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SML 539

STONY HILL

PROGRESS REPORTS TO LICENCE EXPIRY FOR THE PERIOD 21/1/71 TO 20/1/72

Submitted by
The Broken Hill Pty Co. Ltd
1971

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PRIMARY INDUSTRIES AND RESOURCES SA

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TENEMENT: S.M.L. 539

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PLANS:

REPORT:

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003

GROUND MAGNETIC SURVEY

STONY HILL, S.A.

by

M. TOM

MELBOURNE JANUARY, 1971

004

DISTRIBUTION LIST:

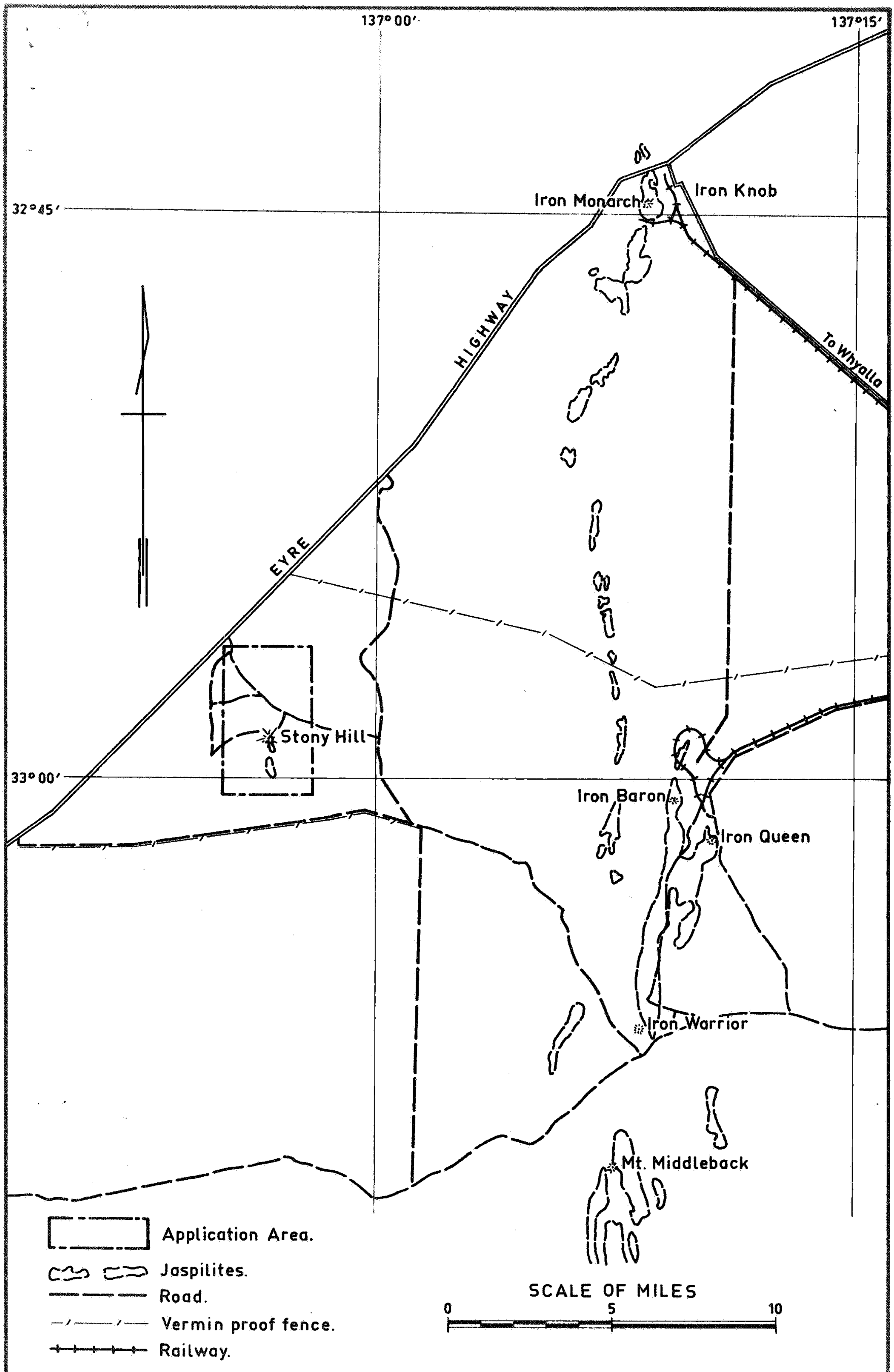
Director of Exploration

Superintending Geologist, Development

Senior Geophysicist

Geological Office, Whyalla

Technical Records



Centre *Melbourne*	THE BROKEN HILL PROPRIETARY CO. LTD.	Project No.
Date *6-1-71*	LOCATION MAP STONY HILL AREA – S.A.	Drawing No. A4·1338

INTRODUCTION

The Stony Hill area is east of the Eyre Highway, 20 miles south-west of Iron Knob, South Australia (Fig.1). On the 1-mile Gilles Sheet prepared by the South Australian Mines Department, these hills are shown as jaspilites; they also correspond with the magnetic anomaly on the contour map from the B.M.R. aeromagnetic survey flown at 1500 feet in 1955-7.

An S.M.L. of 16 square miles has been applied for by the Company to cover the area.

The jaspilites occur as two main outcrops and minor sub-outcrop along a strike length of 10,000 feet, the most extensive of these being Stony Hill, which rises to a height of approximately 100 feet above the surrounding, relatively flat country. Outcrops are up to 400 feet wide, and are not continuous along strike.

The outcropping jaspilites, coarse grained hematite with magnetite, have been tested and are considered especially suitable for beneficiation. Burger, 1970, shows that outcropping jaspilites contain between 1.1 and 16.8% magnetite by volume, indicating that they might be expected to cause a correspondingly higher magnetic response than the country rocks.

A minimum of 60 million tons close to the surface and assaying at least 25% total Fe is considered necessary for economic development of the deposit. If the jaspilites are continuous for 10,000 feet, this would necessitate dimensions of 400 feet width and 150 feet depth (or equivalent) to attain the required tonnage (assuming 10 cubic feet equals 1 ton).

The magnetic survey was designed to test the feasability of such a volume being present. Magnetic readings were taken on traverses 3,000 feet in length and at 2,000 feet intervals to show whether jaspilites are continuous between outcrops. Readings were taken at 100 feet intervals, with infill where necessary.

The survey was made during the period 14. 12. 70, to 23. 12. 70, using Jalander magnetometer No. 7326.

RESULTS

The magnetic results are shown as profiles on Fig. 2.

The strike length of the magnetic jaspilites, indicated by this survey, is at least 16,000 feet from 24,000N to 8,000N, and possibly further to the south.

Where the jaspilites outcrop, for example on traverse 14,000N on Stony Hill, the magnetic profile has characteristic steep gradient and generally higher values with erratic very high and very low readings. Similar profiles occur where jaspilites outcrop on traverses 18,000N, 12,000N, 10,000N and 8,000N. In these cases, the magnetic profile can be used to estimate the width of the surface and near surface jaspilites; and the position of near surface jaspilites is indicated on Fig. 2.

Lower magnitude anomalies up to 1,500 gammas on traverses 20,000N and 22,000N are smooth, suggesting they are caused by magnetic rocks below the surface. It is probable that they are a continuation of the outcropping jaspilites to the south.

The lack of continuity between traverses, at 11,000N and 16,000N indicated by considerably lower magnetic values may be due to lensing of the jaspilites, or to change in magnetite content along strike. In the latter case, high Fe content may be maintained in less magnetic hematite jaspilites; otherwise, the continuous strike length of the jaspilites is reduced.

The estimated width of near surface jaspilites varies from 600 feet on 12,000N to 300 feet, or less, on 8,000N. Great variation in iron content may occur within these bands, and can only be tested by diamond drilling.

In summary the jaspilites are probably present at depth as far north as 24,000N, coming closer to the surface to the south, and outcropping on traverses 18,000N, 14,000N 12,000N, 10,000N and 8,000N. The jaspilites are possibly discontinuous at 16,000N and 11,000N where the magnetic anomalies are considerably lower. Their width varies along strike, becoming narrow on 8,000N.

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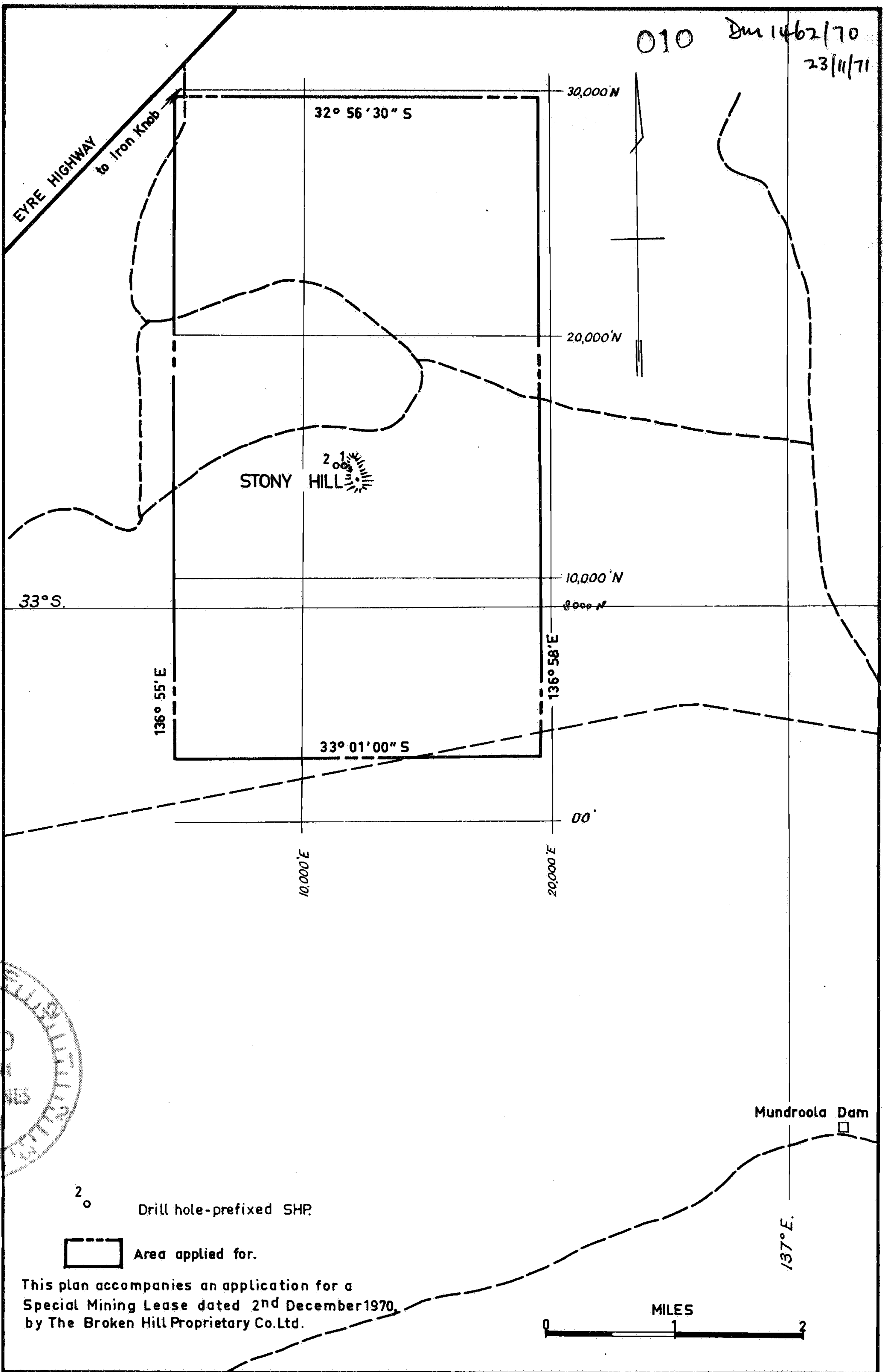
23/11/71



Centre: Melbourne	THE BROKEN HILL PROPRIETARY CO. LTD.	Project No.
Date: 2nd Dec. 1970	APPLICATION FOR SPECIAL MINING LEASE STONY HILL AREA - SOUTH AUSTRALIA	Drawing No. A4/ 1278

SPECIAL MINING LEASE 539

STONY HILL, SOUTH AUSTRALIA

011

REPORT FOR THE THREE MONTHS ENDED 21ST JULY, 1971

GENERAL

During the three monthly period, two percussion holes were drilled on the largest outcrop - Stony Hill (see attached section).

DRILLING

Two holes, ST 1 and ST 2, were drilled by the Company's TRUCM-3 Drillmaster. Footage drilled totalled 438'. ST 1 was an angle hole inclined at 60^{o} in an attempt to intersect the interpreted steeply easterly dipping jaspilite. As the eastern contact was not intersected the hole was terminated at 235' and the rig moved to the top of the hill. Here a vertical hole was drilled to see how deep the outcropping jaspilites in fact went. Jaspilite was encountered to a depth of 125' at which point a green schistose rock was encountered. The hole was terminated at 203' still in schist (drill logs are attached).

ASSAYING

The drill cuttings were assayed every 5' (results attached). ST 2 intersected material with an average grade of 30.2% Fe to a depth of 125'0". Magnetite occurs but in varying and generally small amounts.

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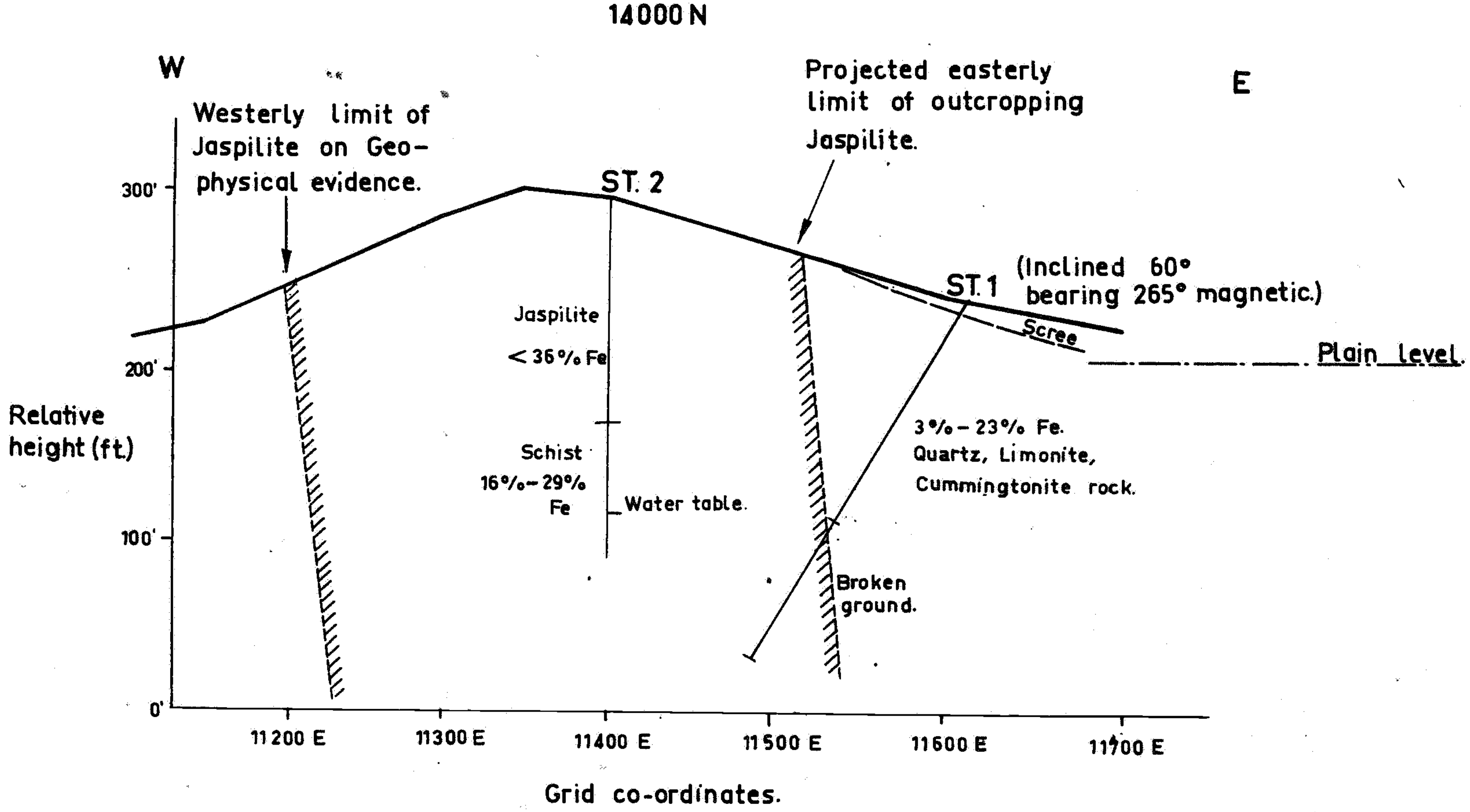

Centre WHYALLA

Date JULY '71

THE BROKEN HILL PROPRIETARY CO. LTD.

Fig. 6

W.E. SECTION THROUGH STONY HILL SHOWING LOCATION OF DRILL HOLES.

Project No. S.A. S.M.L. 539-6.

Drawing No. A4/44

012

013

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B H P
WHYALLA

STONY HILL 12 miles West of Iron Baron 14000N-11613E S.T. 1 Job No. 954/75/11

GEOLOGICAL DEPARTMENT

ASSAY DATA FORMS

A/C Geological Department

Date recorded:

Date punched:

Serial No.	Footage From	Footage To	Int. Ft	Rec %	Fe	SiO_2	Al_2O_3	Ign. Loss	P	CaO	MgO	Mn	S	TiO_2	FeO			Ore	Percussion Drill No.	Diamond Drill No.
	0	5			06.0	73.0	06.9	07.4	0.02	03.2	00.5	00.1	00.01	0.30	.2					
	5	10			06.0	58.0	15.0	12.6	0.03	04.6	00.7	00.1	00.09	0.20	.5					
	10	15			30.2	31.0	10.0	12.4	0.06	02.5	00.8	00.1	00.12	0.10	.3					
	15	20			26.0	43.0	09.7	09.5	0.06	00.4	00.1	00.1	00.08	0.10	.4					
	20	25			13.0	67.0	06.6	07.0	0.03	00.2	00.1	00.1	00.07	0.10	.3					
	25	30			11.0	76.0	03.5	04.1	0.02	00.1	00.1	00.2	00.08	0.05	.5					
	30	35			17.0	69.0	02.5	04.6	0.03	00.1	00.1	00.1	00.06	0.05	.3					
	35	40			16.0	67.0	03.5	04.8	0.02	00.1	00.1	00.9	00.03	0.05	.3					
	40	45			15.0	64.0	06.9	06.4	0.02	00.1	00.1	00.7	00.06	0.05	.4					
	45	50			16.0	66.0	04.3	06.1	0.02	00.1	00.1	00.4	00.06	0.05	.4					
	50	55			23.0	58.0	02.2	05.8	0.03	00.1	00.1	00.2	00.04	0.05	.4					
	55	60			19.0	66.0	01.1	05.0	0.02	00.2	00.1	00.2	00.03	0.05	.5					
	60	65			20.0	65.0	00.9	04.9	0.02	00.1	00.1	00.1	00.03	0.05	.5					
	65	70			12.0	78.0	00.6	03.0	0.01	00.1	00.1	00.2	00.03	0.05	.3					
	70	75			03.0	92.0	00.4	02.0	0.01	00.1	00.1	00.1	00.02	0.05	.3					
	75	80			09.0	81.0	00.7	03.3	0.01	00.1	00.1	00.2	00.03	0.05	.2					
	80	85			08.0	83.0	00.4	04.1	0.01	00.1	00.1	00.2	00.03	0.05	.3					
	85	90			08.0	83.0	00.3	02.7	0.01	00.1	00.1	00.3	00.03	0.05	.3					
	90	95			08.0	83.0	00.4	03.1	0.02	00.1	00.1	00.4	00.04	0.05	.3					
	95	100			08.0	84.0	00.6	02.7	0.02	00.1	00.1	00.2	00.02	0.05	.4					
	100	105			12.0	78.0	00.4	03.0	0.02	00.1	00.1	00.3	00.04	0.05	.3					
	105	110			09.0	82.0	00.2	03.8	0.02	00.1	00.1	00.2	00.03	0.05	.4					
	110	115			10.0	82.0	00.2	02.8	0.02	00.1	00.1	00.2	00.03	0.05	.2					

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ALLA 014

STONY HILL 12 miles West of Iron Baron S.T.1 14000N-11613E Job No. 954/75/11

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GEOLOGICAL DEPARTMENT ASSAY DATA FORMS

A/C Geological Department

Date recorded:

Date punched:

Serial No.	Footage From	Footage To	Int. Ft	Rec %	Fe	SiO_2	Al_2O_3	Ign. Loss	P	CaO	MgO	Mn	S	TiO_2				Ore	Percussion Drill No.	Diamond Drill No.
1 2 3 5	6 9	10 13	14 17	18 20	21 23	24 26	27 29	30 32	33 35	36 38	39 41	42 44	45 48	49 51	52 54	55 57	58 59	60 61	62 64 65 67 68	69 71 72 74 75
	120	125			15.0	72.0	00.8	03.9	0.01	00.1	00.1	00.3	00.02	0.05	.3					
	125	130			15.0	72.0	01.0	03.8	0.01	00.1	00.1	00.3	00.03	0.05	.4					
	130	135			21.0	60.0	01.5	05.4	0.01	00.1	00.2	00.5	00.03	0.05	.3					
	135	140			23.0	57.0	01.6	06.0	0.01	00.1	00.2	00.4	00.07	0.05	.3					
	140	145			12.0	78.0	00.7	03.1	0.01	00.1	00.1	00.2	00.03	0.05	.4					
	155	160			21.0	60.0	02.1	06.8	0.02	00.1	00.1	00.2	00.08	0.05	.3					
	160	165			21.0	60.0	02.3	07.4	0.02	00.1	00.1	00.2	00.09	0.05	.4					
	165	170			19.0	65.0	01.5	05.6	0.02	00.1	00.1	00.2	00.08	0.05	.3					
	170	175			16.0	69.0	01.0	05.6	0.02	00.1	00.1	00.3	00.07	0.05	.3					
	175	180			12.0	77.0	00.5	04.4	0.01	00.1	00.1	00.2	00.01	0.05	.3					
	180	185			11.0	80.0	00.3	02.9	0.01	00.1	00.1	00.2	00.02	0.05	.3					
	185	190			11.0	80.0	00.4	03.0	0.01	00.1	00.1	00.2	00.05	0.10	.3					
	190	195			07.0	86.0	00.2	02.1	0.01	00.1	00.2	00.1	00.19	0.05	.5					
	195	200			09.0	83.0	00.2	02.6	0.01	00.3	00.5	00.1	00.18	0.05	.6					
	203'6"	205			16.0	71.0	00.4	03.8	0.02	00.7	01.0	00.1	00.16	0.65	.8					
	205	210			16.0	72.0	00.6	03.5	0.02	00.6	00.8	00.1	00.12	0.05	.7					
	210	215			21.0	63.0	00.7	02.9	0.03	01.3	01.6	00.2	00.12	0.05	.6					
	215	220			18.0	66.0	01.5	04.4	0.02	00.8	01.0	00.2	00.07	0.05	.6					

15 x2

B H P
WHYALLA
015

STONY HILL GRID 12 Miles West Iron Baron ST 2 14000N-11400E

GEOLOGICAL DEPARTMENT **ASSAY DATA FORMS** Job No. 954/75/11

A/C Geological Department

Date recorded:

Date punched:

