DEPARTMENT OF MINES AND ENERGY
GEOLOGICAL SURVEY
SOUTH AUSTRALIA

REPORT BOOK 97/10

SOUTH AUSTRALIAN STEEL AND ENERGY PROJECT

COOBER PEDY IRON ORE INVESTIGATION

GIFFEN WELL PROSPECT

by

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Mineral Resources

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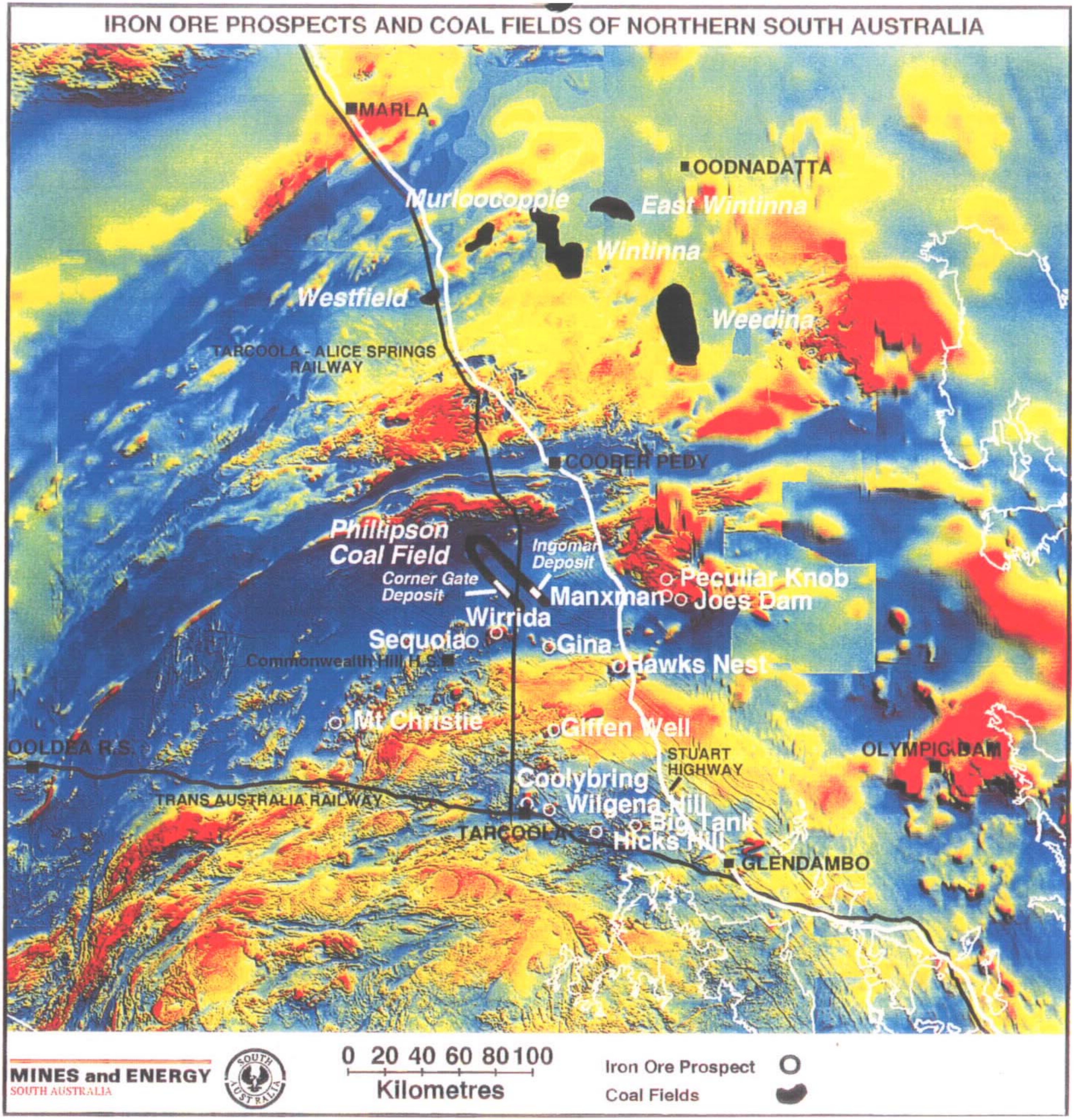
IRON ORE PROSPECTS AND COAL FIELDS OF NORTHERN SOUTH AUSTRALIA
MARLA
OODNADATTA
Murloocoppie
East Wintinna
Wintinna
Westfield
Weedina
TARCOOLA - ALICE SPRINGS RAILWAY
COOBER PEDY
Phillipson Coal Field
Ingomar Deposit
Corner Gate Deposit
Peculiar Knob
Manxman
Joes Dam
Wirrida
Sequoia
Gina
Commonwealth Hill H.S.
Hawks Nest
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SOUTH AUSTRALIAN STEEL AND ENERGY PROJECT
COOBER PEDY IRON ORE INVESTIGATION
GIFFEN WELL PROSPECT

M B Davies, B J Morris
and P P Crettenden

As part of the South Australian Steel and Energy Project, MESA targeted Palaeoproterozoic Banded Iron Formation at Giffen Well as a possible iron ore resource. Ground magnetic, gravity and drilling programmes have identified an Inferred Resource of about 290 Mt to 150m depth of magnetite BIF grading 33.7%Fe. Smaller adjacent untested magnetic anomalies represent a further possible resource of about 100 Mt of magnetite BIF. Preliminary beneficiation tests suggest that a high grade iron concentrate of about 69%Fe with very low levels of alumina and phosphorous may be readily produced.

INTRODUCTION

As part of the South Australian Steel and Energy Project (SASE) Mines and Energy, South Australia (MESA) commenced a search for iron ore on the northern Gawler Craton in January, 1995. The project, in conjunction with Meekatharra Minerals Ltd (MML) and Ausmelt Ltd, aims to produce pig iron near Coober Pedy using local iron ore, coal from MML's Phillipson Coalfield and the direct smelting Ausmelt technology.

Poorly outcropping Palaeoproterozoic Banded Iron Formation (BIF), associated with a prominent magnetic anomaly was identified from the regional MESA geological maps and geophysical surveys on the Tarcoola 1:250 000 sheet, near Giffen Well (figure 1). The area was thought to have potential for haematite ore and for magnetite BIF which might be amenable to beneficiation to a higher grade product.

CLIMATE, VEGETATION AND ACCESS

The Giffen well prospect lies in a semi-arid to arid region of low, irregular rainfall, the area being prone to drought. The vegetation consists of bluebush, saltbush shrubland and sparse Mulga woodland. Near surface BIF forms two subdued hills. The chief activity of the area is sheep grazing, with Giffen Well situated on the Bulgunnia Pastoral lease. The prospect lies close to the Tarcoola to Bulgunnia public access road, with the nearest population centre being Tarcoola, some 70 kilometres to the south. The Tarcoola to Alice Springs railway line lies about 18 kilometres due west and the Lake Phillipson coal deposits 65 kms north. Best access is via the sealed Stuart Highway to the Bulgunnia Homestead turnoff, then via 48 kilometres of well-made dirt road to Giffen Well. From Giffen Well to the prospect site access is cross-country with such travel kept to the minimum required for exploration and drilling.

A site avoidance survey carried out by MESA’s Liaison Officer (Mr R Larkins) with representatives of the Antakarinja people, cleared the Giffen Well prospect area.

The prospect lies on the Tarcoola 1:250 000 sheet and on the Bulgunnia 1:100 000 sheet. Initially exploration by MESA was carried out under an agreement with Dominion Gold Operations Pty Ltd and Resolute Resources Ltd, who held the area as licensees of EL1791. Since the 26th of October 1996, the Giffen Well prospect and surrounding area have been excised from EL 1791 and included in ELA 498/94, currently held by the Director-General, MESA.

PREVIOUS INVESTIGATIONS

Nissho-Iwai, in 1973, took a water sample for analysis from Sextabyng Well, some 3 kms north-northwest of Giffen Well, as part of the exploration for uranium.

A prominent magnetic and gravity ridge stretches for some 20 kilometres east-northeast of Giffen Well and is the extension of the Giffen Well anomaly. It was the scene of exploration for an Olympic Dam style orebody by Samedan in 1979 who carried out ground magnetic and gravity surveys. They subsequently drilltested chosen anomalies in three deep holes, BDH1 to 3. BDH-1 intersected Palaeoproterozoic BIF (presumed equivalent to the near surface BIF at Giffen Well) at 216 metres, whilst drillholes BDH2 and 3 failed to reach the BIF.

In 1986 MESA tested magnetic anomalies in the same region and east of Giffen Well (Bulgunnia 1 and 2). Bulgunnia 1 intersected magnetite BIF at 124 metres depth.

In 1986 CRAE tested a circular magnetic anomaly 8 kms north of Giffen Well. After initial reconnaissance ground magnetic and gravity traverses, they drilltested the anomaly in hole RD/PD84GD-1, which intersected a magnetite-rich lithology from 190 to 232m. Initial petrological examination suggested the magnetite was a magnetite-rich phase of the Gawler Range Volcanics, though a later report identified the rock as Palaeoproterozoic BIF (Pontifex Mineralogical Report No 7075 in appendix 4).

PNC Exploration Australia exploring for uranium in Tertiary channels and in the Palaeoproterozoic drilled 3 holes on a gravity ridge extending northeast, southwest through Sextabyng Well. Hole E1, drilled 2 kms NNE of Giffen Well, intersected granite at 63 metres, whilst holes E2 and E3, drilled 10 kms southeast of Giffen Well, intersected dolomite, tentatively correlated with the Palaeoproterozoic Katunga Dolomite.

Freeport Australia briefly held the ground and carried out some stream sediment sampling.

In 1991 MESA drilled in the area as part of the Tarcoola-Tallaringa bedrock drilling programme. BIF was intersected in holes BUL7 (at 10 metres) and BUL34 (at 8 metres), whilst BUL77 and 79, drilled near holes E2 and E3, also intersected dolomite. Table 1 summarizes the tenement history.

TABLE 1

COMPANY	TENEMENT	REFERENCE (open file)	YEAR
Nissho-Iwai	EL48	Env 2390	1973
Samedan	EL399, 693	Env 3293, 3537	1979
CRAE	EL1089	Env 5047, 6128	1984
PNC Exploration	EL 1058	Env 4943	1984/85
Freeport Australia	EL1362	Env 6771	1987
MESA	-	RB88/38	1986
MESA	-	RB93/4	1991

GEOLOGICAL SETTING

The Giffen Well prospect is interpreted as a near surface block of Palaeoproterozoic metasediments situated on the northeastern margin of the Wilgena subdomain of the Gawler Craton. On the regional aeromagnetics Giffen Well forms the southwestern portion of a magnetic anomaly which continues for 20 kms to the northeast. This anomaly lies on a prominent linear feature (Bulgunnia Shear Zone) bearing about 240° and continuing for about 150 kilometres to the southwest. The prospect is cross-cut by linear magnetic trends, bearing 130-135°, presumed to be related to dolerite dykes of the Gairdner Dyke Swarm.

Locally, there are two subdued hills of poorly outcropping BIF. The BIF is a dull, dark grey to black, poorly to well laminated, with ubiquitous microfaulting. Dips are generally steep to moderately east. Much of the near surface BIF is covered by a thin veneer of BIF scree which grades laterally onto areas of red sandy soils, patches of ironstone and red aeolian sand.

The subsurface extent of the BIF is revealed by detailed ground magnetic and gravity surveys. There is one main strike ridge of BIF, which extends for about 4 kms, north-northeast with a second shorter (1 km) strike ridge parallel and immediately to the west. There is a third parallel strike ridge immediately to the east of the main ridge, but this is covered by about 50 metres of younger sediments. It also has a strike length of about 1 km.

GEOPHYSICS

At Giffen Well Prospect ground magnetics and gravity surveys were carried out over the period from August 1995 to October 1996, totalling 47.2 line kilometres of ground magnetics and 577 gravity stations. Figure 2 shows the location of the geophysical traverses and geophysical profiles are presented in appendix 2.

Ground Magnetics

In August 1995 a grid was established using GPS with a 200m N-S line spacing and a 50m E-W station spacing. This grid was between 6646400mN and 6647400mN and 476700mE and 4767400mE. Ground Magnetics using an Overhauser GSM-19 magnetometer was used, reading stations at 25 m intervals. In October 1995 the grid was extended West, to 475800mE, East to 477800mE and one line to the north (6647800mN) to close some apparent open ended magnetic features. In April 1996 the grid was further extended to the west and extended south to 6644600mN with 400 m line spacings. Magnetics were recorded using an Overhauser GSM-19 Fastman recording at 1 second intervals which equates to approximately 1.5 m. Also in April, 4 short traverses were run over some smaller magnetic anomalies approximately 6 km west of the main Giffen Well anomaly. In June and October 1996 further extensions north and south of the grid were completed extending the grid to 6648600mN and 6644200mN.

All ground magnetic traverses were positioned at 100 m and 200 m stations along traverses using Garmin Survey II GPS receiver in differential mode and data post processed. A base line tie was made to Lewis Trig (PM 5837/1063). The positions of control stations are ±2-5 m with all intermediate stations interpolated using MICROMINE software.

All ground magnetic data were corrected for diurnal drift using R11 software supplied with the magnetometers. On completion of the survey all data were plotted as individual profiles and contoured using MICROMINE software. The contoured data was gridded using Inverse Distance Power of 5, a mesh of 50 m x 50 m and a smoothing tension of 5 (Fig 3).

Gravity

A total of 577 gravity stations were read at Giffen Well Prospect between August 1995 and October 1996 using a Scintrex CG3 Autograv gravity meter.

In August 1995 a gravity survey was conducted in conjunction with ground magnetics over the grid 6646400mN to 6647400mN and 476700mE and 477400mE. Gravity readings were taken every 50 m along the traverses. Stations were levelled using three base and one field Digibar 2000 digital barometers. An elevation tie was made to Lewis Trig (PM 5837/;1063) by running one base barometer at this point. A gravity tie was made to a Solo Geophysics base at Bulgunnia Shearing shed. In October 1995 and October 1996 further gravity stations were read on the extended grid at 50 m and 100 m. These stations were levelled tying to stations from the previous survey using a Sokkisha Set 4 Total Station.

All stations were positioned using Garmin Survey II GPS receiver in differential mode and post processing the data returning positions to ±2-5 m.

Data was processed using GRAVRED a MESA inhouse software and a density of 2.67. Data was plotted as profiles, gridded and contoured using Inverse Distance Power of 5 on a 50 m x 50 m grid with a smoothing tension of 5 using MICROMINE software (Fig 4 and appendix 2).

DRILLING

Table 2 presents a summary of drilling in the Giffen Well area (Figure 2 shows the location of drillholes). MESA drilling at Giffen Well commenced with the “depth to basement” Tarcoola-Tallaringa bedrock drilling programme in 1991. MESA carried out two traverses, one alongside the station track between Sextabyng and Giffen Wells and a second along the vermin-proof fence 5 kms west of Giffen Well.

In November 1995, a single, east-west traverse of 6 angled percussion holes was drilled (holes at 60° toward 090°). Holes GW1 to 6 were designed to test the grade of near surface BIF. Drilling contractors were Thompson Drilling using a G&K 850 track mounted drillrig. Supervising geologists for all drilling programmes were MESA personnel. In May 1996, after reassessment of the geophysical data, Strata Exploration Pty Ltd drilled an angled NQ diamond drillhole, GW-DD1 to 114.2 metres to obtain core of magnetite BIF for testwork. The hole was sited near to GW-1 and drilled parallel to it.

Also in May 1996, further "depth to basement" drilling was carried out by MESA Drilling Services, using RC-blade bit configuration (BUL81A to 101). Holes were sited on magnetic anomalies.

In August 1996, a further programme of deep angled percussion holes commenced (GW7 to 25). An attempt was made to test the grade and resource of the "main" magnetic ridge, with holes drilled at 60° towards 090°, to a total depth of 100 metres and located on a regular grid. Holes GW18, 19 and 22 had to be abandoned due to flowing sands in the younger cover sediments collapsing onto the drillrods. Drilling contractors were Strata Exploration Pty Ltd.

Figure 2 shows the drillhole locations and drill logs and assay results appear in Appendix 1.

On completion of the drilling programmes holes were plugged and backfilled, or, if the casing extended above ground, the holes were capped. Drillsites have been labelled with hole number, AMG co-ordinates and orientation marked on aluminium tags attached to star pickets.

AMG co-ordinates of all drillholes have been measured using a Garmin Survey II, with differential GPS post processing. Accuracy in the x and y dimensions is in the order of 2-5 metres.

TABLE 2
SUMMARY OF DRILLING - GIFFEN WELL AREA

COMPANY	YEAR	REFERENCE	NO OF HOLES	PREFIX	METRES DRILLED	COMMENTS
MESA	Oct'91	RB93/4	21	BUL	902.3	shallow, vert, RC blade-bit
MESA	Nov'95	-	6	GW	410	deep, angled, percussion
MESA	May'96	-	1	GWDD	114.2	deep, angled, diamond
MESA	May'96	-	21	BUL	948.5	shallow, vert, RC blade-bit
MESA	Aug'96	-	19	GW	1581	deep, angled, percussion
TOTAL			68		3956	

In the immediate area of the Giffen Well prospect there is no drilling by private companies. In 1991 as part of the Tallaringa-Tarcoola bedrock drilling programme 21 holes were drilled near to the Giffen Well prospect. A further 47 holes have been drilled as part of the exploration programme for an iron ore resource. Of a total of 68 holes, 26 holes have been “deep” angled holes, totalling 2105.2 metres, which have intersected 1271 metres of BIF, of which 572 metres was unoxidized (magnetite) BIF.

SAMPLING

GW-DD1 was geologically logged, then the core dispatched to the MESA core library, Glenside, where the core was split and selected intervals of ¼ core sent for analysis. Selected intervals were sent for petrological examination and/or had specific gravity measurements taken. The magnetic susceptibility was measured every 50 cms. Selected intervals were sent for comminution and beneficiation testwork. The core is held in storage at the core library, Glenside.

Drill cuttings from BUL holes and GW holes were collected continuously during drilling and laid out in piles, each pile representing a 2 m drilled interval. A representative sample was then collected from each pile, bulked with other 2 m samples and then bagged. Bagged samples (for analysis) were collected at 4, 6, 8 or 10 metre intervals according to the directions of the supervising geologist. Samples for analysis were dispatched to Adelaide, thence to Analabs Pty Ltd for analysis for whole rock and/or a suite of trace elements.

From each 2 metre sample pile a small representative sample was collected in a plastic jar. A magnetic susceptibility reading was taken from this jar (using an Exploranium KT-5, measurements in SI units x10^{-3}) and the jars were sent for storage to the MESA core library, Glenside.

PETROLOGY

Appendix 4 includes 43 petrological descriptions of various lithologies from the Giffen Well area, including 21 petrological descriptions from GW-DD1. In summary, the magnetite BIF described from GW-DD1 is typically meso-microlayered, with layers consisting of subequal amounts of fine magnetite, cherty quartz and lesser amphibole. Individual layers are invariably magnetite or cherty quartz dominant, with the amphibole tending to be associated with the cherty quartz layers. The layers are generally microfaulted, sometimes brecciated. Late stage veins and veinlets of amphibole are common. Minor later carbonate occurs as veinlets. Magnetite grain size estimates vary from <.05 mm to .15 mm, with the magnetite occurring in a granular form.

The presence of minor pyroxene as coarse relict cores within massive decussate, much finer amphibole appears to retrogressively and pervasively replace the pyroxene, suggesting a mid to upper amphibolite metamorphic facies, followed by a lower grade retrogression. Petrological examination of the associated metasediments seems to confirm this conclusion.

GEOCHEMISTRY

MESA has sent some 497 samples of drill cuttings and core for analysis for whole rock and/or selected trace elements. Assay results appear in appendix 1. Analyses were carried out by Analabs Pty Ltd. Whole rock analysis method was Glass Fusion XRF for SiO_2, TiO_2, Al_2O_3, Fe_2O_3 (total), MnO, CaO, K_2O, MgO, P_2O_5, Na_2O, plus gravimetric LOI (precision ±2% or better), with Au, Pt and Pd analysis by fire assay fusion carbon rod (detection limit .001 ppm). Trace element analysis method was a mixed acid digest (aqua regia, perchloric acid, hydrofluoric acid) and AAS determination (precision generally better than ±15%) ie Cu, Pb, Zn, Ni, Cr, Co, Fe, Mn, S and Mo. Analysis for U, Th, Sn and W was by pressed powder XRF.

RESOURCE CALCULATION

These initial resource calculations refer to the "main" magnetic strike ridge. The most well defined cross-section (from drillholes) occurs at 6647000N. Drillholes GW1, 7, 8 and 9 and GW-DD1 define a stratigraphic thickness of magnetite BIF of about 250 metres. Other traverses drilled along strike on this strike ridge, because the east-west hole spacings were much wider, were less successful in defining the stratigraphic thickness of magnetite BIF. A close examination of all the gravity and ground magnetic profiles across this BIF, reveal a very consistent shape, with the profiles having a similar width magnitude and slight tilt to the east, reflecting the easterly dip of the BIF. For a resource calculation a consistent 250 metres stratigraphic thickness of magnetite BIF has been adopted. This "main" ridge trends in a north-northeasterly direction, with 5 drillhole traverses across it, from 6645400N to 6647400N. In the resource calculations a strike length of 3.5 kms will be used. Surface oxidation of the BIF extends on average to 50 metres depth. Assuming that the BIF extends to 500-1000+ metres depth, resource calculations will use a 100 metre depth extent of magnetite BIF, which equates to a depth below surface of 150 metres. A specific gravity of 3.3 is used (see appendix 6). The resource of magnetite BIF at Giffen Well, in the "main" ridge, is 3500 m x 100 m x 250 m x 3.3 ≡ 290 million tonnes (approx).

The two "lesser" strike ridges, west and east of the main ridge have strike lengths of about 1 km, with magnetic profiles suggesting a similar stratigraphic thickness for the BIF. However, neither of these subareas has been drilltested, so resource estimates are very approximate only. Assuming similar stratigraphic widths SG and depth extent of magnetite BIF, the resource estimated for each of these areas, assuming a strike length of 1 km is 1000 m x 250 m x 100 m x 3.3 ≡ 50 million tonnes (approx).

Grade

A weighted average grade of magnetite BIF was calculated by weighting the grade of the intervals of magnetite BIF intersected in drillholes against the total number of metres of magnetite BIF intersected. Calculations are listed in Table 3 for those intervals for which there were whole rock analyses and for Fe assays only. These results apply to a grade for the "main" ridge only.

Now an important consideration in regards to these grade figures is that the geological logs and assay results show that there is a significant content of very talcose magnetite BIF. Though the level of drilling is too sparse to make any definite conclusions, it may be that the main magnetite BIF strike ridge at Giffen Well contains a significant proportion of amphibole rich BIF and any iron tied up in an iron-rich amphibole will not be recoverable by magnetic separation processes. Therefore it must be made clear that the Inferred Resource of 290 million tonnes must be regarded as a maximum figure (remembering of course that the magnetite BIF probably has a considerable depth extent and the figures quoted relate to an arbitrarily assigned mining depth). Note also that the SG figure of 3.3 is slightly conservative (see appendix 6).

TABLE 3
INTERSECTIONS OF MAGNETITE (UNOXIDIZED) BIF

HOLE	DEPTH (m)	WIDTH (m)	Fe	SiO_2	Al_2O_3	CaO	MgO	MnO	P_2O_5	TiO_2	K_2O	Na_2O	SO_3	LOI	Au
1	12-80	68	37.6	41.7	.13	1.09	2.17	.05	.152	<.01	.03	.11	.07	.60	1
7	24-88	64	33.3	47.4	.29	1.75	2.55	.04	.145	<.01	.05	.12	.50	.21	2
8	48-100	52	37.8	29.9	.59	5.4	5.36	.12	.103	.02	<.01	<.05	.11	4.06	<1
11	48-84	36	36.4	41.7	.22	1.41	3.02	.11	.129	.01	.01	.11	.33	.88	2
12	60-100	40	27.2	38.0	2.70	7.96	6.91	.51	.135	.10	.09	.14	.30	4.39	6
16	32-68 80-92	48	34.7	36.2	1.50	4.02	6.19	.21	.128	.05	.11	.06	.02	2.17	2
20	40-84	44	36.2	40.5	1.43	2.76	2.93	.12	.117	.07	.19	.24	.62	.55	14
21	52-68	16	33.7	40.8	1.28	4.40	3.15	.16	.076	.04	.08	.06	1.22	1.09	31
24	48-88	40	33.5	35.1	.64	3.55	9.14	.05	.130	.02	.01	<.05	.01	3.50	<1
25	44-88	44	35.9	36.6	1.61	3.53	5.75	.16	.127	.06	.11	.05	<.01	.87	2
Weighted average		452	34.9	39.0	.78	3.36	4.58	.14	.129	.03	.07	.09	.25	1.76	4
Weighted average (Fe only)			33.7												

DISCUSSION

1. Magnetite BIF at Giffen Well has been deeply weathered to a depth of about 50 metres. Surface oxidation of BIF results in magnetite variably altered to haematite, to a lesser extent limonite/goethite and amphibole altered to limonite/goethite and clay.

2. The stratigraphic succession is unknown due to lack of outcrop and the sparsity of drilling. The form of the geophysical anomalies indicates a moderate to steep easterly dip for the “main” ridge of magnetite BIF. Hole GW-14 intersected dolomite, possibly the Katunga Dolomite equivalent, which, on eastern Eyre Peninsula, underlies the Lower Jaspilite of the Middleback Iron Formation. This comparison suggests that the BIF at Giffen Well is not overturned. There do not appear to be any major interbeds of metasediments within the “main” magnetite BIF horizon.

3. The regular shape of the ground magnetic profile and the consistent high magnetic anomaly along strike suggest some stratigraphic continuity within the BIF horizon. Unfortunately drilling is too sparse to allow for any meaningful comment on the variability of grade along strike. Certainly there are very talcose intersections of magnetite BIF (GW24 and 25) and some interbeds of carbonate (low Al_2O_3, high CaO and LOI). Given that the magnetite content of the BIF is all important in determining the resource of recoverable iron, any iron tied up in iron silicates and iron carbonate (and iron sulphate) will decrease the resource of recoverable iron.

4. The resource might also be diminished by the alteration of magnetite BIF to haematitic BIF occurring marginal to cross cutting dolerite dykes of the Gairdner Dyke Swarm and/or brittle faults and/or later granite dykes and sills of the Hiltaba Granite Suite (see the 1:10 000 cross sections for the location of a granitic intrusion bordering the “main” ridge).

5. In broad terms the BIF at Giffen Well can be categorized as a Lake Superior type BIF (Gross 1995) ie characteristic iron oxide chert laminations in association with shelf-type sediments such as quartzite, black shales, dolomite. Total Fe% is comparable with Canadian Lake Superior type BIF (Gross, 1995) and with BIF from the Middleback Ranges, S Aust (Drexel et al, 1993). Lake Superior type BIF has been categorized into four subunits, an oxide facies ie layered iron oxide chert, silicate facies ie layered iron-silicate-chert, sulphide facies, ie layered pyrite-chert and carbonate facies, ie layered siderite-chert. These subdivisions are not strict definitions, but generally there is a dominant mineralogy which identifies the facies. At Giffen Well there appears to be an intimate mix of oxide-silicate facies, with subordinate sulphide and carbonate facies. It is

the level of predominance of the oxide facies which is the important factor, providing the magnetite which is the recoverable product.

6. GW-10 shows some anomalous geochemical assays which may warrant follow up investigations ie 40-48m 123 ppb Au, 10.5 ppb Pt, 23.5 ppb Pd.

FUTURE WORK

1. It would appear that drill traverses on the "main" ridge at Giffen Well need to have drillholes at a 50 metre spacing east-west. Therefore regular grid drilling needs to proceed on existing traverses and also on closer spaced traverses in order to achieve confidence in the level of the grade and resource of magnetite BIF at Giffen Well.

2. Existing drillholes should be geophysically logged.

3. A programme of diamond drilling is required to obtain core from a variety of BIF.

4. Drilltesting of the "minor" neighbouring strike ridges of BIF, including near surface BIF which outcrops about 5 kms southwest of Giffen Well.

CONCLUSIONS

The geophysics and drilling at Giffen Well has outlined a resource of some 400 million tonnes of magnetite BIF from 50 to 150 metres below surface. This figure is considered to be a maximum, because various mineralogical and geological features will have detrimental effects to the recoverable iron in any beneficiation process.

The "main" ridge at Giffen Well represents a near surface BIF horizon oxidized to a depth of about 50 metres, with a stratigraphic thickness near 250 metres, a steep to moderate easterly dip and a strike length of about 4 kms.

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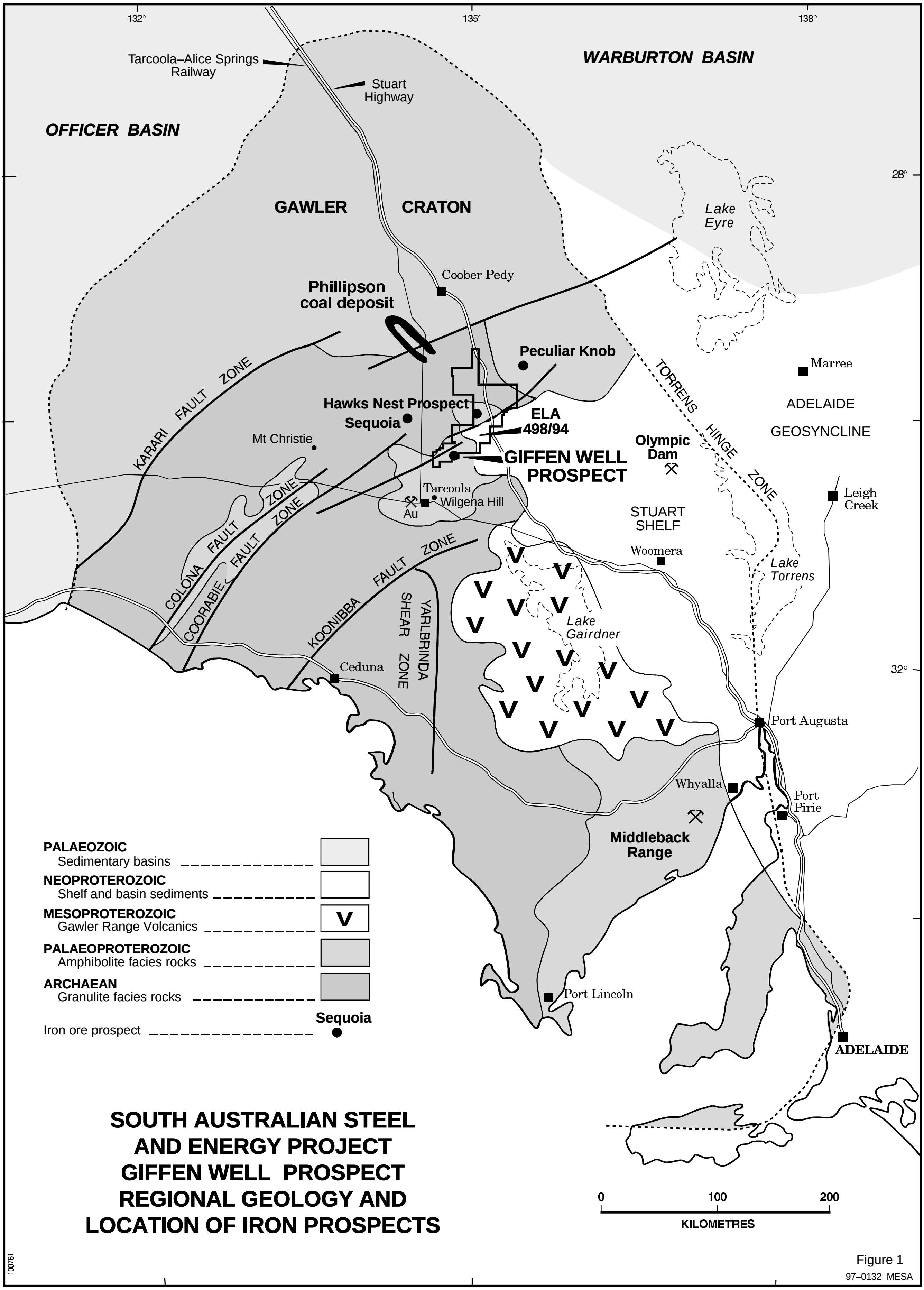


SOUTH AUSTRALIAN STEEL AND ENERGY PROJECT GIFFEN WELL PROSPECT REGIONAL GEOLOGY AND LOCATION OF IRON PROSPECTS

Figure 1

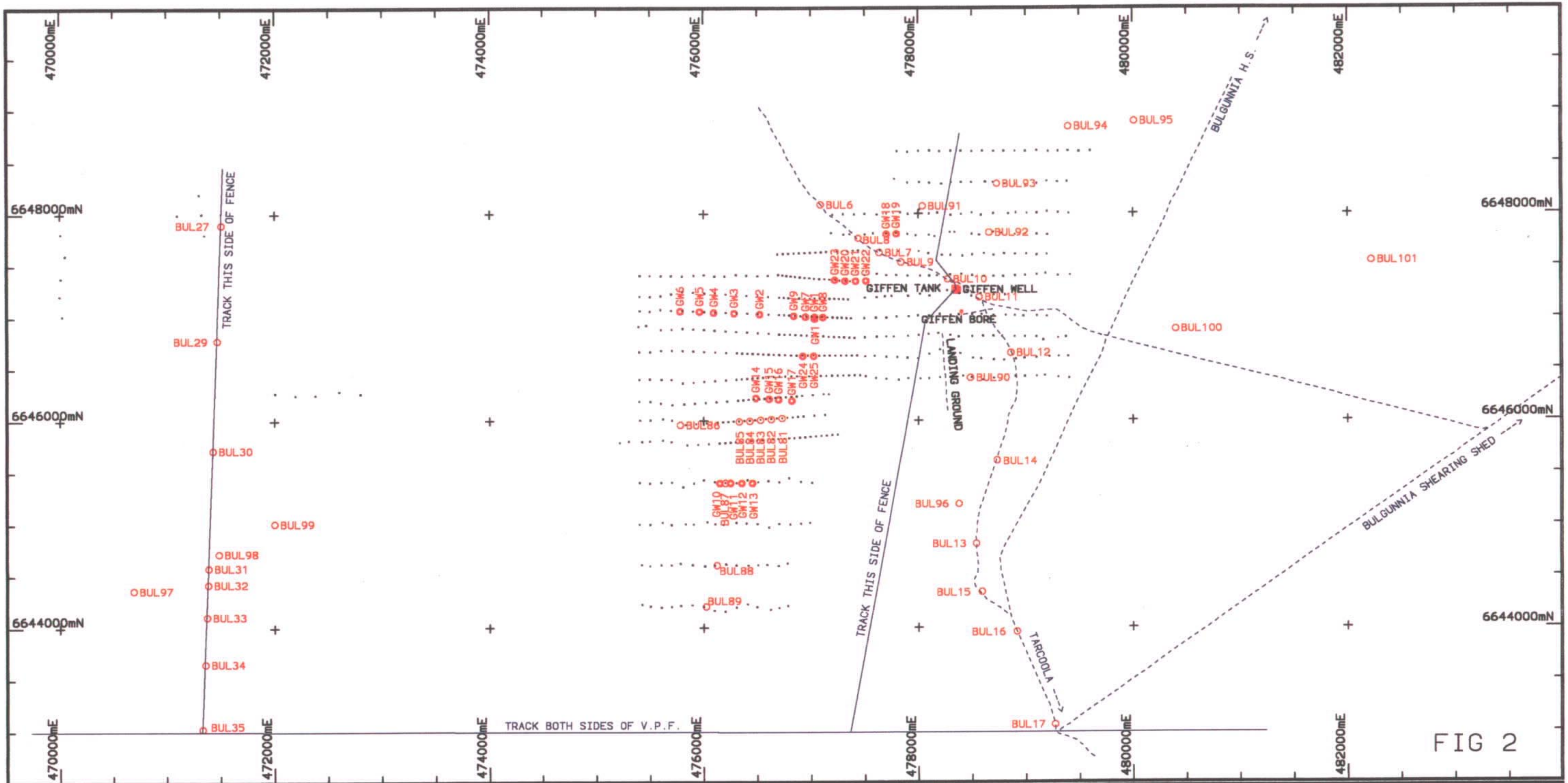
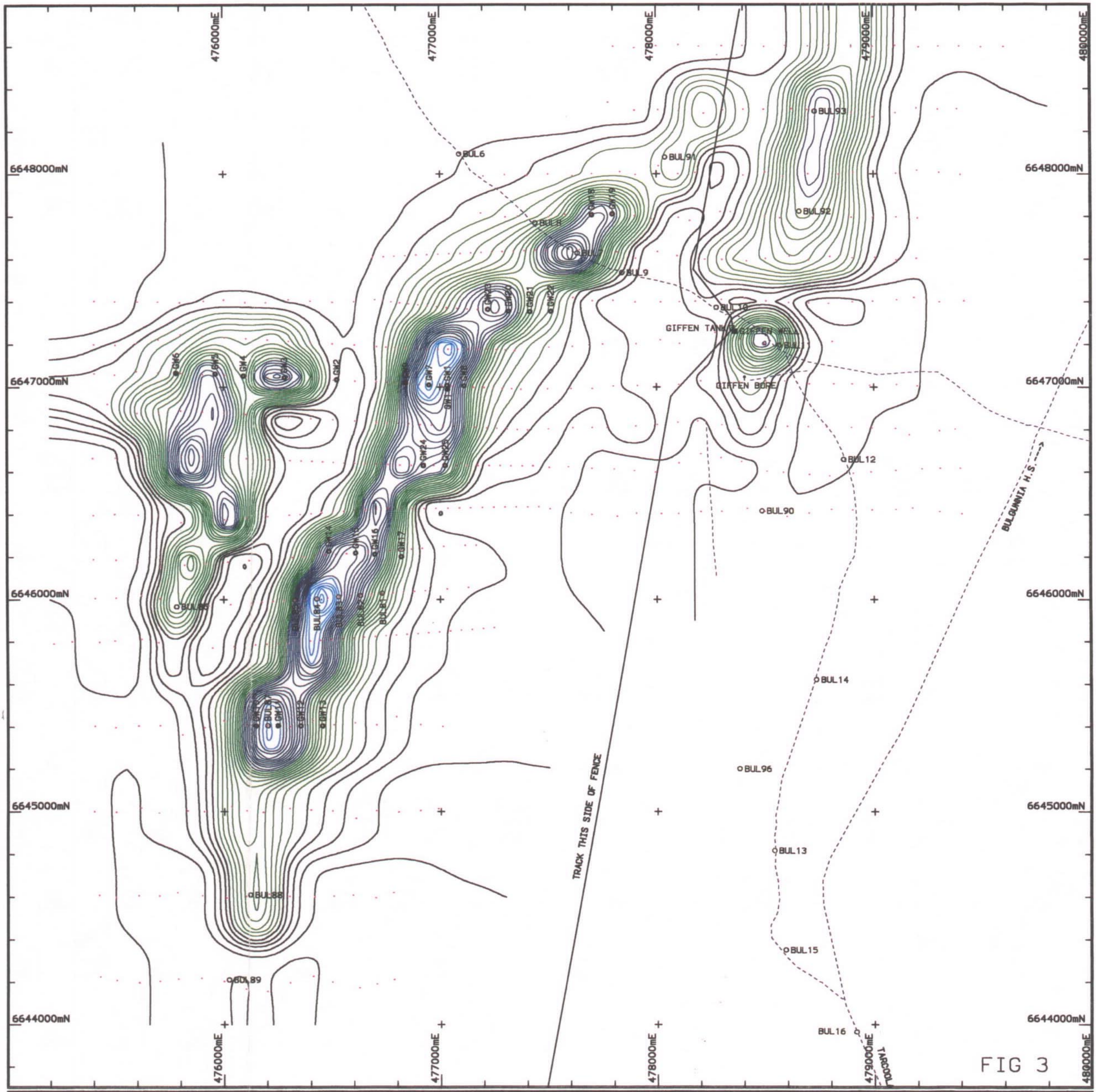


FIG 2

Scale 1:50000	DATE 20/11/96	SHEET 1 of 1	LEGEND		S.A. STEEL AND ENERGY PROJECT GIFFEN WELL PROSPECT DRILLHOLE & GROUND GEOPHYSICAL TRAVERSE LOCATIONS 1991, 1995-1996
	REF No. FIG 2	FILE DHLOC.PLT	○ RC AIRCORE DRILLHOLE RC HAMMER DRILLHOLE ● DIAMOND DRILLHOLE □ TANK	■ WELL WATER BORE WITH WINDMILL GATE · GROUND GEOPHYSICS STATION	
0 — 2500m					



Scale	DATE	SHEET	LEGEND		S.A.STEEL AND ENERGY PROJECT
1:20000	21/11/96	1 of 1	50000nT - 60000nT	WATER BORE WITH WINDMILL	GIFFEN WELL PROSPECT
	REF No. FIG 3	FILE GWELLM.PLT	60000nT - 70000nT	GROUND MAGNETIC STATION	GROUND MAGNETIC CONTOURS
0 1000m			70000nT - 80000nT	TANK	TRAVERSE AND DRILLHOLE LOCATIONS
			80000nT - 90000nT	WELL	
			90000nT - 100000nT		

Scale	DATE 21/11/96	SHEET 1 of 1	LEGEND		S.A. STEEL AND ENERGY PROJECT GIFFEN WELL PROSPECT BOUGUER GRAVITY CONTOURS TRAVERSE AND DRILLHOLE LOCATIONS
1:20000	REF No. FIG 4	FILE GWELLG.PLT	-55mG - -50mG -50mG - -45mG -45mG - -40mG -40mG - -35mG	WATER BORE WITH WINDMILL GATE GRAVITY STATION TANK WELL	
0 — 1000m					

APPENDIX 1

DRILL LOGS AND ASSAY RESULTS

GW1 TO 25

GW-DD1

BUL81A TO 101

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	GW 1	**1:100 000 Map**	5837
Traverse		**UnitNo**	353
Station		**Max Depth (m)**	81.00
Completion Date	7/11/95	**Drilling Method**	RCP
Dip at Collar	-60.00	**AMG Easting**	477034
Azimuth at Collar	270.00	**AMG Northing**	6647007
Logged By	M DAVIES	**Zone**	53
		Depth to Bsmt	2

Comments Water table at 70m. Redox boundary at 32m.

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.35		ALLUVIUM	Cy r-brn, wkly cmtd and BIF, tr Goeth.
2.00	4.00	5.87	33.4	BIF	BIF and lesser r cy as above, minor Goe.
4.00	6.00	6.01	32.5	BIF	BIF tr Goe & r cy.
6.00	8.00	4.97	32.5	BIF	BIF, minor Goe.
8.00	10.00	17.60	34.1	BIF	BIF, tr Goe.
10.00	12.00	34.70	34.1	BIF	As above.
12.00	14.00	4.64	40.1	BIF	As above.
14.00	16.00	116.00	40.1	BIF	As above.
16.00	18.00	119.00	41.9	BIF	BIF more hematitic.
18.00	20.00	21.60	41.9	BIF	As above
20.00	22.00	25.80	43.1	BIF	BIF, well laminated.
22.00	24.00	37.60	43.1	BIF	As above
24.00	26.00	45.20	39.4	BIF	As above rare pl gm to pl g "talc"
26.00	28.00	78.90	39.4	BIF	BIF as above
28.00	30.00	39.30	37.2	BIF	As above.
30.00	32.00	209.00	37.2	BIF	BIF as above, minor Mt BIF.
32.00	34.00	311.00	37.5	BIF	Mt BIF.
34.00	36.00	314.00	37.5	BIF	As above
36.00	38.00	300.00	34.2	BIF	As above
38.00	40.00	361.00	34.2	BIF	As above
40.00	42.00	237.00	35.9	BIF	As above
42.00	44.00	385.00	35.9	BIF	Mt BIF rare Calcite & Pyrite
44.00	46.00	403.00	38.6	BIF	As above
46.00	48.00	341.00	38.6	BIF	Mt BIF.
48.00	50.00	363.00	34.9	BIF	As above.
50.00	52.00	288.00	34.9	BIF	As above.
52.00	54.00	271.00	32.5	BIF	As above.
54.00	56.00	325.00	32.5	BIF	As above.
56.00	58.00	241.00	32.9	BIF	As above.
58.00	60.00	263.00	32.9	BIF	As above.
60.00	62.00	302.00	36.5	BIF	As above.
62.00	64.00	345.00	36.5	BIF	As above.
64.00	66.00	228.00	37.6	BIF	Mt BIF, more friable, more amphiboles.
66.00	68.00	125.00	37.6	BIF	As above
68.00	70.00	109.00	37.9	BIF	As above - water table.
70.00	72.00	224.00	37.9	BIF	Mt BIF as above
72.00	74.00	253.00	40.4	BIF	As above
74.00	76.00	267.00	40.4	BIF	As above

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
76.00	78.00	350.00	38.9	BIF	Mt BIF less amphiboles
78.00	80.00	326.00	38.9	BIF	As above
80.00	81.00	286.00	39.9	BIF	Mt BIF.

30-81. 286

MAX 40%.

GIFFEN WELL GW 1

Sample No	Interval	Fe %	FE2O3 %	SiO2 %	AL203 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb	Pt ppb	Pd ppb
142708	2-4	33.38	47.69	41.31	4.24	0.05	0.07	0.34	0.09	5.77	0.28	0.01	0.09	0.05	-1.00	-0.50	-0.50
142709	4-8	32.49	46.42	47.83	2.18	0.03	-0.05	0.06	0.09	3.54	0.05	0.01	0.04	0.04	1.00	-0.50	-0.50
142710	8-12	34.10	48.71	48.31	0.31	-0.01	-0.05	0.08	0.05	2.15	0.14	0.02	0.01	0.04	-1.00	-0.50	-0.50
162156	12-16	40.12	57.31	39.44	0.37	-0.01	-0.05	0.02	0.04	2.89	0.03	0.02	0.01	0.04	-1.00	-0.50	-0.50
142712	16-20	41.91	59.87	38.30	0.26	-0.01	-0.05	0.02	0.05	1.47	0.04	0.03	-0.01	0.02	-1.00	-0.50	-0.50
142713	20-24	43.06	61.52	36.96	0.10	-0.01	-0.05	0.17	0.19	1.00	0.08	0.05	-0.01	-0.01	-1.00	-0.50	-0.50
142714	24-28	39.40	56.29	39.88	-0.05	0.01	-0.05	1.15	0.90	1.37	0.12	0.06	-0.01	-0.01	-1.00	-0.50	-0.50
142715	28-32	37.18	53.12	42.66	0.06	0.02	0.11	0.72	1.76	0.60	0.09	0.03	-0.01	-0.01	-1.00	-0.50	-0.50
142716	32-36	37.51	53.58	43.42	-0.05	0.02	0.06	1.16	2.10	-0.01	0.11	0.05	-0.01	-0.01	-1.00	-0.50	-0.50
162157	36-40	34.17	48.81	48.65	0.05	0.01	0.05	1.07	1.53	-0.01	0.15	0.03	-0.01	0.04	-1.00	-0.50	-0.50
142717	40-44	35.90	51.29	44.86	0.27	0.13	0.27	1.18	2.11	-0.01	0.10	0.07	0.01	0.59	17.00	-0.50	-0.50
142718	44-48	38.63	55.18	41.10	0.05	0.02	0.12	1.18	2.11	-0.01	0.09	0.09	-0.01	0.03	1.00	-0.50	-0.50
142719	48-52	34.88	49.83	44.00	0.13	0.02	0.05	2.08	3.41	-0.01	0.07	0.10	-0.01	-0.01	-1.00	-0.50	-0.50
142720	52-56	32.45	46.36	46.58	0.10	0.06	0.28	2.23	3.55	-0.01	0.07	0.08	-0.01	0.06	-1.00	-0.50	-0.50
142721	56-60	32.91	47.01	45.57	0.11	0.05	0.24	1.80	4.27	0.25	0.07	0.06	-0.01	0.05	3.00	-0.50	-0.50
142722	60-64	36.46	52.08	43.43	-0.05	0.02	-0.05	0.97	2.80	-0.01	0.15	0.04	-0.01	0.03	-1.00	-0.50	-0.50
142723	64-68	37.62	53.74	41.92	0.09	0.04	0.14	0.73	2.29	0.44	0.13	0.04	-0.01	0.02	-1.00	-0.50	-0.50
142724	68-72	37.86	54.09	35.90	0.41	0.04	0.15	2.27	3.78	1.69	0.93	0.05	-0.01	0.02	-1.00	-0.50	-0.50
142725	72-76	40.35	57.65	36.46	0.09	0.04	0.10	1.13	3.14	0.42	0.13	0.05	-0.01	0.09	-1.00	-0.50	-0.50
142726	76-80	38.93	55.62	40.29	0.05	0.07	0.26	0.72	2.91	-0.01	0.16	0.05	-0.01	0.16	-1.00	-0.50	-0.50
142727	80-81	39.87	56.96	39.25	0.07	0.06	0.12	0.70	2.24	-0.01	0.13	0.05	-0.01	0.01	-1.00	-0.50	-0.50

GIFFEN WELL GW 1

Sample No	Interval	Fe %	Cu ppm	Pb ppm	Zn ppm	Ni ppm	Cr ppm	Co ppm	Mn ppm	S ppm	Mo ppm
162157	36-40	32.60	-5	20	22	-10	96	-10	327	3028	-10
142725	72-76	37.70	-5	-10	15	-10	45	-10	464	744	-10

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name GW 2
Traverse
Station
Completion Date 8/11/95
Dip at Collar -60.00
Azimuth at Collar 270.00
Logged By M DAVIES

1:100 000 Map 5837
UnitNo 354
Max Depth (m) 70.00
Drilling Method RCP
AMG Easting 476523
AMG Northing 6647035
Zone 53
Depth to Bsmt 2

Comments

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.27		SOIL	Sand, fine, clayey r Minor BIF trace.
2.00	4.00	4.49		PORPHYRY	Ironstone - fine, sandy with limonitic cement.
4.00	6.00	0.22		PORPHYRY	Cy. pl brn y to w. Dply wthd. Basement?
6.00	8.00	0.54		PORPHYRY	As above
8.00	10.00	0.21		PORPHYRY	As above
10.00	12.00	6.15		PORPHYRY	As above
12.00	14.00	0.32		PORPHYRY	As above
14.00	16.00	0.29		PORPHYRY	As above
16.00	18.00	0.37		PORPHYRY	As above
18.00	20.00	0.33		PORPHYRY	As above
20.00	22.00	0.24		PORPHYRY	As above
22.00	24.00	0.41		PORPHYRY	As above
24.00	26.00	0.33		PORPHYRY	As above
26.00	28.00	0.41		PORPHYRY	Cy as above, trace v coarse pink felds.
28.00	30.00	0.38		PORPHYRY	Porphyry. V coarse pink x-talline Felds in m to dk g matrix.
30.00	32.00	0.69	3.7	PORPHYRY	As above
32.00	34.00	0.51	3.7	PORPHYRY	As above
34.00	36.00	0.44	3.7	PORPHYRY	As above
36.00	38.00	0.39	3.7	PORPHYRY	As above
38.00	40.00	0.55	3.7	PORPHYRY	As above
40.00	42.00	0.55	3.9	PORPHYRY	As above
42.00	44.00	0.60	3.9	PORPHYRY	As above
44.00	46.00	0.25	3.9	PORPHYRY	As above
46.00	48.00	0.32	3.9	PORPHYRY	As above
48.00	50.00	0.50	3.9	PORPHYRY	As above
50.00	52.00	0.82	3.7	PORPHYRY	As above
52.00	54.00	0.79	3.7	PORPHYRY	Porphyry as above "fresher" v coarse pink felds, x-talline.
54.00	56.00	2.59	3.7	PORPHYRY	As above
56.00	58.00	4.34	3.7	PORPHYRY	As above
58.00	60.00	1.07	3.7	PORPHYRY	As above
60.00	62.00	0.77	3.9	PORPHYRY	As above
62.00	64.00	0.74	3.9	PORPHYRY	As above
64.00	66.00	0.88	3.9	PORPHYRY	As above
66.00	68.00	0.62	3.9	PORPHYRY	As above
68.00	70.00	0.77	3.9	PORPHYRY	As above

GIFFEN WELL GW 2

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Ni ppm	Cr ppm	Co ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	Sn ppm	W ppm	Pt ppb	Pd ppb
142728	30-40	3.69	-1	12	36	78	13	16	-10	1131	-50	-10	4	25	3	-10	-0.50	-0.50
142729	40-50	3.85	3	9	22	86	-10	-10	-10	1186	-50	-10	4	22	5	-10	0.50	1.30
142730	50-60	3.66	-1	12	23	73	-10	-10	-10	781	59	-10	7	29	4	-10	-0.50	-0.50
142731	60-70	3.89	-1	6	29	104	-10	-10	-10	885	109	-10	-3	20	6	-10	-0.50	-0.50

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	GW 3	**1:100 000 Map**	5837
Traverse		**UnitNo**	355
Station		**Max Depth (m)**	77.00
Completion Date	9/11/95	**Drilling Method**	RCP
Dip at Collar	-60.00	**AMG Easting**	476285
Azimuth at Collar	270.00	**AMG Northing**	6647044
Logged By	M DAVIES	**Zone**	53
		Depth to Bsmt	2

Comments Redox boundary at 40m.

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.46	29.4	SOIL	Scree of Hem, Hem BIF, pl brn cy.
2.00	4.00	2.53	29.4	BIF	BIF minor pl brn cy.
4.00	6.00	2.58	43.5	BIF	BIF v hematitic.
6.00	8.00	5.67	43.5	BIF	Hem BIF minor to tr Goethite.
8.00	10.00	3.99	44.9	BIF	As above.
10.00	12.00	12.80	44.9	BIF	As above.
12.00	14.00	2.29	42.6	BIF	As above and rare cy.
14.00	16.00	4.24	42.6	BIF	Hem BIF as above minor G, Hem. Goeth tr cy.
16.00	18.00	2.72	41.9	BIF	Hem BIF, minor G, Hem, Goeth tr cy.
18.00	20.00	2.96	41.9	BIF	Hem BIF tr Goeth.
20.00	22.00	3.30	41.8	BIF	As above
22.00	24.00	2.79	41.8	BIF	Hem BIF, lesser Hem tr CHT.
24.00	26.00	4.25	38.5	BIF	BIF
26.00	28.00	3.63	38.5	BIF	As above
28.00	30.00	3.01	35.7	BIF	As above
30.00	32.00	7.30	35.7	BIF	As above
32.00	34.00	27.30	42.3	BIF	BIF tr Goeth.
34.00	36.00	34.50	42.3	BIF	BIF tr y cy & Goeth.
36.00	38.00	5.92	39.1	BIF	As above.
38.00	40.00	20.70	39.1	BIF	BIF as above med g.
40.00	42.00	2.51	39.6	BIF	Mt BIF, med-dk g, Mt-Cht vaguely laminated tr amph, rare Py.
42.00	44.00	335.00	39.6	BIF	As above
44.00	46.00	359.00	41.2	BIF	As above
46.00	48.00	378.00	41.2	BIF	As above
48.00	50.00	261.00	37.9	BIF	As above
50.00	52.00	303.00	37.9	BIF	As above
52.00	54.00	315.00	38.7	BIF	As above
54.00	56.00	327.00	38.7	BIF	As above
56.00	58.00	309.00	38.6	BIF	As above
58.00	60.00	377.00	38.6	BIF	As above
60.00	62.00	310.00	38.0	BIF	As above
62.00	64.00	235.00	38.0	BIF	As above
64.00	66.00	20.90	10.7	BIF	Mt BIF as above and Dolerite dk grn, fine to v fine grained.
66.00	68.00	11.00	10.7	DOLERITE	Dt as above
68.00	70.00	8.41	7.4	DOLERITE	As above
70.00	72.00	7.21	7.4	DOLERITE	As above
72.00	74.00	135.00	23.6	DOLERITE	As above
74.00	76.00	308.00	23.6	BIF	Dt as above and Mt BIF as above

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
76.00	77.00	405.00	40.9	BIF	Mt BIF as above.

42-77 3

GIFFEN WELL GW 3

Sample No	Interval	Fe %	FE2O3 %	SiO2 %	AL2O3 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb	Pt ppb	Pd ppb
142732	0-4	29.25	41.78	35.39	5.93	0.42	0.24	3.91	0.91	10.08	0.04	0.02	0.22	0.22	2.00	0.60	0.60
142733	4-8	43.46	62.09	32.42	1.48	0.03	0.05	0.12	0.08	3.12	0.04	0.03	0.03	0.06	-1.00	-0.50	-0.50
142734	8-12	44.94	64.20	31.32	0.72	0.01	-0.05	0.05	0.05	2.94	0.03	0.02	-0.01	0.04	-1.00	-0.50	-0.50
142735	12-16	42.55	60.79	35.42	0.66	-0.01	-0.05	0.03	0.06	2.54	0.08	0.03	-0.01	0.04	-1.00	-0.50	-0.50
142736	16-20	41.85	59.79	36.54	0.92	0.02	0.22	0.04	0.11	2.00	0.02	0.03	0.01	0.05	-1.00	0.60	-0.50
142737	20-24	41.78	59.68	36.67	0.86	-0.01	-0.05	0.03	0.07	1.78	0.01	0.03	0.01	0.04	-1.00	-0.50	-0.50
142738	24-28	38.52	55.03	42.54	0.37	-0.01	-0.05	0.02	0.05	1.50	0.03	0.02	-0.01	0.03	-1.00	-0.50	-0.50
142739	28-32	35.68	50.97	45.44	0.86	-0.01	-0.05	0.02	0.05	1.57	0.03	0.02	-0.01	0.02	-1.00	-0.50	-0.50
142740	32-36	42.28	60.40	36.55	0.58	0.02	-0.05	0.03	0.07	2.07	0.09	0.06	-0.01	0.06	-1.00	-0.50	-0.50
142741	36-40	39.14	55.91	39.24	0.39	0.01	-0.05	0.81	0.87	1.87	0.07	0.08	-0.01	0.05	2.00	0.60	-0.50
142742	40-44	39.64	56.63	35.59	0.47	0.02	-0.05	2.81	3.06	0.70	0.12	0.17	0.01	0.97	3.00	-0.50	-0.50
142743	44-48	41.21	58.87	37.15	0.09	0.01	-0.05	1.79	2.16	-0.01	0.13	0.11	-0.01	0.60	1.00	-0.50	-0.50
142744	48-52	37.69	53.84	38.11	0.15	-0.01	-0.05	2.37	4.14	0.39	0.17	0.15	-0.01	0.55	2.00	-0.50	-0.50
142745	52-56	38.74	55.35	39.88	0.21	-0.01	-0.05	1.71	3.10	0.08	0.13	0.10	-0.01	1.27	9.00	-0.50	-0.50
142746	56-60	38.57	55.10	39.57	0.09	-0.01	-0.05	2.27	2.31	-0.01	0.15	0.09	-0.01	0.27	4.00	-0.50	-0.50
142747	60-64	38.04	54.34	35.80	0.10	-0.01	-0.05	4.26	3.26	1.28	0.14	0.17	-0.01	0.05	-1.00	-0.50	-0.50
142748	64-68	10.66	15.23	45.59	10.42	0.19	0.20	2.11	15.54	8.99	0.47	0.47	0.78	0.39	1.00	1.00	0.50
142749	68-72	7.43	10.61	62.12	7.12	0.24	0.26	2.22	9.88	5.74	0.35	0.17	0.47	0.95	12.00	1.30	-0.50
142750	72-76	23.35	33.36	54.29	3.52	0.54	0.05	1.05	4.50	1.41	0.22	0.10	0.22	0.17	-1.00	0.60	-0.50
142751	76-77	40.87	58.38	38.45	0.12	-0.01	-0.05	1.35	1.55	-0.01	0.09	0.07	-0.01	0.08	-1.00	-0.50	-0.50

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Ni ppm	Cr ppm	Co ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	Sn ppm	W ppm	Pt ppb	Pd ppb
142748	64-68	10.90	1	-5	11	151	31	136	-10	3791	2593	-10	5	13	-3	-10	1.00	0.50
142749	68-72	8.29	12	-5	13	112	33	159	-10	1562	5769	-10	3	7	7	-10	1.30	-0.50
142750	72-76	24.30	-1	-5	14	59	19	114	-10	919	917	-10	-3	6	-3	-10	0.60	-0.50

GIFFEN WELL GW 3

Sample No	Interval	Fe %	Cu ppm	Pb ppm	Zn ppm	Ni ppm	Cr ppm	Co ppm	Mn ppm	S ppm	Mo ppm
142742	40-44	35.90	-5	-10	27	-10	55	-10	1317	5083	-10
142743	44-48	38.50	-5	-10	16	-10	35	-10	908	3129	-10
142744	48-52	35.60	-5	20	37	-10	61	-10	1251	3365	-10
142745	52-56	36.30	-5	165	24	-10	52	-10	866	7173	-10
142746	56-60	35.90	-5	10	13	-10	57	-10	775	1306	-10
142747	60-64	34.50	-5	13	34	-10	33	-10	1318	285	-10
142751	76-77	39.40	-5	-10	71	-10	125	-10	638	501	11

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	GW 4	**1:100 000 Map**	5837
Traverse		**UnitNo**	356
Station		**Max Depth (m)**	48.00
Completion Date	10/11/95	**Drilling Method**	RCP
Dip at Collar	-60.00	**AMG Easting**	476094
Azimuth at Collar	270.00	**AMG Northing**	6647052
Logged By	M DAVIES	**Zone**	53
		Depth to Bsmt	4

Comments

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	13.30		SOIL	Soil with Scree of gravel and pebbles of Hem,Hem BIF, minor clay.
2.00	4.00	12.20		SOIL	As above
4.00	6.00	10.60		GRANITE	Cy pl y-brn, minor qtz (deeply wthd acid intrusive)
6.00	8.00	2.93		GRANITE	As above
8.00	10.00	0.54		GRANITE	As above
10.00	12.00	0.43		GRANITE	As above
12.00	14.00	1.59		GRANITE	As above
14.00	16.00	3.00		GRANITE	Cy, pl grn, minor qtz, minor fresh Granite, med gr.
16.00	18.00	2.33		GRANITE	Cy pl grn, minor qtz, minor Qtz-Felds-Amph. Granite as above.
18.00	20.00	1.79		GRANITE	As above
20.00	22.00	0.77		GRANITE	Cy and granite as above but v deeply wthd, med to coarse g.
22.00	24.00	1.95		GRANITE	As above
24.00	26.00	2.16		GRANITE	As above
26.00	28.00	1.82		GRANITE	As above
28.00	30.00	2.68		GRANITE	As above
30.00	32.00	3.20		GRANITE	As above
32.00	34.00	2.24		GRANITE	As above
34.00	36.00	2.13		GRANITE	As above
36.00	38.00	2.21		GRANITE	As above
38.00	40.00	1.65		GRANITE	As above
40.00	42.00	1.57		GRANITE	Granite, Qtz, felds, hblend med to coarse grained. 'fresh'
42.00	44.00	10.50	5.9	GRANITE	As above
44.00	46.00	12.50	5.9	GRANITE	As above
46.00	48.00	11.20	5.9	GRANITE	As above

GIFFEN WELL GW 4

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Ni ppm	Cr ppm	Co ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	Sn ppm	W ppm	Pt ppb	Pd ppb
142752	42-48	5.94	-1	52	31	91	48	201	21	1072	114	-10	3	10	5	-10	3.80	3.70

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name GW 5
Traverse
Station
Completion Date 11/11/95
Dip at Collar -60.00
Azimuth at Collar 270.00
Logged By M DAVIES

1:100 000 Map 5837
UnitNo 357
Max Depth (m) 70.00
Drilling Method RCP
AMG Easting 475964
AMG Northing 6647062
Zone 53
Depth to Bsmt 5

Comments Redox boundary at 40m.

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	5.20		SAND	Sand, fine,clayey r-brn tr Hem - BIF scree
2.00	4.00	7.81		SOIL	Scree, Hem-BIF with minor pl r-brn cy.
4.00	6.00	1.27		SOIL	As above
6.00	8.00	0.51		CHERT	Chert, well laminated pl g. ('bleached ' BIF)
8.00	10.00	8.10		CHERT	As above
10.00	12.00	0.65		CHERT	As above
12.00	14.00	0.72		CHERT	As above
14.00	16.00	1.78		CHERT	As above
16.00	18.00	3.20	36.4	BIF	BIF, Goethitic lesser Goe. tr GH.
18.00	20.00	0.78	36.4	BIF	G BIF. Goeth, minor cy y.
20.00	22.00	2.12	38.0	BIF	G BIF, minor Goe.
22.00	24.00	13.80	38.0	BIF	G BIF, minor cy, w.
24.00	26.00	1.78	35.1	BIF	G BIF, tr cy. w.
26.00	28.00	38.30	35.1	BIF	As above
28.00	30.00	41.50	36.0	BIF	As above
30.00	32.00	15.30	36.0	BIF	BIF, well laminated.
32.00	34.00	18.30	33.2	BIF	As above
34.00	36.00	15.10	33.2	BIF	As above
36.00	38.00	29.60	31.8	BIF	As above
38.00	40.00	69.70	31.8	BIF	BIF, med g, wkly Mt.
40.00	42.00	227.00	35.5	BIF	Mt BIF.
42.00	44.00	287.00	35.5	BIF	As above
44.00	46.00	215.00	32.6	BIF	As above
46.00	48.00	96.80	17.9	DOLERITE	Dolerite, v dk grn fine grained lesser Mt BIF.
48.00	50.00	39.20	17.9	DOLERITE	Dolerite as above and minor Mt BIF.
50.00	52.00	252.00	32.8	BIF	Mt BIF as above
52.00	54.00	242.00	32.5	BIF	As above
54.00	56.00	265.00	32.5	BIF	As above
56.00	58.00	221.00	32.5	BIF	As above
58.00	60.00	236.00	32.5	BIF	As above
60.00	62.00	124.00	26.9	BIF	As above
62.00	64.00	250.00	26.9	BIF	As above
64.00	66.00	266.00	26.9	BIF	As above
66.00	68.00	279.00	33.3	BIF	As above
68.00	70.00	300.00	30.4	BIF	As above

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40-70 243

GIFFEN WELL GW 5

Sample No	Interval	Fe %	FE2O3 %	SiO2 %	AL203 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb	Pt ppb	Pd ppb
142753	16-20	36.41	52.01	37.22	2.63	0.02	0.08	0.15	0.28	6.59	0.10	0.05	0.10	0.06	-1.00	-0.50	-0.50
142754	20-24	37.95	54.22	42.19	0.85	-0.01	-0.05	0.04	0.37	2.98	0.13	0.05	0.03	0.02	-1.00	-0.50	-0.50
142755	24-28	35.06	50.08	39.28	3.19	0.01	-0.05	0.08	0.27	5.81	0.14	0.06	0.11	0.02	1.00	-0.50	-0.50
142756	28-32	36.03	51.47	45.12	0.29	-0.01	-0.05	0.32	0.55	1.99	0.14	0.07	0.01	-0.01	-1.00	-0.50	-0.50
142757	32-36	33.16	47.37	47.80	0.22	-0.01	-0.05	0.88	1.62	1.46	0.12	0.05	-0.01	-0.01	-1.00	-0.50	-0.50
142758	36-40	31.81	45.44	50.96	0.14	-0.01	-0.05	0.94	1.80	1.07	0.11	0.04	-0.01	-0.01	-1.00	-0.50	-0.50
142759	40-44	35.46	50.66	45.86	0.09	-0.01	-0.05	1.07	1.82	-0.01	0.13	0.05	-0.01	-0.01	-1.00	-0.50	-0.50
142760	44-46	32.61	46.58	49.76	0.09	-0.01	-0.05	1.27	1.89	-0.01	0.14	0.05	-0.01	-0.01	-1.00	-0.50	-0.50
142761	46-50	17.91	25.58	52.05	7.13	2.67	0.77	3.20	5.37	1.33	0.37	0.12	0.41	0.31	-1.00	-0.50	-0.50
142762	50-52	32.83	46.90	47.28	0.19	0.02	-0.05	2.02	2.73	-0.01	0.15	0.06	-0.01	0.47	-1.00	0.90	-0.50
142763	52-56	32.54	46.49	46.98	0.29	0.02	-0.05	2.40	3.54	0.35	0.13	0.07	-0.01	0.26	-1.00	-0.50	-0.50
142764	56-60	32.47	46.39	46.79	0.20	-0.01	-0.05	2.81	3.20	-0.01	0.13	0.08	-0.01	0.32	1.00	-0.50	-0.50
142765	60-64	26.89	38.41	53.26	0.93	0.02	0.07	2.64	3.72	0.22	0.13	0.09	0.02	0.08	1.00	-0.50	-0.50
142766	64-68	33.25	47.50	45.87	0.24	-0.01	0.07	3.43	3.48	-0.01	0.13	0.08	-0.01	0.05	-1.00	-0.50	-0.50
142767	68-70	30.40	43.43	49.66	0.11	-0.01	-0.05	2.90	3.16	-0.01	0.17	0.08	-0.01	0.04	-1.00	-0.50	-0.50

GIFFEN WELL GW 5

Sample No	Interval	Fe %	Cu ppm	Pb ppm	Zn ppm	Ni ppm	Cr ppm	Co ppm	Mn ppm	S ppm	Mo ppm
142762	50-52	31.90	-5	21	36	-10	88	-10	508	2287	-10
142763	52-56	31.60	-5	21	50	-10	120	-10	612	1754	-10
142764	56-60	31.40	-5	18	37	-10	128	-10	644	1762	-10
142765	60-64	26.00	-5	-10	33	-10	147	-10	736	559	-10
142766	64-68	31.30	-5	12	24	-10	91	-10	705	314	-10
142767	68-70	30.40	-5	17	27	-10	68	-10	665	247	-10

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	GW 6	**1:100 000 Map**	5837
Traverse		**UnitNo**	358
Station		**Max Depth (m)**	64.00
Completion Date	11/11/95	**Drilling Method**	RCP
Dip at Collar	-60.00	**AMG Easting**	475783
Azimuth at Collar	270.00	**AMG Northing**	6647066
Logged By	M DAVIES	**Zone**	53
		Depth to Bsmt	2

Comments

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	5.11	25.9	SOIL	Scree of BIF, Goethite, minor cy w.
2.00	4.00	4.53	25.9	BIF	BIF v goethitic, minor Goethite, tr Cy.
4.00	6.00	137.00	49.1	BIF	G BIF lesser Goethite Hematite.
6.00	8.00	70.10	49.1	BIF	G BIF lesser Goeth tr Hem.
8.00	10.00	2.76	40.2	BIF	G BIF lesser Goeth tr cy.
10.00	12.00	4.64	40.2	BIF	G BIF lesser Goeth tr cy.
12.00	14.00	83.80	43.1	BIF	G BIF lesser Goeth tr cy & Hem.
14.00	16.00	56.10	43.1	BIF	G BIF lesser Goeth.
16.00	18.00	119.00	43.3	BIF	As above
18.00	20.00	48.70	43.3	BIF	As above
20.00	22.00	0.88	19.4	METASEDIMENT	Cy pl y-brn v limonitic/goethitic. (Dply wthd 'basement')
22.00	24.00	0.97	19.4	METASEDIMENT	As above
24.00	26.00	0.55	19.4	METASEDIMENT	Cy as above and dk g Pelite.
26.00	28.00	0.23	19.4	METASEDIMENT	Cy pl y brn v limonitic.
28.00	30.00	2.24	19.4	METASEDIMENT	As above.
30.00	32.00	0.17	6.3	METASEDIMENT	As above
32.00	34.00	0.37	6.3	METASEDIMENT	Cy as above minor brn. Pelite.
34.00	36.00	0.44	6.3	METASEDIMENT	As above.
36.00	38.00	0.80	6.3	GRANITE	Granite, v coarse wthd.
38.00	40.00	1.23	6.3	GRANITE	As above.
40.00	42.00	0.44	10.9	METASEDIMENT	Dply wthd to y-brn cy, Pelite, minor 'fresher' dk brn Pelite.
42.00	44.00	0.40	10.9	METASEDIMENT	As above
44.00	46.00	0.45	10.9	METASEDIMENT	As above
46.00	48.00	0.43	10.9	METASEDIMENT	As above
48.00	50.00	0.71	2.8	GRANITE	Granite as above.
50.00	52.00	1.11	2.8	GRANITE	Granite as above tr Dply wthd Pelite.
52.00	54.00	0.38	7.2	METASEDIMENT	Pelite dk brn.
54.00	56.00	0.75	7.2	METASEDIMENT	Pelite dk brn.
56.00	58.00	0.57	7.2	SCHIST	Schist, dk g hornblende?
58.00	60.00	0.23	5.9	SCHIST	As above
60.00	62.00	0.32	5.9	SCHIST	As above
62.00	64.00	0.30	5.9	SCHIST	As above

GIFFEN WELL GW 6

Sample No	Interval	Fe %	FE2O3 %	SiO2 %	AL2O3 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb	Pt ppb	Pd ppb
142768	0-4	25.88	36.97	40.77	5.61	0.29	0.17	4.02	0.77	10.50	0.08	0.05	0.18	0.11	2.00	1.10	0.60
142769	4-8	49.12	70.17	16.26	4.00	0.08	0.12	0.23	0.77	7.19	0.05	0.24	0.14	0.06	8.00	1.40	1.50
142770	8-12	40.23	57.47	19.88	6.97	0.14	0.19	0.32	0.60	13.36	0.10	0.23	0.26	0.11	3.00	1.50	1.80
142771	12-16	43.08	61.55	17.08	6.85	0.12	0.18	0.23	0.62	11.99	0.13	0.48	0.25	0.10	3.00	1.50	1.30
142772	16-20	43.25	61.78	17.21	6.75	0.09	0.11	0.23	1.01	10.88	0.17	0.69	0.25	0.06	8.00	1.00	1.60

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Ni ppm	Cr ppm	Co ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	Sn ppm	W ppm	Pt ppb	Pd ppb
142773	20-30	19.40	2	81	79	263	149	172	52	8554	352	-10	8	21	5	-10	2.50	1.60
142774	30-40	6.34	-1	45	159	220	42	19	41	7554	121	-10	3	13	6	-10	0.50	-0.50
142775	40-48	10.90	10	78	153	557	101	103	55	6307	-50	-10	-3	11	4	-10	1.40	0.60
142776	48-52	2.80	3	18	68	117	20	28	-10	595	-50	-10	-3	19	7	-10	-0.50	0.70
142777	52-58	7.18	13	51	38	126	186	322	34	1464	51	-10	-3	16	8	-10	1.40	1.70
142778	58-64	5.92	53	49	46	148	196	322	36	1211	609	-10	-3	13	7	-10	1.50	1.90

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	GW 7	**1:100 000 Map**	5837
Traverse	7000N	**UnitNo**	381
Station		**Max Depth (m)**	100.00
Completion Date	16/08/96	**Drilling Method**	RCP
Dip at Collar	-60.00	**AMG Easting**	476950
Azimuth at Collar	270.00	**AMG Northing**	6647010
Logged By	M DAVIES	**Zone**	53
		Depth to Bsmt	2

Comments Redox boundary at 26m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.35	35.9	COLLUVIUM	Colluvium of BIF goethitic, minor clay r-brn minor calcrete
2.00	4.00	2.32	35.9	BIF	BIF v goethitic, minor clay r-brn
4.00	6.00	1.85	41.7	BIF	BIF brn, v goethitic, trace clay
6.00	8.00	3.55	41.7	BIF	as above
8.00	10.00	2.47	28.6	BIF	BIF, pl y-brn v goethitic, trace clay
10.00	12.00	11.30	28.6	BIF	BIF, pl-brn weakly goethitic trace, clay v well laminated
12.00	14.00	4.37	35.0	BIF	BIF pl brn as above
14.00	16.00	5.89	35.0	BIF	as above
16.00	18.00	14.90	36.9	BIF	BIF, pl brn-g as above v weakly magnetic
18.00	20.00	22.20	36.9	BIF	as above
20.00	22.00	21.00	37.5	BIF	as above
22.00	24.00	19.10	37.5	BIF	BIF pl g, as above, weakly magnetic
24.00	26.00	31.90	34.5	BIF	BIF, pl g, mod magnetic, minor goethitic, BIF, trace clay y
26.00	28.00	126.00	34.5	BIF	BIF, g of Cht Mt/Hem-amph
28.00	30.00	125.00	34.6	BIF	BIF g as above and Metapelite dk grn
30.00	32.00	219.00	34.6	BIF	BIF as above, rare Pyrite, minor Dolerite, pl grn f.g
32.00	34.00	183.00	35.0	BIF	BIF g of Cht-Mt-amph-trace Pyrite
34.00	36.00	254.00	35.0	BIF	BIF g of Cht Mt-amph
36.00	38.00	260.00	35.9	BIF	as above
38.00	40.00	278.00	35.9	BIF	as above
40.00	42.00	320.00	35.5	BIF	as above
42.00	44.00	332.00	35.5	BIF	as above
44.00	46.00	300.00	34.0	BIF	as above
46.00	48.00	285.00	34.0	BIF	as above
48.00	50.00	272.00	33.0	BIF	BIF as above trace Metapelite rare vein Ct
50.00	52.00	284.00	33.0	BIF	as above
52.00	54.00	265.00	32.3	BIF	as above, weakly calcareous
54.00	56.00	260.00	32.3	BIF	as above
56.00	58.00	277.00	32.3	BIF	as above
58.00	60.00	258.00	32.3	BIF	BIF as above, trace BIF of Cht-Mt- Hem-amph, BIF pl r colour
60.00	62.00	284.00	33.1	BIF	as above
62.00	64.00	239.00	33.1	BIF	BIF as above, increase in Carbonate (as calcite?)
64.00	66.00	288.00	32.8	BIF	as above
66.00	68.00	242.00	32.8	BIF	BIF med g of Cht-Mt - amph (talc?)
68.00	70.00	315.00	31.5	BIF	as above
70.00	72.00	267.00	31.5	BIF	as above
72.00	74.00	260.00	32.3	BIF	as above
74.00	76.00	200.00	32.3	BIF	as above
76.00	78.00	268.00	33.2	BIF	as above

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
78.00	80.00	210.00	33.2	BIF	as above
80.00	82.00	196.00	31.0	BIF	BIF pl r of Cht-Hem-Mt, minor BIF, g of Cht-Mt
82.00	84.00	152.00	31.0	BIF	BIF pl r as above, weakly magnetic v cherty
84.00	86.00	251.00	31.0	BIF	BIF as above, minor BIF pl r as above
86.00	88.00	196.00	31.0	BIF	as above
88.00	90.00	234.00	28.2	BIF	as above
90.00	92.00	271.00	28.2	BIF	BIF as above, rare Hematite staining on joint surfaces
92.00	94.00	216.00	31.1	BIF	BIF of Cht-Mt- amph, rare BIF pl r as above
94.00	96.00	215.00	31.1	BIF	BIF g as above
96.00	98.00	239.00	29.7	BIF	as above
98.00	100.00	199.00	29.7	BIF	as above

AK 2/44
24-100.

