DEPARTMENT OF MINES

SOUTH AUSTRALIA

Geological Survey
Iron Exploration Section

SUMMARY REPORT

ON

KNOWN IRON ORE DEPOSITS

CENTRAL PROVINCE

by

Graham Whitten
Senior Geologist

6th April, 1962

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The accompanying resume of current knowledge of ironstone deposits in the Central Province has been prepared for general distribution. It is based on recent field work and supersedes that previously recorded by the writer in Summary Report, RB51/149, G.S. 1888, December, 1960. Some additional data are recorded in Departmental Files and are available for inspection but all essential information has been presented.

For a geological summary of the whole province refer to "The Geology of South Australia - Chapter V - The Central Province" by Dunlop and Parkin (Jour. of Geol. Soc. of Aust., Vol. 5, Part 2, 1957) which describes the Tarcoola Area.

The Department has diamond drilled Mt. Christie, Fingerpost Hill and George Hill and has mapped in detail these and some other deposits. Metallurgical work has been carried out by Australian Mineral Development Laboratories on samples from Mt. Christie and Wilgena Hill submitted by the Department. Samples are also available from West Well and Muckanippie.

Some projects, notably the Muckanippie Group and Wilgena Hill require detailed mapping. All will be covered by one-mile mapping in progress and ground geophysical surveys will be carried out where necessary as opportunity permits. The Department actively assists investigations and development of all such deposits.

The Report is divided into two sections numbered decimally to facilitate reference. Reserves for prospects not mapped or drilled are somewhat less definite than for those investigated in detail; in all cases the data used in calculations are presented. Grades, except for Mt. Christie are based on careful surface sampling. At Mt. Christie a comparison of diamond drill core and surface sample results suggests considerable surface enrichment.

Plan 60-647 attached shows the general location of the Mt. Christie Group and Wilgena Hill. Plan S2476 attached, shows the relation of the various groups of outcrops described.

Graham Whitten
Senior Geologist
IRON EXPLORATION SECTION

6th April, 1962

GENERAL NOTE

This summary is one of a series of Summaries on Known Iron Ore Deposits in South Australia which have been compiled by the writer and are being issued by geological provinces. They are being revised and reissued from time to time as results of further field work or metallurgical testing become available.

Summary Reports exist for:-

CENTRAL PROVINCE

1.	MULGATHING DISTRICT	Issued December 1960
2.	WILGENA HILL & TARCOOLA DISTRICT	Revised and Reissued April 1962
3.	RAZORBACK RIDGE	Issued December 1960 Revised and Reissued March 1962.
4.	OLARY PROVINCE	Revised and Reissued March 1962
4.1	Koolka (Ironstone Well)	First issued December 1960
4.2	Billeroo	
4.3	Plumbago	
4.4	Old Toraminga Dam	
4.5	Aloonie Dam	
4.6	Grants, Alberts & Cutana Quarries, etc. Radium Hill District	First issued December 1960.
5.	MALCOLM CREEK	Issued December 1960 Revision awaits Metallurgical Report.
6.	WARRAMBOO	Issued March 1962
7.	MT. LOFTY RANGES	
7.1	Peeralilla Hill	Compiled 3/10/61
7.2	Mt. Jagged	Compiled 11/10/61
7.3	Hick's, Gladstone	Compiled 1/ 2/62
7.4	Oodlawirra	
8.	FLINDERS RANGES	
8.1	Donnelly's (Comstock)	Compiled 27/11/61
8.2	Iron King	Mapped October, 1961

Graham Whitten
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6th April, 1962

NAME — MULGATHING DISTRICT

INCLUDES	MT. CHRISTIE GROUP	15-20M.	35% Fe (?)
	WEST WELL GROUP	1M?	45% Fe (??)
	MUCKANIPPIE GROUP	2M/100'(?)	50% Fe (??)

Note also Durkin Bore Group
Aristarchus Tank Group.

LOCATION — 30 miles north and north west of Malbooma, East-West Railway.

ACCESS — Malbooma is 337 miles by 4'8½" gauge rail from Port Pirie and 25 miles west of Tarcoola.

REFERENCES

(1) Bollen, L., 1961-62, "Progress Reports Project 1/1/32, Mt. Christie Iron Ore.(CD1 Core)." Australian Mineral Development Laboratories monthly progress reports to S.A. Dept. of Mines Unpublished.

(2) Crawford, A.R., 1957, "Iron Ore near Mt. Christie," S. Aust. Min. Rev. 104.

(3) McPheat, I.W., 1961, "Report of Investigation ML 1/2/0 - 1125," Davis Tube Tests on Drill Core from CD1, Mt. Christie. Australian Mineral Development Laboratories Report to S.A. Dept. of Mines, Unpublished.

(4) Moskovits, E.E., 1961, "Low Grade Iron Ores, Beneficiation of Low Grade Iron Ores by Flotation Methods" (Mt. Christie, Wilgena Hill, Braemar), Australian Mineral Development Laboratories Report, No. AMDL-156, to S.A. Dept. of Mines, Unpublished.

(5) Sandman, C.R., 1961, "Mt. Christie Iron Ore Beneficiation, Dry Magnetic and Gravity Concentration," Australian Mineral Development Laboratories Report, No. AMDL-98, to S.A. Dept. of Mines, Unpublished.

REFERENCES (Contd.) (6) S.A. Dept. of Mines, Diamond Drilling Records, Bore Serial Nos. DD 141/61, DD 178/61, DD 1/62, DD 14/62, Unpublished.

