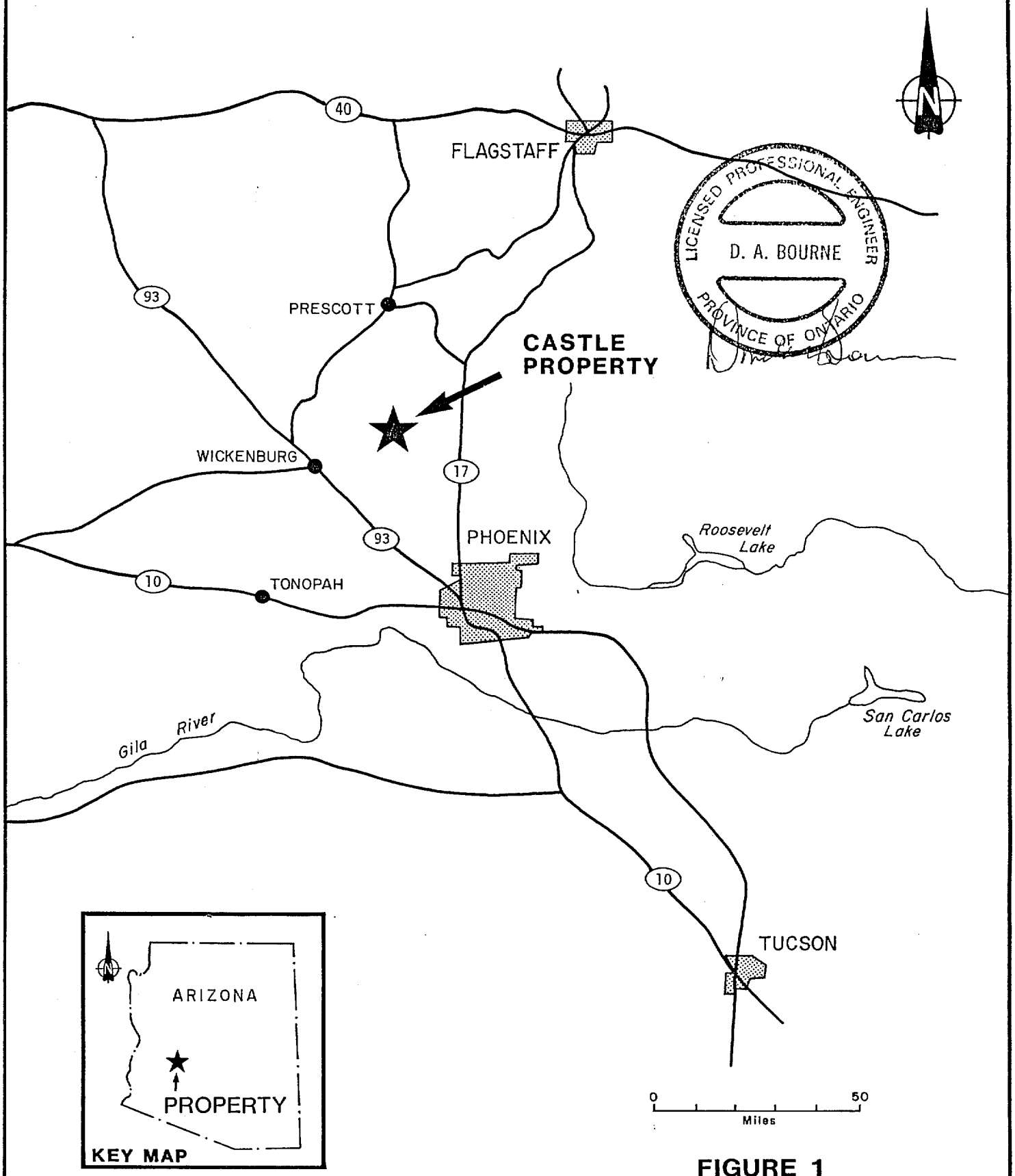



**FIGURE 1**

# LOCATION MAP
# CASTLE PROPERTY

**YAVAPAI COUNTY, ARIZONA, U.S.A.**

August 27, 1990

## PROPERTY DESCRIPTION

The Castle copper-molybdenum property centered on latitude 34° 00'N and longitude 112° 30'W consists of a block of 141 unpatented lode claims covering approximately 2,500 acres located in Sections 10, 11, 14, 15, 17, 20, 21, 22 and 23 in Township 8 North, Range 1 West, Gila and Salt River Meridian, in the south central part of Yavapai County, Arizona, U.S.A. The claims are numbered as follows:

SECTION 10 (12 claims)

| | | |
|---|---|---|
| RAY 1 | RAY 5 | RAY 27 |
| 2 | 6 | 29 |
| 3 | 7 | 53 |
| 4 | 8 | 111 |

SECTIONS 10 AND 11 (4 claims)

RAY 28
30
55
110

SECTIONS 10 AND 15 (2 claims)

RAY 31
32

SECTION 15 (22 claims)

| | | | |
|---|---|---|---|
| RAY 9 | RAY 15 | RAY 21 | RAY 33 |
| 10 | 16 | 23 | 34 |
| 11 | 17 | 23 | 36 |
| 12 | 18 | 24 | 37 |
| 13 | 19 | 25 | |
| 14 | 20 | 26 | |

SECTIONS 14 AND 15 (1 claim)

RAY 35

*Bourne Geological Services*

# FIGURE 2

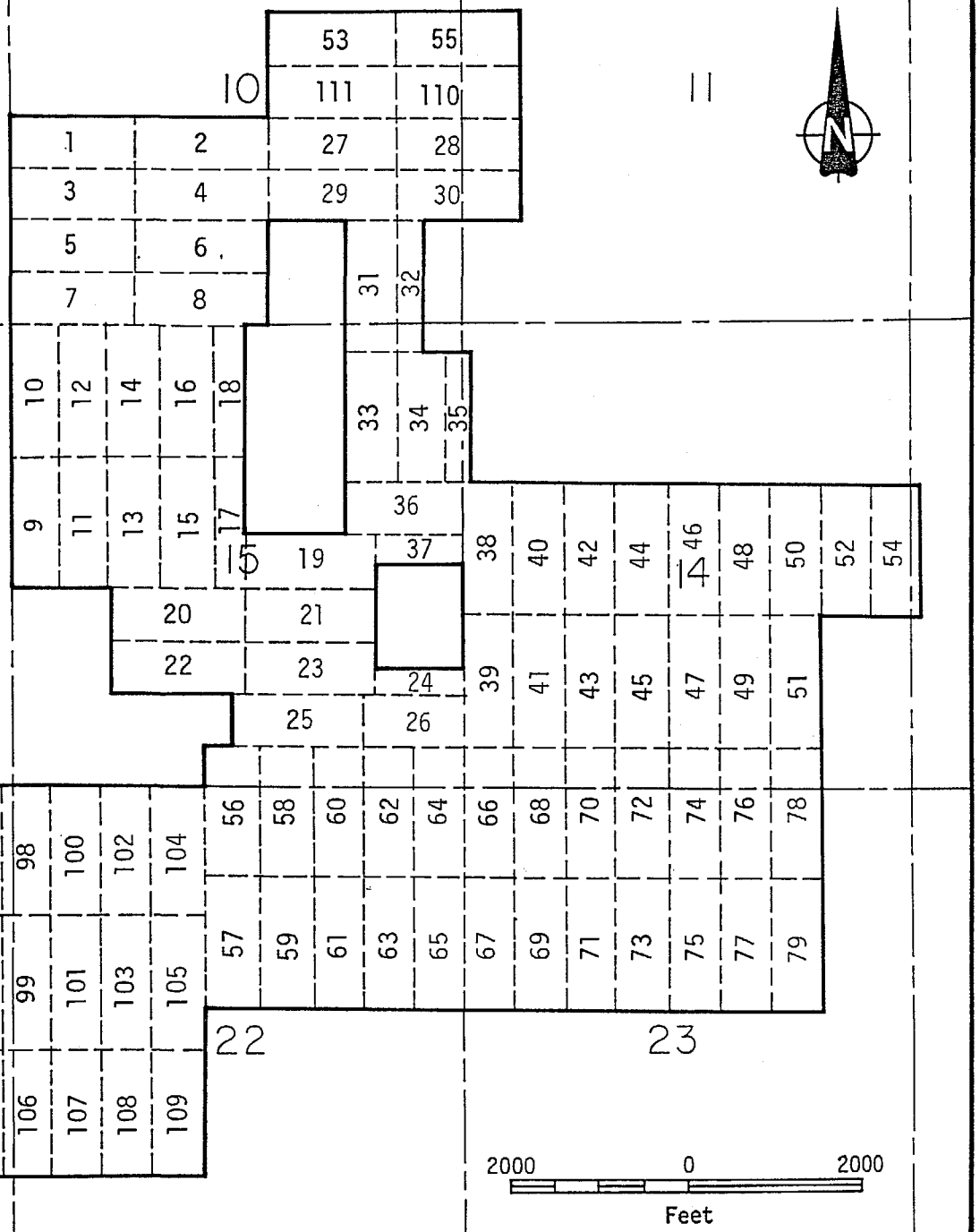
# CLAIM MAP
# CASTLE PROPERTY

**TOWNSHIP 8 NORTH, RANGE 1 WEST**
**YAVAPAI COUNTY, ARIZONA, U.S.A.**

August 27, 1990

Note: Prefix "RAY" omitted on claim numbers

LICENSED PROFESSIONAL ENGINEER
D. A. BOURNE
PROVINCE OF ONTARIO



SECTION 14 (15 claims)

| | | |
|---|---|---|
| RAY 38 | RAY 43 | RAY 48 |
| 39 | 44 | 49 |
| 40 | 45 | 50 |
| 41 | 46 | 51 |
| 42 | 47 | 52 |

SECTIONS 13 AND 14 (1 claim)

