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HAIL PROJECT

PRELIMINARY PROJECT CONSIDERATIONS

for a

COMMERCIAL MINING PROJECT

by

DAVID W PHILIP

4519 VANDERGRIFT CR. NW

CALGARY, ALBERTA

CANADA

T3A 0J1

MAY, 1986

A report submitted to Aurun Mines Ltd. as partial fulfillment of the contract to review the Hail Project and to prepare for mining input to a preliminary feasibility study.

4519 VANDERGRIFT CR NW
CALGARY, ALBERTA
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MAY 21,1986

JOHN A CHAPMAN, P.Eng.
PRESIDENT
AURUN MINES LTD.
PO BOX 602
ALDREGROVE, BC
V0X 1A0

Dear John:

Attached is a report titled "HAIL PROJECT, PRELIMINARY PROJECT CONSIDERATIONS for a COMMERCIAL MINING PROJECT." This is a progress report attempting to identify and give additional technical scope to a number of considerations that should be part of any preliminary feasibility studies.

Yours very truly,

D W Philip, P.Eng.

dwpDWP
cc:file

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INTRODUCTION

The Hail-Harper Creek Copper Prospect is located approximately 7 air kilometers south of the Yellowhead South Highway between the towns of Clearwater and Vavenby, BC. The deposits were discovered and explored in the mid to late 60's. This was followed by preliminary open pit designs and economic cash flows in the early 70's. Although under some assumptions the potential for a profitable mine existed the economic criteria would not indicate the type of profits required for the companies involved. Aurun Mines Ltd. has aquired some interest in these deposits and has contracted D.W.Philip, P.Eng. to review the available data and to look for potential opportunities or mine layouts that will increase the potential profitability of any mining project.

The preliminary feasibilities conducted to date resulted in a final design based on open pit mining of approximateiy:

84 million tons of 0.39% Cu Mill Feed

The private company reports and memorandums upon which this report is based were made available by J.A.Chapman, Aurun Mines Ltd.

SUMMARY

The computer assisted mine layouts prepared to date have only considered surface mining of a number of zones based upon copper values. The proposed mine would consist of two larger open pits and one smaller one.

Molybdenum, gold and silver values have been added to economic cash flows based upon assay values from two drill core compisited samples for molybdenum and estimated values for gold and silver. Metallurgical recoveries of 85% for copper, 30% for molybdenum and copper concentrate grades of 26% are based upon very limited test work on core.

Assuming that work completed by Noranda in the 1970's is of acceptable quality it is apparent that higher recovered dollar values of products and/or lower costs are necessary to define a commercially attractive surface mining operation as proposed in the computer assisted mine layouts.

The potential for a smaller higher grade portion of the deposits located on the property still exists. Geologists now believe that there is a much higher potential that these deposits were formed in a manner similiar manner to the volcanogenic strata formed strata bound deposits(like the Anvil deposit in the Yukon). Previous exploration and evaluation appear to be based upon the bulk type low grade copper mines of central British Columbia.

Titanium values from 1.22 to 2.77% Ti have been reported in various rock types in the area. No work has been done on determining the titanium content of the proposed mill feeds nor any economic potential for titanium recovery that might exist.

CONCLUSIONS

Considerable exploration work has been conducted on the property.

The economic potential for a bulk type low grade surface copper mine has been reviewed. The preliminary feasibility under reasonable assumptions was profitable(Eg. ROR & 0%NPV were greater than zero) but unacceptable economic sensitivities were required to produce an ROR required by Noranda for a commercial project.

The copper distribution in the deposits was obtained from drill core assays. Limited metallurgical testing has been done. Molybdenum, gold and silver values were either estimated or obtained from limited composited core samples. Only very general work has been done on the titanium content of the local area. No work has been to determine the titanium content of any plant feeds nor to see if there is any potentially economic value associated with any titanium content.

