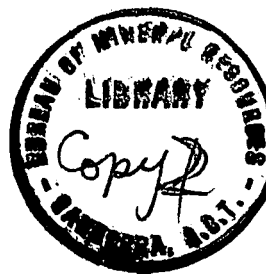


COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS



1959/146

NON-LENDING COPY
NOT TO BE REMOVED
FROM LIBRARY

The information contained in this report has been obtained by the Department of National Development as part of the policy of the Commonwealth Government to assist in the exploration and development of mineral resources. It may not be published in any form or use in a company prospectus or statement without the permission in writing of the Director, Bureau of Mineral Resources, Geology and Geophysics.



GEOLOGICAL SURVEY OFFICE.

FILE NO.

FILE NO.	

SUBJECT: DUPLICATE.....

THIS SHEET IS NOT TO BE WRITTEN ON.

g 10753/10

1959 / 146.

REPORT ON

SURVEY OF MANGANESE DEPOSITS OF WESTERN AUSTRALIA

1958

by

L.E. de la Hunty, B.Sc.,
Geological Survey of
Western Australia.

REPORT ON
SURVEY OF MANGANESE DEPOSITS OF WESTERN AUSTRALIA

1958

by

L.E. de la Hunty, B.Sc.,

Geological Survey of Western Australia.

CONTENTS

	Page
Introduction	5
Personnel	5
Field Work	6
Sampling	6
Tonnage and Grade of Manganese Ore	7
Reliability of Estimates	7
Compilation of Tables	7
Summary of Tables	8
Distribution of Manganese Deposits	8
Production	9
Mining Methods	10
Geology of the Manganese Deposits	10
Environment	11
Types of Deposits	12
Mobility of Manganese	13
Mineralogy	13
Source Rocks	14
Deposits of the Pilbara Goldfield	16
Marble Bar District	16
Nimingarra Station	16
Yarrie Station	17
Ripon Hills	17
Mt. Sydney	25
Woodie Woodie	26
Nullagine District	28
Woodie Woodie	28
Skull Springs	28
Bee Hill	29
Mt. Cooke	34
Mt. Fraser Station	39
Balfour Downs Station	46
Deposits of the Peak Hill Goldfield	49
Horseshoe	49
Peak Hill	50

Tables

	Page
I Manganese Reserves of Western Australia as at 30/9/58, (Revised 11/2/59)	51
II Tonnage Estimates of Individual Mineral Claims - by Claimholders	52
III Manganese Ore on Ground Refused by Minister for Mines	63
IV Localities of Manganese Deposits - Showing Stage of Development	65
V Manganese Production of Western Australia - by Goldfields	67
VI Manganese Production of the Pilbara Goldfield - by Producers	68
VII Manganese Production of the Peak Hill Goldfield - by Producers	69
VIII Sample Details	70

Appendix

Mineral Determinations on Samples from Various Localities	76
---	----

Plates

I	Portion of Western Australia showing Temporary Reserve 1643 ^H for Manganese and Principal Manganese Localities. Scale 40 miles to an inch.
II	Geological Maps of Ripon Hills Manganese Deposits, Marble Bar District, Pilbara Goldfield, Western Australia.
Sheet 1	Location of Mineral Claims for Manganese and Key to Area Mapped in Detail. Scale one mile to an inch.
Sheets 2-5	Geological Map of Principal Manganese Deposits at Ripon Hills. Scale 200 feet to an inch.
Sheet 6	Geological Sections of Manganese Deposits at Ripon Hills. Natural scale 200 feet to an inch.
III	Geological Map of Principal Manganese Deposits at Mt. Sydney, Marble Bar District, Pilbara Goldfield, Western Australia. Scale 200 feet to an inch.
IV	Sheet 1 Geological Map of Mineral Claim 268 at Woodie Woodie, Marble Bar District, Pilbara Goldfield, Western Australia. Scale 100 feet to an inch.

- Sheet 2 Geological Sections of Mineral Claim 268.
Natural Scale 100 feet to an inch.
- = V Sheet 1 Location of Mineral Claims for Manganese at
Bee Hill, Mt. Cooke, Ant Hill, Nullagine District,
Pilbara Goldfield, Western Australia. Scale one
mile to an inch.
- Sheet 2 (a) Geological Sketch Map of Manganese Deposits on
M.Cs. 244^L - 246^L, Ant Hill. Scale 300 feet
to an inch.
- (b) Geological Sketch Map of Manganese Deposit on
M.C. 194^L, Mt. Cooke (Rhodes). Scale 100 feet
to an inch.
- VI Geological Map of Principal Manganese Deposits at Mt. Nicholas,
(scale 200 feet to an inch) and Locality Map of Mineral Claims
for Manganese, Mt. Fraser Station, Nullagine District, Pilbara
Goldfield, Western Australia (scale one mile to an inch).
- VII Balfour Downs Manganese Deposits, Nullagine District, Pilbara
Goldfield, Western Australia.
- Sheet 1 Geological Map of Manganese Deposit Contained
by M.Cs. 265^L - 268^L. Scale 200 feet to an inch.
- Sheet 2 Geological Sections of Manganese Deposit
Contained by M.Cs. 265^L - 268^L (Natural Scale
200 feet to an inch) and Locality Map (Scale
one mile to an inch).
- VIII Sheet 1 Plan, Longitudinal Section and Sub-Surface
Contours of Southern Manganese Deposit, M.C. 24^P,
Horseshoe, Peak Hill G.F. Scale 100 feet to an inch.
- Sheet 2 Cross Sections of Southern Manganese Deposit,
M.C. 24^P, Horseshoe, Peak Hill G.F. Natural Scale
100 feet to an inch.

INTRODUCTION

As a result of applications for licences to export manganese ore from Western Australia, the Bureau of Mineral Resources and the Mines Department of Western Australia have been conducting combined and individual investigations of manganese deposits in this State since 1952. (Earlier investigations of known deposits had been made by the Mines Department for many years).

In 1955 the writer was instructed by the Government Geologist of Western Australia to prepare a bulletin on the manganese resources of this State. However, it was not possible to devote full time to this work and the pegging of more than 120 claims during 1956 and further pegging during 1957 - together with the consequent applications for export licences - showed that much more field work was required. Joint inspections by officers of the Bureau of Mineral Resources and the Mines Department culminated with the recommendation that a joint field party should do some detailed mapping and sampling of the major deposits.

Such a survey was made in 1958 and, although many of the deposits were left unmapped, it was felt that a much better appreciation of the manganese reserves could now be obtained.

PERSONNEL

The field party which left Perth on May 30, 1958 and returned on October 7 consisted mainly of three geologists, a cook-assistant and two driver-assistants. The Bureau provided two new Landrovers, a 30 cwt. Morris 4 x 4 truck and a trailer, and field equipment. Field expenses and wages for the field staff were also supplied by the Bureau of Mineral Resources.

FIELD STRENGTH

Officer	From	To	Remarks
L.E. de la Hunty	30/5/58	7/10/58	Party Leader (G.S.W.A.)
D.J. Forman	30/5/58	7/10/58	B.M.R.
A.T. Wells	30/5/58	29/7/58	do.
J.B. Firman	9/8/58	27/9/58	do.

Field Strength (Con'd).

Officer	From	To	Remarks
Cook-Assistant	30/5/58	7/10/58	Commonwealth employee
Driver-Assistant	30/5/58	3/9/58	do.
do.	6/7/58	7/10/58	do.

K. Johns, Senior Geologist of the Department of Mines, South Australia, accompanied the party until June 15, when he left to inspect some manganese deposits in the southern part of W.A. The writer saw, and discussed the work with H.A. Ellis, Government Geologist of W.A., on August 5. Dr. Fisher, Chief Geologist of the Bureau of Mineral Resources, joined the party on his inspection tour from September 30 to October 7.

FIELD WORK

Plane table mapping of the Balfour Downs deposit (M.Cs. 265^L-268^L) was done in June, and a contoured geological map on a scale of 200 feet to an inch was produced. The principal deposits at Ripon Hills were mapped during July and August in a similar manner. In September, the deposits in M.Cs. 531-535 (Mt. Sydney) were mapped on the same scale and M.C. 268 (Woodie Woodie) was mapped on 100 feet to an inch. Advances made in mining the Southern Deposit at Horseshoe (M.C. 24^P) during 1958 were mapped on October 6, at a scale of 100 feet to an inch.

Most of the 169 samples and specimens submitted were taken by the author, who also made tonnage and grade estimates for about 140 manganese deposits during the season.

With the exception of the mapping done at Horseshoe, the field work was confined to deposits in the Pilbara Goldfield.

SAMPLING

Samples were taken of all grades of ore, and possible source rocks were also sampled. Samples consisted of chips from a line across an outcrop or down the face of a cut; or grab samples were sometimes taken. The sampling interval was such that the programme could only be described as one of scout sampling - as few as one sample only being taken from many of the deposits. Since there were very few openings in the ore-bodies, most of the samples were of surface material only.

Bull. N.M.S. 7 Rev

Assays, check assays and mineral determinations were all made by the Bureau of Mineral Resources.

Table VIII shows sample localities and assay results for the samples which are listed in numerical order. Quite a few of the samples assayed showed a lower manganese content than was anticipated by the writer. This fact demonstrates that "eye assays" can be quite misleading at times, also that scout sampling does not yield sufficient data for the calculation of ore reserves.

The writer freely admits that, while having a fair degree of success in his visual estimates of tonnage and grade of manganese deposits during the past six years, some of his estimates have been proved "wide of the mark".

TONNAGE AND GRADE OF MANGANESE ORE

Reliability of Estimates

Most of the deposits listed in Table II have been measured in area of outcrop (by plane-table, tape or pace and compass), but the depths of the ore-bodies have been determined in very few cases. Although quite a large number of scout samples have been taken (at least 300) by various investigators, many of the grades shown have been estimated by eye,

Many of the estimates made since 1952 have become superseded by later investigations and the latest figures are included in the tables. The estimates used have been made by:-

K. Townley (B.M.R.)	1953
D. O'Driscoll (Asst. Chief Geologist, B.M.R.)	1956
D. O'Driscoll (B.M.R.) and L. de la Hunty (G.S.W.A.)	1956
do.	do.
	1957
L. de la Hunty (G.S.W.A.)	1958.

Compilation of Tables

Table I shows the total manganese reserves of Western Australia on ground held under Mineral Claims. The items shown are sub totals from Table II.

Table II shows the tonnages estimated by individual claims which are grouped in localities under the main headings of the various claim holders. Claims shown as "Pending" in this

table are reserved for the various holders, but can not be mined until "Approved". All of the mineral claims for manganese held at the end of October, 1958 are included.

As a result of the creation during 1958, by the Minister for Mines, of a Temporary Reserve for Manganese over a large portion of the manganese-producing areas of Western Australia (See Plate I), some 53 applications for mineral claims for manganese have been refused. These are listed in Table III.

Summary of Tables

Table I shows that nearly 10,000 acres are held under claim for manganese in Western Australia - made up of 133 claims "Approved" and 193 "Pending" (Total 326).

The total ore above 40% Mn is 3.9 million tons of which some 2.8 million tons occur at Ripon Hills. A further 3.2 million tons of low grade (30-40% Mn) ore is available, of which nearly 1.7 million tons is contained in one deposit at Balfour Downs. This deposit is enclosed by M.Cs. 265^L - 268^L (see Table II).

Table III shows that some 63,000 tons of ore above 40% Mn occurs in deposits not held under claim, while a further 229,000 tons of 30-40% ore also occurs in these deposits.

Tables IV - VII are discussed below.

DISTRIBUTION OF MANGANESE DEPOSITS

Table IV lists the localities at which deposits of manganese ore have been reported, also whether an official inspection has been made in the locality, together with the year of the last visit. The "Stage of Development" refers to the condition of the deposits at the end of 1958.

Ore production has been limited to the Pilbara and Peak Hill Goldfields - the centres being:-

Ripon Hills)	
Mt. Sydney)	
Woodie Woodie)	
Bee Hill)	Pilbara Goldfield
Mt. Cooke (including Ant Hill))	
Mt. Cooke (Rhodes))	
Mt. Fraser Station)	

Horseshoe)	
Mt. Fraser)	Peak Hill Goldfield
Peak Hill)	

PRODUCTION

Claimholders producing ore during 1958 were:-

Westralian Ores Pty. Ltd.
Northern Mineral Syndicate
D.F.D. Rhodes
Hancock and Wright

Ore produced by Hancock and Wright was stockpiled on the claim, but the other producers sold ore.

Table V shows that State production of manganese ore has averaged 60,000 tons per year for the years 1956-1958 for an average value of £840,000. Total ore produced from Western Australian deposits to the end of 1958 was 310,834 tons for an estimated value, f.o.b. port, of £3,921,885. Of this 59,970 tons (£975,589) came from the Pilbara Goldfield and 250,819 tons (£2,946,296) came from the Peak Hill Goldfield.

Manganese production from the Pilbara Goldfield commenced in 1954. Table VI shows that Northern Mineral Syndicate were the only producers for the period 1954-1957 and that their total production to the end of 1958 was 44,451 tons for an estimated f.o.b. value of £682,076. Westralian Ores Pty. Ltd., produced 3,620 tons from Ant Hill (value £40,312) during 1958 and in the same year, D.F.D. Rhodes produced 11,899 tons (value £255,200) from Mt. Sydney, Bee Hill and Mt. Cooke deposits.

Westralian Ores Pty. Ltd., have been the only producers of manganese ore from the Peak Hill Goldfield since 1952, and their total production (1948-1958) has been 237,628 tons for an estimated value f.o.b. of £2,876,627. Broken Hill Pty. Co. Ltd., produced ore for the years 1949-1952 but have not produced since, although they hold mineral claims for manganese in both the Peak Hill and Pilbara Goldfields. Broken Hill Pty. Co. Ltd., buy nearly all of the manganese ore which is sold on the home market.

MINING METHODS

All of the deposits being worked are quarried and the deepest quarry is about 50 feet.

The ore is selectively mined (where possible) from an advancing face and loaded into trucks by a "mechanical navy", for transport to the cracker. (The larger lumps of ore are "sand-blasted" at the quarry). The cracker may be adjacent to the quarry, as at Horseshoe, or at the port (Port Hedland). Mixed ore and gangue is often carted from the quarry face and dumped for later treatment.

During mechanical beneficiation, the ore is crushed and screened giving 5 inch lumps of ore. The ferruginous gangue often powders during crushing and is screened off. The remaining gangue is removed by hand-picking from the belt conveying ore from the cracker to the bin. No chemical treatment of any kind is used during beneficiation.

The ore from the Pilbara Goldfield is carted by semi-trailers (20 ton loads) to Port Hedland, but the ore from the Peak Hill deposits is railed from Meekatharra to the port at Geraldton. The roads are often made and mostly maintained by the ore-producers.

GEOLOGY OF THE MANGANESE DEPOSITS

The deposits of manganese ore in the Pilbara Goldfield are mostly superficial and usually occur on rocks of the Nullagine Series (Proterozoic). The deposits of the Peak Hill Goldfield were seen to overlies meta-sediments of Archaeozoic Era. The protore for all of the deposits is believed to be a mangiferous sediment of the Nullagine Series.

None of the deposits have a hydrothermal origin, nor are they related to magmatic rocks in any way, other than as ultimate source rocks. Nor is there any evidence to suggest that metamorphism has been responsible for the emplacement of any deposit.

The tenor of the ore varies according to the quantity of gangue associated with the ore and also to the nature of the particular manganese mineral. Some samples taken assayed as high

Bath

as 58% Mn, but many were below 30% Mn.

The deposits are mostly small and scattered, but those at Ripon Hills (Northern Mineral Syndicate), Balfour Downs (D.F.D. Rhodes) and Horseshoe (Westralian Ores Pty. Ltd.,) are comparatively large.

Environment

All of the deposits occur on, or close to, rocks of the Nullagine Series, and in all cases are associated with river systems. The deposits form on hillsides, in valleys, at breakaway edges, in caves, sometimes in stream beds, and also form mesa caps (as at Balfour Downs).

All of the deposits occur within, or around the margins of, large topographic basins which contain some Tertiary sediments. Evidence of glaciation (probably Permian) has been seen by the writer in the vicinity of many of the deposits - morainic deposits and a glaciated pavement at Ripon Hills, moraines at Mt. Sydney, glaciated pavement and erratic boulders at Woodie Woodie - so it is believed possible that glacial action may have played some part in the localisation of the deposits.

Most of the Pilbara deposits are in the De Grey - Oakover-Davis Drainage Basin, while the deposit at Balfour Downs is in the divide country at the heads of the Davis and Fortescue Rivers. The deposits on Mt. Fraser Station and those near Wittenoom are in the Fortescue Drainage Basin. The deposits of the Peak Hill Goldfield are in the basin of the Gascoyne River.

Silicification of the surface rocks is common in the Pilbara Goldfield and, although there are beds of chert and chert breccia, many of the surface rocks on which the manganese ore occurs are talus mantles of chert which have been silicified in places, or silicified shale, sandstone or siltstone.

Many of the deposits (especially at Ripon Hills and Balfour Downs) occur directly on, and within the top few feet of, mangiferous shales. These shales vary considerably in character and are discussed under "Source Rocks" below.

Other host rocks are the dolomitic limestone of the

Nullagine Series (which is still high in the succession but below the shales), and the Archean meta-sediments of the Peak Hill Goldfield.

Types of Deposits

X The manganese ore deposits occur as thin cappings, as blocky deposits, as fissure and cave-fillings, as loose and cemented pisolites, and as sedimentary beds with a high manganese content. The deposits may range in age from Proterozoic ~~times~~ to the present and some may have been formed almost continuously through that time range.

Syngenetic beds of ore (Nullagine) were seen in the deposit on Yarrie Station and also in the Mt. Cooke area (5 miles east-south-east of Rhodes' M.C.194^L). A grab sample from the Yarrie deposit assayed 32.6% Mn while a sample from the Mt. Cooke deposit contained 46.2% manganese.

The ore deposits on M.C.24^P and 26^P at Horseshoe rest unconformably on the underlying Archaeozoic meta-sediments and are believed to have been deposited from solution. The deposit on M.C.24^P contains sub-horizontal bands and vertical pipes of iron oxide, and sub-surface contours reveal that the ore has been deposited in an old stream channel (See Plate VIII, Sheet 1). This deposit has been laid down since Proterozoic times. ^{Another} A further sedimentary deposit outcrops on M.C.551 on the eastern side of the Ripon Hills Plateau. Along the eastern edge of the deposit on M.C.551 (which is of indeterminate age) there is a small outcrop of cellular ore (low-grade) which overlies Tertiary sediments at the foot of the hills.

