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BILLITON AUSTRALIA

ELECTROLYTIC ZINC COMPANY OF AUSTRALIA
LITTLE RIVER (RESOURCES) pTY LTD

ROSEBERY EAST J.V., E.L. 1/62, WEST TASMANIA

Progress Report on Exploration for the Period Ending 22nd December, 1987 and Relinquishment Report for the Tenement

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Report No: 08.3910

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SUMMARY

The report details exploration carried out on EL 1/62 by Billiton Australia during the year ended 22nd December 1987 but excluding an area of approximately 20 sq km. This latter area is the subject of an additional report in which application is made for an extension of licence tenure.

Exploration has been carried out on two prospects within the licence, viz Robbies Creek and South Hercules, in the search for massive volcanogenic base metal sulphide mineralization.

At Robbies Creek, UTEM and CSAMT geophysical surveys defined a deep EM conductor (375m below surface) which was later drill tested (RED 87-1, 607m). A wide (41m) annealed shear zone containing disseminated and massive stringers of magnetite-pyrite was intersected at the contact of dacitic-andesitic lavas and altered epiclastics. The high conductivity characteristics of this mineralization are considered to explain the EM anomaly. No economic mineralization was realized from assaying of core splits.

At South Hercules a diamond drill hole has been completed, designed to test along strike from the Hercules Host Rocks and the recently outlined gold-bearing base metal sulphide deposit at Dunnes. No base metal or gold mineralization was intersected in the core.

CONCLUSIONS AND RECOMMENDATIONS

A deep UTEM anomaly adjacent to the northern margin of the Rosebery Mine Lease at Robbies Creek has been drill tested and the source satisfactorily explained by the presence of pyrite-magnetite stringers within a deformed annealed shear zone. The host epiclastic/lava sequence is strongly carbonated and sericitized but no anomalous geochemistry is evident. The partial definition of an hiatus in the volcanic cycle above the Rosebery Host Horizon position is geologically attractive as a locus for VMS mineralization and the possibility of economic mineralization at depth at this stratigraphic level cannot be discounted. However, in practical terms the likelihood of this event is less probable and it is not considered justifiable to carry on exploration using this premise. Accordingly, no further exploration at Robbies Creek is recommended.

At South Hercules, drill hole RED 87-9 intersected the Hercules Host Horizon, and appears to confirm the anticlinal aspect of the volcanic sequence. Laminated siltstones, shales and volcaniclastic sandstone of the White Spur Formation, were present at the bottom of the hole. The core is broken, but it confirms the unconformable nature of the contact. The lack of mineralization or significant hydrothermal alteration downgrades the area significantly, and no further work is recommended.

1.0 INTRODUCTION

The Rosebery East Joint Venture partially surrounds the eastern edge of the Rosebery mine lease (M.L.53M/55) at Rosebery on the west coast of Tasmania. (Fig. 1).

This report summarizes exploration carried out on the licence for the period December 1986 to December 1987 by Billiton Australia. Personnel involved in this work and who jointly present this report are J. Randell, J.G. Purvis and D. Hall (geology) and N. Hungerford (geophysics).

Details of exploration completed and results achieved on the Henty Fault Zone prospects are not included in this report but remain the subject of an additional report (08.2498).

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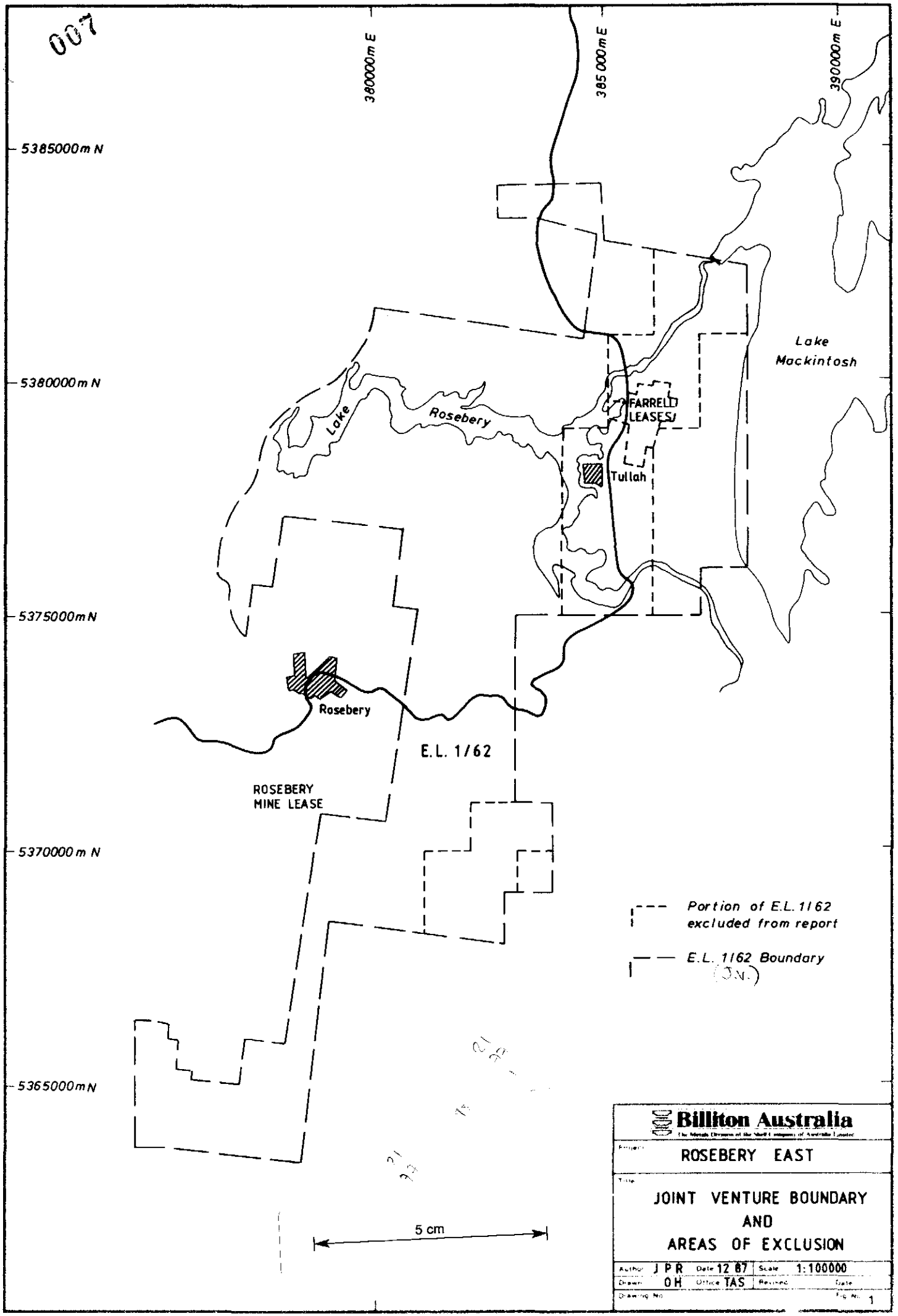

Billiton Australia
The Minerals Division of the Shell Company of Australia Limited

Project: ROSEBERY EAST

Title: JOINT VENTURE BOUNDARY AND AREAS OF EXCLUSION

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2.0 TENEMENT STATUS

Exploration Licence 1/62 consists of one irregular block that partially encloses the Rosebery mine lease.

The Mt. Black EL 1/62 of 170 sq km was granted to the EZ Company in 1962. Since 1978, the EL was the subject of a Joint Venture between EZ Company and Getty Oil Development Corporation. The agreement allowed GODC to earn a 40% interest in 138 sq km of the EL but did not include the 32 sq km Rosebery Mine Lease. EZ was the operator of the Joint Venture from April 1978 to November 1983.

In November 1983, the Mt. Black Joint Venture Supplementary Agreement divided the 138 sq km Joint Venture area into a 22 sq km 'Tin Area', known as the Colebrook Project area (operated by EZ), and a 116 sq km 'Lead-Zinc Area' known as the Rosebery East Project Area (operated by GODC). However, during 1984 GODC was taken over by Texaco at which time the Rosebery East area was put up for tender.

In January 1985, EL 1/62 was reduced to 125 sq km as required by Mines Department regulations. This reduction was from the Rosebery East Project Area which then covered 103 sq km. During 1985, negotiations with prospective buyers resulted in acquisition of the GODC part of Rosebery East area by Little River Goldfields N.L.

On the 26th October 1985, a new agreement was formulated between The Shell Company of Australia Limited, and Little River (Resources) Pty. Ltd. and Electrolytic Zinc Company of Australasia Ltd. Under the terms of this agreement, Shell could earn a 50% equity in the Rosebery East area until 22nd January 1988, at which time, under Mines Department regulations, the entire licence must be relinquished.

The Shell Company had earned its 50% equity by December 1986. As at December 1987, the equities in the Rosebery East Joint Venture are:

Shell Company of Australia	-	52.61%
Norgold	-	26.31%
Little River Resources	-	21.08%

The location and description of the joint venture is diagrammatically represented in Figure 1 but note that the area of the licence differs from the GODC Rosebery East project, being 89 sq km (c.f. GODC JV area 103 sq km).

The portion of licence that is not detailed in this report is also represented in Figure 1 and covers a total area of approximately 20 sq kms.

3.0 PREVIOUS WORK

The original lease holders, EZ Co., carried out extensive basic exploration on the licence over the period 1962-1978. Work included stream sediment sampling, extensive gridding (1 km spaced lines), geological mapping, rock chip sampling and petrology, auger 'C' horizon sampling of selected areas, IP coverage of a large portion of the licence and diamond drilling. Results and discussion of the work to 1978 are not presented here but contained in EZ Co. annual progress reports lodged with the Department of Mines.

More recent exploration carried out by the EZ/Getty Oil Development Company joint venture has included Dighem coverage of the entire EL, geological mapping and rock chip sampling, petrology, VLF and Mx-Min EM, selected IP coverage, auger 'C' horizon geochemistry and diamond drilling. GODC have separated the licence into individual work areas and have reported each separately, a system adopted in this report. Details of their work on EL 1/62 are not presented here but may be ascertained by reference to the following reports:

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	Report No	Company	Period/Title	Author
80-1411	131	EZ Co.	Report on work undertaken to 30th June, 1979.	J.Mill
80-1468	134	EZ Co.	Report on work undertaken 30th June 1979-30th June 1980	J.Mill et al
82-1738	142	EZ Co.	Progress Report on Activity July 1980-June 1981.	I.McDonald
82-1840	144	EZ Co.	Progress Report on Activity 1st July 1981-15th Dec. 1981.	I.McDonald et al
82-1841	148	EZ Co.	Progress Report on Activity 15/12/81 to 4/5/82.	I.Mathieson et al
	152	EZ Co.	Review of Rosebery East JV, April, 1982.	Milovanovic
TCR 83-1920	158	EZ Co.	Progress Report on Exploration Activity 5th May 1982 to 20th November 1982.	I.Mathieson et al
TCR 83-2068	T173	EZ Co.	Progress Report on Exploration 4th May-15th Nov. 1983.	I.McDonald
TCR 85-2313 A		GODC	Rosebery East Exploration Progress Report Aug. 1983 to June 1984.	F.Fitzgerald et al
TCR 85-2516A		GODC	Rosebery East Exploration Progress Report July 1984 to December 1984.	F.Fitzgerald et al
85-2516E		GODC	Rosebery East Exploration Progress Report Jan-Aug 1985.	J.G.Purvis

Details of exploration carried out by Billiton from August 1985 to December 1986 are presented in the following report viz Report No. 08.3412.

Report Title: "Progress Report on Exploration for the Period Ending 22nd December, 1986".

TCR 86-2622

by J.P. Randell, J.G. Purvis, N. Hungerford.

All these reports can be placed on OPEN File to make this relinquishment report complete. Checked with D H 12 28.1.88 DMPD.

4.0 REGIONAL SETTING

The Mt. Read Volcanics comprise a belt of calc-alkaline Middle to Late Cambrian rhyolitic to dacitic volcanics and minor intrusives, with lesser andesites and minor basaltic rocks and intercalated sediments. They unconformably overlie the Precambrian basement to the east and are flanked on the west by trough sedimentary sequences, intruded by mafic to ultramafic bodies.

Although geological knowledge of the volcanics in general remains inadequate, they appear to comprise three main sequences. The Central Sequence, which includes rhyolitic to dacitic lavas, ash flows, pyroclastics, and minor intrusives, is exposed at numerous localities along the West Coast Range. The Western Sequence comprises a laterally variable sequence of felsic to intermediate tuffs and agglomerates; some felsic, intermediate and mafic lavas; and some sedimentary units. The Tyndall Group and correlatives (to the east of the Central Sequence) essentially comprise volcaniclastic facies, which locally unconformably overlie the former sequences.

The volcanics have been extensively altered and mineralized and, in places, are strongly cleaved. Deformation in the Late Cambrian (Jukesian Orogeny) preceded deposition of the Ordovician Owen Conglomerate and Gordon Limestone, and the Siluro-Devonian Eldon Group sandstones and siltstones. A major mid-Devonian deformation (Tabberabberan Orogeny) resulted in widespread folding and faulting.

The Central Volcanics are chiefly composed of massive rhyolites and dacites with lesser andesites, minor basalt and sediments. The volcanics in the south are generally acid or acid-intermediate feldspar-phyric lavas and tuffs, with some minor interbedded fine grained sediments. Cambrian granites occur within the pile, and it is thought that these intrusives represent the root systems to the volcanics. To the north, and north of the Henty Fault, the volcanics are essentially feldspar-phyric lavas and pyroclastics. Sediments occur in the western portion of the sequence, but are scarce in the central and eastern areas. The northern area is distinguished from that in the south by the relative abundance of andesitic volcanics and absence of granite. The andesites occur in two main areas, the first between Mt. Black and the Henty Fault, north from the Stitt River to near Tullah. The second is the Que-Hellyer area at the northern end of the Central Volcanic Sequence. West of the volcanics, massive acid lavas, both submarine and subaerial, are present. These too are feldspar phyric, with the felspar phenocrysts present in a siliceous ground mass. The subaqueous sediments and pyroclastics, which host the Rosebery mineralization, form the western most units of the Central Volcanics. In the area of the mine these have a faulted contact to the west with the sediments of the Stitt Formation (Dundas Group). Further north, near Hellyer, the volcanics appear to have a conformable contact with the overlying western sediments (Que River Shales of the Dundas Group).

Structural information within the volcanics is limited as outcrops are generally massive and bedding/facing criteria is absent. At Rosebery, the volcanics dip and face to the east. However, westerly and horizontal dips have been measured east of the mine. The Henty Fault Zone has been shown to be folded at Mt. Lyell, indicating that post Cambrian folding has influenced the volcanics. This is demonstrated at Hellyer, where the deposit forms at the crest of an anticline. Thus the relative stratigraphic positions of the various volcanic piles is uncertain. However, lead isotope ratios do suggest that the mineralization decreases in age from south to north which in turn indicates a progressive younging of the volcanics in that direction.

The volcanics in the vicinity of the Rosebery and Hercules deposits are chiefly feldspar phyric felsic tuffs and ash flows (Primrose Pyroclastics) and rhyolite/dacite lavas (Mt. Black Volcanics). The eastern portion of the Mt. Black volcanics have been locally termed the Mt. Sale Volcanics, and are predominantly of andesitic composition. These lavas form a large lobate lens east of Mt. Black of maximum width 4 kms and a length in excess of 15 kms.

The Rosebery host sequence is atypical of much of the central belt of the Mt. Read Volcanics as it contains quartz-phyric tuffs and breccias in the hanging wall of the ore horizon.

A black shale/carbonate sedimentary package constitutes the actual host rocks to mineralization at Rosebery, and this package is locally developed southwards, including at the Hercules mine. A more extensive development of meta-sediments occurs to the east - the Farrell Slates.

Exploration licence 1/62 covers both the immediate strike extensions of the Rosebery-Hercules line and a large proportion of the hanging wall Mt. Black and Mt. Sale Volcanics. The Henty Fault transects the eastern portion of the licence from north to south and part of the Farrell Slates sequence is included in the licence. (Figure 2).

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5.0 EXPLORATION OBJECTIVES

The primary objective of exploration within the Rosebery East joint venture was the discovery of a large Volcanogenic Massive Base Metal Sulphide deposit of either the Rosebery or Hellyer types. More specifically within the JV area, the northern strike extent of the Rosebery sequence and the southern strike extent of the Hercules horizon are considered highly prospective for additional mineralization that may be expected to show characteristics similar to Rosebery-Hercules. East of and stratigraphically above the Rosebery horizons, the andesitic lava sequence of the Mt. Sale Volcanics is considered to exhibit lithological and stratigraphic similarities to the host volcanics at Hellyer.

A subordinate exploration target has been gold mineralization, both genetically associated with but spatially distal from massive base metal sulphide mineralization, and mineralization of the hydrothermal and/or epithermal type. Discussion of these models is presented in a report by J.G. Purvis (1984) titled 'Gold Potential of Mt. Black E.L. 1/62'.

The overall thrust of exploration carried out during 1987 has focused on the subsurface assessment of two areas viz

Robbies Creek - adjacent to the northern margin of the Rosebery Mine Lease.

South Hercules - adjacent to the southern margin of the Rosebery Mine Lease.

6.0 EXPLORATION COMPLETED

6.1 ROBBIES CREEK

6.1.1 Location

The prospect is located at the northern margin of the Rosebery Mine Lease at AMG co-ordinates 5377000mN 379000mE (see Figure 2). The Cutty Sark workings and Lake Rosebery are situated approximately 1 km to the north of Robbies Creek.

6.1.2 Local Geology

Assessment of the local setting has been made difficult by the very poor outcrop that exists within this heavily forested area. A small 100m spaced grid has been cut to facilitate geophysical surveying and in addition a 250m spaced grid exists over the whole of Mt. Black. (Figure 3). Mapping along these cut lines has revealed little more than 2-5% outcrop. Within the Mine Lease, EZ Company have drilled eleven surface diamond holes to test the down dip extent of the Rosebery orebodies. The stratigraphy traversed by these drill holes has been extrapolated up dip and along strike to allow a geological interpretation to be constructed in an area immediately south of Robbies Creek (see Figure 4).

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The generalized stratigraphic succession is summarized below. It has been assumed that the volcano-sedimentary sequence is east facing and moderately east dipping although structural data elsewhere within the licence has revealed conflicting results, including west facings, shallow east dips and local overturning.

From west to east (younging to the east) the sequence is:

Thickness(m)	Unit	Comments
40- 60	HOST HORIZON	Quartz sericite carbonate schist, host to the Rosebery ore lenses.
20- 40	ROSEBERY SHALE	Black pyritic shale of uniform 45°E dip.
120-230	HANGING WALL EPICLASTICS	Reworked lithic crystal and vitric crystal tuff.
100-250	ANDESITIC LAVAS AND IGNIMBRITES	Feldspar phyric, complex facies variations. Variably magnetic and pyritic.
100-120	ROBBIES CREEK EPICLASTICS	A mixed sequence of feldspar and quartz phyric epiclastics, mudstones, cherts quartz porphyries.
700-900	DACITIC TO ANDESITIC LAVAS, IGNIMBRITES AND RARE LIMESTONE	Feldspar phyric differentiated series of dacitic to andesitic lava flows with minor ignimbritic development and shallow shelf sedimentation.

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6.1.3 Exploration Completed

The Robbies Creek prospect has been defined by geophysical surveying and tested by diamond drilling. Geophysical work carried out has included:

a) UTEM loops 1020, 24, 23 to detail UTEM anomaly 20A as follows:

Loop 1020 : lines 377000N (Z and X components)
376800N (Z component)

Loop 23 : line 377000N (Z component)
376800N (Z component)

Loop 24 : line 376600N (Z component)
376800N (Z component)
377000N (Z component)
377250N (Z component)
377500N (Z component)

The 10 channel system was used with a base frequency of about 26 HZ.

A plan of the UTEM loop positions is shown in Fig. 5. (Drawing No. LJ50/1062).

b) Sirotem downhole TEM survey, RED 87-1.

c) Detailed ground magnetic survey.

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Detailed geological mapping has been completed together with a compilation of exploration data on the adjacent Mine Lease.

Diamond drill hole RED 87-1 (607m) was completed as a test of the source of the UTEM response on line 377000mN, 150m north of the Mine Lease boundary.

6.1.4 Results

UTEM anomaly 20A (in the vicinity of Robbies Creek) was described in Appendix 1 of the 1986 Mines Department report as being due to a deep conductor. As a result detailing loops were required prior to drilling with their rationale as follows:

Loop 1020 (800 x 500m) (Figs 6-10). The conductor was initially assumed to be shallow dipping and about 200 metres deep, so the transmitter (TX) loop was placed over the anomaly for best coupling. No response was detected so either the conductor is deeper or very steeply dipping. Subsequent modelling showed that a 50° dipping conductor at 375m depth (i.e. the final model) would give a peak to trough amplitude of less than 0.05% (Channel 3) and would thus be undetectable against background noise using this transmitter loop.

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Loop 23 (800 x 800m) (Figs. 11, 12). This was placed to define the strike of the conductor south of 377000mN. The response on Line 377000N at the time of the survey was not thought to indicate an anomaly on the late channels (note change in scale for loop 23), so loop 24 was placed. Loop 23 results are in fact similar to loop 24.

Loop 24 (1600 x 700m) (Figs. 13-17). This loop was used in order the replicate the original anomaly from loop 20 and to extend the survey lines. Positions and sizes of loops 24 and 20 are similar but 24 is longer N-S and 20 wider E-W. Computer modelling using both loops gives very similar responses. However, the important difference is that loop 20 straddles the HEC power line, whereas loop 24 has its far edge along the power line road. The difference in responses of the conductor to these two loops is therefore probably due to the relative inductive effects of the power line on the loops. There is less effect on loop 20 since this loop is symmetrical across the power line. Because of this background effect on the loop 24 results, they have not been primarily used for the quantitative modelling, however an anomaly is evident on lines 377000N, 3765800N and 376600N. This peters out north of 377250N as with loop 20.

Modelling was carried out on line 377000N, loop 20, initially using the UTEM interpretation manual with model curves, and finally using the OZPLTE computer programme originating from University of Toronto.

A shallow weak conductive zone is evident between 379000 and 379100E. This is partly coincident with a gradient array resistivity low and lies just west of Robbies Creek. This low may simply be due to groundwater in and around the creek. Alternatively it could be an expression of the updip extension of the deep UTEM conductor. The glacials east of the creek appear to have little UTEM response but the gradient resistivity shows they are not very conductive (and probably not very thick), although that is hard to determine with available geophysical data.

The drill target was modelled at 375m below surface and dips about 45°E. Significant variations in topography and distances along line could effect the interpretation but this is hard to quantify.

The conductor appeared to be depth limited (about 200m) and appeared to have a conductivity appropriate to Pb/Zn massive sulphides similar to the Rosebery or Hellyer type (i.e. with significant pyrite). Total strike extent is unknown but is at least 700m and open to the south into the Rosebery Mine Lease. Modelling assumed a 1000m strike length.

Magnetics: A detailed ground magnetic survey was carried out with digital proton magnetometers and the profiles are presented on Figure 18. Each profile was modelled and the results indicated in plan. The magnetic source appears to have an almost vertical dip just north of DDH-71R (on 376600N) (contrary to dips from the core). However, going north the dip shallows considerably to about 50°E (similar to the dip in drill hole CS-2). The magnetic body plunges to the north both in respect to ground level and reference level. The magnetic anomaly terminates abruptly by 377300N either due to faulting or a steep plunge (the conductor also terminates before this line). The magnetic source appears to be a wide unit (150-300m) with its top about 150-200m below ground level. It also appears to be depth limited. Note that these magnetic models are only based on a simple tabular model (rectangular cross-section) with remanence, if present, in the direction of the earth's magnetic field. The magnetic profile on Line 377000N indicates a shallow magnetic source in addition to the deep one. No doubt the two are connected, the shallow source perhaps being due to magnetite in veins or disseminations emanating (as an alteration zone) from the deeper source.

A summary of geophysical profiles on line 377000N and an interpretive diagram are shown on Fig. 19. This plan indicates the drill target for DDH RED 87-1.

Diamond Drilling: Diamond drill hole RED 87-1 was drilled to test a UTEM anomaly at AMG co-ordinates 5377000mN 379250mE and depth 375m below surface. A detailed log is presented in Figures 20, 21 and Appendix 1 and summarized below.

0- 44m GLACIAL SCREE
44-505m DACITIC-ANDESITIC LAVAS; feldspar phyric, variably magnetic, often carbonate veined, minor basaltic dykes.

Mineralization:
1) 84.1- 86.7m: bleached weakly pyritic (5%), siderite -chlorite pumiceous tuff.
2) 287.5-287.7m: quartz vein with 3-5% pyrite-chalcopyrite.
3) 294 -296 m: weakly foliated and pyritic (3%) andesitic lava.
4) 385.8-386 m: strongly annealed quartz-carbonate-chlorite-pyrite (3%).
5) 478.5-481.7m: irregular magnetite-pyrite veins and blebs, average 10% py 15% mag. Local concentrations upto 60% mag, 20% py.

505-537m ANNEALED SHEAR ZONE: variably banded, silicified, carbonated with irregular stringers, disseminations of pyrite (upto 80%). Rare disrupted chaotic laminated ?chert.

Mineralization:
529-531m: Stringers (1-6cm) of 5-80% pyrite.

537-546m ANDESITIC LAVA with semi-massive pyrite-magnetite bands

Mineralization:
542-546m: Stringers, plugs (0.5-40cm) of pyrite (20-80%) magnetite (20%) in chloritic zone.
546-569m ANDESITIC LAVA with trace pyrite-carbonate veins.
569-571m FINE BEDDED VOLCANICLASTIC, bleached and carbonated.
571-581m QUARTZ PHYRIC SERICITIZED LAVA.
581-591m BLACK MUDSTONE, finely laminated, minor pyrrhotite.
591-607m FELDSPAR PHYRIC CARBONATED AND SERICITIZED LAVA. (volcaniclastic ?) fig 20
EOH

Assay results have been returned but no economic grades were reported: the only values of interest are:

1) 84.1-85.4m @ 0.16ppm Au in weakly pyritic unwelded vitric tuff.

2) 584.0-590.5m @ 0.2% Zn in weakly pyrrhotitic black mudstone.

Several points of interest have arisen from the geological and petrological work on this drill hole:

1) The hole was terminated in a weakly altered zone of epiclastics and sediments that correlate along strike to the south with lithologies intersected in EZ drill holes.

