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DEPARTMENT OF SUPPLY AND DEVELOPMENT

MINERAL RESOURCES SURVEY BRANCH

PRELIMINARY REPORT ON THE KING ISLAND SCHEELITE MINE

(with special reference to a proposed boring campaign)

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1. INTRODUCTION

This report is written in advance of the main report in order that a drilling campaign to test the scheelite deposits can be considered immediately. The descriptions are necessarily brief and moreover the report is not accompanied by the full set of plates which will accompany the main report. A surface plan (without geology), a plan of the 120-feet level (showing geology), and cross sections (without detailed geology) showing the ore-bearing zone and the proposed drill holes accompany this report and provide sufficient information to facilitate the understanding of the report.

The King Island scheelite mines have been operated during two periods, the first being between 1917 and 1920, and the second from 1938 to date. During the first period 67,710 tons of ore were treated for a production of 589 tons of scheelite concentrate, the average yield of concentrate being 0.87 per cent. During the second period 98,305 tons of ore were treated for a production of 627 tons of scheelite concentrate, the average yield of concentrate being 0.64 per cent. In addition and during the latter period 41,260 tons of tailings were re-treated for a production of 52 tons of scheelite concentrate, the average yield being 0.12 per cent. The mine is being worked at present and some 30,000 tons of ore are treated annually for a recovery of 200 tons of scheelite concentrate.

II. GEOLOGY

The scheelite ore consists mainly of lodes of coarse-grained garnet rock, representing replacements of sedimentary beds. The fine-grained garnet-pyroxene rocks adjacent to the garnet rocks also contain scheelite. The sedimentary rocks near both the above rocks are probably somewhat altered and also contain scheelite.

Where the scheelite content of the garnet-pyroxene and the altered sedimentary rocks is sufficient, the latter are mined and treated as ore. A few narrow quartz-scheelite veins are also present. In the eastern part of the workings, the garnet lodes and the other rocks have a north-easterly strike and a dip to the south-east at 40 degrees. In the western part of the workings, the garnet lodes and the enclosing rocks have a strike 10 degrees north of west and a dip to the south at 40 degrees.

The garnet lodes range in width up to 30 feet and are in most cases between 10 and 20 feet wide. The number of the wider and more prominent of such lodes is probably five. The garnet lodes and the other scheelite-bearing rocks occur in a zone with a horizontal width in the workings of 300 to 400 feet, and a probable maximum width of 500 feet. The latter corresponds to a stratigraphic width of 320 feet, but because the horizontal width of the zone is increased by one fault by nearly 90 feet, it is preferable to regard the maximum stratigraphic width as being about 220 feet.

Although the garnet lodes form less than one half of the zone, the greater part of the zone is ore-bearing. Judging by the statements of the mine foreman and the observations of the work as carried out during the period of the survey, it would appear that very little rock from the open cut is rejected as waste. It may be said, therefore, that the greater part of the zone is ore-bearing, but naturally this matter requires investigation by drilling, sampling of faces, and underground development.

Over most of the area but particularly in the southern portion, Recent deposits of sand cover the ore-bearing rocks. The thickness ranges up to 30 feet but may be even greater in old in-filled gullies. In the north-western portion of the workings, non-mineralised rocks overlie the mineralised ones and have a maximum thickness of about 100 feet.

Several faults are present in the workings. One of these (No.1) has a general north-south strike and forms the boundary between the western portion of the workings (in which the strikes are 10 degrees north of west) and the eastern portion of the workings (in which the strikes are north-easterly). Another important fault (No.2) is that exposed in the western faces of the 120-feet, 140-feet, and 155-feet benches. The No.2 fault has a general east-west strike and a dip of 45° to 60° to the north. In the western face of the 120-feet bench it terminates at depth one of the garnet lodes. The downthrow is probably to the north and the horizontal displacement is approximately 90 feet. Another important fault (No.3) is that on the north-eastern portion of the workings and which partly at least forms the boundary of the ore-bearing zone in that vicinity. The strike is north-westerly and the dip is probably at high angles to the south-west. Other faults occur in the eastern portion of the 90-feet and 120-feet benches and have general east-west strikes. One at least has caused a considerable displacement of a garnet lode. It is possible that some of the latter faults are pre-ore in age and that small vertical garnet lodes were formed along them.