The fissure-filling and cave-filling deposits are typified by the Mt. Sydney deposit and that on M.C.268 at Woodie Woodie. Discontinuous outcrops occur along a fault line at Mt. Sydney (See Plate III), and the main ore-body is at right angles to the fault. This ore has been deposited from descending solutions and the cave in which the main ore-body formed was made in a series of joints in the dolomitic limestone country rock. The ore-body has a depth of more than 50 feet and contains islands of country rock.

On M.C.268 the ore-body has almost vertical, irregular sides and contains caves within the ore. The ore also contains patches of chert and barytes.

The deposits at Ripon Hills are typical of many of the other deposits at Bee Hill, Ant Hill, Mt. Cooke, Mt. Nicholas and Balfour Downs. The ore is often shaley but can be massive and blocky, and usually rests on ferruginous, manganiferous shales. Lenses of ore sometimes extend a few feet into the shales, but the method of formation of the deposit is one of surface enrichment in situ.

Pisolites of ore are not uncommon and a deposit of these at Balfour Downs contains a few hundred thousand tons. The main Balfour Downs deposit contains quite a lot of loose and cemented pisolites and the Southern Deposit at Horseshoe has both types.

Mobility of Manganese

Replacement of country rock by manganese is a common phenomenon. Some outcrops of chert breccia present a face of almost pure manganese dioxide, but this skin may be only an eighth of an inch in thickness. The manganese content decreases rapidly towards the heart of the rock and may be as low as a few per cent at a depth of 3 inches from the surface. This skin of manganese dioxide and replacement of country rock is most apparent in river courses and on waterfalls - being most intense at the base of a fall. Thin skins of manganese dioxide on the surfaces (including vertical faces) of outcrops of ore often exhibit "thin film" iridescence - indicating the soluble nature of manganese.

The mobility of manganese is further demonstrated by the presence of high grade skins of ore beneath even the smallest plant on a deposit. This skin is formed by the washing (by rain or dew) of transpired manganese from the leaves of the plants.

Mineralogy

The high grade ores contain a large percentage of pyrolusite (MnO_2) and some deposits show the development of pyrolusite crystals. Cryptomelane (hydrated oxides of manganese and potassium) is another common ore mineral.

"Manganese Ore from Ripon Hills, Western Australia",
Commonwealth Scientific and Industrial Research Organisation,
Mineragraphic Investigations Report No. 747, June 1958, lists the
ore-forming minerals in specimens from that locality. The minerals
reported were braunite, $3(\text{Mn,Fe})_2\text{O}_3 \cdot \text{MnSiO}_4$, cryptomelane (replacing
braunite), pyrolusite and wad (soft, earthy manganese mineral).
Limonite was reported as a gangue mineral, as well as another non-
manganiferous mineral.

Other common gangue minerals are barytes, calcite,
hematite, chert, quartz grains and clay.

The mineralogist's report on samples submitted to the
laboratory of the Bureau of Mineral Resources was not to hand at
the time of completion of this report, so is included as an
appendix.

Source Rocks

While the manganiferous shale is considered to be the
protore of most of the ore deposits, many of the other rocks
(especially the sediments) contain manganese.

Both
The manganiferous shale varies in mineral content and
lithology. In places, this "shale" has been mapped as a ferru-
ginous siltstone and iron is present in all cases. Sometimes
the manganese occurs in bedding planes, sometimes it is scattered
throughout the rock, and flattened pellets have been seen in the
bedding planes in a few localities. The shale varies in colour
from black to chocolate to purple to red. Some of the black shale
was high grade ore on deposition, but most of the shaley ore has
resulted from surface enrichment on weathering.

Some assays of samples from the manganiferous shales
are shown below. (Many outcrops of these shales have a much
lower manganese content).

Sample No.	Locality	Per cent Mn
98422	Balfour Downs	13.2
98423	" " "	13.2
98445	Yarrie Station	32.6
98457	Ripon Hills	15.1

Sample No.	Locality	Per cent Mn
1311	Mt. Cooke (Rhodes)	10.3
1317	" "	46.2
1366	" "	4.0

A basalt which directly overlies the pelletised manganiferous shale near Rhodes' claims in the Mt. Cooke area showed 3.7% Mn on assay. A similar basalt conformably overlies the manganiferous shale at Ripon Hills - just south of the area mapped in detail.

The dolomitic limestone of the Nullagine Series has been shown to have an appreciable manganese content. (GS/M/102 and GS/M/14) were taken by the writer in 1952.

Sample No.	Locality	Per cent Mn
98498 a	Mt. Sydney	2.9
98498 b	"	2.0
1359	"	0.8
1360	"	1.5
1368	Ripon Hills	1.8
GS/M/10a	Woodie Woodie	0.06
GS/M/14	Mulgul Station (north of Horseshoe)	0.31

Other possible source rocks include Archaeozoic sediments and any igneous rocks. The manganiferous shale protore must have derived its manganese content from older rocks.

DEPOSITS OF THE PILBARA GOLDFIELD

Marble Bar District

Only those deposits visited during 1958 are included in this report, and they have been listed in order of their distance from Pt. Hedland.

Nimingarra Station

In July, the writer inspected M.Cs. 517 (300 acres), 518 (300 acres), 519 (15 acres) which were pegged by Pindan Pty. Ltd., about 7 miles north-east of the station homestead. The deposit is about a mile east of a stock windmill, which provides good water and is about 120 miles by road and track east from Pt. Hedland (94 miles due east by air). At the time of the inspection the deposit was being tested by Pindan and Sims under the direction of H.J. Ward, consulting geologist. Testing included the sinking of pits and shallow diamond drill holes.

Manganese dioxide is present on all claims on the surface of, and in the matrix of a flat-lying conglomerate with a sandstone matrix. Samples taken by Ward, of this rock, assayed 20% Mn. The conglomerate lies on the junction of the steeply dipping jaspilites of the Warrawoona Series (high level) and the granite which forms the plain. The conglomerate is on the breakaway edge - running north-south, parallel to the strike of the jaspilite. M.C.517 is the only claim which contains any ore above 40% Mn and this is in two deposits.

The more northerly deposit near the north-west (datum) peg was shaped like a truncated cone and a pit 4 feet deep had been dug at the crest of the hill. Another 4 feet pit had been dug at the base of the hill to the north - exposing soil and manganese rubble. Experiments with a portable diamond drill were being conducted, but no holes had been dug at the time. The deposit was estimated to contain 12,000 tons of 45-49.9% Mn ore and 13,000 tons of 40-44.9% Mn.

The second deposit outcrops intermittently over a length of 500 feet in a south-east direction. Some 9,000 tons of 45-49.9% Mn and 24,500 tons of 40-44.9% Mn were estimated.

for this deposit.

The total ore available was 58,500 tons above 40% Mn.
(Ward's assay data was used in assessing the grades of ore)

Yarrie Station

Pindan and Sims applied for a 300 acre Mineral Claim on this deposit, but the application was refused. The deposit, which was inspected in August is about 60 chains north of the Yarrie 6-mile well on the road from Pt. Hedland to Mt. Sydney.

The manganese occurs at plain level about 200 feet below a ridge of jaspilite of the Warrawoona Series. The deposit is a few chains south-west of where the jaspilite ridge changes direction abruptly, from north to west. No openings had been made in the ore which occupies a 10-12 inches thick horizon in shales of the Nullagine Series.

The surface expression of the manganese horizon indicates shallow folding of flat-lying shales and the fold axes are east-west. The top 2-3 inches of the manganese horizon contain abundant quartz grains about 1/8 inch diameter, while the assay of a sample of ore below showed a high silica content (24.8% insolubles). The material assayed was a grab sample of rubble shed from the manganese horizon and showed 32.6% Mn and 11.7% Fe.

The estimate for this syngenetic deposit was 1,500 tons at 40-44.9% Mn and 1,500 tons at 30-39.9% Mn.

Ripon Hills

Bolt
Westralian Ores Pty. Ltd. - M.Cs. 504-506, about a mile east of the Yilgalong River and about 13½ miles south of where the river crosses the Pt. Hedland-Mt. Sydney road, were inspected in August. They are disposed along the southern edge of a plateau of sediments of the Nullagine Series - shales, sandstone and underlying dolomitic limestone. *They appear to be due to*

Res
Supergene enrichment of a manganiferous shale was responsible for the deposits which total 2,700 tons of 40-44.9% Mn and 7,600 tons of 30-39.9% Mn. *delete*

M.C. 504 (6 acres) contains some iron oxide of lateritic origin and the manganese dioxide is a surface

enrichment of manganiferous shales. The ore was estimated at 300 tons of 40-44.9% Mn and 1,150 tons of 30-39.9% Mn.

M.C. 505 (10 acres), which is a few chains east of M.C. 504, contains manganese ore with shaley structure on manganese dioxide which contains chert breccia fragments. Some pebbles, weathered from an overlying conglomerate, were present on the surface above the ore which caps a mesa. The mesa is on the eastern (upthrow) side of a fault and dolomitic limestone outcrops on its lower slopes to the south. ^{about} Some 1,200 tons of 40-44.9% Mn and 4,000 tons of 30-39.9% Mn were estimated for this claim. This included blocks of ore which had broken away from the western edge of the mesa cap.

M.C. 506 (20 acres) was pegged on a low-grade manganese deposit which lies on chert breccia, "billy" and sandstone. Some manganiferous shale pebbles were present on the surface. Sandstone outcrops on the crest of a hill to the east of the claim towards M.C. 504. ^{about} The ore content of this claim was estimated at 700 tons of 40-44.9% Mn and 2,500 tons of 30-39.9% Mn.

Northern Mineral Syndicate - This syndicate's claims are M.C.s. 473, 474, 478, 479, 497, 509, 554, 564-574 - 18 claims, containing a total area of 1,942 acres. Their application for M.C. 583 (240 acres) was refused. M.C.s. 473-509 were pegged during 1957 and M.C.s. 554, 564-574 were pegged during 1958 to enclose a large amount of lower grade ore. These latter claims enclosed some of the earlier claims (M.C.s. 500, 501, 502 etc.), which were surrendered. This action gave the syndicate a discontinuous deposit of varying grades of ore - rather than a series of isolated high grade deposits.

The contoured plans of Plate II, Sheets 2-5, were made from plane table maps done by Wells and Forman in July, and Firman and Forman in August. Fifty three samples and specimens of ore were taken from these deposits (mostly by the writer) during that time. No permanent water supply has been established in this area although water is available from rock holes. The deposits are located on a high plateau and are all associated

with mangiferous shales, siltstones etc., of the Nullagine Series.

These mangiferous shales often contain a high percentage of iron, as do some of the ore-bodies. The ore-bodies are formed by concentration of manganese at the outcrop of the mangiferous shales. This surface enrichment sometimes results in replacement of the shales and relict bedding shows in the ore-bodies. The mangiferous horizon is rather thin (down to 1 foot thick), but the average thickness is perhaps 20 feet. Although the shale has a general flat dip, dips of up to 80° have been observed on the sides of valleys. The dips are flat on the hill-tops and in the valley floors. Consequently, the deposits form a thin drape over the land surface. Rocks overlying the mangiferous horizon include basalt, calcareous siltstone, conglomerate, chert, etc., of the Nullagine Series and a chert breccia is sometimes exposed directly overlying the mangiferous horizon.

There is evidence of glaciation in the area. A glaciated pavement was located 800 feet south-east of the north corner (datum) of M.C.573, together with moraine deposits (Sheet 5). Small erratics were also seen in a valley to the east of M.C.564.

During 1958 the syndicate mined 15,641 tons of ore (average grade 48.2% Mn) from the quarry on M.C.564 and some boring ahead of the face was done with a rock drill. The inset on Sheet 3 shows details of the bores with driller's logs and demonstrates the variable nature of the ore within the deposit. With the exception of a rough track cut through the claims, no other development work has been done on this group of claims.

Excluding M.C.478, the ore reserves for the deposits held by Northern Mineral Syndicate at Ripon Hills are 2,782,000 tons above 40% Mn and 937,000 tons of 30-39.9% Mn. Tonnages for the individual claims are given in Table II.

M.C. 478 (18 acres) is about 5 miles south of the other claims and is not easily accessible. The writer visited this deposit in July and estimated that some 10,300 tons of ore above 40% Mn were available. The ore occurs in

discontinuous outcrop running north-west and is about 300 feet above the valley floor on sandstone and chert breccia.

N.M. { M.C. 583 (240 acres) contains deposits on a hillslope. The ore exhibits shaley bedding in places and lies on chert breccia. [In September, the writer estimated this claim to contain 7,000 tons of ore above 40% Mn and 23,000 tons of 30-39.9% Mn.

X H.V. Blackwell and J.M. Henderson - M.Cs. 521-523, 537, 538 on the southern edge of the Ripon Hills plateau, were visited during July. Deposits contained by M.Cs. 541, 542 - pegged by Henderson and Blackwell, but refused by the Minister for Mines - were also inspected. The claims are located 5 miles west of a point on the Yilgalong River which is 1.5 miles south of where the river crosses the Pt. Hedland-Mt. Sydney road (see Plate II, Sheet 1). Access was gained by driving south up the dry bed of the river and across the plain to the foot of the plateau, then proceeding on foot to the top of the plateau (200 feet above). No development work had been done.

Total ore on claims held by Blackwell and Henderson was 32,100 tons above 40% Mn and 9,200 tons of 30-39.9% Mn. Ore on claims refused by the Minister was 4,300 tons above 40% Mn and 6,000 tons of 30-39.9% Mn in the same locality and the total ore for M.Cs. 544-548 was 13,500 tons above 40% Mn and 94,000 tons of 30-39.9% Mn.

M.C. 521 (52 acres) contains most of the ore in this locality and runs north-east along a spur between two deep gullies. The ore outcrops along the claim in small deposits which are residuals from the weathering of a manganiiferous sediment. The underlying rocks are sandstone with an indurated cap, over dolomitic limestone. Samples from this claim assayed 48.5% Mn and 35.5% Mn. The tonnage estimate was 5,000 tons of 45-49.9% Mn, 15,850 tons of 40-44.9% Mn and 7,200 tons of 30-39.9% Mn.

M.C. 522 (37 acres) was pegged on the north-eastern end of M.C. 521 and contains the same type of deposits.

Tonnage for this claim was estimated at 5,650 tons of 40-44.9% Mn and 2,000 tons of 30-39.9% Mn.

M.C. 523 (23 acres) was pegged over a deposit on the breakaway edge at the south-east corner of a natural amphitheatre. A sample cut from the surface of the largest outcrop assayed 21% Mn and, although some of the ore down the vertical 20 feet face looked better than the sample, the estimate of 3,150 tons of 40-44.9% Mn may have been a little generous.

M.C. 537 (8 acres) was pegged along a breakaway edge which faces south. Rocks on the surface are sandstone and chert breccia. Although most of the ore contains a high silica impurity, it was estimated that 1,000 tons of 40-44.9% Mn could be won from this claim.

M.C. 538 (3 acres) was pegged on the western side of the amphitheatre and the manganese outcrops on sandstone and chert breccia over dolomitic limestone. In places the manganese rests on shales which directly overlie the dolomitic limestone. Some 550 tons of 45-49.9% Mn and 900 tons of 40-44.9% Mn were estimated for this claim.

M.C. 541 (38 acres) enclosed outcrops of manganese ore which contained boulders of sandstone. Some 1,000 tons of 40-44.9% Mn could be won by removing these boulders.

M.C. 542 (38 acres) was pegged around a number of outcrops which were mostly high in iron content. Some 3,300 tons of 40-44.9% Mn were available, but the 6,000 tons of 30-39.9% Mn estimated would be at the bottom of the grade scale.

M.Cs. 544-548 were pegged by Blackwell and Henderson on the east side of the Yilgalong River about 12 miles south of where the river crosses the Pt. Hedland-Mt. Sydney road. None of these claims were granted by the Minister for Mines. The applicants cut a track through to these deposits from the main road and blasted a few holes in the various manganese deposits which were inspected by the writer in August. These deposits are located along the north-eastern outcrop of manganeseiferous shales of the Nullagine Series. The shales together

with overlying conglomerate and underlying chert breccia and dolomitic limestone are folded into a syncline which also exhibits minor parallel folds. A plateau is contained by the shale outcrop which continues through M.Cs. 504-506 to the west. Some lateritisation of the plateau surface was evident in places.

M.C. 544 (17 acres) contains only 300 tons of 30-39.9% Mn resting on manganiferous chert breccia.

M.C. 545 (17 acres) also has only low grade ore - 300 tons of 30-39.9% Mn. It contains two prominent hills, the more southerly of which is chert breccia with some "billy" and traces of iron and manganese. The more northerly hill is black with manganese staining and patches of breccia with manganese and iron replacement of the groundmass. Conglomerate boulders are scattered on the top of the hill, while a bedded conglomerate outcrops in the creek bank 70 feet below.

M.C. 546 (38 acres) was estimated to contain 500 tons of 40-44.9% Mn and 1,500 tons of 30-39.9% Mn. The manganese occurs as a replacement of the matrix of a chert breccia and a sample from a shot hole near the northern end of the claim assayed 33.4% Mn. A sample from 3 chains to the south-east assayed 23.8%. This sample was of a manganiferous sandstone which contained conglomerate boulders. Small deposits of higher grade ore occurred on the surface above these manganiferous rocks.

M.C. 547 (231 acres) encloses an estimated 85,000 tons of low grade (30-39.9% Mn) ore and 11,000 tons of 40-44.9% Mn. The manganese replaces breccia near the northern end of the claim (35.9% Mn for some of the better ore from a shot hole), and surface enriched deposits of both manganese and iron have resulted from the weathering of a manganiferous, ferruginous shale.

M.C. 548 (38 acres) was estimated to contain 2,000 tons of 40-44.9% Mn and 7,000 tons of 30-39.9% Mn. Most of the southern part of the claim is covered with laterite (some manganiferous but mostly ferruginous) and the south-eastern part of the breakaway face shows laterite on conglomerate over shale.

D.F.D. Rhodes - All of Rhodes' applications for mineral claims for manganese in the Ripon Hills area were refused. These were M.Cs. 550, 551, 555-563, 575-578, 581. M.Cs. 550 and 551 were seen by the writer in September. M.Cs. 563 (1 acre) and 581 (5 acres) were not seen, and the remainder were inspected in August. (See Plate II, Sheet 1 for localities).

The total ore on these claims which were not granted is 36,400 tons above 40% Mn and 105,100 tons at 30-39.9% Mn.

M.C. 550 (100 acres) contains only low grade ore - 15,000 tons of 30-39.9% Mn. The ore contains abundant limonite and quite a lot of quartz grains. It caps two small mesas which are composed of dolomitic limestone with overlying chert breccia and contains some shaley bedding in places. Some pisolitic ore outcrops near the eastern corner of the claim, and this assayed 35.2% Mn. Two other samples from this claim assayed only 16.5% Mn and 27.5% Mn respectively.

