DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

IRON EXPLORATION SECTION

# SUMMARY REPORT
# ON
# KNOWN IRON ORE DEPOSITS

## MT. LOFTY - FLINDERS RANGES


| | | Page |
|---|---|---|
| 1. | Mt. Jagged | 1 |
| 2. | Wenhams | 2 |
| 3. | Peeralilla Hill | 3 |
| 4. | Mt. Bessemer Mine<br>Malcolm Creek<br>Williamstown Grits | 4 |
| 5. | Angaston | 5 |
| 6. | Hicks | 6 |
| 7. | Oodla Wirra | 7 |
| 8. | Donnelly's Comstock | 8 |
| 9. | Iron King | 9 |


by


Graham Whitten
Senior Geologist



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25th September, 1964.

## 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 have been issued by Provinces.

Summary Reports exist for:-

1. KNOWN IRON ORE DEPOSITS IN SOUTH AUSTRALIA OUTSIDE THE MIDDLEBACK RANGES. Issued December 1960.

2. CENTRAL PROVINCE Issued April 1962.
   Mulgathing District including Mt. Christie, Wilgena Hill and Tarcoola District.

3. OLARY PROVINCE Issued March 1962.
   Koolka, Billeroo, Plumbago, Old Toraminga Dam, Alconie Dam, Radium Hill District.

4. RAZORBACK RIDGE Issued March 1962.

5. WARRAMBOO Issued March 1962.

6. GREENPATCH Issued April 1964.

7. MT. LOFTY - FLINDERS RANGES

In addition the following geological reports give a general coverage.

1. KNOWN IRON ORE DEPOSITS OUTSIDE THE MIDDLEBACK RANGES
   RB 56/26 Issued January 1963

2. IRON IN SOUTH AUSTRALIA
   RB 56/31 Issued February 1963

Graham Whitten
Senior Geologist
IRON EXPLORATION SECTION

25th September, 1964.

NAME — MOUNT JAGGED IRON MINE
(5000 tons(?) 64-66% Fe 3.6 - 5.2% $TiO_2$).

LOCATION — Mineral Sections 10673 and Sections 718 and 719, Hundred Encounter adjoining Section 52, Hundred Encounter Bay and Section 37, Hundred Myponga, County Hindmarsh.

ACCESS — $6\frac{1}{2}$ miles from Myponga on the east side of the road to Hindmarsh Valley.

REFERENCES

1. Brown, H.Y.L., 1908 - "Record of Mines of South Australia", p. 332.
2. Horwitz, R.C., & Thomson, B.P., 1960 - "Milang 1 Mile Sheet", S.Aust. Dept. Mines, Geol. Atlas 1M Series.
3. Jack, R.L., 1915 "Mt. Jagged Iron Mine", S.Aust. Min. Rev. 23 p. 39 with plan.
4. Jack, R.L., 1922 "Iron Ore Resources of South Australia", Geol. Surv. S. Aust. Bull. 9, pp. 24-26.

TITLE — Freehold with mineral rights the property of the Government. Partly covered by Miscl. Lease 12568, Sec. 718, 319, Hundred Encounter Bay.

GEOLOGY — Irregular secondary quartz-ilmenite bodies in Archaean felspathic schists of the Mt. Compass - Yankalilla inlier.

DEVELOPMENT — Ore extracted from open cuts, ranging up to 15' deep. Exploratory shaft sunk 70', and 7' pit sunk adjacent to main working.

PRODUCTION — "Total quantity removed can hardly have exceeded 1000 to 2000 tons" (Jack, Bulletin 9, page 26). In 1873 the first pig iron in South Australia was smelted at this deposit using locally made charcoal.

METALLURGY — The $TiO_2$ content renders the ore difficult for normal smelting but the grade is high.

RESERVES — Surface area of bodies (from Bulletin 9) about 1000 square ft. Assuming continuity to 50', and density of 10 cub. ft./ton, reserves approx. 5000 tons. An inspection by the writer in 1961 disclosed small additions in Hundred Myponga, not shown on Jack's map.

GRADE

| Bulletin 9: | Fe | $SiO_2$ | MnO | $P_2O_5$ | $TiO_2$ |
|---|---|---|---|---|---|
| Average ore | 66.2 | 0.1 | 0.06 | nil | 5.2% |
| Second grade | 64.3 | 2.1 | 0.01 | nil | 4.6% |

RECOMMENDATIONS / REMARKS — Too small to warrant development at present but possibly could add to the tonnage of other small deposits in the district if titanium rich ore is required for export.

PLAN — Bulletin 9, p. 25, Milang 1M Geological Map.

Noted by — G.F. Whitten, Senior Geologist, Iron Exploration Section

Date — 11.IX.64

NAME — WENHAMS IRONSTONE DEPOSIT
(50,000 tons, 40-45% Fe)

LOCATION — Section 85, Hundred Myponga, County Hindmarsh.

ACCESS — 4 miles east of Yankalilla

REFERENCES
1. Campana, B., & Wilson, B., 1954 - "Yankalilla 1 Mile Sheet", S.Aust. Dept. Mines, Geol. Atlas 1 M Series.
2. Campana, B., & Wilson, R.B., 1953 - "The Geology of the Jervis and Yankalilla Military Sheets". Geol. Surv. S. Aust., Rept. Investig. 3.
3. Heath, G.R., 1961 - "Iron Occurrences, Section 85, Hundred Myponga, D.A. Wenham". Geol. Surv. S. Aust. Rept. RB 53/94.

TITLE — Minerals are the property of the government.

GEOLOGY — Massive, coarse grained magnetite, partly altered to martite and goethite outcrops in a zone 200' x 100' in Archaean metasediments. Refer Heath (1961) for details.

DEVELOPMENT — One shallow pit.

PRODUCTION — Nil

RESERVES — 50,000 tons above lowest outcrop; alternately 170,000 tons/100'.

GRADE — 44.3% Fe; 0.16% $TiO_2$; 31.6% Insolubles.

METALLURGY — Davis Tube tests on -52 mesh B.S.S. material recovered 79.9% of the iron at a grade of 65.7% iron. The tonnage is probably too small to support a beneficiation plant.

REMARKS — This deposit has unusually low $TiO_2$ for an Archaean deposit in the area.

PLANS — Geological Plan 61-666 Heath (1961)
Yankalilla 1M Sheet

Noted by — G.F. Whitten, Senior Geologist, 8.3.1963.

NAME — PEERALILLA HILL
(100,000 - 400,000 tons, 45-50% Fe)

LOCATION — Section 264, Hundred Goolwa, County Hindmarsh.

ACCESS — Seven miles north of Victor Harbour.

