

# TR3-42-54 Magnetite Deposits at Tenth Legion, Comstock District

by Terence D. Hughes

## Introduction.

During the past two years added attention has been focussed on the Iron Ore Resources of Tasmania. Many deposits of iron oxide in the West and North West have been investigated by both aerial and ground geophysical methods. The Tenth Legion deposits have not been examined geophysically, but more information concerning them has been obtained by means of two drill holes, recently completed. The deposits had not been drilled previously although the driving of several adits to an average length of 250 feet had allowed inspection and sampling of the iron.

Only the northern or main lens of the magnetite deposits was drilled and this report concerns only that portion of the field.

## Situation and Access.

The Tenth Legion Magnetite deposits are located in the Comstock District, five miles west of Zeehan in Western Tasmania. Three miles from Zeehan on the Trial Harbour Road is the crossing of the former Comstock Tram. The tram formation is still in good order for jeep travel but because the bridge over a large creek has been destroyed this formation cannot be followed westward from the Trial Harbour Road towards the iron deposits. Instead, a track leading from the road half a mile beyond the tram crossing can be followed for 20 chains to the old Comstock Workings. From here a bull-dozed track has recently been made, across the button-grass plains for a mile and a half to the drill sites. This track has some soft patches and steep grades are encountered particularly near the drill site, but a jeep can, with care, negotiate it under normal weather conditions. The southern portion of the magnetite deposits, which are not dealt with in this report, were once reached most easily by following the Kynance Tram-way, however, this has now become overgrown and a deviation from the new track is the best route.

## Previous Reports.

A comprehensive report on these deposits was written by G. A. Waller in 1903. At that time only one adit had been driven to intersect the magnetite. Waller considered that the host rocks formed a contact metamorphic zone round the granite mass of the Heemskirk Range and

postulated this granite magma as the source of the magnetite. The deposits were briefly mentioned by Twelvetrees and Ward in 1910 (Geological Survey Bulletin No. 8) and by Waterhouse in 1916 (Geological Survey Bulletin No. 21). In 1939-40 interest on an Australia-wide basis, was focussed on iron ore deposits and a reconnaissance of the deposits was made by the then Commonwealth Geological Advisor Dr. W. G. Woolnough. As a result a detailed sampling and mapping campaign was undertaken by F. Blake. In 1940 he prepared a Departmental report (typewritten) which quoted assays and indicated tonnages of the various magnetite lenses.

### Topography.

Along the course of the track to, and to the north of, the magnetite deposits, the country shows the typical vegetation and drainage of regions underlain by Precambrian rocks: that is, button grass plains intersected by small gullies, forming a dendritic pattern of drainage. The deposits themselves and the Cambrian rocks to the south are covered by dense vegetation and this area shows less dissection by small streams. Half a mile to the west of the drill sites are the rounded contours of the granite mass of the Heemskirk Range, which rises steeply to culminate in Mt. Agnew, at 2800 feet above sea level.

The northern magnetite lens occupies the summit of a hill, trending a little north of west and rising to over a hundred feet above Pine Creek. This creek forms the northern boundary of the magnetite hill and is a tributary of the Pieman River.

### Geology.

No attempt was made to map, on the ground, the regional geology of the area, but the position of the fault separating the Cambrian rocks from the Precambrian to the north has been obtained from air photographs. Likewise the boundary between the granite to the west and the Cambrian rocks is shown as it appears on the photographs. These relationships are shown on the accompanying map. (fig 30).

The country rocks are a series of quartzites and argillites showing little shearing or cleavage. The argillites are grey in colour, both where well weathered and where only slightly so, as at 50 feet in the bore. The quartzites are cream and weather to buff. These rocks are tentatively regarded as Cambrian and may belong to the Dundas Group. They are in faulted relationship with a series of rather schistose, quartz impregnated rocks assigned to the Precambrian. The strike of this fault is north-west and the downthrow side is to the south-west. It passes a few chains north of the magnetite deposits.

The Cambrian rocks have been intruded by a series of basic bodies which are the host rocks of the magnetite, as well as by the large granite mass forming the Heemskirk Range. The basic intrusion probably occurred during the Cambrian, and the age of the granite is regarded as Devonian.

The petrology of the basic intrusive suite of rocks is extremely interesting and would make an ideal study for detailed petrological work. Thin sections have been cut from various footages of the core and a description of these by Petrologist G. Everard is appended to this report.