M.C. 551 (80 acres) is a Tertiary deposit. It is on the slopes and the eastern edge of the Ripon Hills plateau and overlies the contact of the Nullagine dolomitic limestone and the Braeside Tillite (Permian). The manganese is both pisolitic and cellular and contains quartz grains. It conformably overlies sandy cellular limestone beds of Tertiary age. Two samples assayed 18.2% Mn and 29.2% Mn respectively. Tonnage was 60,000 tons of 30-39.9% Mn.

M.C. 555 (1 acre) was estimated to contain 1,900 tons of 40-44.9% Mn and 5,000 tons of 30-39.9% Mn. Assay of a sample showed 31.6% Mn. The deposit, which contains a fair amount of iron, occurs as a flat body (5 feet average thickness) on "billy" and chert.

M.C. 556 (1 acre) contains a body of ore which is 120 feet long running east-west and is 70 feet wide at its widest part. The shale bedding within the deposit, which is an enrichment of manganiiferous shale, dips south at 20°. The ore-body was estimated to contain 2,800 tons of 40-44.9% Mn.

M.C. 557 (1 acre) was estimated to contain 300 tons of 40-44.9% Mn and 1,600 tons at 30-39.9% Mn. The ore is powdery and is residual from the weathering of a manganiiferous

shale of the Nullagine Series. A stratigraphic section seen near this deposit showed a ferruginous chert sandstone (4 feet) over shales (30 feet) on basalt (flow or sill 20 feet), grey shales (20 feet), red shale (2 feet), conglomerate (2 feet) on manganiferous shale (10 feet) over chert breccia.

M.C.558 (60 acres) contains three deposits of manganese ore which is mostly low grade - assay 20.0% Mn. The tonnage for this claim was estimated at 1,600 tons of 40-44.9% Mn and 6,250 tons of 30-39.9% Mn. The deposits have resulted from surface enrichment from a manganiferous shale which overlies chert breccia.

M.C.559 (80 acres) contains several small deposits which have resulted from weathering of a manganiferous shale. Conglomerate boulders from an overlying bed are present on the surface. Estimates for this claim were 12,000 tons at 30-39.9% Mn and 14,900 tons at 40-44.9% Mn. Analysis results of samples showed 20.2% Mn, 11.7% Fe and 24.8% Insol. and 1.8% Mn, 63.4% Fe and 4.6% Insol. respectively. It seems obvious that the manganese content for the first assay is incorrect, but repetition of the assay gave little variation and the assayer could not account for the strange result.

M.C.560 (4 acres) contains some fairly good-looking ore, also some which is highly ferruginous. A grab sample assayed 13.8% Mn, 49.0% Fe and 4.1% Insol. but the writer estimated that some 5,700 tons of 40-44.9% Mn was available from this claim. The ore deposit is a surface enrichment from manganiferous, ferruginous shale.

M.C.561 (5 acres) contains a thin body of good grade ore (3,200 tons of 45-49.9% Mn) on chert breccia. The manganese was derived from a manganiferous shale which was originally overlain by a conglomerate bed.

M.C.562 (4 acres) contains two deposits in an interrupted line. The deposits are sometimes quite shaley and rest on chert breccia. A sample of the ore assayed 30.9% Mn and the tonnage estimates were 1,900 tons of 40-44.9% Mn and 5,000 tons of 30-39.9% Mn.

M.C. 575 (12 acres) contains two small bodies of ore and some mangiferous shale over chert breccia. A sample of the ore assayed 50.0% Mn and the tonnage estimate was 400 tons at 40-44.9% Mn.

M.C. 576 (7 acres) was estimated to contain 50 tons of 40-44.9% Mn and 200 tons of 30-39.9% Mn. It overlies chert breccia and replaces the groundmass in some places.

M.C. 577 (5 acres) was estimated to contain 150 tons of 40-44.9% Mn and 50 tons of 30-39.9% Mn. There was a little mangiferous shale on the claim and some of the black areas were breccia with both staining and replacement by manganese dioxide.

M.C. 578 (10 acres) contains some good ore - a sample of which assayed 47.2% Mn. There are four deposits on chert breccia and a conglomerate overlies the mangiferous shale from which the ore was derived. Tonnages for the deposits totalled 6,500 tons of 45-49.9% Mn and 1,200 tons of 40-44.9% Mn.

Mt. Sydney

In September, Firman and Forman mapped the area contained by M.Cs. 531-5 at Mt. Sydney, on a scale of 200 feet to an inch, and the contoured map has been reproduced as Plate III. These claims (totalling 245 acres) are held by D.F.D. Rhodes who was mining high grade ore from the main quarry on M.C. 532. (Late M.C. 211 contained the ground in which the main quarry has been made).

Mapping revealed a thin lenticular mangiferous horizon between the brown breccia and the white breccia, but there were no large outcrops of ore. Other small outcrops occur at the unconformity between the chert breccia and the underlying dolomitic limestone (Proterozoic). Two specimens of this limestone (Nos. 98498a, white, and 98498b, purple) assayed 2.9 and 2.0% Mn respectively. Some of this manganese was present as the dioxide in joints. The manganese ore which outcrops along the fault running east-south-east through M.Cs. 531, 532 is high grade but does not exhibit much width. It dips almost vertically and a specimen of ore from the fault zone near the floor of the main

quarry (50 feet deep) assayed 55.8% Mn.

Although the original outcrop of ore above the quarry was in the fault zone, exploitation of this body of ore revealed an extension to the south underneath the dolomitic limestone. There seems little doubt that this main ore-body was emplaced in a cave by waters carrying manganese in solution and that the cave was originally made by water in a zone of weakness. Joints striking north-south caused this weakness and some parallel joints to the east contain manganese ore. There is a possibility that more ore could be found in that locality. This mode of occurrence is similar to that of the ore at M.C.268, Woodie Woodie, but is quite distinct from most of the ore-bodies of the Pilbara Goldfield, which usually form above the land surface.

There is another quarry on M.C.532 - to the east of the main quarry along the fault. The ore-body is narrow and no ore has been shipped from there, but a sample assayed 54.7% Mn. Another shallow quarry has been dug in the fault zone on M.C.531 and a sample from the wall assayed 62.4% Mn. The remaining pit was on M.C.534 and it exposed mixed ore and yellow iron oxide - too low grade to be mined.

The ore in the main quarry is benched and seen to contain remnants of dolomitic limestone within the ore. A vertical chip sample (6 feet) from the southern wall of the quarry assayed 56.8% Mn (No. 1355) while a specimen from a bench in the middle of the quarry (No. 1354) assayed 47.9% Mn. A mechanical navvy in the quarry loaded ore directly on to trucks for transport to Pt. Hedland.

The ore reserves for these claims were estimated in September, to be 21,700 tons of ore above 40% Mn and 4,800 tons of 30-39.9% Mn.

Woodie Woodie

Westralian Ores Pty. Ltd. - M.C.487 (formerly M.Cs.275, 55^L, 57^L) contains 24 acres and is about 18 miles south of Mt. Sydney, just north of the boundary of the Nullagine District. The main ore-body is a low mesa, circular in plan, about 250 feet in diameter. Ferruginous and siliceous patches outcrop on the

mass and the surrounding country is covered with chert rubble. *delete*
The writer visited this claim in October but, since there had been no development work done, there was no occasion to alter O'Driscoll's 1956 estimate of 11,400 tons of ore above 40% Mn.

Northern Mineral Syndicate - M.C.268 (24 acres) is 12 miles south of Mt. Sydney and was mapped by Forman on a scale of 100 feet to an inch in October (see Plate IV). Nearly 30,000 tons of ore have been taken from this claim *delete* and the writer estimated in October, that 10,000 tons of ore above 40% Mn were still available from the deposit. The shape of the ore-body, together with the presence of caves within it, suggest that the ore was deposited from solutions containing manganese, in a cave in the dolomitic limestone. Chert is also present in this body and the ore contains a fair amount of silica. Mining operations had been suspended at the time of inspection.

N. M.
M.C.269 (24 acres) is 5 miles south of M.C.268 and was visited by the writer in September. The deposit was being worked for the first time since mining operations were suspended there some four years earlier. Ore which had been pushed to one side during previous operations was passed over a 3 inch grizzly set at 45 degrees. The larger ore was trucked to Pt. Hedland and the smaller ore was stockpiled for screening later. A bulldozer and a mechanical navy were also operating on the ore-body. Although the main body of the ore may have been deposited as early as Proterozoic times, some of the ore around the base of the deposit appears to be Tertiary in age. Several holes had been drilled around the deposit to a depth of 10 feet, and these were reputed to have disclosed ore from top to bottom. Nearly 6,000 tons of ore were mined during earlier operations *delete* and the tonnage estimate at the end of September, 1958 was 25,000 tons above 40% Mn.

M.C.274 (6 acres), about 2½ miles north-west of M.C.269, was opened up during 1958 and a small tonnage (811 tons) was removed. However, the two ore-bodies, which are on chert breccia on dolomitic limestone, showed little promise *delete* and mining operations were abandoned. The estimate of 700 tons of ore above 40% Mn was made during an inspection in September.

Nullagine District

Woodie Woodie

Broken Hill Pty. Co. Ltd. - M.C.110^L is for 11 acres about 29 miles south of Mt. Sydney on the west side of a valley containing fluvio-glacial deposits. Three deposits outcrop in a north-south line half way up the hill slope and appear to have been formed by the concentration of manganese from a manganiiferous shale. The deposits are underlain by chert breccia and shales, sandstone and conglomerate of the Nullagine Series overlies the protore. The writer estimated 4,600 tons of 45-49.9% Mn for this claim in September and sample No. 1308 assayed 52.3% Mn.

M.C.111^L (6 acres) is about a mile south-east of M.C.110^L on the north bank of Woodie Woodie Creek. The ore is on rubbly laterite over dolomitic limestone and occurs in three main outcrops of blocky ore. O'Driscoll estimated 11,500 tons of 45-49.9% Mn for this claim in 1956 and the writer's sample in September, 1958 assayed 58.0% Mn.

Northern Mineral Syndicate - This syndicate applied for, and was refused, M.C.357^L (60 acres) half a mile south of M.C.111^L. Manganese outcrops along a north-south line on this claim with two small parallel outcrops disposed either side near the southern end. The ore occurs in joints in dolomitic limestone and the ore lenses are seldom wider than 20 feet. Some of the outcrops show a fair amount of iron and a ferruginous laterite is present in places. Chert breccia also overlies the dolomitic limestone which contains beds of chert. This ground is still within the basin which contains M.Cs. 110^L and 111^L.

Sample No. 98500 of some of the better ore assayed 53.0% Mn and the estimate for the deposit is 550 tons of ore above 50% Mn. The extension of the ore in depth is quite a possibility but has not been included in the estimate.

Skull Springs

M.C.121^L (80 acres) was the only claim visited by the writer in this area during 1958. It is owned by Westralian Ores Pty. Ltd., and is about 1½ miles east of where the road crosses the Davis River. No work had been done since the visit

of O'Driscoll and de la Hunty in September, 1957 so their estimate of 24,050 tons above 40% Mn was unaltered.

The ore outcrops on chert breccia on the top of, and on the south slope of, a prominent hill. A narrow open cut has been made in the deposit of better ore, and O'Driscoll took two samples from this deposit (in 1956) which averaged 52.4% Mn. A further sample of lower grade material assayed 26.84% Mn.

Bee Hill

Bee Hill is 50 miles east-south-east of Nullagine, on the west bank of the Davis River. It is a round-topped hill about 200 feet high and is a fairly good landmark. The manganese claims are all on the east side of the river and are all held by D.F.D. Rhodes. Bee Hill is about 240 miles from Pt. Hedland by graded road which runs through Upper Caravine Gorge.

The claims inspected and sampled by the writer in September were:- M.Cs. 163^L, 164^L, 166^L-174^L, 177^L, 179^L-181^L, 186^L-188^L, 190^L, 205^L-207^L, 217^L-222^L, 224^L-227^L.

The manganese ore is sheet or mound-shaped, and overlies a chert breccia which covers shales, sandstones and grits of the Nullagine Series. Dolomitic limestone occasionally outcrops in valleys below the shales and is conformable. The deposits occasionally reach 20 feet in height and are derived from manganeseiferous shales.

To the east of the deposits is an area of basalt outcrop. This basalt is also "Nullagine" and overlies the manganeseiferous shales.

The total ore estimates for claims inspected at Bee Hill are shown in Table II, but only those seen during 1958 are described below. Plate V shows the location of these claims, together with access roads.

M.C.163^L is for 51 acres about 3½ miles south-south-east of Bee Hill. There are eleven outcrops of ore on the slopes of a north-west running valley, the largest of which is 2,500 tons. No development work had been done and the tonnage assessment was 6,450 tons of ore above 40% Mn and 100 tons of 10-19.9% Mn.

M.C.164^L (29 acres) is a few chains east of M.C.163^L enclosing part of a valley which runs south-east. The largest deposit (5,100 tons) has a steep face 20 feet high and may be a remnant from an old breakaway. The estimate for this claim was 8,300 tons of ore above 40% Mn.

M.C.166^L (13 acres) is on the western slope of a broad valley and about half a mile east of M.C.164^L. Some 2,600 tons of ore above 40% Mn rest on chert breccia.

M.C.167^L (4 acres) is about 15 chains south-east of M.C.164^L. It contains 800 tons of ore above 40% Mn. The assay of a sample from this claim showed only 33.4% Mn, but the writer believes the ore would average 40% or better.

M.C.168^L (3 acres) is about 40 chains south of M.C.167^L and contains 400 tons of ore above 40% Mn.

M.C.169^L (105 acres) is just south of M.C.166^L and encloses a small valley. The manganese occurs on a manganiiferous shale which overlies chert breccia. The base of the ore was exposed by a quarry face 20 feet high. A sample of pieces of ore from the floor of the quarry assayed 46.3% Mn and the estimate for the claim was 7,450 tons of ore above 40% Mn and 350 tons of 30-39.9% Mn.

M.C.170^L (34 acres) is about a mile south of M.C.169^L and about 5½ miles south-south-east of Bee Hill. Although some good-looking ore is exposed on this claim, the one sample taken assayed only 29.7% Mn. There were eight bodies of ore - the largest of which was 2,500 tons - and the claim was assessed at 7,650 tons of ore above 40% Mn and 1,000 tons at 30-39.9% Mn.

M.C.171^L (13 acres) is just north of M.C.170^L and, although the grade appeared to be good (in 1956), mining operations revealed a high percentage of hematite in the ore. Mining was discontinued at the deposit and the ore left was assessed at 1,000 tons of ore above 40% Mn. A grab sample of black ore taken in 1953 from the dump assayed 40.1% Mn.

M.C.172^L (13 acres) is about a quarter of a mile west of M.C.170^L and the deposit is about 10 yards from

east to west and 20 yards from north to south. It is on a small ridge between two creeks and a sample across the ore assayed 35.2% Mn. The estimate for this claim was 6,200 tons of ore above 40% Mn.

M.C.171^L (5 acres) is about half a mile north of M.C.172^L and contains a small deposit of 150 tons of ore above 40% Mn, (38.9% Mn on assay). Also present on the claim is a conglomerate containing boulders of manganese ore. This is a Tertiary conglomerate which occupies some of the valleys nearby.

M.C.174^L (34 acres) contains some 15,800 tons of ore above 40% Mn (Sample No. 1338 assayed 41.2% Mn). The ore overlies mangeniferous shale which rests on sandstone. The sandstone is capped with chert breccia which underlies the shale. The ore outcrops west down a hillslope over a length of 120 yards.

M.C.177^L (27 acres) is 3 miles east-south-east of Bee Hill and contains 27 acres. The deposit is on top of a plateau and contains 750 tons of ore above 40% Mn. Sample No. 1348 assayed 38.9% Mn.

M.C.179^L (80 acres) is 5 miles east-south-east of Bee Hill. The manganese ore has been formed by surface enrichment from a mangeniferous shale and rests on chert breccia. The shale is conformable with, and stratigraphically lower than, a considerable thickness of sandstone which dips to the southwest at 30 degrees. More than 3,000 tons of ore occur in the main outcrop and the remainder of the tonnage is made up from scattered outcrops. A sample from this claim (1353) assayed 16.1% Mn.

M.C.180^L (17 acres) is immediately west of M.C.179^L and the manganese ore occurs as thin scabs on the hill-slope. Tonnage was estimated at 200 tons above 40% Mn and 100 tons of 30-39.9% Mn.

M.C.181^L (5 acres) is about 20 chains south of M.C.180^L at the head of a valley. The estimate was 450 tons of ore above 40% Mn.

M.C.186^L (20 acres) is on the western side of a broad valley about 5 miles east-south-east of Bee Hill. The claim contains mangeniferous shales over chert breccia and there

are solid lenses of ore in the shales as well as on the surface. A quarry 60 yards long has been cut west-north-west (parallel to the strike of the shales) and it exposes 2 - 3 feet of ore on shales with patches of ore 2 - 3 feet below the top of the shales. There is little ore below 6 feet and the face is 10 feet high. Sample No. 1352 was taken of pieces from the face at 0 - 6 feet. It assayed 33.0% Mn. The ore-body which contained mixed grades was estimated at 1,200 tons above 40% Mn.

M.C.187^L (300 acres) is 3 miles east-south-east of Bee Hill and the manganese ore is present on manganiiferous shales, over chert breccia. There are eleven small outcrops on the claim and samples Nos. 1349 and 1350^L assayed 19.1% Mn and 36.7% respectively. The tonnage estimates were 1,100 tons of ore above 40% Mn and 1,100 tons of ore at 30-39.9% Mn.

M.C.188^L (2 acres) is half a mile west of M.C.186^L across a valley. The ore occurs on chert breccia towards the bottom of the hill slope and is low grade - 400 tons of 30 - 39.9% Mn. Sample No. 1351 assayed 23.4% Mn.

M.C.190^L (9 acres) is about 5½ miles south-east of Bee Hill. Two small bodies of ore outcrop on chert breccia over sandstone and sample No. 1340 assayed 32.2%. The tonnage estimate was 300 tons at 30-39.9% Mn.

M.C.205^L (10 acres) is about 4½ miles south of Bee Hill and was reached by a track from the east which runs past M.C.171^L. The ore is an enrichment of manganiiferous shales on chert breccia and is low grade. Sample No. 1336 assayed 28.3% Mn and the estimate was 250 tons of 30-39.9% Mn.

M.C.206^L (17 acres) is half a mile north-north-west of M.C.205^L and is on high ground at the head of an inlet of an old Tertiary lake. Remnants of the Tertiary sediments include calcareous sediments, conglomerate and a porous manganiiferous laterite. The ore on the claim is an enrichment from a manganiiferous shale which overlies chert breccia. An outcrop of chert breccia, with manganese replacing some of the groundmass, was also seen on the claim. Sample No. 1335 assayed 28.9% Mn and the tonnage was assessed at 1,600 tons above 40% Mn and 2,800 tons of 30-39.9% Mn.

