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KING ISLAND SCHEELITE (1947) LIMITED

Geological Department

Report No 3

BEACONSFIELD NICKEL PROSPECT, TASMANIA

by

P. J. Anthony
Senior Geologist

May 28, 1968

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S U M M A R Y

Since issuing Report No 2 on the Beaconsfield Prospect in December, 1967 investigations into capital and operating costs for a possible smelting operation at Beaconsfield have been continued. Until very recently no official estimate was available. We now have information available that contradicts the conclusion in Report No 2 that smelting is uneconomic. The figures we have now indicate that a 3000 tons/day smelting operation could prove an economic proposition if our ore reserve can be proved at about 10 million tons of 1% Ni + ore or better. Since, geologically, there is a fair chance of 10 million tons of ore being present at Beaconsfield the conclusion is that drilling and testing at Beaconsfield should be resumed.

The information we have on leaching methods suggests that operating and capital costs would be too high for the modest deposit at Beaconsfield and therefore these methods are not worth considering further at this stage.

On the basis that the figures supplied in a Report by W.M.Billinghurst are fair estimates this report concludes that the Company should go back to Beaconsfield to raise the order of reliability of the ore reserve estimate and to demonstrate that sufficient reserves are or are not present to justify further costly metallurgical tests on the ore. Further, the Company should carry out the investigations into other related matters as listed in the conclusions, and Appendix II.

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C O N T E N T S

INTRODUCTION

Report No 2 on the Beaconsfield Prospect was completed in December, 1967. It was stated clearly in Report No 2 that insufficient tonnage and inadequate grade of ore was present to justify smelting operations. This statement was made in the light of the limited information at hand at the time of writing the report. The grade and tons were considered uneconomic because our calculations were based on capital and operating costs of smelting that were "Guesstimated" by the author (see paragraph 4, page 9, Report No 1). It now appears that this "Guesstimate" was too high or conservative.

In January 1968 it was learnt unofficially that smelting costs particularly capital costs could be very much lower than was originally estimated (Report No 1). The smelting costs indicated were so low that the 7 - 11 million tons of ore estimated to be present at Beaconsfield appeared to be an economic proposition if the cost estimates could be confirmed. All this new information was compiled, feasibility studies calculated and a recommendation for action set out in writing (see Appendix I (a)). The calculations showed that if the unofficial estimates of capital costs could be officially confirmed then further drilling at Beaconsfield was justified. So all that was wanted was an official confirmation of the capital estimates and operating costs from a theoretical point of view based on the limited information then available. Detailed petrological, metallurgical etc investigations were not required or justified at this stage because we are not sure how much ore is present, where it is all located and what determines ore as such, until much more drilling has been carried out.

Our requirements were then, a short report covering the information we needed to enable exploration targets to be recalculated.

On 3rd May, 1968 when this information was still outstanding, the author approached W. Billinghurst with a written outline (see Appendix I (b)) of our requirements and he was subsequently given the job on 6th May, 1968. His report was made available to the Company on 21st May, 1968.

The purpose of this report is to review all the available * information on the prospect and re-present the situation as it now appears.

We now know that the deposit at Beaconsfield is not large on world standards nor is it high grade. Because it is relatively small is one of the reasons why the major Companies have not been greatly interested in the occurrence, but this does not mean to say that the deposit is uneconomic. The deposit may be unacceptable to certain Companies though the deposit is profitable, but may be completely acceptable to other Companies at the same time.

NICKEL EXTRACTION METHODS

Developed techniques available for the extraction of nickel from silicate ores are well known overseas but locally, informed personnel on the techniques are few and far between Basically four different techniques are employed in various parts of the world; (we are not concerned here with sulphide treatment processes)

* available that is to the author

(1) Electric Smelting
(2) Matte Smelting
(3) Ammonia Leaching
(4) Sulphuric Acid Leaching

Electric Smelting

Smelting of nickeliferous serpentine in an electric furnace to produce ferro-nickel is well established in New Caledonia and Oregon. The method is comparitively straight forward and produces a high grade nickel-iron alloy which can be used directly in alloy steel making.

Electric smelting is favoured by low cost power availability. The grade of nickel in an ore is important from the point of view of power costs rather than technical difficulty of extraction. The higher the grade of nickel in ore the less electricity is required to produce a given quantity of nickel.

The mineralogical characteristics of the nickel in an ore i.e. whether it is the form of the garnierite family or merely in the serpentine lattice makes no difference to smelting. These characteristics however are relevant and could be important if the ore is to prove ameniable to upgrading by a simple process such as attrition and screening. Important because of the possible saving in power costs.

Recovery of nickel by this method is normally high. Well in excess of 90% recovery is in evidence in the world's operating smelters.

Matte Smelting

Matte smelting of nickeliferous serpentine has been carried out in New Caledonia for many years. The process involves calcination and sintering of the ore followed by smelting with gypsum in a blast furnace. The resultant nickel-iron matte is refined to remove iron.