2) This epiclastic horizon has been a focus of later deformation that has introduced additional fluids and produced severe carbonate-sericite alteration. Pyritic sulphide and magnetite has been later introduced and coalesced as irregular blebs, veinlets and stringers.

3) Subsequent to this phase of epiclastic development, massive outpourings of lava ensued. Compositionally a broad transition from intermediate to acid/intermediate is observed and it is inferred that these lava flows were predominantly subaqueous. Evidence for this has been obtained from petrological work indicating the presence of thin altered epiclastic or sediment horizons in between the massive lavas.

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Drill-hole Sirotem

A downhole TEM survey of RED 87-1 was attempted, but unfortunately the hole had not been cased beneath the glacials and it collapsed at 210m despite strenuous efforts to clear it.

The downhole Sirotem profile is shown in Figure 22, and indicates no in-hole or off-hole conductor down that portion of the hole surveyed. The UTEM source was modelled to be intersected at a downhole depth of about 460m, much further than the downhole TEM probe could go.

From about 480 to 550 metres veins of pyrite and magnetite occurred in the andesites. These would appear to be the source of the UTEM and magnetic anomalies. To confirm that assumption physical property tests were done on sections of core and the results are attached. (Appendix 3).

These measurements indicate that the pyrite-magnetite veins are conductive and highly magnetic and are the probable source of the geophysical anomalies.

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6.1.5 Conclusions & Recommendations

In terms of economic potential, the lack of anomalous base/precious metal geochemistry recorded in the mineralization in diamond drill hole RED 87-1, together with the likely epigenetic mode, does not auger well for additional potential. The host epiclastic/sediment unit is altered and contains laminated siliceous ?exhalites and black graphitic mudstones. As such it may be indicative of a reducing paleo environment in a sub basinal setting, in which case a favourable site for massive sulphide development is evident. Against this argument is the fact that no UTEM anomalies were recorded along strike to the north of RED 87-1. A northerly plunge of the UTEM was originally proposed by N. Hungerford and agrees with geological reasoning put forth by G. Purvis at Bastyan Dam. It is therefore conceivable that massive sulphide development could occur down plunge from RED 87-1 below the effective penetration limit of UTEM i.e. greater than 400m.

While it is difficult to negate this argument, it is considered that additional favourable characteristics of the area (e.g. anomalous geochemistry) would be required to recommend additional work.

It is therefore proposed that no further exploration be carried out in the Robbies Creek area.

6.2 CUTTY SARK

6.2.1 Location

The Cutty Sark area takes in the volcanics lying between the northern boundaries of the Rosebery Mine Lease and the EL (see Fig. 2).

6.2.2 Local Geology and Intended Exploration

The Rosebery Mine Host Rocks strike northwards through the Cutty Sark area, but a northerly plunge of less than 35° has taken the prospective rocks down to depths in excess of 500m below surface.

A new, separate sub-basin containing massive sulphide is indicated to occur within the Host Rock horizon in the vicinity of the northern boundary of EL 1/62. This conclusion is based on the presence of large massive sulphide boulders and lenses within volcaniclastics now under Lake Rosebery. The likely position of this massive sulphide body is down-plunge to the north, as this is the local direction of Cambrian sedimentary transport. Drilling of this target within EL 1/62 is impossible due to the proximity of the Bastyan Dam.

A major anticlinal axis coincides with the Host Rock position immediately east of the Bastyan Dam. The Cutty Sark area is predominantly covered by the quartz-phyric reworked volcaniclastics of the Rosebery deposit hangingwall sequence which comprises the west and east limbs of the fold.

Getty drillholes CS1 and CS2 intersected the hangingwall volcaniclastics on the eastern limb of the anticline. Neither hole reached the Host Rock position near the anticlinal axis. It was decided to try and extend hole CS1, which is still open, the 200m necessary to pass through the Host Rock position.

6.2.3 Results

Hole CS1 is 451.4m long and is cased to bottom with 44mm ID plastic casing. In examining the feasibility of extending the hole, it became apparent that this plastic casing posed a major problem as it is extremely difficult and expensive to drill out. (This involves using a tungsten-carbide milling bit and is generally slower than normal coring. At any stage the operation could fail or costs escalate substantially, if the reamer deflected from the old hole).

The casing cannot be pulled out of the hole as the top 7m is in clay and boulder scree that has since closed in around it. There is a major caving fault zone in the hole at 175-180.2m which has undoubtably closed in around the casing also.

Quotes from the preferred drill contractor gave a minimum estimate of $11,500 merely to re-open the hole to bottom. To complete the hole extension was estimated at $22,000, giving a total of around $34,000 - $10,000 over the budgetted figure.

Balancing the costs and difficulties against the geological rationale for extending the hole, it was decided to abandon the idea of extending CS1.

6.3 SOUTH HERCULES

6.3.1 Location

South Hercules comprises the area between the southern boundary of the Mine Lease and the southern boundary of EL 1/62 (see Fig. 2).

6.3.2 Local Geology

The South Hercules area is divided by a major angular unconformity into a western volcano-sedimentary sequence (the White Spur Formation), and an eastern altered felsic volcanic sequence. This latter is an east dipping and facing tripartite sequence, broadly comprising in stratigraphic order:

HERCULES HANGINGWALL SEQUENCE	Dacitic and rhyolitic lavas. Feldspar and quartz-phyric volcaniclastics some reworked with tuffaceous sediment lenses. Tuffaceous siltstone-shale.
HERCULES HOST ROCKS (70m thick)	Feldspar crystal tuff. Cherty tuffaceous sediments with carbonate nodules. Reworked feldspar-phyric volcaniclastics.
HERCULES FOOTWALL SEQUENCE	Tuffaceous sediments and reworked felsic volcaniclastics Feldspar-phyric pumiceous volcaniclastic (ignimbrite?)

The Footwall Sequence is very strongly silicified, sericitised, carbonatised and bleached. The rocks have been deformed to quartz-augen and quartz-sericite schists, and are generally pyritic.

The Host Rocks are also strongly sericitised, carbonatised, bleached and schistose, with characteristic carbonate nodules. The Host Rocks contain disseminated pyrite with lesser sphalerite and galena

(sulphides typically average 1-3% with zones up to 10%), as well as gold and silver values.

At Dunns Shaft, 300m north of the EL boundary, EZ have recently outlined within the Host Rocks 565,000 tonnes of stratiform mineralization grading 2.3g/t Au, 127g/t Ag, 1.6% Pb and 2.7% Zn. The mineralization occurs in highly altered cherty tuffaceous sediments containing an average of about 7-10% sulphides (py, sp, gn), mainly disseminated but also as thin bands of semi-massive sulphides.

The Hangingwall Sequence comprises variable felsic volcanics which are only weakly to moderately altered compared to the units lower in the stratigraphy. As at Rosebery, the Hangingwall rocks mark the appearance of quartz-phyric volcanics in the sequence. They contain small zones of sulphide mineralization associated with local areas of stronger alteration.

The sedimentary White Spur Formation to the west of the volcanics largely comprises volcanic detritus derived from the volcanic belt to the east. Sediments range from grey and black shales, through tuffaceous silt-stones and sandstones, to crystal tuffs (generally quartz and feldspar-phyric); to coarser volcaniclastics and lithic breccias - possibly deposited as submarine mass flows. Alteration is generally weak. There are

localised patches of stronger sericitisation and silicification associated with minor occurrences of disseminated and vein pyrite-galena-sphalerite.

A major south-plunging anticline with its axis in the Footwall Sequence limits the southern extent of the Host Rocks (see Fig. 23). On surface the fold nose is less than 200m south of the ML boundary. The angle of plunge on the fold is not known but other folds in the Hercules area have plunges in the range of 10°-30°, so the Host Rocks probably extend sub-surface down the fold nose for a considerable distance south of their outcrop.

On the eastern limb of the anticline, the Host Rocks dip east at 50° beneath the Hangingwall Sequence.

The Host Rocks are not present on the western side of the anticline as they are cut aff by the angular unconformity which divides the volcanics from the White Spur Formation. The anticlinal axis is only about 50m east and parallel to the unconformity. The White Spur Formation faces west and overlies the volcanics to the east.

6.3.3 Exploration Completed

In January-February 1986 EZ drilled two holes near the southern end of the Host Rocks outcrop. Hole H1103 was put down right on the Mine Lease southern boundary and H1102 was put in 85m further north.

In H1103 the altered Footwall rocks contained up to 0.73g/t Au over 2m (part of a 12m intersection averaging 0.23g/t Au, with no associated Pb, Zn or Ag). In H1102 the maximum gold value was 0.25g/t Au over 3m in the upper part of the Footwall rocks, but there was an intersection of 21m @ 0.21% Pb, 0.52% Zn, 8g/t Ag, in the Host Rocks.

While the results from holes H1102 and H1103 did not give much encouragement that the Host Rocks within the EL would contain a stratiform gold body, it was considered that some potential for such a body did exist. As indicated by the grade of the body EZ have located on the Mine Lease, such stratiform gold mineralization could only be mined by opencut methods.

It was therefore decided to put in a shallow hole 120m south of H1103, close to the anticlinal fold nose. This hole, RED 87-9, was completed at 180.7m on 31st October 1987.

035

6.3.4 Results

The log of hole RED 87-9 appears in Appendix 4 and the geological section appears in Fig. 24. The hole was logged by C. Belcher, a temporary contract geologist from NSW.

The hole encountered the anticipated cherty tuffaceous Host Rock and altered volcaniclastic Footwall Sequence. The rocks are pyritic but do not contain any significant precious metal or basemetal mineralization (see sample values attached to drill log).

6.3.5 Conclusions & Recommendations

The disappointing results from hole RED 87-9 effectively end any hope for an economic body of open-cuttable stratiform gold mineralization within the Hercules Host Rocks on EL 1/62.

Any further potential in this area centres on the possibilities for massive sulphides at depth within the down-dip extensions of the Hercules Host Rocks. In 1986 Shell used a Sirotem survey to search for this target with negative results. Further exploration for buried massive sulphides would now appear to be only feasible for EZ, who hold the bulk of the Hercules system.

APPENDIX 1

Diamond Drill Log RED 87-1

SHLMET SYSTEM
METRIC
DECIMAL POINTS AS REQUIRED

The Shell Company of Australia Limited
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DRILL LOG SHEET

HEADING SHEET

0338

COLLAR INFORMATION	DATA TYPE	COLLAR CO-ORDINATES EASTING	NORTHING	ELEVATION	COLLAR SURVEY AZIMUTH	DIP	HOLE NAME	TOTAL DEPTH	HOLE TYPE	DESC CODE	REMARKS
		379481	377000		253	70	RED87-1	607.5			

PROJECT ROSEBERY EAST	HOLE NAME RED 87-1
LOGGED BY J. Randell	TOTAL DEPTH 607.5m
CONTRACTOR LONGYEAR	RIG LY44
CREW W. Andrews	DATE STARTED 2/4/87 FINISHED 11/5/87
CORE STORAGE: Nº OF TRAYS 94; LOCATION Devonport	SAMPLE STORAGE: Devonport
M&P LAB Geochempet	ASSAY LAB Comlabs

DESC.	SIZE	FROM	TO	TOTAL	REMARKS
NON CORE	6"	0	43.5	43.5	
CORE	HQ	43.5	99.0	46.5	
	NQ	99.0	607.5		
	BQ				
CASING					
CASING LEFT	HW	0	43.5	STEEL	(S) steel (P) plastic

SURVEY INFORMATION

DISTANCE FROM COLLAR TO TOP	TO BOTTOM	AZIMUTH	DIP	DEPTH	AZIMUTH	DIP
0		253	70	412	253	51
66		258	65	462	254	49
96		259	64.5	500	254	45
152		258	62	551	252	43
185		259	61	607	250	40
212		257	60.5			
263		256	58.8			
314		255	55.8			
360		253	53.10			

PLOTTING KEY

SYMBOL DESC. CODE	SYMBOL G/LOG	INTERVAL FROM	INTERVAL TO	SYMBOL DESC. CODE	SYMBOL G/LOG	INTERVAL FROM	INTERVAL TO

ASSAY INFORMATION

DISTANCE FROM COLLAR TO TOP	TO BOTTOM	SAMPLE Nº	CORE ANGLE	ROCK TYPE	DIAM	DESC CODE	GRAPHIC LOG	MAG SUSC.	DESCRIPTIVE LOG
									0 – 43.5 // GLACIAL SCREE, SANDS, BOULDERS
0								0	Minor weathered andesitic lavas.
43.5	90.0								// GREY FELDSPAR PHYRIC WEATHERED DACITIC LAVA Variably feldspar phyric (medium grained) porphyritic to aphyric moderately fractured. Numerous zones from 47-47.5m. Layering @ 30°LCA.
52	52.2							10	Strongly amygdaloidal (quartz filled vesicles), some preferred orientation 40° LCA
52.4	54.0								Broken elongate angular clasts of lava in a finer pumiceous matrix. 5-7% lithics
								5	chloritic vesicles Probable flow top.
57	57.5							0	Weakly vesicular
57.5	61.3								Massive very fine feldspar porphyroblastic.
61.3	61.4								Large clast of medium chloritic pumice at 30°LCA.
62.4	62.6								Irregular medium to coarse chloritic + feldspathic pumiceous grains.
65.7	66.0							5	Thick 15cm quartz-chlorite veins 70°LCA and minor coarse amygdales.

DRILLING OBJECTIVES / SUMMARY: Test UTEM conductor (No. 20A) at Robbins Creek. Target is located at AM6 377=20N 379240E at depth below surface of 375 metres. Hole is to test stringer and bands of pyrite-magnetite mineralization within strongly altered deformed shear zone.

REPORT REFERENCE:

SHEET 1 OF 13

8370338

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DRILL LOG SHEET

CONTINUATION SHEET

PROJECT	ROSEBERY EAST	HOLE NAME	RED 87-1
LOGGED BY	J. Randell.	TOTAL DEPTH	607m

ASSAY INFORMATION

DISTANCE FROM COLLAR TO TOP	TO BOTTOM	Cu	Zn	Ag	Au	Pb	As	Ba	Sn	W	SAMPLE NO	CORE ANGLE	ROCK TYPE	DIAM	DESC CODE	GRAPHIC LOG	MAG SUSC.	DESCRIPTIVE LOG
84.1	85.4	5	14	1	0.16	4	1	2270	4	10								66-67.6 Coarsely amygdaloidal (feldspar dol.) 68.8-70.1 Very broken core, moderately chloritic, probable shear. 70.5-74.0. Very broken, some slickensiding 73.3-73.7. Cobra subrounded alkaline basalt, bleached very fine. Thin quartz veinlets at 85° LCA.
85.4	86.0	4	9	2	0.02	4	1	3300	6	10								
86.0	86.7	4	7	1	0.03	<4	1	0400	<4	10								
90.7	91.3	18	40	2	0.02	150	2	2280	10	10								
91.3	92.2	144	80	1	0.02	90	4	2500	<4	10								
92.2	93.0	4	60	1	<0.01	12	12	2400	4	10								
93.0	94.0	8	14	<1	0.01	4	9	1150	<4	10							0	76.6-77 Fine chloritic spotting. 78.0-78.6 Moderate fracturing, fine chlorite in fill. Crude chloritic layering at 45° LCA.
																	0	78.9-84.1. Generally bleached massive lava with 5-10cm zones of medium chloritic spotting
																		84.1-85.4. Bleached massive lava with thin chlorite-pyrite layers. 50° LCA ex pumiceous tuff. At 84.1, 3cm 20% py.
																	0	At 85.2 thin contorted chlorite sericite pyrite (S1) layers.
																	5	85.4-86.7. Massive bleached dacitic lava with thin 1-4mm quartz-pyrite veinlets
																		86.0-89.5 Strongly broken core. Some vuggy quartz veins.
																		90.0-93.0 // MIXED DACITIC-RHYODACITIC LAVA AND UNWELDED PUMICEOUS TUFF. Contact 45° LCA
																		90.0-90.5. Fine chloritic unit, massive with minor lithophytic blebs
																	0	90.5-90.8. Crudely layered (45° LCA) with fine pumiceous patches and carb. vns.
																		90.8-92.3. Weakly brecciated massive lava. Lower 45cms. strongly carbonate veined stockwork. Fine pyrite 3% throughout.
																T.S.		92.3-93.0. Moderately layered 45° LCA strongly sericitised with thin 0.5-1cm long chloritic wisps.
																92.4		
																	5	93.0-96.3 // PINK SILICEOUS RHYODACITIC LAVA
																		93.0-96.3. Massive siliceous pink feldspar porphyritic lava. Small zone of strongly chloritic coarse feldspar layers at 93.8, 94.1, 95.2, 95.4. Lower contact 45° LCA
																T.S. 98.8		96.3-101.6 // FELDSPAR PHYRIC SHEARED DACITIC LAVA. Medium to coarse feldspar porphyroblasts in fine grey green matrix. Layering pink

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CONTINUATION SHEET

PROJECT	ROSEBERY EAST	HOLE NAME	RED 87-1
LOGGED BY	J. Randell.	TOTAL DEPTH	607m

DISTANCE FROM COLLAR TO TOP	TO BOTTOM	SAMPLE NO	CORE ANGLE	ROCK TYPE	DIAM	DESC CODE	GRAPHIC LOG	MAG SUSC.	DESCRIPTIVE LOG
									regular and consistently 45-50° LCA. From 101.0, bands of massive siliceous lava with pink coloration. Feldspar rare, common fine chloritic seams.
									101.6-105.7 // MASSIVE DACITIC-RHYODACITIC SILICEOUS LAVA
								25	103.0-103.4. More basic, strongly broken. Contact sharp but obscured.
									103.4-104.3. Massive quartz veined broken pink rhyolitic lava.
								35-45	104.3-104.7. Dark green quartz veined massive basic dyke. Lower contact 65° LCA.
									104.7-105.7. Massive siliceous quartz veined rhyolitic lava, strongly broken.
									105.7-115.5 // MASSIVE ANDESITIC LAVA
									Upper contact 25° LCA
								400-900	Massive dark green-pink sandy feldspar phyric for 6.5-1cm quartz chlorite vein. Generally uniform throughout
									115.5-117.5 // MASSIVE QUARTZ VEINED DACITIC LAVA
								5-10	Gradational contact with units above and below. Some crackle veining. Some more andesitic zones
									117.5-136.3 // MASSIVE ANDESITIC LAVA WITH FINE FELDSPAR PORPHYROBLASTS.
								5-20 rare 60	Generally massive with fine thin quartz veins. Zone of brecciation and more intense quartz veining at 125.0-125.2. Poorly magnetic although minor zones of high susceptibility.
								10-30	128.1-128.5. Vague layering defined by slightly elongate feldspar porphyroblasts. Layering at 45° LCA.
								30-40	128.5-130.2. Irregular feldspar phyric sections with some brecciation and quartz veining.
									136.3-139.0 // MASSIVE FINE SILICEOUS DACITIC LAVA.
								20-40	Massive green pink lava with minor competent

ASSAY INFORMATION

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PROJECT	ROSEBERY EAST	HOLE NAME	RED 87-1
LOGGED BY	J. Randell.	TOTAL DEPTH	607m

ASSAY INFORMATION

DISTANCE FROM COLLAR: TO TOP | TO BOTTOM

SAMPLE Nº | CORE ANGLE | ROCK TYPE | DIAM | DESC CODE | GRAPHIC LOG

MAG. SUSC.	DESCRIPTIVE LOG
	banding defined by chloritic wisps 40° LCA. gradational contacts top + bottom.
	139.0 - 149.1 // MASSIVE PINK RHYOLITIC LAVA
5.	Rare weak compositional layering 60° LCA. but generally uniform pink and massive with minor quartz veining.
	149.1 - 151.3 // FELDSPAR PHYRIC DACITIC TUFF/ LAVA.
0	Very crude and irregular layering, now siliceous with medium to coarse feldspar porphyroblasts. Layering at low angle LCA. Some chlorite-pyrite layering. Also few thick quartz - carbonate - chlorite veins.
	151.3 - 163.4 // MASSIVE PINK RHYOLITE LAVA
	Fine weak quartz veining. Vague patchy feldspar phyric zones.
50	158.6 - 159. Greenish but still siliceous massive.
200 - 400	161.4 - 163.4. As above, sharp lower contact.
	163.4 - 167.9 // SILICEOUS GREY GREEN DACITIC LAVA WITH THIN CHLORITIZED ARENACEOUS AND FINE VITRO - CLASTIC SEDIMENT.
30-60	
	Two recrystallized green chloritic tuff bands at 163.4/164.6 Graded bedding indicates downhole facing. At 164.6, sharp contact with overlying dacite. Irregular wavy contact at 45° 165.2 - 166.4. Grey crudely layered feldspar phyric rock with weakly chloritic bands, some brecciated siliceous zones. Layering 50° LCA. Elongate angular xenoliths.
T.S. 1645	
T.S. 165.2	
	167.9 - 171.4 // PINK FELDSPAR PHYRIC RHYODACITIC LAVA
30-50	
	Generally crackle veined with spotted feldspar
	171.4 - 204.3 // PINK GREEN MASSIVE DACITIC - ANDESITIC LAVA
100 - 700	
	Top contact 50° LCA, andesitic towards top. Generally uniform with few thin andesitic bands. Footwall contact sharp 30-50° LCA. Post dykes.

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SHLMET SYSTEM
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METALS DIVISION

DRILL LOG SHEET

CONTINUATION SHEET

PROJECT	ROSEBERY EAST	HOLE NAME	RED 87-1
LOGGED BY	J. Randell.	TOTAL DEPTH	607m

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DISTANCE FROM COLLAR TO TOP	TO BOTTOM	Cu	Zn	Ag	Au	Pb	As	Ba	Sn	W	SAMPLE NO	CORE ANGLE	ROCK TYPE	DIAM	DESC CODE	GRAPHIC LOG	MAG. SUSC.	DESCRIPTIVE LOG
211·9	212·9	4	40	<1	0·01	20	8	540	6	10								Thin irregular quartz patches and veinlets.
212·9	213·9	5	24	1	<0·01	14	<2	650	6	10								204·3 - 206·3 // PINK GREY FELDSPAR PHYRIC DACITE
213·9	215·6	4	30	1	0·03	10	7	600	4	10							0-10	Vaguely layered (45° LCA) generally massive. 206·2 - 5cm breccia zone.
																		206·3 - 211·9 // GREY DACITIC LAVA WITH GRADATIONAL ZONES OF STRETCHED FELDSPAR PHENOS.
																	20-40	Some fine feldspar laths in fine matrix. Dominantly grey feldspar phyric weakly carbonate veined, lavalar lava.
																		211·9 - 214·6 // SHEARED DACITIC LAVA
																T.S. 217	10	Broken but sharp upper contact, sharp lower contact 45°. Strongly sheared (45° LCA), strong carbonate veining, moderately broken / wavy cumulation. Fine f.g. pyrite disseminated.
																	20	
																		214·6 - 219·5 // PINK GREEN DACITIC - ANDESITIC LAVA
																	0-20	Generally massive silicified, chloritised and wk carbonate veining. Lower contact diffuse.
																		219·5 - 223·3 // MASSIVE DARK GREEN ANDESITE.
																	60-300	Massive uniform textured weakly carbonate veined, small 10cm breccia zone at 222·0. 15cm carbonate chlorite vein at 220·15. Contact at 40° LCA.
																		223·3 - 232·5 // MASSIVE PINK GREEN DACITIC - ANDESITIC LAVA
																	400-850	Massive weakly carbonate veined feldspar phyric. Uniform composition.
																		232·5 - 233·1 // DARK GREEN BASALTIC VOLCANIC
																	20-75	Sharp upper contact, carbonate veined (50° LCA) but gradational lower contact. Fine grained massive but gradational composition change towards bottom.
																		233·1 - 241·5 // PINK SILICEOUS DACITE - RHYODACITE.
																	30-200	Gradational contacts top + bottom. Becoming more

ASSAY INFORMATION

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CONTINUATION SHEET

SHEET SYSTEM
METRIC

DECIMAL POINTS AS REQUIRED

PROJECT	Roseberry EMT	HOLE NAME	RED 87-1
LOGGED BY	T. Kendall	TOTAL DEPTH	607m

DISTANCE FROM COLLAR		Cu	Zn	Pb	Ag	Au	Ba	Sr	W	Bi	As	SAMPLE No	CORE ANGLE	MOCK TYPE	DIAM	ROCK DESC	GRAPHIC LOG	Mnfr Syst.	DESCRIPTIVE LOG
TO TOP	TO BOTTOM															CODE			
0	2864.5																		Assd of 237.6. Weakly carbonate veind.
2864.5	2887.5	44	36	<4	6	0.01	6460	<4	15										
2887.5	2889.0	1750	75	28	<1	<0.01	5610	<4	10										
2889.0	2890.0	20	38	<4	<1	0.01	9550	<4	10										
2890.0	2891.0	9	30	4	1	0.01	7550	6	10										
2891.0	2892.0	1850	50	<4	1	0.03	8550	4	10										Highly phren. fine grain calcite blebs.
2892.0	2893.0	10	60	<4	1	0.03	6520	4	10										Heavily pyrite - carbonate veinlet.
2893.0	2894.0	12	48	<4	1	0.02	9520	6	10										Local complex 50°LCA
2894.0	2895.0	80	40	8	<1	0.02	6520	8	10										261.0 - 262.5 // FELDSPAR PHYRIC ALTERED
2895.0	2896.0	28	46	16	1	0.01	7520	18	10										DACITIC LAVA
2896.0	2897.0	8	48	<4	1	<0.01	4540	4	10										
2897.0	2901.0																		Trace pyrite throughout. Some alteration - patchy silica & kaolinite matrix.
																			262.5 - 270.3 // MASSIVE SILICEOUS RHYOLITE LAVA
																			Weak pyrite + calcite veining (clear, massive) with red bands. Local contact/structural over 30cm.
																			270.3 - 309.3 // MASSIVE GREEN FELSPAR PHYRIC ANDESITIC LAVA
																			Upper 40cm. Bleached, fgrained weak calcitic basic zone.
																			Minor patchy pink spun carbonate-quartz veins. Trace fine blebby pyrite. Vague texturing (50°LCA) defined by band alignment of clasts.
																			Thin calcite-quartz veins. Trace blebby pyrite. (50°LCA)
																			287.5 - 287.7. Low angle 10° LCA quartz vein
																			Weak 2-5% chlorite cpy py
																			287.1 - 287.4. Carbonate vein.
																			289.5 - 293.5. Mod. carbonate veining
																			294 - 296. Thin pyrite weakly aligned veins
																			Calcite. 1-2%.
																			300.4 - 305.3. Trending fine to medium calcite carbonates
																			305.3 - 305.7. Carbonate quartz-calcite vein (carbonate)
																			305.7 - 309.3. Dacitic composition.
																			309.3 - 323.5 // MOTTLED RED & GREEN DACITIC
																			ANDESITIC LAVA.
																			Minor carbonate veining, non silicious. Trace fine pyrite disseminated throughout and as fracture planes.
																			323.5 - 346.8 // COARSE FELDSPAR PHYRIC ANDESITIC LAVA.
																			Plan banded, minor pink felsic phenocrysts

ASSY INFORMATION

SHEET No. 12

837043

SHLMET SYSTEM
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The Shell Company of Australia Limited
METALS DIVISION

DRILL LOG SHEET

CONTINUATION SHEET

PROJECT	ROSEBERY EAST	HOLE NAME	RED87-1
LOGGED BY	J. Randell	TOTAL DEPTH	607m

ASSAY INFORMATION

DISTANCE FROM COLLAR TO TOP	DISTANCE FROM COLLAR TO BOTTOM	SAMPLE NO	CORE ANGLE	ROCK TYPE	DESC CODE	GRAPHIC LOG	MAG SUSC.	DESCRIPTIVE LOG
								323.5 - 323.8. Strong quartz veining, 10 cm brecciation at 45° to CA.
								325.2 - 325.4. 80% milky quartz 20% chlorite breccia. Trace to rare pyrite dissemination.
							0-40	From 332m, more irregular feldspar patches, more chloritic, weak flow banding.
								346.8 - 353.5 // FINE GRAINED MASSIVE BASALTIC DYKE.
								Sharp contact 45° LCA
							20-30	Minor feldspar porphyro blasts. Medium carbonate veining. Towards bottom, few sub rounded (2-0.8cm) ? vesicles, infilled with quartz-chlorite. 2-5% fg cpy galsph. in small 0.5cm carbonate vein at 349.6m.
								Sharp lower contact 50° LCA.
								353.5 - 362.5 // MASSIVE FELDSPAR PHYRIC ANDESITIC LAVA
							10-20	Coarse feldspar phyric lava with chloritized feldspar. No flow banding. Minor carbonate veining.
								362.5 - 371.6 // FINE BASALTIC ?FLOW
							40-60	Sharp upper contact 50° LCA. Coarsening grain size towards bottom. Thick carbonate vein at 370.8m. (5cm 55° LCA). Gradational contact.
								371.6 - 386.8 // MEDIUM FELDSPAR PHYRIC DACITIC - ANDESITIC LAVA.
							10-20	Medium to coarse feldspar phyric, showing silicious and chlorite 376 & 378. Broken core from 374.5 - 377.
								From 378, pyrite silicified + chlorite, finer grained minor flow banding.
								385.8 - 386.0 Strong deformational banding quartz - carbonate - chlorite - pyrite (1-3%) Banding at 60° LCA.
							0-20	Minor fine to medium pyrite dissemination towards bottom. Gradational contact.
								386.8 - 390.3 // MASSIVE SILICIFIED DACITIC LAVA
								Grey silicified with fine to medium chloritic embedded feldspar. Gradational contacts. Vague flow banding 45° LCA.