REFERENCES

1. Brown, H.Y.L., 1908 - "Record of Mines of South Australia." p. 332.
2. Heath, G.R., 1962 - "Peeralilla Hill Iron Deposit", Report Geol. Surv. S.Aust. RB 54/22.
3. Horwitz, R.C., & Thomson, B.P., 1960 - "Milang 1 Mile Sheet", S.Aust. Dept. Mines., Geol. Atlas 1M Series.
4. Jack, R.L., 1915 - "Peeralilla Iron Deposit".S.Aust. Min. Rev. 23 pp. 38-39.
5. Jack, R.L., 1922 - "The Iron Ore Resources of South Australia". Geol. Surv. S.Aust. Bull. 9, pp. 26-28.
6. Mansfield, L.L., 1947 - "Peeralilla Iron Deposit". S.Aust. Min. Rev. 86, pp. 118-120.
7. Moskovits, E.E., 1962 - "Peeralilla Iron Ore Beneficiation Tests". Aust. Min. Dev. Lab. Rept. to S.Aust. Dept. of Mines, Unpub.
8. Whitten, G.F., 1962 - "Summary Report on Metallurgical Testing of Peeralilla Hill Laterite". Report Geol. Surv. S.Aust. RB 55/125.

TITLE — Freehold, mineral rights are the property of the Government.

GEOLOGY — The deposit consists of earthy and nodular limonite in quartz sand matrix (Tertiary Laterite). It is underlain by a limonitic quartz sandstone and is bounded on the west side by weathered fine grained Kanmantoo (Cambrian) metasediments.

DEVELOPMENT — Superficial, shallow surface workings over most of the deposit. Two shafts. One on the north-west bench (20') and "New Shaft", in south-east (10').

PRODUCTION 8-10,000 tons as flux (Jack, 1922)

4,000 tons as roadmetal (Mansfield, 1947).

RESERVES Approximate dimensions: 700' x 250'.

Thickness: 45'-50' from base of concretionary ore at north end to summit.

Variable thickness and density make tonnage calculations difficult. Reserves probably lie in the range 100,000 - 400,000 tons.

GRADE Whitten (1962) for a bulk sample of 580 lbs. records:-

Chemical Analysis

| | | | |
|---|---|---|---|
| Total Fe | 39.35% | Acid Soluble Iron | 39.30% |
| $SiO_2$ | 21.55 | Mn | 0.10 |
| CaO | 0.07 | MgO | 0.12 |
| $Al_2O_3$ | 2.70 | $TiO_2$ | 0.30 |
| P | 0.12 | S | 0.04 |

Spectrographic Analysis

| | | |
|---|---|---|
| Trace | 0.01 - 0.1% | Pb, Mn, Ca, Ti |
| Faint Trace | 10 - 100 ppm | Cu, Zn, Ni, Cr, V, Ba |
| Very Faint Trace | 1 - 10 ppm | Co, Sn, Ag, Mo, B, Sr |

Others

See also Brown (1908), Jack (1922) and Record Book 5/62 which quote grades of 45.9 to 55.4% Fe with moisture content of 12.0 to 15.3%.

METALLURGY Because of the intimate association of the iron minerals and the gangue, screening, gravity and magnetic methods, flotations and roasting have been unable to produce a high grade concentrate with high recovery. Best results could possibly be achieved by roasting Wilfley Table concentrates to produce a product assaying approximately 59% Fe with a recovery of 54.0%. More effective concentration is not possible except by fine grinding. As reserves are small a high capital expenditure is unwarranted.

RECOMMENDATIONS Further geological or metallurgical work can not be
REMARKS justified. Peeralilla Hill is the highest grade of a number of lateritic deposits mapped on the Milang Sheet.

RECOMMENDATIONS REMARKS (contd.) These can best be utilised as sources of road metal for gravel roads

PLANS S2996, Heath (1962); Jack (1922)

See also - Adastra Aerial Photo 44-50, Milang Run 11 and Milang 1M Geological Sheet. (Not differentiated from less ferruginous lateritic material).

Noted by G.F.W., G.R.H. (3.10.61), G.F.W. (8.3.63).

NAME — WILLIAMSTOWN DISTRICT

(1) Mt. Bessemer Mine
(2) Malcolm Creek
(3) Williamstown Grits

LOCALITY

(1) Sec. 170, etc., Hd. Barossa, Sec. 286 etc. Hd. Para Wirra.
(2) Sec. 32 etc., Hd. Para Wirra
(3) Sec. 119, 125-127, 135, 138, Hd. Barossa

ACCESS

All these deposits lie adjacent to gravel roads in the Williamstown District 30 road miles from Adelaide.

REFERENCES

1. Armstrong, A.T., & Betheras, F.N., "Williamstown Titaniferous Hematite Deposit". S.A. Dept. Mines, Mining Branch Report 36-100 (Unpub.).

2. Bollen, L., 1962., "Malcolm Creek Iron Ore". Aust. Min. Devpt. Lab. Report 200 to S.A. Mines Dept. (Unpub.)

3. Jack, R.L., 1922, "The Iron Ore Resources of S. Australia". Bull. Geol. Surv. S.Aust. 9.

4. King, D., 1953, "The Investigation of Titaniferous Hematite in Basal Adelaide System Sediments near Williamstown" Report Geol. Surv. S.Aust. 35/105 (unpub.).

5. Moffitt, P.B., 1961. "Titaniferous Hematite Grits". Aust. Min. Devpt. Lab. Rept. 121 to S.A. Dept. of Mines (unpub.).

6. Smith, A.D., 1953. "Recovery of Hematite from Williamstown Grits". S.A. Dept. Mines Metall. Branch Report 56 (unpub.).

7. Whitten, G.F., 1965. "Known Iron Ore Deposits in S. Australia outside the Middleback Ranges." In 8th Emp. Min. Metall. Congr. I, Geology of Australian Ore Deposits.

8. Whitten, G.F., & Willington, C.M., 1960. "Summary of Known Iron Ore Deposits in S.Australia outside the Middleback Ranges". S.A. Dept. Mines Report 51/249 (Unpub.).

9 Miles. Bulletin 24

TITLE — Minerals in some parts of the district are privately owned, elsewhere owned by the Government. The area surrounding the Mt. Bessemer Mine has been declared a Water Reserve and no mining is allowable.

GEOLOGY — The ferruginous horizons are the lowest members of the Aldgate sandstone which is the basal member of the Adelaide system in the area. These unconformably overlie Archaean of the Houghton - Barossa Inlier. The beds vary laterally and vertically in grade. Shearing along the unconformity has converted the iron minerals to micaceous hematite.

GEOPHYSICS — Nil

WORKINGS
(1) Mt. Bessemer Mine - See Jack 1922.
(2) A small number of shallow pits have tested outcrop
(3) Nil

PRODUCTION
(1) Details not known
(2), (3) Nil, samples for metallurgical testing only.

RESERVES
(1) The area is no longer available for mining
(2) 1,000,000 tons/100'.
(3) Extremely large!

GRADE

| | (1) | (2) a | (2) b | (3) a | (3) b |
|---|---|---|---|---|---|
| Iron % | 53.8 | 35.3 | 62.0 | 7.7 | 61.1 |
| Silica % | 18.3 | - | 8.0 | - | - |
| Insoluble % | - | 50.0 | 9.6 | - | - |
| $TiO_2$ % | 0.65 | 0.6 | 0.81 | 1.24 | 8.0 |

(1) Mt. Bessemer Mine
Average of 9 samples, (Jack, 1922)
(2) Malcolm Creek
(2a) Average of 16 surface samples collected by King, Whitten.
(2b) Grade of concentrate produced by dry magnetic separation (Bollen, 1962)
(3) Williamstown Grits
(3a) Average of surface samples collected by King (Smith, 1953)
(3b) Average grade of concentrate (Smith, 1953).

