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EL 2484, EL 2513 AND EL 2514

MOUNT HOWE, MOUNT MEAD AND TIEYON (EAST MUSGRAVE PROJECT)

ANNUAL AND FINAL REPORT FOR THE PERIOD 15/1/98 TO 9/9/99

Submitted by

Craton Resources NL
1999

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ANNUAL REPORT OF EXPLORATION ACTIVITIES
EAST MUSGRAVE PROJECT
EL 2484 MT HOWE
EL 2513 MT MEAD
EL 2514 TIEYON

MAY 1999

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2 x Craton Resources NL
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BL Farrell

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EAST MUSGRAVE PROJECT
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INTRODUCTION

The East Musgrave project covering an area of 4,901 square kilometres comprises three Exploration Licences located at the extreme eastern end of the Musgrave Ranges, immediately outside the Pitjantjatjara Aboriginal Freehold Lands, refer Figure 1.

The project includes the following titles:

TITLE		AREA (km²)	ANNIVERSARY DATE
EL 2484	Mt Howe	1,023	15-01-98
EL 2513	Mt Mead	1,408	30-04-98
EL 2514	Tieyon	2,471	30-04-98

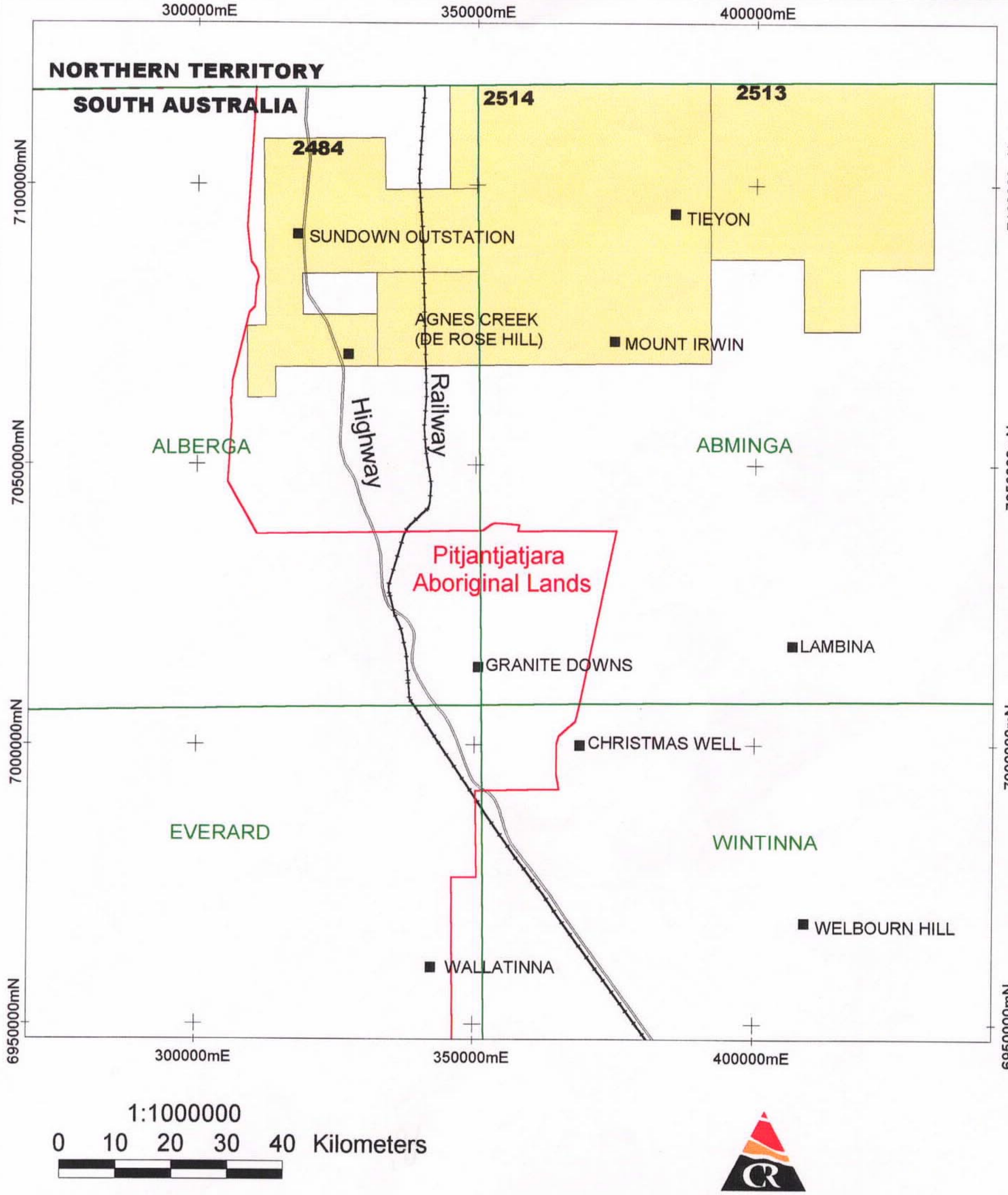
The Alice Springs railway line and Stuart Highway transects the western portion of the Project Area giving needed infrastructure in the event of a discovery.

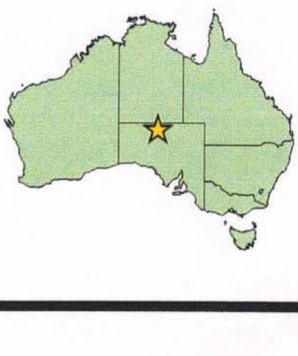
1 TARGET CONCEPT

The Project Area is part of the Musgrave Block, a poorly known highly deformed Proterozoic Craton which straddles, South Australia, Northern Territory and Western Australia. Exploration access to the greater portion of the area was abruptly curtailed in the early 1970's with the establishment of the Pitjantjatjara Aboriginal Freehold. Prior to this time there had been little historical exploration due to the remoteness of the area and limited exploration work carried out in the 1960's resulted in the respective discoveries of large lateritic deposits and several copper and nickel prospects in the western and eastern portions of the Musgrave Block.

As per other cratonic areas world wide, the block is thought to be prospective for wide-ranging style of mineralisations and commodities for example, Broken Hill style lead-zinc-silver deposits, Conclurry style copper-gold deposits, copper-nickel in mafic/ultramafic complexes and shear hosted gold deposits. Potential for other commodities such as diamonds and uranium also exist in younger basins flanking the craton.

Craton Resources NL has a multi-commodity approach to exploration of the Project Area, but it's main exploration target is nickel-copper-cobalt sulphide mineralisation within buried Giles Complex intrusives which are recognisable in aeromagnetics flown by the South Australian Government and CRA Exploration Pty Ltd ("CRAE"). A solitary aircore hole drilled by CRAE into one discrete magnetic anomaly intersected rocks associated with a large layered mafic complex with trace copper and nickel sulphides.





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EAST MUSGRAVES PROJECT
PROJECT LOCATION

Figure 1

2 EXPLORATION ACTIVITIES IN REPORTING PERIOD

2.1 TARGET GENERATION, VOISEY BAY STYLE NICKEL MINERALISATION

As stated above exploration activity has been directed to the search for nickel-copper-cobalt sulphide mineralisation (Voisey Bay Model) within buried Giles Complex intrusives.

As Craton Resources NL is currently denied access for ground exploration by virtue of Native Title, a remote sensing approach has been taken for initial target generation through reinterpretation of three generations of airborne magnetic data of differing orientation, spacing and height of flight lines (i.e. 1969 BMR, 1993 SAEI Abminga, 1994 CRA - RTZ Mt Howe) and Landsat interpretation. These data with geological and structural data were integrated into a GIS database and subjected to interpretation. A summary of the work to date can be seen in Figure 2.

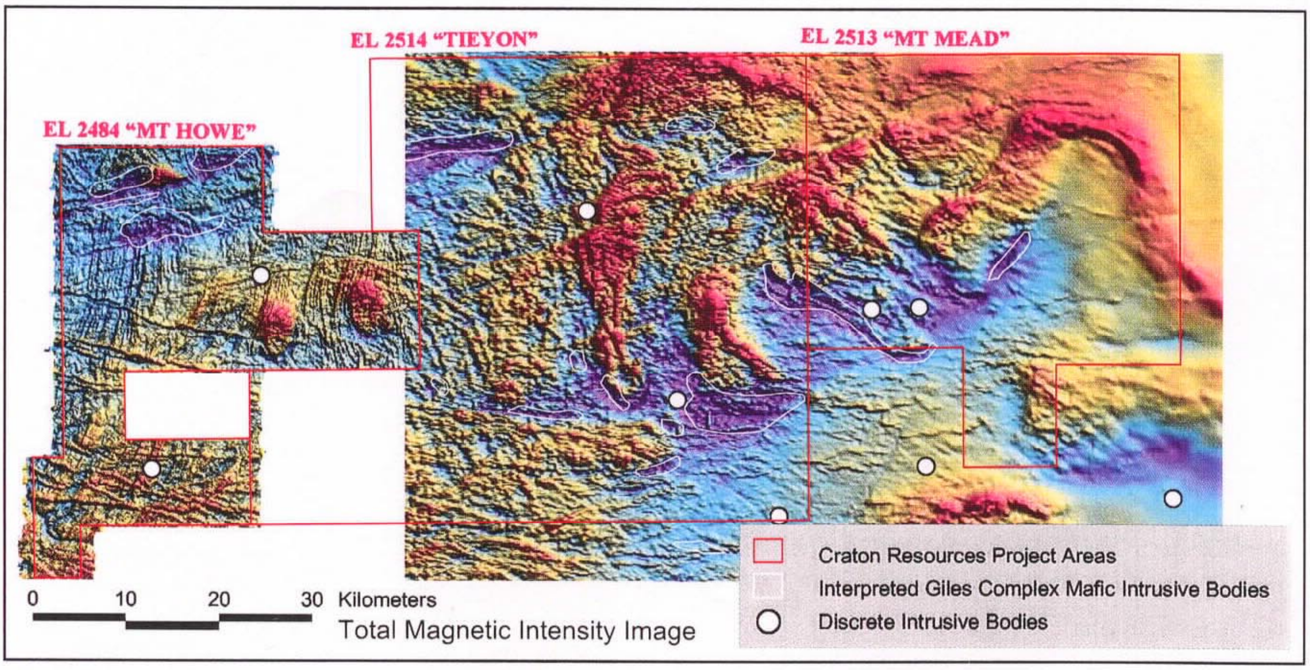
Appendix 1 also outlines the current interpretative work and target generation for sulphide nickel in the East Musgraves.

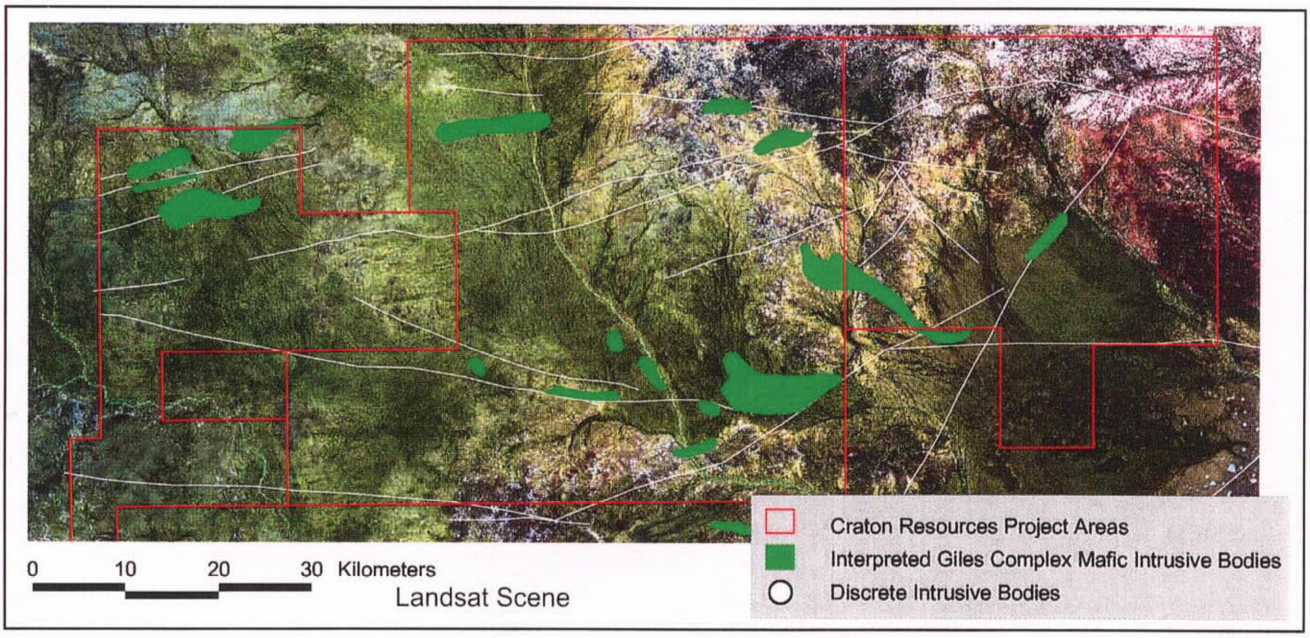
No field work will take place until a 9B Agreement with Claimants is consummated and Access/Heritage clearances are in place.

