015696

September 11/78

Granisle

Mine Personnel -

Jim Chalmers	chief Mine Engineer
Louis Tsang	Mine geologist
Don James	chief Exploration Geologist
Bob Johnston	Mill Superintendent.

Geology -

Excellent References

(a) Fahrni, Kim, Klein, Carter
CIMM Special Volume #15 - Paper 23.

(b) Carter, GEM

(c) Kirkham, Ec Geol 1971

Diamond Drill Holes -

Total drilling resulted in a pattern with some intervening holes. old spacing ± 200 /t ÷ 1. Most of these DDH's are vertical with exception of early holes by Cominco which are inclined -

The 1970 series dupost - down to 1500' elevation some down to bench 33. & still in ore 0.30 (+) Depth 1615' and greater - in ore grade & weaker at bottom. In pit as well as around pit in 1970 program T.D. 1715' or ± 900' below pit bottom.

Percussion hole drill-in 1971-72 - assayed cuttings - Cu representation good - Mo probably not so good - is not as representative

Assays every 5' interval - these assays have been composited into 35' sections to correspond to benches.

Blast holes

Pattern - 15' x 30', staggered grid

drilled to proper elevation for bench below - the order of 35' (±)

Assays used to develop Isopleth maps for each bench.

Because ore grade is quite uniformly continuous downwards it is possible to predict grade on lower benches from isopleths of higher benches -

Mineralization -

Ore grade dependent upon fracture density and thickness of fracture filling -
Ore grade is less dependent upon differences in lithology.

Edge of orebody - sharp drop off of grade across 100' from ore to waste.
Goes from 0.4 to 0.2 within 50 ft.

Pit - Doug Piteau - slope stability studys.
Stability dependent upon fracture density & attitude wrt pit wall.
Pit slope 45° to 50 or 51° in places.
looking at 40° over all. (allowing for haulage roads?) Benches are @ 35' intervals.
Lake level is at bench #10.
Lowest planned level is #33. ultimately 23 benches below lake level.
Presently on #19 or 315' below lake level.

Pit Deepening possibilities -
Might get in with a substantial tonnage of 0.6% Cu — The maximum that would be obtained would be 1½ to 2 m.t.

Reserve Calculations:

Geometric means of averaging rather than arithmetic methods

Computer method - inverse square - computer blocks taking into consideration assays from surrounding holes & intervals above and below

Descrepancy between predicted reserves & mined ore - { Resulted in too great a volume of ore at sharp cut offs.

SEE GRANISLE (5) History of Reserve Calculations.

Marginal grade or marginal material in side of pit ?? ←

Marginal material - not planning to mine it until much later

Ore Control:

All blasthole control little or no visual control of ore to mill - (gouge)

Isopleth maps

Make up isopleth maps for each bench level on basis of blast hole assays at ___ ft intervals averaged over 35' interval.

Used to predict grades on next bench down because of the vertical continuity of ore concept which has been developed empirically during mining

Reserves depleted - production discrepancy is now minimized

Granisle (3)

Stripping Ratio — Waste required for building tailings ponds — no waste dumps

At start at top of hill - there was no stripping ratio — ie 0

Last year (1977) stripping ratio was 2.5:1
will peak in a few years at ± 2.57+:1
Over all stripping ratio expected to be about 1.6 or 1.7 :1.

Critical stripping ratio — ie balance between sufficient mill feed & waste. Generally no problem supplying ore. 2:1 ratio / bench - sometimes closer during priming benches.

Grades: Assays — atomic absorption (incl Au & Ag)
No fire assay — touchy.

Mo — some in about the range of 26 ¢/ton
50% of deposit 0.008 & 0.01% Mo

? Au & Ag — currently smelter returns of 11 to 12% of gross revenue.

— associated with higher grade copper but has spatial distribution in pit

Au	high	.378 to .580	oz Au / ton conc.
		.227 to .377	" " / ton conc.
		.122 to .226	" " / " "
Ag		4.72 → 3.59	oz Ag / ton conc
		3.58 → 2.35	oz " / " "
		1.97 → 2.34	oz " / " "

Au & Ag high in middle of ore body — not associated with pyrite.

Costs

Hydro $400,000 / year - [increasing ≈ 13% a year (Bell Copper)]

Shutdown costs would be about $2,000,000.00

16 months ended July 1978
lost $884,000 accumulated deficit

forcast deficit $68,000

depreciation $1.7 to 1.8 million

Mining costs ≈ 52.3¢ / ton.

? ← Milling 3.389 ¢ / ton

Revenue / ton of ore milled $5.165

? ← Expenses 63.7¢ / lb Cu - includes deprec
(?) 429.5 ¢ / lb Cu.

Production

Milled 441,000 more tons than predicted with Cu production same -
Head grades down, recovery down but increased throughput resulted in same Cu production.