It would appear that the rock as originally intruded was an amphibolite, consisting principally of hornblende and oligoclase. However alteration products have been formed by various metasomatic processes. Whether this alteration took place in one or two stages, however, is not certain. The alteration of serpentine to dolomite is not uncommon (it can be observed in the cores of more recent bores at the Kapi Mine North Dundas) and the formation of diopside-tremolite rocks from magnesium carbonate rocks by increase in temperature has been described by Turner (1948). From the examination of bore cores and adits in this area, it would appear that although the more normal alteration of serpentine to dolomite does occur, an alteration to calcium magnesium silicates has also taken place. Calcite in veins and bunches is quite plentiful throughout the core and the presence of this may be due to the metasomatism during the alteration of the dolomites, rather than to direct mineralization from the granite magma.

At ninety feet and again at one hundred and ten feet in No. 2 Bore, is a curious looking rock resembling a fault breccia. On closer examination, however, it can be seen that the dark angular fragments of rock are areas of serpentine and the lighter groundmass is composed of carbonates and calc-silicates, which have formed by the alteration of the serpentine, leaving little cores of the latter unaltered.

Waller (1903) suggested that this host rock had been formed by the action of hot siliceous solutions, emanating from the granite magma, on beds of limestone, and that it was a contact metamorphic rock rather than an altered basic one.

An interesting comparison may be made between this rock and one described by Baker and Edwards (1957) from Andersons Creek near Beaconsfield. Here a hornblende gabbro has been subjected to a process of lime metasomatism so that the hornblende has been altered to a pale greyish or greenish substance, still retaining crystal outlines, and partly replaced by idocrase and diopside and the feldspar almost completely altered to the garnet, grossularite. This rock has been called a rodingite.

### **The Iron Deposits.**

The iron is almost wholly in the form of magnetite and is considered to be derived from the Cambrian basic intrusion and not, as has been postulated in the past, from the Devonian granite magma. These irregularly spaced concentrations of magnetite, occurring in definite zones in an altered basic rock bear strong resemblance to the more extensive deposits of the Savage River District (Hughes 1957).

In the portion of the Tenth Legion deposits under review, the magnetite forms the summit of a small ridge trending at 285° and rising to an average height of one hundred feet above Pine Creek, which forms its northern boundary. In outcrop the iron oxide is very pure and massive although clay beds show where the host rock has weathered away. In the bore cores, the magnetite appears quite compact, but in some adits it is apt to be friable and occasionally will run. The magnetite itself is very pure but unfortunately it is so mixed with the host rock, rather in the form of segregations than of defined lenses, that a high iron assay could not be obtained over any appreciable footage in any bore. On the surface, the magnetite outcrops over a distance of 1700 feet, with an average width of 150 feet. The widths of the magnetite zone are 240 feet in No. 1 Adit, 150 feet in

# N°1 BORE TENTH LEGION

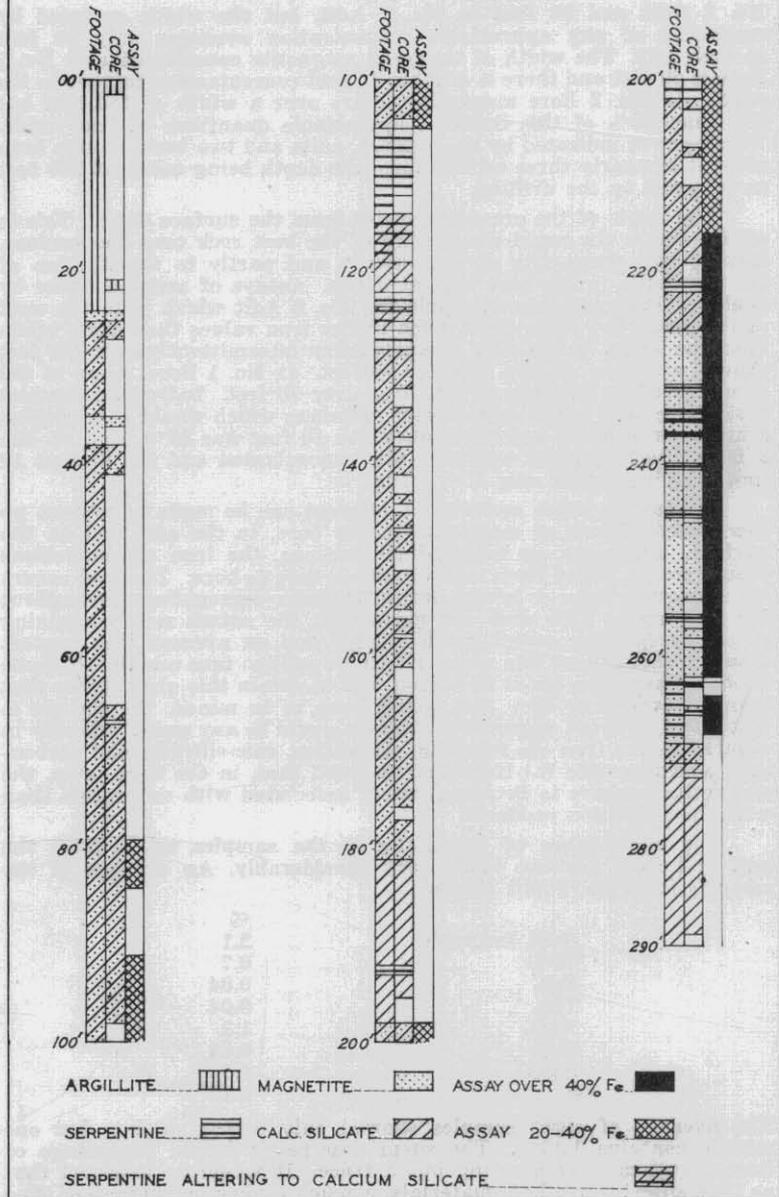
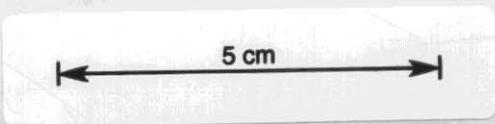