RAY 54

SECTIONS 15 AND 22 (5 claims)

| | |
|---|---|
| RAY 56 | RAY 62 |
| 58 | 64 |
| 60 | |

SECTION 22 (14 claims)

| | | |
|---|---|---|
| RAY 57 | RAY 100 | RAY 105 |
| 59 | 101 | 107 |
| 61 | 102 | 108 |
| 63 | 103 | 109 |
| 65 | 104 | |

SECTIONS 14 and 23 (7 claims)

| | |
|---|---|
| RAY 66 | RAY 74 |
| 68 | 76 |
| 70 | 78 |
| 72 | |

SECTION 23 (7 claims)

| | |
|---|---|
| RAY 67 | RAY 75 |
| 69 | 77 |
| 71 | 79 |
| 73 | |

SECTIONS 21 AND 22 (3 claims)

RAY 98
99
106

SECTION 21 (24 claims)

| | | | |
|---|---|---|---|
| RAY 80 | RAY 91 | RAY 116 | RAY 134 |
| 81 | 92 | 117 | 135 |
| 82 | 112 | 118 | 136 |
| 83 | 113 | 119 | 137 |
| 89 | 114 | 132 | 138 |
| 90 | 115 | 133 | 139 |

SECTIONS 20 AND 21 (3 claims)

RAY 120
121
140

SECTION 20 (15 claims)

| | | |
|---|---|---|
| RAY 122 | RAY 127 | RAY 141 |
| 123 | 128 | 142 |
| 124 | 129 | 143 |
| 125 | 130 | 144 |
| 126 | 131 | 145 |

SECTION 17 (6 claims)

| | |
|---|---|
| RAY 147 | RAY 153 |
| 149 | 155 |
| 151 | 157 |

TOTAL NUMBER OF CLAIMS = 141

Ownership of the minerals is held by the Federal Government through the Bureau of Land Management. Federal statutes provide that not less than $100 worth of labour shall be performed or improvements made on each mining claim during

each year in order to maintain the property in good standing. A lode mining claim on public lands may be brought to lease

> "...after at least $500 worth of work has been done upon it, for $5.00 per acre or fraction of an acre, plus various fees" (Butler, 1967, p.237).

As the Castle property is not in a national park or designated conservation area, there are no environmental or other restrictions which would interfere with exploration and development of the claim group.

The following report is based on data made available to the writer including copies of the original diamond drill logs, assay sheets, geological maps and reports of Phelps Dodge and Utah International both of whom carried out work on the Castle property. As the copper-molybdenum mineralization is not exposed on surface but lies beneath a 1,500 foot capping of post-mineral volcanics, a site examination was not considered necessary although the writer is familiar with the general area having carried out property examinations southwest of Wickenburg in Maricopa County.

## LOCATION, ACCESS, LOCAL RESOURCES

The Castle property lies about 50 miles northwest of Phoenix, the major metropolitan centre in south-central Arizona at an elevation of between 2,600 and 3,000 feet above sea level. It can conveniently be reached by driving north on highway 17 to the Castle Hot Springs turn-off from which well-maintained gravel roads give ready access to all parts of the claim group. The climate is typically dry and arid with sparse vegetation consisting of cactus and low shrubs.

Of the several copper smelters remaining in Arizona, only three are currently being operated. Asarco's Hayden smelter and Cyprus' smelter at Miami have been brought into compliance with air pollution constraints and Magma's smelter at San Manuel has been retrofitted with an Outokumpu flash furnace to bring it into compliance. The Ray unit of Asarco at Hayden with a 400,000 ton year smelter and 900 ton per day acid plant met all significant environmental constraints when last operated in 1982 and is available for custom smelting of copper concentrates (Beard, 1989, p.8).

SHEEP MOUNTAIN EAST HISTORY

The original claims in the area were staked in the early 1960s by two Arizona prospectors, Davis and Williams, who located unpatented lode claims over weakly mineralized Precambrian strata exposed in two small "windows" in Tertiary volcanics in the Sheep Mountain West area.

1963-1966 Phelps Dodge Corporation drilled approximately 44,000 feet in 38 rotary/core holes to explore for possible mineralization beneath the post-mineral Tertiary volcanic capping. They began drilling adjacent to the weakly mineralized "windows" in the Sheep Mountain West area and gradually worked eastward to the Sheep Mountain East area.

> "It should be noted that the Phelps Dodge geologists favored continuation of the project, but the terms of the agreement with Davis and Williams were such that the property payments had become too high to justify further efforts" (Hoyt and Ascencios, 1981, p.1).

1966-1967 Bear Creek Mining Company leased the property and drilled 3,620 feet in 2 holes. Neither of these holes intersected ore and the Company dropped its lease in 1967.

1968-1981 Utah International Inc. entered into a lease agreement to continue exploration of the Sheep Mountain East area. During the period the Company carried out geological mapping at a scale of 1 inch to 400 feet, completed 21,241 feet of rotary/core drilling in 8 holes, conducted geochemical and thin section analyses plus fluid inclusion studies from selected drill core, all at a cost of approximately $825,000. Utah International dropped its lease agreement on the property prior to its merger with BHP Minerals.

## SHEEP MOUNTAIN EAST GEOLOGY

As the only consolidated rocks exposed in the Sheep Mountain East area are gently dipping volcanics of Tertiary age, all data concerning the geology, structure and mineralization of the older underlying rocks have come from diamond drilling.

The oldest rocks of the area are biotite schists of the Yavapai Series of Precambrian age cut by foliated granite alaskite and diorite of the Bradshaw complex also Precambrian in age. Both the intrusive complex and schists are in turn cut by diabase dykes of Precambrian age.

Intrusive into the Precambrian rocks is the Sheep Mountain Stock, a composite body of Laramide (?) age which was possibly intruded as three main phases each with its own textural characteristics. The copper-molybdenum mineralization appears

to be related to this stock. It is a slightly elongated dome measuring 3,400 feet by 2,300 feet whose long axis strikes N 45°W and plunges approximately 50° northwest. The stock appears to be composite in nature with the bulk of the pluton consisting of quartz monzonite porphyry as an outer shell apparently enveloping a biotite quartz latite porphyry which in turn appears to be intruded by a younger quartz latite porphyry at depth.

SHEEP MOUNTAIN EAST STRUCTURE

A major fault zone, the Cow Creek Fault, strikes N 45°W and dips steeply northeasterly along the eastern edge of the Sheep Mountain stock. Although the displacement is unknown, the fault appears to show normal movement with Precambrian rocks to the east moving down relative to those on the west. A 200 foot wide andesite dyke of Tertiary age has been intruded along this fault zone at the northeastern contact of the Sheep Mountain stock. Some shearing and brecciation have been noted in the dyke indicating post-dyke movement along the fault. It is believed that the Cow Creek Fault is an old structural feature possibly Precambrian in age but with several periods of movement. It is further believed that this fault acted as a zone of weakness and helped influence the emplacement of the Sheep Mountain stock.

Rocks of Precambrian age which outcrop two miles southwest and one mile northeast of the Sheep Mountain East area show northeast striking, steeply dipping schistosity and foliation. In addition, these same rocks are cut by several narrow northeast trending quartz latite porphyry dykes of Laramide (?) age. It is believed that these dykes

mark a vague Precambrian structural weakness which appears to have helped localize the Sheep Mountain stock at its intersection with the Cow Creek Fault zone.

From diamond drill hole data, the southwestern edge of the Sheep Mountain stock is marked by a 400 foot wide fault zone, termed the West Fault, which strikes N 60°W and dips from 50° to 60° northeasterly. It generally parallels the Cow Creek Fault and is believed to be part of the same system.

About two miles west of the Sheep Mountain stock, a strong, steeply dipping fault zone striking N 50°W is exposed near Ash Creek and is termed the Ash Creek Fault. It shows normal movement with volcanics of Tertiary age on the hangingwall being down faulted into contact with Precambrian strata on the footwall. The southeast continuation of this fault is indicated in Phelps Dodge drill hole SM-9 which shown post-volcanic dip-slip movement in the order of 1,400 feet.

Drill hole information and pre-volcanic topography strongly suggest the existence of a steeply dipping, north striking post-mineral (?) fault zone through the centre of the Sheep Mountain stock.

> "The significance of this fault zone is not fully understood but it is believed to be a complimentary shear to the Cow Creek, West, and Ash Creek fault zones. If this is the case, the movement on the Cow Creek, West, and Ash Creek fault zones, as determined by stress analysis, is left lateral, normal displacement. Additionally, the same stress analysis shows a northeast-trending tensional direction which corresponds with the trend of the Laramide? porphyry dikes" (Hoyt and Ascencios, 1981, p.7).

SHEEP MOUNTAIN EAST ALTERATION

The associated alteration assemblages and their characteristic minerals are:

| | |
|---|---|
| Potassic | - quartz, K-spar, biotite, and locally calcite |
| Argillic | - quartz, clay |
| Phyllic | - quartz, sericite, pyrite |
| Propylitic | - chlorite |

Both alteration and mineral assemblages show a distinct relationship to the Sheep Mountain stock although their interrelationship is not clear.