GW 7

Sample No	Interval	Fe %	FE2O3 %	SiO2 %	AL2O3 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb
193531	20-24	37.46	53.52	43.20	0.42	0.01	0.14	0.15	0.65	1.65	0.10	0.01	0.01	0.03	1.00
193532	24-28	34.53	49.33	46.30	1.06	0.02	0.06	0.67	1.47	1.30	0.07	0.02	0.02	0.09	1.00
193533	28-32	34.58	49.40	43.40	1.17	0.09	0.07	1.07	3.25	0.63	0.09	0.03	0.06	0.22	1.00
193534	32-36	34.99	49.98	47.10	0.15	0.01	0.05	0.70	1.64	0.01	0.12	0.03	0.01	0.89	3.00
193535	36-40	35.93	51.33	44.50	0.11	0.01	0.08	0.65	2.76	0.19	0.10	0.01	0.01	0.25	1.00
193536	40-44	35.48	50.68	46.00	0.05	0.02	0.16	1.30	2.47	0.01	0.12	0.03	0.01	0.03	2.00
193537	44-48	33.96	48.52	47.00	0.09	0.02	0.11	1.57	2.31	0.01	0.14	0.03	0.01	0.03	1.00
193538	48-52	33.01	47.16	47.40	0.21	0.10	0.35	1.86	2.88	0.01	0.16	0.04	0.01	0.03	1.00
193539	52-56	32.31	46.16	48.10	0.08	0.13	0.47	2.26	2.64	0.01	0.15	0.05	0.01	0.03	1.00
193540	56-60	32.26	46.09	47.50	0.12	0.07	0.22	2.88	2.88	0.01	0.15	0.07	0.01	0.05	2.00
193541	60-64	33.14	47.34	46.60	0.12	0.06	0.15	2.56	3.00	0.01	0.11	0.08	0.01	0.10	1.00
193542	64-68	32.80	46.85	46.90	0.18	0.04	0.06	2.65	3.30	0.01	0.13	0.07	0.01	0.05	1.00
193543	68-72	31.52	45.03	47.00	0.61	0.23	0.09	2.94	3.33	0.11	0.22	0.06	0.02	0.05	1.00
193544	72-76	32.26	46.08	50.50	0.05	0.01	0.05	2.03	2.35	0.01	0.25	0.03	0.01	0.08	1.00
193545	76-80	33.24	47.49	47.60	0.17	0.01	0.05	2.03	2.64	0.39	0.14	0.04	0.01	0.26	5.00
193546	80-84	31.00	44.28	52.60	0.33	0.03	0.05	0.79	1.11	0.77	0.22	0.05	0.01	4.84	21.00
193547	84-88	31.02	44.32	50.10	0.21	0.01	0.05	2.10	2.75	0.01	0.17	0.06	0.01	0.99	4.00

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Cr ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	W ppm	Pt ppb	Pd ppb
193526	0-4	35.90	3	8	50	33	5	10	55	117	527	10	3	4	11	1.50	3.00
193527	4-8	41.70	3	5	50	27	5	10	24	110	154	10	3	4	18	0.50	1.50
193528	8-12	28.56	3	5	50	20	5	10	105	55	248	10	3	4	12	1.00	2.00
193529	12-16	35.00	3	5	50	18	5	10	124	117	50	10	3	4	10	0.50	1.00
193530	16-20	36.90	2	5	50	18	5	10	233	142	50	10	3	4	5	0.50	0.50
193548	88-92	28.16	3	5	50	34	5	10	22	511	50	10	3	4	5	0.50	0.50
193549	92-96	31.10	4	5	50	43	5	10	141	513	50	10	3	4	5	0.50	0.50
193550	96-100	29.71	3	5	50	51	5	10	19	608	50	10	3	4	5	0.50	0.50

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	GW 8	**1:100 000 Map**	5837
Traverse		**UnitNo**	382
Station		**Max Depth (m)**	100.00
Completion Date	15/08/96	**Drilling Method**	RCP
Dip at Collar	-60.00	**AMG Easting**	477112
Azimuth at Collar	270.00	**AMG Northing**	6647005
Logged By	M DAVIES	**Zone**	53
		Depth to Bsmt	3

Comments Redox boundary at 46m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.62	7.6	SOIL	clay r-brn, mod well cemented and calcreted
2.00	4.00	0.53	7.6	IRONSTONE	Ironstone, med sandy, well cemented, minor clay as above
4.00	6.00	0.67	37.0	BIF	Ironstone as above minor, BIF brn of Cht-hem (very cherty)
6.00	8.00	1.32	37.0	BIF	BIF, brn, goethitic, trace clay r-w
8.00	10.00	2.99	34.7	BIF	as above
10.00	12.00	2.58	34.7	BIF	as above
12.00	14.00	5.20	42.3	BIF	as above
14.00	16.00	5.44	42.3	BIF	as above
16.00	18.00	5.73	34.0	BIF	as above
18.00	20.00	5.96	34.0	BIF	BIF, as above, minor Schist dply wthd
20.00	22.00	1.21	9.1	SCHIST	Schist, dk brn,pl y, mostly dply wthd to clay
22.00	24.00	1.03	9.1	SCHIST	as above
24.00	26.00	1.04	19.2	SCHIST	as above
26.00	28.00	10.30	19.2	BIF	BIF, as above, minor schist as above
28.00	30.00	33.00	31.0	BIF	as above
30.00	32.00	28.30	31.0	BIF	as above
32.00	34.00	51.20	36.0	BIF	as above
34.00	36.00	37.60	36.0	BIF	as above
36.00	38.00	34.90	36.9	BIF	as above
38.00	40.00	54.90	36.9	BIF	as above
40.00	42.00	33.00	33.3	BIF	as above
42.00	44.00	18.10	33.3	BIF	BIF as above minor clay -w
44.00	46.00	91.70	30.5	BIF	BIF pl g as above
46.00	48.00	19.70	30.5	BIF	BIF pl g brn as above
48.00	50.00	324.00	42.7	BIF	BIF g of Cht-Mt amphibole, weakly calcareous, well laminated, rare vein Ct
50.00	52.00	331.00	42.7	BIF	as above
52.00	54.00	325.00	22.7	BIF	BIF as above,increased calcite pl g coarsely X-talline
54.00	56.00	143.00	22.7	METASEDIMENT	Metapsammite, v calcareous pl-med g , minor BIF as above
56.00	58.00	520.00	47.8	BIF	BIF, dk g of Cht-Mt-amphibole, weakly calcareous
58.00	60.00	465.00	47.8	BIF	BIF, med g as above
60.00	62.00	400.00	36.1	METAMUDSTONE	Metapelite, dk g, lesser BIF as above, weakly calcareous
62.00	64.00	351.00	36.1	BIF	BIF, g mod calcareous, tr metapelite as above
64.00	66.00	338.00	38.3	BIF	as above
66.00	68.00	423.00	38.3	BIF	BIF as above, minor Metapelite or Dt grn
68.00	70.00	377.00	33.4	BIF	as above
70.00	72.00	419.00	33.4	BIF	BIF as above
72.00	74.00	398.00	40.1	BIF	BIF as above
74.00	76.00	375.00	40.1	BIF	BIF as above

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
76.00	78.00	394.00	38.4	BIF	as above
78.00	80.00	363.00	38.4	BIF	as above
80.00	82.00	438.00	41.3	BIF	as above
82.00	84.00	441.00	41.3	BIF	as above
84.00	86.00	442.00	41.2	BIF	as above
86.00	88.00	342.00	41.2	BIF	as above
88.00	90.00	378.00	35.6	BIF	as above
90.00	92.00	316.00	35.6	BIF	as above
92.00	94.00	325.00	34.4	BIF	as above
94.00	96.00	344.00	34.4	BIF	as above
96.00	98.00	247.00	39.4	BIF	as above
98.00	100.00	325.00	39.4	BIF	as above

48-100, 367

max 526

GW 8

Sample No	Interval	Fe %	FE2O3 %	SiO2 %	AL2O3 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb
193558	28-32	31.04	44.34	45.60	2.32	0.18	0.09	1.23	2.18	3.45	0.04	0.22	0.08	0.01	8.00
193559	32-36	35.97	51.38	38.70	1.26	0.10	0.12	2.46	2.91	2.90	0.07	0.19	0.04	0.01	6.00
193560	36-40	36.95	52.78	38.50	1.10	0.07	0.08	2.01	2.43	2.51	0.07	0.16	0.03	0.01	1.00
193561	40-44	33.33	47.62	40.80	1.49	0.08	0.19	2.83	3.90	2.86	0.11	0.24	0.05	0.01	3.00
193562	44-48	30.51	43.59	42.00	0.66	0.03	0.05	4.95	3.71	3.88	0.13	0.18	0.02	0.06	1.00
193563	48-52	42.71	61.01	9.88	0.86	0.01	0.05	10.91	6.64	10.79	0.11	0.22	0.04	0.09	1.00
193564	52-56	22.70	32.43	11.70	1.40	0.01	0.07	17.16	13.36	23.41	0.12	0.32	0.05	0.16	1.00
193565	56-60	47.81	68.30	15.70	0.92	0.01	0.05	4.30	7.22	3.43	0.12	0.13	0.03	0.07	1.00
193566	60-64	36.13	51.61	7.47	1.97	0.01	0.05	12.43	10.73	15.45	0.20	0.32	0.06	0.13	2.00
193567	64-68	38.32	54.74	16.70	0.57	0.01	0.05	8.88	9.16	9.68	0.12	0.21	0.02	0.07	1.00
193568	68-72	33.41	47.73	46.00	0.54	0.01	0.05	2.05	3.40	0.01	0.14	0.04	0.02	0.58	1.00
193569	72-76	40.09	57.27	37.50	0.11	0.01	0.05	2.29	2.89	0.01	0.06	0.03	0.01	0.03	1.00
193570	76-80	38.37	54.81	40.00	0.09	0.01	0.05	2.78	1.83	0.01	0.04	0.03	0.01	0.20	1.00
193571	80-84	41.32	59.03	37.60	0.14	0.01	0.05	1.63	2.40	0.01	0.07	0.03	0.01	0.03	1.00
193572	84-88	41.16	58.80	36.50	0.24	0.01	0.05	1.85	3.99	0.01	0.08	0.06	0.01	0.06	1.00
193573	88-92	35.63	50.90	44.20	0.22	0.01	0.05	2.08	2.74	0.01	0.11	0.06	0.01	0.01	1.00
193574	92-96	34.43	49.19	45.60	0.33	0.01	0.05	2.00	2.60	0.01	0.10	0.05	0.01	0.03	1.00
193575	96-100	39.38	56.26	39.50	0.27	0.01	0.05	1.84	2.71	0.01	0.07	0.04	0.01	0.04	1.00

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Cr ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	W ppm	Pt ppb	Pd ppb
193551	0-4	7.60	3	8	50	24	5	10	34	56	762	10	3	6	5	0.50	1.00
193552	4-8	37.00	2	5	50	27	5	10	34	226	395	10	3	5	13	0.50	1.50
193553	8-12	34.70	2	5	50	42	5	10	21	491	50	10	3	4	5	0.50	1.00
193554	12-16	42.30	10	5	50	34	5	10	71	556	50	10	5	7	5	0.50	1.00
193555	16-20	34.00	3	7	50	34	5	14	27	451	50	10	3	4	5	0.50	1.50
193556	20-24	9.08	2	34	50	105	18	116	390	323	50	10	3	9	7	2.50	5.00
193557	24-28	19.15	2	14	50	76	8	40	69	993	50	10	3	5	5	1.50	3.00

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name GW 9
Traverse 7000N
Station
Completion Date 16/08/96
Dip at Collar -60.00
Azimuth at Collar 270.00
Logged By M DAVIES

1:100 000 Map 5837
UnitNo 383
Max Depth (m) 94.00
Drilling Method RCP
AMG Easting 476842
AMG Northing 6647020
Zone 53
Depth to Bsmt 2

Comments Redox boundary at 70m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	8.79	28.3	COLLUVIUM	Colluvium of BIF, calcrete, minor cy r-brn
2.00	4.00	13.50	28.3	BIF	BIF, brn, goethitic, of Cht-Hem, minor clay
4.00	6.00	2.06	35.1	BIF	as above
6.00	8.00	7.79	35.1	BIF	as above
8.00	10.00	3.94	27.3	BIF	as above
10.00	12.00	5.71	27.3	BIF	BIF, y-brn, v goethitic, minor goethite, tr clay
12.00	14.00	14.50	33.0	BIF	BIF brn as above
14.00	16.00	14.30	33.0	BIF	BIF brn as above
16.00	18.00	7.46	34.7	BIF	as above
18.00	20.00	6.61	34.7	BIF	as above
20.00	22.00	10.80	32.0	BIF	as above
22.00	24.00	7.12	32.0	BIF	BIF, of Cht-Hem-lim, well lam and lesser cy g (wthd metasediment or amphibolite)
24.00	26.00	8.10	30.5	BIF	BIF of Cht-Hem-lm, and clay y brn (wthd metased or amph)
26.00	28.00	8.83	30.5	BIF	as above
28.00	30.00	10.70	29.4	BIF	as above
30.00	32.00	7.44	29.4	BIF	Schist dply wthd to clay, trace CHT, trace BIF
32.00	34.00	23.70	31.7	BIF	BIF as above, minor schist as above
34.00	36.00	36.00	31.7	BIF	BIF pl brn as above
36.00	38.00	15.60	33.0	BIF	BIF pl brn of Cht-lim-amph, minor schist as above
38.00	40.00	17.40	33.0	BIF	BIF as above, minor schist as above
40.00	42.00	13.70	37.1	BIF	BIF as above, minor schist as above trace goethite
42.00	44.00	10.10	37.1	BIF	BIF of lim-hem-Cht (amph wthd t o cy) pl y
44.00	46.00	11.40	32.1	BIF	as above
46.00	48.00	8.66	32.1	BIF	BIF pl brn of lim-amph- Cht-hem
48.00	50.00	5.25	31.5	BIF	as above
50.00	52.00	5.87	31.5	BIF	as above
52.00	54.00	8.73	35.0	BIF	BIF pl brn of Cht-Hem-lim, well laminated
54.00	56.00	17.30	35.0	BIF	as above
56.00	58.00	20.70	37.4	BIF	as above
58.00	60.00	8.82	37.4	BIF	as above
60.00	62.00	12.90	13.2	CLAY	clay pl y-brn (wthd metasediment)
62.00	64.00	12.90	13.2	CLAY	clay dk r (wthd metasediment)
64.00	66.00	17.00	13.2	CLAY	clay dk r trace CHT g
66.00	68.00	0.96	13.2	METAMUDSTONE	cy pl y-brn to dk r trace CHT g trace Schist/Metapelite dk g to blk
68.00	70.00	0.83	6.7	METAMUDSTONE	Metapelite/Schist v dk g to blk minor schist wthd to y-brn cy
70.00	72.00	0.27	6.7	METAMUDSTONE	as above
72.00	74.00	0.43	6.7	METAMUDSTONE	Metapelite, dk brn-g fissile
74.00	76.00	0.27	6.7	METAMUDSTONE	as above

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
76.00	78.00	0.30	24.5	METAMUDSTONE	as above
78.00	80.00	0.26	24.5	METAMUDSTONE	as above
80.00	82.00	0.38	24.5	METAMUDSTONE	Metapelite dk g rare Pyrite
82.00	84.00	0.31	24.5	METAMUDSTONE	as above
84.00	86.00	0.32	20.8	METAMUDSTONE	as above
86.00	88.00	0.19	20.8	METAMUDSTONE	as above
88.00	90.00	0.23	20.8	METAMUDSTONE	as above
90.00	92.00	0.13	20.8	METAMUDSTONE	as above
92.00	94.00	0.23	12.3	METAMUDSTONE	as above

GW 9

Sample No	Interval	Fe %	FE2O3 %	SiO2 %	AL2O3 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb
193581	20-24	32.04	45.77	47.30	0.61	0.01	0.05	0.12	3.66	2.75	0.09	0.01	0.01	0.01	1.00
193582	24-28	30.53	43.62	40.90	0.45	0.01	0.05	0.38	10.89	3.68	0.19	0.01	0.02	0.01	3.00
193583	28-32	29.39	41.99	40.80	0.40	0.03	0.05	0.36	12.32	3.96	0.18	0.01	0.02	0.01	1.00
193584	32-36	31.68	45.25	46.80	0.18	0.01	0.05	0.30	4.81	1.99	0.17	0.01	0.01	0.01	1.00
193585	36-40	33.04	47.20	45.30	0.32	0.01	0.05	0.35	4.75	2.57	0.17	0.01	0.01	0.01	1.00
193586	40-44	37.10	53.00	33.90	0.38	0.01	0.05	0.29	9.22	3.51	0.15	0.01	0.01	0.01	1.00
193587	44-48	32.08	45.83	47.30	0.18	0.01	0.05	0.26	4.24	1.94	0.10	0.01	0.01	0.01	1.00
193588	48-52	31.52	45.03	45.50	0.31	0.01	0.05	0.15	6.54	2.96	0.09	0.02	0.01	0.01	2.00
193589	52-56	35.01	50.01	45.60	0.12	0.01	0.05	0.08	3.20	1.56	0.09	0.01	0.01	0.01	2.00
193590	56-60	37.35	53.36	41.00	0.46	0.01	0.05	0.07	1.85	2.27	0.11	0.02	0.03	0.01	9.00

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Cr ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	W ppm	Pt ppb	Pd ppb
193576	0-4	28.28	3	5	50	36	5	11	61	131	477	10	3	4	5	1.00	2.00
193577	4-8	35.10	2	5	50	27	5	10	21	152	50	10	3	4	17	0.50	0.50
193578	8-12	27.26	4	5	50	26	5	10	74	103	170	10	3	9	5	1.00	1.50
193579	12-16	33.00	5	5	50	25	5	10	71	176	50	10	5	4	5	0.50	1.50
193580	16-20	34.70	9	5	50	24	5	10	11	153	50	10	5	6	6	0.50	1.00
193591	60-68	13.21	127	15	50	121	20	117	156	9120	122	10	3	13	12	2.00	4.50
193592	68-76	6.73	62	29	50	187	18	99	142	2630	249	10	4	17	15	1.50	3.50
193593	76-84	24.50	16	268	73	49	16	47	213	472	190	10	6	17	5	2.00	4.50
193594	84-92	20.76	8	233	107	114	41	88	141	1010	118	10	3	14	11	1.50	3.00
193595	92-94	12.34	5	241	50	162	84	110	177	1680	50	10	6	15	6	1.50	3.00

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name GW 10
Traverse 5400N
Station
Completion Date 16/08/96
Dip at Collar -60.00
Azimuth at Collar 270.00
Logged By M DAVIES

1:100 000 Map 5837
UnitNo 384
Max Depth (m) 54.00
Drilling Method RCP
AMG Easting 476149
AMG Northing 6645404
Zone 53
Depth to Bsmt 2

Comments Redox boundary >54m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	1.08	9.9	SOIL	Clay r-brn and calcrete
2.00	4.00	0.51	9.9	BIF	BIF, pl r goethitic to denatured
4.00	6.00	0.31	9.9	BIF	BIF, pl r goethitic to denatured
6.00	8.00	0.34	9.9	BIF	BIF as above
8.00	10.00	0.21	8.5	BIF	BIF as above, v pl brn,minor cy (dply wthd metased?)
10.00	12.00	0.27	8.5	BIF	as above
12.00	14.00	0.30	8.5	BIF	BIF denatured pl r
14.00	16.00	0.23	8.5	BIF	as above
16.00	18.00	0.10	4.3	BIF	as above v pl brn
18.00	20.00	0.36	4.3	BIF	as above
20.00	22.00	0.59	4.3	METAMUDSTONE	clay pl y to w, dply wthd metasedement? trace BIF as above
22.00	24.00	2.98	4.3	METAMUDSTONE	clay as above, minor limonite
24.00	26.00	0.60	5.0	METAMUDSTONE	as above
26.00	28.00	0.59	5.0	METAMUDSTONE	clay w and clay y limonitic (dply wthd metapelite?)
28.00	30.00	5.60	5.0	METAMUDSTONE	clay y to w puggy dply wthd metapelite?
30.00	32.00	9.28	5.0	METAMUDSTONE	as above
32.00	34.00	11.60	4.1	METAMUDSTONE	as above
34.00	36.00	10.00	4.1	METAMUDSTONE	as above
36.00	38.00	9.55	4.1	METAMUDSTONE	as above
38.00	40.00	8.43	4.1	METAMUDSTONE	as above
40.00	42.00	9.59	11.3	METAMUDSTONE	as above
42.00	44.00	8.79	11.3	METAMUDSTONE	clay pl y to pl brn
44.00	46.00	10.90	11.3	METAMUDSTONE	clay y as above
46.00	48.00	8.36	11.3	METAMUDSTONE	clay y as above
48.00	50.00	10.30	15.9	METAMUDSTONE	clay y as above
50.00	52.00	6.70	15.9	METAMUDSTONE	clay y as above
52.00	54.00	9.13	15.9	METAMUDSTONE	as above

GW 10

Sample No	Interval	Fe %	FE2O3 %	SiO2 %	AL2O3 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Cr ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	W ppm	Pt ppb	Pd ppb
193596	0-8	9.87	4	233	50	139	55	87	184	2050	71	10	3	12	6	1.50	3.00
193597	8-16	8.49	11	186	50	131	46	94	179	1480	82	10	3	7	5	3.00	6.00
193598	16-24	4.33	8	31	50	83	26	110	166	550	495	10	5	4	5	5.00	11.50
193599	24-32	5.00	7	52	50	164	27	115	172	596	6310	10	6	4	5	5.50	11.50
193600	32-40	4.10	8	35	50	92	28	103	163	468	6830	10	3	4	8	8.50	18.50
193601	40-48	11.28	123	5	50	30	5	12	50	74	724	10	3	4	5	10.50	23.50
193602	48-54	15.92	18	69	50	29	5	25	169	106	166	10	3	4	11	10.50	23.50

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name GW 11
Traverse 5400N
Station
Completion Date 17/08/96
Dip at Collar -60.00
Azimuth at Collar 270.00
Logged By M DAVIES

1:100 000 Map 5837
UnitNo 385
Max Depth (m) 100.00
Drilling Method RCP
AMG Easting 476250
AMG Northing 6645405
Zone 53
Depth to Bsmt 5

Comments Redox Boundary at 48m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	5.42	11.7	SOIL	clay pl r-brn minor calcrete
2.00	4.00	1.00	11.7	SOIL	as above
4.00	6.00	0.97	11.6	SOIL	clay as above and BIF pl, brn denatured
6.00	8.00	1.03	11.6	BIF	BIF pl r denatured
8.00	10.00	0.56	37.7	BIF	BIF, y-brn v goethitic, minor hematite goethitic
10.00	12.00	0.54	37.7	BIF	BIF pl brn, denatured, minor clay
12.00	14.00	0.25	28.9	BIF	BIF dk ppl-brn of Cht-Hem-lim
14.00	16.00	20.70	28.9	BIF	BIF as above, minor Cht w denatured
16.00	18.00	18.10	34.4	BIF	as above
18.00	20.00	32.70	34.4	BIF	as above
20.00	22.00	8.11	34.4	BIF	BIF as above, minor BIF w denatured
22.00	24.00	12.80	34.4	BIF	as above
24.00	26.00	18.10	34.8	BIF	as above
26.00	28.00	10.00	34.8	BIF	BIF as above, minor goethite y-brn
28.00	30.00	30.10	39.7	BIF	BIF pl ppl-brn of Cht-Hem-lim, well laminated, wky magnetic
30.00	32.00	35.10	39.7	BIF	as above
32.00	34.00	23.30	36.7	BIF	as above
34.00	36.00	25.10	36.7	BIF	as above
36.00	38.00	22.10	36.4	BIF	as above
38.00	40.00	33.60	36.4	BIF	BIF pl brn as above
40.00	42.00	54.20	36.9	BIF	as above
42.00	44.00	32.90	36.9	BIF	as above
44.00	46.00	18.80	36.1	BIF	BIF pl g as above, wkly magnetic
46.00	48.00	42.00	36.1	BIF	as above
48.00	50.00	84.00	34.8	BIF	BIF pl g to med g
50.00	52.00	114.00	34.8	BIF	BIF med g mod magnetic
52.00	54.00	206.00	35.8	BIF	BIF med g of Cht-Mt well laminated to fissile
54.00	56.00	205.00	35.8	BIF	as above
56.00	58.00	219.00	35.9	BIF	as above
58.00	60.00	225.00	35.9	BIF	as above
60.00	62.00	144.00	32.0	BIF	BIF as above, minor metapelite dkg fissile with rare Pyrite
62.00	64.00	221.00	32.0	BIF	BIF as above with increased talc?
64.00	66.00	313.00	36.8	BIF	BIF, med g of Cht-Mt-amphibole, well laminated to fissile
66.00	68.00	251.00	36.8	BIF	as above
68.00	70.00	247.00	34.4	BIF	as above
70.00	72.00	284.00	34.4	BIF	as above
72.00	74.00	238.00	34.8	BIF	as above
74.00	76.00	260.00	34.8	BIF	as above
76.00	78.00	297.00	45.9	BIF	BIF, dk g as above (increased Mt)

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
78.00	80.00	296.00	45.9	BIF	as above
80.00	82.00	273.00	36.9	BIF	BIF med g as above
82.00	84.00	282.00	36.9	BIF	as above
84.00	86.00	270.00	31.8	BIF	BIF dk g as above
86.00	88.00	271.00	31.8	BIF	BIF med g as above (increased talc?)
88.00	90.00	310.00	32.6	BIF	BIF med g as above
90.00	92.00	236.00	32.6	BIF	as above
92.00	94.00	227.00	31.8	BIF	as above
94.00	96.00	203.00	31.8	BIF	as above
96.00	98.00	241.00	28.5	BIF	as above
98.00	100.00	246.00	28.5	BIF	as above

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GW 11

Sample No	Interval	Fe %	FE2O3 %	SiO2 %	AL2O3 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb
193608	20-24	34.38	49.12	45.60	2.37	0.01	0.05	0.04	0.04	2.34	0.04	0.02	0.07	0.02	3.00
193609	24-28	34.82	49.74	44.20	2.33	0.01	0.05	0.05	0.04	2.67	0.07	0.02	0.10	0.01	4.00
193610	28-32	39.66	56.66	43.30	0.13	0.01	0.05	0.03	0.07	0.46	0.06	0.02	0.01	0.01	16.00
193611	32-36	36.74	52.48	45.30	0.18	0.01	0.05	0.03	0.18	0.83	0.06	0.01	0.01	0.01	2.00
193612	36-40	36.41	52.01	47.00	0.21	0.01	0.05	0.04	0.08	0.80	0.07	0.04	0.01	0.01	1.00
193613	40-44	36.89	52.70	45.70	0.24	0.01	0.05	0.09	0.18	0.94	0.09	0.04	0.01	0.01	3.00
193614	44-48	36.11	51.58	45.80	0.22	0.02	0.26	0.40	0.82	1.09	0.06	0.04	0.01	0.01	4.00
193615	48-52	34.81	49.73	46.70	0.14	0.03	0.21	0.52	1.08	0.46	0.12	0.06	0.01	0.03	1.00
193616	52-56	35.76	51.09	46.60	0.06	0.03	0.46	0.70	1.48	0.01	0.17	0.05	0.01	0.14	1.00
193617	56-60	35.87	51.24	45.00	0.08	0.03	0.20	1.00	2.28	0.01	0.10	0.06	0.01	0.03	1.00
193618	60-64	32.00	45.72	46.80	0.75	0.03	0.12	1.21	3.46	1.24	0.16	0.09	0.05	0.23	1.00
193619	64-68	36.79	52.56	42.40	0.09	0.01	0.05	0.98	3.24	0.01	0.09	0.07	0.01	0.18	1.00
193620	68-72	34.36	49.09	47.70	0.06	0.01	0.05	0.66	2.55	0.01	0.11	0.07	0.01	0.30	2.00
193621	72-76	34.76	49.66	43.70	0.39	0.01	0.05	1.21	3.10	0.70	0.12	0.12	0.01	0.74	2.00
193622	76-80	45.90	65.57	21.20	0.38	0.01	0.05	3.45	5.36	2.45	0.16	0.24	0.02	1.06	5.00
193623	80-84	36.90	52.71	35.60	0.07	0.01	0.05	2.96	4.63	3.03	0.14	0.27	0.01	0.24	1.00

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Cr ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	W ppm	Pt ppb	Pd ppb
193603	0-4	11.66	7	36	50	49	9	33	132	371	627	10	3	14	5	2.50	5.50
193604	4-8	11.61	5	11	50	21	5	21	117	70	122	10	4	21	5	1.00	2.00
193605	8-12	37.70	4	11	50	35	5	12	41	390	148	10	15	9	5	1.00	2.00
193606	12-16	28.91	3	5	50	17	5	10	30	111	50	10	5	4	8	0.50	1.00
193607	16-20	34.40	2	5	50	19	5	10	91	197	50	10	3	4	5	0.50	0.50
193624	84-88	31.80	2	5	50	31	5	10	10	419	498	10	3	4	5	0.50	0.50
193625	88-92	32.60	3	10	50	27	5	10	90	294	2110	10	3	4	5	0.50	0.50
193626	92-96	31.80	2	5	50	25	5	10	10	323	802	10	6	4	5	0.50	0.50
193627	96-100	28.46	4	33	50	25	5	10	63	356	5330	10	6	4	5	0.50	0.50

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	GW 12	**1:100 000 Map**	5837
Traverse	5400N	**UnitNo**	386
Station		**Max Depth (m)**	100.00
Completion Date	17/08/96	**Drilling Method**	RCP
Dip at Collar	-60.00	**AMG Easting**	476354
Azimuth at Collar	270.00	**AMG Northing**	6645404
Logged By	J HOUGH	**Zone**	53
		Depth to Bsmt	7

Comments Redox boundary at 60m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	1.24	12.4	CALCRETE	Buff calc with red purple wthd ironstone fragments and mag hemite
2.00	4.00	1.43	12.4	CALCRETE	Calcrete y buff rd purp frag as above
4.00	6.00	0.25	12.4	CALCRETE	Calcrete y with rd purple ironstone frag
6.00	8.00	0.19	12.4	CALCRETE	Calcrete/Fe pebbles, orange calc with red purple fragments
8.00	10.00	1.20	3.2	CLAY	Clay - buff. Wthd ?granite
10.00	12.00	0.22	3.2	CLAY	Buff to tan to yell and ple brown clay
12.00	14.00	0.11	3.2	CLAY	Clay as above with occ rnd qtz pebb
14.00	16.00	0.13	3.2	CLAY	Orange clay with occ ironstone choc yb mag hem clasts.
16.00	18.00	0.11	20.3	CLAY	As above orange and choc brown clay
18.00	20.00	0.58	20.3	CLAY	Choc brwn clay a/a plus white clay lenses
20.00	22.00	0.71	20.3	CLAY	Wthrd BIF- Mt-Hm clasts (dissem Hem) in choc and yellow brown clay matrix
22.00	24.00	0.30	20.3	CLAY	Yellow brown and choc brown Clay, less gritty
24.00	26.00	0.44	24.5	CLAY	As above
26.00	28.00	0.32	24.5	CLAY	Clay yellow brown. No Fe
28.00	30.00	0.20	24.5	CLAY	As above
30.00	32.00	0.33	24.5	CLAY	Clay yellow brown
32.00	34.00	1.00	32.5	CLAY	As above
34.00	36.00	1.64	32.5	CLAY	As above
36.00	38.00	1.66	23.7	CLAY	Clay grey and white with grey cherty fragments.Wthrd BIF.
38.00	40.00	2.04	23.7	CLAY	Clay , grey and choc y brwn . Wthrd BIF.
40.00	42.00	1.91	27.5	CLAY	Clay choc brown and yellow brown red purple brown. BIF wthd.
42.00	44.00	2.55	27.5	CLAY	Clay choc and yel brwn to red purp brwn .Wthrd BIF.
44.00	46.00	2.61	24.1	CLAY	Wthrd BIF . Grey with occ gry cryptocrystalline cherty frgs
46.00	48.00	3.86	24.1	CLAY	BIF grey cry/c .
48.00	50.00	2.03	16.6	BIF	As above
50.00	52.00	2.29	16.6	BIF	As above grey cherty fragments more common.
52.00	54.00	2.22	16.5	BIF	As above looks bleached
54.00	56.00	2.77	16.5	BIF	Grey wthd BIF - Chert-hematitic
56.00	58.00	1.49	16.7	BIF	BIF as above grey
58.00	60.00	1.56	16.7	BIF	Finely banded BIF 0-2mm banding with dissem Hm-Mt
60.00	62.00	96.70	25.3	BIF	BIF
62.00	64.00	107.00	25.3	BIF	As above
64.00	66.00	83.80	22.6	BIF	Grey mag BIF Microcryst
66.00	68.00	77.10	22.6	BIF	Dark grey black chert fragments
68.00	70.00	207.00	30.1	BIF	Dark grey BIF
70.00	72.00	160.00	30.1	BIF	Dark grey BIF
72.00	74.00	119.00	25.7	BIF	Dark grey BIF
74.00	76.00	142.00	25.7	BIF	Dark grey BIF

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
76.00	78.00	157.00	17.2	BIF	Dark grey BIF
78.00	80.00	37.70	17.2	BIF	Grey cryptocryst BIF minor chert
80.00	82.00	40.40	20.2	BIF	BIF light grey with dk grey chert frags
82.00	84.00	141.00	20.2	BIF	Grey frsh MT BIF
84.00	86.00	232.00	34.1	BIF	Fresh hard mt BIF c/c dk grey black
86.00	88.00	220.00	34.1	BIF	As above fresh Mt c/c
88.00	90.00	236.00	35.6	BIF	As above
90.00	92.00	244.00	35.6	BIF	as above
92.00	94.00	139.00	27.0	BIF	Light grey > sil content with bleached BIF
94.00	96.00	309.00	27.0	BIF	Dk grey fresh Mt BIF
96.00	98.00	302.00	34.6	BIF	BIF grey very finely banded .025mm BIF-Mt bands
98.00	100.00	309.00	34.6	BIF	Dk gry Mt BIF cyrptocrystalline

62-100 AIF
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Sample No	Interval	Fe %	FE2O3 %	SiO2 %	AL2O3 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb
193646	0-8	12.38	17.69	50.60	16.50	0.32	0.17	2.44	0.47	11.25	0.04	0.01	0.71	0.05	1.00
193647	8-16	3.25	4.64	77.60	11.50	0.06	0.12	0.08	0.14	5.67	0.02	0.01	0.43	0.08	1.00
193648	16-24	20.27	28.96	35.60	20.00	1.24	0.29	0.12	0.55	12.44	0.24	0.33	0.66	0.23	1.00
193649	24-32	24.55	35.07	25.90	18.60	0.51	0.34	0.23	0.70	14.73	0.28	2.53	0.59	0.08	1.00
193650	32-36	32.47	46.38	21.10	13.10	0.16	0.26	0.30	0.94	13.79	0.19	3.29	0.47	0.02	7.00
193651	36-40	23.67	33.82	43.80	8.55	0.12	0.21	0.70	1.30	10.81	0.14	0.38	0.26	0.01	2.00
193652	40-44	27.49	39.27	36.70	8.00	0.13	0.26	1.39	2.02	11.88	0.11	0.69	0.28	0.02	5.00
193653	44-48	24.09	34.41	37.00	8.71	0.19	0.40	1.26	4.38	12.26	0.08	1.06	0.30	0.01	5.00
193654	48-52	16.57	23.67	54.70	5.58	0.16	0.32	2.81	4.44	7.80	0.04	0.82	0.19	0.01	4.00
193655	52-56	16.49	23.55	48.00	5.64	0.23	0.36	5.96	7.66	6.89	0.09	0.97	0.22	0.01	8.00
193656	56-60	16.68	23.83	42.00	9.29	0.22	0.37	3.57	8.22	9.88	0.18	1.19	0.31	0.01	9.00
193657	60-64	25.27	36.10	41.30	2.79	0.04	0.21	7.94	7.42	3.35	0.17	0.53	0.10	0.15	3.00
193658	64-68	22.60	32.28	48.20	2.22	0.12	0.16	7.29	6.73	2.47	0.09	0.48	0.08	0.17	7.00
193659	68-72	30.07	42.96	37.40	2.71	0.09	0.17	7.23	5.70	2.83	0.12	0.48	0.10	0.27	5.00
193660	72-76	25.68	36.68	42.20	2.68	0.06	0.20	7.54	7.00	2.10	0.16	0.60	0.10	0.41	5.00
193661	76-80	17.15	24.50	38.40	5.25	0.23	0.16	12.00	10.18	7.19	0.17	0.81	0.19	0.27	40.00
193662	80-84	20.19	28.84	28.90	4.83	0.25	0.13	13.42	9.23	13.42	0.12	0.82	0.19	0.13	2.00
193663	84-88	34.10	48.72	39.70	1.64	0.05	0.11	4.16	3.72	1.04	0.13	0.37	0.07	0.12	2.00
193664	88-92	35.64	50.92	37.20	1.59	0.03	0.12	4.42	4.49	1.20	0.11	0.29	0.06	0.69	1.00
193665	92-96	26.98	38.54	25.50	2.68	0.01	0.09	12.63	9.44	9.66	0.17	0.54	0.10	0.42	1.00
193666	96-100	34.56	49.37	41.00	0.57	0.01	0.09	2.94	5.14	0.65	0.11	0.22	0.02	0.35	1.00

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Cr ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	W ppm	Pt ppb	Pd ppb

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	GW 13	**1:100 000 Map**	5837
Traverse	6200N	**UnitNo**	387
Station		**Max Depth (m)**	100.00
Completion Date	19/08/96	**Drilling Method**	RCP
Dip at Collar	-60.00	**AMG Easting**	476454
Azimuth at Collar	270.00	**AMG Northing**	6645404
Logged By	J HOUGH	**Zone**	53
		Depth to Bsmt	4

Comments

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	8.98	9.2	CALCRETE	Calcrete orange pisolitic
2.00	4.00	18.40	9.2	CALCRETE	Calcrete orange pisolitic
4.00	6.00	2.33	9.2	CLAY	Clay with BIF, ple pink& white wth red purple BIF fragments
6.00	8.00	2.17	9.2	CLAY	Clay pink and white with fragments as above
8.00	10.00	1.25	7.2	CLAY	Clay pink and white with fragments as above
10.00	12.00	0.85	7.2	CLAY	Clay white, pink purple red and brown with purp red brown BIF fragments clay alunitic?
12.00	14.00	0.29	7.2	CLAY	Clay white non gritty
14.00	16.00	0.18	7.2	CLAY	Clay white and yellow, red, brown
16.00	18.00	0.23	3.6	CLAY	White clayey sand with qtz pebb looks like algebuckina?
18.00	20.00	0.42	3.6	CLAY	As above with blue grey qtz pebb. algebuckina?
20.00	22.00	1.16	3.6	CLAY	White yellow red and brown with mag hem clasts red Feox and choc brown goethitic pebbles (?transported)
22.00	24.00	0.19	3.6	SAND	Tan and yellow brown clayey sand
24.00	26.00	1.92	11.2	SAND	Sand grey wi qtz pebbles rnd and y b BIF goethite pebs
26.00	28.00	0.19	11.2	CLAY	Olive non gritty clay goethitic colour
28.00	30.00	0.35	11.2	CLAY	Yellow and red brn, goethite colour and occ white non gritty clay
30.00	32.00	0.22	11.2	CLAY	Y r br and purp non gritty with occ wthd goethite BIF pebb
32.00	34.00	0.10	5.4	CLAY	Yell tan sl gritty
34.00	36.00	0.08	5.4	CLAY	Yellow tan non gritty
36.00	38.00	0.08	5.4	CLAY	Yell tan and occ white non gritty
38.00	40.00	0.14	5.4	CLAY	Tan non gritty
40.00	42.00	0.05	6.7	CLAY	Tan non gritty clay
42.00	44.00	0.14	6.7	CLAY	Tan non gritty clay
44.00	46.00	0.08	6.7	CLAY	Tan non gritty clay
46.00	48.00	0.08	6.7	CLAY	Clay wih Gneiss , yell, white, buff and grey.Can see relict texture in parts
48.00	50.00	0.14	10.1	CLAY	Olive green non gritty
50.00	52.00	0.12	10.1	CLAY	Olive green non gritty
52.00	54.00	0.15	10.1	CLAY	Buff olive and yell br lenticular wthd non gritty clay
54.00	56.00	0.27	10.1	CLAY	Wthrd bsmt Gneiss as above with occ red lenses
56.00	58.00	2.90	27.5	CLAY	Wthrd bsmt y b white and olive green clay wi rem gneiss text
58.00	60.00	1.84	27.5	CLAY	Clay wthd Bsmt - yb tan and blue grey lenticular wispy , looks like wthd gneiss
60.00	62.00	2.28	27.6	CLAY	Olive green yell brn and rd brn non gritty wthd bsmt.
62.00	64.00	1.07	27.6	CLAY	Olive green yell brn and rd brn non gritty wthd bsmt
64.00	66.00	0.41	22.7	CLAY	Yb tan and white lenses (occ) non gritty
66.00	68.00	1.34	22.7	GNEISS	Wthd bsmt gneiss olive dk grn clay with occ qtz peb limonite goethite gneiss frags
68.00	70.00	2.52	18.3	CLAY	As above

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
70.00	72.00	0.22	18.3	BIF	Olive green chert/BIF or cryptocryst
72.00	74.00	0.16	7.8	CLAY	Clay BIF, olive green wthd wi Mt.
74.00	76.00	0.18	7.8	CLAY	Olive green a/a
76.00	78.00	0.22	7.7	CLAY	As above
78.00	80.00	0.20	7.7	CLAY	Olive green grey wthd basic ?amphibolite.
80.00	82.00	0.17	4.9	BIF	Wthd BIF -Mt
82.00	84.00	0.14	4.9	BIF	Dark green clay and BIF small Mt/hypersthene frag
84.00	86.00	0.29	4.9	BIF	As above variably clayey with BIF fragments
86.00	88.00	0.15	4.9	BIF	As above variably clayey with BIF fragments
88.00	90.00	0.66	7.0	BIF	As above variably clayey with BIF fragments
90.00	92.00	0.61	7.0	BIF	As above cryptocryst fragments
92.00	94.00	2.24	12.7	BIF	As above cryptocryst fragments cherty
94.00	96.00	1.34	12.7	BIF	Cryptocryst blue grey Mt
96.00	98.00	56.60	22.0	BIF	Cryptocryst blue grey Mt
98.00	100.00	105.00	22.0	BIF	As above

Sample No	Interval	Fe %	FE2O3 %	SiO2 %	AL2O3 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb
193705	84-88	4.87	6.95	68.00	13.90	3.58	0.16	0.17	2.08	4.25	0.12	0.04	0.33	0.03	2.00
193706	88-92	6.98	9.97	62.00	14.00	2.80	0.13	0.28	5.46	4.94	0.19	0.10	0.22	0.01	1.00
193707	92-96	12.67	18.10	58.10	10.70	1.60	0.37	1.95	3.42	5.22	0.50	0.18	0.27	0.05	3.00
193708	96-100	21.97	31.38	44.30	6.64	0.70	0.16	6.24	6.78	2.21	0.79	0.49	0.21	0.25	2.00

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Cr ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	W ppm	Pt ppb	Pd ppb
193691	0-8	9.15	3	7	50	25	5	12	117	146	965	10	3	13	9	0.50	1.50
193692	8-16	7.17	2	5	50	5	5	10	75	24	931	10	3	9	5	0.50	1.00
193693	16-24	3.59	3	13	50	12	5	14	265	64	391	10	3	15	5	0.50	0.50
193694	24-32	11.24	3	22	83	49	32	51	223	928	262	10	4	17	5	1.00	2.00
193695	32-40	5.43	2	9	108	49	9	30	64	450	189	10	7	26	6	0.50	1.50
193696	40-48	6.71	1	26	50	102	15	42	126	535	138	10	8	21	14	0.50	1.50
193697	48-56	10.08	1	15	50	127	19	33	72	779	145	10	6	12	7	1.00	1.50
193698	56-60	27.51	2	25	50	186	25	55	83	711	141	10	11	4	5	2.50	5.50
193699	60-64	27.57	1	22	50	208	30	46	59	1160	273	10	19	6	5	2.50	5.00
193700	64-68	22.65	9	6	50	202	21	25	66	821	235	10	18	4	5	0.50	1.50
193701	68-72	18.25	2	17	50	118	21	40	86	801	143	10	15	14	16	1.00	2.00
193702	72-76	7.80	1	8	50	85	20	38	130	666	122	10	12	17	5	1.00	2.00
193703	76-80	7.67	3	18	50	76	18	23	128	936	60	10	5	9	5	0.50	1.00
193704	80-84	4.91	2	15	50	45	9	20	78	659	74	10	5	29	6	0.50	1.00

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	GW 14	**1:100 000 Map**	5837
Traverse	6200N	**UnitNo**	388
Station		**Max Depth (m)**	100.00
Completion Date	17/08/96	**Drilling Method**	RCP
Dip at Collar	-60.00	**AMG Easting**	476486
Azimuth at Collar	270.00	**AMG Northing**	6646226
Logged By	M DAVIES	**Zone**	53
		Depth to Bsmt	2

Comments

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	4.64	6.4	SOIL	Clay r-brn with minor calcrete
2.00	4.00	0.22	6.4	BIF	BIF denatured
4.00	6.00	0.13	6.4	BIF	BIF pl brn denatured
6.00	8.00	0.17	6.4	BIF	BIF pl brn denatured
8.00	10.00	0.16	13.5	BIF	BIF w denatured
10.00	12.00	0.20	13.5	GRANITE	sand qtz, coarse and cy-w (dply wthd granite), BIF denatured?
12.00	14.00	0.17	13.5	GRANITE	as above
14.00	16.00	0.17	13.5	GRANITE	as above
16.00	18.00	0.18	10.5	GRANITE	as above
18.00	20.00	0.14	10.5	GRANITE	clay w
20.00	22.00	0.07	10.5	GRANITE	as above
22.00	24.00	0.06	10.5	GRANITE	as above
24.00	26.00	0.05	7.2	CLAY	clay pl y
26.00	28.00	0.09	7.2	CLAY	as above
28.00	30.00	0.07	7.2	CLAY	as above
30.00	32.00	0.06	7.2	CLAY	as above
32.00	34.00	0.18	13.6	METAMUDSTONE	clay dk brn trace CHT trace goethitic chert
34.00	36.00	0.11	13.6	METAMUDSTONE	as above
36.00	38.00	0.11	13.6	METAMUDSTONE	as above
38.00	40.00	0.59	13.6	METAMUDSTONE	as above
40.00	42.00	0.52	11.6	METAMUDSTONE	as above
42.00	44.00	0.48	11.6	METAMUDSTONE	as above
44.00	46.00	0.28	11.6	METAMUDSTONE	as above
46.00	48.00	0.33	11.6	METAMUDSTONE	as above
48.00	50.00	0.36	5.8	METAMUDSTONE	Clay as above lesser Cht
50.00	52.00	0.18	5.8	METAMUDSTONE	as above
52.00	54.00	0.25	5.8	METAMUDSTONE	as above
54.00	56.00	0.10	5.8	CLAY	clay y-w v calcareous
56.00	58.00	0.08	2.5	CLAY	clay y-brn v calcareous trace marble , dk grey
58.00	60.00	0.40	2.5	CLAY	clay y v calcareous minor marble dk grey
60.00	62.00	0.14	1.8	MARBLE	Marble pl g -w re-xtallised microxtalline
62.00	64.00	0.32	1.8	MARBLE	as above
64.00	66.00	0.42	1.7	MARBLE	as above
66.00	68.00	1.01	1.7	MARBLE	as above
68.00	70.00	0.30	1.5	MARBLE	as above
70.00	72.00	0.25	1.5	MARBLE	as above
72.00	74.00	0.26	4.0	MARBLE	Marble as above, minor metapsammite dk g weakly calcareous

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
74.00	76.00	0.63	4.0	MARBLE	Marble pl g to wh recrystallized
76.00	78.00	0.88	1.7	MARBLE	as above
78.00	80.00	0.49	1.7	MARBLE	as above
80.00	82.00	0.35	1.9	MARBLE	as above
82.00	84.00	0.27	1.9	MARBLE	as above
84.00	86.00	0.82	1.8	MARBLE	as above
86.00	88.00	0.33	1.8	MARBLE	as above
88.00	90.00	0.19	1.6	MARBLE	as above
90.00	92.00	0.37	1.6	MARBLE	as above
92.00	94.00	0.50	1.7	MARBLE	as above
94.00	96.00	0.62	1.7	MARBLE	as above
96.00	98.00	0.26	1.5	MARBLE	Marble as above trace metapelite pl g weakly calcareous
98.00	100.00	0.33	1.5	MARBLE	Marble as above

Sample No	Interval	Fe %	FE2O3 %	SiO2 %	AL2O3 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb
193636	60-64	1.76	2.51	10.40	0.62	0.07	0.05	30.69	16.68	38.49	0.03	1.05	0.03	0.12	6.00
193637	64-68	1.74	2.49	8.04	0.21	0.02	0.05	29.91	18.22	39.05	0.02	1.01	0.01	0.99	3.00
193638	68-72	1.51	2.16	12.30	0.19	0.01	0.05	30.27	16.81	36.16	0.02	1.01	0.01	0.38	5.00
193639	72-76	4.00	5.71	29.60	4.11	0.67	0.58	21.87	14.68	18.15	0.10	0.65	0.22	3.30	8.00
193640	76-80	1.71	2.44	20.80	0.31	0.03	0.05	29.84	16.44	28.64	0.02	0.94	0.01	0.65	3.00
193641	80-84	1.89	2.70	13.10	1.25	0.02	0.05	32.31	14.24	33.76	0.13	0.99	0.10	0.76	2.00
193642	84-88	1.78	2.54	16.50	0.29	0.01	0.05	34.40	12.18	31.29	0.02	0.92	0.01	1.45	8.00
193643	88-92	1.61	2.30	8.72	0.39	0.03	0.05	35.47	13.20	37.05	0.04	1.01	0.02	1.07	5.00
193644	92-96	1.65	2.36	23.40	0.24	0.03	0.05	29.51	16.27	26.34	0.03	0.88	0.02	0.92	4.00
193645	96-100	1.51	2.16	15.60	0.56	0.04	0.05	29.35	17.38	33.12	0.08	0.99	0.06	0.51	2.00
198596	92-94	1.43		23.00	0.28	0.01	0.03	29.40	16.90	26.70	0.01	0.88	0.01		

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Cr ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	W ppm	Pt ppb	Pd ppb
193628	0-8	6.44	3	10	50	35	5	33	93	97	551	10	3	14	5	0.50	1.50
193629	8-16	1.35	3	5	50	16	5	10	80	25	294	10	3	4	7	0.50	0.50
193630	16-24	1.05	2	13	123	69	5	79	45	96	159	10	3	13	5	0.50	0.50
193631	24-32	7.19	11	86	257	304	24	66	49	2130	177	10	3	14	5	0.50	1.00
193632	32-40	13.61	50	46	596	1740	41	235	192	35870	126	10	3	11	9	1.00	2.50
193633	40-48	11.55	69	35	340	694	21	78	107	22980	127	10	3	7	8	1.50	3.00
193634	48-56	5.79	134	13	401	881	16	40	49	8500	194	10	3	9	5	0.50	1.50
193635	56-60	2.48	33	5	156	364	5	13	19	6010	367	10	3	4	9	0.50	1.00
198596	92-94	1.43															

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	GW 15	**1:100 000 Map**	5837
Traverse	6200N	**UnitNo**	389
Station		**Max Depth (m)**	100.00
Completion Date	18/08/96	**Drilling Method**	RCP
Dip at Collar	-60.00	**AMG Easting**	476610
Azimuth at Collar	270.00	**AMG Northing**	6646218
Logged By	J HOUGH	**Zone**	53
		Depth to Bsmt	8

Comments

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	2.10	39.0	SAND	Red brown sand with calc fragments and red ironstone
2.00	4.00	2.10	39.0	CALCRETE	Orange pisolitic rd brown Fe ox in pisoliths
4.00	6.00	0.16	39.0	CLAY	Cream clay qtz rich, dk blue grey pebbles possible wthrd granite or Algebuckina sand
6.00	8.00	0.38	39.0	CLAY	Cream clay with silcrete fragments buff and red brown with cream sand and qtz as above
8.00	10.00	0.21	16.3	SILCRETE	Silcrete Clay fragments buff silcrete and fragments red brown and dark grey maghemite, yellow clay
10.00	12.00	0.30	16.3	CLAY	Yellow r b clay with goethitic clay and rd brown maghemite pebbles and fragments
12.00	14.00	0.20	8.1	CLAY	Lime green clay red Fe ox flecks plus white clay. Possibly be wthd BIF.green clay
14.00	16.00	0.23	8.1	BIF	Banded Fe and cryptocrystalline grey chert (4mm) Hard Fe wthd yellow brown and red goethitic (2mm bands)
16.00	18.00	0.38	13.3	CLAY	Buff yellow to red brown BIF with clay-occ fragments wthd chrt bands and lime goeth bands
18.00	20.00	0.29	13.3	CLAY	Yellow brown clay, goethitic BIF - choc brown goethite
20.00	22.00	0.19	12.9	CLAY	Yellow tan clay with maghemite fragments dark grey silvery cryptocryst hard
22.00	24.00	0.10	12.9	CLAY	Yellow and tan clay and white clay with occ frag dark grey maghemite
24.00	26.00	0.47	36.0	CLAY	Brown clay with fragments grey silvery maghemite cryptocrystalline.
26.00	28.00	0.45	36.0	CLAY	As above
28.00	30.00	0.85	35.8	BIF	BIF clay common BIF fragments grey and yellow brown banded 1-2mm bands
30.00	32.00	0.59	35.8	BIF	Purple grey maghemite
32.00	34.00	0.56	45.3	BIF	BIF dark brown wthd fragments ext fine layering microscopic blue grey maghemite
34.00	36.00	0.63	45.3	BIF	Dark silvery grey BIF Mt-Ht micaceous
36.00	38.00	20.50	39.7	BIF	Finely lam BIF with choc brown clay in parts.BIF hard gry silver cryptocrystalline.
38.00	40.00	7.80	39.7	BIF	Grey occ red purple Mt BIF
40.00	42.00	0.23	16.7	BIF	Wthd goethitic- hypersthene BIF dark green
42.00	44.00	0.25	16.7	BIF	Choc yellow brown wthd BIF frsh
44.00	46.00	0.20	7.8	CLAY	Dark green Mg rich Basic? igeneous rock grey non magnetic. Wthrd.
46.00	48.00	0.22	7.8	CLAY	Yellow brown and green grey clay with dark grey chert fragments.
48.00	50.00	0.36	4.5	CLAY	Yellow tan and grey lenses with occ fragments yellow c/c altered BIF or fine grained acid rock
50.00	52.00	0.23	4.5	CLAY	Tan clay with fragments rd brown purple green wthd chert BIF or wthd acid porphyry.
52.00	54.00	0.23	4.2	CLAY	Tan wthd BIF can just pick relict banding extremely fine grained.
54.00	56.00	0.44	4.2	UNCLASSIFIED IGNEOU	Pink fine grained acid igneous with pk red FeO staining.Chert frags common
56.00	58.00	0.43	4.7	BIF	Pink red BIF epidote altered .Fine grained igneous altered BIF.
58.00	60.00	0.71	4.7	BIF	Pink cryptocryst red BIF and epidote fine grained meta-igneous rock.
60.00	62.00	0.29	4.2	BIF	Yellow tan c/c with dark grey and red lenses altered BIF?

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
62.00	64.00	0.30	4.2	BIF	Grey hypersthene Fe-Mt, fine grained basic meta igneous rock
64.00	66.00	0.39	4.9	BIF	Pink grey fine grained microcrystalline altered BIF.
66.00	68.00	0.20	4.9	BIF	Grey to pink cryptocryst non calc non mag meta-ig chert.
68.00	70.00	0.48	3.9	IGNEOUS MAFIC	Grey cryptocryst non calc meta-basic non mag with sulfide.
70.00	72.00	0.47	3.9	BIF	Gry with dissem sulphide & chert
72.00	74.00	0.38	4.7	BIF	Grey cryptocryst BIF as above with chert
74.00	76.00	0.42	4.7	BIF	As above plus red Feox and epidote
76.00	78.00	0.38	5.3	BIF	Grey BIF wi occ limonitic blebs meta basic cryptocryst
78.00	80.00	0.75	5.3	BIF	Grey cryptocrystalline chert
80.00	82.00	0.49	5.8	BIF	Grey cryptocryst chert with sulphide weak magnetic response
82.00	84.00	1.01	5.8	BIF	Grey c/c chert with bronze sulfide in parts
84.00	86.00	0.68	5.3	BIF	Grey c/c chert
86.00	88.00	0.41	5.3	BIF	As above
88.00	90.00	1.15	3.1	DOLOMITE ROCK	Pink grey calc Dolost with minor Mt.
90.00	92.00	1.19	3.1	BIF	Cryptocrystalline grey Mt - Cht
92.00	94.00	0.63	4.1	BIF	As above
94.00	96.00	1.32	4.1	BIF	As above
96.00	98.00	0.56	4.3	BIF	As above
98.00	100.00	1.03	4.3	BIF	As above

Sample No	Interval	Fe %	FE2O3 %	SIO2 %	AL2O3 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb
193671	20-24	12.88	18.40	52.90	13.30	0.02	0.11	0.20	6.62	8.82	0.02	0.01	0.35	0.03	7.00
193672	24-28	35.97	51.39	35.60	4.39	0.01	0.05	0.09	3.39	5.04	0.05	0.01	0.08	0.02	5.00
193673	28-32	35.83	51.19	42.70	2.42	0.01	0.05	0.07	1.94	2.37	0.03	0.01	0.06	0.01	16.00
193674	32-36	45.34	64.77	26.00	2.00	0.01	0.05	0.07	3.91	3.71	0.06	0.01	0.05	0.01	7.00
193675	36-40	39.70	56.72	35.90	1.63	0.01	0.05	0.16	0.29	5.09	0.12	0.04	0.04	0.01	12.00
193676	40-44	16.66	23.80	46.10	14.00	3.96	0.17	0.40	1.26	9.14	0.09	0.03	0.49	0.01	52.00
193681	60-64	4.21	6.02	58.90	18.60	2.09	7.53	0.46	2.09	3.64	0.09	0.07	0.69	0.04	5.00
193682	64-68	4.93	7.04	57.50	17.80	1.40	6.80	0.65	3.70	4.63	0.17	0.09	0.71	0.02	3.00
193683	68-72	3.87	5.53	64.70	16.20	4.39	1.94	0.32	2.63	3.26	0.10	0.06	0.63	0.53	23.00
193684	72-76	4.66	6.66	59.50	17.40	2.84	4.87	0.75	3.03	3.26	0.42	0.06	0.72	0.08	3.00
193685	76-80	5.29	7.55	58.80	18.20	2.62	6.71	0.40	2.74	2.59	0.11	0.06	0.63	0.74	3.00
193686	80-84	5.83	8.33	53.30	15.00	2.19	3.12	4.02	6.68	5.02	0.26	0.12	0.72	1.02	3.00
193687	84-88	5.26	7.52	60.40	15.00	3.40	2.29	2.25	4.29	3.63	0.16	0.09	0.66	1.62	8.00

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Cr ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	W ppm	Pt ppb	Pd ppb
193667	0-8	3.90	7	6	50	24	5	17	115	270	450	10	3	9	5	0.50	1.50
193668	8-12	16.25	8	5	50	16	5	11	114	71	138	10	4	8	5	1.00	2.00
193669	12-16	8.09	5	5	50	9	5	14	67	32	104	10	3	4	5	0.50	1.00
193670	16-20	13.27	6	5	50	9	5	16	87	33	50	10	4	4	5	0.50	1.00
193677	44-48	7.79	52	31	50	107	21	74	244	330	50	10	8	19	5	2.00	4.50
193678	48-52	4.53	9	22	50	102	25	84	118	550	60	10	8	17	15	1.50	3.50
193679	52-56	4.25	5	13	50	171	21	72	120	505	75	10	6	19	5	1.50	3.50
193680	56-60	4.72	6	21	50	122	23	72	108	665	1560	10	8	20	5	1.50	3.00
193688	88-92	3.13	4	22	50	86	16	109	252	528	1750	10	3	12	5	1.50	3.50
193689	92-96	4.15	3	39	50	84	21	86	216	462	3950	10	7	18	8	1.50	3.00
193690	96-100	4.29	3	41	50	85	21	82	186	463	2430	10	3	18	5	1.50	3.50

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	GW 16	1:100 000 Map	5837
Traverse		UnitNo	390
Station		Max Depth (m)	100.00
Completion Date	19/08/96	Drilling Method	RCP
Dip at Collar	-60.00	AMG Easting	476698
Azimuth at Collar	270.00	AMG Northing	6646212
Logged By	J HOUGH	Zone	53
		Depth to Bsmt	4

Comments

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.55	36.0	CALCRETE	Buff and red purple calcrete
2.00	4.00	0.17	36.0	CALCRETE	Orange pisolitic calcrete
4.00	6.00	0.46	36.0	BIF	BIF with silcrete tan with red Feox fragments and maghemite fragments
6.00	8.00	0.96	36.0	BIF	Tan Mt- BIF
8.00	10.00	0.53	24.7	BIF	Grey BIF, choc brown goethitic.
10.00	12.00	0.99	24.7	BIF	BIF 2mm bands purple red cryptocryst interlaminated wi white siliceous material goethitic.Calcareous
12.00	14.00	0.65	24.7	BIF	Goethitic BIF with occ fragments cryptocryst qtz?
14.00	16.00	0.55	24.7	BIF	Bleached BIF as above plus pink and white cherty fragments .
16.00	18.00	0.94	28.1	BIF	Wthd Mt-BIF and wthd goethite dk yell brown.
18.00	20.00	0.63	28.1	BIF	Wthd BIF bleached as above
20.00	22.00	2.61	28.1	BIF	Wth BIF, pink grey brown goethitic, c/c cherty .
22.00	24.00	0.42	28.1	BIF	BIF dk grey with chert bands & grey purple bands c/c.
24.00	26.00	21.50	43.3	BIF	BIF wthrd wi 1mm dark grey layers, with white clay , y b goethite
26.00	28.00	2.19	43.3	BIF	BIF wth choc brown and cherty Mt fragments as above
28.00	30.00	1.67	36.2	BIF	As above with Magnetite
30.00	32.00	0.48	36.2	BIF	BIF wthrd wi 1mm bands yb goethitic in parts cherty c/c
32.00	34.00	5.60	29.8	BIF	BIF Mt-Cht interlaminae
34.00	36.00	24.00	29.8	BIF	Very finely banded Mt BIF silver grey Mt and dark purple grey c/c chert interlaminae.
36.00	38.00	44.70	28.5	BIF	As above with ?hypersthene BIF
38.00	40.00	9.45	28.5	BIF	Mt BIF and dark grey basic cryptocryst ?hypersthene
40.00	42.00	39.30	38.2	BIF	BIF microscopic bands 1mm I/P other fragments include Mt blue silver grey.
42.00	44.00	311.00	38.2	BIF	Blue silver grey magnetite microcryst no visible banding, fresh .
44.00	46.00	361.00	37.8	BIF	As above
46.00	48.00	354.00	37.8	BIF	BIF silver grey and dark grey ext finely laminae 25mm
48.00	50.00	297.00	33.9	BIF	As above
50.00	52.00	287.00	33.9	BIF	As above with occ purp patches
52.00	54.00	377.00	42.1	BIF	As above
54.00	56.00	371.00	42.1	BIF	Mt BIF dark grey and silver grey fresh
56.00	58.00	395.00	46.9	BIF	Mt BIF as above no visible laminae in chips
58.00	60.00	358.00	46.9	BIF	Mt BIFgrey and light grey i/p bleached?
60.00	62.00	377.00	35.4	BIF	Mt bleached in parts. Red purple banding. Single pyrite crystal visible.
62.00	64.00	234.00	35.4	BIF	BIF grey to light silver grey.
64.00	66.00	311.00	36.0	BIF	BIF grey to ple grey white interlaminae, bleached appearance
66.00	68.00	263.00	36.0	BIF	BIF grey and grey purple layers 1-2mm banding white bleaching in parts.
68.00	70.00	230.00	20.7	BIF	As above

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
70.00	72.00	75.80	20.7	BIF	Pale green Mt BIF with a almost gneissic fabric
72.00	74.00	73.60	13.1	BIF	Pale grey cherty BIF no banding
74.00	76.00	68.50	13.1	BIF	Mt? gneiss? pale grey
76.00	78.00	73.40	13.3	BIF	Pale grey cherty c/c BIF
78.00	80.00	83.80	13.3	BIF	As above
80.00	82.00	211.00	24.9	BIF	Pale grey cherty Mt- BIF.
82.00	84.00	200.00	24.9	BIF	Grey MT with no visible layering
84.00	86.00	268.00	31.4	BIF	BIF grey and red purple cherty c/c
86.00	88.00	243.00	31.4	BIF	Mt pale grey no visible banding
88.00	90.00	192.00	31.7	BIF	Mt dark and grey cryptocrystalline
90.00	92.00	374.00	31.7	BIF	Mt grey and dark grey and red purple in parts.
92.00	94.00	309.00	25.4	BIF	BIF/Talc- grey purple grey BIF and large greasy talc frags
94.00	96.00	76.40	25.4	BIF	BIF/Talc grey pale greasy
96.00	98.00	72.40	26.8	BIF	BIF/Talc pale grey green
98.00	100.00	262.00	26.8	BIF	Pale grey greasy feel vry fine banding.

AVG
42-100m 300

GW 16

Sample No	Interval	Fe %	FE2O3 %	SiO2 %	AL2O3 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb
193714	32-36	29.84	42.63	43.00	4.69	0.80	0.10	0.91	1.90	6.05	0.06	0.17	0.20	0.01	5.00
193715	36-40	28.53	40.75	40.30	3.22	0.36	0.20	4.30	4.71	4.45	0.17	0.48	0.09	0.01	4.00
193716	40-44	38.19	54.55	35.90	0.78	0.04	0.08	3.94	2.73	2.10	0.08	0.23	0.02	0.01	1.00
193717	44-48	37.77	53.95	42.30	0.38	0.02	0.05	2.09	1.72	0.01	0.09	0.14	0.01	0.03	1.00
193718	48-52	33.87	48.39	35.30	1.81	0.03	0.07	6.02	6.43	1.27	0.17	0.36	0.06	0.09	1.00
193719	52-56	42.14	60.20	35.10	0.26	0.01	0.05	2.30	3.04	0.01	0.08	0.10	0.01	0.01	2.00
193720	56-60	46.87	66.95	27.10	0.31	0.01	0.05	3.01	4.01	0.01	0.08	0.15	0.02	0.06	5.00
193721	60-64	35.40	50.57	22.00	0.44	0.01	0.05	10.61	8.78	7.40	0.19	0.23	0.02	0.01	2.00
193722	64-68	36.00	51.43	38.40	0.37	0.01	0.05	3.11	5.64	0.36	0.10	0.13	0.01	0.01	1.00
193723	68-72	20.70	29.57	23.80	3.12	0.01	0.05	16.33	12.23	14.33	0.17	0.29	0.11	0.08	1.00
193724	72-76	13.15	18.78	12.50	3.46	0.01	0.05	23.43	14.37	26.93	0.18	0.42	0.12	0.10	8.00
193725	76-80	13.34	19.06	27.10	2.07	0.03	0.07	19.76	15.41	16.65	0.21	0.43	0.05	0.03	2.00
193726	80-84	24.88	35.54	38.30	2.13	0.03	0.12	7.28	14.09	2.09	0.22	0.24	0.07	0.04	1.00
193727	84-88	31.36	44.80	38.10	1.48	0.03	0.08	2.65	11.65	1.11	0.19	0.13	0.05	0.01	2.00
193728	88-92	31.69	45.27	39.10	2.14	0.04	0.07	2.02	9.60	1.20	0.11	0.11	0.08	0.04	3.00

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Cr ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	W ppm	Pt ppb	Pd ppb
193709	0-8	3.60	3	6	50	13	5	12	119	47	246	10	3	4	5	0.50	1.00
193710	8-16	24.65	2	5	50	52	5	13	61	170	199	10	8	13	5	0.50	1.00
193711	16-24	28.07	2	5	50	49	5	15	52	259	107	10	3	4	5	0.50	0.50
193712	24-28	43.30	2	5	50	33	5	10	99	530	80	10	9	5	14	0.50	0.50
193713	28-32	36.20	3	13	50	48	5	19	35	829	56	10	5	5	5	0.50	1.50
193729	92-96	25.44	3	5	50	52	10	44	145	663	63	10	9	8	8	1.00	2.50
193730	96-100	26.75	1	5	50	41	6	33	109	242	50	10	3	5	5	0.50	1.50

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name GW 17
Traverse
Station
Completion Date 20/08/96
Dip at Collar -60.00
Azimuth at Collar 270.00
Logged By J HOUGH

1:100 000 Map 5837
UnitNo 391
Max Depth (m) 100.00
Drilling Method RCP
AMG Easting 476821
AMG Northing 6646201
Zone 53
Depth to Bsmt 4

Comments

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	1.18	3.7	SILCRETE	Buff silcrete and Festone boulders
2.00	4.00	2.26	3.7	CALCRETE	Buff calcrete
4.00	6.00	0.27	3.7	SILT	Pink and buff silt with red wthd material
6.00	8.00	0.19	3.7	SILT	As above
8.00	10.00	0.09	15.9	CLAY	As above
10.00	12.00	0.00	15.9	CLAY	Off white to buff non gritty clay
12.00	14.00	0.04	15.9	CLAY	Clay tan non gritty
14.00	16.00	0.06	15.9	CLAY	Yellow tan non gritty clay
16.00	18.00	0.05	11.4	CLAY	As above
18.00	20.00	0.14	11.4	CLAY	Yellow brown and red brown non gritty
20.00	22.00	0.11	11.4	CLAY	Yellow tan and red brown non gritty
22.00	24.00	0.11	11.4	CLAY	Tan slightly gritty clay
24.00	26.00	0.13	23.6	CLAY	Tan to pale brown non gritty clay
26.00	28.00	0.19	23.6	CLAY	Brown sl gritty clay
28.00	30.00	0.22	23.6	CLAY	Brown yellow brown and white lenses almost soil like
30.00	32.00	0.11	23.6	CLAY	Purple red brown and yellow brown micaceous clay
32.00	34.00	0.07	6.8	CLAY	Pink and light tan n g clay
34.00	36.00	0.05	6.8	CLAY	Tan micaceous n g clay
36.00	38.00	0.07	6.8	CLAY	Tan with orange tan lenses micaceous n g clay
38.00	40.00	0.11	6.8	CLAY	Tan micaceous non gritty clay with occ white frags clay
40.00	42.00	0.39	6.6	CLAY	Ol gm , tan red brown friable clay
42.00	44.00	0.11	6.6	CLAY	Ol gm Mt- BIF wthrd
44.00	46.00	0.16	8.8	BIF	Clay with BIF olive green microcryst wthd
46.00	48.00	0.20	8.8	CLAY	Clay with large banded iron fragments.
48.00	50.00	0.58	28.0	CLAY	Choc brown olive green, friable clay with rare BIF fragments
50.00	52.00	0.54	28.0	CLAY	Tan gritty clay with no BIF fragments
52.00	54.00	0.20	8.8	CLAY	Olive green clay with rare c/c BIF wthd fragments
54.00	56.00	17.00	8.8	CLAY	As above
56.00	58.00	0.18	4.5	CLAY	As above
58.00	60.00	0.15	4.5	CLAY	As above
60.00	62.00	0.13	9.1	CLAY	As above
62.00	64.00	0.26	9.1	CLAY	As above
64.00	66.00	0.28	10.3	CLAY	Olive green clay /BIF with grey olive green hypersthene microcrystalline
66.00	68.00	0.32	10.3	CLAY	As above
68.00	70.00	0.28	7.9	CLAY	As above
70.00	72.00	0.32	7.9	CLAY	As above with Fe staining
72.00	74.00	0.21	14.2	CLAY	As above

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
74.00	76.00	0.27	14.2	BIF	Wthrd BIF and clay, olive green .Generally poor magnetic response.
76.00	78.00	0.28	8.9	BIF	As above
78.00	80.00	0.18	8.9	BIF	Olive green BIF with olive green hypersthene limonitic fractured.
80.00	82.00	0.25	5.1	BIF	Green grey to grey BIF with bands hypersthene
82.00	84.00	0.29	5.1	BIF	Hard dark grey BIF with occ qtz veins .
84.00	86.00	0.30	4.0	BIF	Dark grey microcryst Mt BIF with hypersthene
86.00	88.00	0.39	4.0	BIF	BIF as above microcrystalline
88.00	90.00	1.30	5.3	BIF	Grey hard c/c hypersthene BIF no visible banding , cherty.
90.00	92.00	0.84	5.3	BIF	as above
92.00	94.00	1.84	3.9	BIF	Dark grey hard cyptocrystalline Mt BIF cherty
94.00	96.00	1.30	3.9	BIF	as above
96.00	98.00	0.85	4.4	BIF	Darker grey c/c cherty Mt BIF
98.00	100.00	2.26	4.4	BIF	As above

Sample No	Interval	Fe %	FE2O3 %	SiO2 %	AL2O3 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb
193745	76-80	8.91	12.73	57.20	15.50	2.49	1.36	0.85	2.26	6.90	0.37	0.07	0.48	0.01	5.00
193746	80-84	5.14	7.34	66.70	14.80	4.66	0.56	0.55	2.21	2.74	0.20	0.04	0.37	0.01	3.00
193747	84-88	4.03	5.75	69.80	14.50	4.52	0.31	0.36	1.91	1.71	0.14	0.02	0.33	0.01	3.00
193748	88-92	5.26	7.51	66.40	14.70	4.11	0.87	0.75	2.33	2.66	0.19	0.05	0.36	0.02	12.00
193749	92-96	3.86	5.52	68.90	15.00	4.76	0.48	0.45	1.99	1.69	0.12	0.02	0.33	0.03	2.00
193750	96-100	4.38	6.25	65.20	14.60	3.53	1.23	4.03	2.12	2.71	0.14	0.08	0.33	0.01	7.00

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Cr ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	W ppm	Pt ppb	Pd ppb
193731	0-8	3.75	2	5	50	19	5	17	117	93	174	10	4	5	5	0.50	1.00
193732	8-16	1.59	2	11	74	32	5	26	119	75	218	10	3	24	11	0.50	0.50
193733	16-24	11.41	4	50	50	133	14	59	137	505	137	10	7	30	5	1.00	2.00
193734	24-32	23.61	8	134	50	410	35	131	106	946	138	10	10	23	5	2.50	5.00
193735	32-40	6.79	6	44	50	165	16	126	256	281	162	10	9	27	11	1.00	2.50
193736	40-44	6.57	6	37	50	207	16	127	116	309	83	10	7	28	8	1.00	2.00
193737	44-48	8.76	5	40	50	195	15	106	140	579	50	10	7	24	9	1.00	2.50
193738	48-52	27.97	9	20	50	147	26	117	83	4080	50	10	12	14	5	2.50	5.50
193739	52-56	8.79	5	14	50	101	14	63	106	538	50	10	6	19	10	1.50	3.50
193740	56-60	4.54	2	9	57	59	8	31	80	482	50	10	4	20	5	1.00	2.00
193741	60-64	9.07	8	18	50	132	15	55	117	553	50	10	3	19	5	1.50	3.50
193742	64-68	10.29	24	10	50	142	13	56	110	586	50	10	3	21	5	1.50	3.50
193743	68-72	7.86	17	24	50	109	12	61	125	365	50	10	3	20	5	1.50	3.50
193744	72-76	14.22	6	51	50	132	14	45	118	1020	50	10	3	10	9	1.50	3.50

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	GW 18	**1:100 000 Map**	5837
Traverse	7800	**UnitNo**	392
Station	7700	**Max Depth (m)**	12.00
Completion Date	21/08/96	**Drilling Method**	RCP
Dip at Collar	-60.00	**AMG Easting**	477700
Azimuth at Collar	270.00	**AMG Northing**	6647807
Logged By	J HOUGH	**Zone**	53
		Depth to Bsmt	

Comments

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.24	2.3	SAND	Red brn surfical sands with calc pisolites
2.00	4.00	0.42	2.3	SAND	Sand red brown with red brown pisolitic maghemite pebbles
4.00	6.00	0.14	2.3	SAND	Sand as above
6.00	8.00	0.08	2.3	SAND	Sand as above into quartzose well rounded poorly sorted sand
8.00	10.00	0.07	1.3	SAND	Sand orange quartzose well rounded and rel well sorted
10.00	12.00	0.18	1.3	SAND	Sand/gravel buff qtzose white and blue grey coarse well rounded and sorted.

GW 18

Sample No	Interval	Fe %	FE2O3 %	SiO2 %	AL2O3 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Cr ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	W ppm	Pt ppb	Pd ppb
193751	0-8	2.25	3	8	50	24	5	13	62	53	141	10	3	9	5	0.50	0.50
193752	8-12	1.25	3	6	50	15	5	13	233	30	97	10	3	4	5	0.50	0.50

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	GW 19	**1:100 000 Map**	5837
Traverse	7800	**UnitNo**	393
Station	7800	**Max Depth (m)**	57.00
Completion Date	21/08/96	**Drilling Method**	RCP
Dip at Collar	-60.00	**AMG Easting**	477796
Azimuth at Collar	270.00	**AMG Northing**	6647811
Logged By	J HOUGH	**Zone**	53
		Depth to Bsmt	28

Comments

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.80	2.4	SAND	Sand red brown surfical coarse grained
2.00	4.00	0.16	2.4	SAND	Sand red brown and purple with r b silcreted maghemite pisoliths
4.00	6.00	0.17	2.4	SAND	Sand red brown purple with pebs as above
6.00	8.00	0.13	2.4	SAND	Sand orange with red white and purple silcreted fragments
8.00	10.00	0.06	.8	SAND	Sand orange med-coarse grained with red white purple silcrete C Mt fragments
10.00	12.00	0.05	.8	SAND	Sand/Gravel med -coarse tan, qtzose blue and white grey well rounded mod STD
12.00	14.00	0.06	.8	SAND	Gravel white buff qtzose well std subrounded algebuckina
14.00	16.00	0.10	.8	GRAVEL	Gravel as above into hard buff white silcrete band into white clay
16.00	18.00	0.05	.5	GRAVEL	Clay white gritty with occ silcreted fragments
18.00	20.00	0.44	.5	CLAY	Clay as above white qtzose
20.00	22.00	0.09	.5	CLAY	Clay as above
22.00	24.00	0.14	.5	CLAY	Clay as above
24.00	26.00	0.41	5.2	CLAY	Clay as above
26.00	28.00	0.57	5.2	CLAY	Clay as above
28.00	30.00	0.33	5.2	CLAY	White clay as above into choc red purple and yellow brown clay weathered BIF
30.00	32.00	0.64	5.2	CLAY	Blue grey and yellow brown weathered BIF and purple clay from BIF
32.00	34.00	1.03	43.2	CLAY	wthd BIF as above
34.00	36.00	1.09	43.2	BIF	wthd BIF red purple and fragments
36.00	38.00	0.05	43.2	BIF	Clay limonitic yellow brown wthd BIF no BIF fragments not gritty
38.00	40.00	0.09	43.2	CLAY	Clay as above not gritty
40.00	42.00	0.06	16.0	CLAY	as above not gritty
42.00	44.00	0.14	16.0	CLAY	clay yellow brown and olive green no fragments non gritty
44.00	46.00	0.21	32.7	CLAY	clay as above not gritty
46.00	48.00	10.50	32.7	CLAY	as above into choc clay with purple grey BIF 47m BIF fragments and clay of same
48.00	50.00	9.33	42.1	CLAY	Clay and BIF fragments yellow brown and grey and choc purple, brown
50.00	52.00	6.46	42.1	BIF	BIF fragments and clay fragments as above and silver blue Mt plus cherty fragments , fragments magnetic
52.00	54.00	4.37	44.5	BIF	BIF fragments as above plus choc purple brown clay of same
54.00	56.00	6.49	44.5	BIF	BIF and clay choc brown purple clay of same wthd BIF
56.00	57.00	0.76	23.5	CLAY	clay olive tan and choc brown and purple clay no BIF fragments wthd BIF

Sample No	Interval	Fe %	FE2O3 %	SiO2 %	AL2O3 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb
193756	24-32	5.22	7.45	78.30	10.10	0.06	0.05	0.04	0.06	3.52	0.01	0.01	0.33	0.01	2.00
193757	32-36	43.18	61.68	31.90	2.11	0.01	0.05	0.06	0.14	4.21	0.17	0.14	0.10	0.01	2.00
193758	36-40	20.41	29.15	29.80	22.80	0.83	0.06	0.17	0.57	13.28	0.41	0.17	2.53	0.02	2.00
193759	40-44	16.00	22.86	33.90	24.30	2.15	0.06	0.21	0.92	11.46	0.30	0.19	2.66	0.01	3.00
193760	44-48	32.74	46.77	24.20	14.20	0.93	0.07	0.26	0.62	11.25	0.35	0.29	1.52	0.01	2.00
193761	48-52	42.09	60.13	35.60	1.36	0.02	0.05	0.06	0.09	2.87	0.11	0.08	0.09	0.01	1.00
193762	52-56	44.46	63.51	17.60	5.72	0.10	0.07	0.31	0.60	11.53	0.31	0.33	0.22	0.01	16.00

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Cr ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	W ppm	Pt ppb	Pd ppb
193753	0-8	2.40	2	12	50	31	5	15	147	81	142	10	3	5	5	0.50	1.00
193754	8-16	0.85	1	5	50	12	5	10	105	28	88	10	3	4	5	0.50	0.50
193755	16-24	0.50	2	5	50	13	5	12	205	48	130	10	3	5	5	0.50	0.50
193763	56-57	23.49	2	16	50	590	31	37	15	2190	50	10	13	4	21	0.50	1.00

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name GW 20
Traverse 7400N
Station
Completion Date 25/08/96
Dip at Collar -60.00
Azimuth at Collar 270.00
Logged By M DAVIES

1:100 000 Map 5837
UnitNo 394
Max Depth (m) 100.00
Drilling Method RCP
AMG Easting 477317
AMG Northing 6647355
Zone 53
Depth to Bsmt 2

Comments Redox boundary at 42 m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.42	35.1	COLLUVIUM	Colluvium cobbles to pebble size of BIF, minor clay red brown
2.00	4.00	115.00	35.1	BIF	Goethite dark g, vitreous, Hematite, goethitic, minor CHT goethitic, trace clay
4.00	6.00	184.00	44.3	BIF	Goethite as above, Hematite as above, trace clay and trace CHT as above
6.00	8.00	106.00	44.3	BIF	Goethite as above, and BIF denatured, minor clay
8.00	10.00	154.00	51.7	BIF	BIF of Cht Hematite, v goethitic hematitic
10.00	12.00	85.50	51.7	BIF	BIF as above dark yellow-brown , trace of clay brown
12.00	14.00	125.00	60.4	BIF	as above
14.00	16.00	228.00	60.4	BIF	BIF as above very dark brown
16.00	18.00	271.00	62.8	BIF	as above
18.00	20.00	110.00	62.8	BIF	as above
20.00	22.00	58.60	52.0	BIF	as above
22.00	24.00	1.41	52.0	BIF	BIF, dark yellow-brown of Cht-Hematite-goethite (yellow ochreous) minor clay
24.00	26.00	3.25	47.7	BIF	BIF as above minor clay y limonitic
26.00	28.00	7.89	47.7	BIF	BIF pl green of amphibole-Cht-Hem
28.00	30.00	5.38	37.2	BIF	as above
30.00	32.00	13.00	37.2	BIF	as above
32.00	34.00	14.50	44.2	BIF	as above
34.00	36.00	21.30	44.2	BIF	as above
36.00	38.00	12.70	32.2	BIF	as above
38.00	40.00	9.90	32.2	BIF	as above
40.00	42.00	23.50	43.1	BIF	as above
42.00	44.00	90.40	43.1	BIF	BIF, dark green of amphibole-Mt-Cht, massive, porous, soft to med hard
44.00	46.00	427.00	31.5	BIF	BIF, as above, rare granite c g pink
46.00	48.00	478.00	31.5	BIF	BIF as above
48.00	50.00	331.00	51.4	BIF	BIF, as above, increase in amphibole pl grn
50.00	52.00	194.00	51.4	BIF	BIF as above, lesser granite c g pink of qutz, feldspar, fresh
52.00	54.00	311.00	36.2	BIF	BIF med g, of Cht-Mt - amphibole weakly calcareous, well laminated
54.00	56.00	281.00	36.2	BIF	as above
56.00	58.00	281.00	34.1	BIF	as above
58.00	60.00	246.00	34.1	BIF	BIF as above
60.00	62.00	242.00	37.8	BIF	as above
62.00	64.00	263.00	37.8	BIF	as above
64.00	66.00	262.00	36.4	BIF	BIF as above, trace Pyrite
66.00	68.00	249.00	36.4	BIF	BIF as above
68.00	70.00	235.00	35.0	BIF	as above
70.00	72.00	244.00	35.0	BIF	as above
72.00	74.00	227.00	27.3	BIF	as above

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
74.00	76.00	103.00	27.3	GRANITE	Granite, pink of qtz-felds, lesser BIF as above
76.00	78.00	226.00	35.5	BIF	BIF as above
78.00	80.00	263.00	35.5	BIF	BIF as above trace, calcite vein
80.00	82.00	289.00	29.5	BIF	as above
82.00	84.00	212.00	29.5	METASEDIMENT	Metapsammite, g with minor pyrite trace BIF as above
84.00	86.00	4.05	19.7	METASEDIMENT	Metapsammite as above, trace Pyrite
86.00	88.00	262.00	19.7	BIF	BIF as above, trace Pyrite, minor Metapsammite as above with trace Pyrite
88.00	90.00	362.00	39.7	BIF	BIF as above poorly laminated
90.00	92.00	213.00	39.7	BIF	BIF as above with trace vein ct
92.00	94.00	138.00	27.6	BIF	as above
94.00	96.00	78.20	27.6	BIF	BIF as above, chertier, also with trace vein Ct
96.00	98.00	222.00	29.5	BIF	BIF as above, rare vein Ct
98.00	100.00	168.00	29.5	BIF	BIF,as above, increase in talc?

44-100 Af. 269

GW 20

Sample No	Interval	Fe %	FE2O3 %	SiO2 %	AL2O3 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb
193769	20-24	51.95	74.22	12.10	4.15	0.02	0.05	0.12	0.12	9.40	0.15	0.13	0.12	0.05	8.00
193770	24-28	47.71	68.16	20.40	2.20	0.04	0.08	0.74	1.27	7.47	0.12	0.15	0.05	0.01	6.00
193771	28-32	37.16	53.08	29.00	2.40	0.12	0.23	2.61	3.90	7.02	0.06	0.77	0.09	0.01	3.00
193772	32-36	44.22	63.17	24.70	1.67	0.11	0.18	2.87	2.67	4.15	0.21	0.58	0.05	0.01	1.00
193773	36-40	32.20	46.00	33.80	3.03	0.24	0.32	4.88	5.36	4.70	0.27	1.19	0.17	0.01	5.00
193774	40-44	43.13	61.62	22.80	3.26	0.26	0.33	4.48	4.55	2.81	0.16	0.36	0.14	0.01	3.00
193775	44-48	31.54	45.06	38.50	3.25	0.36	0.36	5.42	4.84	1.28	0.19	0.28	0.17	0.48	5.00
193776	48-52	51.39	73.42	16.10	2.34	0.17	0.17	5.48	3.43	0.01	0.10	0.25	0.08	0.15	4.00
193777	52-56	36.18	51.69	44.90	0.25	0.01	0.07	1.75	2.06	0.01	0.09	0.05	0.01	0.12	5.00
193778	56-60	34.15	48.78	45.70	0.13	0.01	0.09	3.09	2.21	0.01	0.17	0.05	0.01	0.12	4.00
193779	60-64	37.81	54.01	42.40	0.12	0.01	0.06	1.59	2.19	0.01	0.11	0.06	0.01	0.15	6.00
193780	64-68	36.44	52.05	44.50	0.27	0.01	0.06	1.57	2.35	0.01	0.05	0.06	0.01	0.31	4.00
193781	68-72	34.95	49.93	46.80	0.09	0.01	0.06	1.57	2.20	0.01	0.09	0.03	0.01	0.37	5.00
193782	72-76	27.29	38.98	49.30	3.56	1.12	1.13	2.50	2.63	0.79	0.14	0.08	0.03	0.95	46.00
193783	76-80	35.50	50.71	45.60	0.09	0.01	0.05	1.75	2.37	0.01	0.09	0.04	0.01	0.12	2.00
193784	80-84	29.53	42.18	48.90	2.36	0.12	0.34	1.16	3.41	1.19	0.09	0.05	0.31	4.00	8.00
193785	84-88	19.66	28.08	45.60	9.98	0.30	2.75	2.84	5.92	2.10	0.13	0.19	1.32	4.49	14.00

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Cr ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	W ppm	Pt ppb	Pd ppb
193764	0-4	35.10	4	5	50	47	5	10	69	1170	319	10	3	12	23	0.50	1.00
193765	4-8	44.30	18	5	50	39	5	10	69	2070	72	10	8	4	5	0.50	1.00
193766	8-12	51.70	6	5	50	65	5	10	16	3490	68	10	6	4	5	0.50	0.50
193767	12-16	60.40	6	5	50	78	5	10	14	3760	62	10	3	4	13	0.50	0.50
193768	16-20	62.80	4	5	50	79	5	10	15	3360	70	10	3	5	23	0.50	1.00
193786	88-92	39.70	3	5	50	41	5	10	84	992	315	10	3	4	5	0.50	0.50
193787	92-96	27.61	1	5	50	35	5	10	90	375	58	10	3	4	5	0.50	0.50
193788	96-100	29.46	2	5	50	35	5	10	137	310	325	10	4	6	44	0.50	0.50

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	GW 21	**1:100 000 Map**	5837
Traverse	7400N	**UnitNo**	395
Station		**Max Depth (m)**	100.00
Completion Date	26/08/96	**Drilling Method**	RCP
Dip at Collar	-60.00	**AMG Easting**	477315
Azimuth at Collar	270.00	**AMG Northing**	6647453
Logged By	M DAVIES	**Zone**	53
		Depth to Bsmt	10

Comments Redox boundary at 52 m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	1.21	2.4	SOIL	Clay pl r, fine sandy weakly cemented. Scree of BIF
2.00	4.00	4.38	2.4	SOIL	Clay pl yellow red, fine sandy, weakly cemented, trace Scree of BIF
4.00	6.00	0.39	2.4	SAND	Sand, fine to med , clayey, weakly cemented
6.00	8.00	0.53	2.4	CLAY	Clay, w sandy f to c, weakly cemented
8.00	10.00	0.29	13.3	CLAY	Clay, pl brn to white, sandy, weakly cemented
10.00	12.00	0.65	13.3	CLAY	Clay as above and CHt, very goethitic, lesser goethite
12.00	14.00	0.42	13.3	CLAY	Clay pl brn, minor CHT as above and minor goethite y-brn vitreous
14.00	16.00	0.33	13.3	CLAY	Clay yellow , limonitic trace goethite as above, trace goethitic CHT as above (dpth weathered basm)
16.00	18.00	0.14	20.7	CLAY	Clay as above trace CHT as above
18.00	20.00	0.28	20.7	CLAY	as above
20.00	22.00	0.10	20.7	CLAY	Clay pl yellow
22.00	24.00	0.11	20.7	CLAY	clay pl yellow-brown
24.00	26.00	0.33	8.7	CLAY	clay pl brown
26.00	28.00	0.13	8.7	CLAY	clay pl brown
28.00	30.00	0.13	8.7	CLAY	clay pl brown
30.00	32.00	0.10	8.7	CLAY	Clay pl yellow-brown
32.00	34.00	0.15	14.6	CLAY	clay yellow-brown
34.00	36.00	1.53	14.6	CLAY	Clay y-brown trace CHT
36.00	38.00	6.01	36.6	BIF	BIF, dk brn of Cht goethite-hematite, minor clay as above
38.00	40.00	8.84	36.6	BIF	BIF dark brown as above
40.00	42.00	28.80	39.3	BIF	BIF as above
42.00	44.00	7.25	39.3	BIF	BIF as above, trace clay as above
44.00	46.00	17.70	36.1	BIF	as above
46.00	48.00	9.01	36.1	BIF	as above
48.00	50.00	15.50	36.8	BIF	as above
50.00	52.00	17.30	36.8	BIF	as above
52.00	54.00	81.00	35.1	BIF	BIF as above, trace BIF, of Mt-amphibole-Cht, massive soft, med hard
54.00	56.00	229.00	35.1	BIF	BIF dk g of Mt-amphibole-Cht, massive, porous soft to med hard, weakly calcareous, trace Pyrite, trace Metapelite
56.00	58.00	190.00	35.0	BIF	BIF, as above, with veins of Ct and Pyrite, minor Metapelite med g
58.00	60.00	354.00	35.0	BIF	BIF dark g of Cht-Mt poorly laminated, weakly calc mod hard to hard
60.00	62.00	269.00	34.9	BIF	BIF dkg of Cht-Mt as above, trace Pyrite
62.00	64.00	198.00	34.9	BIF	BIF, dk grn-g of Cht-amphibole-Mt-trace Pyrite, massive mod hd to soft porous tr Metapelite
64.00	66.00	150.00	29.9	BIF	BIF as above trace metapelite, g-grn massive
66.00	68.00	289.00	29.9	BIF	BIF, dkg of Cht-Mt-trace Pyrite, rare Ct
68.00	70.00	177.00	13.3	METAMUDSTONE	Metapelite/Dt? dk grn g with trace Ct, trace BIF, dk g as above, trace Ct veining
70.00	72.00	5.95	13.3	METASEDIMENT	Metaspammite g (or Dt very fine grained)

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
72.00	74.00	1.74	8.4	METASEDIMENT	as above
74.00	76.00	1.77	8.4	METASEDIMENT	as above
76.00	78.00	0.86	8.4	METASEDIMENT	as above
78.00	80.00	1.07	8.4	METASEDIMENT	as above
80.00	82.00	1.00	8.0	METASEDIMENT	as above
82.00	84.00	1.11	8.0	METASEDIMENT	as above
84.00	86.00	1.37	8.0	METASEDIMENT	as above
86.00	88.00	1.55	8.0	METASEDIMENT	as above
88.00	90.00	2.07	7.8	METASEDIMENT	as above
90.00	92.00	1.90	7.8	METASEDIMENT	as above
92.00	94.00	1.89	7.8	METASEDIMENT	as above
94.00	96.00	1.41	7.8	METASEDIMENT	as above rare Pyrite
96.00	98.00	1.14	9.0	METASEDIMENT	as above
98.00	100.00	1.70	9.0	METASEDIMENT	as above

232
54-70m.

