COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF SUPPLY AND SHIPPING
MINERAL RESOURCES SURVEY.

BULLETIN No. 11.
(GEOLOGICAL SERIES No. 2.)

THE KING ISLAND SCHEELITE MINE

BY

P. B. NYE, M.Sc., B.M.E.
ASSISTANT DIRECTOR

AND

C. L. KNIGHT, M.Sc.
GEOLOGIST.

*Issued under the authority of the Hon. J. A. Beasley,
Minister for Supply and Shipping.*

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CANBERRA
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ISSUED

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THE KING ISLAND SCHEELITE MINE, GRASSY, KING ISLAND, TASMANIA.

I. INTRODUCTION.

In the years immediately preceding the present war, 75 per cent. of the world's production of tungsten concentrates came from southeast Asia; approximately 50 per cent. came from China. This production consisted almost wholly of wolfram. With the entry of Japan into the war in 1941 and its occupation of Indo-China, Thailand and Burma, these supplies were cut off from the United Nations. This cessation of supplies made it necessary that all countries amongst the United Nations should make intensive efforts to increase their production of tungsten ores and concentrates.

In Australia, the effort was necessary in order that as much tungsten concentrate as possible could, after domestic requirements were satisfied, be exported to Great Britain and the United States of America.

In order to arrange for increased production of metals and minerals (including those of tungsten) in Australia, the functions of the Commonwealth Copper and Bauxite Committee were changed early in 1942 and its name altered to the Commonwealth Minerals Committee. One of its members, Mr. J. Malcolm Newman, was appointed Controller of Minerals Production. In September, 1942, a Deputy Controller, Mr. G. Lindesay Clark, was appointed.

As the King Island Scheelite Mine was (and still is) the largest producer of tungsten concentrates in Australia, the possibilities of increased production from that mine were among the first to be considered. Arrangements were made by the Minerals Committee and the Controller of Minerals Production for Mr. M. A. Mawby (Member of the Committee) of the Zinc Corporation and Mr. P. B. Nye, Assistant Commonwealth Geological Adviser, to visit and report on the King Island Scheelite and other tungsten mines in Tasmania. The visit was made during April and their report was submitted to the meeting of the Minerals Committee on 14th and 15th May, 1942. In their report, Messrs Mawby and Nye recommended that geological and geophysical surveys of the mine and deposit be made and that a drilling campaign based upon the results of those surveys be conducted. These surveys were made and the drilling carried out, together with several other investigations. The general position regarding all surveys, investigations, etc. is described below.

Geological Surveys. The first geological survey was conducted by Q. J. Henderson, Field Geologist, of the Tasmanian Mines Department and P. B. Nye during three weeks in June-July, 1942. Subsequent detailed surveys were made by P. B. Nye and C. L. Knight during the progress of the drilling campaign between October, 1942 and May, 1943.

Drilling Campaign. Based on the results of the first geological survey, a scheme for a drilling campaign was drawn up by P. B. Nye in September, 1942. The objective was to prove sufficient ore reserves to justify increased production for war purposes. The arrangements for the drilling were made by Mr. G. Lindesay Clark, Deputy Controller of Minerals Production, and £3,000 was allocated on a £1 for £1 basis with the Company. The drilling was carried out under contract by Boyles Bros. between October, 1942, and May, 1943. Thirty-five holes, including thirty-two inclined holes and three vertical holes, were drilled during that period. The original scheme provided for twenty-three holes on four lines (1 to 4 of Plate 3). This scheme was slightly modified and a total of nineteen holes were drilled on those lines. Of the remaining sixteen holes, four were drilled to the west of the No.1 line and twelve to the east of the No.4 line. All except four of these sixteen holes were financed solely by the King Island Scheelite N.L.

Logging and Sampling of Drill Cores. All the work involved in the logging and sampling of the drill cores and sludges was conducted by C.L.Knight at the mine during the drilling operations.

Assaying. By arrangement, the greater part of the assaying of the core and sludge samples was carried out by Mr.J.G.Hart in the Melbourne University Ore-Dressing Laboratory of the Council for Scientific and Industrial Research. The assaying of cores from three holes was done by Mr.W. St.C.Manson, Chief Chemist and Metallurgist, in the Tasmanian Mines Department Laboratory.

Fluorescence in Ultra-Violet Light. During the early part of 1942, Mr.J.M.Rayner, Chief Geophysicist, Mineral Resources Survey Branch, conducted investigations into the fluorescence of scheelite under ultra-violet light and it was decided to import Mineralight V.42 lamps. The first Mineralight lamp imported was taken immediately to King Island and used there during the drilling campaign. All cores were examined under it by C.L.Knight and quick visual estimates of the WO_3 contents were made. The results of subsequent assays indicated that these preliminary estimates were reasonably reliable for most of the core samples. The lamp was particularly useful in determining for sampling purposes the limits of high-grade, medium grade, low grade and barren bands. The Mineralight lamp was also made available to the Mine Manager to facilitate the working of the scheelite deposit, and is still in use. It was stated that the use of the lamp reduced the time necessary for the Quarry Foreman to determine working faces for ore to a fraction of that required without the lamp.

Geophysical Survey. A magnetic survey of the open-cut and the adjacent country was made by L.A.Richardson, Geophysicist, of this Branch in June-July, 1942. The results of this survey will be described in a separate report. A magnetic anomaly of high intensity was obtained on the hangingwall side of the scheelite deposit and as it arose from a bed of rock parallel to the deposit it forms an important marker. Unfortunately it has an abrupt termination at its western end - the direction in which it could be used to indicate the possible position of the ore zone - and the geological significance of this termination is not known. It is, therefore, not certain whether the western extension could be indicated, but further surveys are warranted.

Core Orientation. In order to determine the orientation of the cores and thus enable the amount and direction of dip to be determined in doubtful cases, a magnetic method of investigation was developed and used by L.A.Richardson. The results generally confirmed the interpretations of strike and dip based on geological evidence.

Mineragraphic and Petrological Determinations. Specimens of rocks and ores were determined by Dr.F.L.Stillwell, Mineragraphist, Council for Scientific and Industrial Research (Report No.251,1942). Other petrological determinations both in hand specimens and under the microscope were made by C.L.Knight. The determinations of L.L.Waterhouse (1916) were also used, particularly during the early stages of the investigation.

Calculations of Amounts and Grades of Ore. All calculations were made in the Mineral Resources Survey Branch, chiefly by Mrs.N. H. Ludbrook.

<u>Topographic Surveys.</u> During June-July, L.A.Richardson laid down the baseline and traverses for the geophysical survey. Stations on these traverse lines were used as control points in the geological surveys and formed the basis of the grid shown on mine plans. L.A. Richardson and, later, C.L.Knight determined reduced levels of the drill holes and other fixed points.

During December, G.E.Smith and L.Webberley of the Engineering School, University of Melbourne, made a topographic survey of the flat country to the north of the present treatment mill.

In February and March, 1943, D.R.Dickinson, Extension Officer of the Tasmanian Mines Department, made a comprehensive topographic survey around the mine for engineering purposes.

The reduced levels determined by the above investigators were used in the drawing of contours.

Some unavoidable delay occurred in the assaying of the samples for the last seven drill holes and results were not received until September, 1943. The completion of this report which is based upon the field surveys and the information obtained during the drilling campaign, was delayed until all the assay results were received. Progress reports were prepared in September and November, 1942, and February and April, 1943.

II. LOCATION, ACCESS AND LEASES.

(See Plate 1)

King Island is situated at the western end of Bass Strait and forms part of the State of Tasmania. The King Island Scheelite mine is situated at Grassy on the southeastern coast of the island.

Access to the mine is gained by road (16 miles in length) from Currie, a township and port on the western side of the island. There is a shipping service between Currie, Melbourne and Tasmanian ports, but only small vessels can enter the port. Owing to the unsheltered nature of the port, the regularity of the service is greatly affected by adverse weather conditions. Currie is also connected with Melbourne and Tasmania by an air service with, in normal times, three trips per week each way.

The mine and Currie are connected by road with Naracoopa, a port on the eastern coast. This port is exposed, but only affected by easterly weather. The depth of the water is greater than at Currie and larger vessels can berth at the pier.

There is no equipment for handling cargo on the piers at Currie and Naracoopa and the ship's gear has to be used. The small vessels at Currie can lift loads up to 5 or 6 tons, but the larger vessels which can enter Naracoopa would be capable of lifting loads up to 10 or 11 tons.

The mine is worked by the King Island Scheelite, N.L. This company holds mineral leases 220P/M of 218 acres, 219P/M of 53 acres, 11988/M of 10 acres, and 10W/41 of 1 acre and a water right (2933/W) on the Grassy River.

III. PREVIOUS LITERATURE.

Previous reports on this mine include printed Governmental reports, typewritten Governmental reports and typewritten private reports of mining engineers. The following list contains all known reports on the mine.

Debenham, F., Notes on the Geology of King Island, Bass Strait. Proc.Roy.Soc.N.S.W.,Vol.XLIV, 1910 (printed),pp.560-576.

Waterhouse, L.L., Tungsten and Molybdenum, Part III, King Island. Tas.Geol.Surv.,Mineral Resources No.1,1916 (printed).

Lavers, Herbert. Notes on Tungsten with Reference to King Island Scheelite Treatment and Assays of Low Grade Material. Proc.Aust.I.M.M. New Series No.43,1921 (printed),pp.101-152.

Nye, P.B., Report on the King Island Scheelite Deposits and Boring Campaign to Test Same. Tas.Geol.Surv.,1934 (typewritten).

Nye, P.B., King Island Scheelite Deposit. Chem.Eng. & Min.Review, Vol.XXVII, No.313, 8th Oct.,1934 (printed),pp.14-16.

Conder, Hartwell, Grassy Scheelite Mine, King Island, 1935, (private and typewritten).

Hitchcock, W.E., King Island Scheelite Development, N.L., Scheelite Mine, Grassy, King Island, Tasmania, 1935 (private and typewritten).

Hart, J.G. & Greenwood, Neill, J., Treatment of Scheelite Ore from King Island, Tasmania, C.S.I.R. and Univ. Melb., Ore-Dressing Investigation No.86, 12th October, 1937 (duplicated).

Hart, J.G. & Greenwood, Neill J., Treatment of Products from the King Island Scheelite Mine, King Island, Tasmania, C.S.I.R. and Univ. Melb., Ore-Dressing Investigations Nos.125, 126 and 127, 25th July, 1939 (duplicated).

Stillwell, Frank L., Table Tailings of Scheelite Ore from King Island, Tasmania. C.S.I.R. Mineragraphic Investigations Report No.157, 12th July, 1939 (duplicated).

Stillwell, Frank L., Note on the Composition of King Island Scheelite. C.S.I.R. Mineragraphic Investigations Report No.200, 30th November, 1940 (duplicated).

Hart, J.G. & Dunkin, H.H., Dressing of Scheelite Concentrates from the King Island Scheelite Mine, Grassy, King Island. C.S.I.R. and Univ. Melb. Ore-Dressing Investigation No. 181, 6th December, 1940 (duplicated).

Mawby, M.A. & Nye, P.B., King Island Scheelite Mine, King Island, Tasmania. Commonwealth Minerals Committee, 2nd May, 1942 (duplicated).

Nye, P.B., Preliminary Report on the King Island Scheelite Mine (with special reference to a proposed boring campaign). Min.Res.Survey,15th September, 1942 (typewritten).

Stillwell, Frank L., Rock Specimens from the Scheelite Mine and the Bismuth Products Mine, King Island, Tasmania. C.S.I.R. and Univ.,Melb. Mineragraphic Report No.251, 16th September, 1942 (duplicated).

Nye, P.B., Report on Overburden at the King Island Scheelite Mine. Min.Res.Surv., 11th November, 1942 (typewritten)

Hart, J.G. & Dunkin, H.H., On the Prospects of Applying Flotation to the King Island Scheelite Company's Ores with a Preliminary Survey of the Available Water Resources at King Island, Bass Strait. C.S.I.R. and Univ.Melb.Ore-Dressing Investigation No.225,(issued as part of No.251)16th November, 1942 (duplicated).

Hart, J.G. & Dunkin, H.H., Investigations into the Mill Performance and General Treatmnent of the Ores at the King Island Scheelite Company's Mill at Grassy, King Island. C.S.I.R. and Univ.Melb. Ore-Dressing Investigation No. 251, Interim Report No.1, 16th November, 1942 (duplicated).

Nye, P.B., Preliminary Report No.2 on the King Island Scheelite Mine, Min.Res.Surv., 2nd February, 1943 (typewritten).

Nye, P.B., Ore Reserves at King Island Scheelite Mine, Min.Res. Surv., 28th April, 1943 (typewritten).

Hart, J.G. & Dunkin, H.H., Investigations into the Mill Performance and General Treatment of the Ores at the King Island Scheelite Company's Mill at Grassy, King Island. C.S.I.R. and Univ.Melb. Ore-Dressing Investigation No. 251, Interim Report No.2, 14th June, 1943 (duplicated).

Hart, J.G. & Dunkin, H.H., Investigations into the Mill Performance and General Treatment of the Ores at the King Island Scheelite Company's Mill at Grassy, King Island, C.S.I.R. and Univ.Melb. Ore-Dressing Investigation No.251, Interim Report No.3, 2nd August, 1943, (duplicated).

IV. HISTORY AND WORKINGS.

(See Plate 2).

Scheelite was discovered at Grassy some time prior to 1910 as, in that year, Debenham (1910) reported that the deposit of scheelite had been worked for some time, but that the venture had apparently lapsed for want of capital. There is no information available as to the extent and scope of these early mine workings. In 1916 L.L.Waterhouse stated that the deposits were discovered by Mr.Tom Farrell and that they were developed by the King Island Prospecting Association until 1916. In February, 1917, the King Island Scheelite Company, N.L., was formed to work them. This company conducted active mining and treatment operations from the middle of 1917 to July, 1920, when due to the great decrease in the price of tungsten concentrate, operations became unprofitable and the company ceased working.

In the middle of 1934, Mr.W.E.Hitchcock became interested in the deposits and the King Island Scheelite Development Company was formed. In conjunction with the Department of Mines of Tasmania, a drilling campaign was arranged and seven drill holes were put down by that company during the latter half of 1934. No further work was conducted until 1938, when the present company (King Island Scheelite, N.L.) was formed. Mining and treatment operations were commenced in 1938 and have continued without interruption.

The discovery by Mr.Farrell is reported to have been situated on the beach, and to be visible only when the tide is extremely low. It is also reported that a small amount of work was done near high-water level, but the site is at present covered by beach sand, and the working is not visible. Immediately afterwards a shaft was sunk at a place about 80 feet inland and is said to have cut the same formation. The formation had a strike of about 300 degrees and further prospecting by adits and shafts was conducted farther inland and along the possible line of extension of the formation. During the course of such work, some of the garnet bodies that have been worked in the open cut, were discovered. The formation on the beach was a vertical one and quite distinct from the garnet bodies, and it is interesting to note that the prospecting along its possible extension led to the discovery of the larger and more important bodies.

At the time of the visit of Mr.L.L.Waterhouse in 1916, the mine workings consisted of five adits (two of which had already collapsed), the approach to an adit and three shafts. During the operations of the King Island Scheelite Company in 1916-1920, one of the earlier adits (Waterhouse's No.2) was extended and four other adits driven, one at No.2 level, two at No.3 level and one at beach level; at least twelve prospecting shafts were sunk; and an open cut with two branches (North and West open cuts) was excavated. Ore-breaking was conducted in the open cuts and the ore was trucked from the No.3 North and No.3 West adits.

The present company extended the No.3 North adit, drove adits at levels of approximately 45 feet and 170 feet, and recently completed the driving of another at the 90 foot level (No.3). In addition it sank prospecting shafts A, B, C and D, and in 1941-42 had 21 vertical percussion drill holes put down, the maximum depth of any hole being 100 feet. The company has extended the open cut and has cut benches at the 90, 120, 140 and 170 foot levels - the former 155 foot level is not being retained. In the open cut, mechanical shovels are used to load the ore and overburden into motor trucks which transport the material to ore bin and mullock dump respectively.

Because Waterhouse and Venn Brown (manager during 1917-1920) numbered the adits differently and because of the additional adits driven by the present company, it is deemed advisable to draw up the following suggested scheme for numbering the workings and levels. The table includes the numberings by previous investigators, so that ready reference can be made to previous reports and plans. Some of the older adits have been removed wholly or partly in the course of mining, while others have collapsed, and some are covered by dumps.

	SUGGESTED SCHEME		FORMER SCHEMES	
Reduced Level Portal (Ft.)	Level Number	Adit Numbers	Waterhouse	Venn Brown
170 (app.)	1	No.1	-	-
172 do.		Completely removed by mining.	No.3 adit	No.1 adit
129	2	No.2 (partly removed by mining)	No.2 adit	No.2 adit
		Completely removed by mining.	-	Adit above West open cut.
93	3	No.3 North	-	No.3 Level North.
92		- Centre.	-	-
89 (app.)		- West	-	No.3 Level West.
		(Partly removed and remainder collapsed)	No.1 aidt	No.3 adit
42	4	No.4	-	-
5 (app.)	5	No.5	-	Beach adit

The two adits already collapsed at the time of Waterhouse's visit are not included. The upper one is at a level of approximately 230 feet and is completely collapsed. The lower adit (Venn Brown shows two) is at a level of approximately 60 feet and is collapsed and covered by dumps.

For the remainder of this report the adits will be referred to by the numbers suggested above.

The above scheme could have been extended to the existing benches and numbers given to the latter. However, the existing benches will be destroyed by those which it is proposed to establish in the larger scale operations, and no advantage would have been gained. The existing benches will, therefore, be referred to by their present names, e.g. 170-foot bench. The reduced levels of these benches are shown on Plate 2.

The new benches will probably be at 0, 75 and 150 foot levels with subsidiary ones for removal of overburden and particularly of sand overburden.

For purposes of distinction, the shafts described by Waterhouse have been given the corresponding Roman numerals; those sunk by Venn Brown retain their Arabic numerals; and those sunk by the present company retain the letters given them.

To distinguish the 1934 drill holes from the later ones, they have been given the corresponding Roman numerals. The 1941-42 and 1942-43 drill holes have been numbered consecutively in Arabic numerals.

V. PRODUCTION.

The production during the two periods of working, as obtained from the statistics of the Department of Mines, Tasmania, is given in Tables 1 and 2.

Table 1.

Year	Ore Treated Tons	Concentrate Produced Tons	Yield of Concentrate Per Cent.	Approx. Value of Concentrate £	Dividends £
1917	4,937	69	1.40	12,130	5,000
1918	21,088	216	1.22	39,254	10,000
1919	27,832	199	0.71	43,181	5,000
1920	13,853	105	0.76	17,905	5,000
Total:	67,710	589	Av. 0.87	112,470	25,000

Table 2.

Year	Ore Treated	Concentrate Produced	Yield of Concentrate	Approx. Value of Concentrate	Dividends
	Tons	Tons	Per cent.	£	£
1938	9,705	30.53	0.31	6,193	Nil
1939	28,870	170.69	0.59	33,301	6,250
1940	35,000	275.48	0.79	49,120	15,625
1941	29,810	246.86	0.83	42,700	3,125
1942		215.33		73,353	
1943 Jan.-June		108.49		37,600	
Total:		1047.38		240,267	

The company's figures for the latter period are given in Tables 3 and 4.

Table 3.

Year Ended	Ore Treated	Concentrate Produced	Yield of Concentrate	Approx. Value of Concentrate	Nett Profit (without depreciation & Income Tax Charges.)
	Tons	Tons	Per Cent.	£	£
31/10/38	5,845	27	0.46	6,092	1,065
31/10/39	27,670	168	0.61	38,330	14,680
31/10/40	35,600	228	0.64	53,484	24,970
31/10/41	29,190	204	0.70	44,295	11,191
31/10/42	32,200	243	0.75	97,118	58,358
31/10/43	29,710	189	0.63	81,721	36,514
Total:	160,215	1,059	0.66	321,040	146,778

In addition a tailings re-treatment mill was operated and gave the results shown in Table 4.

Table 4.

Year Ended	Tailings Re-Treated	Concentrate Produced	Yield of Concentrate	Approx. Value of Concentrate	Nett Profit (without Depreciation & Income Tax Charges)
	Tons	Tons	Per Cent.	£	£
31/10/40	22,390	35	0.16	7,944	5,724
31/10/41	18,870	17	0.09	3,741	1,996
Total:	41,260	52	Av. 0.12	11,685	7,720

Using Tables 1, 3 and 4 the total amount of ore treated to 31/10/43 has, therefore, been 227,925 tons and from it has been obtained 1,700 tons of scheelite concentrates, the average yield being 0.75 per cent.

VI. GEOLOGY.

(See Plates 1,3,4,6,7 and 9-12).

A. Introduction.

The rocks in the mine workings and to the west, north and northeast, are chiefly hornfelses of the Grassy series. To the south-southwest and west of the mine, these rocks are intruded by granite. Adjacent to the granite-hornfels contact, the latter are intruded by numerous dykes of porphyry and aplite. Over a large part of the area the hornfelses and granite are overlain by superficial deposits of sand, etc. of Recent age.

Because of the layer of sand and the well-soiled nature of the surface in most places where the sand is absent, outcrops of the older rocks are scarce, and determination of the geological structure outside the mine workings was rendered impossible in most places. Exposures in the mine workings and information obtained from the cores of the diamond drill holes, however, made it possible to determine in some detail the structure in, and near, the mine workings.

A general surface geological map of the area is included in Plate 1. A surface geological map of the open cut and immediate vicinity is shown on Plate 3. It includes all surface geology available for inspection from June, 1942 to May, 1943. Geological sections are shown on Plates 4, 6 and 7 and are based on information obtained from examinations of the cores from the drill holes, and supplemented wherever possible by information from mapping on the surface and in adits. To make each section complete and continuous, the geology between adjacent drill holes and exposures has been inferred. The level plans on Plates 9 to 12 are based almost entirely on the sections and the geology between section lines has been inferred. It is unlikely, however, that inferred geology will be found to be much in error. The largest errors are likely to be found in the positions of inferred boundaries between the two grades of ore shown and of the calcite-hornfels.