Serial No.	Footage From	Footage To	Int. Ft	Rec %	Fe	SiO_2	Al_2O_3	Ign. Loss	P	CaO	MgO	Mn	S	TiO_2	FeO	Ore	Percussion Drill No.	Diamond Drill No.
	0	5			14.0	68.0	01.2	06.3	0.03	04.1	00.3	00.1	00.03	0.05	0.4			
	5	10			14.0	70.0	04.3	05.2	0.05	00.3	00.1	00.1	00.05	0.05	0.4			
	10	15			22.0	55.0	06.2	06.6	0.04	00.1	00.1	00.1	00.03	0.20	0.4			
	15	20			23.0	54.0	04.6	06.4	0.05	00.1	00.1	00.1	00.04	0.10	0.3			
	20	25			27.0	56.0	00.9	04.1	0.05	00.4	00.1	00.1	00.04	0.05	2.6			
	25	30			33.8	49.0	01.5	01.5	0.03	00.1	00.1	00.1	00.04	0.05	5.1			
	30	35			35.0	44.0	02.2	03.6	0.05	00.1	00.1	00.1	00.04	0.05	2.8			
	35	40			35.4	45.0	01.8	02.7	0.03	00.1	00.1	00.1	00.03	0.05	2.7			
	40	45			33.3	44.0	05.0	04.1	0.03	00.1	00.1	00.1	00.04	0.10	2.9			
	45	50			36.7	41.0	02.9	03.9	0.04	00.1	00.1	00.1	00.04	0.15	0.5			
	50	55			35.9	42.0	03.1	03.7	0.04	00.1	00.1	00.1	00.05	0.20	0.7			
	55	60			34.5	43.0	02.1	05.2	0.03	00.1	00.1	00.1	00.03	0.10	0.7			
	60	65			31.2	44.0	04.4	06.1	0.05	00.1	00.6	00.3	00.05	0.20	0.5			
	65	70			29.0	41.0	06.2	06.4	0.05	00.2	03.3	00.7	00.04	0.55	0.9			
	70	75			27.5	43.0	03.8	05.1	0.06	01.9	03.7	00.7	00.04	0.30	0.8			
	75	80			28.8	47.0	01.3	03.5	0.04	01.5	02.6	00.3	00.04	0.15	0.9			
	80	85			31.3	49.0	00.8	03.4	0.03	00.4	00.8	00.2	00.02	0.05	0.7			
	85	90			35.5	44.0	00.7	02.9	0.03	00.1	00.8	00.2	00.01	0.15	0.9			
	90	95			33.2	48.0	00.7	01.9	0.03	00.5	01.4	00.1	00.01	0.05	1.1			
	95	100			32.4	48.0	00.7	01.8	0.04	00.7	01.4	00.1	00.01	0.05	2.1			
	100	105			30.5	48.0	01.2	02.5	0.03	00.5	01.2	00.1	00.01	0.05	1.4			

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B H P WHYALLA 010

STONY HILL GRID 12 miles west Iron Baron ST 2 14000N-11400E

GEOLOGICAL DEPARTMENT **ASSAY DATA FORMS** Job NO. 954/75/11

A/C Geological Department

Date recorded:

Date punched:

Serial No.	Footage From	Footage To	Int. Ft	Rec %	Fe	SiO_2	Al_2O_3	Ign. Loss	P	CaO	MgO	Mn	S	TiO_2		FeO		Ore	Percussion Drill No.	Diamond Drill No.
	105	110			30.0	49.0	03.5	03.4	0.03	00.4	00.6	00.1	00.01	0.05		0.9				
	110	115			32.6	48.0	01.6	03.3	0.03	00.1	00.1	00.1	00.01	0.05		0.8				
	115	120			34.1	49.0	00.3	02.2	0.03	00.1	00.1	00.1	00.01	0.05		1.5				
	120	125			33.8	48.0	00.5	02.8	0.03	00.2	00.1	00.1	00.01	0.05		2.2				
	125	130			16.0	55.0	05.0	08.9	0.02	04.0	00.6	00.1	00.10	0.20		0.4				
	130	135			18.0	57.0	04.2	09.2	0.02	02.3	00.9	00.1	00.10	0.15		0.5				
	135	140			23.0	46.0	02.8	12.2	0.02	02.4	00.9	00.1	00.05	0.10		0.3				
	140	145			22.0	51.0	03.0	12.1	0.03	01.9	00.9	00.1	00.07	0.10		0.2				
	145	150			20.0	46.0	06.1	11.8	0.04	03.7	01.9	00.2	00.09	0.20		0.8				
	150	155			22.0	49.0	06.0	07.6	0.03	01.5	02.8	00.3	00.03	0.20		0.7				
	155	160			21.0	56.0	02.4	06.8	0.02	01.0	02.3	00.2	00.03	0.10		0.2				
	160	165			17.0	57.0	05.2	08.4	0.04	00.8	01.6	00.4	00.03	0.10		0.2				
	165	170			20.0	54.0	05.1	08.8	0.03	00.8	01.8	00.3	00.03	0.15		0.3				
	170	175			19.0	50.0	07.1	09.0	0.04	00.8	02.3	00.2	00.01	0.25		0.5				
	175	180			23.0	48.0	04.3	10.5	0.05	00.6	01.3	00.8	00.03	0.15		0.2				
	180	185			29.0	43.0	03.4	08.0	0.05	00.9	01.3	01.0	00.05	0.10		0.2				
	185	190			27.0	45.0	03.5	07.7	0.06	01.4	02.2	01.4	00.05	0.05		0.2				
	190	195			15.0	65.0	01.3	04.5	0.03	03.9	03.1	00.9	00.04	0.05		0.4				
	195	200			18.0	57.0	02.4	05.8	4.00	03.7	01.3	01.3	00.05	0.05		0.5				

PERCUSSION BORING PROGRESS REPORT 317 **WHYALLA BRANCH**

Bore No. ST 1 Report No. Period

Location and Grid Ref. 14000N/11613E Stony Hill Grid

R.L. at Collar Actual Total Depth (complete) 235'

R.L. at Bottom (complete) Est. Total Depth Feet

Footage for Period 235' Operators M.J. HANSBERRY

Rig TRUCM-3 Drillmaster Sampling Tools Riffler, wet sampling

Date Started 19.4.71 Date Completed 12.5.71

FROM FT.	IN.	TO FT.	IN.	INT. FT.	IN.	DESCRIPTION
0		5		5		Surface sand with scree jaspilite and silcrete
5		10		5		Scree containing fragments of porphyry and kunkar
10		30		20		Enriched scree containing black pellets of limonite and porphyry
30		70		40		Brown quartzose limonite amphibole rock. Slightly magnetic.
70		75		5		Brown limonite amphibole rock with extremely coarse quartz concentrations.
75		120		45		Brown limonite amphibole rock, with bands of grey hematite. Slightly magnetic.
120		145		25		Green and soft weathered horizon, chloritic. Weathered dyke rock?
145		155		10		No sample collected - broken ground
155		215		60		Brown limonite-amphibole "jaspilite", altered to green chloritic weathering products in places. Magnetic bands.
215		235		20		Contaminated sample - cement infusion necessary because of soft horizon and broken ground.
						End of bore
						Test tube etches taken at 100' and 200' showed readings of 64° and 67° (measured from the horizontal)
						<u>Core taken 95' - 97'6"</u> Streaks of grey hematite and magnetite in a brown limonite-amphibole rock. Dip 60°. The rock was petrographically described as a quartzose and altered cummingtonite (i.e. Fe, Mg silicate), rock with a slight magnetic content. Banding is rather poorly defined; and there were signs of deformation.
						<u>Core taken 201'</u> Rock identified as a dolomitic magnetite-hematite-limonite jaspilite. Magnetite content low; textures suggesting iron amphiboles completely altered into an aggregate of fine-grained quartz, limonite and dolomite.

Remarks

Date 15.6.71 Logged by E. EVANS

GEO 699-1

PERCUSSION BORING PROGRESS REPORT

318 **WHYALLA BRANCH**

Bore No. ST 2 **Report No.** **Period**

Location and Grid Ref. 14000N/11400E Stony Hill Grid

R.L. at Collar **Actual Total Depth (complete)** 203'

R.L. at Bottom (complete) **Est. Total Depth** Feet

Footage for Period 203' **Operators** M.J. HANSBERRY

Rig TRUCM-3 Drillmaster **Sampling Tools** Riffler

Date Started 12.5.71 **Date Completed** 20.5.71

FROM FT.	FROM IN.	TO FT.	TO IN.	INT. FT.	INT. IN.	DESCRIPTION
0		3		3		Jaspilite scree
3		15		12		Light brown leached jaspilite. Non-magnetic.
15		60		45		Brownish-grey limonite amphibole jaspilite. Magnetic.
60		75		15		Weathered jaspilite. Magnetic. Basal 5' darker in colour.
75		125		50		Brownish-grey limonite amphibole jaspilite. Magnetic.
125		170		45		Green weathered ferruginous schist having a clayey appearance. Pockets of limonite on joint surfaces.
170		203		33		Limonitised schist.
						End of bore
						<u>Core taken 124' - 125'6"</u> Dark-brown magnetic limonite amphibole "jaspilite". Dip of bedding 20°. Structure extremely porous, abundant jointing.
						Petrological analysis of two parts of the core were taken (as the iron formation schist contact was at 125') One part of the core was identified as a schistose quartz-limonite rock; and the other part as a limonitic quartz-biotite garnet schist.
						<u>Core taken at 145'-150'</u> Greenish brown weathered schist. Limonite concentrated at joint surfaces. Part of the core examined petrographically was described as a quartz biotite-garnet schist containing limonite enriched bands.
						<u>Core taken 200' - 203'</u> Dark-brown fractured limonite rock; slightly magnetic.

Remarks

Date 15.6.71 **Logged by** E. EVANS

GEO 699-1

REPORT ON GEOLOGICAL INVESTIGATIONS
- S.M.L. 539, SOUTH AUSTRALIA

E. EVANS

OCTOBER 1971.

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SUMMARY

Interest was focused initially on Stony Hill during the investigations in S.M.L. 205. The coarse-grain size of the jaspilite hills was thought to be of sufficient potential to warrant further work and a new S.M.L. was taken out over the area.

A systematic study of the area was undertaken which included outcrop mapping, surface sampling, petrological work, structural studies and geophysics.

Testing was carried out at the C.M.D.L. laboratories at Whyalla, the coarse-grained jaspilite proving to be suitable for beneficiation thereby justifying drilling to prove grade and tonnage.

Results of the drilling proved disappointing. The two drillholes (located on Stony Hill) did not prove the jaspilite at depth. As this was the most promising in terms of magnetic profile, and size, drilling was not deemed justifiable on the adjacent hills in view of the results at Stony Hill.

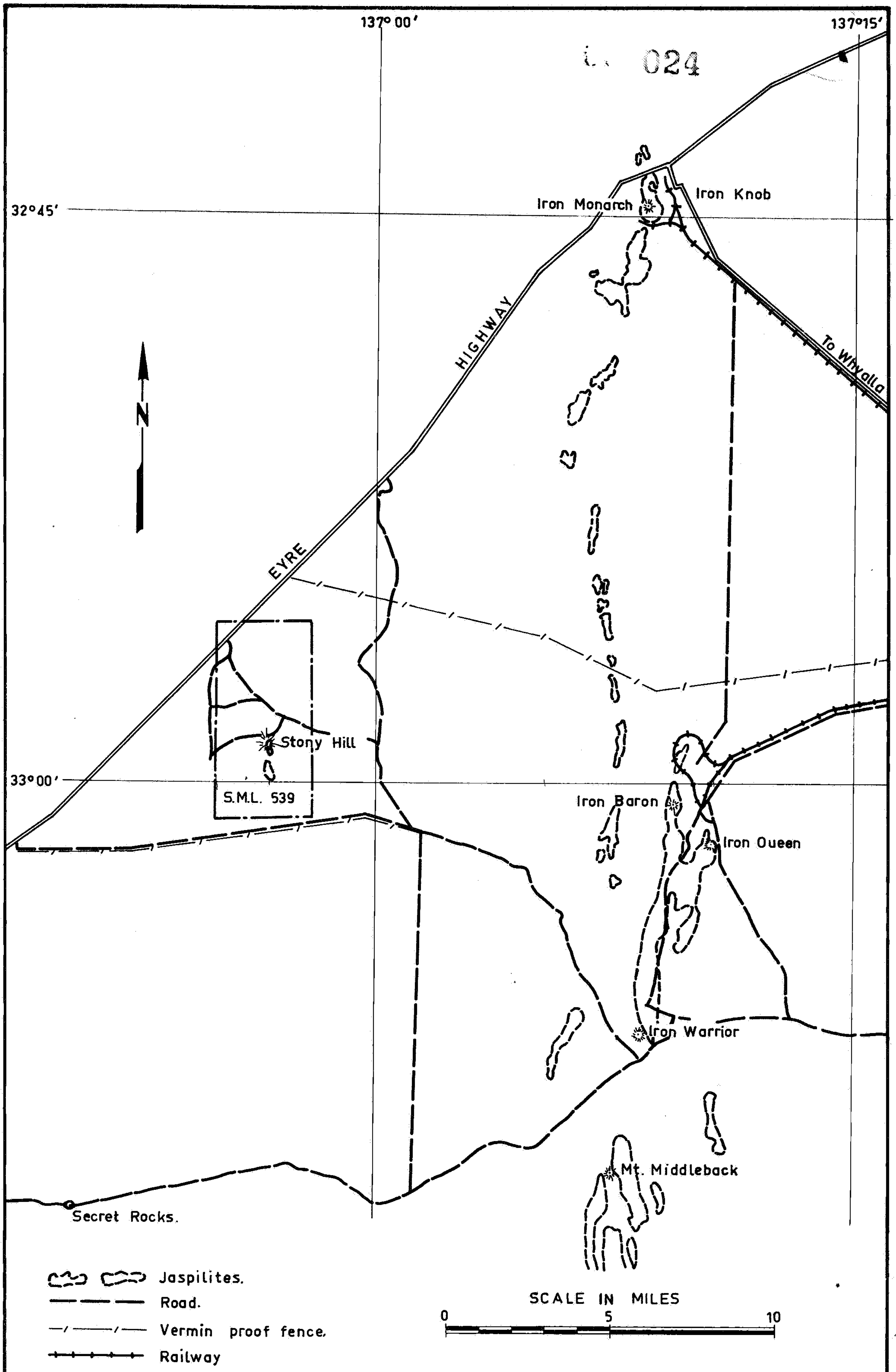
No further work is recommended in the S.M.L.

INTRODUCTION

Stony Hill is located 20 miles (32 Km) south-west of Iron Knob, in north-eastern Eyre Peninsula of South Australia (Fig. 1).

A Special Mining Lease was taken out in the area to investigate the sub-surface quantity and consistency of the outcropping coarse-grained magnetic jaspilites, which have a topographically limited distribution. The outcrops are largely confined to the higher ground (the hills rising up to 100 feet (30.5 m) above plain level), the strike of which is approximately N-S, dipping steeply to the east. Gneiss and amphibolite outcrop to the north and east of the line of hills.

A programme of mapping, sampling, geophysics and drilling was carried out in the area.



Centre WHYALLA	THE BROKEN HILL PROPRIETARY CO. LTD.	Project No. S.A SML 539-2
Date JULY '71	Fig. 1 LOCATION MAP STONY HILL AREA – S.A.	Drawing No. A4/ 41

PREVIOUS WORK

Brief reconnaissance mapping has been conducted in the area by the Department of Mines, and work by the B.M.R. has consisted of an aeromagnetic survey, flown at a height of 1,500 feet.

Geological reconnaissance was carried out in the area by Company geologists in 1970, when part of the present S.M.L. 539 was covered by S.M.L. 205.

A ground magnetic survey was included in this initial work.

REGIONAL GEOLOGY

The area is situated in the Gawler Platform, a stable division of the Precambrian Basement Province of South Australia.

Rocks outcropping in the area are Lower Proterozoic in age, the dominant lithology being the gneisses and amphibolites of the "Gneiss Complex" (Miles, 1954). The term "Basement Complex" has been disfavoured as these rocks have been proven to occur at stratigraphic levels above the Middleback Group.

The term "Cleve Metamorphics" encompasses the underlying gneiss, the Middleback Group, the Warrow Quartzite and iron formations (e.g. Hutchison Group).

The Stony Hill jaspilites may represent iron formations above the Middleback Group, with "gneiss complex" rocks in between, or merely a more intensely metamorphosed Middleback Group sequence.

STRATIGRAPHIC TABLE

B.P. Thomson (1968)

LOWER PROTEROZOIC	CLEVE METAMORPHICS	HUTCHISON GROUP	Schist Iron Formation Schist Dolomite
		WARROW QUARTZITE	Warrow Quartzite
		GNEISS COMPLEX	Gneiss Dolomite + Quartzite Warrow Quartzite Middleback (Iron Formation) Group

K.R. Miles (1954)

MIDDLE PRE-CAMBRIAN OR LATE ARCHAEAN
Middleback Group (Iron Formation)
Gneiss Complex

Following deposition of the Hutchison Group, there was a period of folding and regional metamorphism (the Kimban phase).

The general picture in N.E. Eyre Peninsula is a pattern of meridional folding, with the Middleback Ranges occupying a synclinial structure.

A pattern of N.W. trending faults and dykes is prominent in the region, as displayed on aeromagnetic maps.

RECONNAISSANCE

The area was traversed and all outcrops located were plotted on an outcrop map (Fig. 2) with reference to a base-line. The major outcrop is Stony Hill, which has an elongate shape rising to a height of 100 feet (30.48 m.) above the surrounding plain, being more steeply flanked on the west, and its eastern flank covered by sand.

Strike varies between 345° and 358° (all bearings magnetic), dipping steeply (70° - vertical) to the east. Outcrop length is around 1200 feet (365 m.) width over 300 feet (91.44 m.).

The brownish-grey jaspilite outcrops discontinuously; fractures perpendicular to bedding and parallel to bedding having produced medium-sized blocks in outcrop. Quartz-filled tension gashes are abundant showing preferential enrichment of magnetite at either end of the gash.

There is evidence of folding on the western side; conspicuous on the micro-scale. The outcrop plunges 32° - 40° N.N.E.

The outcrop immediately south of Stony Hill has little topographical expression, striking 344° and dipping 70°-80° to the east. It is much leaner in appearance than its northern neighbour. Despite this there are pockets of extremely coarse-grained magnetic jaspilite. Geophysical evidence points to a width of 600 feet (183 m.) for the magnetic rocks (at the 12000N Traverse line). The length of the outcrop is 750 feet (229 m.).

3/4 mile (1.2 Km) south of Stony Hill jaspilite outcrops discontinuously for 2,000 feet (610 m.) though it rarely reaches more than a hundred feet (30.5 m.) in width. Quartz bands are up to ½" (12 mm.) in width.

No large outcrops of the above dimensions occur north of Stony Hill, and there may be structural reasons for this (Appendix D, Fig. A). A very narrow jaspilite outcrop occurs 2,000 feet (610 m.) north of Stony Hill, its length is 700 feet and it is 50 feet wide (200 m. x 15 m.). A ground magnetometer traverse gave a single high reading (merely a surface band of magnetic material).

Outcrops east of Stony Hill are minor and strike approximately N-S, dipping easterly except for a hilly outcrop located 1½ miles S.E. of Stony Hill which has a variable dip direction and plunges to the south-west.

Rocks known collectively as "undifferentiated Basement Gneiss Complex" outcrop to the north and east of the main jaspilite occurrences. These include metamorphosed arkoses, gneisses, schists, amphibolites, dolerites and quartz-feldspar porphyries. No mineralization is evident.

GEOLOGY OF THE DEPOSIT

(a) Lithology

Jaspilites

Petrological details of the samples submitted are appended (Appendix B). The salient points of the petrological studies are:

(a) The rocks are medium-grained metamorphosed jaspilites containing magnetite, hematite and limonite in widely varying proportions. Cummingtonite (an iron magnesium silicate) is a common mineral.

(b) Total iron oxide content varies from 37% to 73% (by volume). Total iron content (by chemical assay) is in the region of 30% (± 5%). Magnetite content (by volume) ranges from 1% - 20%.

(c) Texture is banded or lenticular. Bands are of the order of 2-3mm. in size, the light brown bands being amphibole (cummingtonite) and the grey bands being hematite and magnetite with quartz.

(d) Grain size of the iron minerals is larger than 0.03mm., and can be up to several mm. long in aggregate form. This means that they are coarse-grained when compared to Middleback Range jaspilites.

(e) The three iron minerals are found to be closely associated when examined in a polished section.

(f) Hematite is commonly found as martite.

(g) Limonite occurs as a local enrichment.

Initial assay data of samples of jaspilite are tabulated in Table 1 (Appendix A). The more systematic bulk strike sampling assay data are tabulated in Table 2.

Chemical assay results were favourable from the metallurgical standpoint, in respect of iron content, lack of impurities and the type of iron minerals present. Metallurgical testing proved favourable in respect of iron liberated (Appendix C). Results indicate that most of the iron can be freed at 100 mesh Tyler.

(b) Structure

The structural interpretation of the area is included in a memorandum (Appendix D). Inferences drawn are:

(a) A NW-SE trending fault cuts off the iron formation to the north.

(b) The individual hills are faulted off from each other.

(c) There is a major synclinal structure in the area, with the Stony Hill line of outcrops representing the western limb.

(d) Iron enrichment is structurally controlled.

(e) The anomaly north of Stony Hill is likely the result of a basic intrusive rather than an iron formation.

GEOPHYSICAL

Initial geophysical data was confined to a B.M.R. aeromagnetic anomaly map flown at around 1500 feet (456 m.) (see Fig. 3). At this height the only anomaly to stand out was centred two miles north of Stony Hill. The anomaly is a closed one.

To try and account for the apparent lack of contrast that these outcropping magnetic jaspilites caused, a comprehensive ground magnetic survey was conducted over the outcrops. Earlier geophysical work, consisting of a few traverses made with a ground magnetometer did not indicate the presence of large bodies of magnetic jaspilites at depth. Location of the traverses are shown in Fig. 4. The only significant anomaly delineated in this earlier survey was the one in Traverse 2A; and magnetic rock was estimated at a depth of 150'-200' (45 m.-60 m.)

In the later more complete survey, ground magnetics were conducted over 10 lines, 3000 feet (915 m.) in length and 2000 feet (610 m.) apart. Further supplementary traverses were made as infill or as extensions. Readings were taken at intervals of 100 (30.48 m.) feet, but more frequently over outcrops or areas of substantial response.

The survey indicated a strike length of at least 16,000 feet (4877 m.) (see Fig. 5), the supplementary survey adding another 4,000 feet (1219 m.) to this. Strike length is discontinuous. Profiles over Stony Hill and kindred outcrops to the immediate south were extremely sharp and high, due to surface and near surface jaspilite. The erratic nature of the profiles is due to the permanent magnetic moments of jaspilites which has a random direction.

Less pronounced anomalies (of the magnitude of 1500 gammas) were recorded in the region of the Aeromagnetic Anomaly to the north of Stony Hill, due to magnetic rocks below the surface. Some lensing of the jaspilites is apparent along the strike, or else the magnetite has been replaced by hematite or martite.

The estimated width of near surface jaspilites varies from 600 feet (183 m.) on 12000N Traverse to 300 feet (91 m.) at 8000N. Width of outcrop at Stony Hill (14000N) is 400 feet (122 m.).

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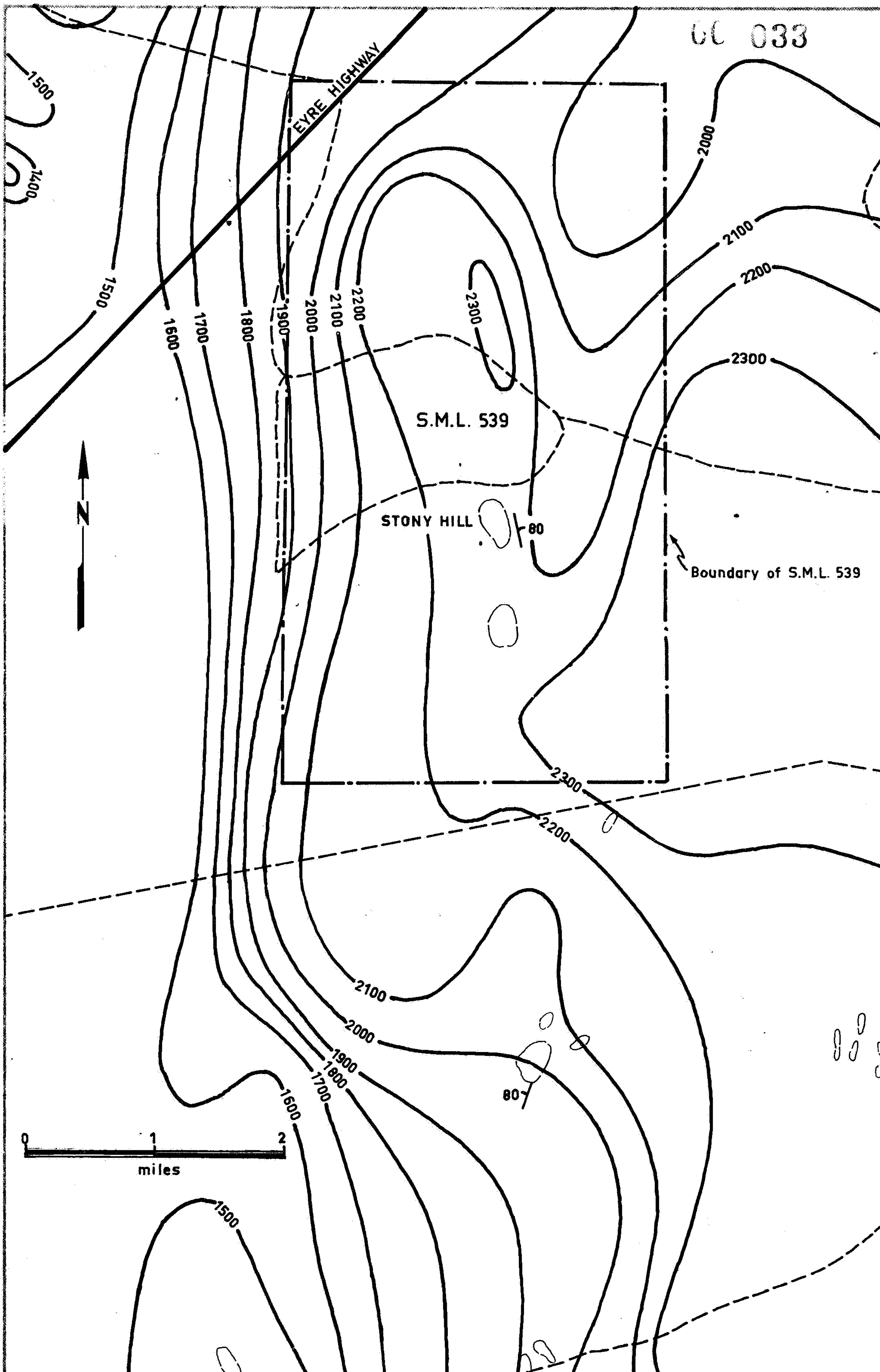

Centre Whyalla	THE BROKEN HILL PROPRIETARY CO LTD Fig.3 SML 539 STONY HILL AREA AEROMAGNETIC CONTOURS (B.M.R.1500')	Project No. SA S.M.L. 539 -2
Date April 1970		Drawing No. A4/42

The extension southwards of the grid (6000N Traverse) showed a maximum response comparable with 8000N - a response of 6000 gammas. However, the profile indicates a deeper source. The traverse at 4000N showed profiles of a lower magnitude (1800 gammas) over a narrow width. An infill traverse across a narrow body of outcropping jaspilite just north of 16000N, showed a sharp rise over an interval of 50 feet (15 m.), probably due to merely a narrow line of magnetic material across the surface.