It is interesting to note that recent new plants established in New Caledonia have been electric smelters and electric smelting is also being considered for benefication of the Philippine ores.

Ammonia Leaching

Leaching of nickel ores with ammonia and ammonium carbonate was developed by Sherritt Gordon Mines Ltd and the Chemical Construction Company. Ammonia leaching has been in operation since about 1950 and is an established process. Plants are in operation in Canada and Nicaro, Cuba. The requirements of large tonnages of ammonia could call for the installation of an ammonia plant on site. Alternatively low cost ammonia from world sources could permit an economic operation to be based on imported ammonia in some locations of the world.

As leaching is a chemical process, the mineralogical composition of the nickel bearing ores assumes naturally, greater importance than in smelting processes.

Sulphuric Acid Leaching

Leaching of nickel ores with sulphuric acid have been developed by Sherritt Gordon Mines Ltd and by Freeport Sulphur Co. One plant, at Moa Bay, Cuba has been established. The principal requirements of an acid leaching plant are sulphuric acid and fuel.

ECONOMICS OF EXTRACTION PROCESSES

This is precisely the area in which knowledge, in Australia, is not widespread. Papers on the technicalities of the various methods of extraction are available but little published data on economics of the methods can be readily found.

Limited information on leaching methods concerning costs both capital and operating is available. Approximate operating costs for the Nicaro process (ammonia leaching) were calculated by R. E. Wilmshurst of Amdel and published in a paper dated March, 1968.

Plant Throughput	Total Operating Costs *	Capital Cost	Estimated Cut Off Grade
1,000 tons/day	$9.9	$ 30M	1.9% Ni
5,000 tons/day	$7.0	$ 78M	1.15% Ni
10,000 tons/day	$6.4	$120M	1.00% Ni

* before tax and depreciation

The capital costs, presumably, are for the basic plant and do not include mining equipment etc. Wilmshurst considers costs for the Moa Bay process (acid leaching) would be similar to those above.

It is interesting to note that Wilmshurst in reference to smelting says "The Cuban ore, being of lower grade (than New Caledonia) cannot be smelted directly, although this is for 'economic rather than technical reasons". He does not explain these economic reasons.

Capital and operating costs for the smelting process are not readily available. In January an estimate θ of $5/ton ore mined was calculated for treatment (smelting costs) on the basis of published power consumption figures for Oregon and New Caledonia. Smelter capital costs could not be found, however it was learned that a manganese smelter established at Bell Bay a few years ago was installed for $7.9 millions and this smelter is not dissimilar to that required for nickel extraction. W.Billinghurst also supplied figures suggesting that the cost to erect a smelter of modest size was of the order of units of millions of $ rather than tens of millions of $ as "guesstimated" by myself in Report No. 1. Calculations based on our own estimated operating costs and Billinghurst's capital costs indicated that the modest deposit of nickel ore at Beaconsfield could well prove economic if

(1) our ore reserve and grade estimates were somewhere near the truth
(2) the estimate of operating cost's was in the right order of probable costs.
(3) the estimate of capital cost was of the right order.

θ see notes Bibliography (3) and Appendix I (a)

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W. Billinghurst was requested to furnish a preliminary report on parts (2) and (3) above on 6th May. This report was received on 20th May and is summarised thus :

Plant Throughput (tons/day)	Smelter Capital Costs	Treatment Costs (Smelting)
1000	$5.5M	$7 - 18
2000	$7.5M	6 - 24
3000	$9.8M	5 - 87

There is a very big difference in the capital costs for leaching as against smelting methods and heavily favours smelting. The single biggest item of cost in operating expenses is electricity as far as electric smelting is concerned, and this is favoured by the location of the Beaconsfield deposit.

TREATMENT OF BEACONSFIELD ORE

Some metallurgical test work on Beaconsfield ore in the form of leaching (both acid and ammonia techniques) were carried out by the Mines Department in Launceston. The limited samples of ore tested did not respond well to such processes. In the course of this test work some screening of ore was carried out but no positive attempt was made to physically upgrade the ore by attrition and screening. The possibility of smelting the ore has been ignored altogether by previous Companies/individual interested in the prospect. This is not surprising when it is realised that no-one prior to King Island Scheelite had even drilled in the right place to seek higher concentrations of ore. Just because no other Company has contemplated smelting, does not mean that smelting is not possible. In actual fact the ore at Beaconsfield is the serpentine type as against the laterite type and therefore almost certainly unlikely to respond to leaching. On the other hand it is similar ore to that at Oregon and New Caledonia where the ores are treated by smelters.

Our geological knowledge of the deposit tells us that the ore, if economic, is likely to be smelted rather than leached. Detailed mineralogical, petrological examination of the ore is then, in the early stages of evaluation, of no interest or practical assistance in assessment.

The feasibility then of treating Beaconsfield ore by smelting must be investigated at an early stage, and this has now been done by Billinghurst.

