KING ISLAND SCHEELITE (1947) LIMITED

Geology Department

REPORT NO. 1

BEACONSFIELD NICKEL PROSPECT, TASMANIA

by

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Accompanying Report:

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SUMMARY

Two miles west of Beaconsfield in northern Tasmania lies a complex of serpentine rock covering a surface area of approximately five square miles.

Application proceedings for an Exploration Licence of 31 square miles were initiated on April 21, 1967.

A large proportion of the serpentine is covered with clays and laterites derived from the serpentine as a result of weathering. Previous investigations by individuals and Companies were directed towards testing the clays and laterites for nickel. Subeconomic grades of nickel were shown to be present in the clays and laterites.

Little exploration has yet been directed towards testing the weathered serpentine underlying the laterites. Weathered serpentines are made up of highly decomposed soft serpentine earths and medium-hard serpentines which are less decomposed. Those soft serpentine earths so far tested below shallow laterite cover, frequently showed value over 1% Ni. Approximately 50 million tons of ore averaging in excess of 1% Ni would have to be found in order to justify a mining operation.

Sufficient ore of the grade required could be available beneath the extensive laterite blankets in the prospect. The depth and grade of these weathered serpentines is unknown.

It is recommended that a programme of exploration be designed to determine the grade and tonnage of this potential ore.

The Prize of successful exploration is an orebody located within 30 miles of Launceston and close to established port facilities, power and water. Exploitation of the minimum orebody would require an estimated capital outlay of $50 millions, but satisfactory return on investment could be expected over a 15-20 year period.

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INTRODUCTION.

An area of serpentine exists approximately 2 miles west of Beaconsfield in Northern Tasmania. The area has been fairly extensively prospected in the past for asbestos, chromiferous iron ore, nickel and chromite. Small quantities of iron ore and asbestos have been won.

The purpose of this report is to review the prospect in terms of nickel potential. It is believed that the area has some merit as a potential large low grade nickel producer.

The prospect was visited twice during April by P.J. Anthony. The second time on April 21, 1967, to peg an area of approximately 31 square miles and apply for an Exploration Licence.

LOCATION.

The town of Beaconsfield lies 27 road miles nor-nor-west of Launceston and 3 miles south-west of Beauty Point on the Tamar River. The prospect lies a further 4 road miles west of Beaconsfield.

First class bitumen roads link Beauty Point, Beaconsfield and Launceston.

FACILITIES/ACCESS.

The prospect lies within 30 miles of Launceston, a city with more than 60,000 inhabitants. The population of Beaconsfield is estimated at approximately 500 people.

Excellent port facilities exist at Beauty Point. Cargo ships up to 15,000 tons can berth at the wharves at the present time.

Water facilities at the prospect are non existent, however development of adequate water facilities should present few problems.

Power is presently available at Beaconsfield. Extension of power lines to the prospect would be a simple matter.

Access to the southern and northern ends of the prospect is by road. The bitumen extends approximately 1 mile from Beaconsfield thereafter all weather gravel roads lead direct to the prospect, a further distance of about three miles.

Within the prospect a network of vehicle and dozer made tracks make accessability reasonable. These tracks would only be accessible to four wheel drive vehicles the year round. Light forest and scrub covers the prospect, however development of additional tracks would not be difficult.

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LEASE HOLDINGS.

It was ascertained from the Department of Mines in Hobart that the area was available for application under Exploration Licence for nickel and related metals, though there are a few minor complications. On the 21st April, 1967, the first steps were taken by the Company to acquire an Exploration Licence covering approximately 31 square miles. The area was pegged and arrangements made for insertion of a newspaper advertisement giving notification of the Company's intention to apply for a Licence in compliance with the Mining Act.

Approximately one half of the area applied for is presently held under Exploration Licence for phosphate in the name of Utah Development Company However, as King Island Scheelite are applying for Exploration Licence for nickel and related minerals, the Mines Department advised that it is in order to "peg over" the existing Licence Within the area applied for by the Company, two smaller areas exist One is a Government Reserve of 366 acres which is exempt from the Mining Act The Reserve covers known iron ore deposits and this area is of interest in the search for nickel deposits. A mining lease 7M/63 consisting of 160 acres is held in the name of Rosetto Investments Pty. Ltd. and adjoins the iron ore reserve. The lease does not cover mining for metallic minerals so if the Exploration Licence is granted the Company will have access to this property automatically. The lease covers an area of only minor interest.