Potassic alteration is best developed within and adjacent to the Sheep Mountain stock as stockwork veinlets and selvages of K-spar with lesser biotite and local calcite. Host rock chemistry governs whether K-spar or biotite is formed as Precambrian diabase and diorite readily host biotite while Precambrian granite and Laramide (?) porphyries normally host K-spar. Potassic alteration intensity appears to be strongest along the porphyry contacts.

Argillic alteration is strongest within and along the southern and eastern margin of the Sheep Mountain stock. It occurs as selective replacement of plagioclase feldspar most often within a halo surrounding quartz - K-spar veinlets. Overlapping of these halos produces a zone of pervasive argillic alteration. The mineralogy of the clay minerals has not been fully determined but is believed to be mainly montmorillonite and kaolinite.

Propylitic alteration has only been identified in four holes on the far east, north and south edges of the argillic zone and thus appears to form an incomplete halo surrounding

the latter. Chlorite is the most diagnostic mineral of the prophylitic zone but K-spar and clay are also present.

Phyllic alteration is the youngest of all the alteration assemblages and occurs erratically throughout the Sheep Mountain area in varying degrees of intensity. It is found as fracture controlled, overprint, destructive alteration composed of quartz with coarse-grained sericite and pyrite as veinlets varying from ½ to 1 inch in width.

SHEEP MOUNTAIN EAST MINERALIZATION

The mineral system at Sheep Mountain East is an extremely large one with significant sulphide mineralization having been identified over an area of 3 or 4 square miles although the better grade mineralization appears to be located within or adjacent to the Sheep Mountain stock.

Hypogene sulphide mineralization consists principally of pyrite with lesser chalcopyrite and molybdenite. Minor amounts of galena,sphalerite, magnetite and specularite are present locally. Pyrite and chalcopyrite occur predominately as discrete grains associated with quartz in randomly oriented veinlets up to ½ inch in width. Molybdenite occurs in a similar manner and also as a coating or "paint" along fractures with or without quartz.

"At least 400 to 800 ppm Cu is present nearly everywhere in premineral rocks at Sheep Mountain East. Indeed, up to 0.25% Cu is not uncommon in intervals in many holes throughout the area. However, the best copper mineralization has been intercepted in Precambrian rocks adjacent to the eastern contact of the Sheep Mountain stock. Phelps Dodge drill hole SM-20 contains the best copper values which have been cut at Sheep Mountain to date. In this hole, about 120 ft of enriched ore averaging 1.70% Cu, plus an additional 550 ft of primary ore with some supergene? ore averaging 0.46% Cu, were cut before the hole was bottomed in about 0.10% Cu. This hole plus holes SM-28, 32, and 39 appear to outline

a narrow, 2500-ft-long, northwest-trending zone of better copper mineralization. this zone which appears to follow the Cow Creek fault zone contains an average of 50 to 70 ft of enriched ore averaging greater than 1% Cu. The primary ore plus some supergene? ore below this enriched zone appear to average about 425 ft thick and grade 0.35% Cu. The Cow Creek fault zone is believed to have played a vital role in the formation of copper enrichment in this zone. Better molybdenum values generally follow the better copper values and average about 0.05 to 0.07% $MoS_2$. Below this zone values drop to about 0.10% to 0.15% Cu and 0.02% to 0.04% $MoS_2$" (Hoyt and Ascencios, 1981, pp.8-9).

Total sulphide distribution appears to be spatially related to the Sheep Mountain stock. Although the core of this pluton contains only 1% or less total sulphides, an additional 1% to 3% total sulphide content has been introduced into the stock margins and adjacent wall rock to form a zone approximately 1,000 feet wide which except for the western contact, nearly surrounds the stock. Beyond this zone, total sulphide content drops to less than 1%.

SHEEP MOUNTAIN EAST GEOCHEMISTRY

A total of 61 composite samples of drill core was taken by Utah International and assayed for Au, Ag, Rb, $K_2O$, Sn and $WO_3$ as well as for Cu and $MoS_2$. The samples were taken from rocks showing varying degrees of potassic and argillic alteration as well as from zones of intense silicification in quartz veinlet stockworks.

"Results of these assays indicate that none of the elements mentioned occurs in anomalous concentrations. Additionally,no pattern could be established for the correlation of metal ratios nor were any of the elements or their ratios correlative with the hydrothermal alteration assemblages. Distribution appears wholly erratic.

"High molybdenum and copper values commonly occur together, although exceptions to this relationship are many. In general,better molybdenum and copper

values appear to ring the Sheep Mountain stock; however, molybdenum more faithfully reflects this relationship than does copper. Additionally, molybdenum more commonly is associated with high K-spar-altered host rock" (Hoyt and Ascencios, 1981, p.15).

MINERAL INVENTORY

The drill indicated copper-molybdenum mineral inventory identified to date on the Castle property occurs in a northwesterly striking zone which appears to follow the Cow Creek Fault along the eastern margin of the Sheep Mountain stock. The zone measures 5,500 feet long by 1,100 feet wide and has been intersected by drill holes UC-1, SM-20, SM-32 and SM-39 spaced from 750 to 1,000 feet apart. Copies of the original logs, sampling intervals and assay sheets for each of these holes were made available to the writer.

In the following drill indicated mineral inventory calculation, the writer has weighted the individual intersections and sampling results from these logs and assay sheets to obtain an average for each hole. In general, the copper values represent individual 10 foot core lengths while molybdenum values, expressed as $MoS_2$, are composite assays taken over 50 foot intervals. Blocks were drawn around each drill hole and the tonnage obtained using a factor of 11.2 cubic feet per ton calculated by the writer from the specific gravity of the host rocks and assuming 5% sulphides. It is further assumed that these intersections of supergene enriched copper-molybdenum mineralization represent a tabular body continuous between drill holes rather than a complex of enriched shear zones or channels. The drill indicated mineral inventory for the Castle property is summarized as follows:

| | TONS | % CU | TXCU | % $MoS_2$ | TX$MoS_2$ |
|---|---|---|---|---|---|
| PROVEN | 15,002,232 | 1.17 | 17,562,298 | 0.047 | 701,261 |
| PROBABLE | 14,070,869 | 1.17 | 16,459,752 | 0.047 | 655,998 |
| SUB TOTAL | 29,073,101 | 1.17 | 34,022,050 | 0.047 | 1,357,259 |
| POSSIBLE | 10,361,383 | 1.55 | 16,032,858 | 0.037 | 383,806 |
| TOTALS | 39,434.484 | 1.27 | 50,054,908 | 0.044 | 1,741,065 |

The weighted averages for copper and $MoS_2$ for each of the four drill holes used in the mineral inventory calculation are shown on pages 19 and 20. The individual blocks are shown on Figure 5 (in back pocket) and the weighted averages for each block are shown on pages 21, 22 and 23. A composite longitudinal section, Figure 4 (in back pocket), illustrates the enriched Cu-$MoS_2$ intersection in each hole and its relationship to the base of the overlying mid-Tertiary volcanics. Also shown on this section are intersections of primary hypogene copper-molybdenum mineralization beneath the enriched supergene blanket indicating the widespread nature of sulphide mineralization in the Sheep Mountain East area.

## CONCLUSIONS AND RECOMMENDATIONS

The Castle copper-malybdenum property consists of 141 unpatented lode mining claims covering approximately 2,500 acres located in the Sheep Mountain East area about 50 miles northwest of Phoenix, Arizona, U.S.A. The property was acquired to cover a zone of enriched copper-molybdenum mineralization within and adjacent to a composite stock of Laramide (?) age intrusive into Precambrian biotite schists and granitic to dioritic rocks.