METALLURGY — Hematite is the major iron ore mineral. Titanium is present as oriented ex-solution bodies of rutile usually less than 20 microns in size.

RECOMMENDATIONS) It is possible to produce a concentrate containing over
REMARKS ) 60% Fe but the high Titanium content limits its uses.

PLANS — S 746 Hematite Deposits, Williamstown District
62-13 Malcolm Creek Hematite Occurrences

Noted by — G.F. Whitten, Senior Geologist

Date — 21.IX.64.

NAME — ANGASTON IRONSTONE
(100,000 tons?, 60%?)

LOCATION — Lot 759, Section 1735, Hundred Moorooroo
This is described as typical of a number of small surficial replacements in limestone in the Angaston District.

ACCESS — 1 mile north of Angaston. Angaston is 50-55 rail miles from Port Adelaide.

REFERENCES

1. Coats, R.P., & Thomson, B.P., 1959 - "Truro 1 Mile Sheet". S.Aust. Dept. Mines, Geol. Atlas 1M Series.
2. Jack, R.L., 1922 - "The Iron Ore Resources of South Australia", Geol. Surv. S.Aust. Bull. 9, p. 29.
3. Johns, R.K., 1949 - "Limestone Deposits - Hundred of Moorooroo". S. Aust. Min. Rev., 90, pp. 152-159.
4. Johns, R.K., 1961 - "Iron Ore Deposits, Hundred of Moorooroo, Allotment 759, Sec. 1735". Report Geol. Surv. S.Aust. R.B. 53/76.
5. Whitten, G.F., 1963a - "Ironstone, Lot 759, Sec. 1735, Hundred Moorooroo". File Memo. D.M. 880/61.
6. Whitten, G.F., 1963b - "Micaceous Hematite Deposit, Sec. 311, Hundred of Moorcoroo". Geol. Surv. S.Aust. Report GS 2733 (Unpub.).

TITLE — Minerals alienated from the crown, i.e. privately owned.

GEOLOGY — The ironstone comprises irregular bodies of hematite surficially replacing limestone (Cambrian) or breccia in sinkholes (see E wall of entrance to main cut) during the Tertiary period of peneplanation.

DEVELOPMENT / PRODUCTION — One larger quarry and 6 smaller ones have produced 2,000 tons of flux (Jack 1922) and 2,500 tons for cement manufacture (Brighton Cement, 1955).

RESERVES — Area mapped as ironstone (Johns, 1949) 150,000 c.ft.
Add 1/3 + for extensions to north (Whitten, 1963) 200,000 s.ft.

RESERVES (contd.)

Assume replacement to 20' only = 4,000,000 cft.

Discount to 25% ironstone 1,000,000 cft.

Possible Reserves (10 cft/ton) 100,000 tons

Much of the ore may be in small pockets or narrow replacements along joints, more favourable beds or in sink holes and hence may be difficult to extract.

GRADE

Johns - 1961 quotes

| | Pseudo-Breccia | Massive Hematite | Powder Hematite |
|---|---|---|---|
| Total Fe | 47.0 % | 64.9 % | 58.1 % |
| Mn | 0.11 | 0.13 | 0.12 |
| $P_2O_5$ | 0.42 | 0.09 | 0.03 |
| $SiO_2$ | 19.1 | 1.40 | 12.8 |

METALLURGY

Direct Shipping, in part.

The remainder could probably be recovered by simple gravity methods.

REMARKS

Apparently such small surficial replacements occur at intervals throughout the district. There is thus a possibility that a small quarrying contractor could produce useful tonnages from various deposits.

PLAN

61-570 Johns (1949, 1961) revised by Whitten (1963)

Noted by

G.F. Whitten, Senior Geologist 11.IX.64.

NAME — HICK'S IRONSTONE QUARRY, GLADSTONE
(30,000 - 100,000 tons, 60% + Fe)

LOCALITY — Section 181, 182, Hundred Yangya, County Victoria

ACCESS — 3.6 miles N.E. of Gladstone, approximately ½ mile north of the Gladstone - Caltowie Road.

REFERENCES

1. Buist, D.S., 1955 - "Iron-ore Deposit near Gladstone". Report Geol. Surv. S.Aust. R.B. 41/83.

2. Mansfield, L.L., 1946 - "Ironstone Deposit, Gladstone - Hicks Quarry". Report Inspector of Mines, S.Aust., R.B. 21/223.

3. Whitten, G.F., 1965 - "Known Iron Ore Deposits in South Australia outside Middleback Ranges". In 8th Emp. Min. Metall. Congr. I, Geology of Australian Ore Deposits (In press).

TITLE — Surface rights freehold (R.E. & E.D. Woolford, Gladstone). Mineral rights alienated in the name of Gladys Roberta Hicks (Gladstone) (1963).

GEOLOGY — The ironstone is a magnetite replacement in banded shales underlying quartzite equated with the Aldgate Sandstone (Torrensian i.e. Upper Proterozoic). However a decomposed basic volcanic, a diapiric breccia containing elements of Willouran (?) rocks and iron ore, and also a weathered dolerite strongly suggest a diapiric association.

DEVELOPMENT — An open cut approximately 330'NS x 100'EW x 60'+ deep has been worked, final extraction apparently being by crane.

PRODUCTION — The S.A. railways record 71,000 tons railed from Gladstone in the period 1895 - 1902. As no production is known from other deposits in the district this is assumed to have come from Hick's Quarry. This production is equivalent to 1,000 tons + per vertical foot.

RESERVES

Assuming a surface area as mapped original reserves could have approximated 200,000 tons/100 vertical feet.

Assuming the present quarry floor approximates the floor as worked, remnants remaining above floor level lie in the range 30-50,000 tons.

GRADE

| Sample Number:- | A107/62 | A100/62 | A109/62 | A110/62 |
|---|---|---|---|---|
| Acid Sol. Fe | 56.7 % | 61.3 % | 59.9 % | 62.8 % |
| Insolubles | 7.3 | 8.0 | 6.65 | 5.7 |
| $SiO_2$ | 5.65 | 6.4 | 5.15 | 4.85 |
| Mn | 0.031 | 0.025 | 0.026 | 0.011 |
| CaO | 4.0 | 0.40 | 1.25 | 0.65 |
| MgO | 0.21 | 0.15 | 0.11 | 0.09 |
| $Al_2O_3$ | 0.64 | 0.68 | 0.22 | 0.40 |
| $P_2O_5$ | 3.23 | 1.28 | 2.87 | 0.91 |
| $TiO_2$ | 1.05 | 0.18 | 0.61 | 0.15 |
| S | 0.004 | N.F. | 0.09 | 0.005 |

Location:

| | | | |
|---|---|---|---|
| A107/62 | S.Wall | 23' | (Kunkarised?) |
| A108/62 | E.Wall | 80' | S. end |
| A109/62 | E.Wall | 65' | Centre |
| A110/62 | W.Wall | 105' | N. End |

N.F. = Not found.