The limited drilling programme carried out by King Island Scheelite between August and October 1967 and reported in Report No 2 indicated the presence of units of millions of tons of ore averaging about 1% Ni. Clearly this order of tonnage and grade is inadequate to support any leaching method of extraction and was thought (Report No 2) to be inadequate to support a smelter. But since issuing Report No 2 the information on smelters shows smelting as a distinct possibility even with the limited tonnage and grade of ore possibly available. Attrition and screening of ore is worth investigating from the viewpoint of upgrading ore feed to smelters or the less likely possibility of upgrading ore sufficiently to sell as high grade ore.

From a theorotical point of view it is distincly possible that a smelting operation could be established at Beaconsfield. We must now aim at investigating in detail those aspects of the deposit that are critical to proving or disproving the possibility.

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Ore Reserve & Grade	Plant Capacity	Total Capacity Involved	Operating Costs / ton Wet Ore $	Annual Depreciation * $	Annual Ton $	Net Annual Profit	Total Net Profit Over Life of Mine	Annual Return on Initial Capital
5 million tons @ 1.03% (Ni + Co) (dry)	1000 tons wet ore/ day	$7M.	11.00	466,000	336,000	$190,000	$2.85M	2.7%
			10.00	466,000	459,000	395,000	5.93M	5.6%
7 million tons @ 1.03% (Ni + Co) (dry)	2000 tons wet ore/day	$10M	9.75	910,000	954,000	946,000	10.4M	9.5%
			9.00	910,000	1,157,000	1,343,000	14.8M	13.4%
10 million tons @ 1.03% (Ni + Co) (dry)	3000 tons wet ore/day	$12M	9.25	1,200,000	1,604,000	1,916,000	19.16M	16%
			8.50	1,200,000	1,856,000	2,404,000	24M	20%
9 million tons @ 1.03% (Ni + Co) (dry)	3000 tons wet ore/day	$12M	9.25	1,335,000	1,604,000	1,781,000	16M	14.8%

* Depreciation evenly spread over life of mine.

FEASIBILITY STUDIES

So we have field investigations in the form of drilling and mapping that indicates that 7 to 11 million tons of 1% Ni ore could be present at Beaconsfield. We also have a paper study undertaken by Billinghurst on smelting possibilities that indicates that a smelter erected could cost from $5.5 to $9.8 millions and smelting costs could range up to $7.2/ton wet ore mined depending on the scale of operations envisaged

When we look at economic studies using these figures as on page 5, we see that satisfactory profits are not indicated unless ore reserves are of the order of 10 million tons and the ore can be treated at a rate of about 3000 tons/ day.

An ore reserve of 10 million tons is possible at Beaconsfield (See Report No 2) but not yet proved. So if we assume Billinghurst's figures to be of the right order then the conclusions are obvious -- we must get back to Beaconsfield and prove or otherwise the existance of at least 10 million tons of ore by closer spaced drilling.

CONCLUSIONS

(1) On the basis of Metallurgical test work carried out by the Tasmanian Mines Department, leaching processes cannot be used for extraction of nickel from the ore because of

a. prohibitively high treatment costs involved.
b. general unsatisfactory level of recovery indicated.

(2) On the basis of the geological nature of the deposit, viz, the ore occurring beneath the laterite cover and consisting of decomposed serpentine material, indicates that treatment of ore would be by smelter rather than leaching because of expected high MgO, etc, content of the ore.

(3) On the basis of published papers by Amdel personnel, leaching processes can be disregarded because of the very high capital costs involved. Clearly only very large deposits can be considered as suitable for these processes to offset the large capital outlay. Beaconsfield is not a large deposit.

(4) On the basis of a preliminary report by W. Billinghurst, studies indicate that smelting of Beaconsfield ore could well be feasible and that proven ore reserves near the upper limit of ore reserves now indicated could prove adequate to support a very profitable operation.

(5) From conclusions (1), (2) and (3) above there is no justification for undertaking any further investigations into leaching possibilities of the ore.

(6) The information we have available to us at this time indicates that further drilling is required at Beaconsfield aimed at

a. outlining the order of 10 million tons of ore and
b. confirming this ore reserve estimate by closer spaced drilling.

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(7) In addition to conclusion (6) the following investigations should be carried out

a. All samples in ore be reassayed to within ± 2% true value for Ni, Co, Cr, Fe, MgO, SiO_2, Al_2O_3, CaO and loss on ignition. Selected samples from time to time be assayed for FeO, Fe_2O_3 P, S, Mn, Ba, Ci, As, Sb, Bi and Sn.
b. Testing ore by attrition and screening to determine if ore can be upgraded by such physical means.
c. Close examination of the possibility of obtaining black coal supplies in Tasmania.
   (i) from established sources
   (ii) from properties/prospects that may be available for the Company to acquire.
d. Close examination of the future supply of water for a possible smelting operation.
e. Assess the quantity and quality of timber on the prospect for possible utilisation as a substitute for coke.
f. Provided the drilling programme (Conclusion (6)) is successful in that ore reserves are known within closer limits of accuracy and that sufficient reserves are indicated to justify further expenditure --- a 5 - 10 ton sample of ore be taken and sent away for trial smelting.