M.C.207^L (20 acres) is about 4 miles south-south-east from Bee Hill and was reached by a rough track which passes M.C.169^L. Sample No.1344 assayed 32.9% Mn and the tonnage estimate was 600 tons of ore above 40% Mn and 250 tons of 30-39.9% Mn.

M.C.217^L (6 acres) is about 7 miles south of Bee Hill and just a few chains north-east of a rock-hole which contains a little fresh water for most of the year. The ore occurs on mangeniferous shales over chert breccia and sample No. 1325, from across the highest outcrop, assayed 31.4%. Some 700 tons of ore above 40% Mn and 850 tons of 30-39.9% Mn were estimated for this claim.

M.C.218^L (50 acres) is about three quarters of a mile south-west of M.C.217^L. Most of the ore occurs in small patches around the edge of a breakaway which runs north-east. It rests on mangeniferous shale on chert breccia. Sample No.1332 assayed 36.3% Mn and the tonnage for the claim was assessed at 1,350 tons above 40% Mn and 2,400 tons at 30-39.9% Mn.

M.C.219^L (4 acres) is about 10 chains north of M.C.218^L and contains scattered lumps of ore totalling 200 tons of 30-39.9% Mn. Sample No. 1330 assayed 22.6% Mn.

M.C.220^L (3 acres) is about 10 chains west of M.C.218^L (the number plate says M.C.320^L) and contains ore on the north and south sides of the bed of a small creek. As on the other claims in this vicinity, the ore occurs as a surface enrichment on mangeniferous shale overlying chert breccia. Sample No.1333 assayed 50.0% Mn and the tonnage estimate was 450 tons above 40% Mn.

M.C.221^L (4 acres) is half a mile south of M.C.220^L and contains three ore-bodies of which the largest was 300 tons. Sample No. 1334 assayed 34.9% and the tonnage was 1,700 tons above 40% Mn.

M.C.222^L (11 acres) is immediately west of M.C.218^L and the ore-body runs east-west on the north side of a creek bed. The ore has a 7 feet face on its southern side and contains 2,900 tons of ore at 30-39.9% Mn. Sample No.1331 assayed 20.4% Mn.

M.C.224^L (20 acres) is about half a mile north of M.C.218^L and some 700 tons of ore above 40% Mn are scattered over the claim in small lumps. Sample No.1326 assayed 40.2% Mn.

M.C.225^L (5 acres) is about 10 chains north of M.C.224^L and contains 300 tons of ore above 40% Mn. Sample No.1327 assayed 31.6% Mn.

M.C.226^L (1 acre) is about 15 chains north of M.C.225^L and contains shaley ore on sandstone and chert breccia. The manganiferous shale strikes east and dips south at 10-20 degrees. Sample No.1328 showed 37.7% Mn on assay and the tonnage estimate was 600 tons above 40% Mn.

M.C.227^L (3 acres) is a few chains west of M.C.225^L and contains manganese ore on manganiferous shale on chert breccia. Sample No.1329 assayed 17.6% Mn and the tonnage estimate was 1,400 tons above 40% Mn and 2,000 tons of 30-39.9% Mn.

Mt. Cooke

Mt. Cooke is a prominent hill about 4.5 miles east of Nullagine and 5 miles west of the Davis River, on Noreena Station. Station wells have tapped good underground water and the river contains water at times. All mineral claims for manganese in this area have been pegged by Westralian Ores Pty. Ltd., and D.F.D. Rhodes.

Westralian Ores Pty. Ltd. - This company holds 18 claims in the Mt. Cooke area, including 6 at Mt. Cooke, 3 on the east boundary of Noreena Station, 3 at Ant Hill and 6 at Sunday Hill - all west of the Davis River (See Plate V). Tracks have been made to most of the deposits but only those at Ant Hill have been mined. The writer visited the area in October and altered the previous estimate for M.C.246^L only.

M.C.246^L (20 acres) was being worked during the previous inspection (September 1957) but no ore was sold that year. After that inspection the original pit on the east face was enlarged and a further pit was made just north of the

old one. This new pit exposed a 50 feet face in October, and work had been suspended. (See Plate V, Sheet 2). The ore was seen to have an uneven base and to rest on manganiferous shales of comparatively low dip. The ore also had a few shaley bands. A stock pile of some 4,000 tons was observed at Ant Hill, and a further 3,620 tons of ore were shipped during 1958. The estimate of ore remaining in the ground was increased to 25,000 tons above 40% Mn and 1,000 tons at 30-39.9% Mn.

D.F.D. Rhodes - Rhodes has pegged 30 claims in this area on the east side of the Davis River and the writer visited 17 of these in September. These were M.Cs. 191^L - 198^L, 208^L - 212^L, 230^L, 231^L, 237^L, 238^L. At the time of inspection, ore was being mined from M.C.194^L and was carted to Port Hedland along a graded road through Ant Hill and Nullagine.

The geology is similar to that at Bee Hill, except for a rather wide distribution of basalt which overlies the manganiferous shale. The manganiferous shale contains flattened pellets of manganese dioxide up to half an inch diameter in the bedding planes.

Tonnage estimates for the various claims are given in Table II and sampling details are shown in Table VIII.

M.C.191^L (1 acre) is about 10 miles east-north-east of Mt. Cooke and 10 chains south of the Davis River. It is on low-lying ground and contains 250 tons of ore above 40% Mn which rests on manganiferous shale.

M.C.192^L (12 acres) is 7 miles east of Mt. Cooke, on the east bank of the Davis River. The claim encloses a small hill and two quarries had been dug at the time of inspection. A quarry near the east corner of the claim was 70 feet long, 30 feet wide and 5 feet deep. Up to 4 feet of high grade ore was seen overlying manganiferous shale. Another quarry in the west corner of the claim was 130 feet long, 50 feet wide and 10 feet deep. High grade ore was exposed on the floor of the quarry at the centre of the face, but the underlying manganiferous shale was exposed at each end. The crown of the hill between the quarries exposes the underlying chert breccia which

is stained with manganese dioxide. Sample No.1314 of ore from the west quarry assayed 56.3% Mn and the tonnage assessment for the claim was 5,300 tons above 40% Mn.

M.C.193^L (1 acre) is about half a mile south-south-east of M.C.192^L. It contains only 200 tons of ore above 40% Mn as a surface enrichment from a manganiiferous shale.

M.C.194^L (5 acres) is half a mile south of M.C.192^L and was being worked in September. The working face was nearly 200 feet long, but most of the work was being done on the southern end of the face which was 20-30 feet deep (See Plate V, Sheet 2). The ore occurs on and in a manganiiferous shale which dips east and rests on breccia on a hill slope. The dips steepen near the foot of the hill to 60 degrees. Soil seams are common in the deposit. Rhodes also made a pit on a small deposit just north of the claim (in M.C.359^L, refused) and the occurrence of ore there was the same.

The larger sized pieces of ore broken from the main quarry face were loaded on to semi-trailers for transport to Pt. Hedland, while the smaller lumps, together with mullock of shale and soil, were moved to a dump for cracking and screening at a later date. The ore from this quarry has a distinctive blue sheen and all of the ore shipped has been high grade. Sample No.1312 from the north end of the quarry assayed 49.5% Mn while sample No.1313 of ore broken at the working face assayed 51.5% Mn. The small (7 feet deep) pit at the south-east corner of the deposit was reported to have yielded assays of 56% Mn. The ore estimate for this deposit was 52,000 tons above 40% Mn (including 28,000 tons above 50% Mn).

M.C.195^L (2 acres) is about 5 chains east of M.C.194^L and contains three small patches of ore on manganiiferous shales. The ore was estimated at 150 tons above 40% Mn and 50 tons at 30-39.9% Mn.

M.C.196^L (1 acre) is about three quarters of a mile north-east of M.C.192^L and 10 chains south-east of the Davis River. The ore is in a body 150 feet long, 27 feet wide and 9 feet high running north-west on the eastern edge of

a small alluvial flat. The base of the ore is only a few feet above the flat - on chert breccia. The estimate was 3,000 tons of ore above 40% Mn for this claim.

M.C.197^L (27 acres) is a quarter of a mile east of M.C.196^L. Although there are eleven ore-bodies on the claim; most of the ore occurs fairly close to the largest body which exhibits a 10 feet face on its south-west side and contains 1,100 tons of ore. The ore is in the low hills just north-east of the alluvial flat mentioned above. The tonnage estimate was 2,900 tons above 40% Mn and 50 tons at 30-39.9% Mn. Sample No. 1315 assayed 35.3% Mn.

Between M.Cs. 196^L and 197^L is an outcrop of flaggy sandstone (with conglomerate pebbles) striking north-west and dipping south-west. One exposure showed siliceous shales on sandstone (6 feet) on more than 20 feet of manganiferous shales.

M.C.198^L (10 acres) is a mile north-east of M.C.196^L and about 10 miles east-north-east from Mt. Cooke, on the east side of the Davis River. It is immediately west of M.C.191^L. The ore-body is a lump of rather massive ore (on manganiferous shale over chert breccia) and it contains 1,000 tons of ore above 40% Mn. Sample No.1316 assayed 44.4% Mn.

M.C.208^L (13 acres) is about 2 miles east of M.C.194^L at the end of a track from the south. The ore-body is continuous and varies in thickness up to 5 feet on the southern slope of a low hill. Sample No.1322 gave only 26.2% Mn on assay, but the tonnage estimate was 1,550 tons above 40% Mn and 2,450 tons at 30-39.9% Mn.

M.C.209^L (6 acres) is just south of M.C.208^L and the ore-body is U-shaped with a wide opening to the north on a low hill. The ore is on manganiferous shales with ferruginous patches and was estimated at 700 tons above 40% Mn and 2,300 tons at 30-39.9% Mn.

M.C.210^L (2 acres) is about nine and a half miles east of Mt. Cooke, 5 chains east of the Davis River and a mile south-west of M.C.198^L. The manganese ore occurs 200 feet above the river bed on a small breakaway face at the head of a

creek. Three ore bodies along the face contain 600 tons of ore above 40% Mn.

M.C.211^L (2 acres) is about three quarters of a mile south-east of M.C.194^L on the track through the leases. The material pegged on this ground looks more like manganimiferous iron ore with its high hematite content. It is strongly banded and blocky, and the claimholder reported assays of 45% Mn. However, a sample taken by the writer in September showed less than 10% Mn on assay. The estimate for this claim was 1,150 tons at 30-39.9% Mn.

M.C.212^L (1 acre) is just over half a mile east-south-east of M.C.194^L. The ore occurs in association with manganimiferous shale on chert breccia over sandstone. Some of the ore is quite ferruginous and a sample (No.1309) showed 37.7% Mn. Tonnage for this claim was 3,000 tons above 40% Mn and 4,000 tons at 30-39.9% Mn.

M.C.230^L (1 acre) is about 12 miles south-east from Mt. Cooke and is reached by a track which runs through the claims past M.C.194^L. It is about 200 yards south of M.C.229^L on rising ground on the east side of a river flat. The ore strikes north, is narrow and has little depth. Sample No.1321 assayed 33.7% Mn and the estimate for the claim was 700 tons above 40% Mn and 600 tons at 30-39.9% Mn.

M.C.231^L (3 acres) is about three quarters of a mile south of M.C.230^L on the east side of a small creek. The ore occurs in three small bodies of negligible height on the slope of a very low hill and sample No.1318 assayed 32.6% Mn. The tonnage estimate was 300 tons above 40% Mn and 300 tons at 30-39.9% Mn.

M.C.237^L (2 acres) is about 400 yards south-south-west of M.C.231^L and on the east side of the track. The ore-body strikes north-west and dips to the south-west. The ore is blocky and a sample (No.1320) assayed 40.5% Mn. The ore-body was estimated to contain 1,400 tons of ore above 40% Mn.

M.C.238^L (2 acres) is about a mile south-west of M.C.230^L and about a mile north-west by track from M.C.237^L. Although a sample (No.1319, 31.9% Mn) was taken from

this claim, the estimate was only 100 tons above 40% Mn and 100 tons at 30-39.9% Mn.

Sample No.1317 was taken from an outcrop of flat-lying flaggy manganese ore. It showed 46.2% Mn on assay and the deposit contained about 100 tons of similar ore. This deposit is about 5 miles east-south-east of M.C.194^L and rests on chert breccia in a depression. The writer believes this ore was laid down as such at the same time as the other beds of the Nullagine Series. It is similar in appearance, outcrop and environment to the deposit at Yarric Station. (See beginning of "Marble Bar District"). Samples Nos.1311 and 1366 were of chocolate coloured manganiferous shale and these, together with No.1365 (basalt overlying Nos.1311 and 1366) are discussed under "Geology of the Manganese Deposits".

Mt. Fraser Station

In this locality the mineral claims for manganese are split into two main groups - the "Mt. Nicholas Group" and the "Limestone Well Group" - with 5 other outlying claims. The claims at Mt. Nicholas are just over 20 miles east of Mt. Lewin and 37 miles east of Roy Hill Homestead. Limestone Well (See Plate V) is 5 miles south of Mt. Nicholas. The deposits are also called the "Ethel Creek Deposits" as the main access road joins the Great Northern Highway at Ethel Creek Homestead (about 30 miles to the south-west).

L.G. Hancock and E.A.M. Wright hold 34 claims in the area and their applications for a further 5 (M.Cs. 332^L, 343^L - 345^L and 347^L) were refused. Early in 1958, Perron Bros. sank pits and established two quarry faces for the owners. They also stockpiled 8,000 tons of high grade ore from these quarries.

Later in the year, a testing programme was carried out by "Mangore" who had an option from the owners. Mangore was a subsidiary of the Union Carbide Co., of America, who also held options over Rhodes' deposits at Balfour Downs. Geologist A. Nelson was in charge of Mangore's operations in the area and test work was completed towards the end of 1958.

The work done consisted of geological mapping, the making of access roads, further pit testing and drilling. A wagon drill was used and the cuttings were assayed in the Company's field laboratory. The results of testing were not made available to the writer, but Mangore relinquished the option at the completion of testing.

The ore deposits have resulted from the weathering of ferruginous, manganiferous shales and the residual deposits have formed along the line of outcrop of a shallow syncline, whose axis runs roughly east-west.

These shales belong to the Nullagine Series and the manganese deposits may have been in the process of formation ever since they were exposed.

The ore reserves for the area were estimated (in July and October) to be 219,100 tons above 40% Mn and 1,900 tons at 30-39.9% Mn. Details for individual claims are shown in Table II, Item 5. (Note areas shown in the table are those applied for).

Mt. Nicholas Group - The 9 claims of this group, M.Cs. 289^L, 290^L, 292^L, 293^L, 310^L-314^L are pegged along a south-east line of low breakaways. Islands of iron oxide have formed in the manganese ore deposits and sometimes the iron and manganese oxides form an intimate mixture. Most of the 190,150 tons of ore above 40% Mn assessed for this group are contained by M.Cs. 292^L, 293^L, 310^L.

M.C. 289^L (12 acres) is the most northerly of the claims and it contains two small outcrops and part of a larger outcrop which extends west into M.C. 310^L. A pit 9 feet deep was sunk near the southern corner of the claim and, although there was little ore showing on the surface, ore was still present at the bottom of the pit. The estimate for this claim was 4,000 tons above 40% Mn.

M.C. 290^L (29 acres) is at the south-east end of this group of claims and it contains three small outcrops totalling 1,000 tons above 40% Mn. Two of the outcrops (900 tons) are on the north-east breakaway face and the other 100 tons outcrop near the south-east corner of the claim.

M.C.292^L (23 acres) is immediately south-east of M.C.289^L and contains some good ore. Quarrying, and a pit in the floor of the longer quarry, revealed a thickness of 20 feet of ore in one deposit. The tonnage for the claim was estimated to be 69,000 tons of ore above 40% Mn. Some 3,000 tons of high grade ore (above 50% Mn) were mined from this claim and stockpiled on M.C.311^L.

M.C.293^L (23 acres) to the south-east of M.C.292^L, has been developed more than any other claim. The quarry face is 230 feet long and the average height of the face is about 9 feet. A pit 6 feet deep has been sunk in the quarry floor and another pit has been sunk a further 8 feet below the floor of the 6 feet pit - giving a total depth explored of 23 feet. The pitting exposed high grade ore with seams and pockets of soil. Ore was still present in the bottom of the pit. Some patches of lower grade ore also occur and one patch looked like the result of manganese replacement of a pelletised manganiferous shale. Some 5,000 tons of high grade ore (above 50% Mn) were removed from the quarry and stockpiled, while the smaller fragments of ore were pushed into dumps together with the soil encountered in the ore. There were four other small deposits on the claim but most of the 105,500 tons estimated were contained in the main outcrop.

M.C.310^L (12 acres) joins the west side of M.C.289^L at the northern end of the group. There is quite a lot of soil cover on the claim and the boundaries of the ore are not well defined. The estimate for this claim was 9,500 tons above 40% Mn. The deposits had not been developed in any way.

M.C.311^L (15 acres) lies on the west side of M.C.292^L, and the ore-body which lies mainly on M.C.292 has been assessed as belonging wholly to that claim. The only tonnage estimated for M.C.311^L was 900 tons above 40% Mn in two small outcrops.

M.C.312^L (21 acres) is south-east of M.C.293^L and encloses a sandy creek-flat. There was no ore on this claim.

M.C.313^L (25 acres) is south-east of M.C.312^L and contains only 200 tons of ore above 40% Mn. A ring-shaped outcrop near the northern end contains about 150 tons and a test pit dug to 4 feet in the centre of the ring exposed shale and gravel. Another 2 feet trench near the east corner of the claim exposed ferruginous shale and soil.

M.C.314^L (22 acres) between M.Cs.313^L and 290^L contains only 50 tons of ore. Three excavations have been made at the breakaway edge. They were each 3 feet deep and exposed limonite and shale in each case.

Limestone Well Group - The 21 claims granted in this group (M.Cs. 286^L, 295^L-298^L, 315^L-330^L) extend 4 miles south-south-west along a breakaway from a point 2.3 miles south of M.C.290^L in the Mt. Nicholas Group. The geology is similar to that of the Mt. Nicholas Group, but there are only 25,850 tons of ore above 40% Mn. The streams referred to below are all non-perennial and were dry at the time of inspection.

M.C.286^L (24 acres) is in the centre of the group and the breakaway line takes a turn here from north to west. On the north face 900 tons of ore overly limonitic manganese and the remainder of the 1,350 tons estimated for this claim is in scattered outcrops on the surface of the breakaway.