Figure 13



No. 2 Adit and 80 feet in No. 3 Adit, but the width occupied by magnetite of any appreciable concentration averages only 70 feet in each adit. The width of the main magnetite concentration in No. 1 Bore is 60 feet and there is another 15 foot concentration further to the north. In No. 2 Bore magnetite occurs over a width of 150 feet but less than 50% of this contains appreciable quantities of iron oxide. The reserves indicated by the outcrop, adits and two bores in this area amount to nearly three million tons, the depth being taken at 200 feet as revealed by the drilling.

The grade of the ore deteriorates from the surface down. This is partly due to the rapid weathering of the host rock near the surface, leaving only magnetite at the outcrop and partly to the dilution of the magnetite in the host rock at depth. Assays of samples taken by Blake in 1940 are only available for No. 2 Adit which is to the west of the bores, but these show much higher iron values than those taken from the bores. In the adit, samples taken intermittently over 150 feet showed an assay of 66% iron for 90 feet. In No. 1 Bore, assay of the core showed an average of 42% iron over 70 feet. Individual samples could have been taken over shorter distances which would have yielded a higher iron figure and the highest for 10 feet was 52% iron. In No. 2 Bore, the magnetite was even less concentrated and the highest 10 foot sample assayed only 35% iron.

In drawing cross sections, no attempt can be made to connect up the concentrations of magnetite in the bore, in the adit and on the surface. Similarly, in longitudinal sections, the iron concentrations should not be joined from adit to adit or bore to bore. The iron occurs not in regular lodes or lenses, but in irregular segregations throughout the host rock. This does not mean that the actual zone containing these segregations cannot be delineated and an average iron content assumed throughout this zone. The three million tons mentioned above probably averages about 50% iron, but to obtain this about twice that tonnage averaging 25% iron would have to be mined. As the ore is magnetite, it is not expected that there would be any great difficulty in separating the iron ore from the serpentine, calc-silicates and carbonates which contain it. It should be noted that, in the bore cores, the magnetite appears to be more closely associated with serpentine than with the alteration products.