Sample No	Interval	Fe %	FE2O3 %	SiO2 %	AL2O3 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb
193794	36-40	36.62	52.31	42.70	1.21	0.04	0.05	0.12	0.24	3.86	0.07	0.04	0.03	0.01	49.00
193795	40-44	39.28	56.12	40.30	0.64	0.02	0.05	0.09	0.21	2.81	0.04	0.03	0.02	0.01	19.00
193796	44-48	36.05	51.50	40.20	1.30	0.07	0.08	0.37	0.71	4.75	0.04	0.36	0.04	0.01	25.00
193797	48-52	36.80	52.57	40.40	1.16	0.06	0.05	0.38	0.60	3.80	0.05	0.17	0.03	0.01	30.00
193798	52-56	35.06	50.08	40.60	1.59	0.09	0.07	2.11	2.29	2.57	0.06	0.11	0.05	0.09	14.00
193799	56-60	34.97	49.96	39.40	0.91	0.02	0.05	4.05	2.36	1.56	0.05	0.09	0.03	1.74	15.00
193800	60-64	34.86	49.80	41.20	0.64	0.01	0.05	4.88	3.31	0.01	0.07	0.18	0.02	1.27	105.00
193801	64-68	29.90	42.72	41.80	1.98	0.21	0.16	6.57	4.65	0.23	0.13	0.25	0.06	1.77	14.00
193802	68-72	13.26	18.94	51.50	10.50	1.67	0.80	2.63	7.41	3.72	0.13	0.27	1.39	1.03	24.00
193806	96-100	9.00	12.85	57.70	12.60	2.76	1.75	3.82	3.30	2.20	0.17	0.16	2.34	0.46	9.00

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Cr ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	W ppm	Pt ppb	Pd ppb
193789	0-8	2.41	5	9	50	25	5	15	149	82	319	10	3	5	5	0.50	1.00
193790	8-16	13.28	9	9	50	49	8	21	111	220	127	10	3	6	5	0.50	1.00
193791	16-24	20.72	8	12	64	214	36	17	42	1370	139	10	3	4	5	0.50	1.00
193792	24-32	8.74	4	16	50	154	31	47	128	1110	132	10	3	6	11	1.00	2.00
193793	32-36	14.57	13	7	50	125	17	21	47	1010	76	10	5	5	5	1.00	2.00
193803	72-80	8.43	14	5	62	221	36	10	58	1580	788	10	4	5	5	0.50	0.50
193804	80-88	7.97	9	5	50	139	37	10	75	1500	2110	10	3	5	5	0.50	0.50
193805	88-96	7.80	7	7	50	128	30	10	47	1150	2520	10	3	6	10	0.50	0.50

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	GW 22	**1:100 000 Map**	5837
Traverse	7400N	**UnitNo**	396
Station		**Max Depth (m)**	12.00
Completion Date	26/08/96	**Drilling Method**	RCP
Dip at Collar	-60.00	**AMG Easting**	477512
Azimuth at Collar	270.00	**AMG Northing**	6647355
Logged By	M DAVIES	**Zone**	53
		Depth to Bsmt	

Comments Hole abandoned due to flowing sands at 6-12m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.60		SANDSTONE	Sandstone, clayey, fine to very fine med well cemented pl pink
2.00	4.00	1.10		SANDSTONE	Sandstone as above
4.00	6.00	0.22		SANDSTONE	as above
6.00	8.00	0.25		SANDSTONE	Sand, med to fine, trace c, pale yellow-red consolidated
8.00	10.00	0.20		SANDSTONE	Sandstone, clayey as above pale yellow
10.00	12.00	0.13		SANDSTONE	as above pale yellow

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	GW 23	**1:100 000 Map**	5837
Traverse		**UnitNo**	397
Station		**Max Depth (m)**	52.00
Completion Date	26/08/96	**Drilling Method**	RCP
Dip at Collar	-60.00	**AMG Easting**	477222
Azimuth at Collar	270.00	**AMG Northing**	6647364
Logged By	M DAVIES	**Zone**	53
		Depth to Bsmt	0

Comments Redox boundary at 32 m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.24	14.4	BIF	clay, pl yellow CHT, pale yellow-white, minor CHT goethitic, minor goethite, vitreous
2.00	4.00	0.19	14.4	BIF	as above
4.00	6.00	0.13	14.4	BIF	as above
6.00	8.00	0.12	14.4	BIF	as above
8.00	10.00	0.31	21.3	METASEDIMENT	Clay yellow limonitic, minor CHT, goethitic trace goethite vitreous
10.00	12.00	0.15	21.3	METASEDIMENT	as above
12.00	14.00	0.21	21.3	METASEDIMENT	as above
14.00	16.00	0.23	21.3	METASEDIMENT	as above
16.00	18.00	0.14	22.4	METAMUDSTONE	clay, yellow brown , limonitic rare goethite vitreous
18.00	20.00	0.22	22.4	METAMUDSTONE	as above
20.00	22.00	0.19	22.4	METAMUDSTONE	Clay as above, yellow-brown pl yellow
22.00	24.00	0.14	22.4	METAMUDSTONE	as above
24.00	26.00	0.14	17.5	METAMUDSTONE	as above
26.00	28.00	0.14	17.5	METAMUDSTONE	as above
28.00	30.00	0.12	17.5	METAMUDSTONE	as above
30.00	32.00	0.15	17.5	METAMUDSTONE	Clay as above, trace granite pink
32.00	34.00	1.00	1.3	GRANITE	Granite, pink coarse g of qtz feld
34.00	36.00	2.07	1.3	GRANITE	as above
36.00	38.00	1.60	1.3	GRANITE	as above
38.00	40.00	1.31	1.3	GRANITE	as above
40.00	42.00	1.68	1.1	GRANITE	as above
42.00	44.00	1.61	1.1	GRANITE	as above
44.00	46.00	0.62	1.1	GRANITE	as above
46.00	48.00	1.79	1.1	GRANITE	as above
48.00	50.00	1.32	1.1	GRANITE	as above
50.00	52.00	1.99	1.1	GRANITE	as above

GW 23

Sample No	Interval	Fe %	FE2O3 %	SiO2 %	AL2O3 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb
193807	0-8	14.36	20.51	52.30	11.60	0.15	0.12	1.82	0.49	11.51	0.03	0.04	1.35	0.03	4.00

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Cr ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	W ppm	Pt ppb	Pd ppb
193808	8-16	21.26	7	5	50	38	5	10	31	213	161	10	5	23	5	0.50	1.50
193809	16-24	22.43	9	9	57	104	10	10	37	575	103	10	3	30	5	0.50	1.00
193810	24-32	17.48	6	17	120	345	17	10	41	727	174	10	17	12	5	0.50	0.50
193811	32-40	1.30	2	6	50	39	5	15	209	215	77	11	9	30	5	0.50	0.50
193812	40-48	1.14	1	21	50	27	5	10	134	252	140	10	6	36	6	0.50	0.50
193813	48-52	1.10	1	5	50	23	5	10	63	199	79	10	11	41	5	0.50	0.50

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	GW 24	**1:100 000 Map**	5837
Traverse	6600N	**UnitNo**	398
Station		**Max Depth (m)**	100.00
Completion Date	27/08/96	**Drilling Method**	RCP
Dip at Collar	-60.00	**AMG Easting**	476923
Azimuth at Collar	270.00	**AMG Northing**	6646631
Logged By	M DAVIES	**Zone**	53
		Depth to Bsmt	0

Comments Redox boundary at 48 m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.45	9.7	PORPHYRY	Porphyry, pink very fine grained wthd
2.00	4.00	2.25	9.7	BIF	BIF pl y-brn v goethitic minor clay yellow brown to red brown
4.00	6.00	1.94	18.4	BIF	as above
6.00	8.00	0.46	18.4	CLAY	Clay y limonitic to red brown
8.00	10.00	0.40	18.2	CLAY	Clay red white mottled puggy
10.00	12.00	0.48	18.2	CLAY	as above
12.00	14.00	0.82	25.6	CLAY	as above
14.00	16.00	14.90	25.6	BIF	BIF, yellow brown of Cht goethitic minor clay yellow-brown
16.00	18.00	15.90	36.2	BIF	BIF, brn of Cht-Hem massive to poorly laminated very weakly magnetic
18.00	20.00	4.69	36.2	BIF	BIF brn of Cht-Hem-limonite, well laminated, hard, trace clay yellow limonitic
20.00	22.00	5.52	32.7	BIF	BIF as above, trace clay yellow brown trace Metapelite pl grn
22.00	24.00	3.47	32.7	BIF	as above
24.00	26.00	12.50	35.9	BIF	BIF pl ppl of Cht-Hematite-amphibole-limonite well laminated rare Metapelite?
26.00	28.00	5.96	35.9	BIF	BIF pl yellow-green of Cht-amphibole-Hematite-Limonite well laminated
28.00	30.00	9.01	38.5	BIF	BIF pl yellow-green of Cht-amphibole-Hematite-Limonite well laminated
30.00	32.00	31.30	38.5	BIF	BIF pl y of amph-Cht-lim-trace Hematite/Mt minor Metapelite pl y
32.00	34.00	78.30	40.6	METAMUDSTONE	Metapelite pl y-g-grn lesser BIF as above
34.00	36.00	19.90	40.6	METAMUDSTONE	Metapelite y-g-grn
36.00	38.00	52.40	38.4	METAMUDSTONE	as above
38.00	40.00	27.70	38.4	METAMUDSTONE	as above and BIF of Cht-limonite-Hematite-amphibole-Mt
40.00	42.00	18.40	45.7	METAMUDSTONE	Metapelite as above trace BIF as above
42.00	44.00	14.70	45.7	METAMUDSTONE	as above
44.00	46.00	10.30	42.9	METAMUDSTONE	as above minor BIF as above
46.00	48.00	113.00	42.9	BIF	BIF g of Cht-Mt-Hem, very well laminated hard, lesser Metapelite as above
48.00	50.00	128.00	39.5	BIF	BIF g of Cht-Mt-amphibole massive to poorly laminated porous soft to med hard
50.00	52.00	90.01	39.5	BIF	BIF pl red Cht-Hem-amphibole, poorly laminated porous, soft to med hard
52.00	54.00	39.40	44.8	BIF	BIF, pl r Cht-Hem-amph-lim minor clay yellow limonitic
54.00	56.00	125.00	44.8	BIF	BIF, pl g of talc-Cht-Mt-trace lim
56.00	58.00	2.09	29.9	BIF	BIF, pl g of Cht-Mt-talc
58.00	60.00	85.10	29.9	BIF	BIF/Dolerite BIF as above and Dolerite, g , med g
60.00	62.00	218.00	29.1	BIF	BIF g, of Cht-Mt trace amphibole
62.00	64.00	190.00	29.1	BIF	as above
64.00	66.00	239.00	29.5	BIF	BIF g of Cht-talc-Mt-amphibole, calcareous
66.00	68.00	157.00	29.5	BIF	BIF as above, chertier
68.00	70.00	100.00	27.6	BIF	BIF as above, very cherty
70.00	72.00	287.00	27.6	BIF	BIF med g of Cht-Mt-trace talc-trace amphibole

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
72.00	74.00	296.00	36.5	BIF	as above
74.00	76.00	248.00	36.5	BIF	BIF g of Cht-talc-Mt- amphibole
76.00	78.00	197.00	35.6	BIF	as above
78.00	80.00	237.00	35.6	BIF	BIF med g of Cht-Mt talc
80.00	82.00	82.80	27.5	BIF	BIF, g of Cht-talc-Mt
82.00	84.00	143.00	27.5	BIF	as above
84.00	86.00	228.00	34.7	BIF	BIF g to med g of Cht-talc Mt
86.00	88.00	243.00	34.7	BIF	BIF g of talc-cht Mt
88.00	90.00	101.00	32.6	BIF	BIF med g of Cht talc in place just a CHT very well laminated
90.00	92.00	164.00	32.6	BIF	BIF dk g of Mt Cht poorly laminated to massive porous, soft to mod hard weakly calc
92.00	94.00	163.00	31.5	BIF	BIF dkg as above well laminated
94.00	96.00	201.00	31.5	BIF	BIF, med of Cht Mt talc
96.00	98.00	208.00	34.2	BIF	as above
98.00	100.00	273.00	34.2	BIF	BIF, dkg of Cht-Mt trace talc

GW 24

Sample No	Interval	Fe %	FE2O3 %	SiO2 %	AL2O3 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb
193818	16-20	36.16	51.65	40.50	1.32	0.04	0.05	0.10	3.50	2.62	0.03	0.01	0.04	0.01	1.00
193819	20-24	32.70	46.71	40.60	3.70	0.08	0.11	0.35	1.48	6.59	0.06	0.14	0.12	0.02	1.00
193820	24-28	35.90	51.29	37.40	1.77	0.04	0.11	1.09	5.27	3.38	0.02	0.07	0.06	0.01	2.00
193821	28-32	38.55	55.07	34.30	0.60	0.01	0.05	0.07	8.16	2.16	0.01	0.01	0.01	0.01	1.00
193822	32-36	40.62	58.03	25.70	2.40	0.03	0.12	0.55	8.41	4.62	0.01	0.18	0.07	0.01	6.00
193823	36-40	38.42	54.89	28.90	1.23	0.02	0.09	0.26	10.23	3.46	0.03	0.04	0.04	0.01	2.00
193824	40-44	45.70	65.29	21.80	1.11	0.01	0.06	0.34	8.75	2.74	0.20	0.01	0.03	0.01	1.00
193825	44-48	42.93	61.33	27.50	1.20	0.02	0.05	0.63	6.84	2.84	0.19	0.04	0.05	0.01	2.00
193826	48-52	39.50	56.43	31.20	0.15	0.01	0.05	2.78	6.06	2.85	0.10	0.09	0.01	0.01	1.00
193827	52-56	44.80	64.00	25.20	0.25	0.01	0.05	1.90	6.63	2.41	0.18	0.09	0.01	0.01	1.00
193828	56-60	29.92	42.74	43.60	1.51	0.11	0.11	2.86	8.57	0.40	0.14	0.06	0.07	0.01	1.00
193829	60-64	29.14	41.63	50.40	0.32	0.01	0.05	2.60	4.85	0.04	0.10	0.06	0.01	0.03	1.00
193830	64-68	29.51	42.15	10.90	0.57	0.01	0.05	15.57	12.12	17.68	0.13	0.15	0.02	0.02	1.00
193831	68-72	27.61	39.44	33.20	3.19	0.01	0.05	4.56	12.52	6.02	0.15	0.05	0.11	0.04	1.00
193832	72-76	36.48	52.12	42.50	0.07	0.01	0.05	0.12	6.00	0.01	0.08	0.01	0.01	0.01	1.00
193833	76-80	35.56	50.80	41.70	0.13	0.01	0.05	0.24	6.34	0.01	0.13	0.01	0.01	0.01	3.00
193834	80-84	27.52	39.31	35.40	0.12	0.01	0.05	4.40	16.26	5.01	0.12	0.03	0.01	0.01	1.00
193835	84-88	34.67	49.53	36.70	0.11	0.01	0.05	0.46	12.06	0.58	0.19	0.01	0.01	0.02	1.00

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Cr ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	W ppm	Pt ppb	Pd ppb
193814	0-4	9.66	7	9	50	50	5	38	151	109	2300	10	3	8	7	2.00	4.00
193815	4-8	18.36	4	5	50	36	6	44	173	66	257	10	3	12	5	2.00	4.00
193816	8-12	18.20	5	5	50	18	7	29	105	117	149	10	3	5	5	1.00	2.00
193817	12-16	25.59	3	5	50	32	8	42	80	217	101	10	11	7	5	1.00	2.00
193836	88-92	32.60	2	5	50	15	5	10	160	80	50	10	6	4	5	0.50	0.50
193837	92-96	31.50	1	5	50	15	5	10	110	92	273	10	3	4	16	0.50	0.50
193838	96-100	34.20	1	5	50	9	5	10	61	62	50	10	3	4	5	0.50	0.50

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name GW 25
Traverse 6600N
Station
Completion Date 28/08/96
Dip at Collar -60.00
Azimuth at Collar 270.00
Logged By M DAVIES

1:100 000 Map 5837
UnitNo 399
Max Depth (m) 100.00
Drilling Method RCP
AMG Easting 447024
AMG Northing 6646631
Zone 53
Depth to Bsmt 0

Comments Redox boundary at 44 m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	6.41	36.1	BIF	BIF pl brn of Cht-Hematite weakly denatured
2.00	4.00	4.72	36.1	BIF	BIF brown of Cht-Hem-goethite
4.00	6.00	13.20	40.5	BIF	BIF dark brown of Cht-Hem-goethite, minor goethite
6.00	8.00	71.10	40.5	BIF	BIF brn-g of Cht-Hem-trace goethite
8.00	10.00	119.00	37.8	BIF	as above
10.00	12.00	4.27	37.8	BIF	BIF yellow brown as above trace goethite
12.00	14.00	5.35	36.6	BIF	BIF y-brn of Cht-goethite-Hem mod well laminated
14.00	16.00	5.22	36.6	BIF	as above
16.00	18.00	3.68	33.9	BIF	BIF as above, trace clay pl red (wthd Porphyry)
18.00	20.00	9.53	33.9	BIF	BIF as above, and qtz Xtalline (large vein of qtz)
20.00	22.00	31.50	38.5	BIF	BIF as above, minor Cht, goethite yellow brown
22.00	24.00	42.40	38.5	BIF	BIF as above, lesser Metapelite/Dolerite fine grained pl g-grn
24.00	26.00	31.00	38.0	BIF	BIF brown of Cht Hematite-trace goethite
26.00	28.00	45.50	38.0	BIF	as above
28.00	30.00	48.40	38.1	BIF	as above
30.00	32.00	29.80	38.1	BIF	BIF as above, minor Metapelite pl yellow-green
32.00	34.00	116.00	40.6	BIF	BIF as above trace Metapelite as above
34.00	36.00	65.40	40.6	BIF	BIF as above, lesser BIF of talc-Limonite- Cht-Mt
36.00	38.00	65.00	35.2	BIF	BIF as above, minor BIF pl yellow as above
38.00	40.00	19.90	35.2	BIF	as above
40.00	42.00	13.70	20.6	METASEDIMENT	Metapsammite grn-g
42.00	44.00	7.58	20.6	METASEDIMENT	Metaspammite as above minor talc-Cht- limonite- Mt
44.00	46.00	224.00	41.8	BIF	BIF of Cht-talc-Mt very pl green
46.00	48.00	348.00	41.8	BIF	BIF med g of Cht-Mt-talc
48.00	50.00	238.00	34.7	BIF	BIF g of Cht talc-Mt massive porous soft to mod hard
50.00	52.00	256.00	34.7	BIF	BIF very pl g of Mt-Cht-talc massive porous soft
52.00	54.00	334.00	33.5	BIF	BIF dkg of Cht-Mt massive porous soft to hard
54.00	56.00	233.00	33.5	BIF	BIFM dk g of Cht-Mt, well laminated chertier, v hard
56.00	58.00	225.00	29.7	BIF	BIF med g of Cht-Mt-talc
58.00	60.00	190.00	29.7	BIF	BIF as above, Metapelite med g
60.00	62.00	339.00	36.4	BIF	BIF dk g of Cht-Mt-jasper, well laminated hard
62.00	64.00	295.00	36.4	BIF	BIF dk g of Cht-Mt-amphibole - jasper, as above
64.00	66.00	221.00	14.4	BIF	BIF dk g of Cht-Mt-trace jasper, trace Metapelite pl g-grn
66.00	68.00	35.50	14.4	BIF	BIF as above, lesser Metapelite pl grn-g
68.00	70.00	282.00	33.4	BIF	BIF dk g of Cht-Mt-amphibole-trace jasper
70.00	72.00	337.00	33.4	BIF	as above
72.00	74.00	348.00	38.9	BIF	as above
74.00	76.00	332.00	38.9	BIF	as above
76.00	78.00	359.00	37.8	BIF	as above

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
78.00	80.00	289.00	37.8	BIF	as above
80.00	82.00	244.00	38.9	BIF	BIF med g of Cht-Mt-amphibole (slightly chertier)
82.00	84.00	183.00	38.9	BIF	BIF, dk g of Cht-Mt-amphibole well laminated trace BIF, pp ppl of CHT-MT amph-Hem
84.00	86.00	211.00	34.0	BIF	BIF dk g, as above trace BIF, pl ppl as above
86.00	88.00	210.00	34.0	BIF	BIF dk g as above with trace jasper, lesser BIF of Cht-amp-talc-Mt very pl g
88.00	90.00	219.00	28.0	BIF	BIF med g of Cht-amph-talc, lesser Metapsammite
90.00	92.00	81.90	28.0	BIF	Metapsammite g minor BIF as above
92.00	94.00	302.00	33.7	BIF	as above, minor Metaspammite as above
94.00	96.00	321.00	33.7	BIF	BIF, pl g of Cht-talc-Mt lesser BIF med g of Cht-Mt-talc/amp
96.00	98.00	130.00	21.8	BIF	BIF pl g as above minor BIF med g as above weakly calcareous
98.00	100.00	162.00	21.8	BIF	BIF, pl g as above, minor BIF, med g as above, minor Cht talc rock, grn to translucent.

BIF
84-100 33

Sample No	Interval	Fe %	FE2O3 %	SiO2 %	AL2O3 %	K2O %	Na2O %	CaO %	MgO %	LOI %	P2O5 %	MnO %	TiO2 %	SO3 %	Au ppb
193844	20-24	38.47	54.96	35.90	2.21	0.07	0.09	0.89	1.51	3.72	0.04	0.67	0.03	0.01	1.00
193845	24-28	37.97	54.24	41.70	0.27	0.01	0.05	0.81	1.18	1.45	0.05	0.07	0.01	0.01	1.00
193846	28-32	38.14	54.49	42.10	0.22	0.01	0.05	0.41	1.17	1.79	0.09	0.09	0.01	0.01	1.00
193847	32-36	40.56	57.94	37.90	0.25	0.01	0.05	0.26	3.00	1.32	0.08	0.03	0.01	0.01	1.00
193848	36-40	35.21	50.30	39.90	0.71	0.03	0.05	2.29	4.80	2.44	0.13	0.14	0.02	0.01	2.00
193849	40-44	20.60	29.43	44.20	2.00	0.10	0.09	5.04	13.52	4.78	0.19	0.34	0.06	0.02	1.00
193850	44-48	41.85	59.78	21.70	1.24	0.03	0.05	3.47	9.55	3.14	0.28	0.08	0.06	0.03	1.00
193851	48-52	34.74	49.63	37.00	1.23	0.05	0.05	1.15	9.09	0.88	0.22	0.07	0.04	0.01	1.00
193852	52-56	33.47	47.81	41.60	0.96	0.01	0.05	4.60	4.70	0.01	0.16	0.22	0.03	0.01	1.00
193853	56-60	29.74	42.49	33.40	6.49	0.72	0.15	3.80	9.35	2.05	0.21	0.51	0.19	0.03	5.00
193854	60-64	36.37	51.95	39.80	2.03	0.08	0.05	1.84	3.59	0.01	0.11	0.11	0.09	0.01	1.00
193855	64-68	14.36	20.52	53.90	9.68	2.09	0.52	1.05	7.54	3.25	0.25	0.07	0.48	0.02	1.00
193856	68-72	33.40	47.71	41.50	1.28	0.07	0.08	3.79	6.05	0.01	0.06	0.12	0.04	0.01	2.00
193857	72-76	38.95	55.64	36.70	0.70	0.04	0.05	4.00	3.82	0.01	0.05	0.12	0.03	0.01	1.00
193858	76-80	37.85	54.07	38.80	0.73	0.04	0.07	3.70	3.36	0.01	0.05	0.11	0.02	0.01	1.00
193859	80-84	38.93	55.62	39.50	0.88	0.05	0.09	2.19	2.79	0.01	0.06	0.07	0.03	0.01	1.00
193860	84-88	34.00	48.57	36.30	0.59	0.01	0.08	6.75	5.23	2.60	0.07	0.15	0.02	0.01	6.00
193863	96-100	18,100.0													2.00

Sample No	Interval	Fe %	Au ppb	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Cr ppm	Mn ppm	S ppm	Mo ppm	U ppm	Th ppm	W ppm	Pt ppb	Pd ppb
193839	0-4	36.10	3	5	50	32	5	10	35	255	354	10	3	4	8	1.00	2.00
193840	4-8	40.50	2	9	50	28	5	10	96	400	175	10	3	4	5	0.50	1.00
193841	8-12	37.80	1	5	50	29	5	10	64	493	165	10	3	4	5	0.50	0.50
193842	12-16	36.60	1	5	50	24	5	10	193	426	66	10	5	4	5	0.50	0.50
193843	16-20	33.90	2	5	50	35	5	10	66	745	50	10	3	4	15	0.50	0.50
193861	88-92	27.97	3	5	50	62	15	15	82	1640	50	10	9	6	47	0.50	0.50
193862	92-96	33.70	2	5	50	60	9	11	45	1290	50	10	3	4	5	0.50	0.50
193863	96-100	21.81	2	5	50	41	5	17	51	1730	50	10	7	4	5	0.50	0.50

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	GW-DD 1	**1:100 000 Map**	5837
Traverse		**UnitNo**	380
Station		**Max Depth (m)**	114.20
Completion Date	3/05/96	**Drilling Method**	DIA
Dip at Collar	-60.00	**AMG Easting**	477035
Azimuth at Collar	270.00	**AMG Northing**	6646989
Logged By	M DAVIES	**Zone**	53
		Depth to Bsmt	2

Comments Pet. Rpt. No. 7166 - 21 samples

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00				not sampled
2.00	6.00	14.00	22.3	BIF	BIF, yellow-brown, well laminated moderately to weakly goethitic very weakly magnetic, minor thin bands of clay/limonite yellow-brown
6.00	10.00	1.00	26.2	BIF	as above
10.00	14.00	1.00	21.0	BIF	as above
14.00	18.00	1.00	42.2	BIF	BIF, as above weakly to mod magnetic
18.00	22.00	9.00	40.7	BIF	as above
22.00	26.00	10.00	29.2	BIF	as above
26.00	30.00	20.00	19.3	BIF	as above
30.00	34.00	85.00	38.3	BIF	BIF, g to dk g, well laminated, fractured rare bands of amphibole, strongly magnetic
34.00	38.00	84.00	26.1	BIF	as above
38.00	42.00	105.00	38.6	BIF	BIF, as above, Dolerite , pl r-grn, fine grained from 41.8 to 41.9m
42.00	46.00	99.00	32.3	BIF	BIF as above
46.00	50.00	103.00	36.7	BIF	as above
50.00	54.00	90.00	29.7	BIF	as above
54.00	58.00	96.00	38.1	BIF	as above
58.00	62.00	87.00	29.3	BIF	as above
62.00	66.00	1.00	6.9	DOLERITE	Dolerite, dk grn, med grained
66.00	70.00	51.00	18.2	BIF	BIF as above dolerite as above from 66-67.9m
70.00	74.00	94.00	36.7	BIF	as above
74.00	78.00	88.00	30.2	BIF	as above
78.00	82.00	86.00	35.7	BIF	as above
82.00	86.00	90.00	30.3	BIF	as above
86.00	90.00	87.00	35.5	BIF	as above
90.00	94.00	87.00	29.0	BIF	as above
94.00	98.00	75.00	34.4	BIF	as above
98.00	102.00	95.00	25.5	BIF	as above
102.00	106.00	76.00	34.1	BIF	as above
106.00	110.00	88.00	27.1	BIF	as above
110.00	114.20	88.00	28.2	BIF	BIF as above thin dolerite from 110.35-110.6m and 112.53-112.60m

GW-DD 1 * R 189167 - 189182 aqua regia digest (ie not total acid digest) and Fe values >20% may be low

Sample No	Interval	Fe	FE2O3	SiO2	AL2O3	K2O	Na2O	CaO	MgO	LOI	P2O5	MnO	TiO2	Au	Pt	Pd	S
189183	14-18	42	60.30	36.80	0.65		0.02	0.07	0.03	2.72	0.16	0.03	0.01	0.60	0.20	0.20	0.05
189184	18-22	41	58.20	40.00	0.17		0.01	0.05	0.02	2.22	0.05	0.04	0.01	0.70	0.20	0.20	0.05
189185	30-34	38	54.80	42.70	0.13		0.07	0.95	1.86	0.65	0.14	0.05	0.01	0.50	0.20	0.20	0.05
189186	38-42	39	55.20	41.50	0.30		0.07	1.32	2.10	0.97	0.11	0.05	0.01	0.40	0.20	0.20	0.05
189187	46-50	37	52.50	43.00	0.13		0.04	2.24	1.87	0.54	0.37	0.10	0.01	2.00	0.20	0.20	0.80
189189	62-66	7	9.82	48.60	12.00		0.57	3.81	11.70	3.84	0.46	0.12	0.72	1.70	1.40	1.40	0.10
189190	70-74	37	52.50	42.70	0.19		0.31	1.57	2.55	0.38	0.32	0.08	0.01	1.00	0.20	0.20	0.05
189191	78-82	36	51.10	46.00	0.19		0.58	0.87	2.71	0.95	0.11	0.03	0.01	3.10	0.20	0.20	0.05
189192	86-87.7	36	50.80	46.40	0.11		0.32	1.06	2.65	1.05	0.19	0.04	0.01	0.80	0.20	0.20	0.05
189193	94-98	34	49.20	48.50	0.16		0.09	1.31	2.41	1.07	0.12	0.03	0.01	0.10	0.20	0.20	0.05
189194	102-106	34	48.80	48.50	0.13		0.15	1.44	2.57	1.09	0.16	0.05	0.01	0.10	0.60	0.20	0.05

Sample No	Interval	Fe	Au	Cu	Pb	Zn	Ag	As	Cd	Co	Ni	Cr	Bi	V	Mn	P	Sb	Mo	Pt	Pd
188308	-																			
189167	2.7-6	22	1.20	5.00	22.00	26.00	0.50	6.00	1.00	1.00	7.00	6.00	5.00	28.00	115.00	60.0	5.00	1.00	0.60	0.20
189168	6-10	26	1.30	7.00	44.00	19.00	0.50	6.00	1.00	2.00	6.00	11.00	5.00	14.00	500.00	20.0	5.00	1.00	0.60	0.20
189169	10-14	21	0.80	5.00	32.00	10.00	0.50	4.00	1.00	1.00	3.00	2.00	5.00	8.00	160.00	70.0	5.00	1.00	0.40	0.20
189170	22-26	29	1.10	4.00	22.00	26.00	0.50	4.00	1.00	1.00	5.00	10.00	5.00	8.00	270.00	60.0	5.00	2.00	0.20	0.20
189171	26-30	19	1.00	7.00	14.00	16.00	0.50	2.00	1.00	2.00	4.00	2.00	5.00	5.00	290.00	20.0	5.00	1.00	0.20	0.20
189172	34-38	26	0.90	2.00	12.00	11.00	0.50	7.00	1.00	1.00	3.00	4.00	5.00	7.00	175.00	20.0	5.00	1.00	0.20	0.20
189173	-	32	1.00	2.00	20.00	14.00	1.00	5.00	1.00	1.00	3.00	2.00	5.00	9.00	350.00	60.0	5.00	2.00	0.20	0.20
189174	50-54	30	0.60	3.00	22.00	20.00	1.00	3.00	1.00	1.00	4.00	2.00	5.00	9.00	195.00	70.0	5.00	1.00	0.20	0.20
189175	58-62	29	0.90	9.00	8.00	15.00	1.00	2.00	1.00	1.00	5.00	6.00	5.00	11.00	410.00	30.0	5.00	1.00	0.20	0.20
189176	66-70	18	0.70	10.00	4.00	15.00	0.50	6.00	1.00	12.00	61.00	35.0	5.00	52.00	440.00	,150.0	5.00	1.00	0.80	0.60
189177	74-78	30	0.80	2.00	8.00	11.00	0.50	7.00	1.00	1.00	5.00	6.00	5.00	8.00	290.00	,250.0	5.00	1.00	0.20	0.20
189178	82-86	30	2.00	1.00	8.00	7.00	0.50	2.00	1.00	1.00	4.00	2.00	5.00	8.00	210.00	20.0	5.00	1.00	0.20	0.20
189179	90.7-94	29	1.20	6.00	6.00	28.00	0.50	2.00	1.00	1.00	11.00	2.00	5.00	8.00	240.00	40.0	5.00	1.00	0.20	0.20
189180	98-102	26	0.10	2.00	6.00	12.00	0.50	1.00	1.00	1.00	4.00	6.00	5.00	7.00	125.00	00.0	5.00	1.00	0.20	0.20
189181	106-110	27	0.30	1.00	4.00	9.00	0.50	1.00	1.00	1.00	5.00	2.00	5.00	7.00	250.00	50.0	5.00	1.00	0.20	0.20
189182	110-114.2	28	0.40	2.00	8.00	11.00	0.50	1.00	1.00	1.00	6.00	5.00	5.00	9.00	175.00	30.0	5.00	1.00	0.20	0.20
189183	14-18		0.60																0.20	0.20
189184	18-22		0.70																0.20	0.20
189185	30-34		0.50																0.20	0.20
189186	38-42		0.40																0.20	0.20
189187	46-50		2.00																0.20	0.20
189188	-		0.80																0.20	0.20
189189	62-66		1.70																1.40	1.40
189190	70-74		1.00																0.20	0.20
189191	78-82		3.10																0.20	0.20
189192	86-87.7		0.80																0.20	0.20
189193	94-98		0.10																0.20	0.20
189194	102-106		0.10																0.60	0.20

BUL 81

Sample No	Interval	Fe	FE2O3	SiO2	Al 2O3	K2O	Na2O	CaO	MgO	LOI	P2O5	MnO	TiO2	SO3	Au
176408	46-48	3.30	4.71	62.60	17.00	4.81	4.55	0.85	0.81	3.24	0.31	0.04	0.68	0.01	2.00

Sample No	Interval	Fe	Au	Cu	Pb	Zn	Co	Ni	Cr	Mn	S	Mo	U	Th	W	Pt	Pd
176405	10-20	3.95	1.00	25.00	93.00	87.00	10.00	18.00	17.00	171.00	84.00	10.00	4.00	20.00	10.00	0.50	0.50
176406	20-38	4.00	1.00	34.00	116.00	120.00	10.00	22.00	14.00	258.00	69.00	10.00	4.00	17.00	10.00	0.50	0.50
176407	38-46	3.13	1.00	18.00	79.00	111.00	10.00	14.00	12.00	255.00	50.00	10.00	3.00	13.00	10.00	0.50	0.50
176408	46-48		2.00														

BUL 82

Sample No	Interval	Fe	FE2O3	SiO2	Al 2O3	K2O	Na2O	CaO	MgO	LOI	P2O5	MnO	TiO2	SO3	Au
176411	30-32	9.98	14.25	58.70	15.20	2.55	0.08	0.17	1.70	6.60	0.15	0.14	0.35	0.01	4.00

Sample No	Interval	Fe	Au	Cu	Pb	Zn	Co	Ni	Cr	Mn	S	Mo	U	Th	W	Pt	Pd
176409	10-20	4.81	1.00	6.00	24.00	21.00	10.00	13.00	15.00	172.00	173.00	10.00	6.00	41.00	10.00	0.50	0.50
176410	20-30	4.93	1.00	7.00	20.00	44.00	10.00	14.00	23.00	185.00	88.00	10.00	7.00	40.00	12.00	0.50	0.50
176411	30-32		4.00														

BUL 83

Sample No	Interval	Fe	FE2O3	SiO2	Al 2O3	K2O	Na2O	CaO	MgO	LOI	P2O5	MnO	TiO2	SO3	Au
176413	2-3	38.73	55.33	39.70	2.33	0.05	0.05	0.07	0.11	2.36	0.02	0.01	0.04	0.04	3.00

Sample No	Interval	Fe	Au	Cu	Pb	Zn	Co	Ni	Cr	Mn	S	Mo	U	Th	W	Pt	Pd
176412	0-2	21.90	1.00	10.00	33.00	14.00	10.00	10.00	37.00	97.00	455.00	10.00	5.00	18.00	14.00	0.50	1.00
176413	2-3		3.00														

BUL 84

Sample No	Interval	Fe	FE2O3	SiO2	Al 2O3	K2O	Na2O	CaO	MgO	LOI	P2O5	MnO	TiO2	SO3	Au
176414	0-2	26.82	38.32	44.30	7.16	0.12	0.05	1.14	0.20	7.56	0.04	0.02	0.26	0.18	3.00

Sample No	Interval	Fe	Au	Cu	Pb	Zn	Co	Ni	Cr	Mn	S	Mo	U	Th	W	Pt	Pd
176414	0-2		3.00														

BUL 85

Sample No	Interval	Fe	FE2O3	SiO2	Al 2O3	K2O	Na2O	CaO	MgO	LOI	P2O5	MnO	TiO2	SO3	Au
176417	16-17.5	3.52	5.03	57.90	23.00	4.56	0.13	0.13	1.06	6.51	0.05	0.02	0.78	0.01	13.00

Sample No	Interval	Fe	Au	Cu	Pb	Zn	Co	Ni	Cr	Mn	S	Mo	U	Th	W	Pt	Pd
176415	2-8	13.10	4.00	14.00	45.00	11.00	10.00	22.00	94.00	183.00	248.00	10.00	8.00	19.00	10.00	0.50	0.50
176416	8-16	6.01	7.00	23.00	52.00	30.00	12.00	60.00	144.00	231.00	102.00	10.00	3.00	14.00	19.00	0.50	1.00
176417	16-17.5		13.00														

BUL 86

Sample No	Interval	Fe	FE2O3	SiO2	Al 2O3	K2O	Na2O	CaO	MgO	LOI	P2O5	MnO	TiO2	SO3	Au
176419	20-21	21.08	30.12	62.30	4.56	0.04	0.05	0.09	0.14	3.49	0.04	0.02	0.11	0.01	4.00

Sample No	Interval	Fe	Au	Cu	Pb	Zn	Co	Ni	Cr	Mn	S	Mo	U	Th	W	Pt	Pd
176418	10-20	1.74	2.00	7.00	17.00	8.00	10.00	10.00	20.00	58.00	159.00	10.00	3.00	4.00	13.00	0.50	0.50
176419	20-21		4.00														

BUL 87

Sample No	Interval	Fe	FE2O3	SiO2	Al 2O3	K2O	Na2O	CaO	MgO	LOI	P2O5	MnO	TiO2	SO3	Au
176420	6-7	17.56	25.09	61.60	6.89	0.06	0.05	0.17	0.20	6.02	0.02	0.01	0.14	0.02	6.00

Sample No	Interval	Fe	Au	Cu	Pb	Zn	Co	Ni	Cr	Mn	S	Mo	U	Th	W	Pt	Pd
176420	6-7		6.00													0.50	2.00

BUL 88

Sample No	Interval	Fe	FE2O3	SiO2	Al 2O3	K2O	Na2O	CaO	MgO	LOI	P2O5	MnO	TiO2	SO3	Au
176422	40-41	18.03	25.76	73.60	0.22	0.01	0.05	0.02	0.03	0.28	0.01	0.02	0.01	0.01	6.00

Sample No	Interval	Fe	Au	Cu	Pb	Zn	Co	Ni	Cr	Mn	S	Mo	U	Th	W	Pt	Pd
176421 176422	36-40 40-41	19.50	3.00 6.00	12.00	24.00	15.00	10.00	10.00	21.00	668.00	67.00	10.00	5.00	4.00	10.00	0.50 0.50	1.00 0.50

BUL 90

Sample No	Interval	Fe	FE2O3	SiO2	Al 2O3	K2O	Na2O	CaO	MgO	LOI	P2O5	MnO	TiO2	SO3	Au
176426	58-59	6.12	8.74	63.90	15.10	3.48	1.44	0.60	2.47	3.68	0.20	0.07	0.43	0.01	25.00

Sample No	Interval	Fe	Au	Cu	Pb	Zn	Co	Ni	Cr	Mn	S	Mo	U	Th	W	Pt	Pd
176423	30-40	14.50	11.00	19.00	45.00	239.00	24.00	60.00	100.00	,194.0	103.00	10.00	10.00	39.00	10.00	2.00	2.00
176424	40-52	18.50	10.00	16.00	53.00	146.00	17.00	41.00	71.00	,025.0	74.00	10.00	5.00	24.00	10.00	2.00	3.50
176425	52-58	9.71	2.00	50.00	62.00	153.00	13.00	43.00	65.00	636.00	204.00	10.00	7.00	52.00	18.00	1.00	1.50
176426	58-59		25.00													1.00	1.50

BUL 91

Sample No	Interval	Fe	FE2O3	SiO2	Al 2O3	K2O	Na2O	CaO	MgO	LOI	P2O5	MnO	TiO2	SO3	Au
176429	54-56	17.56	25.09	48.80	10.00	3.17	2.14	0.79	0.98	7.36	0.16	0.17	0.57	0.02	4.00

Sample No	Interval	Fe	Au	Cu	Pb	Zn	Co	Ni	Cr	Mn	S	Mo	U	Th	W	Pt	Pd
176427	36-42	1.63	3.00	14.00	65.00	18.00	10.00	10.00	14.00	122.00	111.00	10.00	3.00	11.00	11.00	0.50	1.00
176428	42-54	9.90	2.00	16.00	41.00	123.00	10.00	26.00	46.00	579.00	552.00	10.00	14.00	44.00	10.00	0.50	0.50
176429	54-56		4.00													0.50	1.00

BUL 92

Sample No	Interval	Fe	FE2O3	SiO2	Al 2O3	K2O	Na2O	CaO	MgO	LOI	P2O5	MnO	TiO2	SO3	Au
176431	60-62	14.35	20.50	68.90	5.20	2.08	0.05	0.10	0.69	2.12	0.04	0.04	0.12	0.32	3.00

Sample No	Interval	Fe	Au	Cu	Pb	Zn	Co	Ni	Cr	Mn	S	Mo	U	Th	W	Pt	Pd
176430	58-60	5.80	7.00	17.00	29.00	22.00	11.00	42.00	59.00	80.00	,640.0	10.00	4.00	12.00	10.00	0.50	1.00
176431	60-62		3.00													0.50	0.50

BUL 93

Sample No	Interval	Fe	FE2O3	SiO2	Al 2O3	K2O	Na2O	CaO	MgO	LOI	P2O5	MnO	TiO2	SO3	Au
176434	66-67	26.65	38.07	55.60	2.36	0.01	0.05	2.82	0.26	0.91	0.33	0.09	0.01	0.06	5.00

Sample No	Interval	Fe	Au	Cu	Pb	Zn	Co	Ni	Cr	Mn	S	Mo	U	Th	W	Pt	Pd
176432	60-64	4.79	13.00	122.00	26.00	23.00	10.00	19.00	12.00	108.00	9,700.0	10.00	3.00	4.00	10.00	1.00	2.00
176433	64-66	16.70	2.00	47.00	25.00	46.00	41.00	10.00	13.00	321.00	50.00	10.00	3.00	4.00	211.00	0.50	0.50
176434	66-67		5.00													0.50	0.50

BUL 94

Sample No	Interval	Fe	FE2O3	SiO2	Al 2O3	K2O	Na2O	CaO	MgO	LOI	P2O5	MnO	TiO2	SO3	Au
176435	62-63	1.24	1.77	69.50	16.70	6.28	3.73	0.21	0.06	1.44	0.04	0.01	0.48	0.15	2.00

Sample No	Interval	Fe	Au	Cu	Pb	Zn	Co	Ni	Cr	Mn	S	Mo	U	Th	W	Pt	Pd
176435	62-63		2.00													0.50	0.50

BUL 95

Sample No	Interval	Fe	FE2O3	SiO2	Al 2O3	K2O	Na2O	CaO	MgO	LOI	P2O5	MnO	TiO2	SO3	Au
176437	64-65	1.16	1.66	77.00	12.60	6.70	1.73	0.06	0.17	0.72	0.20	0.01	0.19	0.07	2.00

Sample No	Interval	Fe	Au	Cu	Pb	Zn	Co	Ni	Cr	Mn	S	Mo	U	Th	W	Pt	Pd
176436	62-64	1.38	5.00	9.00	20.00	9.00	10.00	10.00	10.00	85.00	,518.0	10.00	3.00	18.00	10.00	0.50	0.50
176437	64-65		2.00													0.50	1.00

BUL 96

Sample No	Interval	Fe	FE2O3	SiO2	Al 2O3	K2O	Na2O	CaO	MgO	LOI	P2O5	MnO	TiO2	SO3	Au
176439	52-54	6.80	9.72	56.60	16.60	3.81	3.46	2.12	2.20	3.15	0.48	0.10	0.89	0.01	3.00

Sample No	Interval	Fe	Au	Cu	Pb	Zn	Co	Ni	Cr	Mn	S	Mo	U	Th	W	Pt	Pd
176438	46-52	4.13	3.00	91.00	20.00	74.00	15.00	20.00	52.00	304.00	250.00	10.00	8.00	22.00	11.00	2.00	4.00
176439	52-54		3.00													3.50	3.50

BUL 97

Sample No	Interval	Fe	FE2O3	SiO2	Al 2O3	K2O	Na2O	CaO	MgO	LOI	P2O5	MnO	TiO2	SO3	Au
176442	16-17	10.29	14.70	72.80	7.79	0.01	0.05	0.04	0.07	4.93	0.01	0.01	0.09	0.01	1.00

Sample No	Interval	Fe	Au	Cu	Pb	Zn	Co	Ni	Cr	Mn	S	Mo	U	Th	W	Pt	Pd
176440	4-14	1.91	2.00	9.00	17.00	7.00	10.00	10.00	14.00	79.00	198.00	10.00	3.00	4.00	10.00	0.50	1.00
176441	14-16	1.19	2.00	7.00	16.00	5.00	10.00	10.00	12.00	66.00	138.00	10.00	3.00	4.00	10.00	0.50	1.00
176442	16-17		1.00													0.50	0.50

BUL 98

Sample No	Interval	Fe	FE2O3	SiO2	Al 2O3	K2O	Na2O	CaO	MgO	LOI	P2O5	MnO	TiO2	SO3	Au
176446	60-65	5.01	7.16	61.40	18.10	3.85	1.22	0.26	1.50	5.06	0.09	0.05	0.83	0.16	5.00

Sample No	Interval	Fe	Au	Cu	Pb	Zn	Co	Ni	Cr	Mn	S	Mo	U	Th	W	Pt	Pd
176443	20-32	11.50	1.00	73.00	351.00	302.00	32.00	128.00	127.00	771.00	819.00	10.00	8.00	28.00	10.00	1.50	3.50
176444	32-50	7.07	1.00	56.00	136.00	190.00	29.00	76.00	71.00	,449.0	155.00	10.00	3.00	15.00	10.00	2.00	1.50
176445	50-60	8.09	9.00	38.00	79.00	248.00	25.00	78.00	80.00	,728.0	151.00	10.00	3.00	11.00	14.00	1.50	2.00
176446	60-65		5.00													1.00	1.50

BUL 99

Sample No	Interval	Fe	FE2O3	SiO2	Al 2O3	K2O	Na2O	CaO	MgO	LOI	P2O5	MnO	TiO2	SO3	Au
176452	76-77	5.35	7.64	59.00	19.50	4.54	0.46	0.16	2.72	4.98	0.08	0.06	0.76	0.01	3.00

Sample No	Interval	Fe	Au	Cu	Pb	Zn	Co	Ni	Cr	Mn	S	Mo	U	Th	W	Pt	Pd
176447	10-22	3.48	6.00	12.00	23.00	19.00	10.00	29.00	80.00	98.00	492.00	10.00	3.00	14.00	10.00	1.00	1.50
176448	22-36	6.49	2.00	30.00	34.00	67.00	17.00	74.00	120.00	905.00	100.00	10.00	5.00	19.00	17.00	1.50	2.50
176449	36-50	4.88	3.00	22.00	84.00	95.00	19.00	56.00	112.00	,196.0	86.00	10.00	3.00	16.00	10.00	2.00	2.00
176450	50-70	7.39	2.00	33.00	57.00	179.00	23.00	81.00	110.00	,088.0	99.00	10.00	8.00	17.00	11.00	1.50	2.00
176451	70-76	6.28	3.00	38.00	36.00	119.00	20.00	72.00	103.00	837.00	92.00	10.00	3.00	17.00	12.00	1.50	2.00
176452	76-77		3.00													1.50	2.50

BUL 100

Sample No	Interval	Fe	FE2O3	SiO2	Al 2O3	K2O	Na2O	CaO	MgO	LOI	P2O5	MnO	TiO2	SO3	Au
176453	58-59	2.84	4.05	63.90	16.10	8.36	2.89	0.43	0.53	0.59	0.15	0.03	0.43	0.06	2.00

Sample No	Interval	Fe	Au	Cu	Pb	Zn	Co	Ni	Cr	Mn	S	Mo	U	Th	W	Pt	Pd
176453	58-59		2.00													0.50	1.00

BUL 101

Sample No	Interval	Fe	FE2O3	SiO2	Al 2O3	K2O	Na2O	CaO	MgO	LOI	P2O5	MnO	TiO2	SO3	Au
176455	56-57	2.86	4.08	73.40	13.40	6.43	2.98	0.10	0.07	0.64	0.03	0.01	0.39	1.05	2.00

Sample No	Interval	Fe	Au	Cu	Pb	Zn	Co	Ni	Cr	Mn	S	Mo	U	Th	W	Pt	Pd
176454	54-56	1.24	2.00	12.00	46.00	126.00	12.00	17.00	10.00	61.00	,616.0	10.00	8.00	31.00	10.00	0.50	1.00
176455	56-57		2.00													0.50	0.50

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	BUL 81A	**1:100 000 Map**	5837
Traverse	6000N	**UnitNo**	359
Station	6700E	**Max Depth (m)**	48.00
Completion Date	1/05/96	**Drilling Method**	RC
Dip at Collar	-90.00	**AMG Easting**	476731
Azimuth at Collar		**AMG Northing**	6646029
Logged By	ROBERT SHAW	**Zone**	53
		Depth to Bsmt	4

Comments Mineralogical Report No 7125 Pet at 48m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.20		SILT	Silt/Sand, minor pk-wh silt, rd-br silt at surface
2.00	4.00	0.10		SILT	as above
4.00	6.00	0.10		GRANITE	Clayey/Granite? off wh- pk, weathered/bleached granite?
6.00	8.00	0.04		CLAY	as above
8.00	10.00	0.04		CLAY	as above
10.00	12.00	0.02		CLAY	as above with occ yl staining, trace granite texture
12.00	14.00	0.00		CLAY	as above
14.00	16.00	0.04		CLAY	as above
16.00	18.00	0.04		CLAY	as above
18.00	20.00	0.04		CLAY	as above
20.00	22.00	0.03		GRANITE	Clayey/Granite yl-br/off wh, sticky, wthd, mottled, trace wth m-cg granite chips
22.00	24.00	0.03		CLAY	as above
24.00	26.00	0.06		CLAY	as above
26.00	28.00	0.04		CLAY	as above
28.00	30.00	0.05		CLAY	as above
30.00	32.00	0.07		CLAY	as above
32.00	34.00	0.11		CLAY	as above
34.00	36.00	0.07		CLAY	as above
36.00	38.00	0.07		CLAY	as above
38.00	40.00	0.06		QUARTZ PORPHYRY	Crystalline f-cg qtz-feld/plag/trace Biotite, pk-br
40.00	42.00	0.01		QUARTZ PORPHYRY	as above
42.00	44.00	0.04		QUARTZ PORPHYRY	as above
44.00	46.00	0.07		QUARTZ PORPHYRY	as above
46.00	48.00	0.11		QUARTZ PORPHYRY	as above

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	BUL 82	**1:100 000 Map**	5837
Traverse	6000N	**UnitNo**	360
Station	6700E	**Max Depth (m)**	32.00
Completion Date	1/05/96	**Drilling Method**	RC
Dip at Collar	-90.00	**AMG Easting**	476631
Azimuth at Collar		**AMG Northing**	6646018
Logged By	R SHAW	**Zone**	53
		Depth to Bsmt	10

Comments Mineralogical Report No 7125 Pet at 32m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.50		METASILTSTONE	Silcrete/Meta-silt- rd-br and lgn, variably silcreted, minor sand
2.00	4.00	0.22		METASILTSTONE	As above
4.00	6.00	0.40		METASILTSTONE	As above
6.00	8.00	0.05		METASILTSTONE	As above
8.00	10.00	0.06		METASILTSTONE	As above
10.00	12.00	0.13		METASILTSTONE	Clay/Meta-Siltst, off wh-lg, talcose, foliated, trace mica, br FeO in joints
12.00	14.00	0.09		METASILTSTONE	As above
14.00	16.00	0.04		METASILTSTONE	As above
16.00	18.00	0.04		METASILTSTONE	As above
18.00	20.00	0.09		METASILTSTONE	As above
20.00	22.00	0.11		METASILTSTONE	As above
22.00	24.00	0.09		METASILTSTONE	As above with minor met-qtzite
24.00	26.00	0.03		METASILTSTONE	as for 10-12m
26.00	28.00	0.06		METAGABBRO	dk gn-br, m-cg, weakly foliated, weathered
28.00	30.00	0.10		METAGABBRO	px/hb/qtz
30.00	32.00	0.17		SCHIST	Shist, pelitic quartz-muscovite andalusite/cordierite, and schist, micaceous weathered

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	BUL 83	**1:100 000 Map**	5837
Traverse	6000N	**UnitNo**	361
Station	6700E	**Max Depth (m)**	3.00
Completion Date	1/05/96	**Drilling Method**	RC
Dip at Collar	-90.00	**AMG Easting**	476530
Azimuth at Collar		**AMG Northing**	6646012
Logged By	R SHAW	**Zone**	53
		Depth to Bsmt	2

Comments Mineralogical Report No 7125 Pet at 3m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.23		SILT	SiltyClay - rd-br unconsol, common BIF scree
2.00	3.00	0.14		BIF	well banded dk gy/or dk-br BIF

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	BUL 84	**1:100 000 Map**	5837
Traverse	6000N	**UnitNo**	362
Station	6700E	**Max Depth (m)**	2.00
Completion Date	1/05/96	**Drilling Method**	RC
Dip at Collar	-90.00	**AMG Easting**	476430
Azimuth at Collar		**AMG Northing**	6646002
Logged By	R SHAW	**Zone**	53
		Depth to Bsmt	1

Comments Mineralogical Report No 7125 Pet at 2m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	1.00	0.21		SILT	Silty Clay rd-br unconsol, minor BIF scree
1.00	2.00	0.21		BIF	dgy-mr well banded, v hard, BIF, 25-30% magnetite

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	BUL 85	**1:100 000 Map**	5837
Traverse	6000N	**UnitNo**	363
Station	6700E	**Max Depth (m)**	17.50
Completion Date	1/05/96	**Drilling Method**	RC
Dip at Collar	-90.00	**AMG Easting**	476332
Azimuth at Collar		**AMG Northing**	6645997
Logged By	R SHAW	**Zone**	53
		Depth to Bsmt	2

Comments Mineralogical Report No 7125 Pet at 17.5m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	1.23		SILT	Siltclay/Gravel, rd-br, with chert and BIF scree
2.00	4.00	0.62		CLAY	Clay/Metasiltstone, off wh-lgn, weathered, common yl-br FeO staining
4.00	6.00	0.71		CLAY	Clay/Metasiltstone, as above
6.00	8.00	0.17		CLAY	Clay/Metasiltstone, as above
8.00	10.00	0.05		METASILTSTONE	lgn-bl, fg, occ yl-br Fe0 trace talcose texture
10.00	12.00	0.09		METASILTSTONE	slightly mod weathered
12.00	14.00	0.12		METASILTSTONE	as above
14.00	16.00	0.05		METASILTSTONE	as above
16.00	17.50	0.03		METASILTSTONE	Schist, quartz sericite, low metamorphic grade

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	BUL 86	**1:100 000 Map**	5837
Traverse	6000N	**UnitNo**	364
Station	475785E	**Max Depth (m)**	21.00
Completion Date	1/05/96	**Drilling Method**	RC
Dip at Collar	-90.00	**AMG Easting**	475784
Azimuth at Collar		**AMG Northing**	6645966
Logged By	R SHAW	**Zone**	53
		Depth to Bsmt	10

Comments Mineralogical Report No 7125 Pet at 21m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.14		SILT	rd-br, Silt/Clay unconsolidated
2.00	4.00	1.09		SILT	rd-br variably cemented by CaCO3
4.00	6.00	0.40		SILT	as above
6.00	8.00	0.13		SILT	as above
8.00	10.00	0.18		SILT	Silty Sand/ m-cg sand, common rd-br Feo staining occ silcreted
10.00	12.00	0.17		BIF	wh dgy banded clayey, weathered/bleached BIF
12.00	14.00	0.14		BIF	as above
14.00	16.00	0.23		BIF	as above
16.00	18.00	0.23		BIF	as above
18.00	20.00	0.28		BIF	as above
20.00	21.00	1.25		BIF	Goethitic BIF/ v hard, gy/rd-br with occ yl-br goethite BIF

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	BUL 87	**1:100 000 Map**	5837
Traverse	5400N	**UnitNo**	365
Station	476200E	**Max Depth (m)**	7.00
Completion Date	2/05/96	**Drilling Method**	RC
Dip at Collar	-90.00	**AMG Easting**	476202
Azimuth at Collar		**AMG Northing**	6645405
Logged By	R SHAW	**Zone**	53
		Depth to Bsmt	6

Comments Mineralogical Report No 7125 Pet at 7m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	1.50		SILT	Silty/Clay rd-br unconsolidated alluvium
2.00	4.00	0.17		SILT	off white with rd-br staining occ $CaCO_3$ cement
4.00	6.00	0.10		SILT	as above
6.00	7.00	0.13		BIF	well banded, gy/rd-br with common yl-br goethite

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	BUL 88	**1:100 000 Map**	5837
Traverse	4600N	**UnitNo**	366
Station	476135E	**Max Depth (m)**	41.00
Completion Date	2/05/96	**Drilling Method**	RCP
Dip at Collar	-90.00	**AMG Easting**	476123
Azimuth at Collar		**AMG Northing**	6644609
Logged By	R SHAW	**Zone**	53
		Depth to Bsmt	36

Comments Mineralogical Report No 7125 Pet at 41M

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.31		SILT	Silty/Clay rd-br, variably cemented by CaCO3
2.00	4.00	0.22		SILT	as above
4.00	6.00	0.17		SILT	as above
6.00	8.00	0.11		SILT	as above
8.00	10.00	0.08		SILT	as above
10.00	12.00	0.08		SILT	off wh-lbr, variably cemented, v hard
12.00	14.00	0.08		SILT	SiltySand/Gravel, f-cg, off wh-lgy, qtz sand/gv in a silt matrix
14.00	16.00	0.01		SILT	as above
16.00	18.00	0.03		SILT	as above
18.00	20.00	0.01		SILT	as above
20.00	22.00	0.03		SILT	as above
22.00	24.00	0.12		SILT	as above
24.00	26.00	0.15		SILT	as above
26.00	28.00	0.13		SILT	as above
28.00	30.00	0.11		SILT	as above
30.00	32.00	0.13		SILT	as above
32.00	34.00	0.13		SILT	as above
34.00	36.00	0.37		SILT	as above
36.00	38.00	0.24		BIF	dgy with common mr oyl Fe0, weathered, well banded
38.00	40.00	0.38		BIF	as above
40.00	41.00	0.39		BIF	as above

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	BUL 89	**1:100 000 Map**	5837
Traverse		**UnitNo**	367
Station		**Max Depth (m)**	74.00
Completion Date	2/05/96	**Drilling Method**	RC
Dip at Collar	-90.00	**AMG Easting**	476022
Azimuth at Collar		**AMG Northing**	6644211
		Zone	53
Logged By	R SHAW	**Depth to Bsmt**	56

Comments Mineralogical Report No 7125 Pet at 2m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.45		SILT	Silty/Clay rd-br, variably cemented by Ca CO3
2.00	4.00	0.29		SILT	as above
4.00	6.00	0.36		SILT	as above
6.00	8.00	0.31		SILT	as above
8.00	10.00	0.12		SAND	Ferruginous Sand, f-mg, rd-or and yl-br stained silt as matrix
10.00	12.00	0.13		SAND	Ferruginous Sand, f-mg, rd-or and yl-br stained silt as matrix
12.00	14.00	0.71		CLAYSTONE	Claystone off wh/pk-br variably silcreted, occ mg sand
14.00	16.00	0.28		CLAYSTONE	lesser
16.00	18.00	0.11		CLAYSTONE	as above
18.00	20.00	0.35		SAND	Sandy Silt, wh, occ m-cg sand/sandstone bands
20.00	22.00	0.17		SAND	as above
22.00	28.00	0.10		SAND	as above
28.00	30.00	0.14		SAND	as above
30.00	32.00	0.20		SAND	as above
32.00	34.00	0.17		SAND	as above
34.00	36.00	0.17		SAND	as above
36.00	38.00	0.10		SAND	as above
38.00	40.00	0.13		SAND	as above
40.00	42.00	0.09		SAND	as above
42.00	44.00	0.09		SAND	as above
44.00	46.00	0.12		SAND	as above
46.00	48.00	0.09		SAND	as above
48.00	50.00	0.07		SAND	as above
50.00	52.00	0.09		SAND	as above
52.00	54.00	0.08		SAND	as above
54.00	56.00	0.05		SAND	as above
56.00	58.00	0.12		BIF	Wthd basement yl-br to lbl-gy, clayey minor cg qtz grains
58.00	60.00	0.06		BIF	as above
60.00	62.00	0.08		BIF	as above
62.00	64.00	0.01		BIF	as above
64.00	66.00	0.02		GRANITE	Weathered Granite, pinkish white, mg, qtz felds/plag
66.00	68.00	0.10		SANDSTONE	Weathered Granite/Sandstone Conglom as above
68.00	70.00	0.01		SANDSTONE	as above
70.00	72.00	0.06		SANDSTONE	as above
72.00	74.00	0.07		SANDSTONE	coarse sandstone to fine conglomerate, also abundant microcline and some volcanic fragments

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	BUL 90	**1:100 000 Map**	5837
Traverse		**UnitNo**	368
Station		**Max Depth (m)**	59.00
Completion Date	2/05/96	**Drilling Method**	RC
Dip at Collar	-90.00	**AMG Easting**	478485
Azimuth at Collar		**AMG Northing**	6646417
		Zone	53
Logged By	R SHAW	**Depth to Bsmt**	30

Comments Mineralogical Report No 7125 Pet at 49m and 59m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.30		SILT	Silty/Clay, rd-br, variably cemented
2.00	4.00	0.29		SILT	Silty/Clay as above
4.00	6.00	0.15		SILT	Silty/Clay as above
6.00	8.00	0.11		SILT	Silty/Clay as above
8.00	10.00	0.25		SILT	Silty/Sand fg qtz sand with pk-br silt matrix
10.00	12.00	0.23		SILT	as above
12.00	14.00	0.23		SAND	Sandy Clay/Claystone off white silt/claystone with f-m sand t/out
14.00	16.00	0.11		SAND	as above
16.00	18.00	0.13		SAND	as above
18.00	20.00	0.09		SAND	as above
20.00	22.00	0.09		SAND	as above
22.00	24.00	0.16		SAND	as above
24.00	26.00	0.10		SAND	as above
26.00	28.00	0.12		SAND	as above
28.00	30.00	0.05		SAND	as above
30.00	32.00	0.03		BIF	Wthd-Basement, rd-br-or puggy, sticky clay trace mica, chlorite
32.00	34.00	0.06		BIF	as above
34.00	36.00	0.07		BIF	as above
36.00	38.00	0.26		BIF	as above
38.00	40.00	0.17		BIF	as above
40.00	42.00	0.10		CLAY	Clayey Schist gn-gy, foliated, v soft, abundant biotite
42.00	44.00	0.12		CLAY	as above (kimberlitic?)
44.00	46.00	0.08		CLAY	as above
46.00	48.00	0.23		CLAY	as above
48.00	50.00	0.16		CLAY	Porphyroblastic garnet - biotite quartz pelitic schist
50.00	52.00	0.12		CLAY	as above
52.00	54.00	4.16		METASILTSTONE	fg, d gy-gn, micaceous trace foliations
54.00	56.00	1.18		METASILTSTONE	as above
56.00	58.00	0.19		METASILTSTONE	as above
58.00	59.00	0.19		METASILTSTONE	Quartzofelspathic metasandstone with schistose chlorite after biotite

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	BUL 91	**1:100 000 Map**	5837
Traverse		**UnitNo**	369
Station		**Max Depth (m)**	58.00
Completion Date	3/05/96	**Drilling Method**	RC
Dip at Collar	-90.00	**AMG Easting**	478039
Azimuth at Collar		**AMG Northing**	6648079
		Zone	53
Logged By	R SHAW	**Depth to Bsmt**	36

Comments Mineralogical Report No 7125 Pet at 56m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.18		SILT	Silty Clay rd-br, variably cemented by CaCO3
2.00	4.00	0.20		SILT	as above
4.00	6.00	0.14		SILT	as above
6.00	8.00	0.02		SILT	Silty Sand fg qtz sand, minor or-yl ferruginous silt
8.00	10.00	0.05		SILT	as above
10.00	12.00	0.17		SILCRETE	Silcrete/Sand, off wh, v hard ,variably silcreted sand, minor silt
12.00	14.00	0.22		SILCRETE	as above
14.00	16.00	0.07		SAND	SandySilt, off wh, silt common f-mg sand, occ clay lesser
16.00	18.00	0.02		SAND	as above
18.00	20.00	0.02		SAND	as above
20.00	22.00	0.07		SAND	as above
22.00	24.00	0.10		SAND	as above
24.00	26.00	0.08		SAND	as above
26.00	28.00	0.08		SAND	as above
28.00	30.00	0.11		SAND	as above
30.00	32.00	0.06		SAND	as above
32.00	34.00	0.05		SAND	as above but more clayey
34.00	36.00	0.10		SAND	as above
36.00	38.00	0.10		GRANITE	Weathered Granite/BIF, off wh lyl-gn, clay occ mr-br FeO Blebs/bands
38.00	40.00	0.18		GRANITE	as above
40.00	42.00	3.29		GRANITE	as above
42.00	44.00	0.36		GRANITE	lbl gn/gy clay talcose, micaceous, chloritic?
44.00	46.00	0.34		GRANITE	as above
46.00	48.00	0.65		GRANITE	as above
48.00	50.00	1.63		GRANITE	as above but with occ dgy Mt rich veins/blebs
50.00	52.00	0.31		GRANITE	as above
52.00	54.00	21.90		GRANITE	Granite/Mag BIF, pk-br dgn f-cg granite with common fg dgy
54.00	56.00	58.60		GRANITE	Qtz Monzonite, weakly to strongly altered, ranging to quartz Syenite

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	BUL 92	**1:100 000 Map**	5837
Traverse	7800N	**UnitNo**	370
Station	478683E	**Max Depth (m)**	62.00
Completion Date	3/05/96	**Drilling Method**	RC
Dip at Collar	-90.00	**AMG Easting**	478658
Azimuth at Collar		**AMG Northing**	6647824
Logged By	R SHAW	**Zone**	53
		Depth to Bsmt	58

Comments Mineralogical Report No 7125 Pet at 62m , some water in sands

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.35		SAND	Sandy Silt/Gravel rd-br, poorly consol, occ Fe0 granules, slightly calcareous
2.00	4.00	0.86		SAND	as above
4.00	6.00	0.22		SAND	as above
6.00	8.00	0.15		SAND	Silty Sand, f-cg, trace yl staining trace silt
8.00	10.00	0.09		SAND	wh, soft, with occ variably cemented
10.00	12.00	0.07		SAND	m-cg sand bands
12.00	14.00	0.06		SAND	m-cg sand bands
14.00	16.00	0.07		SAND	m-cg sand bands
16.00	18.00	0.09		SAND	m-cg sand bands
18.00	20.00	0.11		SAND	m-cg sand bands
20.00	22.00	0.11		SAND	m-cg sand bands
22.00	24.00	0.06		SAND	m-cg sand bands
24.00	26.00	0.09		SAND	m-cg sand bands
26.00	28.00	0.06		SAND	m-cg sand bands
28.00	30.00	0.10		SAND	m-cg sand bands
30.00	32.00	0.17		SAND	as above
32.00	34.00	0.13		SAND	Ferruginious Sand, f-cg sand/gv (upto 10m) common blk-mr Fe0 Cement
34.00	36.00	0.09		SAND	as above
36.00	38.00	0.14		SILT	Silty Sand f-cg sand with minor br and off whi silt rare clay lenses
38.00	40.00	0.06		SILT	as above
40.00	42.00	0.04		SILT	as above
42.00	44.00	0.10		SILT	as above
44.00	46.00	0.04		SILT	as above
46.00	48.00	0.05		SILT	as above
48.00	50.00	0.06		SILT	as above
50.00	52.00	0.09		SILT	as above
52.00	54.00	0.09		SILT	as above
54.00	56.00	0.05		SILT	as above
56.00	58.00	0.08		SILT	as above
58.00	60.00	1.13		GRANITE	Granite/Mag BIF dgn and pk k-feld /plag/qtz/px? mg granite
60.00	62.00	6.75		GRANITE	with occ magnetite rich zones throughout

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	BUL 93		**1:100 000 Map**	5837
Traverse	8300N		**UnitNo**	371
Station	478745E		**Max Depth (m)**	67.00
Completion Date	3/05/96		**Drilling Method**	RC
Dip at Collar	-90.00		**AMG Easting**	478731
Azimuth at Collar			**AMG Northing**	6648295
Logged By	R SHAW		**Zone**	53
			Depth to Bsmt	64

Comments Mineralogical Report No 7125 Pet at 67m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.30		SAND	Sandy Silt/ rd-br soft, occ silcreted, slightly calcareous
2.00	4.00	0.20		SAND	as above
4.00	6.00	0.13		SAND	as above
6.00	8.00	0.16		SAND	as above
8.00	10.00	0.14		SAND	vf-cg common FeO staining, trace silt
10.00	12.00	0.04		SAND	as above
12.00	14.00	0.03		SAND	as above
14.00	16.00	0.07		SAND	as above
16.00	18.00	0.04		SAND	f-cg sand in off wh/pk/yl silt occ qtz gravel
18.00	20.00	0.09		SAND	occ clayey bands
20.00	22.00	0.19		SAND	as above
22.00	24.00	0.15		SAND	as above
24.00	26.00	0.14		SAND	as above
26.00	28.00	0.13		SAND	as above
28.00	30.00	0.09		SAND	as above
30.00	32.00	0.08		SAND	as above
32.00	34.00	0.08		SAND	as above
34.00	36.00	0.15		SAND	as above
36.00	38.00	0.11		SAND	as above
38.00	40.00	0.07		SAND	as above
40.00	42.00	0.41		SAND	as above
42.00	44.00	0.14		SAND	as above
44.00	46.00	0.13		SAND	as above
46.00	48.00	0.11		SAND	as above
48.00	50.00	0.23		SAND	as above
50.00	52.00	0.11		SAND	as above
52.00	54.00	0.09		SAND	m-cg qtz sand, minor lgy silt
54.00	56.00	0.03		SAND	(water struck 1 L/sec)
56.00	58.00	0.04		SAND	as above
58.00	60.00	0.18		SAND	as above
60.00	62.00	2.29		SAND	Sand/Sandstone lgy, variably cemented, trace Pyrite, l-mg clay and qtz gravel
62.00	64.00	2.12		SAND	as above
64.00	66.00	11.90		BIF	Hematitic Mag BIF, finely laminated dgy/wh -rd BIF minor gyn mr Ht
66.00	67.00	71.90		BIF	as above, but less weathered BIF 25-30% magnetite

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name BUL 94
Traverse
Station
Completion Date 4/05/96
Dip at Collar -90.00
Azimuth at Collar
Logged By R SHAW

1:100 000 Map 5837
UnitNo 372
Max Depth (m) 63.00
Drilling Method RC
AMG Easting 479398
AMG Northing 6648843
Zone 53
Depth to Bsmt 62

Comments Mineralogical Report No 7125 Pet at 63m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.15		SILT	Silty/Clay - rd-br variably cemented by CaCO3
2.00	4.00	0.25		SILT	as above
4.00	6.00	0.16		SILT	as above
6.00	8.00	0.04		SAND	Ferruginous Sand- F-mg, common yl/or/rd FeO staining , trace silt
8.00	10.00	0.05		SAND	as above
10.00	12.00	0.27		SAND	as above
12.00	14.00	0.03		SAND	Sandy/Silt - off wh (occ yl-br-lgy) silt , common f-cg
14.00	16.00	0.04		SAND	qtz sand/gravel occ clay lenses
16.00	18.00	0.12		SAND	as above
18.00	20.00	0.09		SAND	as above
20.00	22.00	0.07		SAND	as above
22.00	24.00	0.11		SAND	as above
24.00	26.00	0.10		SAND	as above
26.00	28.00	0.25		SAND	as above
28.00	30.00	0.18		SAND	as above
30.00	32.00	0.21		SAND	as above
32.00	34.00	0.50		SAND	as above
34.00	36.00	0.24		SAND	as above
36.00	38.00	0.19		SAND	as above
38.00	40.00	0.19		SAND	as above
40.00	42.00	0.20		SAND	as above
42.00	44.00	0.10		SAND	as above
44.00	46.00	0.13		SAND	as above
46.00	48.00	0.14		SAND	as above
48.00	50.00	0.17		SAND	as above
50.00	52.00	0.09		SAND	as above
52.00	54.00	0.05		SAND	as above
54.00	56.00	0.13		SAND	as above
56.00	58.00	0.08		SAND	as above
58.00	60.00	0.13		SAND	as above
60.00	62.00	0.12		SAND	as above
62.00	63.00	0.06		GRANITE	Granite/Rhyolite - Br f g dirty matrix with cg rd-br Kfelds o gy qtz trace pyrite in fractures v hard drilling, Pet-Microgranite porphyry

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name BUL 95
Traverse
Station
Completion Date 4/05/96
Dip at Collar -90.00
Azimuth at Collar
Logged By R SHAW

1:100 000 Map 5837
UnitNo 373
Max Depth (m) 65.00
Drilling Method RC
AMG Easting 480012
AMG Northing 6648892
Zone 53
Depth to Bsmt 58

Comments Mineralogical Report No 7125 Pet at 65m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.22		SILT	Silty/Clay - rd-br, occasional CaCO3 cement
2.00	4.00	0.26		SILT	as above
4.00	6.00	0.15		SILT	as above but rare CaCo3 cement
6.00	8.00	0.09		SAND	f-mg, common yl-or Fe0 staining , rare silt
8.00	10.00	0.10		SAND	f-mg, common yl-or Fe0 staining , rare silt
10.00	12.00	0.04		SAND	f-mg, common yl-or Fe0 staining , rare silt
12.00	14.00	0.08		SAND	f-mg, common yl-or Fe0 staining , rare silt
14.00	16.00	0.09		SAND	Sandy/Silt - off wh silt, common f-cg sand , occ clay lenses
16.00	18.00	0.15		SAND	as above
18.00	20.00	0.13		SAND	as above
20.00	22.00	0.13		SAND	as above
22.00	24.00	0.15		SAND	as above
24.00	26.00	0.12		SAND	as above
26.00	28.00	0.18		SAND	as above
28.00	30.00	0.28		SAND	as above
30.00	32.00	0.18		SAND	as above but off wh to maroon
32.00	34.00	0.10		SAND	as above but off wh to maroon
34.00	36.00	0.24		SAND	as above but off wh to maroon
36.00	38.00	0.10		SAND	as for 14-16m
38.00	40.00	0.09		SAND	as above
40.00	42.00	0.06		SAND	as above
42.00	44.00	0.29		SAND	as above
44.00	46.00	0.08		SAND	as above
46.00	48.00	0.08		SAND	as above
48.00	50.00	0.09		SAND	as above with common lgy clay
50.00	52.00	0.09		SAND	as above
52.00	54.00	0.13		SAND	as above
54.00	56.00	0.09		SAND	as above
56.00	58.00	0.08		SAND	as above with minor gy-blk carbonceous clay (cps?)
58.00	60.00	0.09		CLAY	Clay/Granite highly weathered, off wh-pk qtz/plag/k-felds
60.00	62.00	0.07		CLAY	as above
62.00	64.00	0.06		GRANITE	as above but slightly to mod weathered (cg)
64.00	65.00	0.05		GRANITE	qtz/plag/k-feld, cg Glenloth Granite? Pegmatite, very coarse granitiod fractured to fragmented, sericite veined

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	BUL 96	**1:100 000 Map**	5837
Traverse		**UnitNo**	374
Station		**Max Depth (m)**	54.00
Completion Date	4/05/96	**Drilling Method**	RC
Dip at Collar	-90.00	**AMG Easting**	478378
Azimuth at Collar		**AMG Northing**	6645201
		Zone	53
Logged By	R SHAW	**Depth to Bsmt**	46

Comments Mineralogical Report No 7125 Pet at 54m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.47		SILT	Silty Clay- rd-br, variably cemented, calcareous
2.00	4.00	0.61		SILT	as above
4.00	6.00	0.25		SILT	as above
6.00	8.00	0.09		SAND	F-cg, common yl-rd FeO staining, minor pk-br silt
8.00	10.00	0.13		SAND	as above
10.00	12.00	0.09		SAND	as above
12.00	14.00	0.08		SAND	off wh, common f-cg sand ,occ qtz gravel and clay lenses
14.00	16.00	0.06		SAND	as above
16.00	18.00	0.12		SAND	as above
18.00	20.00	0.06		SAND	as above
20.00	22.00	0.15		SAND	as above
22.00	24.00	0.09		SAND	as above
24.00	26.00	0.14		SAND	as above
26.00	28.00	0.21		SAND	as above
28.00	30.00	0.11		SAND	as above
30.00	32.00	0.15		SAND	as above
32.00	34.00	0.10		SAND	as above
34.00	36.00	0.29		SAND	as above
36.00	38.00	0.25		SAND	as above
38.00	40.00	0.11		SAND	as above
40.00	42.00	0.07		SAND	as above
42.00	44.00	0.18		SAND	as above
44.00	46.00	0.05		SAND	as above
46.00	48.00	0.08		GRANITE	Weathered Granite, soft sticky, off wh-lyl -pk/br, clayey
48.00	50.00	0.03		GRANITE	as above
50.00	52.00	0.07		GRANITE	as above
52.00	54.00	0.31		GRANITE	dgn-gy, m-cg, px?/plag/k-feld, crystalline common yl-br FeO staining, Pet: Monzodiorite, albite-sericite-epidote-chlorite-clay altered

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	BUL 97	**1:100 000 Map**	5837
Traverse		**UnitNo**	375
Station		**Max Depth (m)**	17.00
Completion Date	4/05/96	**Drilling Method**	RC
Dip at Collar	-90.00	**AMG Easting**	470690
Azimuth at Collar		**AMG Northing**	6644371
Logged By	R SHAW	**Zone**	53
		Depth to Bsmt	4

Comments Mineralogical Report No 7125 Pet at 17m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.49		SAND	Sandy Silt/Gravel - rd-br, poorly consolidated
2.00	4.00	0.97		SAND	as above
4.00	6.00	0.98		BIF	Weathered BIF - wh-lgy, highly siliceous wh/gy banded, highly weathered/bleached
6.00	8.00	1.17		BIF	as above
8.00	10.00	1.38		BIF	as above
10.00	12.00	1.58		BIF	as above
12.00	14.00	1.04		BIF	as above
14.00	16.00	1.37		BIF	as above
16.00	17.00	1.30		BIF	well banded, gy iron-rich bands and wh-rd/yl chert bands, Common yl-br goethitic staining v hard drilling Pet: BIF magnetite 1-2%

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	BUL 98	**1:100 000 Map**	5837
Traverse		**UnitNo**	376
Station		**Max Depth (m)**	65.00
Completion Date	5/05/96	**Drilling Method**	RC
Dip at Collar	-90.00	**AMG Easting**	471485
Azimuth at Collar		**AMG Northing**	6644725
		Zone	53
Logged By	R SHAW	**Depth to Bsmt**	10

Comments Mineralogical Report No 7125 Pet at 65m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.68		SILT	Silty/Clay - rd-br, soft, variably CaCO3 cemented from 4-10m
2.00	4.00	0.26		SILT	as above
4.00	6.00	0.61		SILT	as above
6.00	8.00	0.08		SILT	as above
8.00	10.00	0.46		SILT	as above
10.00	12.00	0.05		CLAY	Puggy, waxy, off wh-lgy-gn, chloritic, talcose texture
12.00	14.00	0.08		CLAY	as above
14.00	16.00	0.12		CLAY	as above
16.00	18.00	0.08		CLAY	as above
18.00	20.00	0.08		CLAY	as above
20.00	22.00	0.06		CLAY	as above
22.00	24.00	0.07		CLAY	as above
24.00	26.00	0.03		CLAY	as above
26.00	28.00	0.08		CLAY	as above
28.00	30.00	0.04		CLAY	as above
30.00	32.00	0.02		CLAY	as above
32.00	34.00	0.14		DOLERITE	l-dgy-gn, clayey, occ gf-br staining vfg
34.00	36.00	0.06		DOLERITE	as above
36.00	38.00	0.07		DOLERITE	as above
38.00	40.00	0.09		DOLERITE	as above
40.00	42.00	0.07		DOLERITE	as above
42.00	44.00	0.03		DOLERITE	as above
44.00	46.00	0.16		DOLERITE	as above
46.00	48.00	0.05		DOLERITE	as above
48.00	50.00	0.04		DOLERITE	as above
50.00	52.00	0.09		DOLERITE	as above but dgn-bl and yl-br Fe0 in joints trace vein qtz
52.00	54.00	0.11		DOLERITE	as above
54.00	56.00	0.14		DOLERITE	as above
56.00	58.00	0.03		DOLERITE	as above
58.00	60.00	0.05		DOLERITE	as above
60.00	62.00	0.06		DOLERITE	dgy-gn ,crystalline vfg, occ yl-br
62.00	64.00	0.05		DOLERITE	FeO staining
64.00	65.00	0.05		DOLERITE	Fe0 staining Pet: unmetamorphosed claystones to siltstones possibly equivalent or younger than G.R.V

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name BUL 99
Traverse
Station
Completion Date 5/05/96
Dip at Collar -90.00
Azimuth at Collar
Logged By R SHAW

1:100 000 Map 5837
UnitNo 377
Max Depth (m) 77.00
Drilling Method RC
AMG Easting 472003
AMG Northing 6645017
Zone 53
Depth to Bsmt 8

Comments Mineralogical Report No 7125 Pet at 77m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.34		SILT	Silty Clay rd-br soft
2.00	4.00	0.30		SILT	Cemented Silty Clay - as above but variably cemented by CO3
4.00	6.00	0.47		SILT	as above
6.00	8.00	0.98		SILT	as above
8.00	10.00	0.20		METASILTSTONE	Wthd Metasiltstone - soft, waxy, off wh lgn-gy, clayey, chloritic?
10.00	12.00	0.12		METASILTSTONE	as above
12.00	14.00	0.08		METASILTSTONE	as above
14.00	16.00	0.03		METASILTSTONE	as above
16.00	18.00	0.03		METASILTSTONE	as above
18.00	20.00	0.03		METASILTSTONE	as above
20.00	22.00	0.03		METASILTSTONE	as above
22.00	24.00	0.03		SILTSTONE	Weathered Siltstone - l-mgy, homogeneous, clayey, trace mica & yl Fe0 staining and occ mr Fe0 grit
24.00	26.00	0.05		SILTSTONE	as above
26.00	28.00	0.03		SILTSTONE	as above
28.00	30.00	0.03		SILTSTONE	as above
30.00	32.00	0.03		SILTSTONE	as above
32.00	34.00	0.04		SILTSTONE	as above
34.00	36.00	0.10		SILTSTONE	as above
36.00	38.00	0.04		SILTSTONE	as above
38.00	40.00	0.06		SILTSTONE	as above
40.00	42.00	0.07		SILTSTONE	as above
42.00	44.00	0.03		SILTSTONE	as above
44.00	46.00	0.07		SILTSTONE	as above
46.00	48.00	0.05		SILTSTONE	as above
48.00	50.00	0.04		SILTSTONE	as above
50.00	52.00	0.06		SILTSTONE	as above
52.00	54.00	0.03		SILTSTONE	as above
54.00	56.00	0.03		SILTSTONE	as above
56.00	58.00	0.05		SILTSTONE	as above
58.00	60.00	0.06		SILTSTONE	as above
60.00	62.00	0.02		SILTSTONE	as above
62.00	64.00	0.00		SILTSTONE	as above
64.00	66.00	0.04		SILTSTONE	as above
66.00	68.00	0.03		SILTSTONE	as above
68.00	70.00	0.07		SILTSTONE	as above
70.00	72.00	0.13		SILTSTONE	mgy, well indurated, homogenous, trace yl-br Fe0 staining on joint surfaces
72.00	74.00	0.06		SILTSTONE	as above
74.00	76.00	0.09		SILTSTONE	as above

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
76.00	77.00	0.07		SILTSTONE	lava, of G.R.V

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	BUL 100	**1:100 000 Map**	5837
Traverse		**UnitNo**	378
Station		**Max Depth (m)**	59.00
Completion Date	5/05/96	**Drilling Method**	RC
Dip at Collar	-90.00	**AMG Easting**	480400
Azimuth at Collar		**AMG Northing**	6646885
		Zone	53
Logged By	R SHAW	**Depth to Bsmt**	58

Comments Mineralogical Report No 7125 Pet at 59m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	1.00		SILT	Silty/Clay rd-br and lbr, variably cemented by CaCO3 to 8 m
2.00	4.00	0.20		SILT	as above
4.00	6.00	0.43		SAND	as above
6.00	8.00	0.21		SAND	as above
8.00	10.00	0.11		SAND	as above
10.00	12.00	0.07		SAND	as above
12.00	14.00	0.13		SAND	off wh, soft, common f-cg qtz sand minor silcrete (14-18m)
14.00	16.00	0.09		SAND	as above
16.00	18.00	0.09		SAND	as above
18.00	20.00	0.09		SAND	as above
20.00	22.00	0.11		SAND	as above
22.00	24.00	0.09		SAND	as above
24.00	26.00	0.09		SAND	as above
26.00	28.00	0.13		SAND	as above
28.00	30.00	0.10		SAND	as above
30.00	32.00	0.10		SAND	as above
32.00	34.00	0.07		SAND	as above
34.00	36.00	0.04		SAND	as above
36.00	38.00	0.09		SAND	as above
38.00	40.00	0.14		SAND	as above
40.00	42.00	0.12		SAND	lgy-br, clay with common f-mg qtz sand interbeds (occ qtz gravel upto 20mm)
42.00	44.00	0.11		SAND	as above
44.00	46.00	0.12		SAND	as above
46.00	48.00	0.12		SAND	as above
48.00	50.00	0.11		SAND	as above
50.00	52.00	0.06		SAND	as above
52.00	54.00	0.10		SAND	as above
54.00	56.00	0.16		SAND	as above
56.00	58.00	0.05		GRANITE	as above
58.00	59.00	0.02		GRANITE	dbr (minor pk and gn) Kfeld/Hornblende/qtz, Ealbara Rhyolite? Syenite, altered from the Pet.