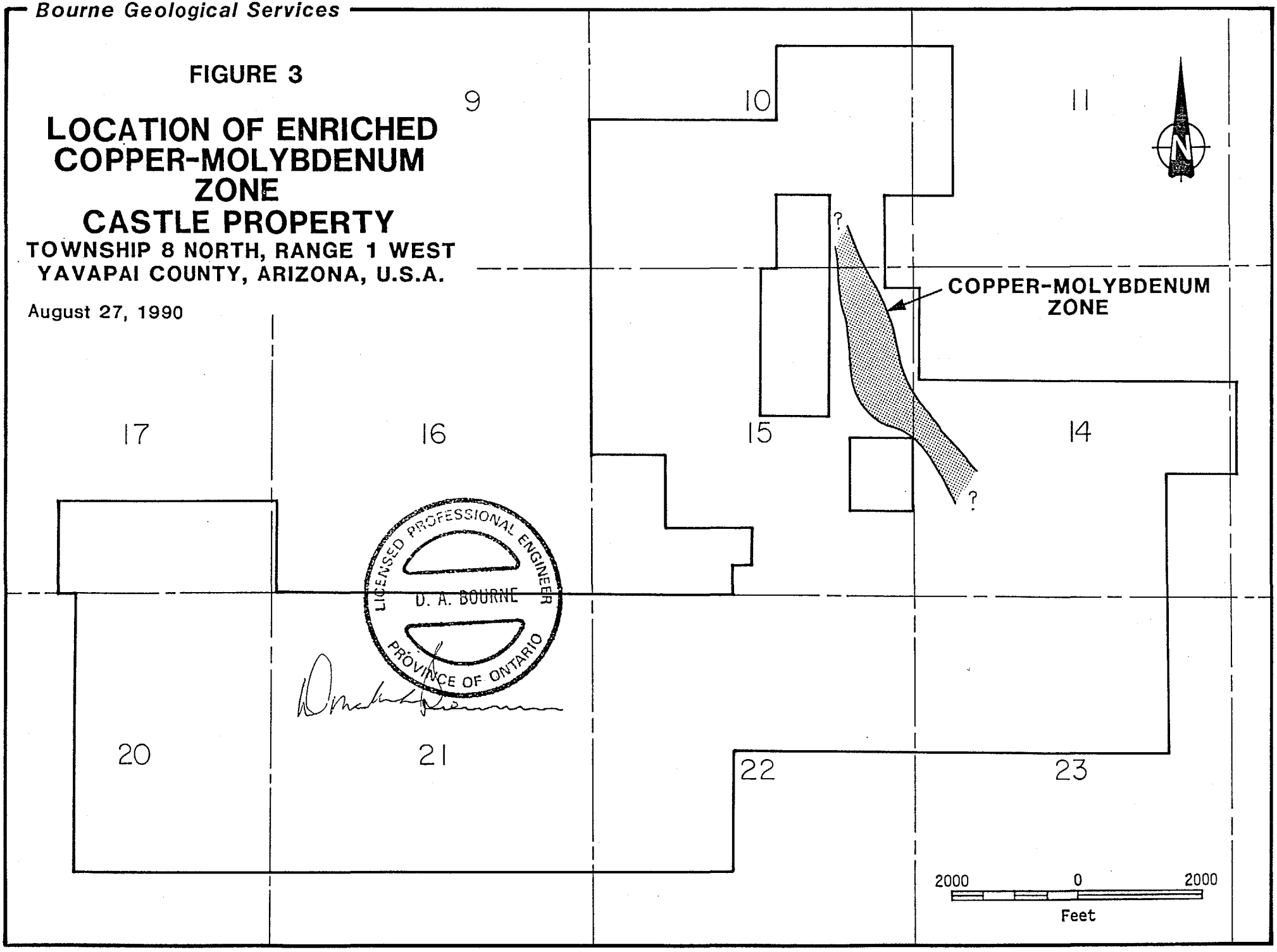
*Bourne Geological Services*

# FIGURE 3

# LOCATION OF ENRICHED COPPER-MOLYBDENUM ZONE CASTLE PROPERTY

**TOWNSHIP 8 NORTH, RANGE 1 WEST**
**YAVAPAI COUNTY, ARIZONA, U.S.A.**

August 27, 1990



# DIAMOND DRILL DATA
# FOR DRILL INDICATED
# MINERAL INVENTORY CALCULATIONS
# CASTLE COPPER-MOLYBDENUM PROPERTY
# YAVAPAI COUNTY, ARIZONA

| HOLE NO. | INTERSECTION FROM | TO | LENGTH | % CU | TXCU | % $MoS_2$ | TX$MoS_2$ |
|---|---|---|---|---|---|---|---|
| UC-1 | 1942' | 1952' | 10.0' | 0.85 | 8.50 | 0.038 | 0.380 |
| | 1952 | 1962 | 10.0 | 1.24 | 12.40 | 0.038 | 0.380 |
| | 1962 | 1965 | 3.0 | 1.80 | 5.40 | 0.014 | 0.042 |
| | 1965 | 1971 | 6.0 | 0.16 | 0.96 | 0.010 | 0.060 |
| | 1971 | 1973 | 2.0 | 1.88 | 3.76 | 0.011 | 0.022 |
| | 1973 | 1980 | 7.0 | 6.74 | 47.18 | 0.013 | 0.091 |
| | 1980 | 1990 | 10.0 | 1.36 | 13.60 | 0.043 | 0.430 |
| | 1990 | 1995 | 5.0 | 0.76 | 3.80 | 0.029 | 0.145 |
| | | | 53.0' | 1.80 | 95.60 | 0.029 | 1.550 |
| SM-39 | 2091' | 2101' | 10.0' | 0.45 | 4.50 | 0.020 | 0.20 |
| | 2101 | 2111 | 10.0 | 0.48 | 4.80 | 0.048 | 0.48 |
| | 2111 | 2121 | 10.0 | 1.21 | 12.10 | 0.048 | 0.48 |
| | 2121 | 2131 | 10.0 | 3.26 | 32.60 | 0.048 | 0.48 |
| | 2131 | 2141 | 10.0 | 0.51 | 5.10 | 0.048 | 0.48 |
| | | | 50.0' | 1.18 | 59.10 | 0.042 | 2.12 |
| SM-32 | 1986' | 1996' | 10.0' | 0.56 | 5.60 | 0.036 | 0.360 |
| | 1996 | 2006 | 10.0 | 1.95 | 19.50 | 0.046 | 0.460 |
| | 2006 | 2016 | 10.0 | 1.28 | 12.80 | 0.046 | 0.460 |
| | 2016 | 2026 | 10.0 | 1.10 | 11.00 | 0.046 | 0.460 |
| | 2026 | 2036 | 10.0 | 0.41 | 4.10 | 0.046 | 0.460 |
| | 2036 | 2046 | 10.0 | 0.38 | 3.80 | 0.046 | 0.460 |
| | 2046 | 2056 | 10.0 | 0.76 | 7.60 | 0.082 | 0.820 |
| | 2056 | 2066 | 10.0 | 0.48 | 4.80 | 0.082 | 0.820 |
| | 2066 | 2076 | 10.0 | 0.49 | 4.90 | 0.082 | 0.820 |
| | 2076 | 2086 | 10.0 | 0.37 | 3.70 | 0.082 | 0.820 |
| | 2086 | 2096 | 10.0 | 0.63 | 6.30 | 0.082 | 0.820 |
| | 2096 | 2006 | 10.0 | 0.36 | 3.60 | 0.052 | 0.520 |
| | 2106 | 2116 | 10.0 | 0.53 | 5.30 | 0.052 | 0.520 |
| | | | 130.0' | 0.72 | 93.00 | 0.060 | 7.800 |

# DIAMOND DRILL DATA
# FOR DRILL INDICATED
# MINERAL INVENTORY CALCULATIONS
# CASTLE COPPER-MOLYBDENUM PROPERTY
# YAVAPAI COUNTY, ARIZONA

| HOLE NO. | INTERSECTION FROM | TO | LENGTH | % CU | TXCU | % $MoS_2$ | TX$MoS_2$ |
|---|---|---|---|---|---|---|---|
| SM-20 | 1843' | 1853' | 10.0' | 1.93 | 19.30 | 0.062 | 0.620 |
| | 1853 | 1863 | 10.0 | 1.13 | 11.30 | 0.062 | 0.620 |
| | 1863 | 1873 | 10.0 | 2.78 | 27.80 | 0.006 | 0.060 |
| | 1873 | 1883 | 10.0 | 1.40 | 14.00 | 0.006 | 0.060 |
| | 1883 | 1893 | 10.0 | 1.29 | 12.90 | 0.006 | 0.060 |
| | 1893 | 1903 | 10.0 | 0.95 | 9.50 | 0.006 | 0.060 |
| | 1903 | 1913 | 10.0 | 1.69 | 16.90 | 0.006 | 0.060 |
| | 1913 | 1923 | 10.0 | 1.72 | 17.20 | 0.061 | 0.610 |
| | 1923 | 1933 | 10.0 | 2.79 | 27.90 | 0.061 | 0.610 |
| | 1933 | 1943 | 10.0 | 1.81 | 18.10 | 0.061 | 0.610 |
| | 1943 | 1953 | 10.0 | 1.86 | 18.60 | 0.061 | 0.610 |
| | 1953 | 1963 | 10.0 | 1.08 | 10.80 | 0.061 | 0.610 |
| | 1963 | 1973 | 10.0 | 0.43 | 4.30 | 0.044 | 0.440 |
| | 1973 | 1983 | 10.0 | 0.77 | 7.70 | 0.044 | 0.440 |
| | 1983 | 1993 | 10.0 | 0.74 | 7.40 | 0.044 | 0.440 |
| | | | 150.0' | 1.49 | 223.70 | 0.039 | 5.910 |

MINERAL INVENTORY CALCULATION
DRILL INDICATED
POSSIBLE ORE
CASTLE COPPER-MOLYBDENUM PROPERTY
YAVAPAI COUNTY, ARIZONA, U.S.A.

| BLOCK | NE/SW | NW/SE | VERT | VOL(FT$^3$) | TONS | % CU | TXCU | $MoS_2$ | % TX$MoS_2$ | HOLE NO. |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 600 | 250 | 53.0 | 7,950,000 | 709,821 | 1.80 | 1,277,678 | 0.029 | 20,585 | RC-UC-1 |
| B | 150 | 250 | 53.0 | 1,987,500 | 177,455 | 1.80 | 319,419 | 0.029 | 5,146 | " |
| D | 200 | 250 | 53.0 | 2,659,000 | 236,607 | 1.80 | 425,893 | 0.029 | 6,862 | " |
| Z | 100 | 250 | 130.0 | 3,250,000 | 290,179 | 0.72 | 208,929 | 0.060 | 17,411 | SM-32 |
| e | 200 | 300 | 150.0 | 9,000,000 | 803,571 | 1.49 | 1,197,321 | 0.039 | 31,339 | SM-20 |
| i | 200 | 175 | 150.0 | 5,250,000 | 468,750 | 1.49 | 698,438 | 0.039 | 18,281 | " |
| m | 200 | 175 | 150.0 | 5,250,000 | 468,750 | 1.49 | 698,438 | 0.039 | 18,281 | " |
| q | 600 | 175 | 150.0 | 15,750,000 | 1,406,250 | 1.49 | 2,095,313 | 0.039 | 54,844 | " |
| r | 400 | 800 | 150.0 | 48,000,000 | 4,285,714 | 1.49 | 6,385,714 | 0.039 | 167,143 | SM-2- |
| s | 400 | 800 | 53.0 | 16,960,000 | 1,514,286 | 1.80 | 2,725,715 | 0.029 | 43,914 | RC-UC-1 |
| | | | | TOTALS | 10,361,383 | 1.55 | 16,032,858 | 0.037 | 383,806 | |