RECOMMENDATIONS

(1) It is recommended that the work programme indicated in conclusions (6) and (7) above be detailed, scheduled, budgeted, approved and implemented without delay.

(2) If the report by Billinghurst is unacceptable to the Company, then it is recommended that my proposal * as presented to Billinghurst be presented to someone else and a positive and quick reply obtained.

* see Bibliography (5) and Appendix I (b)

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B I B L I O G R A P H Y

(1) Anthony, P.J., KIS Report No 1, Beaconsfield Nickel Prospect, April 1967

(2) Anthony, P.J., KIS Report No 2, Beaconsfield Nickel Prospect, December 1967

*(3) Anthony, P.J., KIS Notes for Managing Director, January 1968.

(4) Wilmshurst, R.E., AMDEL Report, The Chemical Metallurgy of Nickel, March 1968.

*(5) Anthony, P.J., KIS Terms of Reference - Notes for W. M. Billinghurst Report, May 1968.

(6) Billinghurst, W.M., Report for KIS, Ferronickel from Beaconsfield Ores, May 20, 1968.

* Copies of these notes appended to this report under Appendix I (a) and I (b).

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A P P E N D I X I (a)

COPY ONLY

Notes for Managing Director (then General Manager)

23rd January 1968

by

P. J. ANTHONY

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Appendix I(a)

BEACONSFIELD NICKEL PROSPECT.

CAPITAL ESTIMATES

re. those used in calculations

1000 tons one/day

Smelter (erected) plus services buildings	£ 6,000,000	(Billingham £3,000,000)
Mining Equipment	1,000,000	
Housing, Office, Store, maintenance Shops	1,000,000	
Contingencies	2,000,000	
TOTAL	£10,000,000	

2000 tons one/day

Smelter (erected) plus service buildings	£ 9,100,000	(Billingham £4,550,000)
Mining Equipment	1,000,000	
Housing, Office, Store, Maintenance Shops	1,000,000	
Contingencies	[illegible]00,000	
TOTAL	£13,000,000	

3000 Tons one/day

Smelter (erected) + service buildings	£11,600,000	(Billingham £5,800,000)
Mining Equipment	1,000,000	
Housing, Office Store, Maintenance Shops	400,000	
Contingencies	1,000,000	
TOTAL	£15,000,000	

NB these estimates are deliberately high in terms of the info available from Billingham at this time.

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4(a)

MINING COSTS

(Assumed in calculations — each case 1000, 2000 & 3000 tons/day)

Mining Cost / ton ore treated (66 : ore = 1 : 1)	# 0–60
Smelting costs — a. power, assuming 30 kwh @ 0.5d to produce 1lb Ni	3–10
b. labour, flumes etc	1–90
Shipping costs of ferronickel	1–00
Overheads & Administration	0–40
Contingency	1–00
	# 8–00

ie. Total costs / ton ore treated = #8

RECOVERIES

Assume 90% recovery

On basis of Hanna Mining Co (Oregon USA) = 91% rec.

Le Nickel (New Caledonia) = 95% rec.

ie. Head grade 1.02% Ni

Rec grade 0.918% Ni

Assume no penalties for As, S, C, Pete

Assume no payment or penalty for Co

METAL PRICES

Quoted Price 90.55 ¢ / lb Ni

'Free' loading price for Ni in ferronickel appox #1–60 / lb Ni

Assumed Metal Price		Grade % Ni (no Co)		Recovered Value of Ore / Ton	Operating Costs / ton ore treated	Operating Profit / ton ore treated
/ lb Ni ¢	/ long ton unit	Assumed Head Grade	Recovered* Grade	#	#	#
90	20.16	1.02	0.918	18.50	8.00	10.50
85	19.04	1.02	0.918	17.50	8.00	9.50
80	17.92	1.02	0.918	16.45	8.00	8.45
75	16.80	1.02	0.918	15.42	8.00	7.42
70	15.68	1.02	0.918	14.40	8.00	6.40

* assume 90% rec (as above)