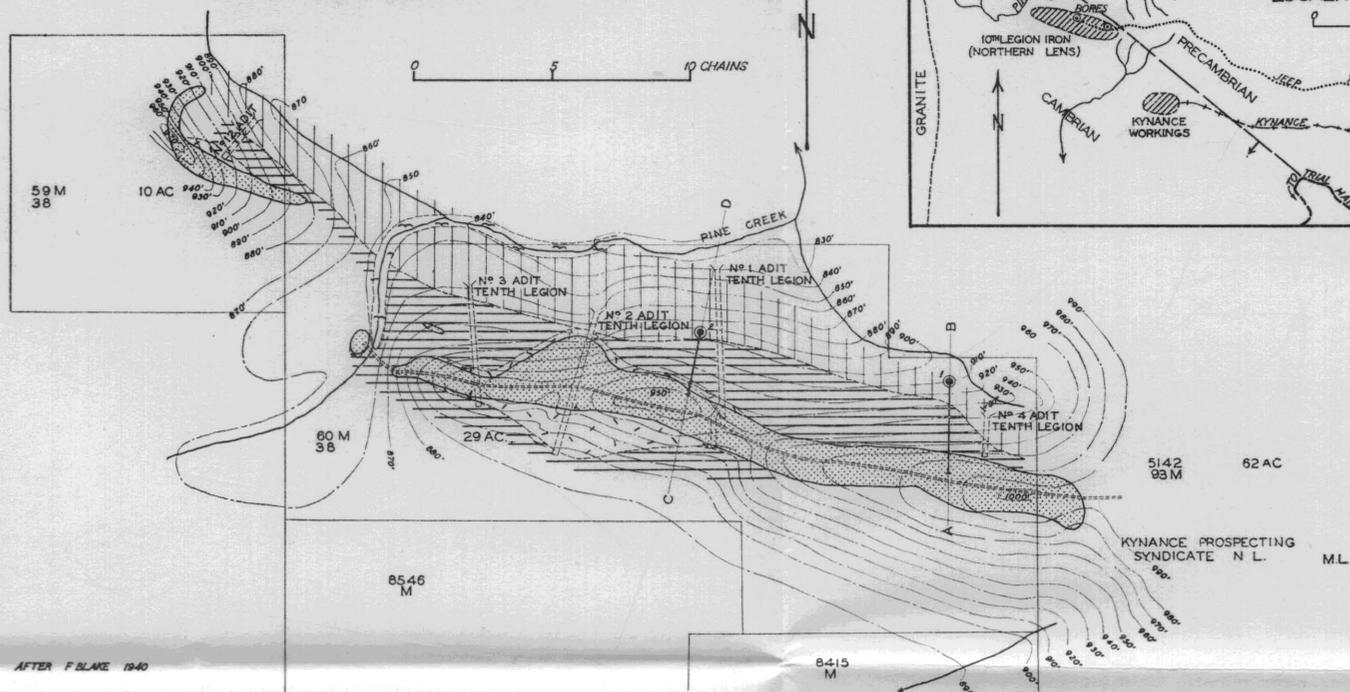
The percentages of impurities in the samples taken from the adit and from the two bores vary considerably. An average of ten samples from No. 2 adit showed:—

Acid Insoluble	.....	2.1
MnO	.....	0.7
P <sub>2</sub> O <sub>5</sub>	.....	0.04
TiO <sub>2</sub>	.....	0.04
Al <sub>2</sub> O <sub>3</sub>	.....	1.3
CaO	.....	0.03
MgO	.....	2.0
S	.....	0.17

The average of eight samples showed only 0.02% sulphur but one sample contains 1.43%. The surprising result is the percentage of lime, many samples showing but a trace. It would be expected that as lime silicates are host materials, a much higher percentage of lime would occur. It seems likely that the principal impurity is the unaltered serpentine, as silica and magnesia are the highest impurities.