Note the high $P_2O_5$ Assays.

METALLURGY

Direct Shipping Ore.

The primary mineral is magnetite altered in part to martite and then to goethite. No phosphorus minerals were identified in thin sections prepared from A107, 108 and 110/62 (See P71,72, 73/62). As the quarry is used to store water, the iron ore remnants are coated by deposits impossible to avoid when sampling and possibly containing high phosphorus values.

REMARKS

A possible source of export ore on a small scale only.

PLANS

Pirie 1M Sheet, Run 5, Photos 2566, 2567.

62-100, Whitten, G.F. (1962) (1" = 100').

Noted by

G.F. Whitten & W.R. Appleby
Revised G.F. Whitten 21.IX.64.

NAME — OODLAWIRRA FLUX QUARRIES
(20,000-50,000 tons, approx. 51% Fe)

LOCATION — Sections 83, 127-128, Hundred Coglin.

ACCESS — 5 miles by gravel roads and tracks NNE of Oodla Wirra Railway Station which is 80 rail miles (3'6" gauge) from Port Pirie.

REFERENCES

1. Brown, H.Y.L., 1908, "Record of the Mines of S. Australia", 4th Edition, p. 332.
2. Jack, R.L., 1920, "Report on Ochre Lease, Sec. 83, Hundred Coglin", S.Aust. Min. Rev. 33, pp. 60-61.
3. Jack, R.L., 1922, "The Iron Ore Resources of South Australia", Geol. Surv. S. Aust. Bull. 9, pp. 22-24.
4. Jack, R.L., 1928, "Pigment Minerals in South Australia", Geol. Surv. S.Aust. Bull. 13, p. 59-90.
5. Whitten, G.F., 1962, "Geological Plan 62-700. 1" = 10 chains.

TITLE — Pastoral Lease

Minerals are the property of the Government.

GEOLOGY — The deposit consists of a number of irregularly distributed lenses of ironstone in a zone $2\frac{1}{2}$-3 miles north-south by $\frac{1}{4}$-$\frac{1}{2}$ mile east-west. The country rock consists of sandstones, shales and limey shales with minor dolomites and quartzites. These have been brecciated along the core of a major fold which is crossed by a fault. A diapiric structure may exist immediately to the north.

Replacement occurs where a breccia zone crosses favourable beds. Much of this replacement is limonite with minor hematite resulting in the formation of a number of disconnected medium and high grade iron ore bodies. At some locations the replacement is siliceous resulting in quartzite breccia "blows" which may contain some limonite.

GEOLOGY (contd.)

The host rock is Upper Proterozoic. Some of the silicification may be related to quartz veins formed during folding. The limonite appears to be related to the existing landsurface i.e. Tertiary to Recent weathering.

GEOPHYSICS

Aeromagnetic: Nil

Ground geophysics: Nil

WORKINGS

No. 1 (South) Workings (Sec. 83)

Three shallow cuts or small quarries in an area 200'EW x 250'NS worked narrow zones of high grade limonite. There are also a number of small surface pits on limonite. One shaft to 108'(?) exposed 22' of yellow ochre in a crosscut on the 98' level.

No. 2 (Central or Main) Workings (Sec. 128)

The main open cut is 500' NS by 10'-50' wide by 0 - 40' deep. It was opened as a series of benches on a spur exposing limonite from 5-40' wide. Limonite is exposed on part of the south face, at intervals on the walls and on the floor at the north end.

Parallel veins 100-300' westerly have been tested by shallow pits but were too narrow to be worked.

No. 3 (North) Workings (Sec. 127)

A limonite zone 80' wide has been tested by three shallow cuts to approx. 10'.

Miscellaneous Workings

Just south of No. 3 workings an opening 40' x 20' by 30' deep tests a limonite zone on the banks of Nackara Creek. A 300' adit said to exist nearby could not be found by the writer but the brow possibly could be hidden by caved material in the cut.

WORKINGS (contd.)

Approx. 2000' North of No. 3 workings, 2 or 3 shallow shafts or pits test a zone containing asbestiform minerals.

Immediately south of No. 2 Workings an area has been tested for alluvial gold.

A shaft at the No. 1 workings has produced ochre which was sold either as yellow ochre (as mined) or as red ochre (calcined).

PRODUCTION

No. 1 Workings:- 4000 tons limonite flux
50? tons ochre

No. 2 Workings:- 12000 tons of flux grading 57% Fe.
This was handpicked from 12000 tons of waste and low grade material.

No. 3 Workings:- 2000 tons of flux grading 51% Fe.

Total Output 18000 tons of +51% Fe sold for £21,101 delivered. All the material was hand picked and production ceased about the time Iron Knob was started up.

RESERVES

As the ore is a surficial replacement by limonite of breccia zones it is unlikely to continue to depth. Modern methods make hand picking uneconomic; even so reserves are small possibly in the range 20-50000 tons.

GRADE

| | Iron Fe | Silica $SiO_2$ | Alumina $Al_2O_3$ | Sulphur S | Phosphorus P | Water -100°c | Water +100°c | Loss on ignition |
|---|---|---|---|---|---|---|---|---|
| No. 1 Workings | | | | | | | | |
| Raw Ochre* | 32.55 | 43.55 | 2.96 | ND | ND | | | 8.2 |
| Calcined Ochre | 28.53 | 49.72 | 4.71 | ND | ND | 1.64 | 2.29 | |
| No. 2 Workings $\bar{y}$ | 51.52 | 7.84 | 6.89 | 0.07 | 0.47 | 0.54 | 10.34 | |
| No. 3 Workings $\bar{y}$ | 51.98 | 9.36 | 5.89 | 0.03 | 0.21 | 0.51 | 9.83 | |

* Mean of 4 assays

$\bar{y}$ hand picked

REMARKS — This deposit was worked as flux about the turn of the century before Iron Knob was discovered. In view of the small reserves and the necessity of hand picking it seems unlikely that it will be worked further.

PLANS — Three-quarters of a mile SW of Oodla Wirra Railway Station and 200 yards from the railway another limonite deposit has been worked in a small way for ochre. See Jack (1928).

PLANS — Nackara 1 Mile Mosaic, Photos 7379, 7380, Run 2.

Geological Plan 62-700, 10 chains to 1 inch, G.F. Whitten

Noted by — G.F. Whitten

Date — 22.IX.64

NAME — DONNELLY'S (COMSTOCK) IRONSTONE QUARRY
(300,000 - 350,000 tons approx. 50% Fe)

LOCATION — Section F, Hundred Yarrah, Co. Newcastle.

ACCESS — 14 miles N. of Quorn which is 25 miles by 3'6" gauge rail from Port Augusta. Regular services are not now maintained on this line.