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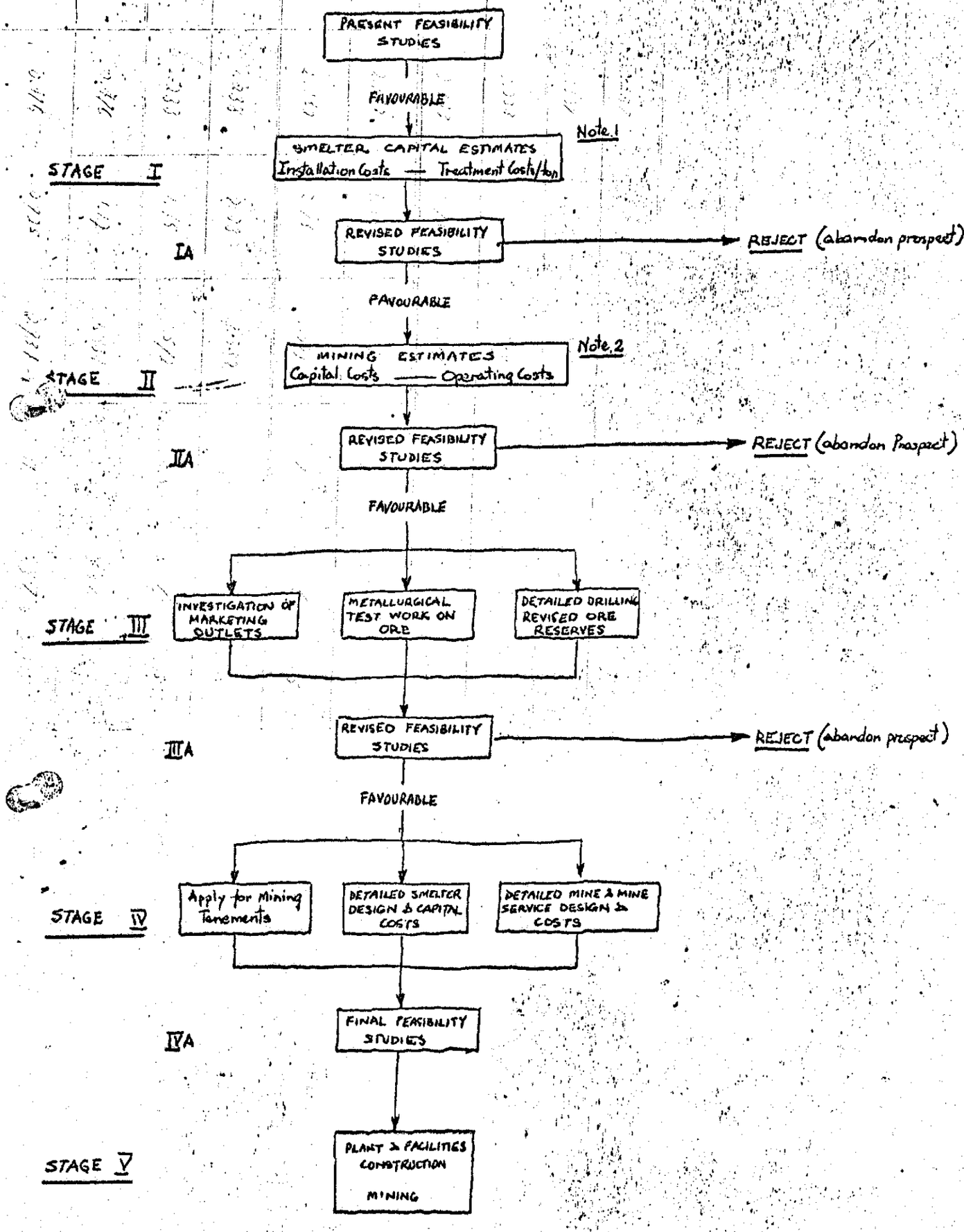
ECONOMIC STUDIES

CASE NO	ORE RESERVES		TREATMENT CAPACITY	CAPITAL ($ millions)	METAL PRICE 1/lb Ni (¢)	Annual Gross Profit ($ millions)	Annual Depreciation ($ millions)	Annual Taxation ($ millions)	Annual Profit after Tax ($ millions)	Life of Mine (years)	Annual Return on Capital	Total Profit after Tax over life of mine ($ millions)
	Inferred Long Tons	Assumed Grade										
I	10 million	1.02	3000 tons/day	15	90	10.5	1.5	3.565	5.435	10	36.2%	54.35
					70	6.4	1.5	2.18	2.72	10	18.1%	27.2
			2000 tons/day	13	90	7.0	0.867	2.38	3.753	15	28.8%	56.3
					70	4.26	0.867	1.45	1.943	15	15.0%	29.2
			1000 tons/day	10	90	3.5	0.333	1.19	1.977	30	19.8%	59.3
					70	2.135	0.333	0.725	1.077	30	10.8%	32.3
II	7 million	1.02	3000 tons/day	15	90	10.5	2.142	3.565	4.793	7	32.0%	33.6
					70	6.4	2.142	2.18	2.078	7	13.4%	14.55
			2000 tons/day	13	90	7.0	1.238	2.38	3.382	10.5	26.0%	35.6
					70	4.26	1.238	1.45	1.572	10.5	12.1%	16.5
			1000 tons/day	10	90	3.5	0.476	1.19	1.834	21	18.3%	38.6
					70	2.135	0.476	0.725	0.934	21	9.3%	19.7

BEACONSFIELD NICKEL PROSPECT

FLOW SHEET OF RECOMMENDED ACTION



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NOTE 1 Nickel Smelter (electric furnace)

STAGE Terms of Reference.

1. Capital Estimates

Basic Plant (erected) 1000 tons/day, 2000 tons/day, 3000 tons/day capacity. Assuming nickel silicate ore containing 1% Ni as feed. Final product ferronickel.