M.C.295^L (3 acres) is near the north end of the group and contains barely 50 tons of manganese ore in two small outcrops capping ferruginous shales at the edge of a low breakaway.

M.C.296^L (3 acres) is 7 chains south of M.C.295^L and contains 3,100 tons of ore above 40% Mn. A small outcrop of 100 tons occurs in the north-west corner of the claim and the remainder forms a cap over ferruginous shales along a low breakaway down the east side of the claim.

M.C.297^L (5 acres) is in the southern part of the group and was pegged along the edge of the breakaway. The breakaway face has been bored and fired, and the ore exposed shows shaley bedding. About 75 feet west of the breakaway edge some further holes have been fired in shaley ore over ferruginous

manganiferous shales. Near the northern corner of the claim a pit 10 feet deep has been sunk near the western edge of a small outcrop. Low grade ore (30-39.9% Mn) containing a lot of iron occurs down to the bottom of the pit. The ore is shaley and contains bands of barren shale with a low westerly dip. The tonnage estimate was 9,100 tons of ore above 40% Mn and 800 tons of 30-39.9% Mn.

M.C.298^L (24 acres) is in the southern part of the Group and immediately south of the track from Limestone Well to Mt. Nicholas. It encloses a high breakaway which is very black along the edge. However, only 250 tons of ore were estimated at the edge of the breakaway and the rest of the ore on the claim occurs as small outcrops on the dip slope on the western side of the claim. Total ore was 1,150 tons above 40% Mn.

M.C.315^L (3 acres) is near the north end of the Group between M.Cs. 295^L and 296^L and is barren of ore.

M.C.316^L (14 acres) is the most northerly claim of this group and is at the northern limit of the breakaway. There is a ferruginous cap on shales and one small outcrop of manganese ore which contains less than 50 tons.

M.C.317^L (29 acres) has been pegged down the dip (west) from M.Cs. 295^L, 315^L and 296^L, but contains only 200 tons of ore above 40% Mn in two small outcrops in the south-east corner of the claim.

M.C.318^L (40 acres) about 400 yards south of M.C.317^L contains a few small deposits around the breakaway edge, but most of the ore occurs in small deposits on the banks of three streams which flow west down the dip slope. The estimate for this claim was 1,300 tons above 40% Mn and 100 tons of 30-39.9% Mn.

M.C.319^L (40 acres) is immediately south of M.C.318^L and contains 850 tons of ore above 40% Mn. Of this, 100 tons occur at the breakaway edge and the remainder is on the low-angle west slope which is traversed by two west-flowing streams.

M.C.320^L (24 acres) is south of M.C.319^L and most of the 550 tons above 40% Mn estimated for this claim occur down the dip slope.

M.C.321^L (12 acres) south of M.C.320^L contains 400 tons of ore in a patch on the north side of a west-flowing creek. Solid ore outcrops over 20 per cent of the patch and the ore contains some seams of limonite. The remainder of the patch is covered with rubble. Some nodules which had weathered from the shale in this vicinity showed limonite pseudomorphs after pyrite (cubes). However it was found, on breaking open these nodules, that the crystalline shape was lost beneath the skin (about one sixteenth of an inch thick) and the limonite became fibrous, radiating from a small powdery hematite core.

M.C.322^L (24 acres) is south of M.C.321^L and no ore is apparent at the edge of the breakaway. Some 1,100 tons of ore above 40% Mn occur in five small outcrops on the gentle western slope. One outcrop which contains 800 tons has been shown (by two shot shales) to have at least 2 feet of ore below the surface.

M.C.323^L (40 acres) is south-west of M.C.322^L. A creek which runs west along the southern boundary of the claim has cut through the breakaway, leaving gentle slopes to the north and south. Some 2,000 tons of ore outcrop on this slope and most of the remaining ore (including 1,000 tons of low grade) is concentrated on the edge of a high breakaway near the east corner of the claim.

M.C.324^L (40 acres) is south-west of M.C.323^L and contains 450 tons of ore above 40% Mn in four outcrops.

M.C.325^L (35 acres) is south of M.C.324^L and south-west of M.C.286^L, and contains only 200 tons of ore above 40% Mn in scattered outcrops on the west slope.

M.C.326^L (43 acres) south of M.C.325^L contains no ore.

M.C.327^L (6 acres) is south of M.C.326^L and west of M.C.297^L. It contains only 50 tons of ore above 40% Mn.

M.C.328^L (40 acres) is south of M.Cs.327^L and 297^L and encloses a short continuation of the ore-body on M.C.297^L. About 1,000 tons of the total 1,400 tons above 40% Mn are contained in that end. The remaining 400 tons outcrop down the dip slope.

M.C.329^L (24 acres) is at the south end of this group of claims, on the west side of M.C.298^L. Some 400 tons of ore outcrop at the heads of west-flowing creeks.

M.C.330^L (60 acres) is the most southerly claim of the Limestone Well Group. A breakaway (facing east) runs down the eastern edge of the claim and numerous watercourses drain west from the higher ground. Surface replacement of shales by manganese along the breakaway edge create the illusion that there is a lot of ore on this claim. However, the manganese only persists for a couple of inches below the skin of the rock outcrops - giving way to ferruginous shales. Some 300 tons of ore were estimated for the breakaway edge and a further 1,000 tons occur in scattered outcrops at the head of the drainage to the west. The total ore for the claim was 1,300 tons above 40% Mn.

Other Claims Held - These include M.Cs.294^L, 307^L, 309^L and 299^L.

M.C.294^L (24 acres) is 3 miles north-north-east of M.C.290^L of the Mt. Nicholas Group and has not been surveyed. Outcrops along the east and south sides of the claim total 1,200 tons of ore above 40% Mn. The ore is associated with shales and dolomitic limestone also outcrops in this locality.

M.C.307^L (105 acres) was pegged around a breakaway containing shales of the Nullagine Series. The shales dip west at a low angle and the breakaway face is continuous from the north peg down the east side of the claim to the south peg. Most of the ore is in patches along the edge of the breakaway, although 600 tons outcrop on the dip slope. The estimate for this claim was 1,550 tons above 40% Mn.

M.C.309^L (11 acres) is half a mile south of M.C.307^L. Some 300 tons of ore occur near the head of a west-flowing creek and a further 50 tons outcrop on the top of the small

island plateau contained by the claim. Total ore was 350 tons above 40% Mn. This claim was not surveyed.

M.C.299^L (10 acres) 3 miles south-west of Limestone Well, was not seen. The claim has not been surveyed.

Claims Refused - M.Cs.343^L (20 acres), 344^L (20 acres), 345^L (20 acres) and 347^L (12 acres) in the northern half of the Limestone Well Group were all refused. They were each estimated to contain "Nil" ore.

M.C.332 (13 acres) about a mile south-south-west of M.C.330^L was also refused. Sporadic outcrops on a dissected westerly slope totalled 300 tons of ore above 40% Mn for this claim. The claim was not surveyed.

Balfour Downs Station

The homestead at Balfour Downs is 44 miles east of the Great Northern Highway (nearly 70 miles by station road from the bend in the highway near Ethel Creek Homestead.). The claims visited in June include M.Cs.265^L and 271^L. All of these claims are owned by D.F.D. Rhodes. L.G. Hancock applied for M.C.335^L just north-west of M.C.267^L, but his application was refused. (The claim was not visited). The manganese ore in this area has resulted from weathering and surface enrichment of manganiferous shales of the Nullagine Series.

M.Cs.265^L-268^L include a total area of 579 acres (unsurveyed). They are adjoining claims and enclose a mesa 2 miles north-east of Balfour Downs Homestead. (The well at the homestead supplies good water). This deposit was mapped by Wells and Forman and sampling was done by the writer with some assistance from them. The locations of these samples, together with those taken by O'Driscoll and the writer in 1957, are shown on Plate VI.

The manganese ore has formed the cap of the dissected mesa and directly overlies low-dipping manganiferous shales. The long axis of the deposit (7,000 feet) runs north-east and the average total width (including barren areas) is about 1,500 feet. The thickness of the ore varies up to 10 feet, but is small in

places. These thicknesses are exposed in costeans 800 feet apart across the southern part of the ore-body.

The costeans, which make good sample openings, reveal massive ore on the surface with underlying flaggy and pisolitic ore. (Some of the pisolitic ore is cemented with manganese ore). Soil fills the interstices between the pieces of ore and also forms a ferruginous earthy coating on the ore. The deposit also contains some ferruginous pisolites as well as cavity fillings and patches of limonite and hematite.

The results of mineral determinations for three samples were not to hand at the time of writing. The shales underlying the ore (and having a low dip towards the long axis of the deposit) were tested for manganese content. Two samples (98420 and 98421) each assayed 13.2% Mn. They were 3,600 feet apart.

Sampling results are shown in Table VIII. Although there were a few samples which showed more than 40% Mn, the main part of the ore-body is in the 30-39.9% Mn range and usually above 35%. The estimate for this body was 1.7 million tons at 30-39.9% Mn and 18,000 tons of ore above 40% Mn.

M.C.269^L (45 acres) is 3 miles east of M.C.268^L. A breakaway face runs along the north boundary of the claim. It is composed of ferruginous laterite with pebbles of manganese. The cap is of boulders and pebbles of manganese ore cemented with ore. The rest of the claim is covered with soil containing pebbles and pisolites of manganese ore over a solid base of manganese ore. A grab count of the pebbles showed that 18 pebbles were ore in 20 counted. The estimate for the claim was 16,000 tons of 30-39.9% Mn.

M.C.270^L (80 acres) is 1.2 miles north of M.C.269^L. This claim contains a low plateau with up to 20 feet of cemented pebble conglomerate over shales in valleys. A thin veneer of boulders of shaley manganese, some cemented pisolitic ore, and small pebbles of manganese, covers a lot of the plateau surface. Boulders and pebbles of indurated sandstone are also scattered over the surface. The manganiiferous material has an average thickness much less than one foot and the tonnage estimate was 6,000 tons of 30-39.9% Mn.

M.C.271^L (23 acres) is 2.5 miles south-west of Balfour Downs Homestead and on the north-west side of the road. About one third of the claim is occupied by manganiferous shale. The Mn content of the shale is comparatively high (due to surface enrichment), but there are no outcrops of solid ore. The estimate for the claim was 12,000 tons of ore at 30-39.9% Mn.

Unpegged about half a mile south of M.Cs.265^L - 268^L and parallel with them, is a deposit of pisolites in soil. The limits of this deposit have not been determined but are approximately a mile by a quarter of a mile. The holes for samples Nos. 98422 and 98423 (See Locality Plan on Sheet 2), were 12 inches and 16 inches deep respectively, but the thickness of the deposit was not found. These samples were screened and the plus-quarter-inch material was assayed for manganese.

26.5% of sample left for No.98422 assayed 36.8% Mn

37.5% of sample left for No.98423 assayed 24.2% Mn

A count of a grab sample near No.98422 showed 40 pisolites of manganese ore, 3 of iron oxide and one pebble of quartzite.

This deposit contains a few hundred thousand tons of low grade ore.

DEPOSITS OF THE PEAK HILL GOLDFIELD

On October 6, 1958, the writer visited M.Cs.24^P and 26^P (at Horseshoe) and M.Ls.61^P and 62^P (Peak Hill) in company with Dr. Fisher. Forman mapped the new outline of Quarry No.3 on M.C.24^P on the same day. These claims and leases are held by Westralian Ores Pty. Ltd.

Horseshoe

Horseshoe is 80 miles north of the railhead at Meekatharra and is the location of M.C.24^P (the "Southern Deposit"). M.C.26^P (the "Northern Deposit") is a mile to the north.

M.C.24^P (143 acres) has been mined continuously since 1948 and the total ore shipped has been a little over a quarter of a million tons (237,628 tons, including a few thousand tons from M.C.26^P). The estimated value of this ore (f.o.b. Geraldton) is about £2,800,000. Table VII shows the annual production. Plate VIII is a hitherto unpublished map of the deposit (made by R.R. Connolly (G.S.W.A.) and the writer in 1956) with additions for 1957 and 1958. The sub-surface contours shown on Sheet 1 indicate that the ore was laid down in an old stream course. Ellis established the barren nature of the underlying meta-sedimentary rocks in 1951 (See "Peak Hill G.F. Manganese Ore Reserves", by H.A. Ellis, Government Geologist, G.S.W.A. Ann. Prog. Rept. 1951). The source of the ore was probably a mangiferous sediment of the Nullagine Series which was topographically higher than the deposit, but has since been eroded.

The expansion of Quarry No.3 during 1958 showed the presence of sub-horizontal bands and vertical pipes of limonite in the ore and also disclosed slightly wider limits to the ore-body than were outlined by diamond drilling in 1957. (See "Report on the Inspection of Manganese Deposits in Western Australia, September 1957", by D. O'Driscoll. Bureau of Mineral Resources Records 1958/7).

The tonnage estimate for this claim at 30/9/58 was 183,000 tons above 40% Mn.

M.C.26^P (48 acres) was mined for the first time in 1957 and O'Driscoll and the writer visited the claim

while the operations were in progress. Subsequent mining reduced that estimate (See report quoted above) to 35,000 tons of ore above 40% Mn.

Peak Hill

The contact of the manganese ore with the underlying rock is not so clearly defined in this area as it is at Horseshoe, and some of the manganese ore extends down vertical cracks into the underlying weathered rock.

M.L.61^P (12 acres) is known as "Mudder-wearie" and is 5 miles west-north-west of Peak Hill. Some high grade ore was shipped from a small east-west outcrop on this lease during 1956. It was of cellular structure and did not appear to have any depth. Subsequently, Westralian Ores Pty. Ltd., have dug a pit 150 feet long, and up to 12 feet deep with widths up to 50 feet. Manganese ore is exposed in the cut which runs north and the ore-body has a dip of about 10 degrees to the north. Pebbly lateritic soil overlies the ore in depth. The ore varies in grade with patches of ferruginous ore, but it was estimated that some 4,000 tons of ore above 40% Mn and 10,000 tons of 30-39.9% Mn were available from this claim.

M.L.62^P (48 acres) is about a mile east of M.L.61^P and is known as "Mick's". Several cuts have been made on the western side of the deposit and, although patches of ore persist vertically down into the decomposed country rock, they are very low grade. A small amount of ore occurs on the surface but it is very thin. The tonnage estimate was 400 tons above 40% Mn.

TABLE I

MANGANESE RESERVES OF WESTERN AUSTRALIA as at 30/9/58

(Revised 11/2/59)

Claim Holder	Area Pegged	Number of Claims			Tonnages by Grades (% Mn)				Total Ore above 40% Mn.
		Approved	Pending	Total	30-39.9%	40-44.9%	45-49.9%	50 + % Mn	
	Acres				Tons	Tons	Tons	Tons	Tons
1. Westralian Ores Pty. Ltd.	2,181	27	52	79	337,100	291,250	134,950	300	425,500
2. Broken Hill Pty. Co. Ltd.	451	22	-	22	-	13,000	52,100	-	65,100
3. Northern Mineral Syndicate	2,322	27	11	38	965,350	2,342,500	522,100	3,000	2,867,600
4. D.F.D. Rhodes	2,833	20	106	126	1,745,950	119,350	40,400	42,350	202,100
5. H. Hancock & E.A.M. Wright	992	23	23	46	2,500	27,900	56,950	138,000	222,850
6. H.V. Blackwell & J.M. Henderson	123	5	-	5	9,200	26,550	5,550	-	32,100
7. Pindan & Sins	615	3	-	3	-	37,500	21,000	-	58,500
8. R.B. Symott	306	2	-	2	16,800	-	4,000	-	4,000
9. Western Development Pty. Ltd.	109	3	-	3	159,000	-	-	-	Nil
10. K. Grant & R. Larson	15	-	1	1	-	-	-	-	-
11. H.J. Andrews	6	1	-	1	-	-	-	-	-
TOTAL	9,957	133	193	326	3,235,900	2,858,050	837,050	183,650	3,873,750

TABLE II

1. WESTRALIAN ORES PTY. LTD. (BELL BROS).

Mineral Claim No.	Area Acres	Tenure	Tonnages by Grades (% Mn)				Total Ore above 40% Mn Tons	Estimated	
			30-39.9%	40-44.9%	45-49.9%	50 + %		By	Year
			Tons	Tons	Tons	Tons	Tons		
PILBARA GOLDFIELD									
Marble Bar District									
Carpwine Gorge									
458	38	Approved	-	-	-	-	-	Not seen	
Woodie Woodie									
487	24	Pending	-	-	11,400	-	11,400	O'Driscoll	1956
Ripon Hills									
504	6	Pending	1,100	800	-	-	800	de la Hunt	1958
505	10	"	4,000	1,200	-	-	1,200	"	"
506	20	"	2,500	700	-	-	700	"	"
Nullagine District									
Skull Springs									
121 ^L	80	Approved	1,000	6,000	18,050	-	24,050	O'Driscoll & de la Hunt	1957
122 ^L	8	"	-	-	1,550	-	1,550	" "	1956
123 ^L	125	"	2,800	1,250	3,050	-	9,300	" "	"
124 ^L	3	Pending	-	-	250	-	250	" "	"
125 ^L	80	"	-	200	350	-	550	" "	"
126 ^L	9	"	-	-	1,500	-	1,500	" "	"
127 ^L	2	"	-	-	100	-	100	" "	"
128 ^L	21	"	1,150	750	700	-	1,450	" "	"
129 ^L	6	"	-	100	150	-	250	" "	"
130 ^L	37	"	-	200	550	-	750	" "	"
131 ^L	40	"	-	700	3,600	-	4,300	" "	"
132 ^L	40	"	-	-	-	-	Nil	" "	"
133 ^L	3	"	-	1,600	-	-	1,600	" "	"
134 ^L	8	"	-	-	800	-	800	" "	"
135 ^L	1	"	-	-	900	-	900	" "	"
136 ^L	2	"	-	400	2,400	-	2,800	" "	"
137 ^L	2	"	-	250	-	-	250	" "	"
138 ^L	51	"	-	-	1,500	-	1,500	" "	"
143 ^L	5	"	-	100	-	-	100	de la Hunt	"
144 ^L	20	"	1,000	-	-	-	Nil	"	"
145 ^L	88	"	-	150	-	-	150	"	"
146 ^L	60	"	-	-	-	-	Nil	"	"
147 ^L	3	"	200	500	-	-	500	"	"
148 ^L	8	"	-	-	-	-	-	Not seen	
149 ^L	8	"	-	50	-	-	50	de la Hunt	1956
150 ^L	2	"	-	-	-	-	-	Not seen	
151 ^L	1	"	-	50	-	-	50	de la Hunt	1956
152 ^L	14	"	-	100	-	-	100	"	"
153 ^L	6	"	-	-	-	-	-	Not seen	
154 ^L	1	"	-	-	-	-	Nil	de la Hunt	1956
155 ^L	12	"	-	-	-	300	300	"	"
156 ^L	68	"	-	400	-	-	400	"	"
157 ^L	120	"	500	950	100	-	1,050	"	"
213 ^L	4	"	-	-	-	-	-	Not seen	
215 ^L	3	"	-	-	-	-	-	"	"
216 ^L	1	"	-	-	-	-	-	"	"
331 ^L	4	"	-	-	-	-	-	"	"
Boondanana Creek									
221 ^L	1	"	-	-	-	-	-	"	"

WESTRALIAN ORES (Con'd).