B. Grassy Series.

(1) General. As indicated above, the rocks of this series occupy

a large tract of country to the west, north and northeast of the mine. They are cut off on the south by the granite, the contact having a general westerly trend.

The No.3 fault divides the rocks into two groups which differ lithologically from each other. This fault is a major one with a displacement amounting to at least several hundred feet and the two groups were originally widely separated stratigraphically. North of the No.3 fault the rocks in the scattered outcrops have a common strike of about 30 degrees and a dip of about 30 degrees to the southeast, and apparently form part of one series. In the exposures of these rocks in the mine workings, the predominant type is a massive white muscovite-quartzite, spotted in places, and with some dark bands. On the shore immediately north of the re-treatment mill, there is a small outcrop of metamorphosed argillaceous sediments with a development of andalusite. On the hill slopes 1,000 feet north and northeast of the mine, dark, bedded biotite-hornfelses outcrop. To the east and beyond the mouth of the Grassy River, (i.e. higher in the series), conglomerate is interbedded with dark hornfels, and, farther along the coast near Bold Head, the series includes volcanic rocks (probably andesite). If there is no faulting or folding, the rocks in this region represent a thickness of about 3,000 feet of strata.

On the southern side of the No.3 fault there is an abrupt change in strike and also in lithology. The strikes and dips are described under Structural Geology (Section VII.). Here, as on the northern side, regional and contact metamorphism have altered the original rocks to hornfelses, but superimposed on this change is the effect of intense and consistent pyrometasomatism, accompanied by scheelite mineralisation, of almost all beds within a defined stratigraphic zone. This has resulted in the formation of a large variety of hornfelses, in which actinolite, biotite and quartz are the dominant minerals outside the mineralised zone, while garnet and pyroxene are dominant inside the mineralised zone.

The diamond drilling has established the fact that there is a well-defined succession of rocks across the mineralised zone. The complete succession persists throughout the known length (1,400 feet) of the deposit in the southern portion of the drilled area. In the northern portion, the upper beds have been removed by overthrust faulting. In most places in the mine workings, the succession across the mineralised zone is interrupted by major faults. In the few places where the succession is not interrupted, it is possible to select two traverses along which exposures of the greater part of the zone can be seen in the open cut and the adits. One such traverse is approximately along section line 13 and the other is about midway between, and parallel to, section lines 11 and 12.

This report is concerned mainly with the rocks south of the No.3 fault and particularly with those of the mineralised zone. They represent a thickness of about 700 feet of which 400 feet is known in some detail from the results of the diamond drilling. These rocks are described in detail below.

(2) Rocks South of No.3 Fault. The succession and the rock types will be described in order from the hangingwall to the footwall side.

(a) Hangingwall Rocks.

(i) All outcrops of hornfels on the hangingwall side of the mineralised zone consist of massively bedded actinolite-hornfels and biotite-hornfels. Spotted fine-grained biotite-hornfels outcrops near the stables, and drill hole No.49 in the same general area passed through actinolite-hornfels, biotite-hornfels and spotted hornfels similar to the above. Outcrops on the shore south from the tailings mill are mainly of spotted biotite-hornfels.

On the ridge west of the gully 20 chains west from the open cut, outcrops and fragments of actinolite-hornfels are well distributed and can be traced southwards to the granite contact.

(ii) Rocks above No.8 Overthrust Fault. The rocks forming the overburden in the open cut have been brought to their present position by the No.8 overthrust fault. They represent some portion of the rocks on the hangingwall side of the mineralised zone, but their exact horizon is not known.

These rocks are exposed on the western and northern faces of the 140-foot bench and along the northern faces of the 155 and 170-foot benches.

Where not mineralised the rock is soft and generally foliated, and has been identified by Stillwell (1942) as a biotite-actinolite-hornfels.

Over the southwestern portion of the 140-foot bench face, mineralising solutions have altered the hornfels to a soft green rock which contains scheelite.

In the western face of the 140-foot bench, the strike is about 280° and the dip vertical. North of the No.2 fault, the strike and dip cannot be satisfactorily determined, but the dip may be to the south at moderate to high angles.

(iii) Calcareous Hornfels. Drill hole No.48 passed through about 48 feet of light coloured, thinly bedded, calcareous hornfels of a type somewhat different from those in the mineralised zone. The bottom of the hole is approximately 60 feet above the top of the pyroxene-garnet-hornfels. The rocks are interbedded with the actinolite-hornfels described in (i) above and (iv) below.

(iv) Actinolite-hornfels. In the immediate vicinity of the hangingwall of the mineralised zone, the country rock is not exposed, but was intersected in all except one of the southernmost drill holes. It consists typically of a hard, fine-grained, massive, dark grey to black actinolite-hornfels with no trace of bedding. In thin section, pale green pleochroic actinolite and quartz make up the bulk of the rock, actinolite predominating. Usually some of the actinolite is idioblastic. Iron ore is abundant. Biotite is, for the most part, only a minor constituent, but in places becomes important, e.g. in hole 56.

It is considered that the actinolite-hornfels was formed by the metamorphism of very thickly bedded and fine-grained dolomitic sandstones generally with little or no argillaceous matter but with a higher content of the latter in some places.

In the area north of the Nos.2 and 5 faults, and in the vicinity of section lines 2, 3 and 4, there is a somewhat smaller development of actinolite-hornfels. It occurs above the mineralised rocks, but, as indicated above (in ii), the upper beds of the normal succession have been removed by the No.8 fault, and its horizon is not quite analogous to that of the hangingwall actinolite-hornfels. The rock is exposed on the road between the 155 and 170-foot benches, and above the latter, and was intersected in drill holes 24 and 26. It is a hard massive actinolite-hornfels containing biotite. It is possible that the formation of the actinolite-hornfels between the 155 and 170-foot benches was associated with the mineralisation.

(b) Pyroxene-garnet-hornfels (Hangingwall type). The actinolite-hornfels is underlain by pyroxene-garnet-hornfels. Typical sections are exposed in the eastern and southwestern ends of the open cut. On the northern side of the cut there is only a minor development between the ore-bearing section and the overlying actinolite-hornfels. On the southern side, the thickness ranges up to 52 feet, but in most places is between 27 and 45 feet and averages 37 feet. The variation in thickness is due to the irregularity of the upper boundary. The lower boundary is regular and follows a bedding plane.

In its typical development in the southern side of the open cut, the rock is massive with no trace of bedding and is very hard and tough. It is light pinkish-brown and pale green in colour, one or other colour prevailing at different places, and it has a vitreous appearance. It also has a finely mottled appearance due to the segregation of the two chief constituents into clusters of very small grains.

In thin section, granular garnet and diopside are seen to be the predominant minerals with a little interstitial quartz and calcite and occasionally cloudy felspar. The garnet usually has numerous minute inclusions. Iron ore is almost entirely lacking. Refractive index determinations indicate that some at least of the garnet is aluminous.

A characteristic feature of the rock is the presence of irregularly ovoid patches of coarser grain size. These patches range in diameter from a fraction of an inch to several inches. Quartz and/or calcite occupy the centres and are separated from the main rock by a fringe of brown garnet. An analysis by J.G. Hart of light brown garnet from one patch showed it to be grossularite with 7.63 per cent. Fe_2O_3 replacing Al_2O_3 (Table 5, No.5). Much of the garnet is darker than the specimen analysed and presumably has a higher Fe_2O_3 content and approaches andradite. Stillwell (1942) reported felspar and wollastonite from one patch. The occurrence of scheelite in the rock is restricted to these patches, in which it is commonly present as relatively coarse grains on the garnet rim.

In some places the pyroxene-garnet-hornfels includes relics of the original actinolite-hornfels (from which it was formed), and, in one or two places, is represented for the most part by only partially altered actinolite-hornfels. The portion which most commonly remained unaltered lies about 10 feet above the base, and one particular schistose band 6 to 24 inches wide is very persistent.

The cause of this variability is not altogether apparent. Variations in the mineral composition of the actinolite-hornfels appear to have had some effect, the presence of biotite apparently inhibiting change to some extent. Probably a more important factor was the amount of pre-mineralisation shearing in the actinolite-hornfels. Where such shearing extended into the hornfels normally above the pyroxene-garnet-hornfels, diopside and, in some cases, garnet have developed up to as much as 25 feet above the top of the latter. The upper portion of the pyroxene-garnet-hornfels is marked in some drill holes by pre-mineralisation fracturing, and brecciation is common within what is now the pyroxene-garnet-hornfels. This provides evidence that movement played some part in the formation of the pyroxene-garnet-hornfels.

All degrees of alteration are represented in the pyroxene-garnet-hornfels. The least altered type is an actinolite-hornfels with green actinolite which has a more intense colour and higher absorption than the normal actinolite and therefore has a higher iron content. The iron may have been derived from accessory iron ore present in the actinolite-hornfels. A more altered type is the pale green diopside-hornfels with a small garnet content, and which forms an appreciable portion of the whole. The diopside developed at the expense of the actinolite. With increase in the garnet content, the typical pyroxene-garnet-hornfels is formed. The introduction of calcite accompanied the alteration.

The ovoid patches referred to above (p.12) are present even in the less altered types. In the least altered type, the patches consist of calcite but in the more altered types the calcite is surrounded by rings of grossularite and diopside. Scheelite is present in extremely narrow veins of calcite and also in the ovoid patches, but only where the latter contain garnet.

(c) Top Orebody. The pyroxene-garnet-hornfels has a sharp contact with the underlying coarse garnet-hornfels which, together with as much as ten feet of garnet-pyroxene-hornfels, etc. on its footwall side, constitutes the Top orebody. This orebody is a very persistent band with a thickness of about 30 feet in the central and eastern portions, but is considerably thinner in the western extension.

(i) Garnet-Hornfels. In hand specimen the garnet-hornfels is uniformly coarse in grain and almost black in colour. It contains interstitial quartz and calcite, not commonly conspicuous in hand specimens but prominent in the cores, to which it gives a mottled appearance. The garnet has crystal faces well developed against the quartz and calcite. The description below is taken from the report by Stillwell (1942).

> "These rocks consist essentially of coarse crystals of brown to greenish garnet carrying crystals of scheelite, and accompanied by lesser amounts of calcite, epidote, zoisite, quartz, diopside and green mica or actinolite. They also contain a little scattered pyrite. The garnet crystals may be 5 mm. in diameter and show pronounced zoning. The depth of the colour in the garnet varies considerably and is reflected in the rocks which appear brown or black. The scheelite grains frequently possess their crystal form and range in size from 0.2 mm. down to 0.05 mm. For the most part they occur as inclusions in the garnet and are often numerous. Occasionally they occur at the margin of garnet and calcite, but they are rarely completely enclosed in the calcite. On the other hand they are sometimes abundant in the interstitial quartz and still attain their crystal outlines. The quartz sometimes seems to have corroded the garnet along zones close to the margin of the garnet crystals. Numerous small patches of greenish material, often pleochroic from green to brown, are enclosed in the garnet. In some cases patches are pseudomorphous after diopside and may contain relics of the altered diopside. Some of this material is fibrous green actinolite. Some is chloritic and some may be biotite. Diopside may be present as scattered grains much smaller than the garnets".

An analysis of a piece of the quartz-free garnet-hornfels made by J. G. Hart is given as analysis 1, in Table 5. Two analyses (3 and 4) of garnet concentrates made by H. Lavers in 1921 are also given and agree closely with that by Hart. The garnet is almost pure andradite. This variety of garnet is the one most commonly reported from pyrometasomatic deposits.

Table 5.

	1	2	3	4	5	6	7
SiO_2	36.8	36.2	34.83	34.00	39.4	35.95	39.55
Al_2O_3	6.65	6.4	2.84	4.01	13.3	12.4	14.8
Fe_2O_3	21.40	20.74	25.35	24.34	7.63	8.6	7.50
FeO	3.95	3.25	1.72	1.26	5.10		2.6
MnO	0.15	0.1	1.28	2.06	0.1	0.65	0.1
CaO	28.95	30.1	32.26	32.61	27.5	36.5	29.9
MgO	0.6	0.95	Trace	0.42	0.95	2.9	0.6
Na_2O	n.d.	n.d.	0.17	0.18	n.d.	n.d.	n.d.
K_2O	n.d.	n.d.	1.10	1.00	n.d.	n.d.	n.d.
TiO_2	n.d.	n.d.	0.26	0.34	n.d.	n.d.	n.d.
WO_3	n.d.	n.d.	n.d.	0.26	n.d.	n.d.	n.d.
H_2O (hygro)	-	-	0.03	0.02	-	n.d.	n.d.
H_2O (comb.)	-	-	0.37	0.36	-	n.d.	n.d.
Ign.loss	2.6	2.95	-	-	1.15	n.d.	0.75
Total:	101.1	100.7	100.21	100.86	95.13	97.0	95.8

1. Specimen of quartz-free garnet-hornfels from Top orebody, southern side, 120-foot bench, analysis by J.G.Hart, 1943.
2. Dark garnet from garnet-pyroxene-hornfels, Bottom orebody, Drill Hole No.53, 59 feet depth, analysis by J.G.Hart, 1943.
3. Coarse garnet rejects from electro-magnets, analysis by H. Lavers, A.I.M.M. No.43, 1921.
4. Fine garnet rejects from electro-magnets, analysis by H. Lavers, A.I.M.M., 1921.
5. Garnet from coarse patch in pyroxene-garnet-hornfels, southern side, 140-foot bench, analysis by J.G.Hart, 1943.
6. Garnet from thin seam in calcite-hornfels, Drill Hole No.52, 77 feet depth. analysis by J.G.Hart, 1943.
7. Light brown garnet from band in Bottom orebody, below Vaudeau's adit, analysis by J.G.Hart, 1943.

(ii) Calcite-Hornfels. In one place calcite-hornfels occurs to the exclusion of garnet-hornfels. It was intersected in the No.4 adit and Drill Hole No.43 in the eastern end of the mine. It is a coarse-grained white to grey rock consisting very largely of calcite with a minor amount of diopside, etc.

(iii) Garnet-Pyroxene-Hornfels, Etc. The footwall portion, about 7 feet wide, varies in rock type from place to place, but a garnet-pyroxene-hornfels is the most common type. This section resembles the Bottom orebody.

(d) Marker Beds. Under this heading is grouped a suite of hornfelses essentially non-garnetiferous and non-mineralised, and constituting a band about 13 feet thick between the Top and Bottom orebodies. This band, like the Top orebody above it, persists throughout the proved length of the mineralised zone, although it thins in the western extension and looses, to a large extent, its characteristic cross-section. It represents a thin band in the rocks which was affected only to a minor degree by the mineralising solutions. The two characteristic rock types are a green-spotted or streaked calcite-hornfels and a black biotite-quartzite. The normal section is as follows:-

(i) Biotite-Quartzite. A band of this rock, less than a foot in thickness, commonly forms the footwall of the Top orebody. This band has been mapped in the open cut north and south of the No.2 fault, in the No.3 west adit between Nos.2 and 7 faults, and on the northern side of the 90-foot bench north of the No.5 fault. Further, several of the drill holes on the southern side of the drilled area passed through it, demonstrating its remarkable persistence. Mineralogically it resembles the main biotite-quartzite band (see (iii) below).

(ii) Spotted Calcite-Hornfels. This type of hornfels is found in many places between (i) and (iii); green pyroxene-hornfels is commonly associated with it. It is usually grey and fine-grained with characteristic green spots or irregular green streaks. The green mineral, in many instances, is soft and under the microscope is seen to be micaceous. Weathering reduces the rock to grey or brownish clay, but the spots are still discernible. At no other horizon, except in Drill Hole No.38, is this rock repeated.

(iii) Biotite-Quartzite. In the central portion of the mineralised zone, both north and south of No.2 fault, a bed of biotite-quartzite approximately six feet thick forms the lower half of the Marker beds. In the eastern end, it splits into two or more narrow bands with interlaminated calcite-hornfels, pyroxene- or pyroxene-garnet-hornfelses and, in one or two places, bands of ore.

Typically the rock is black, fine-grained and fissile along the original bedding. The fissility is due to the parallel orientation of biotite flakes which impart a brilliant sheen to pieces broken along the bedding planes. More siliceous and finer-grained types are found without marked parallelism of mica.

In thin section the rock consists almost entirely of biotite and quartz with iron ore and, in some sections, small amounts of diopside or actinolite. Strings of minute granules indicate original bedding.

(e) Bottom Orebody. The bottom orebody is that portion of the mineralised zone between the overlying Marker beds and underlying Transition section. Actually the base of the orebody has been regarded as being determined by the uppermost band of unmineralised footwall-hornfels. It is well bedded and contains several types of hornfelses. Where the mineralised zone is not affected by the No.8 fault, i.e. in the southern part of the drilled area, the thickness ranges from 48 to 110 feet. Where the zone is affected by the No.8 fault the thickness ranges down to nothing.

Except for the bodies of calcite-hornfels (which have been metamorphosed but not otherwise altered), most of these hornfelses contain garnet, and, in probably 50 per cent. of the orebody, garnet preponderates.

The garnet-bearing hornfelses range in mineral composition from coarse blackish-brown garnet-hornfels, similar to that of the Top orebody, to a fine-grained almost vitreous rock of greenish colour with garnet subordinate to diopside. An intermediate type of finer grain than the Top orebody, and with a slightly greenish tinge, due to the presence of diopside, actinolite and perhaps green garnet, is the most common type and to this, in core logging, the name garnet-pyroxene-hornfels was applied. The term pyroxene-garnet-hornfels was applied as a field term to the fine-grained rocks. Apart from the garnet-bearing rocks, there are narrow bands of green pyroxene-hornfels (normally associated with unaltered biotite-quartzite bands), coarse-grained green and white calcite-actinolite-hornfels and calcite-hornfels.

Brief descriptions of the important types are given below.

(i) Garnet-hornfels is dark brown in colour and has the coarse mottling of quartz and calcite characteristic of the Top orebody. The garnet is andradite. The hornfels occurs as narrow bands and forms the richest ore in the Bottom orebody. The scheelite is disseminated as fine grains through the andradite and the quartz.

(ii) Garnet-pyroxene-hornfels is brownish, with a tinge of green, but in places is distinctly green in colour. The grain-size is coarse, though finer than in (i). Quartz-calcite mottling is lacking, though these minerals have been detected under the microscope. There is usually a distinct and fairly fine (half-inch) banding due to varying grain-size and mineral composition. The dip of this banding remains uniform or only slightly variable throughout considerable thicknesses and agrees with the dip of unaltered bands of biotite-quartzite, etc. It has been interpreted as an original thin bedding in sediments which varied in composition from band to band (c.f. foot-wall rocks in sub-section (g) below).

Garnet is the predominant mineral, with small amounts of diopside, actinolite, epidote, chloritic material, scheelite and sulphides, mainly pyrite. The garnet is of the same type as the Top orebody, viz. andradite (see analysis 2, Table 5.).

The scheelite content is lower than that of the garnet-hornfels, though it occurs in the same way, namely as fine disseminations through the rock.

(iii) Pyroxene-garnet-hornfels consists mainly of fine diopside and light-coloured grossularite garnet. It occurs throughout the orebody, mostly in narrow bands, and nowhere carries scheelite.

(iv) Pyroxene-hornfels and Biotite-quartzite. The latter rock is similar to that of the Marker beds, but is present in only thin bands except in the north crosscut from the No.3 Centre adit, in which a thickness of at least 8 feet is exposed. Pyroxene-hornfels is a normal associate. These rocks contain no scheelite.

(v) Calcite-actinolite-hornfels. The rock is green and white, or, in some places, dark green. In many places bedding is well developed. The green colour is due to the presence of abundant green amphibole - the other minerals being calcite, quartz, diopside, sphene, scheelite and, in some cases, garnet. The scheelite usually occurs as coarse grains.

This rock forms only a minor percentage of the orebody and is found at several different horizons in the central and western portions of it. Wherever found it is apparently only a local development and seems to represent a distinct type of alteration rather than distinct beds. There is some suggestion of association of this rock with the large relics of calcite-hornfels.

(vi) Calcite-hornfels. The rock is light grey to white in colour. It is exposed only in four places, but is cut in several drill holes. Bedding is well developed in the No.3 Centre adit. Im the cores, bedding is indicated by the thin seams of grossularite garnet, (Table 5, analysis 6), and microscopically by the orientation of strings of mineral grains (Stillwell, 1942). This hornfels consists very largely of interlocking grains of calcite and is always barren of scheelite. The greatest thickness of this rock was pierced in Drill Hole No.30 where it forms 58 per cent. of the Bottom orebody. Smaller thicknesses were pierced elsewhere in the central and extreme western sections.

(f) Transition Section. The transition from the ore-bearing section to unmineralised rock on the footwall side differs from that on the hangingwall side. The latter is represented by the pyroxene-garnet-hornfels. The difference is due partly to the well developed and thin bedding of the rocks on the footwall side and partly to the interbedding of different rock types in contrast with the lack of bedding and uniform composition respectively of the hangingwall rocks. Another factor is the greater alteration by mineralising solutions of the hangingwall rocks.

The basal portion of the Bottom orebody, varying up to 15 feet in thickness, in many places contains little garnet, and fine-grained pyroxene-hornfels or pyroxene-garnet-hornfels preponderates.

Stratigraphically below these hornfelses is a section (Transition section) in which footwall hornfels (see (g) below) is interbedded with narrow bands of some of the rock types which occur in the orebody above, i.e. garnet-pyroxene-hornfels, calcite-hornfels, pyroxene-hornfels and pyroxene-garnet-hornfels.

The footwall-hornfels is described under (g) below. It has not been affected as a whole by mineralising solutions, but over narrow widths has been altered to a green pyroxene-hornfels containing pyrrhotite.

Garnet-pyroxene-hornfels is the next most abundant rock type. It is similar to that in the Bottom orebody and is the only scheelite-bearing rock of the section. In several of the drill holes, thin bands of calcite-hornfels, normally less than a foot thick, were intersected.

The thickness of the section varies from a few to 35 feet.