(7) Whitten, G.F., 1960, "Geological Reconnaissance of the Tarcoola Four-Mile Sheet and Eleven Adjoining One-Mile Sheets," Geol. Surv. S. Aust. Report, RB50/162, 68 pages with reconnaissance 4-mile sheet (59-129), Unpublished.

(8) Whitten, G.F., 1961, Five 100 scale plans, sampling and reconnaissance dip needle surveys. Mt. Christie (61-318), Little Hill (61-317), Fingerpost Hill (61-315), George Hill (61-319), Hill Eleven, West Well (61-316).

CLIMATE, ETC. Long, hot summers, short mild winters. Rainfall at Tarcoola averages 6.14"/year having varied from 2.66" to 13.76". Evaporation rate is 76" per year.

TITLE Minerals belong to the Crown. However the Mt. Christie District is withdrawn from the normal operation of the Mining Act. (S.A. Govt. Gazette, 12/10/61). Any request to mine in this area should be submitted to the Minister of Mines for special consideration.

GENERAL GEOLOGY Archaean iron formations of the Lake Superior Type occur in a complex of paragneisses and felspathised metasediments intruded by granites.

The iron was precipitated as 2-10 micron flakes of hematite or goethite, less frequently as magnetite, the whole being recrystallised during dynamic metamorphism. Grain size now varies from 5-30 microns in the jaspilites at Wilgena Hill (60 miles SE) through 100 microns in the Muckanippie Group to 350 microns in the West Well Group and 350-500 microns in the Mount Christie Group. These rocks are metajaspilites or itabirites.

GENERAL GEOLOGY (Contd.)

The beds vary from 10' to 250' in thickness over outcrop lengths of 100'-2000'. The outcrops occur as low (up to 100' high) hills in plain country. Some beds can be traced as discontinuous outcrops or areas of scree on rises for 3 to 5 miles.

Three main groups of outcrops and a number of smaller ones occur in an area 40 miles EW by 25 miles NS. The jaspilites possibly average 45%+ iron in outcrop varying from 34% to 60% in surface samples. Their locations are indicated in plan S2476 attached, the main groups being:-

GEOPHYSICS

Aeromagnetic: The whole district has been covered by aeromagnetic surveys at 500' elevation and 1 mile flight spacings. Christie, Mulgathing, Coates and Muckanippie are the relevant one mile sheets for known outcrops.

Ground Geophysics has been restricted to a few reconnaissance dip needle surveys. More are required to determine continuity or extensions. See individual prospects.

TESTING

Mt. Christie, Fingerpost Hill, Little Hill etc, George Hill etc. of the Mt. Christie Group and Hill Eleven, West Well Group have been mapped on 100 scale.

Mt. Christie, Fingerpost Hill and George Hill have been drilled.

Mt. Christie, Hill Eleven and the main Muckanippie Deposit have been sampled for metallurgical work.

See individual descriptions for details.

WORKINGS / PRODUCTION

NIL

RESERVES	Mt. Christie Group	15-20 M Tons	35% Fe ?
	West Well Group	1 M Tons	45% Fe ??
	Muckanippie Group	2 M Tons/100'	50% Fe ??

These reserves are based to the lowest level of testing for those prospects drilled where the mining width is in excess of 100'. Elsewhere and for narrow prospects an arbitrary figure of 50' has been taken as the maximum economic depth of open cutting. As a result of this approach the reserves of the Mt. Christie Group have increased considerably whilst the others have decreased.

GRADE

For the Mt. Christie group this has been based on sampling of diamond drillhole CD1 at Mt. Christie itself (33.9% Fe). Six surface samples there showed an average of 52.4% Fe indicating considerable surface enrichment.

For the other deposits surface grades are quoted with reservations.

REMARKS

This area is in one of the 3 main iron bearing provinces in South Australia

viz. Eyre Peninsula

Olary Province

Tarcoola District

Further deposits are present in the same district at Wilgena Hill.

Because of the coarse grained nature of the ore, beneficiation is relatively easy. However in view of their small tonnage, isolation, lack of water and distance to ports development may be difficult. Still regional mapping of the Tarcoola 4 Mile sheet is warranted to determine if more outcrops or higher grade concentrations exist.

PLANS	S2476	Tarcoola District Precambrian Outcrops & Iron Formations (attached).	1" = 16M
	59-129	Tarcoola 4 Mile Sheet Reconnaissance Geological Sheet	1" = 4M
	61-318	Mt. Christie Geological Plan	1" = 100'
	61-315	Fingerpost Hill Geological Plan	1" = 100'
	61-319	George Hill Geological Plan	1" = 100'
	61-316	Hill Eleven, West Well	1" = 100'

NOTED BY G. F. Whitten

Date 27/3/62

MT. CHRISTIE GROUP

LOCATION

For location see Plan S2476 attached. The Group lies approximately 30 miles west of Mulgathing Homestead.

"SIGNIFICANT OUTCROPS" with others "Of Lesser Significance" are:-

MT. CHRISTIE *	6M TONS	33.9% Fe	2 D.D.Holes
FINGERPOST HILL *	6M	35% Fe?	1 D.D.Hole
North FingerPost Hill	1M	?	
Little Hill etc. *	500,000	32.7% Fe?	
One Oak Hill	75,000	?	
GEORGE HILL *	400,000	35% Fe?	1 D.D.Hole
George Hill Extended*	50,000	?	
Blackfellow Hill *	50,000	?	
Claude Hill	500,000 ?	?	
Spitfire Paddock	2M ?	?	

