D.M. 1702/55

DEPARTMENT OF MINES

SOUTH AUSTRALIA

Report No. 1

on

GEOLOGICAL APPRAISAL OF IRON KNIGHT AREA MIDDLEBACK RANGES SOUTH DISTRICT

by

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ENGINEERING GEOLOGY & MINERAL RESOURCES SECTION

GEOLOGICAL SURVEY

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56-264	Iron Knight Area Geol. Plan & Sections	1" = 600' 1" = 200'

29th October, 1956

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G.S. Report Reference 588.

DEPARTMENT OF MINES

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Report No. 1

on

GEOLOGICAL APPRAISAL OF IRON KNIGHT AREA

MIDDLEBACK RANGES SOUTH DISTRICT

1. ABSTRACT

An appraisal of the B.H.P. Iron Knight Leases suggests that 35+ M tons of high grade iron ore could occur in depth on unheld land adjoining. One vertical D.D. hole to 800' is recommended to test the geological reasoning and a comprehensive drilling programme considered to ascertain the extent of any ore intersections.

2. INTRODUCTION

In an attempt to find another major iron ore deposit, the Iron Knob and Middleback Ranges (North and South) Districts are being examined geologically to determine areas worth testing. Surface geological work to date has been concentrated on favourable structures in the Lower Middleback Quartzites adjacent to known orebodies on Broken Hill Proprietary leases.

In the Iron Knight areas in the Middleback Ranges South District, easterly dipping iron ore bodies outcrop along the top of a north-south ridge. No ore intersections have been made in depth, either on or off the leases, but because of the major structure in the district there is a distinct possibility that ore could occur outside B.H.P. leases down dip from known outcrops.

This report examines pertinent information and proposes a prospecting programme for consideration.

3. PREVIOUS INVESTIGATIONS

Previous work in the Middleback Ranges South has been carried out by various workers from 1908 to date. For details see "The Geology & Iron Ore Resources of the Middleback Range Area" by K.R. Miles, Geol. Survey of S. Aust., Bull. 33, 1954, Page 11.

The plans and sections accompanying this Bulletin have been used to guide the prospecting; copies of relevant plans accompany this report.

More recent field work has been carried out by R.C. Mirams Geologist and the writer. The area was visited by the Acting Director of Mines and the Chief Geologist on 11/10/56.

For Location see Plan 56.256 attached.

4. GENERAL GEOLOGY

The rocks of the Middleback Ranges South are of Archaean Age and have the following succession:-

Middleback Group

Upper Middleback Quartzite; Thickness 700'-800'
Banded hematite quartzite and interbedded schists.

Cook's Gap Schists; Thickness 20'-1000'.
Foliated grits and pebble schists, phyllites, with cherty and dolomitic bands.

Lower Middleback Quartzite; Thickness 500'-600'.
Banded hematite quartzite and interbedded schists.

Middleback North Dolomite; Thickness 200'-500' +
Cherty dolomitic marble.

Gneissic Complex. Sedimentary schists, quartzite, phyllite, migmatite, lit-par-lit gneiss, granitic gneiss and gneissic granite.

The Middleback Group are folded into a major syncline and extensively intruded by amphibolite (See Plan 56-263 attached). The Lower Middleback Quartzite, which contains the lowest continuous beds of the Group, outcrops on both sides of the Range, the Dolomite occurring as pods near the base. The Cook's Gap

Schists being less resistant to weathering form the topographic lows. The centre of the syncline is occupied by the Upper Middleback Quartzite which forms the high land in the centre of the Range. The structure pitches northerly at the south end and southerly at the north end forming an elongated basin resting on the Gneissic Complex.

This simple fold is complicated by minor flexures which although not affecting the general structure may have important effects on the localisation of iron ore.

Thus the Iron Duke and Iron Duchess orebodies may occur in synclinal flexures arranged en echelon to the main folding and further extensions to them could occur down pitch in the folds.

It should be noted that all the known orebodies in the Middleback Ranges, North and South and in the Iron Knob District are said to occur in the Lower Middleback Quartzite which can therefore be considered a favourable horizon.