The sharp, steep profiles discount a large body of magnetic rock at depth. If these deposits were magnetic to a depth of 250 feet (76 m.), a more normal curve of magnetic response would be expected. The percentage of magnetite usually increases with depth, because extensive weathering oxidises the magnetite to hematite and limonite, at shallow depths at least. But considering the sub-vertical aspect of the bedding, a cut-out at shallow depth is difficult to conceive and would require change with depth from magnetite to martite or hematite. The reverse is usually the case; so the deposit is somehow limited by structure.

The breaks in magnetic response could be due to a change from magnetite jaspilite to hematite jaspilite. A gravity survey would distinguish between non-magnetic jaspilite and "basement" by their gravitational effects on the surface. The density of jaspilite is given as 3.3cc., while other rocks (schists, etc.) would be 2.7cc.

DRILLING

Two exploratory holes were drilled with a Company TRUCM-3 percussion rig, on the largest outcrop (Stony Hill). The first hole was an inclined hole (angle 60° from horizontal) drilled on the down-dip side, at a bearing of 265° magnetic (Fig. 6). On surface indications, the jaspilite would be intersected at depth at approximately 170 feet (52 m.), assuming a dip of 83° to the east.

Loose and consolidated scree was intersected for the first 20-30 feet (6 m.-9 m.), followed by a quartzose-limonite amphibole rock, with slight magnetic content. The first core sample taken at 95 feet (29 m.) showed traces of magnetic iron in a brown limonite-amphibole rock. The dip of the bedding was 60° (shallower than at the surface). Drilling rates indicated broken ground, and the core showed features of disturbance.

A core sample taken at 200 feet (61 m.) was similar in general appearance to the first, but not as disturbed. The rock was described petrographically as a limonite-amphibole jaspilite with dolomite (Specimen ST1B, Appendix B4). The rock was conspicuously porous and indicates leached quartz, and was analysed for trace elements because of its "gossaneous" appearance. Results proved disappointing (Table 3). Alternating soft (chloritic) bands and harder (limonitic) bands were intersected from 218-235 feet (66-72 m.) and sample return was negligible owing to the broken nature of the ground, hence the hole was suspended at 235 feet (72 m.)

To prove the extent at depth of the beneficiable jaspilite the second hole was drilled vertically, approximately at the centre of the outcrop (Fig. 6). But for the first 20 feet (6 m.) brownish-grey magnetite-hematite-limonite-amphibole jaspilite was intersected to a depth of 125 feet (38 m.). A core sample taken at the contact of iron formation and schist showed the porous nature of the jaspilite as in Hole 1. The dip of the bedding was 20°. Average assay for the iron formation was 30%, comparable to surface assays. From 125-170 feet (38-52 m.) a weathered schist was intersected, with considerable healing of the joint surfaces by secondary clay minerals. Reid (1965) refers to the occurrence of clay minerals in the subsurface low grade iron ores of the Middleback Ranges, particularly the Iron Duke. From 170-203 feet (52-62 m.) the schist was limonitized to an extreme degree.

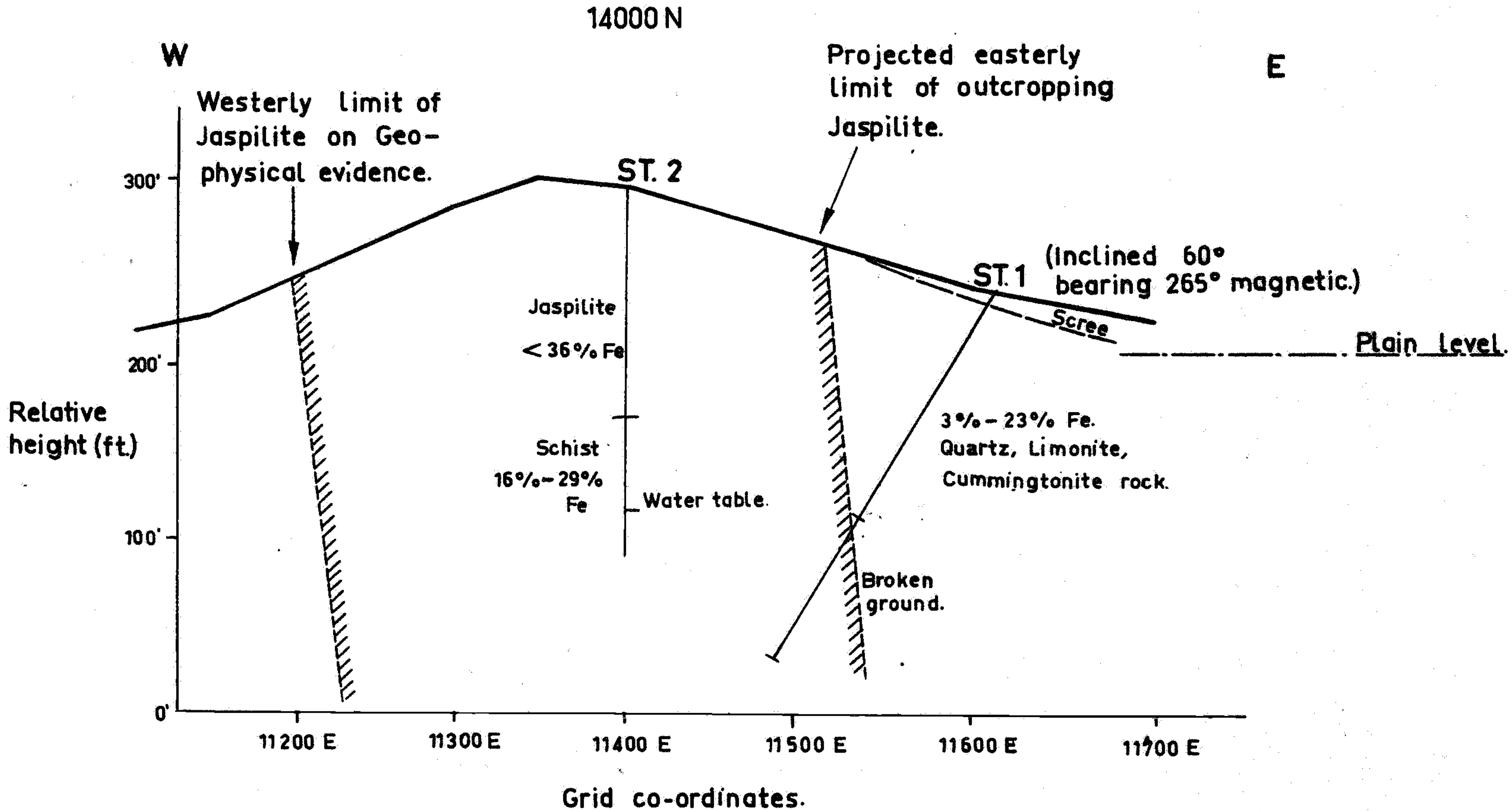

Fig. 6

W.E. SECTION THROUGH STONY HILL SHOWING LOCATION OF DRILL HOLES.

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Centre WHYALLA

Date JULY '71

Project No. S.A. S.M.L. 539-6

Drawing No. A4/44

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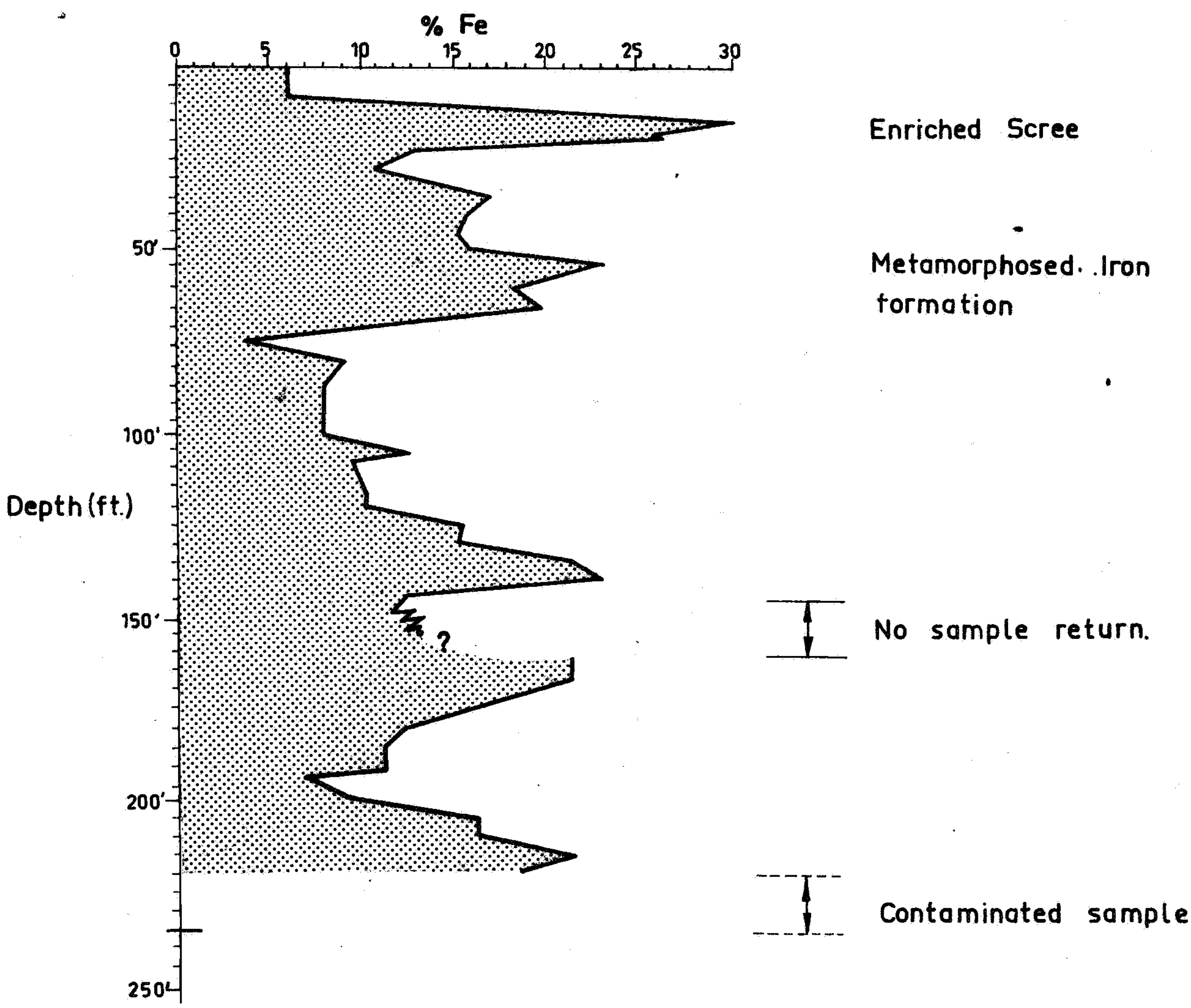
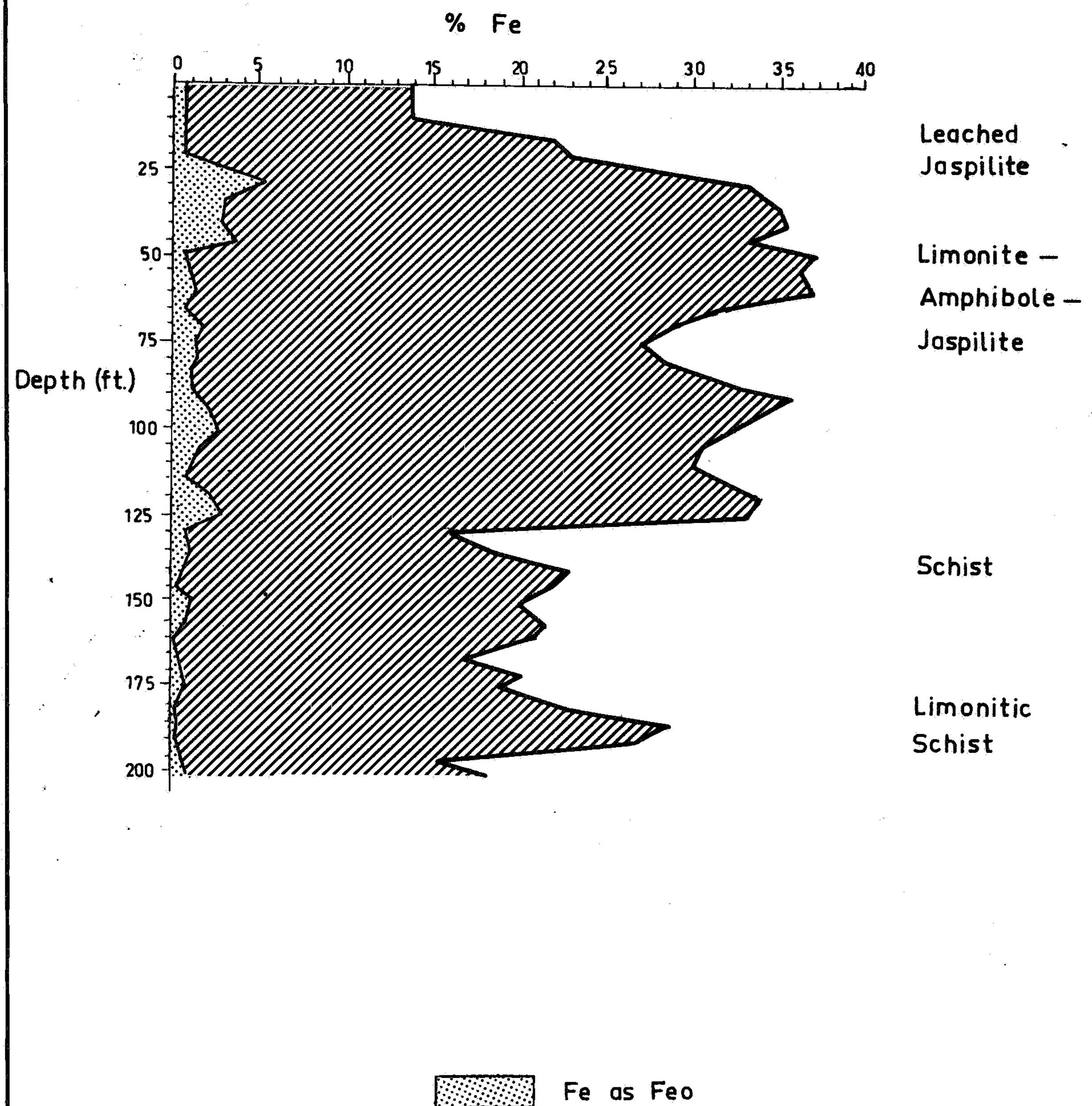
The core samples testify to the leaching that the iron formations have been subjected to. The nature of the subsurface (broken ground) has obviously facilitated the movement of ground waters to leach the quartz from the jaspilite, as this is found in concentrations. Fig. 7(b) shows the amount of magnetite with depth.

Total footage drilled amounted to 438 feet and the contract price for the driller was $731.00.



Centre WHYALLA	THE BROKEN HILL PROPRIETARY CO. LTD.	Project No. S.A. S.M.L. 539 - 7
Date JULY '71	Fig. 7a STONY HILL - ASSAY GRAPH ST 1.	Drawing No. A4/ 45



Centre WHYALLA	THE BROKEN HILL PROPRIETARY CO. LTD.	Project No. S A SML 539 - 8
Date JULY '71	Fig. 7b. STONY HILL — ASSAY GRAPH ST 2	Drawing No. A4/ 46

CONCLUSIONS AND RECOMMENDATIONS

** The Stony Hill line of outcrops may represent the western limb of an inferred synclinal structure; the outcrop 1½ miles SE of Stony Hill being part of the (largely obscure) eastern limb. The individual hills are most probably faulted off from each other.

** Metamorphosed iron formations at Stony Hill cut out at 125' (38 m.) below the summit; the core of the hill being a weathered and limonitized schist. Leaching is evident in the iron formation.

** Due to similarity of the ground magnetometer profiles, there are no congruent reasons for pursuing to drill the other outcrops.

** The pronounced aeromagnetic anomaly north of Stony Hill is probably due to a basic intrusive.

** The area holds little economic interest as far as beneficiable low grade iron ores are concerned.

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APPENDIX A

TABLE I

CHEMICAL ANALYSIS OF JASPILITE WEST OF MIDDLEBACK RANGES

	Fe	SiO_2	Al_2O_3	Ign. Loss	P	CaO	MgO	Mn	S	TiO_2	FeO
ST 1	34.0	49.0	00.2	02.0	0.04	00.1	00.1	00.1	00.03	0.05	02.2
ST 2	34.1	49.0	00.2	01.3	0.04	00.3	00.6	00.1	00.03	0.05	02.1
ST 3	30.9	50.0	00.3	02.7	0.03	00.9	00.8	00.1	00.04	0.05	01.9

TABLE 2

CHEMICAL ANALYSIS OF MATERIAL FROM STONY HILL

Sample No.	% Analysis										
	Fe	SiO_2	Al_2O_3	Ign. Loss	P	CaO	MgO	Mn	S	TiO_2	Fe as FeO
GL/A/1	35.0	47.0	0.2	2.3	0.03	0.3	0.1	0.1	0.02	0.05	3.0
GL/A/2	34.2	49.0	0.1	1.7	0.04	0.1	0.1	0.1	0.01	0.05	3.8
GL/A/3	34.9	49.0	0.2	1.0	0.03	0.2	0.1	0.1	0.01	0.05	3.3
GL/A/4	37.4	45.0	0.1	1.4	0.03	0.3	0.1	0.1	0.02	0.05	3.2
GL/B/1	33.1	50.0	0.1	1.1	0.03	0.3	0.4	0.1	0.02	0.05	2.6
GL/B/2	32.8	51.0	0.2	0.9	0.04	0.2	0.4	0.1	0.01	0.05	2.3
GL/C/1	34.8	48.0	0.2	1.7	0.01	0.1	0.1	0.1	0.02	0.05	3.3
GL/C/2	35.8	46.0	0.2	2.5	0.01	0.1	0.1	0.1	0.02	0.05	2.8
GL/C/3	32.9	50.0	0.1	3.3	0.02	0.1	0.1	0.1	0.02	0.05	2.3
GL/C/4	32.5	51.0	0.2	2.7	0.03	0.1	0.1	0.1	0.02	0.05	3.2
GL/C/5	33.3	50.0	0.2	1.8	0.03	0.1	0.1	0.1	0.02	0.05	3.6

TABLE 3

TRACE ELEMENT ANALYSIS OF STONY HILL DRILL SAMPLES

Sample No.	Cu	Pb	Zn	Co	Ni	Ag
1974	28	30	36	30	24	1.4
1975	12	18	54	26	24	0.8
1976	20	18	20	14	16	0.8
1977	26	22	36	20	46	1.0
1978	12	20	12	22	20	1.3

APPENDIX B1

THE BROKEN HILL PROPRIETARY COMPANY LIMITED

WHYALLA 23rd December 1970

MEMO. From PETROLOGIST

To SENIOR GEOLOGIST

CC 047

Specimens of Jaspilite from the Stony Hill Area, West of the Middleback Range

1. Summary

11 specimens, taken from 11 samples collected from three localities in the area, were microscopically examined by means of thin and polished sections.

The rocks are medium-grained metamorphosed jaspilites containing magnetite, hematite and limonite in widely varying proportions. The total iron oxide mineral content varies between 37 and 73% weight approximately, in which hematite is mainly present as martite.

Apart from quartz, some specimens contain appreciable cummingtonite (a Fe-Mg-silicate).

The bulk of the iron oxide minerals is present in particles larger than 0.03mm, mainly as elongate aggregates up to several mm long.

The specimens are more or less magnetic with the exception of those very low in magnetite.

2. Introduction

As part of a metallurgical investigation at C.M.D.L. 11 jaspilite specimens, taken from 11 samples collected from three localities in the Stony Hill, were microscopically examined. It was required to determine the iron ore minerals and their proportion.

3. Methods of Examination

The specimens were examined megascopically and microscopically by means of thin and polished sections. Also their magnetic properties were checked with a hand magnet and compass.

../2

4. Results of Examination

As the rocks are all jaspilites, individual descriptions were limited to brief remarks on megascopic and magnetic features, listed in Table I.

Weight percentages of mineral constituents were obtained from the microscopic examination and calculated from modal analyses and listed in Table 2.

However, the petrology was treated as a whole, with separate notes on the mineralogy and textures.

TABLE I

Megascopic and magnetic features of jaspilite specimens.

Spec. No.	General Appearance	Magnetic Properties
GL/A/1	Hard quartzose dark grey; medium grained rock with semi-schistose structure and roughly developed banding.	weakly magnetic
GL/A/2	As previous specimen, but only a suggestion of banding	Moderately magnetic
GL/A/3	As GL/A/1	Moderately magnetic
GL/A/4	As GL/A/1	Moderately magnetic
GL/B/1	Hard quartzose grey, medium grained rock containing well developed bands (1-5mm) of pale brown material	Weakly magnetic
GL/B/2	Hard quartzose dark grey medium grained grey rock with poorly defined banding and containing small white spots (1-2mm) of an alteration mineral.	Only slightly magnetic

../3

TABLE I (cont.)

Spec. No.	General Appearance	Magnetic Properties
GL/C/1	Hard, quartzose, dark grey, medium-grained rock showing poorly developed lineation of constituents.	Moderately magnetic
GL/C/2	Hard, quartzose, dark grey medium-grained rock of massive appearance	Moderately magnetic
GL/C/3	As GL/C/2	Slightly magnetic
GL/C/4	As GL/C/2, massive but with slightly developed lineation	Moderately magnetic
GL/C/5	As GL/C/4	Slightly magnetic

TABLE 2

Mineral Content of Jaspilite Specimens
Weight % (calculated from modal analyses)

No. of Specimen, TS & PS	Magnetite	Hematite	Limonite	Quartz	Silicates	Remarks on silicate minerals
GL/A/1 5646	12.4	1.3	37.5	48.8	-	
GL/A/2 5647	17.0	34.5	11.4	37.1	-	
GL/A/3 5648	21.7	44.1	6.9	27.3	-	
GL/A/4 5649	20.7	34.9	8.1	36.3	-	

../4

TABLE 2 (cont.)

No. of Specimen, TS & PS	Magnetite	Hematite	Limonite	Quartz	Silicates	Remarks on silicate minerals
GL/B/1 5650	6.7	29.7	0.2	49.6	13.8	Cummingtonite
GL/B/2 5651	1.6	47.8	0.5	43.6	6.5	Cummingtonite and unidentified alteration mineral.
GL/C/1 5652	16.8	17.1	19.4	46.7	-	
GL/C/2 5653	19.8	7.4	29.1	43.7	-	
GL/C/3 5654	3.6	7.8	44.2	44.4	-	
GL/C/4 5655	7.4	34.5	0.4	53.3	4.4	Partly altered cummingtonite
GL/C/5 5656	Trace	44.3	7.4	39.1	9.2	Completely altered cummingtonite

5. Mineralogy and Textures

5.1. Iron oxide minerals: As shown in Table 2 magnetite, hematite and limonite occur in widely varying proportions. However, the following trends can be noticed.

a. All GL/A specimens and two of the GL/C group show a relatively high magnetite content

b. A relatively high hematite content is found in three specimens of the GL/A group, in the two of the GL/B group and in three of the GL/C group

c. Limonite is a prominent mineral in two specimens of the GL/A group and in three of the GL/C group, while it is insignificant in the GL/C group.