LICENSED PROFESSIONAL ENGINEER
D. A. BOURNE
PROVINCE OF ONTARIO

MINERAL INVENTORY CALCULATION
DRILL INDICATED
PROBABLE ORE
CASTLE COPPER-MOLYBDENUM PROPERTY
YAVAPAI COUNTY, ARIZONA, U.S.A.

| BLOCK | NE/SW | NW/SE | VERT | VOL($FT^3$) | TONS | % CU | TXCU | % $MoS_2$ | TX$MoS_2$ | HOLE NO. |
|---|---|---|---|---|---|---|---|---|---|---|
| C | 400 | 250 | 53.0 | 5,300,000 | 473,214 | 1.80 | 851,785 | 0.029 | 13,723 | RC-UC-1 |
| E | 150 | 250 | 53.0 | 1,987,500 | 177,455 | 1.80 | 319,419 | 0.029 | 5,146 | " |
| G | 250 | 250 | 53.0 | 3,312,500 | 295,759 | 1.80 | 532,366 | 0.029 | 8,577 | " |
| H | 175 | 250 | 53.0 | 2,318,750 | 207,031 | 1.80 | 372,656 | 0.029 | 6,004 | " |
| J | 225 | 250 | 53.0 | 2,981,250 | 266,183 | 1.80 | 479,129 | 0.029 | 7,719 | " |
| L | 225 | 250 | 53.0 | 2,981,250 | 266,183 | 1.80 | 479,129 | 0.029 | 7,719 | " |
| N | 300 | 250 | 50.0 | 3,750,000 | 334,821 | 1.18 | 395,089 | 0.042 | 14,062 | SM-39 |
| P | 300 | 250 | 50.0 | 3,750,000 | 334,821 | 1.18 | 395,089 | 0.042 | 14,062 | " |
| Q | 200 | 250 | 50.0 | 2,500,000 | 223,214 | 1.18 | 263,393 | 0.042 | 9,375 | " |
| S | 350 | 250 | 50.0 | 4,375,000 | 390,625 | 1.18 | 460,938 | 0.042 | 16,406 | " |
| T | 250 | 250 | 50.0 | 3,125,000 | 279,018 | 1.18 | 329,241 | 0.042 | 11,719 | " |
| V | 250 | 250 | 50.0 | 3,125,000 | 279,018 | 1.18 | 329,241 | 0.042 | 11,719 | |
| W | 450 | 250 | 130.0 | 14,625,000 | 1,305,804 | 0.72 | 940,179 | 0.060 | 78,348 | SM-32 |
| Y | 225 | 250 | 130.0 | 7,312,500 | 652,902 | 0.72 | 470,039 | 0.060 | 39,174 | " |
| a | 600 | 250 | 130.0 | 19,500,000 | 1,741,071 | 0.72 | 1,253,571 | 0.060 | 104,464 | " |
| c | 600 | 300 | 130.0 | 23,400,000 | 2,089,286 | 0.72 | 1,504,286 | 0.060 | 125,357 | SM-32 |
| f | 300 | 300 | 150.0 | 13,500,000 | 1,205,357 | 1.49 | 1,795,982 | 0.039 | 47,009 | SM-20 |
| h | 300 | 300 | 150.0 | 13,500,000 | 1,205,357 | 1.49 | 1,795,982 | 0.039 | 47,009 | " |
| j | 300 | 175 | 150.0 | 7,875,000 | 703,125 | 1.49 | 1,047,656 | 0.039 | 24,422 | " |
| l | 200 | 175 | 150.0 | 5,250,000 | 468,750 | 1.49 | 698,438 | 0.039 | 18,281 | " |
| n | 300 | 175 | 150.0 | 7,875,000 | 703,125 | 1.49 | 1,047,656 | 0.039 | 27,422 | " |
| p | 200 | 175 | 150 | 5,250,000 | 468,750 | 1.49 | 698,438 | 0.039 | 18,281 | " |
| | | | | TOTALS | 14,070,869 | 1.17 | 16,459,752 | 0.047 | 655,998 | |

LICENSED PROFESSIONAL ENGINEER
D. A. BOURNE
PROVINCE OF ONTARIO

MINERAL INVENTORY CALCULATION
DRILL INDICATED
PROVEN ORE
CASTLE COPPER-MOLYBDENUM PROPERTY
YAVAPAI COUNTY, ARIZONA, U.S.A.

| BLOCK | NE/SW | NW/SE | VERT | VOL($FT^3$) | TONS | % CU | TXCU | % $MoS_2$ | TX$MoS_2$ | HOLE NO. |
|---|---|---|---|---|---|---|---|---|---|---|
| F | 400 | 250 | 53.0 | 5,300,000 | 473,214 | 1.80 | 851,785 | 0 029 | 13,723 | RC-UC-1 |
| I | 400 | 250 | 53.0 | 5,300,000 | 473,214 | 1.80 | 851,785 | 0.029 | 13,723 | " |
| K | 550 | 250 | 53.0 | 7,287,500 | 650,670 | 1.80 | 1,171,206 | 0.029 | 18,869 | " |
| M | 500 | 250 | 50.0 | 6,250,000 | 558,036 | 1.18 | 658,482 | 0.042 | 23,438 | SM-39 |
| O | 500 | 250 | 50.0 | 6,250,000 | 558,036 | 1.18 | 658,482 | 0.042 | 23,438 | " |
| R | 400 | 250 | 50.0 | 5,000,000 | 446,429 | 1.18 | 526,786 | 0.042 | 18,750 | " |
| U | 575 | 250 | 50.0 | 7,187,500 | 641,741 | 1.18 | 757,254 | 0.042 | 26,953 | " |
| X | 500 | 250 | 130.0 | 16,250,000 | 1,450,893 | 0.72 | 1,044,643 | 0.060 | 87,054 | SM-32 |
| b | 600 | 250 | 130.0 | 19,500,000 | 1,741,071 | 0.72 | 1,253,571 | 0.060 | 104,464 | " |
| d | 800 | 300 | 130.0 | 31,200,000 | 2,785,714 | 0.72 | 2,005,714 | 0.060 | 167,143 | " |
| g | 600 | 300 | 150.0 | 27,000,000 | 2,410,714 | 1.49 | 3,591,964 | 0.039 | 94,018 | SM-20 |
| k | 600 | 175 | 150.0 | 15,750,000 | 1,406,250 | 1.49 | 2,095,313 | 0.039 | 54,844 | " |
| O | 600 | 175 | 150.0 | 15,750,000 | 1,406,250 | 1.49 | 2,095,313 | 0.039 | 54,844 | " |
| | | | | TOTALS | 15,002,232 | 1.17 | 17,562,298 | 0.047 | 701,261 | |

LICENSED PROFESSIONAL ENGINEER
D. A. BOURNE
PROVINCE OF ONTARIO

The Sheep Mountain Stock is a composite body of Laramide (?) age which forms a slightly elongated dome measuring 3,400 feet by 2,300 feet whose long axis strikes N45$^{o}$ W and plunges 50$^{o}$ northwest. The copper-molybdenum mineralization on the Castle property appears to be related to this stock. Unconformably overlying the Precambrian and Laramide (?) rocks is a series of mid-Tertiary volcanic flows and pyroclastics from 1,500 to 2,200 feet thick which cover the entire Sheep Mountain East area.

The mineral system in the Sheep Mountain East area is an extremely large one with significant sulphide mineralization occuring over 3 or 4 square miles although the better grade copper-molybdenum values forming the drill indicated mineral inventory on the Castle property appear to be located within or adjacent to the Sheep Mountain Stock. Hypogene sulphide mineralization consists principally of pyrite with lesser chalcopyrite and molybdenite. Minor amounts of galena, sphalerite, magnetite and specularite are present locally.

The drill indicated copper-molybdenum mineral inventory identified to date on the Castle property occurs in a northwesterly striking zone which appears to follow the Cow Creek Fault along the eastern margin of the Sheep Mountain Stock. The zone measures 5,500 feet long by 1,100 feet wide and has been intersected by four drill holes spaced from 750 to 1,000 feet apart. In the mineral inventory calculation, it is assumed that these intersections of supergene enriched copper-molybdenum mineralization represent a tabular body continuous between drill holes rather than a complex of enriched shear zones or channels. The drill indicated mineral inventory for the Castle property is summarized as follows:

| | TONS | % CU | TXCU | % $MoS_2$ | TX$MoS_2$ |
|---|---|---|---|---|---|
| PROVEN | 15,002,232 | 1.17 | 17,562,298 | 0.047 | 701,261 |
| PROBABLE | 14,070,869 | 1.17 | 16,459,752 | 0.047 | 655,998 |
| SUB TOTAL | 29,073,101 | 1.17 | 34,022,050 | 0.047 | 1,357,259 |
| POSSIBLE | 10,361,383 | 1.55 | 16,032,858 | 0.037 | 383,806 |
| TOTALS | 39,434.484 | 1.27 | 50,054,908 | 0.044 | 1,741,065 |

As can be seen from Figure 4, there are substantial widths of primary copper-molybdenum mineralization below the supergene enriched blanket. Although perhaps of some future interest, no attempt has been made by the writer to calculate a tonnage for this material. Selected examples of this type of material are as follows:

| HOLE NO. | INT. | % CU | % $MoS_2$ |
|---|---|---|---|
| SM-20 | 100.0' | 0.53 | 0.078 |
| | 290.0 | 0.46 | 0.086 |
| SM-39 | 40.0 | 0.50 | 0.050 |
| | 40.0 | 0.50 | 0.041 |
| UC-1 | 180.0 | 0.44 | 0.044 |
| | 32.0 | 0.82 | 0.043 |
| | 31.0 | 0.41 | 0.076 |

The writer recommends a program of fill-in rotary/core drilling and metallurgical test work for the Castle property. Phase I would consist of 5 holes each 2,500 feet in length, the upper 1,000 feet of each hole to be drilled using a rotary bit at a cost of $10 per foot, the remaining 1,500 feet of each hole to be cored at a cost of $35 per foot. The estimated cost of Phase I is $325,000 U.S. Phase II of the proposed work program would consist of an additional 19 rotary/core holes each 2,500 feet in length to be drilled in the same manner as those in Phase I plus a program of metallurgical test work on the drill

core. The estimated cost of Phase II is $1,697,500 U.S. The proposed location of the collar of each of the rotary/core holes is shown in Figure 5 although it is understood that the locations may have to be altered as drilling results dictate. The total cost of the proposed work program is estimated at $2,022,500 U.S.