The current geological understanding of the origin and history of these deposits may have a large effect on the ability to locate smaller significantly higher value deposits within the area.

Minesite, transportation, smelting, and other corporate costs can vary widely depending upon project specific scoping prameters.

RECOMMENDATIONS

1) Geological work should be related to searching for localized higher grade deposits or determining the distribution of titanium, molybdenum, gold and silver.

2) Experts in the various diciplines required (geology, mining, metallurgy, marketing, operations, management, enginering, procurement, construction, etc) should brainstorm and identify potential commercial mining project general parameters for further studies.

3) The program initiated to review the capital project should continue. A +/- 15% scoping and costing for the plant and facilities may be of greater accuracy than the other components (geological deposit model, transportation, marketing, etc) particularly if titanium production is required.

4) Metallurgical test work should be persued to seeif better copper and molybdenum recoveries and concentrate grades are economically attractive.

5) Metallurgical studies should be conducted and if possible metallurgical tests should be conducted to determine the market quality of any recoverable titanium concentrates.

6) Market contacts should be made in order to identify typical conditions that can be expected. Copper, molybdenum, gold and silver may be anticipated but titanium marketing is unknown.

SURFACE MINING POTENTIAL

History

During the mid to late 1960's copper mineralization was found and the area was explored for bulk type low grade copper deposits that could be mined by surface mining methods. By the early 1970's a joint venture agreement between Noranda and Quebec Cartier Mining was in place. Early indications were that two main deposits exist containing at least 100 million tons grading 0.43% Cu. Because of the attitude of the deposits, it was questionable whether the entire reserve could be mined at an acceptable stripping ratio.

Noranda prepared computer assisted open pit designs. A 15 year mine production schedule was prepared to process 84 million tons of 0.386% Cu as plant feed at a rate of 5.7 million tons per year (approx. 15,500 TPD). No consideration was given to byproduct molybdenum, gold, silver values.

A Masters Thesis was submitted by Gary David Belick to the University of British Columbia in November of 1973 "Geology of the Harper Creek Copper Deposit". It containes a table showing titanium values from 1.22% to 2.77% Ti for various local rock types.

James E. Kraft, P.Eng of Noranda in 1974 prepared economic cash flows for the surface mining project which produced the following results:

A) Base Case	0.41% ROR	$2.7million-0% NPV
B) Mo,Au,Ag inc. 85% Cu recovery $0.56 NSR Cu 5% cost escalation	10.7% ROR	$53.8million-0% NPV
C) New pit design	11.4% ROR	$42.2million-0% NPV
D) Revised stripping schedule	11.8% ROR	$41.8million-0% NPV
E) 70% of capital costs	17.4% ROR	$67.9million-0% NPV

The main factor resulting in the 10 to 12% rates of return was the possibility of selling copper into the futures market at a price 36% above the base case value of $0.55 per pound. This potential to sell copper into the futures market combined with a reduction of capital costs results in the 17.4% rate of return.
A reexamination of the economics of the project in 1979 by M Power of Noranda indicated that the surface mining project

would require a copper price 50% above the then current $1.00 per pound of copper before a commercial 15,500 TPD surface mining operation could be considered. The economics run at $1.50 per pound of copper and $10.00 per pound of molybdenum resulted in:

- 14.8% ROR $-0.6million -15% NPV

All scoping, costing and economics work completed to date has been based on gross scaling factors applied by personnel from an experienced mining company. Site specific considerations are general and many rule of thumb parameters were used.

Requirements

The history of the evaluation of these deposits indicates that some combination of:

1) Higher Net Revenues

2) Lower Capital Costs

3) Lower Operating Costs

is required to allow a viable commercial surface mining operation as proposed by Noranda. Any reexamination of this project as proposed should consider:

A) REVENUES

1) Current and future metal markets

2) Canadian/US dollar exchange rates

3) The distribution of of molybdenum, gold, and silver as these could contribute to net revenues. Estimates in the studies by Noranda could result in as much as 10% of the copper values.