5.1. (cont.)

Polished sections show that the three minerals occur closely associated. Magnetite generally occurs as euhedral grains and as much larger elongate aggregates. Their shape is irregular but their elongation is parallel to the general structure and in some specimens resulting in roughly defined bands.

Hematite is found mainly in the form of martite. Some magnetite grains show only little oxidation to martite, while in the hematite rich specimens the magnetite is only found as remnants. An interesting feature are isolated small magnetite grains (0.03-0.10mm) completely unaffected by oxidation next to aggregates which are considerably martitized. This fact suggests a second generation of magnetite in the metamorphic history of the rock.

In the limonite-rich specimens much of the martite has been altered to limonite.

5.2. Quartz

Characteristic are its generally oblong grains (0.05-1.2mm) The elongation is parallel to the general structure and recrystallization has resulted in often polygonal shape. Strain polarization is often pronounced, indicative of stresses in the rock. On the other hand the grains show only a low degree of interlocking.

5.3. Silicate Minerals

Apart from quartz, cummingtonite occurs in appreciable amounts in specimens of the GL/B and GL/C groups.

Particularly in GL/B/1 it forms well defined bands, visible as a pale brown material in the hand specimen. The mineral occurs as slender prismatic crystals, the cross section of which show the characteristic amphibole cleavage. It is further affected by alteration to limonite and quartz as noticed in specimens of the GL/C group.

A white, unidentified alteration mineral, occurs as small white spots (0.5-2mm) in specimen GL/B/2. Table 2 reveals further that the silicate bearing specimens are relatively rich in hematite, but poor in magnetite and limonite.

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6. Conclusions

6.1. The rocks are medium grained jaspilite containing magnetite, hematite and limonite in widely varying proportions. Their combined weight percentages vary between 37 and 73 approximately as show in Table 2.

6.2. Magnetite and hematite are relatively prominent in the GL/A group, while the GL/B group is mainly hematitic.

6.3. A high limonite content is found in one specimen of the GL/A group and three of the GL/C group.

6.4. Apart from quartz, cummingtonite occurs in the GL/B group and in two specimens of the GL/C group. These specimens appear to be high in hematite, but low in magnetite and limonite.

D. BURGER

APPENDIX B2

THE BROKEN HILL PROPRIETARY COMPANY LIMITED

WHYALLA 27th March 1971.

MEMO. From PETROLOGIST

To SENIOR GEOLOGIST

054

Jaspilite and Ironstone Specimens from the Stony Hill Area, S.M.L. 539

1. Summary

8 jaspilite and 2 ironstone specimens were microscopically examined. The jaspilites are of relatively coarse grained texture and composed of quartz, hematite, limonite and altered amphiboles in varied proportions. The iron stones were identified as a high grade limonite and a hematite-sandstone and were probably derived from the jaspilites. Textures of structural interest and features related to the history of the rocks are briefly discussed.
A comparison is made with the Iron Duke jaspilites.

2. Introduction

10 specimens, collected by E. Evans from the Stony Hills Area in S.M.L. 539, were submitted for microscopic examination.

3. Method of Examination

All specimens were examined in thin and polished sections. Their magnetic properties were checked with a small but strong Eclips permanent magnet.
Volume percentages of mineral components were determined by means of micro-traverses across the thin and polished sections.

4. General Observations and Conclusions

4.1. Rock Types

As 8 out of the 10 specimens were identified as amphibole-jaspilites containing varied amounts of magnetite, hematite and quartz, descriptions were kept brief and features listed in the attached table. The 2 remaining specimens are a limonite-ore, probably a local enrichment, and a hematite-sandstone, probably from a formation younger than the jaspilites.

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The combined iron ore mineral content in the jaspilites proper is not particularly high and range from 19 vol.% in GL/3 to 34 vol.% in GL/6 with an average of the order of 25 vol.%.
As the amphiboles are altered to limonitic material and quartz, the actual limonite and quartz content in these jaspilites is expected to be somewhat higher than listed in the attached table.
GL/7 is a high grade limonite ore with almost 100% combined iron oxides.
SML/17 with 33% hematite is a low grade, highly siliceous material.

4.2. Megascopic appearance

The jaspilites proper are generally medium-grained brownish-grey rocks composed of brown to light brown bands of altered amphibole and the grey bands of hematite and/or magnetite with quartz, but free of amphibole.
In some specimens the banding is poorly developed or even lacking.
GL/7 and SML/17 look quite different, being a dark massive type of ironstone without banding or the medium-grained, almost crystalline appearance, characteristic of the true jaspilites in this area.

4.3. Magnetic properties

These were checked with the Eclips hand magnet. As could be expected, the higher the magnetite content in the specimens, the more pronounced their magnetism.

4.4. Mineral Components and their relationships

The mineralogy of the jaspilites is generally simple.
Magnetite, hematite, limonite, quartz and amphibole are the common minerals.

4.4.1. Iron Ore Minerals

Hematite and magnetite occur closely associated in elongated aggregates as partly or completely martitized magnetite grains. Occasionally small isolated magnetite grains were observed, not affected by oxydation and believed to be a second generation of magnetite in the metamorphic history of the rock.
Specimens GL/4 and GL/6 are relatively rich in hematite and almost free of magnetite.
Free limonite is not common in the jaspilites and limited to specimens GL/6 and SML/14 as a direct alteration product

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of hematite or magnetite. In the other specimens limonite occurs intimately associated with alteration products of the amphibole. In oblique reflected light this material shows a pale yellow-brown colour contrasting with the dark brown "clean" limonite derived from hematite or magnetite. In transmitted light the former tends to be turbid, almost opaque, while the latter shows the characteristic amber colour of free limonite.
Specimen GL/7 is a high grade limonite ore and shows some evidence of fracturing and leaching. Goethite occurs in coloform structures around cavities.
Hematite is the principal iron ore mineral in Specimen SML/17 in which it occurs as a matrix between the quartz grains.

4.4.2. Quartz
Recrystallized quartz forms the bulk in the jaspilites. As a general rule the grains are more or less elongate, show a varied degree of interlocking and occur in lenticular aggregates.
Strain polarization is a common feature.

4.4.3. Amphibole
The mineral occurs closely associated with the iron ore lenticles in the jaspilites, where it forms fibrous aggregates of turbid limonitic material and quartz which still contain such features as cleavage lines and crystal outlines. Unaltered remnants were tentatively identified as cummingtonite and a pale green hornblende.

4.4.4. Other Minerals
Small amounts of an unusual mineral were observed in Specimen GL/2 (TS 5734). It occurs closely associated with the altered amphibole as small blebs and subhedral crystals (0.1-0.75mm). In one case it has partly replaced a large amphibole crystal. Optically it is characterised by an unusually strong pleochroism, from pale brown to deep blue-green, and by anomalous blue and purple interference colours. The mineral is tentatively identified as corundophilite, a variety of chlorite. (Winchell & Winchell, 1956, Elements of Optical Mineralogy, Part II page 385.)
A few zircon grains were found in the hematite-sandstone, Specimen SML/17.

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5. Features concerning the history of the rocks

5.1. The presence of amphibole, particularly cummingtonite, indicates that the original sediments contained magnesium-bearing material in addition to ferruginous and siliceous components.

5.2. Compared with the Middleback Range jaspilites, the Stony Hill jaspilites have a definitely coarser grained texture which is already visible in the hand specimens.
In this connection the writer suggests that the coarser texture, particularly of the quartz, is not necessarily due to a higher degree of metamorphism but could be attributed to the normally coarser-grained sediments nearer to the shore of the original lake or sea.
The massive limonite in specimen GL/7 is believed to be a local enrichment, the iron components of which are derived from jaspilite.
In this connection the writer refers to the fairly extensive limonite deposits discovered in the area situated E of the NE ridge of the South Middleback Range.
The hematite sandstone in specimen SML/17 is probably also derived from the erosion of local jaspilites, as suggested by subangular quartz grains with embayed edges and the complete absence of feldspar.

5.3. Textural features, such as the pronounced elongation of quartz and iron ore lenticles, particularly in specimens GL/2 and SML/16, may assist in unravelling local structure and deformation.

6. Sub-Surface Investigation

It is understood that following discussions with the Melbourne Office, a limited amount of diamond drilling will be carried out in the Stony Hill Area.
The microscopic examination of jaspilites in some drill cores of the Iron Duke area, revealed an increase in the magnetite content and the presence of unaltered amphiboles in depth. The writer expects a similar situation in the Stony Hill jaspilite formation.

D. BURGER

TABLE I - Particulars of the Rock Specimens examined

Field No. Petr. No. Location	Megascopic Features	Magnetic Properties	Microscopic Features Mineral Components Volume %		Microscopic Features Grainsize, texture and relationships	Rock type
GL/1 5733 12150'N 11700'E Southerly outcrop.	Medium grained jaspilite composed of grey & pale brown bands (2-5mm). The latter contain fibres of amphibole.	Moderately magnetic	Magnetite Hematite	15%) 8%)	0.03-2mm as partly martitized grains	Magnetite-hematite-amphibole-jaspilite
			Quartz	67%	0.05-2.5mm Interlocking grains showing strain polarization.	
			Amphibole	10%	0.03-0.6mm as small fibres, slightly altered to limonite closely associated with the iron ore grains	
GL/2 5734 12150'N Southerly outcrop	Medium grained jaspilite in which the bands are less sharply defined than in GL/1. The structure is almost gneissic.	Weakly magnetic.	Magnetite Hematite	3%) 21%)	0.04-3mm mainly martite grains in lenticles and streaks carrying remnants of magnetite.	Magnetite-hematite-amphibole jaspilite. Some limonite is present, mainly as alteration product of the amphibole.
			Quartz	56%	0.05-0.5mm. In strongly elongated lenticles in which grains are oblique to the general fabric	
			Amphibole completely altered to limonite and quartz.	20%	0.25-3mm, crystals parallel to the general fabric.	

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TABLE I (cont.)

Field No. Petr. No. Location	Megascopic Features	Magnetic Properties	Microscopic Features: Mineral Components Volume %	Microscopic Features: Grainsize, texture and relationships	Microscopic Features: Rock type
GL/2 (cont)			Chlorite (?) Accessory	Only tentatively identified. A deep-green variety, pleochroic from bluish-green to pale brown. The latter two minerals are closely associated with the iron ore grains.	
GL/3 5732 SE of SML	Medium grained dark brown jaspilites composed of dark grey and dark brown bands (1-8mm) Some brown bands are slightly porous.	Weakly magnetic	Magnetite 7%) Hematite 12%)	0.05-0.7mm 0.03-1mm. Hematite occurs mainly as martite	A lean magnetite-hematite-amphibole jaspilite. Some limonite is present as alteration product of the amphibole.
			Quartz 69%	0.05-1.3mm as interlocking grains.	
			Amphibole 12% completely altered to limonitic material and quartz.	Fibres 0.10-0.8mm, occurs closely associated with the iron ore. Quartz grains & iron ore grains and bodies show only little elongation.	

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TABLE I (cont.)

Field No. Petr. No. Location	Megascopic Features	Magnetic Properties	Microscopic Features Mineral Components	Volume %	Grainsize, texture and relationships	Rock type
GL/4 5738 150 yards W of 3.0 mile peg	Fine to medium grained jaspilite comgrey and pale brown bands (1-4mm)	Slightly magnetic	Magnetite	1%	0.03-0.4mm, as single unaltered grains	A lean magnetite-hematite-amphibole jaspilite. Limonite is mainly present as an alteration product of the amphibole.
			Hematite	23%	0.03-0.5mm mainly as martite grains.	
			Quartz	47%	0.05-0.4mm Grains are only slightly interlocking and show strain polarization.	
			Amphibole considerably altered to limonitic material & quartz.	29%	Fibres and prisms (0.03-0.5mm) closely associated with the iron ore.	
GL/5 5739 900 yards W of 1.8 mile peg	Fine to medium grained dark brown jaspilite The bands are only faintly marked and from 2 to 6mm thick	Weakly to moderately magnetic	Magnetite	11%	0.05-1.8mm as elongate grains and blebs.	A lean magnetite-hematite-amphibole jaspilite. Limonite is present as alteration product of amphibole.
			Hematite	8%	0.05-1.8mm elongate grains and blebs of martite	
			Quartz	37%	0.015-1mm distinctly elongated grains and lenticules showing strain polarization.	
			Amphibole completely altered to fine grained quartz & limonitic material	44%	0.06-0.30mm as remnants of fibres and prisms of amphibole parallel to the general fabric. Associated with the iron ore grains.	

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TABLE I (cont.)

Field No. Petr. No. Location	Megascopic Features	Magnetic Properties	Microscopic Features Mineral Components	Volume %	Grainsize, texture and relationships	Rock type
GL/6 5740 200 yards at 170° from GL/5	Fine to medium grained dark brownish grey jaspilite. The bands (1-4mm) are only faintly marked	Non-magnetic	Magnetite	Trace	0.02-0.06mm single grains unaffected by alteration.	A hematite limonite amphibole jaspilite A part of the limonite is present as alteration product of the amphibole.
			Hematite	14%	0.03-0.6mm as martite grains showing alteration to limonite.	
			Limonite	20%	As alteration product of martite	
			Quartz	55%	0.1-1mm Only slightly elongated grains showing strain polarization	
			Amphibole completely altered to quartz and limonitic material	11%	0.15-0.6mm, fibres and prisms closely associated with the iron ore.	
GL/7 5741 540 yards W of 1.5 mile peg	Slightly porous, hard iron ore	Non-magnetic	Hematite	1%	0.025-0.15mm mainly present as small martite grains	Essentially limonite-ore, probably a local enrichment.
			Limonite	99%	Fractured and porous limonite showing coloform structures.	
			Quartz	Trace	0.01-0.03mm	

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Field No. Petr. No. Location	Megascopic Features	Magnetic Properties	Microscopic Features: Mineral Components	Volume %	Grainsize, texture and relationships	Rock type
SML/14 5761 3800' at 168° from 8000'N 12200'E	Dark brown and grey medium grained jaspilite consisting of grey and brown bands (1-5mm)	Moderately magnetic	Magnetite	14%	0.03-1.3mm partly altered to hematite and limonite	A magnetite hematite limonite amphibole jaspilite.
			Hematite	5%)	Of the same grain size as magnetite.	
			Limonite	6%)	The three minerals are closely associated.	
			Quartz	46%	0.1-1mm as interlocking grains which are elongated parallel to the fabric and show strain polarization.	
			Amphibole almost completely altered to quartz and limonitic material	29%	0.03-0.3mm, as small fibres forming elongate aggregates parallel to the general fabric.	
SML/16 5772 400'N of 16000'N 12080E Traverse grid	A dark grey somewhat porous jaspilite. It shows a parallel orientation of components but no banding.	Non-magnetic	Hematite mainly as martite	32%	0.03-0.4mm The grains occur in lenticular aggregates up to 4mm long.	A hematite amphibole jaspilite showing a lenticular distribution of the components but no banding.
			Quartz	51%	0.05-0.5mm occurs in parallel oriented lenticular bodies between iron ore lenticles.	

TABLE I (cont.)

Field No. Petr. No. Location	Megascopic Features	Magnetic Properties	Microscopic Features Mineral Components	Volume %	Grainsize, texture and relationships	Rock type
SML/16 cont.			Amphibole	17%	0.08-0.8mm As fibres and small prisms arranged parallel to the general fabric & closely associated with the iron ore lenticles.	Some limonite is present as alteration product of the amphibole.
SML/17 5805 1.5 miles W of 16000'N 10000E	A dark reddish brown medium, to fine grained ferruginous and quartzose rock.	Non-magnetic	Hematite	33%	occurs as a matrix between the quartz grains.	A hematite sandstone rather than a jaspilite. Remarkable is the complete absence of feldspar grains.
			Quartz	67%	0.05-1.5mm The majority of the grains are angular to subangular, many with embayed outlines. Only few subrounded grains occur. Strain polarization common.	
			Zircon	Rare	0.06-0.20mm Stubby rounded grains	

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APPENDIX B3

BASEMENT "GNEISS COMPLEX" ROCKS

Specimen SML 8

Greenish-grey rock; semi-schistose structure.
Amphibole: 82%, pale green to bluish green (0.03mm - 0.60mm), as elongate grains and subhedral grains parallel to general fabric, resulting in schistose structure.

Occasional pleochroic haloes. Plagioclase 14% (0.03mm-0.3mm) in lenticular grains parallel to fabric completely altered to sericite and zoisite.

Epidote 2%: mainly in small regular veinlets more or less parallel, and at high angle to schistosity.

Rare carbonate in veinlets, with epidote.

Accessory chlorite, enriched in veinlets with epidote.
Titanium minerals: Parallel streaks of sphene grains.
Polished section shows elongated ilmenite grains (0.015-0.05mm)

therefore amphibole-plagioclase schist derived from basic rock

Specimen SML 9

Fine to medium grained, dark greenish-grey rock of rather massive appearance.

Amphibole 74%: (0.03-0.50mm) pleochroic pale yellowish green - dark green, rarely bluish-green, anhedral to subhedral grains, slightly elongate with sub-parallel orientation.

Plagioclase 25%: partly altered subhedral grains and crystals (0.05-0.75mm).

Titanium minerals 1%: grain of sphene and ilmenite (0.015-0.05mm) in elongate aggregate parallel to general fabric. A few larger opaque grains.

Polished section confirms the presence of anhedral ilmenite grains and a few larger magnetite grains altered to limonite. Therefore, amphibolite probably derived from a micro-gabbro or a basic lava.

Specimen SML 10

Fine grained greenish rock containing minor small phenocrysts.

Green hornblende 81%: mostly anhedral grains (0.015-0.3mm) and subhedral stubby prisms with sub-parallel orientation.

Plagioclase 13%: anhedral to subhedral grains (0.06-0.50mm) a few phenocrysts up to 1.5mm. Sub-parallel orientation.

Quartz 4%: interstitial anhedral grains (0.03-0.20mm)

Opaques 2%: in parallel lenticular and elongate bodies.

Clusters (0.03-0.9mm) always completely surrounded by green hornblende. Sometimes associated with leucoxene. Polished section reveals ilmenite.

Amphibolite (derived from a basic lava?)

THE BROKEN HILL PROPRIETARY COMPANY LIMITED

WHYALLA 20th July 1971

067

MEMO. From PETROLOGIST

To SENIOR GEOLOGIST

Miscellaneous Rock Specimens from SML 539, Stony Hill Area

Introduction

23 rock specimens were examined by means of 23 thin and 14 polished sections.
15 specimens, marked SML, were collected by E. Evans and 8 marked NBO, by the writer.

Summary

Results of the petrographic work have been listed in Table I below.
The rock types identified can be grouped as follows:-

A. Slightly to medium metamorphosed rocks of igneous origin of the acidic and more basic types including pegmatite, quartz-feldspar porphyry, amphibolite, dolerite, hornblendite.

B. Metamorphosed rocks of sedimentary origin including recrystallized arkose, quartz-feldspar-biotite gneiss, and ferruginous rocks, including jaspilite.

Points of interest are:-

1. Varied degrees of deformation caused by dynamic metamorphism.

2. Varied degrees of mineralogical changes occurring in jaspilite and amphibolite.

3. The presence of traces of pyrite in two specimens and of chalcopyrite in one specimen of gneiss.

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TABLE I

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Field No. TS, PS No.	Brief Description
SML/13 TS 5813	Quartz-feldspar-porphyry (Gawler Range porphyry)
SML/19 TS 5814	as SML/13
SML/20 TS 5815	Fractured and recrystallized pegmatite
SML/21 TS, PS 5816	Magnetite-hematite-cummingtonite jaspilite
SML/22 TS, PS 5822	Metamorphosed and recrystallized arkose
SML/23 TS, PS 5823	Quartz-feldspar-biotite gneiss of sedimentary origin. Traces of pyrite and possible chalco-pyrite.
SML/24 TS, PS 5824	Quartz-felspar-biotite gneiss of sedimentary origin.
SML/25 TS 5825	Quartz-feldspar porphyry (Gawler Range porphyry)
SML/26 TS, PS 5826	Amphibolite
SML/27 TS 5827	Metamorphosed and recrystallized arkose
SML/28 TS, PS 5835	Fractured siliceous limonite rock, possibly derived from an amphibole-bearing or feldspathic rock.
SML/29 TS, PS 5836	As SML/28 but much richer in limonite
SML/30 TS, PS 5837	Magnetite-hematite-limonite jaspilite
SML/31 TS, PS 5840	Hematite-limonite-jaspilite
SML/32 TS 5841	Metamorphosed and recrystallized arkose.

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TABLE I (cont.)

Field No. TS, PS No.	Brief Description
NBO/1 TS 5797	Quartz-feldspar-biotite gneiss of sedimentary origin.
NBO/2 TS, PS 5798	Quartz-amphibolite derived from a quartz-dolerite.
NBO/3 TS 5799	Metamorphosed and recrystallized arkose.
NBO/4 TS, PS 5800	Quartz-feldspar-biotite gneiss with traces of pyrite.
NBO/5 TS, PS 5801	Recrystallized quartz-amphibolite
NBO/6 TS, PS 5802	Hornblendite
NBO/7 TS, PS 5803	Dolerite
NBO/8 TS 5804	Quartz-feldspar porphyry (Gawler Range porphyry)

Specimen SML/13 (TS 5813)

Location: ¼ mile W. of 0.7 peg, E-border SML 539
Megascopic: pale pinkish-grey fine grained rock with roughly platy cleavage and containing minor phenocrysts.
Microscopic: The rock has a regular fine grained texture in which the coarser components show a distinctly parallel orientation.
Mineral composition: Fine grained quartz (17%) and feldspar (77%) form together an even grained ground mass (grains 0.03-0.10mm). The grains are recrystallised into a simple mosaic. The feldspar grains are dusty due to alteration to kaolinite. Quartz phenocrysts (3%) are all deformed into lenticular aggregates (1.5-3mm). Feldspar phenocrysts (3%) are not all deformed. Some well formed phenocrysts of orthoclase and oligoclase occur (1-3mm). The deformed ones are lenticular aggregates of recrystallised fragment. The lenticular bodies of quartz and feldspar are arranged parallel.
Accessory minerals are mica flakes (0.2-0.75mm) and iron ore grains (0.02-0.25mm).
Conclusion: Quartz-feldspar porphyry (Gawler Range porphyry) affected by dynamic metamorphism.

Specimen SML/19 (TS 5814)

Location: as for SML/13
Megascopic: darker than SML/13, but shows the same platy cleavage.
Microscopic: Generally similar to SML/13, with only the following minor differences:

(1) quartz phenocrysts (1%), a single one (1.5mm), but majority deformed into lenticular bodies (0.5-3.5mm)
(2) feldspar phenocrysts (9%), more pronounced, mainly well-formed orthoclase crystals (0.5-5mm), with only a few deformed into lenticular bodies. Crystals only slightly altered and generally larger than in SML/13.
(3) Less quartz in the fine grained quartz-feldspar matrix (quartz 9% and 77% feldspar). Grains are somewhat larger (0.015-0.22mm) and more oblong.
(4) The minor minerals amount to 4% combined, including iron ore grains (0.02-0.1mm), and flakes and thin streaks of sericite, biotite which are arranged parallel.

Conclusion: as SML/13 a quartz-feldspar porphyry (Gawler Range porphyry) affected by dynamic metamorphism.

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Specimen SML/20 (TS 5815)

Location: 1/3 mile W. of 1.5 peg on E. border SML 539
Megascopic: a coarsely crystalline rock composed of pink feldspar and pale grey quartz. Feldspar crystals up to 20mm occur in the hand specimen.
Microscopic: The feldspars are large anhedral and subhedral orthoclase crystals showing alteration to kaolinite. Quartz occurs as larger irregular interlocking bodies showing pronounced strain polarization. Several fractures and small shears occur.
Conclusion: fractured and recrystallised pegmatite.

Specimen SML/21 (TS, PS 5816)

Location: 1/3 mile W. of 1.5 peg, E. border SML 539
Megascopic: a banded dark brown ferruginous rock, distinctly magnetic.
Microscopic: a fine grained rock the constituents of which are arranged in bands. The major components are:
Quartz 55%. The grains (0.05-0.6mm) are recrystallized into a simple mosaic.
Iron ore 31% - as single grains from 0.05mm to irregular bodies up to 4mm long. The PS reveals that the 31% of iron ore is made up of 6% magnetite and 25% hematite in the form of martite. The magnetite grains (0.03-0.4mm) are anhedral and practically showing no alteration.
The martite grains (0.03-0.60mm) are generally subhedral and euhedral and do not contain any remnants of unaltered magnetite. The magnetite grains tend to occur in a band.
The presence of euhedral martite and anhedral unaltered magnetite grains suggests that the latter is a second generation of the mineral.
Amphibole 14% - tends to occur in certain bands, closely associated with the iron ore, in fibrous aggregates. Crystals are generally small (0.1-0.5mm) but occasional large ones up to 3mm occur. The amphibole shows considerable alteration to limonite. Extinction angles of unaltered crystals point to cummingtonite.
Conclusion: magnetite-hematite-cummingtonite jaspilite.