Recovery - Heads 0.44 % Cu Tailings .050 % Cu
Cu recovery 88.8 %
Dependent on settlement assay Au & Ag

Molybdenum - 60% is recovered in bulk concentrate, 40% of that is recovered with regrind
?? so finally get .0024 % recoverable Molybdenum

Shipping Cu: 70 % to Japan
20 % to Germany
10 % to Spain
} contracts run for maximum of 3 years

Molybdenum - not separated in concentrate form.

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Problems

(1) Taxes generally –
also income taxes – personal & corporate
sales taxes on equipment
lease payments.

Revise philosophy of "windfall" profits

stumpage – timber too small a quantity to market –
– burn and bury it –

(2) Number and range of disciplines that an operating company has to deal with – Talking about while operating not talking about when trying to get into production.
See Table of Leases, licences & Permits.
Annual payments $25,602.80.

(3) Co-operation with Ministry of Mines is fairly good.

(4) Statistical forms – consolidate them – report the same thing to several different ministries

What does the government do with all the information ??

* Note – Labour relations are excellent.

Equipment - everything electric.
11 Electrotrand trucks = 9 a shift 110 tons.
4 shovels
700 gal/minute pump to dewater bottom of pit. —
?? 3 or 4 caterpillars 1 wheel, 3 D8's.
2 drills w 9" bit.

Operating Time 24 hrs/day 7 days a week with no holidays.

Water - recover 70 to 75% of the water from tailings pond - (25% added from lake ?)

Stockpiles Marginal 6.2 million tons with average grade of 0.269 in A and L stockpiles. (& still to be mined ?)

A stockpile
5 1/2 mt marginal 0.225% Cu.
plus oversize blocks (Note - no secondary blasting at present time).

L stockpile - currently dormant.

?

Reclamation
400,000 tons overburden —
reclamation - active seeding program.

Granisle (5)

History of Reserves calculations

1966 Keith Fahrni
area of influence computer application
stage - 22½ million tons reserves.

1970-71 > 60,000 ft drilling to 1500 ft elevation
drilled deeper holes.
Computer calculation Dick Hewlett -
calculated in blocks - algorithm Tucson
* ≈ 89 m.t > 0.3% Cu
with marginal material 0.3 → 0.2 range

1975 weighted average -
consider blocks 50 x 50 x bench height
& take into consideration up two benches, down two benches & diameter of 300 ft - getting a weighted average.

Had a smoothing effect and created a pattern that wasn't there.
At margin of ore body grade would drop from 0.4 to 0.2 within 50 ft. Computer tends to extend ore reserves outwards.

June 1976 Ordinary sphere of influence method
ie Polygonal method -

Theoretical extraction by volume -
mining, milling ± close correspondence
(±) stockpile to within 5%.
(complaints come to within 2%)
- Computer experience negative -

Now: Use DDH data to estimate reserves of grade
Use blasthole data (assays) to develop isopleths used for mill grade control and short range planning

Present reserves to July 1/78.

Polygonal method
sphere of influence

48,670,453 tons reserves in place
grade 0.424 % Cu based
on DDH

48,796,000 tons reserves including
the stockpile of millable material

48 796 000
48 670 453
125,547 tons stockpile ?

Using cut off of 0.25 % Cu.

Note Actual mining showed 10% less tons of 10% higher grade above computed value.
As of Oct 1/78 cut off will be 0.2% Cu & there will be no material going to the stockpile.
There is in the order of 17 m t of 0.2 → 0.3 Cu
? [& of that material the 0.2 to 0.25 material will be going to the mill instead of to stockpile]

Note < 50,000 tons of oversize material requiring secondary blasting goes directly to low grade pile (?)

Gouge - contamination, goes directly to waste — although some can go through the mill in small quantities.

Milling — Sept 30/77 — (Fiscal year 1976-77)

Heads 0.44% Cu.
Tails 0.040% Cu.

Total 5,002,664 tons milled

Rec 88.8% Cu.
Produced 57,436 tons concentrate containing 34.3% Cu.

[Milling rate 10,000 to 15,000 tons/day.]

Possible Additional Reserves.

Material below planned pit has some potential for additional ore

(a) steepening pit walls (?)

(b) underground if economic situation ever justifies it. Might get in with a substantial tonnage of 0.6% Cu but maximum obtainable is 1½ → 2 m.t.

Other similar geological environments have been investigated around the mine but no additional reserves indicated. Space problem — on an island so therefore limited regarding where a search could be carried out.

From

CIMM.

Milling of Copper & Copper-Molybdenum Ores in Canada

Granisle — J. Lawson, Mine Manager
R. J. Johnston, Mill Superintendent.
W. N. Jeffery - Metallurgist

Mill - 4,000 tons/day. Cu ore - current refinements -

1966 - 5,000 t/d
1968 - 6,000 t/d
1973 - 13,000 t/d

Minerals - Cpy, bornite (Au, Ag)
Pyrite halo around ore body -

Minor occurrences of MoS_2