2.2 NATIVE TITLE NEGOTIATIONS

The bulk of the Project Area is covered by two Native Title Claims, De Rose Claim SC94/2 (affecting EL 2484, Mt Howe) and the Eringa Claim SC96/3 (affecting EL 2513, Mt Mead and EL 2514 Tieyon).

Following discussions with the Aboriginal Legal Right Movement ("ALRM") two identical comprehensive Information Memorandums on the company and its proposed Exploration Programme were forwarded to Claimants and ALRM. A meeting was had with Claimants, their lawyers and ALRM in Adelaide and Oodnadatta. The latter meeting was well received and promised a relatively short ride to consummating a 9B Agreement. Subsequent to the Oodnadatta meeting and ensuing negotiations Form 26's were served and advertised in August. These have now expired in the time sense, in that there are only two Claimants to negotiate with on a 9B Agreement. Regrettably during this time new developments occurred on the Federal front which forced Claimants to undergo a Registration Test of their Claims. This has resulted, until recently, in no activity on the negotiation front. The ALRM is also awaiting the finalisation of the Eyre Peninsula Agreement (in which Craton Resources NL is a participant). ALRM hope to use this agreement as a model template for further 9B Agreements in the state.





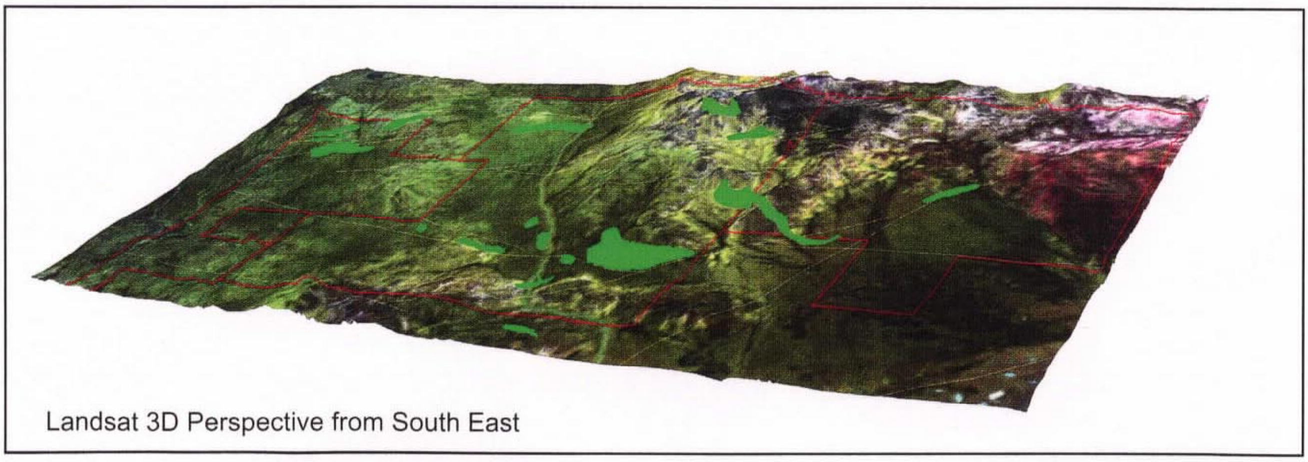


Figure 2 East Musgrave Project Area

3 EXPLORATION EXPENDITURE STATEMENT

During the reporting period Craton Resources NL spent $93,329 on the project. Expenditure breakdown is as follows:

		$
EL 2484	Mt Howe	22,297
EL 2513	Mt Mead	31,876
EL 2514	Tieyon	39,154
		$93,329

APPENDIX 1

East Musgrave Nickel Project

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EAST MUSGRAVES SULPHIDE NICKEL PROJECT

INFORMATION MEMORANDUM

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SUMMARY

- The recent discovery of Voisey's Bay has highlighted the fact that the majority of the worlds nickel production occurs from deposits located on basal contacts and feeder conduits associated with large intrusions of mafic magmas. Recent breakthroughs in the understanding of these deposits has led to the development of new exploration models for this style of deposit.

- Within the Musgrave Block, the Giles Complex represents one of the world's most extensive suites of layered mafic-ultramafic igneous intrusions. Recent work by AGSO has downgraded the potential for PGE and enhanced the potential for nickel sulphides in the Giles intrusive complex by demonstrating that the parent magmas were generally sulphur saturated at the time of emplacement.

- There has been no modern exploration in the Musgrave Block due to land access restrictions (over 90% of the Musgrave Block lies within Aboriginal Freehold Land). In South Australia where the majority of the Giles Complex intrusive bodies occur, no significant exploration has been carried out since the 1970's. Outside the Pitjantjatjara lands minimal exploration has been carried out primarily targeting uranium and diamonds.

- In the eastern Musgrave Block, extensive shallow Quaternary cover has limited understanding of the bedrock geology. However, recently flown airborne magnetics as a State Initiative over the Abminga 1:250,000 map sheet and additional coverage by CRA-RTZ immediately to the west at Mt Howe have clearly demonstrated that several major previously unrecognised east-west intrusive bodies occur cross cutting north-south stratigraphy. These bodies appear likely to be related to the Giles Complex intrusives and are believed to be highly prospective targets for major nickel sulphide deposits.

- The prospectivity is further enhanced by the known occurrence within the Pitjantjatjara lands immediately to the west of the Project Area of metamorphosed iron formations and several historic stratiform base metal prospects containing abundant disseminated sulphides indicating that the rising mafic magmas of Giles Complex intrusions could have assimilated considerable amounts of sulphide-rich material.

- Sulphide saturation is further supported by drill results from recent exploration by CRA-RTZ at Mt Howe in the project area. A distinct negative dipole a few hundred metres in diameter was the target of a single aircore hole. The drill hole intersected fresh, undeformed troctolite containing pyrite, chalcopyrite and possible pentlandite. The textures of the sample had features consistent with coming from a large layered igneous intrusion.

- Craton Resources NL has taken out tenure over in excess of 5,000 square kilometres of the Eastern Musgrave Block. The area lies immediately outside the Pitjantjatjara Aboriginal Lands, is pastoral leasehold land and is transected by the north-south Adelaide-Alice Springs Railway and the Stuart Highway.

- Thirteen large intrusive bodies which are considered to be potential layered cumulate igneous bodies have been outlined and other priority targets exist such as discrete intrusive bodies and mafic dykes. Exploration is proposed to drill test the bodies and evaluate the potential for nickel sulphide mineralisation.

1. INTRODUCTION

The largest three nickel deposits in the world occur within basal contact / feeders to large mafic bodies. Although quite different in specific characteristics, the three deposits, Noril'sk, Jinchuan and Voisey's Bay share common genetic features in that the mineralisation results from magmatic processes acting on a sulphur saturated parent magma venting into a magma chamber.

The Giles Complex remains one of the world's most voluminous mafic-ultramafic layered suites and is notable in that it has not been the subject of significant modern exploration, due to land access restrictions. Recent studies and in particular analogies with the Voisey's Bay model have enabled the potential for major nickel sulphide deposits to be recognized.

Craton Resources have drawn on this recent work and an interpretation of recently available airborne magnetics to propose an exploration program for nickel sulphides in the Eastern Musgrave Block. The area also has potential for Broken Hill and Cloncurry Style base metal mineralisation.

1.1 Access, Land Tenure & Native Title

Craton Resources' Musgrave Project comprises one exploration licence and two exploration licence applications, both of which have been accepted and are awaiting grant of title, the present schedule is presented as Table 1.

TABLE 1 MUSGRAVES PROJECT – TENEMENT SCHEDULE

Tenement	Name	Status	Area sq.km.
EL 2484	Mt Howe	Granted 15/1/98	1023
ELA 431/97	Mt Mead	Offered & Accepted	1408
ELA 432/97	Tieyon	Offered & Accepted	2471

The project covers a large portion of the South Australian Eastern Musgrave Block. It lies entirely within pastoral leases within the Tieyon, Ayers Range South and Agnes Creek Stations.

The project area is transected by the Central Australia and Stuart Highway, providing potentially important infrastructure in the event of a discovery.

Two native claims exist in the area which do not overlap. The Eringa claim covers the east of the project area while the De Rose claim covers a small portion of the extreme south west of the project area. Both claimants have indicated a willingness to enter into an Exploration Access/Heritage agreement over the licences. This allows exploration to be carried out as per Part 9B of the South Australian Mining Act.

Plan 1 shows the native title claims, infrastructure and topography.

2. GEOLOGY OF THE MUSGRAVE BLOCK

The Musgrave Block is a mid Proterozoic craton comprising crystalline basement of mafic and felsic granulites and amphibolite facies gneisses, intruded by mafic and ultramafic rocks of the Giles Complex, granitic plutons and several later suites of mafic dykes.

The craton is traversed by major east west fault systems, which impart an apparent fabric to the regional magnetics. Giles Complex intrusives occur spatially along these major structures.

Recent work by AGSO in the western Musgraves (Glikson et al, 1996), has substantially added to the understanding of the Musgrave Ranges and Giles Complex. Their summary of the probable geological evolution of the Western Musgraves, although not specific to the project area is the most comprehensive synopsis of the evolution history in the Musgrave Block;

- c. 1550 Ma and c. 1300 Ma felsic igneous rocks, including some which probably represent new felsic crust, together with subordinate sedimentary and mafic igneous rocks, form protoliths of the high-grade metamorphic Mount Aloysius Complex.

- Granulite-facies metamorphism and deformation about 1200 Ma ago involved mostly penetrative pure shear during D_1 and D_2 at >750°C and 5± kb. Metamorphism was associated with emplacement of post-D_1, pre D_2 orthopyroxene granites ('charnockites') and post-D_2 granitoids, including rapakivi types (1188±4 Ma) and syenites. Leuconorite was emplaced at 1176±5 Ma.

- Emplacement of voluminous mafic-ultramafic magmas of the Giles Complex occurred 1078±3 Ma ago, with near-isobaric cooling from 1150° to 750°C at 6±1 kb for the Wingellina Hills intrusion and lower pressures (about 4 kb) for troctolitic bodies in the southwestern part of the area. Pervasive granite veining, probably representing back intrusion of crustal melts, was associated with recrystallisation to mafic granulite of marginal parts of the Giles Complex (during D_3), particularly in the western Hinckley Range. Extrusion of the bimodal Tollu Group volcanic rocks onto an uplifted and eroded basement of amphibolite-facies granitic gneisses was coeval with the Giles magmatism. The basement was apparently metamorphosed at shallower crustal levels than the granulite-facies gneisses into which the Giles Complex was emplaced, and may, in part, represent younger felsic crust. Some associated dolerite dykes may well be feeders to Giles Complex intrusions.

- Penetrative simple shear deformation (D_3) produced near-vertical high-strain zones, apparently under high-pressure conditions (650-700°C, ~11 kb). This may reflect increased lithostatic pressures associated with emplacement of the thick (>10 km in total) sills and lopoliths of the Giles Complex. It was apparently followed by near-isothermal decompression, associated with major uplift and erosion of more than 12 km of crust, to about 4 to 5 kb.

- Post-D_3 type C olivine dolerite dykes were emplaced about 1000 Ma ago, although their age is not well constrained. They are chemically and isotopically similar to the slightly older (~1080 Ma) Kulgera (eastern Musgrave Block) and Stuart (Arunta Block) dyke swarms.

- Type B quartz dolerite dykes were emplaced about 800 Ma ago. They are chemically and isotopically equivalent to the Amata dykes (eastern Musgrave Block) and the Gairdner dyke swarm (Gawler Craton), and so form part of a very extensive swarm.

- At least four phases of mylonite and ultramylonite zone formation (D_{4-7}) post-date type B dykes. The c. 550 Ma east-west trending D_6 ultramylonite-pseudotachylite zones are the largest, and were formed during major northward thrusting of the Giles Complex and host gneisses in the Petermann Ranges orogeny. They are best developed in the Bates 1:100,000 sheet area, where they form the western extension of the Woodroffe Thrust, and formed at elevated pressures (>750°C, 14.0±1.1 kb) along the sole of the thrust; sub-eclogite-facies garnet-clinopyroxene-bearing assemblages were formed. Other major thrusts include the marginal thrust of the Officer Basin and the Bell Rock-Blackstone Range thrust fault, which led to the erosional removal of the Tollu Group volcanic rocks from the Tomkinson Ranges and eastern parts of the Musgrave Block.

The Giles Complex, together with coeval mafic volcanic rocks of the Tollu Group (Mummawarrawarra Basalt) and mafic dykes, was derived by melting of an enriched source, probably involving subcontinental lithospheric mantle. A major thermal perturbation, perhaps resulting from lithosopheric thinning associated with crustal extension, and/or mantle plume activity, was clearly necessary to account for the scale of melting involved. The emplacement of voluminous mafic-ultramafic magma with associated felsic plutonic and volcanic activity is a classic example of a coeval mafic magmatism and crustal anatexis in pre-existing sialic crust.