5. IRON KNIGHT LEASES, B.H.P. Etc.

5.1 Topography.

The Iron Knight deposit occurs on a narrow ridge running northerly from the Iron Duke and the Iron Duchess Deposits and separated from them by an erosion gap nearly a mile wide. Crest heights average approx. 1050' with saddles ranging from 950' to 1000'. Western plain level is approx. 700'-750' while the valley bottom to the east varies from 920' at its northern end to 810' at its southern.

5.2 Leases & Claims.

B.H.P. have 6 leases in the area strung out in single line approx. 1¾ miles long and occupying the top and western flanks of the hill. Buckingham has one claim northerly from and adjoining the B.H.P. leases.

Ore occurs on all these tenements as pods or long discontinuous bodies following bedding.

5.3 Geology

Geologically the Iron Knight Deposit occurs on the western limb of the major syncline, the following rock groups being represented.

Cook's Gap Schists

Lower Middleback Quartzite) Intruded by
Middleback North Dolomite) amphibolite

Gneissic Complex.

Minor crenulations occur but are probably not significant, the basic structure being a conformable series of easterly dipping (45° - 55°) sediments resting on a basement complex.

See Plan 56.264 attached.

5.4 Ore & Reserves

The ore occurs as discontinuous pods and lenses following the bedding in the Hematite Quartzite but with amphibolite walls in places. There appear to be 3 or 4 zones of maximum replacement but little real testing has been carried out to prove continuity.

K.R. Miles in Bull. 33 estimated reserves lying above a maximum depth of R.L. 700 (i.e. western plain level) as 5.5 million tons "probable" plus 10.8 million tons "possible" totalling 16.3 million tons averaging on the outcrop 63.62% Fe, 0.26% Mn and 0.038% P.

This estimate appears a little conservative being based on occurrences amenable to quarrying. If mining is considered reserves above RL 700' could probably be extended to twenty million tons.

6. ORE EXPECTANCY EAST OF B.H.P. LEASES

As the leases are on the western flanks of the hills with the outcropping ore near the crests and dipping easterly, it necessarily follows that the ore zones must dip out of the leases at shallow depth. See Plan 56.264 attached for sections.

Extrapolating the revised estimate of twenty million tons above RL 700 (i.e. western plain level) it follows that if mineralisation continues on the same intensity to sea level, i.e. to a depth of 800'-900' below the valley level, there could exist approx. thirty five million tons of high grade iron ore outside the leases.

The situation of this inferred ore and its relation to B.H.P. orebodies could be:-

Area	Lease	Inferred, Possible & Probable Ore in B.H.P. Leases above RL 700'	Inferred Ore Outside Leases Above M.S.L.
Northern	ML 2657	10 M	15 M
Central	ML 2718	2 M	4 M
Southern	ML 2717, 2663	8 M	16 M
Total		20 M	35 M

Note that some inferred ore occurs in B.H.P. Leases below RL 700. This has not been included above.

Geologically the requirements are that an ore zone which occurs over a length of 8000' on the surface should persist to 1000' below the outcrop.

There is no structural reason known at present why the orebodies should bottom inside the leases and there is a possibility that where a minor syncline is approached mineralisation could improve. However because of the lack of testing on the surfaces and in depth on the leases held, it is impossible to do more than indicate these figures as possible target tonnages and to recommend diamond drilling to test for the existence of ore.

7. DRILLING RECOMMENDATIONS

These fall naturally into 3 phases.

1. An initial hole to test the geological reasoning that ore could occur outside the leases.
2. Three holes to test whether an estimated 35 million tons could occur in the area.
3. Should early testing indicate ore, to ascertain the extent of such an occurrence.

7.1 Phase 1

D.D. 1, a vertical diamond drillhole to 800' sited 100' east of ML 2663 to test in depth outside the lease the major ore outcrops in that lease.

D.D. 1 has been sited down dip in such a position that it should accommodate any predictable pitches for the ore shoots in the vicinity. See Plan 56.264, Section FF' for section on the proposed hole.