SHLMET SYSTEM
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The Shell Company of Australia Limited
METALS DIVISION

DRILL LOG SHEET

CONTINUATION SHEET

PROJECT	ROSEBERY EAST	HOLE NAME	RED 87-1
LOGGED BY	J. Rendell.	TOTAL DEPTH	607m

DISTANCE FROM COLLAR TO TOP	TO BOTTOM	Cu	Zn	Ag	Au	Pb	As	Ba	Sn	W	SAMPLE NO	CORE ANGLE	ROCK TYPE	DIAM	DESC CODE	GRAPHIC LOG	MAG. SUSC.	DESCRIPTIVE LOG
401·0	402·0	5	46	<1	<0·01	8	2	40	8	10								390·3 – 397·4 // FINE FELDSPAR PHYRIC ANDESITIC LAVA.
402·0	403·0	6	48	<1	0·01	6	5	720	12	10							20–	
403·0	404·0	3	50	1	0·01	12	5	520	8	10							100	Massive fine – medium grained, weak carbonate veinlets. Minor fine pyrite dissemination in chloritic matrix.
404·0	405·0	3	38	<1	<0·01	<4	3	570	6	10								
405·0	406·0	7	44	<1	<0·01	8	6	450	12	10								397·4 – 407·8 // SILICIFIED MASSIVE DACITIC LAVA
406·0	407·0	7	60	<1	<0·01	<4	7	600	6	10							2000	
407·0	408·0	10	42	1	<0·01	<4	10	800	10	10							–6000	Gradational contacts. Silicified weak fine – medium feldspar phenocrysts.
																		402·3 – 402·5. Carbonate – chlorite vein, irregular diffuse contacts. Poor bonding 70° CA.
																		406·0. 10cm carbonate – chlorite – pyrite shear 45° LCA.
																		401·6. 1cm chlorite – 20% pyrite shear.
																		407·8 – 408·8 // GREY STRONGLY FELDSPATHIC ANDESITIC LAVA.
																	20–	
																	100	Gradational contacts, decreasing chlorite, minor silicification, moderate carbonate veining.
																		408·8 – 415·0 // MASSIVE GREY ANDESITIC LAVA
																	300–	Massive fine to medium feldspar phyric unit, thin chloritic veinlets and minor carbonate – chlorite breccia.
																	800	
																		415·0 – 436·2 // GREY/PINK SILICIFIED DACITIC TO ANDESITIC LAVA.
																		Patchy pink feldspar in green andesitic matrix. Minor carbonate veining.
																	200	Shear Zone: 421·3 – 424. Moderately to strongly broken core, some slickensiding.
																	400	
																		436·2 – 443·8 // GREY MASSIVE ANDESITIC LAVA
																	50–	Gradational contacts. Diffuse compositional change, may be texture only silicification. More mafic towards bottom, less silicification.
																	200	
																	1000–	From 441·3, chlorite bearing breccia with carbonate fragments often rounded. Rare pyrite blebs vaguely layered 45° LCA. Bottom 12cms, carbonate – chlorite breccia. Sharp contact 75° LCA.
																	5000	

ASSAY INFORMATION

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BA5

83704S

SHLMET SYSTEM
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DRILL LOG SHEET

CONTINUATION SHEET

PROJECT	ROSEBERY EAST	HOLE NAME	RED 87-1
LOGGED BY	J. Randell.	TOTAL DEPTH	607m

DISTANCE FROM COLLAR TO TOP	TO BOTTOM	Cu	Zn	Ag	Au	Pb	As	Ba	Sn	W	SAMPLE No	CORE ANGLE	ROCK TYPE	DIAM	DESC CODE	GRAPHIC LOG	MAG SUSC.	DESCRIPTIVE LOG
458·4	460·0	10	32	<1	<0·01	<4		9	790	14	10							443·8 - 445·0 // SHEARED FELDSPATHIC DACITE WITH INTERBEDDED SERICITIZED SILTSTONE.
460·0	461·4	14	28	<1	<0·01	<4		9	730	8	15					T.S. 443·9		
461·4	463·0	6	26	<1	<0·01	4		5	630	8	10							Bleached feldspathic well layered (sheared) lava - good alignment of chlorite clasts. Small included chlorite zones.
463·0	464·5	30	26	<1	<0·01	<4		4	900	6	10							
464·5	466·0	6	34	1	<0·01	6		6	650	10	10							445·0 - 455·4 // MASSIVE PINK GREEN COARSELY FELDSPAR PHYRIC ANDESITIC LAVA
466·0	467·5	75	28	<1	<0·01	4		7	640	12	10							
467·5	469·0	24	28	<1	<0·01	<4		4	590	6	25							
469·0	470·5	30	18	<1	<0·01	<4		6	740	12	10							
470·5	472·0	34	20	<1	0·01	<4		5	700	12	15							
472·0	473·5	28	24	<1	0·01	<4		5	690	8	10							
473·5	475·0	65	30	<1	<0·01	10		<2	680	14	10							
477·5	478·5	9	22	<1	<0·01	4		<2	660	18	10							
478·5	479·5	12	34	<1	<0·01	24		14	540	80	135							
479·5	480·5	12	26	<1	0·01	10		14	650	90	135							
480·5	481·7	5	30	<1	<0·01	<2		9	670	90	135							
																	15-800	Gradational change to clotted massive lava of andesitic composition. Coarsely feldspar phyric, minor thin carbonate veinlets.
																		From 452·6, lava more pink and appr coarsening dacitic composition. Towards bottom, has breccia
																	30-600	appearance - angular clasts to subrounded chloritic - magnetite clasts in pink feldspathic matrix. Suspect this is pseudo-breccia, actually chloritized feldspar.
																		Lower contact sharp 45° LCA.
																		455·4 - 488·4 // GREY MOTTLED ANDESITIC LAVA WITH TRACE PYRITE AND
																	20-30	MAGNETITE BLEBS.
																		Vaguely layered grey green unit from chloritic clasts and veinlets. Thin irregular chlorite veinlets, rare carbonate. Variable texture from patchy feldspar bleached to dark green massive.
																	20-40	458·4 - 461·4 Trace to 2% disem. py.
																		461·4 - 466·8 Rare pyrite disseminated + clots, rare Chalcopyrite.
																	400-700	466·8 - 471·0 Rare to trace pyrite dissemination + blebs associated with irregular angular magnetite clasts.
																	up to 8000	478·5 - 481·7 Irregularly distributed magnetite pyrite veins and blebs average 1% py 15% mag. and local concentrations up to 60% mag 20% py., often in breccia zone. Matrix is fine grained massive carbonate.
																	1500-3000	482 - 488·4 Very strongly silicified, massive dark grey green, few carbonate veinlets.

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PROJECT	ROSEBERY EAST	HOLE NAME	RED 87-1
LOGGED BY	J. Randell	TOTAL DEPTH	607m

DISTANCE FROM COLLAR TO TOP	TO BOTTOM	Cu	Zn	Ag	Au	Pb	As	Ba	Sn	W	SAMPLE NO	CORE ANGLE	ROCK TYPE	DIAM	DESC CODE	GRAPHIC LOG	MINS SYSC.	DESCRIPTIVE LOG
																		487.4 - 504.5 // TOTALLY SILICIFIED BROKEN ANDESITIC LAVA
504.5	505.5	4	85	<1	0.01	4	<4	580	4	10								
505.5	506.5	4	90	<1	<0.01	4	<4	580	6	10								
506.5	507.5	4	85	1	<0.01	4	<4	2650	16	25							20-	
507.5	508.5	4	100	<1	<0.01	14	<4	5650	14	20							90	Gradational contact. Upper 1.8m is chloritic-carbonate patchy with irregular
508.5	509.5	5	55	<1	<0.01	<4	<4	8450	16	15								
509.5	510.5	130	40	<1	<0.01	8	<4	3400	4	10								quartz patches. May be fracture zone.
510.5	511.5	10	38	<1	0.01	4	<4	8700	8	10								Thin alternating dark green/red
511.5	512.5	10	36	<1	<0.01	4	<4	7400	4	10							30-	complexly silicified andesite, rhyolitic appearance.
512.5	513.5	12	30	<1	<0.01	4	<4	5450	4	10							300	Strongly broken core throughout.
513.5	514.2	5	60	<1	<0.01	<4	<4	3000	12	10								495 - 499 Pink green massive silicified.
514.2	515.2	7	70	<1	<0.01	<4	<4	7900	<4	10								498.5 - 499.7 Lost angle (5° LCA) quartz-chlorite-pyrite vein.
515.2	516.2	10	60	<1	<0.01	<4	<4	6100	<4	20								From 497, rare pyrite dissemination.
516.2	517.1	7	55	<1	<0.01	<4	<4	8400	10	10								Trace to minor thin 3mm. chlorite+magnetite
517.1	518.3	12	46	<1	<0.01	<4	<4	10800	10	10								veinlets usually at 10-20° LCA.
518.3	519.5	250	28	<1	<0.01	26	<4	14900	<4	10								497.3m: 3cm carbonate-andesitic breccia. 40° LCA.
																		From 499.8m, core still silicified but
																	400-	becoming strongly chloritic. Thin magnetite,
																	3500	and carbonate blebs persist. Fine banding
																		enabling mag. texture developed. Some quartz-
																		mag-carb-chlorite banding 5° LCA.
																		504.5 - 513.2 // DEFORMATION ZONE: ANNEALED QUARTZ-CHLORITE-MAGNETITE - PYRITE-CARBONATE SHEAR.
																	20-	
																	50	Gradational contact over 2cms. Intrafolial
																		chlorite milky quartz blebs up to 2cm elongate.
																	Rare	Irreg. distributed quartz has been fractured
																	up to	and infilled by chlorite. Minor carbonate
																	90%	veinlets and blebs. Very thin magnetite
																		veinlets. Trace pyrite disseminations (+py?)
																		Vague banding around 507 - 513.2m
																		defined by quartz + mag. + chlorite bands
																		at high angle ~ 85° LCA.
																		Irregular magnetite blebs up to 3cm. thin
																		carbonate veinlets. Vague banding 70-80° LCA.
																		Pyrite disseminations (2-3mm) in small
																		clusters but only 1-2% total.
																		513.2 - 517.1 // CHLORITIC SILICIFIED ANDESITIC LAVA (BASALTIC?)
																	20-	
																	30	Massive chloritic with minor carbonate
																		veinlets, some irregular patchy bleached
																		zones. Trace pyrite dissemination.

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PROJECT	ROSEBERY EAST	HOLE NAME	RED 87-1
LOGGED BY	J. Randell.	TOTAL DEPTH	607m.

DISTANCE FROM COLLAR TO TOP	TO BOTTOM	Cu	Zn	Ag	Au	Pb	As	Ba	Sn	W	SAMPLE NO	CORE ANGLE	ROCK TYPE	DIAM	DESC CODE	GRAPHIC LOG	MAG SUSC.	DESCRIPTIVE LOG
529·2	530·2	14	55	<1	0·01	10	7	1500	8	10								517·1-519·5 // DEFORMATION ZONE: BANDED ANDESITIC LAVA WITH ANNEALED QUARTZ-CHLORITE-PYRITE
530·2	531·2	9	55	<1	0·02	<4	12	1200	8	10								
531·2	532·2	5	40	1	<0·01	<4	10	1300	4	15							0-30	
532·2	533·2	4	12	<1	<0·01	4	6	850	8	10								Well banded mottled silicified and milky quartz blebs and chloritic and bleached zones. Banding at 70-80° LCA. Trace py disseminations. Gradational contact over 5-10cms.
533·2	534·2	12	20	<1	<0·01	<4	8	1200	12	15								
534·2	535·2	8	36	1	<0·01	6	7	1200	8	10								
535·2	536·0	7	60	1	0·02	<4	<2	1100	<4	10								
536·0	536·8	8	38	<1	<0·01	<4	20	1250	6	10								
536·8	537·8	60	70	<1	<0·01	8	9	870	16	10								
537·8	538·8	200	75	<1	<0·01	<4	12	870	12	15								
538·8	539·8	120	26	<1	<0·01	<4	7	810	8	10								519·5 - 529·2 // SILICIFIED ANDESITIC LAVA
539·8	540·8	16	34	<1	<0·01	4	6	810	14	10								
540·8	541·5	40	38	<1	<0·01	<4	10	870	10	15							20-100	Generally massive pyritic silicified but not chloritic. Vague layering defined by more or less chloritic areas. Fine carbonate veinlets, trace pyrite disseminations ring. distributed in small clusters. Significant low angle (0-10°) quartz veining at 521·6-522·2. Gradational contact over a few cms.
541·5	542·3	38	34	<1	<0·01	<4	5	710	24	20								
542·3	542·7	1300	85	<1	0·12	20	60	720	36	90								
																		529·2 - 536·8 // DEFORMATION ZONE: VARIABLY BANDED SILICIFIED AND CHLORITIZED BLEACHED
																T.S. 5304	20-400	
																		Vague to prominent layering (75-80° LCA) Coarse pyrite concentrated in bands and patches at 529·25 1cm band 75% py 50° LCA 529·5 3cm stringer 5-7% py 530·0 0·5cm band 40-60% py 530·4 10cm band fine planar laminated chert. 531·0 6cm irreg. band 80% py. 531·4 0·6cm vein 80% py.
																		535·6 - 536·2 Chloritic + carbonate veined massive andesitic lava.
																	20-40	532·3 8cm band fine laminated chert.
																		536·8 - 546·2 // MASSIVE ANDESITIC LAVA WITH SEMI MASSIVE PYRITE-MAGNETITE BANDS.
																	20-50	
																		Massive green in places milky siliceous carbonate veined with semi massive pyrite and magnetite blebby veins. 541·0 0·5cm band 40% py + chl 65° LCA 541·4 1cm band 20% py + chl 55° LCA 542·3 40cm band 60% py 20% mag 20% chl 75° LCA.

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PROJECT	ROSEBERY EAST	HOLE NAME	RED87-1
LOGGED BY	J. Randell.	TOTAL DEPTH	601m

DISTANCE FROM COLLAR TO TOP	TO BOTTOM	Cu	Zn	Ag	Au	Pb	As	Ba	Sn	W	SAMPLE No	CORE ANGLE	ROCK TYPE	DIAM	DESC CODE	GRAPHIC LOG	MAG SUSC.	DESCRIPTIVE LOG
																		543·1 7cm patch bkbby vein mag. 2%.
542·7	543·7	145	60	<1	<0·01	<4	2	640	42	65							200	544·4–545·3 Bleached siliceous chloritised
543·7	544·4	220	70	<1	0·03	<4	8	700	46	50							-5000	pyritic 2-3% zone.
544·4	545·3	1150	100	<1	0·02	10	8	640	40	30								545·3 20cm irreg. zone Stringer pyrite 7%.
545·3	546·2	860	70	<1	0·04	12	44	400	42	40								545·9 10cm band 40% py 60% chl 80° LCA
546·2																		546·05 15cm band 85% py 15% chl 75° LCA
550·5	551·0	720	60	<1	0·02	<4	12	680	<4	10								546·2–569·6 // GREEN MASSIVE ANDESITIC LAVA
554·4	554·9	1050	50	<1	0·02	<4	10	930	10	55								
559·5	560·5	200	80	<1	0·01	34	12	1000	8	10							200-	Generally massive with minor zones of
560·5	561·5	75	85	<1	<0·01	8	36	900	<4	10							400	quartz ± magnetite ± chlorite ± pyrite blebs
561·5	562·6	12	110	<1	<0·01	12	16	1000	2	15								or banding.
562·6	563·6	5	175	<1	<0·01	<4	4	360	12	15								555·5–561·05 Moderately banded (85° LCA)
563·6	564·6	10	95	1	<0·01	<4	3	770	14	10								bleached milky siliceous chloritic
564·6	565·6	18	75	<1	<0·01	6	3	730	12	10								zone. Trace py dissemination.
565·6	566·6	9	160	<1	<0·01	22	14	640	<4	30								554·75–554·95 Low angle 20° LCA quartz vein
566·6	567·6	14	70	<1	<0·01	<4	6	690	6	15								with 5-7% py.
567·6	568·2	20	90	<1	<0·01	<4	12	690	8	15								554·45–554·75 Moderately banded (85° LCA) milky
568·2	569·0	14	70	<1	<0·01	<4	8	710	14	10								siliceous chl chloritic zone with
569·0	569·6	26	75	<1	<0·01	<4	8	750	14	10								fine pyrite dissemination.
569·6	570·5	16	65	<1	<0·01	6	3	910	4	10								557·9–559·5 Bleached silicified + minor
570·5	571·1	16	300	<1	<0·01	185	16	670	<4	10							20-	andesite with few carbonate veins.
571·1	572·0	7	165	<1	<0·01	360	12	840	8	10							40	559·5–562·6 Poor to moderately banded silicified
																		+chloritic shear zone with fine
																		disseminated pyrite
																		562·35 7cm band chlorite + pyrite 30% 45° LCA.
																		562·6–563. Strongly carbonated.
																		565·6–568·2 Strongly broken core, quartz
																		chloritic & bubbly
																		561·6–569·6. Quartz chloritic fine fine stockwk
																		po Stringers and trace pyrite blebs.
																		Diffuse lower contact over 10cms.
																		569·6–571·1 // FINELY BEDDED SILICEOUS SILTSTONE.
																T.S.		
																569·8	010	Well layered carbonated bleached and
																		moderately silicified fine bedded volcani-
																		clastic.
																		Lower contact 80° LCA.
																		571·1–581·1 // COARSE FELDSPATHIC WEAKLY
																		SERICITISED WEAKLY QUARTZ
																		PHYRIC LAVA.
																	10-	
																	20	Coarse patchy feldspathic and sericitised
																		chloritic vaguely layered (70° LCA) fine

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CONTINUATION SHEET

PROJECT	ROSEBERY EAST	HOLE NAME	RED 87-1
LOGGED BY	J. Rankin.	TOTAL DEPTH	607m.

ASSAY INFORMATION

DISTANCE FROM COLLAR TO TOP	TO BOTTOM	Cu	Zn	Ag	Au	Pb	As	Ba	Sn	W	SAMPLE Nº	CORE ANGLE	ROCK TYPE	DIAM	DEBC CODE	GRAPHIC LOG	DESCRIPTIVE LOG
580·0	581·1	7	330	<1	<0·01	<4	7	750	<4	10							Mostly cracked. Carbonated to 573m. Rare galena specks in carb vein @ 571.5m.
581·1	582·0	55	1200	<1	<0·01	220	55	890	<4	10							
582·0	583·0	55	790	1	<0·01	630	90	750	<4	10							581·1 - 590·5 // FINE BLACK MUDSTONE
583·0	584·0	42	1300	<1	0·02	50	110	850	4	10							
584·0	585·0	34	3300	1	0·01	530	75	650	<4	10							Upper contact 70° LCA.
585·0	586·0	26	2450	1	0·02	240	55	680	<4	10							Finely laminated black mudstone
586·0	587·0	20	1350	<1	0·01	280	85	730	<4	10						20° -40°	with numerous pinstriped carbonate
587·0	588·0	32	1500	<1	0·03	165	90	710	<4	10							lenses and blebs. Minor po blebs along
588·0	589·0	46	1100	1	0·01	75	85	870	4	10							fracture planes. 10-20% carbonate
589·0	590·5	34	2550	1	0·02	230	85	990	8	60							586·65 - 586·8. 15cm milky grey carbonate
590·5	591·5	10	470	<1	<0·001	6	5	120	<4	10							content 60°.
																	586 - 587·2. Few small zones of vitreous
																	sandstone. Lower contact 75-70°.
																	No foliation evidence
																	590·5 - 607·5 // COARSELY FELDSPAR PHYRIC
																	CARBONATED SERICITIZED
																T.S. 602·4	VOLCANICLASTIC
																0-10	moderately carbonated and sericite
																	altered. Vaguely layered medium
																	feldspar porphyritic. Coarse feldspar pebble
																	E.O.H. 607·5m.

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050

837050

APPENDIX 2

Petrographic Descriptions, Core /samples RED 87-1

837052

053

Geochempet Services

PETROLOGICAL and GEOCHEMICAL CONSULTANTS

REGISTERED IN QUEENSLAND
Principal : A.S. Joyce B.Sc. (Hons), Ph.D.
200 Chapel Hill Road
Chapel Hill, Qld. 4069

Telephone: (07) 892 1789
A/H 378 6467

PETROLOGICAL REPORT ON

NINE SAMPLES OF DRILL CORE

FROM NNE OF ROSEBERY

prepared for

BILLITON AUSTRALIA

RED 87-1
ROBBIES CK.

Order No. : 11606

Location Code : LJ50

Ref : J.P. Randell

Stan Joyce

A. S. Joyce, B.Sc.(Hons), Ph.D.

1st June, 1987.

GENERAL COMMENTS

1. Two samples (98.8m and 165.2m) are interpreted to represent feldspar phyric dacite lava, and one (92.4m) is regarded as unwelded tuff, but all of the others are interpreted to represent silty to sandy clastic sediments or reworked tuffs.

   Thus, a dominantly subaqueous setting is inferred.

2. I have been unable to disprove the apparent down hole facing direction of the sample from 164.5m. Thus, part, if not all, of the sequence seems to be overturned.

3. There is substantial sericitization (commonly accompanied by chlorite and minor carbonate) throughout the section. It seems likely to be of hydrothermal origin , rendered partly foliated by later dynamothermal metamorphism.

   Traces of pyrite are encountered, variously disseminated or related to quartz-chlorite-carbonate fissure veins. Some samples also carry later thinner veins of carbonate.

055

837054

Sample Number : RED 87-1/92.4

Identification : Intensely sericitized, lightly carbonated unwelded vitric pumice crystal tuff of probable andesitic composition

Description :

The sample is a drill core specimen which displays small yellowish grey phenocrysts or clasts of feldspar and light olive grey wisps (ranging up to about 8mm in size) scattered through a light greenish grey matrix.

A cobaltinitrite staining test revealed no K-feldspar.

In thin section the sample displays partly altered phenoclasts of plagioclase (about 0.1 to 1mm) and intensely sericitized, ragged pumiceous clasts (0.5 to a few millimetres in size) scattered through an intensely sericitized matrix within which there are many recognisable pseudomorphs of unwelded vitric shards, about 0.2 to 0.3mm in size.

The plagioclase phenoclasts have been moderately altered to slightly brownish carbonate (presumably ankerite). There are a few leucoxene aggregates after titaniferous mineral clasts and tiny specks of probable leucoxene are also disseminated throughout the sericitized matrix. Sericite in the matrix has a preferred crystallographic orientation, but the rock is not substantially deformed.

Very fine pyrite (about 0.01 to 0.1mm in size) occurs as disseminated multifaceted crystals and aggregates of crystals.

There are a few thin (less than 0.2mm) mildly deformed veins of quartz and calcite.

An approximate mode is :

4-6%	phenoclasts of moderately carbonated plagioclase
5-10%	intensely sericitized pumiceous clasts
0.1-0.2%	leucoxenized mineral clasts
85-90%	intensely sericitized vitroclastic matrix
0.2-0.3%	disseminated pyrite
0.1-0.2%	veins of quartz and calcite

Comments and Interpretations :

This rock is confidently interpreted to have originated as unwelded vitric pumice crystal tuff of probably andesitic composition. It may have been deposited on land or into water, but there are no indications of reworking.