With regard to the exempt area held by the Government, the Registrar of Mines in Hobart advised that he felt there would be little difficulty in the Company obtaining permission to enter and drill the area if this was desired by the Company.

GENERAL GEOLOGY.

Serpentine outcrops intermittently over an area approximately 4 miles long and up to 1½ miles in width. The area is bounded by quartzites to the east and claystones and slates to the west. Permian conglomerates overlie the serpentine to the north and south. The quartzites are of Cambrian age and were intruded by the ultrabasic rocks in Cambrian times. The ultrabasics were subsequently altered to serpentines. In turn the serpentine was intruded by granitic type rocks in the Devonian period.

Weathering of serpentine has resulted in the development of clays on one hand and ferruginous laterite materials on the other over large portions of the serpentine. The exposed serpentine itself is weathered to varying degrees. Recent alluvium and tertiary gravels mask the underlying rocks particularly in the vicinity of creeks traversing the area.

The belt of serpentine occupies a topographic low and is surrounded to the west and north by rugged hills.

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ECONOMIC GEOLOGY.

The nickel mineral is believed to be garnierite, a hydrous silicate of Ni and Mg. Nickel was very likely a primary constituent of the original untrabasic intrusive which was subsequently serpentinised and later decomposed by weathering to varying degrees. Weathering in places resulted in formation of laterite and iron ores while in other places only clays were developed and in other places again, hard and soft serpentine can be seen outcropping.

The nickel content of the fresh ultrabasic rock was probably very low of the order of 0.1% Ni. Subsequent chemical decomposition of the rock by weathering processes resulted in concentration of the nickel.

It should be noted that the ore mineral garnierite is a so-called nickel silicate ore and distinct from sulphide nickel ores both in mode of formation and amenability to treatment. Nickel silicate ores, as occur in New Caledonia, are treated by smelting or in some cases, by acid leaching, while sulphide ores can be treated simply by flotation methods. Further more, nickel silicate ores are not rich, rarely do ore deposits exceed a grade of 2% Ni. On the other hand sulphide ores are introduced and far higher grades occur.

Within a serpentine complex, economic concentrations of nickel can occur in the overlying laterites or in the decomposed serpentine and serpentine clays. In Cuba it is the laterites which are mined for ore, while in New Caledonia it is the decomposed serpentine/serpentine clay which is mined for ore.

King Island Scheelite is interested in the decomposed serpentine ore which occurs below the laterite development and clays, which form a substantial area of the prospect.

Attention in the past has been directed towards the shallow cover of serpentine clays and no attention has been directed to the weathered serpentine which undoubtedly exists below the laterites and ferruginous clay cover.

PREVIOUS INVESTIGATIONS.

The serpentine complex has been subject to various investigations over a considerable period of time. Attention has been directed towards asbestos, iron ore, nickel and chromite possibilities. A brief history is as follows:

1866 This was the first reference to the area. Iron ores and asbestos occurrences were recorded by Gould.

1899 Twelvetrees reported on asbestos investigations undertaken by the Australian Asbestos Company. References to iron ore were made.

1900 Twelvetrees, in a report, was concerned with descriptions of serpentine rocks and the rock types of the original ultrabasics.

1903 Twelvetrees recapitulates much of his previousrreport regarding general geology and description of serpentine. Reference to asbestos is again made.

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1917 Twelvetrees reported on the failure of the Australia Asbestos Company to make good.

1919 Reid dealt with much the same area as Twelvetrees and gives further details on the asbestos occurrences at that time.

1923 Loftus Hills briefly reported on the general geology of the area.

1930 A report by Nye deals with the results of boring operations on Mount Scott, Mt Vulcan and Barnes Hill in the search for iron ore. A total of 21 holes were drilled and it was concluded that "chromiferous iron ores are of such composition that they cannot be used for the manufacture of ferrochrome, refractories or chemicals". The percentage of NiO in the iron ores varied from 0.10% at Mt. Vulcan to 0.02% NiO at Mt. Scott, while metallic chromium varied from 5.3% on Barnes Hill to 3.5% and 3.8% at Mt. Scott and Mt. Vulcan respectively. These iron ore deposits are particular cases of laterite development over serpentine.