(g) Footwall Rocks. Footwall rocks are exposed in only two places, viz. in the No.3 Centre adit and No.3 North adit, and, in both places, over only short distances. Almost all the information concerning them has come from the examination of cores from the drill holes. These footwall rocks are uniform in type throughout the length of the drilled area and throughout the maximum stratigraphic thickness pierced - 150 feet.

The predominant rock type is a thin-bedded actinolite-biotite-hornfels (footwall-hornfels) altered here and there to green pyroxene-hornfels. A very subordinate amount of massive biotite-quartzite and a few narrow bands of garnet-pyroxene-hornfels are interbedded.

In thin section, the banding is well marked, the thickness of individual bands ranging down to microscopic dimensions. Some of these consist of interlocking fine actinolite prisms and quartz with a little iron ore. In others, various proportions of biotite are present. A few thin seams are made up almost entirely of biotite. There can be no doubt that this banding represents original bedding.

This actinolite-biotite-hornfels has been produced by regional and thermal metamorphism. It has been altered to a minor degree by mineralising solutions, two types of alteration being noted:-

(1) Garnet-pyroxene-hornfels and pyroxene-garnet-hornfels are developed, being associated with calcite-hornfels in some places, but more commonly not. A few bands were met with to the greatest depth pierced, i.e. 150 feet below the Transition section.

(2) The development of light green bands with, usually, associated pyrrhotite. This development is fairly extensive in some sections, and bands from half an inch to three inches thick are affected. Under the microscope the resultant rock is seen to consist very largely of pyroxene granules and quartz.

Both types of alteration are commonly present where some bedding-plane movement has taken place, indicated by small differences in dip above and below the altered band.

3. Age. The age of the Grassy series cannot be determined. No fossils have been found in these rocks, and, because of the degree of metamorphism, it is unlikely that any contained in them would have been preserved.

The rocks are intruded by granitic rocks, the age of which also is not known. Most Tasmanian granites are regarded as being of Devonian age, but it is possible that a Lower Palaeozoic granite may also be present.

In comparison with Tasmanian rocks on general lithological and structural features, the age of the Grassy series is probably very low in the Lower Palaeozoic. Comparison with Victorian rocks also suggests a similar age.

C. Granitic Rocks.

Granitic rocks occur along the shore to the southeast of the mine at intervals as far at least as the Jetty point some 30 chains distant. Similar rocks outcrop in the southwestern portion of mineral lease 220P/M, some 30 chains to the west of the open cut. These two areas of granitic rocks are probably portions of a much larger body. This body occurs to the south of the Grassy series, and the junction has a general trend of 330 degrees. On the coast immediately to the southeast of the mine, a dyke, about 200 to 300 feet wide, of granitic rock has a general strike of 50 degrees and traverses the hornfels exposed on the beach. Along the shore south of this dyke, innumerable narrow veins and dykes of granitic rocks penetrate the hornfels.

In the mine workings, there are numerous narrow and irregular dykes and sills of acid rock ranging in type from an aplite to a medium-grained porphyry. The widest and longest of these dykes occurs on the 90-foot, 120-foot and 135-foot benches in the eastern part of the open cut. These dykes and sills traverse all the rocks in the mineralised zone, the actinolite-hornfels which forms the hangingwall on the southern side of the open cut, and the biotite-actinolite-hornfels on the northern side of the cut.

At the western end of lease 220P/M, a narrow dyke of quartz porphyry outcrops for approximately 20 chains. It has a general east-west strike and is situated several chains north from the boundary between the granite and the actinolite-hornfels. Pieces and boulders of aplitic rocks occur to the northwest and west of the Manager's house and represent either a continuation of the above dyke or one or more parallel dykes.

The field occurrences described above indicate clearly that the granitic rocks are intrusive into the Grassy series and, therefore, younger than the latter.

D. Recent.

The surface of much of the country is covered by sand probably largely wind-borne from the adjacent coast. The sand extends to heights of at least 260 feet above present sea level. It is thickest immediately to the west of the western part of the open cut where it attains a thickness of 80 to 90 feet. To the north, the thickness decreases and is usually between 5 and 10 feet.

In the southern part of the open cut, conglomerates, grits and clays occur as in-fillings of a former gully. These are probably of marine origin and were deposited when the sea covered this portion of the island. The deposits in the gully extended to a height of 140 feet above the present sea level and had a maximum thickness of about 50 feet.

VII. STRUCTURAL GEOLOGY.

A. General.

The general structure of the area is simple. The stratified rocks have been folded but not intensely. Much faulting occurs in the mine workings and it is probable that the rocks are extensively faulted throughout.

One large intrusion and numerous dykes and sills of granitic rocks occur.

Thin layers of wind-blown sand cover much of the surface, and gravels and clays occur in gullies and along the coast.

B. Folding.

On the coast to the southeast, and on the hills to the north and northeast, of the mine, the general strike of the stratified rocks is 20 to 30 degrees and the dip is to the southeast at 30 to 40 degrees. Similar strikes and dips continue as far as Bold Head about two miles to the east-northeast of the mine. Further, it would appear from Debenham (1910) that such strikes and dips are the prevailing ones along the eastern side of the island.

In the mine workings, the directions of strike and dip differ considerably from the above. The westernmost drill holes indicate that the strike there is about 270 degrees. In the western part of the mine workings, the strike is about 285 degrees, and the dip is to the south at angles ranging from 40 to 70 degrees. Towards the eastern end of the workings, the strike changes to 230 degrees and the dips are to the southeast at 40 degrees. This change in strike occurs within a distance of 50 feet near the No.7 fault and represents a shallow fold in the rock. In the extreme northeastern portion of the workings, the strike changes to 300 degrees and the dip is to the south at 40 degrees. This change occurs over only a short length between the Nos.4 and 3 faults and is probably caused by the latter fault.

A minor anticlinal fold occurs on the southern side of the No.2 fault in the western portion of the open cut, and represents a drag-fold caused by movement along that fault. The folding extends to distances of 20 to 25 feet southwards from the fault.

Other cases of probable drag-folding by faults are on the southern side of, and adjacent to, the No.3 fault in the No.3 North adit, and on the northern side of, and adjacent to, the No.5 fault in the North crosscut from the No.3 Centre adit.

C. Faulting.

Numerous faults are present in the rocks in the open cut and the probable presence of others has been deduced from the geological structure as revealed by the surface exposures and the information obtained from the diamond drill cores. These faults include at least five major faults and many minor ones.

All the faults cut across the beds and are diagonal faults, but a few, e.g. Nos.2, 7 and 5, in part of their length approach dip faults. Excepting No.8 and probably No.3, the faults appear to be normal and of the dip-slip type. This is certainly true for No.2 fault as the drag-folding indicates vertical movement. Some of them, e.g. Nos.5 and 7 have almost vertical dips and the displacement could be consistent either with dip-slip or strike-slip faults.

No.8 is a reverse fault representing a low angle overthrust. No.3 is probably also a reverse fault, but the only evidence of the type of fault and direction of movement is the small amount of drag-folding on the hangingwall, or southern, side which suggests that the southern side moved up. If such is the case, the two faults with largest displacement are reverse faults.

The No.8 fault is displaced by the Nos.2 and 5 faults and is, therefore, one of the earlier ones. As No.8 is a reverse fault, the occurrence is in agreement with the statement by Lahee (1941) that "in a given region, tension faults are usually younger than compression faults". No.3 fault may, therefore, also be one of the earlier ones.

No.8 fault is earlier than the mineralisation (unless there are two periods of scheelite mineralisation) and, from the above reasoning, No.3 may also be. The occurrence of quartz-sulphide veins along Nos.2 and 8 faults provides evidence that some of the mineralisation is later than the faulting.

<u>The No.1 fault</u> is exposed on the northern face between the 90 and 120-foot benches. It has a general northerly strike and probably a vertical dip. The strikes of the rocks to the east and west of the fault differ considerably. It was at first thought that much of the change of strike in the eastern portion of the open cut was caused by this fault, but this was later proved incorrect.

This fault is, therefore, not regarded as so important as was at first thought. Where exposed between the 90 and 120-foot benches, the fault has a quartz vein associated with it. The fault cannot be seen elsewhere, but a quartz vein is present at several places, generally along the possible northern extension of the fault. Such places are in the No.3 Centre and the No.3 North adits, and the mine staff reports that a similar quartz vein extended up the northern face between the 120 and 170-foot benches - this portion of the face is at present covered by detritus.

The No.2 fault is one of the major faults. It has a strike of 310 degrees and a dip of 48 degrees to the northeast. It is exposed in the western faces between the 120 and 140-foot benches, between the 140 and 170-foot benches and was exposed in the western face between the 140 and 155-foot benches. Its extensions along this strike, both to the northwest and the southeast, have been proved generally by the drill hole/formation. in/ The downthrow is on the northeastern side and the displacement down the surface of the fault is 60 to 70 feet. The beds on the southern side of the fault have been drag-folded into a small anticline, the folding extending to distances of 20 to 25 feet from the fault. Several minor faults (either parallel or branching) are associated with the No.2 fault and are chiefly on its southern side. The No.2 fault displaces the No.8 fault, but is apparently more or less contemporaneous with the Nos.5 and 7 faults with which it forms a network or system. An irregular quartz vein with an appreciable sulphide content is associated with the No.2 fault in the western faces between the 120 and 140-foot benches and between the 140 and 170-foot benches. Drill Hole No.41 probably intersected this fault, hole No.56 possibly intersected it and hole No.32 was probably very close to the faulted zone associated with No.2 fault. Quartz and sulphides were intersected in holes 41 and 56 at the places where it is considered that the No.2 fault was intersected.

The No.3 fault is probably the largest and most important fault in the mine workings. It has a general strike of 293 degrees (range from 270 to 310 degrees) and a dip to the south-southwest of 50 to 70 degrees. The rocks of the mineralised zone and the footwall occur on the southern side of, and are terminated by, this fault. On the northern side of the fault, the rocks are white and spotted quartzites (muscovite-hornfels, etc.) quite different from any in the mineralised zone and do not appear to be mineralised to any important degree, if at all. The rocks of the mineralised zone have a general strike of 270 degrees and those to the north of the No.3 fault have a strike of 20 to 30 degrees. The exposures in No.3 North adit show a decrease in the dip as this fault is approached and suggest that the southern (or hangingwall side) moved upwards. The fault would, therefore, be a reverse one. The drag of the beds between the Nos.4 and 3 faults suggests a possible horizontal movement of the northern side to the east. The amount of displacement on this fault must be at least several hundred feet.

The No.4 fault is exposed in the northeastern portion of the 90-foot bench. It has a strike of approximately 135 degrees and dips to the northeast at 50 degrees. The downthrow is to the north and is approximately 10 feet.

The No.5 fault is traceable across the northern side of the 90-foot bench and in the faces above the 90 and the 120-foot benches. It has a general strike of 110 degrees and its dip varies a few degrees on either side of the vertical. On the northern side of the 90-foot level, the pyroxene-garnet-hornfels and Top orebody are either downthrown as by a dip-slip fault or moved horizontally as by a strike-slip fault. In the north crosscut from the No.3 Centre adit, the beds on the northern side of, and adjacent to, the fault have a low dip as if drag-folded upwards on the downthrow side of a dip-slip fault.

The downthrow is on the northern side and the vertical displacement down the fault ranges from 40 to 50 feet. Between the intersections with the Nos.7 and 2 faults, its downthrow is reduced by that of the No.7 fault and amounts to only 20 to 30 feet. As already indicated, the No.5 fault intersects the No.7 fault - the No.7 appears to be a branch of the No.5 and not to pass through the latter. To the west, the Nos.2 and 5 faults converge because of their different strikes and moreover they are shown on section lines 2, 1, 5 and 6 (Plate 4) as having joined at depth because of their different dips.

The fault formed by the continuation of the Nos.2 and 5 faults has not been numbered. Its strike and dip are not known and could only be determined by further drilling. This fault would have a downthrow to the north and equal in amount to the sum of those of the Nos.2 and 5 faults, i.e. 100 to 120 feet.

The No.6 fault is exposed on the northern faces between the 90-foot and the 120-foot benches and between the 120 and 155-foot benches. It has a general strike of 140 degrees and dip to the north of 60 degrees. It junctions at shallow depth with the No.5 fault. The displacement is to the north and is approximately 5 feet.

The No.7 fault is deduced mainly from the geological structure. It should cross the No.4 and No.3 Centre adits, but close-timbering prevents examination. Information supplied by the mine staff, however, suggests that faults probably cross the adits where the No.7 fault is shown. It should also be visible above the Glory Hole on the 120-foot bench and there is some evidence of abrupt termination of beds and of brecciation near the probable position. Lack of exposures prevents the observation of this fault at other places. The fault should have a strike of approximately 145 degrees and either a vertical or a steep dip. The downthrow is on the southwestern side and is approximately 20 feet near the No.5 fault and equal to that of the No.2 fault near the latter. To the northwest No.7 fault junctions with the No.5 and to the southeast probably junctions with the No.2 fault, and thus forms a branch or link between these two major faults.

The No.8 fault is exposed in the western faces between the 120 and 140-foot benches and between the 140 and 170-foot benches. Its strike is generally parallel to that of the No.2 fault and is approximately 320 degrees. The dip is to the south at 28 degrees. This fault is a reverse one, the upthrow being on the southwestern side and of indeterminate, but probably considerable, amount. This fault appears to have been one of the earliest, and is displaced by the Nos.2 and 5 faults. Between the No.2 and No.5 faults, it will be referred to as the No.8A fault. In this vicinity, the dip is almost horizontal, but towards the No.5 fault, the No.8a fault appears to coincide with the bedding, and to have a general strike of 270 degrees and a dip to the south of 30 to 40 degrees.

To the north of the No.5 fault, the continuation (possibly 8B fault) is not so definite. It would be coincident with the bedding and would, therefore, not be so easy to detect. Moreover, the alteration of the rocks in, and about, the mineralised zone is somewhat different from that to the south of the No.5 fault and it is difficult to determine where the fault would occur.

The No.9 fault is not exposed at the surface, but is deduced from the structure as determined by the drill holes. Its probable strike is similar to that of the No.5 fault and its dip is to the northeast at approximately 50 degrees. The downthrow is on the northeastern side and the displacement down the fault ranges from 10 to 20 feet.

Several other minor faults are shown on Plate 3, but their known extent and displacement are not such as to warrant individual descriptions. In general, their strike is similar to that of the No.5 fault.

It is probable that a major fault exists between Nos. 3 and 5 faults and west from 400E. It would have a strike of approximately 270 degrees and the downthrow would be to the north. Such a fault is necessary to explain the position of the ore in drill holes 15 and 33. To explain the much greater thickness of mineralised zone in hole 33 than in hole 32, the fault must have been earlier than No. 8 fault and have enabled a greater thickness of favourable beds to exist below No. 8 fault.

D. Igneous Intrusives.

The granitic rocks to the south and west of the mine are portions of a large intrusive body probably occurring under King Island and the adjacent parts of Bass Strait.

On the beach immediately southeast of the mine a granitic dyke about 200 to 300 feet wide traverses the hornfels. South of this dyke there are innumerable narrow ramifying dykes and veins in the hornfelses. Near the western boundary of lease 220P/M, a porphyry dyke 20 to 60 feet wide extends for at least 20 chains.

In the mine workings, numerous narrow dykes and sills of aplite and porphyry are present, the largest dyke being 20 feet wide and 300 feet long.

E. Time Relationships.

The folding of the rocks occurred first and was followed by faulting. The regional folding was probably caused by compressive forces from the east-southeast (or west-northwest). The forces which caused the change in strike (to general westerly) in the vicinity of the mine cannot be deduced with certainty. It is possible that the change is associated with large scale faulting (similar to No. 3 fault) associated with the east-southeast forces. Alternatively, forces may have acted from the south (or north) and the same forces may have caused some at least of the faulting e.g. Nos. 8 and 3 faults.

Subsequent to the folding, thrust faulting occurred, e.g. Nos. 8 and 3 faults. As indicated above, this faulting may have been associated with any second phase of folding if such occurred.

The remainder of the faulting (herein referred to as normal faulting) occurred later. Some at least of it is later than the intrusion of the granitic magma, because at least two of the aplite dykes appear to be affected by the faulting.

At least some, and probably all, of the mineralisation was later than the normal faulting. It is possible that the intrusion of the granitic rocks, the normal faulting, and the mineralisation were closely associated.

The general succession of events appears, therefore, to have been regional folding, later folding, thrust faulting, granitic intrusion, normal faulting and mineralisation.

VIII. ECONOMIC GEOLOGY.

A. Introduction.

Scheelite is the only mineral of economic importance present in commercial quantities in the mineral deposit in the King Island Scheelite Mine. Wolfram has not been detected and is presumably absent.

Molybdenite is present, but not in sufficient amount to justify special arrangements to recover it separately. The scheelite concentrates contain up to 2 per cent. molybdenum partly as molybdenite, free and included in the scheelite grains, and partly as a constituent of the scheelite. Small amounts of sulphides - mainly pyrite and pyrrhotite - are present but are not of economic importance.

The deposit is of the contact metamorphic or pyrometasomatic type and has resulted from the alteration and replacement of favourable beds (calcite-hornfels, etc.).

B. Stratigraphic Limits of Scheelite Mineralisation.

Scheelite occurs throughout a thick zone. In the light of present information, the upper limit is, with one exception, the hangingwall of the mineralised zone, i.e. the top of the pyroxene-garnet-hornfels, and the lower limit is at an unknown depth in the footwall rocks.

On the hangingwall side, Drill Hole No.44 at the extreme western end of the drilled area, pierced 70 feet of barren hornfels before entering the mineralised zone. Several other holes passed through much smaller thicknesses. At the eastern end, vertical Drill Hole No.48 proved a stratigraphic thickness of at least 48 feet of calcareous hornfels, which was not mineralised except for traces of scheelite in veins at the bottom of the hole. It appears to occupy a position some 60 feet above the top of the mineralised zone.

Deposition of the bulk of the scheelite took place within a series of beds which were more or less completely altered by mineralising solutions. This mineralised zone has a stratigraphic thickness ranging generally from 150 to [illegible] feet.

The footwall rocks are exposed in only two places in the mine and only small thicknesses are represented. In the No.3 North adit, blue-fluorescing scheelite occurs in small amounts to a depth of 20 to 30 feet below the footwall. Most of the drill holes penetrated the footwall rocks to a depth of 20 to 50 feet, and the assays of core samples gave results up to 0.2 per cent. WO_3, but generally less than 0.05 per cent. Hole No.36 passed through 76 feet of footwall rocks with grades up to 0.1 per cent. WO_3. Hole No.22, which was extended well into footwall country, passed through 180 feet with grades up to 0.05 per cent. WO_3. The scheelite of this footwall section is contained in thin mineralised bands in otherwise barren country.

C. Mineralised Zone and Orebodies.

1. Introduction. Deposition of most of the scheelite took place within a series of beds about 200 feet thick which was subjected to selective metasomatism by mineralising solutions. During the

mineralisation, interchange of material between invading solutions and host rock took place on a large scale, and most of the rocks were completely altered both chemically and mineralogically. This resulted in the formation of hornfelses in which garnet and, to a less extent, diopside are the chief constituents.

Original differences in composition of various rocks of the series are reflected in the different types of hornfelses formed, which now constitute the mineralised zone. On lithological and stratigraphical evidence, this zone has been divided into five sections - Pyroxene-garnet-hornfels (hangingwall type), Top orebody, Marker beds, Bottom orebody and Transition section (see VI).

As scheelite forms an integral part of some of the hornfelses and as scheelite content is closely related to type of hornfels, the above division applies equally well to scheelite distribution. Ore of profitable grade is restricted generally to the Top and Bottom orebodies. The Top orebody is consistently of higher grade than the Bottom orebody and is separated from it by the barren Marker beds. The Transition section, although in two or three places carrying bands of ore, is, on the whole, low grade. The hangingwall pyroxene-garnet-hornfels is everywhere low grade.

The thickness of the mineralised zone in the southern and eastern portions of the drilled area, where the stratigraphic succession from hangingwall rock to footwall rock is complete, ranges from 150 to 222 feet, but is generally between 150 and 220 feet and averages 180 feet. The variation in thickness is due in part to lenticularity of the various sections, and in part to irregularity of the upper limit of mineralisation, which is in massive rocks. The lower limit of the zone appears to follow fairly closely a stratigraphic horizon.

In the northern portion, the upper limit of mineralisation is controlled by the No.8 overthrust fault which apparently removed part of the upper beds of the series before mineralisation took place. Measured thickness of the zone here ranges down to 46 feet and averages 113 feet.

The thickness of the ore-bearing section of the mineralised zone (Top to Bottom orebody), in the southern and eastern portions of the drilled area, ranges from 101 to 155 feet and averages 117 feet. In the northern portion, due to the effect of the No.8 fault, the thickness decreases, the smallest measured being 10 feet, and the average being 69 feet.

The more important details concerning the five sections of the mineralised zone are given below; the sections being described in order from the hangingwall to the footwall side.

2. <u>Pyroxene-Garnet-Hornfels Section</u>. This section ranges up to 52 feet in thickness, but is generally between 27 and 45 feet and averages 37 feet. It has been described in some detail in Section VI.

The scheelite content is low and the average grade is less than 0.2 per cent. WO_3. The grade varies with the degree of alteration of the actinolite-hornfels, being highest where garnet has developed most abundantly. The scheelite is restricted to the coarse quartz-calcite-garnet patches and is present as coarse grains associated with the andradite garnet forming the rims of the patches.

3. <u>Top Orebody</u>. This orebody occurs immediately below the pyroxene-garnet-hornfels. It consists mainly of massive, coarse-grained garnet-hornfels which, towards the base, gives place to banded garnet-pyroxene-hornfels.

The orebody is lenticular, the thickness ranging from 7 to 38 feet, but being generally between 20 and 38 feet and averaging about 25 feet. The greatest thickness occurs near the Nos. 2 and 7 faults. To the east, it thins to 22 feet in hole 53. West from line 2, the thickness is least and ranges from 8 to 12 feet and averages 9 feet. The thickness decreases down the dip on section lines 2, 3, 4, 11 and 12.