# TENTH LEGION MAGNETITE DEPOSITS

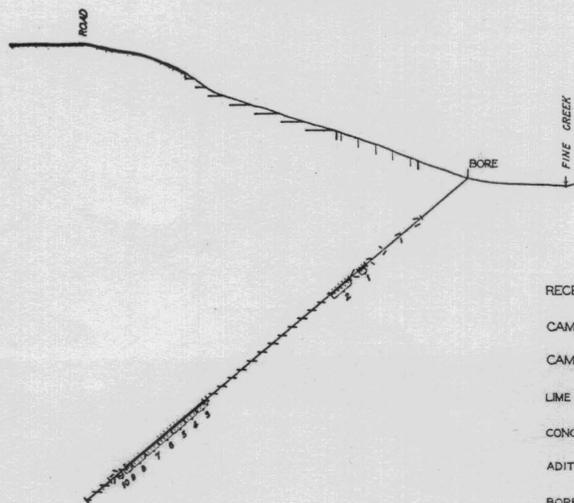
## BORING CAMPAIGN



### SECTION A-B

#### N° 1 BORE

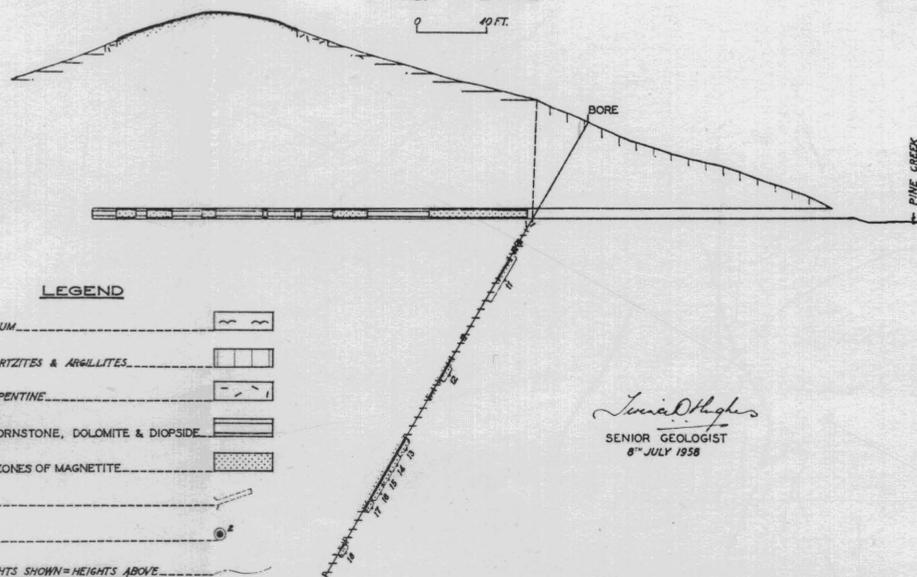
0 40 FT



### SECTION C-D

#### N° 1 ADIT N° 2 BORE

0 40 FT



#### LEGEND

RECENT ALLUVIUM	
CAMBRIAN QUARTZITES & ARGILLITES	
CAMBRIAN SERPENTINE	
LIME SILICATE HORNSTONE, DOLOMITE & DIOPSIDE	
CONCENTRATED ZONES OF MAGNETITE	
ADIT	
BORES	
CONTOURS (HEIGHTS SHOWN = HEIGHTS ABOVE SEA LEVEL PLUS 70 FEET)	

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8<sup>th</sup> JULY 1958

5 cm

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FIGURE 30

# № 2 BORE TENTH LEGION

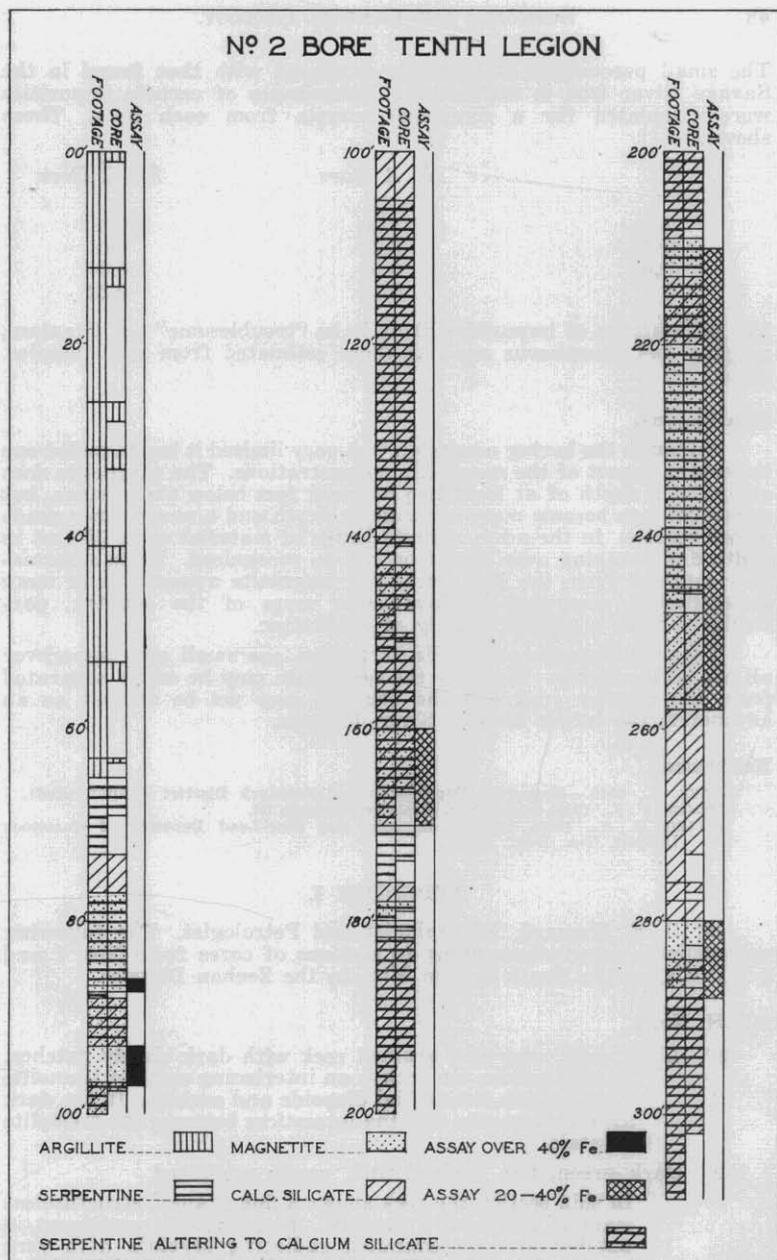
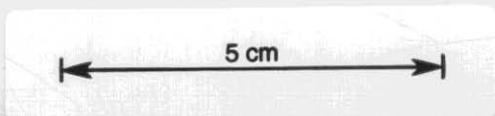