III THE WORKINGS.

Working has been conducted by means of open-cuts, and levels and benches have been formed at the 90, 120, 140, 155 and 170-feet levels. Work was commenced at the eastern end of the scheelite deposits and the open cuts have progressed in a general westerly direction. The surface of the land slopes both to the east and to the south, so that the face of the open cut has become deeper as it progressed, to the west, and the highest portion of the faces are on the northern side of the open cut.

IV ECONOMIC GEOLOGY.

Scheelite-bearing garnet ore is known over a length of 1400 feet in a general east-west direction. The horizontal width of the ore-bearing zone in the open cut ranges from 300 to 400 feet. The stratigraphical thickness over which the ore occurs, ranges from 150 feet to at least 200 feet. Ore has been worked for 600 feet in a general east-west direction and over a maximum horizontal width (in a general north- south direction) of 310 feet at the eastern end of the 120-feet level. The latter width corresponds to a stratigraphical thickness of 200 feet,

(not allowing for displacement of beds by faulting). The zone probably attains a maximum horizontal width of 500 feet and after making allowance for increased thickness due to faulting, the maximum stratigraphic width is about 200 feet.

The above dimensions suggest that the scheelite deposits contain a considerable amount of ore, and that they could be worked on a much larger scale than the present one. Before a decision can be made as to the maximum scale of operations, and the plant and finance necessary to put such scheme into operation, it is necessary to know the amount and grade of the scheelite ore present. It has been suggested by Mr.G.L.Clark, Assistant Controller of Minerals Production, that the first step should be the proving, if possible, of 1,000,000 tons of ore.

V DRILLING CAMPAIGN

Assuming a vertical depth of 100 feet and a horizontal width of 320 feet, the length necessary to prove 1,000,000 tons would be 375 feet (allowing 12 cub. feet per ton). However the full width is probably not ore-bearing and it might be necessary to reduce the width by an amount ranging up to say 160 feet. Such a reduction would mean that only 500,000 tons would be proved. By increasing the length to be drilled to 500 feet, the ore likely to be proved would be increased to 750,000 tons. There are other factors to be considered below, which could be regarded as likely to increase this amount.

It is considered that the block of 500 feet to be drilled should be that extending westwards from the No.1 fault, and embracing the western parts of the open-cut. The advantages would include:

(1) Such a block would contain beds with uniform strike and dip and thus facilitate working.

(2) It would include a length in which the open-cut has already been opened, thus permitting inspection and sampling of the deposits.

(3) The overburden has been removed for a length of 300 feet and a width varying from 200 to 330 feet.

(4) A length of 250 feet of open cut occurs to the east and would facilitate the working of the 500-foot block at depth.

(5) The block occurs generally between the six 1934 drill holes on the east and twentyone 1941-2 drill holes on the west.

(6) Ore is known to occur both to the east and west so that there are possibilities of further reserves.

(7) Higher faces would be attained than in the eastern part of the open cut.

As the determination of the grade of the ore is the important factor in determining the amount of ore, the number of drill holes should be as large as possible. Four lines of holes are regarded as the minimum and the campaign has been based accordingly. The lines should be at right angles to the strike of the rocks and lodes and therefore have a bearing of 10° east of north. The four lines are numbered 1 to 4 from west to east and are spaced at approximately 140 feet intervals, the distance between Nos. 1 and 4 therefore being 420 feet.

The No.1 line (holes I to III) of the 1934 campaign is situated 70 to 80 feet to the east of the No.4 line - these holes were drilled to sea-level. Lines 1 and 2 include an area in which exist some of the 1941-42 drill holes - these were drilled to 100 feet depth from surface.

Six sites (A to F) have been selected on Nos. 1, 2 and 3 lines and five sites (A to E) on No.4 line. These were selected for holes drilled at right angles to the lodes and beds, and therefore with directions of 10° east of north, and depressed at angles of 50°from the horizontal. The sites are spaced at horizontal intervals of 160 feet or intervals of 123 feet along the lodes and beds. This interval is altered slightly where necessary to provide a convenient site for drilling operations. The proposed holes are shown in the sections on the attached plate 3. They are shown only to sea level, but the details to the foot-wall of the ore-bearing zone are shown in the table on the section.