MESA - South Australian Steel and Energy Project
Drillhole Summary

Drillhole Name	BUL 101	**1:100 000 Map**	5837
Traverse		**UnitNo**	379
Station		**Max Depth (m)**	57.00
Completion Date	5/05/96	**Drilling Method**	RC
Dip at Collar	-90.00	**AMG Easting**	482222
		AMG Northing	6647546
Azimuth at Collar		**Zone**	53
Logged By	R SHAW	**Depth to Bsmt**	54

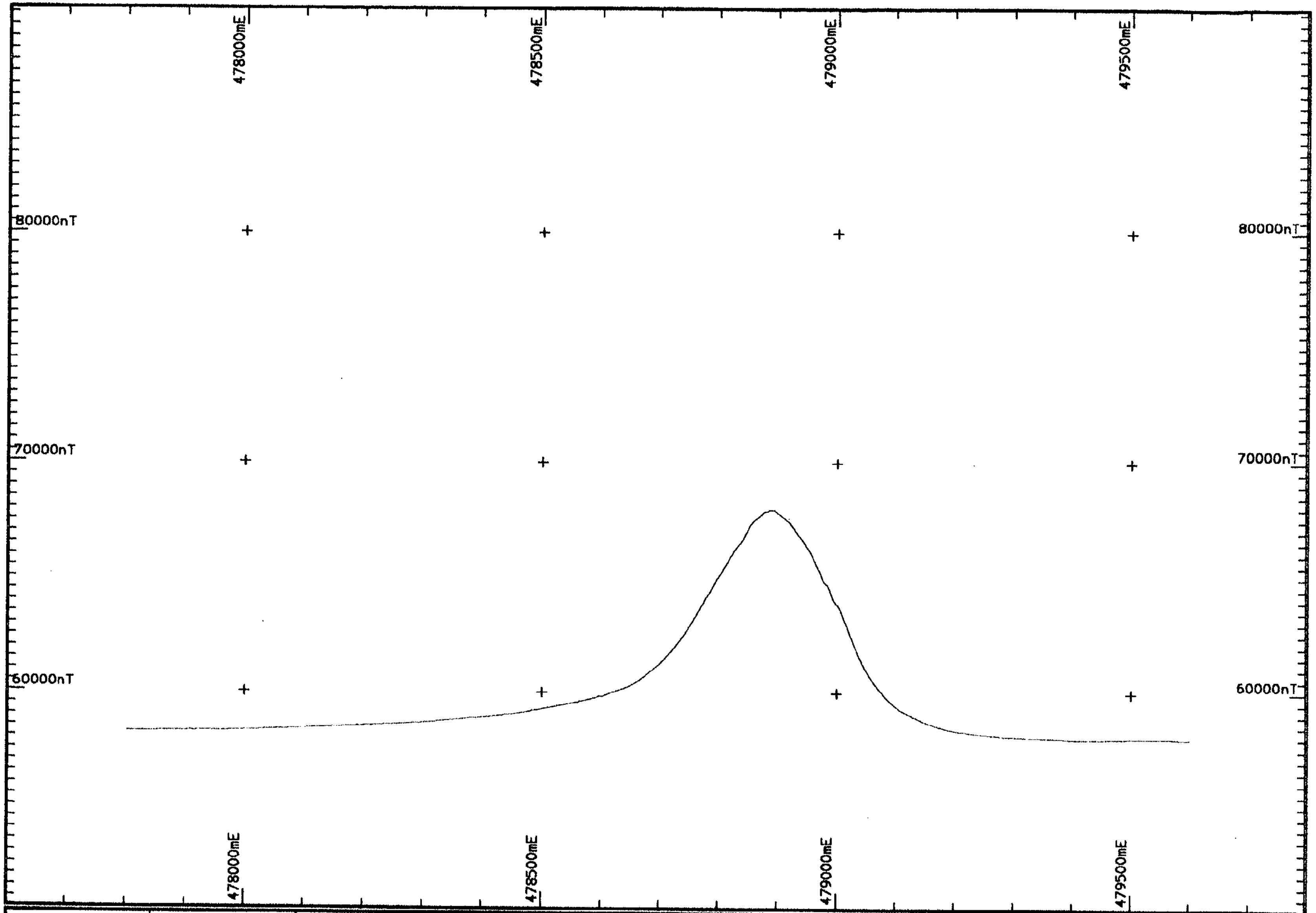
Comments Mineralogical Report No 7125 Pet at 57m, strong sulphide smell coming from cyclone at 56-57m

From	To	Mag Susc SIUnits *1000	Fe %	Major Rock	Lithology Description
0.00	2.00	0.75		SILT	Silty/Clay, trace gravel
2.00	4.00	0.34		SILT	Silty/Clay/Gravel - rd-br/lbr silty clay and gravel cemented by CaC03
4.00	6.00	0.74		SILT	as above
6.00	8.00	0.12		SILT	as above
8.00	10.00	0.13		SILT	as above
10.00	12.00	0.12		SAND	Sandy/Silt off wh, soft, common f-cg qtz sand
12.00	14.00	0.06		SAND	as above
14.00	16.00	0.10		SAND	as above
16.00	18.00	0.10		SAND	as above
18.00	20.00	0.04		SAND	as above
20.00	22.00	0.10		SAND	as above
22.00	24.00	0.06		SAND	as above
24.00	26.00	0.03		SAND	as above
26.00	28.00	0.05		SILT	lgy-wh, slightly carbonaceous, puggy
28.00	30.00	0.02		SILT	as above
30.00	32.00	0.03		SILT	as above
32.00	34.00	0.13		SILT	as above
34.00	36.00	0.14		SILT	as above
36.00	38.00	0.12		SILT	f-mg sand with common wh/yl/pk/br silt
38.00	40.00	0.12		SILT	as above
40.00	42.00	0.11		SILT	as above
42.00	44.00	0.13		SILT	as above
44.00	46.00	0.06		SILT	as above
46.00	48.00	0.14		SAND	f-cg, minor l-mgy, cb, silt and occ clay lenser
48.00	50.00	0.08		SAND	as above
50.00	52.00	0.10		SAND	as above
52.00	54.00	0.08		SAND	as above
54.00	56.00	0.14		GRANITE	Granite with Breccia l-mg clayey
56.00	57.00	0.11		GRANITE	L br-gy, f-cg, K-feld/Hornblende/Qtz occ qtz veining pyrite/sulphide throughout Rhyolite porphyritic, with clay qtz leucoxene alteration

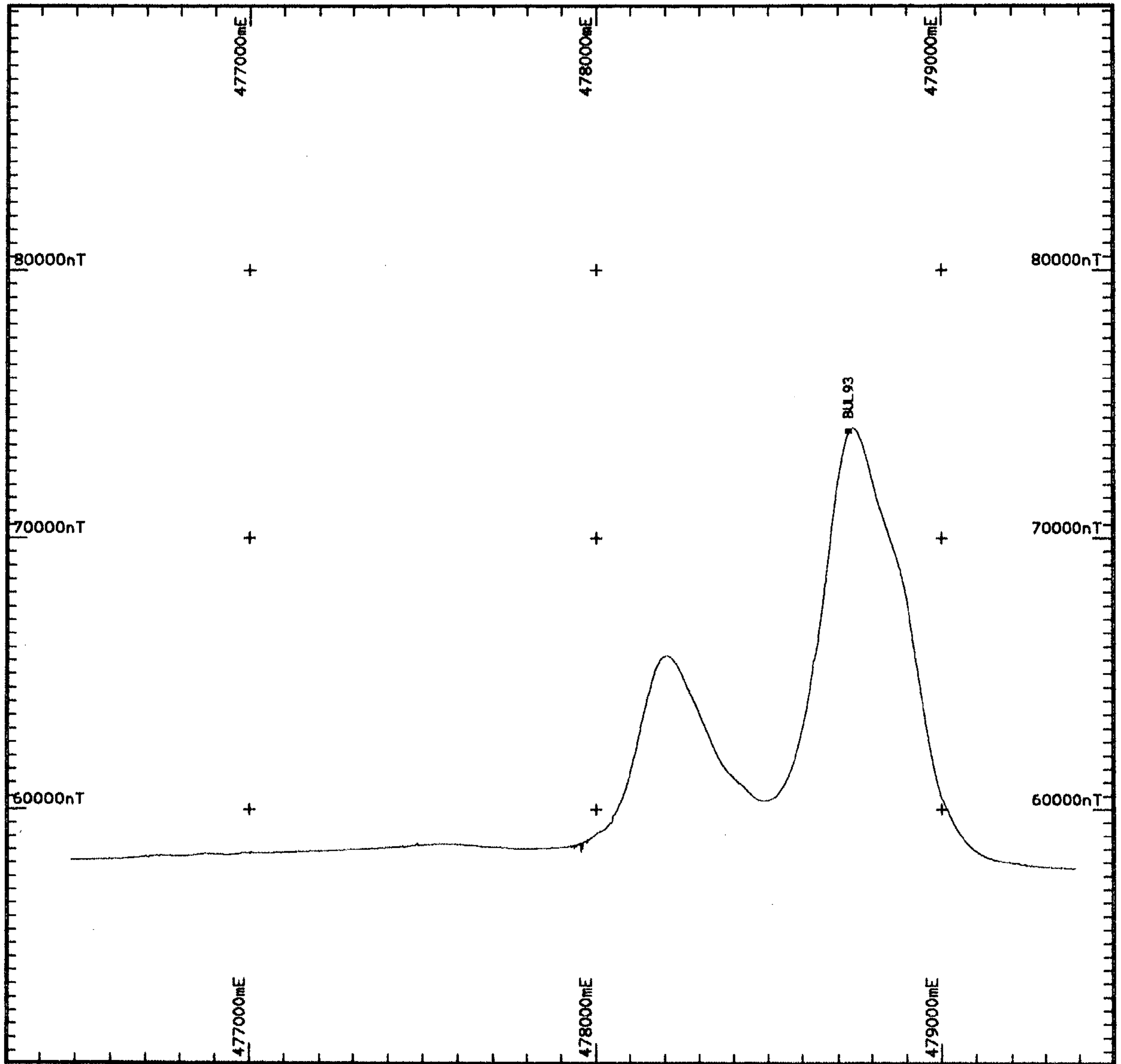
APPENDIX 2

GROUND MAGNETIC AND GRAVITY PROFILES

1:10 000 OR 1:20 000 SCALE



XSCALE 1:10000 YSCALE 1:250000	DATE 22/11/96	SHEET 1 of 1	LEGEND	
	REF No. 1	FILE 8600NM.PLT	*GW23 RC HAMMER DRILLHOLE *BUL10 RC AIRCORE DRILLHOLE	S.A.STEEL AND ENERGY PROJECT GIFFEN WELL PROSPECT GROUND MAGNETIC PROFILE 6648600N
0 500m				



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YSCALE 1:250000	REF No. 1	FILE 8300NM.PLT

0 1000m

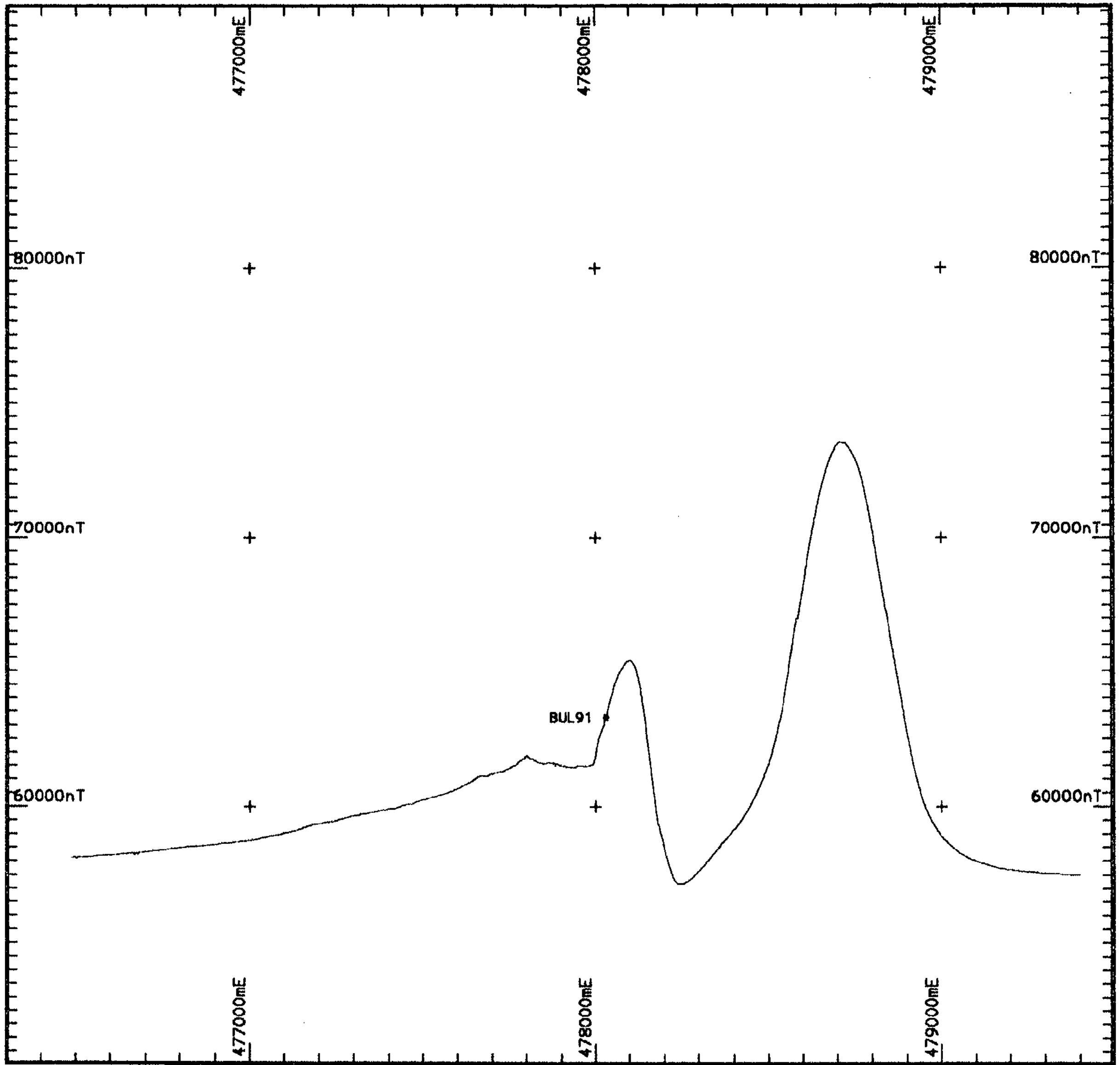
LEGEND

* GW23 RC HAMMER DRILLHOLE
* BUL10 RC AIRCORE DRILLHOLE

S.A.STEEL AND ENERGY PROJECT

GIFFEN WELL PROSPECT

GROUND MAGNETIC PROFILE 6648300N



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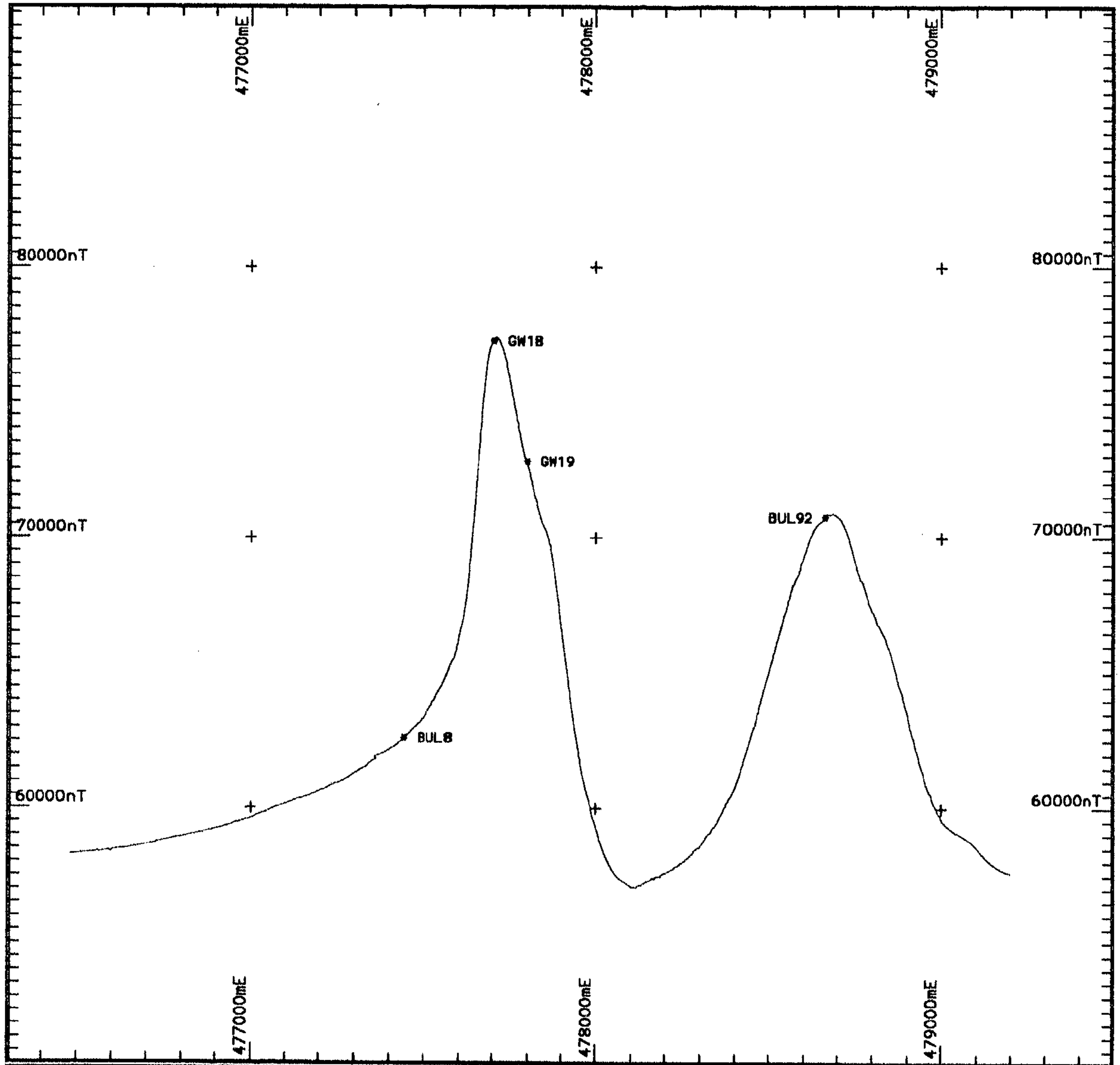
	REF No. 1	FILE 8000NM.PLT
0 … 1000m		

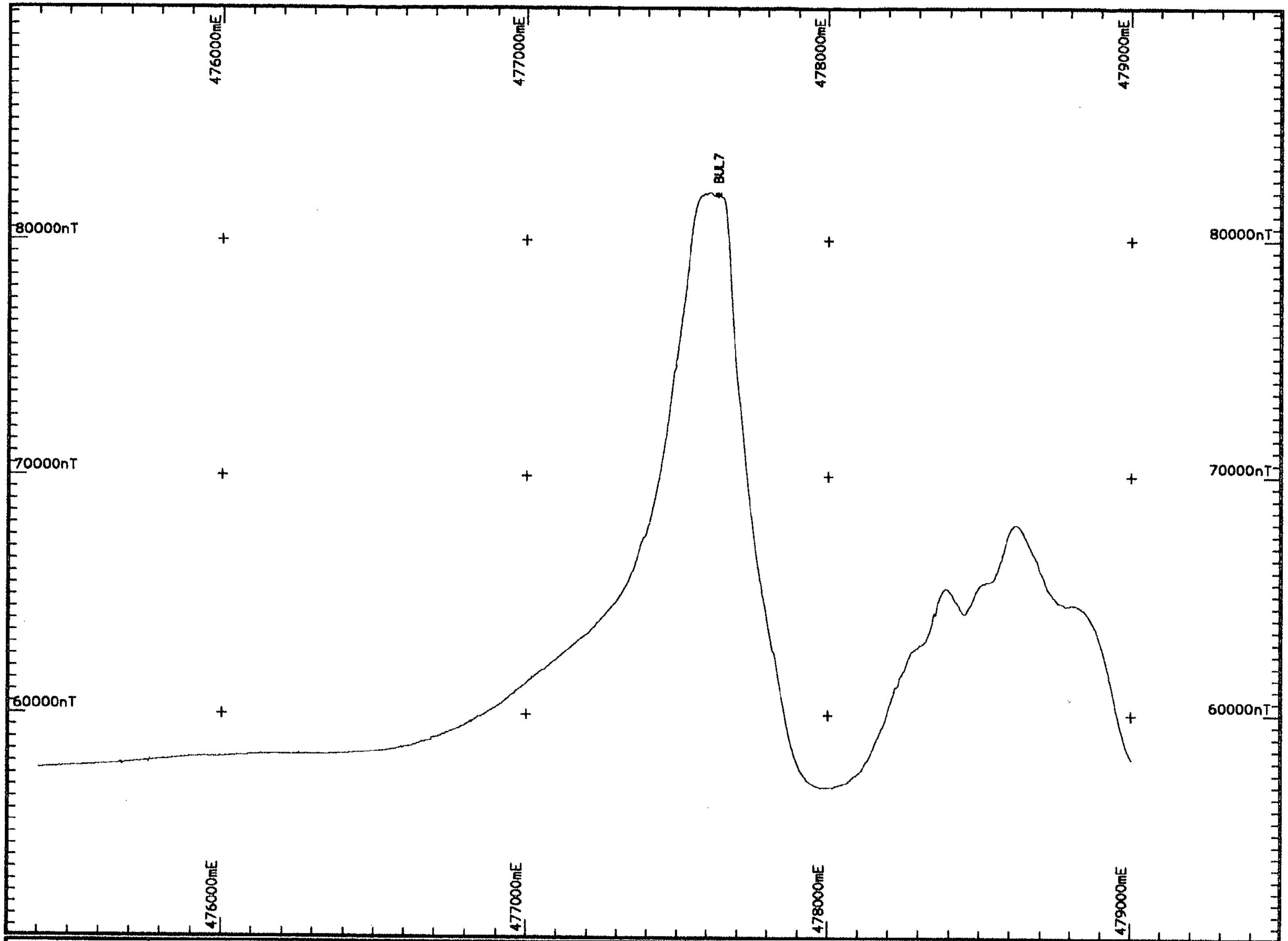
LEGEND
*GW23 RC HAMMER DRILLHOLE
*BUL10 RC AIRCORE DRILLHOLE

S.A.STEEL AND ENERGY PROJECT
GIFFEN WELL PROSPECT
GROUND MAGNETIC PROFILE 6648000N

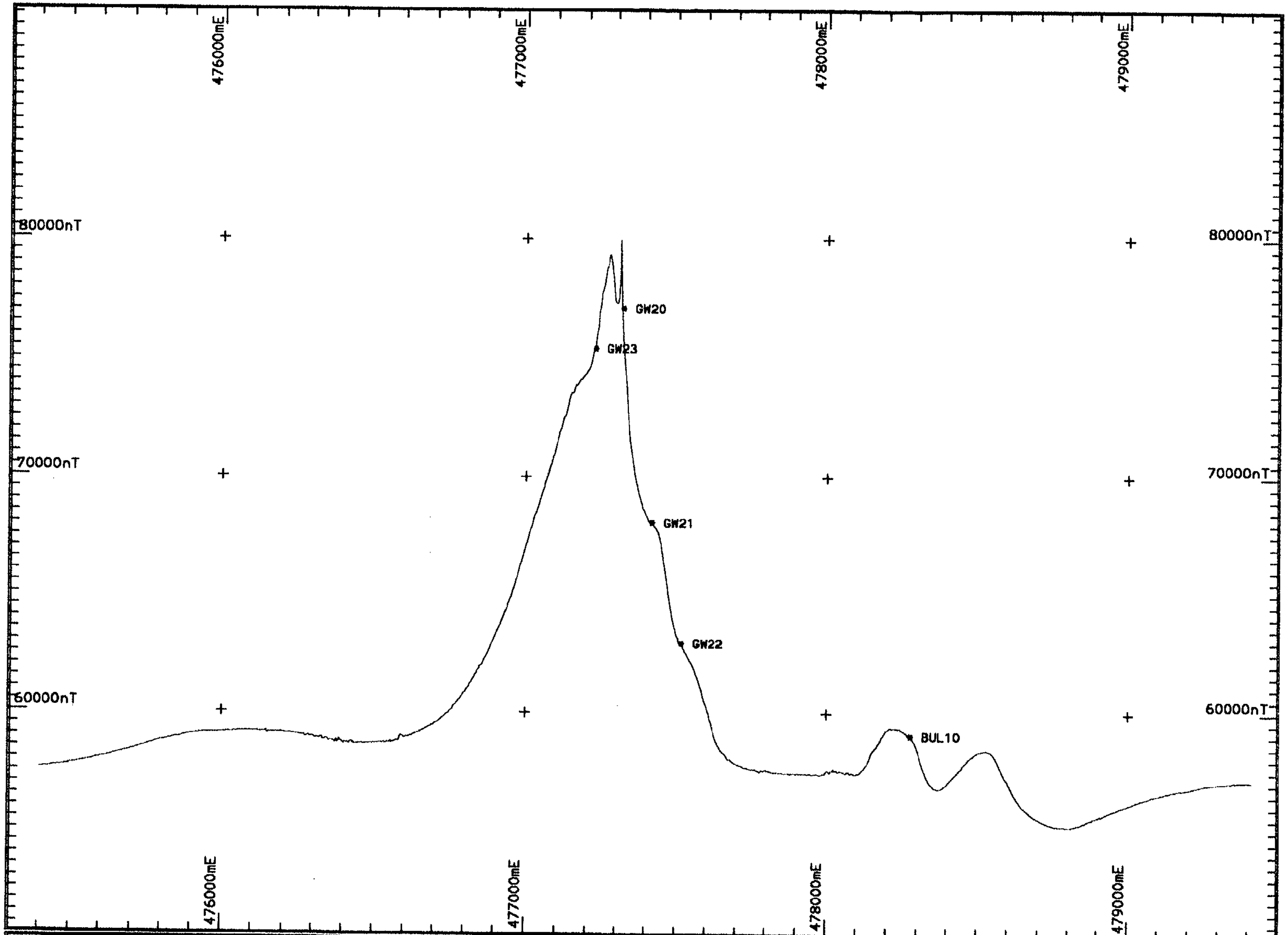


XSCALE 1:20000 YSCALE 1:250000	DATE 22/11/96	SHEET 1 of 1	LEGEND
	REF No. 1	FILE 7800NM.PLT	*GW23 RC HAMMER DRILLHOLE *BUL10 RC AIRCORE DRILLHOLE

S.A.STEEL AND ENERGY PROJECT
GIFFEN WELL PROSPECT
GROUND MAGNETIC PROFILE 6647800N



XSCALE 1:20000	DATE 22/11/96	SHEET 1 of 1	LEGEND	S.A.STEEL AND ENERGY PROJECT
YSCALE 1:250000	REF No. 1	FILE 7600NM.PLT	* GW23 RC HAMMER DRILLHOLE	GIFFEN WELL PROSPECT
0 — 1000m			* BUL10 RC AIRCORE DRILLHOLE	GROUND MAGNETIC PROFILE 6647600N



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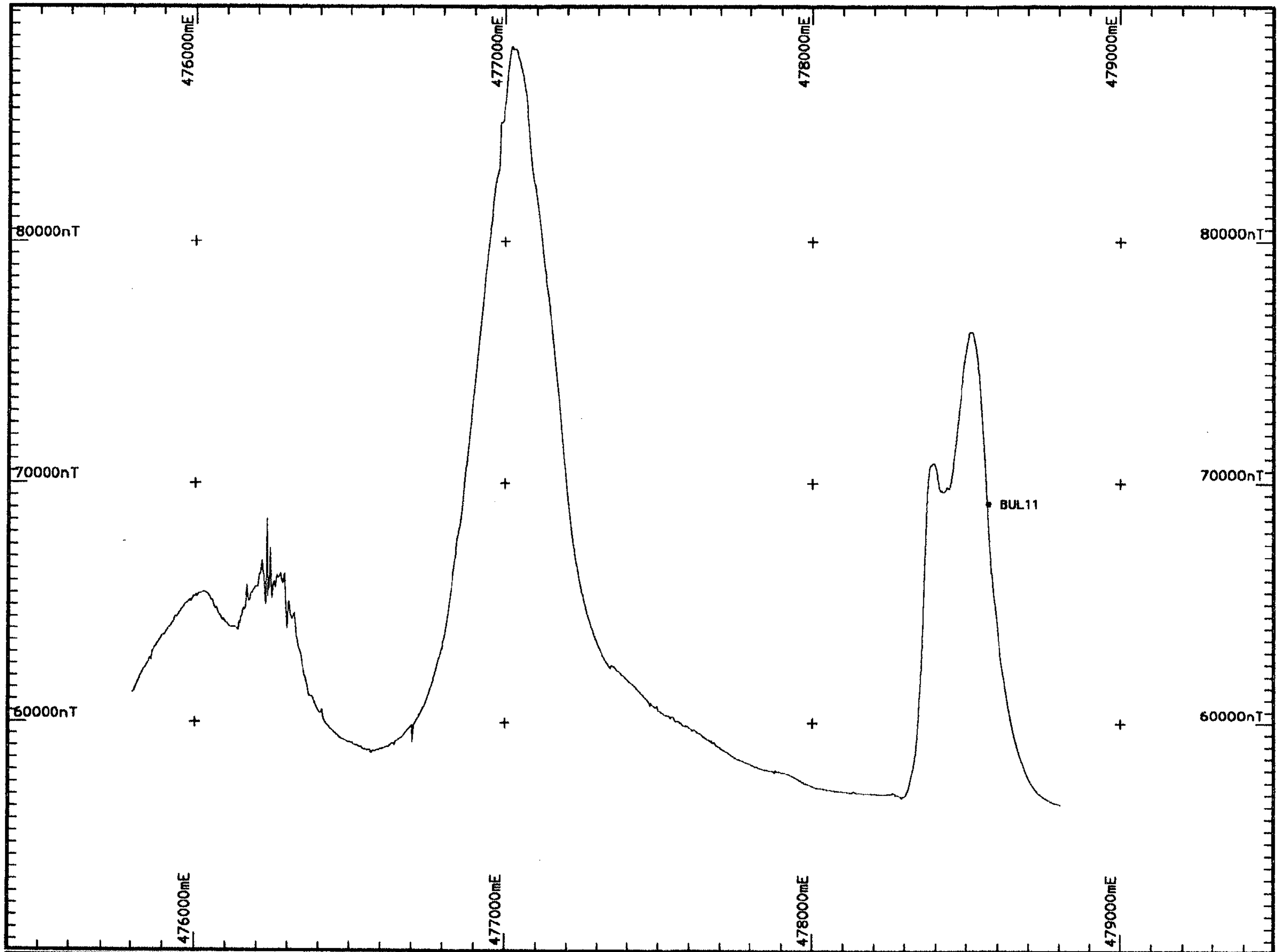
	REF No. 1	FILE 7400NM.PLT	*GW23 RC HAMMER DRILLHOLE *BUL10 RC AIRCORE DRILLHOLE	GIFFEN WELL PROSPECT GROUND MAGNETIC PROFILE 6647400N
0 1000m				

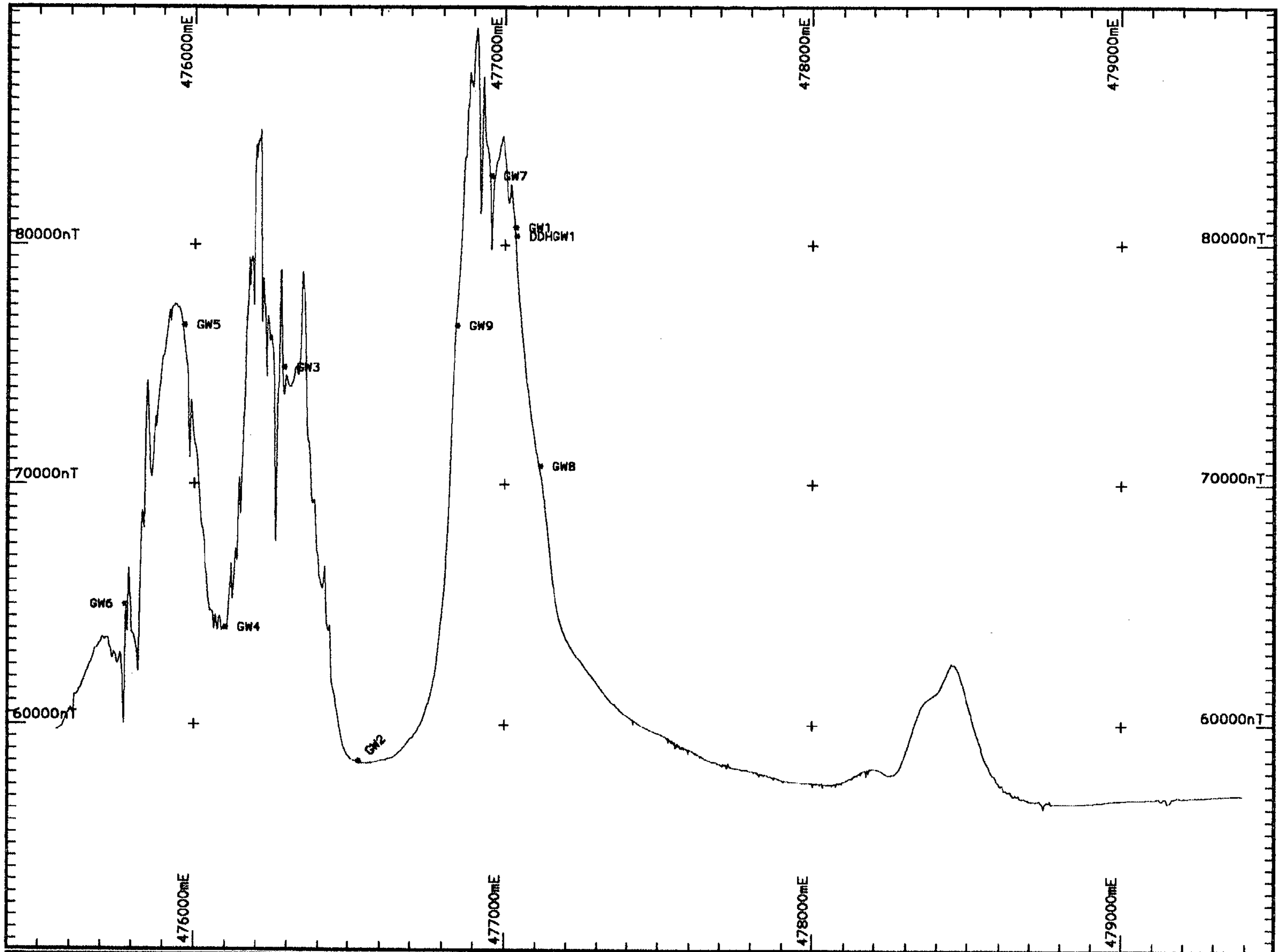


XSCALE 1:20000 YSCALE 1:250000	DATE 22/11/96	SHEET 1 of 1
	REF No. 1	FILE 7200NM.PLT

0 1000m

LEGEND
*GW23 RC HAMMER DRILLHOLE
*BUL10 RC AIRCORE DRILLHOLE

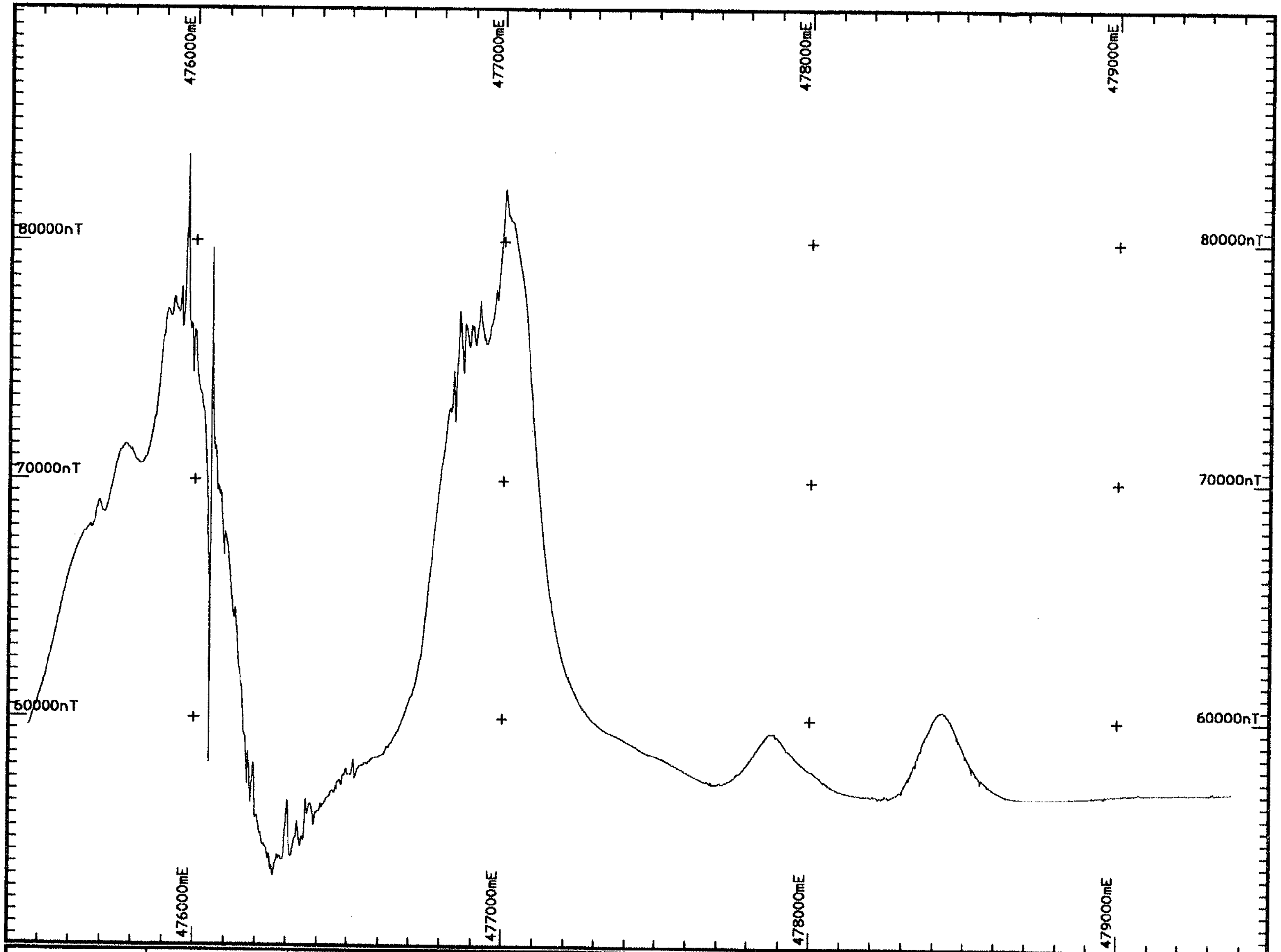
S.A.STEEL AND ENERGY PROJECT
GIFFEN WELL PROSPECT
GROUND MAGNETIC PROFILE 6647200N



XSCALE 1:20000 YSCALE 1:250000	DATE 22/11/96 REF No. 1	SHEET 1 of 1 FILE 7000NM.PLT	LEGEND * GW23 RC HAMMER DRILLHOLE * BUL10 RC AIRCORE DRILLHOLE

0 1000m

S.A.STEEL AND ENERGY PROJECT
GIFFEN WELL PROSPECT
GROUND MAGNETIC PROFILE 6647000N



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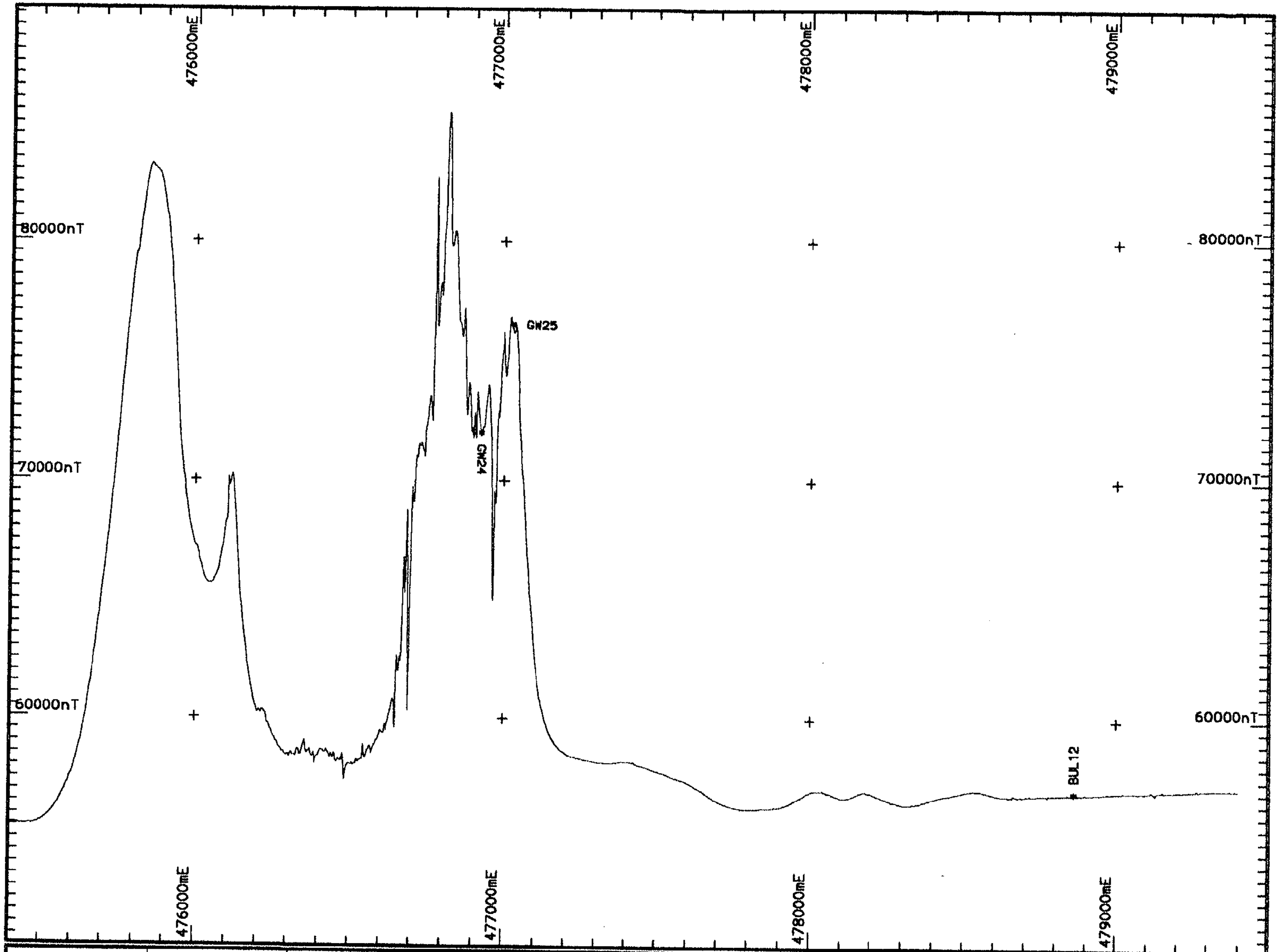
YSCALE 1:250000	REF No. 1	FILE 6800NM.PLT
0 1000m		

LEGEND
*GW23 RC HAMMER DRILLHOLE
*BUL10 RC AIRCORE DRILLHOLE

S.A.STEEL AND ENERGY PROJECT
GIFFEN WELL PROSPECT
GROUND MAGNETIC PROFILE 6646800N



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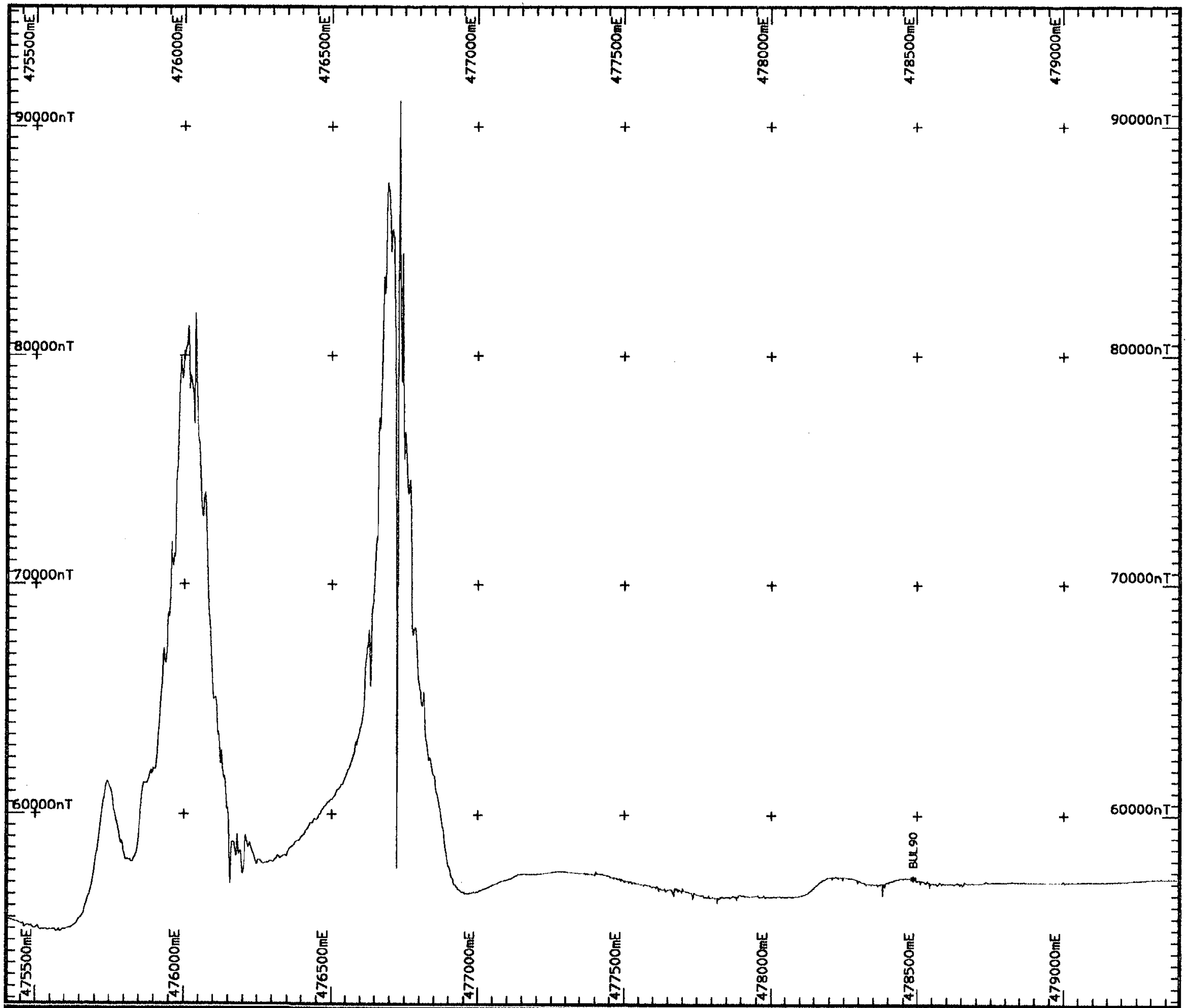
	REF No. 1	FILE 6600NN.PLT	*GW23 RC HAMMER DRILLHOLE *BUL10 RC AIRCORE DRILLHOLE

0 1000m

S.A.STEEL AND ENERGY PROJECT
GIFFEN WELL PROSPECT
GROUND MAGNETIC PROFILE 6646600N



XSCALE 1:20000	DATE 02/12/96	SHEET 1 of 1
YSCALE 1:250000	REF No. 1	FILE 6400NM.PLT

0 1000m

LEGEND

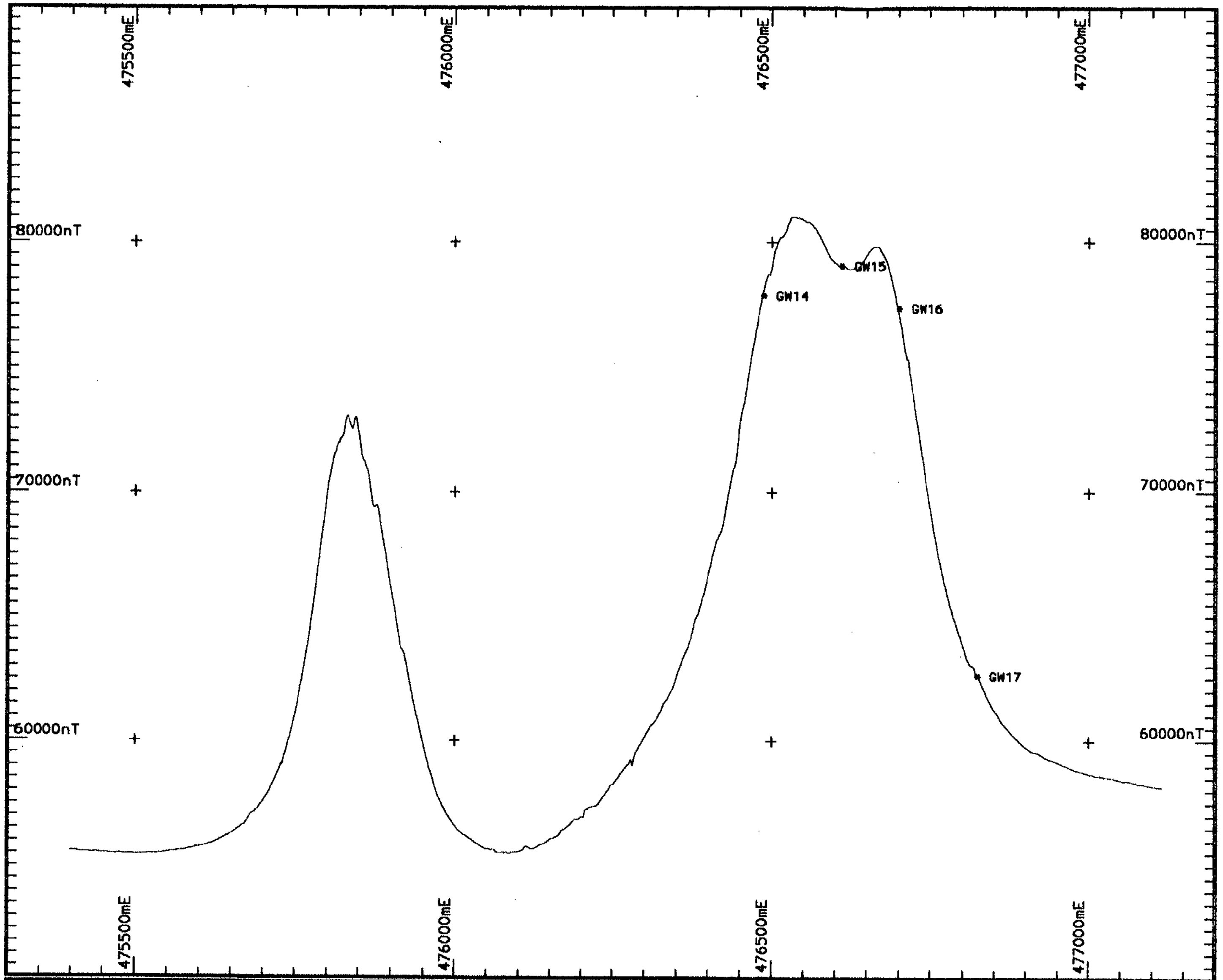
*GW23 RC HAMMER DRILLHOLE

*BUL10 RC AIRCORE DR[illegible]HOLE

S.A.STEEL AND ENERGY PROJECT

GIFFEN WELL PROSPECT

GROUND MAGNETIC PROFILE 6646400N



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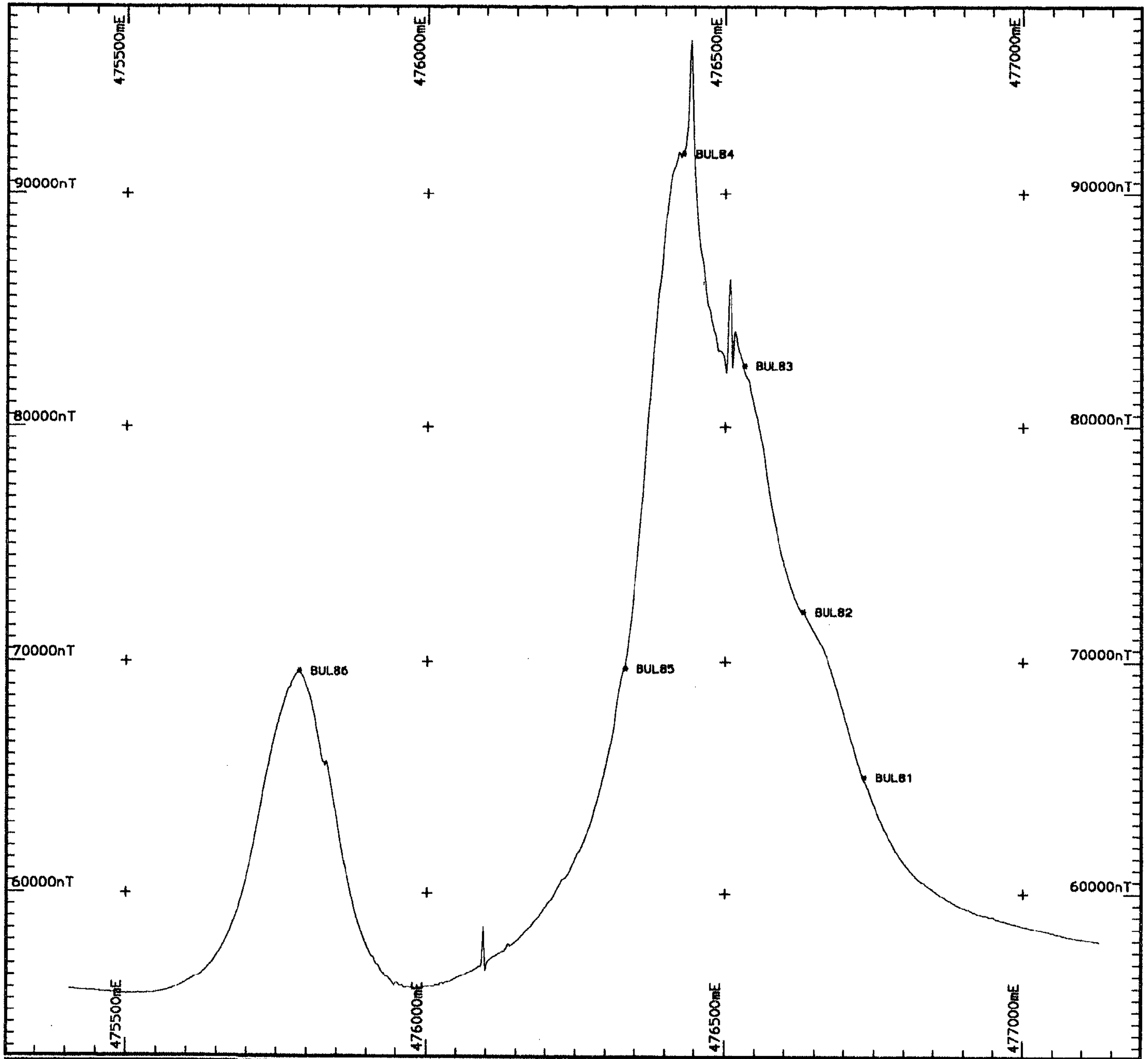
YSCALE 1:250000	REF No. 1	FILE 6200NM.PLT	*GW23 RC HAMMER DRILLHOLE	GIFFEN WELL PROSPECT
0 — 500m			*BUL10 RC AIRCORE DRILLHOLE	GROUND MAGNETIC PROFILE 6646200N



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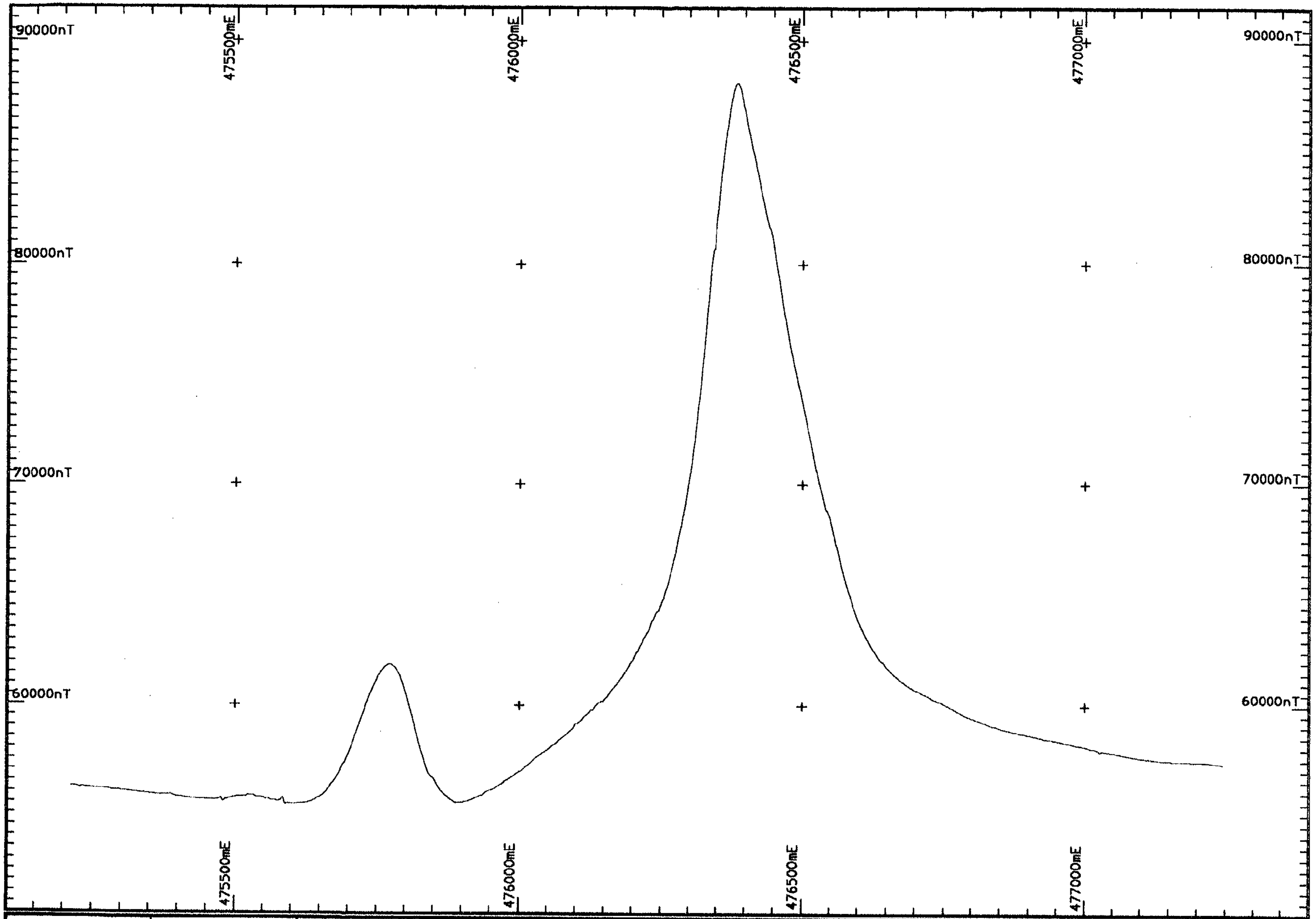
0 500m

S.A.STEEL AND ENERGY PROJECT
GIFFEN WELL PROSPECT
GROUND MAGNETIC PROFILE 6646000N



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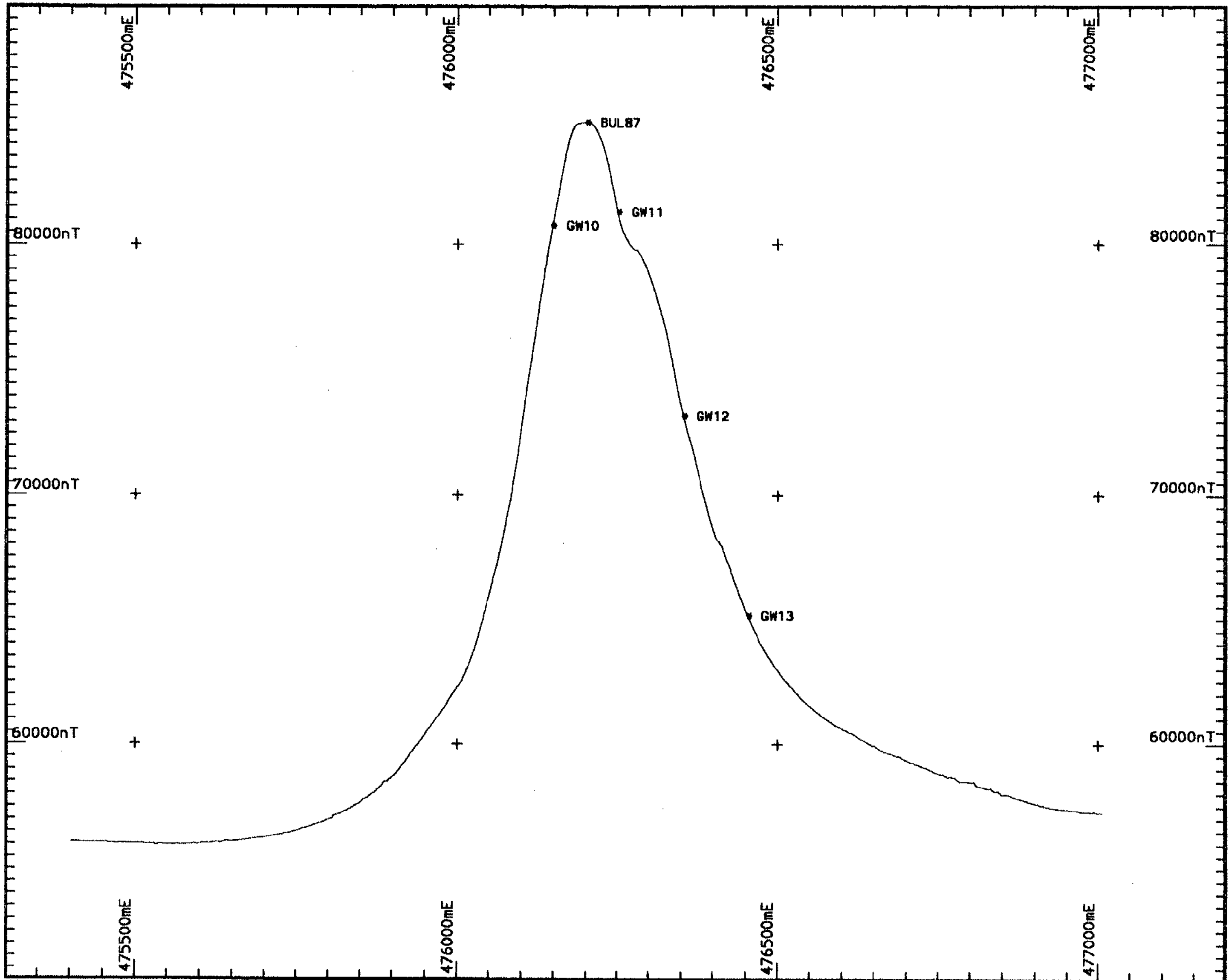
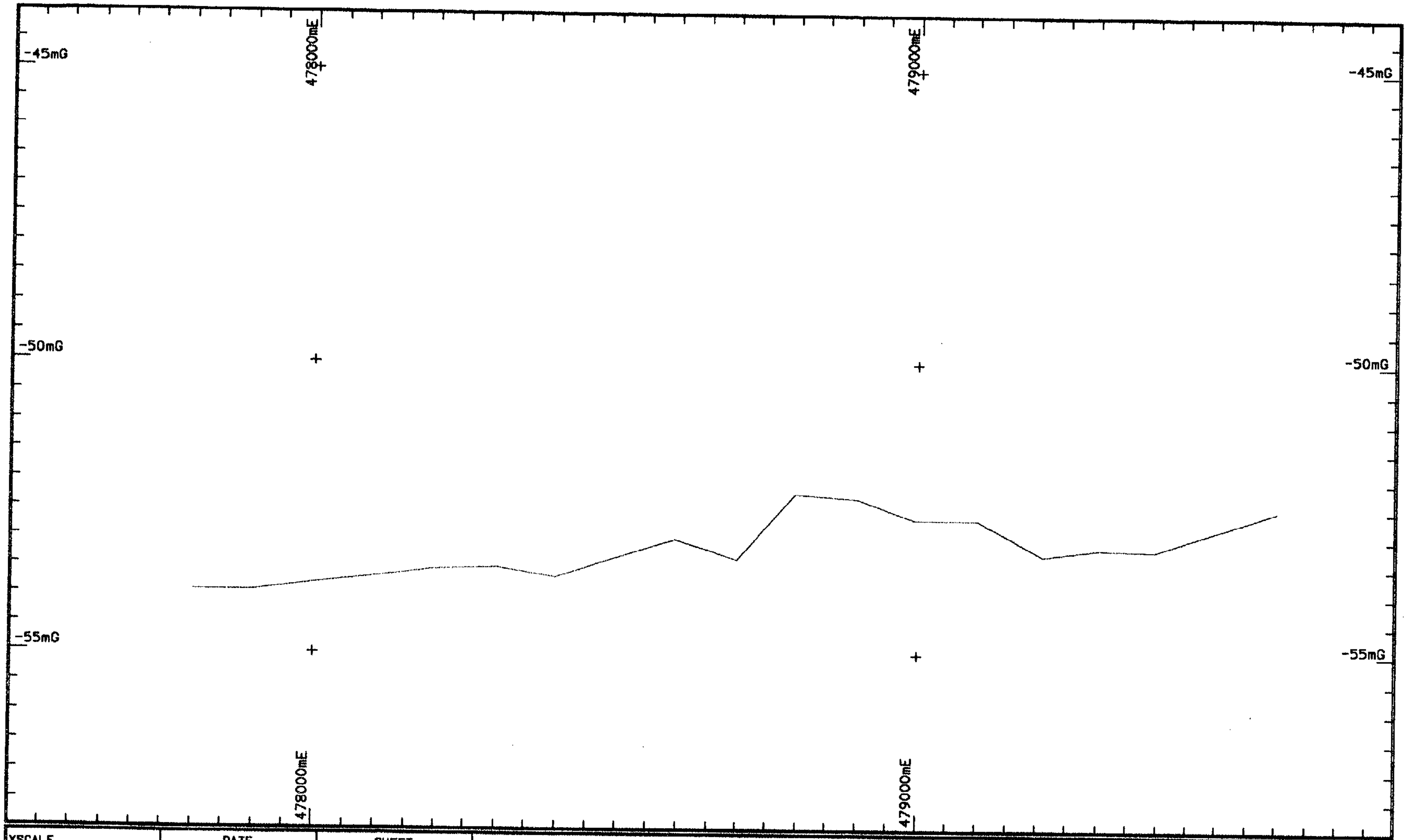
0 500m

S.A.STEEL AND ENERGY PROJECT
GIFFEN WELL PROSPECT
GROUND MAGNETIC PROFILE 6645800N



XSCALE 1:10000	DATE 26/11/96	SHEET 1 of 1	LEGEND ✱GW23 RC HAMMER DRILLHOLE ✱BUL10 RC AIRCORE DRILLHOLE	S.A.STEEL AND ENERGY PROJECT GIFFEN WELL PROSPECT GROUND MAGNETIC PROFILE 6645400N
YSCALE 1:250000	REF No. 1	FILE 5400NM.PLT		
0 500m				

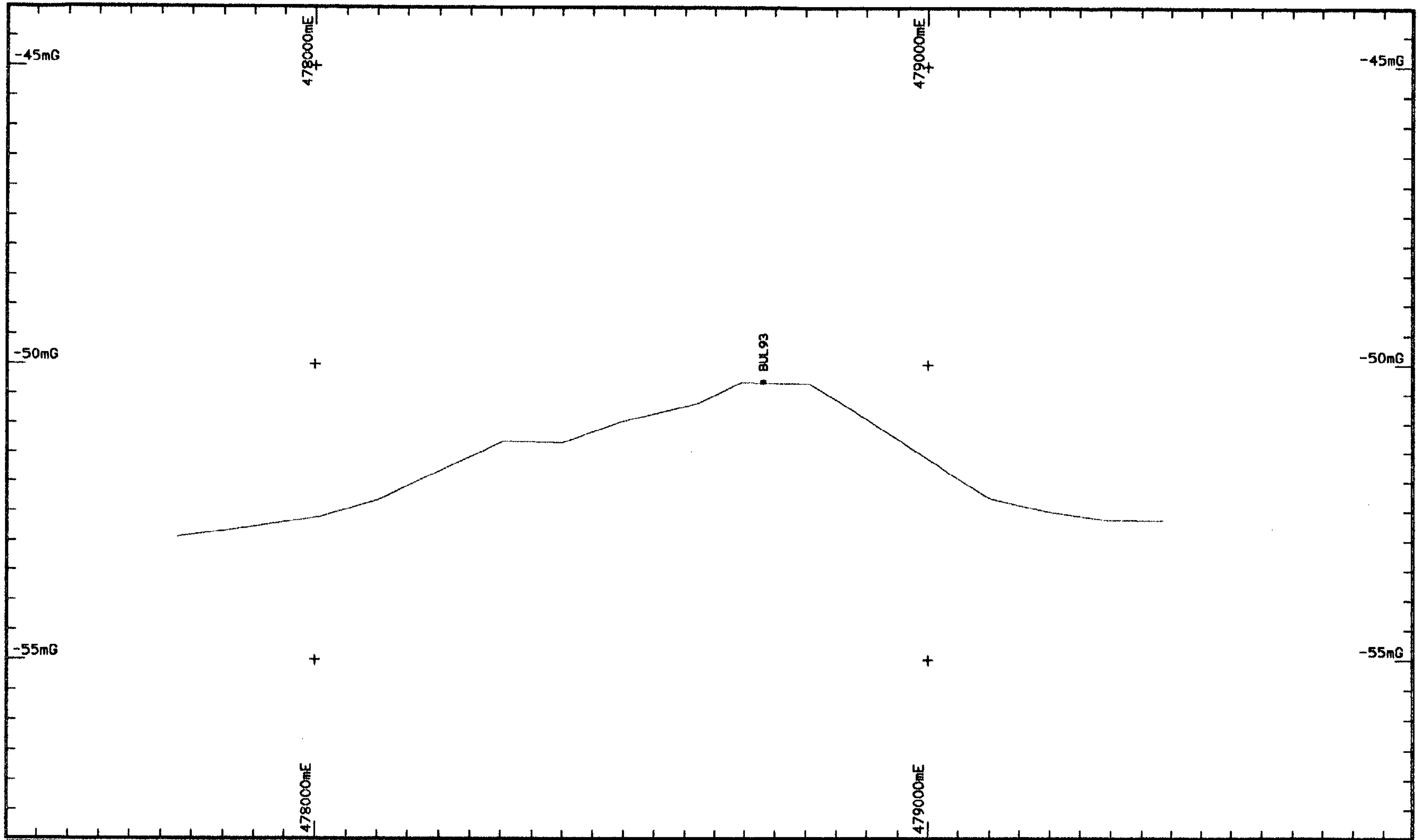


XSCALE 1:10000 YSCALE 1:100	DATE 26/11/96	SHEET 1 of 1
	REF No. 1	FILE 8600NG.PLT
0 500m		

LEGEND

* GW23 RC HAMMER DRILLHOLE
* BUL10 RC AIRCORE DRILLHOLE

S.A.STEEL AND ENERGY PROJECT
GIFFEN WELL PROSPECT
GRAVITY PROFILE 6648600N



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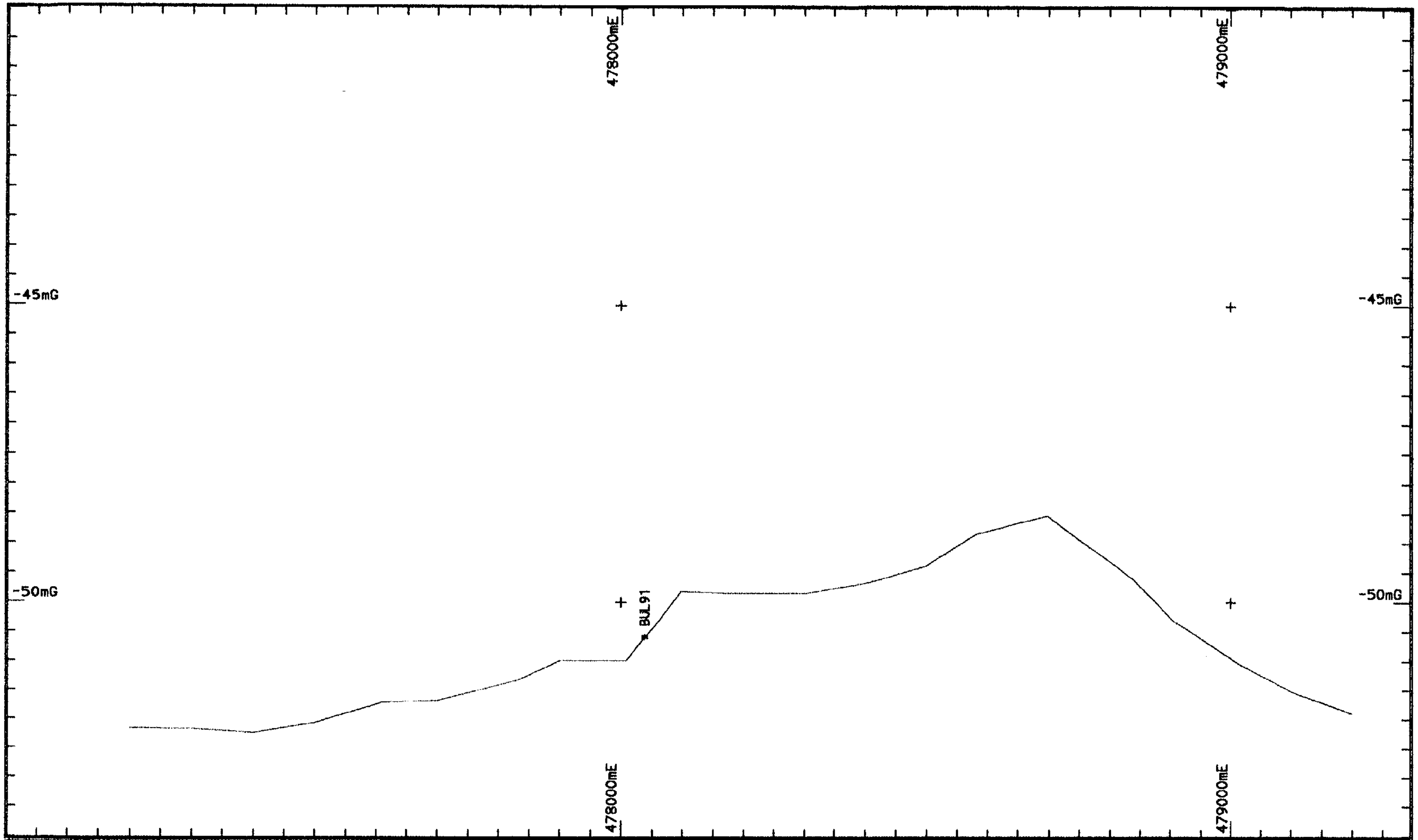
YSCALE 1:100	REF No. 1	FILE 8300NG.PLT
0 — 500m		

LEGEND

* GW23 RC HAMMER DRILLHOLE
* BUL10 RC AIRCORE DRILLHOLE

S.A.STEEL AND ENERGY PROJECT
GIFFEN WELL PROSPECT
GRAVITY PROFILE 6648300N



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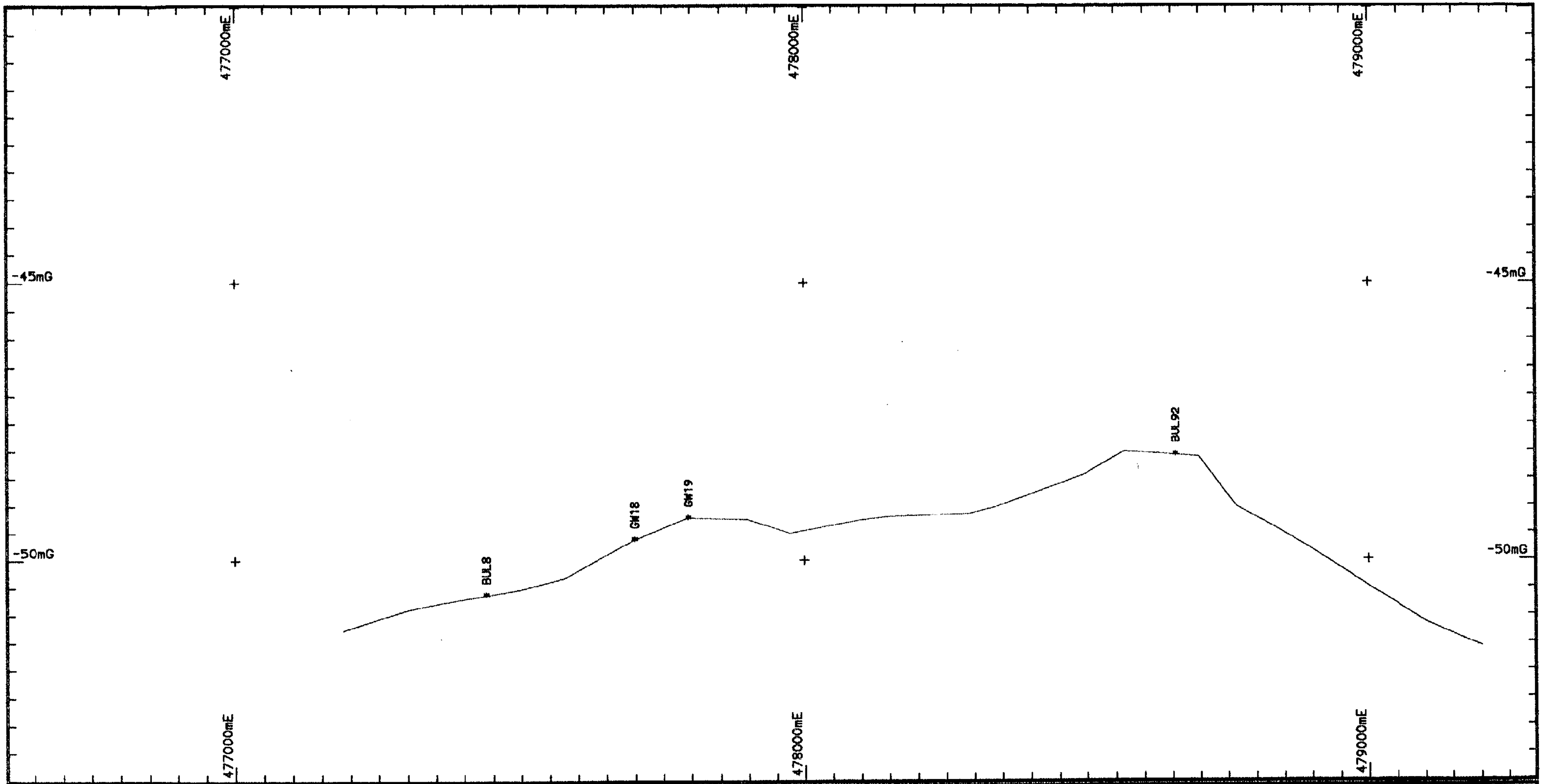
YSCALE 1:100	REF No. 1	FILE 8000NG.PLT	* GW23 RC HAMMER DRILLHOLE	GIFFEN WELL PROSPECT
0 500m			* BUL10 RC AIRCORE DRILLHOLE	GRAVITY PROFILE 6648000N



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YSCALE 1:100	REF No. 1	FILE 7800NG.PLT

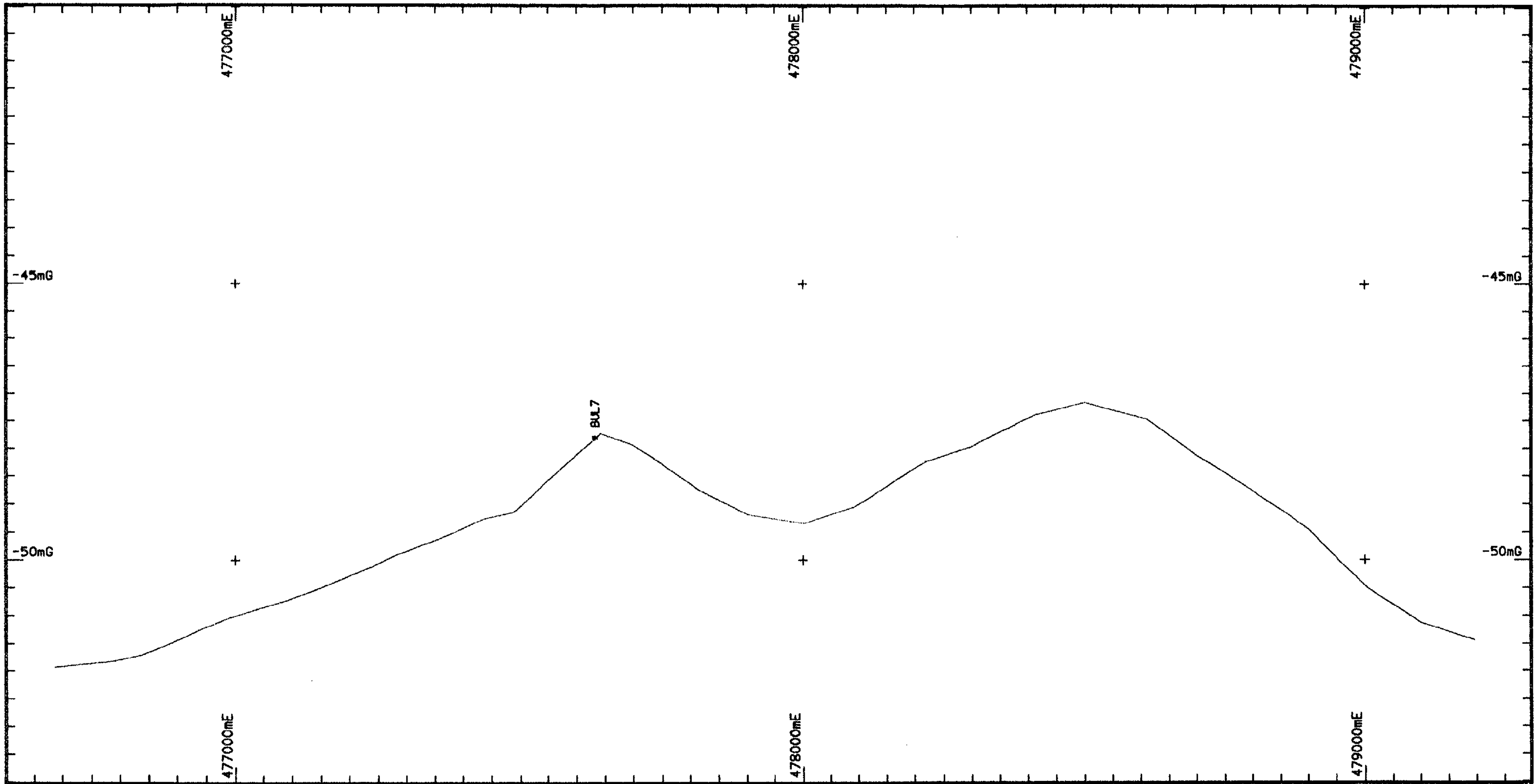
0 500m

LEGEND

* GW23 RC HAMMER DRILLHOLE

* BUL10 RC AIRCORE DRILLHOLE

S.A.STEEL AND ENERGY PROJECT
GIFFEN WELL PROSPECT
GRAVITY PROFILE 6647800N



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YSCALE 1:100	REF No. 1	FILE 7600NG.PLT