The results of assays of core samples range up to 3.5 per cent. WO_3, but are mostly between 1 and 2 per cent. The highest average grade over the full width of the orebody was 2.13 per cent. in Drill Hole No.50. The upper portion (garnet-hornfels) is invariably of higher grade than the lower portion which, though commonly of good grade, is barren in one or two places. In Drill Hole No.35, the orebody was badly fractured or weathered and is barren, but this is probably only a local development.

Taking into consideration the whole of the orebody, the average grade calculated from assay results from core samples is 1.21 per cent. WO_3. In the tested area, and down to sea level, the probable reserves indicated by drilling are 415,619 tons. This orebody contains about 40 per cent. of the total scheelite in the ore-bearing section.

In the garnet-hornfels, the scheelite is disseminated regularly throughout. It occurs in the garnet (andradite) and in the interstitial quartz. The grain size ranges from less than 0.07 mm. to 0.7 mm. - these figures are based on comparisons under ultra-violet light of samples of ore and screened scheelite concentrates. Stillwell (1942) gave the size as 0.05 to 0.2 mm. as the result of microscopic examination of several specimens.

4. <u>Marker Beds</u>. The thin section termed the Marker beds consists of interbedded biotite-quartzites, spotted calcite-hornfels, and pyroxene-hornfels. It separates the Top and Bottom orebodies. The thickness ranges between 4 and 25 feet, but is, in most places, between 10 and 20 feet and averages 13 feet.

With the exception of holes 36, 41 and 50, where a little garnet-pyroxene-hornfels has developed, this section is barren of scheelite.

5. <u>Bottom Orebody</u>. This orebody is the thickest of the five sections and occurs between the Marker beds and the Transition Section It consists mainly of medium-grained garnet-pyroxene-hornfels, and some coarse-grained garnet-hornfels and calcite-actinolite-hornfels with fine-grained pyroxene-garnet-hornfels, pyroxene-hornfels and thin biotite-quartzite bands. In drill holes 23, 30, 40, 25, 27 and 42 and in No.3 Centre adit considerable thicknesses (maximum aggregate thickness of 56 feet in hole 30) of barren calcite-hornfels were passed through.

Due to the No.8 overthrust fault and its extensions (8A and 8B), the overburden hornfels rests directly on different bands in the Bottom orebody over much of the northern portion of the deposit. Here a thin band of pyroxene-garnet-hornfels has developed in some places along the top of the portion of the mineralised zone immediately below the fault. In drill holes 24 and 25, the thinning of the Bottom orebody to about 30 feet is attributable in part to the No.8A fault, but some actinolite-hornfels appears to occupy a position in the Bottom orebody normally occupied by mineralised rocks.

Outside the area affected by the No.8 fault, the thickness ranges from 48 to 110 feet and averages about 90 feet. It is greatest in the area embracing lines 2 and 3, where it is somewhat greater than 100 feet. To the east there is a pronounced thinning, the minimum being 48 feet in hole 43 (Plate 13,d). To the west, there is no appreciable thinning, the thickness in the most westerly line of drill holes being 101 to 102 feet.

The assay results of core samples from this orebody range from less than 0.05 to 1.04 per cent. WO_3. Within the limits of the proposed open cut, the probable reserves indicated by drilling are 1,388,814 tons with an average grade of approximately 0.55 per cent. WO_3.

6. Transition Section. Between the lower limit of the Bottom orebody and the footwall rocks there is a zone which ranges in thickness from 10 to 35 feet, but which is usually between 15 and 25 feet thick and averages 21 feet. It consists of footwall hornfels, garnet-pyroxene-hornfels and thin bands of calcite-hornfels. In most places, this Transition section contains no ore of profitable grade, but, in a few places, thin bands of ore are known to occur as low in the succession as the bottom of this section.

7. Other Ore. The occurrence of profitable ore is not restricted entirely to the above bedded replacements. A few quartz veins containing coarse scheelite traverse the mineralised zone and extend upwards into the overburden hornfels above No.8 fault.

Of greater economic importance, however, is the body formed in the biotite-actinolite-hornfelses above the No.8 fault. Over a limited area these rocks have been altered by the mineralising solutions to a soft greenish rock, containing scheelite in veins and as coarse disseminated grains. In other parts the hornfels is unaltered and the scheelite is contained in numerous veins.

The body was exposed only on the southwestern portion of the 140-foot bench and had a maximum area of 4,000 square feet on and above that bench. It is limited at depth by the No.8 fault, above which it occurs. It has no eastern extension, but there may possibly be a western extension. It appears that the body was formed above the truncated Top orebody, and any western extension of it would probably be above the western extension of the latter body. Any western extension would, however, have been largely removed by erosion and be overlain by sand. The ore represented by this body was high grade and at least comparable with that of the Top orebody.

D. Scheelite.

Two distinct types of occurrence of scheelite are represented in the deposit - (a) as grains disseminated through the hornfelses and (b) as a constituent of veins cutting the hornfelses.

(a) By far the greater part of the scheelite occurs as grains disseminated through the garnet and garnet-pyroxene-hornfelses of the two orebodies. The grain-size is invariably small, and the bulk of the grains have dimensions less than 0.2 mm. The scheelite of the low grade hangingwall pyroxene-garnet-hornfels is, on the average, much coarser.

This disseminated scheelite is greyish-green in colour and has the typical lustre of scheelite. It is not readily visible in the greater part of the ore. Under ultra-violet light it fluoresces for the most part yellow.

In the calcite-actinolite-hornfels (which is present in narrow bands at several horizons in the mineralised zone), scheelite occurs mostly as relatively coarse disseminated grains, which fluoresce blue.

(b) In the quartz veins the scheelite is coarse, and pieces up to 5 inches in largest dimension have been found. Crystals up to 2 inches in largest dimension are present in the vughs which occur sparingly in the mineralised zone. This is the greyish-green variety which fluoresces yellow.

In cores of the footwall hornfels in drill holes 52 and 36, and also in footwall hornfels exposed in No.3 North adit, a blue-fluorescing scheelite occurs as small grains in very thin veins which approximately follow the bedding. There is also a small development in No.1 adit. In a small irregular formation showing in the face between 120 and 140-foot benches during November, 1942, crystals of this variety of scheelite occurred in a gangue of calcite and arsenopyrite. The crystals measured up to three-quarters of an inch in maximum size, and showed the development of pyramidal faces of at least two orders typical of scheelite. They were generally of a whitish colour with the outer margin darker than the interior.

Two types of scheelite have been described above, the distinction being based in some cases on physical characteristics and in others on the colour of the fluorescence under ultra-violet light. Samples of concentrates under ultra-violet light fluoresce with colours ranging from blue through whitish blue, white and pale yellow to strong yellow. According to American experience (Eng.& Min.Journ., 1942) the colour of the fluorescence depends on the molybdenum content as follows:

Pure scheelite	blue.
Scheelite with traces of molybdenum ..	bluish white.
Scheelite with 0.50 per cent.molybdenum..	neutral white.
Scheelite with 0.50 per cent. to 4.8 per cent. molybdenum ..	yellow.

For scheelite with a molybdenum content above 0.50 per cent. the intensity of the yellow increases (being a distinct yellow at 1 per cent.), until a content of 4.8 per cent. is reached. Above 4.8 per cent. the intensity does not change.

It is obvious that the molybdenum content of King Island scheelites is not uniform, but ranges from a trace up to possibly 4.8 per cent. The two types of fluorescence described above, therefore, represent generally the end members of the series of scheelite varieties based on their molybdenum content. The amount of yellow-fluorescing scheelite is greatly in excess of the blue- and white-fluorescing varieties in the King Island scheelite ores and concentrates.

Analyses made for the Company of six parcels of scheelite concentrates showed that the molybdenum content ranged from 1.65 to 2.16 per cent. The concentrates contained sulphur ranging from 0.495 to 1.86 per cent., and it would appear from an investigation of these figures that the scheelite concentrates contained a maximum of about 2 per cent. of molybdenite and a minimum of about 0.8 per cent. of molybdenum in the composition of the scheelite. Some of the sulphur is probably combined with iron and it is not possible to determine accurately the distribution of the molybdenum. The presence of molybdenite in the scheelite had been indicated previously by Stillwell (1942) as a result of his microscopical investigation.

The outer margins of the larger crystals and irregular pieces of scheelite generally appear darker than the interiors, and this appears to be due to the inclusion of small flakes of molybdenite near the boundaries of the crystals and pieces. On the mine this darker scheelite has been referred to as powellite, but the microscopic work of Dr. Stillwell suggests that the mineral powellite is not present in the ore.

The 0.8 per cent. would represent the minimum average content of the various varieties which fluoresce from blue to yellow. Possibly one-sixth of the scheelite fluoresces blue and much fluoresces white, but the greater part fluoresces yellow, suggesting a molybdenum content greater than 1 per cent. It appears probable that the molybdenum content of the variety fluorescing the most intense yellow would be at least 2.0 per cent.

E. Associated Metallic Minerals.

Metallic minerals present in the scheelite deposit include sulphides such as molybdenite, pyrite, pyrrhotite, arsenopyrite, chalcopyrite and sphalerite, but the amounts are very small.

Molybdenite is present in the mineralised zone and in the hanging and footwall rocks, partly as disseminations and partly in the concentrations to be described below. It is most plentiful in, and near, the wide aplite dyke, and is particularly associated with the pyrite segregation alongside that dyke. Molybdenite is associated with a small irregular quartz vein in the eastern portion of the workings. In the actinolite-hornfels, it is associated, in small amounts, with pyrite along fractures. The inclusion of molybdenite in the scheelite crystals has been referred to above.

Pyrite occurs sparingly as fine grains throughout the mineralised zone, but the total amount present is small. Its association with molybdenite alongside the wide aplite dyke has been referred to above. A similar association was evident in the cores from Hole 56.

Pyrrhotite is most plentiful in the footwall rocks in which it occurs as small grains within the light green altered bands. It is present to a small extent in the actinolite-hornfels on the hanging-wall side of the mineralised zone and in the rocks of the latter zone.

Arsenopyrite appears to be restricted to some of the quartz veins such as that associated with the No.2 fault. Its occurrence with calcite and scheelite in a formation in the face between the 120 and 140-foot benches has already been referred to. It was reported by the mine management that it occurred in association with the quartz vein at the western end of the 90-foot bench (above the north cross-cut from the No.3 West adit). Reports of the old company indicate that the stope below contained abundant sulphide.

Chalcopyrite and sphalerite are present in extremely small amounts. Tin and bismuth are shown in some of the chemical analyses quoted by Waterhouse (1916) and the same investigator stated that the mine manager had found several pieces of metallic bismuth.

None of the sulphide minerals has any direct association with the disseminated scheelite.

Metallic oxide minerals are also present in small amounts. Stillwell (1942) reported ilmenite present in biotite-quartzite and calcite-actinolite-hornfels, and iron ore in calcite-actinolite-hornfels from the mineralised zone. He also reported hematite, ilmenite, magnetite and probably titan-hematite in the hangingwall hornfelses, and iron ore in the biotite-actinolite-hornfels forming the overburden. From the weathered rocks east of the No.11 shaft, small amounts of magnetite and/or ilmenite were obtained by concentrating in a prospecting dish.

F. ROCKS OF MINERALISED ZONE BEFORE MINERALISATION.

A feature of the unmineralised hangingwall and footwall hornfelses is the low alumina and high magnesia and lime content, reflected in the development of actinolite almost to the exclusion of biotite in the hangingwall actinolite-hornfels, and in the subordinate amount of biotite in the footwall-hornfels. In the latter rock the more normal aluminous bands formed biotite-hornfels. The original sediments were possibly dolomitic sandstones with interbedded argillaceous bands in the footwall section.

The development of the pyroxene-garnet-hornfels from actinolite-hornfels by metasomatic processes has been described already in Section VI.

The garnet-hornfels of the Top orebody occurs throughout that orebody and gives place to another rock in only one part of the orebody. This is in the No.4 adit (and in Drill Hole No.43) where a relatively small body of calcite-hornfels was intersected. In the adit (Plate 9), the contact with the garnet-hornfels transgresses the bedding, and irregular quartz segregations are associated with the contact. The upper contact with the pyroxene-garnet-hornfels is sharp and represents a bedding plane. The latter rock here is for the most part, only partly altered actinolite-hornfels with slight development of garnet. The calcite-hornfels is bedded. It seems most probable that this rock, i.e. metamorphosed limestone, is part of the original bed, which for some reason, was not affected by the mineralising solutions. The garnet-hornfels is therefore, regarded as having been derived from metamorphosed limestone or calcite-hornfels.

In the Bottom orebody there are much larger bodies of calcite-hornfels. Drill Hole No.30 passed through the greatest known thickness, which aggregated 56 feet in a total thickness of 96 feet of Bottom orebody. In hole No.40 the aggregate thickness is 30 feet, the calcite-hornfels occupying the lower part of the orebody. Drill Holes Nos.27, 23, 25, 28 and 42 also passed through important bodies of calcite-hornfels, - all in the upper or middle part of the Bottom orebody. All except one of these occurrences are grouped around the central part of the proved length of the orebody, that is, in the vicinity of section lines 3 and 4. The exception is in Drill Hole No.42 on section line 6 at the extreme western end of the proved western extension. In the eastern section calcite-hornfels is present only in small isolated patches. It is also noteworthy that down the dip the amount of calcite-hornfels decreases considerably.

From the above, it is apparent that calcite-hornfels occurs at many places sectionally across, and laterally along, the Bottom orebody.

This rock is much the same everywhere - white or grey and fairly coarsely granular with bedding apparent in many places. Bedding is well developed in the No.3 Centre adit where dip and strike are in agreement with those of other beds. Thin bedding plane seams of pale brown garnet (grossularite) are common. Narrow bands of black biotite-quartzite are interbedded and are plentiful at some places. Interaction between the two rocks under the influence of heat has resulted in the sequence calcite-hornfels, garnet (grossularite), pyroxene-hornfels, biotite-quartzite across all contacts. In many places there are narrow bands of garnet-pyroxene-hornfels within the calcite-hornfels.

From drill hole logging and surface mapping, it is apparent that calcite-hornfels passes along the strike and down the dip into mineralised rock fairly abruptly. For example, the bottom of the western face of the 120-foot bench was largely in calcite-hornfels in the Bottom orebody, while the top of the face showed none. The actual change-over was available for inspection at only one or two places. In the No.4 adit a band of garnet-pyroxene ore ends abruptly on a steep fracture with no displacement, and, on the other side, is represented by garnet-pyroxene and a two-foot band of calcite-hornfels. A similar feature was seen on a small scale in a narrow band of calcite-hornfels in the Transition zone in the No.3 Centre adit. On the 140-foot bench, small patches of calcite-hornfels pass abruptly along the strike into ore.

The calcite-hornfels has every appearance of an altered bedded sediment and it must be presumed that this rock, together with interbedded biotite-hornfels and, probably, actinolite-hornfels, formerly constituted a stratigraphic unit, and that mineralising solutions invading these rocks produced, by interacting and replacement, the garnet and pyroxene hornfelses of the Bottom orebody.

In this orebody some of the biotite-quartzite remains unaltered, but much of it has been altered to fine-grained pyroxene-garnet (grossularite)-hornfels and pyroxene-hornfels.

Except to a very limited extent, correlation of any individual beds of the Bottom orebody from hole to hole was impracticable. It seems that varying degrees of alteration have more or less obliterated any original differences that may have existed.

lower case

G. INTERCHANGE OF MATERIAL DURING MINERALISATION.

The change from calcite-hornfels to garnet-hornfels of the Top orebody involves a very considerable change in the chemical composition. This garnet-hornfels consists of at least 80 per cent. of andradite together with minor amounts of quartz and calcite, diopside, etc. An analysis by J.G.Hart of a typical piece of the hornfels (Table 5, analysis 1) gave SiO_2 36.8 per cent., Fe_2O_3 21.4 per cent., CaO 28.98 per cent. The formation of a rock of this composition from ore composed mainly of calcite, would require the addition of very considerable quantities of ferric oxide and silica, and removal of lime and carbon dioxide on an equally large scale.

The same large scale interchange of material would be involved in the formation of the garnet-pyroxene-hornfels which constitutes about 65 per cent. of the Bottom orebody and which contains a high percentage of andradite.

A pale brown garnet (iron-bearing grossularite) occurs in the fine pyroxene-garnet-hornfels, but the amount would be a maximum of 10 per cent. of the Bottom orebody. The alumina in this garnet was probably derived from biotite-quartzite beds in what is now the Bottom orebody, but might have been introduced (wholly or partly) as in the case of the hangingwall pyroxene-garnet-hornfels to be discussed below.

Several stages in the evolution of hangingwall pyroxene-garnet-hornfels from actinolite-hornfels were detected. The initial stage was the formation of calcite areas in the hornfels apparently by replacement, and these produced, by reaction, encircling rims of garnet and pyroxene. In the totally reconstituted rock, grossularite garnet forms a considerable percentage (about 70) of the rock, and the formation of the garnet and the diopside from the actinolite-hornfels would involve the introduction of lime and alumina and the loss of silica and magnesia.

There is strong evidence to support the view that the tungstic acid of the disseminated scheelite was introduced by the solutions containing ferric oxide and silica, which were responsible for the formation of the garnet-bearing rocks. This view rests on the following observations:-

(a) Scheelite was found in all drill holes from the top of the pyroxene-garnet-hornfels section to the base of the Transition section, i.e. the zones of metasomatic alteration and scheelite deposition are co-extensive.

(b) In the orebodies, and also in the footwall rocks, scheelite is present with few exceptions wherever medium to coarse-grained andradite-bearing rocks are developed. The exceptions are in places where the rocks are affected by movement. The fine-grained pyroxene-grossularite-hornfels and pyroxene-hornfels are everywhere barren.

(c) Scheelite occurs in the orebodies as fine disseminations throughout the andradite rocks, and a common occurrence of the scheelite is as crystals within the garnet grains.

(d) There is an almost invariable association of coarse grain-size in the garnet rocks with higher scheelite contents.

(e) Higher scheelite contents are found wherever free quartz is visible in the garnet-hornfels.

(f) In the pyroxene-garnet-hornfels, the scheelite is restricted to the ovoid patches composed of coarse-grained quartz, calcite and garnet, ~~the scheelite occurring with the garnet~~ around the rims. The intervening fine-grained pyroxene-grossularite-hornfels is barren.

(g) The overburden hornfels is intensely altered above the No. 8 fault where disseminated scheelite is found.

To summarise, the processes which brought about the alteration of limestone to scheelite-bearing andradite-hornfelses included the introduction of very large quantities of silica and iron, relatively small amounts of tungsten, and traces of molybdenum. The crystallisation of the andradite, scheelite and quartz appear to have gone on simultaneously.

H. Localisation of Mineralisation and Ore.

(1) Introduction. It is obvious that the main factors localising the mineralisation were chemical and that they included the presence of beds with chemical compositions that allowed ready alteration of the beds by mineralising solutions. The same factors also governed the localisation of the ore within the mineralised zone.

Structural features such as folding, faulting, fractures, etc. played a part in some places in the mineralised zone in controlling the mineralisation and the localisation of ore, but the amount of control is subordinate to that exercised by the chemical factors. Structural controls probably had little effect on the distribution of ore sectionally across the mineralised zone, but probably had a maximum effect laterally throughout the mineralised zone and the orebodies. In general, however, the amount of information concerning the distribution of grades, etc., laterally throughout the orebodies, is too limited to determine the control which may have been exercised by structural features. If adequate records are kept of width and grade of ore, etc., during future mining operations, it may be possible at some future date to determine the structural control in greater detail.

(2) Chemical Composition of Rocks. The most important factor in localising the mineralisation (including scheelite) was the composition of the original rocks. This factor determined the position and the extent of the mineralised zone.

The most significant feature of the mineralised zone is the distribution of the scheelite sectionally across it. Thus from the hangingwall to the footwall side, there is the low grade pyroxene-garnet-hornfels, the high grade Top orebody, the barren Marker beds, the Bottom orebody and the slightly mineralised Transition section. This distribution is a direct expression of the differences in the original rocks of the mineralised zone. Two prominent beds, composed mainly of limestone, were altered almost completely to the garnetiferous scheelite-bearing hornfelses of the Top and Bottom orebodies. The beds above and below these two orebodies were probably dolomitic sandstones and were apparently less amenable to replacement. The beds between the two limestone ones were apparently of quite different composition (shales and impure limestones) and, except in two places, were not mineralised.

The thicknesses of the two orebodies appear to have depended solely on the thicknesses of the original limestone beds. Variations in the thickness of both orebodies are quite considerable, but are regular and probably indicate lenticularity of the original limestone beds.

The effect of the differences in chemical composition of the original beds is also apparent on a smaller scale within the mineralised zone. Thus within the Top orebody, the upper section consists of coarse-grained hornfels with a high content of scheelite, but the lower section consists of finer-grained hornfels with a higher diopside content and a much lower scheelite content. This difference almost certainly indicates a difference in the composition of the original beds. Throughout the Bottom orebody there are numerous types of hornfelses and these differences are reflections of the different compositions of the original rocks.

(3) Degree and Nature of Alteration of the Original Rocks. It is difficult to separate the effect of this factor from that of the composition of the original rocks. Nevertheless the kind and amount of the alteration must also have played an appreciable part in the localisation of the mineralisation and of the deposition of scheelite. Within the mineralised zone there are comparatively large bodies of calcite-hornfels. These bodies contain no scheelite and represent unmineralised portions of the limestones. Though the kind of the hornfelses in the mineralised zone is determined mainly by the composition of the original beds, it is important as regards the distribution of the scheelite. The scheelite is generally restricted to those hornfelses which are composed mainly of the dark andradite garnet. Hornfelses, in which the garnet is the lighter coloured grossularite, contain no scheelite.

The grain size of the garnetiferous hornfelses also has a distinct relationship to the scheelite content. The highest concentrations of scheelite occur where the grain size is coarse and where the interstitial quartz in such rocks is readily visible. Thus, the quartz-bearing garnet-hornfels of the Top orebody forms the highest grade ore within the deposit.