4) Increasing the molybdenum recovery above the 30% used in the studies

5) Economic potential for titanium production

-Geological Distribution
-Recovery Potential
-Marketing

B) LOWER CAPITAL COSTS

Aurun is in the process of initiating a project to brainstorm mining and milling alternatives, to select the most attractive alternatives then to scope and cost the selected case or cases.

C) LOWER OPERATING COSTS

Noranda gave no consideration to lowering operating costs below those chosen for the base case. Scoping of geological and mine layout parameters may present some opportunity for cost savings evaluation. The local metasedimentary folded phylites and schists may provide lower rock breaking, crushing and grinding costs. A mine layout of waste dumps and tailings ponds may provide haulage, or pumping savings.

An undrestanding must be that the goal is to improve overall economics. To recover and sell more higher quality marketable products the capitat and operating costs may have to increase.

Titanium

If capital and operating costs do not change then some minimum amount of titanium must be recovered and sold to make the proposed project viable. Currently no byproduct titanium producers from copper mines have been located and all assumptions are made from general reference descriptions of the industry.

1) Value required based upon the assumption that the project requires $1.50 per pound copper with markets now at $1.00 per pound,

Copper grade - 0.39%
Copper yield - 80%
Pounds of copper sold per ton milled
0.39x20x0.80 = 6.3 pounds
Value required per ton milled
6.3x0.50 = $3.15

2) Value of titanium per pound of 95% TiO2 rutile concentrate,

- 1982 TiO2 price per short ton of concentrate:

Small lots $450 - 475 US ($640 - 675 Can)
Large lots $275 - 300 US ($390 - 430 Can)
Synthteic rutile (FOB Mobile AL) $350 US ($500 Can)

- TiO2 estimated to be 60% Ti

1 ton of concentrate contains
2000x0.95x0.60 = 1140 pounds of Ti

- At $400 per ton of concentrate
400/1140 = $0.35 per pound Ti
=================

- At $600 per ton of concentrate
600/1140 = $0.53 per pound Ti
==================

3) Pounds of marketed Ti required

- At $0.35 per pound Ti
3.15/0.35 = 9 pounds per ton of plnt feed

- At $0.53 per pound Ti
3.15/0.53 = 6 pounds per ton of plant feed

4) Percent Ti required in the plant feed (must be able to produce an acceptable rutile or synthetic rutile concentrate).

- At $0.35 per pound Ti, 50% yield
  9/0.50/20 = 0.9% Ti
  =======

- At $0.35 per pound Ti, 70% yield
  9/0.70/20 = 0.6% Ti
  =======

- At $0.53 per pound Ti, 50% yield
  6/0.50/20 = 0.6% Ti
  =======

- At $0.53 per pound Ti, 70% yield
  6/0.70/20 = 0.4% Ti
  =======

4) No allowances have been included for costs of production and marketing the 95% TiO_2 concentrate.

Conclusions

The titanium head grades calculated from the preliminary assumptions are all within the values found for the general rock types by Gary D Belick in his 1973 masters thesis. If the titanium is within and adjacent to areas of sulfide mineralization as hypostulated then there appears to be adequate evidence to persue further the possibility of sufficient titanium to plan, develop and operate a commercially attractive mine as proposed in the 15,500 TPD project.

The new geological deposit origin and history hypothesis if found to be true and locally higher grade deposits can be identified then by more selective mining and perhaps a lower milling rate commercial project can be identified.

The possibility of heap leaching the near surface lower grade, possibly altered, copper mineralization has been suggested. Heap leaching with aqueous leach solutions is effected very much by climatic conditions such as rainfall and temperature. Excessive amounts of precipitation dilute the leach solutions making control of the process difficult and add to losses of leach reagents. While cool temperatures above freezing help prevent evaporation of water, prolonged winter freezing could shorten the active leaching season. Weather records and leach activity testing would very essential. Mining, leach pile preparation and leach operating costs must be recovered.