0 500m

LEGEND

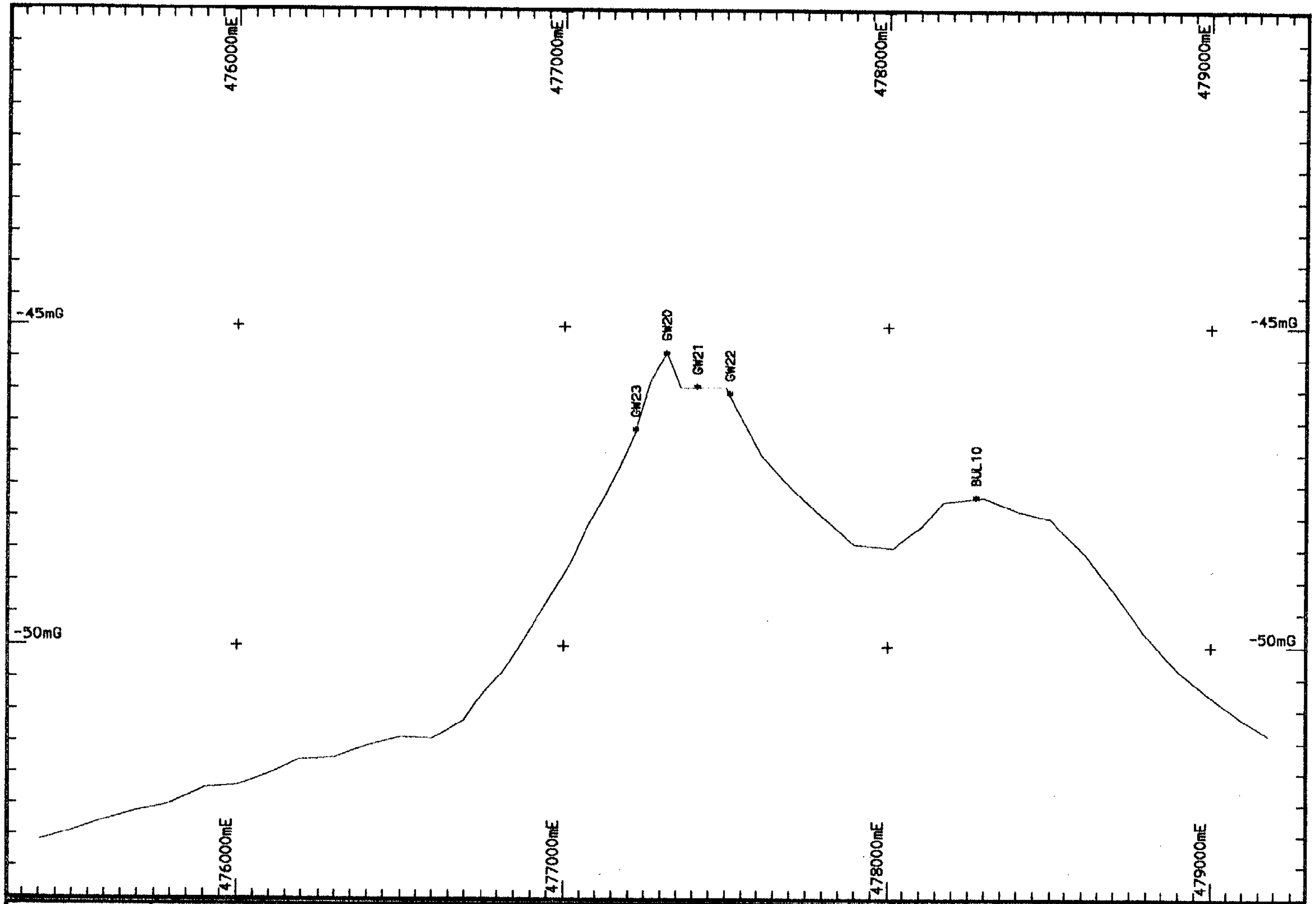
* GW23 RC HAMMER DRILLHOLE

* BUL10 RC AIRCORE DRILLHOLE

S.A.STEEL AND ENERGY PROJECT

GIFFEN WELL PROSPECT

GRAVITY PROFILE 6647600N

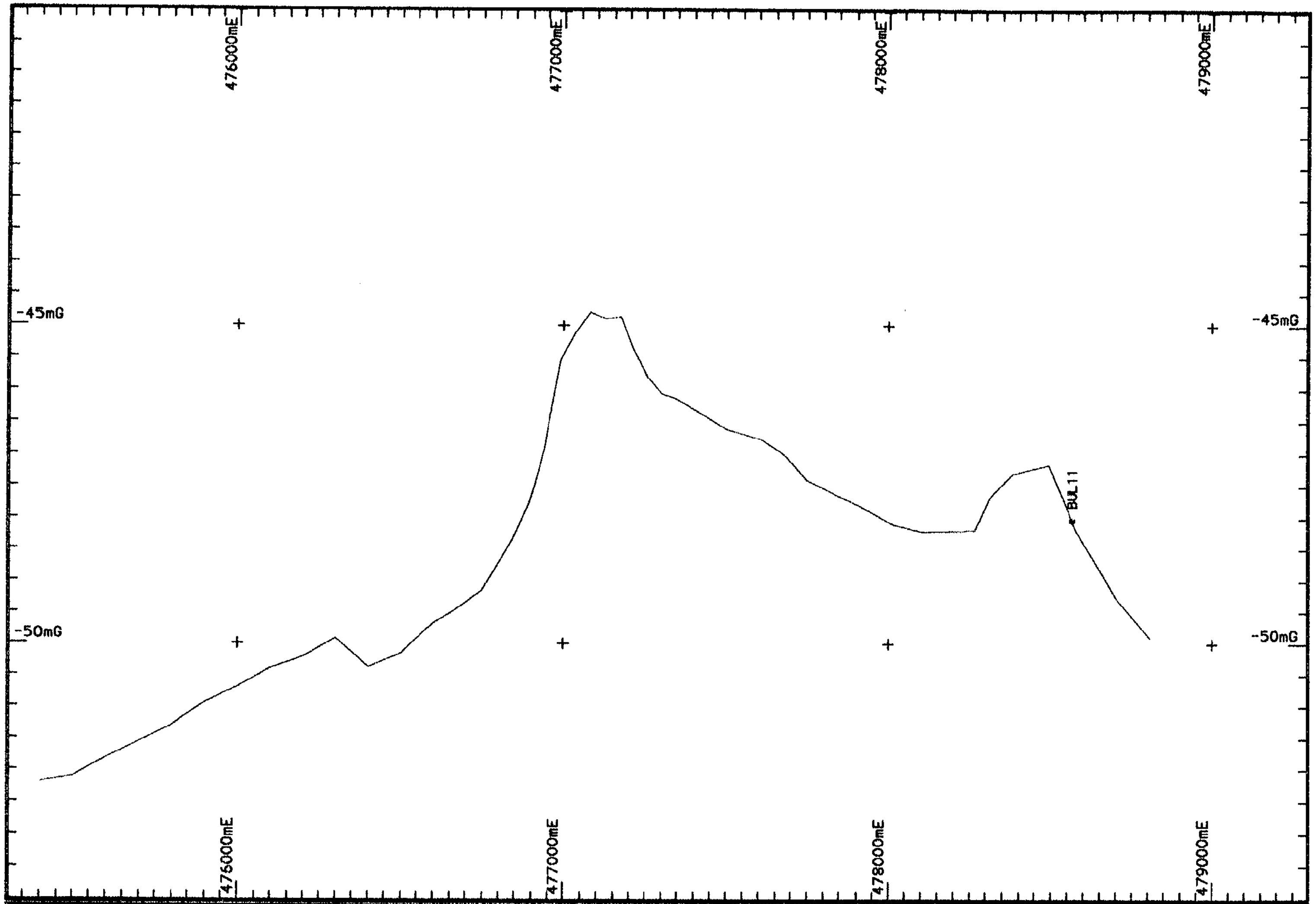


XSCALE 1:20000 YSCALE 1:100	DATE 26/11/96	SHEET 1 of 1
	REF No. 1	FILE 7400NG.PLT
0 — 1000m		

LEGEND

* ✱ GW23 RC HAMMER DRILLHOLE
* ✱ BUL10 RC AIRCORE DRILLHOLE

S.A.STEEL AND ENERGY PROJECT
GIFFEN WELL PROSPECT
GRAVITY PROFILE 6647400N



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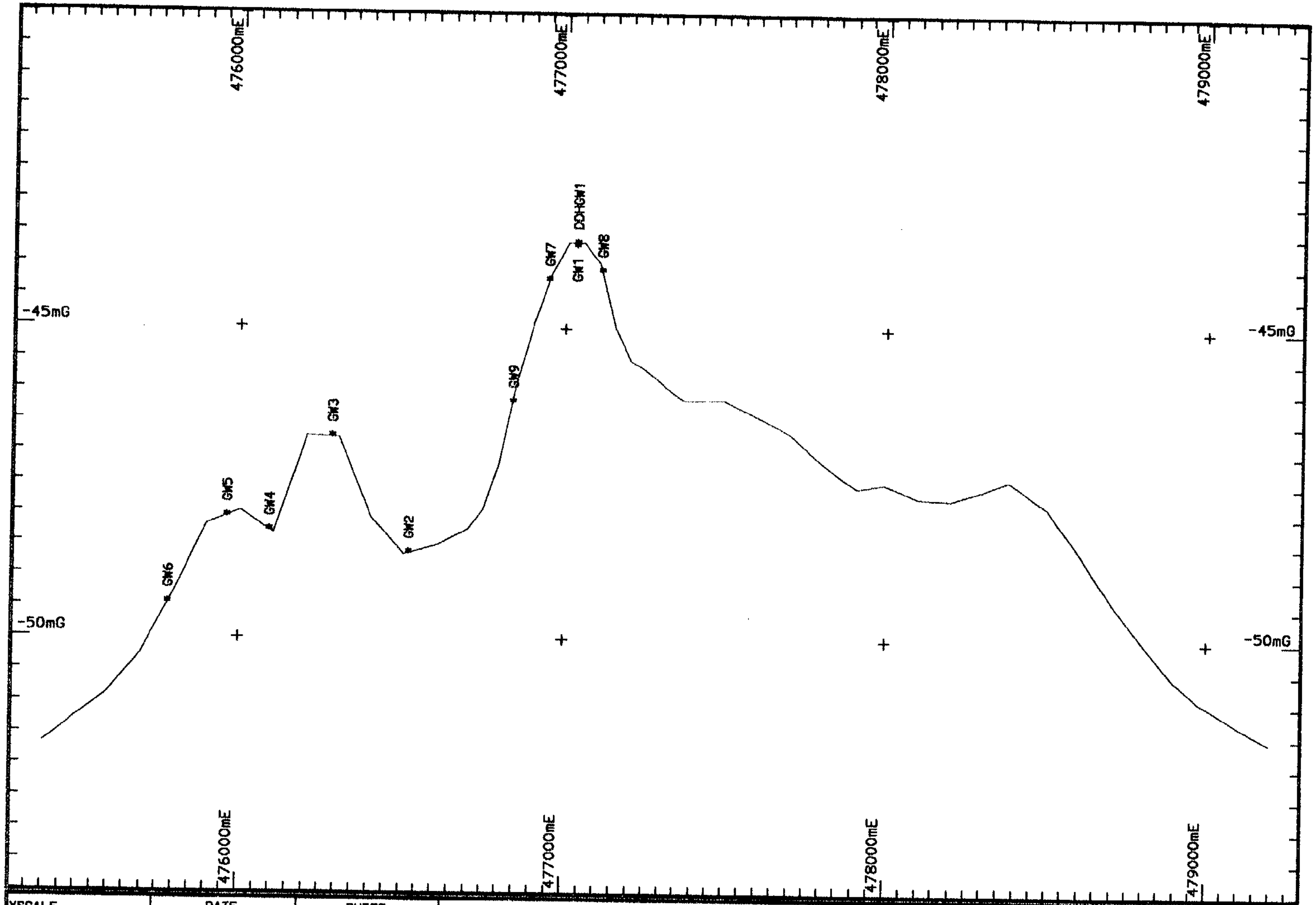
YSCALE 1:100	REF No. 1	FILE 7200NG.PLT

0 1000m

LEGEND

* GW23 RC HAMMER DRILLHOLE
* BUL10 RC AIRCORE DRILLHOLE

S.A.STEEL AND ENERGY PROJECT
GIFFEN WELL PROSPECT
GRAVITY PROFILE 6647200N



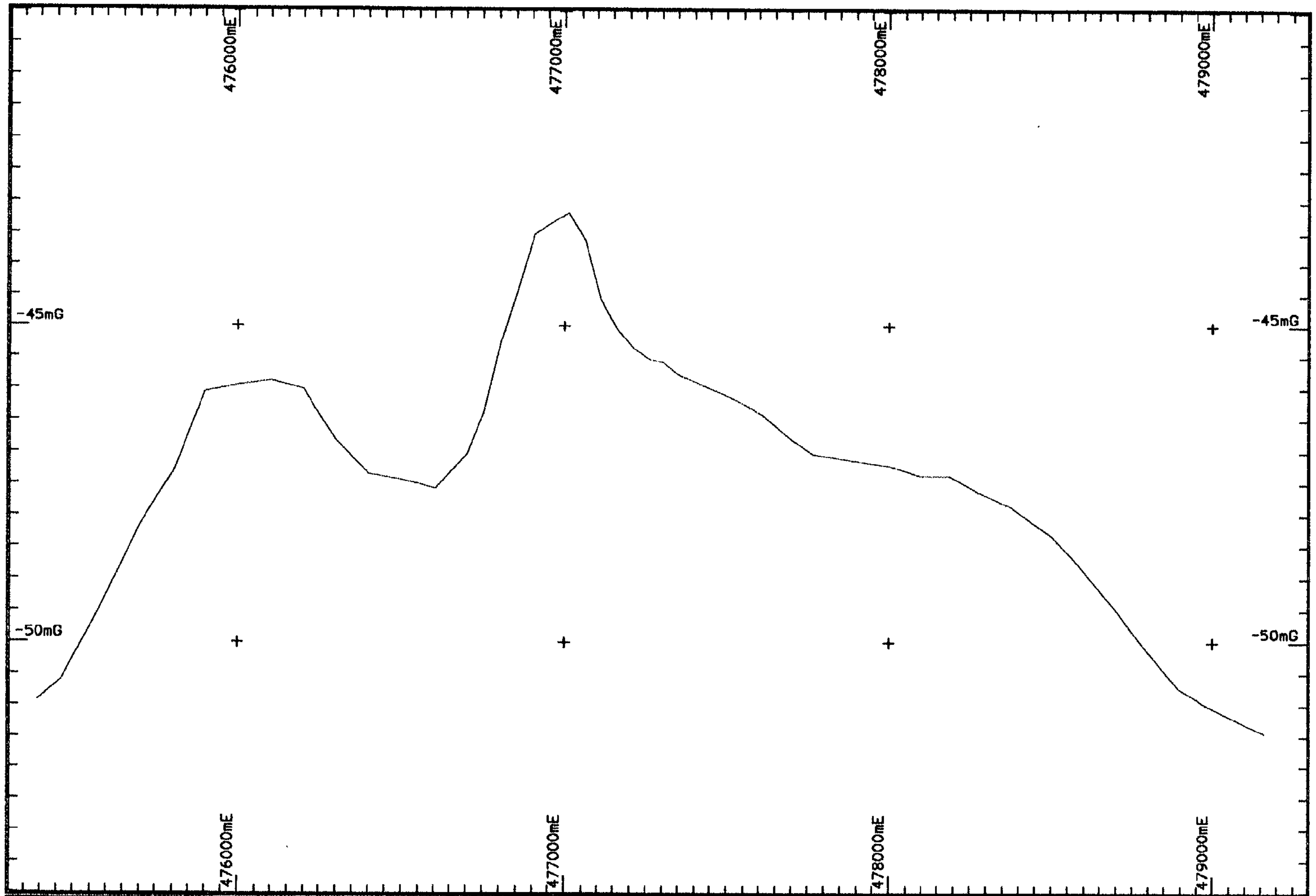
XSCALE 1:20000	DATE 26/11/96	SHEET 1 of 1
YSCALE 1:100	REF No. 1	FILE 7000NG.PLT

LEGEND

* GW23 RC HAMMER DRILLHOLE

* BUL10 RC AIRCORE DRILLHOLE

S.A.STEEL AND ENERGY PROJECT
GIFFEN WELL PROSPECT
GRAVITY PROFILE 6647000N



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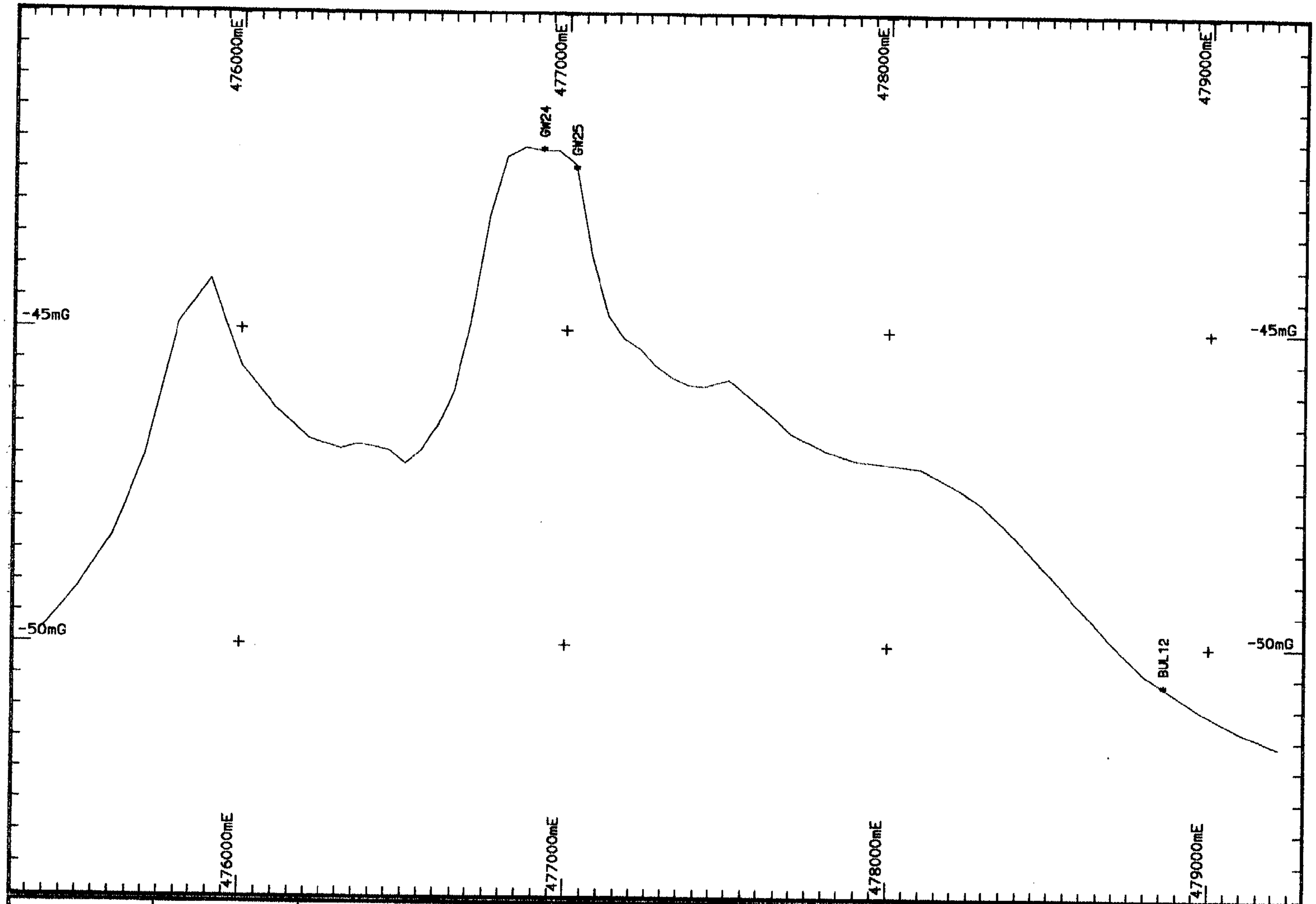
0 — 1000m	REF No. 1	FILE 6800NG.PLT

LEGEND

- * GW23 RC HAMMER DRILLHOLE
- * BUL10 RC AIRCORE DRILLHOLE

S.A. STEEL AND ENERGY PROJECT
GIFFEN WELL PROSPECT
GRAVITY PROFILE 6646800N



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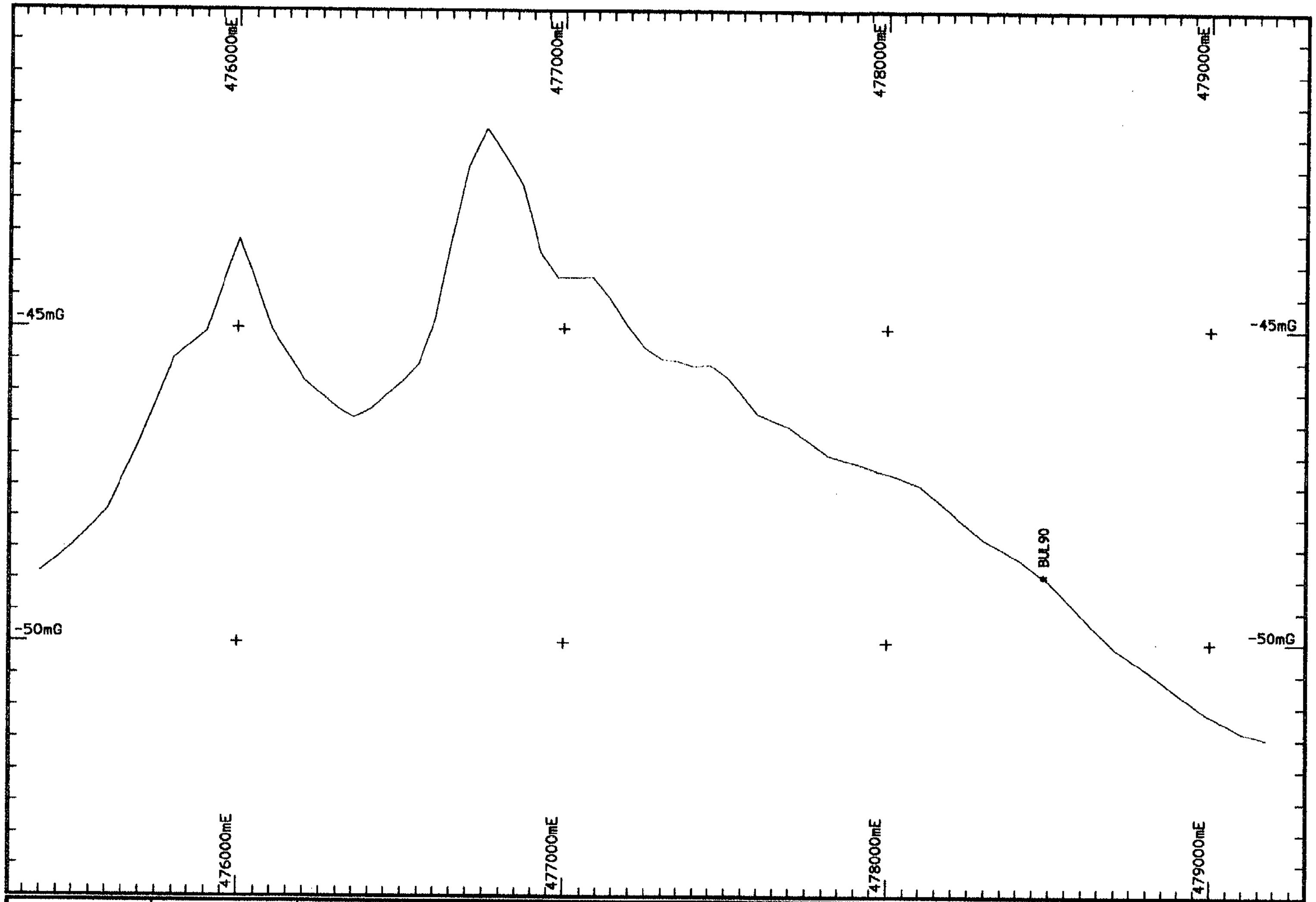
YSCALE 1:100	REF No. 1	FILE 6600NG.PLT	* GW23 RC HAMMER DRILLHOLE	GIFFEN WELL PROSPECT
0 1000m			* BUL10 RC AIRCORE DRILLHOLE	GRAVITY PROFILE 6646600N



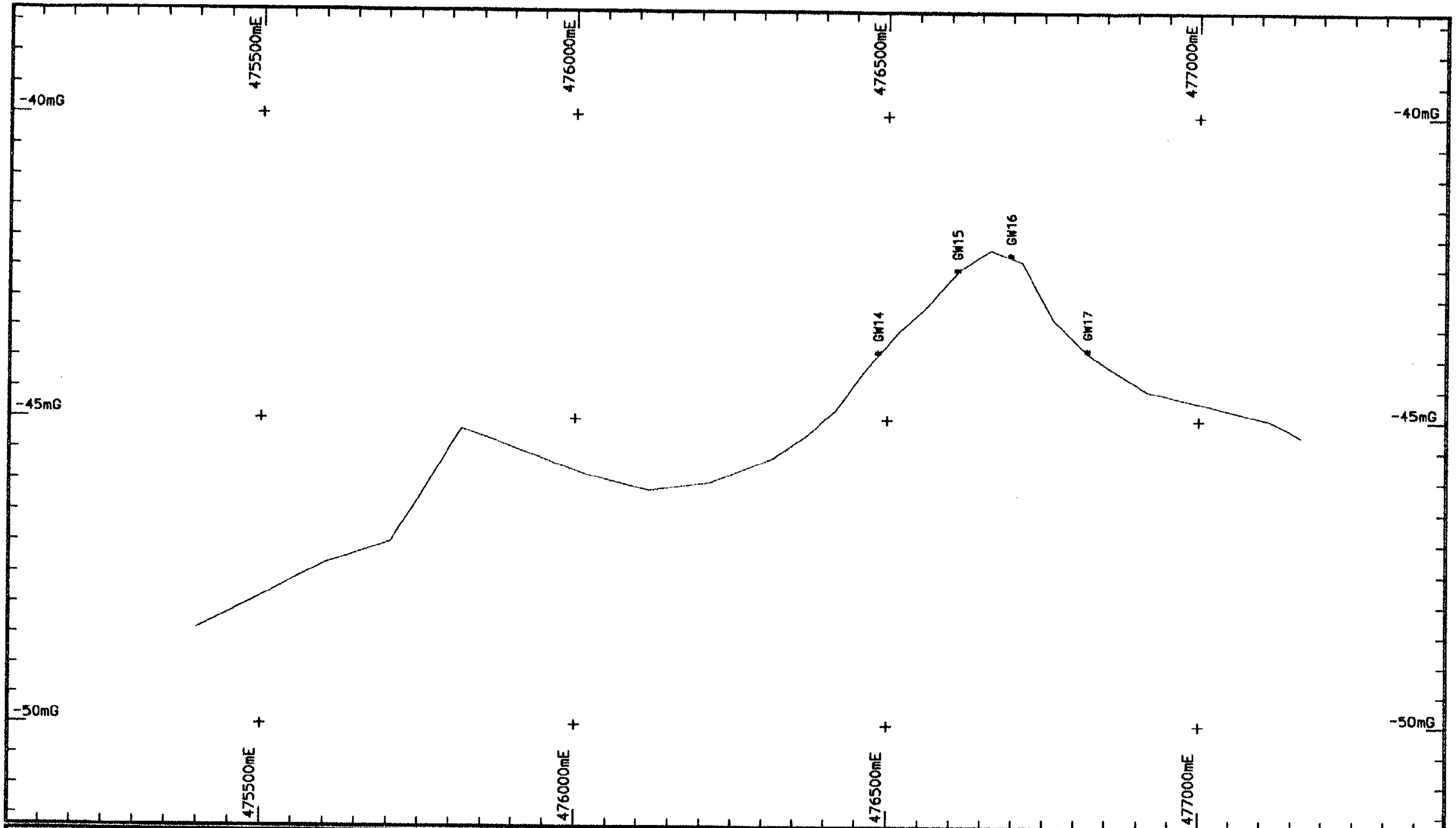
XSCALE 1:20000 YSCALE 1:100	DATE 26/11/96	SHEET 1 of 1
	REF No. 1	FILE 6400NG.PLT

0 1000m

LEGEND

* GW23 RC HAMMER DRILLHOLE
* BUL10 RC AIRCORE DRILLHOLE

S.A.STEEL AND ENERGY PROJECT
GIFFEN WELL PROSPECT
GRAVITY PROFILE 6646400N



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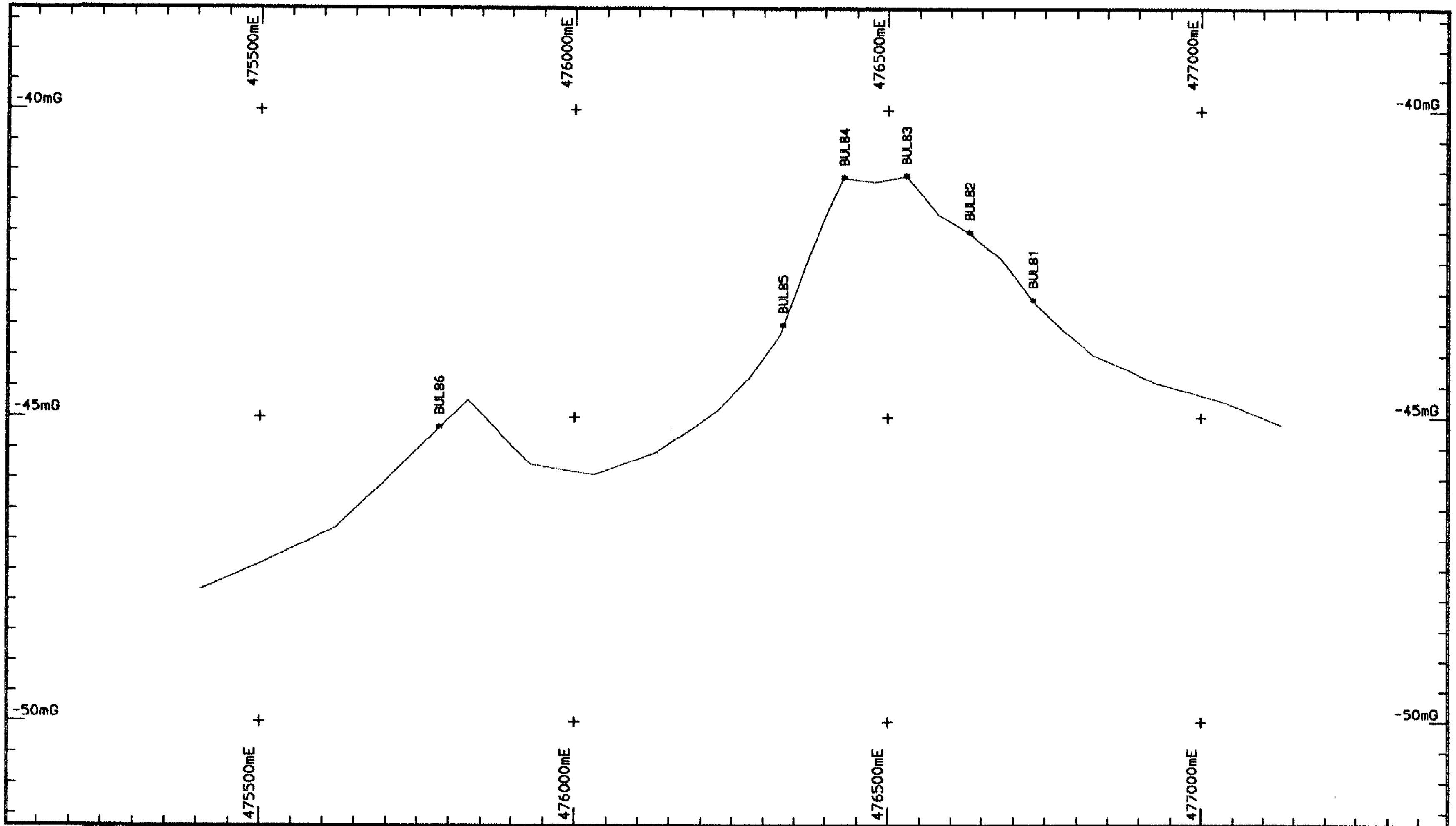
	REF No. 1	FILE 6200NG.PLT	
0 500m			

LEGEND
* GW23 RC HAMMER DRILLHOLE
* BUL10 RC AIRCORE DRILLHOLE

S.A.STEEL AND ENERGY PROJECT
GIFFEN WELL PROSPECT
GRAVITY PROFILE 6646200N



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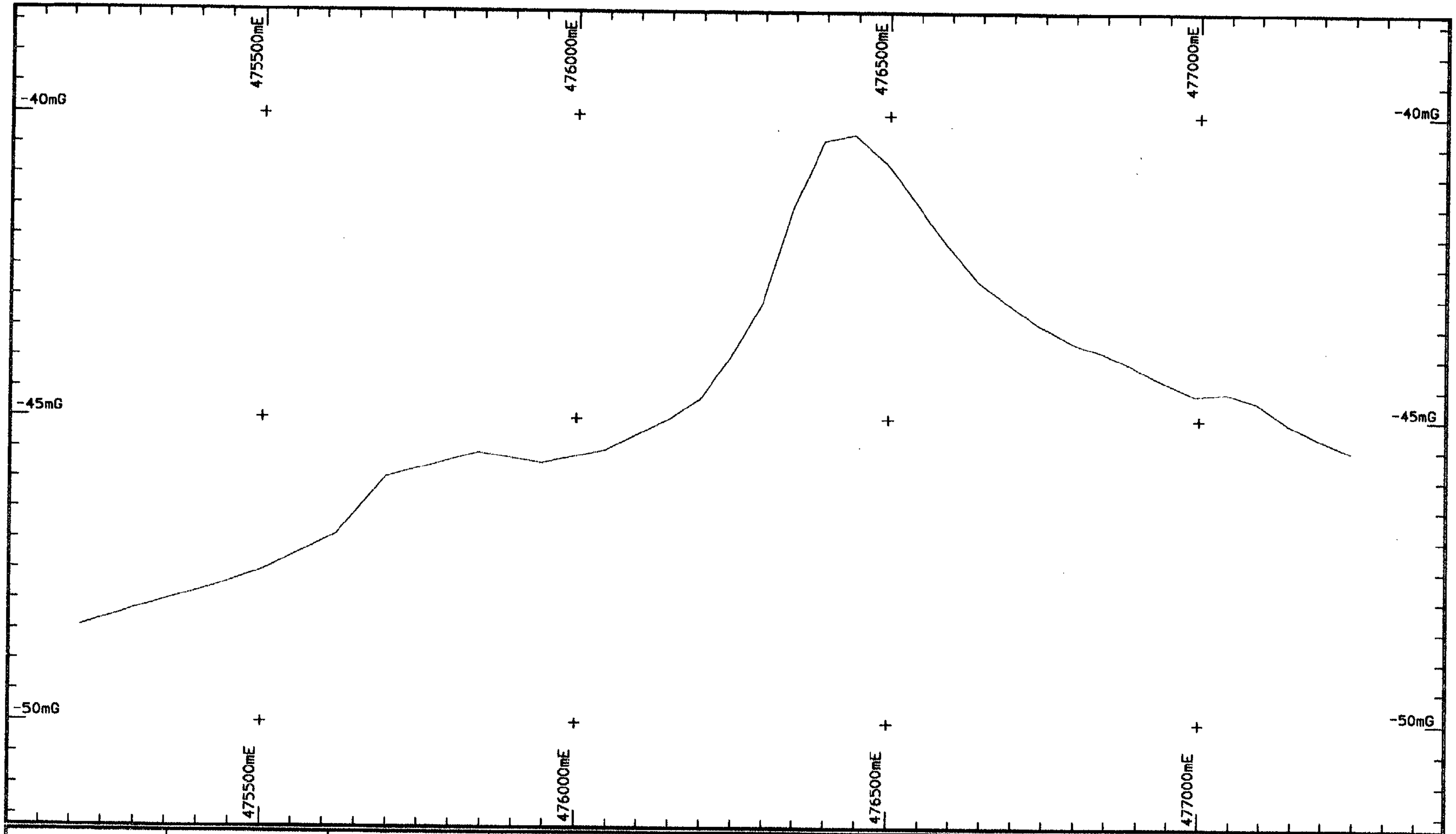
YSCALE 1:100	REF No. 1	FILE 6000NG.PLT	* GW23 RC HAMMER DRILLHOLE	GIFFEN WELL PROSPECT
0 500m			* BUL10 RC AIRCORE DRILLHOLE	GRAVITY PROFILE 6646000N



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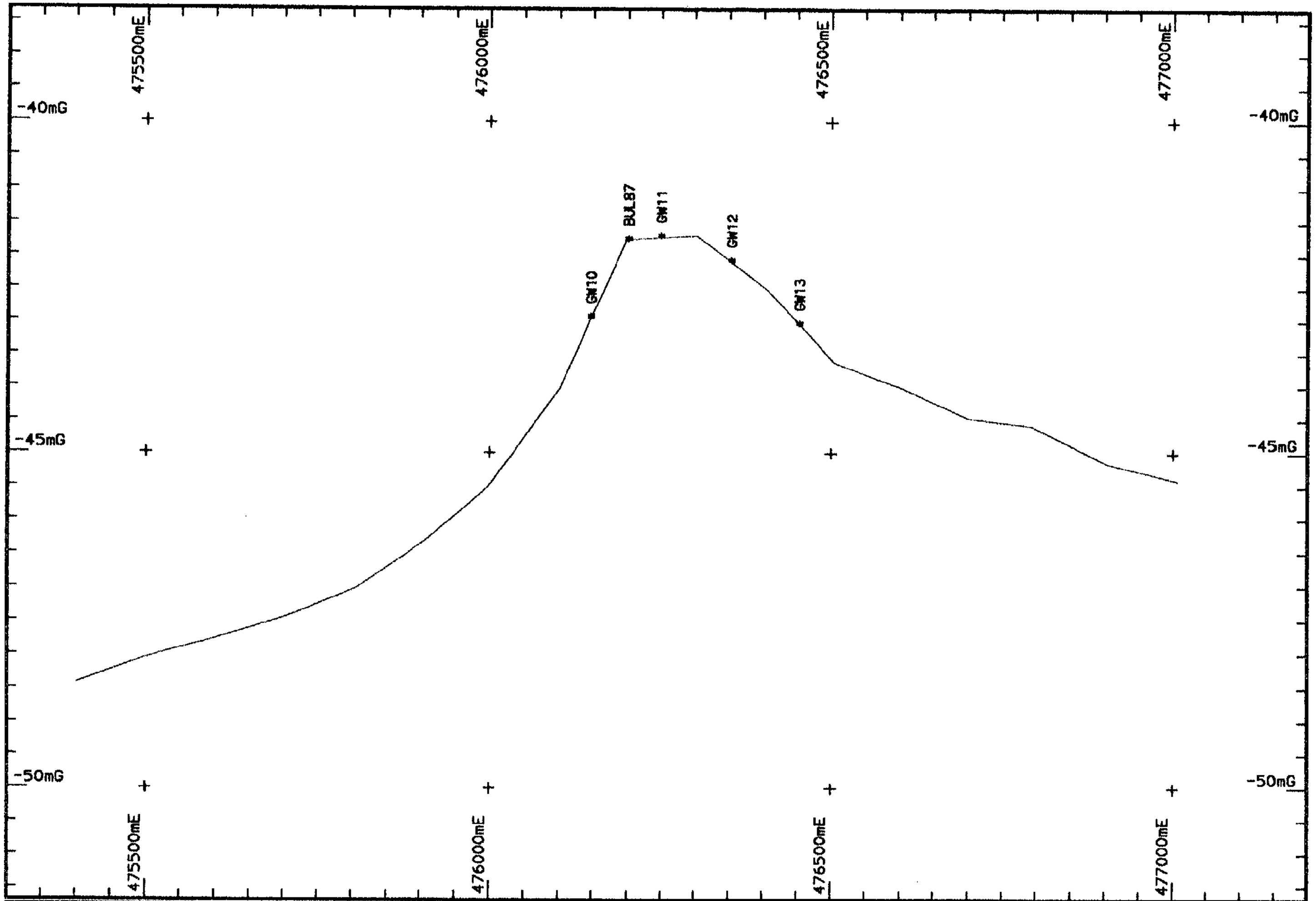
	REF No. 1	FILE 5800NG.PLT	* GW23 RC HAMMER DRILLHOLE	GIFFEN WELL PROSPECT
0 — 500m			* BUL10 RC AIRCORE DRILLHOLE	GRAVITY PROFILE 6645800N



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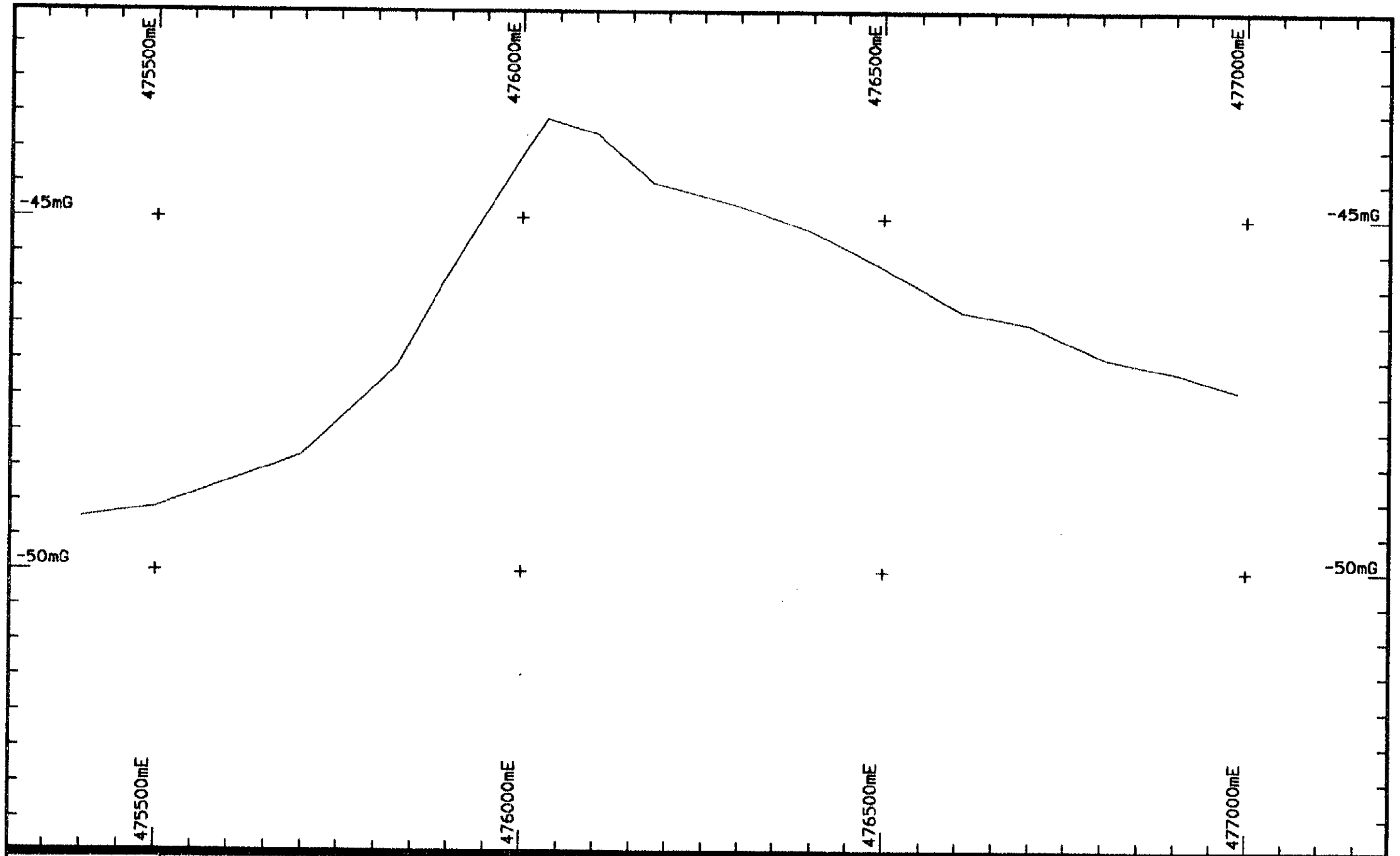
	REF No. 1	FILE 5400NG.PLT	* GW23 RC HAMMER DRILLHOLE	GIFFEN WELL PROSPECT
0 500m			* BUL10 RC AIRCORE DRILLHOLE	GRAVITY PROFILE 6645400N



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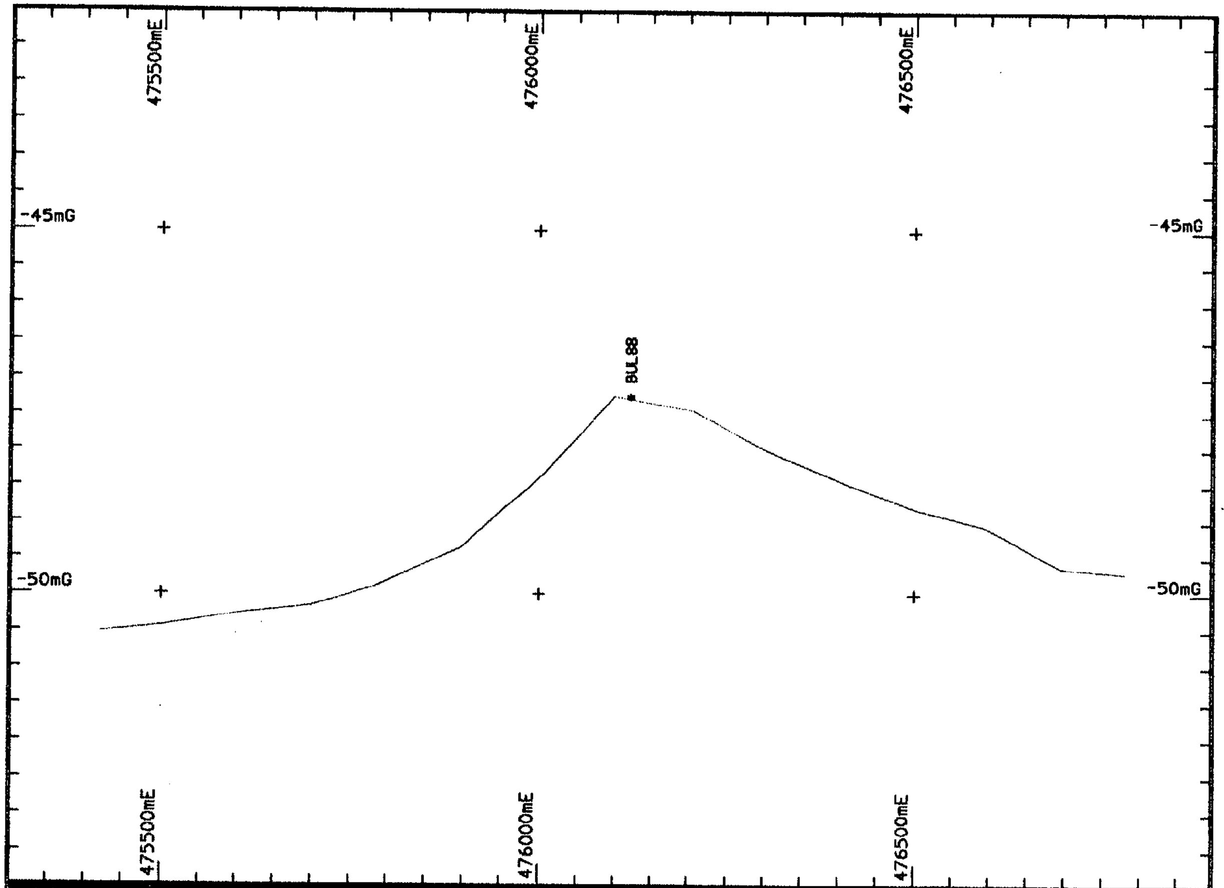
	REF No. 1	FILE 5000NG.PLT

0 500m

LEGEND

* GW23 RC HAMMER DRILLHOLE
* BUL10 RC AIRCORE DRILLHOLE

S.A.STEEL AND ENERGY PROJECT
GIFFEN WELL PROSPECT
GRAVITY PROFILE 6645000N



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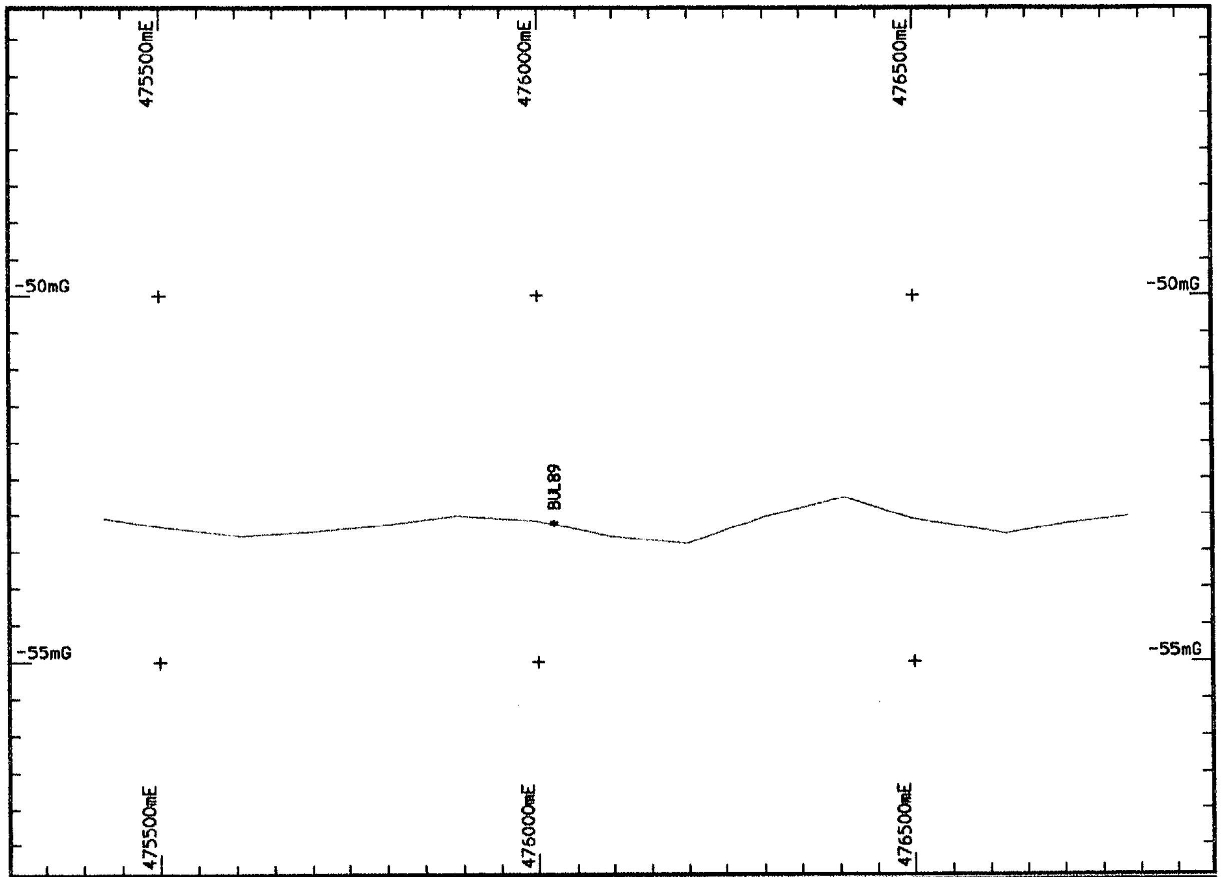
YSCALE 1:100	REF No. 1	FILE 4600NG.PLT	* GW23 RC HAMMER DRILLHOLE	GIFFEN WELL PROSPECT
0 500m			* BUL10 RC AIRCORE DRILLHOLE	GRAVITY PROFILE 6644600N



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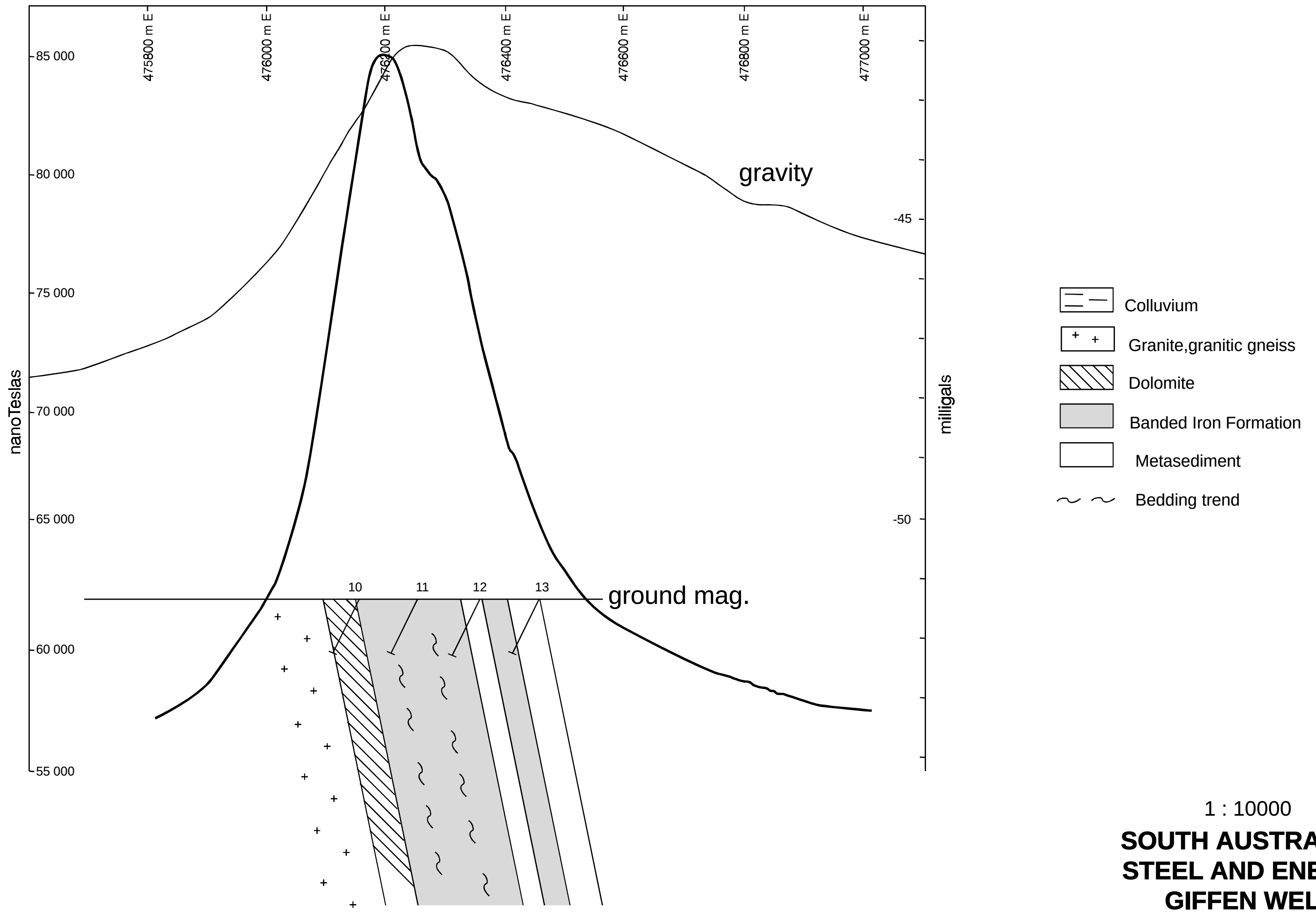
YSCALE 1:100	REF No. 1	FILE 4200NG.PLT	* GW23 RC HAMMER DRILLHOLE	GIFFEN WELL PROSPECT
0 500m			* BUL10 RC AIRCORE DRILLHOLE	GRAVITY PROFILE 6644200N

APPENDIX 3

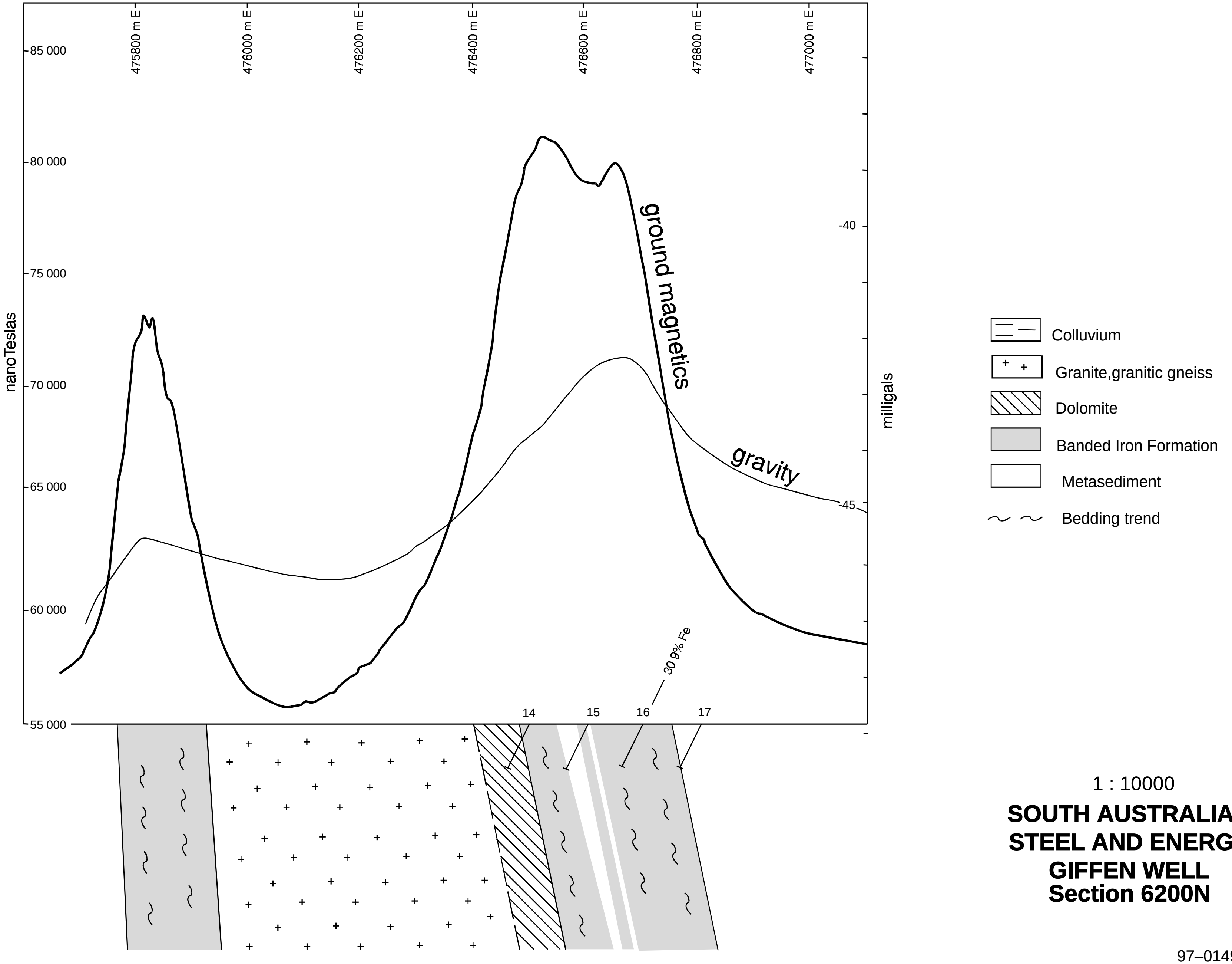
CROSS SECTIONS 1:10 000 SCALE



1 : 10000

SOUTH AUSTRALIAN STEEL AND ENERGY
GIFFEN WELL
Section 5400N

97–0148 MESA



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SOUTH AUSTRALIAN STEEL AND ENERGY GIFFEN WELL Section 6200N

97–0149 MESA

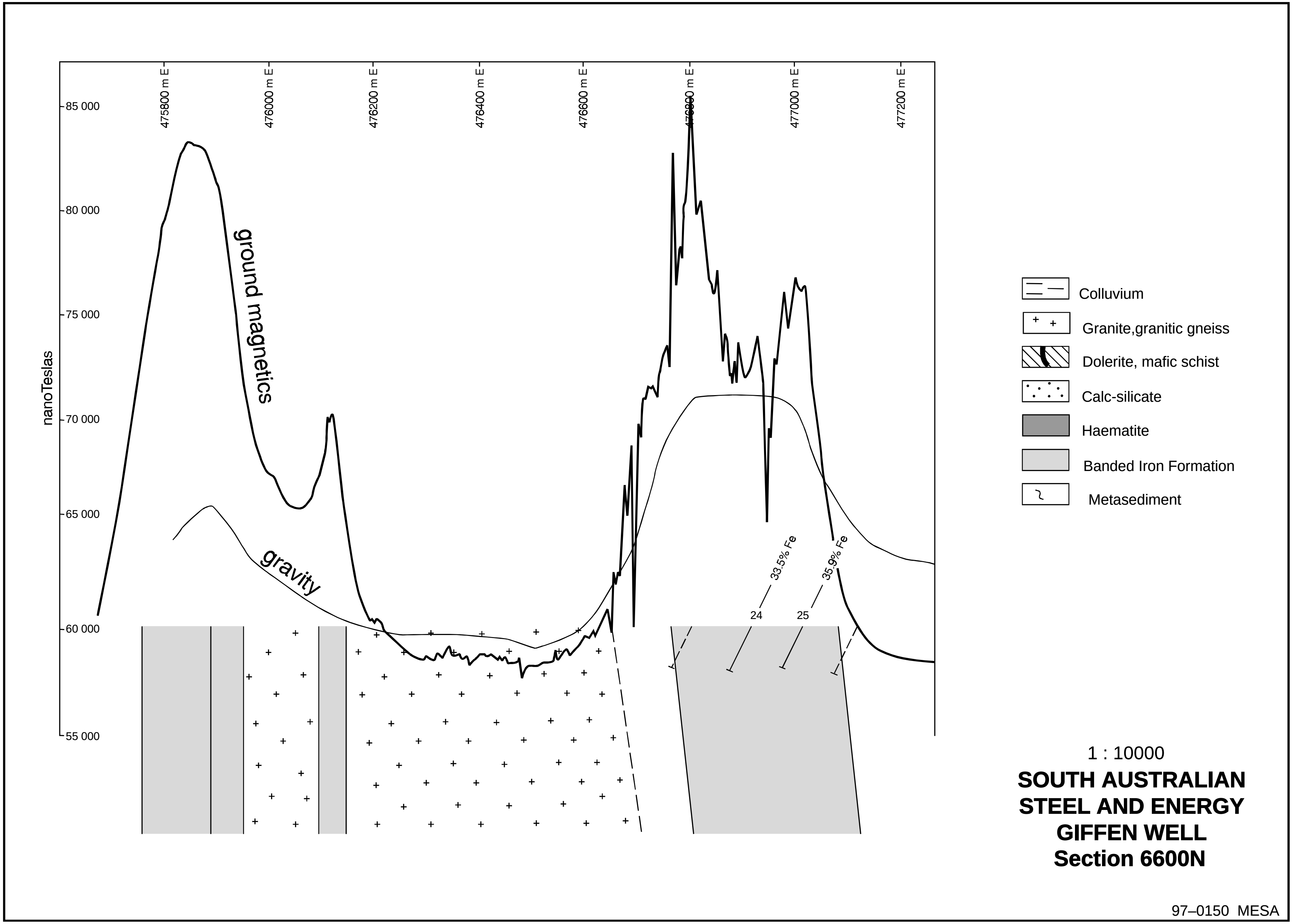
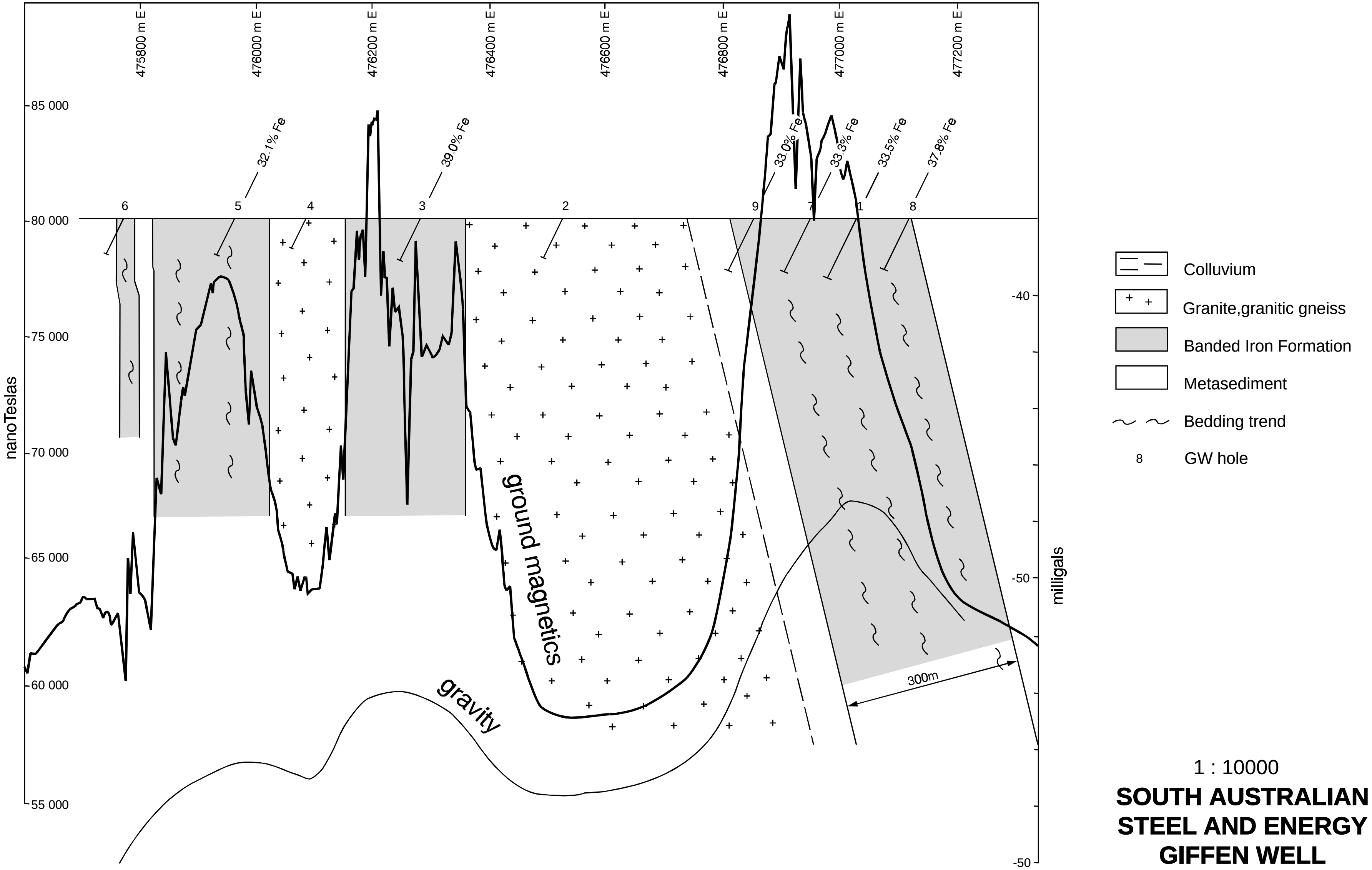


Fig. ? *South Australian steel and energy, Giffen Well - section 6600N*



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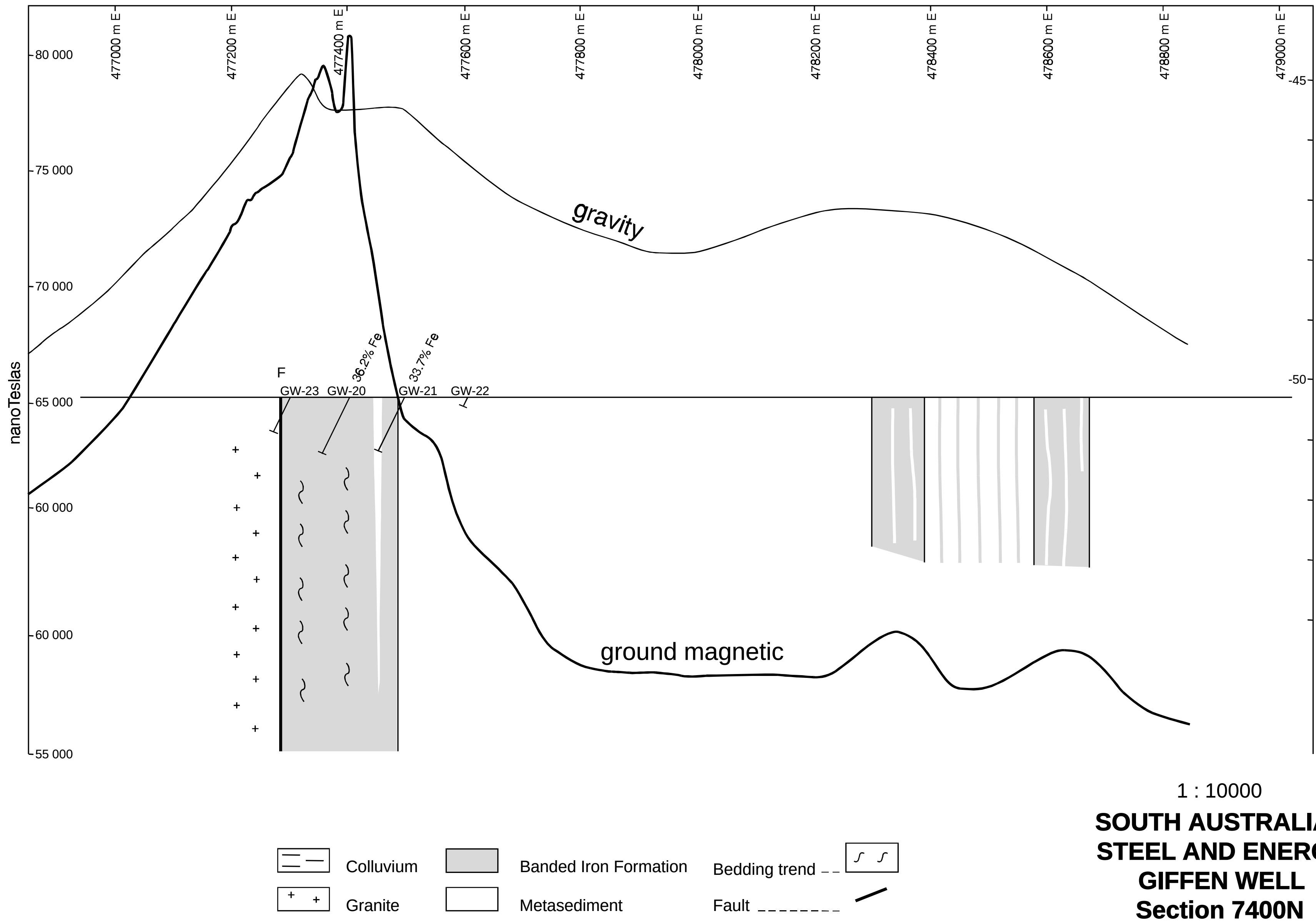
SOUTH AUSTRALIAN STEEL AND ENERGY GIFFEN WELL Section 7000N

97–0151 MESA



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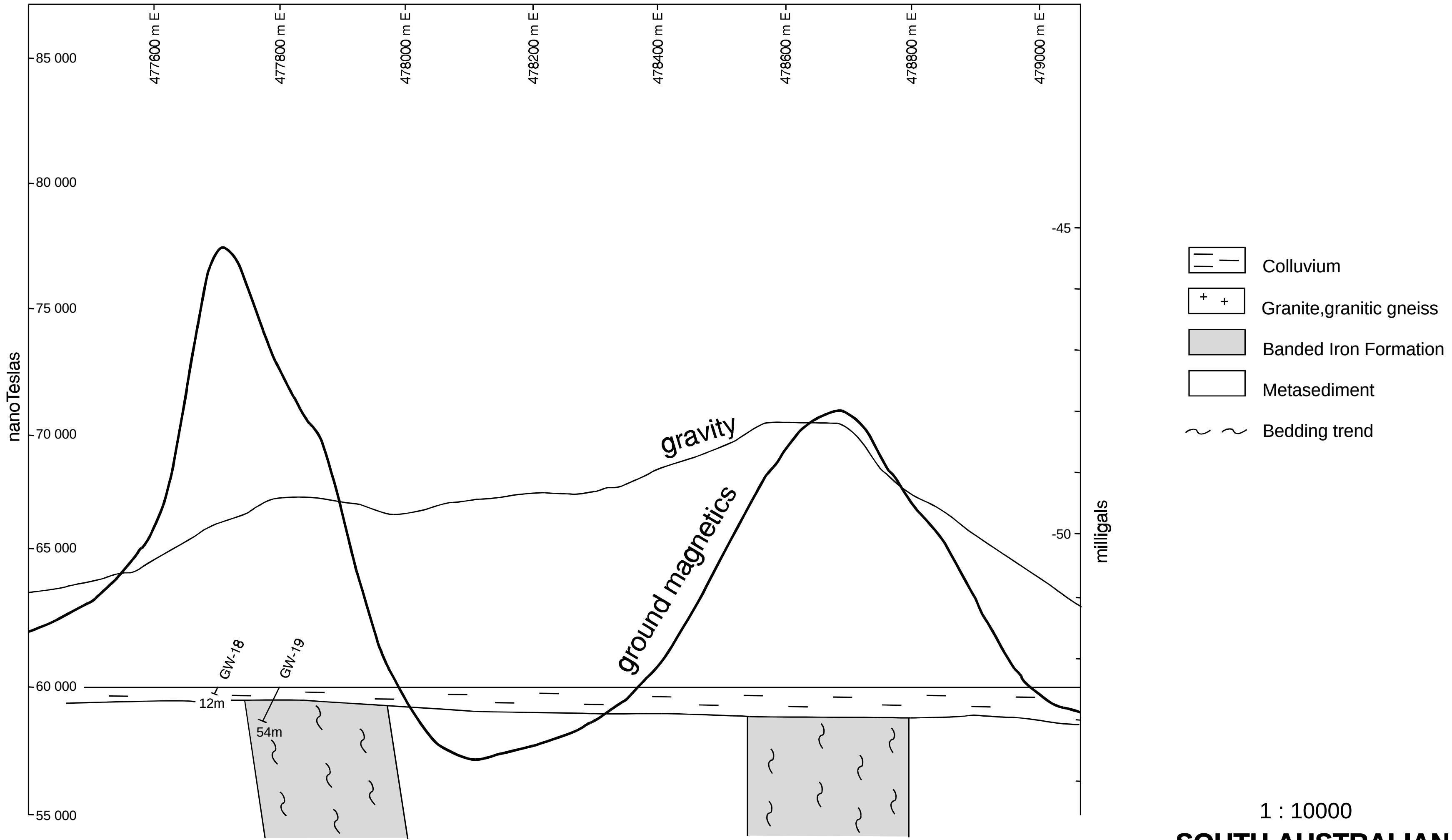
97–0152 MESA



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SOUTH AUSTRALIAN STEEL AND ENERGY GIFFEN WELL Section 7800N

97–0153 MESA

APPENDIX 4

Mineralogical Report No 7075	GW1 to 6 & RDPD84GD-1 (5 samples)
Mineralogical Report No 7125	BUL81A to 101 (20 samples)
Mineralogical Report No 7166	GW-DD1 (21 samples)

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MINERALOGICAL REPORT NO. 7075

by Ian R. Pontifex, MSc and A.C. Purvis, PhD

Ex 2335

March 29, 1996

TO :	The Director Mines and Energy of S.A. 191 Greenhill Rd EASTWOOD SA 5063 Attention : Brian Morris
YOUR REFERENCE :	Cost Code EX2335 Order No. 58GR2 A06 9F9
MATERIAL :	Drill Cuttings
IDENTIFICATION :	Prefix HKN, GW1, SE1, various hole numbers and depth; also RDPD84GD-1 (15 in all). [170417 to 170431]
WORK REQUESTED :	Polished thin section preparation, petrographic/mineragraphic description and report, with comments as specified.
SAMPLES & SECTIONS :	Returned to you with this report.

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GW Samples

These `include banded iron formation samples as well as metasiltstone and an alkali felspar-rich possibly igneous lithology (quartz syenite + contaminated or altered equivalents).

No.	Oxides	Gangue Minerals
170424	Granular magnetite with rare granular hematite, also up to 5% lamellar hematite in the magnetite.	Quartz and possibly tremolite or cummingtonite.
170425	Mostly microgranular magnetite, but up to 25% microgranular hematite in two chips, also patches of pyrite in the same chips.	Quartz and minor to abundant tremolite (flooding magnetite-only chip), with rare carbonate
170426	Magnetite + rare secondary hematite; folded to disrupted	Microcrystalline clinopyroxene and/or tremolite-actinolite, also clay-carbonate layers and veins.
170428 (part)	Two chips with magnetite, largely microcrystalline	Quartz

Other Lithologies

No.	Oxides	Gangue Minerals
170427	Metasiltstone, laminated biotite-muscovite-quartz, rare pyrite in quartz veinlets	Laminated but not schistose
170428 (part)	Five chips, alkali felspar-rich rocks, some with chlorite-quartz-altered possible clinopyroxene, some with decussate biotite or clays partly after cordierite, usually minor quartz, pyrite and magnetite.	Possibly metamorphosed pyroxene quartz syenites with altered or contaminated variants containing altered possible cordierite.

1704024
GW-1, 30-80 m

Quartz-oxide-amphibole BIF, with low-birefringent colourless amphibole (?tremolite), rare apatite.

Estimated gross mineralogy :

quartz, micromosaic	35-40%
magnetite, granular ± hematite rims	35-40%
hematite, fine granular to microplaty	7%
amphibole (?tremolite)	10-12%
apatite	1%

Relatively thin mesobands, from 1 to 3 mm thick throughout these chips consist of finer scale microbands 0.05 to 0.2 mm thick. In one chip, the fine layering is disrupted.

The microbands are alternately rich in fine granular magnetite and quartz plus amphibole. The amphibole seems to have an unusually low birefringence but is monoclinic and possibly tremolite.

In some areas the layering seems to have been pulled apart across the bedding direction, with the resulting cavities filled by vein quartz. Accessory fine apatite occurs locally as grains to 0.1 mm in diameter.

Although the oxide is essentially granular to microplaty magnetite, this is locally accompanied by fine granular hematite (to 0.1 mm) diameter, also there are fine rims of hematite around some magnetite, and in some areas up to 5% fine lamellar secondary hematite occurs in the magnetite. Several microbands are relatively rich in extremely fine hematite.

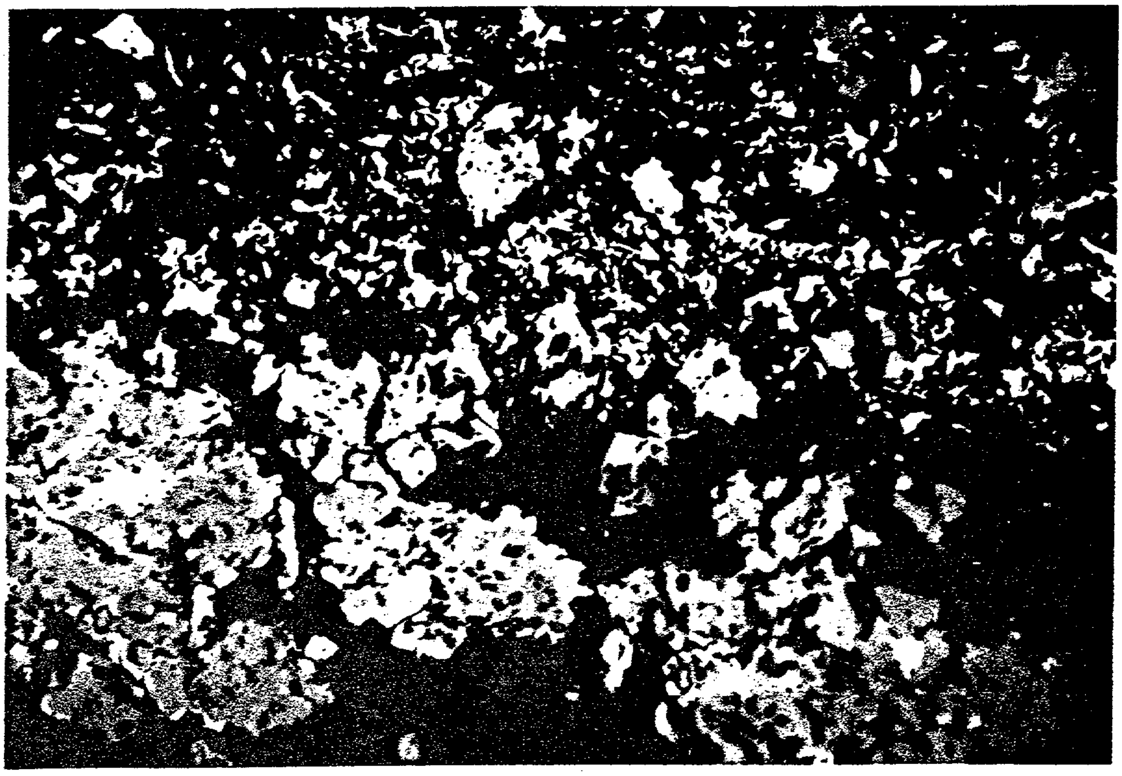

Fig 9 **174024** **0.05 mm**

Top layers of very fine granular to microplaty hematite (white), lower layer rich in coarser brownish magnetite commonly rimmed by hematite.

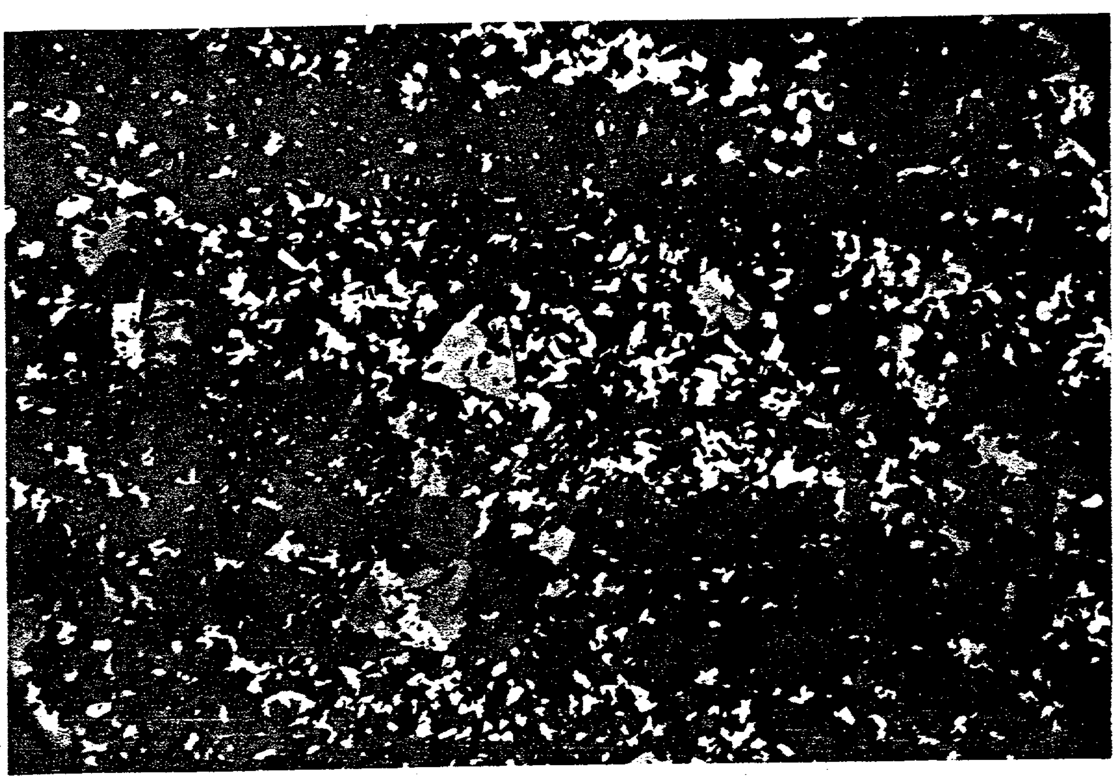

Fig 10 174024 0.05 mm

[illegible]

170425
GW-3, 40-60 m

Folded, veined and disrupted BIF with layers variously rich in magnetite ± hematite, quartz and tremolite. Also veins of tremolite and areas flooded by tremolite ± carbonate. Accessory poikilitic pyrite.

Estimated gross mineralogy :

quartz	20%
magnetite	40%
hematite	5-7%
tremolite	3-5%
carbonate	5%
pyrite	2-3%

The layering in these three chips on a scale of 0.5 to 2 mm are variably folded to disrupted. Most layers are generally quartz or magnetite-rich but in diffuse areas decussate tremolite occurs in both the quartz-rich and magnetite-rich layers. There are cross cutting veins of decussate tremolite ± magnetite to 2 mm wide in one of the chips, and large areas in one chip have been flooded by tremolite, rarely with lenses of carbonate, disrupting the layering.

Magnetite in two of the chips is largely microgranular to 0.1 mm but intricately accompanied by 25% microgranular and rim-like hematite (martite) about 20 µm in size, as well as rare microplaty hematite to 0.1 mm. Minute silicate inclusions are locally abundant in magnetite. Several small patches of pyrite in these chips, to 1 mm long, are partly in quartz, partly adjacent to magnetite-rich masses. In one of the chips, which has been flooded by tremolite, there is only magnetite and no hematite, with the magnetite commonly containing sparse minute inclusions of silicate.

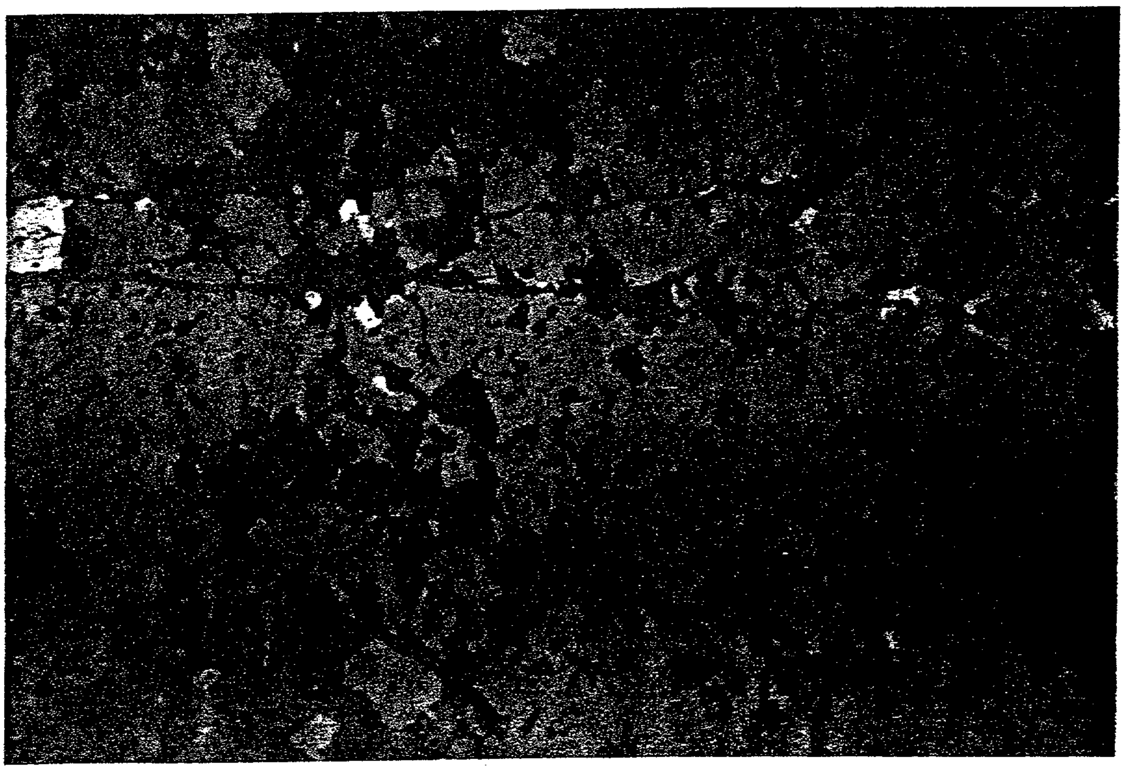

Fig 11 **174025** 0.05 mm

Layered quite coarse magnetite, with anomalously abundant very fine silicate inclusions. [Rims of hematite around magnetite are common in some other layers in this sample.]

170426
GW-5

Planar to folded to microbrecciated, BIF. Partly with abundant microcrystalline clinopyroxene in layers and veins, ± tremolite-actinolite (and clay-carbonate veins) also quartz-magnetite-amphibole BIF.

Estimated gross mineralogy :

quartz	25%
magnetite	35-40%
hematite	1-2%
amphibole (tremolite-actinolite)	15%
clinopyroxene (microcrystalline)	30%
clays	2-3%

The three large chips mounted for this polished thin section are BIF, but with structures variably planar, isoclinally folded and disrupted to brecciated. Mesobands are from 1 to 10 mm thick with microbands to 0.5 mm thick.

Quartz-rich bands alternate with bands of fine granular magnetite, some of which contain abundant interstitial tremolite-actinolite as poikilitic grains, whereas others have abundant microcrystalline clinopyroxene, ± minor tremolite-actinolite. In two of the chips the layering has been severely disrupted, largely manifest as veinlets now composed of microcrystalline clinopyroxene, also with minor tremolite-actinolite. Some veins with clays and carbonate occur in these chips.

One chip seems to lack clinopyroxene, having only tremolite or possibly cummingtonite as well as quartz and magnetite, and this has been cut by quartz-rich veins with only minor tremolite or cummingtonite.

170427
GW-6

Laminated metasiltstone with largely decussate muscovite and biotite, less abundant quartz, accessory fine opaque oxide, tourmaline. Minor small patches of chlorite, and lenses and stringers of quartz, trace fine pyrite.

Field Note: Metasediment.

These chips represent a metasiltstone, finely with laminations, probably bedding dominated by fine decussate muscovite and biotite, intricately mixed with generally subordinate fine quartz. Minor fine opaque oxides occur within the laminations, and there are minor irregularly disseminated small porphyroblasts of brown tourmaline about 0.5 mm long. Irregular small patches of chlorite, small irregular lenses and stringers of quartz are common, including planar quartz veinlets to 0.5 mm wide. Traces of extremely fine pyrite occur in the quartz veinlets.

170428
RDPD-84-GD-1

Two small chips of quartz-magnetite BIF.
Five larger chips of alkali felspar-rich probable meta-igneous rocks, locally with altered possible pyroxene, also decussate biotite or clays after biotite, clays possibly after cordierite or indeterminate poikiloblastic grains, and quartz, disseminated and in veins. Accessory disseminated pyrite and magnetite.

