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DEPARTMENT OF SUPPLY AND SHIPPING.  
**MINERAL RESOURCES SURVEY.**

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**REPORT No. 1945/6 .**

REPORT ON

PROBABLE GRADE OF ORE TO BE MILLED BY KING ISLAND SCHEELITE, N.L.  
IN THE NEXT TWO YEARS.

- By -

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**CANBERRA.**

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MINERAL RESOURCES SURVEY BRANCH.

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I. INTRODUCTION.

At the request of Mr. G. Lindesay Clark, Deputy Controller of Minerals Production, estimates have been made of the grade of ore likely to be delivered to the mill during the next two years under conditions of half-scale production.

To enable this to be done, copies of the company's plans and sections were obtained by Mr. Lindesay Clark and sent to this office. They were:-

1. Copies of Plates 5 and 8 of Bulletin No. 11 - "The King Island Scheelite Mine". Plate 5 represents assay sections along lines 1 to 6 and Plate 8 along lines 8 and 10 to 13. On these were drawn the boundaries of the open cut to which the company proposed to work.
2. "Cruising" plans. These represented plans of the proposed 30, 50, 70, 90, 110, 130 and 150 foot benches and indicated the bench faces as they would exist at the ends of periods of working of 6, 12, 18 and 24 months from the recommencement of operations. These plans were drawn by the company and the sides of the cut at the various levels differ slightly from those drawn on Plates 5 and 8. On them was shown the estimated amount of ore in the different blocks which would be mined each 6 months between the benches. These figures indicated a mining rate of about 4,800 tons per week and apparently were intended to represent mining at approximately the rate for the full-scale production (about 5,000 tons) planned during 1943 and subsequent years.

As, however, estimates are required for half-scale production, the company's figures for tonnage and/or the progress of the mining in the open cut will have to be amended accordingly.

II. AMOUNTS OF ORE TO BE MINED.

The figures taken from the Company's plans are:-

Bench	First 6 months	Second 6 months	Third 6 months	Fourth 6 months
	A	B	C	D
30 feet				5,500
50 feet	-	29,200	20,000	36,100
70 feet	44,200	27,100	34,400	26,000
90 feet	15,400	34,800	27,100	27,000
110 feet	47,400	7,000	21,300	20,200
130 feet	-	15,600	15,700	9,800
150 feet	17,700	4,300	4,700	3,000
	124,700	118,000	123,200	127,600

These figures indicate an average rate of treatment (in tons) as follows:-

	Full-Scale	Half-Scale
Per 6 months.	125,000	62,500
" 1 month.	20,800	10,400
" 1 week.	4,800	2,400

Our estimates of the tonnages in the blocks to be mined in each 6 months are:-

- A - 114,000 tons.
- B - 108,000 "
- C - 118,000 "
- D - 112,000 "

The differences could arise from the different methods of calculation of volumes of irregular blocks. As the differences do not, in general, exceed 10 per cent. they have little or no significance as it is doubtful if any estimates can be practically realised to within 10 per cent.

On half-scale production, the above quantities would have to be halved. Alternatively the amount (A) could be considered as that which would be mined during the first 12 months instead of the first 6 months and similarly that the amount (B) would be mined during the second 12 months instead of the second 6 months.

Estimates are not being made for each 6-monthly period at half-scale production, because of the absence of plans of mining for such production.

### III. METHOD ADOPTED FOR ESTIMATES OF TONNAGE.

Estimates of tonnage are based primarily upon the blocks of ore shown on the Company's "cruising" plans. The edges of the eastern part of the open cut as shown on these plans differ slightly from those shown on the sections in Plates 5 and 8 - in such cases the edges of the blocks shown on the "cruising" plans are adopted. In places where the edges of the cut did not agree with the geological boundaries (particularly the hangingwall of the Top orebody), minor adjustments were made to the edges of the blocks.

The shapes of the blocks of ore, as shown on the Company's "cruising" plans, rendered it impossible to determine amounts and grades from section lines drawn across the mineralised zone.

The orebody is naturally divided into three parts - Top orebody, Marker and Bottom orebody. It was apparent from the shapes of the blocks and from the fact that the footwall batter of the cut is in ore in most places that the proportion of Top orebody to Bottom orebody in the ore mined, would be greater than that in the mineralised zone as a whole. As a result, it was necessary to calculate separately the amounts of Top and Bottom orebody to be mined.