TOTAL Say 15-20M Tons, possibly 35% Fe.

* indicates mapped on 100' to 1".

MT. CHRISTIE GEOLOGY

Itabirite striking 15° magnetic and dipping 75° west outcrops over a strike length of 2200' and to a maximum width of 240' in a hill 70'-110' above plain level. This area has been mapped on 100 Scale. (See Plan 61-318).

GEOPHYSICS

Four reconnaissance dip needle surveys have been made, two along the 2 diamond drillhole profiles over the outcrop and 2 immediately to the north. At least 3 more are required to test for southern extensions.

TESTING

Two diamond drillholes CD1 - 349' and CD2 - 386.5' penetrated itabirite from 71.5' to 301' (229.5') and from 143' to 348' (205') respectively.

TESTING (Contd.) Summarised Logs are:-

CD1	CD2	
0 - 71.5	0 - 143	Decomposed Schist.
71.5-150	-	Medium grained martite and magnetite itabirite.
150 - 250	143 - 259	Coarse grained magnetite itabirite with occasional acidic veinlets.
250 - 301	259 - 348	Medium and coarse grained magnetite itabirite with much chlorite and numerous acidic and one basic dyke.
301 - 349	348 - 386.5	Medium to coarse grained pink and grey "granite" with garnets.

Fifteen tons of surface material were collected for metallurgical testing early in 1961.

WORKINGS NIL

PRODUCTION NIL

RESERVES Outcrop Length 2200'

Maximum Width - 240' (surface), 220' (DD Hole-CD1)

Surface Area 251,000 sq. ft.

Both Diamond Drillholes CD1 and CD2 at vertical depths of 60' (Hanging Wall) to 250' (Foot Wall) show intersected widths comparable to that shown by the outcropping ore.

Indicated tonnage therefore is $2\frac{1}{2}$ M tons per 100 vertical feet or 6 M tons to 250'.

GRADE The following after Crawford 1957 are summarised results from 6 sample lines across the outcrop.

	Mean %	Range %	
Fe	52.4	44.5	58.1
Mn	0.04	0.03	0.06
SiO_2	19.3	8.44	33.1
CaO	0.28	0.12	0.52
MgO	0.11	0.06	0.17
Al_2O_3	1.86	1.62	2.64
P_2O_5	0.28	0.12	0.75
TiO_2	0.055	0.03	0.08
S	0.035	0.02	0.06

GRADE (Contd.)

	Mean %	Range %	
Total H_2O	2.65	1.41	3.85
H_2O at 105°C.	0.13	0.06	0.29

Assay results from the core of CD1 are:-

Sample	Acid Soluble Fe	Insoluble
70' - 150'	40.2 %	36.8 %
150' - 250'	36.7 %	43.9 %
Average 70-250'	38.2 %	40.7 %
250' - 300'	18.6 %	51.5 %
Average 70-300'	33.9 %	45.7 %

There is a significant difference in the assay results of the diamond drill samples and the surface samples suggesting surface enrichment. However an average grade of 33.9% over 230' or 38.2% over 180' seems likely.

METALLURGY

Surface weathering has partly converted the 100-500 micron magnetite to martite and minor limonite.

Sample 1 Surface Material, Hand Picked.

Test 1 Preliminary dry magnetic separation tests on surface samples at 18-20 mesh recovered 70-75% of the iron with a concentrate grade of 60-65% Fe. Spirals produced a higher grade concentrate but the limonite present on surface material showed a tendency to slime.

Sample 2 15 Tons from one four-foot bed 400' south of Trig. Results are after Sandman, 1961.

Test 2a Dry Magnetic Separation using a Dings Cross-Belt Magnetic Separator. 300 lb. of sample.

Feed		Fe Concentrate		
Grade %	Grind	Grade %	Recovery %	Weight %
49.5	-10 Mesh BSS	60.7	77.9	63.0

Test 2b As Test 2 with Tabling of Tails. 300 lb. sample.

Feed		Fe Concentrate		
Grade %	Grind	Grade %	Recovery %	Weight %
48.4	-18 Mesh BSS	64.9	80.4	60.5

METALLURGY (Contd.) Test 2c Low and high intensity dry magnetic separation on -18 mesh +300 mesh material with recleaning of high intensity concentrate after grinding to 100% -36 mesh.

Feed		Fe Concentrate		
Grade %	Grind	Grade %	Recovery %	Weight %
45.8	-18+300Mesh	62.3	70.5	51.8

Test 2d Rejection of tails by Stearns "Pick Up" Type Magnetic Separator.

Feed		Products		
Grade %	Grind	Fe Grade %	Recovery %	Weight %
46.1	-18 Mesh BSS	56.4	87.3	71.3
		38.9	10.7	12.7
		5.7	2.0	16.0

Test 2e Humphrey Spirals - One Batch Test on a 500 lb. sample with no recirculation of middlings.

Feed		Fe Concentrate		
Grade %	Grind	Grade %	Recovery %	Weight %
49.5	-10 Mesh BSS	62.2	57.9	46.2

Sample 3 Same as Sample 2 (15 tons surface material) Results are after Moskovits, 1961.

Test 3a Cationic Flotation.