Two small chips in this sample consist of a diffusely banded BIF, dominated by quartz, with about 25% microgranular magnetite. This has been cut by quartz stringers at a high angle to the layering, with some chlorite and magnetite, or by layer-parallel quartz veinlets.

The remaining five, larger chips are dominated by fine granular alkali felspar, highlighted stained yelow on the offcut, and seen as equant to weakly elongate grains 0.2 to 0.8 mm long. In one of the chips these are well-aligned, possibly in a flow-orientation, but in the others they do not show any preferred orientation. The apparently flow-oriented chip has blocky masses of quartz and chlorite to 4 mm long, with inclusions of apatite and with magnetite concentrated along the margins of the area. These seem to have replaced a ferromagnesian mineral, most probably clinopyroxene. There are also patches clays which may be after decussate biotite, and small aggregates of granular magnetite. Rare aggregates of clouded plagioclase are also evident.

Large diffuse lenses of decussate biotite, partly altered to clays, occur in one of the more granular chips and are up to 8 mm long. Minor apatite occurs both within the biotite aggregates and in the alkali felspar, and opaque grains (magnetite and pyrite) are disseminated. One of the other chips has blocky orange clay patches, possibly after cordierite, as well as rare decussate muscovite and disseminated fine pyrite. The pyrite occurs commonly in irregular small aggregates and also in a curious circular feature, with the pyrite concentrated along the circumference of the circle. A chip dominated by sericite and chlorite after poikilitic grains of unidentified minerals also occurs. There are accessory patches of pyrite to 0.3 mm in many of the chips, as well as up to 7% magnetite.

These chips all have accessory to minor quartz, locally interstitial (as in the flow-textured chip), but also in small polycrystalline aggregates and in narrow veins (locally containing fine pyrite). It seems possible that these rocks are of meta-igneous origin, with possibly contamination or alteration prior to or during metamorphism resulting in the possible cordierite in one chip, with altered possible pyroxene in another chip.

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MINERALOGICAL REPORT NO. 7125
by A.C. Purvis, PhD & Ian R. Pontifex MSc.

June 19, 1996

TO :

The Director
Mines and Energy of S.A.
191 Greenhill Rd
EASTWOOD SA 5063

Attention : Brian Morris

YOUR REFERENCE : EX2376, Debit Code 36G37/A06/689

MATERIAL : 47 Samples. SASE Project

IDENTIFICATION :

HKR74 to HKR 101
BUL 81A to BUL 101
and ING 1

WORK REQUESTED : Thin and polished thin section preparation, petrographic/mineragraphic description and report, with comments as specified, and photomicrographs.

SAMPLES & SECTIONS : Returned to you with this report.

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CONTENTS

[A] SUMMARY COMMENTS BIF SAMPLES

Twenty two of the samples in this batch nominated as BIF in your field notes, are confirmed as BIF by this investigation (even though sample HKR 93, 37m is a massive cummingtonite, silicate-facies BIF, basically without opaque iron oxides).

Cherty quartz, almost invariably forms 50% or more of both the HKR and BUL, BIF samples, albeit locally recrystallised to slightly coarser, and occasionally stressed mosaic than would be normal for 'chert'.

Magnetite originally formed as little as 5% and more commonly about 30% of these samples, and rarely >30%, but with some exceptions, magnetite no longer exists, or occurs only as sparse relicts. This original magnetite has been very predominantly pseudomorphically replaced by **hematite, variety martite**, with the former euhedral crystal morphology of the pre-existing magnetite fairly well preserved in most cases. Almost all of these martite replicas have been oxidised, manifest as a sparse internal microporosity in least oxidised examples, but with increased oxidation (and apparent associated leaching) this internal microporosity increases, ultimately to a microscopic internal boxwork (with the original criss-cross octahedral crystal fabric of the ex-magnetite). Even more advanced oxidation is manifest by invasion and replacement by (lateritic) goethite ± limonite, within and between martite crystals and aggregates.

As noted, sparse minute inclusions of magnetite remain as relicts in some martite, and magnetite also occurs as micron-size inclusions in quartz, sufficient for the chips to attract a suspended magnet. Relatively abundant fresh magnetite occurs in HKR 84, HKR 93, HKR 99, BUL 84 and BUL 93.

Up to possibly 10% of the total hematite seen throughout this suite is **decussate microplaty hematite,** (i.e. basically micromosaic, bladed), generally in association with martite, more or less interstitial to martite aggregates and/or within cherty quartz. This is interpreted to have a basically metamorphic genesis. The exceptional example of this is HKR 99, 20 m, which is a compact mass of apparently very predominantly platy hematite, with small voids surrounded by microplaty hematite, with sparse magnetite which may be relict, or may be metamorphic.

Minor amphibole (and/or micas) occur in some BIF samples, but this is almost invariably (pseudomorphically) replaced by secondary hematite and/or goethite ± clays, locally ±

carbonate. The exact species of amphibole is indeterminate, but it almost certainly relates to the massive cummingtonite in HKR 93, 37 m; which is not an uncommon component in banded iron formation. The sparse carbonate alteration of minor amphibole suggests a more Ca-Mg-rich species may be present however. Indeed, fine oxidised amphibole occurs in some crosscutting veins, which are obviously late stage, some together with recrystallised quartz. The presence of trace fine epidote > apatite in BUL 93, 67 m is unique within the suite.

TABLE 2 : Approximate Volume % Gross Mineralogy, BIF Samples

		quartz	magnetite	martite (variably oxidised)	microplaty hematite	limonite-goethite + clays	amphibole ± micas (mostly altered)
HKR	81, 30 m	2-3	-	80	5	7-10	-
	82, 30.5 m	50	-	-	30-35	20	2-3
	84, 45 m	30	10	← 25-30 →		5-7	-
	85, 16 m	65-70	-	30	-	3-5	-
	86, 29 m	40	5-7	← 25 →		5	25-30
	87, 8 m	65	-	1-2	-	30	-
	88, 9 m	35	-	10	-	55	-
	89, 28 m	5	-	40	-	60	-
	90, 22 m	50-60	1-2	25	10	3	-
	93, 37 m	30-35	7-10	← 20-25 →		15-20	?10
	94, 8.5 m	50	-	40	-	10	?10
	97, 29 m	60	-	25-30	7-10	7-10	-
	98, 29 m	40-50	1-2	← 25-30 →		25-30	-
HKR	99, 20 m	5-7	5-7	← 85 →		-	-
BUL	83, 3 m	50	-	25	25	3	-
	84, 2 m	20	25-30	35-40	7-10	10-15	-
	86, 21 m	50-55	1-2	35-40	-	10	-
	87, 7 m	50-55	-	40-50	-	-	-
	88, 41 m	60-65	-	25-30	-	10	-
	93, 67 m	45-50	25-30	1	-	-	25-30
BUL	97, 17 m	50-60	1-2	-	-	35	15

[B] SUMMARY COMMENTS OTHER LITHOLOGIES

The samples summarised below are exclusive of banded iron formation. These include a variety of metasediments to unmetamorphosed sediments, as well as metamorphosed and unmetamorphosed volcanic rocks and intrusives, including a sample collected from the subcrop of a Gairdner Dyke Swarm dolerite with an unconformity.

METASEDIMENTS

The metasediments are classified as high grade (amphibolite facies) medium grade (greenschist to amphibolite) and low-grade, with, as indicated some sediments which seem not to have been metamorphosed at all.

The **high-grade metasediments** include:

BUL 82, 32 m Pelitic quartz-muscovite-andalusite/cordierite(?) schist and weathered micaceous schist (meta-claystone) with quartz and limonite veins, also limonite after pyrite.

BUL 90, 49 m Porphyroblastic garnet-biotite-plagioclase-quartz schists (pelitic) and quartz-epidote rock (calc silicate).

BUL-90, 59 m Quartzofelspathic metasandstones with schistose chlorite after biotite and quartzofelspathic veins poor in quartz, locally with altered sphene, and chlorite-quartz lenses.

Low to medium-grade metasediments are:

HKR 75, 60 m Sericitic to chloritic (meta)claystones, locally passing into carbonate-rich lithologies, variously containing quartz, leucoxene and fine tourmaline.

HKR 95, 29m Weathered quartz-muscovite-biotite metasiltstone to metasandstone (very fine grained sandstone) with narrow quartz veins and limonite lined fractures.

HKR 101, 37m Metabasalt, **sericite schist flooded by quartzofelspathic material**, and quartz-rich hydrothermal aggregates with clays and fresh to oxidised pyrite.

BUL 85, 17.5m Quartz-sericite schists derived from sandy claystones (bimodal, possibly diamictites)

Unmetamorphosed Sediments

These seem to be at least as young as, or younger than the Gawler Range Volcanics.

HKR 83, 44 m Claystones with elliptical weathered spots, narrow quartz veins, also clay veins and limonite lined fractures.

BUL 89, 74 m Coarse sandstone to fine conglomerate with intraclasts of claystone ± siltstone, also abundant microcline and some volcanic fragments, partly derived from Hiltaba Granite Suite plutons and Gawler Range Volcanics.

BUL 98, 65 m Partly slumped claystones to siltstones with beds containing altered apparently authigenic crystals (?felspar) also quartz veins and clay veins. Essentially unmetamorphosed, and possibly similar in age to, or younger than, Gawler Range Volcanics.

Metabasalt

Minor metabasalt occurs in a sample which also contains metasediments and low-temperature hydrothermal quartz.

HKR 101, 37m (part) Metabasalt with abundant albitised plagioclase, partly as microphenocrysts, plus interstitial actinolite partly representing microphenocrysts.

Gawler Range Volcanics

Two samples of Gawler Range Volcanics are present:

BUL 99, 77 m Clay-altered possibly plagioclase porphyritic devitrified probable lava possibly from the Gawler Range Volcanics.

BUL 101, 57 m Porphyritic rhyolite with clay-quartz-leucoxene alteration and very minor sulphides, locally banded, locally net-veined by quartz and clays.

INTERMEDIATE INTRUSIVE ROCKS

These vary from microdiorite to syenite, and are undeformed and unmetamorphosed:

BUL 81A, 48 m Plagioclase porphyritic microdiorite with <1% quartz and clay-altered accessory biotite.

BUL 96, 54 m Albite-sericite-epidote-chlorite-clay-altered monzodiorite with very minor quartz, also oxides and apatite.

BUL 91, 56 m Weakly to strongly altered quartz monzonite to quartz syenite with albitised to sericitised felspars, also iron-rich chlorite ± `smectites, opaque oxides, apatite and minor late magmatic quartz. Cut by veins containing clays, quartz + clays ± carbonate and granular quartz with fresh to limonitised carbonate (including very thin bladed carbonate possibly formed in a zone of boiling).

BUL 100, 59m Altered syenite with minor actinolite + quartz after pyroxene, partly chloritised biotite, magnetite and stubby apatite prisms.

GRANITOIDS AND PEGMATITE, POSSIBLY HILTABA GRANITE SUITE

These are massive to brecciated but quartz-rich, passing into pegmatite.

HKR 96, 19 m Altered coarse potassic leucogranite, possibly Hiltaba Granite Suite.

BUL 92, 62 m Typically quartz-chlorite-flooded and veined granitoids apparently varying from granite to granodiorite.

BUL 94, 63 m Possible microgranite porphyry with alkali felspar > plagioclase > quartz as phenocrysts in an alkali felspar-rich quartzofelspathic groundmass. Clays + leucoxene apparently after biotite ± hornblende, and leucoxene after sphene.

BUL 95, 65 m Fractured to fragmented and sericite-veined possible pegmatite or very coarse granitoid with alkali felspar (microcline) > plagioclase, quartz, also oxidised to leucoxenised opaque oxides.

DOLERITE (GAIRDNER DYKE SWARM)

HKR 91, 64 m Fresh dolerite possibly of the Gairdner Dyke Swarm and carbonate-flooded dolerite cut by a sandstone dyke, with quartz, plagioclase and microcline as poorly rounded grains also some plagioclase, clays, opaque oxide and fragments (with interstitial granophyre) of doleritic origin. Possibly represents a dolerite 'subcrop' against an unconformity.

HYDROTHERMAL QUARTZ, CHERT

HKR 99, 20 m Coarse vein quartz with feathery optically continuous overgrowths and limonite possibly after sulphides, also fine granular quartz.

HKR 100, 40m Brecciated chert with early quartz veins in a clay matrix and later limonite lined fractures.

HKR 101, 37m (part) Microcrystalline to microsparry quartz ± minor alkali felspar in irregular lenses. Limonite-stained clays containing adularia, rare pyrite to 0.5 mm grainsize, as well as limonite after pyrite and in veins.

CONCLUSIONS

The stratigraphy represented by these non-BIF samples is unclear. The high grade metasediments could be Hutchison Group or older (Archaean), and the low-grade metasediments could be Hutchison Group or younger (e.g. Doora Schist). Also the age and affinities of the massive intermediate intrusives and possible relationships with the Malabooma Anorthosite, Bradman Outstation Suite, Hiltaba Granite Suite or other intrusive suites in the Gawler Craton are unclear.

The unmetamorphosed sediments seem to be of Gawler Range Volcanics age or younger, including probable post Hiltaba Granite Suite sediments. There are also massive to fractured to fragmented granitoids and pegmatites which seem to correspond with the Hiltaba Granite Suite. Metabasalt is rare, and a single sample apparently of the Gairdner Dyke Swarm seems to have been captured at an unconformity with younger sandstones.

BUL 83, 3 m

BIF, microlayers variably dominated by cherty quartz, martite (weakly microporous), finer/coarser, decussate/interstitial, more or less microplaty hematite.

Estimated gross mineralogy (2 large chips).

* cherty quartz	~50%
* hematite, martite partly oxidised	20%
* hematite, finer martite gradational to microplaty/interstitial	20%
* hematite, coarser decussate platy	10%
* limonite, interstitial	3%

The gross composition and textures in these chips compares with HKR 97, 29 m, but it is less oxidised and somewhat more distinctly laminated.

Layers of opaque oxide consist mostly of planar, continuous bands to 3mm thick dominated by aggregates of martite crystals, individual size 0.1mm but locally continuous to 3mm. These martite crystals have an internal microporosity and minor finer quartz, also finer incipiently microplaty hematite is interstitial.

Thinner relatively lenticular layers consist of hematite of individually finer size (<0.1mm) more or less interstitial to quartz, but interconnected in micronetworks and without internal porosity.

Relatively discrete small random blades of hematite, slightly coarser than the decussate microplaty is a subordinate, morphological form of hematite in some martite-rich layers. Sparse limonite occurs as local intergranular staining.

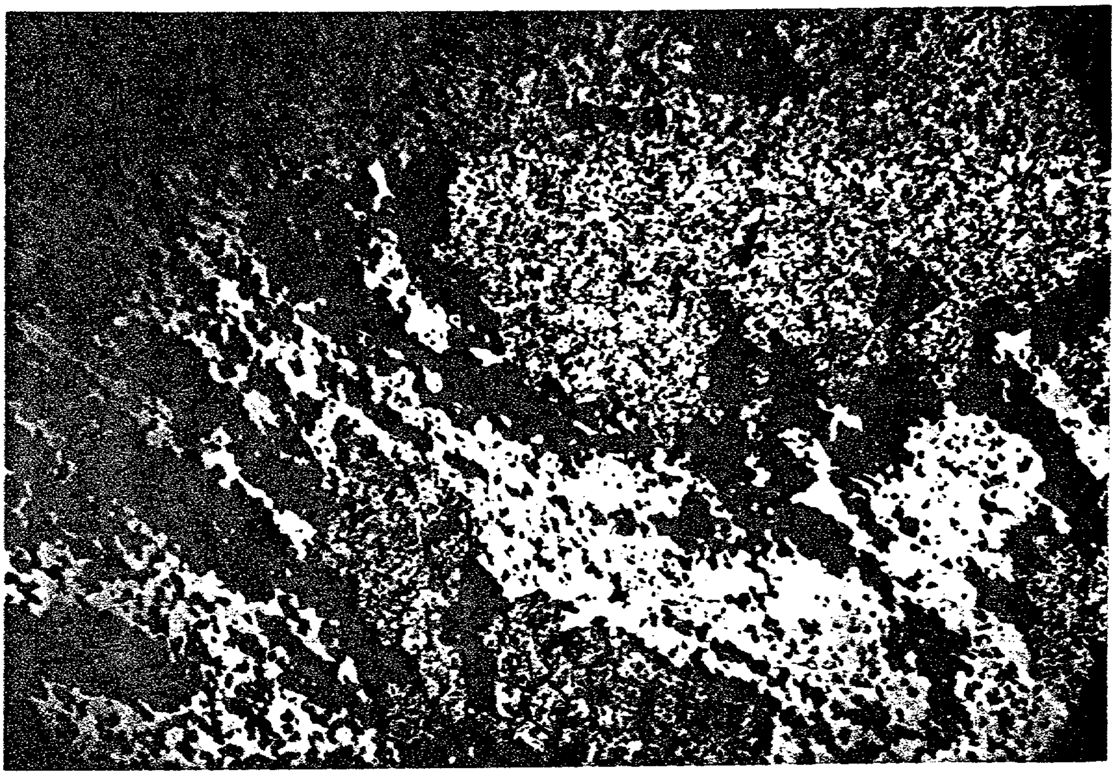


Fig 30 **BUL 83, 3m** 0.05 mm

Two varieties of layered hematite (within quartz) in this sample : (1) relatively coarse martite crystals with a moderate internal microporosity (2) finer more 'solid' granular hematite.

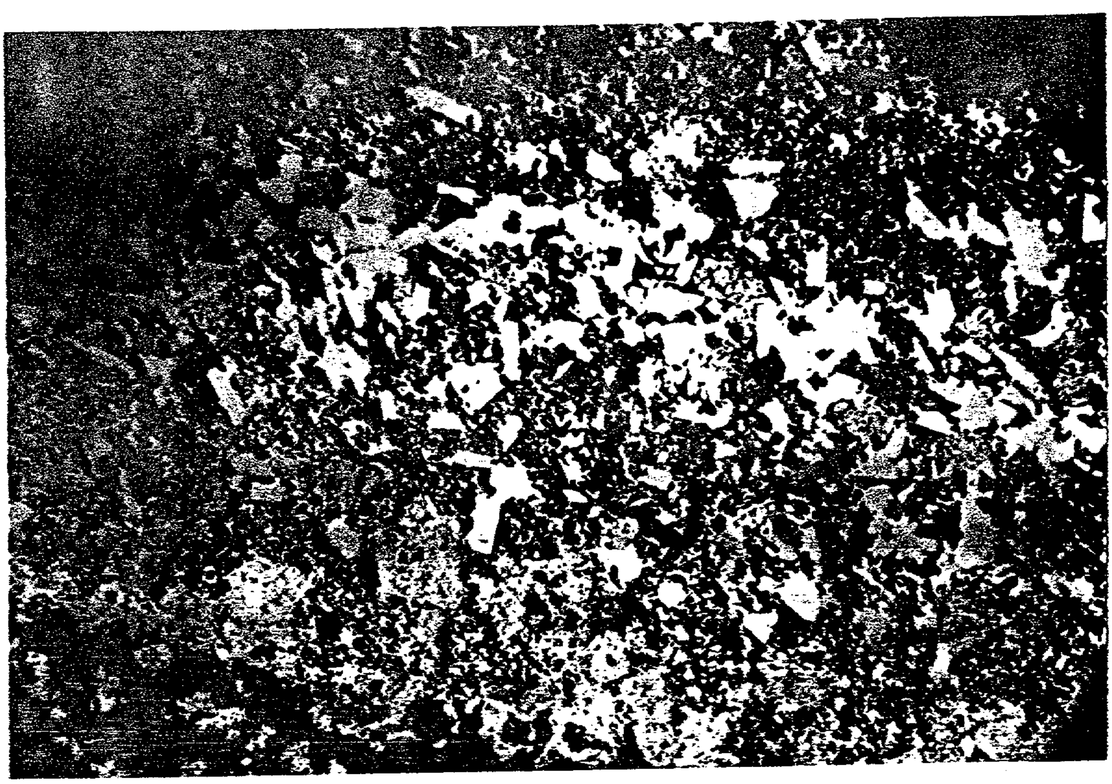


Fig 31 BUL 83, 3m 0.05 mm

[illegible] a third variety of hematite in this band as discrete relatively coarser blades, together with martite and [illegible]

BUL 84, 2 m

BUL 84, 2 m	**One chip :**	**BIF with microlayers of partly oxidised magnetite quartz; also minor ex-mica or amphibole oxidised to limonite.**
	One chip :	**BIF, poorly defined layers of oxidised martite within quartz, minor patchy goethite.**

Estimated gross mineralogy (2 large chips)

* cherty quartz	20%
* magnetite	25-30%
* hematite, martite	35-40%
* hematite, incipiently microplaty	7-10%
* limonite/goethite	10-15%

These two chips are more iron-rich than any other of the BUL series. The remarkable aspect of them is that one chip contains up to 50% magnetite (albeit partly oxidised) in quartz, and the other chip contains up to 50% oxidised martite (+ goethite) but no magnetite, and with almost completely fresh magnetite crystals adjacent to almost completely oxidised magnetite crystals.

The magnetite-rich chip consists of microlayers of magnetite crystals, average size <0.1mm, commonly fairly tightly aggregated, in fairly continuous layers, within 'chert'. Almost all magnetite crystals have an extremely narrow rim of hematite (martite), but up to ⅔ of the magnetite shows 20% to 60% replacement by martite, rarely with complete replacement and locally with limonite. [Note that BUL 93, 67 m chips are also magnetite-rich].

Also, there is a schistose component within the quartz which appears to have been an ex-mica or amphibole, now completely oxidised into limonite.

The other chip consists of relatively more poorly defined lenticular layers (and patches) through quartz, composed of aggregates of oxidised (?and partly leached) microporous martite, commonly rimmed by goethite throughout a matrix of quartz. Several small patches of goethite, and more or less disseminated very fine oxidised mica? also occurs in this quartz.

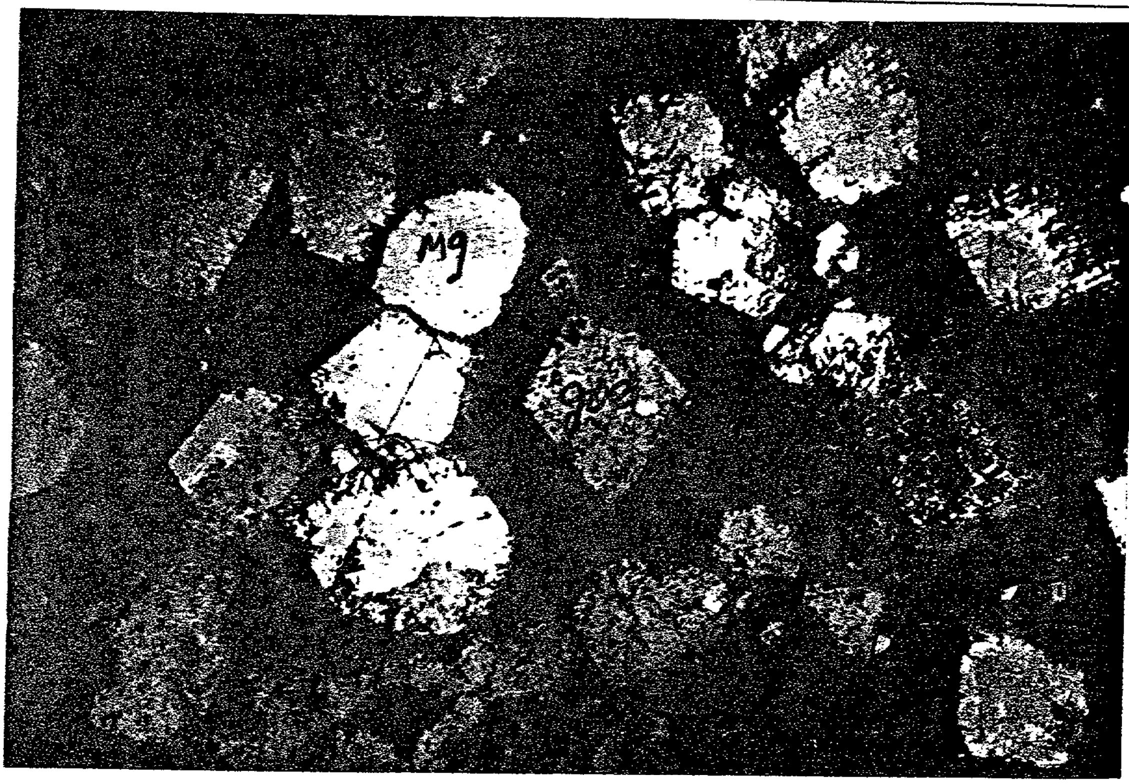


Fig 32 **BUL 84, 2 m** 0.05 mm

Almost entirely fresh (pale brownish) crystals of magnetite (mg), adjacent to almost completely oxidised crystals of magnetite, now (grey) goethite (goe).

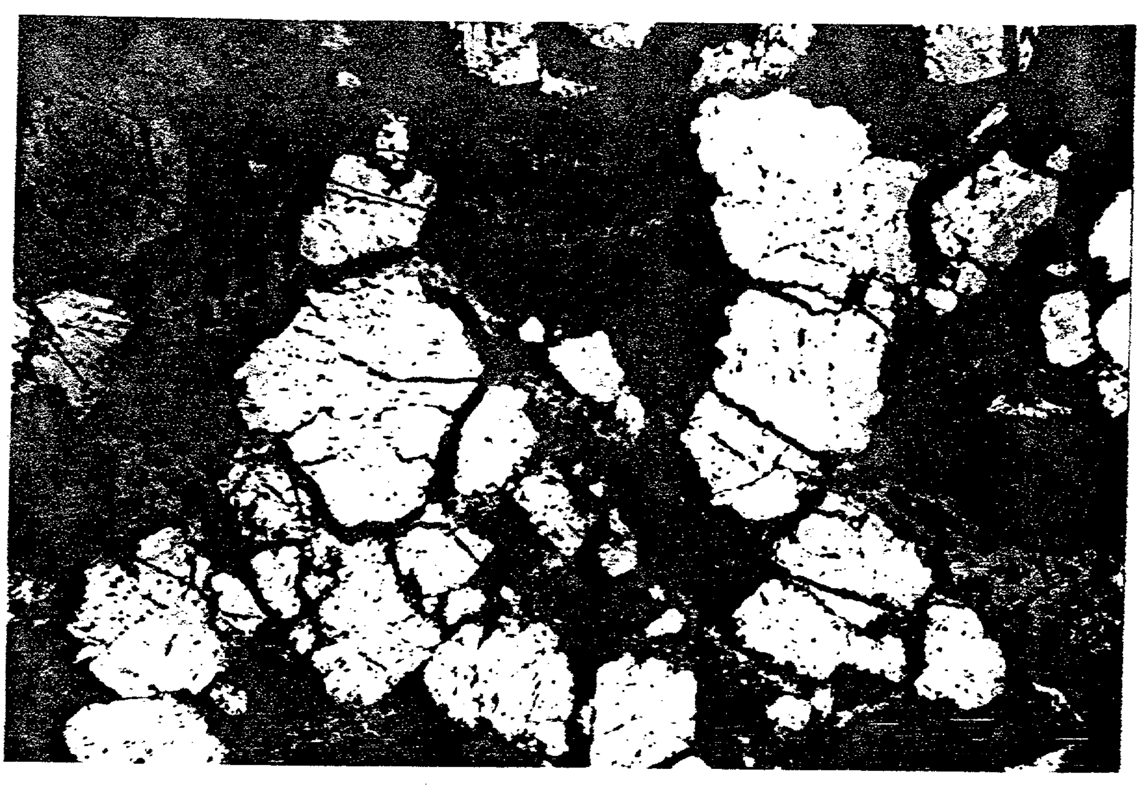


Fig 33 **BUL 84, 2 m** 0.05 mm

Coarse magnetite crystals, partly oxidised to hematite, in chert with an extensively [illegible] schistose component.

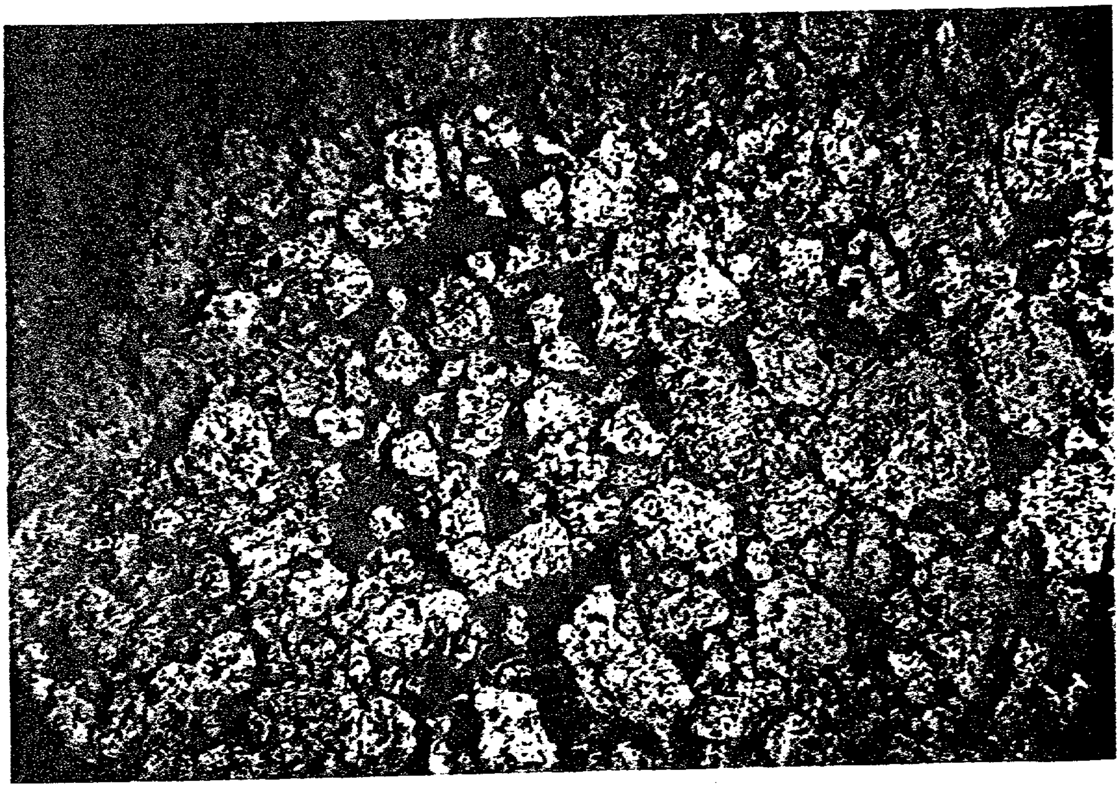


Fig 34 **BUL 84, 21 m** 0.05 mm

In the second chip of this sample. white martite crystals are rimmed by grey goethite.

BUL 86, 21 m	**BIF, fairly regular laminations of cherty quartz and fine oxidised martite, local micro-fractures with mm-scale dislocation. Trace fresh magnetite grains in quartz.**

Estimated gross mineralogy (4 chips)

* cherty quartz	50-55%
* hematite, oxidised martite	35-40%
* magnetite	1-2%
* limonite, minor stringers/veinlets	10%

Three of these BIF chips are laminated on a scale of 1 to 3 mm, with more or less alternating microlayers dominated by cherty quartz and hematite. In one of these chips, the laminations are cut by microfractures with local dislocation on a mm scale. The fourth chip in this mount is less regularly laminated, with fine lenticular layers more or less truncated by a microfracture, and poorly defined micropatches (1 to 2mm) of hematite in a cherty quartz host.

The hematite occurs almost exclusively as trains and elongate aggregates of oxidised martite, with individual crystals generally <0.2mm in size, but with rare scattered single crystals to 0.25mm. These are all oxidised varying from weakly microporous to more advanced development of internal boxwork. Accessory individual grains of basically fresh magnetite ± rare hematite oxidation are locally completely enclosed in quartz.

Limonite ± goethite is locally interstitial to oxidised martite, rarely within oxidised martite, also in random threads and stringers.

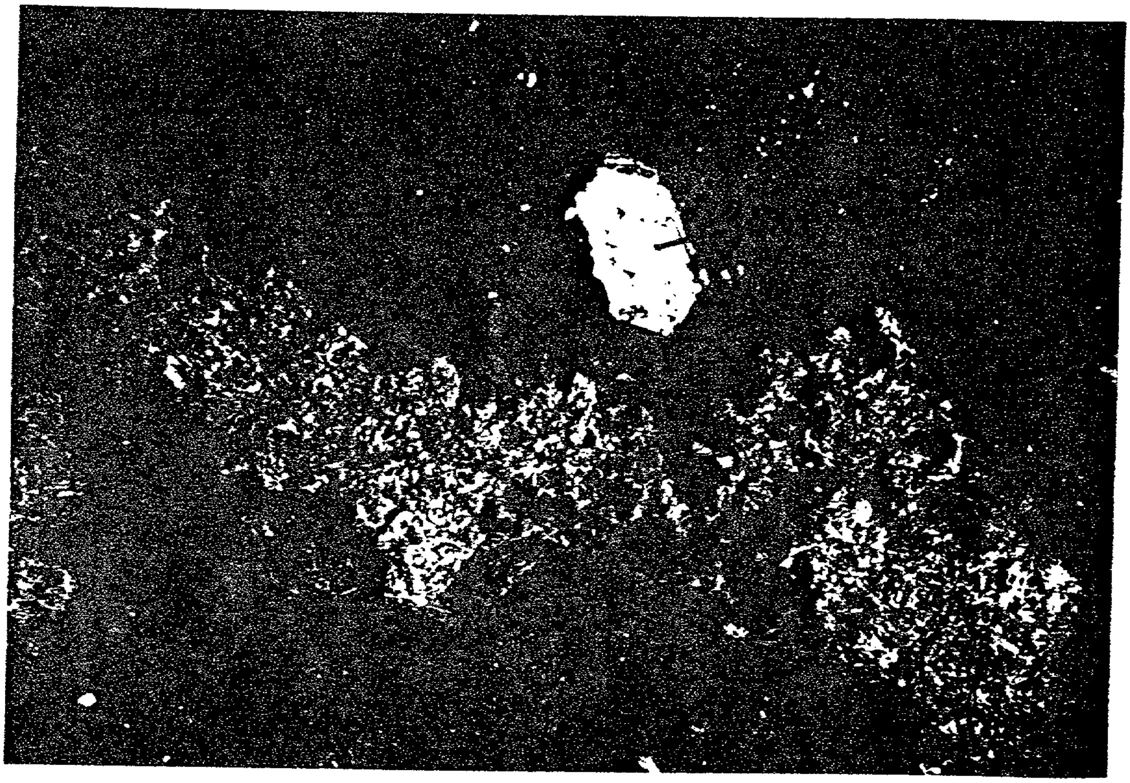


Fig 35 **BUL 86, 21 m** 0.05 mm

Layer of extensively oxidised martite crystals, and a single crystal of fresh magnetite (mg), all in quartz.

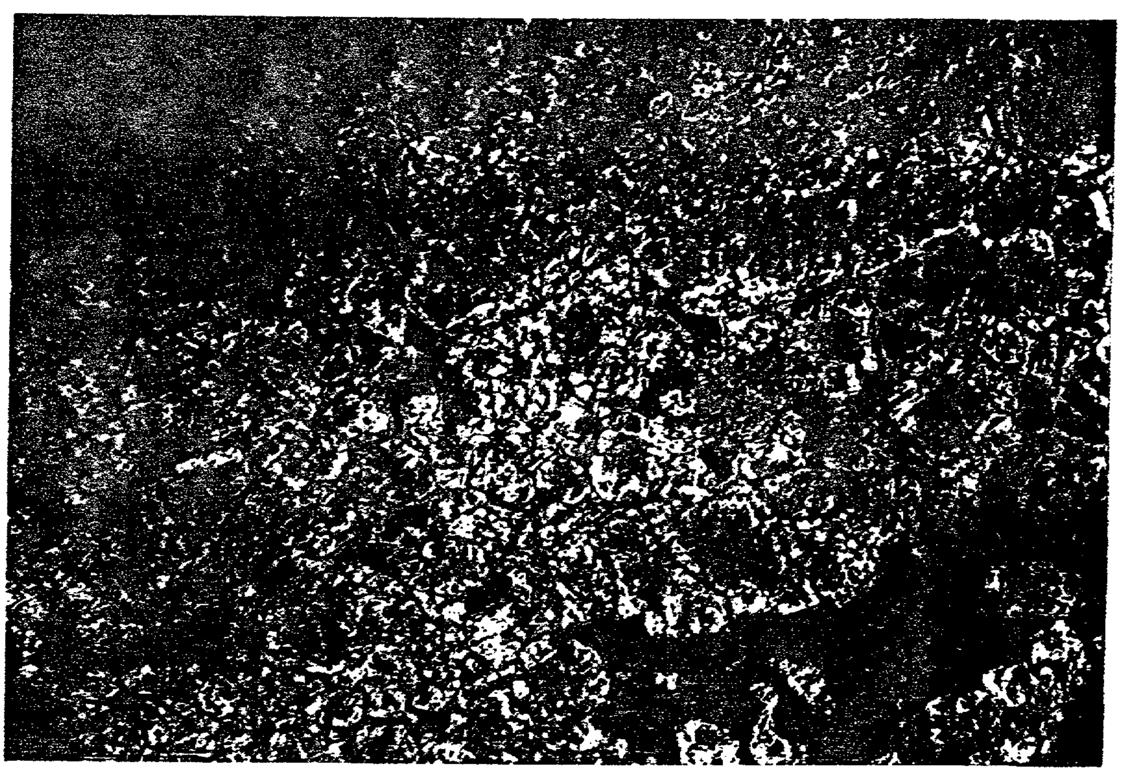


Fig 36 BUL 86, 21 m 0.05 mm

Typical oxidised BIF, showing layers of oxidised and leached martite crystals, some rimmed by goethite

BUL 87, 7 m

BIF of laminated cherty quartz and fine partly oxidised martite. Local microfractures and microflexuring of martite laminae with incipient oblique foliae in cherty matrix stained by limonite.

Estimated gross mineralogy (3 large chips)

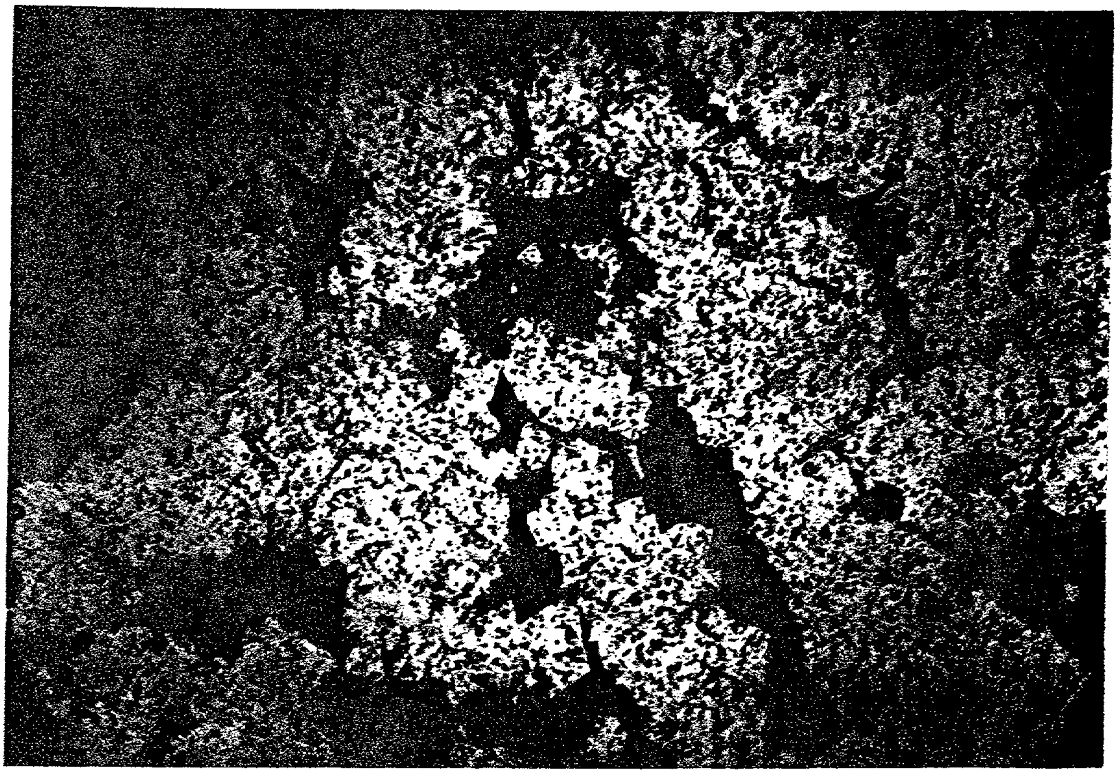
* cherty quartz	50-55%
* hematite	40-45%

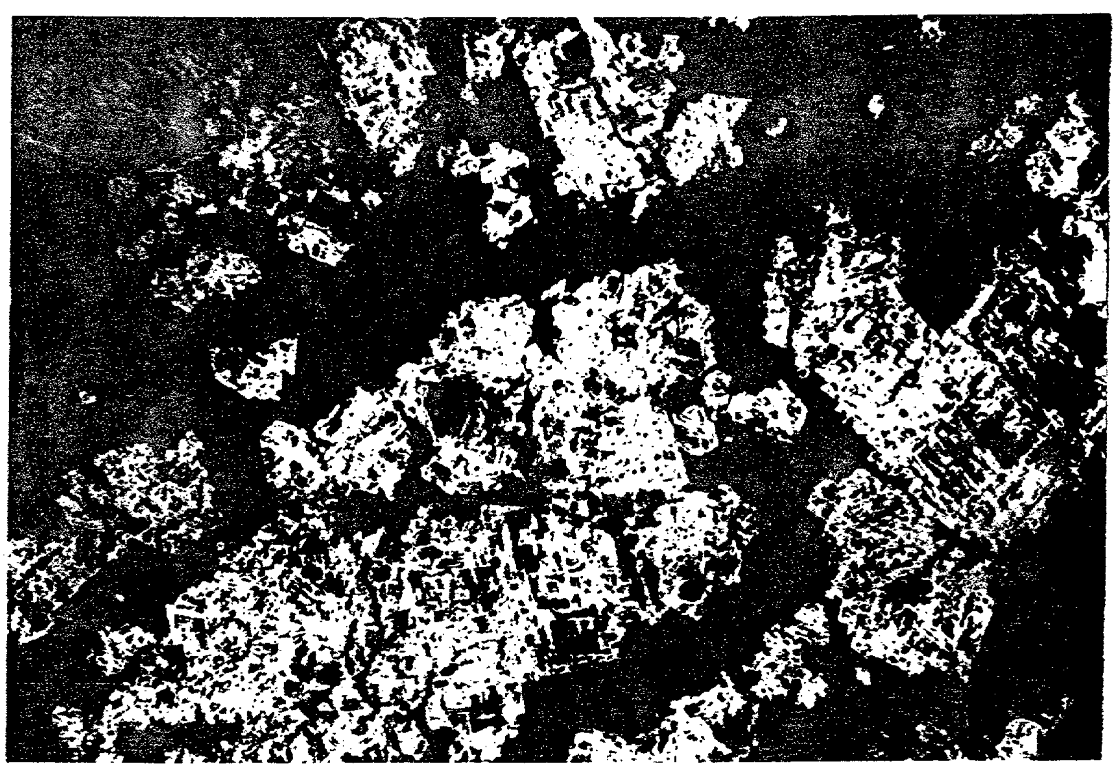
As for the other BUL BIF samples in this suite, these three chips consist of fairly planar and continuous, intercalated microlayers dominated by cherty quartz and by fine hematite. Layer thickness is quite variable however, from 0.05mm to (rarely) 3mm and the concentration of the laminae is also variable with a dominance of quartz over 8mm thickness in one chip, and a dominance of hematite over 12mm thickness in another.

The cherty quartz mosaic is locally stressed and incipiently recrystallised, and several microfractures cut the rock, with local mm scale dislocation. Also, there are minor local micro-flexures of the martite-rich laminae, with incipient fine oblique foliae within the cherty matrix stained by limonite.

The hematite occurs as martite crystals, average individual size about 0.1mm, mostly clustered at several mm scale, to form variably continuous layers. These martite crystals have a very sparse internal microporosity, but generally not developed to the same (advanced) extent as in the BUL 86, 21 m.

Magnetite was not seen in these chips.





Figs 37 & 38 BUL 87, 7 m

0.05 mm

Example in Fig 37 of martite crystals which are relatively less porous (leached) than in BUL 86, 21m
However in Fig 38, oxidation of martite crystals is somewhat more advanced

BUL 88, 41 m

BIF of cherty quartz > oxidised fine martite. Layering locally disrupted with recrystallisation of the quartz. Minor yellowish limonite ± clays locally pseudomorphs ex-cubic crystals of ?pyrite.

Estimated gross mineralogy (5 small chips)

* cherty quartz	60-65%
* hematite, oxidised martite ('earthy')	25-30%
* limonite/limonitic clays	10%

These BIF chips are mostly well laminated on a scale of 1 to 3mm, however in two of the chips the microlayering is substantially disrupted, with local recrystallisation/distortion of the cherty mosaic. The laminations consist predominantly of cherty quartz with a subordinate number of more or less alternating microlayers dominated by trains and loose aggregates of oxidised, very fine (0.02 to 0.1mm) martite crystals. These martites are generally microporous, apparently due to advanced oxidation (and associated leaching) resulting in the hematite now having a somewhat earthy, even ochreous character.

Yellowish limonite and limonitic clays occupies minor voids, particularly in areas of disrupted fine layering, and this material also permeates cherty mosaic more extensively in some layers than in others. Indeed, in some disruption areas, limonitic clays pseudomorphically replace loosely clustered, pre-existing (?pseudo) cubic-form crystals up to 0.5mm in size. These original crystals seem most likely to have been pyrite, and "beards" of recrystallised quartz are commonly attached to their margins, in pressure shadows.

BUL 93, 67 m

Magnetite-dominant BIF; minor altered amphibole; rare hematite alteration of magnetite and trace minute inclusions of epidote and apatite in quartz.

Estimated gross mineralogy (5 chips)

*	quartz	45-50%
*	amphibole, partly altered to carbonate and/or chlorite	25-30%
*	epidote > apatite	<1%
*	magnetite	25-30%
*	hematite	<1%

These chips are rather unique in the entire suite, because of the relatively very high abundance of fresh magnetite, negligible hematite and the presence of widespread (altered) amphibole, plus accessory epidote and apatite. Abundant mangeitte also occurs in BUL 84, 2 m however.

The chips consist basically of intercalated microlayers alternately dominated by metamorphic quartz mosaic (which is somewhat coarser 0.3 to 0.8 mm than the relatively more cherty quartz in other samples), and by trains of subhedral to euhedral magnetite crystals, also with an average individual crystal size of about 0.5mm. Most of the quartz is crowded with abundant, minute (0.03mm) inclusions of magnetite. The magnetite shows nil to negligible oxidation to hematite.

Amphibole occurs as small (0.5mm) ragged prisms randomly intergrown as individuals and in clusters within quartz mosaic, and at least two thirds of this amphibole is partly to completely altered to extremely fine clouded carbonate and/or chlorite.

Accessory (1%) very small (0.03mm) grains of dark green apparent epidote, and rarer, even smaller crystals of apatite are scattered as inclusions in quartz.

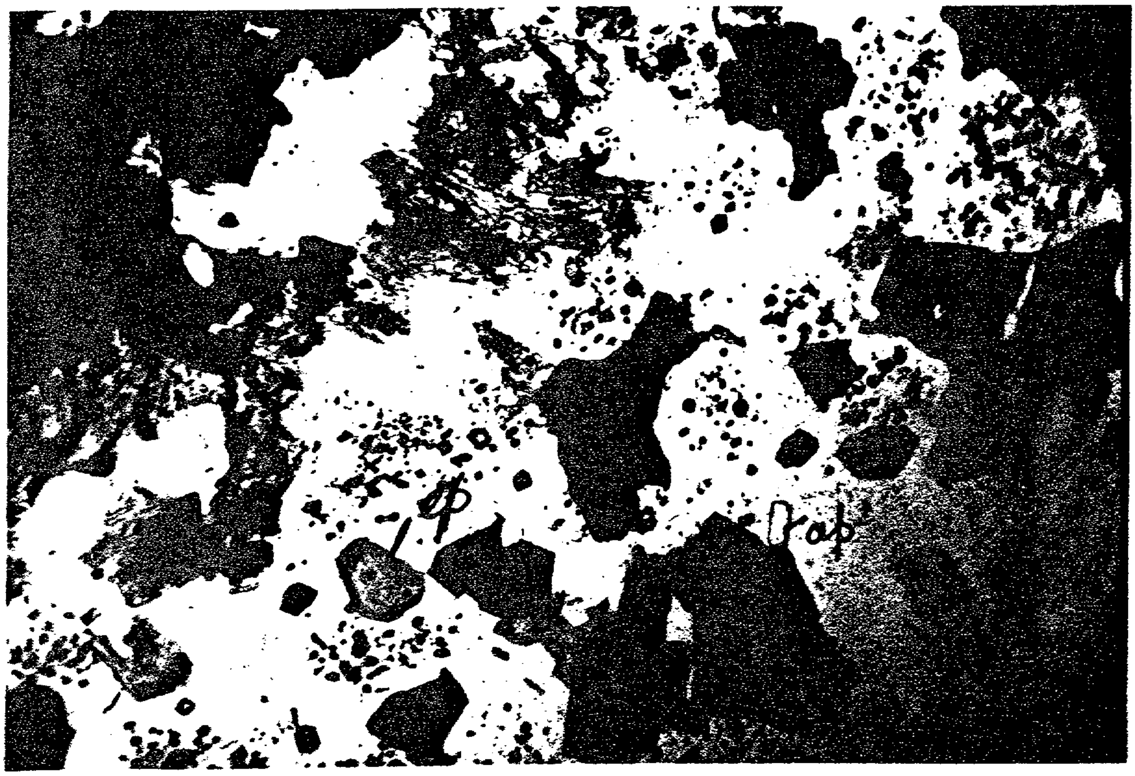


Fig 39 **BUL 93, 67 m** 0.03 mm

Thin section: black (opaque) coarse grains of magnetite, also numerous minute inclusions of magnetite in quartz mosaic. Clouded fibrous areas are altered amphibole. Green grain (ep) is epidote; much smaller clear crystal (ap) is apatite.

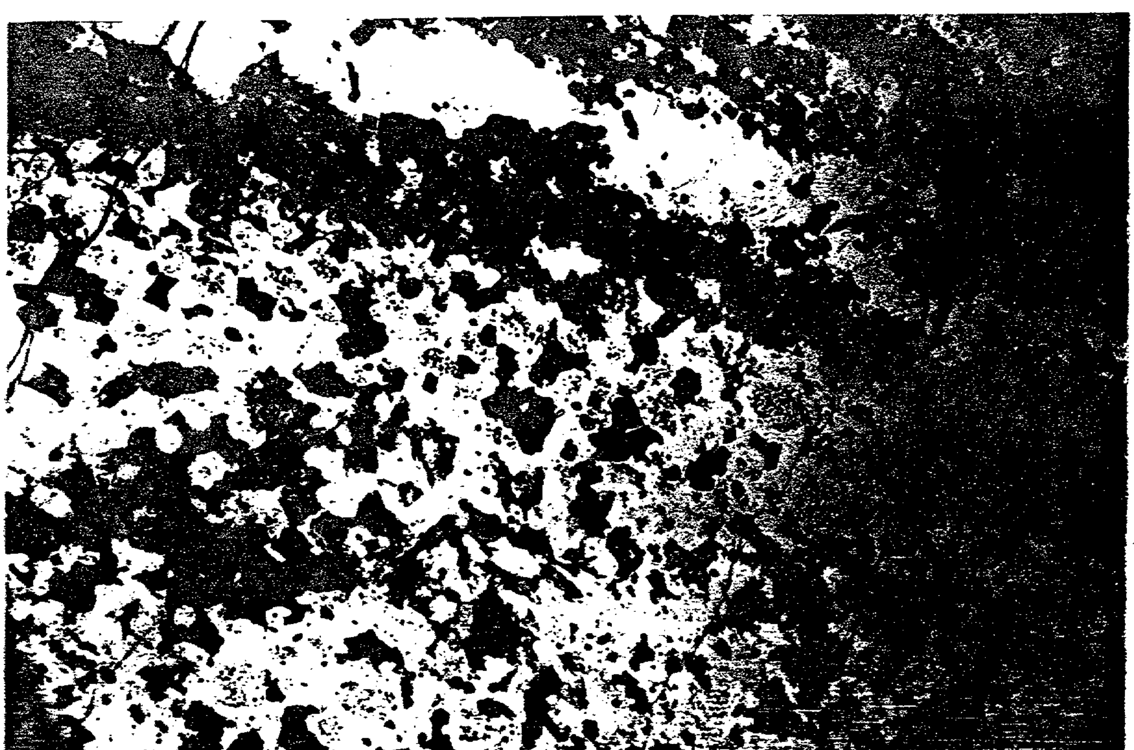


Fig 40 BUL 93, 67 m 0.32 mm

Thin section; caption as for Fig 39, but lower magnification to show layered [illegible] of the magne[illegible] and [illegible]

BUL 97, 17 m

Three chips BIF, with almost completely limonitised ex-martite and quartz; minor ex-amphibole also limonitised, crosscutting veinlets of migratory limonite. Three chips relatively more quartzose BIF variable grain size, sparse minute inclusions of magnetite in quartz, minor layer veins of clay-silica possibly after amphibole.

Estimated gross mineralogy (5 chips)

* quartz	50-60%
* magnetite ± hematite, minute inclusions in quartz	1-2%
* clays ± silica, apparently altered amphibole	7-10%
* limonite, replacing exmartite, amphibole + veins	35%

The three largest chips in this sample are dominated by laminations and microlayers of yellowish-brown limonite, which in microscopic detail is seen to mostly represent complete pseudomorphous replacement of pre-existing microlayers of ex-martite, intercalated with quartzose microlayers.

This same limonite is also seen to replace minor amphibole, with the same mode of occurrence as relatively fresh amphibole in BUL 93, 67 m, but also with minor much finer fibrous apparent amphibole in some quartz layers. Several crosscutting microfractures are also occupied by microcellular migratory limonite/goethite ± clays.

Three smaller chips are relatively far more quartzose, composed of intercalated microlayers of cherty quartz, and apparent layer veins of somewhat coarser quartz mosaic, 0.5mm grain size. These layers compare with layers in BUL 93, 67 m, including the presence of abundant, but minute (0.03mm) inclusions of magnetite ± rarer associated hematite. Several conformable 'layer-veins' of supergene clay + silica through these quartzose chips may be entirely exotic, however, some relict textures indicate at least partial in-situ replacement of former amphiboles.

BUL 81A, 48 m — **Plagioclase porphyritic microdiorite with <1% quartz and clay-altered accessory biotite.**

Field Note: quartz porphyry.

This sample has yellow-brown chips which, in hand-specimen, seem to be plagioclase porphyritic. This is confirmed in thin section where plagioclase phenocrysts to 6 mm long, commonly containing patches of clays (sericite and/or smectite). There are clay-limonite patches apparently after ferromagnesian grains to 2 mm in size. The groundmass is dominated by plagioclase laths to 0.5 mm long, rarely rimmed by alkali felspar, and <1% late magmatic quartz. Limonite-clay-leucoxene aggregates have replaced very thin biotite flakes in the groundmass. Some epidote occurs in the plagioclase phenocrysts and in felspar in the groundmass. Leucoxene is common but apatite is rare.

This sample would seem to be a microdiorite porphyry.

BUL 82, 32 m — **Pelitic quartz-muscovite-andalusite/cordierite(?) schist and weathered micaceous schist (meta-claystone) with quartz and limonite veins, also limonite after pyrite.**

Field Note: metasiltstone?

One of the chips in this thin section has sericitised ellipsoidal porphyroblasts to 4 mm long in a sparse matrix of quartz-muscovite schist, weathered and carrying scattered quartz grains to 0.25 mm diameter. The original nature of the porphyroblasts is not clear, although andalusite would seem to be more probable than cordierite. The other is weathered to well-foliated clays, possibly smectites ± illite, with diffuse and irregular limonite staining and veining. Small patches and lenses of quartz occur including some vein quartz, and there are layer-parallel fibrous clay veins. Minor limonite after pyrite is seen as well as limonite in irregular veins, locally with limonite-free clay lenses. The second chip may represent a meta-claystone but the first is a pelitic schist of probable amphibolite facies.

BUL 85, 17.5 m **Quartz-sericite schists derived from sandy claystones (bimodal, possibly diamictites).**

Field Note: metasiltstone.

These pale yellowish chips are seen in thin section to be dominated by foliated sericite, but have very minor to abundant quartz with grains whose maximum size and abundance varies between chips. The maximum grainsize varies from 0.2 mm in the most quartz-poor chip to 0.6 mm in the most quartz-rich-chip. This suggests bimodal sediments, possibly diamictites, which may be classified as sandy claystones. The silt fraction indeed seems to be rare or lacking. Metamorphism is quite weak in this sample.

BUL 87, 7 m

Field Note : BIF

Fractured to fragmented layers of quartzite, containing quartz grains from 0.03 to 1 mm in size in various layers, occur in this rock with a cement of limonite carrying abundant quartz grains. Fragments of limonite and quartzite also occur .

BUL 89, 74 m

Coarse sandstone to fine conglomerate with intraclasts of claystone ± siltstone, also abundant microcline and some volcanic fragments, partly derived from Hiltaba Granite Suite plutons and Gawler Range Volcanics.

Field Note: sandstone, conglomerate or weathered granite?

These chips are mostly coarse-grained in hand-specimen and in thin section are gritty sandstones, locally with large fragments, possibly intraclasts of claystone to siltstone. The sandstone pass into fine conglomerates with grains to 4 mm in diameter, including quartz and fresh to carbonate-flooded alkali felspar (microcline) grains, as well as composite grains containing quartz and alkali felspar. There are also grains of quartz porphyritic acid volcanic lithologies with weakly sericitised granophyric groundmasses. One of the finer sandstone chips has a single pebble 10 mm in diameter of banded very fine grained sandstone containing lamellae rich in quartz as well as abundant sericite-clouded possibly authigenic quartz grains. The debris in this chip is mostly quartz with less abundant microcline and is well-rounded with a grainsize typically smaller than 1 mm. Rare acid volcanics with microgranular to spherulitic devitrification occur. Interstitial sericite ± carbonate, locally with other clays, are common.

Intraclasts, to 10 mm long, of claystone, locally interbedded with quartz-rich siltstone, occur in sandstones which are quartz-rich and have grains usually about 0.5 mm in size.

These sediments would seem to have contributions from Hiltaba Granite Suite plutons and Gawler Range Volcanics.

BUL 90, 49 m **Porphyroblastic garnet-biotite-plagioclase-quartz schists (pelitic) and quartz-epidote rock (calc silicate).**

Field Note: clayey schist (?kimberlite)

These chips are all coated in clays, but when washed are fine-grained and micaceous with scattered larger brown grains. However in thin section the larger grains are porphyroblasts of garnet, not olivine or altered olivine as would be the case if this were a kimberlite. The garnet porphyroblasts are from 1 to 5 mm in diameter and are enclosed in a generally fine-grained quartz-plagioclase-biotite schist with totally sericitised plagioclase. There are usually inclusions of quartz in the garnet. The grainsize of the host schist is generally 0.05 to 0.5 mm, but in one chip there are quartz grains to 2 mm in size.

One of the chips is dominated by ragged quartz grains to 3 mm in size with 15-20% epidote as small grains and patches of sericitic clays, possibly after felspar. This is coated with fragments of biotite-plagioclase schist.

These represent pelitic schists and a calc silicate possibly derived from the pelite.

BUL 90, 59 m

Quartzofelspathic metasandstones with schistose chlorite after biotite and quartzofelspathic veins poor in quartz, locally with altered sphene, and chlorite-quartz lenses.

Field Note: metasiltstone.

These chips have abundant quartz and sericitised plagioclase as grains from 0.05 to 0.25 mm in size. One of the chips has too much quartz (~55%) for a normal igneous rock, but the other is less quartz-rich, with about 20% quartz. However both may be quartzofelspathic metasandstones representing fine grained sandstone rather than siltstone as suggested in your notes. Both chips have about 15% chlorite apparently after schistose biotite, plus rare muscovite. In the less quartz-rich chip there are diffuse segregations and more clearly defined veins with coarser sericite-clouded plagioclase, locally to 4 mm grainsize, in complex intergrowths with quartz. Some leucoxene, apparently after sphene, occurs in one of these veins, which also has limonitised crystals of uncertain type. A lens in one of these veins consists of chlorite intergrown with columnar quartz. Later veins of adularia and limonite lined fractures occur and there are some narrow zones within which microbrecciation seems to have taken place.

BUL 91, 56 m

Weakly to strongly altered quartz monzonite to quartz syenite with albitised to sericitised felspars, also iron-rich chlorite ± smectites, opaque oxides, apatite and minor late magmatic quartz. Cut by veins containing clays, quartz + clays ± carbonate and granular quartz with fresh to limonitised carbonate (including very thin bladed carbonate possibly formed in a zone of boiling).

Field Note: Granite/BIF.

Granular grey to reddish fragments occur in this sample. In thin section, these are seen to be quartz-poor granitoids which in terms of their present-day mineralogy would seem to range from quartz diorite to quartz syenite. However this seems to be at least partly due to albitisation and the alkali felspar-free chip has quite abundant checkerboard albite, which may be after alkali felspar. One of the chips seems to have been a quartz monzonite, however, with primary plagioclase as well as orthoclase, but one is a quartz syenite with less abundant plagioclase relative to orthoclase.

The most albitised chip has felspar laths to 8 mm long, the largest of which seem to be albitised alkali felspar laths with discrete inclusions of plagioclase. Lenses of probable iron-rich chlorite ± smectites ± oxidised magnetite occur as well as lenses of partly leucoxenised opaque oxides, There is less than 5% late magmatic quartz but some areas appear to have been fractured to fragmented to recrystallised and have abundant fine-grained plagioclase. Veins of 'dog-tooth' quartz occur to 1.5 mm wide with lensoidal cores of clouded clays and rare carbonate. There are also wider veins, to 3 mm wide, with microgranular quartz and fresh carbonate as well as limonite possibly after very thin-bladed carbonate, suggesting deposition within a zone of boiling. Some fragments of albitised felspar occur in this vein.

The relatively fresher quartz monzonite chip has orthoclase laths to 4 mm long, commonly enclosing plagioclase, also separate plagioclase laths. There are patches of chlorite ± opaque oxide, as in the previous chip, and there is accessory apatite. There is again <5% granular late magmatic quartz. This chip has been cut by a laminated vein to 3 mm wide with laminations of clays (commonly foliated parallel to the vein walls), carbonate and 'dog-tooth' quartz as grains elongate at a high angle to the vein walls. Lenses of highly clouded clays occur as in the equivalent vein in the first chip, and there are narrow veins of chlorite ± smectite.

The quartz syenite is more granular than the other chips with more equant orthoclase grains to 4 mm in maximum dimension and only very minor weakly sericitised plagioclase. However, altered ferromagnesian grains (chlorite + leucoxene + carbonate after biotite, clays + carbonate + opaque oxides representing former possible hornblende or pyroxene) comprising perhaps 10-15% of the chip. These aggregates commonly enclose primary opaque oxides and apatite. There is less than 5% late magmatic quartz and rare narrow veins of quartz and/or clays.

BUL 92, 62 m **Typically quartz-chlorite-flooded and veined granitoids apparently varying from granite to granodiorite.**

Field Note: Granite/BIF

These chips are essentially all altered granitoids with fresh quartz and fresh to chlorite-veined alkali felspar, as well as quartz to sericite to chlorite-altered probable plagioclase ± ferromagnesian minerals. One chip has only quartz and largely fresh alkali felspar, but the others have minor to abundant altered plagioclase ± ferromagnesian grains. There are also some irregular areas flooded by felted-prismatic quartz as well as narrow veins of similar material. Leucoxene to limonite altered grains occur as accessories, with some of the limonite possibly after sulphides. The original lithologies seem to vary from granite to granodiorite in the different chips, with a grainsize varying from 0.4 to 4 mm.

BUL 94, 63 m

Possible microgranite porphyry with alkali felspar > plagioclase > quartz as phenocrysts in an alkali felspar-rich quartzofelspathic groundmass. Clays + leucoxene apparently after biotite ± hornblende, and leucoxene after sphene.

Field Note: Rhyolite/granite?

Very abundant phenocrysts of alkali felspar, now perthitic microcline, occur in this sample and are up to 6 mm long. There are relatively uncommon totally sericitised plagioclase phenocrysts to 4 mm long, as well as minor quartz as phenocrysts to 2 mm in diameter, typically rounded to bipyramidal in habit. The groundmass is sparse, as in a classical porphyry (e.g. a copper porphyry), and is quartzofelspathic with abundant alkali felspar. There are some patches of lamellar clays + leucoxene which seem to represent small flakes of biotite (possibly microphenocrysts), as well as more irregular clay-leucoxene patches, possibly after hornblende, and leucoxene patches apparently after sphene. The original lithology would seem to have been a microgranite porphyry.

BUL 95, 65 m

Fractured to fragmented and sericite-veined possible pegmatite or very coarse granitoid with alkali felspar (microcline) > plagioclase, quartz, also oxidised to leucoxenised opaque oxides.

Field Note: Granite.

These chips tend to be fractured to fragmented with some diffuse areas of microbreccia and anastomosing sericite-rich veins. They are also largely coarse to very coarse-grained and heterogeneous suggesting something of the character of a pegmatite. There a large grains of perthitic microcline to 12 mm long and less abundant plagioclase laths to 7 mm long as well as quite variable amounts of granular quartz. Accessory oxidised to leucoxenised opaque oxides occur to 1 mm in grainsize and some of the sericite veins carry patches of probable hematite as fine recrystallised aggregates. The microbreccia zones are up to 4 mm wide and have small angular fragments of quartz and felspar as in the adjacent host rock.

It is difficult to give a reliable visually estimated mineralogy as the grainsize is large relative to the size of the chips and the chips are fractured to fragmented and heterogeneous. However it seems that alkali felspar is the dominant mineral with less abundant quartz and plagioclase.

BUL 96, 54 m **Albite-sericite-epidote-chlorite-clay-altered monzodiorite with very minor quartz, also oxides and apatite.**

Field Note: Granite.

These are strongly porphyritic chips with abundant, commonly oriented, plagioclase phenocrysts to 5 mm long, with albite-sericite-epidote (saussuritic) alteration. Also abundant are chlorite-clay-leucoxene-(quartz)-altered ferromagnesian phenocrysts, apparently including biotite and hornblende, to 4 mm long. Some of the smaller phenocrysts have residual cleavage lamellae at 120°, indicating former hornblende, but most of the larger phenocrysts were possibly biotite. There are some possible glomeroporphyritic aggregates of ferromagnesian minerals with yellow clays possibly after hornblende and chlorite possibly after biotite.

The groundmass is essentially felspathic with small laths of sericitised plagioclase enclosed in granular to poikilitic microcline, rarely to 1 mm grainsize. There is only very minor late magmatic quartz (2-3%) but opaque oxides apatite and clay-altered ferromagnesian grains are present.

The visually estimated mineralogy is as follows:

Plagioclase	55%
Microcline	20%
Hornblende + Biotite	20%
Quartz	3%
Oxides	2%
Apatite	<1%

This suggests a former monzodiorite.

BUL 100, 59 m **Altered syenite with minor actinolite + quartz after pyroxene, partly chloritised biotite, magnetite and stubby apatite prisms.**

Field Note: Granite/Rhyolite?

Inequigranular clouded orthoclase grains to 7 mm long are by far the most abundant component in this sample. There are patches of decussate actinolite in the orthoclase and also (with minor quartz) replacing clearly defined clinopyroxene grains to 3 mm long (~4-5%). Minor (2-3%) primary biotite occurs, partly altered to chlorite, a poikilitic late magmatic flakes to 2 mm in length. The altered pyroxene has abundant inclusions of magnetite and there are disseminated stubby apatite prisms to 1 mm long. Some magnetite also occurs disseminated, rather than in the altered pyroxene. There is only rare quartz, mostly within actinolite aggregates after pyroxene, and this rock is an altered syenite.

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MINERALOGICAL REPORT NO. 7166
by Ian R. Pontifex MSc.

August 7th, 1996

TO : The Director
Mines and Energy of S.A.
191 Greenhill Rd
EASTWOOD SA 5063

Attention : Mark Davies

YOUR REFERENCE : EX2402, Debit Code 52/5045/42911

MATERIAL : Drill Core Samples (29)

IDENTIFICATION : R189239 to R189267
HK-DD-4: 30.41m to 67.47m (8)
GW-DD-1: 6.66m to 111.55m (21)

WORK REQUESTED : Polished thin section preparation, petrographic/mineragraphic description and report.

SAMPLES & SECTIONS : Returned to you with this report.

PONTIFEX & ASSOCIATES PTY. LTD.

SUMMARY COMMENTS

Eight core samples from HK-DD-4 (30.41m to 67.47m) and 21 core samples from GW-DD-1 are described in this report from polished thin section. Selected photomicrographs are included to illustrate various aspects of the petrography and mineragraphy mainly of the various iron oxides. A summary follows below :

HK-DD-4 (R189239 to R189246)

The six samples R189239 to 244 are basically chlorite-rich clastic sediments, with all except R189240 composed of mixtures of coarse sand and rounded/subrounded pebbles i.e. basically sandy conglomerates. Petrographically, the clasts are seen to consist variably of altered claystone, siltstone, sandstone, also of chert, and of altered felsic volcanic in 189242 and possibly in 243. The whole rock matrix in these facies consists of fine to coarse sand, as finer detritus equivalent to the pebbles, and indefinite pelitic material. The variety and rounding of the clasts suggests considerable transport of at least some of the rock-forming components, however there may be an element of intraformational (reworking) sedimentation.

Sample R189240 is not a (coarse) clastic, but partly a fine laminated chlorite-carbonate altered pelitic sediment, with laminae of fine magnetite. This is akin to some clasts in the conglomerates, and given the small size of this core samples, may represent a single large pebble or boulder in an overall conglomeratic sequence). A central band in this sample is more massive and objectively could be interpreted as a metabasalt?

Alteration is ubiquitous throughout these six samples from HK-DD4, mostly manifest as chloritisation commonly with associated carbonate, quartz micromosaic, scattered magnetite and local fine amphibole. This assemblage appears to have more or less pervasively replaced (or derived in-situ from), "susceptible" expelitic components, variably interstitial within sandstone clasts, also interstitial to the whole rock matrix, and indeed, previously forming the whole of some clasts. Chlorite is commonly intricately intergrown ± carbonate, with decussate, microfibrous, sheaf-like fabric. Ultrafine material of this composition replaces basically the whole of R189240, but magnetite is in fact laminated in this sample to indicate an affinity to BIF. The same components, notably carbonate, occurs in veins and random interstitial fillings throughout this suite of six samples, and the evidence indicates that this alteration has been superimposed on the original clastic facies and is broadly regarded to be of metasomatic genesis.

The remaining two deepest samples in the HK-DD-4 hole R189245 and 246, respectively at 49.30 m and 67.40 m are quartz-hematite BIF, quite strongly brecciated/disrupted, with veining between breccia blocks variably of quartz, hematite, also chlorite-'clay" alteration in R189245 (akin to the alteration in the conglomerates above).

GW-DD-1 (R189247 to R189267)

With the exception of R189260 which is a lamprophyre of approximate minette type, all of these samples are BIF, of essential iron oxide, chert and amphibole, with minor apatite and pyrite in several samples.

Original magnetite (and amphibole) is oxidised in the upper part of the hole to hematite (martite) ± limonite/goethite; down through a transition zone with hematite and magnetite, and into an unoxidised 'primary' zone in which magnetite and commonly abundant amphibole are fresh. These approximate intervals, within the scope of the sample distribution are :

	Interval m
hematite (martite) ± limonite goethite and chert	6.66 to 21.20
magnetite partly oxidised to hematite ± amphibole also partly oxidised	21.20 to 36.38
fresh magnetite, fresh amphibole (rare hematite)	36.38 to 111.55

The individual descriptions record the estimated mineral abundances, also comment on macro and microscopic structures/textures, and grain size of the iron oxides. The estimated modal abundances (volume %) are tabulated below to provide a guide to the likely tenorof the ore down-hole.

GW-DD-1

Depth	R number 189	Magnetite	Hematite (martite)	'Limonite'	Chert	Amphibole	Apatite	CO_3
6.66	247	-	30	20	50-55	-	-	-
13.47	248	-	30	20	50	-	-	-
17.84	249	tr	30	25-30	40-45	-	-	-
18.35	250	-	35-40	15-20	40-50	-	-	-
21.12	251	tr	35	10-12	55	-	-	-
25.58	252	35	10-15	35	-	20	-	-
29.27	253	20	50*	-	20	7-10	-	-
34.15	254	20-25	5	5	55	10	1-2	--
36.32	255	35	5-7	-	40	20	-	-
45.57	256	45-50	1-2	-	25	15-20	-	1-2 -
49.35	257	35-40	2	-	50	10	-	1-2 -
52.83	258	30-35	-	-	30-35	35	-	-
54.59	259	30-35	2-3	-	30-35	30	-	5
66.50	260		lamprophyre of minette to vogesite type					
74.52	261	20-25	-	-	35-40	30-35	3	-
76.32	262	35-40	-	-	45-50	10-15	-	-
88.20	263	20-25	-	-	50-60	20	3	3
97.20	264	30	-	-	50	20	-	-
101.43	265	25-30	-	-	40-50	25-30	-	-
109.03	266	35	-	-	35	30	-	-
111.50	267	35	-	-	35	35	-	-

* includes extremely fine microplaty hematite
\- accessory iron sulphide
\-- 12% secondary pyrite after pyrrhotite

Amphibole is largely incorporated within cherty quartz layers, but is also interstitial to magnetite and occurs in (remobilised) veins. The composition of this (fresh) amphibole is variable, including relatively extremely fine fibrous decussate to weakly schistose apparent cummingtonite, based on it being relatively colourless (although clouded due to the compactness and weak brownish oxidation), also rarely micro-twinned. Actinolite is indicated in the descriptions for slightly coarser, fine prismatic-lamella-form crystals, which are pale green in colour. This colour grades however in some samples to a bluish (green) colour to suggest an alkaline (Na) content, not apparently riebeckite, but possibly arfvedsonite. The exact identity of these amphiboles would require follow-up analyses, possibly by XRD and/or microprobe.

Minor clinopyroxene occurs in R189258 in a 10mm band, as coarse relict cores within massive decussate much finer amphibole which appears to (retrogressively) pervasively replace the pyroxene. The relationships between the amphibole and pyroxene suggest an upper metamorphic grade of mid to upper amphibolite facies, followed by somewhat lower grade retrogression.

Apatite occurs as very small (<0.05mm) crystals, variably disseminated, locally clustered and forming a continuous microlayer 0.3mm thick in R189263. Carbonate occurs mostly in veins (± quartz ± amphibole). The accessory pyrite is mostly secondary microporous after pyrrhotite (up to 12% in R189254), but some 'primary' euhedral pyrite occurs in R189257 and 258.

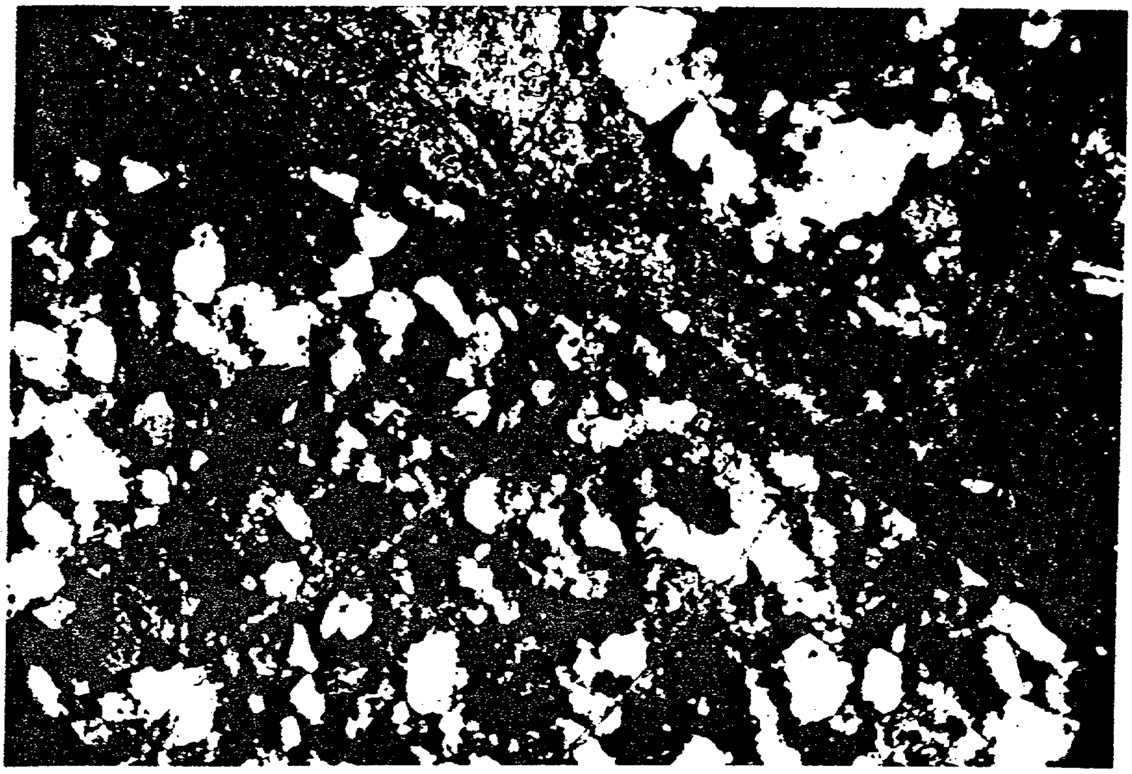


Fig 1 **R189239** 0.32 mm

TS. Ordinary light (OL). Lower ²/3 of photo is sandstone clast with chloritised matrix, scattered black-opaque magnetite. Cross cutting 'lens' is carbonate vein.

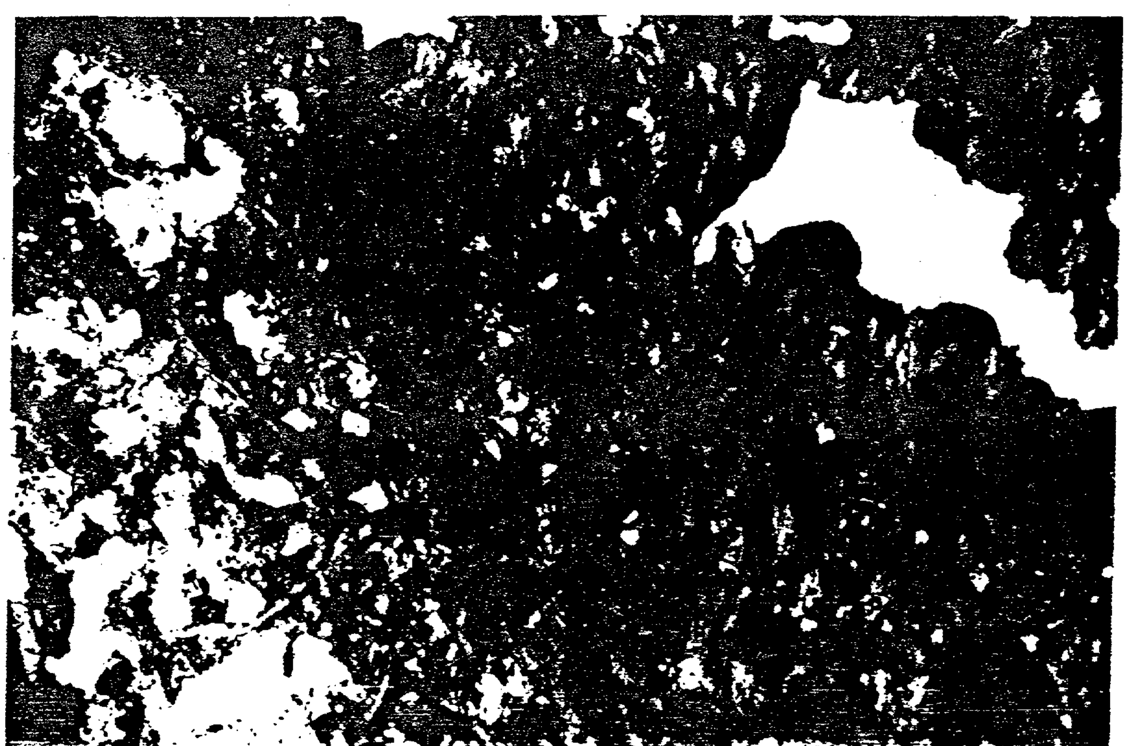


Fig 2 R189239 0.32 mm

TS. OL. Clast left side gradational to chlorite rim, then to more intensely chloritised matrix.

R189248
W-DD-1
13.47 to 13.54 m

BIF, laminated sequence with layers alternately rich in cherty quartz incorporating limonitic clays after (schistose) amphibole, and rich in fine oxidised martite.

*	hematite, martite (microporous)	30%
*	cherty quartz	50%
*	limonite/limonitic clays (including probable oxidised amphibole)	20%

This BIF consists of a microbanded, to rarely mesobanded sequence of layers more or less alternately dominated by limonitic cherty quartz and hematite.

Most layers of cherty quartz incorporate minor to subordinate limonite or limonitic clays which is partly 'interstitial', but thin lenses and discontinuous layers of this material have a microdecussate to schistose relict texture, including microporosity, to suggest completely oxidised ex-amphibole. Locally, there are crosscutting veinlets of this same material, along oblique microfractures, with displacement of the layering rarely up to 3mm. Iron oxide 'dust' is also dispersed through quartzose layers.

Grains of martite forming the hematite-rich layers have an average size of about 0.15mm. Most of these grains are weakly microporous ± limonite, indicating moderate oxidation (and leaching).

R189249
GW-DD-1
17.84 m to 17.90 m

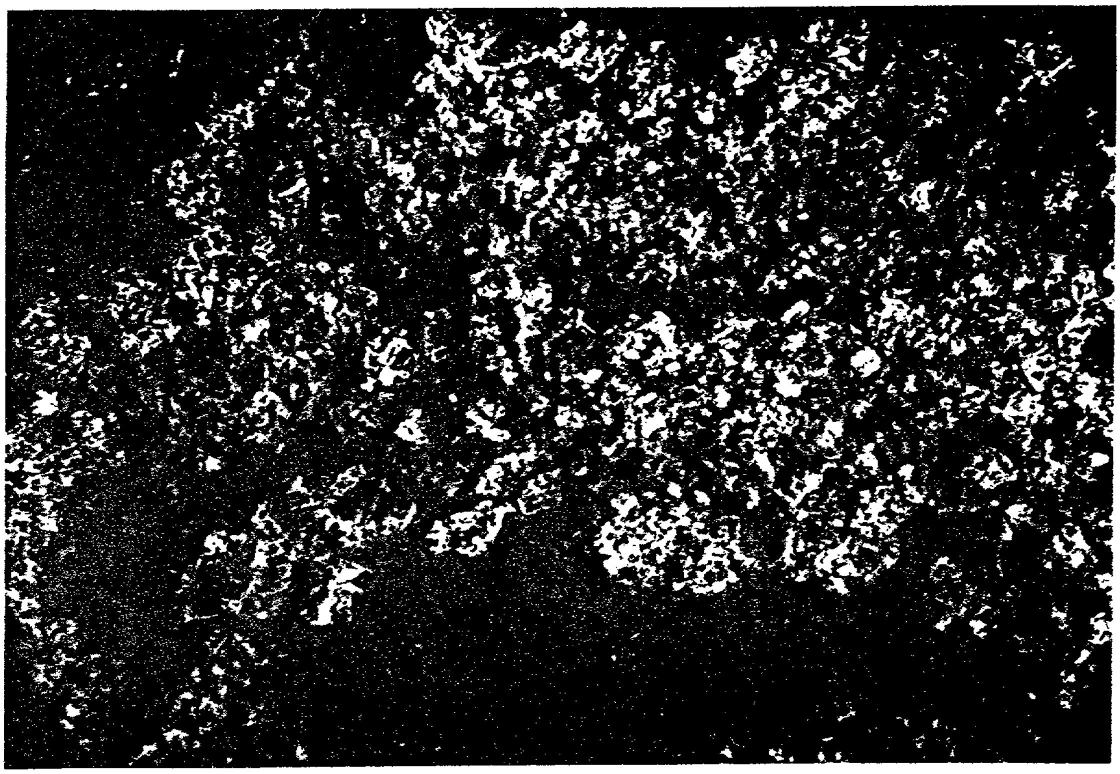
BIF, regularly laminated with microlayers dominated by oxidised/microporous martite; and more abundant intercalated microlayers of limonite-rich cherty quartz. Trace residual magnetite.

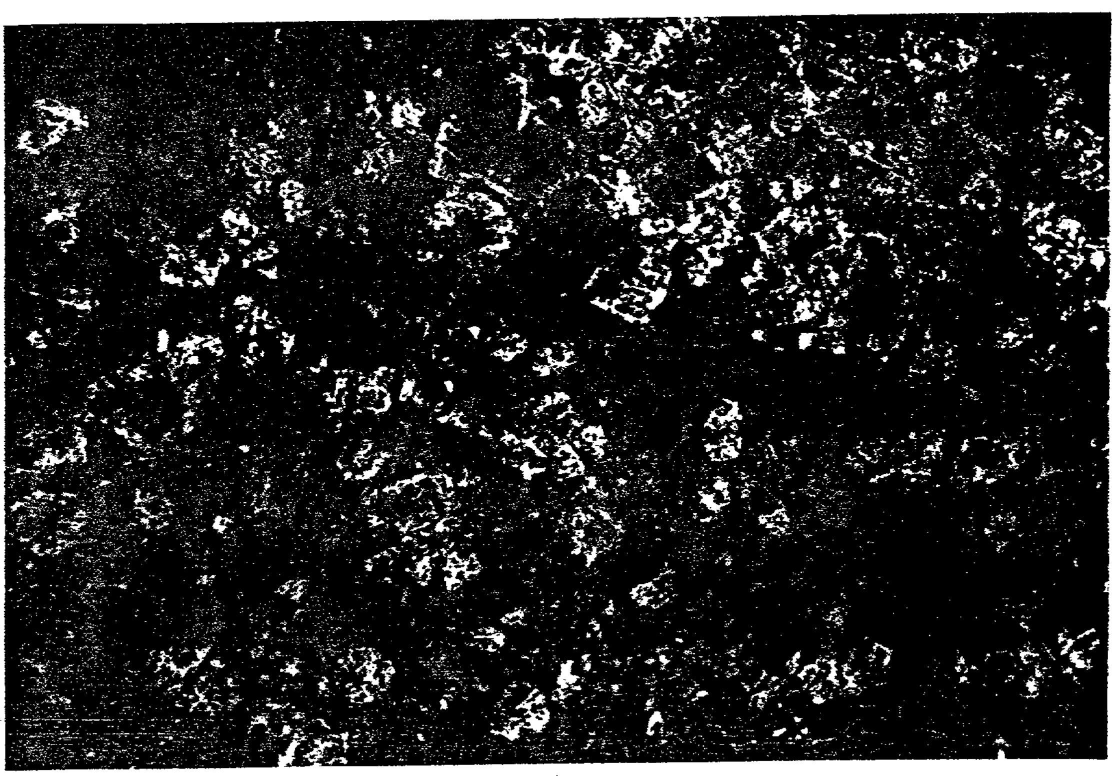
*	magnetite	trace
*	hematite, martite (leached microporous)	30%
*	cherty quartz	40-45%
*	limonite/limonitic clays	25-30%

This BIF is somewhat more regularly laminated/microbanded than the otherwise same facies represented by R189247, 248 described above. Limonite is also more widespread than in these samples.