(4). Structural Features.

(a) Sectionally. As already stated above, structural features probably have little effect in localising the ore sectionally across the mineralised zone. Such localisation is controlled essentially by the chemical composition of the rocks.

However, No.8 fault has an important effect on the localisation of ore in that it has, on the northern side of the drilled area, removed the upper portion of the favourable beds from which the mineralised zone was formed. Thus the thickness of the mineralised zone is considerably reduced and, further, the grade is affected insofar as the Top orebody is not present over the northern portion of the area.

It might be thought that, in view of the smaller thickness of favourable beds below the No.8 fault and available to the mineralising solutions, the grade of the mineralised zone in such portions might be higher than where the solutions had the full thickness of the favourable beds available for alteration. In only two places, however, is there a suggestion that the grade of the reduced thickness of the mineralised zone is appreciably higher than adjacent portions of the Bottom orebody, and in neither place is the total amount of scheelite content in the reduced portion comparable with that in the full thickness of the mineralised zone where the Top orebody is present.

In holes 37, 32, and 25 there appear to be local enrichments immediately below No.8 fault. A similar enrichment occurred under the same conditions in the working face above the 140-foot bench.

(b) Laterally. Structural features may play a more important part in the localisation of ore and control of grade laterally along the deposit than it does sectionally across the deposit. It is to be realised, however, that no past records of grade and thickness of ore are in existence and, further, that the scheelite deposit has been tested by only a limited number of drill holes, the number of effective holes being thirty-two. As these holes are distributed over a length of 1,400 feet and a width of 400 feet, it is obvious that they do not yield sufficient evidence to enable structural controls to be elucidated over such a large area. Moreover, although there are 32 holes, only 17 yield information concerning the Top orebody and only about 20 yield satisfactory information about the Bottom orebody.

The thickness of the mineralised zone and of the Top and Bottom orebodies is governed by the thickness of the beds which they replace. In general, such thicknesses would be the original thicknesses of the beds, and the variations would be due to the lenticularity of the beds. An analysis of the known thicknesses of the mineralised zone and of the orebodies shows that there is an appreciable decrease down the dip and to the east and also a slight decrease towards the west (see Plate 13b). The only way in which structural features could have affected the thicknesses would be if there were thickening of the beds in the open fold near the No.2 and No.7 faults. As far as can be determined at present, the variation in thickness is very likely due to the lenticularity of the beds.

Faults and fractures play some part at least in localising mineralisation. With the information available, it does not appear as though the major faults have played any important part in this respect, but further information might possibly prove otherwise. The influence of a smaller fracture is illustrated in the No.4 adit where a fracture with no displacement separates unaltered calcite-hornfels from garnet-pyroxene-hornfels. The rapid changes from calcite-hornfels to ore occurring elsewhere in the mineralised zone, might possibly also be due to fractures, and the general disposition of the calcite-hornfels would suggest that such fractures are steeply dipping ones.

Because of the limited information available, it has not been possible to determine whether there is any pitch associated with the Top and Bottom orebodies. Consideration of the grades and the amounts of scheelite at different points within those orebodies suggests that there might be a southeasterly pitch. However, comparable results cannot always be obtained for the Top and Bottom orebodies and such a pitch cannot be regarded as being definitely established. The progress of future mining operations should yield sufficient information to determine if there is any pitch in the orebodies. As used above, the pitch refers to zones of different grades within the orebodies. Except against the No.3 fault, the terminations of the orebodies have not been reached, and so no information can be given about the pitch of the orebodies as a whole.

IX. AMOUNTS OF ORE, OVERBURDEN, ETC. AND PROBABLE GRADE OF ORE.

The following figures are based almost entirely upon information obtained from the thirty-two drill holes which intersected the mineralised zone. Other information was obtained from the mine workings and from a small amount of sampling in the open cut and the adits.

The area drilled is 1400 feet long in an east-west direction and 400 feet wide in a north-south direction and represents an area of approximately 10 acres. The thirty-two holes did not give detailed information concerning the whole of that area and further drill holes would be necessary to supply such information.

The figures for amounts of ore, etc. are calculated for an open cut approximating to that which will probably be developed during the mining operations. The open cut is based essentially on that assumed by Mr.T.L.Barson of the Broken Hill Pty.Company, who, early in 1943, reported on the proposed open cutting operations. On the footwall or northern side of the deposit, the sides of the cut have a batter of 40 degrees. On the hangingwall or southern side, the batter is 60 degrees in rock and 40 degrees in sand overburden. Thirty feet roadways are allowed for. The base of the open cut is regarded as being at sea-level. In places where the interpretation of the geological structure was slightly amended after Mr.Barson's recommendation was submitted, slight alterations have been made in the positions of the sides of the cut. On section lines 5 and 6 the batter on the footwall side has been made steeper to agree with the steeper dip of the footwall in that portion of the deposit. The figures have been calculated as though the whole of the ore has been extracted down to sea-level, that is to say, all blocks of ore, etc. necessary to support roads from level to level during the course of the operations, have been regarded as being extracted. The working levels are assumed to be those proposed by Mr.Barson, namely sea-level, 75 feet and 150 feet above sea-level. The amounts and grade of ore, etc., between these levels have also been calculated. The assay sections on Plates 5 and 8 show the area and grade of each band. The sampling and assay results are given in Table 6 at the end of this report.

The material which will be excavated in the open cut has been divided into ore, sand overburden, rock overburden, waste rock, and waste rock which on testing will probably be found to contain much ore. The term "waste rock" is used to denote material underlying the ore and which has to be removed to permit of extraction of adjacent blocks of ore and to maintain a more or less regular open cut. The waste rock does not, however, include the bands of low-grade rock within the ore zone and which may or may not be excluded from the ore by selective mining. The waste rock which on testing will probably be found to contain much ore, exists on the northern side of the open cut and in those portions of the deposit where the drilling was not carried sufficiently far to the north to reach the northern limit of the ore.

The following conversion factors were used in the calculations:-

		Cubic Feet per Ton
Ore (whole zone)	..	11.4
Top orebody	..	11.0
Marker beds	..	13.0
Bottom orebody	..	11.3
Rock overburden	..	12.2
Sand overburden	..	20.0
Waste rock	..	12.2

The lines of drill holes are generally 140 feet apart and the distance between drill holes from 80 feet to 160 feet. It is assumed that the grade as determined in each hole extends halfway to the next hole. In view of the distance between drill holes, such an assumption will not necessarily be correct. However, as the mineralised zone has been intersected by 32 drill holes, grades calculated from such holes should approach the average grade of the deposits. For the above reason, the ore from the viewpoint of grade is regarded as being probable reserves only. The amount of ore should be sufficiently accurate for all practical purposes.

In the drilling, the recovery of core was not 100 per cent. for all samples. The recovery was, however, high for the greater number of the samples. The grade of the unrecovered core could not, of course, be determined and assumptions had to be made regarding it. For the purposes of calculation, it was assumed that the unrecovered core in each sample was of the same grade as the recovered portion of that sample. For the purpose of indicating the worst possible set of conditions, calculations were also made in which it was assumed that the unrecovered portions of all samples were barren.

The above information and particularly the following factors have been considered in calculating the amounts of ore, etc.

(a) The geological information on section lines 1 to 13 (Plates 4, 6 and 7) and the sampling and other information on Plates 5 and 8.

(b) A length of 1260 feet - 40 feet west of line 6 to 100 feet east of line 13.

(c) A depth extending to sea-level.

Assuming that unrecovered core in each sample has the same grade as the recovered core, the figures are:-

	Tons	Grade % WO_3
Ore	2,028,573	0.64
Waste rock (untested mineralised zone) ..	931,006	
Sand overburden ..	910,342	
Rock overburden ..	1,541,164	
Waste rock (including 28,519 tons of aplite) ..	294,861	

There are, therefore, 2,959,579 tons of ore and untested mineralised zone, and 2,746,367 tons of barren material to be excavated.

The 2,028,573 tons of ore with an average grade of 0.64 per cent. WO_3 includes the following:-

<u>Top orebody</u>: 415,619 tons of average grade 1.21 per cent. WO_3.

<u>Marker beds</u>: 224,140 tons with a content of less than 0.05 per cent. WO_3.

<u>Bottom orebody</u>: 1,388,814 tons with an average grade of 0.56 per cent. WO_3.

The distribution between the three working levels is as follows:-

		Above 150-foot.	Between 150 and 75-foot.	Between 75-foot and sea-level.
Ore	Per Cent WO_3	0.74	0.71	0.58
	Tons	88,714	751,078	1,188,781
Waste rock (Untested mineralised zone)	Tons	357,845	401,524	171,637
Sand overburden	Tons	470,686	436,306	3,350
	C.yd	348,656	323,190	2,481
Rock overburden	Tons	439,830	608,754	492,580
	C.yd	198,738	275,066	222,573
Waste rock	Tons	59,483	157,660	49,199
Aplite	Tons	Nil	4,753	23,766

The above 2,028,573 tons of ore includes all the ore-bearing zone, i.e. the Top orebody, Marker beds, and Bottom orebody and also any ore in the Transition section. The following tables show the amounts and grades of the ore above and below 0.3 and 0.2 per cent. WO_3 respectively.

		Above 150-foot.	Between 150-foot and 75-foot.	Between 75-foot and sea-level.	Total
0.3 per cent. WO_3 & greater.	Tons	75,248	511,026	768,498	1,354,772
	Per Cent WO_3	0.84	0.97	0.84	0.89
Below 0.3 per cent. WO_3	Tons	13,466	240,052	420,283	673,801
	Per Cent WO_3	0.2	0.12	0.09	0.1

		Above 150-foot.	Between 150-foot and 75-foot.	Between 75-foot and sea-level.	Total
0.2 per cent. WO_3 and greater.	Tons	86,861	589,863	875,872	1,552,596
	Per Cent. WO_3	0.76	0.87	0.77	0.81
Below 0.2 per cent. WO_3	Tons	1,853	161,215	312,909	475,979
	Per Cent WO_3	0.15	0.04 (<0.05)	0.05	0.05

On the assumption that the unrecovered core is barren, the grade of the 2,028,573 tons would be reduced to 0.51 per cent. WO_3. The amounts of ore above and below 0.3 and 0.2 per cent. WO_3 and its distribution between the working levels are shown in the following table:-

		Above 150-foot	Between 150-foot and 75-foot.	Between 75-foot and sea-level.	Total
0.3 per cent. WO_3 and greater	Tons	70,350	426,138	707,478	1,203,966
	Per Cent. WO_3	0.60	0.95	0.78	0.81
Below 0.3 per cent. WO_3	Tons	18,364	324,940	481,303	824,607
	Per Cent. WO_3	0.16	0.12	0.09	0.1
0.2 per cent. WO_3 and greater.	Tons	80,574	530,682	799,790	1,411,046
	Per Cent. WO_3	0.56	0.76	0.72	0.73
Below 0.2 per cent. WO_3	Tons	8,140	220,396	388,991	617,527
	Per Cent. WO_3	0.07	0.05	0.06	0.06

The above assumption would, however, reduce the grade in two places on the footwall side (on lines 1 and 4) below that (0.2 per cent. WO_3) included as ore on Plates 5 and 8. The material in such places should, therefore, be regarded as waste rock. The amount is small (33,660 tons) and while the amount of ore would be reduced by that amount, the grade would not be appreciably increased.

The above figures regarding ore are based on the assumption that the ore is broken cleanly from the overlying rock overburden and the underlying waste rock. Such a condition could not be attained in open cutting on the scale that is proposed, and either some of the ore would be lost in the overburden and waste rock or the ore would be diluted with overburden and waste rock.

At the request of Mr. G. Lindesay Clark, Deputy Controller of Minerals Production, it has been assumed that the ore will be diluted by 2 feet of rock overburden on the hangingwall and 5 feet of underlying waste rock on the footwall. Such assumptions would increase the amount of material to be excavated by 48,060 tons; the diluted ore would be increased by 129,476 tons and the grade reduced to 0.60 per cent. WO_3, and the amount of waste rock (untested mineralised zone) increased by 30,744 tons. In accordance with the above assumptions and considering the unrecovered core as being of the same grade as the recovered, the following figures have been calculated to show the amounts of ore, overburden, and waste rock and their distribution between the three working levels.

		Above 150-foot	Between 150- and 75- foot	Between 75- foot and sea-level	Total
Total ore	Tons	107,810	798,769	1,251,476	2,158,049
	Per Cent. WO_3	0.62	0.67	0.56	0.60
Waste rock (untested mineralised zone).	Tons	373,809	412,006	175,935	961,750
Sand overburden	Tons	474,691	436,306	3,350	914,347
Rock overburden	Tons	432,668	593,077	474,188	1,499,933
Waste rock	Tons	51,680	132,244	20,142	204,066
Aplite	Tons	Nil	4,753	23,766	28,519

As indicated in the tables in this section of the report, there are considerable quantities of material in the ore-bearing zone with scheelite content below 0.3 per cent. WO_3. Included in some of the above tables, quantities are given for the material with scheelite content below 0.3 and 0.2 per cent. WO_3 respectively. These low-grade portions occur mainly as bands parallelling the bedding. The most prominent and continuous of these bands is the barren Marker beds. The details of the mining practice to be followed are not known at present. It may be that the minimum content of scheelite which forms profitable ore will be determined and an effort made by selective mining to reject the larger portions of the ore-bearing zone containing material below that grade. If this course is followed another dilution problem will arise. Some ore would be included in the low-grade material sent to the dump or alternatively low-grade material would be included in the ores sent for treatment. No figures for such loss of ore or dilution of ore are included in the above calculations. However, Mr. T. L. Barson, in his report on the open cut operations, included figures which would apply if an attempt were made to discard the Marker beds by selective mining. Figures have not been calculated for the other low-grade bands if these are to be rejected - such calculations should be left until the mining policy has been decided.

The ore-bearing zone includes the Top orebody of high and uniform grade; the Marker beds almost everywhere barren; and the Bottom orebody with the ore occurring in bands separated by low-grade material. The effects of this variation in grade sectionally across the ore-bearing zone have been discussed immediately above. There is marked variation in grade along the orebodies and particularly in the bands in the Bottom orebody. For satisfactory planning of the mining operations and particularly if selective mining is resorted to, it would be essential to determine the grade of ore some distance ahead of the faces. The determination would best be done by diamond drilling across the ore-bearing zone. This could probably be very conveniently conducted if a diamond drilling plant were available continuously on the mine (as it would be if a plant of that type were in use for drilling the blast holes).

X. EXTENSIONS OF THE MINERALISED ZONE.

A. Introduction.

The ultimate limits of the mineralised zone in every direction have not yet been proved by the existing outcrops, developmental work and drilling. These limits are determined by the geological structure.

The general conditions governing the possible extensions will be discussed below, and the possible extensions in the different directions will be discussed in greater detail.

Owing to the covering of sand in many places and the well-soiled nature of the surface elsewhere, outcrops of rocks of the Grassy Series are few. Surface geological mapping cannot, therefore, help to any important extent in tracing the favourable beds and in detecting structural features likely to affect their continuity. A geophysical survey by the magnetic method was made of the mineralised zone and its possible western extension. The results of this survey are contained in a separate forthcoming report, but are summarised below (p.41). The possible application of the results to tracing extensions of the mineralised zone are also discussed below (pp.43,44). It may be stated, however, that in the light of our present knowledge, the extensions of the favourable beds and the mineralised zones will have to be defined largely, if not wholly, by diamond drilling.

B. General Considerations.

In considering possible extensions to the known mineralised zone, the main factors are:-

(1) Extension of the Favourable Beds. The favourable beds may either have a more or less unlimited extension or be lenticular. If the beds are lenticular, the directions in which any such lenticularity would affect possible extensions to the mineralised zone would be along the strike (i.e. to the west) and down the dip. In the short length down the dip tested by the drill holes, there is a pronounced decrease in the thickness of the mineralised zone. Also to the west there is a decrease in the thickness of the Top orebody and the Marker beds, but the thickness of the Bottom orebody is uniform. It is probable that these decreases represent lenticularity of the beds in those two directions. The only alternative explanation would be that the faulting and folding had produced a thickening of the favourable beds near Lines 4 and 11 and at the present height of 150 feet above sea-level.

(2) Structural Features. Structural features which might affect the continuity of the favourable beds include faulting and igneous intrusives. The No.3 fault forms the known eastern end of the favourable beds and of the mineralised zone, and the faulted portion of the favourable beds has not been found.

The southerly dip of the favourable beds would eventually bring them into contact at depth with the granitic intrusive which outcrops to the south. If the beds continue down the dip, they would be cut off by the granite at a vertical depth of approximately 600 to 1,000 feet below sea-level or a distance down the dip of approximately 800 to 1,200 feet.

(3) Mineralisation of the Favourable Beds. Although the favourable beds may extend, orebodies will be present in them only where the beds have been invaded and altered by the mineralising solutions. In the light of present knowledge, it is impossible to indicate the possible extent of mineralisation.

C. Results of the Magnetic Survey.

The only result that need be considered is the Southern anomaly - an anomaly of high intensity occurring along a distance of 1,100 feet on the southern or hangingwall side of the mineralised zone. In plan it is sub-parallel to the hangingwall of the Top orebody, the axis of the anomaly being about 80 to 100 feet south from it at the eastern end and 230 feet at the western end. This divergence is regarded as being due to the greater depth of the anomaly body at the western end. The anomaly is regarded as arising from a magnetic bed of actinolite-hornfels, the magnetic properties being due to contained magnetite. If this interpretation is correct, the magnetic actinolite-hornfels would form an important marker as it is conformable with the beds of the mineralised zone and has its base 40 to 50 feet stratigraphically above the hangingwall of the Top orebody from which it is separated by pyroxene-garnet-hornfels. The hornfels is overlain by sand, etc., and the depth to it determines the distance in plan of the anomaly from the hangingwall of the Top orebody. However, the upward extensions of the beds in the region of the anomaly are cut off by the No.8 fault - a fault with a general westerly strike and a dip which, where observable, is generally about 28 degrees, but ranges up to 55 degrees. The rocks above the No.8 fault consist of actinolite-hornfels and biotite-actinolite-hornfels (the overburden rocks in the open cut), some of which are magnetic as is evident from the fact that the Northern anomalies are ascribed to them. If the No.8 fault maintains a low angle of dip, the amount of overburden rocks above it is small and not likely to give any appreciable anomaly. If, however, the fault has, in places where it is not exposed, a high angle of dip, it is possible that part at least of the Southern anomaly might arise from magnetic beds in the rocks above the fault. If such were the case, the anomaly and the magnetic beds would not represent a marker which could be used to indicate the hangingwall of the Top orebody. Unfortunately the information from the drill holes is such that the position and dip of the No.8 fault cannot be determined.

In the following discussions, it will be assumed that the conclusion reached in the geophysical report, viz., that the Southern anomaly arises from a magnetic actinolite-hornfels bed with its base 40 to 50 feet stratigraphically above the hangingwall of the Top orebody is correct.

D. Eastern End.

(1) Geological Considerations. Towards the east the mineralised zone terminates against the No.3 fault. Although small amounts of garnet and scheelite are stated to have been found by the early prospecting to the east of the open cut, and along what is now considered to be the No.3 fault, there is no evidence of the faulted portion, if any, of the mineralised zone north of the No.3 fault. It is

probable that the No.3 fault was earlier than the mineralisation and that the garnet-pyroxene-hornfels found on, and near, the sea-shore represents mineralisation along the No.3 fault. It is not known whether the favourable beds of the mineralised zone were mineralised on the northern side of the No.3 fault. Further, the probable position of such beds is not known. If the No.3 fault is a normal one (which seems unlikely), the faulted portion of the favourable beds to the north of the fault will be under Bass Strait. If, as seems probable, the No.3 fault is a reverse one, the faulted portion of the favourable beds would be at an unknown distance to the west-northwest of the eastern end of the open cut, dependent upon the amount of displacement by the fault. There is no evidence of the presence of such beds within a reasonable distance of the mine, but soil and sand occupy the surface and there are no outcrops of the hornfels. Further, there are no reports of scheelite or garnet occurring in that direction.

For the present, therefore, no information can be given as to the possibility of finding the mineralised zone north of the No.3 fault, but search should, in the first place, be directed along the northern side of the No.3 fault west-northwest from the eastern end of the open cut. The valley of the Grassy River should be searched for any evidence of favourable beds (calcite-hornfels).

(2) Geophysical Survey Results. The geophysical survey extended only to 800E and not to the eastern termination of the mineralised zone against the No.3 fault. The Southern anomaly ended abruptly at about 400E, and immediately east of the most intense part of the anomaly. High anomalous values do not appear along the easterly extension of the beds, but moderately high values appear to the south and southeast. Several geological structures which would cause this termination can be pictured, but the structure is fairly well known in that vicinity and some need not be considered.

It has been assumed that the anomaly arises from the magnetic actinolite-hornfels overlying the pyroxene-garnet-hornfels. The actinolite-hornfels (irrespective of whether it is magnetic or not) is known to occur further east, but there is a gap of 200 feet east of the termination of the anomaly, in which it is not known whether the hornfels is present or not. However, the pyroxene-garnet-hornfels is known to occur in its expected position in this gap and it is reasonable to infer that the actinolite-hornfels is also present. If the actinolite-hornfels extends easterly, then the termination of the anomaly must be caused by the absence of magnetite in the eastern extension of the hornfels. Other features such as faulting, presence of igneous rocks, change of dip, change of strike, could not adequately explain the known occurrences and the absence of the anomaly to the east.

If the anomaly is considered to arise from a magnetic bed in the overburden rocks, the termination of the anomaly could be explained by the No.8 fault. The trend of the latter is along the the northern and northeastern sides of the intense anomaly. Overburden rocks occur south of the fault and occupy the same region as the anomaly. East and northeast of the fault there are no overburden rocks and there is no magnetic anomaly. The areas of moderately high values south and southeast of the termination of the anomaly would be caused by other beds or lenses of magnetic rocks.