2. Service facilities for smelter operation (Assay Office etc). Capital costs to purchase & erect.

3. Estimate of nickel recovery & minimum % of nickel in ferronickel produced.

4. Power requirements

a. Electricity to produce 1lb Ni (in Kw-hr)

b. Other fuel requirements

c. Cost/unit of electricity (assume purchased from HEC)

5. Total labour requirements to operate smelter & facilities

6. Estimated total smelting cost/ton ore treated subdivided into a. power costs

(i) electricity

(ii) other fuels

b. labour costs

c. service, fluxes etc, overheads.

7. Estimated cost of metallurgical test work required before detailed design of a smelter could proceed. Quantities of ore required for metallurgical test purposes.

8. Time estimate for design & construction of smelter to point of commissioning.

9. Provide a list of metals for which analyses are relevant & necessary if and when future drilling/pitting of the orebody is undertaken eg. Ni, Co, C, S, As, Cr, P, Fe, Mg, Si

10. Feasibility of upgrading the ore by attrition & screening

a. prior to smelting

b. for the purpose of selling ore as ore (min grade 1.6% Ni+Co)

NOTE 2 Mining Operations 126018

Terms of Reference.

1. Capital estimate of equipment & services to excavate
   a. 1000 tons ore & 1,000 tons waste / day.
   b. 2000 tons ore & 2000 tons waste / day
   c. 3000 tons ore & 3000 tons waste/day

   Estimate to include total labour requirements, housing of key personnel, mine offices, maintenance shops, ~~etc~~ stores etc.
   Assume gently undulating sub-horizontal orebody of soft rippable material, average depth 14 feet and varying from 5 to about 40 feet in depth. Overburden, variable in depth from near zero to 40 or 50 feet, is also soft & rippable with some hard cappings of ironstone. Ore and waste of clayey nature & area subject to persistent winter rain.
2. On site administration requirements (accounts etc).
3. Total mining & administration cost estimates / ton ore treated for each of the 3 cases in 1. above (all costs exclusive of treatment/assaying costs).

RJA.
23/1/1968

A P P E N D I X I (b)

COPY ONLY

Notes for W. M. Billinghurst

May, 1968

by

P. J. ANTHONY

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Appendix I(b)

PRELIMINARY STUDY ON CERTAIN METALLURGICAL ASPECTS OF THE BEACONSFIELD PROSPECT

Introduction

A preliminary study is required by the Company on certain aspects of benefication of Beaconsfield ore.

Actual testing of ore samples is not required at this early stage because there are far too many unknowns (av. grade and tonnage of ore etc.)

In effect we need the services of a metallurgical engineer who can furnish us with some basic facts and figures and fill in some gaps in our knowledge of the subject. A statement of our problems is presented below and an invitation to quote for the job of furnishing this information is extended to you.

The Problem

Broadly we require certain figures on capital costs and operating costs relating to smelting operations of nickel silicate ores in order that we can undertake a preliminary economic assessment of the property in order to determine if large sums of money are justified in being spent on the property. Yours is to be a paper study only and as such we fully realise that any figures quoted indicate the order of possible costs rather than likely costs, because we are aware that likely cost estimates cannot be made without detailed knowledge of ore characteristics which are not available or relevant at this time.

Terms of Reference of Report

A brief report is required covering these following points and we would like the points dealt with in the same order as set out hereunder.

(1) Capital Estimates of a possible smelter of the following capacities.

a. 1000 tons ore/day
b. 2000 tons ore/day
c. 3000 tons ore/day

Estimate to include materials and construction for basic plant plus ancilliary services.

Assumptions

a. nickel silicate ore containing 1% (Ni) as feed
b. final product ferronickel - say, 20 - 25% Ni
c. ore itself fluxing unless available information to the contrary is available.

(2) Operating costs for smelting and allied services (e.g. assay office etc). Total costs/ton ore treated, subdivided into

a. Power (electricity)
b. Other fuels - timber, coal, oil etc.
c. Fluxes
d. Labour
e. Maintenance
f. Miscellaneous

Include an organisation chart showing manpower numbers, responsibility and skilled hand requirements.

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(3) General Information and Queries

a. Recovery

What general factors are likely to effect recovery of nickel from ores such as at Beaconsfield? For instance are there any undesirable elements that can occur that inhibit or prevent ore from being smelted? Does it necessarily follow that the lower the head grade of ore the lower the recovery of nickel or vice versa.

b. Fluxes

What are the common fluxes used in silicate nickel smelting operations? What elements or combination of elements in the ores necessitate the use of such common fluxes?

c. Smelter Sites

Is it necessary or advantageous to locate a smelter in areas of some topographic relief? What factors generally influence the location of a smelter site apart from power and proximity to mine workings?

d. Electricity

A considerable amount of power is required to produce one pound of nickel. Is there a relationship between head grade of ore and electricity consumed? What upper quantity (in Kw.hr) of electricity could possibly be required to produce one pound of nickel assuming a head grade of ore (dry) of 1% Ni.