Although selected for depressed holes the same sites are generally suitable for vertical holes but are not equally spaced (this is because the different levels of the ground had to be considered in the depressed holes). The vertical holes are not shown on the sections.

In the tables adjacent to each section line, details for the lengths of each hole are shown for four sets of conditions, viz: depressed holes to sea-level, depressed holes to the footwall of the ore-bearing Zone, vertical holes to sea-level, and vertical holes to the footwall of the zone.

With depressed holes drilled to sea-level, the A holes are more or less exploratory but should be drilled. If the holes are to be drilled to the footwall of the zone, the A holes are important and should certainly be drilled. With vertical holes the A holes have been omitted although they would yield valuable information. If drilled to sea level, they would be purely exploratory, but if drilled to the footwall they would, although long, give important information.

As regards the merits of depressed as compared with vertical holes, there are several factors to be considered. In considering the length, the advantage is with the vertical holes when drilling is to be to sea level, but with the depressed holes when the drilling is to be continued to the footwall of the zone (if the same number of holes are drilled in each case)- the A holes do not appear for vertical holes in the table. The depressed holes would cut the beds at right angles and the vertical holes cut them at an angle of 50 degrees - the latter would give a longer length of core, but would represent the same true thickness of lode as that in the depressed hole. The depressed holes would reveal the vertical or high dipping faults whereas the vertical holes would miss them. As regards the No.2 fault, the vertical holes would intersect it whereas the depressed ones would not, but as its position is known, it is preferable to intersect the lodes on either side and obtain more certain information about them .

In accordance with the arrangements shown in the tables on plate 3, the total amount of drilling in each of the four schemes would be -

Depressed holes	to sea-level	5110 feet
"	to footwall	6915 feet
Vertical holes	to sea-level	3645 feet
"	to footwall	6345 feet

The examination of the cores, preparation of logs, and sampling of the cores for assay should be done by a geologist. This work should be done concurrently with the drilling. The geologist would be fully occupied if in addition he supervised the sampling of the faces in the open cuts and adits, and conducted such other geological surveys as would be necessary.

VI OTHER TESTING

1. UNDERGROUND DEVELOPMENT.

Almost the whole of the adit workings are confined to the country to the east of the 500-feet block to be tested, and the only portions which can be said to enter the block are the western portions of the 90-feet level west adit and the 170-feet adit, and these only enter it for short distances (less than 100 feet in each case).

Any development should be conducted on either the 90-feet level or the 45-feet level. The best arrangement would be to drive an adit with a bearing of W.10°N and centrally situated in the ore-bearing zone, and to extend crosscuts both north and south to the limits of the zone. The intervals between crosscuts would be 200 or 250 feet.

On the 90-feet level, the centre adit (at present being driven) is suitably sited for this purpose. Its direction should be altered slightly if necessary and it should be connected to the west adit at the same level.

The 45-feet level adit is also fairly well situated and could be used. It would be necessary to drive north-westwards to reach the centre of the zone in the western block.

2. SAMPLING

The grade of the ore should be determined by sampling of the cores of the drill holes and of all faces in the open cuts and the underground workings. The samples would be assayed for their tungsten content.

It is also recommended that examinations and determinations of grade should be made by fluorescence in ultra-violet light. The latter would in general be additional to the chemical assays, but it might be found possible to use such determinations in lieu of assaying to a greater or less extent, and save considerable time and expense. The Mineral Resources Survey Branch has recently completed an investigation into the fluorescence of scheelite and has ordered from the U.S.A. the necessary apparatus (Mineralight) to conduct such examinations and determinations.

VII ECONOMIC FACTORS

It is not proposed to deal in full with economic factors, but brief reference will be made to the grade and to the proportion of the overburden.

1. Grade: The grade of the material in the ore-bearing zone will be determined by the sampling of the drill cores and the existing faces. Such sampling will also determine the proportion of profitable ore in the zone.

At present the ore being mined contains about 1 per cent WO_3. Not all of the ore is necessarily of that grade.

The lowest grade of ore that can be mined and treated profitably is governed mainly by the WO_3 content of the tailings - in the current treatment this averages about 0.3 per cent WO_3.

2. Overburden: The overburden to be removed in the open cut mining operations includes -

(a) The rocks above the hanging wall of the ore-bearing zone (any Recent deposits (c) above this portion will also be included)

(b) The non-mineralised rocks overlying the ore-bearing zone in the north-western portion of the workings and area.