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Specimen SML/22 (TS, PS 5822)

Location: SML 539 - Northern Basement outcrop 1000' E. of fence
Megascopic: medium grained pinkish-brown rock containing minor dark mineral.
Microscopic: the specimen has a granular texture and its composition is as follows:-
Feldspars 63% - are the major mineral occurring as oblong, subrounded grains (0.75-3mm) often interlocking. They have a dusty appearance due to alteration to kaolinite.
Quartz 32% - as single anhedral grains (0.05-0.8mm) and in aggregates (0.5-5mm) of interlocking grains. Some aggregates are roughly elliptical or oblong in shape. The general impression is that many of the quartz grains were crushed and subsequently recrystallized. Strain polarization is common.
Biotite 5% - it is strongly pleochroic from pale brown to dark reddish brown. Flakes (0.1-1.25mm) are irregular in shape and many show alteration to chlorite.
Accessory minerals: mainly opaque iron ore grains as irregular blebs (0.05-0.6mm) often associated with the biotite. In addition some rare zircon grains (0.15-0.30mm).
Conclusion: a metamorphosed and recrystallised arkose.

Specimen SML/23 (TS, PS 5823)

Location: M.E. border of SML - 520 yards E. of fence.
Megascopic: a grey medium grained rock in which the dark mineral is concentrated in subparallel, discontinuous wavy lines.
Microscopic: The rock has a relatively coarse-grained texture and has the following composition:
Feldspar 60% - grains 0.2-3mm. Many of the larger grains of orthoclase and plagioclase are subhedral and subrounded. Their appearance is turbid due to part alteration to sericite and kaolinite.
Quartz 29%: many grains are cracked and recrystallised. They range in size from 0.2 to 2.5mm. The majority are smaller than the feldspar grains and the larger ones show pronounced strain polarization. Interlocking grains are common. A few subrounded grains occur.
Biotite 11%: flakes (0.2-1.5mm) are strongly pleochroic in brown. Some flakes contain minute zircon grains in-side pleochroic haloes.

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Accessory minerals: a few pockets of chlorite and muscovite. Chlorite occurs also as an alteration product of biotite. The PS reveals grains (0.01-0.1mm) of magnetite and ilmenite and traces of chalcopyrite and pyrite (0.05-0.1mm).
Conclusion: Quartz-feldspar-biotite gneiss. The presence of subrounded feldspar and quartz grains suggests a sedimentary origin.

Specimen SML/24 (TS, PS 5824)

Location: N.E. border of SML 539, 518 yards E. of fence
Megascopic: a dark grey medium-grained rock showing a gneissic structure. It contains also a light coloured rock.
Microscopic:
(1) Light coloured rock: Its texture is gneissic and its composition is as follows:
Feldspar 55% as relatively coarse grains (0.4-5mm). The majority are plagioclase grains with minor orthoclase. All grains show part alteration to a turbid mass of kaolinite and sericite and accessory epidote. Shattered grains are sometimes recrystallised into roughly lenticular aggregates.
Single grains are generally oblong, subhedral in shape and subrounded.
Quartz 44% - forms the matrix between the feldspar grains. The majority are completely shattered and fragments recrystallised into parallel orientated, strongly elongated bodies (0.03-0.75mm), interlocking, parallel orientated and and bent around feldspar grains, sometimes forming eye structures. Pronounced strain polarization.
Accessory minerals: a little biotite altering to chlorite and a few iron ore grains (0.02-0.2mm)

(2) Dark grey rock consists of:
Feldspar 62% - grains 0.4-3mm, on the average smaller than in the light coloured material. Orthoclase is more prominent, more fractured, but less altered. A few single subhedral and subrounded grains occur.
Quartz 27% - it shows the same textural features as in the light coloured rock.
Biotite 10% - flakes 0.1-0.5mm, rather prominent as interstitial material, in subparallel wavy streaks around feldspar grains.
Opaque minerals 1% - the PS reveals irregular grains of ilmenite and magnetite (0.05-0.6mm).

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Conclusion: the light coloured rock is a quartz-feldspar gneiss and the dark rock a quartz-feldspar-biotite gneiss. There is a sharp contact between the two rock types, the colour of which is mainly determined by the presence or absence of biotite.
The presence of subrounded grains suggests a sedimentary origin.

Specimen SML/25 - TS 5825

Location: Northern border of SML 539, 520 yards E. of fence
Megascopic: a hard, brown porphyritic rock.
Microscopic: The TS reveals well developed phenocrysts of quartz, orthoclase, microcline and oligoclase. The quartz phenocrysts have embayments and rounded corners. Strain polarization is common. The feldspar phenocrysts tend to occur in small clusters and show part alteration to sericite. Some show zonal structures. Amongst the phenocrysts are sanidine, oligoclase and microcline. The matrix is holo-crystalline and mainly composed of dusty orthoclase, quartz and rare plagioclase.

Mineral percentages		Grainsize mm.
Quartz phenocrysts	10	0.5 - 4.5
Feldspars phenocrysts	7	" "
Quartz matrix	12	0.03 - 0.15
Feldspars matrix	71	" "
Hornblende phenocrysts	Accessory	0.3 - 1.0
Green biotite "	"	0.4 - 1.2
Sphene "	"	0.1 - 0.8
Fluorite	Rare	
Opaque grains	Accessory	0.015 - 0.10

Accessory minerals
Hornblende: rare clusters of green phenocrysts showing alteration to chlorite. Also some anhedral grains.
Biotite: an olive green variety as rare phenocrysts and small flakes, partly altered to chlorite.
Sphene: in well developed orange crystals, tend to be associated with the biotite and opaque grains, probably ilmenite.
Fluorite: a rare mineral, as colourless grains with purple patches and optically isotropic.
It tends to be associated with biotite.
Opaque grains: fairly regularly distributed often in a reddish brown patch of hematite dust. The latter causes the brown colour of the rock. Opaque grains associated with the biotite flakes are believed to be ilmenite.

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Conclusion: a quartz-feldspar porphyry. It has the typical appearance of the Gawler Range porphyry. The quartz content of the matrix is relatively low.

Specimen SML/26 (TS, PS 5826)

Location: near Northern border of SML 539, 210 yards W. of fence.
Megascopic: a dark greenish-grey rock of fine to medium grain.
Microscopic: The rock consists essentially of amphibole, plagioclase and minor opaque minerals.
Amphibole (63%): is a green to bluish-green hornblende. The grains (0.25-2.5mm) are generally anhedral with the exception of one crystal which still shows a core of unaltered pyroxene. The green colour is strongest along the run of the generally anhedral crystals.
Plagioclase (34%): the majority are partly altered to sericite, but a few unaltered crystals were identified as andesine and labradorite.
Feldspar crystals range in size from 0.2 to 1.5 mm and form ophitic structures with the hornblende.
Opaque grains (3%) were identified in the PS as skeletal ilmenite crystals (0.05-1.5mm).
Conclusion: a typical amphibolite derived from dolerite as shown by the ophitic structures.

Specimen SML/27 (TS 5827)

Location: near Northern border of SML 539, 500 yards W. of fence
Megascopic: a medium-grained buff and grey rock.
Microscopic: the rock is composed of:

	%	Grainsize mm.
Quartz	33	0.05 - 2
Feldspars	65	0.2 - 5
Biotite	2	0.1 - 0.5
Opaques) Epidote)	Accessory	0.5 - 1

The texture can be described as even grained. Quartz grains are anhedral and interlock with adjacent quartz and feldspar grains. Strain polarization is common in the larger quartz and feldspar grains. The latter tend to be subhedral and somewhat larger than the quartz grains. The feldspars include grains of orthoclase, oligoclase, and microcline which all show

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alteration to sericite and kaolinite resulting in a turbid appearance. Biotite occurs as small brown flakes regularly distributed, but apparently without a preferred orientation. Rare opaque grains (0.5 - 1mm) occur and a little epidote as small blebs associated with biotite.
Conclusion: a metamorphosed and recrystallised arkose.

Specimen SML/28 (TS, PS 5835)

Location: Approx. ½ mile E. of 5000N/1300E, Stony Hill, SML 539.
Megascopic: a hard siliceous and limonitic rock which does not show any banding.
Microscopic: The TS reveals a rock essentially composed of quartz, limonite and opaques. The mineral percentage is as follows:-

Opaques	4%
Limonite	21%
Quartz (coarse grained)	6%
Quartz (fine grained)	69%

Textures and distribution of components: the general impression is that the rock was fractured and subsequently invaded by fine grained quartz and limonite. Textures observed include:
(1) Parts showing a fairly regular granular texture, composed of stubby polygonal grains (0.2-1.7mm) believed to be former amphibole or feldspar grains, replaced by fine grained chalcedony and limonite along cleavage traces.
(2) Coarse grained angular quartz occurs between the above silified feldspar grains.
(3) Irregular fractures infilled with small colloform structures of chalcedony and limonite around small cavities.
(4) Limonite is irregularly distributed, partly as parallel streaks marking the cleavage in the former feldspar, partly as large fractured massive bodies.
(5) The opaques are martite grains (0.04-0.4mm) as revealed in the PS. Many of the larger grains are cracked. Their distribution is irregular. The grains occur often embedded in massive limonite.

Conclusion: Textures and ghost structures suggest that the rock is a fractured siliceous limonite rock, possibly derived from an amphibole-bearing or feldspathic rock. Because of the absence of banding, this rock is not classified as a jaspilite.

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Specimen SML/29 (TS, PS 5836)

Location: approx. ½ mile E. of 5000N/1300E, Stony Hill
Megascopic: a strongly limonitic rock, somewhat porous and showing "healed" fractures.
Microscopic: The rock has the following composition:
Quartz 7%
Limonite 93%
The TS reveals that the limonite forms a fine grained texture. In parts it clearly shows oblong grains with fibrous texture strongly suggesting minerals with good cleavage replaced by limonite. These grains (0.3-0.6mm) may represent completely altered amphibole or feldspar crystals.
Quartz is a relatively minor mineral occurring as single grains (0.05-0.5mm) and as elongate aggregates up to 1.5mm long. Further it occurs as chert and chalcedony in small pockets and in a shear.
Fractures are marked by colloform structures of limonite and travertine around small cavities. One fracture (1.2-1.6mm wide) is a breccia zone composed of fragmented limonite in a cherty matrix.
The PS confirms the presence of ghost structures with parallel streaks of limonite, suggesting completely altered amphiboles or feldspars. Small blebs of hematite (0.01-0.08mm) and rare martite grains (0.02-0.10mm) occur.
Conclusion: fractured slightly siliceous limonite rock, derived from an amphibole-bearing or feldspathic rock.

Specimen SML/30 (TS, PS 5837)

Location: S.E. of 18000N/1300E, Stony Hill
Megascopic: a dark brown banded siliceous and ferruginous rock, slightly magnetic.
Microscopic: The rock has a banded structure with the following mineralogical composition:

Mineral	%	Grainsize mm.
Coarse grained quartz	66	0.08 - 0.45
Fine grained quartz	5	0.02 - 0.05
Limonite	18	0.02 - 0.2
Opaque	11	0.06 - 1

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The coarser grains of quartz are distinctly lenticular in shape, are interlocking and show strain polarization, all features caused by dynamic metamorphism. Limonite and fine grained quartz occur closely associated. Shreds and small blebs of limonite, sometimes with parallel orientation, form with the fine grained quartz elongate bodies and bands. Some of these aggregates may represent altered amphiboles.

PS 5837 reveals following details:
Rough bands and elongate aggregates of martite grains (0.06-1mm), many of which carry remnants of unaltered magnetite (0.03-0.5mm). Single unaltered magnetite grains occur also, but only as a minor component.
Apart from occurring as small shreds and blebs in elongate bodies, some minor massive limonite occurs as matrix and as a vein between and around martite grains.
Percentage of magnetite is estimated 2% of the rock.
Conclusion: A magnetite-hematite-limonite jaspilite. Most of the limonite may have been derived from altered amphiboles.

Specimen SML/31 (TS, PS 5840)

Location: 750' S. of 22000N/10700E
Megascopic: The specimen is a dark brown thinly banded strongly ferruginous-porous rock, reported to occur as a floater.
Microscopic: The rock is mainly composed of iron oxides and quartz distributed in thin bands and narrow lenticles. The quartz (55%) occurs as small angular grains (0.03-0.5mm), their boundaries marked by hematite or limonite.
The PS shows that the iron oxides are hematite and limonite. Hematite (37%) is present as martite-grains (0.08-0.8mm) in elongate aggregates and bands.
Limonite (8%) occurs also as elongate bodies and bands between the hematite bands. It is replacing the hematite.
Conclusion: thinly banded hematite-limonite jaspilite.

Specimen SML/32 (TS 5841)

Location: Approx. 17000N/10000E, Stony Hill Area.
Megascopic: a fine to medium grained pale grey rock. The specimen is a floater.

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Microscopic: The TS reveals a rock, mainly composed of feldspars and quartz occurring in a fairly regular pattern of often interlocking grains.
Quartz (40%) occurs as anhedral grains (0.2-2.5mm), the larger ones showing pronounced strain polarization. Grains are elongated parallel to the general texture.
The feldspars (59%) include orthoclase, oligoclase and microcline. The grains (0.1-3.00mm) have a dusty appearance due to alteration to kaolinite and sericite. The larger ones tend to be subhedral in shape and are sometimes subrounded.
Opaque minerals and mica (combined 1%) include elongate blebs of iron oxides and ilmenite and irregular flakes (0.2 - 1.0mm) of pale brown biotite oriented roughly parallel to the general texture. These minerals are often closely associated in elongate aggregates.
Conclusion: The generally regular texture and presence of subrounded grains suggest that the rock is a recrystallized arkose rather than an aplite.

Specimen NBO/1 (TS 5797)

Location: SML 539 - three yards W. of fence
Megascopic: Medium to coarse grained pink and buff rock with dark streaks. Eye structures and several large porphyroblasts of feldspar (10-20mm) can be seen.
Microscopic: The rock is composed of quartz (41%) feldspar (43%) and biotite (16%). The slide contains several zones of crushing and deformation resulting in "mortar" and "eye" structures. Former quartz and feldspar grains have been completely crushed into roughly parallel streaks. Elongate narrow streaks of quartz occur wrapped around feldspar crystals. These zones of crushing also contain streaks and bands of brown biotite. The latter occurs also in pockets and blebs between quartz and feldspar grains. The mineral shows alteration to chlorite. The rock between the zones of crushing consists of an aggregate of interlocking quartz and feldspar grains which show remarkably little elongation. Grains range in size from 0.2 to 2.5mm., but one large feldspar porphyroblast of 6mm occurs.
Accessory minerals include elongate blebs of opaque matter probably ilmenite and occasional rows of minute grains of zircon (0.03-0.06mm) associated with the biotite streaks.
Conclusion: A quartz-feldspar-biotite gneiss. The presence of subrounded zircon grains suggests a sedimentary origin.

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Specimen NBO/2 (TS, PS 5798)

Location: from outcrop 5 yards W. of fence, Northern portion SML 539.
Megascopic: a massive fine to medium grained dark greenish-grey rock.
Microscopic: The rock has a regular igneous texture showing ophitic structures formed by amphibole and plagioclase.
The major minerals are:-
Amphibole (63%) as angular pale green bodies up to 3mm. long with dark green rims and pleochroic from pale green to bluish-green. The bodies are composed of numerous small hornblende crystals (0.03-0.43mm), generally anhedral to subhedral.
Plagioclase (25%): as subhedral and anhedral crystals (0.25-2.5mm) showing part alteration to sericite. Crystals of which extinction angles on twining were determined, were identified as labradorite and andesine.
Quartz (6%) occurs in interstitial pockets containing clusters of small blebs (0.05-1mm). Rare graphic intergrowths with plagioclase.
Opaque minerals (6%) - The PS reveals skeletal crystals of ilmenite as the more prominent mineral with accessory limonite blebs and small bodies with rectangular outlines. The latter are probably oxidised pyrite crystals.
The thin section shows that all opaque minerals occur enclosed in the amphibole bodies.
Conclusion: a quartz-amphibolite derived from a quartz-dolerite.

Specimen NBO/3 (TS 5799)

Location: Northern Basement Outcrop - about 50 yards W. of fence, SML 539
Megascopic: A pink medium to coarse grained rock containing minor darker material.
Microscopic: The rock is composed of quartz (32%), feldspar (64%) and biotite (4%)
Quartz and feldspar occur as interlocking grains widely varying in size (0.05-12mm). The larger grains show strain polarization. The quartz grains form occasionally coarse grained aggregates up to 10mm across. Single feldspar grains tend to be subhedral and one large crystal is 12mm long,

enclosing much smaller quartz and feldspar grains. Microcline, oligoclase, albite and orthoclase occur. The smaller feldspar grains show alteration to sericite.
Biotite occurs as small borwn flakes (0.2-1.5mm) without any preferred orientation. Some flakes show alteration to chlorite.
Accessory minerals include opaque iron ore grains (0.2-0.8mm) and small rods (0.02-0.15mm) of apatite enclosed in feldspars.
Conclusion: the rock is probably an arkose affected by regional metamorphism resulting in recrystallization of its original grains and the forming of larger bodies of quartz and porphyroblasts of feldspars.

Specimen NBO/4 (TS, PS 5800)

Location: SML 539, 80 yards W. of fence, Northern Basement outcrop.
Megascopic: Medium to coarse grained pale grey rock containing irregular streaks of dark mineral.
Microscopic: The rock is mainly composed of quartz, feldspar and biotite and has a coarse fabric.
Quartz (39%) and feldspar (49%) occur

(1) as relatively large grains (2-6mm) showing pronounced strain polarization. The feldspars, mainly untwinned orthoclase and minor oligoclase, are subhedral in shape, and are partly altered to sericite
(2) as much smaller grains occurring around the larger grains evidently resulting from the breaking of the latter.

Biotite (12%) as strongly pleochroic brown flakes (0.05-0.3mm)
Accessory opaques: small grains of hematite, magnetite, and limonite (0.05-0.3mm) closely associated with the biotite.
Also minute thin rods of apatite (0.03-0.15mm) enclosed in feldspar grains. Also traces of pyrite (0.04-0.10mm).
Conclusion: a quartz-feldspar-biotite gneiss.

Specimen NBO/5 (TS, PS 5801)

Location: Northern basement outcrop, SML 539 Approx. 170 yards W. of fence.
Megascopic: fine to medium grained dark greenish grey rock containing minor light coloured minerals.

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Microscopic: The rock is mainly composed of amphibole (78%) feldspar (15%) and quartz (7%).
The amphibole is an olive-green hornblende occurring as stubby subhedral and euhedral crystals (0.2-2.5mm). It forms a well developed granuloblastic texture. Some hornblende crystal still contain relics (0.2-0.5mm) of pyroxene, partly altered to limonite.
The feldspars are plagioclase crystals (0.25-1mm) almost completely altered to a turbid mass of sericite and kaolinite. The grains are anhedral and tend to have rounded extremeties.
Quartz occurs as single anhedral grains (0.05-0.5mm) in small pockets often associated with the feldspars.
Amongst the accessory minerals are opaque grains (0.05-0.25 mm) identified as limonite in the polished section, zircon grains (0.03-0.10mm) with pleochroic haloes enclosed in hornblende, pink anhedral sphene grains (0.1-0.5mm) and occasional blebs of pale yellow epidote (0.03-0.10mm).
Conclusion: a recrystallised quartz-amphibolite.

Specimen NBO/6 (TS, PS 5802)

Location: Northern basement outcrop, SML 539, 170 yards W. of fence.
Megascopic: Medium grained dark greenish grey crystalline rock.
Microscopic: The rock, which consists mainly of 97% amphibole and 3% quartz, has a well developed granuloblastic texture.
The amphibole is an olive-green hornblende occurring as stubby to euhedral crystals (0.25-3mm), the larger ones of which show a subparallel orientation.
Quartz occurs as scattered single grains (0.05-0.6mm) often with round or elliptic outlines, which are either enclosed in hornblende or concentrated in small interstitial pockets.
The distribution is irregular.
Accessory minerals: zircon grains (0.03-0.15mm) enclosed in hornblende, exhibiting pleochroic haloes. Chlorite as pale green flakes (0.15-0.60mm), probably altered biotite, which tend to occur in areas of the slides where the quartz is relatively prominent.
The PS reveals in addition traces of magnetite.
Conclusion: a hornblendite.

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Specimen NBO/7 (TS, PS 5803)

Location: Northern basement outcrop, SML 539 Approx. 150 yards W. of fence

Megascopic: fine grained dark greenish-grey rock.

Microscopic: The rock is composed of plagioclase (42%) pyroxene (51%), opaques (4%) and quartz (3%). It has the characteristic texture of the finer grained igneous rocks.

Plagioclase: generally turbid subhedral to euhedral lath shaped crystals (0.25-2mm) showing twinning lamellae and slight alteration to kaolinite resulting in a dusty appearance. Extinction angles measured on twinning lamellae are indicative of labradorite and andesine.

Pyroxene: as generally slender prismatic crystals often showing simple twinning. Their appearance is somewhat dusty due to fine cracks and minor alteration to green secondary amphibole resulting in a green rim. Their size is in the same range as the plagioclase. Plagioclase and pyroxene form ophitic structures.

Quartz: as irregular blebs (0.1-0.75mm) occurring single or in small aggregates and clusters between the plagioclase and pyroxene crystals.

Opaques: the PS reveals grains (0.1-0.8mm) of ilmenite and subhedral grains showing intergrowths of ilmenite and hematite. The latter are relatively common and show well developed exsolution lamellae of ilmenite in martite. Also rare blebs of pyrite (0.015-0.06mm).

Conclusion: a dolerite which is only slightly affected by alteration.

Specimen NBO/8 (TS 5804)

Location: SML 539, Northern basement outcrop, 5 yards W. of fence.

Megascopic: fine grained dark purplish-brown rock containing minor larger grains.

Microscopic: The components of this rock, essentially fine grained feldspar and quartz, occur in parallel discontinuous bands and drawn-out lenticles, with scattered phenocrysts of the same minerals. Mineral percentages:

Fine grained quartz	13%	0.03-0.3mm
Fine grained feldspar	81%	0.015-0.1mm

The minerals form a fine grained mosaic.

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Feldspar phenocrysts 5%, size 1 - 2.5mm.
Mainly orthoclase and microcline, often well formed crystals, but some of which are fractured. They show alteration to kaolinite and epidote and sometimes carry inclusions of fluorite. Quartz phenocrysts 1%, size 0.5-1mm, generally oblong and sometimes fractured.
One phenocrysts with embayed outline.
Accessory minerals include:

1. Opaque iron ore grains (0.015-0.10mm)
2. Flakes and streaks of dark green biotite, mostly altered to chlorite.
3. Epidote blebs, evidently an alteration product of the feldspars.
4. Hematite dust.

Conclusion: Quartz-feldspar porphyry (Gawler Range Porphyry). The parallel distribution of the components is probably caused by the original flow structure. Also the presence of well formed feldspar phenocrysts with inclusions of fluorite, and embayed phenocrysts of quartz points to the igneous nature of the rock rather than a sedimentary one.

D. BURGER

APPENDIX B4

CORE SAMPLES FROM BORES ST1 and ST 2, STONY HILL AREA, SML 539

Summary

Four core specimens were examined by means of 6 thin and 4 polished sections with the following results:

Sample No. TS, PS No.	Depth	Brief Description of Rock
ST1/1A TS, PS 5877A and 5877B	79'	Quartzose and altered cummingtonite rock containing minor magnetite, hematite and limonite.
ST1/1B TS, PS 5878	201'	Dolomitic magnetite-hematite-limonite jaspilite. Part of the components derived from altered cummingtonite.
ST2/2A TS,PS 5879A TS 5879B	124'6"	5879A: Schistose quartz-limonite rock 5879B: Limonitic quartz-biotite-garnet schist.
ST2/2B TS 5880	147'	Limonitic quartz-biotite-garnet schist

In the samples ST1/1A and ST1/1B the iron oxide minerals are martite and limonite. Magnetite is present as remnants in martite grains and sometimes as single unaltered grains.

Sample ST1/1A (TS 5877A and TS 5877B)

Location: Bore ST/1, 97' 14000N/11610E

Handspecimen: A brown fairly hard rock showing poorly defined banding. Signs of deformation.

Microscopic: The general texture in TS 5877A could be best described as roughly lenticular.
The main mineral is cummingtonite, showing considerable alteration to limonite. Crystals are generally small (0.2-0.5mm) and occur in elongate aggregates.
Opaque minerals are a minor component only in the form of subhedral, sometimes polygonal grains of magnetite (0.25-2mm) almost completely altered to martite and limonite.
It occurs associated with irregular bodies of quartz and cummingtonite together forming a lenticular aggregate.