Feed		Fe Concentrate		
Grade %	Grind	Grade %	Recovery %	Weight %
49.5-50.0	-72 + 150 Mesh BSS	61.3-67.7	87.1-97.2	47.1-68.0

Test 3b Anionic Flotation was unsatisfactory.

Sample 4 Same as Sample 2 (15 tons surface material) Results after Bollen, 1962.

Test 4 Humphrey Spiral Continuous Test.

Feed		Fe Concentrate		
Grade %	Grind	Grade %	Recovery %	Weight %
48.0	-18 Mesh BSS	62.8	77.5	59.2

Sample 5 Diamond Drill Core from CD.1.

Test 5a Determination of Magnetic iron content by Davis Tube Tests. Results after McPheat, 1961.

METALLURGY (Contd.) Operating conditions:- Water flow rate - 920 cos/minute

Strokes per minute - 78

Coil Current - 3.0 amps.

Grind - -52 Mesh

Results:-

Sample			Magnetics		
Footage	Acid Soluble Fe %	Magnetic Fe %	Acid Soluble Fe %	Recovery % Fe	Recovery % Weight
70'-150'	40.2	21.8	65.5	54.2	33.2
150'-250'	36.7	33.8	69.6	92.1	48.4
250'-300'	18.6	18.5	66.8	99.5	27.6
Averages					
70'-250'	38.2	28.5	67.8	75.3	41.6
70'-300'	33.9	26.3	67.6	80.5	38.6

Test 5b Humphrey Spiral Batch Test. Results after Bollen, 1961-62.

Feed			Concentrate		
Footage	Grade %	Grind	Grade %	Recovery %	Weight %
70'-150'	38.6	-18 Mesh	60.3	71.2	49.9
150'-250'	36.3	-18 Mesh	60.2	79.2	50.3
250'-300'	20.7	-72 Mesh	60.5	45.8	16.5
Averages					
70'-250'	38.2	-18 Mesh	60.24	75.6	50.1
70'-300'	33.9*	*	60.3	69.2	42.8

* -18 Mesh, 70'-250'; -72 Mesh 250'-300'.

Test 5c Dry Magnetic Separation after Bollen 1961-62.

Feed			Concentrate		
Footage	Grade %	Grind	Grade %	Recovery %	Weight %
70'-150'	38.6	-18 Mesh	57.9	70.3	48.0
"	"	-36 Mesh	61.3	69.6	44.6 ✓
150'-250'	36.25	-18 Mesh	64.9	89.9	57.3
250'-300'	20.7	-36 Mesh	55.6	87.2	32.5 ✓
"	"	-72 Mesh*	60.9	86.5	29.7 ✓

* Stage crushed and deslimed

METALLURGY (DISCUSSION)

The variation in grade between surface samples and diamond drill core suggests surface enrichment and indicates the desirability of subsurface testing on all similar projects.

However both surface and underground samples are easily treated by magnetic or gravity methods.

FINGERPOST HILL

LOCATION

$1\frac{3}{4}$ miles NW of Mt. Christie.

GEOLOGY:

Itabirite approximately 250' in stratigraphic thickness occurs on the nose of an anticline plunging north easterly at 30-40°. The outcrop forms a hill 50-100' above plain level. See Plan (61-315).

GEOPHYSICS

Two reconnaissance dip needle profiles suggest:-

(a) the nose of the fold contains iron formation for a horizontal distance of 900' beyond the outcrop of the hanging wall. The footwall would be approximately 900' below the surface at this point.

(b) the South-East limb which is attenuated in outcrop may be wider or may dip more flatly south east than the outcrop suggests.

TESTING

One diamond drillhole CD.3 (451')drilled on the nose of the fold at right angles to the plunge intersected iron formation from 57.5' to 437' with better grade material from 85' to 342'.

WORKINGS

NIL

PRODUCTION

NIL

RESERVES

Main outcrop 600' approximately by 350' approximately.

Height above plain level	50 - 100'
Surface Area	213,000sq. ft.
Depth Tested by Drilling	300'
Indicated Tonnage	2M tons per 100 vertical feet
	6M tons to 300'

GRADE

Crawford (1957) from one sample line reports -

Fe	51.2 %	Mn	0.07
SiO_2	19.2 %	CaO	0.48
MgO	0.12	Al_2O_3	1.44
P_2O_5	0.20	TiO_2	0.06
S	0.02		
Total H_2O	2.56	H_2O at 105°C	0.08

Pending metallurgical work the diamond drill core has not been assayed. By comparison with Mt. Christie however a subsurface grade of about 35% Fe may be expected.

METALLURGY

NO WORK TO DATE -

Awaiting finalised results on Mt. Christie.

OTHERS IN VICINITY OF FINGERPOST HILL

NORTH FINGERPOST HILL

Half a mile north of Fingerpost Hill.

900' NS by 125' x 30 above plain level. Reserves possibly 1M tons/100 vertical feet. Grade possibly 30-35% Fe.

LITTLE HILL

Half a mile east of Fingerpost Hill.

Four outcrops each 200-300' x 50'-100'. This area has been mapped on 100 Scale - See Plan 61-317.

Reserves possibly 0.5-1 M tons/100 vertical feet.

Grade:- One surface sample on the main outcrop assayed Fe - 32.7%; Mn - 0.05%; Insol. - 49.9%.

OTHERS IN VICINITY OF FINGERPOST HILL (Contd.)

ONE OAK HILL

One mile west of Fingerpost Hill.