7.2 Phase 2

Three diamond drill holes totalling 2400' to test crown land immediately to the east of other major ore occurrences in the B.H.P. Leases.

Details from north to south are -

Opposite Lease No.	Hole Number (i.e. order of drilling)	Proposed Depth
2657	3	900'
2718	4	600'
2663	2	900'

See Plan 56.264, Sections EE', GG', HH'.

Should all 4 holes of Phases 1 & 2 intersect ore comparable in grade and width to the existing outcrops it seems reasonable to expect that 35 million tons of high grade iron ore could exist in the area. Should holes 1, 2 or 3 fail to intersect ore this figure should be reduced by 10 million tons for each hole not intersecting ore. Failure of hole 4 could reduce this figure by 5 million tons.

Because of these tonnage factors, while Phase 1 is presented as a separate unit, it seems desirable to review results at the end of each of the first four holes to determine whether sufficient ore could occur to warrant continuation of the programme.

7.3 Further Testing along Strike

Should the first four holes produce favourable results further drilling is necessary to ascertain the extent of the ore. Pending results from them, this drilling can not be detailed but a suggested programme might well be -

(a) Phase 3a - up to 12 holes totalling 9600' adjacent to the successful holes of Phases 1 & 2.

(b) Phase 3b - 15 + holes totalling approx. 12000' extending intersections of Phase 3a and filling in "gaps" in testing.

Locations of all these holes and their priorities are shown on plan 56.264 attached and details of depths etc. on the following table -

IRON KNIGHT D.D. HOLES

Opposite Lease No.	Hole No.	Phase No.	Depth Phase 1	Depth Phase 2	Depth Phase 3a
2657		3b			
		3b			
		3a			850'
		3a			900'
		3a			900'
	3	2		900'	
		3a			900'
		3a			850'
2719		3b			
		3b			
		3b			
		3b			
2718		3a			800'
		3a			600'
	4	2		600'	
		3a			600'
		3b			
2717		3b			
		3b			
		3b			
		3b			
		3b			
2663		3b			
		3a			800'
	1	1	800'		
		3a			750'
		3a			850'
	2	2		900'	
		3a			800'
2704		3b			
		3b			
Total Holes each Phase			1	3	12
Total Footage each Phase			800'	2400'	9600'

7.4 Further testing down Dip.

This programme will confirm the presence or absence of mineralisation in depth along a strike length equivalent to that of the outcropping ore. In conjunction with this, further holes will be necessary to test width, i.e. down dip. No recommendations can be made for this testing until details of the initial results are known.

7.5 Drilling Conditions

The first four holes ~~and~~ aggregating 3,200' will best be put down by diamond drills. Hydraulic feed machines would be preferred but providing core recovery in ore is satisfactory screw feed machines could be used. It will be necessary to recover sludge.

These holes would probably be started in schists and schisty quartzite which should be moderately easy drilling especially near their collars. Later holes could possibly be collared by percussion holes thereby making better use of diamond plants and reducing costs.

At present water would need to be carted but 3 shallow water bores have been pegged in the area by the Chief Geologist and there is a good possibility that drilling water may be available within 2 miles of most drill sites. See Plan 56.263 for location of water bore sites.

8. CONCLUSION

An evaluation of the geological environment of the Iron Knight Leases suggests that, if the mineralisation which outcrops over a length of 8000' on the B.H.P. leases continues with the same intensity to 1000' below the outcrop, there could occur 35 million tons of high grade iron ore outside the leases.

A comprehensive drilling programme has been considered to appraise the project.

It is recommended that D.D. 1 be put down to 800' just east of ML 2663 to test the geological argument that ore could exist and that if this hole intersects ore DD's. 2, 3 & 4 be put down to test whether the estimated tonnage could occur.