COST ESTIMATES (U.S. FUNDS)

PHASE I

| | |
|---|---|
| 1. Mobilization and demobilization | $ 2,000 |
| 2. Diamond drilling: 5 holes each 2,500 feet in length, 0.0 to 1,000 feet rotary drilling @ $10 per foot, 1,000 to 2,500 feet core drilling @ $35 per foot to include contract price, splitting, logging, assaying | 312,500 |
| 3. Site clean-up | 2,500 |
| 4. Report, typing drill logs and report, drafting, printing | 8,000 |
| PHASE I | $ 325,000 |

PHASE II

| | |
|---|---|
| 1. Diamond drilling: 19 holes each 2,500 feet in length, 0.0 to 1,000 feet rotary drilling @ $10 per foot, 1,000 to 2,500 feet core drilling @ $35 per foot to include contract price, splitting, logging, assaying | $ 1,187,500 |
| 2. Metallurgical test work | 500,000 |
| 3. Final report | $ 10,000 |
| PHASE II | $ 1,697,500 |
| TOTAL ESTIMATED COST | $ 2,022,500 |

Respectfully submitted,

LICENSED PROFESSIONAL ENGINEER
D. A. BOURNE
PROVINCE OF ONTARIO

DONALD A. BOURNE, P.ENG.

SCARBOROUGH, ONTARIO
AUGUST 27, 1990

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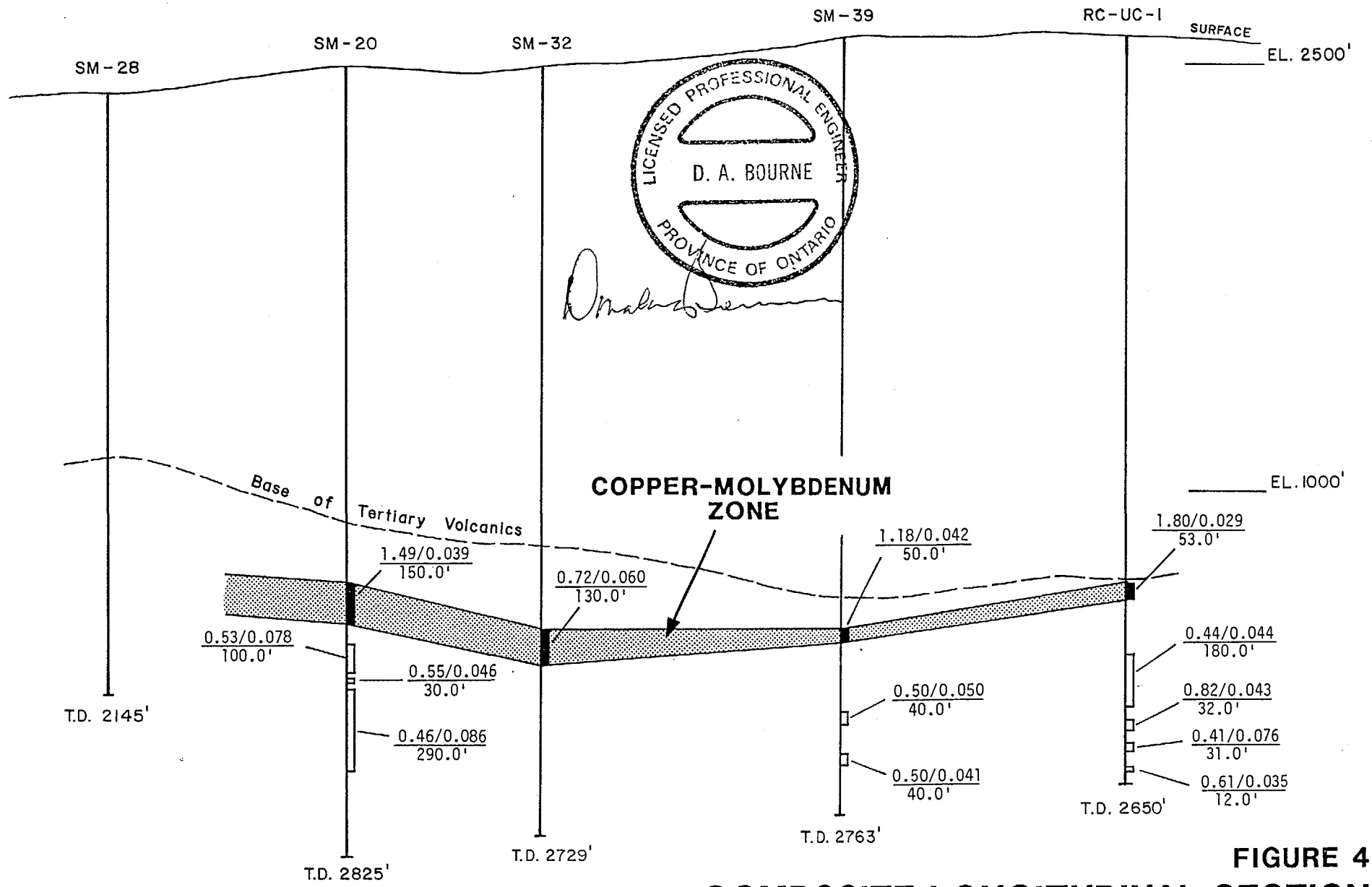



LICENSED PROFESSIONAL ENGINEER
D. A. BOURNE
PROVINCE OF ONTARIO

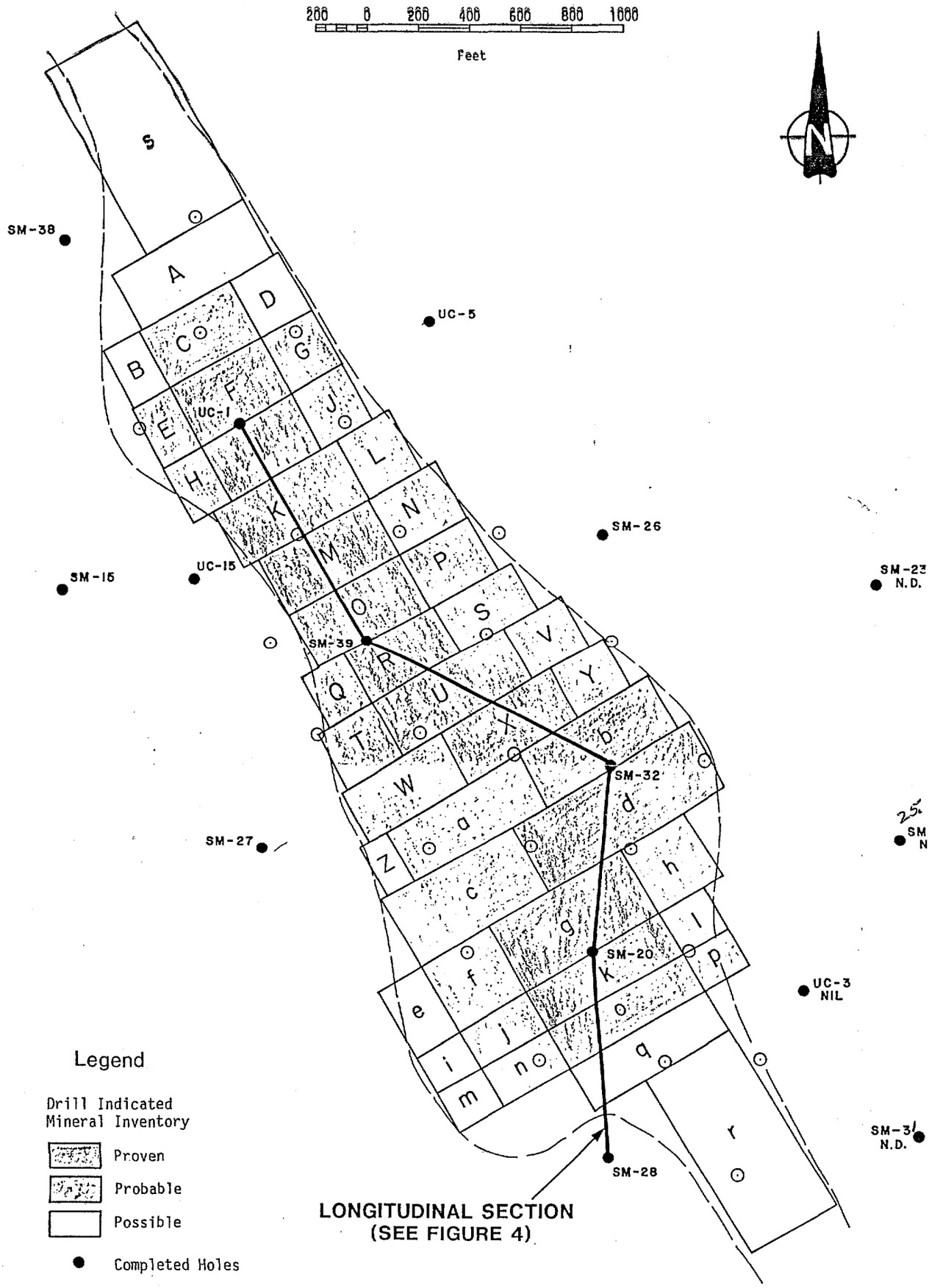
Mineralized Intersection

1.18/0.042 / 50.0' — %Cu/%$MoS_2$ / length (feet)