E. Western Extension.

(1) Geological Considerations. The mineralised zone extends as far west as drill holes 42 and 44 and probably also farther west to holes 21 and 20. The only difference in the mineralised zone in holes 42 and 44 compared with portions farther to the east is that the thicknesses of the Top orebody and of the Marker beds have decreased.

To the west of these holes, the surface is well soiled and/or covered by a thin layer of sand for a distance of 500 feet, and there is no outcrop of the rocks of the mineralised zone or the hornfelses with which they are interbedded. On the ridge farther west, all outcrops and loose pieces of rock are actinolite-hornfels which appears to be identical with that of the hangingwall country.

Southwards along the ridge, the actinolite-hornfels extends as far as the granite boundary. Northwestwards along the ridge, the outcrops and pieces of actinolite-hornfels end along a line with a general westerly trend (see Plate 1).

To the north of this line, the country is well-soiled and there is a complete absence of outcrops and pieces of rock except at the extreme head of a gully where a small outcrop of biotite-actinolite-hornfels occurs. It is possible that this biotite-actinolite-hornfels represents the westerly extension of the overburden on the northern side of the open cut. If the mineralised zone extends as far westerly as this locality, it most likely occurs at depth below the biotite-actinolite-hornfels. The northern side of this belt of well-soiled country is defined by pieces of the white quartzites which are the typical rocks of the northern side of the No.3 fault, and it is possible that the latter fault extends north-northwesterly to this locality. This fault would form the northern boundary of any westerly extension of the mineralised zone.

In the valley of Nichol Creek to the west of the ridge referred to above, a small amount of prospecting work was carried out in the past. The workings include two short adits, three shafts and several short and shallow trenches. The adits and shafts cannot be entered and the only information obtainable from them is that to be deduced from the rocks on the dumps. None of the rocks is typical of those in the mineralised zone. Very small amounts of garnet are present, however, as irregular replacements in the actinolite-hornfels of the southernmost shaft. There is thus some evidence that alteration similar to that in the mineralised zone has occurred in this locality. Very small amounts of scheelite can be obtained at a few places near the head of Nichol Creek.

(2) <u>Geophysical Survey Results</u>. The magnetic survey was conducted as far as 1000W, but the Southern anomaly did not extend westwards beyond about 600W. The anomaly is regarded as terminating abruptly at its western end, but there is a small area of high values to the north of this termination.

The geophysical evidence suggests that the termination is too abrupt to be due to a gradual decrease to the west of the content of magnetic minerals in the anomaly body. It could be due either to the sudden termination of the magnetic mineral content of the anomaly body or of the anomaly body with its magnetic mineral content. The first explanation is most improbable, but, if correct, would mean that the anomaly body would not be a satisfactory marker. The second explanation is the more probable one and will be further considered.

The sudden termination of the anomaly body would be related to the geological structure. Unfortunately there are no outcrops of bedrock around the termination and for 800 feet westwards from it. Further, there are no drill holes in that area, but Nos.20 and 21 holes are close to it. Structures which would explain the sudden termination are:-

(a) The surface of the bedrock descends abruptly to greater depths. This structure would only be present if there were cliffs on the eastern side of a former valley now filled in with sand. The valley would be the ancestor of the present Burn Creek. This structure might be possible from the geological aspect, but it is doubtful if the form of the geomagnetic contours is compatible with such a structure. There would probably be more agreement with the contours if the anomaly body is part of the overburden rocks above the No.8 fault.

(b) Faulting. A fault with considerable displacement would explain the abrupt termination of the anomaly body. It would have a strike between north and northwest. The downthrow could be either to the east or to the west. There is no surface evidence for or against this suggested fault.

(c) Igneous Intrusive. The abrupt termination of the anomaly body could be caused by an igneous intrusive. Granitic rocks occur to the south of the mine and it is possible that the boundary with the Grassy Series is not a straight northwesterly trending one as suggested on Plate 1, but that either the granitic rock or a large dyke trending northerly from it, extends up the valley of Burn Creek. There is little or no direct evidence for the presence of granitic rocks west from 600W. However, boulders of aplites and/or porphyries occur immediately west of the Manager's residence, and at three places to the west-northwest thereof. Some of these may be outcrops, but could represent narrow dykes and not necessarily part of the granitic rock or one large dyke therefrom. It is reported that drill hole No.20 passed through decomposed granite between 47 and 100 feet. Examination of the cuttings around the hole showed one piece of unweathered porphyry and numerous small pieces of angular quartz, and suggests that the material passed through was possibly detrital and not a granitic rock.

The above considerations would apply irrespective of whether the anomaly body occurs above or below No.8 fault.

Unfortunately the magnetic survey did not extend onto the granitic rocks, otherwise it might have been possible to determine if such rocks occurred immediately west of the termination of the anomaly body.

(d) Change of Strike. While it might be assumed that the western termination of the anomaly is due to a change in strike of the anomaly body from west to north-northwest, it would then be necessary to explain the termination of the latter portion near the Manager's residence. It is probable that the high values immediately south of the Manager's residence need not be regarded as a north-northwestern extension of the anomaly, but can be explained otherwise (it is possibly connected with the lesser thickness of sand in that area).

(3) Conclusions. It is obvious that there is no information about the mineralised zone west from drill holes 20, 21, 42 and 44, and that testing is desirable and necessary.

Diamond drilling is recommended as the best method of testing the extension of the mineralised zone. The Nos.5 and 6 lines should be completed and the campaign then continued to the west of No.6 line.

The geophysical (magnetic) survey could be continued beyond the area already surveyed. It is obvious, however, that some drilling should precede the magnetic survey in order that the significance of the western termination of the southern anomaly may be determined. The drilling would also provide geological information upon which the interpretation of the extended magnetic survey could be based. Any magnetic survey should be extended southerly to embrace the contact of the granite and the hornfels, and westerly to include the ridge upon which the actinolite-hornfels outcrops.

F. Extension at Depth.

The drill holes have shown that the mineralised zone extends below sea-level, the greatest depths to which it has been proved being 100, 80 and 60 feet below sea-level in drill holes Nos.44, 31 and 56 respectively. Below the No.2 fault, the zone appears to extend downwards uninterruptedly except where it is cut by the No.9 fault, and it is probable that it extends some distance at least below the deepest point at which it is known, namely 100 feet below sea-level.

The thickness of the zone is decreasing with depth, but there is no evidence to indicate whether such decrease will continue or not. At least it will not affect the economic exploitation of the zone as far as the depth to which open cutting would be continued, viz. between sea-level and 200 feet below sea-level.

Nothing can, of course, be said as to the grade at depths greater than the drill holes. As far as the available information extends, there appears to be a decrease in grade with depth, but there is no information to determine whether such decrease will continue or not.

As indicated above (p.40), the favourable beds would, if they continue, be cut off by the granitic rocks at distances down the dip ranging from 800 to 1,200 feet.

Drilling will be necessary to prove the extension, thickness and grade at depth.

G. Northern Limit of Mineralised Zone at Surface.

This limit is not definitely determined at the present time. Near the northeastern portion of the workings it is, of course, defined by the No.3 fault. Towards the west, its limit should be determined by the Transition section and/or the footwall rocks coming to the surface on the southern side of the No.3 fault. The footwall of the zone is, however, faulted down to the north successively by the No.2 and 5 faults and by a fault of similar displacement to the north of the No.5. A limited number of shallow drill holes would be required to determine more accurately the northern limit of the mineralised zone near the surface.

H. Parallel Mineralised Zones.

It has been shown above (p.24) that small quantities of scheelite are present in the footwall hornfels to a depth 180 feet stratigraphically below the base of the Transition section. This occurrence suggests that the scheelite-bearing solutions had access to the footwall hornfels. If, therefore, favourable beds similar to those which existed in the mineralised zone, occur at depths of say 200 to 500 feet below the mineralised zone, it is possible that they might also have been altered and mineralised. It is not known whether such beds exist, and drilling below the mineralised zone would be necessary to determine if parallel orebodies exist in the footwall at depths greater than 180 feet below the mineralised zone.

As regards the hangingwall side, scheelite does not occur in rocks above the pyroxene-garnet-hornfels. However, in Drill Hole No.48, traces of scheelite occurred in narrow veins (up to $\frac{1}{8}$ inch) in the rocks about 60 feet above the hangingwall of the pyroxene-garnet-hornfels. If favourable rocks exist in the hangingwall country, there is the possibility that parallel mineralised zones may occur.

Discontinuous outcrops occur along the shore south from the re-treatment mill, but none of the rocks is of the favourable carbonate type. The only possibility of favourable rocks is, therefore, in those beds which do not outcrop along the shore. Drill holes 48 and 49 were put down to test portion of the hangingwall country, but the only scheelite found was that in hole 48 referred to immediately above (p.45).

XI. SUMMARY AND CONCLUSIONS.

The Grassy scheelite deposit is a pyrometasommatic deposit, occurring at a distance of approximately 1,300 feet from a granite intrusive, and formed by the replacement and alteration of beds of limestone interbedded with a series of hornfelses. Outside the mineralised zone, the rocks are actinolite-hornfels, biotite-actinolite-hornfels, muscovite-hornfels, etc. Within the mineralised zone, the typical assemblage is garnet (andradite and grossularite), diopside, epidote, etc.

The mineralised zone has been proved by workings and drill holes to have a general westerly strike and southerly dip at 40 degrees; a thickness, where not reduced due to faulting, ranging from 150 to 222 feet and averaging about 180 feet; and a length of at least 1,400 feet. The eastern end is determined by the No.3 fault and is situated about 450 feet inland from the southeastern coast of the island. The limits of the zone to the west and at depth have not been reached.

The mineralised zone has an ore-bearing portion which has a thickness, where not reduced due to faulting, ranging from 80 to 162 feet and averaging 117 feet for the known length of the zone, viz. 1,400 feet. This portion contains two orebodies - the Top and Bottom orebodies - with a barren section, the Marker beds, between them. The Top orebody is continuous throughout almost the whole of the southern or hangingwall side of the zone. Its thickness ranges from 0 to 38 feet and averages 25 feet. The Bottom body is continuous throughout almost the whole of the zone. Its thickness ranges up to 110 feet exclusive of any low-grade band immediately above the Transition section. In places where the thickness is not reduced due to faulting, it ranges from 48 to 110 feet and averages 90 feet. The Marker beds have a thickness ranging from 4 to 25 feet and averaging about 13 feet.

The probable reserves as indicated by drilling are for the Top orebody 415,619 tons with an average grade of 1.21 per cent. WO_3, and for the Bottom orebody 1,388,814 tons with an average grade of 0.56 per cent. WO_3.

The deposit is at present being worked by open cut methods at a rate of approximately 700 tons per week. It was desired that production should be increased to 5,000 tons of ore per week and a drilling campaign was conducted to prove sufficient ore reserves to enable this rate to be maintained for several years.

Within the area drilled, the following figures represent the amounts of ore, overburden, etc., in the proposed open cut and considered as extending to sea-level.

	Tons	Grade % WO_3
Ore	2,028,573	0.64
Waste rock (untested mineralised zone). ..	931,006	
Sand overburden ..	910,342	
Rock overburden ..	1,541,164	
Waste rock (including 28,519 tons of aplite) ..	294,861	

As far as a comparison can be made with similar scheelite deposits in other parts of the world, it appears that the Grassy deposit is the largest single deposit known. The Pine Creek mine in the United States of America is treating ore at a greater rate than that proposed at Grassy, but the ore reserves are comparable and the Pine Creek mine contains a group of deposits and not one single deposit.

The limits of the deposit have not been reached to the west and at depth. The extensions of the deposit in those directions would best be determined by diamond drilling. As regards the extension in depth, testing of the whole deposit should be carried out at least to a depth to which it is considered that open cut methods could be economically extended. Further, the testing of the Top orebody should be conducted to greater depths as it may be possible to mine that orebody by underground mining methods to considerably greater depths than would be possible by open cutting.

(P. B. Nye)
ASSISTANT DIRECTOR.

CANBERRA, A.C.T.
December, 1943.

(C. L. Knight)
GEOLOGIST.

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- APPENDIX -

Sampling and Assaying Results of Drill Cores.

Sample No.	Diam. of Core	Limiting Depths From	Limiting Depths To	Length of Core Recovered	Core Recovery	Weight of Core Recovered	Weight Per Foot of $1\frac{1}{8}$" Core	Assay Result WO_3
	In.	Feet	Feet	Feet	%	Grams	Grams/Foot	%
			Drill Hole 22, Site 20					
C1.	$1\frac{5}{8}$	11.0	21.0	1.6	16	865	259	<0.05
C2.	$1\frac{5}{8}$	21.0	31.0	.9	13	439	612	<0.05
	$1\frac{1}{8}$			.4		195		
C3.	$1\frac{1}{8}$	31.0	36.2	1.0	19	342	342	0.06
C4.	"	36.2	46.8	6.5	61	3455	532	1.0
C5.	"	46.8	51.1	1.7	40	969	570	1.57
C6.	"	51.1	63.7	6.8	54	3685	542	0.2
C7.	"	63.7	71.5	7.0	90	4570	653	0.58
C8.	"	71.5	81.5	9.9	99	6347	641	0.58
C9.	"	81.5	91.5	10.0	100	5990	599	0.24
C10.	"	91.5	102.1	10.0	94	6309	631	0.3
C11.	"	102.1	109.3	6.1	85	3670	602	0.25
C12.	"	109.3	122.6	12.5	94	8029	642	0.4
C13.	"	122.6	135.9	12.2	97	7892	647	0.35
C14.	"	135.9	141.0	4.9	98	3182	649	1.0
C15.	"	141.0	151.0	9.8	98	6400	653	0.25
C16.	"	151.0	157.5	5.4	83	2900	537	0.1
C17.	"	157.5	171.0	13.2	98	7670	581	0.1
C18.	"	171.0	184.0	10.0	77	5940	594	0.15
C19.	"	184.0	192.0	7.6	95	4290	564	<0.05
C20.	"	192.0	199.5	6.9	92	4000	580	<0.05
C21.	"	199.5	209.5	9.9	99	5482	554	Nil x
C22.	"	209.5	220.0	9.9	94	5830	589	<0.05
C23.	"	220.0	230.5	10.0	95	5685	569	<0.05
C24.	"	230.5	240.5	9.9	99	5810	587	<0.05
C25.	"	240.5	251.0	10.1	96	5960	590	<0.05
C26.	"	251.0	261.0	9.3	93	5470	588	Nil
C27.	"	261.0	272.0	10.3	94	6064	589	Nil
C28.	"	272.0	282.5	9.7	92	5244	541	<0.05
C29.	"	282.5	291.0	7.0	82	3960	566	<0.05
C30.	"	291.0	301.0	9.7	97	5910	609	0.05
C31.	"	301.0	308.0	6.5	93	3935	605	0.05
C32.	"	308.0	318.0	9.8	98	5840	596	0.05
C33.	"	318.0	331.5	12.1	90	7350	607	0.05
			Drill Hole 23, Site 30					
C34.	$1\frac{1}{8}$	2.2	11.9	6.9	72	4000	580	1.65
C35.	"	11.9	17.1	4.8	92	3050	635	1.8
C36.	"	17.1	27.5	8.3	80	5145	620	1.25
C37.	"	27.5	34.5	3.8	47	1780	465	Nil
C38.	"	34.5	41.8	7.1	98	3570	503	0.2
C39.	"	41.8	57.3	13.0	84	7492	576	0.3
C40.	"	57.3	67.3	9.3	93	4930	530	<0.05
C41.	"	67.3	78.0	10.1	94	5440	539	Nil
C42.	"	78.0	89.8	11.0	93	6322	575	0.15
C43.	"	89.8	98.8	8.6	95	5510	641	0.57
C44.	"	98.8	107.5	8.0	92	4910	614	0.25
C45.	"	107.5	117.5	8.4	84	5050	601	0.5
C46.	"	117.5	127.5	8.8	88	5327	605	0.45
C47.	"	127.5	137.0	9.5	100	6330	666	0.60
C48.	"	137.0	147.5	9.9	94	6160	622	0.55

Sample No.	Diam. of Core	Limiting Depths From	Limiting Depths To	Length of Core Recovered	Core Recovery	Weight of Core Recovered	Weight Per Foot of $1\frac{1}{8}$" Core	Assay Result WO_3
	In.	Feet	Feet	Feet	%	Grams	Grams/Ft.	%
Drill Hole 23, Site 3C (cont'd.)								
C49	$1\frac{1}{8}$	147.5	158.0	9.8	93	6642	678	0.4
C50	"	158.0	163.0	2.9	58	1600	552	0.05
C51	"	163.0	172.5	9.5	100	5705	600	0.25
C52	"	172.5	183.0	10.4	99	6310	607	Barren
C53	"	183.0	192.0	8.1	90	4720	583	"
C54	"	192.0	202.3	6.1	59	2899	475	"
C55	"	202.3	212.5	8.2	80	3959	483	"
C56	"	212.5	222.3	8.8	90	4959	563	"
C57	"	222.3	230.0	6.8	88	3650	536	"
C58	"	230.0	239.5	8.5	90	4700	553	"
Drill Hole 24, Site 2D								
C59	$1\frac{1}{8}$	19.0	29.0	3.9	39	1650	423	Barren
C60	"	29.0	40.8	4.6	39	2145	466	"
C61	"	40.8	51.0	5.7	56	2550	447	"
C62	"	51.0	61.0	5.7	57	2500	438	"
C63	"	61.0	71.3	9.2	89	5139	559	"
C64	"	71.3	84.5	5.7	43	2785	471	"
C65	"	84.5	89.4	4.9	100	2745	560	0.65
C66	"	89.4	97.0	7.2	95	4609	640	0.45
C67	"	97.0	103.8	6.8	100	4049	595	0.3
C68	"	105.0	115.7	9.2	86	4774	519	0.1
C69	"	115.7	128.6	10.6	82	5680	536	0.05
C70	"	128.6	137.5	8.4	94	4390	523	Barren
C71	"	137.5	147.5	8.1	81	4130	510	"
C72	"	147.5	159.5	9.2	77	4955	539	"
C73	"	159.5	175.0	12.3	79	6425	522	"
C74	"	175.0	187.0	5.7	48	2757	484	"
C75	"	195.0	209.0	12.8	92	6895	539	"
C76	"	209.0	220.8	10.2	87	5655	554	"
C77	"	220.8	228.0	6.7	93	3625	541	0.15
Drill Hole 25, Site 3D								
C78	$1\frac{1}{8}$	0	10.0	2.0	20	1590	795	1.65
C79	"	10.0	20.8	3.8	35	1730	455	1.5
C80	"	20.8	30.3	8.2	86	5160	622	0.75
C81	"	30.3	40.7	9.7	93	5910	609	0.4
C82	"	40.7	48.0	6.9	95	3880	562	0.15
C83	"	48.0	62.5	13.3	92	7540	567	0.05
C84	"	62.5	68.0	5.2	95	3060	588	0.35
C85	"	68.0	75.7	7.2	94	4380	608	0.35
C86	"	75.7	79.7	3.3	82	2270	688	0.55
C87	"	79.7	90.0	9.8	95	5720	584	0.6
C88	"	90.0	96.8	5.2	77	2870	552	0.45
C89	"	96.8	106.5	9.3	96	5420	583	0.1
C90	"	106.5	116.7	9.6	94	4630	482	0.05
C91	"	116.7	124.3	5.6	74	3460	618	0.1
C342	"	124.3	127.3	2.2	73	1385	629	$<$0.05
C343	"	127.3	142.0	13.0	90	6770	521	$<$0.05
Drill Hole 25 (re-drilled)								
C349	2.34	0	4.0	2.2	55	2472	592	0.75
C350	"	4.0	13.0	2.0	22	1870	492	0.50
C351	1.17	13.0	21.0	3.0	37	977	348	0.40

Sample No.	Diam. of Core	Limiting Depths From	Limiting Depths To	Length of Core Recovered	Core Recovery	Weight of Core Recovered	Weight Per Foot of $1\frac{1}{8}$" Core	Assay Result WO_3
	In.	Feet	Feet	Feet	%	Grams	Grams/Ft.	%
Drill Hole 26, Site 3E								
C92	$1\frac{1}{8}$	68.0	74.0	3.4	57	1889	556	0.05
C93	"	74.0	82.2	7.4	90	4752	642	0.2
C94	"	82.2	92.0	9.6	98	5860	610	0.9
C95	"	92.0	102.9	9.6	88	6080	633	1.0
C96	"	102.9	115.3	9.8	80	5690	581	0.15
C344	"	115.3	122.5	7.2	100	4206	584	<0.05
C345	"	122.5	133.0	7.8	74	4474	573	<0.05
Drill Hole 27, Site 4D								
C352	$1\frac{1}{8}$	18.0	24.0	2.6	43	1484	571	0.15
C97	"	53.8	61.0	6.0	83	1285	214	0.3
C98	"	61.0	70.8	9.5	97	5770	602	0.1
C99	"	70.8	81.5	9.5	88	5430	572	0.15
C100	"	81.5	92.0	9.8	93	5690	581	0.1
C101	"	92.0	101.0	8.8	98	5680	645	0.45
C102	"	101.0	111.0	9.5	95	6145	647	0.15
C103	"	111.0	122.5	11.5	100	7800	678	0.6
C104	"	122.5	131.0	8.3	98	5480	660	0.4
C346	"	131.0	143.0	11.8	98	6410	534	<0.05
C347	"	143.0	151.7	7.2	83	3532	406	<0.05
Drill Hole 28, Site 4B								
C105	$1\frac{1}{8}$	3.0 ?	4.8	1.2	?	780	650	3.1
C106	"	4.8	15.2	10.2	98	7130	699	2.35
C107	"	15.2	25.5	9.7	95	6910	712	2.1
C108	"	25.5	30.2	2.5	53	1370	708	2.85
C109	"	30.2	43.8	13.1	97	8470	647	0.7
C110	"	43.8	52.2	6.8	81	3230	475	<0.05
C111	"	52.2	61.2	7.4	82	3580	484	<0.05
C112	"	61.2	74.3	9.7	74	5470	564	0.25
C113	"	74.3	82.7	8.4	100	3980	474	0.05
C114	"	82.7	96.0	13.1	99	7890	602	0.6
C115	"	96.0	105.2	7.8	85	4259	546	0.45
C116	"	105.2	116.0	8.1	75	4590	567	0.15
C117	"	116.0	124.0	7.5	83	4600	613	0.45
C118	"	124.0	133.0	8.1	90	5300	654	0.5
C119	"	133.0	142.3	8.9	96	4530	509	0.15
C120	"	142.3	153.4	9.8	88	5852	597	<0.05
C121	"	153.4	162.3	8.9	100	5129	576	<0.05
C	"	162.3	172.0	9.6	99	4895	510	<0.05
Drill Hole 29, Site 1C								
C140	$1\frac{1}{8}$	70.0	81.0	1.9	17	1057	556	0.2
C141	"	81.0	88.0	4.0	57	2145	536	0.9
C142	"	88.0	98.5	3.3	31	1850	561	0.15
C143	"	98.5	106.2	2.5	33	1380	552	0.55
C144	"	106.2	113.3	6.9	95	4260	617	0.95
C145	"	113.3	120.0	6.4	96	3937	615	0.6
C146	"	120.0	126.5	6.5	100	4124	634	1.3
C147	"	126.5	136.5	9.8	98	6400	654	0.7