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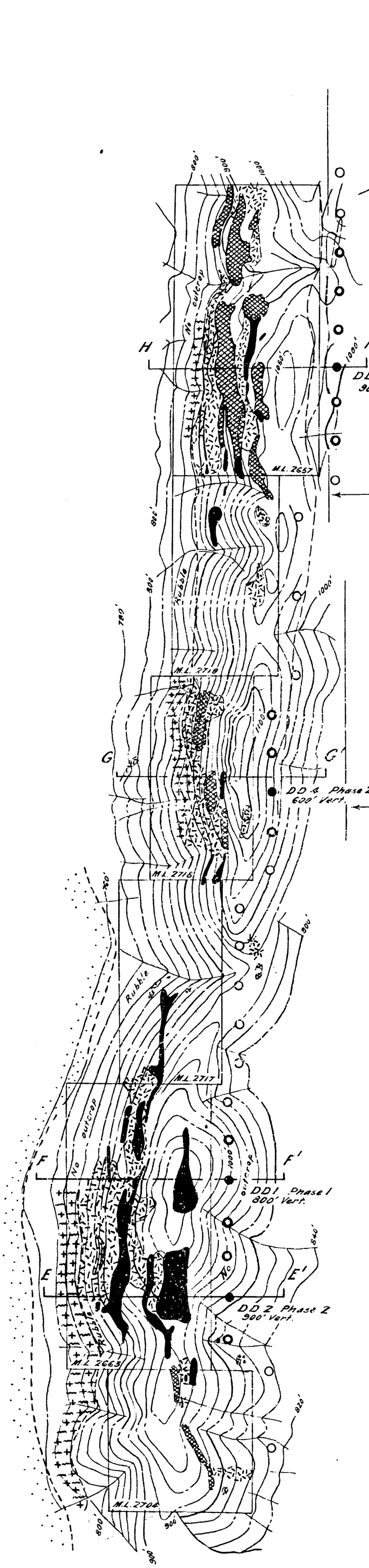
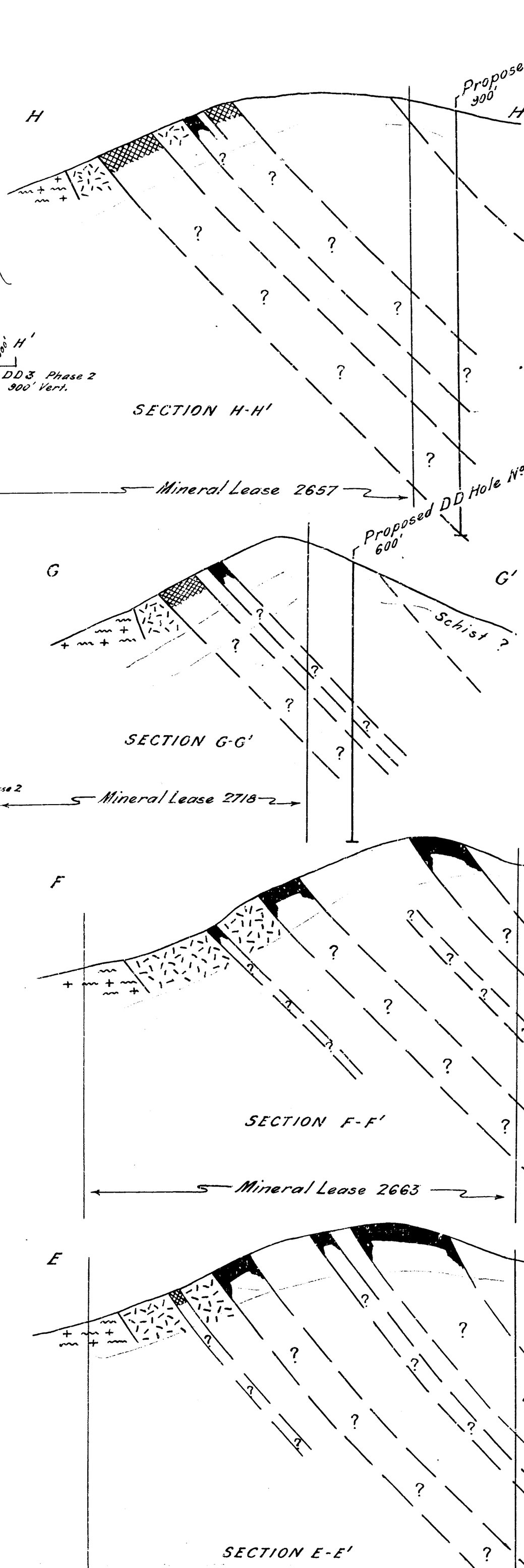
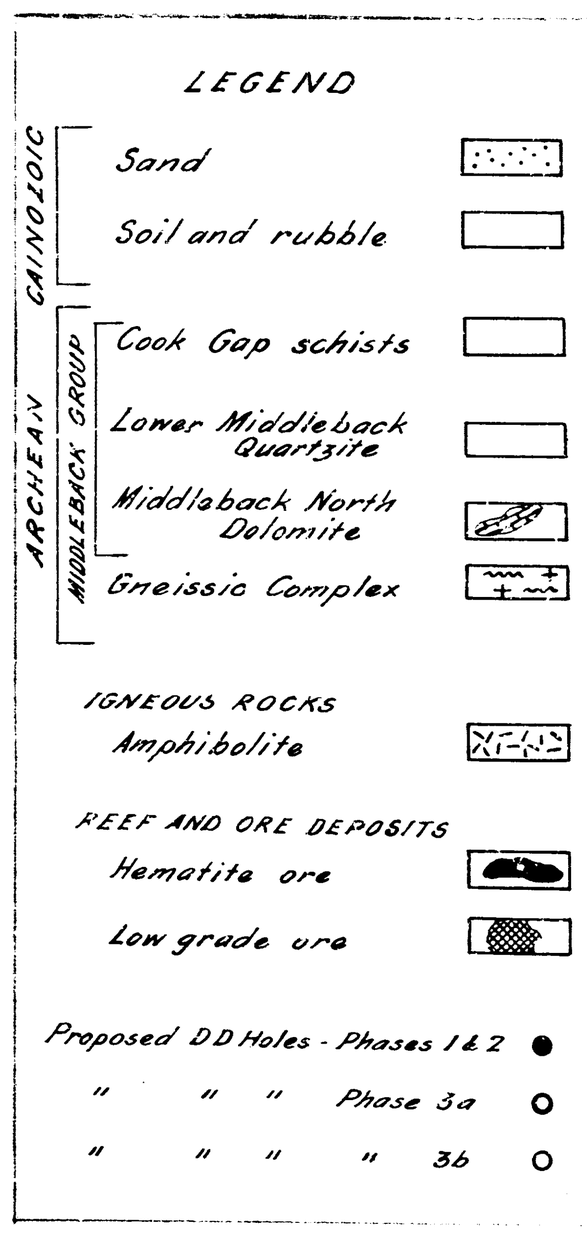
GFW:AGK
29/10/56.