In the Eastern Musgraves, there is widespread evidence of the 1100 Ma Kulgeran phase of metamorphism and intrusion of massive granites and adamellites along with similar aged dolerite and gabbro dyke swarms. The small amounts of outcrop tend to reflect distribution of these lithologies. The craton margins are flanked by mesozoic sediments of the Arckaringa and Eromanga Basins.

3. MINERAL EXPLORATION IN THE MUSGRAVE BLOCK OF SOUTH AUSTRALIA

Mineral exploration of the Musgrave Block was carried out predominantly in the period 1953 until 1981 when the Pitjantjatjara Land Rights Act was proclaimed. Target minerals have included nickel, base metals, rare earths and gold. The only commercial discoveries were of chrysoprase and opal although potentially economic nickel laterites were found in the Western Musgraves.

3.1 Exploration Potential of the Felsic Granulite Terrain

The Eastern Musgrave Block was a focus of exploration for lateritic nickel and stratabound copper and base metal mineralisation prior to 1981. The area is considered to have significant potential for Broken Hill Pb-Zn-Ag and Cloncurry style Cu-Au mineralisation, (Connor, 1998). Of particular note is the large number of copper sulphide occurrences in the Eastern Musgraves such as the Kenmore 2 Ni Cu Prospect where copper anomalism surrounding an ultramafic body was traced to an envelope of stratabound disseminated sulphides . The best drill intersection returned was 10 metres at 0.41% Cu. Several other prospects are located in similar stratigraphic settings elsewhere on the Abminga 1:250,000 map sheet (see Figure 1). These occurrences along with the presence of metamorphosed banded iron formations are important indications of a sulphide rich host sequence with which rising Giles Complex magmas may have interacted.

3.2. Exploration Potential of the Giles Complex

Potentially economic mineralisation associated with the Giles Complex includes;

- Lateritic nickel (Wingellina 61Mt @ 1.32 % Ni confined to serpentinised sheared pyroxenites and dunites and at Claude Hills 4.5 Mt @ 1.5% Ni in nickeliferous laterite deposits in palaeodepressions overlying a peridotite/gabbro intrusion.)

- Vanadiferous titano-magnetite units within troctolitic intrusions, particularly in the Jameson Range of Western Australia.

- The Giles Complex has long been considered as having great potential for PGE enriched stratabound sulphide concentrations associated with layered mafic-ultramafic bodies (Tonkin, 1991). However, recent work by AGSO (Glikson et al, 1996), has demonstrated the presence of magmatic sulphides at Wingellina, significantly reducing the perceived potential. AGSO's work also established that the many layered intrusives had independent crystallisation and magma evolution histories, making the often suggested theory that the individual intrusive bodies were structural slices from a very large initial Bushveldt type lopolith unlikely.

- The work by AGSO has conversely increased significantly the potential for Ni-Cu-Co sulphide mineralisation associated with basal contacts and feeder zones of Giles Complex Intrusives. Sulphides have been reported within Giles Complex Bodies at Wingellina (Glikson et al, 1996), Trudinger Pass, (Tonkin, 1991) and at Cavanagh (Appendix B). A discussion of the potential for nickel sulphide deposits is included as Appendix A.

4. PREVIOUS MINERAL EXPLORATION IN THE PROJECT AREA

Within Craton Resources' Project Area, little previous exploration has been carried out. In the early 1980's AFMECO drilled three holes in the extreme SE of the project area targeting Proterozoic unconformity hosted uranium mineralisation. CRA subsequently carried out a regional heliborne gravel and stream sediment sampling program over the central portion of the tenement in 1990. The paucity of outcrop suggests that this program would be of limited effectiveness.

In 1994, CRA-RTZ took out a licence over the portion of the Project Area lying within the Alberga 1:250,000 map sheet, now the Mt Howe exploration licence, targeting three major magnetic anomalies which they thought may represent Giles Complex Ultramafics. All three eventuated to be magnetic granites, two of which were outcropping, the third, (Bruces Bore) being detected by drilling. The low magnetic response adjacent to the Bruces Bore prospect was drilled by shallow traverses to approximately 10 metres. The drilling intersected a range of lithologies including metamorphosed mafic and felspar rich rocks, the latter being petrographically described as possible anorthosites. There is a strong possibility that this may indicate a layered mafic body.

CRA-RTZ also drilled a single aircore hole into a small discrete negative magnetic anomaly termed the Cavanagh Prospect. The Cavanagh drill hole intersected fresh, undeformed troctolite containing pyrite, chalcopyrite and possibly rare pentlandite. Although limited in dimensions, the textures of the sample had features consistent with coming from a much larger post deformational layered mafic body. The hole passed through 8 metres of Quaternary cover into weathered clays and returned assays of 3000 ppm Ni in weathered samples and 1500 ppm Ni in fresh samples. Of significance is the fresh unaltered and undeformed nature of the sample, refer Appendices A, B.

CRA-RTZ flew three reconnaissance traverses of Questem EM perpendicular to geological strike but parallel to the intrusive bodies. CRA-RTZ subsequently dropped the ground when restructuring in late 1997, retaining a small area south of the Cavanagh Prospect where an EM anomaly had been detected, Appendix C.

5. PROJECT GEOLOGY AND INTERPRETATION OF AIRBORNE MAGNETICS.

In the immediate Project Area, the basement has been mapped as foliated feldspar-quartz-biotite, quartz-biotite gneiss and Hornblende-plagioclase gneiss intruded by biotite and biotite-hornblende adamellite and granite (Spring et al, 1959 and Major et al 1984). Mesozoic sediments and Tertiary silcrete covers the extreme east and south east of the Project Area with the majority of the area veneered by Quaternary sand and silt with scattered patches of maghemite gravel. The little outcrop noted in mapping by the SA Mines Department consists of Kulgeran granite and adamellite and similar aged mafic dykes of the Alcurra Dyke Swarm (Plan 5). Drilling by CRA-RTZ suggests that much of the Quaternary cover may be very shallow.

In the past few years, detailed and semi-detailed airborne magnetics data has become available over the Project Area. A map of the coverage is shown in Figure 2.

Survey	Orientation	Spacing	Height
1969 BMR	N-S	1600	200
1993 SAEI Abminga	N-S	400	80
1994 CRA-RTZ Mt Howe	E-W	200	60

Pseudocolour and greyscale images of the BMR and Abminga magnetics are included as 1:1,000,000 plans 1, 2, 3. This demonstrates the variable magnetic response of the mapped Giles Complex and illustrates the strong spatial association with the major E-W structures, particularly the Mann Fault in the Western Musgraves. This structure deflects abruptly at the boundary of the Woodroffe and Alberga map sheets, where it intersects the north east trending Ferdinand Fault from which splays the Marryat Fault and Coglin Lineament, the two dominant structures in the Project Area (refer Figure 1 & Plan 9).

More detailed magnetics (Plans 6, 7, 8 at 1:250,000 of the Abminga and Mt Howe datasets) show the dramatic difference between E-W and N-S flight direction datasets. Most significant is the obvious N-S trending stratigraphy / metamorphic fabric within the Proterozoic gneisses and the strong magnetic response of the granites at Mt Howe, Wallaby Rock, and Bruces Bore in the CRA-RTZ dataset.

From those relationships, it is clear that there are several major intrusive features in the area;

(i) Magnetic high signatures of magnetite rich Kulgeran granites.

(ii) Magnetic lows striking east west, often confined within the major structures and interpreted to be potentially layered mafic and ultramafic bodies of Giles Complex. Possibly including remnantly magnetised bodies.

(iii) Other discrete intrusive features similar to the Cavanagh anomaly.

(iv) Swarms of generally east-west trending dolerite dykes

An interpretation of the magnetic data is presented as Plan 9. It identifies potential intrusive bodies of these four main types.

6. POTENTIAL FOR NICKEL SULPHIDE MINERALISATION IN THE PROJECT AREA

The intrusive complexes and discrete intrusive features interpreted in the airborne magnetics distributed along major east-west structures are considered to be likely to be related to the Giles Complex. As such, they represent prime targets for nickel sulphide mineralisation.

No exploration has been carried out over the vast majority of the Project Area. The minimal work of significance carried out by CRA-RTZ at Mt Howe yielded encouraging results with a single hole intersecting a cumulate textured troctolite containing copper (and nickel?) sulphides at Cavanagh, whilst a traverse of holes at nearby Bruces Bore intersected lithologies including a possible anorthosite that could indicate a layered intrusive.

Immediately west of the project area, within the Pitjantjatjara Lands, the numerous stratabound sulphide occurrences within the granulite terrain and the presence of metamorphosed banded iron formations indicate a potentially significant source of sulphur which could be assimilated during the upward migration of Giles Complex magmas.

The remoteness of the area and shallow Quaternary cover would have hampered early prospectors, whilst the Pitjantjatjara Lands Act has effectively halted exploration in the Musgrave Block since 1981. The Project Area is unique in allowing free access for exploration with good quality aeromagnetics.

Modern airborne geophysical methods such as magnetics and EM provide ideal tools to explore identified targets. The main North South Highway and Adelaide Alice Springs railways provide vital infrastructure in the event of a discovery.

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MUSGRAVE PROJECT AREA & NATIVE TITLE CLAIMS

Legend

- Native Title Claims
- Craton Resources Exploration Licences & Applications
- Pitjantjatjara Aboriginal Lands

9513-1

N

5 0 5 10 15 Kilometers

1:250000


FIRST EDITION 1959
REFERENCE
Alluvial deposits.
Sand plain and sand dunes.
Laterite: Heavily laterised sands, shales and granitic rocks with underlying bleached and mottled horizons usually interstratified with porcellanite.
Porcellanite: Silicified and opalised sands, quartzites and shales.
Sands, clays and gravels of uncertain age usually preserved beneath cappings of porcellanite or laterite.
Mt. Chandler sandstone: Predominantly massive sandstones and quartzites, red and pink massive bedded limestone higher up in the sequence with thin conglomerate and shaly bands near basal unconformity.
Sturtian Series Undifferentiated: Purple green and grey slates and shales with minor quartzites and dolomites.
Purple and green slates.
Chambers Bluff Tillite: Hematitic and calcareous tillite, tillitic sandstones and tillitic slates, minor quartzites.
Grey shales with minor quartzites, felspathic quartzites, calcareous shales, dolomites.
Arkosic grits with minor intercalations of conglomerate, slate, sandstone.
Moorilyanna Conglomerate: Predominantly conglomerate, tillitic conglomerate with minor purple slates, quartzites.
Gneissic pyroxene adamellites, gneissic granites, granitic gneisses, pyroxene granulites, pyroxene gneisses, amphibolites.
Quartz reef
Younger intrusives: Micro-gabbro
Micro-norite.
Micro adamellite, microgranite.
Biotite and hornblende adamellites.
Hypersthene adamellite.
Aplite of Indulkana shear zone.
4 MILE GEOLOGICAL SERIES SHEET G 53-9 ZONE 4
MUSGRAVE PROJECT GEOLOGY
SCALE:- 5 0 5 10 15 20 Kilometers
1:250000
Generated from 1:250,000 Scale Alberga & Abminga Geology Sheets From The Geological Survey of SA
CRATON RESOURCES NL
Location of Musgrave Project Area
FIRST EDITION 1984
REFERENCE
Sand, gravel, silt and clay of modern drainage channels.
Sand of source-bordering dunes adjacent to larger streams.
SIMPSON SAND: Red-brown, fine to medium quartz sand of linear dunes and clayey sands of interdunal flats.
Flat spreads of red-brown sand and silt with scattered patches of fine maghemite gravel.
PEDIRKA FORMATION: Red-brown, structured sandy clay, overlain by thick mantle of silcrete clasts.
MOUNT WILLOUGHBY LIMESTONE and equivalents
MIRACKINA CONGLOMERATE equivalent
CORDILLO SILCRETE (Tsi)
EYRE FORMATION
SEQUENCE OF EROMANGA BASIN
WINTON FORMATION
OODNADATTA FORMATION
COORIKIANA SANDSTONE
BULLDOG SHALE
ALGEBUCKINA SANDSTONE
CRYSTALLINE BASEMENT OF MUSGRAVE BLOCK
Dolerite and gabbro dykes.
WATARU GNEISS
ABMINGA SHEET SG 53-10
9513-2

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SA Musgrave Ranges
Total Magnetic Intensity
Distribution of Giles Complex Ultramafics

CRATON

N

20 0 20 40 60 Kilometers

1:1000000

CRATON RESOURCES NL

SA Musgrave Ranges

Gravity

Distribution of Giles Complex Ultramafics

CRATON

Plan 4

Scale 1:1 000 000

20 0 20 40

Kilometers

CRATON RESOURCES NL
SA Musgrave Ranges
Total Magnetic Intensity
Distributions of Giles Comple Ultramafics

SURVEY SPECIFICATIONS

M. E. S. A. SURVEY
Line Spacing : 400 m
Line Direction : 0-180 degrees

RIO TINTO SURVEY
Contractor : Kevron Geographics
Line Spacing : 200 m
Station Spacing : 7 m
Line Direction : 90-270 degrees
Survey Date : 1994

PLOT SPECIFICATIONS

First Level Contours : 10 nT
Second Level Contours : 50 nT
Third Level Contours : 250 nT

Grid Cell Size : 50 mE x 50 mN

PROCESSING DETAILS

Diurnal magnetic variations have been removed.