Mineral Claim No.	Area	Tenure	Tonnages by Grade (% in)				Total Ore above 40% in Tons	Estimated	
			30-39.9% Tons	40-44.9% Tons	45-49.9% Tons	50 + % Tons		By	Year
Mt. Cooke									
241 ^L	120	Approved	8,150	12,300	4,000	-	16,300	O'Driscoll & de la Hunty	1957
242 ^L	15	Pending	500	300	-	-	300	" "	"
243 ^L	20	"	-	1,000	-	-	1,000	" "	"
244 ^L	160	Approved	17,300	36,050	-	-	36,050	" "	"
245 ^L	20	"	300	1,300	2,200	-	3,500	" "	"
246 ^L	20	"	1,000	8,000	17,000	-	25,000	de la Hunty	1958
247 ^L	120	"	500	1,450	100	-	1,550	O'Driscoll & de la Hunty)	1957
248 ^L	120	Pending	8,500	2,700	-	-	2,700	" "	"
249 ^L	15	"	-	200	-	-	200	" "	"
250 ^L	8	"	-	100	-	-	100	" "	"
251 ^L	5	"	-	350	-	-	350	" "	"
252 ^L	17	"	200	550	-	-	550	" "	"
Sunday Hill									
253 ^L	4	Approved	-	600	200	-	800	" "	"
254 ^L	4	Pending	-	1,700	-	-	1,700	" "	"
255 ^L	2	"	-	1,300	-	-	1,300	" "	"
256 ^L	5	"	1,000	3,500	500	-	4,000	" "	"
287 ^L	1	"	-	-	-	-	-	Not seen	
288 ^L	2	"	-	-	-	-	-	" "	
PEAK HILL GOLDFIELD									
Horseshoe									
24 ^P	143	Approved	125,000	138,000	45,000	-	133,000	de la Hunty	1953
26 ^P	48	"	-	21,000	14,000	-	35,000	" "	"
32 ^P	34	"	-	-	-	-	-	Not seen	
33 ^P	48	"	-	-	-	-	-	" "	
63 ^P	1	"	-	-	-	-	-	" "	
Mt. Fraser									
77 ^P	2	"	-	-	-	-	-	" "	
78 ^P	2	"	-	-	-	-	-	" "	
79 ^P	3	"	-	-	-	-	-	" "	
80 ^P	1	"	-	-	-	-	-	" "	
81 ^P	14	"	-	-	-	-	-	" "	
82 ^P	1	"	-	-	-	-	-	" "	
83 ^P	5	"	-	-	-	-	-	" "	
Peak Hill									
38 ^P	5	"	400	-	-	-	Nil	de la Hunty	1956
M.L. 61 ^P	12	"	10,000	4,000	-	-	4,000	"	1958
M.L. 62 ^P	48	"	-	400	-	-	400	"	"
SOUTH WEST LAND DIVISION									
Neandip									
463 ^H	24	Approved)	150,000	40,000	-	-	40,000	Townley	1953
464 ^H	24	")							
DUNDAS GOLDFIELD									
Bremer Range									
41	60	Pending	-	-	-	-	-	Not seen	
TOTALS									
Claims		Approved							
70	2,131	27	337,100	291,250	134,950	300	426,500		
		Pending							
		52							

TABLE II

2. BROKEN HILL PTY. CO. LTD.

Mineral Claim No.	Area	Tenure	Tonnages by Grades (% min)				Total Ore above 40% min Tons	Estimated	
			30-39.9% Tons	40-44.9% Tons	45-49.9% Tons	50 + % Tons		By	Year
	Acres								
PILBARA GOLDFIELD									
Marble Bar District									
Woodie Woodie									
247	24	Approved	-	-	23,000	-	23,000	O'Driscoll	1956
Nullagine District									
Woodie Woodie									
110 ^L	11	Approved	-	-	4,600	-	4,600	do la Hurty	1958
111 ^L	6	"	-	-	11,500	-	11,500	O'Driscoll	1956
Warrie Station									
300 ^L	4	"	-	-	-	-	-	Not seen	
301 ^L	10	"	-	-	-	-	-	"	"
302 ^L	13	"	-	-	-	-	-	"	"
303 ^L	10	"	-	-	-	-	-	"	"
304 ^L	3	"	-	-	-	-	-	"	"
305 ^L	160	"	-	-	-	-	-	"	"
306 ^L	100	"	-	-	-	-	-	"	"
WEST PILBARA GOLDFIELD									
Mavilana Station									
100 ^{WP}	8	Approved	-	-	-	-	-	"	"
101 ^{WP}	3	"	-	-	-	-	-	"	"
102 ^{WP}	2	"	-	-	-	-	-	"	"
103 ^{WP}	9	"	-	-	-	-	-	"	"
104 ^{WP}	12	"	-	-	-	-	-	"	"
105 ^{WP}	1	"	-	-	-	-	-	"	"
PEAK HILL GOLDFIELD									
Horseshoe									
28 ^P	18	"	-	-	-	-	-	"	"
29 ^P	12	"	-	-	-	-	-	"	"
Mt. Fraser									
30 ^P	18	"	-	13,000	13,000	-	26,000	O'Driscoll	1956
31 ^P	8	"	-	-	-	-	-	Not seen	
M.L.64 ^P	5	"	-	-	-	-	-	"	"
M.L.65 ^P	14	"	-	-	-	-	-	"	"
TOTALS									
Claims 22	451	Approved 22	-	13,000	52,100	-	65,100		

TABLE II

3. NORTHERN MINERAL SYNDICATE

Mineral Claim No.	Area	Tenure	Tonnages by Grades (% Mn)				Total Ore above 40% Mn	Estimated	
			30-39.9%	40-44.9%	45-49.9%	50 + %		By	Year
	Acres		Tons	Tons	Tons	Tons	Tons		
PILBARA GOLDFIELD									
Marble Bar District									
Woodie Woodie									
268	24	Approved	-	-	7,000	3,000	10,000	de la Hunty	1958
269	24	"	-	10,000	15,000	-	25,000	"	"
271	24	"	1,650	6,000	-	-	6,000	O'Driscoll	1956
272	22	"	-	1,500	-	-	1,500	"	"
273	9	"	-	-	750	-	750	"	"
274	6	"	-	-	700	-	700	de la Hunty	1958
276	6	"	2,400	-	-	-	Nil	O'Driscoll	1956
429	1	"	-	1,200	-	-	1,200	"	"
430	1	"	-	-	700	-	700	"	"
431	22	"	-	4,000	3,200	-	7,200	"	"
432	3	"	-	-	300	-	300	"	"
433	4	"	-	-	850	-	850	"	"
434	5	"	-	-	600	-	600	"	"
435	10	"	-	2,850	1,000	-	3,850	"	"
Ripon Hills									
473	10	Approved	-	40,000	-	-	40,000	de la Hunty	1958
474	54	"	100,000	167,000	50,000	-	217,000	"	"
478	18	"	-	7,300	3,000	-	10,300	"	"
479	10	"	-	49,000	45,000	-	94,000	"	"
497	12	Pending	-	15,000	-	-	15,000	"	"
509	20	"	-	4,000	-	-	4,000	"	"
554	102	Approved	57,000	323,000	134,000	-	457,000	"	"
564	39	"	-	111,000	50,000	-	161,000	"	"
565	129	Pending	171,000	13,000	9,000	-	22,000	"	"
566	125	Approved	84,000	52,000	44,000	-	96,000	"	"
567	200	Pending	70,000	751,000	24,000	-	775,000	"	"
568	50	"	70,000	50,000	-	-	50,000	"	"
569	220	"	17,000	257,000	-	-	257,000	"	"
570	35	"	-	17,000	-	-	17,000	"	"
571	300	"	94,000	113,000	91,000	-	204,000	"	"
572	300	"	140,000	248,000	22,000	-	270,000	"	"
573	300	"	-	87,000	15,000	-	102,000	"	"
574	18	"	134,000	11,000	-	-	11,000	"	"
Nullegine District									
Woodie Woodie									
53 ^L	155	Approved	13,700	-	5,000	-	5,000	O'Driscoll	1956
54 ^L	50	"	9,000	1,500	-	-	1,500	"	"
56 ^L	2	"	1,600	-	-	-	Nil	"	"
114 ^L	2	"	-	150	-	-	150	"	"
119 ^L	5	"	-	-	-	-	-	Not seen	
120 ^L	5	"	-	-	-	-	-	"	"
TOTALS									
Claims 38	2,322	Approved 27 Pending 11	965,350	2,342,500	522,100	3,000	2,867,600		

4. D.F.D. RHODES

Mineral Claim No.	Area	Tenure	Tonnages by Grade (% Mn)				Total Ore above 40% Mn	Estimated	
			30-39.9%	40-44.9%	45-49.9%	50 + %		By	Year
	Acres		Tons	Tons	Tons	Tons	Tons		
PILBARA GOLDFIELD									
Marble Bar District									
Mt. Sydney									
451	1	Pending	-	-	-	-	-	Not seen	
452	3	"	-	-	-	-	-	" "	
531	49	Approved	-	1,000	1,000	-	2,000	de la Hunty	1958
532	49	"	3,500	4,000	12,000	-	16,000	"	"
533	49	"	100	-	-	-	Nil	"	"
534	49	"	1,200	600	-	-	600	"	"
535	49	"	-	700	2,400	-	3,100	"	"
536	7	"	-	-	-	-	-	Not seen	
Carawine Gorge									
480	13	Pending	-	-	-	-	-	" "	
481	1	"	-	-	-	-	-	" "	
482	2	"	-	-	-	-	-	" "	
Breeside									
485	9	"	-	-	-	-	-	" "	
486	2	"	-	-	-	-	-	" "	
Hallagine District									
Skull Springs									
139 ^L	1	"	-	-	200	-	200	O'Driscoll & de la Hunty)	1956
140 ^L	3	"	-	-	50	-	50	" "	"
141 ^L	80	"	100	-	-	-	Nil	" "	"
142 ^L	3	"	-	-	-	-	Nil	" "	"
199 ^L	1	"	-	-	-	-	-	Not seen	
200 ^L	5	"	-	-	-	-	-	" "	
201 ^L	1	"	-	-	-	-	-	" "	
Bee Hill									
158 ^L	5	"	-	-	-	-	-	" "	
159 ^L	157	"	-	-	-	-	-	" "	
160 ^L	2	"	-	-	-	-	-	" "	
161 ^L	45	"	-	-	-	-	-	" "	
162 ^L	12	"	-	-	-	-	-	" "	
163 ^L	51	"	100	6,450	-	-	6,450	de la Hunty	1958
164 ^L	29	Approved	-	8,300	-	-	8,300	"	"
165 ^L	5	Pending	-	100	150	-	250	"	1956
166 ^L	13	"	-	2,600	-	-	2,600	"	1958
167 ^L	4	"	-	800	-	-	800	"	"
168 ^L	3	"	-	400	-	-	400	"	"
169 ^L	105	Approved	350	450	7,000	-	7,450	"	"
170 ^L	34	"	1,000	7,650	-	-	7,650	"	"
171 ^L	13	"	-	1,000	-	-	1,000	"	"
172 ^L	13	Pending	-	6,200	-	-	6,200	"	"
173 ^L	5	"	-	150	-	-	150	"	"
174 ^L	34	"	-	8,000	7,800	-	15,800	"	"
175 ^L	2	"	-	-	-	-	Nil	"	1956
176 ^L	1	"	50	-	-	-	Nil	"	"
177 ^L	27	"	-	650	100	-	750	"	1958
178 ^L	1	"	-	-	-	150	150	"	1956
179 ^L	80	"	1,950	2,500	-	-	2,500	"	1958
180 ^L	17	"	100	200	-	-	200	"	"
181 ^L	5	"	-	400	50	-	450	"	"

Mineral Claim No.	Area	Tenure	Tonnages by Grades (% Mn)				Total Ore above 40% Mn	Estimated	
			30-39.9%	40-44.9%	45-49.9%	50 +%		By	Year
	Acres		Tons	Tons	Tons	Tons	Tons		
182 ^L	10	Approved	-	-	250	3,000	3,250	de la Hunt	1956
183 ^L	37	Pending	100	100	50	-	150	"	"
184 ^L	3	"	-	-	400	-	400	"	"
185 ^L	1	"	-	100	-	-	100	"	"
186 ^L	20	Approved	-	1,200	-	-	1,200	"	1958
187 ^L	300	Pending	1,100	1,100	-	-	1,100	"	"
188 ^L	2	"	400	-	-	-	Nil	"	"
189 ^L	3	"	-	-	-	-	-	Not seen	
190 ^L	9	"	300	-	-	-	Nil	de la Hunt	1958
202 ^L	1	"	100	-	-	-	Nil	"	1956
203 ^L	10	"	-	350	100	-	450	"	"
204 ^L	1	"	-	-	200	-	200	"	"
205 ^L	10	"	250	-	-	-	Nil	"	1958
206 ^L	17	"	2,800	1,600	-	-	1,600	"	"
207 ^L	20	"	250	600	-	-	600	"	"
217 ^L	6	"	850	700	-	-	700	"	"
218 ^L	50	"	2,400	1,350	-	-	1,350	"	"
219 ^L	4	"	200	-	-	-	Nil	"	"
220 ^L	3	"	-	250	300	-	550	"	"
221 ^L	4	"	-	1,700	-	-	1,700	"	"
222 ^L	11	"	2,900	-	-	-	Nil	"	"
223 ^L	1	"	-	200	-	-	200	"	1956
224 ^L	20	"	-	-	700	-	700	"	1958
225 ^L	5	"	-	300	-	-	300	"	"
226 ^L	1	"	-	600	-	-	600	"	"
227 ^L	3	"	2,000	1,400	-	-	1,400	"	"
260 ^L	2	"	-	-	-	-	-	Not seen	
261 ^L	15	"	-	-	-	-	-	"	"
263 ^L	2	"	-	-	-	-	-	"	"
264 ^L	2	"	-	-	-	-	-	"	"
336 ^L	14	"	-	-	-	-	-	"	"
337 ^L	12	"	-	-	-	-	-	"	"
338 ^L	7	"	-	-	-	-	-	"	"
Mt. Cooke									
191 ^L	1	Pending	-	250	-	-	250	de la Hunt	1958
192 ^L	12	"	-	300	150	4,850	5,300	"	"
193 ^L	1	"	-	150	-	50	200	"	"
194 ^L	5	Approved	-	24,000	-	28,000	52,000	"	"
195 ^L	2	Pending	50	50	100	-	150	"	"
196 ^L	1	"	-	2,000	-	1,000	3,000	"	"
197 ^L	27	"	50	2,600	300	-	2,900	"	"
198 ^L	10	"	-	-	1,000	-	1,000	"	"
208 ^L	13	"	2,450	1,550	-	-	1,550	"	"
209 ^L	6	"	2,300	700	-	-	700	"	"
210 ^L	2	"	-	-	600	-	600	"	"
211 ^L	2	"	1,150	-	-	-	Nil	"	"
212 ^L	1	"	4,000	3,000	-	-	3,000	"	"
228 ^L	1	"	350	-	-	-	Nil	"	1956
229 ^L	1	"	-	300	350	-	650	"	"
230 ^L	1	"	600	700	-	-	700	"	1958
231 ^L	3	"	300	300	-	-	300	"	"
232 ^L	2	"	-	-	-	2,900	2,900	"	1956
233 ^L	2	"	-	200	-	-	200	"	"

D.F.D. RHODES (Con'd)

Mineral Claim No.	Area	Tenure	Tonnages by Grades (% Mn)				Total Ore above 40% Mn	Estimated	
			30-39.9%	40-44.9%	45-49.9%	50 + %		By	Date
	Acres		Tons	Tons	Tons	Tons	Tons		
234 ^L	2	Pending	50	-	50	-	50	de la Hunty	1956
235 ^L	13	"	1,200	1,450	3,350	-	4,800	"	"
236 ^L	3	"	-	-	150	-	150	"	"
237 ^L	2	"	-	-	1,400	-	1,400	"	1958
238 ^L	2	"	100	100	-	-	100	"	"
239 ^L	3	"	-	-	200	-	200	"	1956
240 ^L	4	"	-	-	-	2,400	2,400	"	"
257 ^L	1	"	-	-	-	-	-	Not seen	
258 ^L	5	"	-	-	-	-	-	" "	
259 ^L	2	"	-	-	-	-	-	" "	
262 ^L	125	"	-	-	-	-	-	" "	
Balfour Downs Station									
265 ^L	176	Approved	30,000	6,000	-	-	6,000	de la Hunty	1958
266 ^L	175	"	670,000	12,000	-	-	12,000	"	"
267 ^L	148	"	723,000	-	-	-	Nil	"	"
268 ^L	80	"	252,000	-	-	-	Nil	"	"
269 ^L	45	"	16,000	-	-	-	-	"	"
270 ^L	80	"	6,000	-	-	-	-	"	"
271 ^L	23	"	12,000	-	-	-	-	"	"
354 ^L	30	Pending	-	-	-	-	-	Not seen	
355 ^L	17	"	-	-	-	-	-	"	
Walton Station									
272 ^L	80	Pending	2,000	-	-	-	Nil	O'Driscoll & de la Hunty	1957
275 ^L	6	"	-	-	-	-	-	Not seen	
276 ^L	10	"	-	-	-	-	-	" "	
356 ^L	45	"	-	-	-	-	-	" "	
Woblogun Hill									
308 ^L	5	"	-	-	-	-	-	" "	
Saddleback Hill									
333 ^L	1	Pending	-	-	-	-	-	" "	
334 ^L	1	"	-	-	-	-	-	" "	
339 ^L	3	"	-	-	-	-	-	" "	
340 ^L	8	"	-	-	-	-	-	" "	
341 ^L	3	"	-	-	-	-	-	" "	
TOTALS									
Claims		Approved							
126	2,838	20	1,745,950	119,350	40,400	42,350	202,100		
		Pending							
		106							