REFERENCE

1. Armstrong, A.T., 1937. Donnelly's Ironstone Quarries, S.Aust. Min. Rev. 66, pp. 75-76.

2. Brown, H.Y.L., 1908. Record of Mines of South Australia, 4th Ed., pp. 332-3.

3. Brown, H.Y.L., 1910. Iron Ore Deposits of South Australia, Int. Geol. Cong. 11th, Stockholm, Iron Ore Resources of the World, Vol. 2, pp. 837-840.

4. Jack, R.L., 1922. The Iron Ore Resources of South Australia, Geol. Survey S.Aust. Bull. 9. pp. 44-48, with Plan.

5. Kingsbury, C.J.R., 1955. Mt. Arden (Copper) Mine, S.Aust. Min. Rev. 103, pp. 89-93.

6. Webb, B.P., and Von der Borch, C., 1962. "Willochra 1 Mile Sheet." S.Aust. Dept. Mines geol. Atlas, 1M. Series.

7. Whitten, G.F., 1962. Contoured Geological Plan 62-701, 1" = 200'.

TITLE — Minerals are the property of the Government.

GEOLOGY — The deposits occur near the keel of a syncline in shales, limey shales and sandy siltstones of basal Cambrian Age. These overlie conformably the Pound Quartzite (Upper Proterozoic). Four groups of ore-bodies occur, the north-eastern, the north-western, the south-eastern or main quarry and the south-western group. The ore consists of limonite, with a little hematite, and has more or less completely replaced some beds near their outcrops.
The orebodies form a zone which can be traced round

GEOLOGY (contd.) the keel of the syncline. Adits and creek exposures prove that the ore does not persist in depth.

GEOPHYSICS Nil

WORKINGS (1) North-eastern outcrop.
Length 700', Average width 40', Depth exposed 30', Depth assumed 50', Tonnage Factor 10 c.ft./ton, Reserves 140,000 tons, Grade 48.4% Fe. A cut 30' x 70' x 30' exists on this body.

(2) South-eastern or Main Outcrop
Surface area 40,000 s.ft., Depth Exposed 40', Average depth assumed 30', Tonnage Factor 12 c.ft./ton, Reserves 100,000 tons, Grade 51.7% Fe. A quarry exposes 40' of ore near the centre of this body.

(3) North-western Outcrop.
Length 400', Average width 16', Mean Depth 30', Tonnage Factor 12 c.ft./ton. Reserves 16,000 Tons. A caved adit may test this body.

(4) South-western group of outcrops.
A number of superficial outcrops aggregating 63,000 tons occur. These have been tested by an adit, pits etc. Manganiferous ore also occurs.

PRODUCTION In 1890's 17,500 tons to Port Pirie for flux.

RESERVES Recent detailed Mapping (Whitten, 1962) confirms the figures suggested by Jack (1922) viz. 300,000 tons with a possible upper limit of 350,000 tons. The ore is a superficial replacement of country rock by limonite and the bodies are likely to cut out at shallow depths.

GRADE An arithmetic average of results for 11 samples of the better grade unmanganiferous ore gives 53.0% Fe, 7.9% insolubles, with the iron values ranging from 48.4 to 58.7 and insolubles ranging from 0.7 (for limonite) to 15.8%. Little is known of the origin of some of these samples (hand picked samples?) or of the tonnage each

GRADE (contd.)

represents. Jack (1922) following an inspection suggested 49.17% Fe, 14.71% insol., 1.60% $P_2O_5$, 0.06% S and 9.44% $H_2O$, an assessment somewhat too detailed for the information available.

Manganese Assays of 34.50 (Brown, 1908) and 30.99 (Jack, 1922) are recorded, the latter from the south-western outcrops.

REMARKS

The individual lenses are too small and too low grade to be considered iron ore under present economic conditions.

PLANS

Hundred Yarrah

Photo 7194, Willochra, Run 4 and Photo 8336, Willochra Run 3

Willochra 1M. Geological Sheet

Geological Plan 62-701, 1" = 200'.

Noted by

G.F. Whitten, Senior Geologist

Date

22.IX.64.

NAME — IRON KING MAGNETITE DEPOSIT

50,000 tons?, 66% Fe.

LOCALITY — PL's 1665, 1665 A, Hd. Adams, Co. Hanson

ACCESS — 26 road miles E and N.E. of Hawker via Shaggy Ridge Homestead, Hawker is 204 rail miles from Pt. Pirie.

REFERENCES

1. Brown, H.Y.L., 1908 - "Record of Mines of South Australia," p. 63.

2. Crawford, A.R., 1957 - "Iron King Magnetite Deposit". S.Aust. Min. Rev. 106 p. 63.

3. Whitten, G.F., 1961 - "Iron King Deposit". File Memo. D.M. 1418/61.

TITLE — Minerals are the property of the Government. No mining titles as at 14.IX.64.

GEOLOGY — The magnetite deposit occurs in a sandstone - chocolate shale - dolomite-sandstone sequence with altered dolerite in the Worumba diapir. Of approximately 40 ferruginous outcrops 3 only are significant. A line of copper mineralisation in shears occurs immediately south of the main line of outcrops.

GEOPHYSICS — Seven dipneedle traverses have been read (See Plan 61-787); Aeromagnetics - nil.

WORKINGS — One shaft (130') immediately north of the main outcrop, a number of small pits, shallow shafts and costeans elsewhere, especially on the copper line.

PRODUCTION — Nil

RESERVES — Main Outcrop:
Surface area is 4500 s.ft. Assuming a depth extent equal to half the strike length possible reserves could lie in the range 30-35,000 tons.

RESERVES (contd.)

Eastern Outcrops: Possibly similar tonnage.

No testing in depth has been carried out.

GRADE

Chemical Analysis:

| Sample No. | A3001/61 | A3002/61 | A3003/61 | A3004/61 |
|---|---|---|---|---|
| Acid Sol.FE | 66.4 | 65.8 | | |
| Mn | 0.035 | 0.035 | | |
| Cu | | | 6.35 | 2.90 |
| Insolubles | 1.26 | 5.75 | | |
| Silica | 1.08 | 3.32 | | |
| $Al_2O_3$ | 0.20 | 0.42 | | |
| CaO | 1.45 | 0.275 | | |
| MgO | 0.095 | 0.035 | | |
| $TiO_2$ | 0.045 | 0.055 | | |
| $P_2O_5$ | 0.65 | 0.13 | | |
| S | 0.5 | 0.12 | | |

LOCATION

A3001/61 Main Outcrop (near H1 Shaft)

A3002/61 Outcrops 700-800' NE.of Main Outcrop (H9)

A3003/61 35' Shaft, 400'SW. of Main Outcrop (H2)

A3004/61 48' Shaft, 250' ENE. of Main Outcrop

METALLURGY

Direct shipping ore, magnetite partly altered to martite and goethite. Apatite and a titanium mineral have been recorded, as well as gold.