Mining and leach pile preparation costs of $0.60 to $1.00 per ton and waste mining costs of $0.60 per ton with leach operating costs of $0.25 to $0.50 per ton and overhead costs at $0.50 per ton would dictate that at a:

- 0:1 waste to leach material ratio the minimum copper yield at $1.00 per pound of copper must be:

  0.60+0.25+0.50/1.00 = 1.35 pounds of copper

  to 1.00+0.50+0.50/1.00 = 2.0 pounds of copper

- 0.5:1 waste to leach material ratio

  0.90+0.25+0.50/1.00 = 1.65 pounds of copper

  to 1.30+0.50+0.50/1.00 = 2.30 pounds of copper

- 1:1 waste to leach material ratio

  1.20+0.25+0.50/1.00 = 1.95 pounds of copper

  to 1.60+0.50+0.50/1.00 = 2.60 pounds of copper

No allowances have been made for transportation and marketing of ultimate leach products.

UNDERGROUND MINING POTENTIAL

History

There does not appear to be reported history of investigations of underground mining potential.

Discussion

There is a gentle northerly dip to the main mineralized zones and some apparent increase in grade down dip. If this is any indication that localized higher grade zones will be found then a mill site down the north side of the hill towards the North Thompson River with the plant located somewhere between 4000 and 4500 feet above sea level might accomodate both surface and underground mining.

1) A 1 to 2 kilometer conveyor would allow processing of surface mined plant feed from the designed pits.

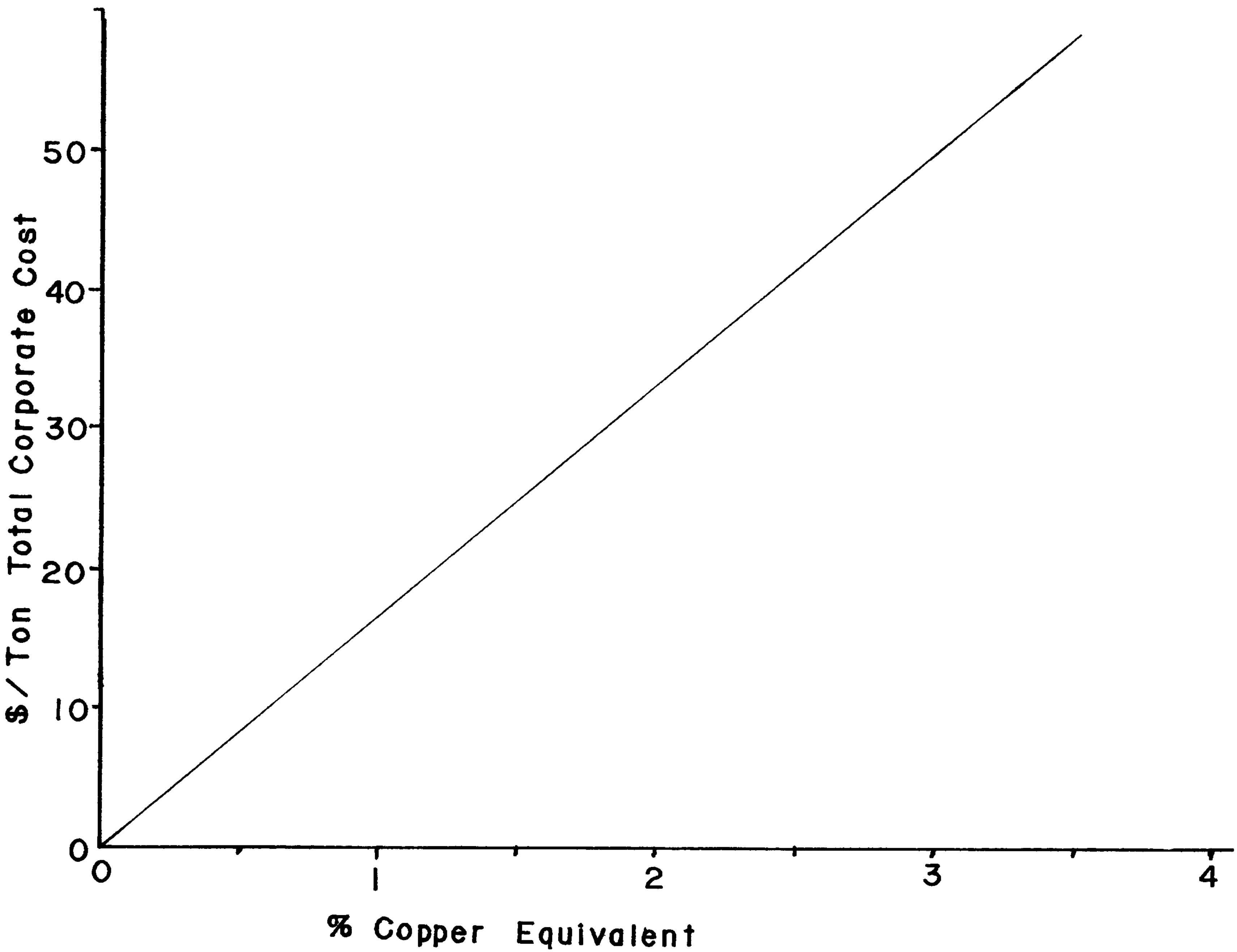
2) A 1 to 1.5 kilometer adit would intersect the bottom of or be below the deepest mineralized copper intersection in drill hole J-33 of 150 to 200 feet of 0.60% copper