Figure 14



The small percentage of titanium compared with that found in the Savage River iron is interesting. Percentages of certain impurities were calculated for a composite sample from each bore. These showed:—

	No. 1 Bore	No. 2 Bore
	%	%
SiO <sub>2</sub>	4.80	12.7
TiO <sub>2</sub>	0.03	0.07
P <sub>2</sub> O <sub>5</sub>	0.03	0.04
S	0.14	0.22

The percentages of impurities likely to be "troublesome" e.g. titanium, sulphur and phosphorus are like those estimated from adit samples, quite low.

### Conclusions.

Although the boring campaign was very limited it has revealed one important aspect of the magnetite concentrations. The magnetite does extend to a depth of at least two hundred feet below the surface, but concentrations become more sporadic at depth and a much lower grade of ore results. In the adits, definite bands of material up to 30 feet in width and assaying over 60% iron can be recognised. From information obtained from the bore cores the magnetite appears to be more disseminated, occurring in favourable zones of the country, particularly those composed mainly of serpentine.

The iron deposits of the Tenth Legion are small and taken over all are of low grade. However the magnetite may be easily separated from the country rock and the deposits may yet be utilised as an adjunct to the larger Savage River deposits.

### References.

- BLAKE, F., 1940.—Magnetite Deposits in the Comstock District (unpublished).  
 TURNER, F. J., 1948.—Geol. Soc. America, Memoir 30.  
 WALLER, G. A., 1903.—Report on Iron and Zinc-Lead Deposits of Comstock District. Tas. Dept. Mines.

## APPENDIX I.

By G. B. Everard, Mineralogist and Petrologist. The following petrographic descriptions apply to sections of cores from Nos. 1 and 2 D.D.H's, on the Tenth Legion Mine in the Zeehan District.

### D.D.H. No. 1.

- 89' Light grey, very fine grained rock with dark cloudy patches. In thin section the rock is an interlacing mass of tremolite needles with interstitial diopside and sericite. In the dark areas, magnetite fills the interstices between the tremolite crystals.
- 106' Dark green, fine grained rock, easily scratched. In thin section the rock shows a fine grained structureless mass of interlacing crystals. Serpentine is prominent in patches and disseminated radiating crystals with very low birefringence. Hornblende also is plentiful in plates, corroded to appear acicular or granular masses, according

to whether orientation is along or normal to the *c* axis. Idocrase appears as small grains and larger irregular masses of neutral tint showing cleavage and with anomalous polarisation colours of the first order. The rock is an amphibolite.

115' Fine grained greenish mottled rock.

In thin section, the rock is seen to consist of masses of interlacing needles of hornblende, which in some areas have been altered to serpentine. Calcite is plentiful in granular masses and magnetite is rather sparsely disseminated. There are also several small irregular areas of oligoclase into which hornblende needles project. The oligoclase areas may consist of small anhedral crystals fitting tightly together in a mosaic or single crystals, sometimes showing simple twinning. The rock is an amphibolite.

192' Dark greyish green mottled rock, not easily scratched.

In thin section, a composite structure is revealed, definite textures and mineral assemblages being confined to different areas. Plastic flow texture is prominent. Veinlets containing quartz, quartz and sericite, and serpentine cut through the rock. There are areas of quartz—felspar—sericite mosaic, heavily disseminated with pyrite in cubes up to about 1 mm. across. Other areas consist of dark coloured graphite sericite schist, containing pyrite in lines and bunches of very fine particles. These schistose areas show confused banding and minute folding.

272' Mottled light grey rock.

In thin section the rock is seen to consist of tremolite in large irregular corroded crystals about 1 mm. across and in smaller laths about 2 mm. long. A small amount of idocrase, yellow or colourless, is scattered through the section in angular grains and subhedral crystals with anomalous interference colours.

**D.D.H. No. 2.**

97' Contact specimen showing serpentine and white calc-silicate, with veinlets of serpentine penetrating the calc-silicate and gradually passing over to calc-silicates themselves.

In thin section the rock is seen to consist mainly of granular diopside, stained by translucent greenish material. Some porphyroblasts of diopside up to 1 mm. long are present also. Areas of sericite together with some pale green mica make up part of the rock. The micaceous areas contain some magnetite.

107' The rock is a breccia of angular pieces of serpentine in a light green groundmass.