The vitroclastic matrix and the pumice clasts have been intensely sericitized (no chlorite detected), plagioclase phenoclasts have been moderately carbonated (ankerite rather than calcite) and titaniferous clasts have been leucoxenized. There is very fine disseminated pyrite and some thin veins of quartz-calcite.

The rock is mildly deformed, but not sheared.

Sample Number : RED 87-1/98.8

Identification : Brecciated and heavily sericitized, feldspar phyric dacite lava

Description :

The sample is a drill core specimen which displays rock of sheared and brecciated appearance, involving clasts of porphyritic yellowish grey rock, about 1 to 20mm in size and a light olive grey, sericitic matrix.

A staining test revealed no K-feldspar.

In thin section the clasts are seen to be equant to ovoid and enclosed by a web of moderately foliated richly sericitized rock of otherwise similar appearance : boundaries are sharp in some cases and blurred in others.

Within the clasts the rock displays simple porphyritic textures, with subhedral, tabular phenocrysts of plagioclase (0.5 to 2mm) and leucoxene pseudomorphs of smaller oxide grains scattered through a sutured, allotriomorphic groundmass of quartz and partly sericitized, untwinned plagioclase (0.1 to 0.2mm). The plagioclase phenocrysts are cracked and carry some calcite and sericite. The web between the clasts consists of abundant sericite, quartz grains similar to those in the clasts, and small specks of leucoxene.

A very few grains of very fine pyrite occur as disseminated patches and short veins. There are several thin (mainly less than 0.1mm) mildly deformed fissure veins of quartz and calcite.

An approximate mode is :

3-4%	phenocrysts of plagioclase, lightly carbonated and sericitized
70-75%	fine quartz and untwinned plagioclase (not quantitatively distinguishable)
20-25%	sericite
0.3-0.4%	leucoxene
tr	pyrite
0.1-0.2%	veins of quartz and calcite

Comments and Interpretations :

This rock is interpreted to have originated as feldspar phyric dacite lava, but it has been brecciated by shearing and recrystallized and heavily sericitized.

The sericite developed mainly in a granulated matrix between rigid, less altered clasts. Traces of pyrite were introduced. There is no chlorite. Small phenocrysts of ilmenite or titaniferous magnetite were altered to leucoxene.

Like the sample from 92.4m, this sample carries some deformed, thin fissure veins of quartz-calcite.

057

Sample Number : RED 87-1/164.5

Identification : Carbonated, chloritized and sericitized finely vitroclastic sediment and pelite in contact with scoured, probable feldspathic arenite

Description :

The sample is a specimen of drill core which appears to display a scour channel about 10 to 15mm deep, cut into a light olive grey, sandy textured unit and filled with finely laminated, very fine-grained, greenish grey rock. The scour appears to indicate a facing direction down the hole.

A staining test revealed no K-feldspar.

In thin section the uppermost unit which appears to have been scoured displays a framework of densely packed, equant grains of intensely sericitized feldspar mainly about 0.5mm in size, with an interstitial network of much finer quartz (0.1 to 0.2mm) with carbonated and sericitized grains of similar size. There are a few chlorite-calcite aggregates and a few subhedral leucoxenized grains of inferred opaque oxide, about 0.1 to 0.5mm in size. There are sparse subhecral, tabular phenocrysts or clasts of intensely sericitized plagioclase about 2mm in size. An approximate mode is :

70-80%	intensely sericitized feldspar grains
10-15%	quartz
8-10%	calcite
1-2%	leucoxene
0.5-1%	chlorite

In contact with the apparent scour there is a continuous 1mm layer of richly sericitic pelitic rock, composed of about :

88-92%	sericite
4-6%	chlorite
3-4%	leucoxene
1-2%	calcite

Generally similar, laminated pelitic rock, dominated by sericite, chlorite and calcite extends for a further 5 to 15mm, there is a layer of about 20-25mm of coarser rock with vague, possibly vitroclastic textures involving platy shards about 0.2mm long (now calcite-chlorite-sericite) and partly recrystallized angular quartz clasts (0.2 to 0.3mm). There are also many specks of leucoxene. A mineralogical mode is :

35-40%	calcite
30-35%	sericite
20-25%	chlorite
4-6%	quartz
2-3%	leucoxene

Within the probably vitroclastic regime there is a 12mm, subrounded pebble of intensely sericitized dacite.

2/...

Comments and Interpretations :

This sample does seem to indicate a down hole facing direction, despite efforts to find a contrary interpretation.

The rock at the top of the core seems to have been scoured and its textures can be interpreted as indicating a formerly well sorted feldspathic sand with a quartzose cement. There is a possibility that the textures alternatively represent an unusual style of intrusive quartzose intermediate, subvolcanic rock (perhaps a dyke or sill), but such an interpretation seems improbable. The rock does not have textures consistent with lava.

Filling the apparent scour there is laminated sericitic pelite which appears continuously laminated and not hornfelsed. Overlying the pelite there is a coarser, less sericitic, more carbonated and chloritized, quartzose sediment which seems to have characteristics consistent with sorted, probably water laid vitroclastic sediment (reworked vitric tuff).

053

837058

Sample Number : RED 87-1/165.2

Identification : Intensely sericitized feldspar phyric dacite lava with xenoliths of finely vitroclastic sediment

Description :

The sample is a drill core specimen which displays aligned lenticular, light olive grey clasts (about 2 to 20mm long) dispersed through a dark greenish grey, mildly foliated matrix with yellowish grey phenocrysts of feldspar. There are some irregular very light grey veins.

A staining test revealed no K-feldspar.

In thin section the lenticular clasts are seen to consist of partly recrystallized, well sorted, angular clasts of quartz (about 0.1mm in size) set in a foliated and wispy matrix of sericite and specks of leucoxene. The textures suggest a finely vitroclastic rock, not pumice.

The host rock displays altered subhedral phenocrysts, about 0.3 to 3mm in size, scattered through an altered, allotriomorphic groundmass, now dominated by fine sericite and anhedral quartz (0.2 to 0.3mm) clouded by sericite. The phenocrysts are mainly carbonated and albitized plagioclase, but there are some leucoxenized grains of former ilmenite or titaniferous magnetite and some sericite-sphene aggregates after mafic silicates. There are a few disseminated grains and a veinlet of pyrite.

Irregular fissure veins (ranging up to about 2mm wide) carry quartz and carbonate (apparently calcite).

An approximate mode is :

15-20%	clasts of sericitized, finely vitroclastic sediment
6-8%	phenocrysts of plagioclase (albitized and moderately carbonated)
0.2-0.3%	sericite-sphene pseudomorphs of inferred mafic silicate phenocrysts
0.2-0.3%	leucoxenized oxide phenocrysts
35-45%	groundmass sericite
30-35%	groundmass quartz
3-4%	veins of quartz-carbonate
tr	pyrite

Comments and Interpretations :

This sample is interpreted to represent intensely sericitized and mildly foliated, feldspar phyric dacite lava carrying xenoliths of sericitized finely vitroclastic sediment (reworked vitric tuff).

Traces of disseminated and replacement vein pyrite are present. Late fissure veins carry quartz and carbonate.

The rock is sericitic, not chloritic.

060

837059

Sample Number : RED 87-1/213.0

Identification : Strongly foliated, sheared, ankerite and quartz-veined, intensely sericitized finely fragmental sediment

Description :

The sample is a drill core specimen of strongly foliated light olive grey and dark olive grey rock cut by irregular thin, yellowish grey veins.

A staining test revealed no K-feldspar.

In thin section the sample displays abundantly veined then sheared, schistose textures. The host rock consists of angular small grains (0.1 to 0.2mm) of strained and partly recrystallized quartz scattered through a matrix of fine sericite and a few specks of sphene. Fine carbonate of faintly brownish, ankeritic, style is prominent as deformed and discontinuous veinlets and blebs. Thicker, deformed and partly recrystallized veins (0.2 to 3mm thick) carry quartz and the ankeritic carbonate and traces of sphene.

The rock carries inconspicuous, very fine, disseminated pyrite (0.005 to 0.02mm).

An approximate mode is :

4-5%	quartz clasts
75-80%	sericite
10-12%	ankeritic carbonate
6-8%	deformed, fine vein quartz
tr	pyrite

Comments and Interpretations :

This rock has been intensely sericitized, abundantly veined by ankeritic carbonate and quartz, then sheared to produce a strong foliation.

There are no remnant textures which would be consistent with lava or distinctly pyroclastic rock. The general impression gained is that the rock was probably a fine sediment similar to the quartz-bearing vitroclastic sediment at 164.5m in RED 87-1. The source of the detritus was probably quartz andesite or andesite plus dacite.

061

837060

Sample Number : RED 87-1/443.9

Identification : Foliated, sericitized siltstone and slate with chloritized blebs of former glass or pumice

Description :

The sample is a drill core specimen which displays a laminated, olive grey to brownish zone about 5mm thick hosted by light olive grey rock with crudely lenticular, dark greenish grey spots.

A staining test revealed no K-feldspar.

In thin section the 5mm band is seen to consist of sericite slate, with its schistosity orientated at about 25° to internal sedimentary laminations which are defined by tiny aggregates of secondary sphene and by lenticular aggregates of chlorite and carbonate after probable vitric blebs about 0.3 to 1.5mm long. An approximate mode is :

94-97%	sericite
2-3%	sphene
1-3%	chlorite
tr	calcite

The enclosing host rock displays disturbed layering and finely sericitic, quartzose, coarsely silty textures (0.05mm grainsize common for the quartz), but with many disseminated chloritic clasts resembling blebs of former glass or pumice, about 0.5 to 3mm in size. Such blebs now consist of chlorite-quartz-sphene. Minor chlorite occurs with some of the sericite which forms a foliated matrix between silt-sized quartz grains. Some chlorite has been streaked from the clasts. One chloritic clast carries pyrite. Several deformed, thin fissure veins carry chlorite and traces of calcite along with dominant quartz.

An approximate mode of the main portion of the sample is :

55-65%	sericite
30-40%	quartz
3-4%	chlorite
0.1-0.2%	sphene
rare	pyrite

Comments and Interpretations :

This sample is interpreted to represent foliated, sericitized and chloritized quartzose siltstone and minor slate with disseminated former vitric or pumiceous blebs.

Textural contrasts suggest that the blebs probably dropped by distal tuffaceous processes into a silty sedimentary environment.

The sericite accounts for light olive grey colours, the sphene for olive grey to brownish and the chlorite for dark greenish grey colours.

062

837061

Sample Number : RED 87-1/530.4

Identification : Planar laminated sericitic slate and disturbed laminated sericitic siltstone with altered blebs of inferred glass.

Description :

The sample is a long specimen of drill core. About 100mm of the core consist of mottled dark olive grey and light olive grey rock. The next 100mm consists of apparently laminated, light olive grey, fine-grained rock. The remaining part of the core consists of a 35mm band of the mottled dark olive grey type, then about 15mm of the light olive grey type. There are some dark chloritic veins and some light grey carbonate veins.

A staining test revealed no K-feldspar.

A thin section was prepared to show parts of the mottled dark olive grey rock and the laminated light olive grey type.

The laminated type is seen to be sericite-dominated slate, with a metamorphic foliation orientated at about 45° to the subtle laminations. Very fine quartz (0.01mm and less) is a variable minor component.

The mottled rock type is seen to consist of crenulated and disrupted layers (about 1 to 2mm thick) of richly sericitic, silty rock. The coarsest siltstone layers have quartz clasts of coarse silt to fine sand size (about 0.05 to 0.08mm). The finest layers are more finely siliceous and less sericitic. Scattered throughout the disturbed layers there are altered blebs (about 0.1 to 1.5mm) of fine chlorite-sericite-quartz ± greenish brown biotite ± sphene : they resemble altered blebs of former glass. An approximate mode of the mottled regime is :

60-70%	sericite
30-40%	quartz
1-2%	chlorite
0.2-0.3%	biotite
0.1-0.2%	sphene

Mildly deformed fissure veins (0.05 to 2mm) carry quartz-chlorite-calcite, accompanied in one case by pyrite and brown tourmaline. They amount to about 3-5% of the sectioned specimen.

Comments and Interpretations :

This sample is considered to display finely laminated sericitic slate in contact with more disturbed laminated sericitic and quartzose siltstone with chloritized and micaceous blebs of inferred glass which probably dropped into the sedimentary setting by pyroclastic processes.

Mildly deformed fissure veins carry quartz-chlorite-calcite ± pyrite and tourmaline.

063

837062

Sample Number : RED 87-1/569.8

Identification : Sericitic and chloritic, laminated slate and siliceous siltstone with traces of pyrite and some deformed veins

Description :

The sample is a drill core specimen of well foliated, fine-grained dark greenish grey and light olive grey rock. There are inconspicuous specks of sulphide and some thin veins.

A staining test revealed no K-feldspar.

In thin section this sample displays disturbed slaty and finely silty laminations a fraction of a millimetre to several millimetres thick.

The dominant layers are sericitic and mildly chloritic slate with foliation acute to the layering; they carry small amounts of leucoxene and fine carbonate.

The silty layers have fine quartz (0.01 to 0.02mm), prominent chlorite and minor calcite.

Fine subhedral pyrite (0.05 to 0.1mm) occurs as disseminations along the siliceous layers and a few coarser grains and aggregates occur in deformed quartz fissure veins (up to 1mm) with chlorite and minor calcite. Additional calcite occurs in later, deformed fissure veins (about 0.1mm wide).

An approximate mode of the bulk rock is :

65-75%	sericite
10-15%	chlorite
10-15%	quartz
tr	leucoxene
tr	calcite
2-3%	veins of quartz-chlorite-calcite
0.2-0.3%	veins of calcite
0.2-0.3%	pyrite, as disseminations and in the quartz veins

Comments and Interpretations :

This sample is interpreted to represent sericitic and chloritic slate and siliceous siltstone with fine laminations disturbed by a metamorphic shear foliation which intersects the layering acutely. There are no recognisable tuffaceous or volcaniclastic characteristics.

Traces of fine pyrite occur in the siliceous layers and to a lesser extent in deformed quartz-chlorite-calcite fissure veins.

064

Sample Number : RED 87-1/602.4

Identification : Moderately sericitized and lightly carbonated and chloritized volcaniclastic arenite

Description :

The sample is a drill core specimen of greenish grey rock of vaguely sandy or tuffaceous appearance. There are several, irregular, dark chloritic veins.

A staining test revealed no K-feldspar.

In thin section the sample displays moderately sorted volcaniclastic textures, involving densely packed, altered, subangular, mineral clasts (about 0.2 to 3mm) and a mildly foliated matrix of mainly sericite and chlorite.

The main mineral clasts are tabular plagioclase, moderately sericitized and lightly carbonated. There are very sparse clasts of quartz. Mafic silicate grains have been completely altered to chlorite and cloudy sphene and opaque oxides are represented by leucoxene or cloudy sphene. There seem to be some finely feldspathic, sericitic clasts, not readily distinguishable from the sericitic matrix.

Calcite forms some thin (0.1mm), slightly deformed fissure veins. A thicker, more deformed vein (1mm) carries calcite-chlorite-quartz.

An approximate mode is :

60-65%	clasts of moderately sericitized, lightly carbonate plagioclase
0.3-0.4%	clasts of quartz
3-4%	chlorite-sphene after mafic silicate clasts
2-3%	leucoxene or sphene after titaniferous opaque oxides
25-30%	matrix and probable lithic clasts of sericite, fine feldspar and chlorite
2-3%	veins of calcite and of calcite-chlorite-quartz

Comments and Interpretations :

This sample is interpreted to represent moderately sorted volcaiclastic arenite (loosely crystal tuff), composed mainly of phenoclasts derived from andesitic tuffs or lavas.

The rock is moderately sericitized and lightly carbonated and chloritized, but does not carry any sulphides.

Chlorite-calcite-quartz has formed some fissure veins and calcite alone has formed later, thinner veins.

APPENDIX 3

RED 87-1, Conductivity Measurements

837065

068: Nigel Hungerford, Billiton, FAX (03) 6095839

PRELIMINARY

PETROPHYSICAL DATA RECORD SHEET

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Date: 26.6.87

Reference: Billiton Lot B7/1
4 cores NTC. of Rosebery

D.W. Emerson, Dept. Geology & Geophysics
The University of Sydney. NSW. 2006
Phone: (02) 692 2031 692 2912

Samples No. m (DEPTH)	Physical Properties: mag. susc. k (SI units) (MAGNETIC SUSCEPTIBILITY)	Galvanic ρ Ω-m 10Hz (GALVANIC RESISTIVITY)	Inductive (EM) (CONDUCTIVITY) IND. em σ S/m average whole core	Inductive (EM) (RESISTIVITY) 2.5 MHz ρ Ω-m
479.8 (Andesitic lava + magnetite + pyrite)	~100k v. high	7.5 sulphide end 3065 shaley end	13	0.08
542.4 (Andesite + massive py + mags)	~100k v. high	0.08	65	0.02
546 (Altered andesite ~90% py)	3k → 30k high	0.09 sulphide end 68,500 shaley end	48	0.02
581 (Fine black mudstone)	~200 low	30,600 :- bedding note: numerous v. fine bands sulphide // bedding (despite some cavings mag. susc. high)	9	0.1

em σ readings (EM Conductivity) probably OK - lot of sulphide occluded by siliceous material esp. #586 so galvanic ρ ave [> em ρ], see my previously sent notes on this

Comments:

NB Measurements made on core from DDH REN 871

APPENDIX 4

Diamond Drill Log: RED 87-9 (South Hercules)

SHLMET SYSTEM
METRIC
DECIMAL POINTS AS REQUIRED

The Shell Company of Australia Limited
METALS DIVISION

DRILL LOG SHEET

HEADING SHEET

COLLAR INFORMATION

DATA TYPE	COLLAR CO-ORDINATES EASTING	NORTHING	ELEVATION	COLLAR SURVEY AZIMUTH	DIP	HOLE NAME	TOTAL DEPTH	HOLE TYPE	DESC CODE	REMARKS
BHOLE	376418·4	6520611·1	960·4	270	-50	RED 87-9	180·7			

PROJECT	SOUTH HERCULES / ROSEBERY EAST
LOGGED BY	C. BELCHER
CONTRACTOR	F. ORTNER
CREW	P. WALTER
HOLE NAME	RED 87-9
TOTAL DEPTH	180·7m
RIG	MINDRILL F49J
DATE STARTED	16·10·87 FINISHED 31·10·87

CORE STORAGE

NO OF TRAYS	LOCATION
29	DEVONPORT

SAMPLE STORAGE: DEVONPORT. ORDER NOS. 11661,

M & P LAB

ASSAY LAB: COMLABS, ADELAIDE

DESC.	SIZE	FROM	TO	TOTAL	REMARKS
NON CORE					
CORE	HQ				
	NQ	0	180·7	180·7	
	BQ				
CASING					
CASING LEFT	HQ (S)	0	3	3	(S) steel (P) plastic
40mm ID SLOTTED PVC		0	180·7	180·7	

SURVEY INFORMATION

DISTANCE FROM COLLAR TO TOP	TO BOTTOM	AZIMUTH	DIP	REMARKS
48·0		264·0	-46·2	AZIMUTH IN AMG (= MAG + 12°)
101·8		262·5	-43·7	
165·7		259·5	-35·7	

PLOTTING KEY

SYMBOL DES. CODE	SYMBOL G/LOG	INTERVAL FROM	INTERVAL TO	SYMBOL DES. CODE	SYMBOL G/LOG	INTERVAL FROM	INTERVAL TO

ASSAY INFORMATION

DISTANCE FROM COLLAR TO TOP	TO BOTTOM	SAMPLE NO	CORE ANGLE	ROCK TYPE	DIAM	DESC CODE	GRAPHIC LOG	DESCRIPTIVE LOG

DRILLING OBJECTIVES / SUMMARY

REPORT REFERENCE :

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METALS DIVISION

DRILL LOG SHEET

CONTINUATION SHEET

PROJECT SOUTH HERCULES / ROSEBERY EAST	HOLE NAME RED 87-9
LOGGED BY C. BELCHER	TOTAL DEPTH 180.70 M

DISTANCE FROM COLLAR TO TOP	TO BOTTOM	SAMPLE NO	CORE ANGLE	ROCK TYPE	DIAM	DESC CODE	GRAPHIC LOG	DESCRIPTIVE LOG
0.00	2.00		50		HQ NQ			LIGHT COLOURED SILTSTONE/SHALE WITH WEATHERED QTZ VEINS EVIDENCE OF SULPHIDES.
2.00	5.50							I.M AS ABOVE.
								VOLCANIC SEDIMENTS IN FINING UPWARD SAND TO MUDSTONE.
5.80	6.50							SILTSTONE / SLATE WITH QTZ VEIN.
6.50	9.70							VOLCANO CLASTIC BEDDING 70° TO L.C.A
9.70	10.90							DARK VOLCANO CLASTIC & TUFF, INTERBANDED.
10.90	14.00							BANDED TUFF AND DACITE. SILICIOUS REPLACEMENT COMMON FINE GRAINED PYRITE IN GROUNDMASS 1% OF CORE. BEDDING 65-60° TO L.C.A.
14.00	15.70							AS ABOVE
15.70	18.70							AS ABOVE
18.70	21.70							AS ABOVE
21.70	24.70							FELDSPATHIC TUFF WITH SMALL PYRITE PHENOCRYSTS
24.70	27.70							AS ABOVE
27.70	30.70							CHERTY TUFFACEOUS SEDIMENT OF TUFF PREDOMINANTLY REPLACED BY SILICA. AREAS OF FINE PYRITE ASSOCIATED WITH DARK VEINLETS & STRINGERS. BEDDING 60° TO L.C.A.
30.70	33.70							AS ABOVE
33.70	36.50							AS ABOVE
36.50	39.60							AS ABOVE BEDDING 60° TO L.C.A.
39.60	42.70							AS ABOVE
42.70	45.70							AS ABOVE
45.70	49.30							55cm FROM BASE. SLICKENSIDES & SCHISTOSITY 60° TO L.C.A
46.50	51.40							ASSOCIATED WITH QUARTZ & PYRITE 20cm.
								SILICA REPLACED TUFF WITH LATE QUARTZ VEINING
								PREDOMINANTLY DARK GREY SILICA PYRITE VERY COMMON

ASSAY INFORMATION

CHLORITIZED ARGILLITE

VOLCANO CLASTIC

SHLMET SYSTEM
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CONTINUATION SHEET

PROJECT	SOUTH HERCULES/ROSEBERY EAST	HOLE NAME	RED 87-9
LOGGED BY	C. BELCHER	TOTAL DEPTH	180.7M

ASSAY INFORMATION

DISTANCE FROM COLLAR TO TOP	TO BOTTOM	SAMPLE NO	CORE ANGLE	ROCK TYPE	DIAM	DESC CODE	GRAPHIC LOG	DESCRIPTIVE LOG
51.40	54.50							1M SERICITISED TOFF WITH DARK VEINLETS & STRINGERS THEN HIGHLY SILICIFIED TUFF DARK GREY IN COLOUR PYRITE VERY COMMON 2½-5% OF CORE. @ 53.4 50cm MILKY QUARTZ VEIN. SUB PARALLEL TO CORE.
54.50	57.60							SILICIFIED TUFF MINOR QUARTZ VEINS UP TO 1CM THICK AT VARIOUS ANGLES TO CORE. CORE VERY BROCKEN AT BASE.
57.60	58.90							SILICIFIED TUFF - FAULT (SLICKENSIDES) SUB PARALLEL TO CORE.
58.90	60.70							SILICIFIED TUFF AS ABOVE - SERICITISATION AROUND MINOR FAULT 45° TO LCA @ 59.3.
60.70	63.70							SILICIFIED TUFF BEDDING 55° TO LCA.
63.70	68.00							2.4M ANDESITIC? TUFFACEOUS SEDIMENT. [illegible] FOLLOWED BY 20CM OF SERICITISED ROCK WITH QUARTZ VEINS. (BEDDING 55-50° TO LCA) 65cm CHERT WITH LAMS OF PYRITE
68.00	69.70							SERICITISED ROCK WITH MASSIVE CHERT WITH MINOR QUARTZ VEINS.
69.70	72.70							SERICITISED ROCK WITH NUMEROUS PYRITE LENSES DARK VEINLETS FORM NETWORK 5cm BANDED PYRITE 10CM FROM BASE
72.70	75.70							AS ABOVE 5CM BAND OF PYRITE @ 74.60. (SERICITE APPEARS TO POST DATE SILICA)
75.70	78.00							BEDDING 55-50° TO LCA.
78.00	79.00							CHERT LIGHT GREY MINOR PYRITE - QUARTZ VEINS & FAULT? FROM 77.30 TO 77.70 60° TO LCA
79.00	81.70							CHERT WITH COMMON PYRITE - DARK VEIN NETWORK.
81.70	84.70							CHERT AS ABOVE 40cm FROM BASE TUFFACEOUS SEDIMENT WITH MINOR PYRITE
84.70	87.70							SILICIFIED RHYOLITE? PYRITE ASSOCIATED WITH BEDDING OCCURING IN LENSES - QUARTZ VEINS
87.70	90.70							Φ.9M MASSIVE SILICEOUS ROCK - CHERT ANDESITIC ROCK
90.70	93.70							AS ABOVE BEDDING 45° TO LCA.
93.70	96.70							AS ABOVE @ 92.65 5CM BAND OF PYRITE - PYRITE COMMON IN SURROUNDING ROCK RUNNING 60° TO LCA. ANDESITIC VOLCANIC AS BEFORE
96.70	99.70							Φ.5M AS ABOVE THIN BROKEN SERICITISED ZONE QUARTZ VEINS & DARK (CHLORITIC?) VEINS COMMON.