A mill capacity of 6000 TPD would require 22 million tons of plant feed for a 10 year plant life. Graph 1 represents in graphic form for general guideline purposes the approximate relationship of Total Corporate Costs (incl. shipping and treatment) in $/ton of plant capacity and the Copper Equivalent Cuttoff Grade. The Marginal Revenue = Marginal Cost cuttoff assumption was used. This represents the case where no levered ownership positions exist and all taxes are profit taxes. The following list prepared from the graph might be helpful when looking at geological data for local high grade deposits:

Total Cost	Copper Equivalent Cuttoff
$20.00 per ton	1.2% Cu
$30.00 per ton	1.8% Cu
$40.00 per ton	2.4% Cu
$50.00 per ton	3.0% Cu

Any equivalent value of final marketed products would effect the required copper grade. An estimated 10% of the copper values may be found in combined molybdenum, gold and silver.

The understanding of titanium economics is more uncertain therefore at this time it would be of little value to try to be to certain about any copper equivalents for titanium grades. They could definately have an effect on any project economics. With marketed titanium values of from $0.35 to $0.53 per pound and 50% to 70% yields a 2% Ti grade would


$/Ton Total Corporate Cost
50
40
30
20
10
0
0
1
2
3
4
% Copper Equivalent

GRAPH I

40x0.5x0.35 = \$ 7.00 per ton of plant feed
40x0.5x0.53 = \$10.60
40x0.7x0.35 = \$ 9.80
40x0.7x0.53 = \$14.84

An investigation of the potential for producing marketable titanium from rutile should include the production of synthetic rutile from other titanium minerals if they are present.