300' NE-SW x 60' x 20' above plain level.

Reserves possibly 75,000 tons to 50 feet, or 150,000 tons/100 vertical feet.

Grade possibly 30-35% Fe.

GEORGE HILL

LOCATION — 2 miles SE of Mt. Christie.

GEOLOGY — Itabirite approximately 85' to possibly 100' in stratigraphic thickness occurs in the keel of a syncline plunging north easterly at 45°. The outcrop forms a hill 40' above plain level. See Plan 61-319.

GEOPHYSICS — No ground work has been done but reconnaissance dip needle surveys are desirable to determine continuity between outcrops.

TESTING — One diamond drillhole CD.5 (280') drilled on the keel of the fold at right angles to the plunge intersected canga from 0'-50' and martite itabirite from 50' to 135'.

WORKINGS — NIL

PRODUCTION — NIL

RESERVES

Main Outcrop is semicircular	300' x 150'
Height above plain level	40'
Surface Area	44,500 sq. feet.
Depth intersected by drilling	100'
Indicated Tonnage	400,000 tons/100 vertical feet.
ie.	1 M tons to 250'.

OTHERS IN VICINITY OF GEORGE HILL (Contd.)

CLAUDE HILL and CLAUDE HILL EXTENDED

1200' SE of George Hill.

Low ridges of steeply dipping iron formation.

Reserves 0.5M-1M ton/100 vertical feet.

Crawford (1957), from surface material quotes:-

Fe	49.9	Mn	0.06
SiO_2	26.4	CaO	0.68
MgO	0.11	Al_2O_3	1.54
P_2O_5	0.09	TiO_2	0.07
S	0.03		
Total H_2O	3.41	H_2O at 105°C	0.11

HILLS IN SPITFIRE PADDOCK

Further iron outcrops form hills on the north boundary of Spitfire Paddock. Reserves at 3000' x 100'(?) may possibly be 2 million tons of "average grade" per 100 vertical feet.

WEST WELL GROUP

For location see Plan S2476 attached.

This groups consists of a number of scattered outcrops, 20 miles WNW of Mulgathing Homestead. Most are small and Maximum Reserves are unlikely to exceed 1 M tons to 100'.

HILL ELEVEN

LOCATION — The outcrop is 1 mile NW of the Well.

GEOLOGY — Itabirite outcrops in a zone 800' x 250' on a small hill 30'-40' above plain level. The small scale folding present suggests that the outcrop is near the nose of a fold. Grain size of the iron oxide minerals is quoted as 350 microns. This area has been mapped on 100 scale. See Plan 61-316.

GEOPHYSICS — NIL

However a variation of 12° in magnetic north was noticed on the outcrop.

TESTING — The area has been mapped on 100 feet to 1 inch.

A 3 ton parcel has been collected for metallurgical testing. This work has been deferred pending final results on Mt. Christie.

WORKINGS — NIL

PRODUCTION — NIL

RESERVES — Surface Area of Zone of Outcrops 187,000 sq. ft.

However the proportion of eluvium is high - probably over 80% so that reserves are likely to be less than 0.5 M tons per 100 feet. A diamond drill site has been laid out to test the outcrop but drilling is not planned for the near future.

GRADE — Whitten (1960) reports 44.8% Fe, 31.2% insoluble for a surface sample. In view of the amount of eluvium and surface enrichment this grade requires checking.

OTHERS IN VICINITY OF WEST WELL

Small non economic outcrops run in a line south westerly from Hill Eleven, through Hilga South Paddock and across the NW corner of Merloo Paddock, a distance of approximately 5 miles. Whitten (1960) reports assays of 43.4% Fe, 34.1% insolubles and 48.2% Fe, 25.0% insolubles from surface samples from two of the many outcrops.

Centred 1½ miles south of West Well is a large anomaly, 3-4,000 gamma above background. Only a small area of jaspilite rubble has been found and the area may warrant further attention if and when the Mt. Christie Group 15-20 miles south west are being reinvestigated.

MUCKANIPPIE GROUP

LOCATION — This group lies in a small area approximately 6 miles NE of Mulgathing Homestead.

GEOLOGY — On a low (100') hill, 2,000' NS by 300' EW outcrop medium grained jaspilite beds 10' to 30' wide aggregating over 100'. Grain size of the iron ore minerals is reported as 100 microns.

GEOPHYSICS — Ground geophysics - NIL

TESTING — The area requires 100 scale mapping.
A 3 ton parcel has been collected for metallurgical testing. However as this does not appear to be entirely representative it is proposed to defer this work till the area has been mapped.

WORKINGS — NIL

PRODUCTION — NIL

RESERVES — Indefinite but possibly 2 million tons above plain level or 2 million tons per 100 feet.

GRADE — Whitten (1960) reports 50.2% Fe and 17.2% Insoluble for a representative surface sample. In view of the surface enrichment at Mt. Christie this figure may need to be discounted to perhaps 35-40% Fe. Underground testing is necessary to determine this.

OTHERS IN VICINITY — Small rubbly outcrops of ironstone with large barren areas in between occur over a length of $\frac{3}{4}$ mile and a width of 150 yards north easterly from the main outcrop. These occur on low hills.
Detailed mapping would be required to determine the true thickness.

DURKIN BORE GROUP

Small non economic outcrops occur as follows:-

(1) Durkin W - Mallee Hen Boundary. Gate on Mt. Christie Track. 38.8% Fe, 42.0% insolubles.