The method adopted, therefore, was to draw a geological plan of the top and bottom surfaces of each block of ore for each level. On these plans, the ore in each block was allocated to the three divisions of the orebody.

Areal measurements were made by planimeter and the general accuracy of measurements is considered to be about 5%.

### IV. GENERAL CONSIDERATIONS REGARDING GRADE.

The operations for the first two years extend westerly as far as line 5, but become shallower as they approach that line. Thus while there are thirty-nine drill holes on, and to the east of, line 5, only sixteen holes intersect the ore that is to be mined. The other holes have, of course, some use in determining the grade of the ore, but the sixteen holes are insufficient in number to render it possible to calculate the grade of the ore by drawing sections across it at regular intervals. In particular, in only a small number of cases are the holes in the Bottom orebody in the block or sufficiently close to it to be of direct use in assessing the grade of ore in that block.



Other general factors affecting the question of grade are discussed below.

The average grades of the three main bands in the mineralised zone (Top orebody, Marker and Bottom orebody) were estimated in Bulletin 11 from diamond drill holes Nos. 22 to 56. They were estimated for the zone occurring above sea-level in the open cut assumed in that Bulletin. The grades for the eastern and western portions of the mineralised zone were as follows:- (Grades are expressed as percentages of  $WO_3$ ).

	<u>WESTERN PORTION</u> (No.6 to No.4 line)	<u>EASTERN PORTION</u> (No.8 to No.13 line)	<u>AVER-</u> <u>AGE</u>
Top orebody.	1.32	1.06	1.21
Marker.	Nil	Nil	Nil
Bottom orebody.	0.56	0.58	0.56
Whole of zone.	0.64	0.63	0.64

The grade is, therefore, seen to be uniform when large tonnages are considered and markedly so for the Bottom orebody and the whole of the zone. The agreement in the grades of the eastern and western ends suggests that the grade of the zone considered as a whole has been reasonably well tested and that the true average grade would be as indicated above. It is known that the scheelite is disseminated uniformly throughout and that there are no large high-grade masses of ore in the zone. Assays of over 2% may be obtained where scheelite veins are intersected, but are uncommon. Assumptions that the average grades given above can be applied to ore untested or insufficiently tested are justified.

The Top orebody is uniformly high-grade and the average of 1.21% can be assumed with confidence. Furthermore on all the section lines east of Number 1, the grade of this orebody as tested by drilling decreases down the dip. This makes it highly probable that higher figures than the average could be taken to represent the grade of the orebody to be mined in the upper levels.

In the Bottom orebody, no systematic variation of grade has been definitely established by the drilling. There is a suggestion, however, that there may be a very small diminution in grade down the dip.

#### V. REJECTION OF BARREN AND LOW-GRADE MATERIAL.

The barren Marker bed between the Top and Bottom orebodies has an average thickness of 13 feet. It is regular in dip and width and its strike is not disturbed by folding, except possibly in the vicinity of the No. 2 fault. It is easy to recognise the difference between it and the Top orebody in the cuttings from blast holes. It is considered, therefore, that the Top orebody could be mined fairly cleanly from the underlying Marker bed and with a minimum of dilution from the latter. The conditions are somewhat similar at the base of the Marker bed, but are not as favourable as at the top. Clean separation would not be necessary because of the low grade of the top portion of the Bottom orebody, which underlies the Marker. It is considered, therefore, that the Marker bed could be removed by selective mining. Even if a portion of the top of the Marker is broken with the Top orebody, an amount of material equivalent to the Marker bed could be rejected by the inclusion in it of a portion of the top of the Bottom orebody. The calculations of tonnage have been made on this assumption.

It is probable that an average width of about 2 feet of the bottom of the pyroxene-garnet overlying the Top orebody will have to be included in the latter. A drop in grade of only .02 per cent. in the second year would result.

In the Bottom orebody, there are small to large masses of barren calcite-hornfels. The largest of these could be rejected as waste and such rejection has been allowed for in some of the calculations.



## VI. ASSUMPTIONS MADE AND METHODS OF CALCULATING GRADE.

The grade has been calculated by three methods.