250 0 250 500
Feet

# FIGURE 4
# COMPOSITE LONGITUDINAL SECTION COPPER-MOLYBDENUM ZONE CASTLE PROPERTY
## YAVAPAI COUNTY, ARIZONA, U.S.A.

August 27, 1990




Legend

Drill Indicated
Mineral Inventory

- Proven
- Probable
- Possible

- Completed Holes
- Proposed Holes
- Edge of Enriched Copper Blanket

LICENSED PROFESSIONAL ENGINEER
D. A. BOURNE
PROVINCE OF ONTARIO

FIGURE 5

# MINERAL INVENTORY
# CASTLE COPPER-MOLYBDENUM DEPOS
# DIAMOND DRILL PLAN MAP AND LOCATION OF COPPER-MOLYBDENUM ZONE

YAVAPAI COUNTY, ARIZONA

August 27, 1990

| | | | | |
|---|---|---|---|---|
| **Profit per year:** | .95 X 7,000,000 (tons) = $6,650,000 | | | |
| **Federal Tax:** | | Net per year = $6,650,000 | | $6,650,000 |
| **Depreciation:** 20¢/ton | X | 7,000,000 tpy = | 1,400,000 | |
| | | | 5,250,000 | |
| **Depletion:** | | 15% of gross | 2,604,000 | |
| | | 52% Fed. tax | 2,646,000 = | 1,376,000 |
| | | Net per year | | $5,274,000 |

Dollars of capital per $1.00 return per year $\frac{33,350,000}{5,274,000}$ = $6.32

Return at 19 year life (uniform cash flow assumed) 14.6%

Tons of copper conecntrate per year 72,400

Tons of $MoS_2$ per year Concentrate 4,800

The above is only a rough approximation and subject to revision, however a fair return on capital is indicated, although obviously the operation would not be in a strong competitive position with the principal producers of copper and moly. However, I believe the project merits further study. Therefore, it is recommended that an attempt be made to negotiate a deal with Bear Creek wherein sufficient time without substantial cash payments would be allowed to thoroughly evaluate the two deposits (Lofton Peak deposit not included in the above outcome). Considering the geometry of the deposit, the 500' drill hole spacing appears far too great for acceptably accurate ore estimation and pit design. At least 20 more interspaced and fringe holes would be required. These holes would total about 12,000 feet, or $84,000.00 at $7.00 per foot.

Bear Creek holds 6 options covering 190 unpatented mining claims and one State permit on 315 acres. Payments totalling $54,004 have so far been made. A payment of $67,500 is due November 25 of this year; otherwise there are no sizeable payments due until March 17 of 1964.

A firm proposal was not obtained from Bear Creek, but it was suggested that they would consider something like $1.5 million for their "position".

Yours very truly,

J. H. COURTRIGHT

JHC/jk
Enclosure
cc: DJPope w/o Enclosure
TASnedden w/o Enclosure
KERichard 1 extra w/Enclosure

The 10 holes drilled for metallurgical samples were positioned 20' to 30' from 10 of the holes in "ore". No pair of holes showed close correspondence from sample to sample (20' intervals), but the over-all average of the metallurgical holes was only .02% Cu (equivalent) below the exploration holes. These results demonstrate local irregularity of values, but strongly support the over-all average. Assaying was done by Jacobs in Tucson with occasional checks by Hawley & Hawley and The Kennecott Research Center in Salt Lake City. Close correspondence was obtained except in the Au-Ag values which were finally dropped from $.25/ton (Jacobs) to .08 (Kennecott Research Center). A further close check on the Cu-Mo values was obtained by returning the 10 metallurgical hole sample pulps to Jacobs in Tucson.

Some eight different outcome estimates have been made by Bear Creek and other departments. Cu ore estimates ranging from 80 million tons of .286% Cu and .081% $MoS_2$ (No. 5) to 170 million tons of .34% Cu and .071% $MoS_2$ (No. 6a). These returns at 30¢ Cu and 79½¢ $MoS_2$ are shown in the brochure as follows:

| | tpd | Life | Capital | Payout (yrs) | Rate of Return (after Fed. taxes) |
|---|---|---|---|---|---|
| No. 5 | 15,000 | 18.4 | $26,332,000 | 7.02 | 12.43% |
| No. 6a | 20,000 | 28.4 | 33,350,000 | 7.54 | 13.00% |

Assuming a uniform cash flow, the rate of return according to the Present Value method is 5½% for No. 5 and 9.0% for No. 6a.

Using approximated Mission costs and Bear Creek's tons and grade in column 2 and, capital estimate in column 6a, Table II, plus 20% dilution in tons and 10% in grade, outcome by the Present Value method at 30¢ Cu and 79½¢ $MoS_2$ shows a return of 14.6% for a 19 year life, as follows:

Grades

| | Tons | Cu% | $MoS_2$% | tpd | w/o |
|---|---|---|---|---|---|
| | 112,000,000 | .38 | .079 | 20,000 | 2.16:1 |
| 20% dilution | 22,400,000 | | | | |
| | 134,400,000 | .34 | .071 | | 1.63:1 |

| | %Cu | | Rec. | | lbs. | | Cu. ¢ per lb. | | |
|---|---|---|---|---|---|---|---|---|---|
| Net Mill: | .34 | x | .90 | x | 20 | x | .23 | = | $1.41 |
| | $\%MoS_2$ | | | | | | $MoS_2$ | | |
| | .071 | x | .88 | x | 20 | x | .795 | = | .99 |
| Au-Ag | - | | - | | - | | - | = | .08 |
| | | | | | | | | | $2.48 per ton |

Costs:

| | |
|---|---|
| Mining (22¢) | $ .58 |
| Milling | .55 |
| Indirect | .40 |
| | $1.53 |

1.53
$ .95 op. profit per ton

@ 25¢ Cu and 70¢ $MoS_2$ — net mill 1.75
5% interest on 30 million capital cost 1.53
.22 op profit

file

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

October 25, 1963

Mr. Kenyon Richard, Chief Geologist
American Smelting and Refining Company
120 Broadway
New York, N. Y. - 10005

SIERRITA-LOFTON PEAK PROPERTY
Twin Buttes District
Pima County, Arizona

Dear Sir:

Enclosed is a copy of Bear Creek's brochure on the Sierrita-Lofton Peak Ore Bodies. As I mentioned to Mr. Pollock by phone, we approached Mr. Walthier, local exploration manager, after learning that the property had been offered to other companies.