Underground Mining Costs

Graph 2 and graph 3 were prepared for underground Canadian mines from generally available public data in annual reports, journals, newspapers, etc. and by word of mouth in the late 1970's. They are included here to show:

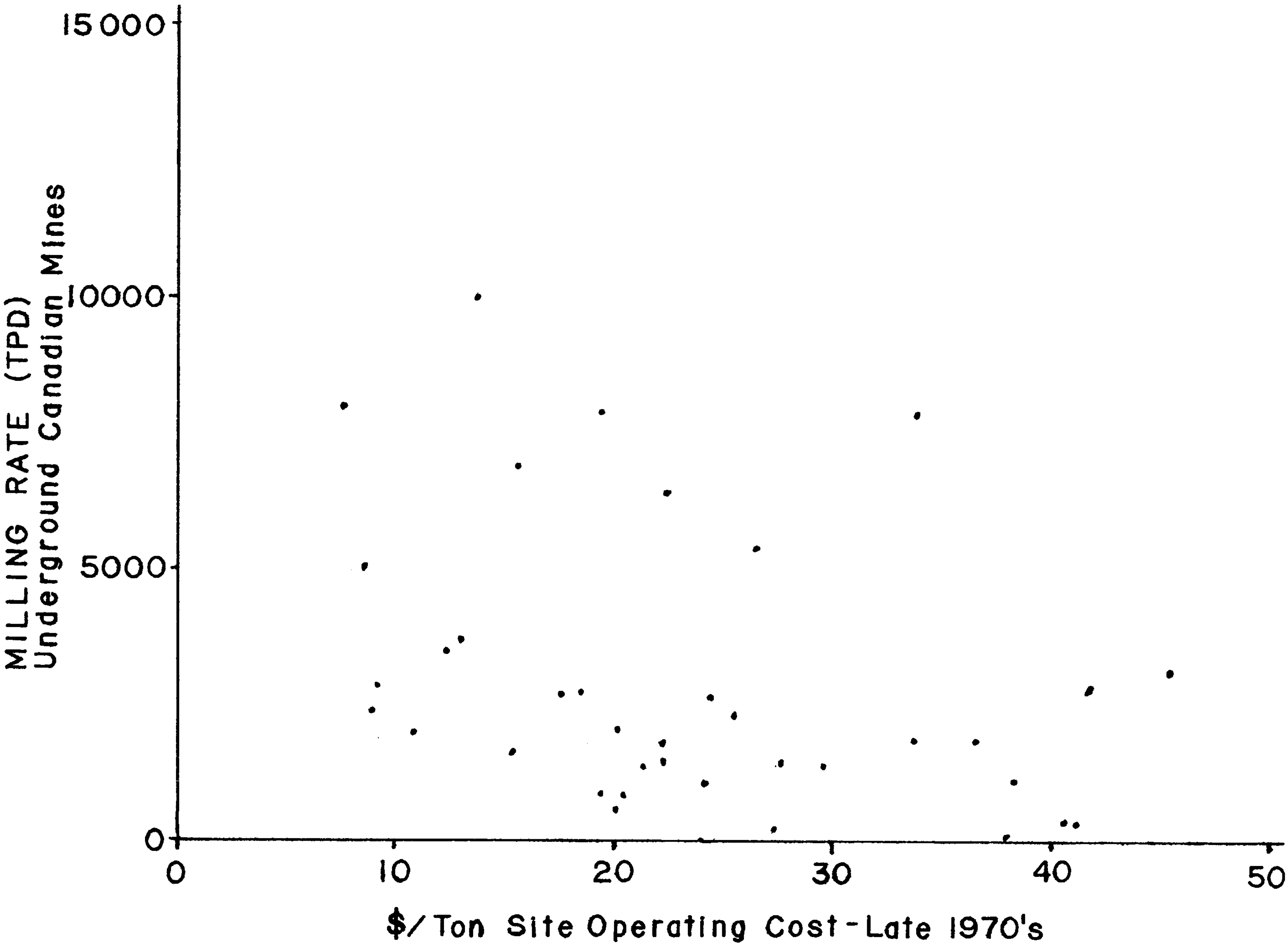
1) There can be a wide range of operating costs associated with any mill size. These can to a great extent be explained by differences in the technical scope of the various projects.

2) In the ranges from 1 to 3% copper equivalent from Graph 1 a further investigation of the project specific scope, current cost estimates and economics is necessary for definative evaluation.