RECOMMENDATIONS / REMARKS

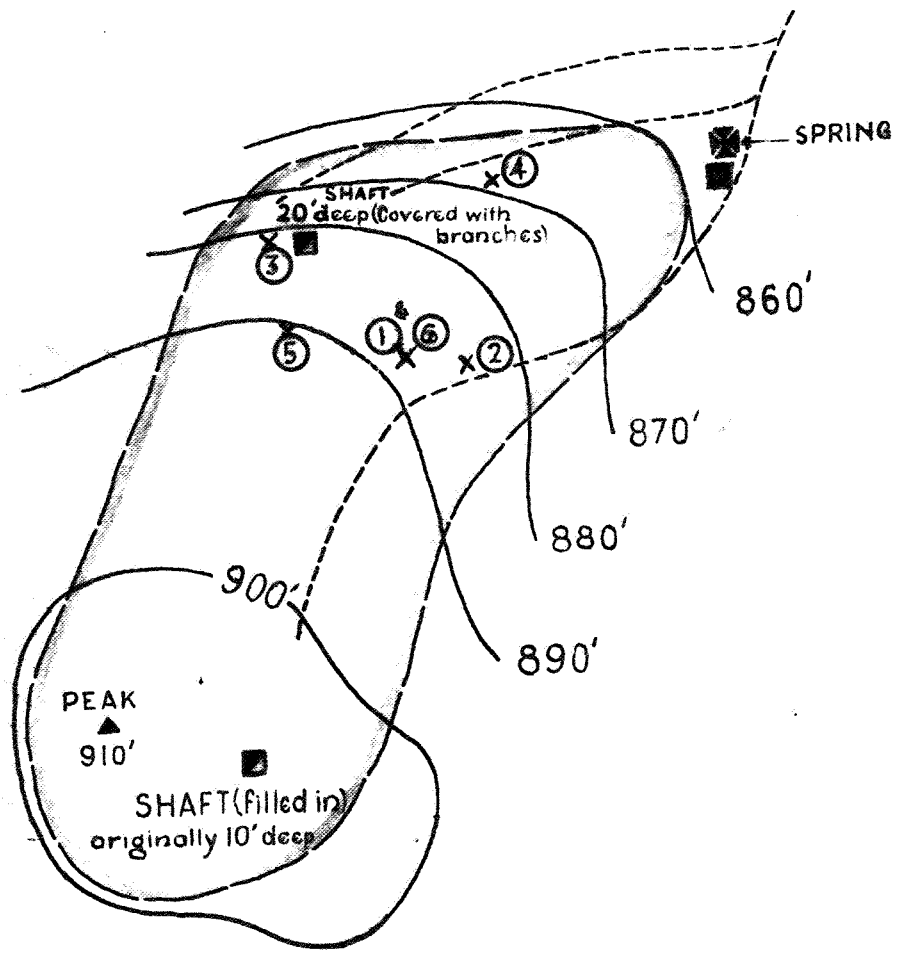
Too small to warrant development and too far from the coast. A number of diapirs in the Flinders Ranges have small concentrations of magnetite associated with carbonate and/or doleritic rocks.

PLAN

| | | |
|---|---|---|
| 61-787 | Whitten (1961) | 1" = 100' |
| S2929 | Whitten (1961) | attached. |

Noted by G.F. Whitten, Senior Geologist

Date 15.IX.64.




Sketch surface geological plan

Scale : 1 inch = 200 ft

N (Approx)

Tertiary, lateritic, nodular, compact & earthy limonite containing abundant quartz sand grains.

Cambrian Kanmantoo fine grained sandy schists. Somewhat decomposed, leached, limonite stained & silicified.

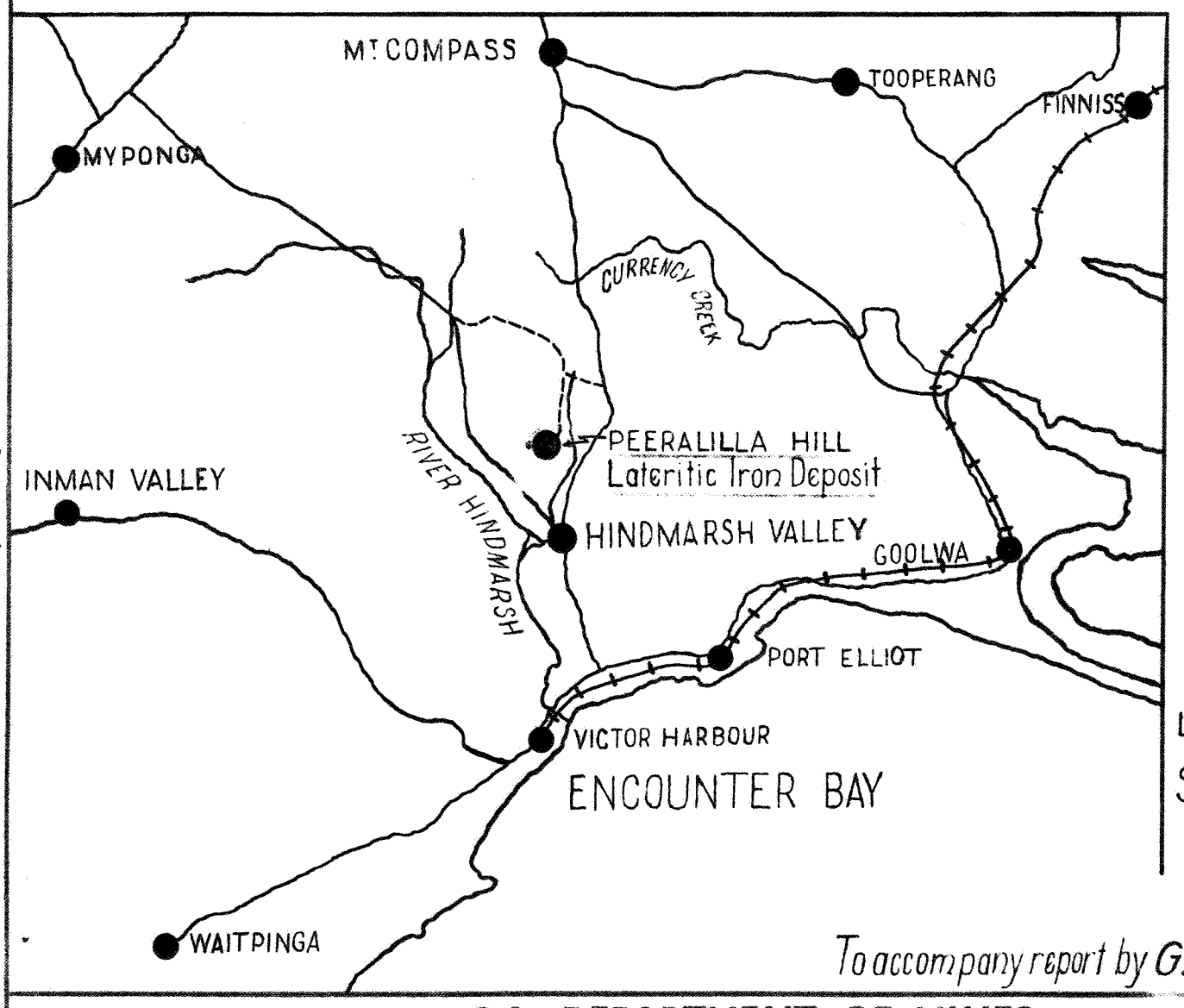
■ Well

----- Track

——880'—— Contours (approx. height above sea level)

x ⑤ Location of bulk samples collected 11-10-1961

◪ Shaft




N

LOCALITY PLAN

Scale : 1 in. = 4 miles

To accompany report by G.F. Whitten

**S.A. DEPARTMENT OF MINES**

| Approved | Passed | Drn. | PEERALILLA HILL | D.M. | Scales: As shown |
|---|---|---|---|---|---|
| | | Tcd. G.M. | Co HINDMARSH Hd GOOLWA Sec. 264 | Req. | S 2996 Hc 9 |
| | | Ckd. R.R. | | | |
| Director | | Exd. | LATERITE OCCURRENCE | | Date 24-1-62 |