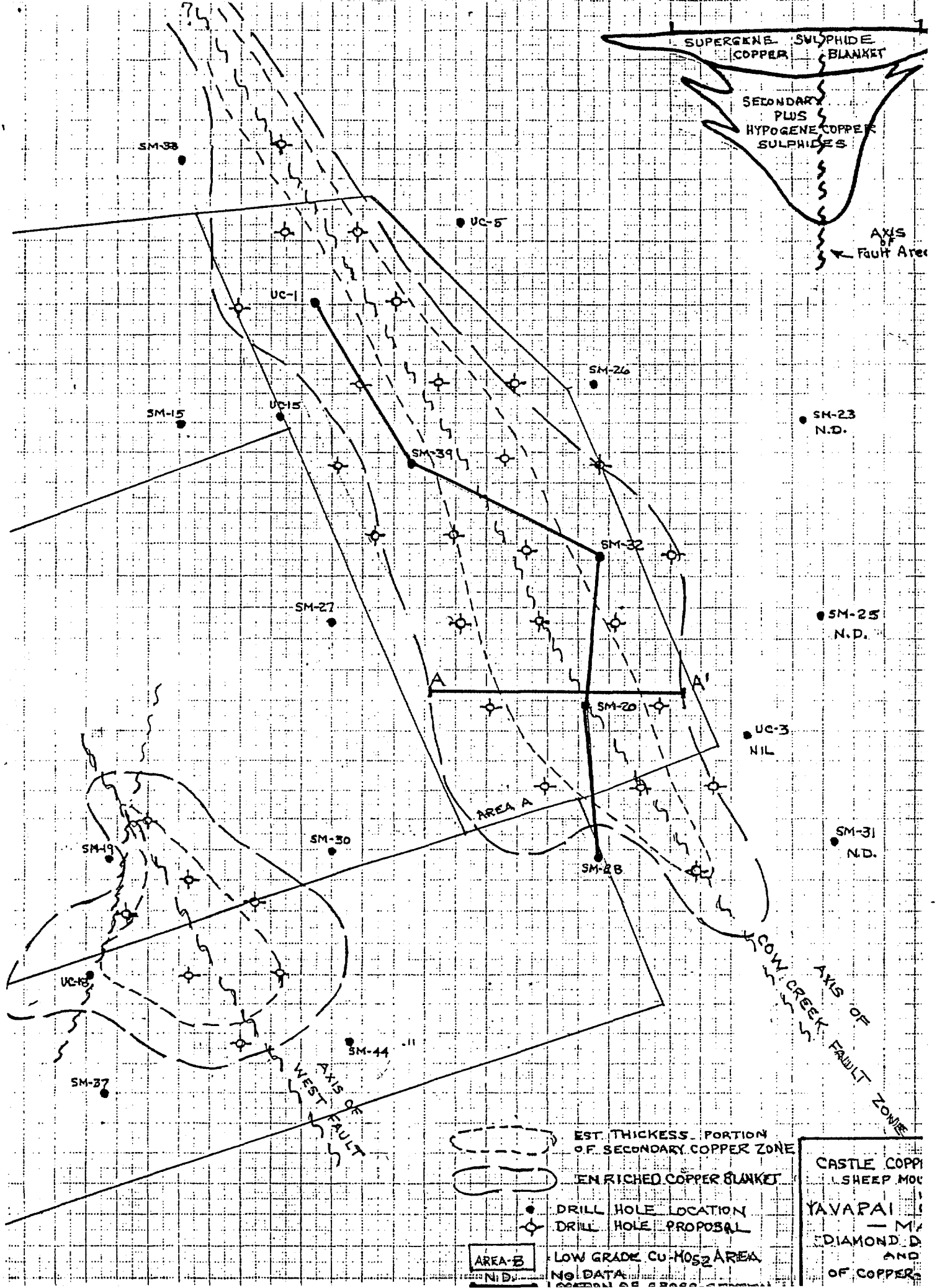
In brief, the ore zones are gently dipping tabular bodies of disseminated chalcopyrite and moly in diabase and monzonite, extending from the surface to over 1000' in depth. Since all rock in the vicinity contains values, the limits (and shape) of ore zones are determined by assay boundaries.

During the past day or two we have made a brief examination of Bear Creek's data and a brief tour in the field. The property adjoins Duval's ground on the west and north.

Good exposures occur in several washes and road cuts. Oxidation and leaching is shallow, varying from zero to 30' depth. In the diabase copper and moly with minor pyrite (total sulphides less than 2.0%) are confined almost entirely to narrow stringers of diverse orientation. The diabase has a dark, unaltered appearance. The quartz monzonite and biotite quartz monzonite occasionally exhibit weak alteration in sheeted zones and mineralization in these rocks is partially disseminated. As shown by the drill results in the Sierrita area, slightly higher Cu-Mo values form a zone extending down to the SE in the diabase. The Lofton Peak mineralization is entirely within the quartz monzonite.

Except for the "regression analysis" method, ore reserves were computed on 100' interval plans coordinated with information on N-S and E-W sections. Continuity of the thin tabular zones shown on section is questionable. A series of discontinuous lenses is the more probable pattern. However, the thin bands of "waste" average at least half the ore grade, so the effect of mining dilution, say 20%, would be a 10% reduction in grade.

Core recovery was exceptionally high --- 99% over-all average. Drilling costs were low --- $5.00 per foot contract (Joy) and $1.25 for sampling, assaying, and roads. Progress averaged 30' per 8-hour shift with NX wireline.


SUPERGENE COPPER
SULPHIDE BLANKET
SECONDARY PLUS HYPOGENE COPPER SULPHIDES
AXIS OF Fault Area
SM-38
UC-5
UC-1
SM-26
SM-15
UC-15
SM-23
N.D.
SM-39
SM-32
SM-27
SM-25
N.D.
A
A'
SM-20
UC-3
NIL
AREA A
SM-31
N.D.
SM-19
SM-30
SM-28
UC-18
SM-44
SM-37
AXIS OF WEST FAULT
COW CREEK FAULT ZONE
AXIS OF
EST. THICKESS PORTION OF SECONDARY COPPER ZONE
ENRICHED COPPER BLANKET
DRILL HOLE LOCATION
DRILL HOLE PROPOSAL
AREA-B
LOW GRADE Cu-MoS2 AREA
N.D.
NO DATA
CASTLE COPP
SHEEP MOU
YAVAPAI
— M
DIAMOND D
AND
OF COPPER

SAVANNA RESOURCES LTD. (SV-Alberta)

ANTA ROSA

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INC. M-V)

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two-year program totalling US$300,000.

92 new companies listed on the VSE, bringing t

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ORENDA FOREST PR T)

to build a Finnish designed zero-effluent pulp and paper

mill would employ 143 full-time workers and injec

JDS

# ASARCO

Exploration Department
Southwestern United States Division
James D. Sell
Manager

November 8, 1991

Mr. Raymond J. Mongeau
President, Orcana Res. Ltd.
121 Richmond Street West, Suite 405
Toronto, Ontario M5H 2K1
Canada

Castle Cu-Mo Deposit
Sheep Mountain
Yavapai County, AZ

Dear Ray:

Your FAX arrived and your conclusion is correct. I have not yet been able to move any thoughts within Asarco to take on your property at this time.

However, as you know, one good drill hole may turn it around and I hope Asarco will have a chance to change its mind.

Thank you for the loan of all the data.

I'm sending it all back with the maps in a map box and the reports in a separate box, by Federal Express.

Thanks again for all your help.

Sincerely,

James D. Sell

JDS:mek

cc: W.L. Kurtz

ASARCO Incorporated P.O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue FAX (602) 792-3934 Phone (602) 792-3010

JDS

**ASARCO**

Southwestern Exploration Division

November 8, 1991

FILE NOTE

PD's Logs-Assays
Castle Cu-Mo Deposit
Sheep Mountain Area
Humbug Mining District
Yavapai County, Arizona

Orcana Resources Limited had loaned SWED some material on the Sheep Mountain project.

Included were some of the Phelps Dodge drill holes which SWED previously did not have copies of.

Copies have now been sent to the files for following drill hole logs and assays. Holes SM-5 (log only), SM-7, -8, -10, -11, -12, -13, -23, -29, -33 (assay only), -34 (post-mineral volcanics), -35 (post-mineral volcanics), -36 (not drilled), -41 (post-mineral volcanics), -42, and SM-43.

Orcana intends to drill 4 or 5 new holes this winter.

James D. Sell

James D. Sell

JDS:mek

cc: W.L. Kurtz

JDS

**ASARCO**

Southwestern Exploration Division

November 8, 1991

FILE NOTE

Castle Cu-Mo Deposit
Sheep Mountain Area
Humbug Mining District
Yavapai County, Arizona

Raymond Mongeau of Orcana Resources Ltd., has requested his packet of data be returned. It will be sent Federal Express 11/8/91.

Ray says he has raised enough money for five holes and plans on spending a few months in sunny Arizona this winter putting down the holes and proving his concept.

He leaves the door open for Asarco SWED to look at the core etc., and hopefully, to change their mind on such a deep target.

James D. Sell

JDS:mek

James D. Sell

cc: W.L. Kurtz
S.A. Anzalone

* NO.95(MAY 15, 1992) * GEORGE CROSS NEWS LETTER LTD. * FORTY-FIFTH YEAR OF PUBLICATION *

FOR THE RECORD

J. H. C.

MAR 13 1970

AMERICAN SMELTING AND REFINING COMPANY
SOUTHWESTERN EXPLORATION DIVISION
P. O. BOX 5795 TUCSON, ARIZONA 85703

W. E. SAEGART
SUPERVISOR

W. L. KURTZ
ASSISTANT SUPERVISOR

1150 NORTH 7TH AVENUE
TELEPHONE 602-792-3010

March 11, 1970

Mr. Hollis Peacock, Manager
Mineral Development and Geology
Utah Construction and Mining Co.,
550 California Street
San Francisco, California 94123

Sheep mt

Dear Mr. Peacock:

This will confirm our telephone conversation of this morning concerning our interest in your Sheep Mountain Property, Yavapai County, Arizona.

We first became acquainted with Phelps Dodge's Sheep Mountain discovery during a general reconnaissance of the Bradshaw Mountains in 1965. During the following two or three years, we attempted to keep ourselved informed of their continuing drilling activities. From a personal source within Phelps Dodge, I was advised that their drilling had outlined a large primary copper-moly deposit beneath the exposed post-mineral volcanics. The grade of the deposit was considered sub-marginal at the then existing metal prices. We subsequently assumed that the property had been "put on the shelf" by Phelps Dodge. It was only recently that we learned of their relinquishment and that the property had subsequently been acquired by Utah Construction and Mining Company.

My telephone call this morning to you was for the purpose of inquiring as to whether Utah Construction and Mining Company might consider a joint venture with ASARCO for the exploration and/or development of the Sheep Mountain Property.

I have been assured by our management that ASARCO is interested in acquiring equities in large tonnage (marginal grade) copper deposits. One of our objectives is to secure assured supplies of copper concentrates which would permit long range planning relative to smelting capacities. Perhaps this subject would be of mutual interest to both our Companies.

We would be most happy to meet with you at any time to discuss the possible advantages of a joint venture development at Sheep Mountain.

I will look forward to meeting you during one of your next visits to Tucson.

Very truly yours,

W. E. Saegart

W. E. Saegart

WES:lab

cc: J.J.Collins
J.H.Courtright
Wm.L.Kurtz