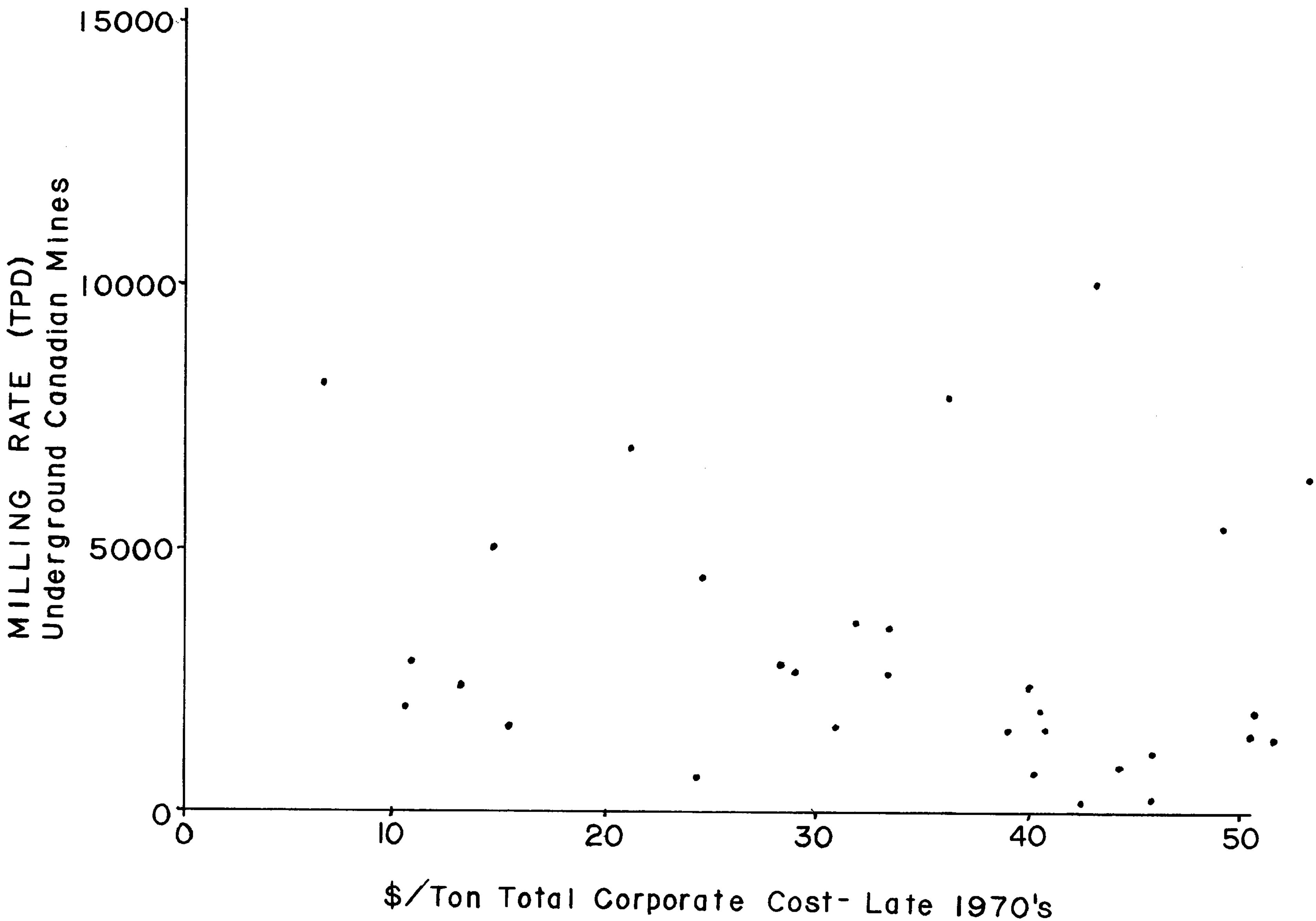
Estimates made in the late 1970's from public data indicated that the Craigmont mine had a mill capacity of 5000 TPD, an ore reserve of 5.2 million tons of 1.85% copper. The minesite operating costs were \$8.00 to \$8.25 per ton of plant capacity and the total corporate costs were \$14.00 to \$15.00 per ton of plant capacity. These are generally considered to be low costs when compared to most underground mines with capacities near 5000 TPD.