(2) Four Mile Paddock, One mile from Gate on Mallee Hen Boundary. 34.2% Fe, 48.0% insolubles. (after Whitten, 1960).

ARISTARCHUS TANK GROUP

(1) Half a mile east of the Tank.

Recrystallised jaspilite strikes NE and dips 45-60°SE.

Length 1000', Width 100 ft.(?)

Tonnage possibly 0.5-1 M tons/100 feet.

Grade 50.0% Fe, 23.9% insolubles (after Whitten, 1960).

(2) A small outcrop occurs half a mile to the north.

Both these groups have significance only in the interpretation of regional structures and the reserves quoted above have not been recorded in district totals.

NAME — WILGENA HILL and TARCOOLA DISTRICT

INCLUDES WILGENA HILL	40-60 M tons	40% Fe
Kenella Ironstone	1- 2 M tons	40% Fe
Hicks Hill	1 M tons	34% Fe
Big Tank Prospect	-	-
Commonwealth Hill	0.3 M tons	40% Fe

This report is concerned mainly with Wilgena Hill.

LOCATION — These deposits lie astride the East-West Railway, easterly from Tarcoola. Wilgena Hill is 2 miles north of the railway and 8 miles east of Tarcoola. For details of other outcrops see individual description.

ACCESS — Tarcoola is 314 miles by 4'8½" gauge rail from Port Pirie.

REFERENCES

(1) Brown, H.Y.L., 1908, "Record of the Mines of South Australia" 4th Edition, P.311. Extract from Annual Report of Government Geologist for the year ending 30th June, 1894.

(2) Crawford, A.R., 1956, "Ironstone Occurrence - South of Earea Dam, (Kenella Rock)," S. Aust. Min. Rev. 104.

(3) Hosking, P.K., and Moskovits, E.E., 1960, "Beneficiation of Low Grade Iron Ores, Tarcoola Deposits (ie. Wilgena Hill)," Australian Mineral Development Laboratories Report, No. A.M.D.L.-67, to S.A. Dept. of Mines, Unpublished.

(4) Moskovits, E.E., 1961 "Low Grade Iron Ores, Beneficiation of Low Grade Iron Ores by Flotation Methods" (Mt. Christie, Wilgena Hill, Braemar), Australian Mineral Development Laboratories Report No. A.M.D.L.-156, to S.A. Dept. of Mines, Unpublished.

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(6) Whitten, G.F., 1959, "Iron Ore Deposits and Aeromagnetic Anomalies near Tarcoola," S. Aust. Min. Rev. 108.

(7) Whitten, G.F., 1960, "Geological Reconnaissance of the Tarcoola Four-Mile Sheet & Eleven Adjoining One-Mile

REFERENCES (Contd.) (7)(Contd.)

Sheets, " Geol. Surv. S. Aust. Report, RB 50/162, 68 pages with reconnaissance 4-mile sheet (59-129), Unpublished.

CLIMATE, ETC. Long, hot summer, short mild winter. Rainfall at Tarcoola averages 6.14"/year having varied from 2.66" to 13.76". Evaporation rate is 76" per year.

TITLE Minerals belong to the Crown. However the Tarcoola District is withdrawn from the normal operation of the Mining Act. (S.A. Govt. Gazette, 12/10/61. See also S.A. Govt. Gazette 22/3/62 for amendments). Any request to mine in this area will be submitted to the Minister of Mines for special consideration.

GEOLOGY The deposits consist of Archaean iron formations of the Lake Superior Type in a complex of metasediments intruded by granites and porphyry of the Gawler Range type. The iron was precipitated as 2-10 micron flakes of hematite or goethite, less frequently as magnetite; the whole has been recrystallised during metamorphism into 2-30 (usually 5-10) micron range.

The Wilgena Hill Deposit consists of one large hill of jaspilite (4,000' NW-SE by 1000' SW-NE by 200-300' high) and three smaller ones (maximum 1000' by 500' by 200'). The rocks strike 150-160° Magnetic and dip 50-65°E. To the northwest they appear to have a faulted contact with a range of three quartzite hills which strike SW-NE and dip steeply.

The jaspilite consists of $\frac{1}{4}$"-1" (usually $\frac{1}{4}$"-to $\frac{1}{2}$") bands of red jasper separated by similar sized bands of martite after magnetite. The jaspilite beds are 5-80' wide (usually 20-40'), separated by 10-200' (usually 30-50') bands of limonite stained quartzite, schist etc. The jaspilite bands are widest at the top of the hill. One large dyke (100'?) and possibly one narrow dyke of

GEOLOGY (Contd.) porphyry intrude the hill. One quarter to one third of the hill is jaspilite.

GEOPHYSICS Aeromagnetic: The whole district has been covered by an aeromagnetic survey at 500' elevation and one mile flight spacings. Whitten (1959) records inspections of the anomalies on the Tarcoola Sheet and Whitten (1960) elsewhere in the district.

TESTING
(1) 5000' of grab sampling for grade.
(2) Surface sample (7 tons) for preliminary metallurgical testing - not representative.
(3) Surface sampling (3 tons) for further metallurgical testing - representative of one bed only.

WORKINGS NIL

PRODUCTION NIL

RESERVES

Main Hill:

4,000' long x 2,000' wide x 200-300' high.
Of this one quarter to one third is jaspilite.
Tonnage (of jaspilite) 40 M tons above plain level
20 M tons/100' thereafter.