Processing : Southern Geoscience
Composition : T. N.
Supervision : B. CRAVEN

9513-3

N

5000 0 5000 10000 15000

SCALE 1: 250000

AUSTRALIAN MAP GRID ZONE 53
AGD 66 SPHEROID
SOUTHERN HEMISPHERE

SOUTHERN GEOSCIENCE CONSULTANTS
PTY. LTD.
A. C. N. 067 552 461

CRATON RESOURCES N. L.
MUSGRAVES PROJECT
AIRBORNE GEOPHYSICAL SURVEY
TOTAL MAGNETIC INTENSITY IMAGE
SHADED WITH 75% SE AGC (LIN)
TOTAL MAGNETIC INTENSITY CONTOURS

SCALE 1: 250,000	B. CRAVEN
DATE 06-01-98	Plan 6

SURVEY SPECIFICATIONS

M. E. S. A. SURVEY
Line Spacing : 400 m
Line Direction : 0-180 degrees

RIO TINTO SURVEY
Contractor : Kevron Geographics
Line Spacing : 200 m
Station Spacing : 7 m
Line Direction : 90-270 degrees
Survey Date : 1994

PLOT SPECIFICATIONS

First Level Contours : 20 nT
Second Level Contours : 200 nT
Third Level Contours : 2000 nT

Grid Cell Size : 50 mE x 50 mN

PROCESSING DETAILS

Diurnal magnetic variations have been removed.

Processing : Southern Geoscience
Composition : T. N.
Supervision : B. CRAVEN

9513-4

N

5000 0 5000 10000 15000

SCALE 1: 250000

AUSTRALIAN MAP GRID ZONE 53
AGD 66 SPHEROID
SOUTHERN HEMISPHERE

SOUTHERN GEOSCIENCE CONSULTANTS
PTY. LTD.
A. C. N. 067 552 461

CRATON RESOURCES N. L.

MUSGRAVES PROJECT

AIRBORNE GEOPHYSICAL SURVEY

TOTAL MAGNETIC INTENSITY CONTOURS

SCALE 1: 250, 000	B. CRAVEN
DATE 06-01-96	Plan 7

SURVEY SPECIFICATIONS

M. E. S. A. SURVEY		
Line Spacing	:	400 m
Line Direction	:	0-180 degrees
RIO TINTO SURVEY		
Contractor	:	Kevron Geographics
Line Spacing	:	200 m
Station Spacing	:	7 m
Line Direction	:	90-270 degrees
Survey Date	:	1994

PROCESSING DETAILS

Diurnal magnetic variations have been removed.

Processing : Southern Geoscience
Composition : T. N.
Supervision : B. CRAVEN

9513-5

N

5000 0 5000 10000 15000

SCALE 1: 250000

AUSTRALIAN MAP GRID ZONE 53
AGD 66 SPHEROID
SOUTHERN HEMISPHERE

SOUTHERN GEOSCIENCE CONSULTANTS
PTY. LTD.
A. C. N. 067 552 461

CRATON RESOURCES N. L.

MUSGRAVES PROJECT

AIRBORNE GEOPHYSICAL SURVEY

TOTAL MAGNETIC INTENSITY IMAGE

FIRST VERTICAL DERIVATIVE (LIN)

SCALE: 1: 250, 000	B. CRAVEN
DATE: 06-01-98	Plan 8

Inferred Dolerite Dykes

Isolated Magnetic Anomaly – Possible 'Late' Intrusive

Inferred Weakly Magnetic Intrusive – Mostly Granitic. Gneissic in Part

Inferred Magnetic Intrusive – Mostly Granitic. Gneissic in Part

Possible Zones of Mafic to Ultramafic Intrusives (Weakly Magnetic)

Undifferentiated Non Magnetic Wataru Gneiss (± Granite)

Inferred Weakly Magnetic Wataru Gneiss (+ Granite)

Magnetic Trend, Minor Magnetic Unit within Wataru Gneiss

Inferred Major Fault (Indicates Likely Down Thrown Side)

Inferred Secondary Fault (Indicates Likely Down Thrown Side)

HIGH Magnetic Contact

Target

NOTE: Interpretation concentrates on Lower to Mid Proterozoic basement features. This basement is obscured by varying thickness of Tertiary to Adelaidean cover rocks throughout most of the eastern half of the area.

N

5000 0 5000 10000 15000

SCALE 1: 250000

AUSTRALIAN MAP GRID ZONE 53
AGD 66 SPHEROID
SOUTHERN HEMISPHERE

9513-6

SOUTHERN GEOSCIENCE CONSULTANTS PTY. LTD.
A. C. N. 067 552 461

CRATON RESOURCES N. L.

MUSGRAVES PROJECT

AIRBORNE GEOPHYSICAL SURVEY

INTERPRETATION PLAN

SCALE: 1: 250, 000	B. CRAVEN
DATE 08-01-98	Plan 9

APPENDIX A

Nickel Sulphide deposits in mafic-ultramafic igneous complexes – Exploration potential of the Musgrave Project Area South Australia.

Martin Gole & Associates

Appendix A

MARTIN GOLE AND ASSOCIATES

Geological Services

Anitco Holdings Pty Ltd
A.C.N. 009 446 511

8 Landor Road
GOOSEBERRY HILL WA 6076
phone/fax 9293 4958

REPORT TO: CRATON RESOURCES NL

NICKEL SULPHIDE DEPOSITS HOSTED IN MAFIC - ULTRAMAFIC IGNEOUS COMPLEXES - EXPLORATION POTENTIAL OF THE MUSGRAVE PROJECT AREA SOUTH AUSTRALIA

Martin Gole

March 1998

INTRODUCTION

A large majority of the worlds' Ni sulphide resources are contained within mafic and mafic-ultramafic igneous complexes. Some of these complexes are likely to have analogues within Australia although for others this is unlikely. An example of the latter is the Sudbury Complex, Canada, widely accepted as having formed via a meteorite impact.

However, rather than looking for close analogues of the various known mineralised geological environments it is likely to be more productive to rely on a generalised genetic model to guide project generation and initial exploration programs. Such a model (or models) should not be restrictive but still allow recognition of potentially mineralised areas that can then be followed up by a more detailed and focused exploration assessment.

DEPOSIT CHARACTERISTICS

The major Ni sulphide deposits of the world are Noril'sk, Jinchuan and Voisey's Bay. Research on these deposits over the last few years, particularly by Naldrett and co-workers (eg. Naldrett et al., 1995, 1996; Naldrett 1996) show that these seemingly disparate deposits do share common genetic features and processes. From these common igneous processes it is possible to formulate a generalised, highly simplified genetic model that can effectively guide project generation and initial exploration programs.

The main geological features of these deposits are given below (Naldrett 1996).

- The Noril'sk - Talnakh deposits are located within 100-300 m thick intrusions that are interpreted to have been conduits for magma rising to feed the flows of the overlying flood basalts. These conduits acted as physical traps for immiscible sulphide liquid carried by through-flowing silicate magma that had become S-saturated by contamination from sulphide-bearing lower crustal rocks.

- The Jinchuan deposits are hosted within olivine cumulates that are interpreted to be remnants from a high-MgO (~12%) parented, layered mafic-ultramafic dyke-like intrusion, the mafic portion of which is missing. The mineralisation is located within the interpreted feeder zone of the intrusion. The intrusion and surrounding host rocks occur as a fault block within younger sequences along a contact zone between a Precambrian platform and an early Palaeozaoic fold belt.

- The Voisey's Bay deposits are located within a dyke-like feeder conduit leading into a relatively unfractionated mafic intrusion. The intrusion forms part of a complex plutonic suite (dated at ~1.30by) intruded along an older continental collision suture zone (~1.80by). The magma become S-saturated by assimilation of sulphide-bearing country rocks.

The main common feature of these major Ni deposits is that the massive sulphides are located within the magma conduit systems of the respective igneous complexes whether they be intrusive or volcanic. The mineralisation is hosted within intrusive bodies located well below, just below or along the base of the complexes.

This generalised geological model is sufficient to guide area selection. A proviso is that any igneous complex to be investigated is of sufficient size to be able to host a significant massive sulphide deposit.

RELATED CHARACTERISTICS

Other characteristics of the ore forming process or environment are also important for these deposits:

- The geochemical signature of chalcophile (particularly Ni) depletion within associated magma. Such a signature within an igneous complex is highly significant and is a clear, strong indication that the complex may host magmatic sulphide deposits. This signature may readily recognised in fine-grained volcanic rocks but appropriate data are commonly difficult to obtain from cumulate rocks formed within intrusive complexes. Thus in order to rank the Ni sulphide potential of a mafic complex containing volcanic rocks the determination of whether parts of the sequence are depleted is a critical, and perhaps essential, step. For cumulate-dominated complexes the presence of magmatic sulphides, even if minor, may provide an indication of the S-saturation status of the complex. In unmetamorphosed complexes S content and other geochemical signatures may also provide a guide although rarely a definitive measure of the saturation status.

- Evidence of contamination. This may be in the form of geochemical signatures (eg. light REE enrichment) or be more indirect such as the presence of S-bearing rocks underlying the igneous complex that are potential sources of contamination. There are, however, problems in using this characteristic as one of several prime criteria for area selection. Firstly the role of contamination (S, Si) in Ni sulphide ore formation is still a hotly debated and uncertain process. Secondly the geochemical signature of contamination may be difficult to detect or it may not be possible to recognise potentially contaminating lithologies within a given area. Such lithologies may be deeply buried, poorly exposed or their critical contaminating features may be subtle and not readily recognised. Commonly the presence of such rocks is only recognised after extensive research. It is suggested that this characteristic should not be used in a restrictive manner for area selection.

Characteristics that are excluded from the model are age, tectonic setting and magma composition (other than generally mafic or ultramafic). These are excluded as the fundamental genetic factors in ore formation are the igneous processes of S-saturation and sulphide concentration. These processes operate in a variety of tectonic settings and magma types, irrespective of age.

APPLICATION TO THE MUSGRAVE BLOCK

The Musgrave Block in northern South Australia is composed of granulite-facies felsic gneisses of the Mount Aloysius Complex that have been intruded by voluminous mafic magmas of the Giles Complex at around 1080 Ma. The protoliths to the Mount Aloysius gneisses are 1550 Ma and 1300 Ma felsic and minor mafic igneous rocks that were metamorphosed at around 1200 Ma. The region has been subjected to post-Giles deformation and intrusion of several generations of mafic dykes. The Giles Complex consists of at least 17 exposed mafic-ultramafic layered intrusions with 5 different types recognised (Glikson et al., 1996). The intrusions are spread over 600-700 km with an east-west strike and it is apparent that other intrusions occur further east under shallow cover.

The intrusions formed from several distinct parental magmas formed under different conditions of depth and temperature, degrees of fractionation and timing (Glikson et al., 1996). As a result most individual intrusions have undergone their own, unique magmatic history, not only during crystallisation, but importantly, during magma formation, passage through the crust and final intrusion into their current site.

Two other important aspects of the Giles Complex geology that have a significant impact on the prospectivity of the Complex for massive sulphide mineralisation are:

1. The recognition of mafic dykes that in all probability represent feeder conduits to the larger layered complexes (Glikson et al., 1996).

2. The finding that the parental magmas for the layered complexes were S-saturated or close to S-saturation (Glikson et al., 1996, pages 103, 162-163). This finding is based on limited S assay data from the intrusions and the presence in some intrusions of magmatic sulphides with the layered cumulate sequence.

This latter finding, in particular, greatly enhances the prospectivity of the many Giles Complex intrusions, both those that have been studied and those undercover, to host massive sulphide mineralisation. On the other hand, as argued by Glikson et al. (1996), S-saturation of the magmas prior to their emplacement into the layered complexes down grades their potential to host PGE mineralisation.

CRATON RESOURCES MUSGRAVE PROJECT AREA

Southern Geosciences' interpretation of aeromagnetic data shows that there are several large to medium sized (5-30 km) mafic-ultramafic complexes under cover within Craton Resources' tenements in the eastern Musgrave Block. Limited petrographic work on drill chips from 25m depth shows that very fresh rocks with characteristic cumulate textures are present in this area (Appendix I). The textures and mineralogy of these rocks strongly suggest that they are from a relatively large, layered igneous complex.

Thus both aeromagnetic and petrographic data indicate that the layered complexes are indeed present in the tenements and that they may not be deeply buried. Such igneous intrusions are highly likely to be part of an eastward strike extension of the Giles Complex.

An important finding from the very limited petrographic descriptions is that the igneous rocks are exceptional fresh and apparently unaltered by metamorphism. In particular olivine is very fresh. If this is a widespread characteristic then the basal ultramafic rocks of the intrusions may not form distinctive magnetic highs, so characteristic of serpentinised ultramafic rocks.