Sample No.	Diam. of Core	Limiting Depths		Length of Core Recovered	Core Re-covery	Weight of Core Recov-ered	Weight Per Foot of $1\frac{1}{8}$" Core	Assay Result WO_3
		From	To					
	In.	Feet	Feet	Feet	%	Grams	Grams/Ft.	%
Drill Hole 29, Site 1C								
C148	$1\frac{1}{8}$	136.5	148.4	11.2	94	7444	665	0.8
C149	"	148.4	158.7	9.8	95	5642	576	0.05
C150	"	158.7	170.0	10.7	95	6[illegible]84	606	0.2
C151	"	170.0	180.4	10.0	96	6307	631	0.2
C348	"	180.4	193.0	11.9	95	5610	471	0.05
Drill Hole 30, Site 4C								
C122	$1\frac{1}{8}$	3.5	10.7	6.7	93	3530	527	0.1
C123	"	10.7	18.5	7.7	99	3750	487	<0.05
C124	"	18.5	29.2	5.9	55	2775	470	<0.05
C125	"	29.2	40.0	9.3	86	5079	535	<0.05
C126	"	40.0	49.0	5.2	58	3025	582	<0.05
C127	"	49.0	57.5	7.7	92	2225	289	<0.05
C128	"	57.5	63.2	5.0	88	2832	566	<0.05
C129	"	63.2	73.5	7.6	74	4162	548	0.1
C130	"	73.5	84.5	10.0	91	5337	534	<0.05
C131	"	84.5	95.5	9.3	85	4930	530	<0.05
C132	"	95.5	107.5	9.5	79	5010	527	<0.05
C133	"	107.5	115.5	6.5	81	3560	548	0.1
C134	"	115.5	127.0	10.4	90	5765	554	0.1
C135	"	127.0	139.8	9.1	71	4779	525	<0.05
C136	"	139.8	147.2	7.4	100	4012	542	<0.05
C137	"	147.2	154.5	5.3	73	2965	559	<0.05
C138	"	154.5	165.8	10.4	92	5729	551	<0.05
C139	"	165.8	179.3	8.2	61	4375	534	0.15
C240	"	179.3	186.0	2.0	30	850	425	<0.05
C241	"	186.0	193.7	5.7	74	3000	526	<0.05
Drill Hole 31, (3' W. of 3B)								
C152	1.12	114.0	119.8	4.9	84	2635	538	<0.05
C153	1.12	119.8	130.0	10.0	98	6185	619	0.1
C154	1.12	130.0	140.6	10.1	95	6175	611	0.2
C155	1.12	140.6	150.8	9.8	96	6084	621	0.1
C156	1.13	150.8	160.7	9.6	97	5952	609	0.15
C157	1.15	160.7	171.8	11.0	99	6580	566	0.1
C158	1.15	171.8	181.2	8.4	89	5580	628	0.85
C159	ø	181.2	184.7	3.3	94	2015	630ø	2.65
C160	1.18	184.7	187.3	2.3	88	1630	632	1.25
C161	1.10	187.3	196.0	8.5	98	5190	630	0.8
C162	1.10	196.0	206.0	7.2	72	3620	521	0.1
C163	1.10	206.0	210.6	4.0	87	1945	504	<0.05
C164	1.11	210.6	215.0	2.9	66	1590	524	0.05
C165	1.11	215.0	224.5	7.9	83	5060	652	0.05
C166	1.11	224.5	236.0	8.7	76	5140	601	0.75
C167	1.11	236.0	246.6	9.8	92	6100	634	0.55
C168	1.11	246.6	256.8	10.0	98	6190	630	0.35
C169	1.12	256.8	267.0	10.1	99	6140	608	0.80
C170	1.12	267.0	277.2	7.1	70	4310	607	0.35
C171	1.12	277.2	287.5	8.6	84	5410	629	0.60
C172	1.14	287.5	297.6	4.9	49	3050	600	0.8
C173	1.15	297.6	302.0	2.8	64	1830	618	0.35
C174	1.15	302.0	313.0	9.0	82	5230	550	0.05
C181	1.15	313.0	319.5	6.4	98	3780	559	0.4
C219	1.15	319.5	329.5	7.1	71	3590	359	<0.05

ø Core was re-drilled. Weight per foot taken as average of C158 and 160.

Sample No.	Diam. of Core	Limiting Depths From	Limiting Depths To	Length of Core Recovered	Core Recovery	Weight of Core Recovered	Weight Per Foot of $1\frac{1}{8}$" Core	Assay Result WO_3
	In.	Feet	Feet	Feet	%	Grams	Grams/Ft.	%
			Drill Hole 32, (Site 1D)					
C175	1.14	54.0	64.5	3.7	34	2070	539	4.1
C176	1.14	64.5	73.0	7.9	93	4250	518	0.2
C177	1.12	73.0	83.5	4.3	41	2320	469	0.1
C178	1.12	83.5	89.0	2.6	47	1140	438	0.05
C179	1.14	89.0	96.5	6.4	85	2090	315	< 0.05
C180	1.14	96.5	109.3	7.8	61	4220	522	< 0.05
			Drill Hole 33, (Site 1E)					
C210	1.16	94.0	97.5	3.0	86	1850	578	0.15
C211	1.17	97.5	106.8	3.2	34	1870	537	< 0.05
C212	1.17	106.8	116.8	10.0	100	6400	588	< 0.05
C213	1.13	116.8	127.6	9.0	82	4950	550	< 0.05
C214	1.13	127.6	138.5	8.6	78	4500	519	< 0.05
C215	1.13	138.5	150.0	5.8	50	3620	619	0.25
C216	1.13	150.0	154.5	4.0	89	2270	563	0.55
C217	1.13	154.5	164.2	8.1	84	4060 (a)	497	< 0.05
C218	1.12	164.2	177.2	9.6	74	4620	486	0.05
C242	1.13	177.2	184.5	5.2	71	2580	496	< 0.05
C243	1.15	184.5	194.5	9.9	99	5410	522	< 0.05
C244	1.15	194.5	200.7	5.7	92	3080	516	< 0.05
C245	1.15	200.7	211.0	9.3	90	5030	517	< 0.05
C246	1.15	211.0	215.0	3.8	95	2460	619	0.7
C247	1.16	215.0	226.3	10.1	88	5700	529	< 0.05

(a) Weight correction factor of 1% to be added.

Sample No.	Diam. of Core	From	To	Length of Core Recovered	Core Recovery	Weight of Core Recovered	Weight Per Foot of $1\frac{1}{8}$" Core	Assay Result WO_3
			Drill Hole 34, (Site 2B)					
C182	1.60	72.0	75.0	2.6	87?	1835	346	0.2
C183	1.30	75.0	85.0	2.0	20	1070	355	0.2
C184	1.75	85.0	99.0	4.5	32	6250	508	0.1
C185	1.15	99.0	107.0	6.3	79	3940	592	0.1
C186	1.11	107.0	113.2	5.9	95	3270	564	0.05
C187	1.11	113.2	119.9	6.0	90	3645	619	0.1
C188	1.11	119.9	127.9	6.3	79	3835	620	0.15
C189	1.11	127.9	135.4	7.5	100	4920 (a)	681	1.05
C190	1.15	135.4	146.6	11.2	100	7690	650	2.55
C191	1.11	146.6	153.2	6.5	98	3840 (b)	581	0.35
C192	1.11	153.2	163.4	9.4	92	4850 (c)	551	< 0.05
C193	1.11	163.4	171.0	6.9	91	3260	481	< 0.05
C194	1.11	172.8	178.0	2.4	46	1415	600	< 0.05
C195	1.12	178.0	189.0	9.8	89	6117	624	1.25
C196	1.13	189.0	194.0	3.6	72	2342	639	0.5
C197	1.14	194.0	204.0	4.8	48	2790	560	1.05
C198	1.14	204.0	207.2	3.0	94	1890	607	0.35
C199	1.12	207.2	217.8	9.7	91	6330	652	1.4
C200	1.12	217.8	228.0	8.7	85	5740	660	1.2
C201	1.12	228.0	236.2	4.6	56	3030	659	1.05
C202	1.12	236.2	245.0	7.2	82	4510 (b)	651	0.95
C203	1.12	245.0	252.0	5.6	80	3600	643	0.8
C204	1.12	252.0	261.0	7.6	85	4635	610	0.8
C205	1.13	261.0	265.0	4.0	100	2627	645	0.7
C206	1.11	265.0	270.0	5.0	100	2889	588	0.2
C207	1.11	270.0	280.0	8.7	87	5030	588	< 0.05
C208	1.12	280.0	285.5	3.8	70	2150	566	< 0.05
C209	1.12	285.5	293.5	4.3	54	2645	615	< 0.05
C239	1.12	293.5	303.2	5.0	52	2387	477	< 0.05

(a) Weight correction factor of 2 per cent. to be added.
(b) " " " " 4 " " " " "
(c) " " " " 5 " " " " "

Sample No.	Diam. of Core	Limiting Depths		Length of Core Recovered	Core Recovery	Weight of Core Recovered	Weight Per Foot of $1\frac{1}{8}$" Core	Assay Result WO_3
		From	To					
	In.	Feet	Feet	Feet	%	Grams	Grams/Ft	%
				Drill Hole 35, (Site 1B)				
C258	0.82	131.0	136.5	4.2	76	1190	537	1.25
C259	0.83	136.5	140.5	4.0	100	1240	564	0.95
C260	0.83	140.5	147.2	5.0	75	1430	520	0.2
C261	0.83	147.2	152.5	2.2	41	694	573	0.1
C262	0.83	152.5	162.1	6.8	71	2044	548	0.05
C263	0.83	162.1	168.3	3.9	63	979	457	0.05
C264	0.83	170.0	180.0	9.9	99	3390	623	0.4
C265	0.83	180.0	189.2	8.1	88	2812	632	0.2
C266	0.83	189.2	195.0	5.6	97	1670	608	0.1
C267	0.83	195.0	205.0	10.0	100	3477	634	0.5
C268	0.83	205.0	211.0	0.7	11	247	643	0.15
C269	0.83	211.0	221.0	9.9	99	3640	670	0.45
C270	0.83	221.0	231.0	9.4	94	3165	614	0.15
C271	0.83	231.0	239.8	7.9	90	2440	562	0.15
C272	0.84	239.8	250.0	9.7	95	2970	552	0.05
C273	0.84	250.0	261.8	9.1	77	2670	528	0.05

Weight correction factor uniform and not applied.

Drill Hole 36, (Site 4G)

C220	1.15	81.0 ?	86.5	3.9	71	2590(a)	654	0.05
C221	1.15	86.5	94.0	6.2	83	3340	515	0.05
C222	1.15	94.0	104.5	9.8	93	6580	642	0.15
C223	1.17	104.5	115.0	9.4	89	5990	586	0.10
C224	1.19	115.0	121.5	5.9	91	3670	549	0.15
C225	1.10	121.5	128.2	6.0	90	3570	623	0.05
C226	1.11	128.2	137.2	9.0	100	5680	642	3.1
C227	1.11	137.2	143.2	5.2	87	3070	607	1.0
C228	1.09	143.2	152.8	8.8	92	5090	618	0.85
C229	1.09	152.8	162.0	7.5	81	4530	643	0.45
C230	1.09	162.0	166.1	3.1	76	1600	550	0.10
C231	1.09	166.1	171.0	2.8	56	1430	544	0.05
C232	1.12	171.0	178.0	4.0	57	2130	538	0.05
C233	1.12	178.0	188.0	10.0	100	5710	577	0.5
C234	1.13	188.0	192.0	2.6	75	1497	571	0.4
C235	1.12	192.0	197.3	5.1	96	2890	572	0.25
C236	1.12	197.3	202.8	5.0	90	2775	561	0.05
C237	1.12	202.8	211.8	5.3	59	3390	646	0.8
C238	1.12	211.8	216.5	4.3	91	2770	651	0.35
C248	1.12	216.5	227.0	9.9	94	5850	597	0.4
C249	1.12	227.0	237.8	10.0	92	6320	638	0.6
C250	1.12	237.8	251.0	8.9	68	5150	584	0.05
C251	1.12	251.0	258.0	14.7	67	2660	572	0.05
C252	1.12	258.0	266.6	7.8	91	4280	554	0.05
C253	1.12	266.6	277.2	9.9	93	5710	583	0.1
C254	1.12	277.2	288.4	8.8	79	4900	562	0.05
C255	1.12	288.4	293.5	4.6	90	2580	566	0.05
C256	1.13	293.5	313.1	13.8	70	7640	549	0.05
C257	1.13	313.1	329.3	13.6	84	7610	560	0.1

(a) Weight correction factor of 4% to be added to sample C220.
" " " " 1% " " " " " C221-257.

Sample No.	Diam. of Core	Limiting Depths From	Limiting Depths To	Length of Core Recovered	Core Recovery	Weight of Core Recovered	Weight Per Foot of $1\frac{1}{8}$ Core	Assay Result WO_3
	In.	Feet	Feet	Feet	%	Grams	Grams/Ft.	%
				Drill Hole 37, (Site 2G).				
C274	1.13	63.5	70.0	4.2	65	2480 (a)	597	3.5
C275	1.13	70.0	78.2	7.4	90	4890 (b)	662	1.9
C276	1.13	78.2	86.0	6.8	90	4507 (c)	657	1.5
							600 (z)	
C277	1.13	109.0	115.0	0.7	12	329	466	0.2
C278	1.14	115.0	119.0	3.0	75	1870	607	0.65
C279	1.14	119.0	129.5	9.8	93	5968	593	0.2
C280	1.11	129.5	140.0	9.6	91	6000	643	0.55
C281	1.11	140.0	150.4	9.8	94	5834	612	0.2
C282	1.11	150.4	160.5	9.9	98	6264	651	0.55
C283	1.11	160.5	171.0	9.6	91	5998	642	1.1
C284	1.11	171.0	175.0	3.9	97	2430 (c)	641	0.6
C285	1.11	175.0	185.5	8.2	78	4984	625	0.2
C286	1.11	185.5	197.0	9.9	86	6314	656	0.65
C287	1.11	197.0	207.0	10.0	100	6488	667	0.2
C288	1.11	207.0	215.8	6.5	74	3890	609	0.15
C289	1.12	215.8	225.8	6.8	68	3686	547	0.1
C290	1.12	225.8	231.0	5.2	100	3030	588	0.15
C291	1.13	231.0	239.9	6.3	71	3452	543	< 0.05

(a) Weight correction factor of 3 per cent. to be added.
(b) " " " " 2 " " " " "
(c) " " " " 1 " " " " "

Sample No.	Diam. of Core	Limiting Depths From	Limiting Depths To	Length of Core Recovered	Core Recovery	Weight of Core Recovered	Weight Per Foot of $1\frac{1}{8}$ Core	Assay Result WO_3
				Drill Hole 38, (Site 3G).				
C292	1.13	37.0	45.1	7.1	87	4310	602	0.3
C293	1.13	45.1	53.5	6.2	74	3857	617	< 0.05
C294	1.13	53.5	65.9	11.3	91	6714	589	0.15
C295	1.13	65.9	72.0	5.6	92	3396 (c)	601	< 0.05
C296	1.13	72.0	80.6	8.3	97	5009	599	< 0.05
C297	1.14	80.6	87.8	7.0	97	4282	596	0.2
C298	1.14	87.8	95.2	6.5	88	3917 (a)	598	0.15
C299	1.14	95.2	103.6	7.9	94	5280 (a)	663	1.65
C300	1.14	103.6	107.8	4.1	98	2817 (c)	669	1.4
C301	1.14	107.8	115.0	7.2	100	4834 (b)	660	1.7
C302	1.14	115.0	122.7	7.2	93	4930	667	0.4
C303	1.14	122.7	128.5	5.0	86	3075	599	0.6
C304	1.08	128.5	134.0	4.1	75	2239	591	0.1
C305	1.12	134.0	139.0	2.7	54	1109	415	0.05
C306	1.12	139.0	150.7	10.2	87	6119	606	0.5
C307	1.13	150.7	154.1	1.2	33	515	426	< 0.05
C308	1.14	154.1	159.0	1.4	29	704	489	0.55
C309	1.14	159.0	168.2	8.7	95	5530	619	0.5
C310	1.11	168.2	181.7	12.1	90	7370	626	0.45
C311	1.12	181.7	186.7	4.0	80	2330 (c)	588	0.05
C312	1.12	186.7	195.5	8.2	93	5179	638	0.3
C313	1.12	195.5	200.8	4.1	77	2500	616	0.1
C314	1.12	200.8	210.8	9.4	94	5550	596	0.4
C315	1.12	210.8	216.0	4.3	83	2570	604	0.1
C316	1.13	216.0	226.0	5.2	52	3240	618	0.4
C317	1.13	226.0	229.3	1.8	55	1200	661	0.4
C318	1.13	229.3	240.8	11.4	99	6780	590	0.25
C319	1.13	240.8	244.0	2.2	70	1360	613	< 0.05
C320	1.16	244.0	249.6	5.1	90	3100	570	< 0.05

(a) Weight correction factor of 3 per cent. to be added.
(b) " " " " 2 " " " " "
(c) " " " " 1 " " " " "

Sample No.	Diam. of Core	Limiting Depths From	Limiting Depths To	Length of Core Recovered	Core Re-covery	Weight of Core Recov-ered	Weight Per Foot of $1\frac{1}{8}$" Core	Assay Result WO_3
	In.	Feet	Feet	Feet	%	Grams	Grams/Ft.	%
				Drill Hole 38. (Site 3G).				
C321	1.16	249.6	258.8	8.5	92	5077	560	< 0.05
C322	1.16	258.8	268.1	9.0	97	5738 c)	598	0.15
C323	1.17	268.1	278.1	9.8	98	5902	543	< 0.05
C324	1.17	278.1	283.8	4.9	87	2940	540	< 0.05

Drill Hole 39. (Site 1G).

C325	1.75	64.0	68.0	3.8	95	2970(a)	301	< 0.05
C326	1.14	68.0	78.3	1.8	17	907(b)	495	0.25
C327	1.18	78.3	87.0	2.9	33	1627(b)	511	0.4
C328	1.18	87.0	96.4	9.1	97	6350(c)	629	0.25
C329	1.14	96.4	107.0	10.1	95	6544(b)	637	0.3
C330	1.14	107.0	118.0	9.8	89	6269(c)	623	0.3
C331	1.14	118.0	123.5	5.1	93	3312(c)	632	0.25
C332		123.5	130.0	1.8	28	969(d)	632	0.5
C333	1.14	130.0	138.0	7.3	91	4850	647	0.85
C334	1.14	138.0	148.8	6.1	56	3600	575	< 0.05
C335	1.15	148.8	160.0	6.3	56	4212	639	0.4
C336	1.09	160.0	168.0	2.4	30	1482	657	0.5
C337	1.09	168.0	178.2	9.8	96	5740 c)	618	0.2
C338	1.10	178.2	188.8	9.5	90	5180	571	0.1
C339	1.10	188.8	199.5	9.8	92	5540	591	0.15
C340	1.10	199.5	210.0	5.5	52	3145	598	0.2
C341	1.10	210.0	217.5	1.9	25	945	520	< 0.05

(a) Weight correction factor of 5% to be added.
(b) " " " " 2% " " "
(c) " " " " 1% " " "
(d) Weight of core to be calculated from weight per foot of sample 331.

Drill Hole 40. (Site 4F).