Assuming, say, 30 Kw-hr of electricity is required to produce one pound of nickel in each of the three plants referred to in (1) above and assuming 90% recovery of nickel, calculate maximum load and consumption quantities of power, and obtain an estimate of the likely power cost/unit under such theoretical circumstances, from the H.E.C. in Tasmania.

e. Service Buildings

What service buildings etc would be required besides the basic smelting plant i.e. service buildings for smelting operations only.

f. Assays

Assuming future drilling, pitting of the orebody is undertaken, provide a list of metals which you consider necessary for analysis not only nickel and cobalt but Mg, Si, As P etc that may have metallurgical significance or implications.

g. Design, construction and commissioning of a smelter. Order of time involved once metallurgical test work has been carried out and the ore characteristics are known.

h. Leaching and/or other processes

Applicability of these processes to the type of ore at Beaconsfield and comparison with possible smelting ops. Brief comments only.

G J Ewbank
3rd May 1965.

APPENDIX II

PORT MACQUARIE NICKEL - COBALT

The rocks occurring in the neighbourhood of Port Macquarie (NSW) consist chiefly of Carboniferous sandstones which have been intruded by serpentine. The cobalt ore is found only in the serpentine and in the iron bearing clays resulting from its decomposition. An analysis of the average of samples of a few tons of picked ore was reported in a Bulletin dated 1925 by H.G.Raggatt and quoted as NiO content 1.36%, cobalt oxide 7.48%.

The ore consisting of cobalt bearing wad occurs irregularly in pockets. Some ore was mined up to 1904.

The irregular occurrence of the deposits has apparently (?) prevented economic exploitation. Although limited tonnages of high grade ore may be available (?) there is probably insufficient reserves to justify a mining operation in its own right (?)

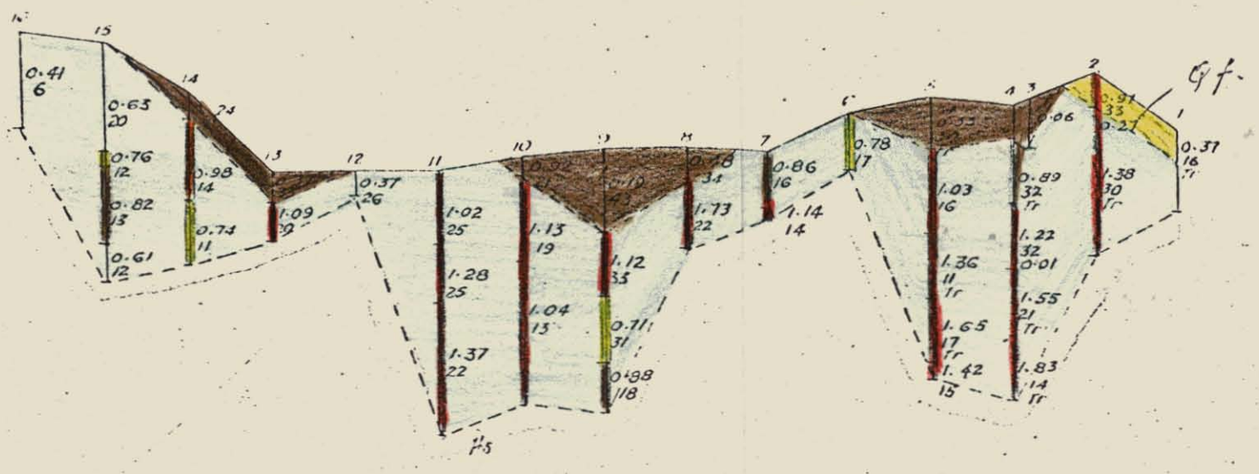
Because of the proximity of this occurrence to port facilities and the apparent extremely high cobalt content, this ore could possibly be used in conjunction with the ore at Beaconsfield to upgrade the Beaconsfield ore.

As far as we know at the present time the area is held under exploration licence by Nickel Leach Pty Ltd who are not listed in the Melbourne or Sydney telephone directory. Enquiries elsewhere will be made and an inspection made of the area with the view of assessing its tonnage potential for the purposes explained above.