1955 Taylor in a report summaried the previous literature in the area with particular reference to asbestos. He concluded that "while no spectacular developments could be expected at Beaconsfield there is a reasonable quantity of medium grade ore available which may serve as the basis of a profitable small industry capable of supplying Tasmania's requirements of asbestos fibre ....".

1956 Hughes reported on the occurrence of nickel in serpentine at Beaconsfield. Although nickel in small quantities was reported in the iron ore assays in 1930, the presence of nickel was not considered until about 1955 when a prospector, Pitulej, reported nickel in serpentine. Mines Department geologists visited the area and reported on theresults of limited sampling of shallow trenches excavated, and outcrops. Nickel assays varied from 0.07% to 6.70% Ni and averaged about 0.5% Ni. It was recommended that more work be undertaken in the form of drilling.

1956-7 The Ben Lomond Mining Company through Pitulej, carried out furher prospecting and found the nickel was more widespread in the area than was previously known. Pitulej concentrated on the serpentine outcrops but found the grades disappointing. Attention was then transferred to the brown clays developed over the serpentine. Consolidated Zinc Pty. Ltd. then took an option over the prospect.

1957 Knight, in a report on the findings of Consolidated Zinc, concluded that "as indicated grade was well below 2.5% Ni, which seems to be the lowest level at which a laterite nickel body can be regarded as interesting, the option was abandoned".

The mapping of Consolidated Zinc showed that outcrops of garnierite bearing weathered serpentine were restricted largely to a triangular shaped area 4,000 feet by 2,500 feet at the south-eastern tip of the

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ultrabasic mass. Although the total ultrabasic area measures 4 miles by 1½ miles, only one third of the area consists of unconcealed weathered ultrabasics the rest being covered by laterites and alluvium. The triangular area of interest was tested by boring hand auger holes at 100 feet intervals along three parallel lines - 1,400, 1,700 and 2,400 feet long. The assays were completed by the Mines Department in Launceston. On completion of this test, seven other areas of unconcealed ultrabasic rock were reconnaissance bored along lines aggregating 3 miles in length. All holes were bottomed on "hard" serpentine.

The assay results are summaried from the report and are as follows:

Triangular Area of Interest.

Line 1: Length: 1,400 feet
Av. Depth: 9'
Av. Assay: 0.96% Ni, 19% Fe.
Best continuous section: 1,000' long;
assay 1.1% Ni over 10' feet depth.
Best hole: 1.35% Ni over 15'
Best Assay: 1.83% Ni over 4'

Line 2: Length: 1,500'
Av Depth: 5.5'
Av. Assay: 0.41% Ni, 14% Fe.
Best Assay: 0.83% Ni over 5'

Line 3: Length: 2,200'
Av. Depth: 7'
Av Assay: 0.52% Ni, 19% Fe
Best Assay: 1.3% Ni over 4'

Other Areas. (holes spaced 200' apart)

	Length ft.	Av. Depth ft.	Av. Assay % Ni	Best Assay % Ni	Best Assay Length (ft)
Line 4:	2,400	4.5	0.23	0.42	6
Line 5:	2,600	5.5	0.21	0.43	5
Line 6:	1,600	6	0.30	0.41	7
Line 7:	600	5	0.22	0.25	6
Line 8:	3,200	5	0.20	0.50	3.5
Line 9:	3,600	5	0.05	0.25	6
Line 10:	1,600	4	0.16	0.32	4.5

1958 Hughes again reported on additional sampling at Beaconsfield and commented that although large tracts of laterite occurred, none of the laterite cover was bored by Consolidated Zinc. Pitulej, the prospector, on completion of the boring by Consolidated Zinc, transferred his attention to the laterite material. Several trenches were excavated to a depth of up to 15 feet. Samples were taken of the brown laterite material and the underlying highly decomposed serpentine material. The results of the three samples taken were as follows:

No.SA	0' - 6'	6'	0.50%Ni	(brown laterite)
	6' - 10'	4'	1.15%Ni	(decomposed serpentine)
No.SB	0' - 4'	4'	0.04%Ni	(mainly soil)
	4' - 7'	3'	0.46%Ni	(brown laterite)
	7' - 11'	4'	1 13%Ni	(decomposed serpentine)
No.SC	0' - 2'	2'	soil	
	2' - 6'	4'	0.50%Ni	(brown laterite)
	6' - 8'	2'	1.25%Ni	(decomposed serpentine)

Hughes recommended that more boring be carried out.