(c) The Recent sand, clay and pebbly clay.

The approximate proportions of each of these and the total proportion of overburden to total excavation on each of the four lines of drill holes are as follows:-

LINE	(a)	(b)	(c)	TOTAL
1	1: 4.37	1:25.6	1: 7.70	1: 2.51
2	1: 5.00	1:38.5	1: 9.62	1: 3.03
3	1: 4.77	1:61.2	1:24.48	1: 3.75
4	1: 5.04	1:42.1	1:10.54	1: 3.15

The above are calculated for working down to sea-level only. The amounts of (b) and (c) would remain constant, but the proportions would decrease if working was continued to greater depth. The amounts and the proportion of (a) would increase at a very high rate as the depth increases (as the depth is doubled the amount would increase fourfold not allowing for any change in the surface level).

VIII CONCLUSIONS AND RECOMMENDATIONS

The large width of the ore-bearing zone, and the probable high proportion of ore of profitable grade in that zone in the King Island Scheelite mine indicate that it might be possible to operate the mine on a much larger scale than the present one.

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In order to determine the possibilities it is recommended that:

(1) A drilling campaign be conducted in the western part of the workings and vicinity, to prove a length of 500 feet along the zone and ore reserves of between 500,000 and 1,000,000 tons.

(2) Consideration be given to the driving of an adit (with crosscuts) at either the 45-feet or 90-feet levels westwards under the block being tested.

(3) The drill cores and all available faces be sampled and the samples assayed to determine the content of tungstic oxide (WO_3).

(4) An examination of all faces to be made and the grade of ore determined by fluorescence in ultra-violet light - such determinations to be at first supplementary to the assaying and, if found satisfactory, to partly replace the assaying.

(5) The geological report and plans based on a recent survey and about to be completed, should be revised at the conclusion of the drilling and other testing.

P B Nye

(P.B.NYE)
ASSISTANT DIRECTOR.

Canberra.
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ADDENDUM

TO

PRELIMINARY REPORT ON THE KING ISLAND SCHEELITE MINE

ORE RESERVES: In calculating the amount of ore likely to be present in the 500 feet of ore-bearing zone to be drilled, assumptions were made, particularly as regards the depth. In the process of estimating the proportions of overburden on the four proposed lines of drill holes, more accurate figures were obtained as to the area of the ore-bearing zone on each section line. Using the latter figures and applying them to a length of 500 feet, the total amount of possible ore-bearing material would be 3,750,000 tons.

Assuming that only 50 per cent of the material in the zone is ore, the amount of ore would be 1,875,000 tons. This figure is about double that in the other calculations, because the depth in the four sections averages nearly 200 feet whereas a depth of 100 feet was assumed in the other calculations.

The amount of ore likely to be obtained from the zone to the east of the 500-feet block would be approximately 250,000 tons.

DRILLING AND SAMPLING: In order to guard against the possibility of recovery of only a small proportion of core, it is recommended that consideration be given to the casing of the holes while drilling and to the sampling and assaying of the sludges.

LOCALISATION OF ORE: No reference was made to any structural features possibly controlling the localisation of ore. Actually there are no records (assay or production plans) of past workings, and the length of any one lode in the workings is short, so that at present there is no information available to indicate in any way the structural features governing the localisation of ore.

The lode being worked on the southern side of the 120-feet level and in the south-western faces of the 120, and 140-feet levels is apparently maintaining a high grade as it is followed to the west, because it is one of the main places from which the ore is being drawn. Bore No.7 situated 80 feet ahead of the 140-feet level face intersected ore with 0.5 to 1.1 per cent WO_3 (average for 60 feet of hole was 0.76 per cent). In Nos. 10 and 11 bores (300 and 260 feet respectively west from the 140-feet face) 50 feet of core gave assays ranging from 0.45 to 0.80 per cent (average 0.55) and from 0.4 to 0.9 per cent (average 0.58) respectively. The ore in these three holes is probably not portion of one and the same lode, but indicates an extension of ore to the west.

The drilling and sampling campaigns will yield considerable information on the distribution and localisation of ore, but it is probable that the information from the future working will enable the matter to be decided finally.

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