From the same sample was cut TS 5877B, representing an orientated section (vertical plane East-West). It also consists of mainly altered cummingtonite crystals (0.2-1.5mm). Opaque minerals and scattered quartz grains are in the minority. A small slab of the sample is slightly magnetic, indicative of remnants of magnetite in the opaque grains.
Quartz is a minor mineral only.
The average mineral percentage of the two slides is:

Quartz	3%
Altered cummingtonite	87%
Opaque iron oxide	10%

The 87% of altered cummingtonite includes 40-50% limonite as alteration product.

Polished sections 5877A and 5877B reveals:

(1) The presence of martite crystals, some of which still carry small cores of maghemite (bluish-grey)
(2) Irregular veinlets of hematite
(3) Limonite
   a. as a matrix between martite crystals
   b. in veinlets and along shears
   c. as an alteration product of amphibole along cleavage lines.

In addition many martite grains are cracked.

Conclusion: The rock is best described as a quartzose and altered cummingtonite rock with minor magnetite, hematite and limonite.

Sample ST1/1B (TS 5878)

Location: Bore ST/1 at 201'

Handspecimen: A brown fairly hard rock containing narrow bands (1-3mm) of dark brown material. Cold HCl 1:1 produces slow effervescence, indicative of dolomite. The rock is slightly magnetic.

Microscopic: The bands consist of hematite and minor magnetite, as revealed in small samples of crushed material. Individual grains in these bands are in the 0.1-1mm range.
Quartz occurs: (1) as relatively coarse grains (0.1-0.7mm) and (2) as much smaller grains (0.015-0.1mm) associated with blebs of dolomite and limonite in bodies, the texture of which suggests altered amphiboles (probably cummingtonite).

Approximate Mineral Percentages

Iron oxides	40%
Quartz (coarse grained)	20%
Quartz (fine grained)	30%
Dolomite	10%

Polished Section 5878: reveals the presence of minor unaltered magnetite and many partly martitized magnetite grains carrying 20-80% unaltered magnetite (brownish-grey).

Conclusion: A dolomitic magnetite-hematite-limonite jaspilite. Its magnetite content is low and textures suggest iron-amphiboles probably cummingtonite, completely altered into an aggregate of fine grained quartz, limonite and dolomite.

The general impression is that in this sample the alteration of magnetite to hematite is not so far advanced as in sample ST1/1A. Limonite occurs as a thin rim around martite grains, in veinlets and along cleavage traces of altered amphiboles.

Sample ST2/2A (TS 5897A and TS 5879B)

Location: Bore ST2 124'6" 14000N/11400E

Handspecimen: Sections from two rock types in this core were examined:

5879A: A hard limonitic rock, porous in parts.
The TS shows a rock mainly composed of limonite (70-80%) and fine grained quartz (20-30%) occurring in a schistose pattern.
The limonite tends to occur in parallel shreds. The quartz is introduced along fractures and shears, obliquely across the schistose texture. A coarse grained quartz vein occurs also.

PS 5879A: confirms that limonite is the main iron ore mineral and distributed in a schistose pattern. Hematite is present only in traces.

Conclusion: This rock is a schistose quartz-limonite rock.

5879B: is the other part of the core. It is a soft schistose rock, with minor limonite. The TS reveals as major minerals:

Biotite (40-50%) as strongly pleochroic brown flakes (0.05-0.3mm)
Quartz (40-50%) as small aggregates (grains 0.03-0.3mm). The larger grains show strain polarization.
Limonite (5-10%) is confined to fractures.
Garnet (5-10%) a pale pink variety, as badly cracked anhedral crystals (0.15-0.75mm)

Conclusion: A limonitic quartz-biotite-garnet schist.

Sample ST2/2B (TS 5880)

Location: Bore ST2 147' 14000N/11400E

Handspecimen: A brown schistose rock

Microscopic: The TS contains a limonite-enriched band and material rich in biotite.

(1) Limonite enriched band consists of limonite, greenish-brown biotite and minor garnet. These components are all arranged in a schistose and lenticular pattern.
(2) Biotite-rich material is composed of strongly pleochroic greenish-brown biotite (40-50%, flakes 0.06-0.45mm long), quartz (40-50%, grains 0.06-0.25mm) and garnet (5-10%). The latter mineral occurs as more or less round and colourless to pink lenticular bodies (0.15-0.75mm).

Conclusion: The rock is best described as a quartz-biotite-garnet schist containing limonite-enriched bands.

D. BURGER

APPENDIX B5

PERCUSSION BORING PROGRESS REPORT

Bore No.: ST 1

Location and Grid Ref.: 14000N/11613E Stony Hill Grid

Footage for Period: 235'

Actual Total Depth (complete): 235'

Rig: TRUCM-3 Drillmaster

Operators: M.J. Hansberry

Sampling Tools: Riffler, wet sampling

Date Started: 19.4.71

Date Completed: 12.5.71

From	To	Int.	Description
0	5'	5'	Surface sand with scree jaspilite and silcrete
5'	10'	5'	Scree containing fragments of porphyry and kunkar
10'	30'	20'	Enriched scree containing black pellets of limonite and porphyry
30'	70'	40'	Brown quartzose limonite amphibole rock. Slightly magnetic.
70'	75'	5'	Brown limonite amphibole rock with extremely coarse quartz concentrations
75'	120'	45'	Brown limonite amphibole rock, with bands of grey hematite. Slightly magnetic.
120'	145'	25'	Green and soft weathered horizon, chloritic. Weathered dyke rock?
145'	155'	10'	No sample collected - broken ground
155'	215'	60'	Brown limonite-amphibole "jaspilite", altered to green chloritic weathering products in places. Magnetic bands.
215'	235'	20'	Contaminated sample - cement infusion necessary because of soft horizon and broken ground.

End of bore

Date 15.6.71

Logged by E. Evans

Test tube etches taken at 100' and 200' showed readings of 64° and 67° (measured from the horizontal).

Core taken 95' - 97'6"

Streaks of grey hematite and magnetite in a brown limonite-amphibole rock. Dip 60°. The rock was petrographically described as a quartzose and altered cummingtonite (i.e. Fe, Mg silicate), rock with a slight magnetic content. Banding is rather poorly defined; and there were signs of deformation.

Core taken at 201'

Rock identified as a dolomitic magnetite-hematite-limonite jaspilite. Magnetite content low; textures suggesting iron amphiboles completely altered into an aggregate of fine-grained quartz, limonite and dolomite.

PERCUSSION BORING PROGRESS REPORT

Bore No.:	ST 2
Location and Grid Ref.:	14000N/11400E Stony Hill Grid
Footage for Period:	203'
Actual Total Depth (complete):	203'
Rig:	TRUCM-3 Drillmaster
Operators:	M.J. Hansberry
Sampling Tools:	Riffler
Date Started:	12.5.71
Date Completed:	20.5.71

From	To	Int.	Description
0	3'	3'	Jaspilite scree
3'	15'	12'	Light brown leached jaspilite. Non-magnetic.
15'	60'	45'	Brownish-grey limonite amphibole jaspilite. Magnetic.
60'	75'	15'	Weathered jaspilite. Magnetic. Basal 5' darker in colour.
75'	125'	50'	Brownish-grey limonite amphibole jaspilite. Magnetic.
125'	170'	45'	Green weathered ferruginous schist having a clayey appearance. Pockets of limonite on joint surfaces.
170'	203'	33'	Limonitised schist.

End of bore

Date: 15.6.71

Logged by: E. Evans

Core taken 124' - 125'6"

Dark-brown magnetic limonite amphibole "jaspilite". Dip of bedding 20°. Structure extremely porous, abundant jointing.

Petrological analysis of two parts of the core were taken (as the iron formation schist contact was at 125').

One part of the core was identified as a schistose quartz-limonite rock; and the other part as a limonitic quartz-biotite garnet schist.

Core taken at 145' - 150'

Greenish brown weathered schist. Limonite concentrated at joint surfaces. Part of the core examined petrographically was described as a quartz biotite-garnet schist containing limonite enriched bands.

Core taken 200' - 203'

Dark-brown fractured limonite rock; slightly magnetic.

APPENDIX B6

B H P WHYALLA

STONY HILL 12 miles West of Iron Baron 14000N/11613E

GEOLOGICAL DEPARTMENT ASSAY DATA FORMS

ST 1

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Serial No.	Footage From	Footage To	Int. Ft	Rec %	Fe	SiO_2	Al_2O_3	Ign. Loss	P	CaO	MgO	Mn	S	TiO_2	FeO
	0	5			06.0	73.0	06.9	07.4	0.02	03.2	00.5	00.1	00.01	0.30	00.2
	5	10			06.0	58.0	15.0	12.6	0.03	04.6	00.7	00.1	00.09	0.20	00.5
	10	15			30.2	31.0	10.0	12.4	0.06	02.5	00.8	00.1	00.12	0.10	00.3
	15	20			26.0	43.0	09.7	09.5	0.06	00.4	00.1	00.1	00.08	0.10	00.4
	20	25			13.0	67.0	06.6	07.0	0.03	00.2	00.1	00.1	00.07	0.10	00.3
	25	30			11.0	76.0	03.5	04.1	0.02	00.1	00.1	00.2	00.08	0.05	00.5
	30	35			17.0	69.0	02.5	04.6	0.03	00.1	00.1	00.1	00.06	0.05	00.3
	35	40			16.0	67.0	03.5	04.8	0.02	00.1	00.1	00.9	00.03	0.05	00.3
	40	45			15.0	64.0	06.9	06.4	0.02	00.1	00.1	00.7	00.06	0.05	00.4
	45	50			16.0	66.0	04.3	06.1	0.02	00.1	00.1	00.4	00.06	0.05	00.4
	50	55			23.0	58.0	02.2	05.8	0.03	00.1	00.1	00.2	00.04	0.05	00.4
	55	60			19.0	66.0	01.1	05.0	0.02	00.2	00.1	00.2	00.03	0.05	00.5
	60	65			20.0	65.0	00.9	04.9	0.02	00.1	00.1	00.1	00.03	0.05	00.5
	65	70			12.0	78.0	00.6	03.0	0.01	00.1	00.1	00.2	00.03	0.05	00.3
	70	75			03.0	92.0	00.4	02.0	0.01	00.1	00.1	00.1	00.02	0.05	00.3
	75	80			09.0	81.0	00.7	03.3	0.01	00.1	00.1	00.2	00.03	0.05	00.2
	80	85			08.0	83.0	00.4	04.1	0.01	00.1	00.1	00.2	00.03	0.05	00.3
	85	90			08.0	83.0	00.3	02.7	0.01	00.1	00.1	00.3	00.03	0.05	00.3
	90	95			08.0	83.0	00.4	03.1	0.02	00.1	00.1	00.4	00.04	0.05	00.3
	95	100			08.0	84.0	00.6	02.7	0.02	00.1	00.1	00.2	00.02	0.05	00.4
	100	105			12.0	78.0	00.4	03.0	0.02	00.1	00.1	00.3	00.04	0.05	00.3
	105	110			09.0	82.0	00.2	03.8	0.02	00.1	00.1	00.2	00.03	0.05	00.4
	110	115			10.0	82.0	00.2	02.8	0.02	00.1	00.1	00.2	00.03	0.05	00.2
	115	120			10.0	80.0	00.2	03.0	0.01	00.1	00.1	00.2	00.03	0.05	00.4

B H P
WHYALLA

GEOLOGICAL DEPARTMENT ASSAY DATA FORMS

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Serial No.	Footage From	To	Int. Ft	Rec %	Fe	SiO_2	Al_2O_3	Ign. Loss	P	CaO	MgO	Mn	S	TiO_2	FeO
	120	125			15.0	72.0	00.8	03.9	0.01	00.1	00.1	00.3	00.02	0.05	00.3
	125	130			15.0	72.0	01.0	03.8	0.01	00.1	00.1	00.3	00.03	0.05	00.4
	130	135			21.0	60.0	01.5	05.4	0.01	00.1	00.2	00.5	00.03	0.05	00.3
	135	140			23.0	57.0	01.6	06.0	0.01	00.1	00.2	00.4	00.07	0.05	00.3
	140	145			12.0	78.0	00.7	03.1	0.01	00.1	00.1	00.2	00.03	0.05	00.4
	155	160			21.0	60.0	02.1	06.8	0.02	00.1	00.1	00.2	00.08	0.05	00.3
	160	165			21.0	60.0	02.3	07.4	0.02	00.1	00.1	00.2	00.09	0.05	00.4
	165	170			19.0	65.0	01.5	05.6	0.02	00.1	00.1	00.2	00.08	0.05	00.3
	170	175			16.0	69.0	01.0	05.6	0.02	00.1	00.1	00.3	00.07	0.05	00.3
	175	180			12.0	77.0	00.5	04.4	0.01	00.1	00.1	00.2	00.01	0.05	00.3
	180	185			11.0	80.0	00.3	02.9	0.01	00.1	00.1	00.2	00.02	0.05	00.3
	185	190			11.0	80.0	00.4	03.0	0.01	00.1	00.1	00.2	00.05	0.10	00.3
	190	195			07.0	86.0	00.2	02.1	0.01	00.1	00.2	00.1	00.19	0.05	00.5
	195	200			09.0	83.0	00.2	02.6	0.01	00.3	00.5	00.1	00.18	0.05	00.6
	203'	6" 205			16.0	71.0	00.4	03.8	0.02	00.7	01.0	00.1	00.16	0.65	00.8
	205	210			16.0	72.0	00.6	03.5	0.02	00.6	00.8	00.1	00.12	0.05	00.7
	210	215			21.0	63.0	00.7	02.9	0.03	01.3	01.6	00.2	00.12	0.05	00.6
	215	220			18.0	66.0	01.5	04.4	0.02	00.8	01.0	00.2	00.07	0.05	00.6

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B H P

WHYALLA

STONY HILL GRID 12 Miles West Iron Baron . ST 2 14000N-11400E

GEOLOGICAL DEPARTMENT **ASSAY DATA FORMS** Job No. 954/75/11

A/C Geological Department

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Serial No.	Footage From	Footage To	Int. Ft	Rec %	Fe	SiO_2	Al_2O_3	Ign. Loss	P	CaO	MgO	Mn	S	TiO_2		FeO
	0	5			14.0	68.0	01.2	06.3	0.03	04.1	00.3	00.1	00.03	0.05		0.4
	5	10			14.0	70.0	04.3	05.2	0.05	00.3	00.1	00.1	00.05	0.05		0.4
	10	15			22.0	55.0	06.2	06.6	0.04	00.1	00.1	00.1	00.03	0.20		0.4
	15	20			23.0	54.0	04.6	06.4	0.05	00.1	00.1	00.1	00.04	0.10		0.3
	20	25			27.0	56.0	00.9	04.1	0.05	00.4	00.1	00.1	00.04	0.05		2.6
	25	30			33.8	49.0	01.5	01.5	0.03	00.1	00.1	00.1	00.04	0.05		5.1
	30	35			35.0	44.0	02.2	03.6	0.05	00.1	00.1	00.1	00.04	0.05		2.8
	35	40			35.4	45.0	01.8	02.7	0.03	00.1	00.1	00.1	00.03	0.05		2.7
	40	45			33.3	44.0	05.0	04.1	0.03	00.1	00.1	00.1	00.04	0.10		2.9
	45	50			36.7	41.0	02.9	03.9	0.04	00.1	00.1	00.1	00.04	0.15		0.5
	50	55			35.9	42.0	03.1	03.7	0.04	00.1	00.1	00.1	00.05	0.20		0.7
	55	60			34.5	43.0	02.1	05.2	0.03	00.1	00.1	00.1	00.03	0.10		0.7
	60	65			31.2	44.0	04.4	06.1	0.05	00.1	00.6	00.3	00.05	0.20		0.5
	65	70			29.0	41.0	06.2	06.4	0.05	00.2	03.3	00.7	00.04	0.55		0.9
	70	75			27.5	43.0	03.8	05.1	0.06	01.9	03.7	00.7	00.04	0.30		0.8
	75	80			28.8	47.0	01.3	03.5	0.04	01.5	02.6	00.3	00.04	0.15		0.9
	80	85			31.3	49.0	00.8	03.4	0.03	00.4	00.8	00.2	00.02	0.05		0.7
	85	90			35.5	44.0	00.7	02.9	0.03	00.1	00.8	00.2	00.01	0.15		0.9
	90	95			33.2	48.0	00.7	01.9	0.03	00.5	01.4	00.1	00.01	0.05		1.1
	95	100			32.4	48.0	00.7	01.8	0.04	00.7	01.4	00.1	00.01	0.05		2.1
	100	105			30.5	48.0	01.2	02.5	0.03	00.5	01.2	00.1	00.01	0.05		1.4

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B H P
WHYALLA

STONY HILL GRID 12 miles west Iron Baron ST 2 14000N-11400E
GEOLOGICAL DEPARTMENT ASSAY DATA FORMS Job NO. 954/75/11
A/C Geological Department

Serial No.	Footage From	To	Int. Ft	Rec %	Fe	SiO_2	Al_2O_3	Ign. Loss	P	CaO	MgO	Mn	S	TiO_2		FeO
	105	110			30.0	49.0	03.5	03.4	0.03	00.4	00.6	00.1	00.01	0.05		0.9
	110	115			32.6	48.0	01.6	03.3	0.03	00.1	00.1	00.1	00.01	0.05		0.8
	115	120			34.1	49.0	00.3	02.2	0.03	00.1	00.1	00.1	00.01	0.05		1.5
	120	125			33.8	48.0	00.5	02.8	0.03	00.2	00.1	00.1	00.01	0.05		2.2
	125	130			16.0	55.0	05.0	08.9	0.02	04.0	00.6	00.1	00.10	0.20		0.4
	130	135			18.0	57.0	04.2	09.2	0.02	02.3	00.9	00.1	00.10	0.15		0.5
	135	140			23.0	48.0	02.8	12.2	0.02	02.4	00.9	00.1	00.05	0.10		0.3
	140	145			22.0	51.0	03.0	12.1	0.03	01.9	00.9	00.1	00.07	0.10		0.2
	145	150			20.0	46.0	06.1	11.8	0.04	03.7	01.9	00.2	00.09	0.20		0.8
	150	155			22.0	49.0	06.0	07.6	0.03	01.5	02.8	00.3	00.03	0.20		0.7
	155	160			21.0	56.0	02.4	06.8	0.02	01.0	02.3	00.2	00.03	0.10		0.2
	160	165			17.0	57.0	05.2	08.4	0.04	00.8	01.6	00.4	00.03	0.10		0.2
	165	170			20.0	54.0	05.1	08.8	0.03	00.8	01.8	00.3	00.03	0.15		0.3
	170	175			19.0	50.0	07.1	09.0	0.04	00.8	02.3	00.2	00.01	0.25		0.5
	175	180			23.0	48.0	04.3	10.5	0.05	00.6	01.3	00.8	00.03	0.15		0.2
	180	185			29.0	43.0	03.4	08.0	0.05	00.9	01.3	01.0	00.05	0.10		0.2
	185	190			27.0	45.0	03.5	07.7	0.06	01.4	02.2	01.4	00.05	0.05		0.2
	190	195			15.0	65.0	01.3	04.5	0.03	03.9	03.1	00.9	00.04	00.05		0.4
	195	200			18.0	57.0	02.4	05.8	4.00	03.7	01.3	01.3	00.05	0.05		0.5

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APPENDIX C

TABLE 1

RESULTS OF WET MAGNETIC SEPARATION TESTS ON STONY HILL JASPILITE GROUND TO MINUS 270 MESH

Sample No.	Test Product	% Wt.	% Analysis Fe (tot.)	% Analysis Fe as FeO	Distribution % Fe
GL/A/1	CON 2	10.2	70.0) 57.1	27.0	20.4) 39.5
	TAIL 2	14.0	47.7)	5.7	19.1)
	TAIL 1	75.8	28.0	1.0	60.5
	TOTAL	100.0	35.0	4.3	100.0
GL/A/2	CON 2	13.5)	69.0)	23.5)	34.8
	TAIL 2	3.7)	)	)	
	TAIL 1	82.8	26.8	1.3	65.2
	TOTAL	100.0	34.1	5.1	100.0
GL/A/3	CON 2	10.2	70.8) 64.8	24.2	21.1) 37.7
	TAIL 2	9.7	58.5)	6.5	16.6)
	TAIL 1	80.0	26.7	1.3	62.3
	TOTAL	100.0	34.3	4.1	100.0
GL/A/4	CON 2	9.7)	68.3)	13.2)	26.4
	TAIL 2	4.4)	)	)	
	TAIL 1	85.9	31.2	1.5	73.6
	TOTAL	100.0	36.4	3.2	100.0
GL/B/1	CON 2	7.1	71.2) 62.2	25.5	15.6) 25.1
	TAIL 2	6.0	51.5)	3.5	9.5)
	TAIL 1	86.9	28.0	1.7	74.9
	TOTAL	100.0	32.5	3.5	100.0
GL/B/2	CON 2	4.8)	59.8)	19.9)	28.2
	TAIL 2	9.7)	)	)	
	TAIL 1	85.5	25.8	1.7	71.8
	TOTAL	100.0	30.7	4.3	100.0

TABLE 1 (cont.)

Sample No.	Test Product	% Wt.	% Analysis Fe (tot.)	% Analysis Fe as FeO	Distribution % Fe
GL/C/1	CON 2 TAIL 2 TAIL 1	7.9) 3.3) 88.8	64.5)) 29.6	26.0)) 1.5	21.6 78.4
	TOTAL	100.0	33.5	4.2	100.0
GL/C/2	CON 2 TAIL 2 TAIL 1	7.6 6.2 86.2	70.7) 67.9 64.5) 29.5	23.0 8.0 1.6	15.4) 26.9 11.5) 73.1
	TOTAL	100.0	34.8	3.6	100.0
GL/C/3	CON 2 TAIL 2 TAIL 1	5.6) 3.3) 91.1	67.0)) 30.8	23.5)) 1.6	17.5 82.5
	TOTAL	100.0	34.0	3.6	100.0
GL/C/4	CON 2 TAIL 2 TAIL 1	10.3) 5.8) 83.9	66.2)) 27.7	21.8)) 1.5	31.4 68.6
	TOTAL	100.0	33.9	4.8	100.0
GL/C/5	CON 2 TAIL 2 TAIL 1	13.5) 3.3) 83.2	69.5)) 27.8	25.5)) 1.4	33.5 66.5
	TOTAL	100.0	34.8	5.3	100.0

TABLE 2.1.

MAGNETIC REDUCTION/WET MAGNETIC SEPARATION TEST RESULTS ON SAMPLE GL/A/1 STONY HILL

Mesh Size Tyler	Test Product	% Wt.	% Fe		% Distribution Fe	
100	CON 2	49.5	64.8)	58.2	89.1)	96.8
	TAIL 2	10.4	26.5)		7.7)	
	TAIL 1	40.1	2.9		3.2	
	TOTAL	100.0	36.0		100.0	
150	CON 2	52.2	65.1)	58.7	92.0)	97.6
	TAIL 2	9.2	22.4)		5.6)	
	TAIL 1	38.6	2.3		2.4	
	TOTAL	100.0	36.9		100.0	
200	CON 2	52.0	65.2)	59.5	92.1)	97.7
	TAIL 2	8.4	24.5)		5.6)	
	TAIL 1	39.6	2.1		2.3	
	TOTAL	100.0	36.8		100.0	
270	CON 2	49.4	65.8)	60.3	88.7)	97.4
	TAIL 2	9.8	32.5)		8.7)	
	TAIL 1	40.8	2.3		2.6	
	TOTAL	100.0	36.6		100.0	
325	CON 2	45.6	66.3)	60.1	83.5)	97.8
	TAIL 2	13.3	38.9)		14.3)	
	TAIL 1	41.1	1.9		2.2	
	TOTAL	100.0	36.2		100.0	

TABLE 2.2.

MAGNETIC REDUCTION/WET MAGNETIC SEPARATION TEST RESULTS

ON SAMPLE GL/A/2 STONY HILL

Mesh Size Tyler	Test Product	% Wt.	% Fe	% Distribution Fe
100	CON 2 TAIL 2 TAIL 1	48.0 7.6 44.4	67.6) 62.1 27.0) 2.0	91.7) 97.5 5.8) 2.5
	TOTAL	100.0	35.4	100.0
150	CON 2 TAIL 2 TAIL 1	47.8 8.1 44.1	68.0) 62.3 28.4) 1.9	91.2) 97.7 6.5) 2.3
	TOTAL	100.0	35.6	100.0
200	CON 2 TAIL 2 TAIL 1	47.5 8.6 43.9	68.3) 63.0 33.4) 1.8	89.9) 97.9 8.0) 2.1
	TOTAL	100.0	36.1	100.0
270	CON 2 TAIL 2 TAIL 1	46.0 8.5 45.5	68.5) 63.2 34.4) 2.4	88.7) 96.9 8.2) 3.1
	TOTAL	100.0	35.5	100.0
325	CON 2 TAIL 2 TAIL 1	43.4 10.7 45.9	68.5) 62.8 39.7) 2.1	85.1) 97.3 12.2) 2.7
	TOTAL	100.0	34.9	100.0

TABLE 2.3.