200—2·61 3305

HD BAROSSA

WILLIAMSTOWN

Victoria Creek

South

MT. BESSEMER MINE

Para Creek

Plan 62-13

Plan 53-39

HD PARA WIRRA

N

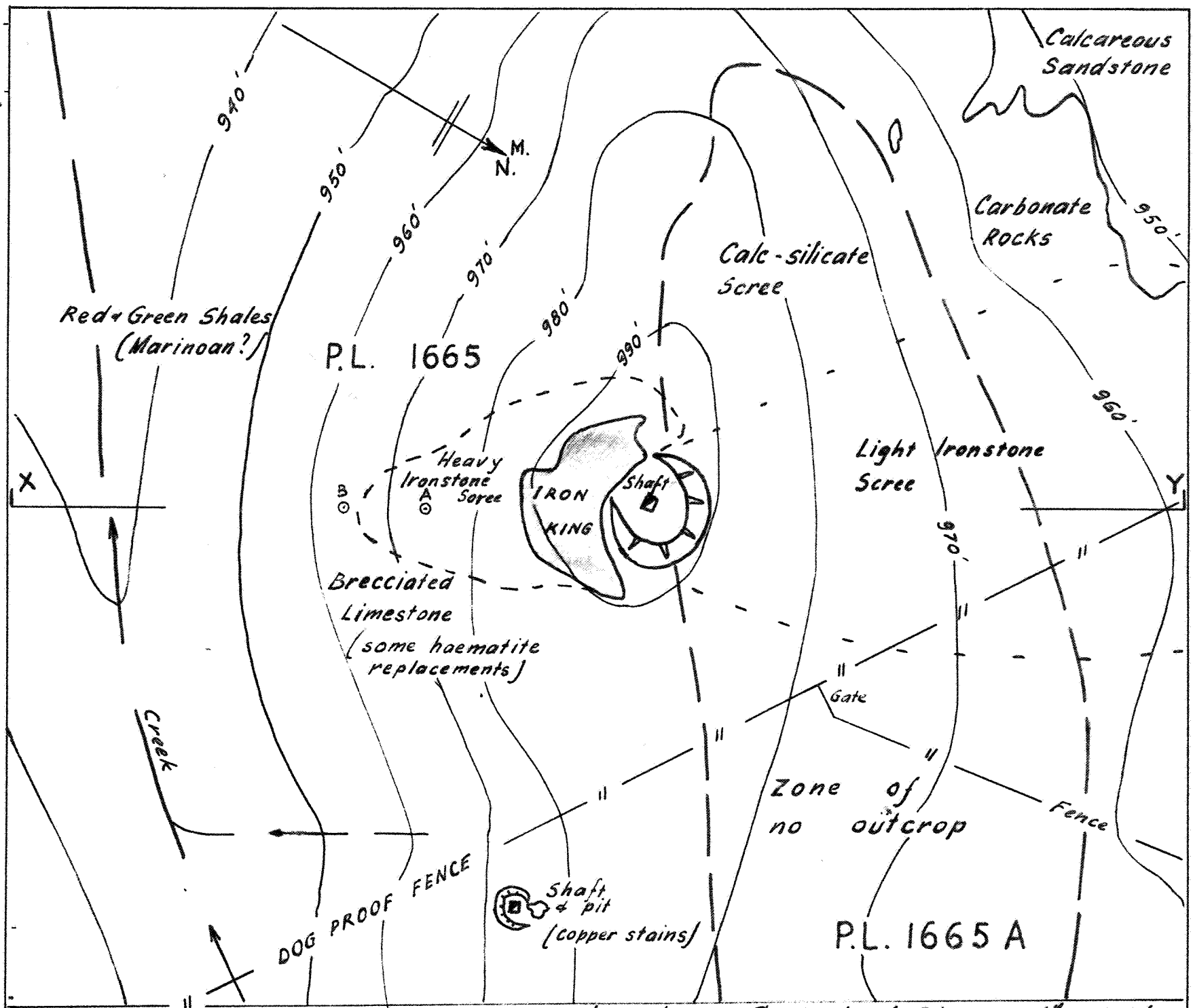
LEGEND

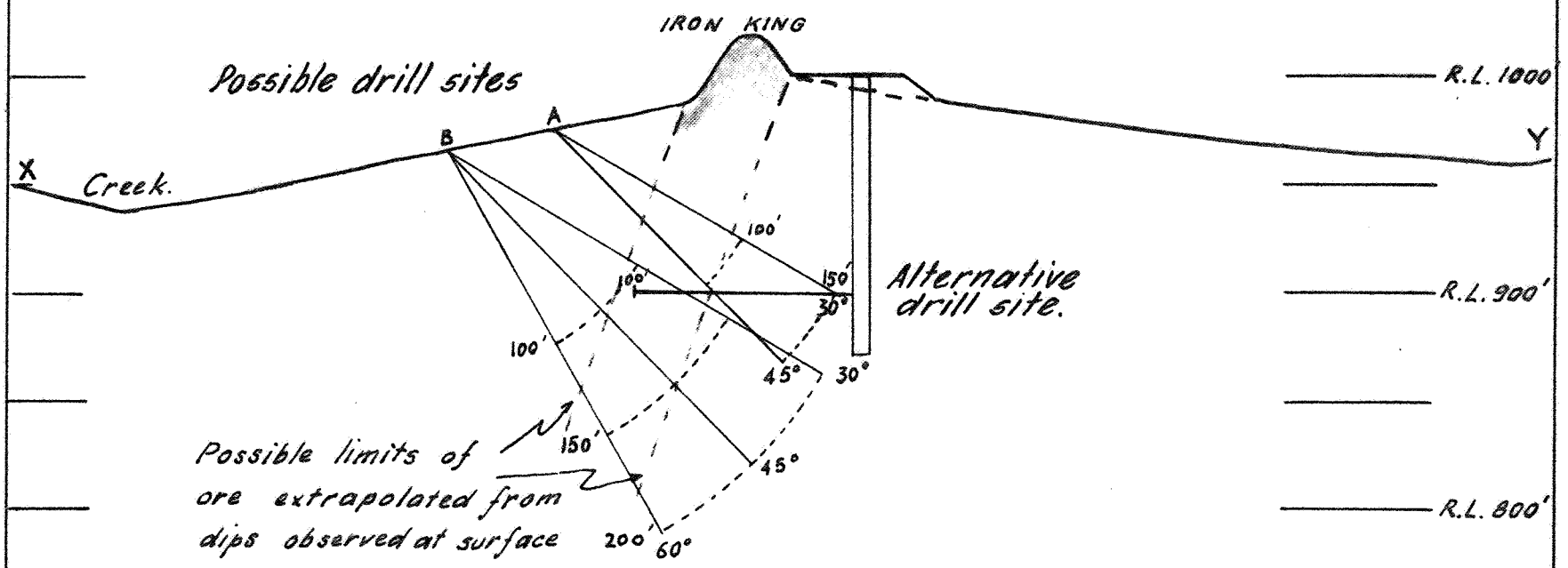
- Alluvium
- TERTIARY
- ADELAIDE SYSTEM
  - Lower Torrension
  - Basalt Grit
- ARCHEAN
- HEMATITE SCHIST LENSES
- Proposed Reservoir
- Area surveyed in detail

To accompany report by G.E. Whitten.