1959 Stefanski reported on the results of additional samples taken by the Mines Department from trenches excavated in the southern end of the prospect. The material sampled in each case was not described in the report, but inspection of a few of the trenches by P. J. Anthony, revealed the material to be a highly ferruguous clay or laterite in each case. Results were as follows:

Trench B:	0' - 9'	0.515% Ni	0' - 12'	0.65% Ni
	9' - 12'	1.04% Ni		
Trench C:	0' - 12'	0.23% Ni	0' - 15'	0.37% Ni
	12' - 15'	0.97% Ni		
Trench D:	0' - 12'	0.29% Ni	0' - 12'	0.29% Ni
Trench F:	0' - 8'	0.61% Ni	0' - 8'	0.61% Ni
Trench X:	0' - 12'	0.40% Ni	0' - 14'	0.48% Ni
	12' - 14'	0.96% Ni		
Trench G:	0' - 8'	0.20% Ni	0' -12'	0.41% Ni
	8' - 12'	0.83% Ni		
Trench H:	0' - 4'	0.30% Ni	0' - 9'6"	0.61% Ni
	4' - 9'6"	0.83% Ni		

The report makes no recommendation but concludes that if more information on the value and quantity of nickeliferous ores is desired, further boring should be carried out.

1961 Hughes reported on the results of a single diamond drill hole put down by the Department of Mines to test the values of a particular type of weathered serpentine in depth. The hole was drilled in 1960 and sampled and assayed by the Department of Mines. The hole was depressed at 50 degrees and drilled to a final depth of 159 feet.

Assays and a summarised log are as follows:

0' - 7 75'	7.75'	0.56% Ni	brown clay
7.75' - 24.5'	16.75'	0.62% Ni	brown clay and decomposed greenish white serpentine.

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24.5' - 49.5'	25'	0.40% Ni	decomposed greenish white serpentine plus yellow blue and green varieties. Variable hardness.
49.5' - 74.5'	25'	0.44% Ni	yellow green serpentine and magnetite bands.

Average value of serpentines (some of which were reported as decomposed) from 74.5 feet to the bottom of the holes at 159 feet, was about 0.3% Ni.

Hughes recommended that no further boring be carried out.

1962 Noldart reported on the chromite deposits at Beaconsfield as a result of Mines Department investigations in 1961 and 1962. A number of auger holes were put down. The following conclusions were drawn:

(1) Chromiferous deposits of economic grade occur in the basal zone of the Tertiary quartz gravels overlying the ultrabasic complex in the vicinity of Barnes Hill.

(2) Whilst the deposits are of economic or potentially economic grade, known tonnages available are too small to warrant exploitation.

1965 In this year Broken Hill Pty. Company Ltd. held the prospect under Exploration Licence and undertook some exploration. The exploration took the form of an aeromagnetic survey plus some limited ground magnetics plus a geochemical survey over 30 square miles and a diamond drilling programme totalling 13 holes. BHP did not furnish the Department of Mines with a report on their investigations so the results are not available. The diamond drill holes were put down to test for iron ore and it is not known if the holes penetrated the weathered serpentines below the iron ore occurrences.

REWARDS AND ECONOMIC FEASIBILITY.

The rewards of successful exploration at Beaconsfield are great. In order to be economic, an orebody of the order of 50,000,000 tons of 1% Ni plus, must be found. Exploitation of such an orebody would require an estimated capital investment of $50 millions, but would yield a net profit of the order of $130 millions over a 15 year period after return of initial investment. The rewards then are not inconsiderable particularly when it is clear that initial exploration in the form of drilling could be carried out for some tens of thousands of dollars.

Economic Study.