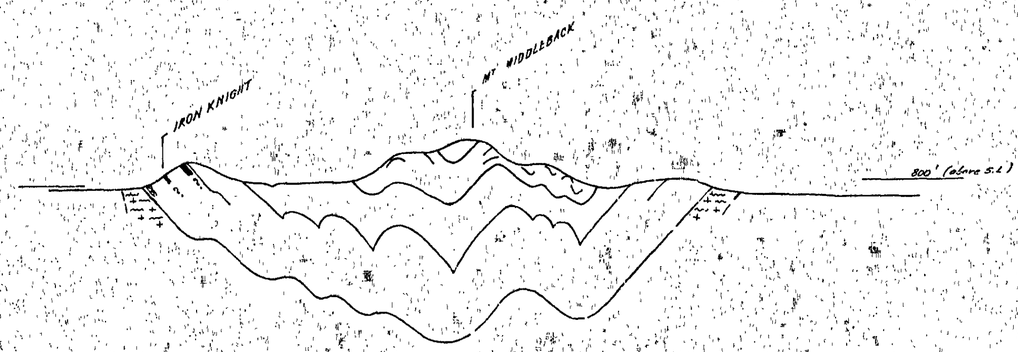
S.A. DEPARTMENT OF MINES

No.	Amendment	Exd.	Date
	MIDDLEBACK RANGE SOUTH DISTRICT GEOLOGICAL PLAN AND SECTION	56-263	