S.A. DEPARTMENT OF MINES

| Approved | Passed | Drn. | HEMATITE DEPOSITS | D.M. | Scale 40 chns to 1" |
|---|---|---|---|---|---|
| | | Tcd. J.McC | WILLIAMSTOWN DISTRICT | Rec. | S 746 |
| | | Ckd. R.R. | GEN. GEOLOGICAL PLAN | | Ha 3/4 |
| Director | C.D. | Exd. | | | Date 18-3-53 |



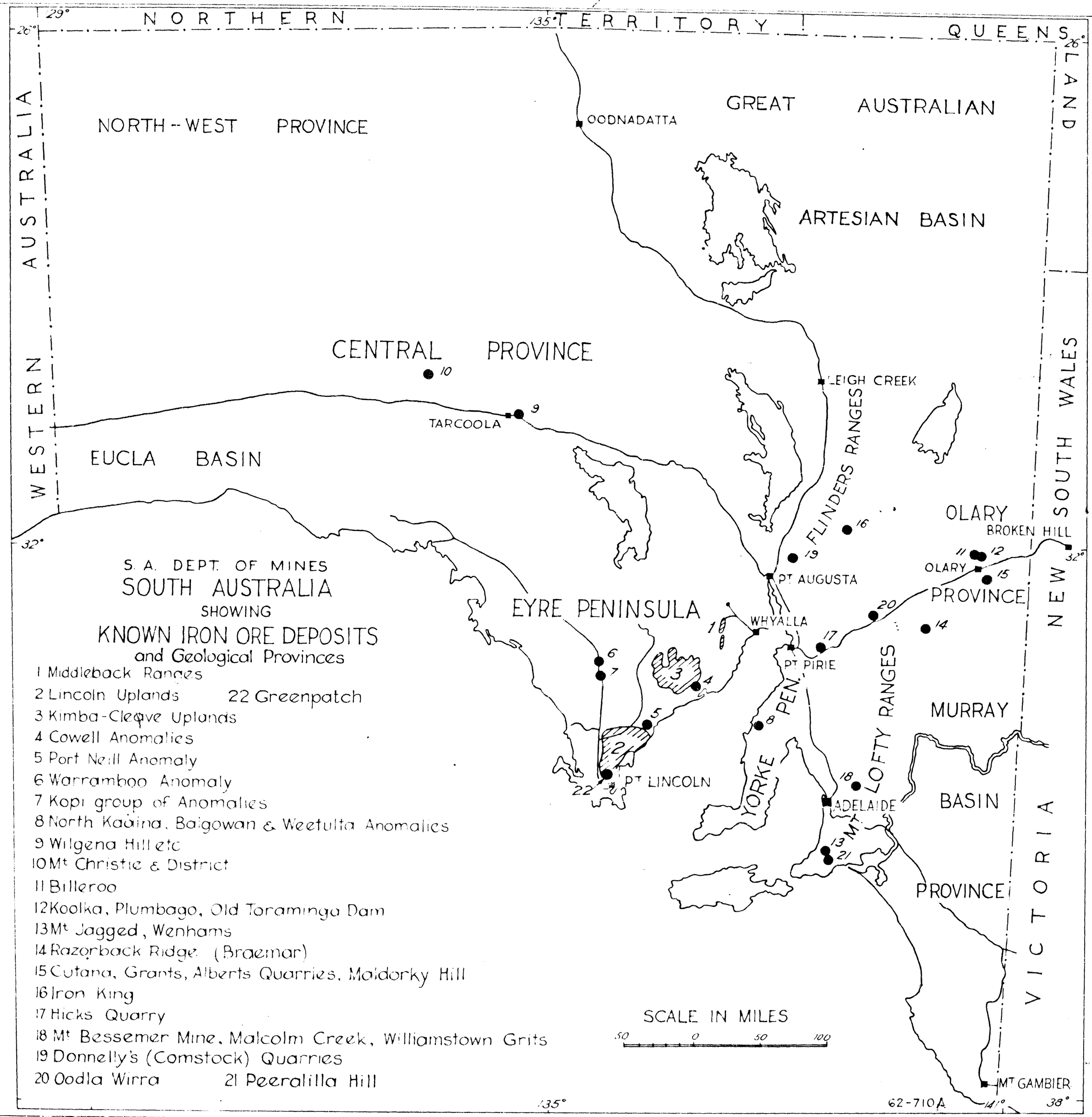




Iron King Cross Section 1" = 100'
Looking 240° Mag.

To accompany Preliminary report by G. Whitten.

**S.A. DEPARTMENT OF MINES**

| | | | | | |
|---|---|---|---|---|---|
| Approved | Passed | Drn. | IRON KING IRON OCCURRENCE | D.M. | Scale 1" = 100' |
| | | Tcd. G.W. | Preliminary Geological Plan and Cross Section – Main Outcrop | Req. | S 2929 Fc 5 |
| | | Ckd. R.R. | Pastoral leases 1665 & 1665A Hd. ADAMS Co. HANSON J.L. & E.A. MORGAN | | |
| Director | | Exd. | | | Date 2-11-61 |




S. A. DEPT. OF MINES

# SOUTH AUSTRALIA

SHOWING

## KNOWN IRON ORE DEPOSITS

and Geological Provinces

1 Middleback Ranges
2 Lincoln Uplands
3 Kimba-Cleave Uplands
4 Cowell Anomalies
5 Port Neill Anomaly
6 Warramboo Anomaly
7 Kopi group of Anomalies
8 North Kaaina, Balgowan & Weetulta Anomalies
9 Wilgena Hill etc
10 Mt Christie & District
11 Billeroo
12 Koolka, Plumbago, Old Toraminga Dam
13 Mt Jagged, Wenhams
14 Razorback Ridge (Braemar)
15 Cutana, Grants, Alberts Quarries, Maldorky Hill
16 Iron King
17 Hicks Quarry
18 Mt Bessemer Mine, Malcolm Creek, Williamstown Grits
19 Donnelly's (Comstock) Quarries
20 Oodla Wirra
21 Peeralilla Hill
22 Greenpatch

62-710A