1. The grades of the Top and Bottom orebodies are assumed to be 1.24 and 0.56 per cent. WO<sub>2</sub>. These figures were those calculated for these orebodies in Bulletin 11 from the results of drill holes 22 to 56 and for that part of the mineralised zone in the assumed open cut extending down to sea-level. It has already been shown above that such figures can be used with confidence as averages for large tonnages of ore.
2. The grades in each block have been assumed to be those determined by the nearest drill holes. In general, these are higher than the figures used in (1). As far as the Top orebody is concerned this is due largely to the fact that the higher parts of that orebody are involved and, as discussed above, the grade is, therefore, somewhat higher than the average of the tested portion. The remaining differences are due to the small natural variation of grade within the mineralised zone.
3. Grades of 1.36 and 0.62 are assumed for the Top and Bottom orebodies respectively. The figures are obtained from those in Bulletin 11 representing the whole length of the mineralised zone tested by drill holes 22 to 56, but only that part above a level of 75 feet above sea-level. Such conditions correspond more closely to those under which the ore will be mined during the first two years. As this includes only the upper part of the tested ore, the grade of the Top orebody will be greater than used in (1).

## VII. ESTIMATES.

Estimates of tonnage and grade, based on the three different assumptions as to grade, listed under VI, are given below.

1. Assuming average grades for Top and Bottom orebodies determined for whole of zone above sea-level from drill holes 22 to 56, i.e. Top orebody 1.24, Bottom orebody .56, Whole .64.

	<u>TOP</u>	<u>MARKER</u>	<u>BOTTOM</u>	<u>WHOLE OF ZONE</u>		<u>TOP &amp; BOTTOM OREBODIES</u>	
	Tons	Tons	Tons	Tons	Grade	Tons	Grade
1st 6 months	16,000	13,400	84,800	114,200	.58	100,800	.63
2nd " "	27,400	18,700	62,400	108,500	.63	99,800	.76
3rd " "	29,100	14,800	74,400	118,300	.66	103,500	.74
4th " "	31,200	17,800	63,300	112,300	.65	104,500	.77

2. Grades for various sections of Top and Bottom orebodies determined from nearest drill holes: Marker and large blocks of limestone rejected.

	<u>TOP</u>		<u>BOTTOM</u>		<u>TOTAL</u>	
	Tons	Grade	Tons	Grade	Tons	Grade
1st 6 months	16,000	1.07	84,800	.63	100,800	.70
2nd " "	27,400	1.53	49,300	.58	76,700	.92
3rd " "	29,100	1.35	63,500	.64	92,600	.86
4th " "	31,200	1.56	52,700	.59	83,900	.95

3. Using average grade of Top and Bottom orebodies above 75 feet level, i.e. Top orebody 1.36, Bottom orebody .62, Marker and large blocks of limestone rejected.

	<u>TOTAL</u>	
	<u>Tons</u>	<u>Grade</u>
1st 6 months	100,800	.73
2nd " "	76,700	.88
3rd " "	92,600	.85
4th " "	83,900	.89

### VIII. CONCLUSIONS.

It is considered that assumptions 2 and 3 probably represent the existing conditions more closely than assumption 1. Further the results from assumptions 2 and 3 agree fairly closely.

Factors affecting the accuracy of any determinations of average grade include.

1. The tungsten assays used were reported to the nearest 0.05 per cent. because the assay method was not considered to be more accurate.
2. Core recoveries averaged about 80 per cent.
3. There are insufficient drill holes (and therefore sampling) in the blocks to be mined.
4. The blocks of ore were generally sufficiently irregular to introduce an error in the volume calculations of about 5 per cent.

It is considered that the following figures represent the position at full-scale mining rate as nearly as can be gauged at present.

	<u>TONS</u>	<u>%</u>
First 6 months.	100,800	.7
Second 6 months.	76,700	.9
Third 6 months.	92,600	.85
Fourth 6 months.	73,900	.90

They are based on calculations which assume that the unrecovered core from drill holes is of the same grade as recovered core.

Estimates have not been made on the assumption that unrecovered core was barren. It is considered, however, that as the core recovery averaged about 80 per cent. such figures could be obtained by reducing by 20 per cent. these figures given above. This represents the worst case for unrecovered core, and such a large reduction is not warranted from the geological aspect.

Having regard to the factors discussed above, it is thought that the figures in the list given immediately above may be accurate only within 10 per cent. This limit would probably also include variations due to lack of knowledge of the unrecovered core as it is considered that the grade of such core is not likely to differ materially from that of the recovered core.

CANBERRA, A.C.T.  
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