TABLE II
5. L.G. HANCOCK AND E.A.M. WRIGHT

Mineral Claim No.	Area	Tenure	Tonnages by Grade (% Mn)				Total Ore above 40% Mn Tons	Estimated	
			30-39.9%	40-44.9%	45-49.9%	50 + %		By	Year
	Acres		Tons	Tons	Tons	Tons			
PILBARA GOLDFIELD									
Marble Bar District									
Goodiadarrie Hills									
465	7	Approved	-	2,100	-	-	2,100	O'Driscoll & de la Hunty	1957
466	10	"	-	-	-	-	-	Not seen	
467	24	"	-	-	-	-	-	" "	
468	10	"	-	400	400	-	800	O'Driscoll & de la Hunty	1957
469	4	"	-	-	-	-	-	Not seen	
470	4	"	-	-	-	-	-	" "	
483	4	"	200	-	-	-	Nil	O'Driscoll & de la Hunty	1957
489	10	"	-	-	-	-	-	Not seen	
Mullagine District									
Warrie Station									
285 ^L	10	Approved	-	-	-	-	-	" "	
291 ^L	24	"	-	-	-	-	-	" "	
Mt. Fraser Station									
286 ^L	10	Approved	-	1,350	-	-	1,350	de la Hunty	1958
289 ^L	10	"	-	1,000	3,000	-	4,000	"	"
290 ^L	10	"	-	200	100	-	1,000	"	"
292 ^L	24	"	-	-	30,000	39,000	69,000	"	"
293 ^L	24	"	-	-	6,500	99,000	105,500	"	"
295 ^L	24	"	-	1,200	-	-	1,200	"	"
296 ^L	3	"	-	50	-	-	50	"	"
297 ^L	3	"	-	3,100	-	-	3,100	"	"
298 ^L	24	"	800	4,100	5,000	-	9,900	"	"
299 ^L	24	"	-	1,150	-	-	1,150	"	"
307 ^L	105	Pending	-	850	700	-	1,550	Not seen	
309 ^L	11	"	-	300	50	-	350	de la Hunty	1958
310 ^L	12	"	-	-	9,500	-	9,500	"	"
311 ^L	15	"	-	-	900	-	900	"	"
312 ^L	20	"	-	-	-	-	Nil	"	"
313 ^L	24	"	-	150	50	-	200	"	"
314 ^L	24	"	-	50	-	-	50	"	"
315 ^L	3	"	-	-	-	-	Nil	"	"
316 ^L	14	"	-	50	-	-	50	"	"
317 ^L	35	"	-	-	200	-	200	"	"
318 ^L	40	"	100	1,300	-	-	1,300	"	"
319 ^L	40	"	-	850	-	-	850	"	"
320 ^L	24	"	-	550	-	-	550	"	"
321 ^L	12	"	-	400	-	-	400	"	"
322 ^L	24	"	-	750	350	-	1,100	"	"
323 ^L	40	"	1,000	2,850	-	-	2,850	"	"
324 ^L	40	"	-	450	-	-	450	"	"
325 ^L	38	"	-	200	-	-	200	"	"
326 ^L	50	"	-	-	-	-	Nil	"	"
327 ^L	4	"	-	50	-	-	50	"	"
328 ^L	40	"	-	1,400	-	-	1,400	"	"
329 ^L	24	"	-	400	-	-	400	"	"
330 ^L	60	"	-	1,300	-	-	1,300	"	"

L.C. Hancock and E.A.W. Wright (Con'd)

Mineral	Area	Tenure	Tonnages by Grade (% Au)				Total Ore	Estimated	
Claim No.			30-39.9%	40-44.9%	45-49.9%	50 + %	above 40% Au	By	Year
	Acres		Tons	Tons	Tons	Tons	Tons		
WEST PILBARA GOLDFIELD									
Mulga Downs Station									
93 ^{VP}	10	Approved	400	500	-	-	500	O'Driscoll & de la Hunty	1957
Coordiner Pool									
95 ^{VP}	10	Approved	-	150	200	-	350	" "	"
TOTALS									
Claims		Approved							
46	992	23	2,500	27,900	56,950	138,000	222,350		
		Pending							
		23							

Mineral Claim No.	Area	Tenure	Tonnages by Grades (% Mn)				Total Ore above 40% Mn	Estimated	
			30-39.9%	40-44.9%	45-49.9%	50 + %		By	Year
	Acres		Tons	Tons	Tons	Tons	Tons		
PILBARA GOLDFIELD									
Marble Bar District									
Ripon Hills									
521	52	Approved	7,200	15,850	5,000	-	20,850	de la Hunt	1958
522	37	"	2,000	5,650	-	-	5,650	"	"
523	23	"	-	3,150	-	-	3,150	"	"
537	8	"	-	1,000	-	-	1,000	"	"
538	3	"	-	900	550	-	1,450	"	"
TOTALS									
Claims		Approved							
5	123	5	9,200	26,550	5,550	-	32,100		

7. PINDAN AND SINS

PILBARA GOLDFIELD

Marble Bar District

Nimngarra Station

517	300	Approved	-	37,500	21,000	-	58,500	de la Hunt	1958
518	300	"	-	-	-	-	Nil	"	"
519	15	"	-	-	-	-	Nil	"	"
TOTALS									
Claims		Approved							
3	615	3	-	37,500	21,000	-	58,500		

TABLE II

8. R.B. SYMHOTT

Mineral Claim No.	Area Acres	Tenure	Tonnages by Grade (% Mn)				Total Ore above 40% Mn Tons	Estimate By
			30-39.9%	40-44.9%	45-49.9%	50 + %		
			Tons	Tons	Tons	Tons		
PEAK HILL GOLDFIELD								
51 ^P	Woodlands Station 300	Approved	14,800	-	-	-	141	de la Hunty
57 ^P	Mulgul Station 6	Approved	2,000	-	4,000	-	4,000	O'Driscoll
TOTALS								
Claims 2	306	Approved 2	16,800	-	4,000	-	4,000	

9. WESTERN DEVELOPMENT PTY LTD.

PHILLIPS RIVER GOLDFIELD

Whoogarup								Sofoulis & Holdart
71	80	Approved	135,000	-	-	-	-	
72	4	"						
Desmond								de la Hunty
73	24	Approved	24,000	-	-	-	-	
TOTALS								
Claims		Approved						
3	108	4	159,000	-	-	-	-	

10. K. GRANT AND R. LARSEN

ASHBURTON GOLDFIELD								
Mt. Florrie								
20	15	Pending	-	-	-	-	-	Not seen

11. M.J. ANDREWS

PEAK HILL GOLDFIELD								
Mt. Labouchere								
76 ^P	6	Approved	-	-	-	-	-	Not seen

TABLE III

MANGANESE ORE ON GROUND REFUSED BY MINISTER FOR MINES

Mineral Claim No.	Area Acres	Applicant	Tonnes by Grades (% Mn)				Total Ore above 40% Mn Tons	Estimated	
			30-39.9%	40-44.9%	45-49.9%	50 + %		By	Year
			Tons	Tons	Tons	Tons	Tons		
PILBARA GOLDFIELD									
Marble Bar District									
Ripon Hills									
541	38	H.V. Blackwell & J.M. Henderson	-	1,000	-	-	1,000	de la Hunty	1958
542*	38	" " "	6,000	3,300	-	-	3,300	"	"
544	17	" " "	300	-	-	-	Nil	"	"
545	17	" " "	200	-	-	-	Nil	"	"
546	38	" " "	1,500	500	-	-	500	"	"
547	231	" " "	85,000	11,000	-	-	11,000	"	"
548	38	" " "	7,000	2,000	-	-	2,000	"	"
550	100	D.F.D. Rhodes	15,000	-	-	-	Nil	"	"
551	80	"	60,000	-	-	-	Nil	"	"
555	1	"	5,000	1,900	-	-	1,900	"	"
556	1	"	-	2,800	-	-	2,800	"	"
557	1	"	1,600	300	-	-	300	"	"
558	60	"	6,250	1,600	-	-	1,600	"	"
559	80	"	14,900	12,000	-	-	12,000	"	"
560	4	"	-	5,700	-	-	5,700	"	"
561	5	"	-	-	3,200	-	3,200	"	"
562	4	"	1,900	600	-	-	600	"	"
563	1	"	-	-	-	-	-	Not seen	
575	12	"	-	400	-	-	400	de la Hunty	"
576	7	"	200	50	-	-	50	"	"
577	5	"	50	150	-	-	150	"	"
578	10	"	-	1,200	6,500	-	7,700	"	"
581	5	"	-	-	-	-	-	Not seen	
583	240	P.R. Fletcher	23,000	7,000	-	-	7,000	de la Hunty	"
584	5	H.V. Blackwell & J.M. Henderson	-	-	-	-	-	Not seen	
585	5	" " "	-	-	-	-	-	" "	
586	13	" " "	-	-	-	-	-	" "	
Mt. Sydney									
539	7	D.F.D. Rhodes	-	-	-	-	-	" "	
540	20	"	-	-	-	-	-	" "	
549	6	"	-	-	-	-	-	" "	
Yarric Station									
543	300	Pindan & Sims	1,500	1,500	-	-	1,500	de la Hunty	1958
Koongalin									
552	5	D.F.D. Rhodes	-	-	-	-	-	Not seen	
553	3	"	-	-	-	-	-	" "	
Nimigarra									
580	20	Pindan & Sims	-	-	-	-	-	" "	
Nullagine District									
Woodie Woodie									
350 ^L	1	D.F.D. Rhodes	-	-	-	-	-	" "	
357 ^L	60	P.R. Fletcher	-	-	-	550	550	de la Hunty	1958
Mt. Cooke									
348 ^L	2	D.F.D. Rhodes	-	-	-	-	-	Not seen	
349 ^L	4	"	-	-	-	-	-	" "	
358 ^L	1	"	-	-	-	-	-	" "	
359 ^L x	30	"	-	-	-	-	-	(See M.C.194 ^L)	

Mineral Claim No.	Area	Applicant	Tonnages by Grades (% Mn)				Total Ore above 40% Mn	Estimated	
			30-39.9%	40-44.9%	45-49.9%	50 + %		By	Year
	Acres		Tons	Tons	Tons	Tons	Tons		
350 ^L	2	D.F.D. Rhodes	-	-	-	-	-	Not seen	
Balfour Downs									
335 ^L	300	L.G. Hancock	-	-	-	-	-	Not seen	
Mt. Fraser Station									
332 ^L	13	L.G. Hancock & E.A.M. Wright	-	300	-	-	300	de la Hunty	1958
343 ^L	20	" " "	-	-	-	-	Nil	"	"
344 ^L	10	" " "	-	-	-	-	Nil	"	"
345 ^L	29	" " "	-	-	-	-	Nil	"	"
347 ^L	12	" " "	-	-	-	-	Nil	"	"
Roy Hill Station									
346 ^L	10	L.G. Hancock & E.A.M. Wright	-	-	-	-	-	Not seen	
351 ^L	13	" " "	-	-	-	-	-	" "	
352 ^L	17	" " "	-	-	-	-	-	" "	
353 ^L	30	" " "	-	-	-	-	-	" "	
Warrie Station									
342 ^L	24	L.G. Hancock & E.A.M. Wright	-	-	-	-	-	" "	
PEAK HILL GOLDFIELD									
Ilgararrie Station									
89 ^P	29	Broken Hill Pty. Co. Ltd.	-	-	-	-	-	" "	
TOTALS									
Claims									
53	2,024		229,400	53,300	9,700	550	63,550		

* Includes late MC524^L (withdrawn)

x Includes MC194^L (conditionally surrendered)

TABLE IV

LOCALITIES OF MANGANESE DEPOSITS

Centre	Claimholders	Official Investi- gation	Stage of Develop- ment *
PILBARA GOLDFIELD			
Marble Bar District			
Nimingarra Station	Pindan and Sims	1958	D
Yarrie Station	Not held	"	U
Ripon Hills	Westralian Ores Pty.Ltd.	"	U
" "	Northern Mineral Syndicate	"	M
" "	Blackwell and Henderson	"	D
Braeside	D.F.D. Rhodes	Not seen	Believed U
Carawine Gorge	"	" "	" "
Mt. Sydney	"	1958	M
Woodie Woodie	Westralian Ores Pty.Ltd.	"	U
" "	Broken Hill Pty.Co.Ltd.	1956	U
" "	Northern Mineral Syndicate	1958	M
Koongalin	Not held	Not seen	Believed U
Goodiadarrie Hills	Hancock and Wright	1957	D
Nullagine District			
Woodie Woodie	Broken Hill Pty.Co.Ltd.	1958	U
" "	Northern Mineral Syndicate	"	M
Skull Springs	Westralian Ores Pty.Ltd.	"	D
" "	D.F.D. Rhodes	1957	U
Boondamane Creek	Westralian Ores Pty.Ltd.	Not seen	Believed U
Bee Hill	D.F.D. Rhodes	1958	M
Mt. Cooke (incl. Ant Hill)	Westralian Ores Pty.Ltd.	"	M
Mt. Cooke	D.F.D. Rhodes	"	M
Sunday Hill	Westralian Ores Pty.Ltd.	"	D
Woblegun Hill	D.F.D. Rhodes	Not seen	Believed U
Saddleback Hill	"	" "	" "
Warrie Station	Broken Hill Pty.Co.Ltd.	" "	" "
" "	Hancock and Wright	" "	" "
Roy Hill Station	Not held	" "	" "
Mt. Fraser Station	Hancock and Wright	1958	M
Balfour Downs Station	D.F.D. Rhodes	"	D
" " "	Not held	Not seen	Believed U
Walgun Station	D.F.D. Rhodes	1957	" "
WEST PILBARA GOLDFIELD			
Marillana Station	Broken Hill Pty.Co.Ltd.	Not seen	" "
Mulga Downs Station	Hancock and Wright	1957	D
Goodinor Pool	" "	" "	D

TABLE IV (Cont.).

Centre	Claimholders	Official Investi- gation	Stage of Develop- ment *
ASHBURTON GOLDFIELD			
Mt. Florrie	Grant and Larsen	Not seen	Believed U
PEAK HILL GOLDFIELD			
Ilgararrie Station	Not held	" "	" "
Woodlands Station	R.B. Synnott	1952	U
Mulgul Station	"	1956	U
Mt. Labouchere	M.J. Andrews	Not seen	Believed U
Horseshoe	Westralian Ores Pty.Ltd.	1958	M
"	Broken Hill Pty.Ltd.	Not seen	Believed U
Mt. Fraser	Westralian Ores Pty.Ltd.	" "	" "
"	Broken Hill Pty.Co.Ltd.	1956	M
Peak Hill	Westralian Ores Pty.Ltd.	1958	M
MT. MARGARET GOLDFIELD			
Mt. Lucky	Not held (Abandoned)	1953	D
SOUTH WEST LAND DIVISION			
Naendip	Westralian Ores Pty.Ltd.	1958	D
PHILLIPS RIVER GOLDFIELD			
Whoogarup	Western Development Pty.Ltd.	1958	D
Desmond	" " " "	"	D
DUNDAS GOLDFIELD			
Bremer Range	Westralian Ores Pty.Ltd.	Not seen	Believed U

* U - No deposits developed.

D - Some testing and/or development has been done on one or more of the deposits.

M - Ore has been mined from one or more of the deposits.

TABLE V

MANGANESE PRODUCTION OF WESTERN AUSTRALIA -- BY GOLDFIELDS

YEAR	Pilbara G.F.			Peak Hill G.F.			State Total		
	Ore Produced	Assayed Metallic Content Mn	Est. Value F.O.B. Geraldton	Ore Produced	Assayed Metallic Content Mn	Est. Value F.O.B. Geraldton	Ore Produced	Assayed Metallic Content Mn	Est. Value F.O.B. Geraldton
	Long tons.	Long tons.	£A	Long tons.	Long tons.	£A	Long tons.	Long tons.	£A
1922	-	-	-	18.11	Not known	142.00	18.11	Not known	142.00
1924	-	-	-	58.63	" "	294.00	58.63	" " "	294.00
1948	-	-	-	1,600.00	768.00	10,150.00	1,644.85*	768.00*	10,441.82*
1949	-	-	-	9,420.31	4,864.41	56,288.57	9,420.31	4,864.41	56,288.57
1950	-	-	-	11,961.64	5,643.92	65,459.33	11,961.64	5,643.92	65,459.33
1951	-	-	-	5,256.52	2,541.58	33,788.90	5,256.52	2,541.58	33,788.90
1952	-	-	-	5,044.80	2,285.28	35,633.77	5,044.80	2,285.28	35,633.77
1953	-	-	-	16,324.00	7,023.68	150,990.57	16,324.00	7,023.68	150,990.57
1954	8,982.00	4,767.41	163,472.85	31,599.00	14,672.88	444,742.00	40,581.00	19,440.29	608,214.85
1955	7,594.00	3,853.22	95,146.00	29,396.66	13,238.66	328,684.30	37,490.66	17,091.88	423,830.30
1956	7,525.25	3,788.41	102,159.00	49,797.89	21,787.64	546,797.00	57,323.14	25,576.05	648,956.00
1957	13,496.14	6,685.62	227,328.60	50,440.92	22,940.20	702,491.55	63,937.05	29,625.82	929,820.15
1958	22,372.42	11,062.70	387,482.50	39,400.91	17,973.54	570,833.95	61,773.33	29,036.24	958,316.45
Totals	50,969.81	30,157.36	975,588.95	250,819.39	113,739.79 ⁺	2,946,295.94	310,834.05	143,897.15 ⁺	3,921,884.89

* State totals for 1948 include (a) 20 tons from the Mt. Margaret G.F. at an estimated value of £180/F.O.B. - of unknown metallic content (not included).

(b) 24.85 tons from the South West Land Division at an estimated value of £111.82/F.O.B. - of unknown metallic content (not included).

⁺ "Assayed Metallic Content MnO₂" for Peak Hill Goldfield 1922 and 1924 is not known so is not included in these totals.