EXPLORATION ASSESSMENT AND METHODOLOGY

It is suggested above that exploration for magmatic Ni-Cu sulphides in mafic-ultramafic layered intrusions should not be too dependant on genetic models derived from studies of the three large world class Ni sulphide deposits. Rather these should be used as a guide only to the possible wide range in interplays between magma, timing of S saturation, the fluid dynamics of the magma, and the geometry of magma conduit systems and of the final magma chamber.

For igneous layered intrusions the sites that have the highest potential for accumulation of massive sulphide mineralisation are:

1. Within the magma conduit system where there has been marked change in the magma fluid dynamics. This could be where the feeder enters the main magma chamber or at some point along the conduit where it increases in size, turns a sharp corner or changes attitude.

2. In trap sites along the base of the intrusion or just below the base of the intrusion where massive sulphides may have been injected to footwall rocks.

Thus in order to direct exploration activity towards the area with greatest potential (ie. the base, country rocks below the base and feeder conduits) it is critical to determine the younging direction of a given intrusion. Where such an intrusion is undercover, as in the Musgrave Project area, some stratigraphic drilling may be required to enable the fractionation sequence to be recognised sufficiently to enable the way up to be determined. Once this is recognised then the most prospective areas can be targeted initially by a detailed aeromagnetic survey to define the basal contact and to search for possible feeder conduits. These can then be further targeted by airborne EM to detect any massive sulphide conductors for follow up drilling.

Martin Gole

References

Glikson, AY, Stewart, AJ, Ballhaus, CG, Clarke, GL, Feeken, EHJ, Leven, JH, Sheraton, JW, Sun, S-S, 1996. Geology of the western Musgrave Block, central Australia, with particular reference to the mafic-ultramafic Giles Complex. AGSO Bull 239, 206 p.

Naldrett, AJ, Federenko, VA, Lightfoot, PC, Kunilov, VI, Gorbachev, NS, Doherty, W, Johan, Z, 1995. Ni-Cu-PGE deposits of Noril'sk region and other world-class sulphide deposits. Trans Inst Mining Metall 104: B18-B36.

Naldrett, A J, Keats, H J, Sparkes, K, Moore, R, 1996. Geology of the Voisey's Bay Ni-Cu-Co deposit, Labrador, Canada. Explor Min Geol 5: 169-179.

Naldrett, A J, 1996. Post-Archean magmatic sulphide deposits - theory, reality and exploration. AMF Course Notes.

APPENDIX B

Petrology of the Cavanagh sample.

Pontifex and Associates

Martin Gole and Associates.

Appendix B

Martin Gole and Associates

Geological and Petrological Services

8 Landor Road
Gooseberry Hill W.A. 6076
Telephone (09) 293 4958

MEMORANDUM

TO :Dave Jackson DATE:9/2/96

FROM :Martin Gole

SUBJECT :Petrography of the Mt Howe Ultramafic. Sample 3336559 from Hole AC95MH01

The rock is a very fresh, almost pristine, medium-grained igneous rock. The igneous mineralogy consists of cumulus olivine (50 mode %) and minor orthopyroxene (15%) with oikocrystic plagioclase (30%) and minor biotite and spinel (5%). Olivine grains range up to 5 mm across and the plagioclase oikocrystic grains are up to 10 mm long. Olivine grains are crowded with minute symplectic intergrowths of opaque (probably chromite) and a silicate (probably pyroxene). The oxide minerals show complex exsolution textures and intergrowths. Most biotite appears to be igneous although some has been partly recrystallised where grains are cut by fine retrograde veinlets.

Pontifex call the rock a troctolite. However based on cumulate terminology (Irvine, 1982) the rock is a harzburgite or, more completely an olivine-orthopyroxene cumulate with oikocrystic plagioclase (oeC/p*, e=enstatite).

The overall texture is clearly igneous. Here is no apparent metamorphic overprint except for trace amounts of alteration associated with uncommon fine veinlets. The relatively coarse grain size certainly suggests that the rock is from a large igneous body. The symplectic oxide/silicate intergrowths within olivine also suggest slow cooling. Such intergrowths are a relatively common feature within large layered intrusions but not within other igneous rocks.

The presence of coarse-grained plagioclase oikocrysts is probably even more suggestive of a large igneous body. Such textures form in igneous bodies undergoing fractionation. The fact that these are plagioclase oikocrysts suggests that rock is from a fairly evolved, upper part of an Ultramafic Zone within an intrusion and that it is probable that a relative thick, more primative ultramafic sequence may lie stratigraphically below this rock.

Because the olivine in this rock is so fresh the magnetic susceptibility of the rock would be expected to be low. If the remainder of a probable associated Ultramafic Zone is equally as fresh then it would not form obvious patterns and anomalies on aeromagnetic maps.

The rock is highly unlikely to come from a late stage dyke and is almost definitely from a large layered igneous intrusion. The rock retains igneous textures and mineralogy but it may have been protected from effects of metamorphism by surrounding rocks, ie. it may be part of the Musgraves Sequence.

Regardless of its stratigraphic/structural position the igneous body from which this rock comes may have significant potential for magmatic sulphides. Further work in defining the size of the body and layering within it is very firmly warrented. Such data will allow a better assessment of the likely economic potential of the rocks.

Martin Gole

Pontifex & Associates Pty. Ltd.

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SOUTH AUSTRALIA 5067
A.C.N. 007 521 084

P.O. BOX 91, KENT TOWN
SOUTH AUSTRALIA 5071

MINERALOGICAL REPORT NO. 7020
by I.R. Pontifex

December 19, 1995

TO : Mr Alan Hughes
CRA Exploration Pty Ltd
PO Box 254
KENT TOWN SA 5071

COPY TO : (with invoice)
CRAE Information Resources Group
Private Bag
BUNDOORA MDC VIC 3083

Attention : Kerry Richardson

YOUR REFERENCE : Order No. P57706

MATERIAL : Core samples

IDENTIFICATION : 3336559, 560, 561

WORK REQUESTED : Polished thin section preparation, petrographic/mineragraphic descriptions

SAMPLES & SECTIONS : Returned to you with this report

PONTIFEX & ASSOCIATES PTY. LTD.

INTRODUCTION

Three core samples 3336559, 560, 516 are described in this report from polished thin section as requested..

Sample 3336559 is distinctive, as a fresh, undeformed cumulus troctolite, with abundant euhedral (cumulate) crystals of olivine and rarer hypersthene, enclosed in coarse post-cumulus labradorite. Accessory scattered grains include magnetite and ilmenite. Spinel is also an accessory phase, probably hercynite and commonly as composite intricate (exsolution) intergrowths with magnetite and/or ilmenite but the exact identity of this phase requires probe analysis. Rarer, much finer pyrite > chalcopyrite (and trace possible pentlandite) loosely accompany the accessory oxide minerals.

Sample 3336560 is a stressed, locally microfractured plagioclase-rich rock of essentially dioritic (to possibly anorthositic composition), with minor altered pyroxene, biotite, magnetite, lesser quartz and kspar.

Sample 3336561 has a mixed dioritic composition, similar to 560 (with minor quartz k-spar, altered magnetite, pyroxene and biotite), to a granitoid composition with more quartz and k-spar, lesser magnetite, altered pyroxene and biotite than in the dioritic area. These areas may represent a gradational contact, within a differentiated single felsic intrusive. They are both moderately tectonised but to a lesser extent than in 3336560.

3336559

Fresh, cumulate-textured-troctolite, with cumulus crystals of olivine >> (later) hypersthene within coarse post-cumulus labradorite. Accessory complex oxide grains of mixed spinel (?hercynite)-magnetite-ilmenite composition; rarer finer pyrite chalcopyrite, trace ?pentlandite.

This completely fresh rock has a homogeneous composition and cumulus texture. Abundant subhedral to euhedral crystals of olivine 2mm to 5mm size, are crowded with minute inclusions, including microscopic dendrites of opaque oxide. These crystals are randomly very loose packed to form about 45% of the rock. They are locally accompanied by scattered, smaller, subhedral to euhedral crystals of clearer hypersthene/orthopyroxene, which form about 15% of the rock. This orthopyroxene crystallised after the earlier olivine crystals.

Extensive intergranular areas, as a later stage post-cumulus matrix, to the olivine and pyroxene crystals, consist of plagioclase (labradorite) crystals (35% of the rock), commonly optically continuous for up to 5mm.

Minor small flakes of brown phlogopite (5%) have a random distribution, mainly through the plagioclase, but some in pyroxene.

Grains of opaque oxide (5%), 0.1mm to rarely 0.3mm, are disseminated mainly as inclusions in olivine and these are seen in reflected light to have a fairly complex and variable composition as :

(1) grains of (optically pale grey) magnetite with ultrafine exsolved ilmenite and/or spinel (see below)

(2) as for (1) above but rarely composite with 'solid' ilmenite

(3) grains of optically darker grey and incipiently "translucent-looking" apparent spinel (?hercynite) intricately composite with the paler magnetite-ilmenite of (1) above, including partial rims of these oxides in some grains. This ?hercynite is basically opaque apparently due to exsolved, submicron magnetite. Very minor amounts of these oxides also occur as ultrafine myrmekitic intergrowths within some pyroxene.

It is noted that a detailed identification of these intricately intergrown opaque oxides/spinel minerals requires electron probe analysis.

In addition to these oxides, there are minor amounts of sulphide in this rock (?1%), as extremely small grains (1 micron to 50 microns) with a similar mode of occurrence to, and locally accompanying, the oxides. These sulphides appear to be mostly pyrite (although at this extremely fine size, this is difficult to optically distinguish from pentlandite), with subordinate chalcopyrite, and rare-trace pyrrhotite.

APPENDIX C

Notes relating to the interpretation of the Musgraves Project aeromagnetics.

Bruce Craven, Southern Geoscience Consultants.

Appendix C.

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Bill Peters: (61 8) 9316 2814
Bruce Craven (61 8) 9316 2804

MEMORANDUM

Date: **Wednesday, 21 January 1998**
Project: **Musgraves**

From: **Bruce Craven**

To: **Neil O'Loughlin,**
Craton Resources N.L.,
Level 1, 40 Kings Park Road,
West Perth, W.A. 6005.

Neil,

Please find attached the following items for the Musgraves aeromagnetics:

- The film original and a paper copy of the preliminary 1:250000 scale interpretation that I have put together. I have marked several areas/magnetic features that warrant follow up and/or field checking. These include a variety of possible geological settings and target types, including layered mafic/ultramafic hosted nickel, kimberlitic intrusives and granite related mineralization.
- TMI contours on film and paper copies of two 1:250000 scale image maps that we generated for the interpretation (FVD greyscale and SE AGC shade). For their longer term preservation, these image maps should be laminated.
- The various maps and information that you provided. Let me know if I have forgotten anything.
- The two CD's containing the Musgraves data sets (MESA and CRA/RTZ)-picked up on Tuesday afternoon.

This is very much an initial interpretation, restricted to the area of Craton's main tenement block as requested. I have used the regional images and geology plots, plus John's initial work as a guide. At this scale, with the limited geological control on the Geological Survey mapping, it is difficult to resolve the detail in this very complicated environment. The resolution of the MESA magnetic data is also somewhat suspect, particularly when compared to the CRA/RTZ data over the Mt. Howe block. In the RTZ data set, numerous thin, northerly trending magnetic "stratigraphic" units are apparent. These trends appear to be metamorphic layering or relict stratigraphy within the Wataru Gneiss. They could also represent an early (?) dyke swarm. There is little indication of this fine but distinct layering in the MESA data to the immediate east of RTZ's data. This is likely to be a function of the orientation and resolution of the different surveys rather than a fortuitous geological change near the survey boundaries.