MAGNETIC REDUCTION/WET MAGNETIC SEPARATION TEST RESULTS

ON SAMPLE GL/A/3 STONY HILL

Mesh Size Tyler	Test Product	% Wt.	% Fe		% Distribution Fe	
100	CON 2	47.9	69.1)	63.8	92.7)	97.6
	TAIL 2	6.7	26.3)		4.9)	
	TAIL 1	45.4	1.9		2.4	
	TOTAL	100.0	35.7		100.0	
150	CON 2	48.1	68.8)	59.0	93.2)	98.0
	TAIL 2	11.0	15.6)		4.8)	
	TAIL 1	40.9	1.7		2.0	
	TOTAL	100.0	35.5		100.0	
200	CON 2	47.9	69.0)	63.9	92.5)	97.7
	TAIL 2	6.7	27.7)		5.2)	
	TAIL 1	45.4	1.8		2.3	
	TOTAL	100.0	35.7		100.0	
270	CON 2	47.1	69.0)	64.4	91.8)	97.8
	TAIL 2	6.7	31.8)		6.0)	
	TAIL 1	46.2	1.7		2.2	
	TOTAL	100.0	35.4		100.0	
325	CON 2	48.2	69.1)	63.9	91.3)	97.8
	TAIL 2	7.6	31.1)		6.5)	
	TAIL 1	44.2	1.8		2.2	
	TOTAL	100.0	36.5		100.0	

TABLE 2.4.

MAGNETIC REDUCTION/WET MAGNETIC SEPARATION TEST RESULTS

ON SAMPLE GL/A/4 STONY HILL

Mesh Size Tyler	Test Product	% Wt.	% Fe	% Distribution Fe
100	CON 2 TAIL 2 TAIL 1	50.5 7.8 41.7	69.0) 62.5 20.5) 1.6	93.9) 98.2 4.3) 1.8
	TOTAL	100.0	37.1	100.0
150	CON 2 TAIL 2 TAIL 1	50.6 9.9 39.5	69.1) 60.8 18.2) 1.6	93.5) 98.3 4.8) 1.7
	TOTAL	100.0	37.4	100.0
200	CON 2 TAIL 2 TAIL 1	49.5 11.4 39.1	68.9) 58.9 15.6) 1.5	93.5) 98.4 4.9) 1.6
	TOTAL	100.0	36.5	100.0
270	CON 2 TAIL 2 TAIL 1	49.8 9.2 41.0	69.0) 61.7 22.2) 1.7	92.6) 98.1 5.5) 1.9
	TOTAL	100.0	37.1	100.0
325	CON 2 TAIL 2 TAIL 1	48.3 7.2 44.5	69.4) 65.4 38.4) 1.8	90.4) 97.9 7.5) 2.1
	TOTAL	100.0	37.1	100.0

TABLE 2.5.

MAGNETIC REDUCTION/WET MAGNETIC SEPARATION TEST RESULTS

SAMPLE GL/B/1 STONY HILL

Mesh Size Tyler	Test Product	% Wt.	% Fe	% Distribution Fe
100	CON 2 TAIL 2 TAIL 1	45.5 7.6 46.9	69.0) 62.4 22.6) 2.4	91.7) 96.7 5.0) 3.3
	TOTAL	100.0	34.2	100.0
150	CON 2 TAIL 2 TAIL 1	45.5) 5.5) 49.0	64.1)) 2.4	96.5 3.5
	TOTAL	100.0	33.9	100.0
200	CON 2 TAIL 2 TAIL 1	44.2) 5.4) 54.4	64.5)) 2.2	96.4 3.6
	TOTAL	100.0	33.2	100.0
270	CON 2 TAIL 2 TAIL 1	43.5 6.3 50.2	68.4) 63.7 31.6) 2.3	90.4) 96.5 6.1) 3.5
	TOTAL	100.0	32.9	100.0
325	CON 2 TAIL 2 TAIL 1	43.1 7.2 49.7	69.0) 64.0 34.4) 1.9	89.7) 97.2 7.5) 2.8
	TOTAL	100.0	33.2	100.0

TABLE 2.6.

MAGNETIC REDUCTION/WET MAGNETIC SEPARATION TEST RESULTS ON SAMPLE GL/B/2 STONY HILL

Mesh Size Tyler	Test Product	% Wt.	% Fe	% Distribution Fe
100	CON 2 TAIL 2 TAIL 1	42.2 7.4 50.4	69.8) 62.9 23.7) 2.5	90.7) 96.1 5.4) 3.9
	TOTAL	100.0	32.5	100.0
150	CON 2 TAIL 2 TAIL 1	43.5) 4.9) 51.6	65.6)) 2.2	96.5 3.5
	TOTAL	100.0	32.9	100.0
200	CON 2 TAIL 2 TAIL 1	43.2 6.0 50.8	70.1) 64.7 25.8) 2.3	91.8) 96.5 4.7) 3.5
	TOTAL	100.0	33.0	100.0
270	CON 2 TAIL 2 TAIL 1	44.3) 4.7) 51.0	66.6)) 2.2	96.7 3.3
	TOTAL	100.0	33.8	100.0
325	CON 2 TAIL 2 TAIL 1	43.2 7.0 49.8	69.9) 64.9 34.3) 2.0	89.9) 97.0 7.1) 3.0
	TOTAL	100.0	33.6	100.0

TABLE 2.7.

MAGNETIC REDUCTION/WET MAGNETIC SEPARATION TEST RESULTS

ON SAMPLE GL/C/1 STONY HILL

Mesh Size Tyler	Test Product	% Wt.	% Fe	% Distribution Fe
100	CON 2 TAIL 2 TAIL 1	48.5) 5.6) 45.9	65.7)) 1.8	97.7 2.3
	TOTAL	100.0	36.4	100.0
150	CON 2 TAIL 2 TAIL 1	49.9) 3.7) 46.4	67.6)) 1.5	98.1 1.9
	TOTAL	100.0	36.9	100.0
200	CON 2 TAIL 2 TAIL 1	48.0) 3.3) 48.7	68.1)) 1.4	98.1 1.9
	TOTAL	100.0	35.6	100.0
270	CON 2 TAIL 2 TAIL 1	47.6) 4.4) 48.0	68.0)) 1.5	98.0 2.0
	TOTAL	100.0	36.1	100.0
325	CON 2 TAIL 2 TAIL 1	47.2) 4.4) 48.4	68.0)) 1.5	98.0 2.0
	TOTAL	100.0	35.8	100.0

TABLE 2.8.

MAGNETIC REDUCTION/WET MAGNETIC SEPARATION TEST RESULTS ON SAMPLE GL/C/2 STONY HILL

Mesh Size Tyler	Test Product	% Wt.	% Fe		% Distribution Fe	
100	CON 2	50.2	69.9)	65.6	93.4)	97.6
	TAIL 2	5.7	27.7)		4.2)	
	TAIL 1	44.1	2.0		2.4	
	TOTAL	100.0	37.6		100.0	
150	CON 2	50.1	69.9)	62.7	93.8)	98.4
	TAIL 2	8.5	20.1)		4.6)	
	TAIL 1	41.4	1.5		1.6	
	TOTAL	100.0	37.4		100.0	
200	CON 2	49.5	70.2)	66.9	93.7)	98.1
	TAIL 2	4.9	33.6)		4.4)	
	TAIL 1	45.6	1.5		1.9	
	TOTAL	100.0	37.1		100.0	
270	CON 2	47.8	70.3)	67.0	91.5)	97.8
	TAIL 2	5.8	40.1)		6.3)	
	TAIL 1	46.4	1.7		2.2	
	TOTAL	100.0	36.7		100.0	
325	CON 2	47.8	70.3)	67.1	91.5)	97.7
	TAIL 2	5.7	40.2)		6.2)	
	TAIL 1	46.5	1.8		2.3	
	TOTAL	100.0	36.7		100.0	

TABLE 2.9.

MAGNETIC REDUCTION/WET MAGNETIC SEPARATION TEST RESULTS ON SAMPLE GL/C/3 STONY HILL

Mesh Size Tyler	Test Product	% Wt.	% Fe	% Distribution Fe
100	CON 2 TAIL 2 TAIL 1	48.3 9.8 41.9	66.9) 58.6 17.6) 2.2	92.5) 97.4 4.9) 2.6
	TOTAL	100.0	35.0	100.0
150	CON 2 TAIL 2 TAIL 1	48.2 6.5 45.3	67.7) 63.1 29.0) 1.6	92.6) 97.9 5.3) 2.1
	TOTAL	100.0	35.2	100.0
200	CON 2 TAIL 2 TAIL 1	47.4 5.9 46.7	67.9) 64.3 35.4) 1.6	91.9) 97.9 6.0) 2.1
	TOTAL	100.0	35.0	100.0
270	CON 2 TAIL 2 TAIL 1	44.1 14.2 41.7	68.6) 60.1 33.7) 1.8	84.5) 97.9 13.4) 2.1
	TOTAL	100.0	35.8	100.0
325	CON 2 TAIL 2 TAIL 1	46.3 7.9 45.8	68.8) 63.8 34.6) 2.2	89.5) 97.2 7.7) 2.8
	TOTAL	100.0	35.6	100.0

TABLE 2.10.

MAGNETIC REDUCTION/WET MAGNETIC SEPARATION TEST RESULTS ON SAMPLE GL/C/4 STONY HILL

Mesh Size Tyler	Test Product	% Wt.	% Fe		% Distribution Fe	
100	CON 2	46.7	66.9)	61.4	91.1)	96.8
	TAIL 2	7.4	26.4)		5.7)	
	TAIL 1	45.9	2.4		3.2	
	TOTAL	100.0	34.3		100.0	
150	CON 2	47.8	67.2)	61.3	91.7)	97.1
	TAIL 2	7.7	24.6)		5.4)	
	TAIL 1	44.5	2.3		2.9	
	TOTAL	100.0	35.0		100.0	
200	CON 2	46.3	67.4)	61.1	90.9)	97.0
	TAIL 2	8.2	25.5)		6.1)	
	TAIL 1	45.5	2.3		3.0	
	TOTAL	100.0	34.3		100.0	
270	CON 2	44.6	68.2)	63.1	88.1)	97.2
	TAIL 2	8.6	36.5)		9.1)	
	TAIL 1	46.8	2.1		2.8	
	TOTAL	100.0	34.5		100.0	
325	CON 2	43.1	68.7)	62.3	84.4)	97.4
	TAIL 2	11.6	39.4)		13.0)	
	TAIL 1	45.3	2.0		2.6	
	TOTAL	100.0	35.1		100.0	

TABLE 2.11.

MAGNETIC REDUCTION/WET MAGNETIC SEPARATION TEST RESULTS

ON SAMPLE GL/C/5 STONY HILL

Mesh Size Tyler	Test Product	% Wt.	% Fe	% Distribution Fe
100	CON 2	48.3	67.9) 59.3	93.0) 98.2
	TAIL 2	10.1	18.0)	5.2)
	TAIL 1	41.6	1.5	1.8
	TOTAL	100.0	35.2	100.0
150	CON 2	48.1	68.6) 59.5	92.8) 98.4
	TAIL 2	10.7	18.7)	5.6)
	TAIL 1	41.2	1.4	1.6
	TOTAL	100.0	35.6	100.0
200	CON 2	47.3	68.1) 61.9	91.7) 97.7
	TAIL 2	8.1	25.9)	6.0)
	TAIL 1	44.6	1.8	2.3
	TOTAL	100.0	35.1	100.0
270	CON 2	46.4	68.3) 63.2	91.8) 98.1
	TAIL 2	7.2	30.1)	6.3)
	TAIL 1	46.4	1.4	1.9
	TOTAL	100.0	34.5	100.0
325	CON 2	47.6	68.9) 63.1	92.0) 98.1
	TAIL 2	7.8	28.0)	6.1)
	TAIL 1	44.6	1.5	1.9
	TOTAL	100.0	35.6	100.0

APPENDIX D

NOTES ON A BRIEF STRUCTURAL GEOLOGICAL INVESTIGATION OF THE STONY HILL AREA, S.M.L. 539, WEST OF THE MIDDLEBACK RANGES.

Introduction

A limited amount of time was spent making field observations in an attempt to provide some information on the subsurface extensions of the coarse-grained iron formations in this area. Airphoto-interpretation was of some use to compensate for the relative lack of outcrop.

Ground magnetic traverses were made to test a hypothetical basement fault north of Stony Hill. Structural information was derived from microscopic examinations of surface and drill core samples.

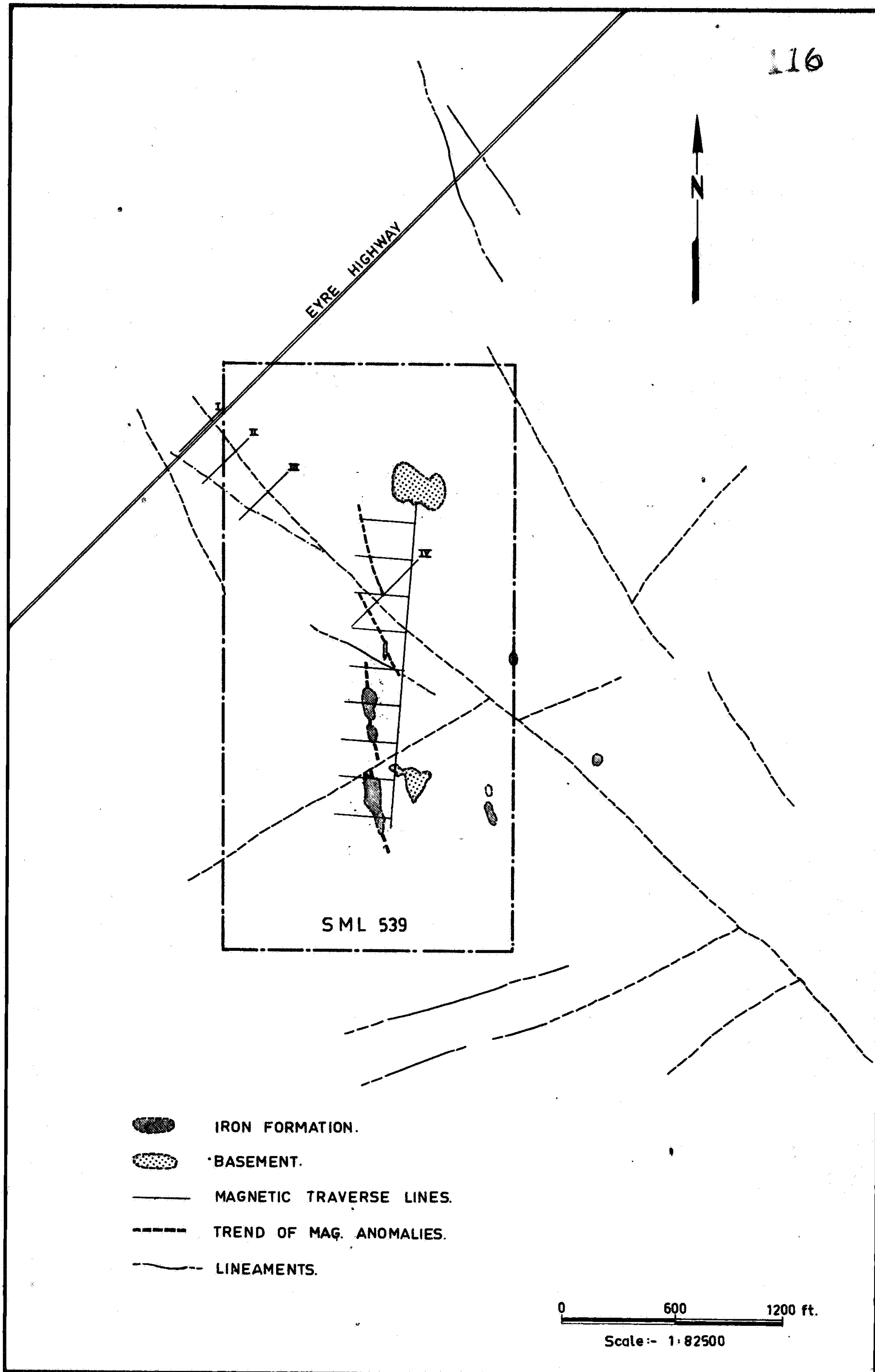
Observations

The Stony Hill iron formations occur along a string of outcrops roughly north-south, about three miles long, flanked by exposures of granitic gneisses. West of these are some scattered "jaspilite" outcrops, extending beyond the boundaries of S.M.L. 539 and continuing to the SW (Fig. A).

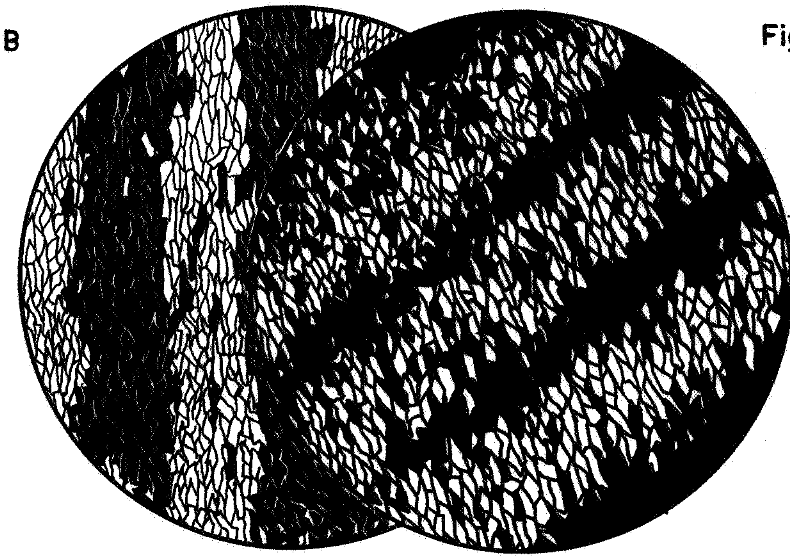
Although the iron formations concerned are distinctly banded, there is a difference with the Middleback Range jaspilites, mainly with regard to their coarseness in grain-size (up to 3mm.) of both quartz and magnetite/hematite.

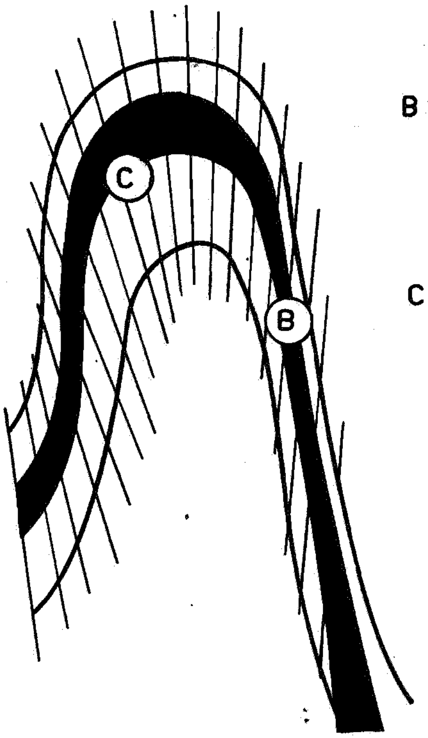
On a microscopic scale one observes magnetite/hematite rich bands interchanging with quartz-rich bands; the crystals frequently having their longest dimensions parallel to this banding (Fig. B). However, sometimes their orientation makes an acute angle with the compositional banding (SS), as a result of recrystallization a reorientation at right angles to the stress during deformation. This resulted in the incomplete development of a fracture cleavage, representing the axial plane (Sax) of the related folding (Fig. C).

Whereas a varying SS was indicated by both surface and subsurface data, Sax where recognized, was found to be consistently subvertical and N-S striking. The accompanying B-lineations are a result of Sax intersecting SS and often coincide with the longest dimensions of quartz and magnetite crystals. They were observed to be sub-horizontal to moderately N-plunging (up to 40^{o}).



Centre WHYALLA	Fig.A THE BROKEN HILL PROPRIETARY CO. LTD.	Project No. S.A S.M.L. 539-5
Date JULY '71	STONY HILL STRUCTURAL INTERPRETATION	Drawing No. A4/ 43





B: BEDDING AND FOLIATION SUBPARALLEL.

C: BEDDING AND FOLIATION CROSSCUTTING.

Centre WHYALLA	Fig. B & C	THE BROKEN HILL PROPRIETARY CO. LTD. STONY HILL - ROCK FABRICS IN HINGE AND LIMB OF FOLD	Project No. SA S.M.L. 539-10
Date JULY '71			Drawing No. A4/ 48

Although the original attitude had not been marked on cores from the two percussion holes (ST 1 and ST 2), Sax and B provided fairly reliable criteria for core orientation afterwards. This was necessary in order to obtain data on the bedding configuration to be used in the construction of an interpretative cross section through the deposit (Fig. D).

Most of the rocks from the area W of borehole ST 2 are characterized by the occurrence of only one plane of foliation, which is vertical to steeply E-dipping. In contrast with this, rocks east of ST 2 are found to show cross-cutting relationships between SS and Sax described above. A short distance south of the 14000N line however, thick quartz-rich layers were observed to have been deformed into isoclinal folds, of which Sax is parallel to the local foliation (Fig. F). Orientation of magnetite crystals in the hinge zones, parallel to Sax suggest that at least in the western part of the hill Sax replaced SS as the most conspicuous banding in the rock.

To explain it, this penetrative development of Sax must be related to the intense deformation that takes place in hinge zones of folds, much the same way as illustrated in Fig. F only on a much bigger scale.

An interesting fact worth noting is the sharp increase of the amount of magnetite toward the hinge of the minor fold, a feature also observed by others although on a bigger scale and in a higher grade ore.

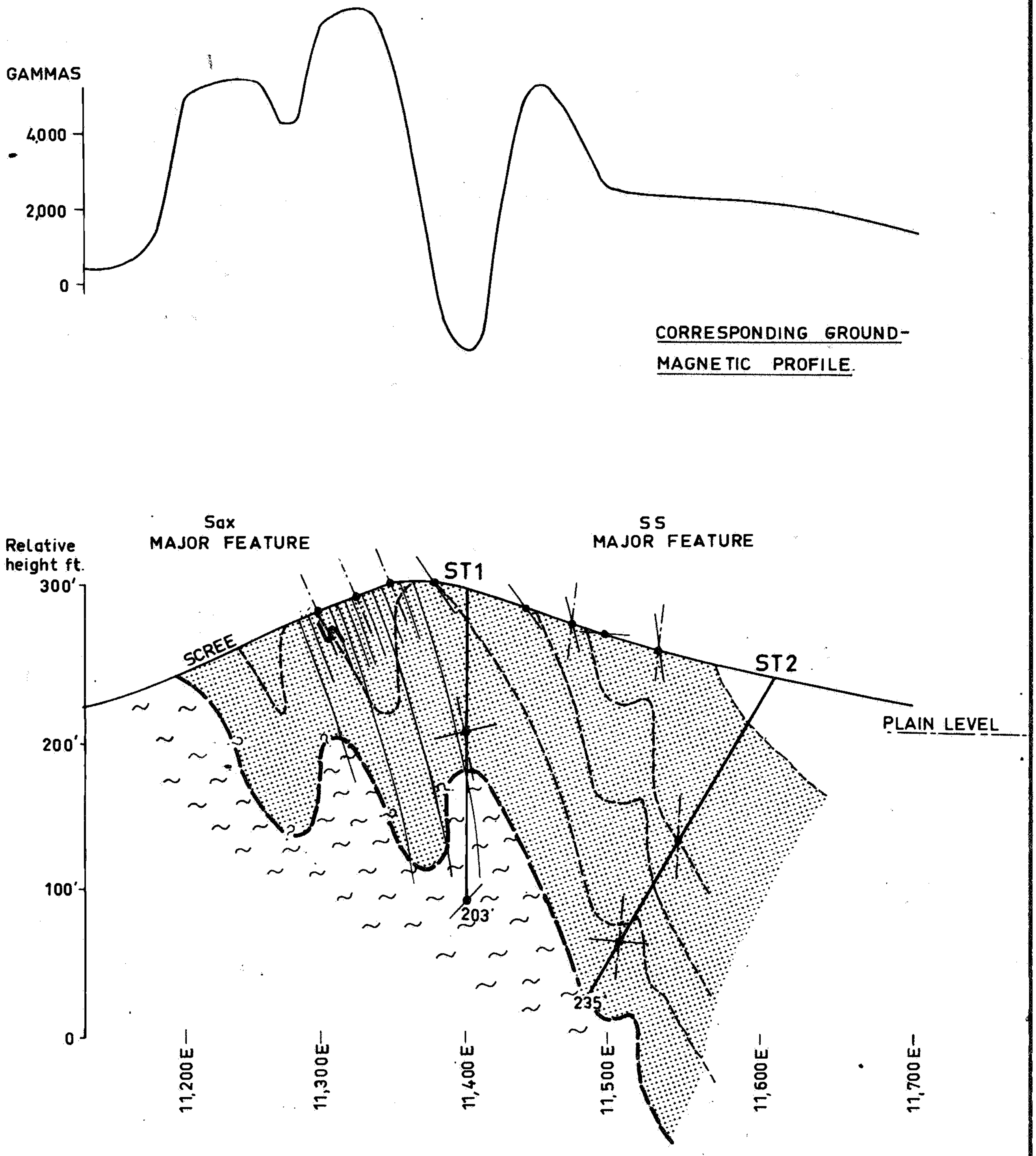
Hoffman, 1970, states:

"as fold axes (read: hinge zones) are approached:

1) soluble iron content increases
2) iron formation thickens
3) relative proportions of iron formation to total stratigraphic section increase until iron formation constitutes continuous section
4) grain of ore mineral coarsens."