IRON KNIGHT AREA
MIDDLEBACK RANGE SOUTH DISTRICT
GEOLOGICAL PLAN AND SECTIONS

Approved	Passed		Scale: PLAN 600'-1" SECS. 200'-1"
		Drn.	56-264
		Tcd. R.R.	DE
		Ckd.	
Director		Exd.	Date 25-10-56

PLAN
SCALE
0 20 40 80 CHAINS



SECTION
SCALE
0 10 20 40 60 CHAINS

CAINOZOIC
- Dune sand
- Alluvium
- Talus
- Laterilic Gravel

ARCHEAN
MIDDLEBACK GROUP
- Upper Middleback quartzite
- Cook Gap schists
- Lower Middleback quartzite
- Middleback North dolomite
- Gneissic Complex

IGNEOUS ROCKS
- Dolerite Amphibolite

REEF AND ORE DEPOSITS
- Hematite Ore
- Anticline
- Syncline

Plan after Miles Bulletin 33.
Section after Whitten.

S.A. DEPARTMENT OF MES

IRON KNIGHT AREA MIDDLEBACK RANGE SOUTH DISTRICT GEOL. PLAN AND SECTIONS...	56-264				Req. No. D.M. Compiled from	MIDDLEBACK RANGE SOUTH DISTRICT GEOLOGICAL PLAN AND SECTION	Approved / Passed — Director of Mines
Associated Drawing	No.	No.	Amendment	Exd. Date			Drn. Tcd. Ckd. Exd.

Scale: PLAN - 40 Chains to 1 inch. SECTION 20 " " 1 "
56 - 263 DE
Date 25 - 10 - 56

Corunna Hills

CORUNNA AREA

RACECOURSE AREA

IRON KNOB

Iron Knob

Iron Monarch

KATUNGA HILLS NORTH AREA

WEST KATUNGA AREA

KATUNGA HILLS EAST AREA

KATUNGA HILLS SOUTH AREA

NORTH PROSPECT

COOYERDOO HILLS AREA

SSE. PROSPECT

Iron Knob District
(See Index to Plans – 57-11)

Iron Prince

IRON BARON

Iron Baron

CAMEL HILL AREA

Iron Baron South

Iron Queen

Iron Queen South

SOUTH QUEEN AREA

Mt. Middleback North

S.W. AREA

Iron Warrior

Kimba Gap

Kimba Road

Cooks North

Iron Count

Iron Chieftain

Iron Knight North

IRON KNIGHT AREA (East strip)

Iron Knight South

COOKS GAP AREA

EAST FLANK AREA

WEST GAP AREA

Iron Duchess North

Iron Duchess

IRON DUKE - IRON DUCHESS AREA (West strip)

Iron Duke

Middleback Range North District
(For Plan and Section see 57-144)

Middleback Range South District
(For Plan and Sections see 56-263 & 56-264A)

Eyre Highway

Lincoln Highway

To Port Augusta

WHYALLA

LOCALITY PLAN

WESTERN AUSTRALIA

SOUTH AUSTRALIA

NEW SOUTH WALES

VICTORIA

Oodnadatta

Ceduna

Iron Knob

Pt. Augusta

Whyalla

Pt. Lincoln

River Murray

ADELAIDE

Mt. Gambier

SCALE
0 20 40 60 80 100 120 140 MILES

N

CONVENTIONS

Iron Ore	▲
B.H.P. Deposits	Iron Prince
D. of M. Prospects	RACECOURSE AREA
Railways	
Roads	
Tracks	

To accompany report by G.F. Whitten, Senior Geologist.

S.A. DEPARTMENT OF MINES

No.	Amendment	Exd.	Date

IRON KNOB, MIDDLEBACK RANGE (NORTH & SOUTH) DISTRICTS
IRON ORE PROSPECTS
DEPARTMENT OF MINES DRILLING AREAS

Approved	Passed		Scale : 4 Miles to 1"
		Drn.	56-256
		Tcd. R.R.	DE
		Ckd.	
Director		Exd.	Date 15-10-56