Other interpretation assumptions and difficulties include

- Boundaries between the layered gneissic rocks and the intrusives, mostly granitoids, are often gradational and poorly defined. In reality, the Wataru Gneiss is likely to be a very complex mixture of layered metamorphics, intrusives and granitic segregations. I haven't seen any mention in the literature, but this could well be a migmatitic terrain. Several of the mapped granites have a layered appearance, suggesting a migmatitic or xenolithic character. For this interpretation, I have not attempted to separate early and late stage granitoids. My feeling would be that those with layered appearance are more likely to be early, whereas the simple, elliptical, well defined intrusives are more likely to be late.
- From the regional data that you supplied, the majority of the mapped Giles Complex mafic intrusives are weakly to non magnetic. This is somewhat unexpected, but has been observed in similar terrains elsewhere. I have picked a series of low magnetism features as areas that warrant checking for possible layered mafic/ultramafic complexes. These are mostly along inferred, large scale faults or lineaments. These low magnetic zones could also represent non magnetic granites or Wataru Gneiss. From the regional data, the distribution of the Giles Complex bodies seem to be associated with ESE and ENE structures. Thus the interpreted gabbroic/ultramafic bodies that follow similar structures should represent the higher priority targets for field checking. The series of bodies (I1-I4) in the north-western corner of the Mt. Howe data set (along the possible extension of the Intersection Fault Zone) are considered the most likely equivalents to the Giles Complex.
- It is quite likely that some phases of the gabbroic complexes will be magnetic. These could readily be confused with the magnetic granitoids. Interpreted small granitoid G1 (between I2 and I3) could be a magnetic phase of the Giles Complex. It looks different from the other mapped magnetic granites in the data set. From your comments, RTZ's drilling may have confirmed that this anomaly is over a magnetic granite.
- Numerous dolerite dykes are evident in the magnetics. These frequently follow the same basic structural trends as the interpreted Giles Complex gabbroic intrusives. Normally and reversely magnetized varieties are present. They can produce responses that, at the interpretation scale, are difficult to distinguish from the elongate members of the inferred Giles Complex equivalents. The majority of the dykes are clearly post the main metamorphic-deformation events in the basement. The Giles Complex intrusives are reportedly syn deformation/metamorphism. However, for most of the target areas, the magnetic pattern is consistent with either be syn or post metamorphism emplacement. The post metamorphic option may fit the Voisey Bay model better.
- The smaller, circular to elliptical magnetic or non magnetic features in the data set could represent kimberlitic intrusives. The Cavanagh anomaly falls into this category. On the interpretation plan, most of these anomalies have been shown as small granitic intrusives or unassigned, discrete magnetic bodies. Field checking and ground follow up will be necessary to determine the significance of these (at this scale) local anomalies.
- Depending on their affinities, the later granites may have potential for Olympic Dam or Tunkilla style mineralization. Petrological and whole rock geochemical data would be required to determine if this line of investigation is worth pursuing (i.e. alkaline or rare earth rich granites).
- The uranium potential of the area has obviously attracted some interest in the past (Afmeco and perhaps Getty and BHP). From the published geology, I would expect that the best potential would be either associated with the later granites (if they are "hot" or rare earth bearing) or in Palaeozoic to Recent roll front or calcrete style deposits. Some elements of the Mid Proterozoic unconformity style setting seem to be missing-i.e. the flat lying Mid Proterozoic unconformity and sandstones). The possibilities of this model

should be investigated further. It would be worth checking the radiometrics from the airborne data for any obvious uranium anomalies. The radiometrics would also help determine which of the outcropping granites are hot.

The Musgrave block has several major elements of the conceptual Voisey Bay nickel model and geological setting. These include:

- High grade Lower Proterozoic/Archaean metamorphic basement.
- Major crustal scale structures.
- A suite of major gabbroic to ultramafic layered intrusive complexes. The emplacement of these intrusive bodies seems to be at least partially controlled by the major ENE to ESE structures. The age of these intrusives is inconclusive. They may be early or syn-metamorphism, or post metamorphism. If they are early, recognition of the original feeder dyke system (thought to be a key element of the Voisey Bay model) and the layering will be difficult. For younger, post deformation bodies, the original morphology, including possible feeder dykes should be more readily recognizeable.
- The relationship between the late mafic dyke swarm and possible late, layered intrusives is unclear. The larger members of the easterly trending dyke swarm could be feeders for late, layered complexes.

The Musgraves project area has good conceptual possibilities for a Voisey Bay analogy, or for classical layered gabbro (e.g. Stillwater) style deposits. Geological checking of the geophysical interpretation should be a high priority to confirm the nickel exploration model and the other exploration possibilities mentioned above. Assuming this confirms the prospectivity of the region, re-interpretation at a larger scale should be a high priority element of the exploration programme to refine both the structural and lithological setting. A high powered, low frequency, airborne transient EM system (e.g. GEOTEM DEEP) may be an effective means of rapidly identifying massive sulphide style conductors in the subcropping portions of the tenement block-ie the western half. Alternatively, selective ground TEM surveys could be used at a prospect scale. The Voisey Bay deposit produces a clear EM response. The eastern half of the block, where the target basement is beneath a considerable thickness of younger cover, will be a more difficult exploration problem in the short term.

Please call if you have any questions on the interpretation or the above comments.

Regards,

Bruce Craven

Bruce Craven

APPENDIX D

Partial Surrender Report on EL2020.

CRA-RTZ.

RIO
TINTO

October 17, 1997

Director General
Department of Mines & Energy Resources
GPO Box 2355
Adelaide S.A. 5001

Dear Sir,

Re: **EL 2020 Mt. Howe, South Australia**

Enclosed please find Rio Tinto Exploration Report No. 23518 (in duplicate) entitled EL 2020 Mt. Howe Partial Surrender Report For The Period Ending April 15, 1997 South Australia, written by J.E. Terrill dated July 1997.

Yours faithfully,

Mrs Pru Quinn
Administration Officer

Enc.

DEPT OF MINES AND ENERGY REGISTRATION BRANCH

Rio Tinto Exploration Pty. Limited (ACN 000 057 125) 31 Osmond Terrace Norwood SA 5067 Australia
Telephone +61 8 8362 8871 Facsimile +61 8 8363 1795
Postal Address: PO Box 254 Kent Town SA 5071 Australia

Abstract

Exploration Licence 2020, Mt. Howe was granted on September 26, 1994. The tenement is situated approximately 10 km south of the NT-SA Border straddling the Stuart Highway and the Tarcoola-Alice Springs railway line. The initiative for the title application was three positive magnetic features prominent in the 1969 BMR regional magnetic data that were possibly Giles Complex comparatives.

In late 1994 Kevron Geophysics Pty. Ltd. flew on behalf of Rio Tinto Exploration Pty. Limited a semi-detailed magnetic/radiometric survey. The survey located and delineated the three initial magnetic anomalies. The survey also delineated predominantly north-south striking stratigraphy with ESE trending dolerite dykes and another discrete negatively polarised magnetic body named Cavanagh. A radiometric anomaly attributed to an outcropping foliated arkosic rock was the only feature of note defined by radiometrics. *

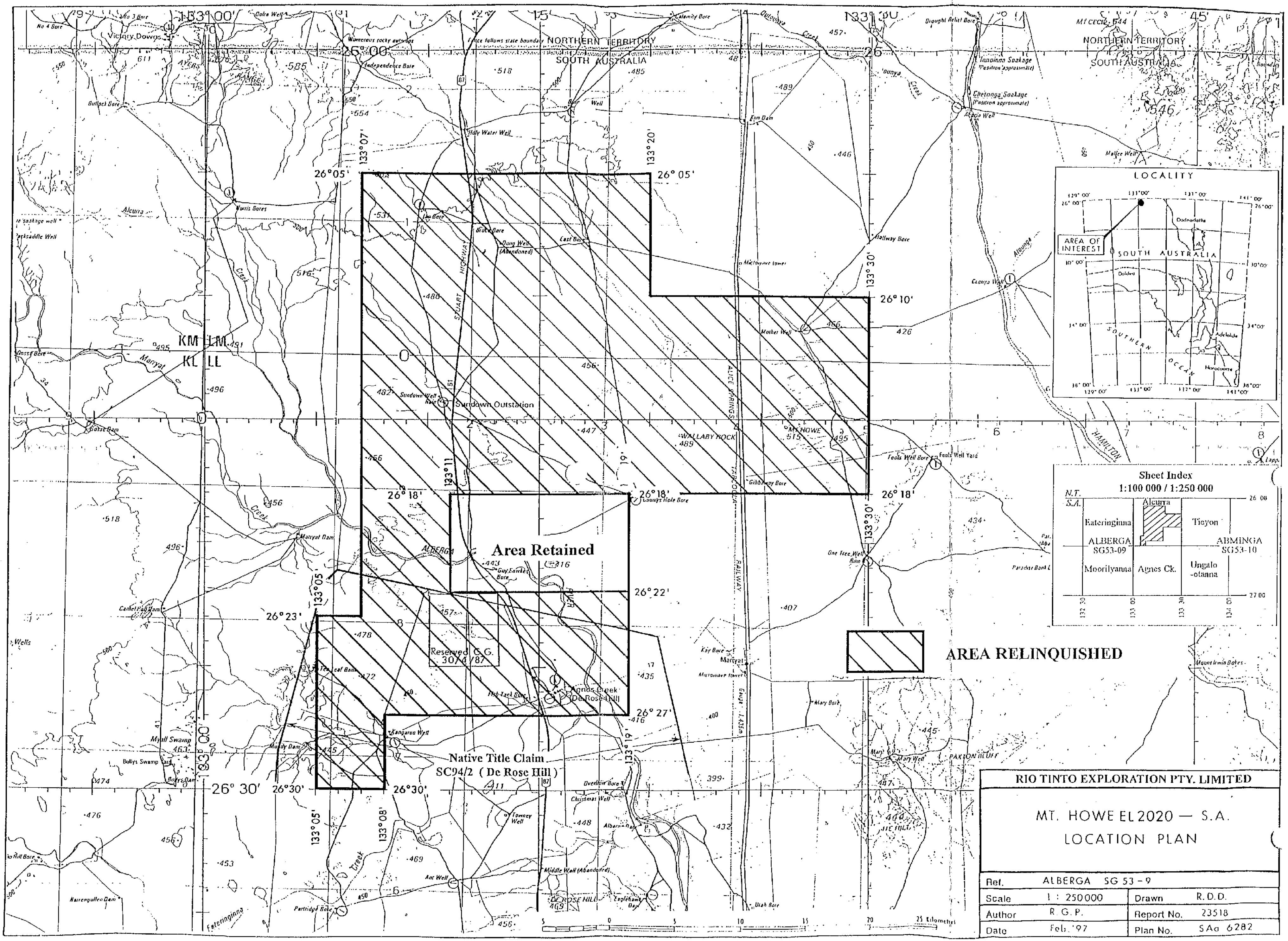
Two of the initial magnetic anomalies were found to be due to outcropping magnetic granite. Aircore drilling of the third intersected a magnetite rich granite-granodiorite. A drill hole (28 m) tested the Cavanagh magnetic anomaly and intersected fresh medium grained olivine cumulate, notably poor in magnetite. Petrology of a sample from 26-28 m revealed a number of features evident with the sample coming from a layered ultramafic body. *

Three one kilometre long surface TEM traverses over the Cavanagh prospect did not define any bedrock conductors. Unfortunately most of the data was dominated by Frequency Dependent Conductivity effects (FDC) previously referred to as IP effects. The magnitude and time decay of the early time data and the FDC effect is best in the profile over the geographic center of the Cavanagh magnetic anomaly. This indicates an increase in the conductivity/depth of the overburden coincident with the Cavanagh anomaly.

Four lines of Airborne Electromagnetic (AEM) traverses were flown as a trial over EL 2020. Three anomalies were identified and followed up with surface TEM. One displayed no feature of interest.

All prospects have had representative samples analytically tested and to date none has recorded any values of significance.

All of the tenement - except for a 100 sq km rectangular area which encompasses two AEM anomalies of interest - has been relinquished.



NORTHERN TERRITORY
SOUTH AUSTRALIA
Area Retained
AREA RELINQUISHED
Native Title Claim
SC94/2 (De Rose Hill)
Reserved C.G. 30/4/87
Sundown Outstation
Victory Downs
STUART HIGHWAY
ALICE SPRINGS - TAROOLA RAILWAY
MT HOWE
WALLABY ROCK
Agnes Creek
De Rose Hill
26° 05'
26° 10'
26° 18'
26° 22'
26° 23'
26° 27'
26° 30'
133° 05'
133° 07'
133° 08'
133° 11'
133° 19'
133° 20'
133° 30'
LOCALITY
AREA OF INTEREST
SOUTH AUSTRALIA
SOUTHERN OCEAN
Sheet Index
1:100 000 / 1:250 000
N.T.
S.A.
Alcurra
Eateringinna
Tieyon
ALBERGA SG53-09
ABMINGA SG53-10
Moorilyanna
Agnes Ck.
Ungalo -otanna
RIO TINTO EXPLORATION PTY. LIMITED
MT. HOWE EL 2020 — S.A.
LOCATION PLAN
Ref. ALBERGA SG 53 - 9
Scale 1 : 250000
Author R G P.
Date Feb. '97
Drawn R.D.D.
Report No. 23518
Plan No. SAo 6282

Contents

List of Plans

Plan No.	Title	Scale
SAa 6670	Mt. Howe EL 2020 - S.A., Location Plan Showing Prospects, Airborne TEM Traverses and Surface TEM Survey Areas	1:250 000
SAa 6282	Mt. Howe EL 2020 - S.A. Tenement Location Plan Showing Areas Relinquished and Retained	1:250 000

List of Appendices

1. Conclusions and Recommendations

Three magnetic anomalies identified in the regional aeromagnetic data set and initially the focus for the Mt. Howe Exploration Licence application have been tested. The source of these anomalies was found to be magnetite-rich granite and granodiorite-diorite. Rock, soil and drill chip samples failed to record any results of economic significance.