S.E. Hill

1,000' long x 500' wide x 50' high.
Tonnage (of jaspilite) 0.5 M tons above plain level
1.0 M tons/100' thereafter.

N.N.E. Hill

1,000' long x 500' wide x 200' high
Tonnage (of jaspilite) 2.0 M tons above plain level
1.2 M tons/100' thereafter.

Small Hill near N.N.E. Hill

Tonnage (of jaspilite) 0.25 M tons above plain level.
0.25 M tons/100' thereafter.

GRADE

Main Hill

For a grab surface sample taken right across the hill, Whitten (1961) reports 41.0% Fe, 41.0% insolubles.

A combined surface sample of rock in situ and cemented scree from 2 places on the west slope of the hill assayed 43.4% Fe.

N.N.E. Hill

For a 300 yards (approx.) sample across the strike taken by collecting 1 cubic inch every 5' in jaspilite only Whitten (1961) reports 40.8% Fe and 41.7% insolubles.

The other 2 hills appear to have similar grades. A sample from Wilgena Hill and collected by a prospector assayed 56.1% Fe having come from an outcrop of rich jaspilite containing numerous veinlets and pods of secondary hematite At Mt. Christie much such surface enrichment occurs.

METALLURGY

Extract from Petrological Report on TS6091, PS5532 by M. J. Bucknell (A.M.D.L.) (after Whitten, 1960).

"Composition:- Hematite and Goethite 2-10 microns 25%
Quartz 2-25 microns 75%
Magnetite traces

Texture - The constituents are separated in sharp or partly graded bands varying in thickness from 15 microns to 1 m.m. Bands wider than 50 microns are persistent across the sections examined. The iron-rich bands have 60% of iron oxides, in an interlocking network of 2-10 micron flakes. Occasional grains are up to 15 microns and some of these have magnetite centres and are equant in shape."

Sample 1:- 7 tons of nonrepresentative surface material.

Petrological Summary:-

Mineral	Grain Size	Grain Count(202 grains
Quartz	5-30 microns	34%
Haematite	5-25 microns	62%
Magnetite		1½%
Limonite	5-30 microns ?	2½%
Pyrite		Trace
Clay		-

METALLURGY (Contd.) Summarised results after Hosking and Moskovits (1960.)

Flotation:- Feed was prepared by grinding 500 gram charges at 60% solids in a laboratory ball mill. Pulp density was then adjusted to 18% solids using Adelaide tap water.

Anionic Flotation:-

A summary of 21 tests suggest the following results:-

Feed		Concentrate		
Grade %	Best Grind	Grade %	Recovery %	Weight %
43.4	86% -200 mesh	60	60	40-45
		56	83	65-70

Two stage grinding, closer sizing and increased reagent consumption would help to improve results.

Cationic Flotation:-

Of 9 tests, 3 with different reagents gave encouraging results:-

Feed		Concentrate		
Grade %	Grind	Grade %	Recovery %	Weight %
43.4	88.5% -200 mesh	55.5	63.1	49.7
"	" "	58.3	58.5	43.3
"	" "	58.1	64.4	48.9

Cationic flotation proved faster and no recleaning was necessary.

Summarised results after Moskovits (1961).

Cationic Flotation:-

Feed		Concentrate		
Grade %	Grind	Grade %	Recovery %	Weight %
43.5	-200 mesh deslimed	57.0	81.7	62.1

Anionic Flotation:-

Feed		Concentrate		
Grade %	Grind	Grade %	Recovery %	Weight %
43.5	-200 mesh	59.6	57.6	42.3
	deslimed	55.6	76.3	58.6

KENELLA IRONSTONE

LOCATION	10 miles south of Earea Dam which is 32 miles east of Tarcoola.
ACCESS	Refer Crawford (1956)
GEOLOGY	Jaspilite striking NE-SW and dipping SE
GEOPHYSICS	Aeromagnetic Only.
TESTING etc.	NIL
RESERVES GRADE	Crawford reports 1½-2M tons of jaspilite assaying 38.6 - 43.0% Fe and 39.0 to 31.4% SiO_2. The tonnage may be over generous and not make sufficient allowance for schist. Surface enrichment may affect the grade.

HICKS HILL

LOCATION ACCESS	4.6 miles north of railway from a point 34.3 road miles east of Tarcoola
GEOLOGY	A hill approximately 800' EW by 200-400' NS by 50' high. The rocks strike E-W with near vertical dips. Jaspilite outcrops over 25-50% of the area and continue easterly but are lost eventually under sand.
GEOPHYSICS	Aeromagnetic only.
TESTING etc.	NIL
RESERVES	1 M tons for 100' below top of hill
GRADE	Whitten (1960) reports 34.3% Fe and 49.3% insolubles.

BIG TANK PROSPECT

LOCATION — 10 miles N.E. of Hicks Hill

GEOLOGY — A hill 150' high and a quarter of a mile in diameter is covered by jaspilite rubble so as to suggest three main jaspilite zones 20'-60' wide separated by cherty zones and softer rock. (See Whitten, 1960).

COMMONWEALTH HILL

LOCATION — 55-60 miles N. of Tarcoola.

ACCESS — Via Malbooma and Commonwealth Hill Homestead.

GEOLOGY — A hill 1000' NS x 400' EW and 50-100' high contains outcrops of itabirite 2 to 20 ft. wide (usually 5 to 10') separated by 10'-50' (usually 30'-40') areas of scree. Approximately 25% of the surface is outcrop.