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SHLMET SYSTEM
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The Shell Company of Australia Limited
METALS DIVISION

DRILL LOG SHEET

CONTINUATION SHEET

PROJECT	SOUTH HERCULES / ROSEBERY EAST	HOLE NAME	RED 87-9
LOGGED BY	C. BELCHER	TOTAL DEPTH	180.7M

DISTANCE FROM COLLAR TO TOP	TO BOTTOM	SAMPLE NO	CORE ANGLE	ROCK TYPE	DIAM	DESC CODE	GRAPHIC LOG	DESCRIPTIVE LOG
99.70	101.80							EXTREMLY BROKEN FIRST METRE
101.80	104.90							ANDESITIC DACITIC TUFF AS ABOVE.
								AS ABOVE BEDDING 45° TO CORE
104.90	108.00							AS ABOVE
108.00	111.10						107.2	108.4 TO 108.6 2 QUARTZ VEINS 45° TO LCA 1CM AND 2CM WIDE. *
111.10	114.20							ANDESITIC OR DACITIC WITH MINOR SILICA REPLACEMENT AND FELDSPATHISATION.
							110.3	MILKY QUARTZ VEINS 30° TO LCA IN SILICIFIED VOLCANIC ROCK. BEDDING 50° TO LCA
114.20	117.30						SHEARED ZONE	AS ABOVE.
117.30	120.30						118.6	AS ABOVE LARGE MILKY QUARTZ VEIN FROM 117.4 TO 117.6 AT 55 TO LCA.
120.30	123.30							FINE GRAINED RHYO-DACITIC TUFF. **
123.30	126.40							FINE GRAINED VOLCANIC OR TUFF AS ABOVE, NUMEROUS QUARTZ VEINS AND DARK STRINKERS (CHLORITIC). QTZ VEINS RUNNING APROX 30° TO LCA
								AS ABOVE DARK STRINGERS POST DATE QUARTZ VEINS
126.40	129.50						ACIDIC ZONE	AS ABOVE FROM 129.0 SILICIFIED VOLCANIC.
129.50	132.60							SILICIFIED VOLCANIC. QUARTZ 50-70% OF CORE PINK FELDSPARS MAY BE AS A RESULT OF FELDSPATHISATION. SILICA FOCUS BEDDING 50° TO LCA.
132.60	135.70						SERICITIC	AS ABOVE.
135.70	136.70							AS ABOVE
136.70	141.70							AS ABOVE
141.70	144.70							AS ABOVE
144.70	147.70						CHLORITIC ALTERATION	AS ABOVE TO 147.4M. @ 146.9 QUARTZ VEINS WITH SPHALERITE AND PYRITE 30° TO LCA
147.70	150.70						147.4	COARSE GRAINED VOLCANIC CLASTIC BRECCIA.

ASSAY INFORMATION

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SHLMET SYSTEM
METRIC
DECIMAL POINTS AS REQUIRED

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DRILL LOG SHEET

CONTINUATION SHEET

PROJECT	SOUTH HERCULES / ROSEBERRY EAST	HOLE NAME	RED 87-9
LOGGED BY	C. BELCHER	TOTAL DEPTH	180.7m

DISTANCE FROM COLLAR TO TOP	TO BOTTOM	SAMPLE NO	CORE ANGLE	ROCK TYPE	DIAM	DESC CODE	GRAPHIC LOG		DESCRIPTIVE LOG
150.7Φ	153.7Φ							SANDSTONES	VOLCANOCLASTIC BRECCIA FINER GRAINED THAN ABOVE.
153.7Φ	156.7Φ								VOLCANIC OR TUFF FINER GRAINED THAN ABOVE.
156.7Φ	159.7Φ								AS ABOVE
159.7Φ	162.7Φ							& BRECCIAS	AS ABOVE
162.7Φ	165.7Φ								AS ABOVE @ 164.6 QUARTZ VEIN WITH SPHALERITE AND PYRITE 45° TO LCA
165.7Φ	168.7Φ								AS ABOVE
168.7Φ	171.7Φ							VOLCANIC	AS ABOVE.
171.7Φ	174.7Φ								SILICIFIED BRECCIATED ROCK WITH QUARTZ VEINS RUNNING ALL ANGLES TO CORE + SPHALERITE WITH SOME VEINS
174.7Φ	177.7Φ								RHYOLITE WITH PRISMATIC VEINS WITH PYRITE AND SPHALERITE. FROM 176.1 BANDED BLACK SHALE AND VOLCANOCLASTIC SANDSTONE. QUARTZ VEINS COMMON NEAR TOP WITH PYRITE AND SPHALERITE. PYRITE COMMON IN THE THIN SANDSTONE LAMELA. BEDDING 60° TO LCA VEINS 30° TO LCA.
177.7Φ	180.7Φ								END OF HOLE

ASSAY INFORMATION

SHLMET SYSTEM
METRIC
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ANALYSED BY COMLABS, ADELAIDE.
GOLD ANALYSED BY FIRE ASSAY
* Average of two determinations.

DESPATCH ORDER Nos 11661,

The Shell Company of Australia Limited
METALS DIVISION

DRILL LOG SHEET

CONTINUATION SHEET

PROJECT SOUTH HERCULES / ROSEBERY EAST	HOLE NAME RED 87-9
LOGGED BY C. BELCHER	TOTAL DEPTH 180.7 M

RESULTS ENTERED BY J.G. AURIS

ASSAY INFORMATION

DISTANCE FROM COLLAR TO TOP	TO BOTTOM	Au	Cu	Pb	Zn	Ag	Sn	As	SAMPLE No	CORE ANGLE	ROCK TYPE	DIAM	DESC CODE	GRAPHIC LOG	DESCRIPTIVE LOG
10.9	12.9	<0.01	18	62	96	<1	4	6	14501			NQ			
12.9	14.9	<0.01	17	420	520	<1	8	36	14502						
14.9	16.9	<0.01	19	185	220	<1	8	11	14503						
16.9	18.9	<0.01	19	92	94	<1	6	15	14504						
18.9	20.9	<0.01	22	24	52	<1	12	4	14505						
20.9	22.9	<0.01*	14	16	50	<1	8	9	14506						
22.9	24.9	<0.01	5	20	66	<1	<4	<2	14507						
24.9	27.4	<0.01	6	36	98	<1	8	9	14508						
27.4	29.4	<0.01*	8	46	1010	<1	10	18	14509						
29.4	31.4	<0.01	11	56	175	<1	6	10	14510						
31.4	33.4	<0.01*	9	42	98	<1	6	28	14511						
33.4	35.4	<0.01	7	20	64	<1	4	13	14512						
35.4	37.4	<0.01	6	10	34	<1	6	<2	14513						
37.4	39.4	<0.01	6	12	30	<1	8	6	14514						
39.4	41.4	<0.01	5	6	30	<1	6	6	14515						
41.4	43.4	<0.01	5	6	26	<1	4	9	14516						
43.4	45.4	<0.01	8	14	34	<1	8	20	14517						
45.4	47.4	<0.01	7	26	58	<1	4	40	14518						
47.4	49.4	<0.01*	8	64	50	<1	4	78	14519						
49.4	51.4	<0.01*	10	50	34	<1	8	150	14520						
51.4	53.4	<0.01	13	16	38	<1	10	38	14521						
53.4	55.4	<0.01	7	16	30	<1	10	18	14522						
55.4	57.4	0.01	12	24	28	<1	6	32	14523						
57.4	59.4	<0.01	6	6	32	<1	8	7	14524						
59.4	61.4	<0.01	8	4	32	<1	8	12	14525						
61.4	63.6	<0.01	8	<4	46	<1	6	22	14526						
63.6	65.0	0.01	7	<4	62	<1	<4	2	14527						
65.0	66.4	<0.01	9	<4	60	<1	8	4	14528						
66.4	68.4	<0.01	9	8	19	1	8	56	14529						
68.4	70.4	<0.01	6	<4	26	1	10	12	14530						
70.4	72.4	0.01	4	10	26	<1	6	9	14531						
72.4	74.4	<0.01	13	14	34	<1	4	12	14532						
74.4	76.4	<0.01	6	10	26	1	8	18	14533						
76.4	78.4								14534						
78.4	80.4								14535						
80.4	82.4								14536						
82.4	84.4								14537						
84.4	86.3								14538						
86.3	88.3								14539						
88.3	90.3								14540						
90.3	92.3								14541						
92.3	94.3								14542						
94.3	96.3								14543						
96.3	98.3								14544						
98.3	100.3								14545						
100.3	102.3								14546						
102.3	104.3								14547						
104.3	106.3								14548						
106.3	108.2								14549						
108.2	110.2								14550						

013

837072

SHLMET SYSTEM
METRIC
DECIMAL POINTS AS REQUIRED

The Shell Company of Australia Limited
METALS DIVISION

DRILL LOG SHEET

CONTINUATION SHEET

PROJECT SOUTH HERCULES/ROSEBERY EAST	HOLE NAME RED 87-9
LOGGED BY C. BELCHER	TOTAL DEPTH 180.7 m

RESULTS ENTERED BY J.G. PURVES

DISTANCE FROM COLLAR TO TOP	TO BOTTOM	Au	Cu	Pb	Zn	Ag	Sn	SAMPLE Nº	CORE ANGLE	ROCK TYPE	DIAM	DESC CODE	GRAPHIC LOG	DESCRIPTIVE LOG
110.2	112.3							14551			NQ			
112.3	114.3							14552						
114.3	116.3							14553						
116.3	118.6							14554						
118.6	120.6							14555						
120.6	122.6							14556						
122.6	124.6							14557						
124.6	126.6							14558						
126.6	129.0							14559						
129.0	131.0							14560						
131.0	133.0							14561						
133.0	135.0							14562						
135.0	137.0							14563						
137.0	139.0							14564						
139.0	141.0							14565						
141.0	143.0							14566						
143.0	145.0							14567						
145.0	147.4							14568						
147.4	149.4							14569						
149.4	151.4							14570						
151.4	153.4							14584						
153.4	155.4							14571						
155.4	157.4							14572						
157.4	159.4							14573						
159.4	161.4							14574						
161.4	163.4							14575						
163.4	165.4							14576						
165.4	167.4							14577						
167.4	169.4							14578						
169.4	171.4							14579						
171.4	173.4							14580						
173.4	176.1							14581						
176.1	178.1							14582						
178.1	180.7							14583						
		END OF HOLE												

ASSAY INFORMATION

SHEET 7 OF 7

074

8370073

80 000mE

85 000mE

80 000mN

75000mN

70000mN

CHESTER

DACITIC–IGNIMBRITIC LAVAS

DACITIC–ANDESITIC LAVAS

LAKE ROSEBERY

LAKE MACKINTOSH

TULLAH

CUTTY SARK

ROBBIES CREEK

LANGDONS

MT. SALE

ANDESITIC LAVAS

MT. BLACK

MT. BLACK

DUNDAS GROUP

FELSIC IGNIMBRITE

DACITIC–ANDESITIC LAVAS

ROSEBERY

MURCHISON HIGHWAY

FAULT

ZONE

FELSIC VOLCANICS

STERLING VALLEY

DUNDAS GROUP

FELSIC PYROCLASTICS

ALTERATION ZONE

ROSEBERY

SOUTH STITT

CENTRAL VOLCANICS

DACITIC LAVAS

ORDOVICIAN

OWEN CONGLOMERATE

HERCULES

MT READ

HENTY

RHYOLITIC – DACITIC VOLCANICS

SOUTH HERCULES

HENTY PROSPECT

837074

5 cm

87-2752

0 1 2 3 km

Billiton Australia
The Metals Division of the Shell Company of Australia Limited

Project: TASMANIA
ROSEBERY EAST J.V.

Title:

REGIONAL GEOLOGY

6874

Author	J.P.R.	Date	12/86	Scale	1:50000
Drawn	H.M.R.	Office	AHO	Revised	Date
Drawing No.	LJ50/1055			Fig. No.	2

AREA A1

AREA A2

AREA B

AREA C

AREA D

AREA E

Marionook River

Murchison River

Pieman River

Mackintosh River

Sterling River

Stitt River

Rosebery - Hercules M.L.

Farrell M.L.

Lake Rosebery

Pieman Road

Murchison Hwy

Bastyan Dam

Cutty Sark

Langdons

Tullah

Rosebery

Hercules

MT. BLACK 950 m

MT READ

CSAMT LINES

1372mN

1208mN

T.SALE 480 m

PRIORITY

8a
8b
7a
9a
10b
10a

TEM SURVEYS

1st. HALF 1986	AREA A	30·5km	UTEM
	AREA B	66·5km	
	AREA C	15·0km	
	TOTAL	112·0km	
2nd. HALF 1986	AREA D	24·0km	UTEM
	AREA E	7·4km	SIROTEM
	TOTAL	31·4km	

UTEM Anomalies

Roads, tracks

HEC power lines

EL Boundary

Survey lines

Base line

Access lines

TEM Transmitter Loop

CSAMT line

0 2 5 km

837075

5 cm

87-2752

Billiton Australia

The Metals Division of the Shell Company of Australia Limited

Project: ROSEBERY EAST J V

Title: 1985/86 TEM GRIDS WITH ANOMALIES

6875

Author N H	Date	Scale 1:50,000	
Drawn A S	Office AHO	Revised N H	Date 8/86
Drawing No LJ 50/1029			Fig No 3

377 500mE
378 000mE
378 500mE
379 000mE
379 500mE
380 000mE
378 000mN
377 500mN
377 250N
377 100N
377 000mN
376 800N
376 500mN
379 400E
378 900E
950E
100E
200E
300E
350E

LAKE ROSEBERY

BASTYAN DAM

CUTTY SARK

ROSEBERY THRUST

SEMI MASSIVE PY CLASTS

MASSIVE PY BANDS

MASSIVE PY SPH CLASTS

SECTION 184
vein py gal

strong chl + py alteration

BD 1

BD 269

CS1

V clastic, Epiclastic, Volc. Ssts Shale Epiclastics | Epiclastics | Pyroclastic

CS2

V clastics | V clastics | V clastic Ash, Pyroclastics | E clastic

HAWKSBURY

CSAMT (weak)

CSAMT CONDUCTOR

RED 87-1

Collar from Fig 20

mag-py | Andesitic Lava | mag-py | Rhyolitic-Dacitic Lava

Deformed Carbonated Chloritised V clastic

GROUND MAGNETIC SOURCE
d = 185m, 50°E

GROUND MAGNETIC SOURCE
d = 142m 86°E

GROUND MAGNETIC SOURCE
d = 157m 91°E

UTEM TREND
(projected vertically)

ROSEBERY MINE LEASE BOUNDARY

71R

P'clastic | HOST HOR | V clastic | Epiclastic | chert | P'clastics | mag-py | Andesitic Lava | Felsic V clastic

99R

P' clastic | HOST HOR | Epiclastics | mag-py | Epiclastics Qf In tr

65R

Rhyolitic - Dacitic Lst | Lava | V clastic or Lava | Dacitic Lava

74R 78R
76R 80R

57R

56R

49R

51R

46R

60R

P' clastic | HOST HOR | Epiclastics | Dacitic-Andesitic Lava | Dacitic-Andesitic Lava | P'clastic Ign | Dacitic-Andesitic Lava | Lst | P'clastic Ign | Dacitic Lava

ORE POS

ROSEBERY NORTH OPEN CUT

ROSEBERY OPEN CUT

Qf Intr

LEGEND

- Δ Δ — PYROCLASTICS – undifferentiated, welded entaxitic texture
- E E — EPICLASTICS – undifferentiated, layered, some degree of sorting
- V V — ANDESITIC LAVA – massive feldspar phyric
- Λ Λ — DACITIC LAVA – massive feldspar phyric, siliceous
- $Λ_R$ $Λ_R$ — RHYOLITIC RHYODACITIC LAVA – pink to grey massive siliceous

P'clastic — Pyroclastic
E'clastic — Epiclastic
Ign — Ignimbrite
Lst — Limestone
Qf Intr — Quartz Feldspar Intrusive

UTEM Conductor Position

Recent BAUS grid

5 cm

837076

87-2752

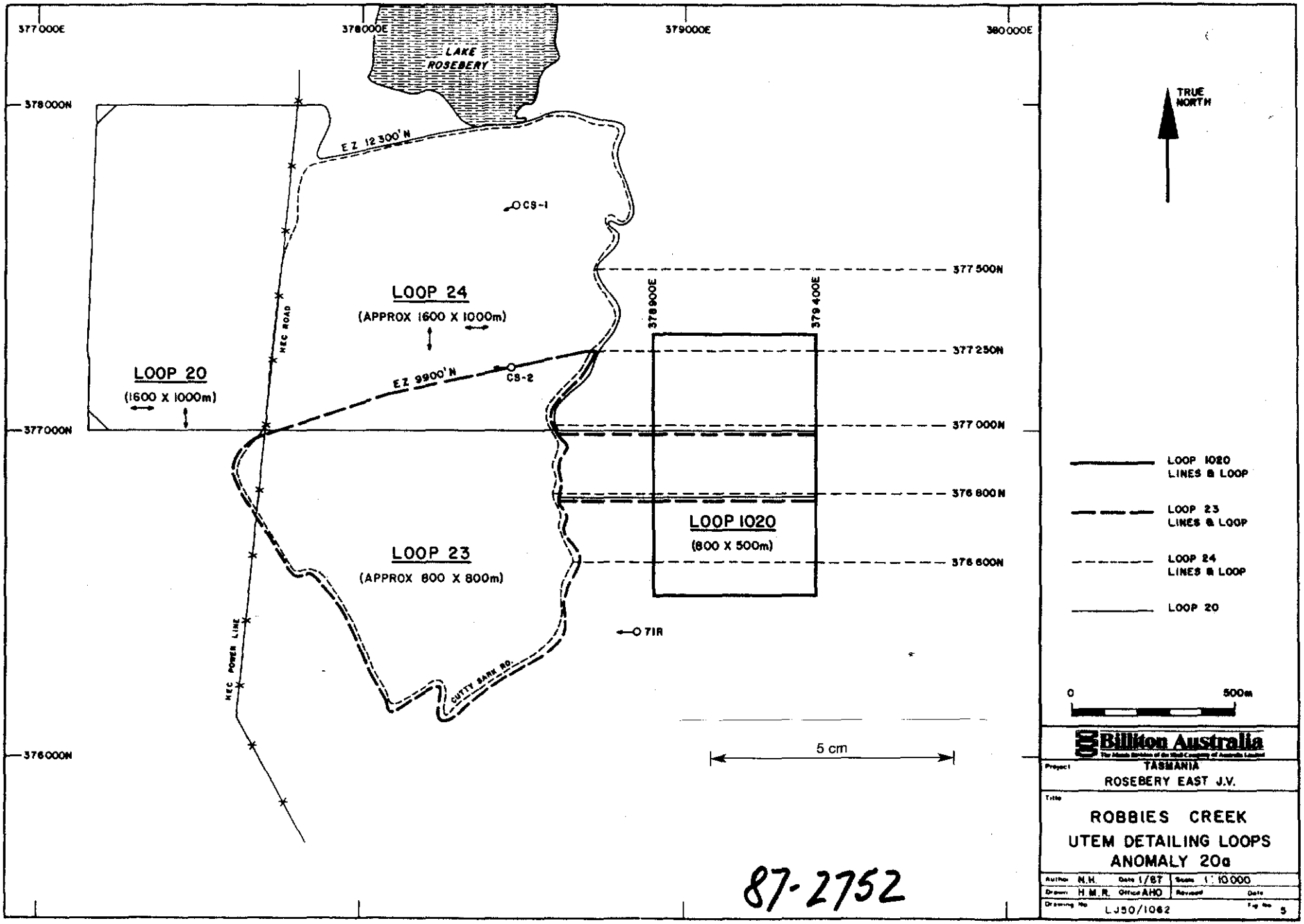
Billiton Australia
The Metals Division of the Shell Company of Australia Limited

Project	ROSEBERY EAST
Title	ROBBIES CREEK GEOLOGICAL SETTING
Author J.P.R	Dept.
Drawn O.H	Date 6/87
Checked	Date
Sheet No. FIG No. 4	
Scale 1:5000	
Revised	Date
S'ceded	Date
Drawing No. DEV LJ 50/003	

6876

075

837077



87-2752

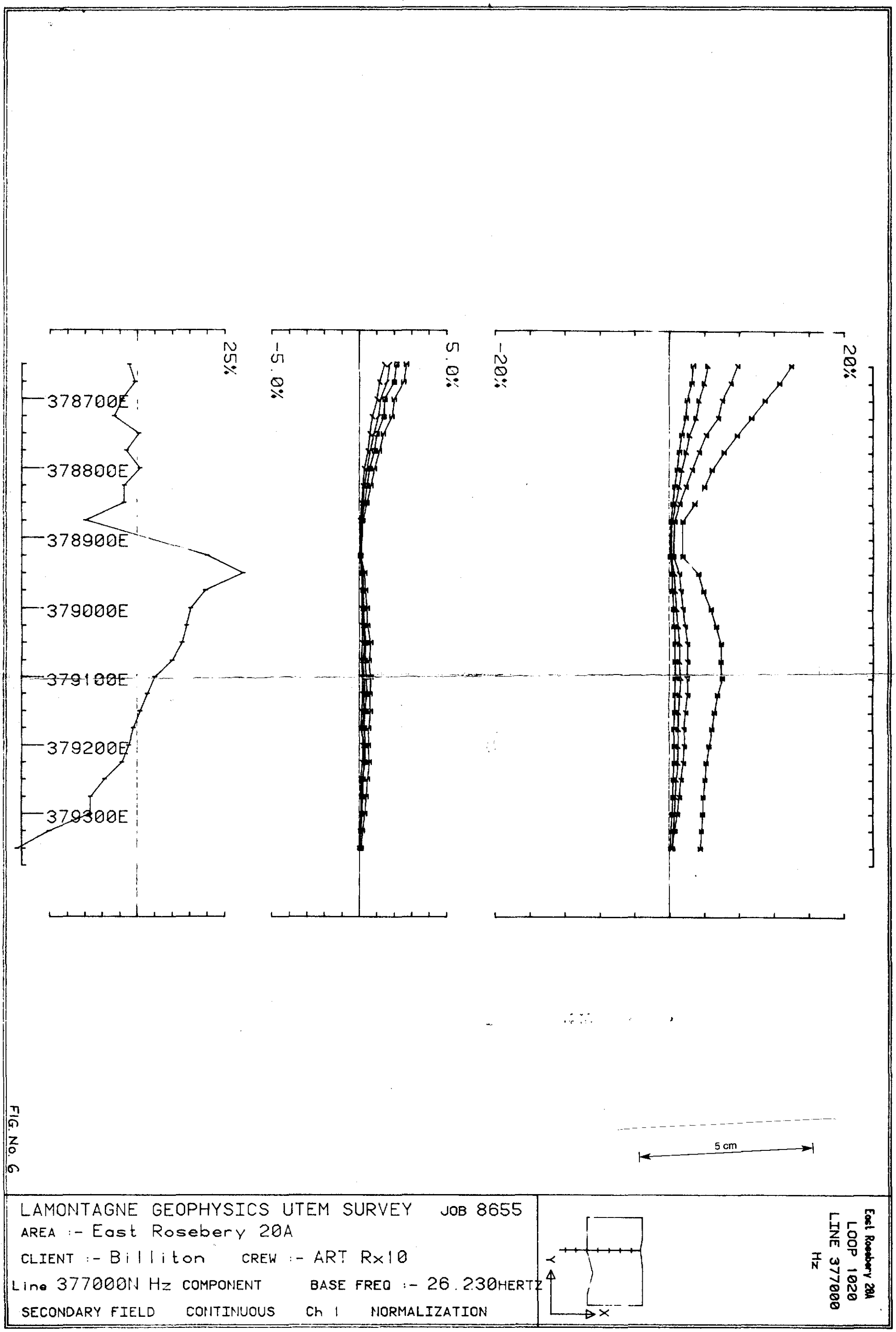


FIG. No. 6

837078

87-2752

077

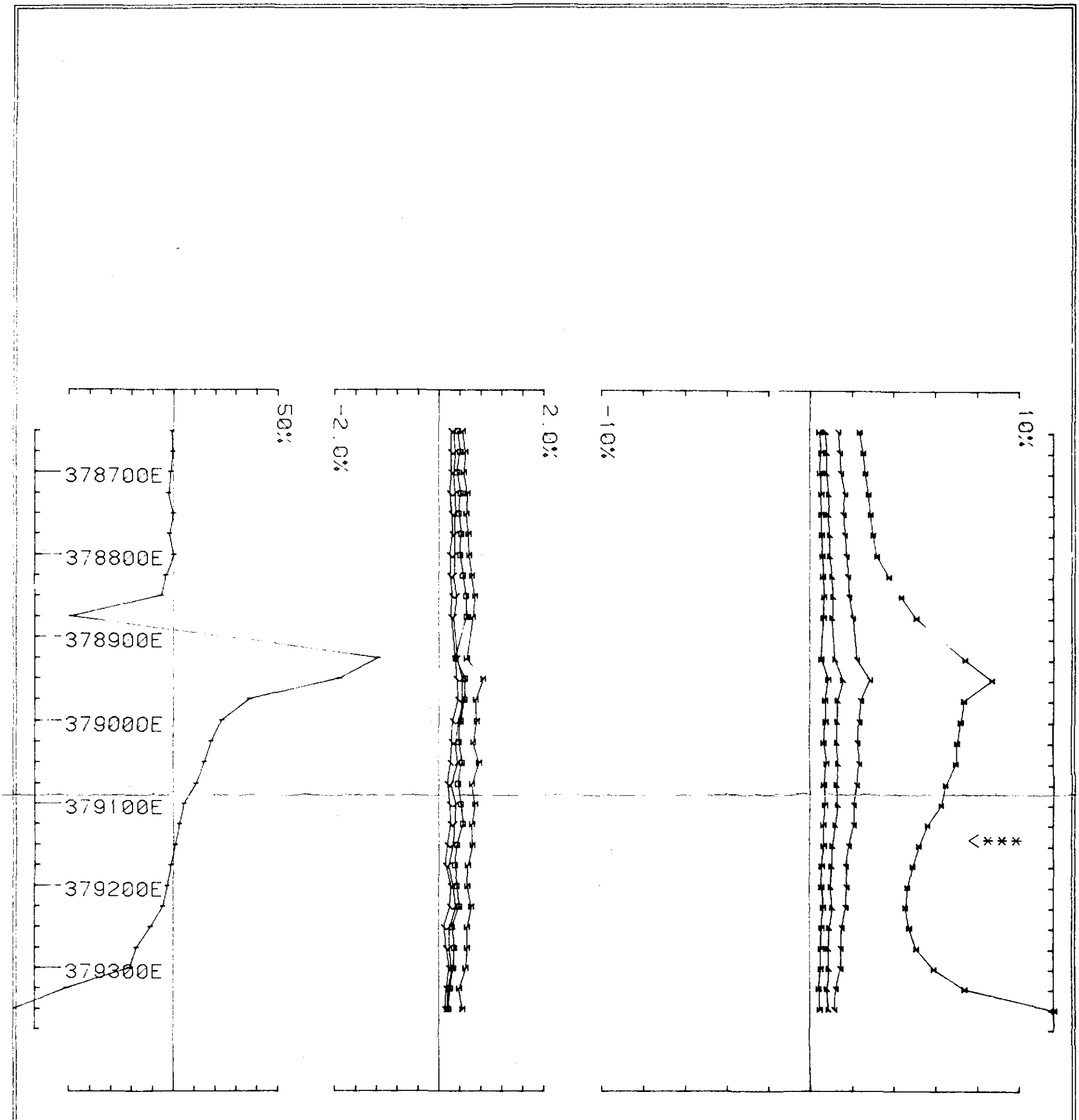


FIG. No. 7

LAMONTAGNE GEOPHYSICS UTEM SURVEY JOB 8655
AREA :- East Rosebery 20A
CLIENT :- Billiton CREW :- ART Rx10
Line 377000N Hz COMPONENT BASE FREQ :- 26.230HERTZ
SECONDARY FIELD POINT Ch 1 NORMALIZATION