C353	1.14	0	10.0	1.2	12	632(a)	558	0.45
C354	1.14	10.0	19.0	1.4	16	731(a)	554	0.6
C355	1.13	40.0	48.0	7.6	95	4088	534	< 0.05
C356	1.13	48.0	56.1	6.3	78	3735	588	0.25
C357	1.12	56.1	65.3	7.0	76	3990	576	0.15
C358	1.12	65.3	73.2	7.2	91	4620	648	0.1
C359	1.13	73.2	84.9	10.1	86	5535	543	< 0.05
C360	1.13	84.9	94.8	8.9	90	5180 b)	577	< 0.05
C361	1.14	94.8	102.5	7.4	97	4300	566	< 0.05
C362	1.14	102.5	113.7	9.0	80	5165	548	< 0.05
C363	1.14	113.7	124.1	8.3	80	4432	520	< 0.05
C364	1.14	124.1	136.1	9.9	82	3505	344	< 0.05
C365	1.14	136.1	143.0	4.7	68	2340	485	< 0.05
C366	1.14	143.0	156.9	12.8	92	6935	528	< 0.05

(a) Weight correction factor of 10% to be added.
(b) " " " " 1% " " "

Sample No.	Diam. of Core	Limiting Depths From	To	Length of Core Recovered	Core Recovery	Weight of Core Recovered	Weight Per Foot of $1\frac{1}{8}$" Core	Assay Result WO_3
	In.	Feet	Feet	Feet	%	Grams	Grams/Ft.	%
Drill Hole 41, (730 East/138 South).								
C367	1.13	42.0	54.5	11.5	92	6960 (b)	612	0.1
C368	1.14	54.5	66.5	11.3	94	7020	605	< 0.05
C369	1.14	66.5	76.2	9.4	97	5980	619	< 0.05
C370	1.14	76.2	80.4	3.7	88	2275	599	0.2
C371	1.14	80.4	87.2	6.0	88	4057	658	1.85
C372	1.14	87.2	97.3	9.9	98	6910	680	1.85
C373	1.14	97.3	107.4	8.3	82	5650	663	1.4
C374	1.13	107.4	115.3	7.4	94	4900	657	0.7
C375	1.14	115.3	124.5	9.1	99	5182	554	< 0.05
C376	1.13	124.5	129.5	4.4	88	2815	635	0.35
C377	1.13	129.5	135.8	3.9	62	2875	731	< 0.05
C378	1.13	135.8	140.0	3.9	93	2025	515	< 0.05
C379	1.13	140.0	150.0	9.4	94	5775	609	1.3
C380	1.13	150.0	160.0	9.0	90	5505 (a)	607	0.7
C381	1.13	160.0	168.8	4.9	56	2667	540	0.45
C382	1.13	168.8	174.7	4.4	75	2625	592	0.7
C393	1.13	174.7	181.0	5.5	87	3415	616	0.1
C394	1.13	181.0	186.7	5.0	88	3184	632	0.4
C395	1.13	186.7	199.7	11.5	88	6315	545	< 0.05
C396	1.14	199.7	207.8	7.6	94	4730	606	< 0.05
C397	1.14	207.8	217.8	9.7	97	5995	602	< 0.05
C398	1.14	217.8	227.8	9.7	97	5670	569	< 0.05
C399	1.14	227.8	235.2	7.2	97	4110	556	< 0.05

(a) Weight correction factor of 1% to be added.
(b) " " " 3% " " "

Sample No.	Diam. of Core	From	To	Length of Core Recovered	Core Recovery	Weight of Core Recovered	Weight Per Foot of $1\frac{1}{8}$" Core	Assay Result WO_3
Drill Hole 42, (Site 6B).								
C383	1.14	96.0	102.0	5.8	97	3872	650	0.25
C384	1.14	102.0	107.1	5.1	100	3480	665	4.05
C385	1.14	107.1	114.5	7.1	97	4585	629	0.45
C386	1.15	114.5	120.0	4.1	75	2355	549	< 0.05
C387	1.15	120.0	124.0	3.8	95	2605	655	0.25
C388	1.15	124.0	131.5	5.6	75	3160	539	< 0.05
C389	1.15	131.5	143.5	6.1	51	3470	543	0.05
C390	1.15	143.5	152.0	7.9	93	4645	563	0.05
C391	1.16	152.0	164.0	11.6	97	6456	522	0.25
C392	1.16	164.0	174.0	9.6	96	6490 (a)	634	0.4
C400	1.16	174.0	186.0	9.8	82	6487	621	0.6
C401	1.10	186.0	196.0	9.9	99	6350	671	0.8
C402	1.13	196.0	204.0	7.9	99	5000	626	0.5
C403	1.13	204.0	208.6	4.6	100	2653	572	< 0.05
C404	1.13	208.6	216.0	6.9	93	4456	634	0.2
C405	1.13	216.0	223.5	6.3	84	4000	630	0.2
C406	1.14	223.5	234.0	9.0	86	4965	537	< 0.05
C407	1.16	234.0	241.0	4.5	64	2718	566	0.1
C408	1.16	241.0	250.0	8.6	96	5270	569	< 0.05

(a) Weight correction factor of 1% to be added.

Sample No.	Diam. of Core	Limiting Depths From	Limiting Depths To	Length of Core Recovered	Core Recovery	Weight of Core Recovered	Weight Per Foot of $1\frac{1}{8}$" Core	Assay Result WO_3
	In.	Feet	Feet	Feet	%	Grams	Grams/Ft.	%
Drill Hole 43, (826 East/78 South).								
C409	1.18	36.0	45.8	7.6	77	4810	570	0.05
C410	1.10	45.8	54.3	7.3	86	4060	582	0.05
C411	1.14	54.3	63.2	7.6	85	4240	543	<0.05
C412	1.14	63.2	70.2	5.4	77	2678 a)	483	<0.05
C413	1.15	70.2	78.7	4.4	52	2130	463	<0.05
C414	1.15	78.7	89.0	8.9	87	5150	553	<0.05
C415	1.15	89.0	97.3	0.4	5	220 (z)	552 z	n.d.
C416	1.15	97.3	104.0	1.9	28	1098	552	<0.05
C417	1.16	104.0	112.3	8.3	100	5710	645	1.1
C418	1.16	112.3	117.3	4.3	86	2535	553	0.15
C419	1.16	117.3	127.9	9.0	85	5100	531	0.05
C420	1.16	127.9	134.2	4.6	73	2335	476	0.05
C421	1.16	134.2	142.5	5.6	67	2962 a)	496	0.1
C422	1.13	142.5	149.0	5.4	83	3110	570	0.25
C423	1.13	149.0	157.1	7.0	86	4210	596	0.30
C424	1.15	157.1	167.3	10.2	100	6860	642	0.35
C425	1.16	167.3	177.5	10.1	99	6580	616	0.45
C426	1.17	177.5	183.3	5.8	100	3915	620	0.55
C427	1.17	183.3	189.8	5.2	80	3530	624	0.05
C428	1.17	189.8	196.0	4.5	73	2525	516	<0.05
C429	1.17	196.0	203.0	6.7	96	3765	516	<0.05
C430	1.17	203.0	206.5	3.2	92	2235	642	<0.05
C431	1.17	206.5	213.4	5.7	83	3352	541	<0.05

(a) Weight correction factor of 1% to be added.

Drill Hole 44, (Site 6A).

C432	1.14	182.5	187.5	4.3	86	2446	554	< 0.1
C433	1.14	187.5	192.0	3.6	80	1875	479	< 0.1
C434	1.14	192.0	201.0	7.7	86	4808	608	< 0.1
C435	1.14	201.0	211.0	9.3	93	5838	611	< 0.1
C436	1.14	211.0	220.0	7.5	83	4764	619	0.27
C437	1.14	220.0	230.0	9.7	97	6372	640	<0.1
C438	1.13	230.0	234.7	4.5	96	2825	623	<0.1
C439	1.13	234.7	242.5	7.2	92	4561 a)	628	1.13
C440	1.13	242.5	247.5	1.3	26	628	628 (y)	<0.1
C441	1.14	247.5	257.0	9.0	95	5846	632	0.37
C442	1.14	257.0	262.8	5.5	95	3224	571	<0.1
C443	1.14	262.8	269.0	5.1	82	3084	589	0.50
C444	1.15	269.0	279.3	9.5	92	5867	590	0.26
C445	1.15	279.3	289.7	9.8	94	6506	634	0.72
C446	1.15	289.7	300.0	9.9	96	6822	658	0.83
C447	1.15	300.0	308.0	5.6	70	3527	620	0.67
C448	–	308.0	315.0	1.1	16	561 (b)	620 (y)	0.21
C449	1.13	315.0	326.0	9.8	89	6304	638	0.61
C450	1.13	326.0	329.5	2.9	83	1809	619	0.77
C451	1.13	329.5	338.0	6.2	73	3585	573	0.13
C452	1.13	338.0	348.0	10.0	100	6076 a)	603	0.23
C453	1.14	348.0	359.0	9.8	89	6059	602	<0.1
C454	1.14	359.0	370.5	8.7	86	4463	500	<0.1
C455	1.14	370.5	378.5	5.0	63	3046	593	<0.1

(a) Weight correction factor of 1% to be added.
(b) Weight correction factor large.
(y) Figure for previous sample used.

Sample No.	Diam. of Core	Limiting Depths From	Limiting Depths To	Length of Core Recovered	Core Recovery	Weight of Core Recovered	Weight Per Foot of $1\frac{1}{8}$" Core	Assay Result WO_3
	In.	Feet	Feet	Feet	%	Grams	Grams/Ft.	%

Drill Hole 45, (Site 5A).

C456	1.14	156.5	163.5	3.9 ?	56	2868 (a)	?	<0.1
C457	1.14	163.5	170.5	6.9	99	4260	601	<0.1
C458	1.14	170.5	179.5	8.8	98	5537	613	1.14
C459	1.14	179.5	189.5	9.6	96	5784	587	<0.1
C460	1.14	189.5	198.8	8.7	94	5734	643	0.48
C461	1.13	198.8	208.6	9.5	97	5812	607	0.20
C462	1.13	208.6	216.9	8.3	100	4714 (b)	563	0.91
C463	1.14	216.9	223.8	6.8	99	4665	668	1.01
C464	1.14	223.8	234.3	10.0	95	6359	619	0.21
C465	1.14	234.3	244.3	9.5	95	6092	624	0.16
C466	1.14	244.3	251.5	6.9	96	4504	636	1.06
C467	1.12	251.5	257.4	5.5	93	3463	636	0.85
C468	1.13	257.4	265.5	8.0	99	5097	632	0.49
C469	1.13	265.5	270.8	4.0	75	2544	637	0.59
C470	1.13	270.8	276.7	5.0	85	3013	604	<0.1
C471	1.15	276.7	284.5	3.3 ?	42	2782	600 z	<0.1
C472	1.15	284.5	290.7	5.1	82	3035 (c)	574	0.27
C473	1.15	290.7	299.0	6.5	78	3781	561	0.30
	1.15	299.0	305.3	3.3	53	1841	538	<0.1

(a) Weight correction of 3% to be added.
(b) " " " 1% " " "
(c) " " " 2% " " "

Drill Hole 46, (Site 5B).

C474	1.12	127.0	132.0	1.1	22	627	570	0.16
C475	1.12	132.0	143.4	1.6	14	613	383	<0.1
C476	1.12	143.4	154.0	4.1	38	2028	495	<0.1
C477	1.12	154.0	162.0	2.0	25	999	500	<0.1
C478	1.12	162.0	166.0	2.4	60	1340	558	<0.1
C479	1.12	166.0	175.0	7.2	80	4575	649	0.31
C480	1.12	175.0	177.7	1.7	63	962	566	0.56

Weight correction large, no estimate made.

Drill Hole 50, (650 East/58 South).

C481	1.15	7.0	11.5	2.3	51	1407 (a)	596	<0.1
C482	1.18	11.5	16.5	4.3	86	3223	676	1.91
C483	1.12	16.5	24.3	4.3	55	2716	638	3.71
C484	1.17	24.3	34.0	8.6	89	4864	520	2.19
C485	1.17	34.0	38.0	2.9	72	2020	640	2.5
C486	1.18	38.0	42.5	3.1	56	2110	613	0.65
C487	1.13	42.5	47.0	2.4	53	1570	648	0.95
C488	1.13	47.0	55.5	5.0	59	2990	592	0.05
C489	1.13	55.5	64.0	5.5	65	3200 (b)	576	<0.05
C490	1.13	64.0	68.2	3.8	90	2220	580	0.35
C491	1.13	68.2	75.2	5.6	80	3580	634	0.7
C492	1.13	75.2	81.5	4.4	70	2520	568	0.55
C493	1.13	81.5	91.0	8.5	89	5190	606	0.75
C494	1.13	91.0	100.0	7.1	79	3290	460	<0.05
C495	1.13	100.0	107.0	5.7	81	3030	527	0.05
C496	1.13	107.0	112.0	3.8	76	2260	590	0.6

(a) Weight correction factor of 3% added.
(b) " " " " 1% "

Sample No.	Diam. of Core	Limiting Depths From	Limiting Depths To	Length of Core Recovered	Core Recovery	Weight of Core Recovered	Weight Per Foot of $1\frac{1}{8}$" Core	Assay Result WO_3
	In.	Feet	Feet	Feet	%	Grams	Grams/Ft.	%

Drill Hole 50, (650 East/58 South).

Sample No.	Diam. of Core	From	To	Length of Core Recovered	Core Recovery	Weight of Core Recovered	Weight Per Foot	Assay Result WO_3
C497	1.13	112.0	120.2	8.0	98	5030	623	0.6
C498	1.13	120.2	129.0	7.0	80	4410	625	0.85
C499	1.12	129.0	138.2	3.3	36	1850	565	0.65
C500	1.14	138.2	149.5	9.0	79	5760	623	0.35
C501	1.14	149.5	158.0	7.6	89	4680 (b)	599	0.3
C502	1.14	158.0	164.5	5.0	77	2920	568	0.45
C503	1.14	164.5	170.0	5.1	93	3190	609	0.15
C504	1.14	170.0	180.0	6.7	67	4140	602	<0.05
C505	1.14	180.0	188.5	4.5	53	2530	547	0.5
C506	1.14	188.5	193.0	3.1	69	1420	445	0.1

(b) Weight correction factor of 1% to be added.

Drill Hole 51, (473 East/148 South).

Sample No.	Diam. of Core	From	To	Length of Core Recovered	Core Recovery	Weight of Core Recovered	Weight Per Foot	Assay Result WO_3
C507	0.84	67.0	74.9	3.1	39	1247	715	0.25
C508	0.81	74.9	84.5	6.9	72	2282	632	1.1
C509	0.81	84.5	88.9	3.2	73	1040	621	0.8
C510	0.81	88.9	93.1	2.4	57	868	692	0.1
C511	0.81	93.1	103.8	10.1	94	3272	619	1.1
C512	0.81	103.8	115.2	10.6	93	3343	603	0.45
C513	0.81	115.2	124.0	1.9	22	515	518	<0.05
C514	0.81	124.0	131.5	3.7	49	1040	537	<0.05
C515	0.83	131.5	146.5	11.7	78	3898	607	0.25
C516	0.83	146.5	154.1	6.6	87	2282	630	0.4
C517	0.81	154.1	162.8	3.8	44	1212	610	0.35
C518	0.82	162.8	166.5	2.7	73	919 (a)	635	0.35
C519	0.82	166.5	176.0	5.4	57	1403	485	0.25
C520	0.82	176.0	183.0	5.4	77	1504	520	0.4
C521	0.82	183.0	190.2	6.8	94	2070	568	<0.05
C522	0.78	190.2	198.8	7.8	91	2009	531	0.05
C523	0.78	198.8	203.6	4.4	92	1560	730	0.25
C524	0.78	203.6	210.0	6.1	95	1484	501	<0.05
C525	0.78	210.0	222.0	8.4	70	2823	693	<0.05
C526	0.78	222.0	228.0	5.0	63	1504	620	0.1
C527	0.78	228.0	238.5	10.1	96	2515	513	<0.05

(a) Weight correction factor of 1% added.

Drill Hole 52, (738 East/12 North).

Sample No.	Diam. of Core	From	To	Length of Core Recovered	Core Recovery	Weight of Core Recovered	Weight Per Foot	Assay Result WO_3
C559	1.8	0	8.0	0.5	6	275 (a)	400 z	0.35
C560	1.8	8.0	18.0	0.6	6	520 (a)	400 z	0.2
C561	1.14	18.0	23.5	1.6	29	714 (b)	430	0.95
C562	1.14	23.5	32.0	1.0	12	535	516	1.4
C563	1.15	32.0	38.0	4.1	68	3050	706	2.05
C564	1.15	38.0	42.0	3.0	75	1495	473	0.05
C565	1.12	42.0	50.0	5.9	74	3222 (c)	546	<0.05
C566	1.13	50.0	57.0	5.6	80	2818	494	<0.05
C567	1.12	57.0	66.5	8.2	86	4131	504	<0.05
C568	1.15	66.5	75.3	7.9	90	4434	533	<0.05
C569	1.14	75.3	82.5	6.5	90	3495	519	0.15

(a) Weight correction large, no adjustment made.
(b) " " of 2% added.
(c) " " of 1% added.

Sample No.	Diam. of Core	Limiting Depths From	Limiting Depths To	Length of Core Recovered	Core Re-covery	Weight of Core Recov-ered	Weight Per Foot of $1\frac{1}{8}$" Core	Assay Result WO_3
	In.	Feet	Feet	Feet	%	Grams	Grams/Ft.	%
			Drill Hole 52, (738 East/12 North). (cont'd.)					
C570	1.14	82.5	89.0	6.2	95	3656)	569	1.1
C571	1.15	89.0	98.0	8.3	92	4737)	542	<0.05
C572	1.15	98.0	102.4	4.3	98	2808)	620	0.8
C573	1.15	102.4	111.6	8.8	96	5858)c)	632	1.1
C574	1.16	111.6	120.3	7.6	87	4949)	607	0.6
C576	1.15	120.3	132.0	9.2	79	7302)	753	0.57
C577	1.15	132.0	140.8	7.3	83	4969)	646	<0.05
C578	1.15	140.8	151.0	7.6	74	4565)	570	0.1

(c) Weight correction of 1% added.

Drill Hole 53, (741 East/103 North).

C543	1.15	9.0	13.0	1.3	33	676(a)	493	0.75
C544	1.15	13.0	20.0	5.5	79	3600(b)	621	1.35
C545	1.15	20.0	27.0	6.6	94	4447(b)	639	0.75
C546	1.15	27.0	34.0	4.8	69	3353)	663	<0.05
C547	1.15	34.0	45.0	10.4	95	6413)	585	0.05
C548	1.13	45.0	53.0	3.2	40	1878)	576	<0.05
C549	1.15	53.0	61.0	6.5	81	4353)	636	0.65
C550	1.15	61.0	69.5	7.4	87	4403)	565	0.15
C551	1.15	69.5	77.0	5.9	79	3616)c)	582	0.15
C552	1.16	77.0	87.0	9.7	97	6656)	639	0.85
C553	1.16	87.0	96.0	8.1	90	5282)	608	0.5
C554	1.16	96.0	107.8	9.5	80	6414)	663	0.75
C555	1.13	107.8	119.0	10.3	92	6545)	624	0.3
C556	1.13	119.0	124.0	4.7	94	2899)	606	0.95
C557	1.13	124.0	135.0	9.3	85	5616)	593	0.05
C558	1.13	135.0	150.0	8.3	55	5170(b)	612	0.05

(a) Weight correction of 4% added.
(b) " " " 2% "
(c) " " " 1% "

Drill Hole 54, (513 East/7 South.

C528	1.17	18.0	29.2	4.0	36	2214(a)	507	0.1
C529	1.17	29.2	36.0	2.0	29	1349(a)	618	0.9
C530	1.14	36.0	41.5	4.7	85	3050(b)	626	0.95
C531	1.16	41.5	49.2	5.0	65	3383)	631	1.15
C532	1.16	49.2	60.0	0.5	46	267)	498	0.7
C533	1.16	60.0	67.9	0.6	76	283)	440	0.15
C534	1.16	67.9	77.5	0.8	83	444)c)	517	<0.05
C535	1.16	77.5	90.2	1.6	13	768)	447	<0.05
C536	1.16	90.2	94.0	2.2	58	1111)	470	0.8
C537	1.14	94.0	100.0	2.5	42	1394)	538	<0.05
C538	0.81	100.0	113.5	7.3	54	1938)	508	<0.05
C539	0.83	113.5	118.4	3.0	61	826)	501	<0.05
C540	0.85	118.4	125.3	5.3	77	1570(b)	514	<0.05
C541	0.80	125.3	134.3	7.4	82	2222(b)	589	0.2
C542	0.80	134.3	140.9	5.3	80	1443(b)	534	<0.05

(a) Weight correction of 3% added.
(b) " " " 2% "
(c) " " " 1% "

Sample No.	Diam. of Core	Limiting Depths From	Limiting Depths To	Length of Core Recovered	Core Recovery	Weight of Core Recovered	Weight Per Foot of $1\frac{1}{8}$" Core	Assay Result WO_3
	In.	Feet	Feet	Feet	%	Grams	Grams/Ft.	%
Drill Hole 55, (615 East/185 North).								
C579	1.15	0	13.0	1.3	10	769 (a)	561	0.05
C580	1.15	13.0	20.0	2.7	39	1288 (a)	453	0.7
C581	1.15	20.0	27.8	4.4	57	2620 (b)	565	0.8
C582	1.16	27.8	35.0	4.5	63	2575	533	0.45
C583	1.16	35.0	44.0	6.1	68	4141	633	0.45
C584	1.13	44.0	55.7	3.4	29	2060	595	0.35
C585	1.25	55.7	61.5	4.7	81	3697 (c)	631	0.55
C586	1.12	61.5	69.0	6.2	83	3585	578	0.05
C587	1.14	69.0	75.2	5.3	86	3040	554	<0.05
C588	1.14	75.2	83.0	5.8	74	3282	546	<0.05

(a) Weight correction of 4% added.
(b) " " " 2% "
(c) " " " 1% "

Drill Hole 56, (609 East/187 South).

Sample No.	Diam. of Core	From	To	Length of Core Recovered	Core Recovery	Weight of Core Recovered	Weight Per Foot	Assay Result WO_3
C589	0.79	89.6	95.5	3.7	63	1444	784	0.8
C590	0.79	95.5	106.3	10.4	91	3151	609	0.2
C591	0.79	106.3	117.1	8.5	79	2414	571	0.25
C592	0.81	117.1	125.0	6.8	86	2232	628	4.1
C593	0.81	125.0	129.5	4.4	98	1525	663	1.0
C594	0.81	129.5	141.5	7.4	62	2191	566	0.1
C595	0.84	141.5	149.5	6.7	84	2080	552	0.25
C596	0.84	149.5	159.7	8.7	85	2747	561	0.8
C597	0.84	159.7	169.0	9.1	98	2716 (a)	530	0.2
C598	0.84	169.0	176.8	7.2	92	2202	543	0.3
C599	0.84	176.8	187.3	10.5	100	3495	591	0.75
C600	0.84	187.3	191.0	3.2	86	1000	555	0.55
C601	0.84	191.0	202.0	9.3	85	2687	513	0.15
C602	0.84	202.0	213.5	9.5	83	2899	542	0.35
C603	0.84	213.5	224.0	8.2	78	2394	519	0.05
C604		224.0	233.0			1879		<0.05

(a) Weight correction of 1% added.

x Indicates determination by ultra-violet lamp.

z Assumed.