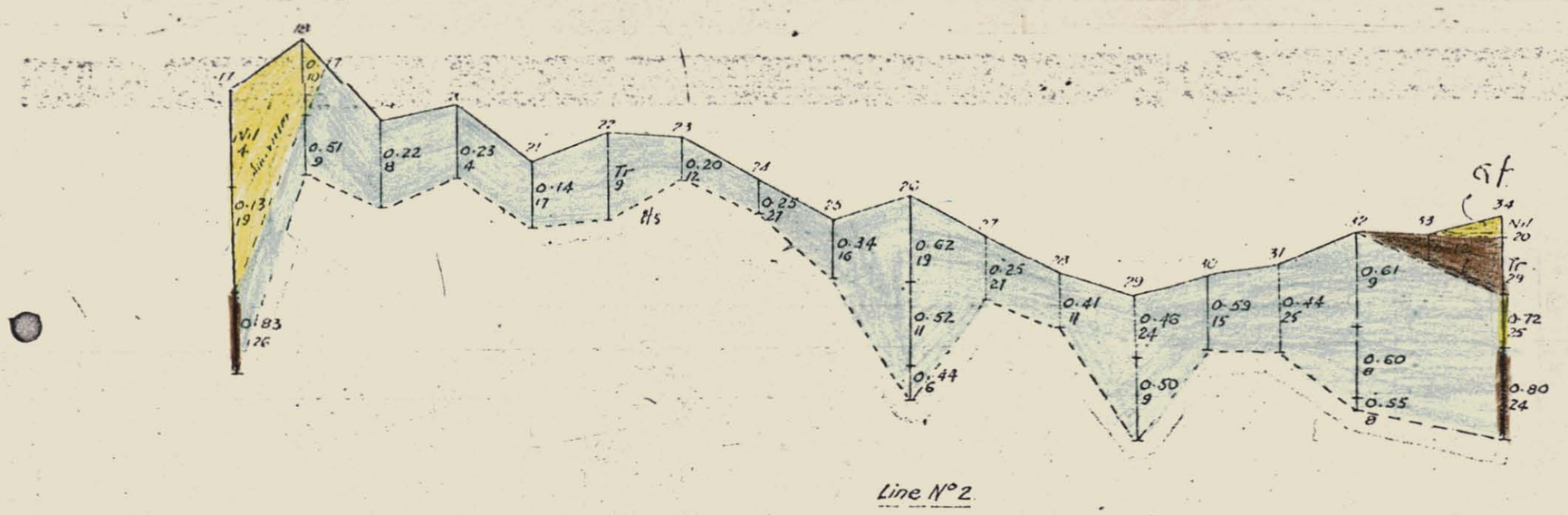
Colour Code

% Ni (range)

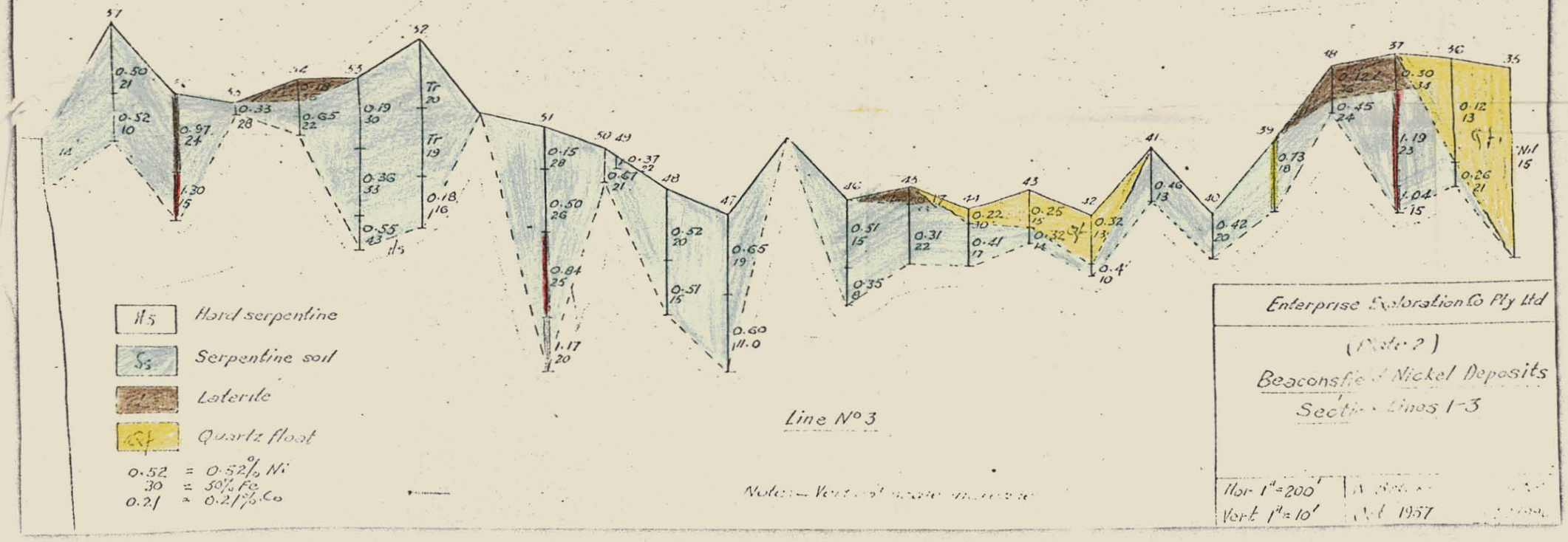
- 1.0 +
- 0.9 – 0.99
- 0.80 – 0.89
- 0.70 – 0.79



Line No 1



Line No 2



Line No 3

Notes – Vert ... scale magnified ...

Enterprise Exploration Co Pty Ltd

(Plate 2)

Beaconsfield Nickel Deposits

Section Lines 1-3

Hor 1" = 200'
Vert 1" = 10'

... 1957

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