East Rosebery 20A
LOOP 1020
LINE 377000
Hz

837079

87-2752

078

50%

2.0%

4.0%

378700E

378800E

378900E

379000E

379100E

379200E

379300E

<***

FIG. No 8

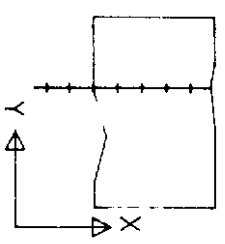
LAMONTAGNE GEOPHYSICS UTEM SURVEY JOB 8655

AREA :- East Rosebery 20A

CLIENT :- Billiton CREW :- ART Rx10

Line 377000N Hx COMPONENT BASE FREQ :- 26.230HERTZ

SECONDARY FIELD POINT Ch 1 NORMALIZATION



East Rosebery 20A
LOOP 1020
LINE 377000
Hx

837080

87-2752

079

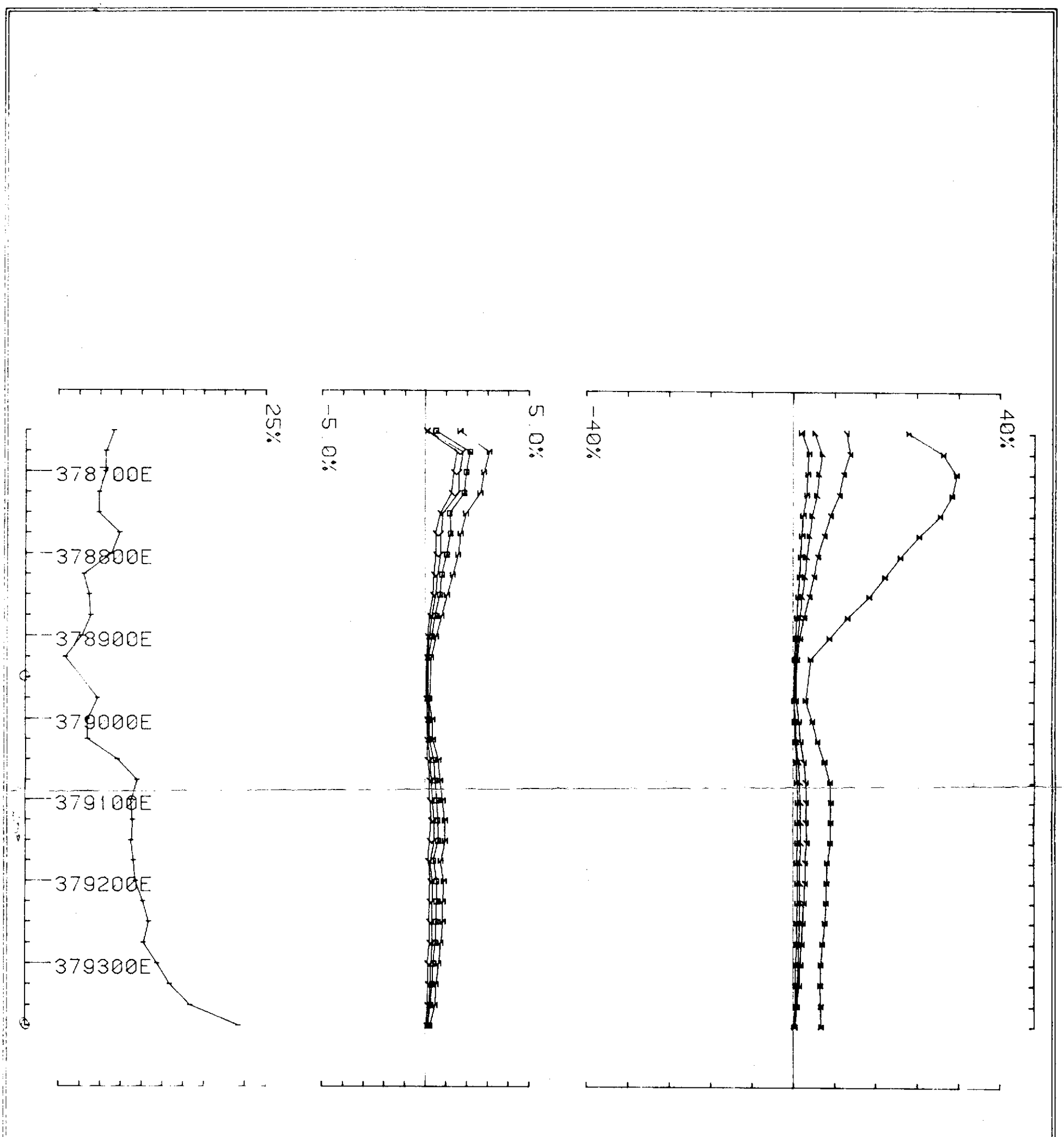


FIG. No. 9

LAMONTAGNE GEOPHYSICS UTEM SURVEY JOB 8655
AREA :- East Rosebery 20A
CLIENT :- Billiton CREW :- ART Rx10
-e 376800N Hz COMPONENT BASE FREQ :- 26.230HERTZ
SECONDARY FIELD CONTINUOUS Ch 1 NORMALIZATION

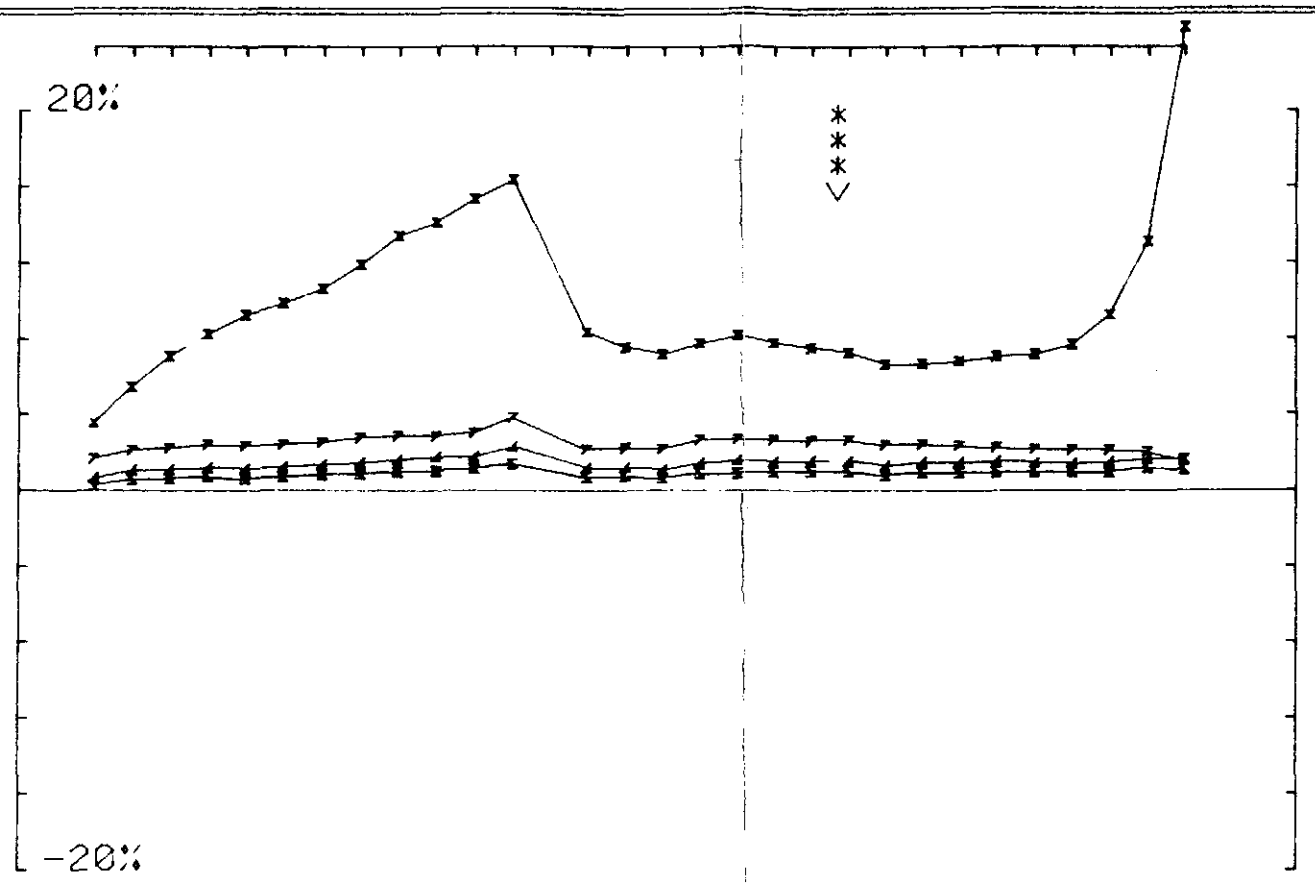
Y
X

East Rosebery 20A
LOOP 1020
LINE 376800
Hz

8370081

87-2752

837082



East Rosebery 20A
LOOP 1020
LINE 376800
Hz

X
Y

LAMONTAGNE GEOPHYSICS UTEM SURVEY JOB 8655
AREA :- East Rosebery 20A
CLIENT :- Billiton CREW :- ART Rx10
Line 376800N Hz COMPONENT BASE FREQ :- 26.230HERTZ
SECONDARY FIELD POINT Ch 1 NORMALIZATION

FIG. No. 10

87-2752

Obu

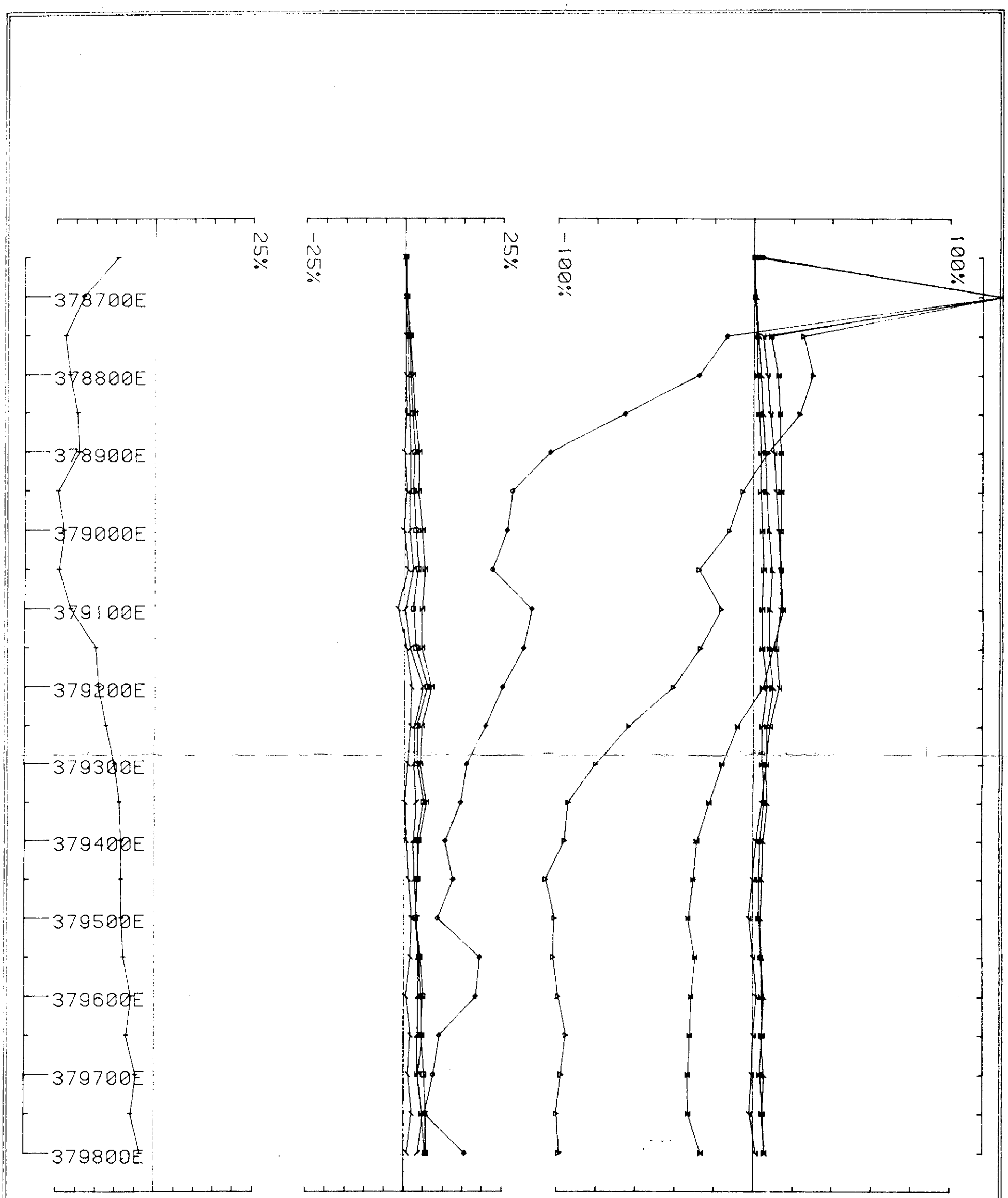
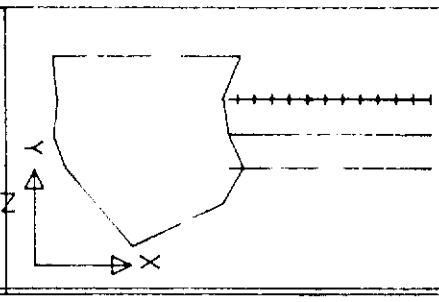


FIG. No. 11

LAMONTAGNE GEOPHYSICS UTEM SURVEY JOB 8655
AREA :- Rosebery East
CLIENT :- Billiton CREW :- ART Rx10
Line 377000N Hz COMPONENT BASE FREQ :- 23.810HERTZ
SECONDARY FIELD CONTINUOUS Ch 1 NORMALIZATION



Rosebery East
LOOP 0023
LINE 377000
Hz

837083

87-2752

082

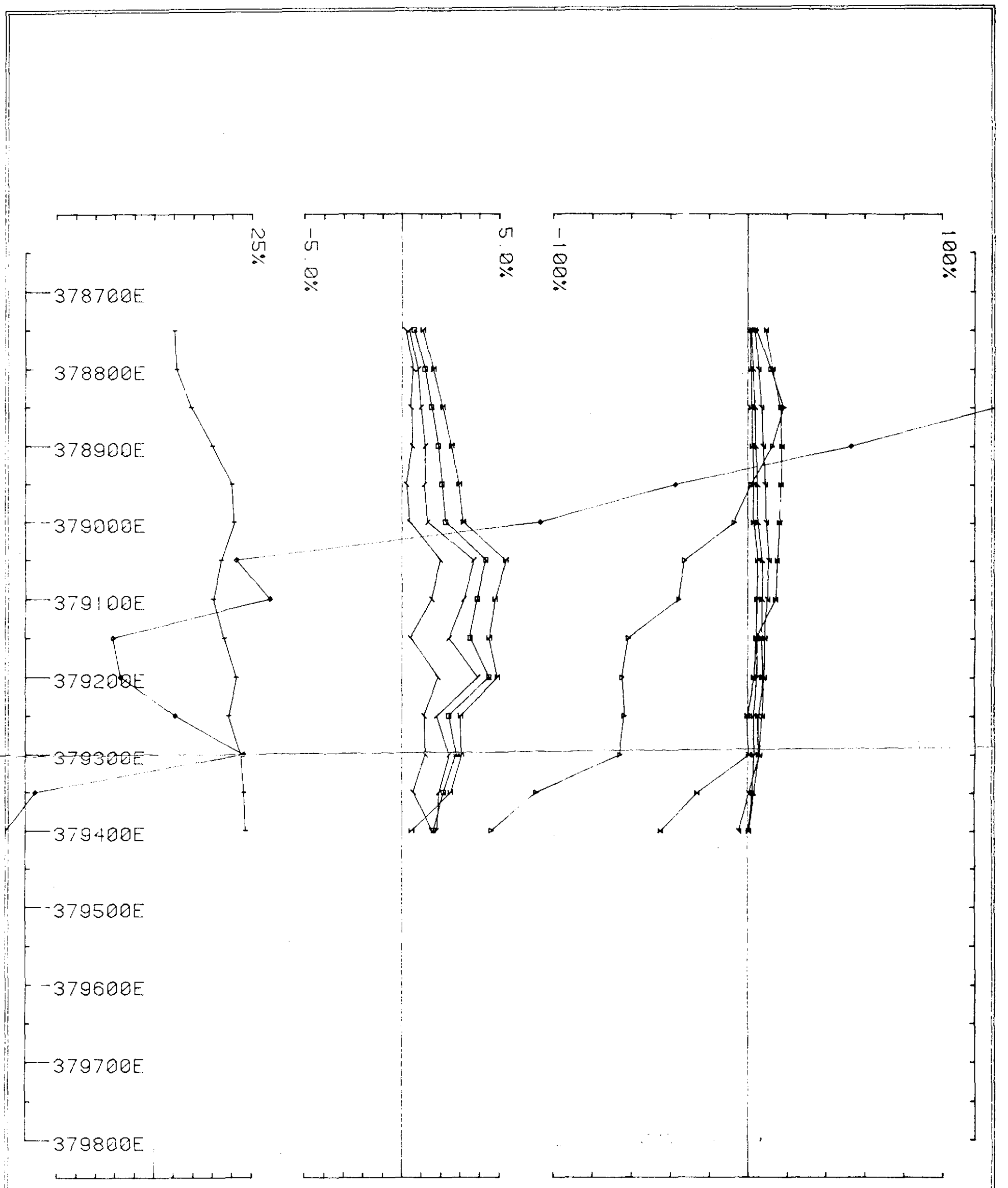


FIG. No. 12

LAMONTAGNE GEOPHYSICS UTEM SURVEY JOB 8655
AREA :- Rosebery East
CLIENT :- Billiton CREW :- ART Rx10
Line 376800N Hz COMPONENT BASE FREQ :- 23.810HERTZ
SECONDARY FIELD CONTINUOUS Ch 1 NORMALIZATION

Rosebery East
LOOP 0023
LINE 376800
Hz

8370 84

87-2752

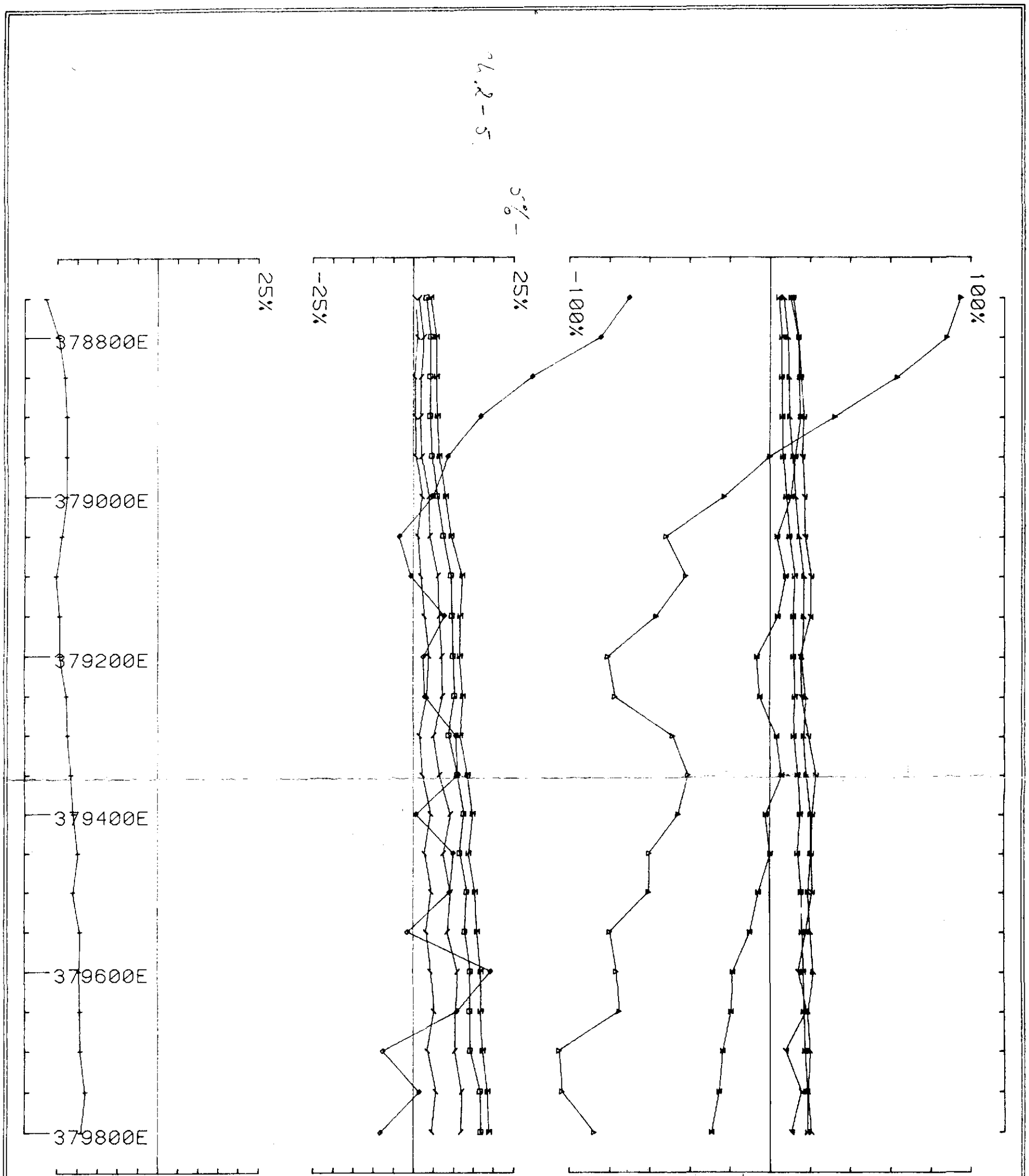


FIG. No. 13

LAMONTAGNE GEOPHYSICS UTEM SURVEY JOB 8655
AREA :- Roseberry East
CLIENT :- Billiton CREW :- ART
Line 377500N Hz COMPONENT BASE FREQ :- 26.230HERTZ
SECONDARY FIELD CONTINUOUS Ch 1 NORMALIZATION

837085

87-2752

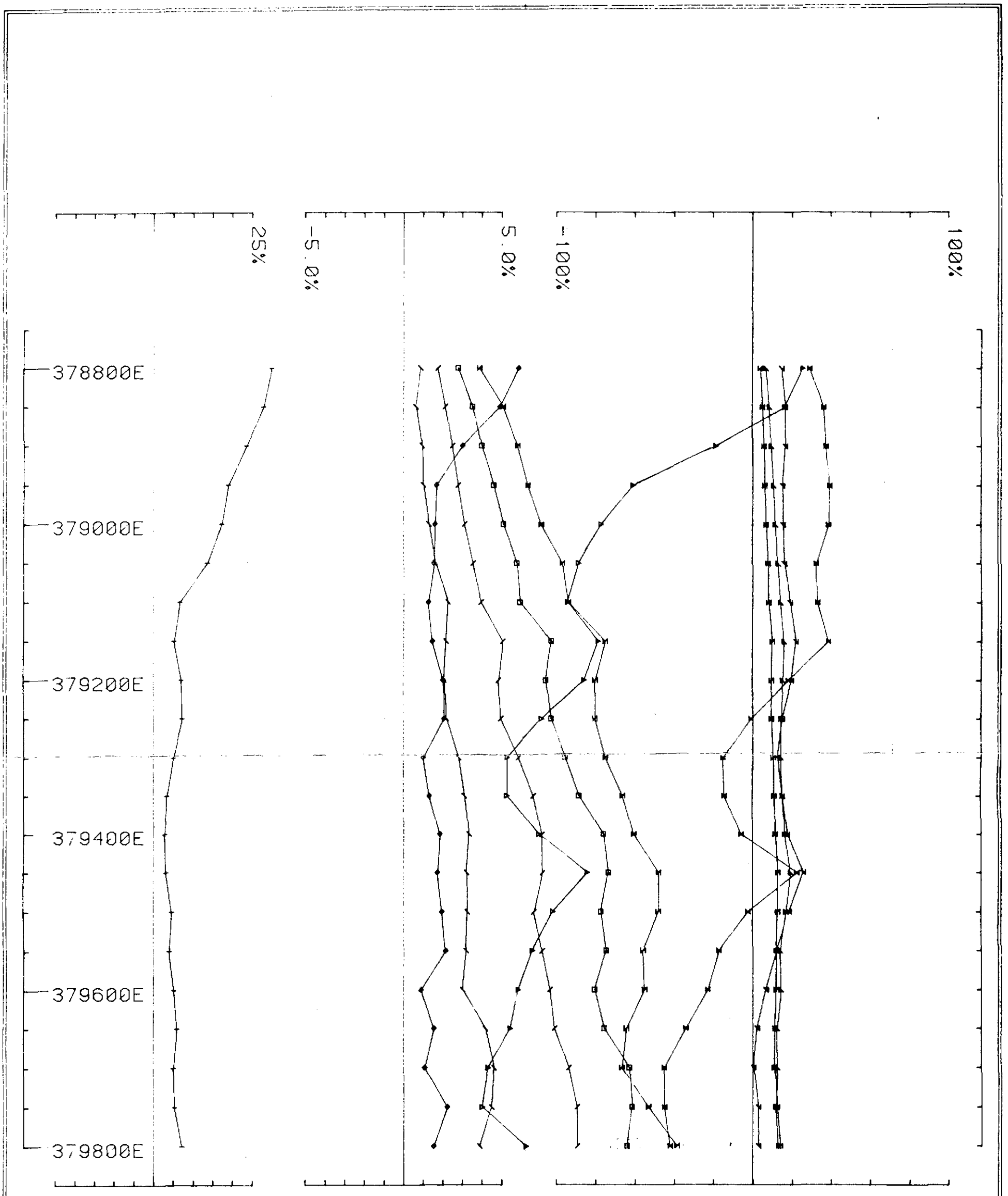
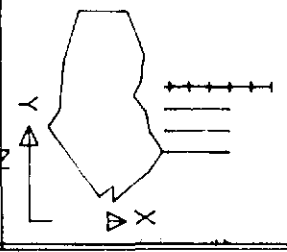