RESERVES — Whitten (1960) suggests 0.3 M tons per 100'.

A surface sample taken across the hill assayed 40.8% Fe and 36.0% insolubles. Limonite indicates surface enrichment.

GENERAL REMARKS

Wilgena Hill is the only significant deposit, the main importance of the others being in the interpretation of regional structures. Hicks Hill, Kenella Rock and Big Tank Prospects are also of interest because the lack of lattice twinning in the hematite removes any certainty that all the iron oxide was once magnetite. Obviously recrystallisation and oxidation (and hence metamorphism) here has taken place under conditions different from those in the Mulgathing District.

Wilgena Hill is to be mapped on blown up aerial photos.

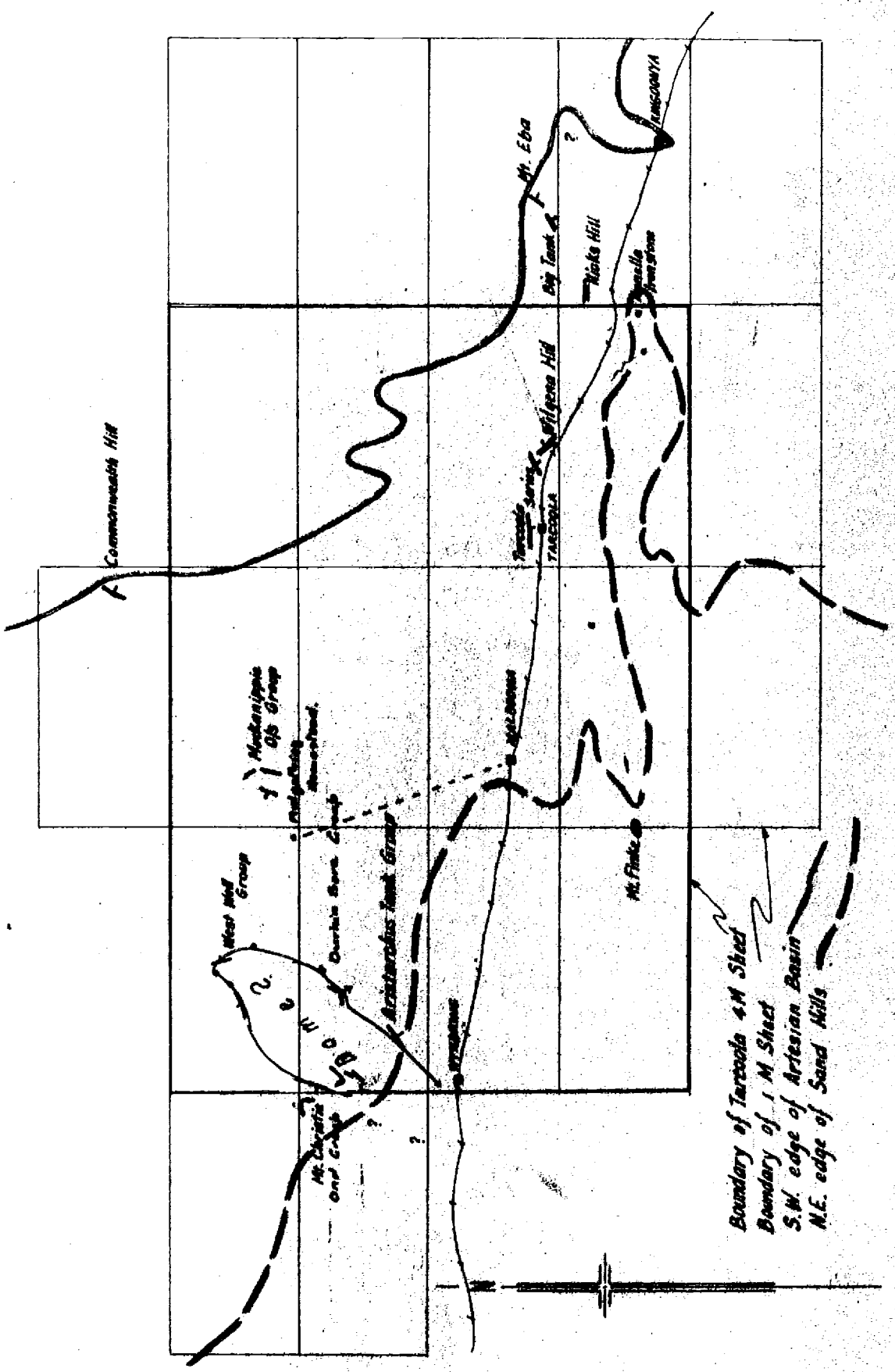
PLANS

S2476	Tarcoola District Precambrian Outcrops and Iron Formations (attached)	1" = 16 M
59-129	Tarcoola 4 M Sheet Reconnaissance Geological Sheet	1" = 4 M

NOTED BY G. F. Whitten

Date 6/4/62

PLATE 4



To accompany report by G.F. Whitten.

S.A. DEPARTMENT OF MINES					
Approved	Passed	Drn. G.A.W.	TARCOOLA DISTRICT	D.M.	Scale 1" = 16 M approx
		Tcd. J.E.	Precambrian Outcrops and Structures.	Req.	S 2476
		Ckd.	(Ironstone shown in Red)		B 6
Director		Exd.			Date 6-6-'60

200—8.60 2776