TABLE VI

MANGANESE PRODUCTION OF PILBARA G.F. — BY PRODUCERS

YEAR	Northern Mineral Syndicate			Westralian Ores Pty.Ltd.			D.F.D. Rhodes		
	M.Cs. 268, 269, 274, 564, 53 ^L , 54 ^L			M.Cs. 244 ^L etc. (Ant Hill)			M.Cs. 531, 171 ^L , 194 ^L etc.		
	Ore Produced	Assayed Metallic Content Mn	Est.Value F.O.B. Pt. Hedland	Ore Produced	Assayed Metallic Content Mn	Est.Value F.O.B. Pt. Hedland	Ore Produced	Assayed Metallic Content Mn	Est.Value F.O.B. Pt. Hedland
	Long tons	Long tons	£A	Long tons	Long tons	£A	Long tons	Long tons	£A
1954	8,982.00	4,767.41	163,472.85	-	-	-	-	-	-
1955	7,594.00	3,853.22	95,146.00	-	-	-	-	-	-
1956	7,525.25	3,788.41	102,159.00	-	-	-	-	-	-
1957	13,496.14	6,685.62	227,328.60	-	-	-	-	-	-
1958	6,853.67	3,298.08	93,970.00	3,620.00	1,546.10	40,312.00	11,898.85	6,218.52	255,200.50
TOTALS	44,451.06	22,392.74	682,076.45	3,620.00	1,546.10	40,312.00	11,898.85	6,218.52	255,200.50

TABLE VII

MANGANESE PRODUCTION OF PEAK HILL G.F. -- BY PRODUCERS

Year	Broken Hill Pty. Co. Ltd.			Westralian Ores Pty. Ltd.			General Chemical Supply Co. Ltd.		
	M.Cs. 28-31P, Mt. Fraser Centre			M.Cs. 24 ^P , etc., Horseshoe, Peak Hill			M.Ls. 54-56 ^P , Horseshoe Centre		
	Ore Produced	Assayed Metallic Content Mn	Est. Value F.O.B. Geraldton	Ore Produced	Assayed Metallic Content Mn	Est. Value F.O.B. Geraldton	Ore Produced	Assayed Metallic Content Mn	Est. Value F.O.B. Geraldton
	Long tons	Long tons	£A	Long tons	Long tons	£A	Long tons	Long tons	£A
1922	-	-	-	-	-	-	18.11	Not known	142.00
1924	-	-	-	-	-	-	58.63	" "	294.00
1948	-	-	-	1,600.00	768.00	10,150.00	-	-	-
1949	4,993.72	2,687.15	26,222.72	4,426.59	2,177.26	30,065.85	-	-	-
1950	5,050.75	2,470.18	22,858.33	6,910.89	3,173.74	42,601.00	-	-	-
1951	2,166.00	1,121.12	14,620.00	3,090.52	1,420.46	19,168.90	-	-	-
1952	904.00	438.12	5,532.00	4,140.80	1,847.16	30,101.77	-	-	-
1953	-	-	-	16,324.00	7,023.68	150,990.57	-	-	-
1954	-	-	-	31,599.00	14,672.88	444,742.00	-	-	-
1955	-	-	-	29,896.66	13,238.66	328,684.30	-	-	-
1956	-	-	-	49,797.89	21,787.64	546,797.00	-	-	-
1957	-	-	-	50,440.92	22,940.20	702,491.55	-	-	-
1958	-	-	-	39,400.91	17,973.54	570,833.95	-	-	-
TOTALS	13,114.47	6,716.57	69,233.05	237,628.18	107,021.22	2,876,626.89	76.74	Not known	436.00

TABLE VIII

SAMPLING DETAILS

Sample No.	Local-ity	Description of Sample	Assay Results		
			Mn %	Fe %	Insol. %
	Balfour Downs	(See Plan)			
98401	M.C.267 ^L	Chip of ore over 50 ft. length	45.3	-	-
2	"	Vertical channel of Mn rubble and soil 0"-9", plus $\frac{1}{4}$ " mesh (39% of sample)	36.2	-	-
3*	"	Chip of ore over 90 ft. length	50.3	-	-
4	266 ^L	Chip of ore down breakaway face, 1'-4'	38.2	-	-
5	"	" " " " " " , 0'-3'	40.9	-	-
6	"	Grab chips of ore from 4 blast holes 1'6" deep	36.8	-	-
7	"	Grab chips of ore along 30 ft. costean 1'6" deep	43.1	-	-
8	"	Grab chips of ore along 30 ft. costean 1'6" deep	44.5	-	-
9	265 ^L	Grab chips of ore from 30 ft. line of blast holes	40.9	-	-
10	"	Vertical chip of ore down breakaway face, 0'-3'	38.2	-	-
11	"	Vertical channel of Mn and soil from costean 0'-3', plus $\frac{1}{4}$ " mesh (73% of sample)	17.3	-	-
12*	"	Vertical channel of ore down breakaway face, 0'-6'	38.7	-	-
13	266 ^L	Vertical chip of ore down W. face of costean, 2'-8'	35.7	-	-
14	"	Surface chip of ore over 12 ft.	39.0	-	-
15	268 ^L	Vertical chip of ore down N. face of costean, 0'-6'	36.5	-	-
16	"	Vertical chip of ore down breakaway face, 0'-3'	42.3	-	-
17*	265 ^L	Vertical chip of ore down S.W. face of costean, 0'-3'	38.7	-	-
18	"	Grab of Mn pisolites (no soil) from floor of costean	30.2	-	-
19	"	Chip of ore across sporadic outcrop, 80 ft.	41.7	-	-
20	268 ^L	Grab of manganiferous shale from S. bank of creek	13.2	-	-
21	266 ^L	Grab of manganiferous shale from 17 ft. down breakaway face	13.2	-	-
22	40 chns. S.E. of M.C.265 ^L	Channel of Mn pisolites with soil 0"-12" + $\frac{1}{4}$ " mesh (26.5% of sample)	36.8	-	-
23	40 chns. S. of M.C.266 ^L	Channel of Mn pisolites with soil 0"-16", + $\frac{1}{4}$ " mesh (37.5% of sample)	24.2	-	-

* Mineral determinations made by BSR.

Sample No.	Local-ity	Description of Sample	Assay Results		
			Mn	Fe	Insol.
			%	%	%
	Ripon Hills	(See Plans)			
98424	M.C.566	Chip of ore over surface, 27 ft.	18.8	-	-
5	565	Grab of Mn rubble over 55 ft.	21.0	-	-
6*	566	Chip of ore over surface, 35 ft.	19.0	-	-
7	565	" " " " " , 35 ft.	23.4	-	-
8	"	" " " " " , 10 ft.	31.8	-	-
9*	554	" " " " " , 30 ft.	34.4	-	-
		Second assay with ignition loss of 8.8%	33.9	21.5	13.0
30	"	Chip of ore over surface, 30 ft.	36.2	-	-
		Second assay with ignition loss of 7.8%	38.9	29.5	1.5
31	478	Chip of ore over surface, 25 ft.	38.9	-	-
32	521	" " " " " , 20 ft.	48.5	-	-
33	"	" " " " " , 20 ft.	35.5	-	-
34	523	" " " " " , 20 ft.	21.0	-	-
35	474	" " " " " , 25 ft.	23.4	-	-
36	"	" " " " " , 55 ft.	29.6	-	-
37	"	" " " " " , 25 ft.	40.1	-	-
38	569	" " " " " , 30 ft.	30.5	-	-
39	"	" " " " " , 20 ft.	30.1	-	-
40	473	" " " " " , 10 ft.	23.8	-	-
41	568	" " " " " , 20 ft.	34.2	-	-
42	547	Grab of pieces of ore from blast hole, 2 ft. deep	35.9	-	-
43*	546	Grab of pieces of Mn replacing chert breccia	33.4	-	-
44	"	Grab of pieces of manganiferous sandstone	25.8	-	-
	Yarrie				
45	M.C.543	Grab of rubble from manganese shale horizon	32.6	11.7	24.8
	Ripon Hills	(See Plans)			
46	M.C.559	Grab of ore	20.2	4.3	7.1
47	"	Grab of ferruginous ore	1.8	63.4	4.6
48	564	Vertical channel down quarry face, 3'-9'	48.0	5.0	3.4
49*	"	Specimen 30 ft. N. of No. 98448, 5 ft. down face	42.8	1.1	5.1
50	564	Chip of ore over surface, 20 ft.	28.9	28.2	4.8
51	568	" " " " " , 20 ft.	33.8	24.5	2.2
52	"	Chip of ferruginous ore over, 20 ft.	3.0	59.5	4.4
53	569	Chip of ore over surface, 30 ft.	41.4	13.3	3.9
54	567	" " " " " , 30 ft.	14.5	46.5	4.0

Sample No.	Local-ity	Description of Sample	Assay Results		
			Mn	Fe	Insol.
			%	%	%
98455	M.C.567	Chip of ore over surface, 20 ft.	38.8	14.0	7.3
56	"	" " " " " , 20 ft.	39.0	16.8	2.3
57*	"	Grab of manganiferous shale	15.1	17.7	39.5
58	"	Chip of ore over surface, 20 ft.	35.9	17.0	8.5
59	560	Grab of ferruginous ore	13.8	49.0	4.1
60	570	Chip of ore over surface, 20 ft.	28.5	25.7	7.6
61	"	" " " " " , 20 ft.	32.4	23.8	5.9
62	474	" " " " " , 20 ft.	33.8	25.0	2.6
63	571	" " " " " , 20 ft.	44.3	12.6	9.1
64	"	" " " " " , 20 ft.	44.0	-	-
65	"	" " " " " , 20 ft.	35.4	-	-
66	573	Chip of ferruginous ore, 15 ft.	3.8	-	-
67	555	Chip of ore over surface, 20 ft.	31.6	-	-
68	557	" " " " " , 30 ft.	21.9	-	-
69	558	" " " " " , 20 ft.	20.0	-	-
70*	572	" " " " " , 20 ft.	42.7	-	-
71	"	" " " " " , 20 ft.	35.2	-	-
72	"	" " " " " , 20 ft.	15.1	-	-
73	"	" " " " " , 20 ft.	32.7	-	-
74	"	Vertical chip up face from ground level, 20 ft.	45.2	-	-
75	575	Chip of ore over surface, 20 ft.	50.0	-	-
76	577	Specimen of Mn-stained chert breccia	-	-	-
77	578	Chip of ore over largest body, 20 ft.	47.2	-	-
78	561	Chip of ore along body in middle of claim, 20 ft.	44.2	-	-
79*	562	Grab of typical ore - south end of deposit	30.9	-	-
80	573	Chip of ore over surface, 20 ft.	20.2	-	-
81	"	" " " " " , 20 ft.	43.8	-	-
82	"	" " " " " , 20 ft.	16.9	-	-
83*	"	Vertical chip of ore down bottom 10 ft. of face	29.0	-	-
84	571	Chip of ore over surface, 20 ft.	42.2	-	-
85	"	" " " " " , 20 ft.	45.2	-	-
86	572	" " " " " , 20 ft.	30.0	-	-
87	"	" " " " " , 20 ft.	20.2	-	-
88	"	" " " " " , 20 ft.	38.7	-	-
89	550	Chip of ore near N.W. corner, 20 ft.	16.5	-	-
90*	"	Chip of ore near S.E. corner, 20 ft.	27.5	-	-
91	"	Specimen of pisolitic ore at No.98490	35.2	-	-
92	551	Chip of ore over surface, S.E. corner, 20 ft.	18.2	-	-
93	"	Chip of ore near N.E. peg, 20 ft.	29.2	-	-
94	"	Specimen of pisolitic ore at No.98493	-	-	-

Sample No.	Local-ity	Description of Sample	Assay Results		
			Mn	Fe	Insol.
			%	%	%
98495	M.C.583	Chip of ore down steep slope, 0'-15'	24.8	-	-
96	564	Specimen of ore at 98449	-	-	-
	Mt.Sydney				
97	M.C.534	Specimens of ore	-	-	-
98 (a)	"	White dolomite	2.9	-	-
(b)	"	Purple dolomite	2.0	-	-
	Woodie Woodie				
99	M.C.435	Specimens of Collenia	-	-	-
98500	357 ^L	Chip of ore over surface, 20 ft.	53.0	-	-
	Ripon Hills				
1301	M.C.479	Chip of ore over surface, 20 ft.	39.3	-	-
2	"	" " " " " " , 12 ft.	49.0	-	-
3	497	Chip of ore vertically down face, 6 ft.	38.5	-	-
4	"	Chip of ore over surface near N.W. peg, 20 ft.	32.4	-	-
5	574	" " " " " " , 5 ft.	49.8	-	-
6	"	" " " " " " , 10 ft.	28.4	-	-
	Woodie Woodie				
7	M.C.111 ^L	Grab of pieces of ore 20 ft. apart	58.0	-	-
8	110 ^L	Chip across central ore-body, 20 ft.	52.3	-	-
	Mt. Cooke (See Plan)				
9	M.C.212 ^L	Chip of ore over surface, 20 ft.	37.7	-	-
10	211 ^L	" " " " " " , 20 ft.	10.0	-	-
11*	212 ^L	Specimen of shale containing Mn nodules, half mile east of claim	10.3	-	-
12	194 ^L	Vertical chip down face of north quarry, 10 ft.	49.5	-	-
13*	"	Grab of broken ore from working face	51.5	-	-
14	192 ^L	Grab of broken ore from quarry near N.W. peg	56.3	-	-
15	197 ^L	Chip of ore over surface, near E. peg, 20 ft.	35.3	-	-
16	198 ^L	Chip of ore over surface, north end of claim	44.4	-	-
17*	4 miles south of M.C.194 ^L	Grab of manganese shale	46.2	-	-
18	231 ^L	Chip of ore over surface, 10 ft.	32.6	-	-
19	238 ^L	" " " " " " , 20 ft.	31.9	-	-
20	237 ^L	" " " " " " , 20 ft.	40.5	-	-
21	230 ^L	" " " " " " , 20 ft.	33.7	-	-
22	208 ^L	" " " " " " , 20 ft.	26.2	-	-

Sample No.	Local-ity	Description of Sample	Assay Results		
			Mn	Fe	Insol.
			%	%	%
	Bee Hill	(See Plan)			
1323	M.C.171 ^L	Grab of black ore from dump	40.1	-	-
24	170 ^L	Chip of ore over surface near N.E. peg, 20 ft.	29.7	-	-
25	217 ^L	Chip of ore over surface, 20 ft.	31.4	-	-
26	224 ^L	" " " " " , 20 ft.	40.2	-	-
27	225 ^L	" " " " " , 20 ft.	31.6	-	-
28	226 ^L	" " " " " , 20 ft.	37.7	-	-
29	227 ^L	" " " " " , 20 ft.	17.6	-	-
30	219 ^L	" " " " " , 20 ft.	22.6	-	-
31	222 ^L	" " " " " , 20 ft.	20.4	-	-
32	218 ^L	" " " " " , near S.W. peg, 20 ft.	36.3	-	-
33	220 ^L	" " " " " , southern body, 20 ft.	50.0	-	-
34	221 ^L	Chip of ore over surface, 20 ft.	34.9	-	-
35	206 ^L	" " " " " , 20 ft.	28.9	-	-
36	205 ^L	Grab of pieces across strike near N. end of claim	28.3	-	-
37	173 ^L	Chip of ore over surface, 20 ft.	38.9	-	-
38	174 ^L	" " " " " , 30 ft.	41.2	-	-
39	172 ^L	" " " " " , 20 ft.	35.2	-	-
40	190 ^L	" " " " " , 20 ft.	32.2	-	-
41	169 ^L	Grab pieces from quarry floor	46.3	-	-
42	163 ^L	Chip of ore over surface, 15 ft.	41.8	-	-
43	168 ^L	" " " " " , 20 ft.	31.9	-	-
44	207 ^L	" " " " " , 20 ft.	31.9	-	-
45	164 ^L	" " " " " , 20 ft.	33.1	-	-
46	167 ^L	" " " " " , 20 ft.	33.4	-	-
47	166 ^L	" " " " " , 20 ft.	34.6	-	-
48	177 ^L	" " " " " , 20 ft.	38.9	-	-
49	187 ^L	" " " " " , north end, 20 ft.	19.1	-	-
50	187 ^L	" " " " " , south end, 20 ft.	36.7	-	-
51	188 ^L	" " " " " , 20 ft.	23.4	-	-
52	186 ^L	Chip down quarry face, 0' - 6'	33.0	-	-
53	179 ^L	Chip of ore over surface, 20 ft.	16.1	-	-
	Mt. Sydney				
54*	M.C.532	Specimen of ore from bench in main quarry	47.9	-	-
55	"	Vertical chip up from main quarry floor, 6 ft.	56.8	-	-
56*	"	Specimen from fault in W. wall of main quarry	55.8	-	-
57	"	Grab of pieces from W. wall of main east quarry	54.7	-	-

Sample No.	Local-ity	Description of Sample	Assay Results		
			Mn	Fe	Insol.
			%	%	%
1358	M.C.531	From top of quarry face	62.4	-	-
59	25 chns. S.W. of NO.1358	Specimen of purple dolomite from outcrop on plain	0.8	-	-
60	5 chns. S.W. of NO.1359	Specimen of red dolomite from outcrop on plain	1.5	-	-
	Woodie Woodie				
61*	M.C.268	Grab of typical ore from E. wall of quarry	56.4	-	-
62	"	Specimen of ore with chert from 30 ft. down N.W. wall of quarry	-	-	-
63*	"	Grab of barytic manganese ore from 15 ft. down S.W. wall of quarry	35.3	-	-
64	1 mile E. of M.C.268	Specimens of various rock types from "Upper Limestone Sequence"	-	-	-
	Mt.Cooke				
65	2½ miles S. of M.C.194 ^L	Specimen of basalt	3.7	-	-
66	2 miles S. of M.C.194 ^L	Specimen of chocolate manganiiferous shale (underlies basalt of No.1365)	4.0	-	-
	Upper Carawine Gorge				
67	1 mile S.W. of gorge	Chips from limestone near mesa cap	-	-	-
	Ripon Hills				
68	M.C.565	Specimen of dolomitic limestone, 7 chns. E. of N.E. corner	1.8	-	-
69	551	Specimen of Tertiary sediment, 5 chns. S. of N.E. corner			

* Mineral determinations made on these samples, by Bureau of Mineral Resources.
All assays made by Bureau of Mineral Resources.

APPENDIX

MINERAL DETERMINATIONS ON SAMPLES
FROM VARIOUS LOCALITIES

Some of the samples were used entirely in the chemical analysis, and others were completely ground so that no polished section could be made. In this latter case a specimen of the powder was X-rayed and the mineral or minerals determined.

Wherever any doubt existed X-ray diffraction was used as a check on the optical work.

1307 Woodie Woodie

Pyrolusite.

1317 Mt. Cooke

Braunite containing fine veins of pyrolusite.

1354 Mt. Sydney

Cryptomelane.

1356 Mt. Sydney

Large grains of hausmannite ranging up to 10.0 mm.
in a mass of fine-grained cryptomelane.

1361 Woodie Woodie

Coarsely granular braunite with fine veinlets of
pyrolusite.

1363 Woodie Woodie

Crystalline braunite containing a very small quantity
of pyrolusite.

98425 Ripon Hills

Only hematite could be determined.

98429 Ripon Hills

Veins of pyrolusite up to 2.0 mm. in width in very
fine grained hematite.

98442 Ripon Hills

Veins of very fine grained pyrolusite cutting fine
grained quartz.

98443 Ripon Hills

Pyrolusite and some very fine grained cryptomelane.

98444 Ripon Hills S.E.

Coarse grained braunite with interstitial fillings of
pyrolusite.

98470 Ripon Hills

Pyrolusite and hematite.

98479 Ripon Hills

Very fine grained cryptomelane with some pyrolusite.

98483 Ripon Hills

Hematite.

98490 Ripon Hills

Cryptomelane.