Thin section shows the groundmass, in which angular fragments of serpentine occur, to consist principally of carbonates together with fibrous coiled bands and crystalline patches of serpentine and light coloured opaque material.

123' Light green, fine grained rock with irregular dark green patches and veinlets.

The rock consists of minute crystals of diopside. The crystals are usually equidimensional in outline, but rods and laths and sheaf-like aggregates are also prominent. The darker patches occur when serpentine and magnetite occur with diopside. Veinlets of serpentine and carbonates traverse the rock.

## APPENDIX II.

### ASSAYS OF BORE CORES.

The cores were split and half the core forwarded for assay.

#### No. 1 Bore

Sample No.	Footage	% HCl soluble Iron
1	79'—84'	24.3
2	91'—105'	31.2
3	199'—207'	22.1
4	207'—216'	28.8
5	216'—226'	48.0
6	226'—236'	52.3
7	236'—246'	51.5
8	246'—257'	43.1
9	257'—262'6"	56.2
10	264'—268'	42.8

#### No. 2 Bore

11	86'—87'	} 43.5
	93'—97'	
12	160'—170'	27.7
13	210'—220'	11.1
14	220'—230'	16.6
15	230'—240'	29.1
16	240'—250'	35.3
17	250'—258'	28.3
18	280'—288'	33.4

## APPENDIX III.

### BORE LOGS

No. 1 Bore	Core Obtained.	Rock.
0 — 20' 6"	1' 6" BX	Broken country and boulders
20' 6"— 24'	9" BX	Argillite
24' — 25'	1' BX	Magnetite
25' — 35'	2' AX	Calc-silicate with some magnetite
35' — 38'	1' AX	Magnetite
38' — 65'	3' AX	Calc-silicate with some magnetite
65' — 67'	1' 6" AX	ditto
67' — 71'	4' AX	ditto
71' — 79'	8' AX	ditto

No. 1 Bore		Core Obtained.		Rock.
79'	— 84'	5'	EX	Calc-silicate mainly magnetite
84'	— 90'	6'	EX	ditto—mainly calc-silicate
90'	—105'	12'		ditto—mainly magnetite
105'	—114'	7'		Serpentine
114'	—119'	3'		Serpentine altering to calc-silicates
119'	—122'	2'		Calc-silicate
122'	—123' 6"	1' 6"		Serpentine
123' 6"	—126'	1' 6"		Serpentine altering to calc-silicates
126'	—128'	2'		Serpentine
128'	—134'	4'		Calc-silicate with sparse serpentine and magnetite
134'	—138'	3'		ditto
138'	—143'	3'		ditto
143'	—145'	1'		ditto
145'	—147'	1' 6"		ditto
147'	—151'	2'		ditto
151'	—154'	3'		ditto
154'	—156'	1'		ditto
156'	—158'	1' 6"		ditto
158'	—164'	3'		ditto
164'	—174'	10'		Calc-silicate with little magnetite
174'	—177'	1' 6"		ditto
177'	—181'	4'		ditto
181'	—192'	9'		Calc-silicate
192'	—193'	1'		Black rock (see Appendix I)
193'	—198'	2'		ditto
198'	—200'	2'		Magnetite in calc-silicate
200'	—202'	2'		Serpentine
202'	—207'	1'		Magnetite in calc-silicate
207'	—211'	1'		ditto
211'	—216'	5'		ditto
216'	—221'	3'		ditto
221'	—226'	5'		ditto Serpentine 221'—222'
226'	—236'	10'		Magnetite $\frac{1}{2}$ " serp. at 232', 234' 6" and 235' 6"
236'	—246'	9' 6"		Magnetite serp. at 236' 6"—237' 239' 6"—240' 6" 243' 6"—244' 6"
246'	—257'	8'		Magnetite, 1" serpentine at 256'
257'	—259'	9"		Magnetite
259'	—262' 6"	3'		Magnetite — more friable