An inversely polarised magnetic anomaly (named Cavanagh) was identified by Rio Tinto Exploration's airborne magnetic survey and delimited by a small ground magnetic survey. A single aircore hole into the magnetic anomaly intersected weathered ultramafic from 8 m. The hole was stopped at 28 m due to drilling difficulties. A bottom hole sample taken from the hole (26-28 m) recorded slightly elevated Ni, Pt, Pd, Mg, Cr, and Co. A petrological report suggests that the material is from a layered ultramafic. Low amounts of magnetite in thin section and low magnetic susceptibilities recorded for the length of the drill hole indicate that none of the material intersected is responsible for the magnetic anomaly.

The inverse magnetic signature of the Cavanagh anomaly is similar to a number of Giles complex ultramafics in the adjacent Musgrave Block. Unfortunately the surface TEM survey was dominated by the Frequency Dependent Conductivity effect (FDC. ref. IP effects). However where the FDC is greatest, coincidentally over the approximate center of the magnetic anomaly, there is a weak twin peak anomaly indicative of a dipping bedrock conductor.

2. Introduction

Exploration Licence 2020, Mt. Howe was initially acquired to test three large magnetic anomalies, identified in the regional 1968 magnetic data, as potential Giles complex layered intrusives. The anomalies were named Bruces Bore, Wallaby Rock and Mt. Howe. The locations of the three prospect areas are shown on plan SAa 6670

Exploration Licence 2020, is approximately 1121 km^2. Rio Tinto Exploration Pty. Limited (Rio Tinto Exploration) was granted the EL on September 26, 1994. The licence area is situated approximately 10 km south of the SA-NT border straddling the Stuart Highway and the Tarcoola to Alice Springs railway line. The exploration licence covers part of the Cavanagh, De Rose Hill and Tieyon properties.

The area is transported cover on the Eastern flank of the Musgrave Block and may contain equivalent Musgrave stratigraphy. This presents the potential for the occurrence of base metal, precious metal and diamond mineralisation associated with basement structures. The stratigraphy is generally north south striking with ESE trending magnetic dolerite dykes. There are three large positive magnetic features attributed to intrusives. There is also a discrete negatively polarised magnetic anomaly possibly related to Giles complex layered mafic intrusives.

This report documents the investigations undertaken by Rio Tinto Exploration during the third year of tenure from September 26, 1996 to March 27, 1997.

3. Review of Previous Work

3.1 Prior to Current Tenement

A review of previous exploration has not been completed. A listing of the historic Exploration Licences along with the MESA envelope number is included in Table 1.

3.2 During Current Tenement

3.2.1 Airborne and Radiometric Survey

An airborne magnetic and radiometric survey was flown over the entire EL area. The survey was flown with 200 m flight line spacing and with a mean flight clearance of 60 m by Kevron Geophysics. The main features evident in the magnetic survey are the north-south striking stratigraphy and the ESE trending magnetic dolerite dykes. The three positive magnetic features, initially identified in the regional magnetics, were well defined and accurately located by the survey.

A number of other subdued magnetic responses were also defined by the magnetic survey and these maybe responses attributed to intrusives covered with varying amounts of overburden. A small, discrete inversely polarised dipole feature was also defined by the survey. This feature was named the Cavanagh prospect. Some elevated radiometric responses that correspond with outcrops of granitic or arkosic rocks were also recorded. The strongest radiometric response was named the Mt. Howe East prospect.

3.2.2 Mt. Howe Magnetic Anomaly

On the ground at the Mt. Howe prospect numerous outcrops of granite with coarse magnetite grains and magnetic susceptibilities between 2000 and 6000 by 10^{-5} SI units were located within the area defined by the aeromagnetic anomaly. Soil sampling in the area recorded no results considered to be significant.

3.2.3 Wallaby Rock Magnetic Anomaly

Numerous outcrops of granite similar to those at the Mt. Howe prospect were also observed at the Wallaby Rock prospect. Soil sampling at 100 m spacing failed to record any results considered to be significant.

3.2.4 Bruces Bore Magnetic Anomaly

No outcrop was located in the vicinity of the magnetic high associated with the Bruces Bore prospect. Soil sampling over the prospect recorded one sample (3330705) with a value of 220 ppm Zn against a background of 60 ppm.

3.2.5 Cavanagh Magnetic Anomaly

The Cavanagh prospect is a small intense bipolar magnetic anomaly with reverse polarity. It is situated in an area of no outcrop approximately six kilometres NW of the Wallaby Rock prospect. Soil sampling in the area recorded no values of significance. Heavy mineral sampling revealed three grains of chromite. Six ground magnetic traverses totalling seven line kilometres were surveyed over the Cavanagh anomaly.

3.2.6 Mt. Howe East Radiometric Anomaly

The Mt. Howe East prospect was identified as the strongest radiometric response from the airborne survey completed over the EL. An outcrop of foliated arkosic rocks which gave a reading of 500 counts per second was recorded coincident with the area defined by the airborne survey. Two rock samples from the area were assayed but no significant results were recorded.

3.2.7 Soil Sampling

Fifty nine -40# +80# soil samples were collected over the EL. Of these only one sample (3330705) recorded any values of significance (220 ppm Zn). Eighty two -20# +40# soil samples were collected over the EL none of the samples recorded any values of significance.

3.2.8 Rock Sampling

Five rock samples were collected over the EL. None of the samples recorded any values of significance.

3.2.9 Airborne Electromagnetic Survey

Four airborne electromagnetic (AEM) traverses, summing to approximately 100 line kilometres, were trialed over the Mt. Howe Exploration Licence (plan SAa 6670). The lines were flown in an east west direction with a mean flight clearance of 120 m. Details of the survey specifications are included in Appendix 1.

Line 40583

This was the most northern traverse flown during the test survey. The Area 3 anomaly was defined on this profile. The anomaly is a complex moderate-amplitude twin-peak anomaly. Initially the trailing peak has the higher amplitude; in later time the leading peak is the dominant component of the anomaly. The leading peak anomaly has a moderate time decay, no peak migration and no component of spheric noise. The anomaly is on the flank of a magnetic anomaly with a discrete source defined in the first vertical derivative.

A large portion of the profile is flat with a low signal response. This area must have an overburden with a low conductivity/depth variation. This is highly encouraging as it improves the possibility of defining a bedrock conductor. To the west of the flat zone of the profile is an area with a variable mildly conductive overburden. Most of the signal is depleted by the 9th window.

To the west of this conductive zone is a narrow, symmetrical response that should be followed up. The anomaly has a low to moderate response with some signal apparent in the very late time. There is no cultural or spheric noise associated with the anomaly. The anomaly has a corresponding subtle magnetic anomaly with a discrete source defined in the first vertical derivative.

Line 40590

Most of the profile is flat with no features of interest. There are four areas where the overburden has a variable conductivity/depth.

3.2.10 Bruces Bore Magnetic Anomaly

3.2.10.1 Drilling

The Bruces Bore prospect was one of the three magnetic anomalies first identified in the regional 1968 magnetic data. Initial ground checking revealed no outcrop in the area. Sixty nine samples from forty aircore holes for a total of 219 m were collected over the Bruces Bore magnetic anomaly. None of the samples recorded any assays of significance. The source of the anomaly was found to be a magnetic granite-granodiorite-diorite cross cut by dolerite dykes. The drill hole ledger and assay values for the samples collected are included in Appendix 2.

3.2.10.2 Petrological Analysis

Two samples (3336560 and 3336561) were sent to Pontifex and Associates Pty. Ltd. for petrological analysis. The deductions from the petrological work are that the two samples are from within a differentiated single felsic intrusive. A more detailed description of this work is included in Appendix 3.

3.2.11 Cavanagh Inverse Magnetic Anomaly

3.2.11.1 Drilling

One aircore hole was drilled into the Cavanagh magnetic anomaly (AC95MH01). The hole intersected weathered ultramafic at a depth of 8 m. The ultramafic rock had a moderate to low magnetic susceptibility, but it is important to note that the anomaly is dominated by remnant magnetisation and not induced. The hole ended at a depth of 28 m. due to drilling difficulties, in fresh medium grained olivine cumulate with minor pyrite, chalcopyrite and magnetite. No significant assay results were recorded in any of the 14 samples submitted for analysis. As expected when intersecting the ultramafic there was an increase in Ni, Pt, Pd, Mg, Cr, and Co. The drill hole ledgers and assay results are included in Appendix 4.

3.2.11.2 Petrological Analysis

One sample was initially sent to Pontifex and Associates Pty. Ltd. for petrological analysis, and then sent later to Martin Gole of Martin Gole and Associates. Several features present in the sample tend to suggest that it is from a large layered intrusive body. R.J. Smith stated in his interpretation of magnetic and gravity data in the Musgraves block (1979) 'discrete negative anomalies are generally associated with remanently magnetised rocks of the Giles Complex (mafic and ultramafics)'. These two points suggest that the Cavanagh ultramafic may be analogous to the Giles complex ultramafics in the Musgrave Block. This is significant for the potential of magmatic sulphides. The results of the petrological work by both Pontifex and Martin Gole are included in Appendix 5. The lack of magnetite in the petrographical analysis indicates that the source of the magnetic anomaly has not been tested.

3.2.11.3 Surface TEM

Three surface TEM traverses were completed over the Cavanagh magnetic anomaly in the search for massive sulphide mineralisation. The survey used a twin turn 200 m by 200 m transmitter loop. Station spacing for the survey was 50 m and the spacing between lines was 400 m. A minimum of four soundings was completed at each station with a survey frequency of 2 Hz. A single component SIROTEM RVR was used to sense the secondary magnetic field (effective area is 10 000 m²) with a ZONGE GGT25 and a ZONGE GDP16 used for transmitting the primary and recording the secondary signal respectively. Synchronization between the receiver and transmitter was achieved by the use of quartz clock. The response from the RVR antenna was jumped across two channels of the GDP16 and the second channel's gain setting was increased by two binary stages. The increased gain setting improves the late time signal but results in saturation of the early time signal. The use of two channels allows for a merger of the data from the two channels and thus good early time data and cleaner late time data. The traverses were completed in a north south direction.

Copies of the three profiles are in Appendix 6. A bedrock conductor response is not clearly defined in any of the three traverses. However the recorded signal is overprinted by a large amount of Frequency Dependent Conductivity (historically referred to as IP effect). The FDC effect results in a changing of the secondary signals polarity in the moderate to late times. This may result in the masking of a response from a bedrock conductor. The source of the FDC effect may be some form of current channel along preferentially weathered zones.

On profile 332800E where the FDC effect is most typical (i.e. has a negative decay) there is also a mild early time anomaly that is most like a response from an increase in the conductivity/depth of the overburdened (N.B. similar to source of Ernest Henry TEM anomaly). However in the early to moderate times there is a transferring of a low between stations 7099500 and 7099550. This allows for the interpretation of a twin peak anomaly typical of a dipping conductor. The first and smaller peak is between stations 7099400 and 7099550 the second peak is between stations 7099500 and 7099750. The top of such a source would be at approximately 7099550 and dipping to the North. The depth is more difficult to ascertain but from the mild wavelength of the anomaly along with early time signal response and the increase in the apparent conductivity/depth it would be between approximately 80 m. Note that the this traverse is over the approximate geographic centre of the negative magnetic anomaly.

3.2.12 Area 3

3.2.12.1 Surface TEM

Area 3 was identified from the AEM survey. It is in a very remote position to the east of the Alice Springs, Tarcoola railway. The area is covered by loose aeolian sand with patches of thick vegetation. Due to the sand and vegetation cover only two traverses were completed over the anomaly. The two profiles are included in Appendix 8.

Traverse 7098600N was terminated early due to the scrub making the rest of the traverse inaccessible. The profile shows a broad increase in all early time channels from west to east. This is due to an increase in the conductivity/depth of the cover sequence. The single station inflection at 489100 is unexplained.

Traverse 7098800N shows a broad low amplitude anomaly. The source of such an anomaly is an increase in the conductivity/depth of the overburden. Once again there is a strong FDC effect recorded in the data.

4. Exploration Completed Between September 26, 1996 & March 27, 1997

No field work was undertaken.

The work done on the tenement was carefully reassessed. A decision was made to relinquish all but a 100 square kilometre rectangular area of the tenement.

5. Rehabilitation

Drill Site MH01 has been rehabilitated, but further work could be done to remove rig wheel marks on the access track. The country is flat, scrubby and sandy and these are more a cosmetic problem than environmental and do not pose an erosion hazard.

All flagging used in the TEM survey was removed whilst the survey was in progress. Grid pegs were used every 200 m to mark out the traverses and these still remain at the four areas where surface TEM was undertaken.