FIG. No 14

LAMONTAGNE GEOPHYSICS UTEM SURVEY JOB 8655
AREA :- ROSEBERY EAST
CLIENT :- BILLITON CREW :- BM
Line 377250N Hz COMPONENT BASE FREQ :- 23.810HERTZ
SECONDARY FIELD CONTINUOUS Ch 1 NORMALIZATION



ROSEBERY EAST
LOOP 0024
LINE 377250
Hz

837086

87-2752

085

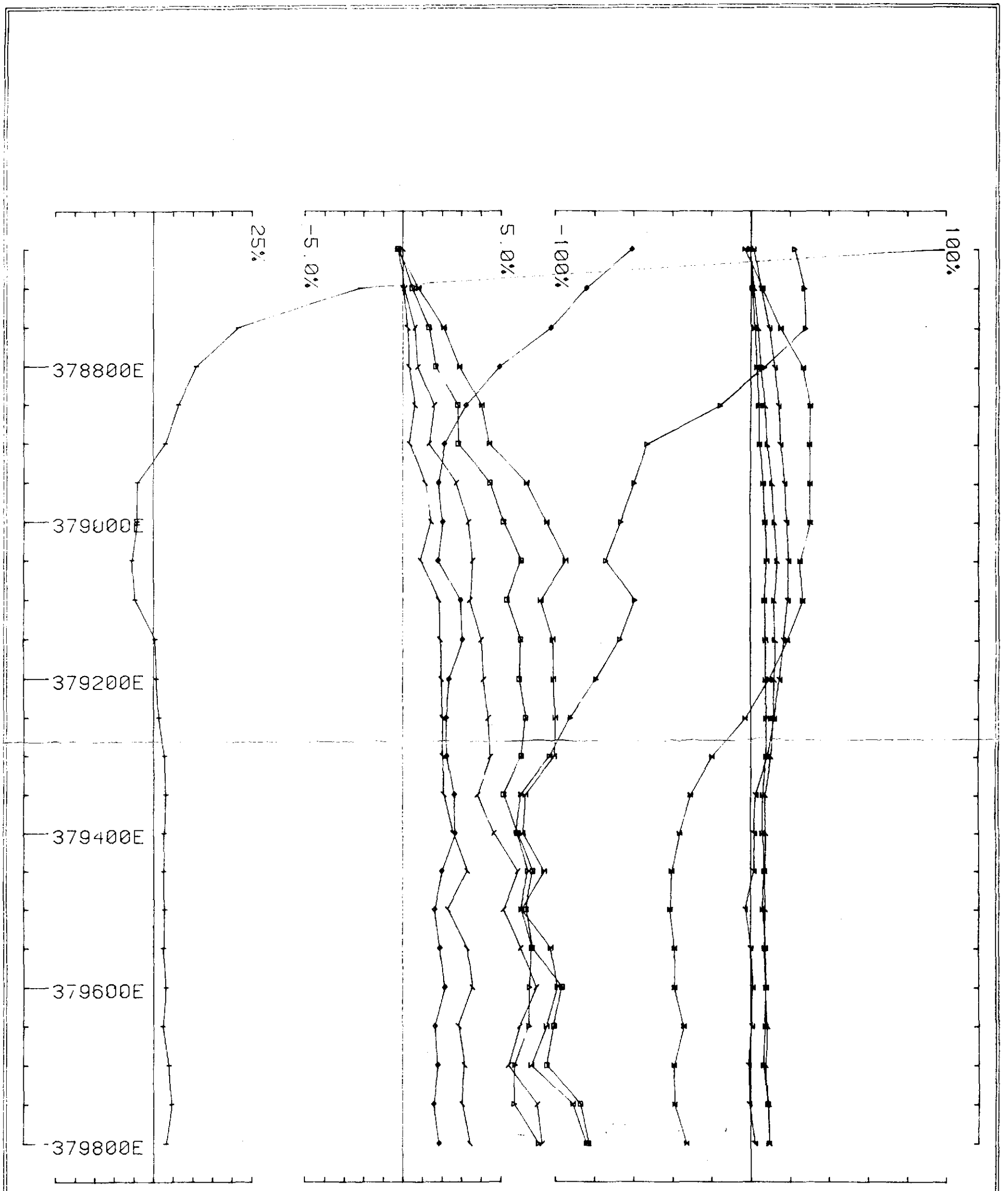
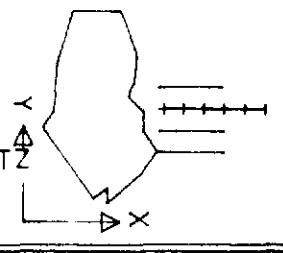


FIG. No. 15

LAMONTAGNE GEOPHYSICS UTEM SURVEY JOB 8655
AREA :- ROSEBERY EAST
CLIENT :- BILLITON CREW :- BM
Line 377000N Hz COMPONENT BASE FREQ :- 23.810HERTZ
SECONDARY FIELD CONTINUOUS Ch 1 NORMALIZATION



ROSEBERY EAST
LOOP 0024
LINE 377000N
Hz

83708?

87-2752

086

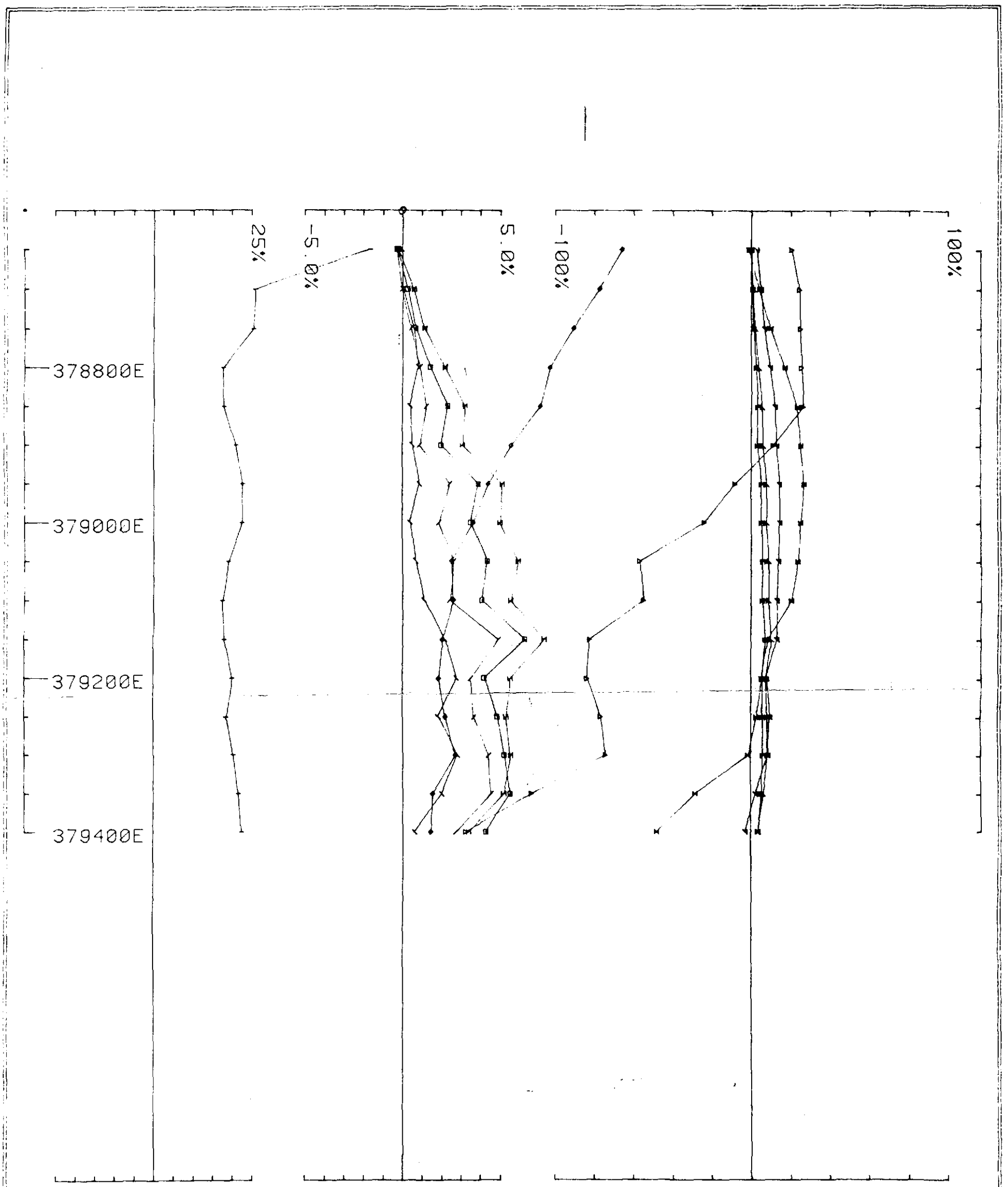
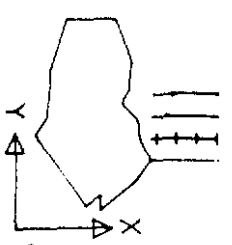


FIG. No. 16

LAMONTAGNE GEOPHYSICS UTEM SURVEY JOB 8655
AREA :- ROSEBERY EAST
CLIENT :- BILLITON CREW :- BM
Line 376800 N Hz COMPONENT BASE FREQ :- 23.810HERTZ
SECONDARY FIELD CONTINUOUS Ch 1 NORMALIZATION



ROSEBERY EAST
LOOP 0024
LINE 376800
Hz

837088

87-2752

087

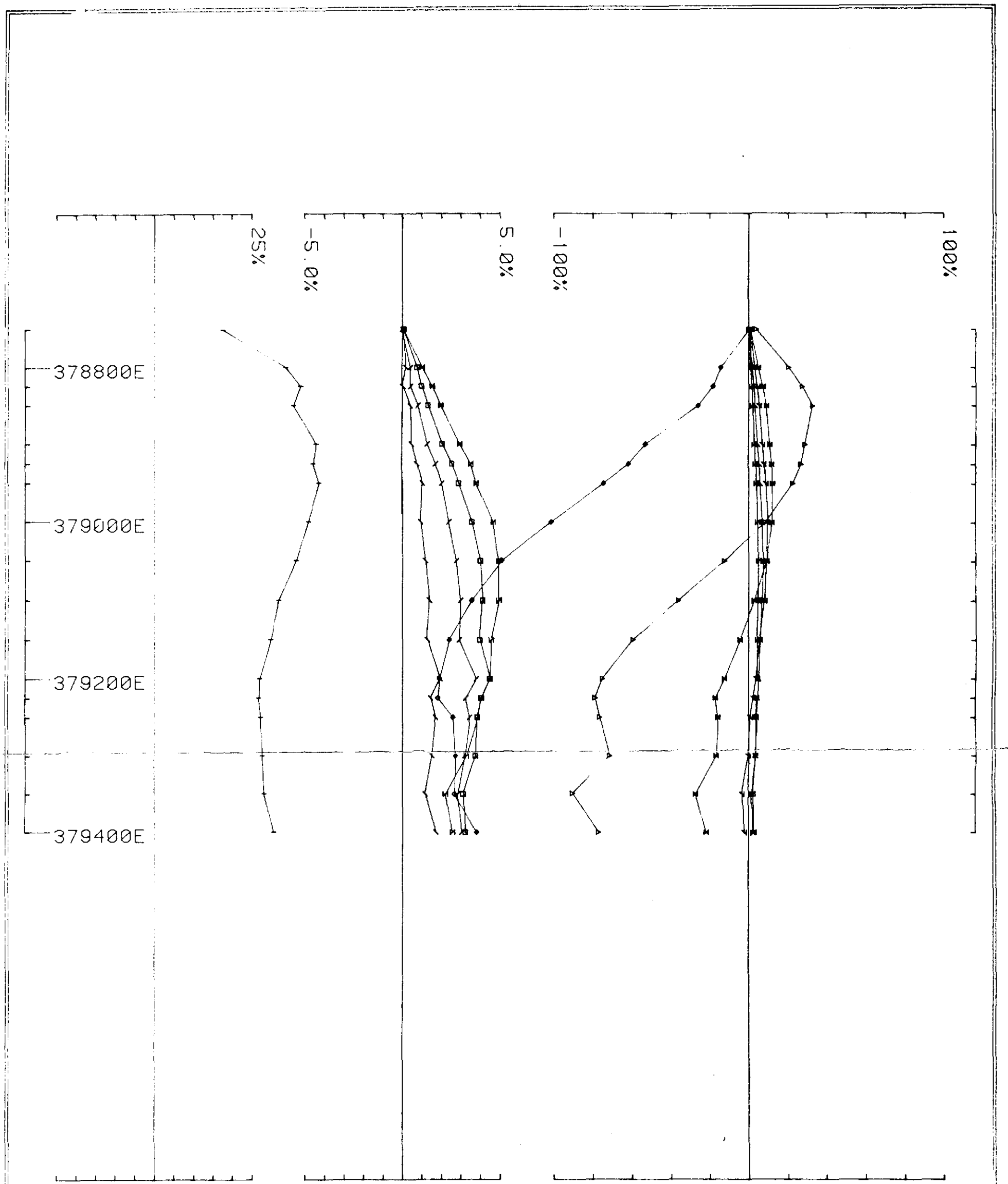


FIG No. 17

LAMONTAGNE GEOPHYSICS UTEM SURVEY JOB 8655
AREA :- ROSEBERY EAST
CLIENT :- BILLITON CREW :- BM
Line 376600N Hz COMPONENT BASE FREQ :- 23.810HERTZ
SECONDARY FIELD CONTINUOUS Ch 1 NORMALIZATION

ROSEBERY EAST
LOOP 0024
LINE 376600
Hz

8370 89

87-2752

088

SHELL COMPANY OF AUSTRALIA

METALS DIVISION

R.O.C.S. - PROTEM

N.W. TASMANIA
ROSEBERY J.V.
ROBBIES CREEK (20a)
GROUND MAG

SCALE 1 : 5000

FIG No :	1
DATE :	
AUTHOR :	
OFFICE :	
DRAWN :	

LEGEND	
BASE LEVEL =	62400.T
	200.T/cm
	RAW MAG

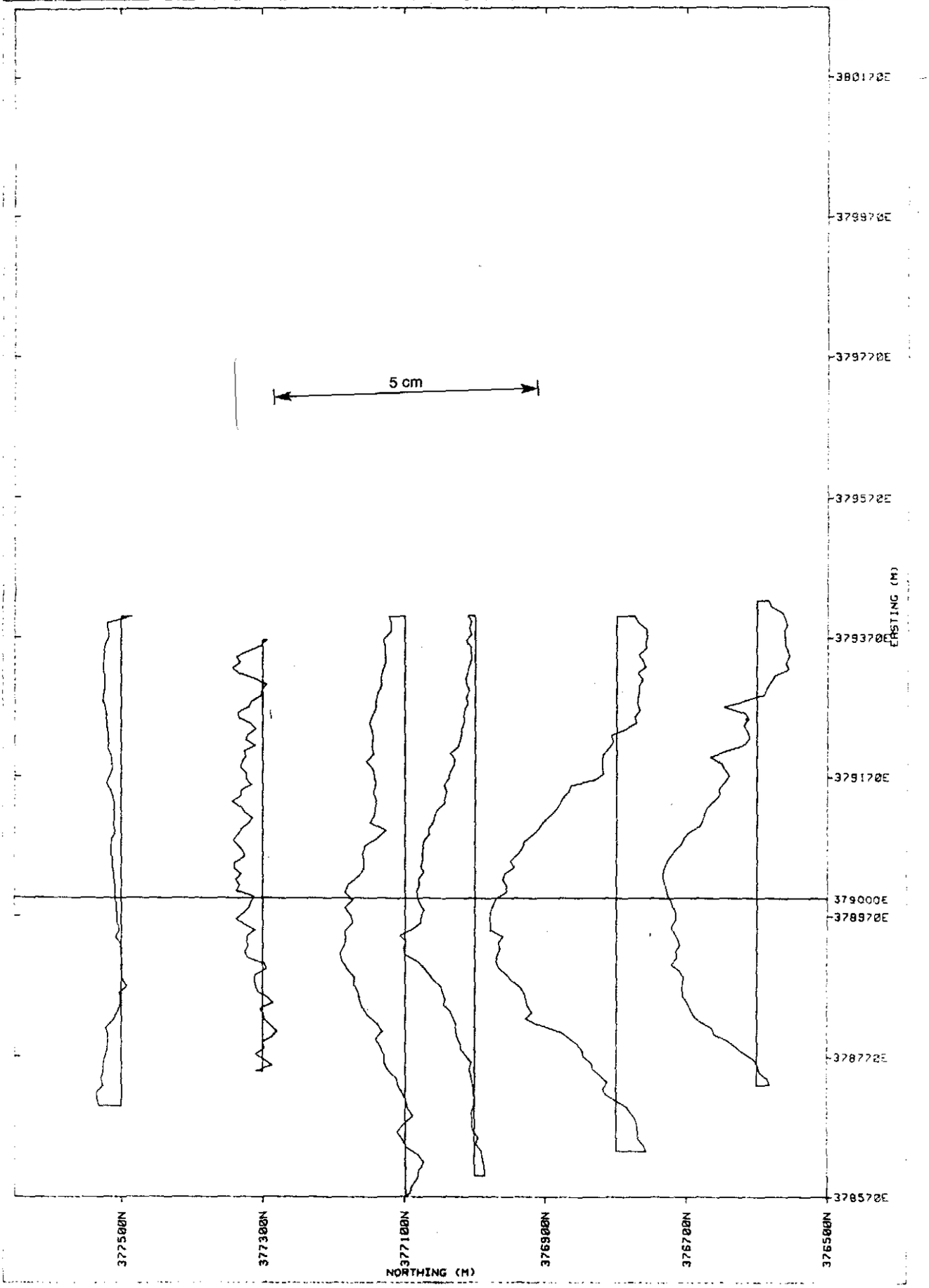
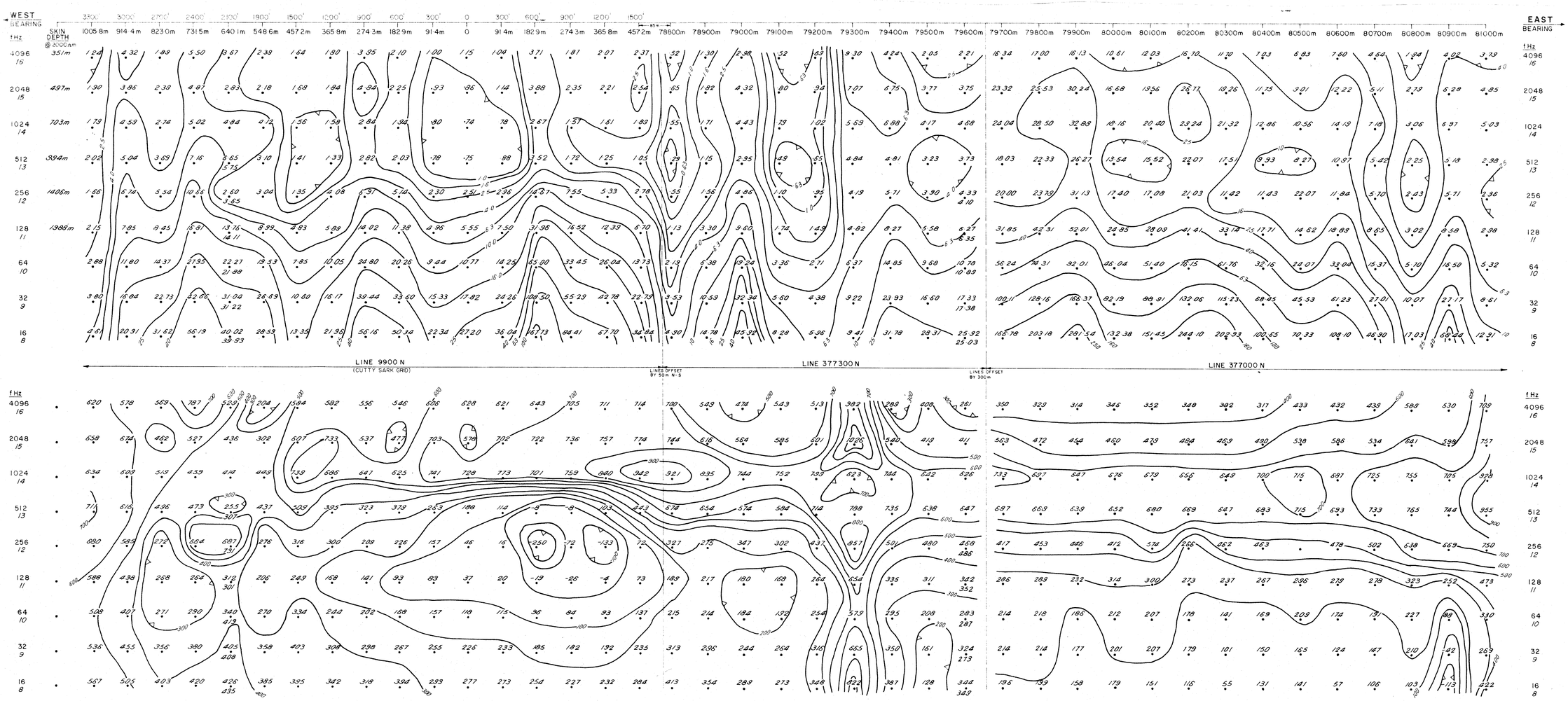


FIG. No. 18

87-2752

837090



LINE 377 300 N

CSAMT

CAGNIARD RESISTIVITY

Km

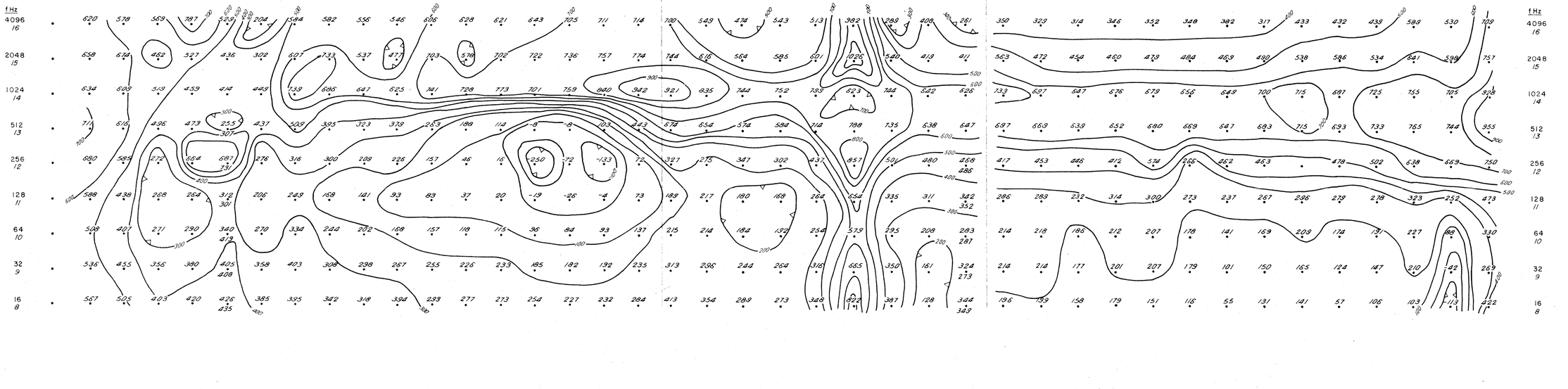
R x length = 100m (300ft Line 9900N)

T x length = 11 km

T x position 6.0km to South

T x orientation N 85°E

By Zonge for Billiton 2/86

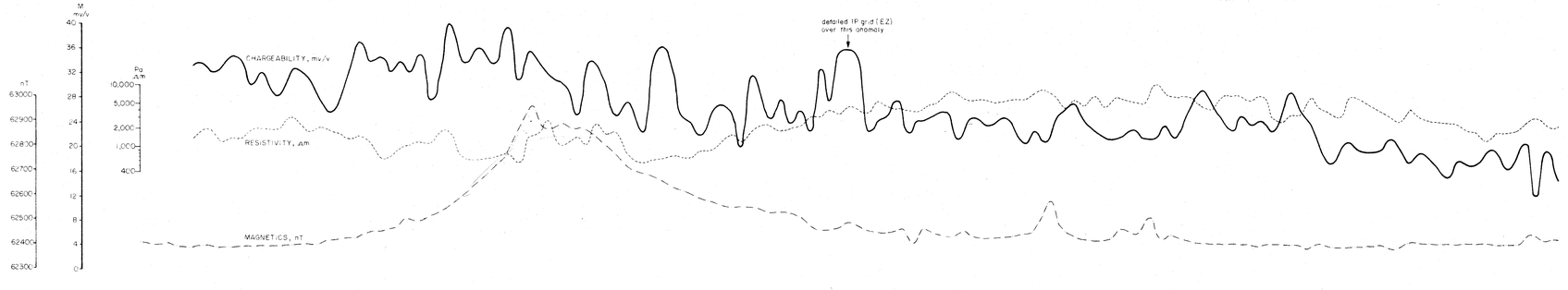


LINE 377 300 N

CSAMT

PHASE DIFFERENCE

milli - radians



LINE 377000 N

I.P. & MAGNETIC SURVEYS

By Scintrex for E.Z. 12/78 & 1/79

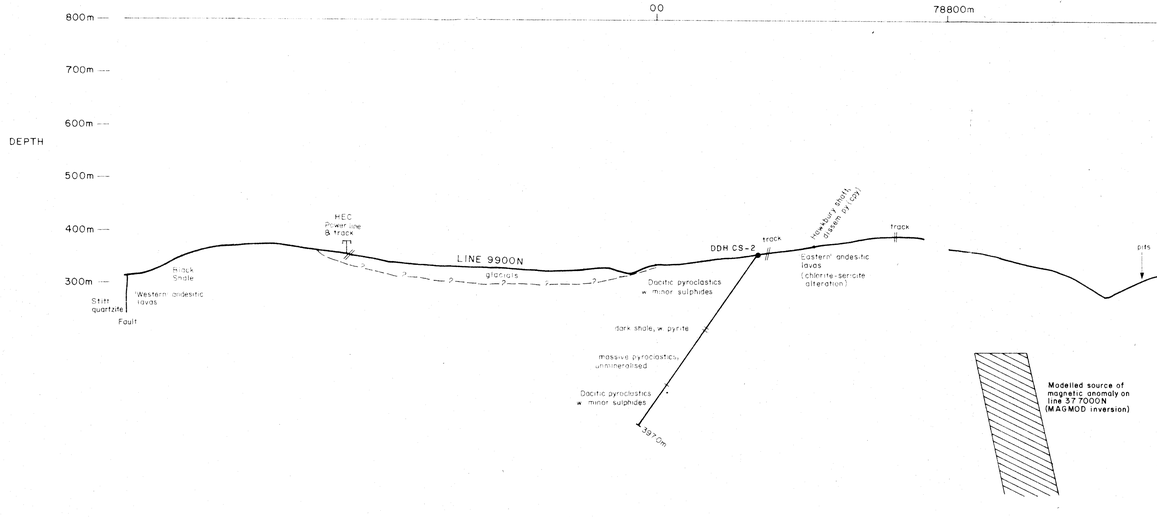
Gradient array : $C_1 C_2$ = 6500m

$P_1 P_2$ = 20m

Rx = IPR-8

Timing = 2 sec on-off

Ms plotted



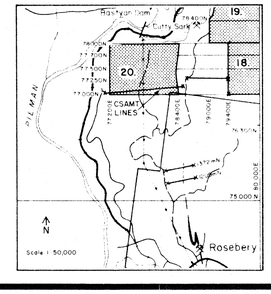
TOPOGRAPHY

from 1:10,000 topo maps (EZ)

837091

5 cm

-87-2752



6877

Billiton Australia

The Metals Division of the Shell Companies in Australia Limited

Project: ROSEBERY EAST J.V., TAS

Title: CUTTY SARK AREA GEOLOGICAL CROSS-SECTION WITH IP, CSAMT & MAGNETICS

Author N.H.	Dept AHO	Scale 1:5000	
Drawn S.L.P.	Date 8/86	Revised	Date
Checked	Date	Traced	Date
Sheet No. FIG. No. 19		Drawing No.	LJ 50/1035

750E 78800E 850E 78900E 950E 79000E 050E 100E 150E 200E 250E 300E 350E 400E 400E Mallinson 450E 500E 550E

Glacial Erratics leached clays

Zone of variable magnetic andesitic lava with magnetite-pyrite veinlets and breccia zones

253° 253·5° 255° 256° 257° 259° 258° 259° 258° 253°

349m

Collar Co-ordinates
377 000N
379 481E
-70°
253°

Zone of dacitic-andesitic lava amygdaloidal usually non-magnetic.