No. 1 Bore		Core Collected.		Rock.
262'	6"—265'		6"	Serpentine
265'	—269'	1'		Serpentine
269'	—271'	2'		Calc-silicate with little magnetite
271'	—272' 6"		6"	Calc-silicate
272'	6"—290'	16'		Calc-silicate
No. 2 Bore				
0'	— 12'	6"	BX	Argillite pieces very broken and oxid- ised
12'	— 26'	2'	BX	Hard argillite—some weathering
26'	— 27'	6"	BX	ditto
27'	— 31'	1' 6"	BX	ditto
31'	— 41'	2'	AX	Hard argillite (Some secondary silicific- ation)
41'	— 53'	1' 6"	AX	ditto (weathered)
53'	— 55'	4"	AX	ditto (weathered)
55'	— 57'	6"	AX	Soft argillite
57'	— 58'	9"	AX	Argillite (some sili- cification)
58'	— 60'	4"	AX	Quartzite (weather- ed)
60'	— 63'	3"	AX	ditto
63'	— 65'	3"	AX	Soft argillite—very weathered — some calcite crystals
65'	— 67'	7"	EX	Serpentine
67'	— 69'	9"	EX	Serpentine (calcite veins)
69'	— 71'	1' 6"	EX	Serpentine
71'	— 73'	1' 2"	EX	Serpentine
73'	— 74'	11"		Serpentine — nearly all altered to calc- silicate
74'	— 76'	1' 6"		ditto
76'	— 77'	1'		ditto
77'	— 80'	3'		Serpentine altering to calc-silicate
80'	— 82'	1' 9"		Nearly all serpen- tine — 78' — 79' sparse magnetite
82'	— 83'	9"		Mainly serpentine
83'	— 85'	1' 6"		ditto
85'	— 88'	3'		ditto ditto
88'	— 90'	1' 4"		ditto 86' 6"—87' 6" magnetite
90'	— 92' 6"	2'		Serpentine altering to calc-silicate — some magnetite — breccia-like rock
92'	6"—95'	1' 7"		ditto little magnetite Mainly magnetite

No. 2 Bore	Core Collected.	Rocks.
95' — 97'	1' 5"	Magnetite to 96' 8" then calc-silicate
97' — 99'	1' 5"	Calc-silicate very sparse magnetite
99' — 105'	4' 6"	ditto (becoming weathered)
105' — 113'	8'	Serpentine altering to calc-silicate breccia appearance some calcite at 105' 6"
113' — 123'	10'	Serpentine altering to calc-silicate (sparse magnetite)
123' — 127'	4'	ditto
127' — 140'	8'	ditto (Weathered and oxidised 130'—145')
140' — 143'	1'	ditto (Calcite veins 141'—142')
143' — 150'	4' 6"	ditto (Magnetite 144'—146')
150' — 152'	1'	ditto
152' — 154'	2'	ditto (Calcite at 153' 6")
154' — 159'	5'	ditto (25% calcite veins)
159' — 160' 8"	1' 8"	ditto
160' 8"—171'	5' 6"	Mainly magnetite (170'—171' serpentine)
171' — 176'	2' 6"	Serpentine with sparse magnetite (Calc. silicate 175'—176')
176' — 178'	1'	Serpentine altering to calc-silicate little magnetite and pyrite
178' — 180'	1'	Serpentine with sparse magnetite
180' — 181'	9"	ditto
181' — 181' 6"	4"	ditto (some pyrite) to calc-silicate
182' — 184'	1' 6"	ditto
184' — 186'	1' 6"	ditto
186' — 190'	3'	ditto (sparse magnetite)
190' — 192'	2'	Serpentine altering to calc-silicate
192' — 194'	2'	ditto (little pyrite)
194' — 197'	1' 6"	ditto
197' — 201'	1' 6"	ditto

<i>No. 2 Bore.</i>	<i>Bore Collected.</i>	<i>Rock.</i>
201' —202'	1'	ditto (sparse magnetite)
202' —204'	1' 6"	ditto
204' —207'	3'	ditto
207' —209'	2'	ditto
209' —209' 6"	6"	Serpentine
209' 6"—213'	3' 6"	Serpentine and magnetite
213' —220'	7'	Serpentine altering to calc-silicate intermittent magnetite
220' —223'	1' 6"	Serpentine and magnetite
223' —227'	4'	Mainly magnetite little serpentine
227' —236'	9'	ditto
236' —239'	3'	Mainly magnetite little serpentine
239' —245'	2'	ditto
245' —248'	1'	Magnetite & quartz —little serpentine
248' —251'	3'	Calc-silicate with little magnetite
251' —255'	4'	Magnetite in calc-silicate
255' —261'	5'	Calc-silicate (magnetite 257'—258')
261' —268'	6' 6"	Calc-silicate with sparse magnetite
268' —276'	5' 6"	ditto
276' —278'	1'	Calc-silicate
278' —280'	2'	ditto
280' —281'	1'	Mainly magnetite
281' —284' 6"	1' 6"	Mainly magnetite—little calc-silicate
284' 6"—287'	1' 6"	Serpentine to calc-silicate (281'—287' some pyrite) some magnetite
287' —293'	4'	Serpentine altering to calc-silicate
293' —298'	5'	ditto
298' —307'	5'	ditto
307' —309'	1'	ditto