Consequently the occurrence of a fold hinge in the western part of Stony Hill is strongly suggested by the increase in grainsize and magnetite-content when approaching this area. This would also be in accordance with the ground magnetic profile (Tom, 1970) included in Fig. D.

Since stratigraphical correlation was not feasible, the cross-section is entirely the result of structural interpretation on the basis of the above described criteria.



IRON FORMATION.

SCHIST.

OBSERVED ATTITUDE AXIAL PLANE. (Sax)

OBSERVED ATTITUDE BEDDING PLANE. (S.S.)

Centre WHYALLA	THE BROKEN HILL PROPRIETARY CO. LTD.	Project No. S.A. SML 539 - 12
Date JULY 1971	Fig. D INTERPRETATIVE CROSS SECTION STONY HILL	Drawing No. A4/ 50

Whereas at the Stony Hill line, SS is generally E-dipping, the opposite is found in the outcrops on either side of the eastern border of S.M.L. 539. There, an overall W-dip prevails.

Fig. E shows a stereogram with the various orientations of SS observed in both areas. It suggests the existence of a broad syncline, of which the Stony Hill line represents the western limb.

This relatively simple pattern is slightly complicated by the rotation of SS about often steep plunging axes (π). The orientation of π roughly conforms with a steep E-W striking plane, that is thought to belong to a later deformation phase, with stress-directions in a roughly N-S direction.

Observations elsewhere confirm the existence of such a stress-field.

At Secret Rocks (Refer Fig. G) e.g. intrusion of dark igneous material parallel to the NS-foliation indicates a NS-compression or at least a period of "elastic release" after the formation of the foliation.

Later renewed EW-compression caused these dykes to break up along conjugate shear planes (Fig. G)

From the Middleback Ranges also, evidence for an E-W "cross folding" confirms this hypothesis.

Going back to Fig. A, the fault pattern shown is mainly based on photo geological interpretation. Some of these, viz. the ones with a NW-orientation, are likely to be of the strike-slip type, the movement in agreement with N-S compression.

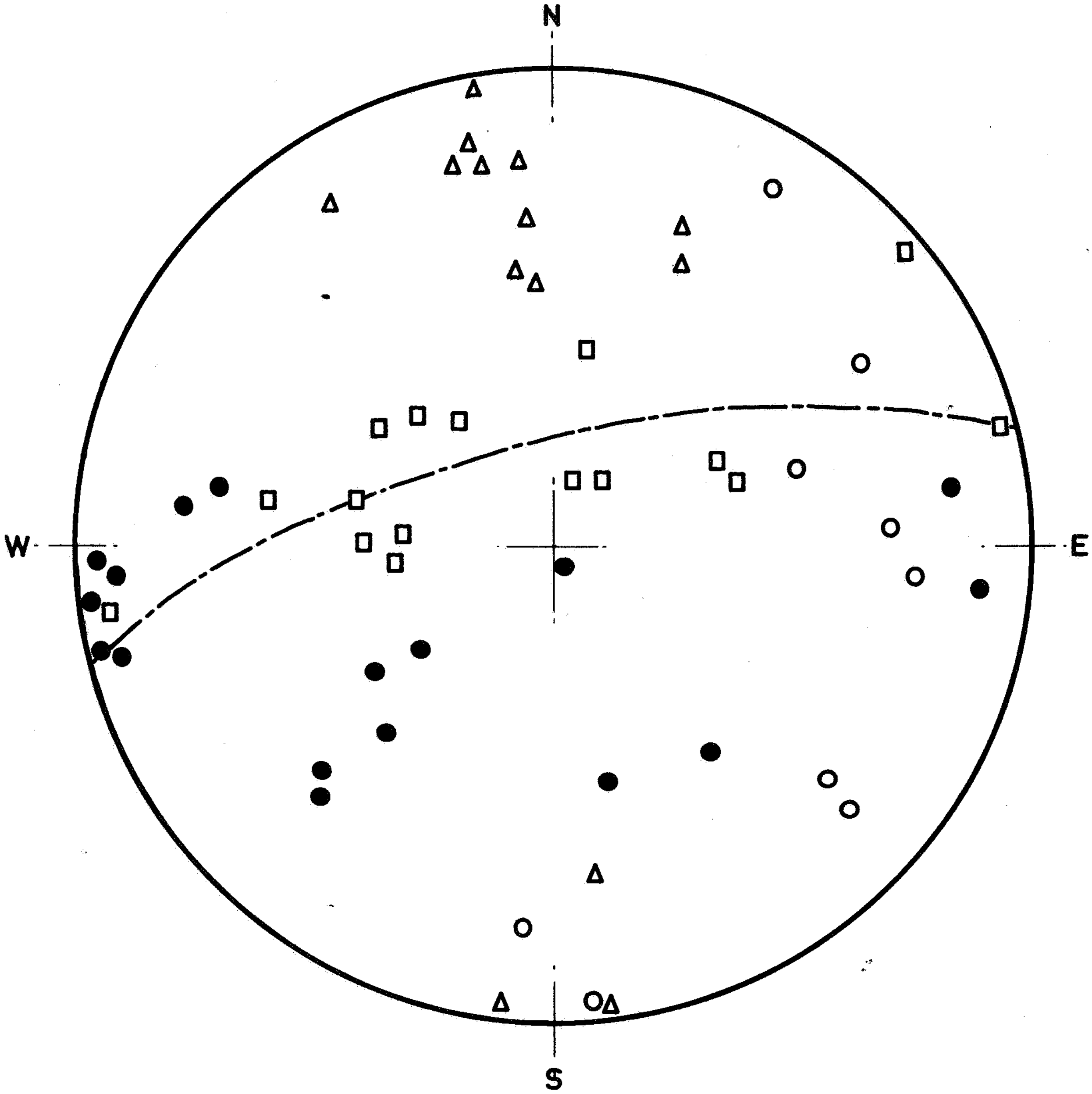
Apart from these, other wrench-faults are consistent with an E-W stress field, probably belonging to the earlier phase of deformation. Trend lines of ground magnetic anomalies (see Fig. A) appear to indicate off sets in both directions.

Although the amount and sense of movement along the major NW-SE lineament is still uncertain, interpretation of the "northern-anomaly" as a deep seated jaspilite is questionable. This is emphasized by the assay data of Stony Hill drilling samples, indicating a pronounced decrease in magnetite content at depth apparently due to some mechanism of leaching, the effects of which are visible in the drill cores.

A basic rock, outcropping N of the fault and found to cause magnetic readings as high as 3750 gammas, is suggested as more likely to be responsible for the northern anomaly.

H. vanWEES

WHYALLA
8.7.71



SYMBOLS

● Poles to bedding-planes, Stony Hill

○ Poles to bedding-planes, eastern part S.M.L. 539

△ Main fold axes determining structural trend.

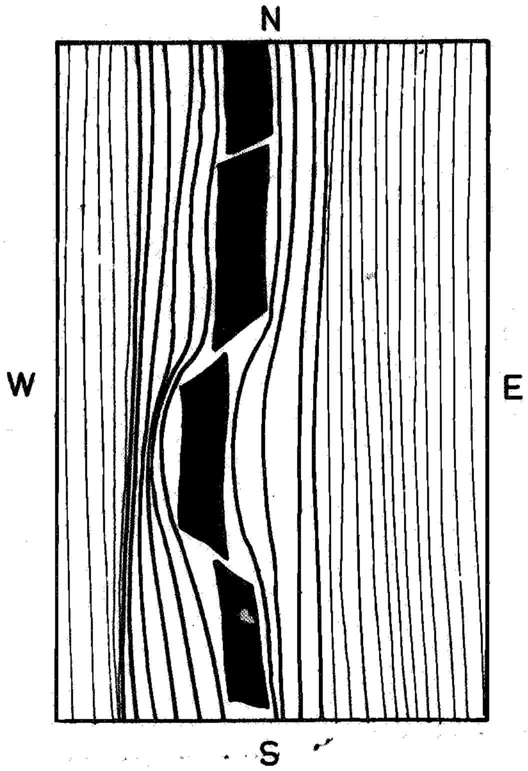
□ Fold axes, disturbing previous stuctures.

-·-· Suggested orientation of "E-W-refolding".

Centre WHYALLA	THE BROKEN HILL PROPRIETARY CO. LTD.	Project No. S.A. S.M.L. 539 - 9
Date JULY '71	Fig. E FOLDING & REFOLDING S.M.L. 539	Drawing No. A4/ 47

Fig. G

Secret Rocks
Basement structure.



Gneissic foliation.

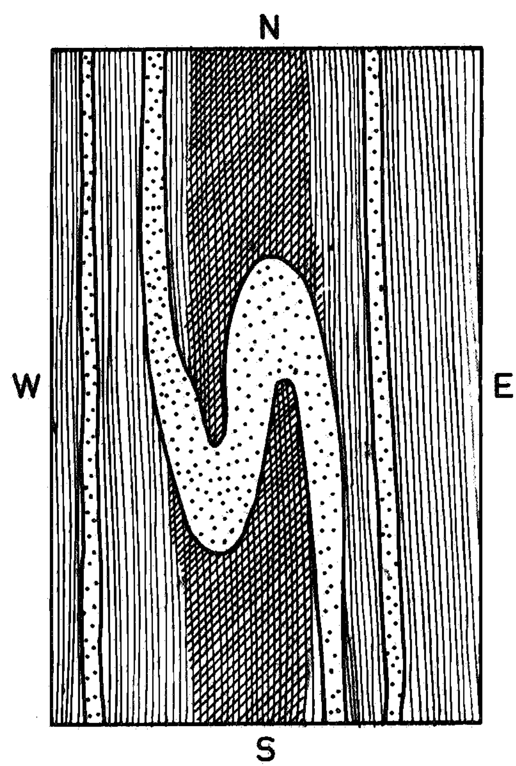
Basic intrusive.

<u>Sequence of events.</u>

1. E-W compression (foliation)
2. N-S compression (intrusion)
3. Renewed E-W compression.

Fig. F

Stony Hill
Fold structure.



Quartz-rich layers.

Trend of foliation.

Highly magnetic zone.

SCALE
0 1 2 ft

Centre WHYALLA	Fig. F & G	THE BROKEN HILL PROPRIETARY CO. LTD. STRUCTURAL FEATURES STONY HILL - SECRET ROCKS	Project No. S.A. SML 539-II
Date JULY '71			Drawing No. A4/ 49

(blue)	Iron formation	⤫	Strike & dip	⌊_	Boundary SML 539
(green)	Basic intrusives	→	Plunge	- - -	Track
(yellow)	Basement complex	-V-	Strike of vertical bed	-+-	Fence
		===	Trend lines	•	Bore hole (ST1 angle of 60°)

0 0·25 0·5 0·75 1 mile

Scale

Note :- Grid north 5° 30' east of true north.

Fig. No.......................

To accompany......................

Dated.......................

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Fig. 2 S.M.L. 539

OUTCROP MAP, STONY HILL AREA

Drawn E.E.	Date 19-4-71	Centre WHYALLA
Traced J.C.G	Project No. S.A.	Drawing No.
Checked E.E.	S.M.L.539 - 1	AI- 241
O.I.C. D.V.F.		

ENV 1584 - 1

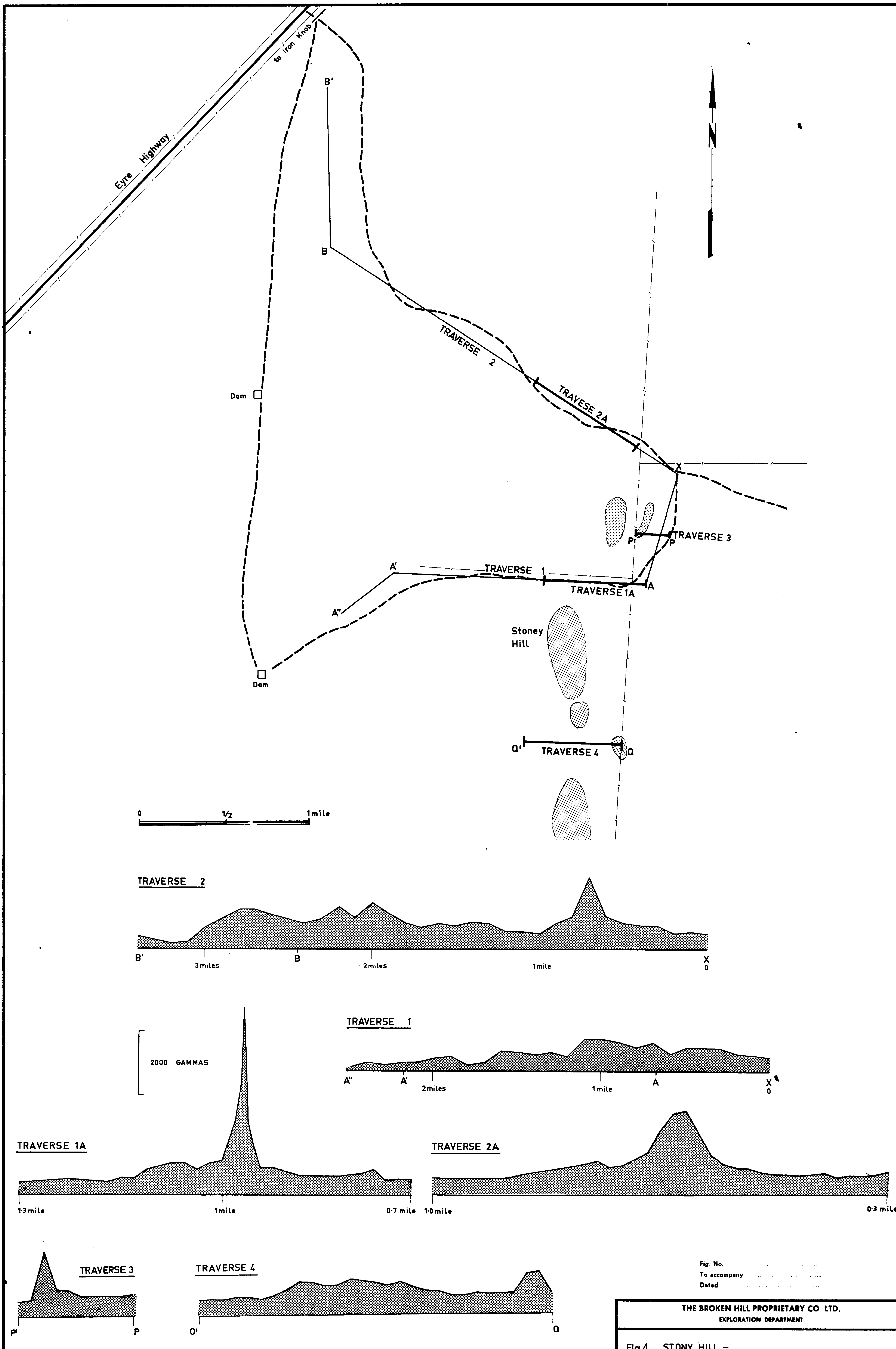

Fig. No.
To accompany
Dated

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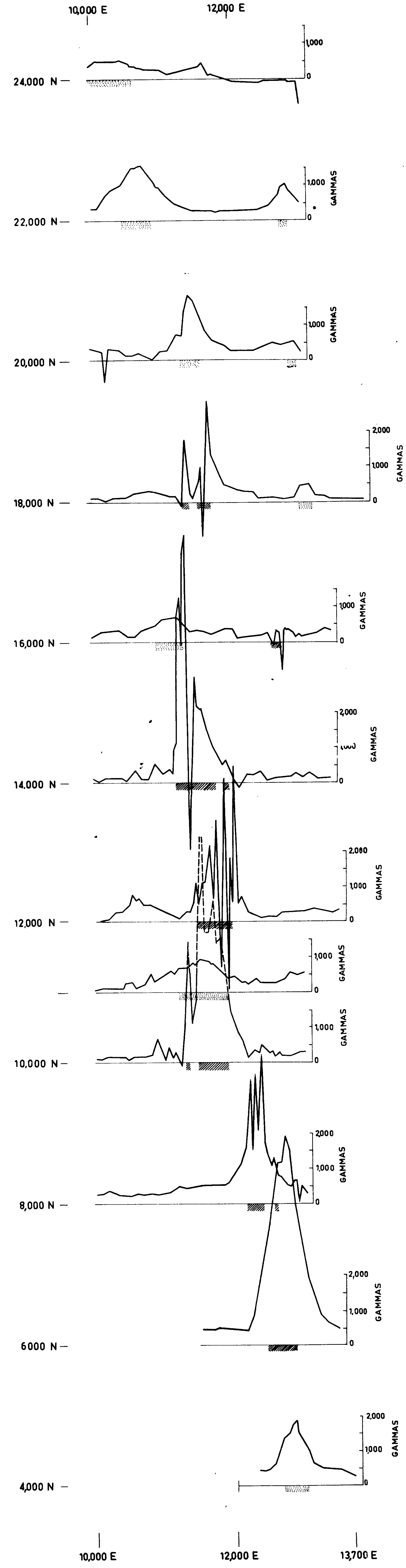
EXPLORATION DEPARTMENT

Fig 4. STONY HILL – PRELIMINARY GROUND MAGNETICS

Drawn J. GEHLING	Date 29/6/70	Centre WHYALLA
Traced J.C.G.	Project No. SA	Drawing No.
Checked E.E.	SML 205 – 7 539	A2- 68
O.I.C. D.V.F.		

ENV 1584 -2



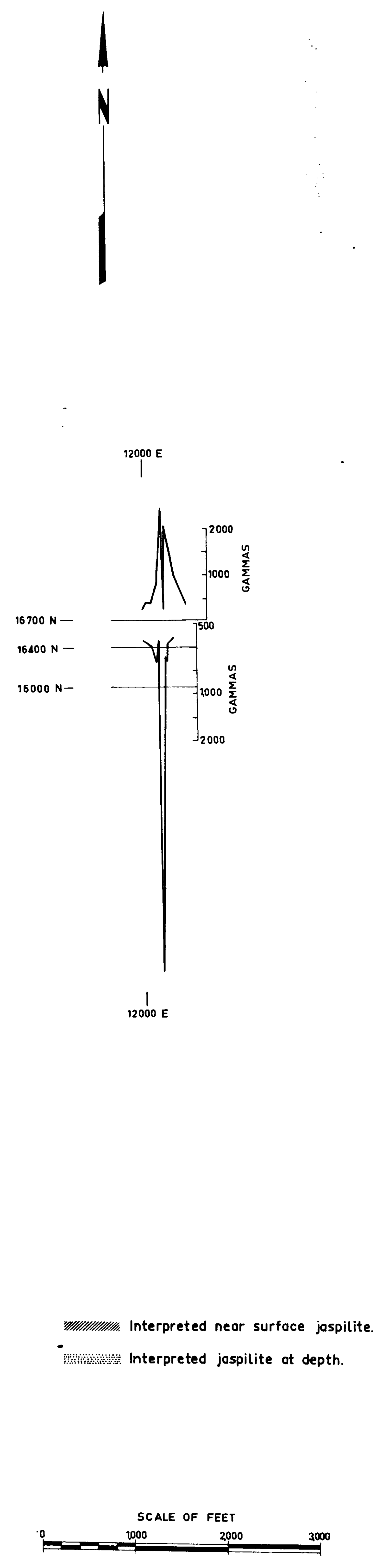


Fig. No.
To accompany
Dated

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EXPLORATION DEPARTMENT

Fig. 5 STONY HILL AREA - S.A.
GROUND MAGNETIC PROFILES

Drawn M.T. & E.E.	Date JULY '71	Centre WHYALLA
Traced R.K.	Project No. S.A.	Drawing No.
Checked E. E.	S.M.L. 539-4	A2- 85
O.I.C. D.V.F.		

ENV 1584-3

FIG. 2

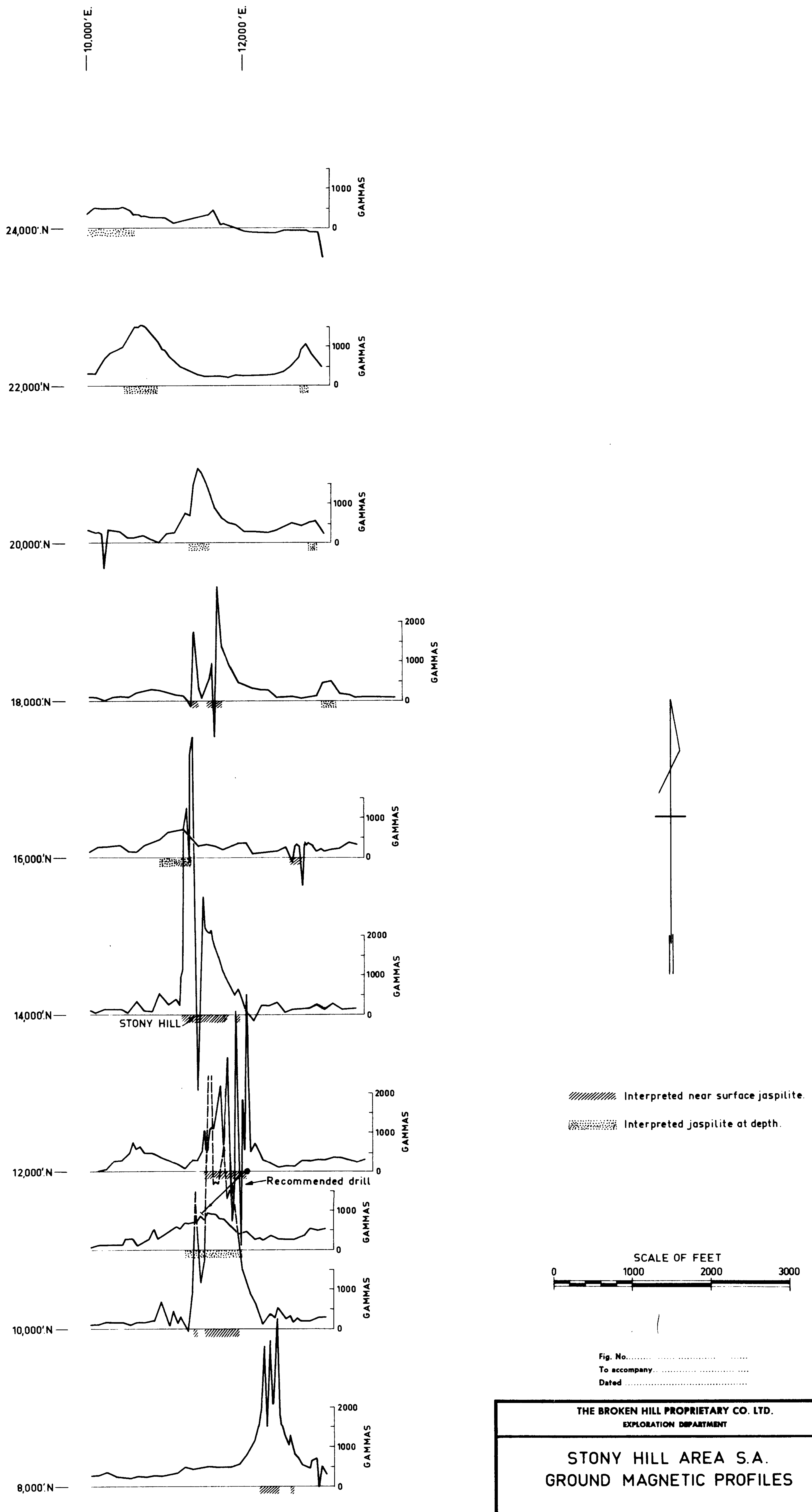

Fig. No.
To accompany
Dated

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STONY HILL AREA S.A.
GROUND MAGNETIC PROFILES

Drawn M.T	Date 11-1-71	Centre Melbourne
Traced A.S. Czigler	Project No.	Drawing No. A2-1111
Checked		
O.I.C.		

ENV 1584-4