Assumptions:

Ore Reserves: 50 million tons
Grade: Recovered 1.00% Ni
Life of Mine: say, 15 years (re annual ore mining rate of 3,330,000 tons)
Total Costs: estimate $10/ton of ore
Capital Requirement: estimate $50 millions
Metal Price: adopt 67¢ Aust/lb. (= $1,500/ton)
(actual 82.8¢ Aust/lb. for refined Ni)

Gross Value of Ore: $50{,}000{,}000 \times \frac{1}{100} \times \$1500$	$750,000,000
Less Costs(mining, smelting, overheads) $10/ton	500,000,000
	$250,000,000
Less Capital Investment	50,000,000
Profit before tax	$200,000,000
Less Tax on 80% @ 42.5¢ in $	68,000,000
	$132,000,000
Net Annual Profit	$ 8,800,000
Annual Return on Capital	17.6%

DISCUSSION.

The prospect is very favourably located being within 30 miles of Launceston, about 7 miles from established port facilities and close to existing water and power facilities.

There is considerable evidence to show that the serpentine is nickeliferous and that weathering is widespread and apparently deep. The development of clays and laterites extends over about three-quarters of the serpentine complex, while the single deep drill hole bored into the serpentine showed evidence of weathering to a depth exceeding 100 feet. The nickel content of the laterites and iron ores would appear to be uneconomic. In some of the laterite areas tested by trenching the nickel values have been shown to increase in depth, i.e. higher nickel concentrations occur at the base of the laterites and are of the order of 1%. This is also supported by the hand boring results of Consolidated Zinc. The 'serpentine earths' which are highly decomposed serpentines occurring immediately below the laterite profile, have been shown to be enriched in nickel. This is shown particularly in the case of the hand boring results of Consolidated Zinc where the soft 'serpentine earths' were sampled. Good results, i.e. 1% Ni or better, were nearly always obtained below areas of laterite cover. Refer to cross sections on Lines 1, 2 and 3. Elsewhere the results were poor. Consolidated Zinc's result are generally poor but it must be remembered that the boring was deliberately confined to serpentine areas that were not covered by laterites. In view of the results shown on Line 1, it is strange that some attention was not paid to the serpentine below the laterites.

There are a couple of other features of the Consolidated Zinc report that deserve comment. First of all, it was mentioned that all holes were bottomed on hard serpentine after penetrating the soft serpentine earth. It was admitted in the report that it was possible that some of the holes bottomed on residual boulders and not bedrock. The impression one obtains from the report is that hard serpentine (i.e. that unable to be penetrated with a hand auger) is equated with barren fresh serpentine. This could be very misleading as typically nickel values comparable to the overlying serpentine earths are to be obtained

in the medium hard serpentines below. This is exemplified by the diamond drill hole results which showed fairly consistent, though uneconomic, values to a depth of 75 feet.

As stated in their report, Consolidated Zinc were seeking ore grades of 2.5% Ni and when this was not achieved they abandoned the prospect. This figure of 2.5% Ni quoted by Consolidated Zinc appears to be above the minimum economic grade that could be mined, e.g. head grade at Moa Bay in Cuba is 1.35% and that of Hanna Nickel in U.S.A. is 1.5% Ni

It is believed that the value of the prospect must be assessed on the nickel content of the weathered serpentine between the bottom of the laterites and the unweathered serpentine. This has not been done by any previous investigations.

In an endeavour to calculate the minimum tonnage and grade requirements for an ore deposit of this type to be an economic proposition, certain assumptions were made, some guesswork was involved particularly as to capital costs, operating costs, etc. Therefore the figures in the feasibility study section of this report should be taken as a guide to the size of operation involved rather than likely results.

The aim of this report is to furnish background information on the prospect, present the concept of the ore we are looking for and give some indication of the large scale, high initial cost operation that could result from successful exploration.

Finally, it should be pointed out that this area is only a prospect and the presence of an economic orebody is not established. An early report such as this tends to highlight the virtues of a prospect but once testing work commences and more information becomes available, the data will be reviewed in a more critical light. The results of the test work will have to approach the minimum tonnage and grade requirements at a fairly early stage for more extensive exploration to be warranted.

RECOMMENDATION.

It is recommended that a programme of exploration be designed in stages to undertake the assessment of the weathered serpentine zone that exists below the laterites at Beaconsfield.

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