Conclusions

This very general discussion of unerground mining may be of help when trying to review geological data. The most attractive underground potential should recieve at least a preliminary review for commercial mining potential.


MILLING RATE (TPD)
Underground Canadian Mines
15000
10000
5000
0
0
10
20
30
40
50
$/Ton Site Operating Cost - Late 1970's

GRAPH 2


15000
10000
5000
0
MILLING RATE (TPD)
Underground Canadian Mines
0
10
20
30
40
50
$/Ton Total Corporate Cost- Late 1970's

GRAPH 3

TITANIUM

The recovery of titanium concentrates from plant feeds can be by gravity or floatation methods depending on the size of the particles. The separation of a heavy metal titanium concentrate may include electrostatic or magnetic methods.

The rutile or synthetic rutile concentrate in modern plants is upgraded to sponge metal or pigment grade TiO2 using a chlorite process. Lower grade ilmenite or tantiliferous iron slag concentrates are usually upgraded using the older sulfate process.

1982 US reports of ilmenite concentrate shipments of 233 thousand tons having a value of $19 million US would result in concentrate values of approx $80.00 US per ton ($115 to 120 Can.).

US producers of pigment grade TiO2 are E.I.duPont deNemours & Co. Inc., NL Industries Inc., American Cyanamid Co., SCM Corp., and Gulf & Western Natural Resources. 1982 titanium dioxide pigment consumption has been reported at 700 to 725 thousand tons at a price of $0.69 US per pound ($0.98 Can) for the anatase form and $0.75 US per pound ($1.07 Can) for the rutile form.

US producers of titanium sponge are Timet (Henderson, Nevada), RMI (Ashtabula, Ohio), Ormet (Albany, Oregon), D-H Titanium (Free Port, Texas), TWCA (Albany, Oregon), and International Titanium (Moses Lake, Washington). 1982 US sponge metal consumption was reported at approx. 17 thousand tons at $5.55 Us per pound ($7.90 Can). 1985 individual US plant capacities were expected to range from approx. 1000 TPY to 16,000 TPY for a total US capacity of 36 to 37,000 TPY. The Japanese total 1985 production capacity was expected to be approx. 59 to 60,000 TPY. Finished metal products are produced by reducing the sponge metal. Finished metal can have a value of $12 to $13 US per pound ($17 to $18 Can)

The historical titanium production data included in this report should be used for preliminary scoping purposes only. If any potential for commercial titanium production exists after a review of the geological data combined with some metallurgical evidence that acceptable concentrates can be produced the economics of titanium production must be further investigated.

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CERTIFICATE AND PERMISSION TO USE REPORT

I, DAVID W PHILIP, P.Eng., resident of Calgary, Alberta, Canada, hereby certify that:

1) I am a registered member of the Association of Profesional Engineers of the Province of British Columbia and a registered member of the Association of Profesional Engineers, Geologists and Geophysicists of Alberta.

2) I am a 1971 graduate of the Colorado School of Mines, Golden, Colorado, USA, with a degree of Bachelor of Science (Mining Engineering).

3) I have practiced in my profession continuously since graduation mainly in western North America or in central Canada.

4) This report is partly based upon general knowledge of this property gained from study of the references cited herein and partly upon my general knowledge of the subject.

5) I am a shareholder of Aurun Mines Ltd.

6) I hereby grant Aurun Mines Ltd. permission to use this report for its corporate purposes.

DAVID W PHILIP, P.Eng.

MAY, 1968