Zone of pyritic sericitic altered tuff, lava. Along strike represented by qtz (f) porphyry, epiclastic breccia, sericitized rhyolitic tuff and bedded carbonate.

Glacial Ledge

R.L. Datum

Creek

185 Cu <5Pb 40 Zn <0·05 Ag 20 As 710 Ba <0·008 Au
Py silic. seric. porph. andesite lava, tuff

13123

Glacial Terrace 35-40m thick

Creek

METERAGE SAMPLED (Cu Pb Zn Ag As Ba Sn W Au)

FROM	TO
84·1	86·7
90·7	94·0
211·9	214·6
286·5	296·0
401·0	407·0
458·4	473·5
477·5	481·7
504·5	519·5
529·2	546·2
550·5	551·05
554·45	554·95
559·5	572·0
580·0	591·5

ANOMALOUS GEOCHEMISTRY

FROM	TO	INTERVAL	Cu	Pb	Zn	Ag	Au	As	Ba	Sn	W
84·1	85·4	1·3m					0·16				
287·5	288·0	0·5	1750								135
478·5	479·5	1·0									135
479·5	480·5	1·0									135
480·5	481·5	1·0									175
542·3	542·7	0·4	1300								
544·4	545·3	0·9	1150								
554·45	554·95	0·5	1050								
571·1	572·0	0·9		360	1200						
581·1	582·0	0·9		220							
582·0	583·0	1·0		630							
583·0	584·0	1·0			1300						
584·0	585·0	1·0		530	3300						
585·0	586·0	1·0		240	2450						
586·0	587·0	1·0		280	1350						
587·0	588·0	1·0			1500						
588·0	589·0	1·0			1100						
589·0	590·5	1·5		230	2550						

MODELLED MAGNETIC SOURCE

185m

DETAIL ①

477·5
478
mag 97%mag 3% py
478·5
35% py 25%mag
479
95%mag
60%mag
40%py
20%mag
70%py
25%mag
85%mag
5% py
479·2
25%mag
15% py
50%mag
5% py
60%mag
480
20%py
60%mag
5-10% mag
90%mag
480·5
35%mag
3% py
15%mag
481
70%py
20%mag
20%mag
481·5
35% py
20%mag
70%mag
tr py
482

GREY MOTTLED ANDESITIC LAVA

DETAIL ②

529
75%py
529·5
5%py
VARIABLY BANDED CARBONATED SILICIFIED AND CHLORITIZED SHEAR ZONE
530
50%py
Laminated Chert
530·5
531
80%py
80%py
531·5

DETAIL ③

542
mass py mag
542·5
mass mag py
mass py 60%mag 35%py
543
chl mag
60%mag 40%chl
MASSIVE CARBONATED ANDESITIC LAVA
543·5
544
60%py
20%chl
5% py
544·5
545
Strong carbonate chlorite banding
5%py
80%py
545·5
20%py 60%chl
546
90%py
546·5

MODELLED UTEM SOURCE

MODELLED PREFERRED UTEM CENTRE

DETAIL ①
DETAIL ②
DETAIL ③

RED 87-1

Glacial Sands and Boulders

b/f

Pumiceous amygdaloidal flow

Pumiceous porphyritic feldspathic crystal tuff, coarse amygdaloidal pyroclastic flows

chloritic layered

5%py diss

3%py diss

chloritic 5%pyritic carbonate porphyroblastic

coarse pumiceous flows, quartz veined strongly broken feldspar phyric

quartz veined grad

quartz infill

grad chlorite layering grad compositional layering grad sanding

feldspar phyric amygdaloidal

graded beds trachyte facing feldspar spotted andesitic dykes iron mag

vague flow banding

trace py diss

grad

grad cb vein 45°-0A

weak cb qtz veining

trace py

basaltic

trace bebby fine py quartz vein 3-5% py blebs elongate

banded qtz-cb-chl-py

carb vein grad broken core

trace py grad

mag-cb-chl-py 3% shear grad

carb-chl-py breccia grad

strongly broken

grad flow ton chl grad

rare py

trace 2% py

rare py-mag blebs

over 15%mag-grad upto bebby mag py upto 60%mag 20%py

grad chl cb broken

mag vns grad chl-mag-py 3%

qtz-chl-py 3%

trace py

10cm lam

grad upto 75% py 20% chl

upto 60%py 20%mag

py mag bands chl-cb 30

trace py diss and veins

trace py diss and veins shear

fine lam tr py blebs

sericite dusting moderate carbonate veining

EOH 607·5m

FELDSPAR PHYR CARBONATED SERICITIZED VOLCANICLASTIC

FINELY BEDDED CARBONATED SERICITIZED FELDSPATHIC CRYSTAL AND QUARTZ PHYRIC LAVA

FINE BLACK MUDSTONE

CARBONATED SERICITIZED FELDSPATHIC HEAVY PYRITE BEDDED SILTSTONE

ANDESITIC LAVA WITH ANNEALED DEFORMED ZONES

ANNEALED BANDED FELDSPATHIC SEMI-MASSIVE PYRITE-MAGNETITE

ANNEALED DEFORMED ZONES

SILICIFIED ANDESITIC LAVA

CHLORITIC SILICIFIED ANDESITIC LAVA

ANNEALED DEFORMATION ZONE

SILICIFIED BROKEN ANDESITIC LAVA

ANNEALED DEFORMED ZONE

MOTTLED ANDESITIC LAVA WITH COARSE PY-MAGNETITE VEINS AND BLEBS

DACITIC LAVA WITH THIN QUARTZ INTERBEDS

GREY-PINK SILICIFIED DACITIC-ANDESITIC LAVA

MASSIVE ANDESITIC LAVA

SILICIFIED ANDESITIC LAVA

FELDSPAR PHYRIC ANDESITIC LAVA

SILICIFIED DACITIC LAVA

FELDSPAR PHYRIC DACITE/ ANDESITIC LAVA

FINE GRAINED BASALTIC DYKE (?FLOW)

FINE GRAINED BASALTIC FLOW

FELDSPAR PHYRIC ANDESITIC LAVA

COARSE FELDSPAR PHYRIC ANDESITIC LAVA

MOTTLED DACITIC ANDESITIC LAVA

FELDSPAR PHYRIC ANDESITIC LAVA

GREY RHYOLITIC LAVA

FELDSPAR PHYRIC RHYODACITIC LAVA

RHYOLITIC LAVA

DACITIC ANDESITIC LAVA

BASALTIC LAVA FLOW BOUNDARY

DACITIC RHYODACITIC LAVA

ANDESITIC LAVA

PINKISH GREY DACITIC LAVA SHEARED LAVA WITH SMALL FELDSPAR PHYRIC SHEARED SERICITIZED FINE EPICLASTIC

MASSIVE DACITIC-ANDESITIC LAVA

RED RHYOLITIC LAVA

DACITIC LAVA WITH THIN CHLORITIC TUFFACEOUS PUMICEOUS BANDS

PINK RHYOLITIC LAVA

DACITIC TUFF/LAVA

DACITIC LAVA

MASSIVE ANDESITIC LAVA

FELDSPAR PHYRIC ANDESITIC LAVA

PINK RHYOLITIC LAVA

DACITIC LAVA

MASSIVE DACITIC LAVA

SHEARED DACITIC RHYODACITIC LAVA

PINK SILICEOUS RHYODACITIC LAVA

MIXED DACITIC LAVA UNWELDED VITRICTUFF

quartz chlorite veins

pumiceus tuff quartz pyrite veinlets

FELDSPAR PHYRIC DACITIC LAVA

END OF TRICONE

T.S. 92·4m [V'CLASTIC] Intensely sericitized carbonated unwelded vitric pumice crystal tuff (andesitic).

T.S. 98·8m [LAVA] Brecciated and heavily sericitized feldspar phyric dacitic lava.

T.S. 164·5m [EPICLASTIC] Carbonated, chloritized and sericitized finely vitroclastic sediment and pelite in contact with scoured, probable feldspathic arenite.

165·2m [LAVA] Intensely sericitized feldspar phyric dacite lava with xenoliths of finely vitroclastic sediment.

T.S. 213·0m [EPICLASTIC] Strongly foliated, sheared, ankerite and quartz-veined, intensely sericitized finely fragmental sediment.

T.S. 443·9m [LAVA / SEDIMENT] Foliated sericitized siltstone and slate with chloritized blebs of former glass or pumice.

T.S. 530·4m [SEDIMENT] Planar laminated sericitic slate and disturbed laminated sericitic siltstone with altered blebs of inferred glass.

T.S. 569·8m [SEDIMENT] Sericitic and chloritic laminated slate and siliceous siltstone with traces of pyrite and some deformed veins.

T.S. 602·4m [EPICLASTIC] Moderately sericitized and lightly carbonated and chloritized volcaniclastic arenite.

DETAIL OF FACING EVIDENCE

163·5
164
sericite dusting DACITIC LAVA
fine carbonate veinlets
FELDSPATHIC ARENITE WITH CARBONATED CHLORITIZED FINE VITROCLASTIC SEDIMENT
164·5
scour structure inferring a down hole facing
DACITIC LAVA
fine quartz phenocryst
SERICITIZED DACITIC LAVA WITH ANGULAR XENOLITHS OF FINE VITROCLASTIC SEDIMENT
165
autobreccia
FELDSPAR PHYRIC CARBONATED DACITIC ANDESITIC LAVA
165·5
166

DACITIC LAVA — Feldspar phyric often siliceous and massive. Pink to grey green in colour

ANDESITIC LAVA — Medium to coarse feldspar phyric grey green, often massive. Grades into dacitic composition.

RHYOLITIC LAVA — Strongly siliceous massive pink to grey. Some flow banding.

BASALTIC LAVA — Very fine grained often chloritized may be intrusive.

DEFORMED ZONE — Annealed shear zone strongly carbonated, chloritized and silicified.

FINE LAMINATED MUDSTONE — Extremely fine regular laminations, weakly pyrrhotitic.

Core angles – shearing
– foliation
– bedding, contact

T.S. 443·9 Petrology: thin section 443·9 metres

grad Gradational control

5 cm

837092
87-2752

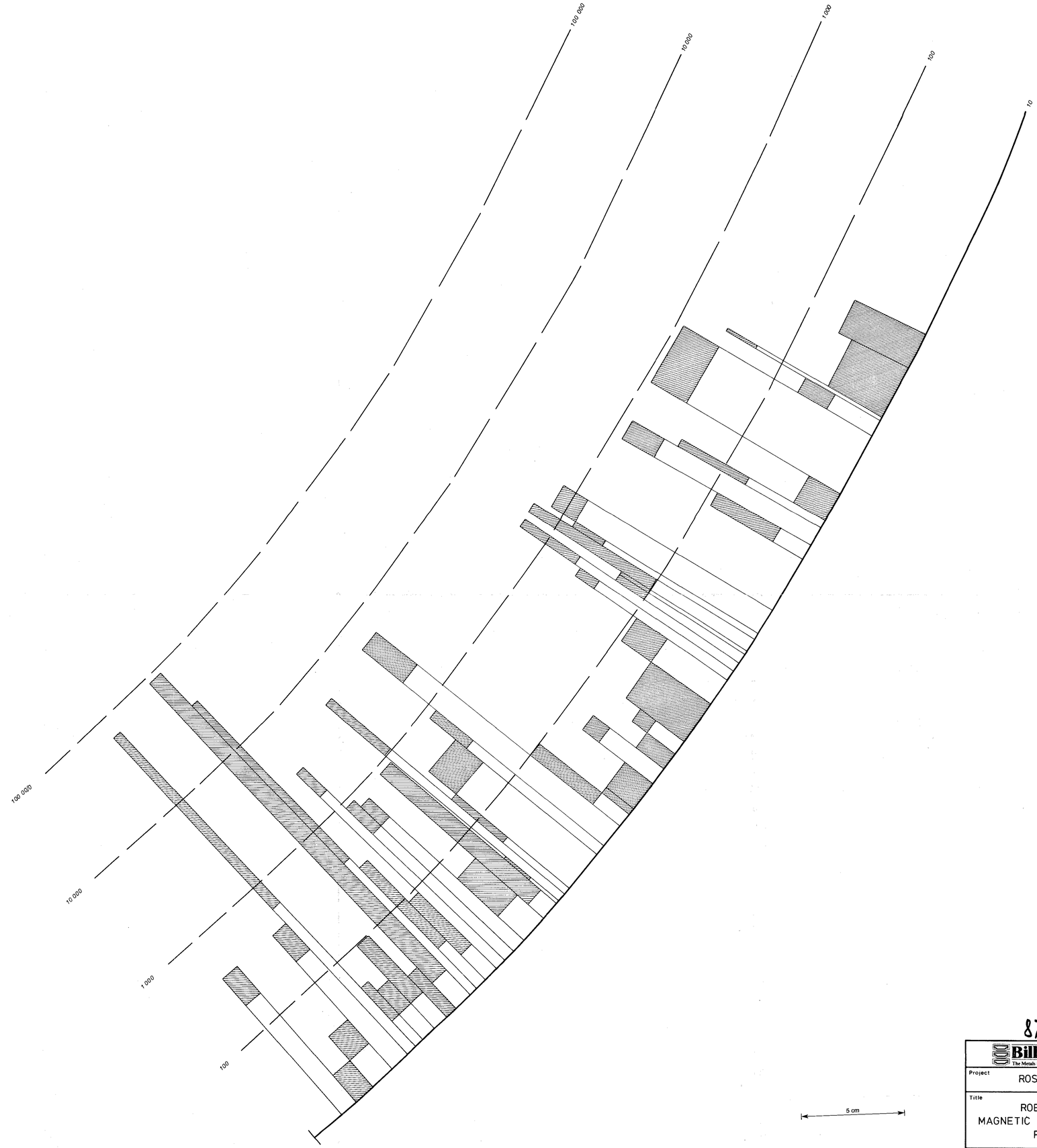
Billiton Australia
The Metals Division of the Shell Company of Australia Limited

Project: ROSEBERY EAST

Title: ROBBIES CREEK DRILL HOLE SECTION RED 87-1

Author J P R	Dept.	Scale 1:1000	
Drawn G H	Date MAY 87	Revised	Date
Checked	Date	S'ceded	Date
Sheet No.	FIG. No. 20	Drawing No.	TAS: LJ 50/001

6878



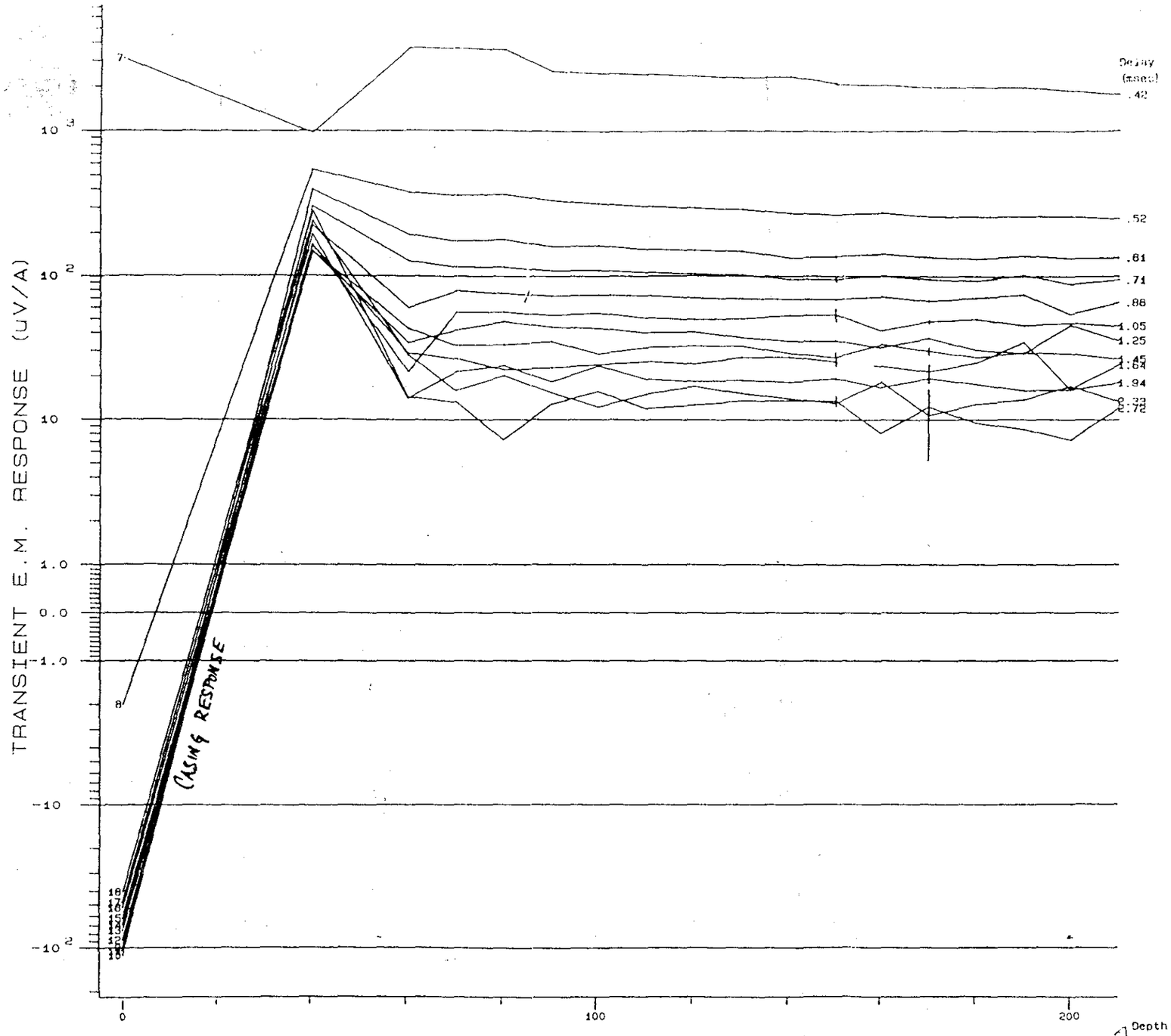
837093

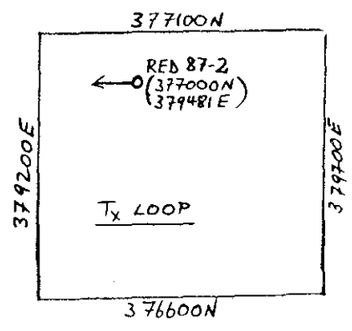
87-2752

Billiton Australia
The Metals Division of the Shell Company of Australia Limited

Project	ROSEBERY EAST		
Title	ROBBIES CREEK MAGNETIC SUSCEPTIBILITY LOG RED 87-1		
Author J.P.R.	Dept.	Scale S.I. UNITS	
Drawn O.H.	Date 5/87	Revised	Date
Checked	Date	S'ceded	Date
Sheet No. FIG. No. 21		Drawing No. TAS-LJ 50/002	

6879





837094

5 cm

BILLITON AUSTRALIA
AREA: ROSEBERY, TASMANIA
GRID: MOUNT BLACK (ROBBIES CREEK)
HOLE RED 87-1 uncased EARLY TIMES
SIROTEM Survey by SOLO Geophysics & Co. 2/ 6/87
SOLO hole ref. 100 Reading interval 10.0 m
SCALE 1 : 1000 600M X 600M
LOOP configuration : Drill hole
Plotted : 6.16 PM 17/ 8/87

SOLO

FIG. No. 22

089

87-2752

375500mE
376000mE
376500mE
377000mE

DUNN'S SHAFT STRATIFORM GOLD BODY: 290,000t @ 2·6g/t Au; 120g/t Ag 1·6% Pb; 2·6% Zn

FOOTWALL SEQUENCE
Altered silicified tuffaceous sediments and ignimbrite(?)

HOST ROCKS

H880, 881
H1107
H1108, 1109
H951
H1098, 1099
H1106
H1104, 1105
H1101
H953
H1102
H954

ALTERED SILICIFIED PUMICEOUS VOLCANICLASTIC

QUARTZ-FELDSPAR-PHYRIC VOLCANICLASTIC

TUFFACEOUS SEDIMENTS

365 500mN

WHITE SPUR FORMATION
(VOLCANO-SEDIMENTARY SEQUENCE)

TUFF SHALE

QUARTZ-FELDSPAR CRYSTAL TUFF

RED 87-9

MINE LEASE

365 000mN

CHLORITE-PYRITE ALTERATION ZONE
(part of East Hercules line of mineralisation)

996, 997, 998, 819, 820, 821

QUARTZ-AUGEN SCHIST ZONES WITH PYRITE

FELDSPAR-PHYRIC LAVAS AND INTRUSIVES

CRYSTAL TUFF

Zone of quartz-sericite alteration with sulphides

strong silicification along contact

qtz-fe oxide veins

li-qtz veins

981, 982
979, 980

MASSIVE FELDSPAR-PHYRIC VOLCANICLASTIC OR LAVA

364 500mN

TUFFACEOUS SEDIMENT

UNCONFORMITY

ANGULAR

FELDSPAR-CRYSTAL-LITHIC VOLCANICLASTIC
(Reworked in places)

QUARTZ-FELDSPAR PORPHYRY INTRUSIVE

364 000mN

363 500mN

WSP 190
WSP 178, 179
WSP 191

E.L. 1/62
E.L. 11/85

837095

5 cm

× 816 SHELL ROCK SAMPLE 1986
(All samples prefixed 12___)

87-2752

6880

0 100 200 300 400m

Billiton Australia
The Metals Division of the Shell Company of Australia Limited

Project: TASMANIA
ROSEBERY EAST JOINT VENTURE

Title: MT. BLACK E.L. 1/62

SOUTH HERCULES INTERPRETED GEOLOGY

(BASED ON LEES 1985, WITH MODIFICATIONS)

Author J.G.P.	Dept. TAS.	Scale 1:5000	
Drawn H.M.R.	Date 12/86	Revised	Date
Checked	Date	S'ceded	Date
Figure No. 23		Drawing No. LJ50/1056	

PLAN

RED 87-9
365 206 1 N
376 418 4 E

WEST

EAST

EOH

ANTICLINAL AXIS

RED 87-9
-50°

12809
(0·10g.t. Au)

12810
(0·04g.t. Au)

small pit on py-cp

limonite stains

limonite after py

Road

140W 120W 100W Road 80W 60W 40W 20W Road 00 20E 40E

Highly schistose feldspar-phyric volcaniclastic

Tuffaceous siltstone black shale and feldspar crystal tuff

Quartz schist (Footwall alteration zone)

Cherty Tuffaceous Sediments (Host Rocks)

TUFFACEOUS SHALES & SILTS

FELSIC VOLCANICLASTIC

Highly deformed lithic volcaniclastic breccia

WESTERN VOLCANO-SEDIMENTARY SEQUENCE (WHITE SPUR FORMATION)

2·5m-5%py

50

55mm bands of pyrite

CHERTY TUFFACEOUS SEDIMENT

FELSIC VOLCANICLASTIC

CHERTY ACIDIC VOLCANICLASTIC

100

150

BLACK SHALE AND VOLCANIC LITHIC SANDSTONE

CHERTY TUFFACEOUS SEDIMENT

ACIDIC VOLCANICLASTIC

FELSIC VOLCANICLASTIC

VOLCANIC LITHIC BRECCIA & SANDSTONE

Brecciated silicified, qtz veined rock

EOH
180·7m
15·8m S

HERCULES MINE SEQUENCE OF MT READ VOLCANICS

LEGEND

- Bedding
- Geological contact
- F — F Fault
- Shear
- Unconformity
- X 12810 Rock chip sample

837096

5 cm

6881

Billiton Australia
The Metals Division of the Shell Company of Australia Limited

Project: ROSEBERY EAST

Title: SOUTH HERCULES DRILL SECTION RED 87-9

87-2752

Author C B	Date 12/87	Scale 1 1000	
Drawn Q H	Office TAS	Revised J.G.P	Date 12/87
Drawing No D/L J 50/041			Fig No 24