Basically, about 1/3 of the sequence consists of microlayers dominated by small crystals of martite (mostly <0.3mm), variably scattered and aggregated within (limonitic) cherty quartz. These martite crystals are distinctly microporous due to supergene oxidation. In spite of this oxidation, trace extremely fine magnetite occurs in rare oxidised martite crystals.

The more numerous intercalated microlayers of cherty quartz are crowded with extremely fin limonite or limonitic-clays which are mostly dispersed-interstitial, but some have relict textures to suggest derivation from former equally microfine micas or possible amphibole.





Figs 15 & 16 **R189249** 0.05 mm

PS. Patchy aggregates and layered martite (bright grey). oxidised. leached. microporous. even as boxwork in [illegible] thin [illegible] limonitic clays

R189250
GW-DD-1
18.35 to 18.40m

BIF, of weakly oxidised martite layers ± interstitial/interlayered goethite; intercalated cherty microlayers (not limonitic as in above samples).

*	hematite, martite microporous/oxidised	35-40%
*	cherty quartz	40-50%
*	goethite ± lesser limonite	15-20%

Martite is slightly more abundant in this BIF sequence than in R189247 to 249 above, including several mesolayers to 10mm of fairly compact aggregates of the martite grains with intercalated goethite, also as the 'normal' intercalated microlayers (with less concentrated martite) in the remainder of the sequence. Most of the martite is weakly microporous due to oxidation. Also fine goethite occurs along the layering and is irregularly interstitial, and this tends to be microcrystalline, even rarely microbotryoidal, rather than the relatively microscopically diffuse limonite in the samples above.

Interlaminated cherty quartz contains dispersed ultrafine iron oxide, and rare limonite spicules possibly after amphibole, but has less of the relatively diffuse limonitic material through most chert layers in the samples immediately above. Several stringers/veinlets of limonitic/goethite are subparallel and cut the sequence at a high angle.

In spite of the apparently less extensive supergene oxidation, there is no evidence of relict magnetite (even though this does occur in R189249).

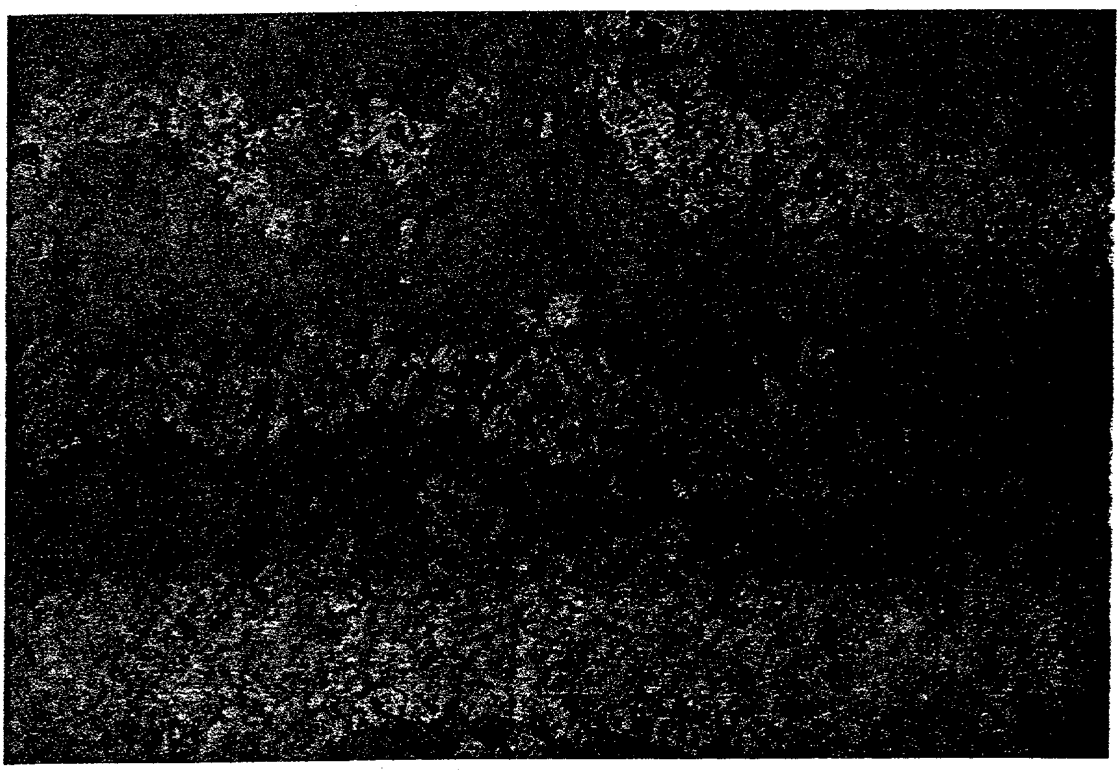


Fig 17 **R189250** 0.05 mm

PS> An iron oxide-rich mesolayer in this sample, showing microlayers of martite (very pale grey), with intercalated layers of microporous goethite.

R189251
GW-DD-1
21.12 to 21.20 m

BIF, fairly irregularly intercalated microlayers of partly oxidised martite, and chert which incorporates limonitic replicas after fine amphibole. Trace magnetite.

*	magnetite	trace
*	hematite, martite, weakly/moderately microporous	35%
*	cherty quartz	55%
*	limonite ± clays probably after amphibole	10-12%

This sample is dominated by a fairly irregularly microlayered sequence of cherty/hematitic laminations very similar to R189249 at 17.84m. Martite forming the opaque oxide layers is fine grained (individual crystals about 0.15mm) and aggregated to form fairly continuous layers. These crystals are weakly to moderately microporous. Trace similarly small grains of magnetite occur locally.

The intercalated cherty layers contains variably up to 10% scattered equally fine martite, also relatively localised small clusters of limonite/limonitic clays, with a relict morphology indicating pseudomorphic replacement of pre-existing amphiboles. The cherty layers do not contain widespread diffuse limonite however, such as in the higher samples in this drillhole.

Very minor displacement has taken place along one or two oblique planar microfractures.

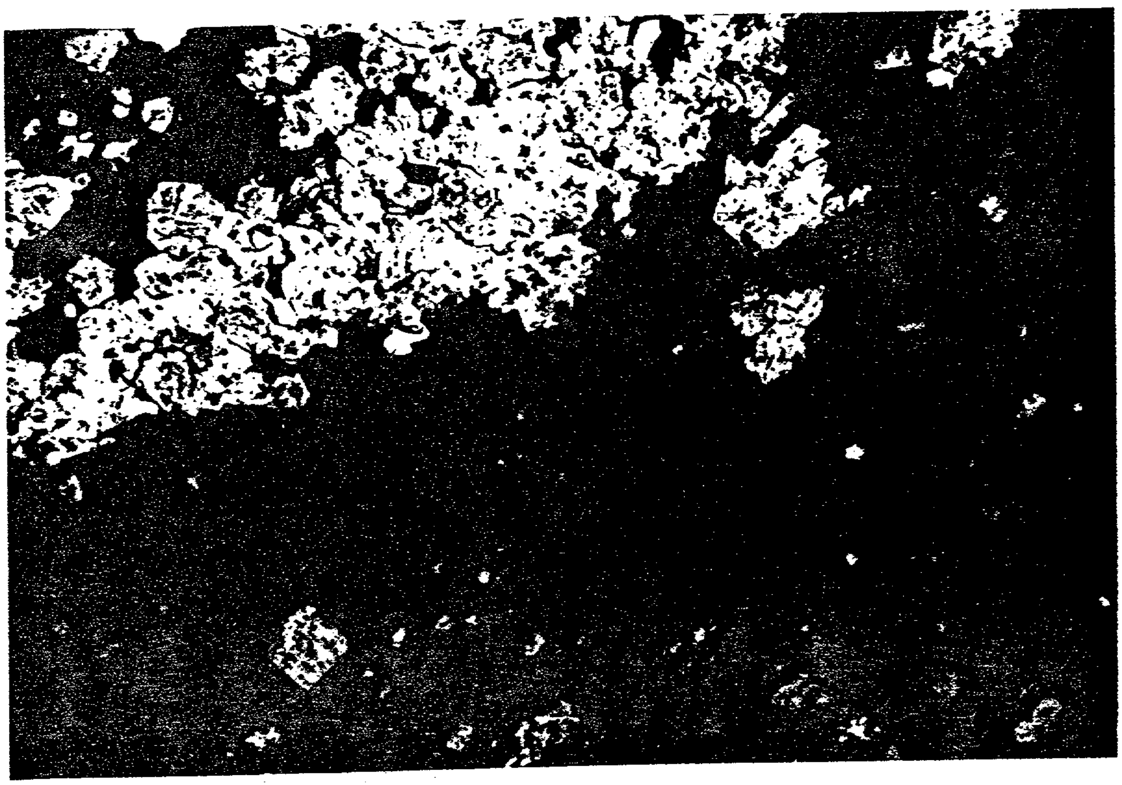


Fig 18 **R189251** 0.05 mm

PS. Part of a layer of martite aggregate, white with minor internal microporosity: in contact with a cherty layer which has reddish-limonitised small clusters of original amphibole.

R189252
GW-DD-1
25.58 to 25.63 m

BIF, microcrenulated meso/microlayered sequence of fine magnetite (partly martitised) cherty quartz incorporating minor to locally abundant (fresh) decussate amphibole, some layers almost entirely of amphibole. Minor crosscutting stringers of carbonate and green clays.

*	magnetite	35%
*	hematite, martite	10-15%
*	cherty quartz	35%
*	amphibole, fresh decussate	20%

This BIF has a fairly regular laminated/microlayered structure, but some relatively concentrated to include several mesolayers within the sequence to 8mm. Many of the micro/mesolayers are microcrenulated, (a structure not seen in the relatively planar laminated sequence seen above).

The (crenulated) laminations of opaque oxide are dominated by aggregates of microgranular magnetite (individual crystals <0.15mm), mostly rimmed by hematite (martite), and in some layers the martite constitutes 50% to 80% of given combined oxide grains.

Intercalated silicate laminations are mostly cherty quartz but these incorporate variably about 10% to 60% of decussate, quite compact fine amphibole, indeed with about $^1/_5$ of the layers composed almost entirely of amphibole. Minor stringers of carbonate and/or of apple green chloritic clays locally cut across the layering, mostly the amphibole-rich layers.

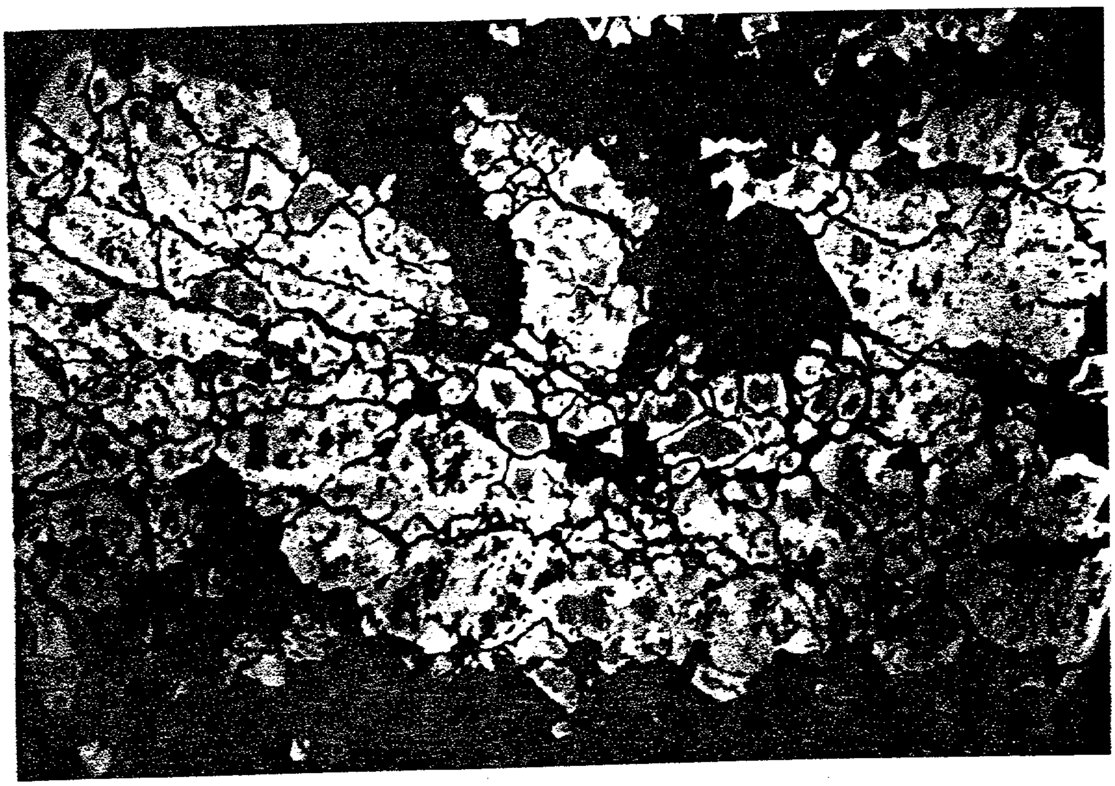


Fig 19 **R189252** 0.05 mm

PS. Part of a layer of martite white, as aggregated crystals incorporating relict cores of magnetite, pale pinkish-brown. Fresh amphibole in quartz is the black pitting along the top of the photo.

R189253
GW-DD-1
29.27 to 29.32 m

BIF dominated by fairly compact sequence of microlayers of extremely fine microplaty hematite > magnetite in chert. Subordinate intercalated layers of coarser granular martitised magnetite, and of minor amphibole.

*	magnetite	20%
*	hematite, martite	15%
*	hematite, extremely fine microplaty	30-35%
*	cherty quartz	20%
*	amphibole	7-10%

This BIF appears macroscopically to consist of a somewhat more compact laminated sequence or iron oxide than in most samples above (and than in most below), largely due to very abundant extremely fine microplaty crowded within layers of cherty quartz. Indeed, as indicated above, layers of microplaty hematite >> magnetite all within chert dominate the rock, with individual crystals of the fine hematite generally <0.05 mm in size.

Subordinate grains of martitised magnetite are somewhat coarser, generally 0.05mm to 0.1mm, as scattered individuals, trains and aggregates forming layers mostly less than 0.8mm thick. The magnetite-rich layers are intercalated at irregular intervals within the hematitic cherty sequence.

Fine decussate-fibrous amphibole occurs irregularly within quartz layers, generally those relatively poorer in hematite. This amphibole ± indefinite clays, also several quartz stringers ± magnetite occur in some oblique and subparallel crosscutting microfractures.

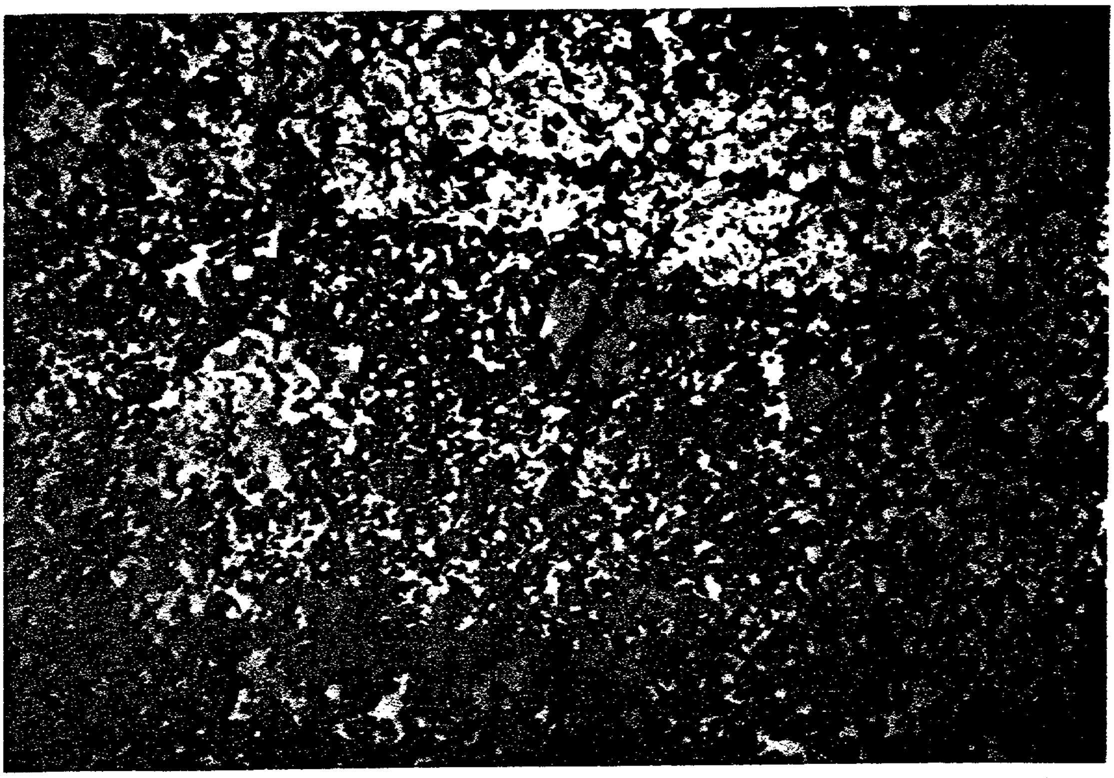


Fig 20 **R189253** 0.05 mm

PS. Example of mixed iron oxide species in this sample. Layer across the top 1/3 of the photo is of loosely aggregated martite with relict small cores of magnetite.. Across the bottom 2/3, single crystals of pale brownish magnetite, also martitised magnetite, scattered in band also rich in extremely fine microplaty hematite. Background matrix in all layers is chert.

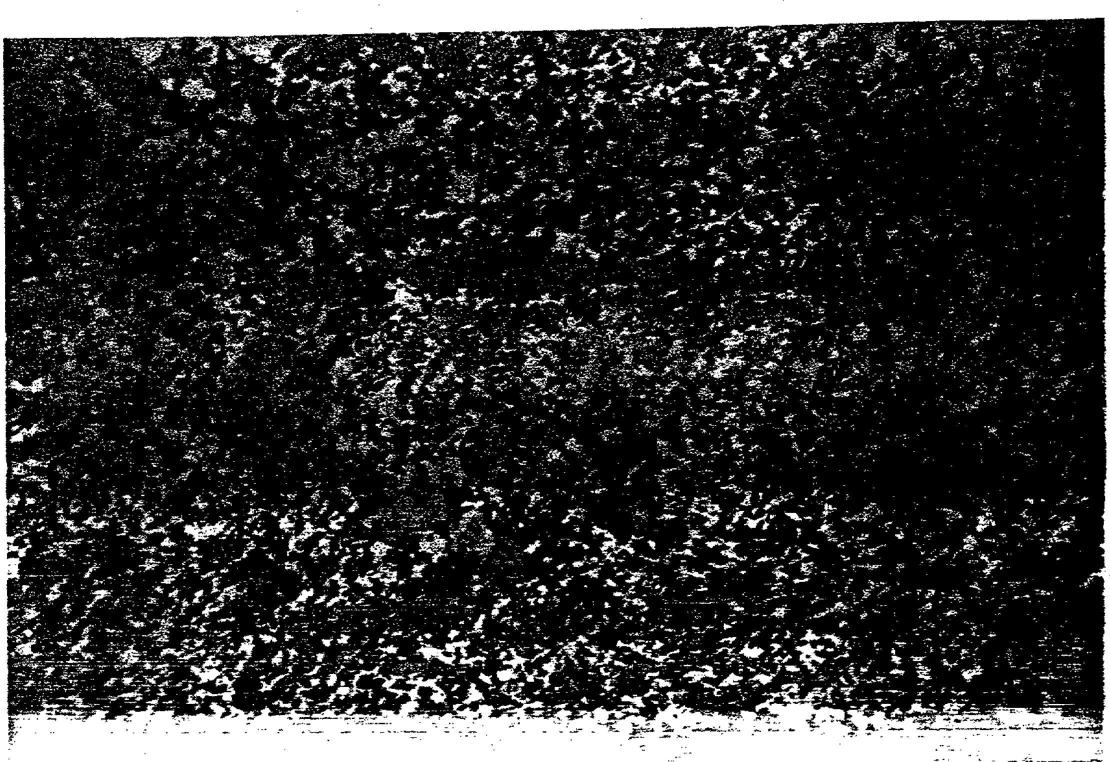


Fig 21 R189253 [illegible]

[illegible]

R189254
GWDD-1
34.15 to 34.22 m

Magnetite-poor, chert-rich BIF (unusually rich in fine secondary pyrite after pyrrhotite); also with amphibole and accessory apatite. Extensively disrupted.

Gross mineralogy with estimated abundances :

*	cherty quartz	55%
*	amphibole, ?cummingtonite	10%
*	apatite	2-3%
*	magnetite	2-3%
*	hematite	5%
*	pyrite, secondary after pyrrhotite ± 'limonite'	12%
*	pyrite, primary	1-2%

The unique characteristics about this sample is the extensive disruption, manifest mainly as magnetite grains, as small patchy aggregates, and in abundant small (1 to 3mm) broken segments of microbanded BIF, all with a chaotic distribution through cherty quartz. Some of the magnetite shows alteration to accessory martite.

In addition, there are numerous small grains and shred-like patches of secondary (microporous) pyrite after pyrrhotite ± limonite, and numerous small shred-like patches and disrupted foliae of fine fibrous amphibole, some intergrown with magnetite locally layered, but overall randomly scattered through chert. The amphibole is basically colourless, rarely greenish, but commonly clouded, suggesting cummingtonite with partial oxidation to produce secondary iron clouding. The chert occurs partly as fragments, largely as texturally heterogeneous, recrystallised micromosaic. Minute crystals (<0.1mm) of apatite are scattered and locally clustered within chert.

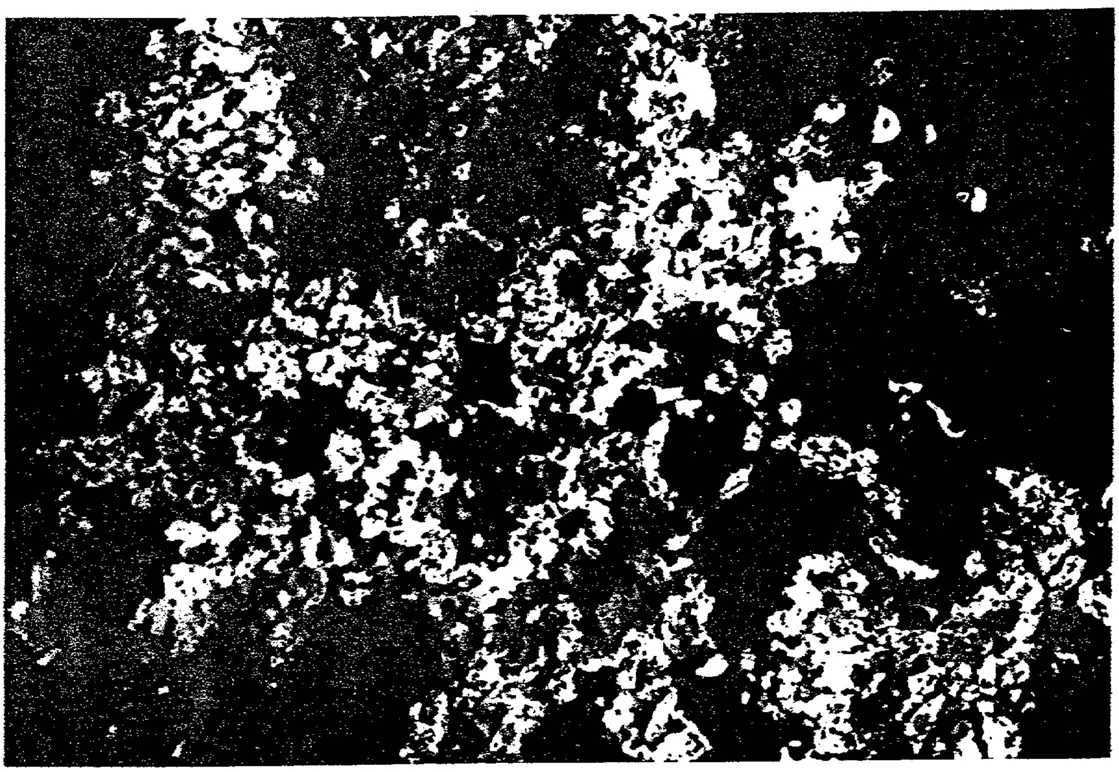


Fig 22 **R189254** 0.05 mm

PS. Example of secondary microporous pyrite (bright cream colour) intergrown with magnetite + midgrey minor associated goethite, darker grey and microporous.

R189255
GW-001
36.32 to 36.38 m

BIF of mesolayered cherty quartz incorporating amphibole and magnetite ± accessory fine hematite.

*	magnetite	35%
*	hematite, martite	5-7%
*	cherty quartz	40%
*	amphibole, probably cummingtonite	20%

Abundant microlayers <1mm, occur in 'sets' of slightly greater and lesser concentration to form mesolayers 5mm to 8mm thick in this BIF. This layering is locally disrupted by oblique microfractures, which are permeated by quartz generally crowded with very fine fibrous amphibole also with minor scattered grains of magnetite.

The layering is manifest as grains of magnetite, individually about 0.15mm which are variably scattered, occur in trains and/or banded aggregates within cherty quartz, or where these are more concentrated, they are intercalated with bands of cherty quartz. The 'regular' layers of quartz incorporate minor to subordinate fine fibrous amphibole, but as noted above, this amphibole is also locally concentrated in (remobilised) quartz, permeating disruptions across the layering. Minor, much finer grains of magnetite (0.01 to 0.04 mm) are also disseminated through the quartzose layers. About 10% of the magnetite grains are partly surrounded by extremely thin rims of hematite.

The amphibole is basically colourless, occasionally twinned and some clouded apparently to incipient oxidation of inherent iron. These characteristics indicate probable cummingtonite but this would need to be checked by XRD or probe analysis.

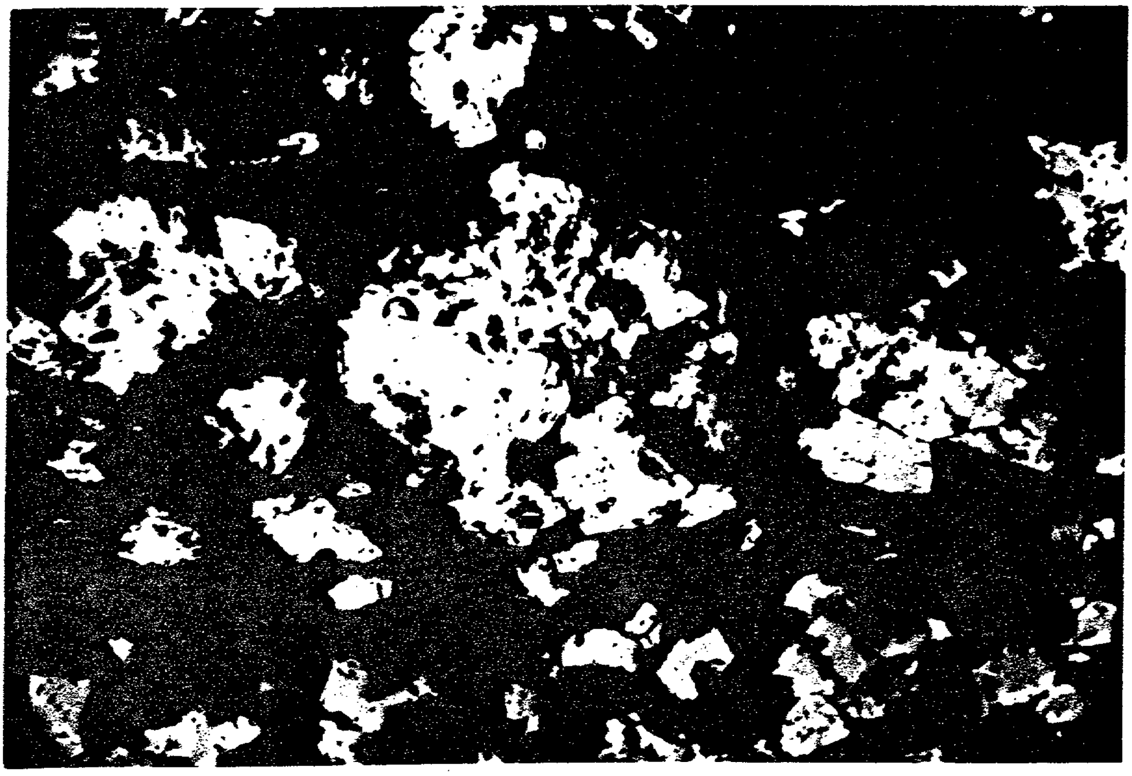


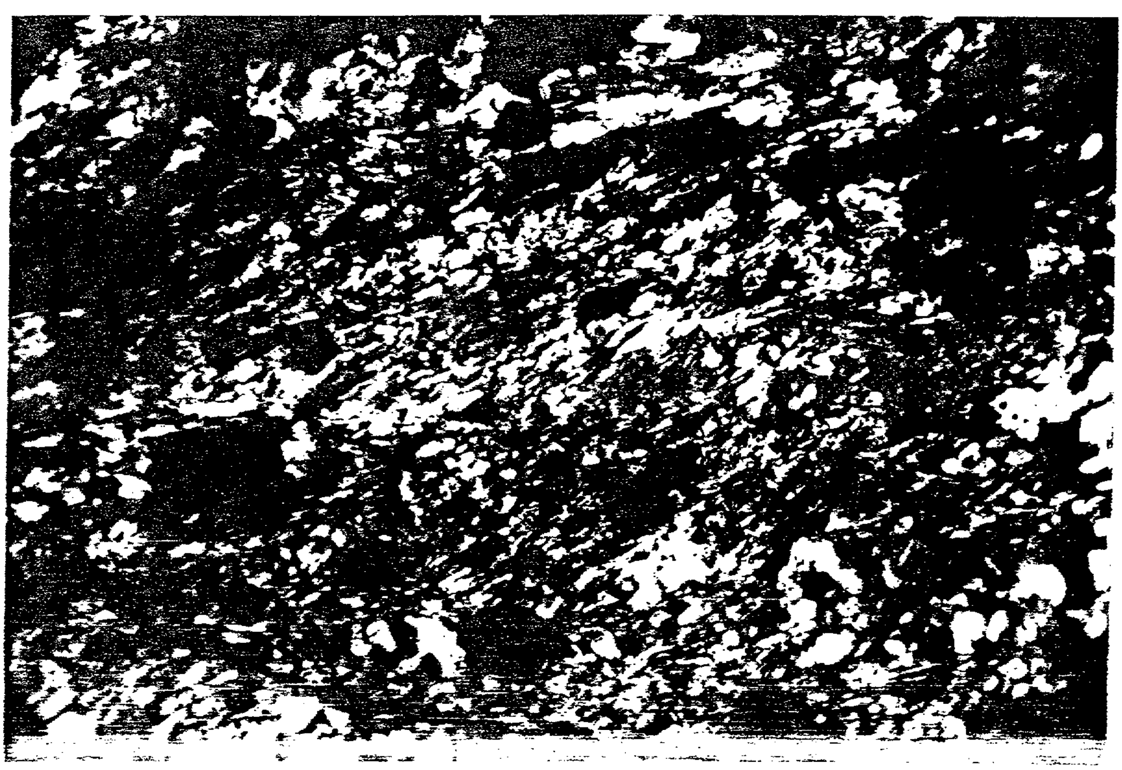
Fig 23 **R189255** 0.05 mm

PS. Grains of pale brown magnetite, with partial rims of white hematite; scattered through a silicate layer rich in amphibole and fine cherty quartz.

Fig 24 R18?255

Fig 25 **R189255** 0.09 mm

TS. OL. Same field of view, higher magnification as Fig. 24, to show detail of amphibole, probably cummingtonite, together with scattered magnetite: all in cherty quartz.



[illegible]

R189256
GW-DD-1
45-57 to 45.62 m

BIF, laminated sequence of fine and coarse magnetite > cherty quartz incorporating subordinate fine fibrous amphibole. Rare hematite, trace pyrite.

*	magnetite	45-50%
*	hematite	1-2%
*	cherty quartz	25%
*	amphibole	15-20%
*	pyrite	<1%
*	carbonate	1-2%

This BIF consists of a fairly regularly laminated sequence of more or less alternating microlayers of iron oxide and cherty quartz, locally with a set of relatively close-spaced laminae (weakly microcrenulated) forming poorly defined mesolayers to about 8mm thick.

Most magnetite grains which dominate layers throughout this rock are 0.05 to 0.12 mm in size, but minor, finer magnetite (0.01mm) is disseminated through the intercalated laminae dominated by chert. Trace extremely fine hematite accompanies rare magnetite grains.

Fine fibrous amphibole also occurs through the cherty quartz layers, variably decussate to weakly schistose in some layers. Numerous discontinuous threads of quartz ± fine fibrous amphibole cut the rock (but with only very minor displacement), and there is one continuous crosscutting veinlet, 0.5 mm wide of carbonate-amphibole.

Three grains of secondary, microporous pyrite to 0.8mm are present, probably after pyrrhotite.

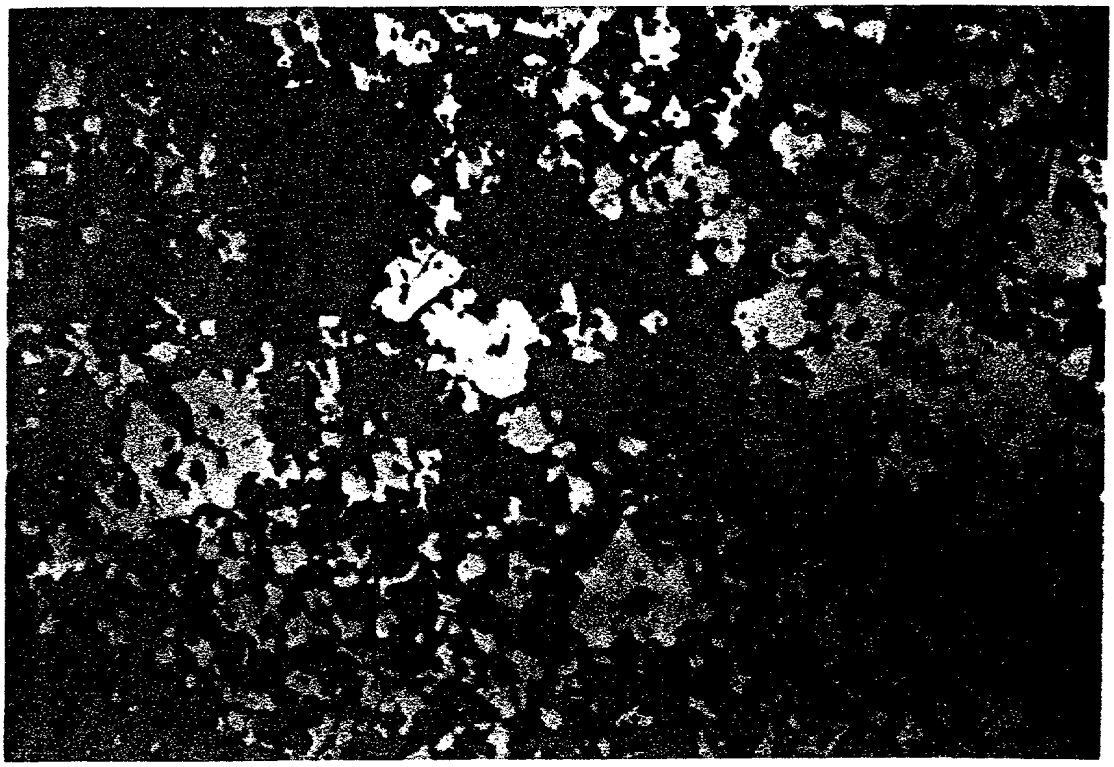


Fig 27 **R189256** 0.05 mm

PS. Finer and coarser magnetite scattered to form layers within cherty quartz, also incorporating fine amphibole.

R189257
GW-DD-1
49.35 to 49.45 m

BIF of intercalated magnetite-rich layers and chert-rich layers incorporating minor amphibole. Local disruption, microcrenulation with associated primary and secondary pyrite. Vein of quartz-carbonate with a broken internal lamination of fine hematite + limonite.

*	magnetite	35-40%
*	hematite, microplaty restricted to vein	2%
*	cherty quartz	50%
*	amphibole	10%
*	pyrite	2-3%
*	carbonate	1-2%

The meso-microlayering in this BIF is locally warped to microcrenulated, also obliquely cu by several planar microfaults. and by a complex quartz-carbonate vein to 5mm wide.

About $^1/_3$ of the layers consist of fine granular (0.3mm) magnetite crowded within chert, intercalated with a subequal number of paler layers dominated by chert but incorporating minor fine fibrous amphibole (commonly schistose) and lesser extremely fine (0.02mm) disseminated magnetite. The layering is locally distorted/disrupted as noted above, and amphibole tends to be more abundant in quartz along these structures. Also crystals of 'primary euhedral' pyrite, composite with secondary 'sooty' pyrite after pyrrhotite, tend to be clustered and occur in trains along some margins of these disruptions.

The main vein noted above consists of quite coarse granular mosaic of quartz > carbonate, incorporating a kinked, disrupted thin layer of microplaty hematite rimmed along the inner vein core side by microfibrous limonite.

R189258
GW-DD-1
52.83m - 52.88 m

BIF with subordinate microlayers of fine magnetite (some with iron sulphide) interlayered with a greater number of quartz-amphibole microlayers. Several mesolayers of amphibole > clinopyroxene, accessory authigenic pyrite.

*	magnetite	30-35%
*	hematite	nil
*	cherty quartz	30-35%
*	amphibole > clinopyroxene	35%
*	pyrite (trace chalcopyrite)	2-3%

This BIF consists of a subordinate number of dark layers/laminae of magnetite from <1mm to 3mm thick, intercalated at irregular intervals with a large number of pale layers of cherty quartz and fine amphibole in variable concentrations in different layers. There is no evidence of hematite in the magnetite layers, but minor (apparently secondary) pyrite after pyrrhotite, with trace associated chalcopyrite occurs in one magnetic layer, and accessory grains of authigenic pyrite are scattered through one of the very amphibole-rich bands, 12mm thick.

Indeed, this band consists of massive, but decussate fine prismatic to fibrous amphibole incorporating several quite coarse (1 to 2mm) crystals of clinopyroxene. The massive fine amphibole also has intergrown fine fibrous/prismatic clinopyroxene and it appears that the mass of extremely fine amphibole is replacing the coarser clinopyroxene residuals.

The co-existence of clinopyroxene and amphibole, (which is apparently dominantly colourless cummingtonite) indicates a metamorphic grade of middle (?to upper) amphibolite facies.

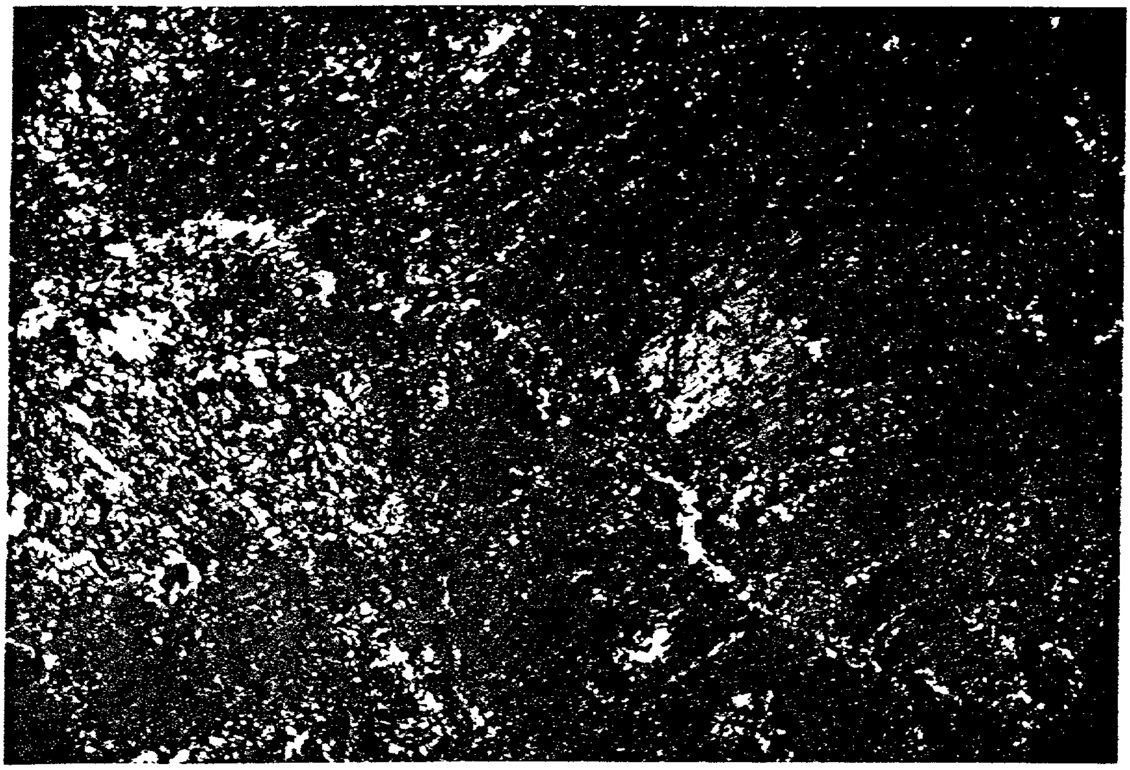


Fig 29 R189258 0.32 mm

TS. Low magnification of Fe-Ca-silicate layer, with residuals of clinopyroxene (blue) within massive decussate much finer-fibrous amphibole, (probably cummingtonite).

Fig 30 R189258 [illegible]

[illegible]

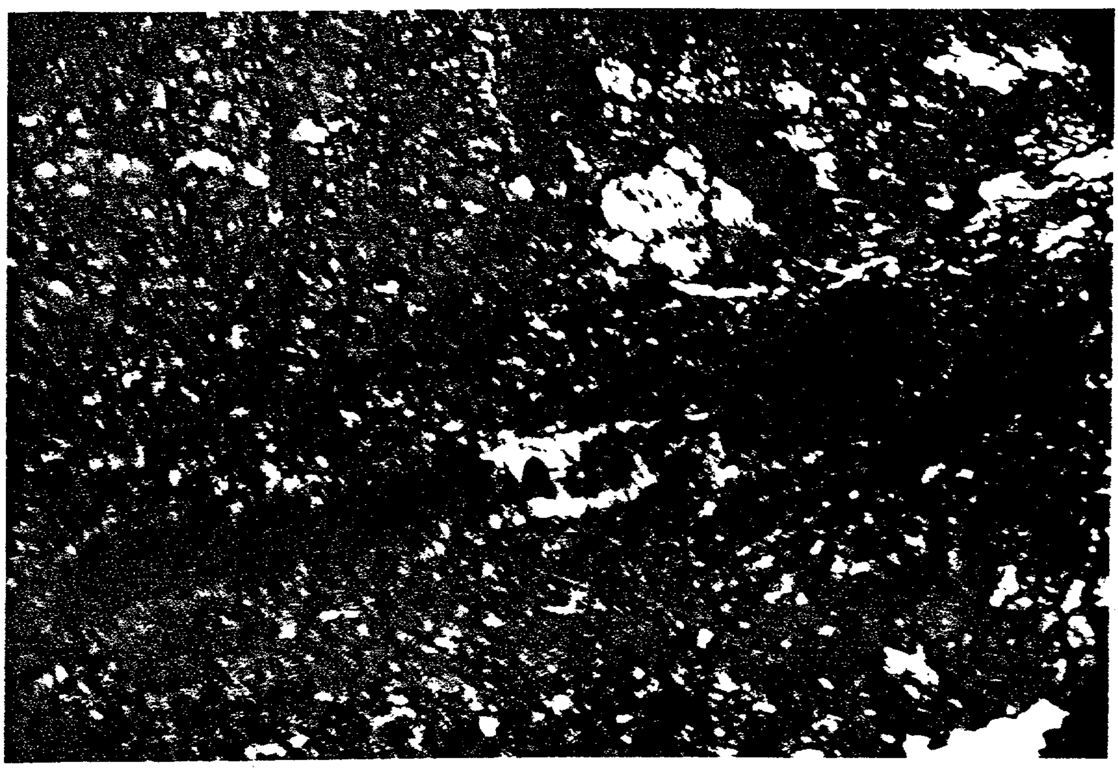


Fig 31 **R189258** 0.09 mm

TS. Xnic. Basically as for Fig 30, but with late stage crosscutting vein of carbonate carrying magnetite.

R189259
GW-DD-1
54-59 to 54.66 m

BIF, mesolayers and microlayers (some locally folded) of fine granular magnetite, and of chert incorporating fine fibrous amphibole. Vein of (quartz) carbonate.

*	magnetite	30-35%
*	hematite, decussate microplaty (in vein)	2-3%
*	cherty quartz	30-35%
*	amphibole, cummingtonite >> actinolite	30%
*	carbonate, vein	5%

This is a relatively amphibole-rich BIF (but without bands of almost entirely amphibole as in 189258). Microlayers of fine granular magnetite, individual grains size 0.15mm, are closely spaced in sets to form mesolayers to 10mm thick. Some of the mesolayers are locally microfolded.

Laminations between the magnetite microlayers, and bands between the magnetite mesolayers consist of chert crowded with a subequal amount of weakly schistose to decussate fine fibrous mostly colourless amphibole, probably cummingtonite. Minor intergrown fine amphibole however, is interpreted as actinolite.

A vein to 2mm wide truncates one of the microfolds. This consists mainly of carbonate, with narrow rims of quartz and carries accessory decussate microplaty hematite.

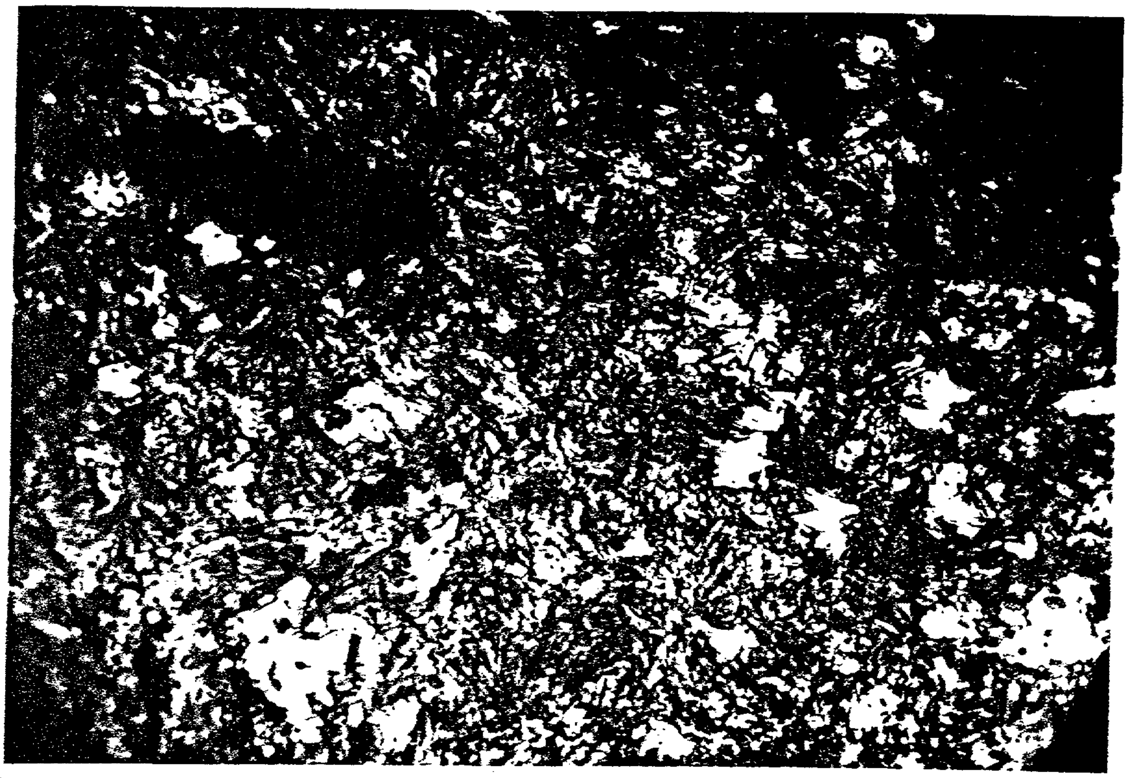


Fig 32 **R189259** 0.09 mm

TS. OL. Decussate fine fibrous amphibole, probably cummingtonite crowded within cherty quartz. Minor scattered grains of magnetite.

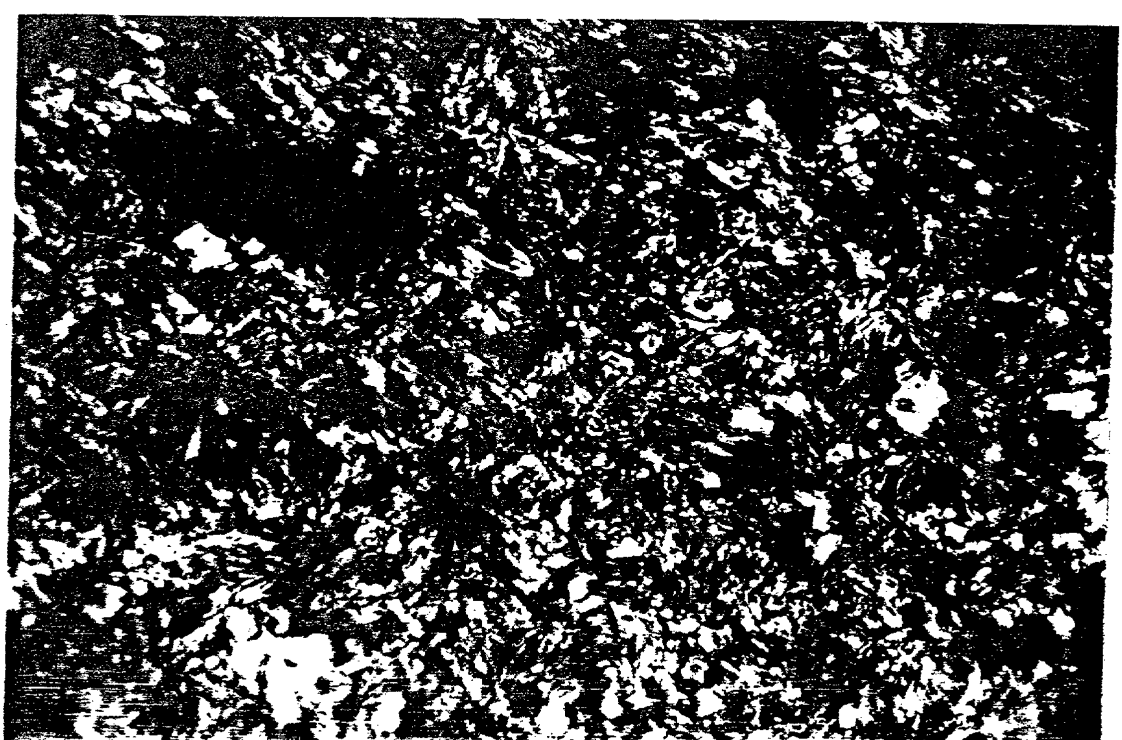


Fig 33 [illegible] 0.09 mm

[illegible]

R189260
GW-DD-1
66.50 to 66.58 m

Lamprophyre, phenocrysts of altered pyroxene > biotite, also 'vesicles' occupied by decussate amphibole; in groundmass of biotite + kspar (minette to vogesite). [High level to intrusive].

Field Note : Dolerite

The petrography confirms that this is the only non-BIF sample in this GW-DD-1 suite. Numerous phenocrysts of uralitised pyroxene crystals, 1mm to 2.5mm are scattered with similar orientation to form 25 to 30% of the rock. Other phenocrysts of similar size consist of single flakes/plates of fresh biotite (5-7%) and of apparent minor felspar crystals also extensively altered to clouded clay-sericite and secondary biotite.

Other 'coarse' components, 1mm to 3mm, are seen as irregular lenses (15-20% of the rock) similarly elongated/oriented, as apparent vesicles now occupied by small aggregates of amphibole.

These components occur in a matrix/groundmass of diffuse extremely fine k-spar (stained yellow on the offcut treated with sodium cobaltinitrite), crowded with abundant similarly oriented flakes of biotite and much finer uralite/actinolite.

The texture and composition of this rock indicates a probable lamprophyre of minette to vogesite type, with the vesicles (?or ocelli) suggesting a high level or even possible extrusive genesis.

R189261
GW-DD-1
74.52 to 74.60 m

Micro/mesolayered and locally folded, BIF with cherty-quartz incorporating abundant amphibole of variable composition, intercalated the magnetite laminations. Abundant accessory apatite.

*	magnetite	20-25%
*	cherty quartz	35-40%
*	amphibole (variable composition)	30-35%
*	apatite	3%

This meso/microlayered sequence is locally microfolded/buckled. It consists of relatively subordinate dark laminations of fine granular magnetite, some closely spaced (<1mm) to form weak mesolayers. These are intercalated with more extensive and more numerous microlayers and mesolayers of cherty silica, which incorporates similarly abundant silicate phases, also minor apatite. The microlayers of magnetite are commonly fractured and very locally dislocated in the nose of the fold structures.

The silicate phases consist mainly of individually small (<0.3mm), ragged random prisms, but more or less interconnected within each chert layer, mostly of clouded greenish amphibole, apparently actinolite or actinolitic-hornblende, but the morphology of these grains suggests that these may be retrograde after ex-pyroxene. In several layers of chert, random small amphibole prisms are clearer and pale bluish in colour to suggest an alkaline species. Also very small (0.05mm to rarely 0.12mm) crystals of apatite are locally very abundant in some of the chert-amphibole layers.

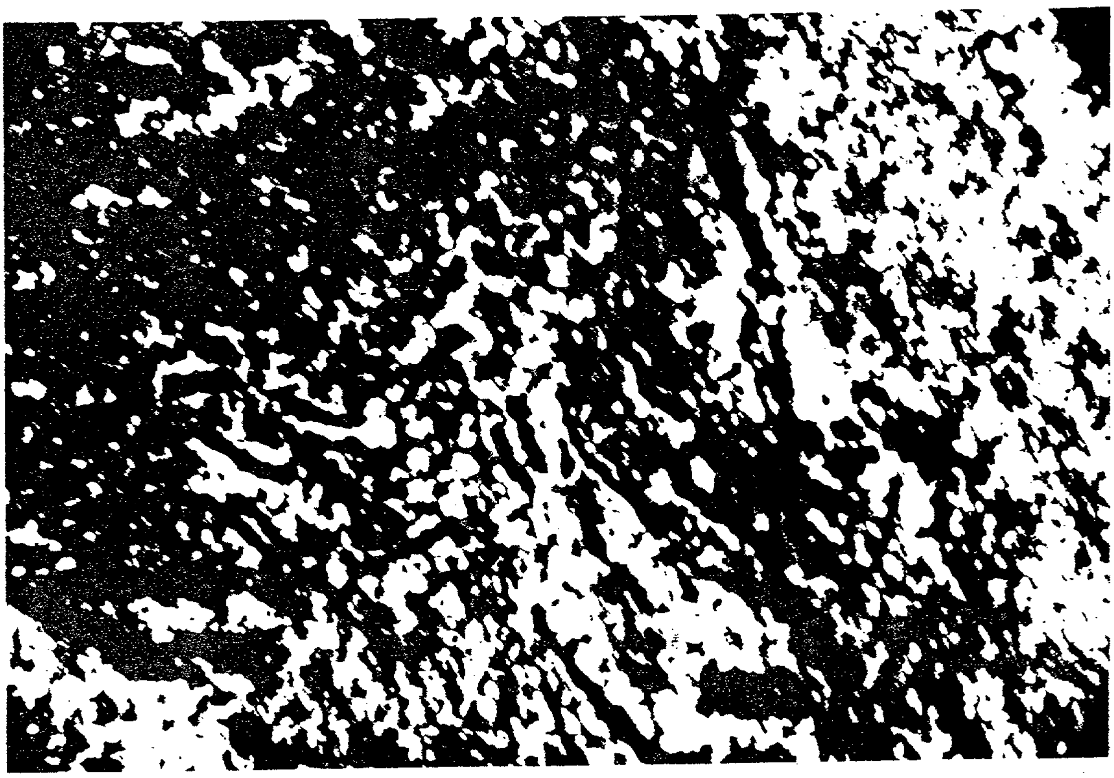


Fig 36 **R189261** 0.32 mm

TS. Xnic. Crenulated, disrupted microlayers of magnetite in chert, with scattered fine (coloured) amphiboles.

R189262
GW-DD-1
76.32 to 76.40 m

Meso/micro-layered BIF of fine magnetite, cherty quartz and (probable alkaline) fine amphibole.

*	magnetite	35-40%
*	cherty quartz	45-50%
*	amphibole (variable composition)	10-15%

This BIF consists of a fairly homogeneous, regular micro/mesolayered sequence of fine granular magnetite and chert incorporating fine amphibole. Some of the layering appears to be more or less graded, and/or repeated through the sequence in a rhythmic sense.

The most intense and thicker dark iron-oxide layers consist of aggregated magnetite grains, average individual size about 0.08mm. As the magnetite becomes sparser within the intervening chert-rich layers, it also becomes finer (0.01mm to 0.05mm).

Fine fibrous to prismatic amphibole is mostly weakly oriented (schistose), but some at random, and these crystals are fairly commonly bluish to bluish green, quite commonly with distinctly anomalous interference colours, and variable (optical) extinction angle. This amphibole appears therefore to have an alkaline component, but not apparently riebeckite, and more probably of arfvedsonite composition. Some amphibole however is basically pale green, and must surely be actinolite. An irregular crosscutting stringer of quartz cuts across the layering, and this carries extremely fine decussate amphibole.

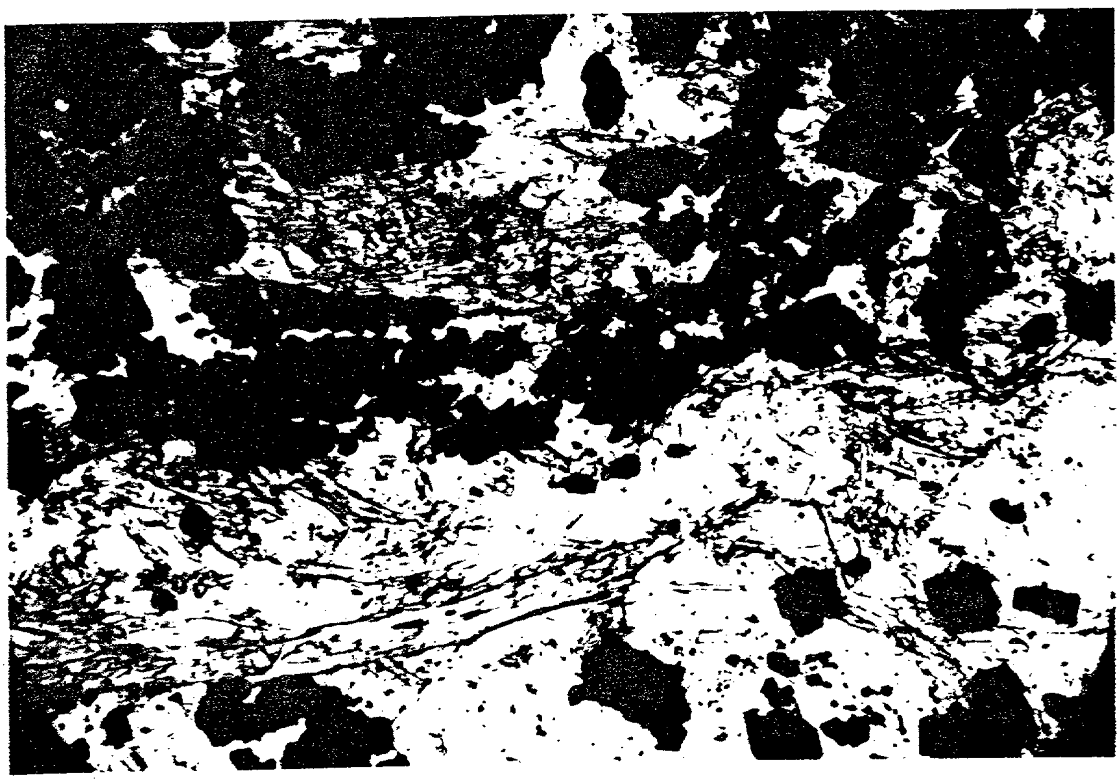


Fig 37 **R189262** 0.09 mm

TS. OL. Clear cherty layer, with layered (black) magnetite, amphibole in chert is pale green and appears therefore to be actinolite.

R189263
GW-DD-1
88.20 to 88.28 m

BIF of mostly microbanded magnetite and chert crowded with fine amphibole. One microlayer of apatite, and an oblique carbonate vein.

*	magnetite	20-25%
*	cherty quartz	50-60%
*	amphibole, variable composition	20%
*	apatite, mostly in one microband	3%
*	carbonate (in a vein)	3%

Most of the sequence forming this BIF consists of regularly laminated microlayers of fine granular magnetite, individual grains size about 0.1mm, with intercalated, more abundant interlayers of chert quite crowded with fine amphibole, also incorporating minor, very fine (0.02 to 0.05mm) magnetite. The layering is commonly gently microcrenulated, locally lenticular, oblique at a low angle and 'curved'.

At least two species of amphibole are present. Most abundant are small (0.02 mm x 0.1mm) fairly distinct prisms, generally similarly oriented (weakly schistose), pale green and apparently actinolite. Less abundant is colourless to pale biscuit-coloured and relatively fine fibrous amphibole (seen for example to be fairly widespread in R189258) and is tentatively identified as cummingtonite. Several stringers consist largely of this same fine fibrous amphibole.

Apatite is fine granular (individually to 0.03mm) and in this sample, is mostly confined to a single microlayer, to 0.3mm thick, forming at least 50% of this layer together with chert, equally fine magnetite and amphibole.

A white carbonate vein, 1mm wide, cuts obliquely across the layering at one end of the sample.

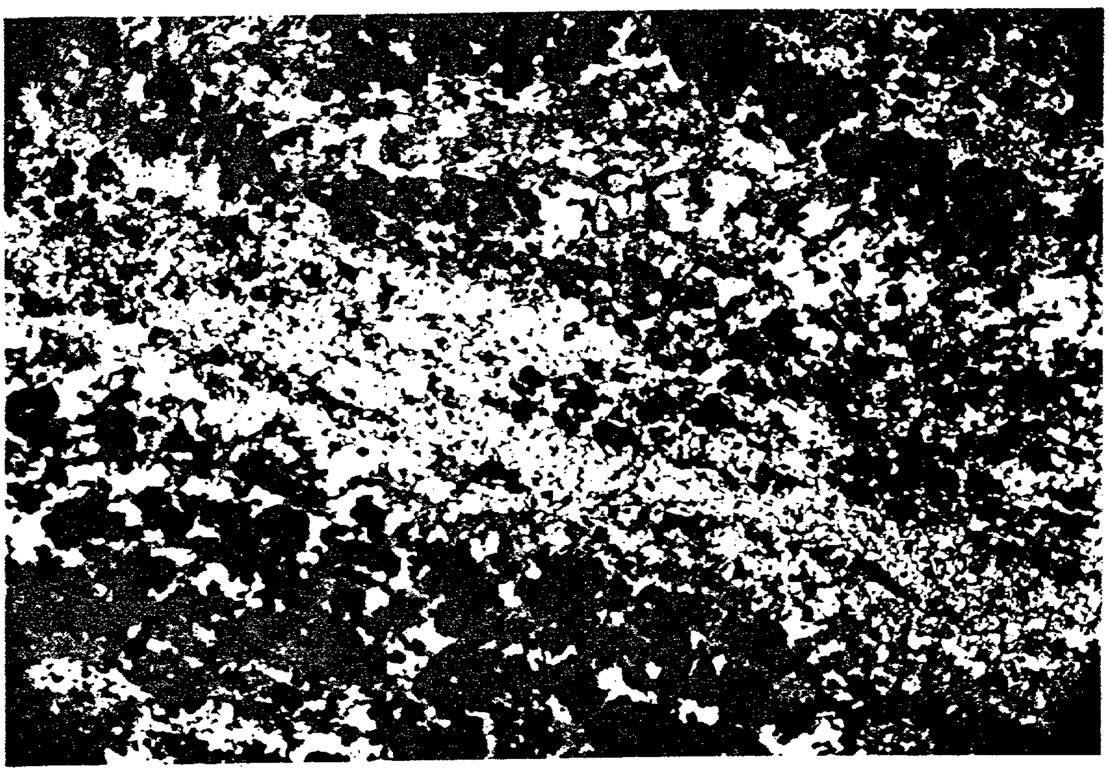


Fig 38 **R189263** 0.32 mm

TS. OL. Central layer is dominated by very fine granular apatite mosaic (petrographically seen to have higher relief than quartz, but not so obvious in this photo). Bands above and below are quartz, magnetite, brownish fine amphibole.

R189264
GW-DD-1
97.20 m to 97.28 m

BIF, microlayered and weakly mesolayered sequence of fine magnetite and of chert crowded with fine amphibole of variable composition.

*	magnetite	30%
*	cherty quartz	50%
*	amphibole, actinolite > cummingtonite	20%

Abundant microlayers of fine magnetite occur throughout this sequence, most more or less as individuals through chert, but several sets which are relatively more closely spaced to form weakly developed mesolayers about 10mm thick. Individual grain size of the magnetite in all layers is <0.1mm although there are several scattered tight clusters visible in hand specimen 1 to 2mm in size. Several microfaults cut obliquely across the layering at about 45° with an overall crudely enechelon arrangement with microscale displacement along these, and infillings of 'pale green', extremely fine prismatic/fibrous actinolite.

Fine fibrous to fine prismatic amphibole is widespread through the chert meso and microlayers broadly oriented along the layering but some at random. As in samples above, notably in R189263, there are two species of amphibole; mostly pale green very fine prismatic probable actinolite, but with colourless to pale biscuit-coloured relatively fibrous probable cummingtonite, in several bands, interstitial to quite tightly packed fine magnetite.

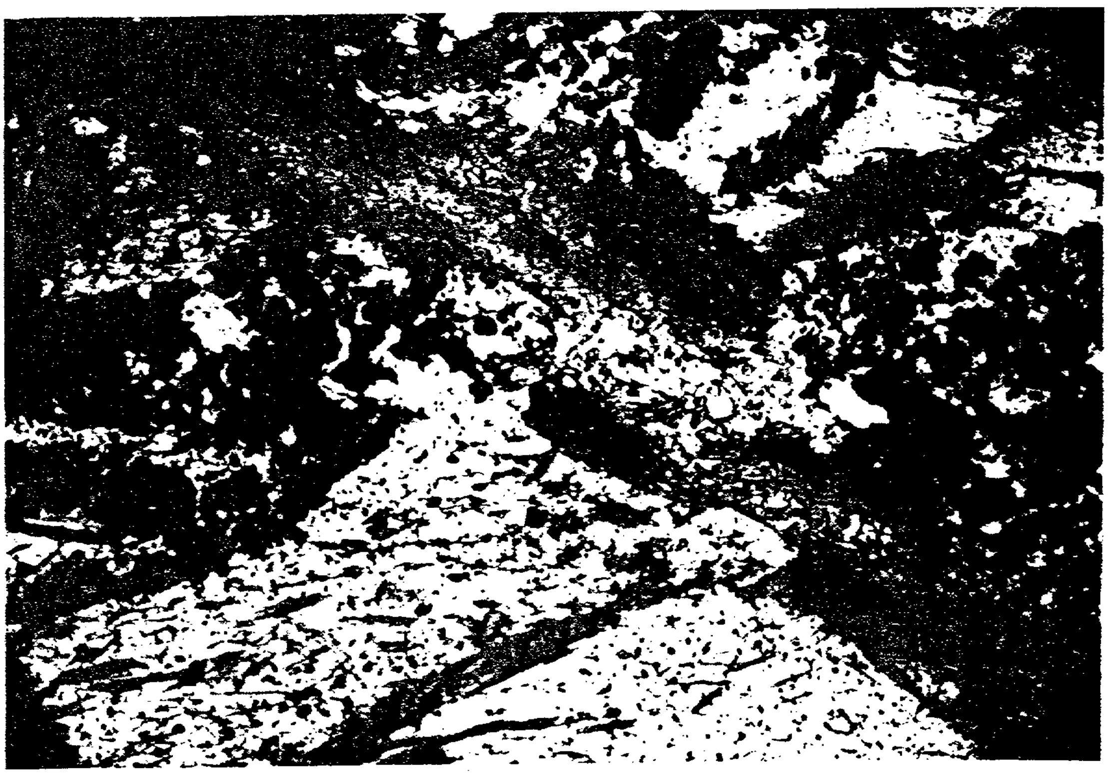


Fig 39 **R189264** 0.32 mm

TS. OL. Two different modes of occurrence of amphibole; (1) fine oriented schistose prisms within chert (2) greenish ?actinolite in a sinusoidal cross-cutting shear-vein.

R189265
GW-DD-1
101.43 to 101.48 m

BIF, microfolded mesolayers of laminated magnetite with chert + actinolite, more or less alternating with mesolayers of chert incorporating fine actinolite > cummingtonite.

*	magnetite	25-30%
*	cherty quartz	40-50%
*	amphibole, actinolite >> cummingtonite	25-30%

Five dark basically mesolayers 5 to 10mm thick of closely spaced laminations of magnetite (within chert and/or fine amphibole) are separated by pale layers about 5mm thick dominated by chert, but incorporating fairly abundant fine amphibole and rare-fine magnetite. The magnetite-rich mesolayers are commonly microflexured/crenulated, with local, microscale disruption of individual magnetite laminations.

Individual grain size of the magnetite in the main oxide layers is about 0.1mm, but the sparser magnetite scattered through chert layers is about 0.05mm.

Amphibole within the chert layers, and interstitial in magnetite-rich layers is predominantly pale green, mostly more or less oriented along the layering (weakly schistose) but some is random/decussate. Minor braided foliae of pale brownish more fibrous apparent cummingtonite occurs along some layering contacts.

Fig 40 **R189265** 0.32mm

TS. OL. Crenulated, disrupted microlayers of magnetite, within clear cherty quartz, and relatively clouded amphibole (higher RI than quartz).

R189266
GW-DD-1
109.03 to 109.09 m

BIF, microlayered magnetite, chert incorporating fine fibrous amphibole (cummingtonite > actinolite). Local boudin thickening one with a core axial vein of coarse quartz-carbonate + hematite.

*	magnetite	35%
*	cherty quartz	35%
*	amphibole, cummingtonite > actinolite	30%
*	coarse vein quartz + carbonate + microporous hematite	5%

This is a fairly evenly microlayered BIF of essential and overall subequal amounts of magnetite, chert and amphibole (mostly within chert). One intercalated thicker band (8mm) of predominantly chert is weakly boudinaged. One lenticular/boudinaged mesolayer rich in magnetite mixed with fine fibrous amphibole has a central core-like vein of stumpy coarse pyramidal quartz crystals, intergranular carbonate, and fine micro-oolitic/microporous hematite (of low temperature genesis).

Individual grain size of the magnetite is mostly <0.1mm, slightly coarser in the boudin with the axial core vein. The main amphibole throughout the chert layers is clouded very fine fibrous pale brown, apparent cummingtonite, mostly weakly schistose in bifurcating foliae along the layering, some microdecussate. Minor extremely fine prismatic pale green 'actinolite' occurs in some clearer bands of chert.

APPENDIX 5

AMDEL COMMINUTION AND BENEFICIATION REPORTS

Report N8047	(Revision 1)	24 April 1996
Report N8117	Magnetite Testwork	24 July 1996
Report G650100G/96	Mineralogy of Magnetic Separation Products of an Iron Ore	3 September 1996
Report G651000G/96	Electron-Probe microanalysis of magnetite and amphibole in iron ores	30 September 1996

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24 April 1996

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PO Box 151
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Attention: Mr B J Morris

REPORT N8047 (Revision 1)

UPGRADING OF MAGNETITE ORES

This report replaces Amdel Report N8047 dated 19 April 1996

YOUR REFERENCE:	Order EX2337
SAMPLE IDENTIFICATION:	SE1 & 3, GW 1 & 3, KKN 41, 1, 3 AND 7
MATERIAL:	Magnetite Ore
LOCATION:	Central South Australia
DATE RECEIVED:	1 March 1996

Project Manager: J R Tuffley JRT.

Ric Phillips
Manager
Mineral Processing Services

The results contained in this report relate only to the sample(s) submitted for testing. Amdel Ltd accepts no responsibility for the representivity of the samples submitted.

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1. INTRODUCTION

Deposits of coal and magnetite occur in relatively close proximity in the central north of South Australia. One plan which is currently being investigated for the commercial exploitation of these deposits involves smelting the iron ore on site using local coal in an Ausmelt furnace. In order to render the iron ore suitable for smelting the grade must be increased to at least 50% Fe and preferably to around 55% Fe from the in-situ grades which range from 30 to 40% Fe.

Amdel was commissioned to carry out magnetic separation tests on RC drill chips from four different locations to determine the suitability of this method of processing for upgrading the ores with high recovery of iron to the magnetic concentrate.

2. SAMPLES RECEIVED

The following samples were received:

Identification	Sample No	Weight, kg
SE1	R170509	15.0
SE3	R170510	12.0
GW1	R170511	14.2
GW3	R170512	14.1
HKN41	R170513	15.7
HKN 1	R170514	18.4
HKN 3	R170515	18.7
HKN 7	R170516	16.3

For testwork, the samples were combined into four composites accordingly to their location or horizon as follows:

Composite	Samples
1	SE1 and SE3
2	GW1 and GW3
3	HKN 41 and HKN 1
4	HKN 3 and HKN 7

Visual inspection showed that composite 4 contained a significant quantity of hematite whereas composites 1 to 3 appeared not to contain any hematite.

3. PROCEDURE AND RESULTS

3.1. Sample Preparation

Each composite was formed by blending together 4kg of each of the two individual samples. Each composite was then stage crushed to pass a 2mm screen. After thorough re-blending, each composite was riffle split into eight 1kg lots.

3.2. Grind Curve Establishment.

A 1kg sample of each composite was ground in a laboratory rod mill for a predetermined number of revolutions. A sample of the product was sized and then further grinding was carried out with the aim of producing samples with 80% passing sizes ranging from 500 to 60 microns. A sample of about 10 grams was taken at each suitable sizing for Davis tube magnetic separation tests.

3.3. Davis Tube Tests

Four samples of each composite were processed in the Davis tube separator to examine recovery and grade as functions of grind size. A current of 1 amp was used in the electromagnet.

The products were dried and weighed. Samples of the feed and the magnetic fractions were analysed for iron. The results are listed in Table 1A and 1B. These showed the following:

3.3.1. Composite 1

A recovery of 90 to 95% was achieved at all grind sizes, while the concentrate grade increased from 50% Fe at P_{80} = 440μm to 70%Fe at P_{80} = 70μm. This illustrated the continuing release of gangue material with finer grinding.

3.3.2. Composite 2

The results were confused by two anomalous assays which were not re-checked because of time constraints. Since very high recoveries were achieved at the other two grind sizes, the calculated grades at 100% recovery have been shown in brackets. A grade of 56% Fe was achieved at P_{80} = 60μm.

3.3.3. Composite 3

Recoveries in the mid nineties were achieved at all grind sizes, but a fine grind (P_{80} = 55µm) was required to obtain a grade of 58% Fe.

3.3.4. Composite 4

Recovery was poor and decreased with finer grinding. This was attributed to the release of hematite which reported in the non-magnetic fraction. This sample required high intensity magnetic separation to recover hematite as well as magnetite.

3.4. Low Intensity Magnetic Separation Tests

An Eriez wet drum magnetic separator was used on 3kg samples of Composite 1, 2 and 3 to confirm the previous results on a larger scale. After consultation with the client, it was decided to grind each feed as follows:

Composite	Revs	P_{80}µm (aim)	P_{80}µm (actual)	Grade, %Fe (aim)
1	300	230	215	60
2	600	85	82	55
3	750	70	69	55

Three 1kg batches of each composite were ground and the product sizings were checked. The results are listed above.

Each 3kg sample was mixed with water to form a 20% solids slurry and fed to the Eriez separator using 1 amp current in the electromagnet. This equates to a field strength of 650 Gauss. The products were allowed to settle overnight and the clear supernatant water was decanted. The products were dried, weighed, and analysed. Complete analyses of each head and all products together with the magnetic separation results are listed in Tables 2 to 4. A summary is given below.

	Magnetics			
Composite	Weight, %	Fe, %	Fe recovery, %	SiO_2, %
1	44.7	64.7	86.9	7.4
2	64.2	52.7	89.9	22.6
3	65.1	50.1	89.7	23.4

4. CONCLUSIONS

The results show that composites 1 to 3 can be upgraded to an iron content of greater than 50% by low intensity magnetic separation. A higher grade of concentrate can be obtained by a greater degree of liberation as the grind size is decreased and this can be achieved without loss of iron recovery. The optimum will be an ecenomic balance between the benefits of obtaining a higher grade and the additional cost of finer grinding.

The results for composite 4 are not attractive as they stand at present. However, the results indicate a need for much finer grinding because of the very high silica contents of the magnetic and middling products.

In all cases, the iron lost in the non-magnetic fraction is probably present in the form of a non-magnetic iron silicate mineral. However, x-ray diffraction or optical mineralogy would be required to confirm this.

5. RECOMMENDATIONS

Although the tests have demonstrated in principle the feasibility of upgrading the ores by magnetic separation, if more definitive results are required for economic assessments to be made the following tests are recommended:

1. Mineralogical examination to determine mineral associations and estimate the probably grind size required for liberation.

2. Further magnetic separation tests on composites 2, 3 and 4 at finer grind sizes.

3. Ball mill work index test so that the cost of additional grinding can be estimated.

TABLES 1 to 5

TABLE 1A: DAVIS TUBE RESULTS

COMP 1(SE1 + SE3)

Mill Revs	100	200	600	1200
P_{80}µm	440	290	135	70
Weights, g				
Mag	5.17	5.07	4.01	4.25
Non-mag	3.80	4.56	5.39	5.51
Total	8.97	9.63	9.40	9.76
Assays, %Fe				
Head	31.7	31.7	31.7	31.7
Mag	49.4	56.5	66.5	70.0
Fe Recovery, %	89.8	93.8	89.5	96.2

COMP 2(GW1 + GW3)

Mill Revs	200	400	500	700
P_{80},µm	385	150	115	60
Weights, g				
Mag	7.56	6.74	6.77	5.92
Non-mag	2.01	2.71	2.93	2.99
Total	9.57	9.45	9.70	8.91
Assays, %Fe				
Head	37.2	37.2	37.2	37.2
Mag	43.8	66.7 (51.7)	69.2 (53.4)	56.6
Fe Recovery, %	93	128 (100)	130 (100)	101

TABLE 1B: DAVIS TUBE RESULTS

COMP 3(HKN41 + HKN1)

Mill Revs	100	200	500	850
$P_{80}\mu m$	565	385	140	55
Weights, g				
Mag	7.16	6.93	6.83	5.33
Non-mag	1.90	2.58	2.55	4.08
Total	9.06	9.51	9.38	9.41
Assays, %Fe				
Head	35.5	35.5	35.5	35.5
Mag	43.2	46.0	50.7	58.3
Fe Recovery, %	96.2	94.4	104	93.0

COMP 4(HKN3 + HKN7)

Mill Revs	200	500	900	1350
$P_{80},\mu m$	465	275	125	65
Weights, g				
Mag	5.41	5.58	3.97	2.81
Non-mag	3.88	4.32	5.22	7.04
Total	9.29	9.90	9.19	9.95
Assays, %Fe				
Head	38.5	38.5	38.5	38.5
Mag	45.2	47.1	51.6	56.0
Fe Recovery, %	68.4	69.0	57.9	41.1

TABLE 2 :LOW INTENSITY MAGNETIC SEPARATION(ERIEZ)

COMPOSITE 1 215μm

Product	Weight %	Analyses,%										
		Fe	P2O5	SiO2	Al2O3	CaO	MnO	MgO	TiO2	K2O	Na2O	LOI
Magnetics	44.7	64.7	0.03	7.4	0.55	0.65	0.09	0.47	0.16	0.11	0.03	1.08
Non Mags	55.3	7.9	0.18	69.3	5.39	4.14	0.28	3.22	0.25	1.51	0.97	0.97
Calc Head	100.0	33.3	0.11	41.6	3.23	2.58	0.20	1.99	0.21	0.88	0.55	1.02
Assay Head		32.2	0.12	41.7	3.23	2.48	0.15	2.03	0.19	0.92	0.62	< 0.01

Product	Distribution,%										
	Fe	P2O5	SiO2	Al2O3	CaO	MnO	MgO	TiO2	K2O	Na2O	LOI
Mags	86.9	11.9	7.9	7.6	11.3	20.6	10.6	34.1	5.6	2.4	47.4
Non Mags	13.1	88.1	92.1	92.4	88.7	79.4	89.4	65.9	94.4	97.6	52.6
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 3 :LOW INTENSITY MAGNETIC SEPARATION(ERIEZ)

COMPOSITE 2 82μm

Product	Weight %	Analyses,%										
		Fe	P2O5	SiO2	Al2O3	CaO	MnO	MgO	TiO2	K2O	Na2O	LOI
Magnetics	64.2	52.7	0.06	22.6	0.14	0.73	0.09	1.33	< 0.01	0.03	0.04	0.14
Non Mags	35.8	10.6	0.29	70.6	0.38	3.73	0.18	4.69	0.01	0.08	0.16	1.90
Calc Head	100.0	37.6	0.14	39.8	0.23	1.80	0.12	2.53	< 0.01	0.05	0.08	0.77
Assay Head		37.2	0.14	40.1	0.23	1.82	0.10	2.64	< 0.01	0.02	0.08	< 0.01

Product	Distribution,%										
	Fe	P2O5	SiO2	Al2O3	CaO	MnO	MgO	TiO2	K2O	Na2O	LOI
Mags	89.9	27.1	36.5	39.8	26.0	47.3	33.7	0.0	40.2	31.0	11.7
Non Mags	10.1	72.9	63.5	60.2	74.0	52.7	66.3	100.0	59.8	69.0	88.3
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Product	Weight %	Analyses,%										
		Fe	P2O5	SiO2	Al2O3	CaO	MnO	MgO	TiO2	K2O	Na2O	LOI
Magnetics	65.1	50.1	0.10	23.4	0.26	2.03	0.18	1.81	0.01	0.03	0.03	0.09
Non Mags	34.9	10.7	0.27	67.0	0.55	6.76	0.72	5.68	0.01	0.04	0.08	2.93
Calc Head	100.0	36.3	0.16	38.6	0.36	3.68	0.37	3.16	0.01	0.03	0.05	1.08
Assay Head		35.3	0.15	37.8	0.41	3.60	0.33	3.19	0.01	0.03	0.06	0.07

Product	Distribution,%										
	Fe	P2O5	SiO2	Al2O3	CaO	MnO	MgO	TiO2	K2O	Na2O	LOI
Mags	89.7	40.9	39.4	46.9	35.9	31.8	37.3	65.1	58.3	41.2	5.4
Non Mags	10.3	59.1	60.6	53.1	64.1	68.2	62.7	34.9	41.7	58.8	94.6
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

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24 July 1996

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EASTWOOD SA 5063

Attention: Mr B. Morris

REPORT N8117

MAGNETITE TESTWORK

YOUR REFERENCE:	Order No. EX 2394
SAMPLE IDENTIFICATION:	See list under 2
MATERIAL:	Magnetite and hematite ores
LOCATION:	South Australia
DATE RECEIVED:	24 June 1996

Project Manager: J R Tuffley JRT

Ric Phillips
Manager
Mineral Processing Services

1. INTRODUCTION

In April 1996, Amdel carried out preliminary magnetic beneficiation studies on several magnetite samples from the central north of South Australia using RC drill chips. The tests indicated that a concentrate with a sufficiently high grade for furnace feed could be produced.

In June 1996, Amdel was commissioned to carry out comminution tests and confirmatory beneficiation tests on drill core from various deposits.

2. SAMPLES RECEIVED

The following samples were received in the form of NQ core. Samples 1 to 3 were whole core, while samples 4 and 5 were half core.

Sample No.	Identification	Prospect	Drill Hole Intervals, m.
1	SEDD1	Sequoia	87.7 to 89.5
			93.0 to 93.45
			94.6 to 96.4
2	GWDD1	Griffen Well	43.5 to 45.3
			54.9 to 56.9
			88.7 to 90.7
3	HKNDD3	Hawks Nest	41.6 to 43.5
			58.2 to 60.1
			93.6 to 95.6
4	-	Peculiar Knob	58.0 to 60.0
			69.6 to 70.6
			79.2 to 80.2
			86.0 to 87.0
5	HKDD1	Hawks Nest	73.2 to 74.2
			89.3 to 90.3
			95.3 to 96.4
			100.8 to 101.8

3. WORK REQUIRED

3.1. Comminution

Samples 1 and 3 were to be tested for:

- ➢ impact crushing work index
- ➢ abrasion index
- ➢ ball mill work index

Only the last two tests were required for samples 4 and 5 because the half core was not thick enough for impact crushing tests.

However, it was later determined the samples 4 and 5 would in practice only be crushed to about minus 6 mm and fed directly to the furnace. Accordingly, the ball mill work index tests for those two samples were cancelled after sample preparation and head sizing had already been done.

3.2. Beneficiation

Each of samples 1, 2 and 3 was to be ground to a nominated size and passed through the Eriez wet drum magnetic separator. The magnetic concentrate was to be ground to a finer size to achieve a higher grade. All products were to be analysed.

No beneficiation was required on samples 4 and 5.

4. PROCEDURE AND RESULTS

4.1 Comminution

4.1.1 Impact Crushing Index

The procedure for the Impact Crushing Work Index test is described in Appendix A. Detailed results for the tests are given in Tables 1 to 3 and a summary is given below. For each sample, 10 specimens were stuck across the diameter and 10 along the length of sections cut to about 50 mm long.

Work Index, kWh/tonne

	SEDD1	GWDD1	HKNDD3
Average	14.3	16.7	19.7
Maximum	20.6	28.8	32.8
Minimum	7.6	9.0	7.3
Standard Deviation	4.1	6.4	4.5

Published Impact Crushing Work Indices (in kWh/ton) for various materials are listed in Appendix A for comparison.

4.1.2 Abrasion Index

The materials were tested according to the Bond procedure described in Appendix A. The following results were obtained.

Sample	Abrasion Index
SEDD1	0.435
GWDD1	0.467
HKNDD3	0.601
Peculiar Knob	0.128
HKDD1	0.302

Abrasion indices for various materials are included in Appendix A together with published information which gives a correlation between Abrasion Index and metal wear in comminution.

4.1.3 Ball Mill Work Index

Work Index was determined using the ball mill grindability procedure described in Appendix A.

Feed and product sizings are given in Table 4 and the grindability reports are presented in Tables 5 to 7.

The results are summarised below.

	SEDD1	GWDD1	HKNDD3
Feed size, F_{80}µm	2050	2280	2320
Product size, P_{80}µm	71	64	60
Work Index, kWh/tonne	15.5	11.5	13.5

Work indices (given in kWh/sort ton) for various materials are listed in Appendix A for comparison.

4.2 Beneficiation

For each of samples 1 to 3, a grind curve of revolutions versus product size was established. Three 1 kg charges for each sample were then ground to achieve the following sizes:

Sample	P_{80}, µm
1	106
2	38
3	38

For each sample, the 3 kg of ground material was passed through the Eriez magnetic separator using 1 amp (630 Gauss) on the electromagnet.

The magnetic fraction from each sample was reground to achieve the following sizes:

Sample	P_{80}, µm
1	63
2	30
3	28

The products were re-passed through the Eriez magnetic separator at the same magnetic intensity. A summary of the results obtained is given below while full analyses are listed in Tables 8 to 13.

MAGNETIC SEPARATION TESTS

1st PASS

R ecov.	SAMPLE	SIZING P_{80}, µm	MAGS WT%	MAGS Fe%	NON-MAGS WT%	NON-MAGS Fe%
89.7%	SEDD1	106	55.0	61.9	45.0	8.6
[illegible]	GWDD1	38	64.6	61.7	35.4	6.0
[illegible]	HKNDD3	38	71.9	55.3	28.1	11.9

2nd PASS

	SAMPLE	SIZING P_{80}, µm	MAGS WT%	MAGS Fe%	NON-MAGS WT%	NON-MAGS Fe%
[illegible]	SEDD1	63	89.2	70.3	10.8	10.3
[illegible]	GWDD1	30	86.9	69.5	13.1	15.6
[illegible]	HKNDD3	28	80.8	64.2	19.2	20.4

The results show that the finer grinding of the first pass magnetic concentrates resulted in a much higher grade of final product. For the Sequoia and Griffen Well samples, the total iron content was increased to about 70% and the only significant impurity was silica at about 4%. The Hawks Nest sample was upgraded to 64% Fe with 10% SiO_2 remaining in the product as the only significant impurity.

TABLES 1 - 13

TABLE 1 : IMPACT CRUSHING WORK INDEX
SAMPLE 1 - SEDD1

Specimen No	Thickness mm	Impact Energy joules	Work Index kWh/tonne
1	50	30.5	9.2
2	50	35.9	10.8
3	50	41.8	12.6
4	50	35.9	10.8
5	50	35.9	10.8
6	50	41.8	12.6
7	50	41.8	12.6
8	50	25.4	7.6
9	50	54.5	16.4
10	50	41.8	12.6
11	49	61.3	18.8
12	51	48.0	14.1
13	50	68.4	20.6
14	51	48.0	14.1
15	49	35.9	11.0
16	51	68.4	20.2
17	51	48.0	14.1
18	50	68.4	20.6
19	50	68.4	20.6
20	50	54.5	16.4
Average			**14.3**
Maximum			**20.6**
Minimum			**7.6**
Standard Deviation			**4.1**
Sp Gr =	**3.56**		

TABLE 2 : IMPACT CRUSHING WORK INDEX
SAMPLE 2 - GWDD1

Specimen No	Thickness mm	Impact Energy joules	Work Index kWh/tonne
1	50	41.8	12.4
2	50	35.9	10.7
3	50	35.9	10.7
4	50	35.9	10.7
5	50	41.8	12.4
6	50	61.3	18.2
7	50	35.9	10.7
8	50	30.5	9.0
9	50	54.5	16.2
10	50	30.5	9.0
11	52	68.4	19.6
12	51	48.0	14.0
13	52	75.7	21.6
14	50	61.3	18.2
15	51	61.3	17.9
16	50	54.5	16.2
17	50	75.7	22.5
18	51	90.9	26.5
19	51	98.8	28.8
20	51	98.8	28.8
Average			**16.7**
Maximum			**28.8**
Minimum			**9.0**
Standard Deviation			**6.4**
Sp Gr =	**3.60**		

TABLE 3 : IMPACT CRUSHING WORK INDEX

SAMPLE 3 - HKNDD3

Specimen No	Thickness mm	Impact Energy joules	Work Index kWh/tonne
1	50	25.4	7.3
2	50	68.4	19.6
3	50	61.3	17.5
4	50	75.7	21.7
5	50	114.7	32.8
6	50	61.3	17.5
7	50	68.4	19.6
8	50	68.4	19.6
9	50	61.3	17.5
10	50	61.3	17.5
11	62	90.9	21.0
12	55	68.4	17.8
13	51	75.7	21.2
14	51	68.4	19.2
15	50	68.4	19.6
16	50	75.7	21.7
17	50	68.4	19.6
18	50	68.4	19.6
19	50	83.2	23.8
20	50	68.4	19.6
Average			**19.7**
Maximum			**32.8**
Minimum			**7.3**
Standard Deviation			**4.5**
Sp Gr =	**3.74**		

TABLE 4 : BALL MILL SIZINGS

Screen Size microns	Cumulative Percent Passing		
	Sample 1 SEDD1	Sample 2 GWDD1	Sample 3 HKNDD3
Feed			
2800	94.7	92.2	91.5
2360	86.2	82.0	81.0
2000	78.9	72.9	71.2
1700	74.1	65.8	63.9
1400	66.6	58.6	56.5
1180	61.9	53.2	50.8
850	54.2	44.6	41.6
600	46.8	35.7	32.3
300	34.1	24.7	21.0
150	22.2	18.8	15.2
125	19.0	17.7	14.2
106	17.5	16.9	13.5
90	15.5	16.0	12.8
Product			
75	83.7	87.7	89.7
63	69.4	78.3	81.6
53	59.6	70.4	74.9
45	52.8	63.1	69.0
38	43.0	51.7	60.9

TABLE 5 : BALL MILL GRINDABILITY
SAMPLE 1 - SEDD1

Grinding Stage	Mill Revs	Gross Product Wt, g	Net Product Wt, g	Grind-ability g/rev	Circ Load %
1	220	454.1	194.4	0.88	270
2	464	555.2	485.0	1.05	203
3	376	530.3	444.5	1.18	217
4	337	503.7	421.7	1.25	233
5	321	453.6	375.7	1.17	270
6	350	517.0	446.9	1.28	225
7	335	482.5	402.6	1.20	248
8	337	479.0	404.4	1.20	251

Volume of Feed in Mill	=	700	ml
Weight of Feed in Mill	=	1679.8	g
Average for last 2 Stages:			
Grindability	=	1.20	g/rev
Circulating Load	=	250	%
Feed 80% passing	=	2050	microns
Product 80% passing	=	71	microns
Product Screen	=	90	microns
WORK INDEX	=	**14.1**	**kWh/sh.ton**
	=	**15.5**	**kWh/tonne**

TABLE 6 : BALL MILL GRINDABILITY

SAMPLE 2 - GWDD1

Grinding Stage	Mill Revs	Gross Product Wt. g	Net Product Wt. g	Grind-ability g/rev	Circ Load %
1	200	548.0	273.9	1.37	213
2	293	501.2	413.5	1.41	242
3	290	516.6	436.4	1.50	232
4	270	508.6	425.9	1.58	237
5	259	500.6	419.2	1.62	242
6	253	482.1	402.0	1.59	255
7	259	485.4	408.3	1.58	253

Volume of Feed in Mill	=	700	ml
Weight of Feed in Mill	=	1713	g
Average for last 2 Stages:			
Grindability	=	1.58	g/rev
Circulating Load	=	254	%
Feed 80% passing	=	2280	microns
Product 80% passing	=	64	microns
Product Screen	=	90	microns
WORK INDEX	=	**10.4**	**kWh/sh.ton**
	=	**11.5**	**kWh/tonne**

TABLE 8 : LOW INTENSITY MAGNETIC SEPARATION (ERIEZ)

SEDD1 - FIRST PASS - P80=106um

Product	Weight %	Analyses,%										
		Fe	P_2O_5	SiO_2	Al_2O_3	CaO	MnO	MgO	TiO_2	K_2O	Na_2O	LOI
Magnetics	55.0	61.9	0.03	12.9	0.52	0.80	0.06	0.74	0.08	0.14	0.05	-2.69
Non Magnetics	45.0	8.6	0.34	74.3	2.39	4.56	0.15	4.15	0.07	0.52	0.19	1.32
Calc Head	100.0	37.9	0.17	40.5	1.36	2.49	0.10	2.27	0.08	0.31	0.11	-0.89
Assay Head		37.2	0.18	41.0	1.36	2.53	0.10	2.41	0.08	0.36	0.15	-1.14

Product	Distribution,%										
	Fe	P_2O_5	SiO_2	Al_2O_3	CaO	MnO	MgO	TiO_2	K_2O	Na_2O	LOI
Magnetics	89.8	9.7	17.5	21.0	17.7	32.8	17.9	58.3	24.8	24.3	167.1
Non Magnetics	10.2	90.3	82.5	79.0	82.3	67.2	82.1	41.7	75.2	75.7	-67.1
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

89.8 Fe Recovery

TABLE 9 : LOW INTENSITY MAGNETIC SEPARATION (ERIEZ)

SEDD1 - SECOND PASS - P80=63um

Product	Weight %	Analyses,% Fe	P_2O_5	SiO_2	Al_2O_3	CaO	MnO	MgO	TiO_2	K_2O	Na_2O	LOI
Magnetics	89.2	70.3	< 0.01	3.7	0.29	0.23	0.04	0.22	0.08	0.04	0.01	-3.27
Non Magnetics	10.8	10.3	0.31	71.8	2.54	3.97	0.18	3.85	0.07	0.36	0.15	1.44
Calc Head	100.0	63.8	0.03	11.1	0.53	0.63	0.06	0.61	0.08	0.07	0.03	-2.76
Assay Head		61.9	0.03	12.9	0.52	0.80	0.06	0.74	0.08	0.14	0.05	-2.69

Product	Distribution,% Fe	P_2O_5	SiO_2	Al_2O_3	CaO	MnO	MgO	TiO_2	K_2O	Na_2O	LOI
Magnetics	98.3	0.0	30.0	48.5	32.4	64.7	32.1	90.4	47.9	35.5	105.6
Non Magnetics	1.7	100.0	70.0	51.5	67.6	35.3	67.9	9.6	52.1	64.5	-5.6
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

88.2% total recovery

TABLE 10 : LOW INTENSITY MAGNETIC SEPARATION (ERIEZ)

GWDD1 - FIRST PASS - P80=38um

Product	Weight %	Analyses,%										
		Fe	P_2O_5	SiO_2	Al_2O_3	CaO	MnO	MgO	TiO_2	K_2O	Na_2O	LOI
Magnetics	64.6	61.7	0.02	13.9	0.07	0.47	0.07	0.93	< 0.01	0.02	0.04	-2.72
Non Magnetics	35.4	6.0	0.27	81.0	0.54	2.78	0.08	5.76	< 0.01	0.06	0.25	1.28
Calc Head	100.0	42.0	0.11	37.7	0.24	1.29	0.07	2.64	< 0.01	0.03	0.11	-1.30
Assay Head		37.8	0.26	41.5	0.15	1.73	0.07	3.01	< 0.01	0.06	0.13	-0.99

Product	Distribution,%										
	Fe	P_2O_5	SiO_2	Al_2O_3	CaO	MnO	MgO	TiO_2	K_2O	Na_2O	LOI
Magnetics	94.9	11.9	23.8	19.1	23.6	61.5	22.8		37.8	22.6	134.7
Non Magnetics	5.1	88.1	76.2	80.9	76.4	38.5	77.2		62.2	77.4	-34.7
	100.0	100.0	100.0	100.0	100.0	100.0	100.0		100.0	100.0	100.0

96.7% recovery

TABLE 11 : LOW INTENSITY MAGNETIC SEPARATION (ERIEZ)

GWDD1 - SECOND PASS - P80=30um

Product	Weight %	Analyses,%										
		Fe	P_2O_5	SiO_2	Al_2O_3	CaO	MnO	MgO	TiO_2	K_2O	Na_2O	LOI
Magnetics	86.9	69.5	< 0.01	4.4	0.11	0.14	0.07	0.31	< 0.01	0.03	0.02	-3.34
Non Magnetics	13.1	15.6	0.17	68.2	0.79	1.94	0.10	4.28	< 0.01	0.36	0.18	0.94
Calc Head	100.0	62.4	0.02	12.8	0.20	0.38	0.07	0.83	< 0.01	0.07	0.04	-2.78
Assay Head		61.7	0.02	13.9	0.07	0.47	0.07	0.93	< 0.01	0.02	0.04	-2.72

Product	Distribution,%										
	Fe	P_2O_5	SiO_2	Al_2O_3	CaO	MnO	MgO	TiO_2	K_2O	Na_2O	LOI
Magnetics	96.7	0.0	30.1	48.0	32.4	82.3	32.5		35.6	42.4	104.4
Non Magnetics	3.3	100.0	69.9	52.0	67.6	17.7	67.5		64.4	57.6	-4.4
	100.0	100.0	100.0	100.0	100.0	100.0	100.0		100.0	100.0	100.0

91.3% total recovery

TABLE 12 : LOW INTENSITY MAGNETIC SEPARATION (ERIEZ)

HKNDD3 - FIRST PASS - P80=38um

Product	Weight	Analyses,%										
	%	Fe	P_2O_5	SiO_2	Al_2O_3	CaO	MnO	MgO	TiO_2	K_2O	Na_2O	LOI
Magnetics	71.9	55.3	0.05	21.3	0.13	1.38	0.10	1.24	< 0.01	0.02	0.02	-2.19
Non Magnetics	28.1	11.9	0.36	68.0	1.10	5.92	0.22	5.80	< 0.01	0.03	0.07	1.74
Calc Head	100.0	43.1	0.14	34.4	0.40	2.66	0.13	2.52	< 0.01	0.02	0.03	-1.09
Assay Head		40.0	0.15	37.2	0.18	3.30	0.13	2.91	< 0.01	0.01	0.04	-0.71

Product	Distribution,%										
	Fe	P_2O_5	SiO_2	Al_2O_3	CaO	MnO	MgO	TiO_2	K_2O	Na_2O	LOI
Magnetics	92.2	26.2	44.5	23.2	37.4	53.8	35.4		63.0	42.2	145.0
Non Magnetics	7.8	73.8	55.5	76.8	62.6	46.2	64.6		37.0	57.8	-45.0
	100.0	100.0	100.0	100.0	100.0	100.0	100.0		100.0	100.0	100.0

92.2% recovery

TABLE 13 : LOW INTENSITY MAGNETIC SEPARATION (ERIEZ)

HKNDD3 - SECOND PASS - P80=28um

Product	Weight %	Analyses,%										
		Fe	P_2O_5	SiO_2	Al_2O_3	CaO	MnO	MgO	TiO_2	K_2O	Na_2O	LOI
Magnetics	80.8	64.2	< 0.01	10.0	0.20	0.44	0.07	0.50	< 0.01	0.03	0.01	-2.87
Non Magnetics	19.2	20.4	0.23	60.0	1.40	3.38	0.17	3.97	< 0.01	0.03	0.05	0.77
Calc Head	100.0	55.8	0.04	19.6	0.43	1.00	0.09	1.17	< 0.01	0.03	0.02	-2.17
Assay Head		55.3	0.05	21.3	0.13	1.38	0.10	1.24	< 0.01	0.02	0.02	-2.19

Product	Distribution,%										
	Fe	P_2O_5	SiO_2	Al_2O_3	CaO	MnO	MgO	TiO_2	K_2O	Na_2O	LOI
Magnetics	93.0	0.0	41.2	37.5	35.4	63.4	34.6		80.8	45.7	106.8
Non Magnetics	7.0	100.0	58.8	62.5	64.6	36.6	65.4		19.2	54.3	-6.8
	100.0	100.0	100.0	100.0	100.0	100.0	100.0		100.0	100.0	100.0

85-8?% total recovery

APPENDIX A - COMMINUTION TEST DETAILS

BOND IMPACT CRUSHING TEST FOR WORK INDEX DETERMINATION

This test is used to determine the Work Index of an ore for use in calculating power requirements for primary crushing.

In this test ore pieces are broken using twin pendulum hammers which simultaneously impact on opposing faces of the rock piece.

The Impact Crushing Work Index is calculated from the energy required to fracture the rock, the thickness of the rock and the specific gravity.

Sample Requirement

The test is carried out on up to 20 rock pieces (if available) selected as passing a 76 mm square aperture screen and being retained on a 51 mm square aperture screen. The specimens should not be slabby or acicular in shape.

Test Result

The Work Index (kWh/tonne) determined from this test is applicable to a primary crusher.

Reference

BOND, F.C. (1946), "Crushing Tests by Pressure and Impact", Trans. AIME, Vol. 169, pp. 58 to 65.

AVERAGE IMPACT WORK INDICES

(kWh/short ton or ft-lb/inch thickness)

Material	No. Tests	Average	Range
Basalt	15	20.2	9.9-34.8
Bauxite	8	5.3	2.5-12.2
Calcite	4	8.2	5.8-12.2
Cement clinker	3	4.2	1.4-8.8
Cement raw Material	35	11.7	3.6-27.4
Clay	4	4.8	3.7-6.1
Copper-nickel matte	3	6.3	5.7-7.2
Copper-nickel ore	3	14.1	10.7-17.4
Copper ore	227	12.4	1.8-40.2
Copper silver ore	4	16.0	13.0-18.8
Coral	3	8.6	7.9-9.5
Diorite	11	20.1	13.3-27.3
Dolomite	24	12.8	5.4-31.4
Ferrochrome alloy	13	9.5	1.9-24.5
Ferromanganese	6	4.8	3.2-9.0
Ferrosilicon	6	7.1	3.3-11.4
Fullers earth	3	1.3	0.1-.3.3
Gabbro	7	18.6	16.7-21.2
Gneiss	7	15.9	8.0-23.7
Gold ore	15	17.5	3.7-34.2
Granite	63	15.7	6.7-38.0
Gravel	11	16.7	6.9-26.8
Gypsum rock	6	6.9	4.3-11.7
Ilmenite	3	12.7	10.7-16.4
Iron ore, unidentified	77	10.0	2.3-33.6
Hematite	64	9.6	2.0-29.4
Magnetite	44	10.1	2.4-19.2
Taconite	30	14.9	9.3-27.3
Lead ore	4	15.5	11.0-21.8
Lead-zinc ore	11	9.3	5.5-14.3
Limestone	178	11.1	3.3-27.6
Manganese ore	3	5.3	0.4-8.9
Molybdenum ore	24	12.5	5.8-18.6
Nickel ore	8	10.1	2.1-19.0
Oil shale	7	15.8	11.5-20.2
Phosphate rock	7	3.3	0.5-11.7
Quartz	11	12.8	6.8-22.1
Quartzite	17	12.9	5.2-19.1
Sandstone	7	13.1	6.5-28.6
Schist	6	12.5	4.1-23.5
Shale	7	10.6	5.8-19.0
Silica rock	6	9.4	4.2-15.9
Slag	10	12.8	1.3-21.9
Stone	8	16.9	10.4-27.5
Tin ore	3	18.0	16.6-19.5
Trap rock	95	19.0	4.9-55.5
Zinc-lead ore	4	10.5	4.5-16.3
TOTAL	1115		

Weiss, N.L. (Ed), *SME Mineral Processing Handbook*
Society of Mining Engineers, New York, 1985

BOND ABRASION INDEX

This test is used to determine the abrasiveness of a material in relation to metal wear in crushing and grinding.

The test material, in the size range minus 19.0 plus 12.7 mm, is tumbled in a drum and cascades over a hardened steel paddle which rotates concentrically with the drum.

The test material is replaced with a fresh charge after each 15 minutes and the test continues for a total period of one hour.

The weight (g) lost by the paddle for the full test period is the Abrasion Index.

Sample Requirement

Minimum of 3 kg of minus 19.0 plus 12.7 mm material.

Reference

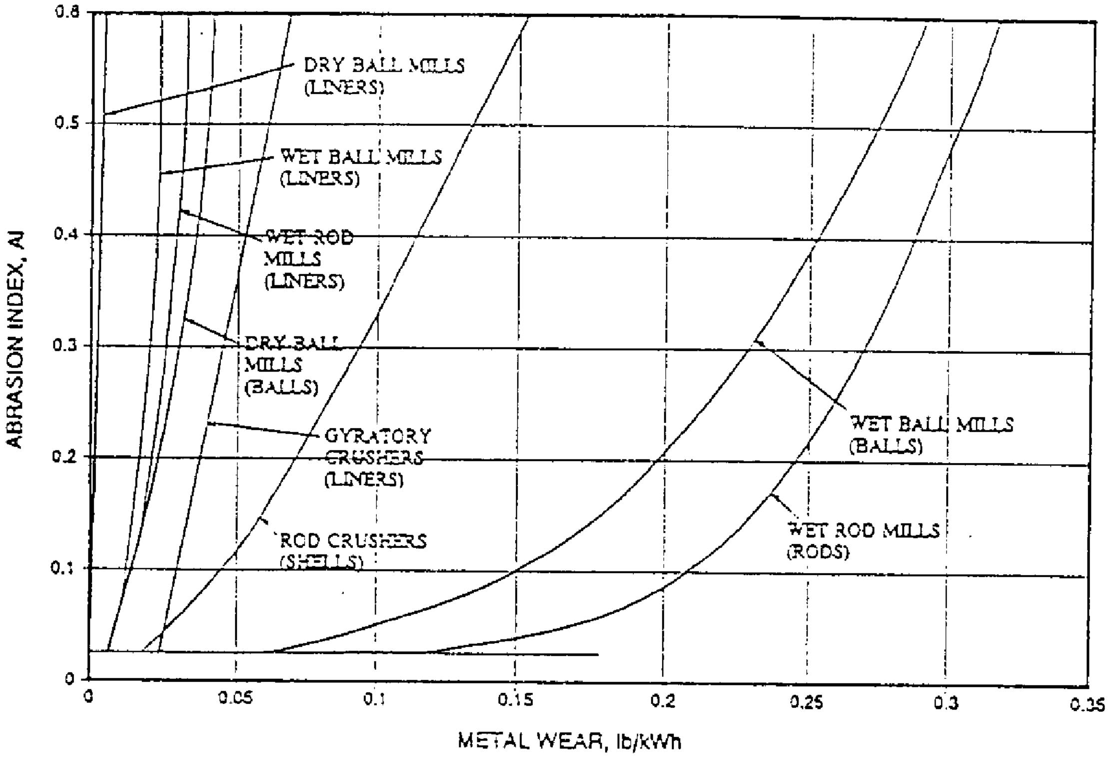
BOND, F.C. (1963), "Metal Wear in Crushing and Grinding", 54th Ann. Mtg. of Amer. Inst. Chem. Engrs., Houston, Texas.

AVERAGE ABRASION INDICES

Material	No. Tests	Average	Range
Aluminium oxide	2	0.86	0.58-1.14
Basalt	5	0.45	0.19-0.83
Bauxite	11	0.02	0.003-0.12
Beryllium ore	2	0.45	0.45-0.45
Cement clinker	15	0.08	0.009-0.17
Cement raw mix	37	0.05	0.001-0.83
Clay, calcined	2	0.04	0.004-0.07
Copper-nickel matte	2	0.002	0.001-0.003
Copper-nickel ore	2	0.46	0.43-0.49
Copper ore	112	0.26	0.002-0.91
Copper silver ore	2	0.62	0.58-0.65
Dolomite	8	0.03	0.01-0.07
Feldspar	2	0.19	0.07-0.030
Ferrochrome alloy	3	0.35	0.27-0.52
Ferromanganese	2	0.25	0.18-0.32
Fullers earth	2	0.001	0.00-0.001
Gold ore	4	0.48	0.30-0.71
Granite	18	0.40	0.10-0.78
Gravel	6	0.29	0.11-0.43
Iron ore, unidentified	33	0.25	0.01-0.98
Hematite	38	0.37	0.00-1.79
Limonite	6	0.13	0.01-0.23
Magnetite	18	0.48	0.11-0.83
Taconite	15	0.60	0.32-0.85
Lead-zinc ore	9	0.21	0.03-0.41
Limestone	52	0.05	0.00-0.65
Magnesite	3	0.08	0.04-0.10
Marble	3	0.01	0.002-0.04
Molybdenum ore	8	0.41	0.13-0.68
Nickel ore	5	0.03	0.01-0.06
Oil shale	3	0.02	0.01-0.02
Phosphate rock	2	0.02	0.01-0.02
Quartzite	7	0.69	0.19-0.99
Schist	2	0.12	0.11-0.13
Shale	2	0.004	0.003-0.005
Silica rock	4	0.29	0.06-0.83
Silver ore	2	0.74	0.72-0.76
Slag	9	0.28	0.01-0.52
Slate	2	0.003	0.003-0.003
Stone	5	0.22	0.07-0.32
Tin ore	4	0.24	0.03-0.35
Trap rock	18	0.35	0.02-0.70
TOTAL	487		

Weiss, N.L. (Ed), *SME Mineral Processing Handbook*
Society of Mining Engineers, New York, 1985

Abrasion Index plotted against metal wear in lb/kWh



BOND, F.C., *Metal Wear in Crushing and Grinding,*
54th Ann. Mtg., American Inst. Chem. Engrs., Houston, Texas, 1963.

BOND BALL MILL GRINDABILITY TEST FOR WORK INDEX DETERMINATIONS

This test is used to determine the Work Index of an ore for calculating ball mill size and power requirements.

Feed is prepared by stage crushing to minus 3.35 mm and the size distribution determined by wet and dry sieving.

A tightly packed 700 mL feed sample is weighed and then dry ground in a 305 x 305 mm batch ball mill rotating at 70 rpm.

The ground charge is screened at the selected mill screen size and the undersize product is replaced with an equal weight of minus 3.35 mm feed. The charge is again ground for a number of revolutions calculated to yield a 250% circulating load.

Testing is continued until the net weight of product generated per mill revolution (Gbp) becomes constant.

The Work Index is calculated as follows:

$$Wi = \frac{44.5}{P^{0.23} \times G^{0.82} \left(\frac{10}{\sqrt{P_{80}}} - \frac{10}{\sqrt{F_{80}}} \right)}$$

where

P	-	mill product screen aperture
G	-	grindability
F_{80}	-	80% passing size of feed
P_{80}	-	80% passing size of product

Sample Requirement

Ore sample of 15 kg, stage crushed to minus 3.35 mm.

Test Result

The Work Index (kWh/tonne) determined from this test is for material ground in a closed circuit wet ball mill of 2.44 m diameter.

Reference

BOND, F.C. (1961), "Crushing and Grinding Calculations," Brit. Chem. Engng., Vol 6, Nos 6 and 8.

AVERAGE ROD AND BALL MILL WORK INDICES (kWh/short ton)

Material	Rod Mill			Ball Mill		
	No. Tests	Avg	Range	No Tests	Avg	Range
Alumina	3	12.2	9-17	6	17.9	7-34
Barite	6	5.7	2-12	7	5.8	4-9
Bauxite	33	10.8	2-20	29	14.5	1-31
Cement clinker	29	12.1	8-15	180	13.6	7-77
Cement raw material	115	12.3	4-18	284	10.0	3-27
Chrome ore	2	7.9	7-9	5	13.4	7-17
Clay	4	12.5	6-18	11	10.8	4-23
Clay, calcined	4	7.0	3-13	7	19.6	15-26
Coal	4	9.8	8-12	6	15.4	13-18
Coke	7	16.9	12-24	4	33.5	29-40
Copper-nickel ore	4	19.2	16-24	6	15.5	13-18
Copper ore	396	14.3	4-34	769	12.8	4-30
Copper-zinc ore	4	11.0	6-16	9	9.8	5-14
Diorite	7	17.5	10-30	2	11.6	10-13
Dolomite	11	14.2	3-24	5	13.9	6-25
Feldspar	7	11.0	8-16	7	11.7	9-14
Ferrochrome	1	8.4	-	6	20.4	3-77
Ferromagnesium				5	7.2	6-9
Ferromanganese	2	7.6	7-8	5	7.9	5-14
Ferrosilicon	3	7.1	4-11	8	17.9	6-51
Flint	1	18.1	-	5	27.4	22-31
Fluorspar	4	11.0	9-13	9	12.7	6-25
Gold ore	42	15.2	8-29	183	14.6	3-42
Granite	10	16.3	8-36	8	9.9	10-11
Gravel	21	15.9	8-24	6	18.0	11-27
Iron ore, unidentified	54	11.3	3-20	118	12.4	4-31
Hematite	64	12.5	5-22	116	11.1	2-31
Conc				5	18.5	7-29
Limonite	12	9.3	4-16	20	9.0	5-19
Magnetite	43	11.4	5-25	73	13.2	6-29
Conc				23	19.2	7-27
Siderite				5	10.4	9-14
Taconite	35	19.3	7-37	20	12.0	8-19
Conc	12	11.6	10-13			
Lead ore	14	12.6	10-15	12	10.3	8-13
Lead-zinc ore	31	12.4	7-19	58	12.5	7-26
Limestone	84	13.7	7-50	177	9.9	4-36
Limestone, burnt				5	11.0	6-18
Magnesite	3	15.9	10-22	18	14.6	5-25
Manganese ore	3	10.9	7-14	19	13.9	6-23
Marl	2	10.6	10-11	8	10.2	4-18
Molybdenum ore	25	11.8	8-18	43	11.6	10-16
Nickel matte	2	9.8	9-11	6	28.4	12-37
Nickel ore	19	14.9	8-22	39	12.5	2-24
Oil shale	1	27.0	-	5	38.2	16-78
Oyster shells	5	17.6	2-28	5	15.1	13-19
Phosphate fertilizer				6	16.5	12-30
Phosphate rock	22	12.8	5-28	36	13.6	3-25
Pyrite	3	8.7	8-10	6	10.1	7-13
Quartz	1	14.4	-	13	14.4	11-21
Quartzite	8	12.3	8-19	13	11.2	7-16
Sand, silica	14	13.0	3-33	45	23.8	9-50
Sandstone	6	11.4	1-20	8	27.4	16-38
Shale	4	13.4	6-24	12	10.1	3-21
Silica rock	6	8.9	7-12	11	14.3	8-23
Slag	10	16.0	10-27	26	17.2	10-27
Slag, blast furnace	4	10.1	5-13	8	18.3	12-26
Talc				10	15.3	8-22
Tin ore	4	14.1	11-16	12	11.8	10-14
Titanium ore	3	10.9	10-12	9	11.4	7-17
Tungsten ore	5	12.8	9-17	4	11.0	7-17
Uranium ore	13	13.3	3-18	18	14.6	10-20
Zinc ore	6	12.9	7-22	9	10.9	6-16

Weiss, N.L. (Ed), *SME Mineral Processing Handbook*
Society of Mining Engineers, New York, 1985

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3 September 1996

Mines and Energy South Australia
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Attention: Brian Morris

REPORT G650100G/96
MINERALOGY OF MAGNETIC SEPARATION PRODUCTS OF AN IRON ORE

YOUR REFERENCE:	EX 2417
SAMPLE IDENTIFICATION:	SEDD1 (Sample 1), GWDD1 (Sample 2), HKNDD3 (Sample 3)
MATERIAL:	Magnetic separation products
DATE SAMPLES RECEIVED:	16 August 1996
DATE AUTHORISATION RECEIVED:	16 August 1996
WORK REQUIRED:	Mineralogical analysis
INVESTIGATION AND REPORT BY:	Michael J W Larrett and Frank Radke

Keith Henley

Dr Keith J Henley
Manager, Mineralogical Services

tc/cjc

The results contained in this report relate only to the sample(s) submitted for testing.
Amdel Limited accepts no responsibilities for the representivity of the sample(s) submitted.

MINERALOGY OF MAGNETIC SEPARATION PRODUCTS OF AN IRON ORE

1. INTRODUCTION

12 magnetic separation products consisting of first pass magnetic and non-magnetic products and second pass magnetic and non-magnetic products were submitted by Mines and Energy South Australia for mineralogical analysis to determine mineral proportions and the liberation/locking characteristics of the iron oxides and silicate gangue minerals. The magnetic separation was carried out for Amdel Report N8117 dated 24 July 1996. The samples submitted were named SEDD1 (Sample 1), GWDD1 (Sample 2), HKNDD3 (Sample 3).

A quotation for this work (quotation no. G9608-18) was sent to Brian Morris at Mines and Energy South Australia by facsimile message on 15 August 1996. Colour photomicrography mentioned in this quotation was also requested by Brian Morris on 16 August 1996.

2. PROCEDURE

Polished sections (PS57186-97) were prepared a riffled portions of each magnetic separation product and examined by reflected light microscopy. Mineral proportions and the liberation/locking characteristics of magnetite and non-opaque (silicate) gangue minerals were determined by point counting a minimum of 500 points. The point counting involved the use of a 10x10 eyepiece graticule in combination with a objective of such a power that the distance between the graticule crosses was greater than the largest particles. For each cross intersecting a particle the identity of the mineral under the cross was recorded. For magnetite and non-opaque gangue the liberation/locking of the mineral was also recorded and classified into liberated particles, apparently binary particles (two minerals) or ternary particles (three or more minerals). In the case of binary particles of the identity of the other mineral was also recorded but in the case of ternary particles no further subdivision was attempted, the particles being merely recorded as "ternary". The point count data (volume %) were adjusted using the following specific gravities to calculate weight percentages.

Mineral	Sp. Gr
Magnetite	5.2
Non-opaques	2.7
Pyrite	5.0
Sulphides	6.0
Tramp iron	7.3

Further point counting to give a minimum of 70 points each on magnetite and non-opaque gangue in each sample was carried out. Both the pass 1 and pass 2 non-magnetic products of Sample SEDD1 contained very low magnetite contents so the liberation/locking characteristics of magnetite in these two samples were determined by area counting. This involved the use of a fine mesh eyepiece graticule to determine the area proportions of magnetite occurring as liberated magnetite and locked magnetite. The locked magnetite was classified in the same manner as for point counting.

Photomicrographs were taken of each sample to illustrate the minerals and their textural features. The non-magnetic products were briefly examined in temporary oil mounts to identify the major non-opaque gangue minerals present.

3. RESULTS

Mineral proportions in the samples as determined by point counting are given in Table 1. It can be seen that the samples consist mainly of magnetite, which is concentrated in the magnetic separation products, and non-opaque gangue, which is concentrated in the non-magnetic separation products. Minor pyrite and other sulphides are also present in all of the samples. The other sulphides present include galena (which appears to be the most abundant of the other sulphides), sphalerite and chalcopyrite. It is difficult to determine whether these sulphides represent minerals in the original sample or contamination. Many of these sulphides are liberated grains and could be contamination.

The non-opaque gangue minerals present in the samples are mainly quartz and amphibole. Sample SEDD1 also contains small amounts of biotite and accessory apatite. Samples GWDD1 and HKNDD3 contain trace to accessory levels of carbonate which are slightly better developed than HKNDD3. Small amounts of a birefringent phyllosilicate which could be sericite or talc were also noted in Sample GWDD1.

Traces of hematite were noted in all samples but hematite makes a negligible contribution to the iron oxide mineralogy. A very small proportion of magnetite grains in all samples contain fine intergrowths of hematite.

Photomicrographs illustrating the samples are given in Plates 1 - 6. Examples of magnetite and non-opaque gangue are labelled on Plate 1a.

Liberation/locking characteristics of magnetite and non-opaque gangue are given in Tables 2 and 3 respectively.

TABLES

TABLE 1: MINERALOGY (Wt%) OF MAGNETIC SEPARATION PRODUCTS

Mineral	Pass 1		Pass 2	
	Magnetic	Non-Magnetic	Magnetic	Non-Magnetic
Sample SEDD1				
Magnetite	81	1	96	2
Non-opaques	18	96	4	95
Pyrite	1	3	-	2
Sulphides	-	-	-	1
Total	100	100	100	100
Sample GWDD1				
Magnetite	80	7	92	22
Non-opaques	20	92	8	75
Pyrite	-	1	-	2
Sulphides	-	-	-	1
Total	100	100	100	100
Sample HKNDD3				
Magnetite	71	8	84	18
Non-opaques	28	91	15	80
Pyrite	-	1	-	1
Hematite	1	-	-	-
Tramp iron	-	-	1	-
Sulphides	-	-	-	1
Total	100	100	100	100

- [illegible] non-opaques [illegible] magnetic, 38% [illegible] liberated grains
  - [illegible] grade by 3% and recovery
- 22% magnetite in non-mag fraction, of which 64% is liberated grains
  may be potential to increase recovery

- [illegible] mag fraction, [illegible] grains
  [illegible] increase grade by 5% [illegible] recovery
- 18% magnetite in non-mag fraction of which 42% is liberated grains
  may be potential to increase recovery

[illegible] I would increase yield but have 26% of magnetite as composite grains in mag fraction i.e. better recovery

TABLE 2: LIBERATION/LOCKING OF MAGNETITE IN MAGNETIC SEPARATION PRODUCTS

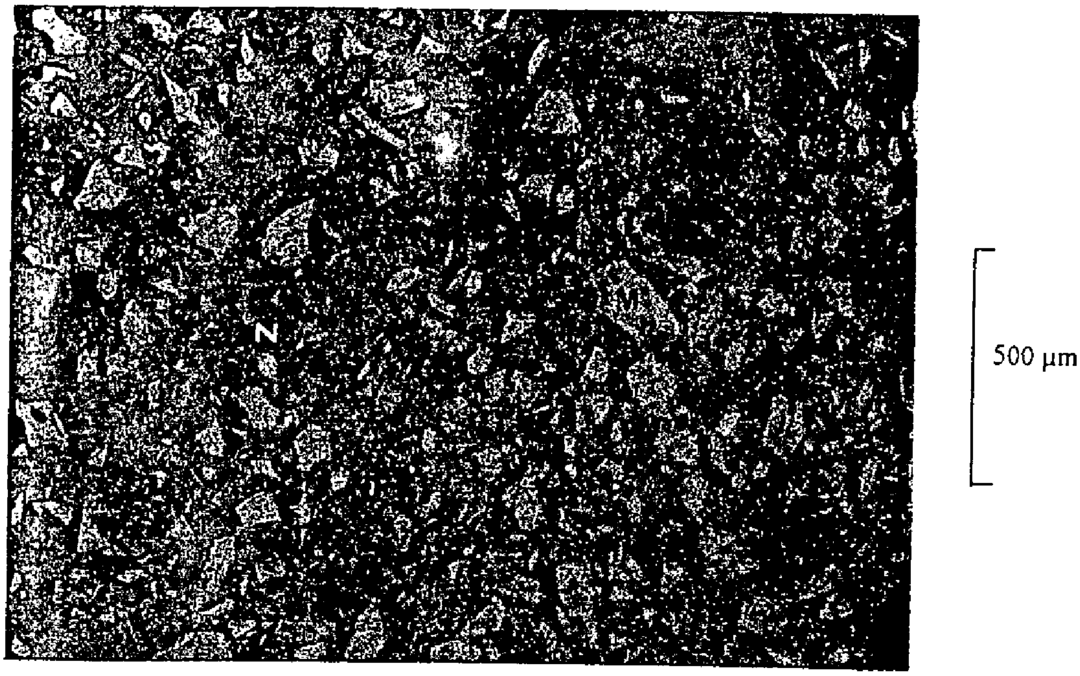
Product	% Liberated	% Locked in Binary Particles with.....			% Locked in Ternary Particles	Total %
		Non-opaques	Pyrite	Hematite		
		Sample SEDD1				
Pass 1 magnetic	84	15	0.5	-	0.5	100
Pass 1 non-magnetic	59	41	-	-	-	100
Pass 2 magnetic	97	2	1	-	-	100
Pass 2 non-magnetic	67	33	-	-	-	100
		Sample GWDD1				
Pass 1 magnetic	57	42	-	-	1	100
Pass 1 non-magnetic	53	47	-	-	-	100
Pass 2 magnetic	92	8	-	-	-	100
Pass 2 non-magnetic	54	40	1	-	5	100
		Sample HKNDD3				
Pass 1 magnetic	32	66	-	1	1	100
Pass 1 non-magnetic	45	54	-	-	1	100
Pass 2 magnetic	74	26	-	-	-	100
Pass 2 non-magnetic	42	53	1	-	4	100

TABLE 3: LIBERATION/LOCKING OF NON-OPAQUES IN MAGNETIC SEPARATION PRODUCTS

Product	% Liberated	% Locked in Binary Particles with..... Magnetite	Pyrite	% Locked in Ternary Particles	Total %
Sample SEDD1					
Pass 1 magnetic	60	38	1	1	100
Pass 1 non-magnetic	94	4	2	-	100
Pass 2 magnetic	70	29	1	-	100
Pass 2 non-magnetic	98	1	1	-	100
Sample GWDD1					
Pass 1 magnetic	47	53	-	-	100
Pass 1 non-magnetic	97	3	-	-	100
Pass 2 magnetic	36	64	-	-	100
Pass 2 non-magnetic	92	8	-	-	100
Sample HKNDD3					
Pass 1 magnetic	21	76	1	2	100
Pass 1 non-magnetic	96	4	-	-	100
Pass 2 magnetic	38	62	-	-	100
Pass 2 non-magnetic	90	10	-	-	100

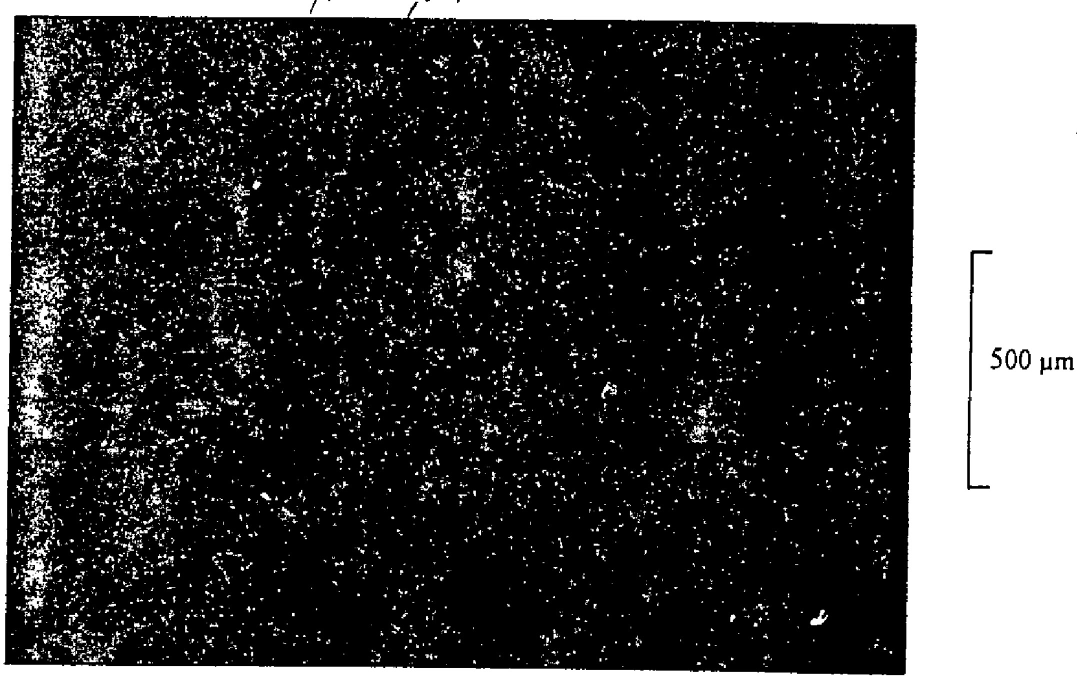
PLATES

PLATE 1 : Sample : SEDD1, Pass 1



(a) Magnetic product, PS57186 (0, 5)

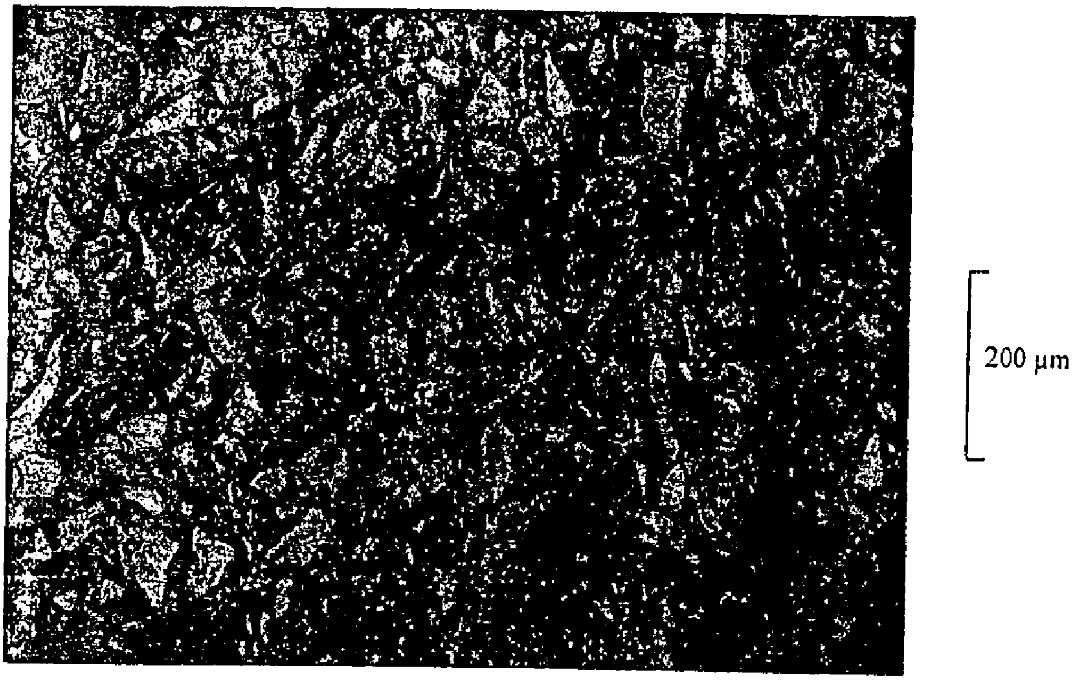
This sample consists mainly of magnetite (M) with smaller amounts of non-opaque gangue (N). The labelled non-opaque gangue particle is locked with magnetite.



(b) Non-magnetic product, PS57187 (2, 5)

This sample consists mainly of non-opaque gangue with very minor magnetite (very light grey). Most of the magnetite in this field is locked with non-opaque gangue.

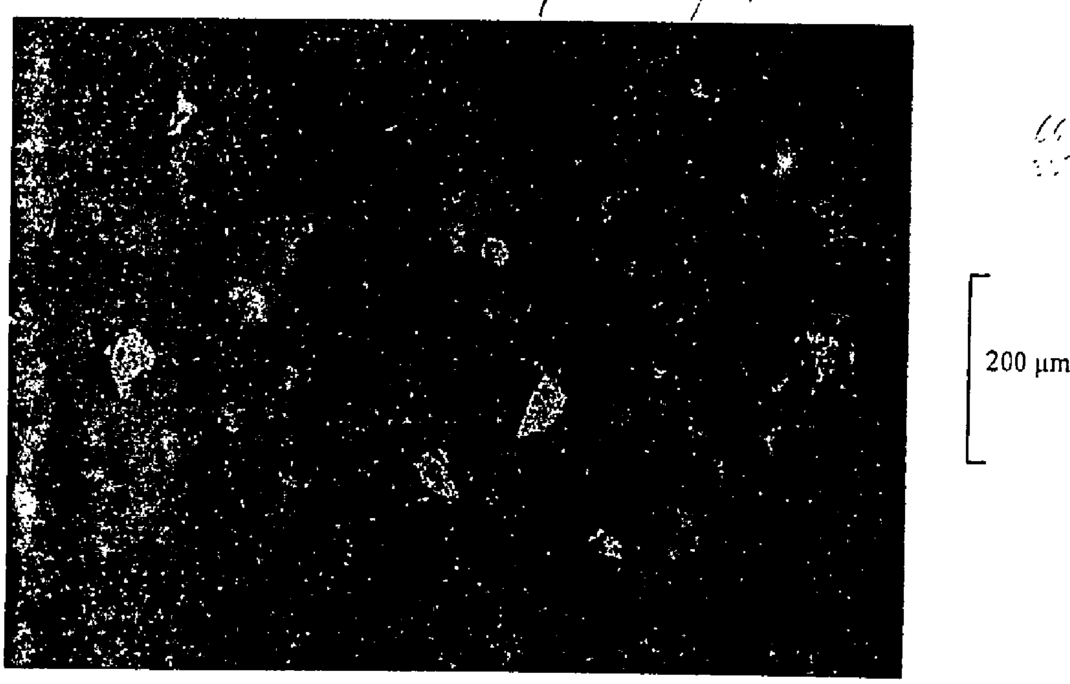
PLATE 2 : Sample : SEDD1, Pass 2



(a) Magnetic product, PS57188 (5, 10)

This sample consists mainly of magnetite with minor non-opaque gangue.

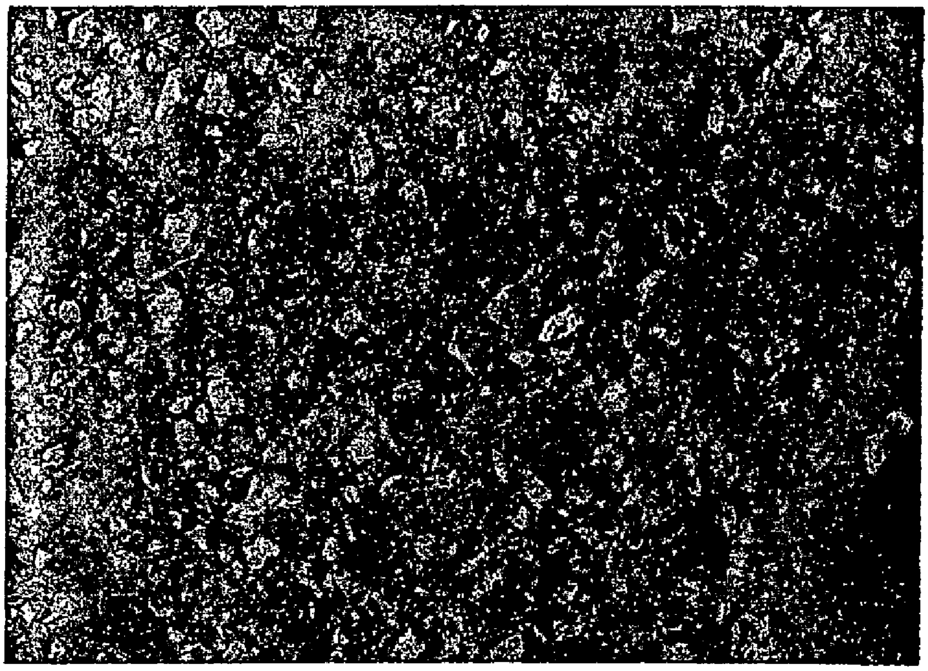
qtz amph



(b) Non-magnetic product, PS57189 (6, 10)

This sample consists mainly of non-opaque gangue and minor magnetite. Most of the magnetite in this field is liberated.

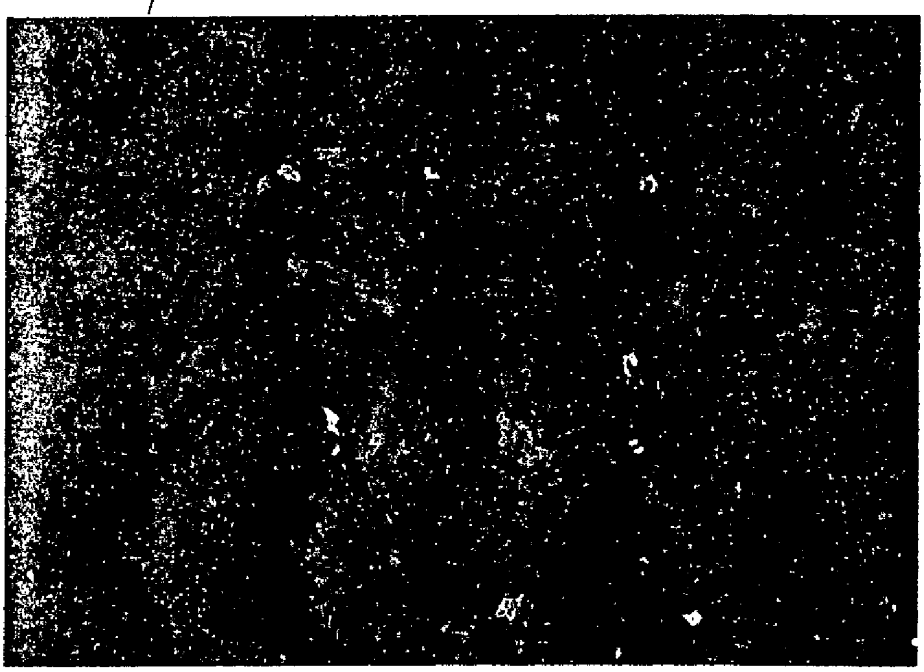
PLATE 3 : Sample : GWDD1, Pass 1



200 μm

(a) Magnetic product, PS57190 (8, 10)

This sample consists mainly of magnetite with minor non-opaque gangue. A hematite particle (bluish-grey) is located near the centre of field.

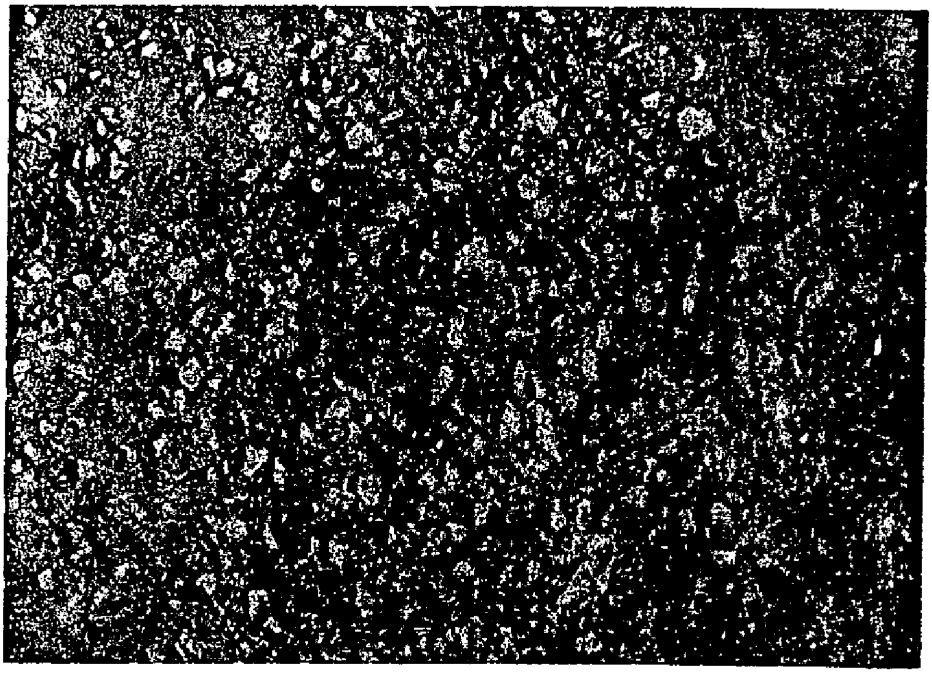


200 μm

(b) Non-magnetic product, PS57191 (10, 10)

This sample consists mainly of non-opaque gangue and minor magnetite.

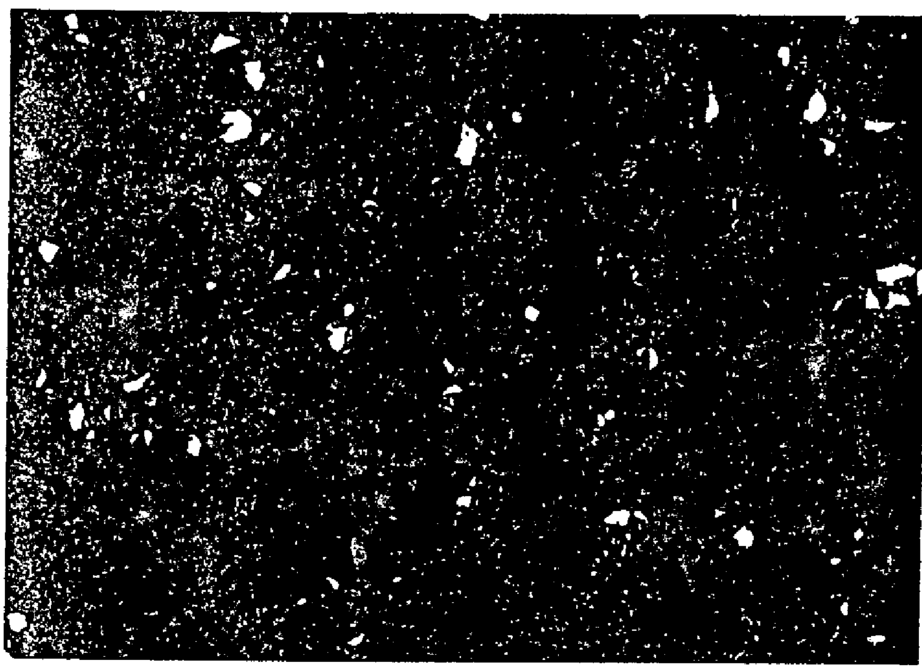
PLATE 4 : Sample : GWDD1, Pass 2



200 µm

(a) Magnetic product, PS57192 (12, 10)

This sample consists mainly of magnetite with minor non-opaque gangue.



qtz
amph
talc

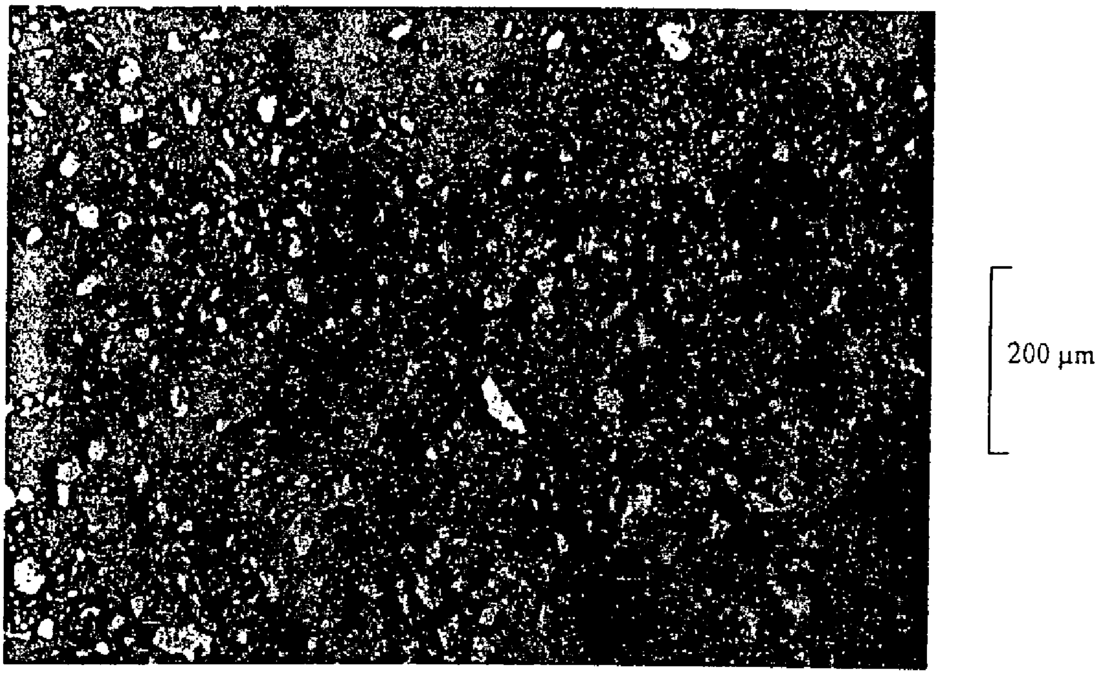
80% qtz
10% amph
10% talc

200 µm

(b) Non-magnetic product, PS57193 (30, 10)

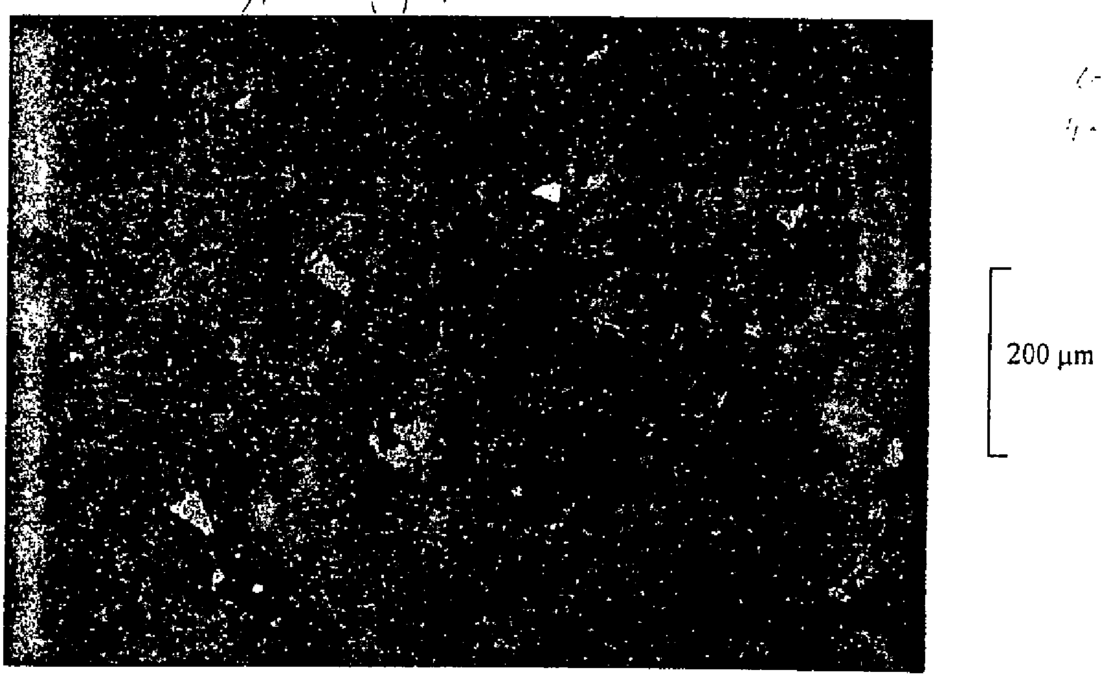
This sample consists mainly of non-opaque gangue with minor magnetite.

PLATE 5 : Sample : HKNDD3, Pass 1



(a) Magnetic product, PS57194 (17, 10)

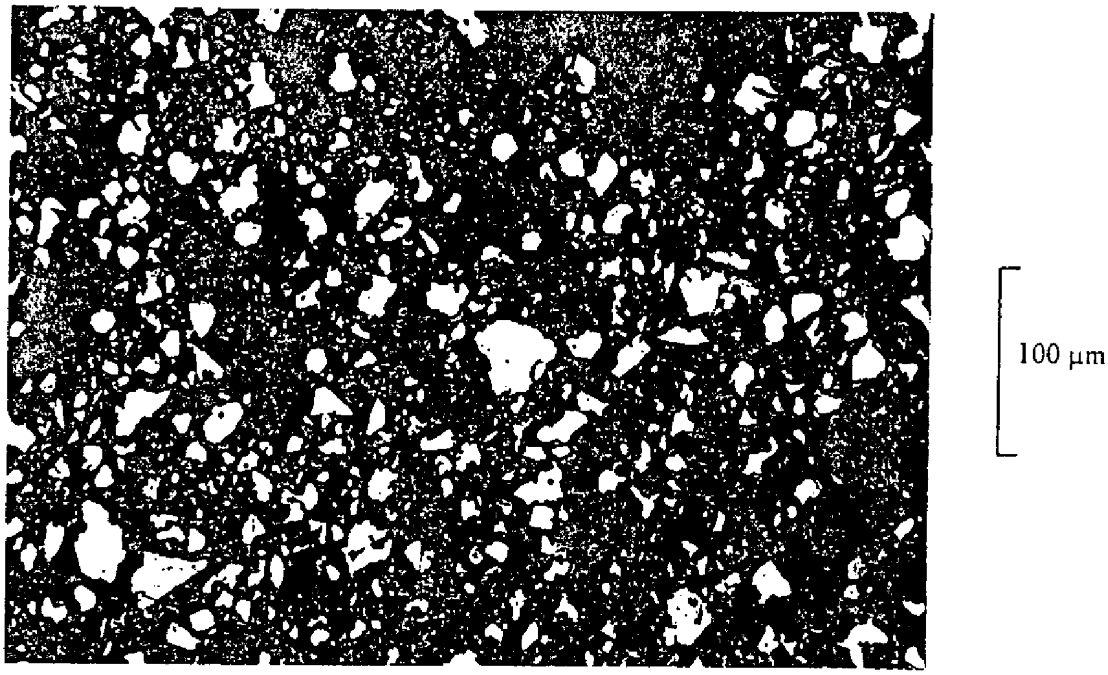
This sample consists mainly of magnetite with minor non-opaque gangue.



(b) Non-magnetic product, PS57195 (18, 10)

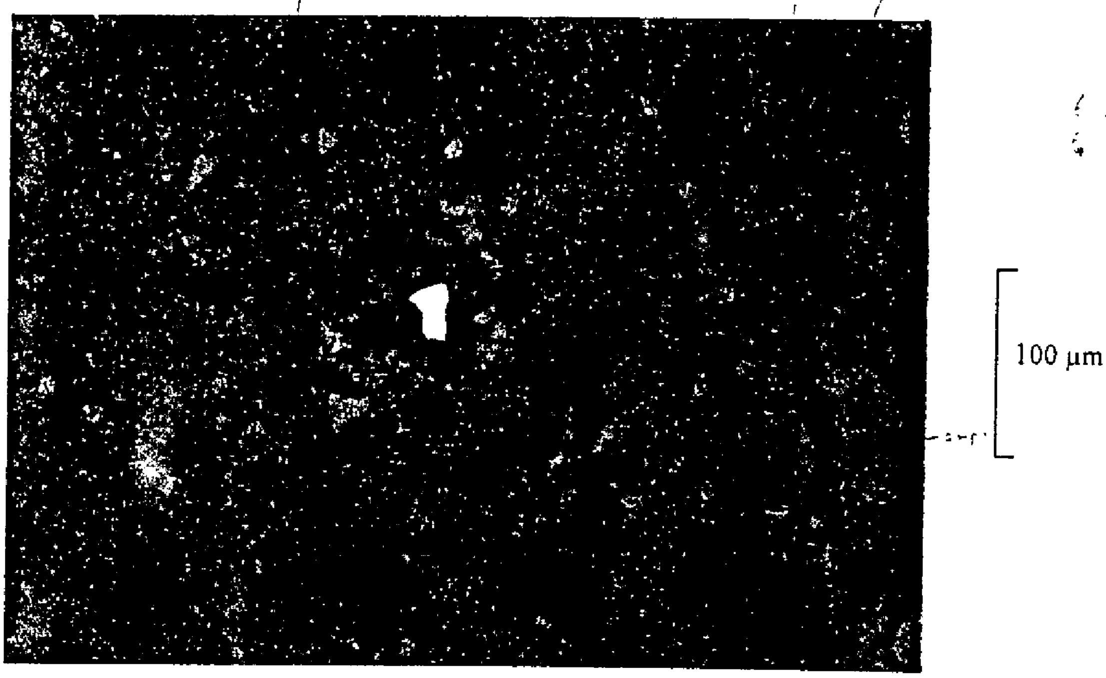
This sample consists mainly of non-opaque gangue and minor magnetite.

PLATE 6 : Sample : HKNDD3, Pass 2



(a) Magnetic product, PS57196 (37, 20)

This sample consists mainly of magnetite with minor non-opaque gangue.



(b) Non-magnetic product, PS57197 (24, 20)

This sample consists mainly of non-opaque gangue with minor magnetite. A pyrite particle (white) is in the centre of the field.

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30 September 1996

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Attn: Mr Brian Morris

REPORT G651000G/96

ELECTRON-PROBE MICROANALYSIS OF MAGNETITE AND AMPHIBOLE IN IRON ORES

YOUR REFERENCE:	Application 1521/5045/42911 dated 27 August 1996
SAMPLE IDENTIFICATION:	SEDD1, GWDD1 and HKNDD3 (188307-309)
MATERIAL:	Magnetic separation products of iron ore
DATE SAMPLES RECEIVED:	16 August 1996
DATE AUTHORISATION RECEIVED:	27 August 1996
WORK REQUIRED:	Electron-probe microanalysis
INVESTIGATION AND REPORT BY:	Dr Peter K Schultz and Frank Radke

Keith Henley

Dr Keith J Henley
Manager, Mineralogical Services

cjc

ELECTRON-PROBE MICROANALYSIS OF MAGNETITE AND AMPHIBOLE IN IRON ORES

1. INTRODUCTION

Further work involving electron-probe microanalysis of the three iron ore samples mineralogically examined for Amdel Report G650100G/96 was requested by Mines and Energy South Australia. Analysis of the magnetite in sample in HKNDD3 and analysis of the amphibole in all three samples (SEDD1, GWDD1 and HKNDD3) was requested. A quotation for this work (Quotation No. G9608-27) was sent to Brian Morris of Mines and Energy South Australia on 26 August 1996 and accepted on 27 August 1996.

2. PROCEDURE

Polished thin sections (PTS C66813-815) were made of the Pass 1 non-magnetic fraction of all three samples. The polished thin sections, as well as the polished section of HKNDD3 Pass 1 magnetic fraction (PS 57194), were carbon coated and examined with an electron-probe microanalyser. The amphiboles in all three samples were analysed for SiO_2, TiO_2, Al_2O_3, MgO, CaO, MnO, FeO (i.e., total Fe as FeO), Na_2O and K_2O. The magnetite in sample HKNDD3 was analysed for Fe as Fe_3O_4, TiO_2, SiO_2 and Al_2O_3 Operating conditions for all analyses were 15 kV accelerating voltage and 20 nA beam current with counting times of 10 seconds on the peak and 5 seconds on either side of the peak. These operating conditions give a detection limit of approximately 0.05% for all elements.

3. RESULTS

The magnetite analyses from sample SEDD1 are given in Table 1. TiO_2 in magnetite is below the detection limit of 0.05% for all analyses except for analyses 12 and 15. Moderate amounts of SiO_2 and barely detectable Al_2O_3 were noted in most analyses. MnO near the detection limit of 0.05% is present in some magnetite grains but has not been included in Table 1.

The results of the amphibole analyses for all three samples are given in Table 2. The analyses have been sorted by increasing CaO content.

TABLES

TABLE 1: ELECTRON-PROBE MICROANALYSES OF MAGNETITE IN SAMPLE HKN003

Analysis No	Analysis, %				
	Fe_3O_4	TiO_2	SiO_2	Al_2O_3	Total
1	97.5	-	1.86	0.05	99.4
2	98.0	-	2.14	0.07	100.2
3	98.1	-	1.87	0.08	100.0
4	98.8	-	0.32	0.09	99.7
5	99.0	-	1.29	0.05	100.3
6	99.2	-	0.56	0.05	99.9
7	99.3	-	0.25	-	99.6
8	99.4	-	0.07	0.05	99.5
9	99.4	-	0.66	0.06	100.1
10	99.5	-	0.56	0.12	100.2
11	99.6	-	0.63	0.05	100.3
12	99.6	0.05	0.40	-	100.0
13	99.9	-	0.45	-	100.4
14	100.1	-	0.05	0.05	100.2
15	100.2	0.06	-	0.09	100.3
Average	99.2	0.01	0.77	0.05	100.0

- : below detection limit of 0.05%

TABLE 2: ELECTRON-PROBE MICROANALYSES OF AMPHIBOLE

Analysis No	Analysis, %									
	SiO2	TiO2	Al2O3	MgO	CaO	MnO	FeO*	Na2O	K2O	Total
Sample: SE001										
1	51.9	0.09	2.26	10.88	8.40	0.31	22.61	0.31	0.09	96.8
2	53.8	0.05	0.93	11.38	12.00	0.24	18.93	0.16	-	97.5
3	53.5	-	0.89	12.09	12.07	0.21	18.59	0.08	-	97.6
4	51.6	-	1.76	10.27	12.07	0.32	20.69	0.24	0.08	97.1
5	51.4	0.05	2.06	10.39	12.12	0.21	20.14	0.21	0.08	96.6
6	51.6	0.09	2.14	10.20	12.21	0.18	20.17	0.25	0.07	97.0
7	52.0	0.07	1.47	10.42	12.29	0.39	20.01	0.24	-	96.9
8	50.8	-	1.69	8.59	21.84	0.31	15.24	0.48	-	99.0
9	50.4	0.05	2.02	8.81	21.85	0.34	15.03	0.53	-	99.1
10	50.9	-	1.10	9.03	22.10	0.46	15.08	0.39	-	99.1
11	51.6	-	0.92	8.74	22.84	0.48	14.74	0.31	-	99.6
Average	51.8	0.04	1.57	10.07	15.43	0.31	18.30	0.29	0.03	97.8
Sample: GW001										
1	58.0	-	-	16.29	2.59	-	13.56	5.40	0.82	96.7
2	57.3	-	0.17	18.73	2.62	0.30	15.74	2.00	0.11	97.0
3	56.6	-	-	17.35	6.86	-	11.10	3.38	1.77	97.1
4	58.2	-	0.08	19.69	7.89	-	7.37	2.94	1.24	97.4
5	58.0	-	0.10	19.04	8.14	0.12	8.09	2.75	1.20	97.4
6	58.1	-	0.06	20.01	8.45	0.08	7.10	2.73	0.69	97.2
7	57.6	-	0.05	20.08	10.55	0.10	6.56	1.48	0.71	97.1
8	55.7	-	0.11	16.17	11.39	1.87	11.54	0.20	-	97.0
9	54.9	-	0.72	15.05	12.01	0.14	13.83	0.43	0.20	97.3
10	57.3	-	0.19	19.22	12.08	0.08	7.41	0.64	0.27	97.2
11	55.6	-	0.23	14.88	12.10	0.16	14.10	0.28	0.06	97.4
Average	57.0	-	0.15	17.86	8.61	0.26	10.58	2.02	0.64	97.2
Sample: HKK003										
1	52.4	-	0.39	8.17	11.80	0.37	24.32	0.10	0.11	98.2
2	53.5	-	0.45	11.35	11.88	0.37	19.91	0.11	0.06	97.6
3	53.7	-	0.38	11.10	12.13	0.27	19.92	0.05	-	97.5
4	53.5	-	0.57	11.35	12.15	0.33	18.97	0.05	-	97.0
5	54.5	-	0.29	11.04	12.17	0.42	20.20	0.07	-	98.7
6	54.9	-	0.49	12.18	12.25	0.31	17.32	-	-	98.2
7	54.4	-	0.22	12.34	12.28	0.30	18.12	-	-	97.7
8	54.7	-	0.37	11.55	12.36	0.30	19.73	0.05	-	99.1
9	54.7	-	0.32	12.16	12.42	0.35	18.25	-	-	98.2
10	54.6	-	0.13	12.08	12.43	0.30	18.05	-	-	97.6
Average	44.2	-	0.36	9.20	9.95	0.27	16.12	0.04	0.02	80.2

- : below detection limit of 0.05%

* : Total Fe as FeO

amdel

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Department: Mineralogical Services

We were not happy with the low values obtained previously on the magnetites so they were reanalysed using a different standard. The new analyses follow and give much better totals. These will be given in the final report.

Regards
Frank

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EPMA results on Magnetite and Amphibole follow.
Detection limits are 0.05%

TABLE 2: ELECTRON-PROBE MICROANALYSES OF AMPHIBOLE

Analysis No	Analysis, %									
	SiO2	TiO2	Al2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
Sample: SEDD1										
1	50.8	-	1.69	8.59	21.84	0.31	15.24	0.48	-	99.0
2	51.6	-	0.92	8.74	22.84	0.48	14.74	0.31	-	99.8
3	50.4	0.05	2.02	8.81	21.85	0.34	15.03	0.53	-	99.1
4	50.9	-	1.10	9.03	22.10	0.46	15.08	0.39	-	99.1
5	51.6	0.09	2.14	10.20	12.21	0.18	20.17	0.28	0.07	97.0
6	51.6	-	1.75	10.27	12.07	0.32	20.69	0.24	0.08	97.1
7	51.4	0.05	2.08	10.39	12.12	0.21	20.14	0.21	0.08	96.6
8	52.0	0.07	1.47	10.42	12.29	0.39	20.01	0.24	-	96.9
9	51.9	0.09	2.28	10.88	8.40	0.31	22.81	0.31	0.09	96.8
10	53.8	0.05	0.93	11.38	12.00	0.24	18.93	0.16	-	97.5
11	53.5	-	0.89	12.09	12.07	0.21	18.69	0.08	-	97.6
Sample: GWDD1										
1	55.6	-	0.23	14.88	12.10	0.16	14.10	0.28	0.06	97.4
2	54.9	-	0.72	15.05	12.01	0.14	13.83	0.43	0.20	97.3
3	55.7	-	0.11	16.17	11.39	1.87	11.54	0.20	-	97.0
4	58.0	-	-	16.29	2.59	-	13.56	5.40	0.82	96.7
5	58.6	-	-	17.35	8.86	-	11.10	3.38	1.77	97.1
6	57.3	-	0.17	18.73	2.62	0.30	15.74	2.00	0.11	97.0
7	58.0	-	0.10	19.04	8.14	0.12	8.09	2.75	1.20	97.4
8	57.3	-	0.19	19.22	12.08	0.08	7.41	0.64	0.27	97.2
9	58.2	-	0.08	19.69	7.89	-	7.37	2.94	1.24	97.4
10	58.1	-	0.08	20.01	8.45	0.08	7.10	2.73	0.69	97.2
11	57.6	-	0.05	20.08	10.55	0.10	6.56	1.48	0.71	97.1
Sample: HKNDD3										
1	52.4	-	0.89	8.17	11.80	0.37	24.32	0.10	0.11	98.2
2	54.5	-	0.28	11.04	12.17	0.42	20.20	0.07	-	98.7
3	53.7	-	0.38	11.10	12.13	0.27	19.92	0.05	-	97.5
4	53.5	-	0.45	11.35	11.88	0.37	19.91	0.11	0.06	97.6
5	53.5	-	0.57	11.35	12.15	0.33	18.97	0.05	-	97.0
6	54.7	-	0.37	11.55	12.38	0.30	19.73	0.05	-	99.1
7	54.8	-	0.13	12.08	12.43	0.30	18.05	-	-	97.6
8	54.7	-	0.32	12.16	12.42	0.35	18.25	-	-	98.2
9	54.9	-	0.49	12.18	12.25	0.31	17.92	-	-	98.2
10	54.4	-	0.22	12.34	12.28	0.30	18.12	-	-	97.7

- = below detection limit of 0.05%

TABLE 1: ELECTRON-PROBE MICROANALYSES OF MAGNETITE IN SAMPLE HKND03

Sample	Fe3O4	TiO2	SiO2	Al2O3	MnO	Total
1	91.0	-	2.03	0.08	0.07	93.18
2	91.2	-	2.98	0.10	-	94.32
3	92.2	-	2.25	0.09	0.13	94.71
4	92.9	0.05	0.54	0.08	-	93.61
5	93.0	-	1.31	-	-	94.34
6	93.1	-	0.38	0.07	0.08	93.66
7	93.3	-	1.25	0.14	-	94.64
8	93.3	-	0.72	-	-	94.07
9	93.6	-	0.05	-	0.05	93.66
10	93.6	-	0.27	0.05	0.05	93.95
11	93.6	-	0.58	0.07	-	94.27
12	93.8	-	0.26	-	-	94.02
13	93.8	-	0.38	0.07	-	94.28
14	94.1	-	-	-	-	94.14
15	94.2	-	0.93	0.11	-	95.22
16	94.2	-	0.28	-	-	94.47
17	94.6	-	0.08	-	0.08	94.81
18	95.8	-	0.58	-	-	96.41

- = below detection limit of 0.05%

TABLE 1: ELECTRON-PROBE MICROANALYSES OF MAGNETITE IN SAMPLE HKN003

Analysis No	Analysis, %				
	Fe_3O_4	TiO_2	SiO_2	Al_2O_3	Total
1	97.5	-	1.86	0.05	99.4
2	98.0	-	2.14	0.07	100.2
3	98.1	-	1.87	0.08	100.0
4	98.8	-	0.82	0.09	99.7
5	99.0	-	1.29	0.05	100.3
6	99.2	-	0.56	0.05	99.9
7	99.3	-	0.25	-	99.6
8	99.4	-	0.07	0.05	99.5
9	99.4	-	0.66	0.06	100.1
10	99.5	-	0.56	0.12	100.2
11	99.6	-	0.63	0.06	100.3
12	99.6	0.05	0.40	-	100.0
13	99.9	-	0.45	-	100.4
14	100.1	-	0.05	0.05	100.2
15	100.2	0.06	-	0.09	100.3
Average	99.2	0.01	0.77	0.05	100.0

- : below detection limit of 0.05%

APPENDIX 6

SPECIFIC GRAVITY MEASUREMENTS

SPECIFIC GRAVITY

AREA	LITHOLOGY	NO OF MEASUREMENTS	RANGE	AVERAGE
Hawks Nest	Haematitic BIF	60	2.97-3.83	3.36
	Haematite	27	4.12-5.11	4.63
	magnetite BIF	31	3.48-4.15	3.70
	Metasediment	5	2.20-2.88	2.75
Giffen Well	Magnetite BIF	13	3.45-3.75	3.59
Sequoia	Magnetite BIF	8	2.74-3.68	3.38
	TOTAL (not including Peculiar Knob)	144		

For resource calculations an SG for magnetite BIF of 3.3 is adopted.
For resource calculations an SG for oxidized BIF of 3.3 is adopted.
For resource calculations an SG for haematite ore of 4.2 is adopted.

SPECIFIC GRAVITY MEASUREMENTS

HOLE NO	DEPTH (m)	ROCK TYPE	SG
PD89HNDD1	9.86	claystone	2.2
	15.45	BIF (wthd)	2.71
	20	BIF (wthd)	2.63
	25.3	BIF (wthd)	2.53
	30.5	BIF	3.66
	35.9	BIF	3.30
	41	BIF	3.50
	45	BIF	3.0
	49	BIF	2.97
	50.25	BIF	3.33
	55.2	Hem	4.22
	60.3	BIF	3.19
	65	BIF	3.09
	70.8	BIF	3.63
	75.5	BIF	3.35
	80	BIF	3.07
	85.2	BIF	3.20
	90.4	claystone	2.88
	95.5	claystone	2.86
	100.5	BIF	3.32
	105.5	BIF	3.50
	110.5	Hem	4.27
	116	Hem	4.37
	120.6	BIF	3.13
	125.5	BIF	3.03
	130.2	BIF	3.08
	135.25	BIF	3.33
	140	BIF	3.55
	144	BIF	3.41
	148.2	BIF	3.64
	155	Hem	5.11
	160	BIF	3.24
	165	BIF	3.28
	170	BIF	3.17
	175	Hem	4.28
	180	BIF	3.36
	185	BIF	3.09
	190	BIF	3.26
	195	BIF	3.40
	200	BIF	3.30
	205	Hem	4.70
	210	BIF	3.56
	215	Hem	4.83
	220	Hem	4.43
	225	BIF	3.10
	230	BIF	3.47
	235	BIF	3.20
	240	BIF	3.33
	245	BIF	3.33
	250	BIF	3.25
	255	BIF	3.31
	265	BIF	3.33
	270	BIF	3.44
	275	BIF	3.44
	280	BIF	3.75
	290	BIF	3.40
	295	BIF	3.43
Overall Average		BIF	3.32
		Hem	4.53
		claystone	2.87
HK-DD1	16.8	Hem	4.98
(MESA)	24.65	BIF	3.14
	24.85	BIF	3.41
	30.88	BIF	3.21
	35.56	Hem	4.71
	40.75	Hem	4.86
	44.81	Hem	4.76
	50.05	Hem	4.81
	55.35	Hem	4.89
	58.10	Hem	4.68
	59.85	Hem	4.96
	64.75	Hem	4.16
	68.22	BIF	3.26
	71.20	BIF	3.34
	73.80	Hem	4.65
	75.26	Hem	4.63
	78.81	claystone	2.75
	80.20	BIF	3.27
	85.22	Hem	4.85
	90.00	Hem	4.71
	94.70	Hem	4.86
	98.06	Hem	4.72
	102.00	BIF	3.59
	105.00	Hem	4.12
	110.00	Hem	4.22
	112.79	Hem	3.86
	114.56	BIF	3.19
HK-DD2	20.27	Hem	4.61
	40.59	BIF	3.37
	51.20	BIF	3.32
HK-DD3	110.1	MtBIF	3.54
	111.4	MtBIF	3.64
	110.1	MtBIF	3.69
	109.5	MtBIF	3.64
	108.6	MtBIF	3.74
	107.6	MtBIF	3.92
	106.6	MtBIF	3.72
	105.6	MtBIF	3.80
	81.4	MtBIF	4.15
	80.3	MtBIF	3.75
	78.8	MtBIF	3.84
	77.4	MtBIF	3.58
	76.4	MtBIF	3.56
	99.4	MtBIF	3.56
	98.2	MtBIF	3.48

HOLE NO	DEPTH (m)	ROCK TYPE	SG
HK-DD3	96.5	MtBIF	3.88
	95.8	MtBIF	3.69
	46.4	MtBIF	3.49
	45.5	MtBIF	3.56
	44.6	MtBIF	3.55
	44.3	MtBIF	3.70
	39.5	MtBIF	3.60
	40.6	MtBIF	3.80
	37.8	MtBIF	3.70
	36.6	MtBIF	3.54
	35.5	MtBIF	3.65
	101.6	MtBIF	3.69
	100.5	MtBIF	3.69
GW-DD1	81.5	MtBIF	3.55
	81.7	MtBIF	3.50
	81.7	MtBIF	3.49
	79.6	MtBIF	3.57
	68.6	MtBIF	3.59
	71.5	MtBIF	3.61
	76.6	MtBIF	3.68
	41.5	MtBIF	3.65
	40.5	MtBIF	3.51
	39.5	MtBIF	3.75
	38.6	MtBIF	3.58
	37.65	MtBIF	3.73
	36.5	MtBIF	3.45
HK-DD4	72.9	BIF	3.56
	69.1	BIF	3.67
	68.2	BIF	3.83
	65.9	BIF	3.56
	62.3	BIF	3.68
	60.4	BIF	3.82
	55.0	BIF	3.49
	48.1	sandy congl	2.77
	41.0	whole core	2.72
SE-DD1	98	MtBIF	3.68
	97	MtBIF	3.61
	95	MtBIF	3.52
	92.3	MtBIF	3.43
	91	MtBIF	3.55
	90.0	MtBIF	2.74
	90	MtBIF	3.57
	88	MtBIF	2.90