6. References

Hughes, A.R.	Mt. Howe EL 2020, South Australia, Annual Report For The First Year of Tenure Ended September 25, 1995 (CRAE Report No. 21155)
McInnes, D.J.	Mt. Howe EL 2020, South Australia, Annual Report For The Second Year of Tenure Ended September 25, 1996 (CRAE Report No. 22658)

7. Location

Alberga SG53-09 1:250 000 sheet

8. Keywords

Airborne Electromagnetic, TEM, Magnetic, Radiometric, Bruces Bore, Cavanagh, Mt. Howe, Mt Howe East

9. DPO Register

DPO Number	LAB	LAB Location	DPO Date	Office	Geologist	Tenement Name	Tenement Number	Sample Type	Number of Samples	250 000 Mapsheet
57701	AMDEL	ADL	19-Apr-95	ADL	A. Hughes	Mt. Howe	EL 2020	-20#+40#SL / Rock	82 / 5	Alberga SG53-09
57703	AMDEL	ADL	11-Sep-95	ADL	A. Hughes	Mt. Howe	EL 2020	-40#+80#SL	59	Alberga SG53-09
57704	AMDEL	ADL	13-Nov-95	ADL	A. Hughes	Mt. Howe	EL 2020	AC	83	Alberga SG53-09
57705	AMDEL	ADL	27-Nov-95	ADL	A. Hughes	Mt. Howe	EL 2020	AC	1	Alberga SG53-09
57706	Pontifex	ADL	27-Nov-95	ADL	A. Hughes	Mt. Howe	EL 2020	Petrological - AC	3	Alberga SG53-09
54326	AMDEL	ADL	07-Apr-96	ADL	D. Jackson	Mt. Howe	EL 2020	Soil / Rock	99 / 6	Alberga SG53-09
54327	Pontifex	ADL	07-May-96	ADL	D. Jackson	Mt. Howe	EL 2020	Petrological - AC	2	Alberga SG53-09

Table 1

Listing of Historic Exploration Licences
(with MESA Env. No.)

Special No. (SML)	Company	Local Name	Exp. Date	Env. No.
332	Aust Aquitaine Petroleum Pty Ltd	Granite Downs	23/10/69	1215
342	Aust Aquitaine Petroleum Pty Ltd	Granite Downs	22/10/70	1215
357	Kennecott Expln (Aust) Pty Ltd	Sundown	26/08/70	1281
358	Kennecott Expln (Aust) Pty Ltd	Everard Ranges	26/08/70	1292
417	Kennecott Expln (Aust) Pty Ltd	Agnes Creek	06/11/70	1476
418	Kennecott Expln (Aust) Pty Ltd	Artoonanna Hill	06/11/70	1477
490	Aust Aquitaine Petroleum Pty Ltd	Granite Downs	28/10/71	1729
510	Kennecott Expln (Aust) Pty Ltd	Artoonanna Hill-Marble Hill	18/11/71	1579
571	RMC Minerals Pty Ltd	Sundown	28/10/71	1648
(EL)				
3	Savage Exploration Pty Ltd	De Rosa Hill	08/09/72	—
4	Savage Exploration Pty Ltd	Moorilyanna Granite Downs	08/09/72	—
93	Director of Mines	Pine Ridge	12/07/74	2363
97	Dampier Mining Company Ltd	Granite Downs	23/12/74	2380

Appendix 1

AEM Survey Details and The Four Traverses

MT. HOWE
SOUTH AUSTRALIA

QUESTEM AIRBORNE GEOPHYSICAL SURVEY
LOGISTICS REPORT
JOB : 1143

Data acquired and processed by:

WORLD GEOSCIENCE CORPORATION LIMITED
65 Brockway Road
FLOREAT WA 6014

Tel: (61 9) 273 6400
Fax: (61 9) 273 6466

MT. HOWE
SOUTH AUSTRALIA
QUESTEM AIRBORNE GEOPHYSICAL SURVEY
LOGISTICS REPORT
JOB : 1143

CONTENTS

1. LOGISTICS

1.1 *Operating Base*

The main operating base was from Marla for the Mt. Howe area.

1.2 *Flight Summary*

The MT. Howe survey was flown between the 20th and 24th January 1996 at 75 Hz.

1.3 *Aircraft Details*

Survey Aircraft	-	Britten Norman Trislander
Registration	-	VH-NKW

1.4 *Field Crew*

Ian Payne	-	Pilot
Chris Harrison	-	Engineer / Operator
Mark Cowen	-	Operator
Matt Owers	-	Geophysicist

2. SURVEY DETAILS

AREA 4 (VERNON HILL) : *75 Hz* Total line kilometres - 996 km.

	Line Numbers	*Orientation*	*Line Spacing*
Reconnaissance lines	40583 - 40610	090° - 270°	n/a

2.2 *Navigation*

Navigation was by Novatel GPS satellite positioning incorporating real-time differential corrections via the Omnistar system. An Ashtech receiver collected base station information for post flight differential corrections.

2.3 *Flight Path Recovery*

Flight path recovery was confirmed on-site using Aerodata post flight processing software.

2.4 *Altimeters*

(i) King KRA-405 radar altimeter.
(ii) Barometric altitude using a Digiquartz 215A-101 transducer - operating range 0-15 psi.

2.5 *Aircraft Magnetometer*

Type	-	Scintrex Cs-2 split-beam cesium vapour
Resolution	-	0.01 nT
Operating Range	-	17,000 - 95,000 nT

Mounting	-	Nose Stinger
Sampling Rate	-	0.5 second
Sample Separation Along Line	-	30 m

2.6 QUESTEM Airborne Time Domain EM System

QUESTEM is an airborne electromagnetic mapping system designed and operated by World Geoscience Corporation Limited. Half-sine waveforms of electric current with alternating polarity are pulsed through the transmitter loop slung around the aircraft. The electromagnetic field generated by the loop penetrates the ground below the aircraft and induces secondary, decaying currents from any conductive material. These are sensed by a receiver towed behind the aircraft. The secondary current amplitude and decay rate depends on the three dimensional distribution of the electrical conductivity in the ground.

Frequency of Transmitter Operation	-	75 Hz
Channels Recorded	-	64
Transmitter Waveform	-	Half-sine wave pulse
Transmitter On-Time	-	2.0 msec
Transmitter Off-Time	-	4.67 msec (75 Hz)
Bird Height	-	50 m
Flying Height	-	120 m
Peak Transmitter Loop Current	-	240A
Transmitter Loop Turns	-	6
Transmitter Loop Moment	-	267,840 ATm^2
Number of Digital Samples per Waveform	-	128 (75 Hz)
Sample Size	-	52.08 microsec
Sensor	-	Horizontal coil in towed bird
EM Reading Duration	-	200 msec
EM Readings Per Second	-	4
Sample Separation Along Line	-	15 m

75 Hz Window Times

Window	Start (µsecs)	End (µsecs)
1	272	428
2	376	533
3	481	637
4	585	741
5	689	949
6	897	1,157
7	1,105	1,366
8	1,314	1,678
9	1,522	1,887
10	1,730	2,199
11	2,043	2,512
12	2,460	3,032
13	2,980	3,553
14	3,501	4,074
15	3,918	4,491

2.7 Acquisition System

The airborne data acquisition system used was the Picodas PDAS 1000 system and Aerodata navigation software.

2.7.1 Digital Recording

Line Number
Flight
Year
Date
Time
Barometric Pressure
Radar Altimeter
Raw Magnetic Intensity
Navigation String (latitude, longitude, quality, age etc.)
AC Time
+64 Channel EM Data

2.7.2 RMS Graphic Recorder

Channel 0 EM1	FS	10000 ppm
Channel 1 EM2	FS	10000 ppm
Channel 2 EM3	FS	10000 ppm
Channel 3 EM4	FS	10000 ppm
Channel 4 EM5	FS	10000 ppm
Channel 5 EM6	FS	10000 ppm
Channel 6 EM7	FS	10000 ppm
Channel 7 EM8	FS	10000 ppm
Channel 8 EM9	FS	10000 ppm
Channel 9 EM10	FS	10000 ppm
Channel 10 EM11	FS	10000 ppm
Channel 11 EM12	FS	10000 ppm
Channel 12 EM13	FS	10000 ppm
Channel 13 EM14	FS	10000 ppm
Channel 14 EM15	FS	10000 ppm
Channel 15 Radar Altimeter	FS	1000 ft
Channel 16 Spherics Monitor	FS	1000 ppm
Channel 17 Power Line Monitor	FS	1000 ppm
Channel 18 Raw Mag	FS	100 nT
Channel 19 Latitude	FS	0.010 deg
Channel 20 Longitude	FS	0.010 deg
Channel 21 Barometric Altimeter	FS	1000 ft

2.8 Magnetic Base Station

Type	-	Geometrics G-856AX
Resolution	-	0.1 nT
Sampling Rate	-	5 seconds
Locations	-	Marla Airstrip
Recorder	-	Internal

3. CALIBRATIONS

3.1 *Magnetics*

3.1.1 Noise Envelope

The noise envelope matched or bettered the required specification of ±0.2 nT.

3.2 *Electromagnetics*

3.2.1 Reference File

The primary waveform is measured at a great height prior to the flight. This is used in converting the data to ppm.

3.2.2 Drift Correction

A zero file is recorded at a great height prior to the flight, and a drift file is collected at the end of the flight to enable a correction for transmitter drift due to warming.

4. PROCESSING

4.1 *Infield Verification*

Magnetic and electromagnetic data quality was checked daily using a Sun SparcStation and aircraft analogs. Flight path was also checked against survey specifications.

4.2 *Magnetic Data Processing*

The airborne magnetic data were corrected for diurnal adjustments. The IGRF (1990 epoch extrapolated to 1996) was then removed at calculated intervals along each flight line. The data were also corrected for system parallax and heading differences. The data were then gridded at a cell size of 50 metres and imaged.

4.3 *Electromagnetic Data Processing*

The airborne electromagnetic data was corrected for transmitter drift. Algorithms were also applied to the data to compensate for varying bird-plane geometry. Stages of processing of the digital data included:

- binning of the 64 channels into 15 windows
- parallax correction based on vertical conductors (eg. test lines flown over a railway line)
- spatial filtering to remove noise but conserve geological information

- gridding of selected channels and calculation of apparent conductance grids
- two time constants each calculated over 5 channels : one centred on channel 9, the other centred on channel 12

Apparent conductance grids were derived for a range of delay times from early time (approximately 100 μsec) through to mid and late times (4 milliseconds). An apparent conductance grid is superior to raw EM amplitude as it can solve two major problems in gridding airborne electromagnetic data. The first is the variation in signal caused by variations in flying height. The second occurs in terrain where conductivity is higher than the conductive limit (the level at which responses at a particular delay time start to fall with increasing conductivity), resulting in ambiguous EM amplitudes. The apparent conductance calculation process accounts for these problems. Further subtle adjustments of parallax are also applied to these grids.

The time constant included on the line profiles was calculated from channels 7 to 11 and centred on channel 9.

Appendix 2

Bruces Bore Aircore Holes

CRA EXPLORATION PTY LIMITED
Aircore/Reverse circulation/Diamond drill log
EL 2020 MT HOWE

15700 EAST

CONTRACTOR Budd Drilling	Date: 6th November 1995	DRILLING RIG UDR 600
DRILLERS Craig Burgess, Rob Budd	Geologist Alan Hughes	PROSPECT Bruces Bore magnetic anomaly
LOCATION Alberga 1 250000 Sheet	DPO 57704	

HOLE	EAST	NORTH	DESCRIPTION	SAMPLE	FROM	TO	INT	Mag Susc SI/100000	cps
			Granite	3330787	3	6	3	30	70
AC95MH34	315710	7108400	Red sandy soil		0	1	1	600	70
			Red sandy soil and calcrete	3330788	1	4	3	300	70
			Calcrete clay and gravel	3330789	4	9	5	200	70
			Granodiorite and dolerite	3330790	9	12	3	500	70
AC95MH35	315720	7108500	Red sandy soil		0	1	1	700	70
			Red sandy soil and calcrete	3330791	1	5	4	300	70
			Calcrete clay and gravel	3330792	5	9	4	400	70
			Granodiorite and dolerite	3330793	9	12	3	200	70
AC95MH36	315730	7108600	Red sandy soil		0	1	1	600	70
			Red sandy soil and calcrete	3330794	1	5	4	400	70
			Granodiorite	3330795	5	6	1	1500	70
AC95MH37	315740	7108700	Red sandy soil		0	1	1	50	70
			Red sandy soil and calcrete	3330796	1	3	2	500	70
			Granodiorite	3330797	5	6	1	500	70
AC95MH38	315750	7108800	Red sandy soil		0	1	1	700	70
			Red sandy soil and calcrete	3330798	1	3	2	600	70
			Granodiorite	3330799	3	4	1	600	70
AC95MH39	315760	7108900	Red sandy soil		0	1	1	100	70
			Granodiorite	3330800	1	3	2	200	70
AC95MH40	315770	7109000	Red sandy soil		0	1	1	800	70
			Dolerite	3330801	1	2	1	1500	70
AC95MH41	315780	7109100	Red sandy soil		0	1	1	10	70
			Diorite	3330802	1	3	2	50	70

CRA EXPLORATION PTY LIMITED
Aircore/Reverse circulation/Diamond drill log
EL 2020 MT HOWE

15700 EAST

CONTRACTOR Budd Drilling		Date: 6th November 1995	DRILLING RIG UDR 600
DRILLERS	Craig Burgess, Rob Budd	Geologist Alan Hughes	PROSPECT Bruces Bore magnetic anomaly
LOCATION	Alberga 1:250000 Sheet	DPO 57704	

HOLE	EAST	NORTH	DESCRIPTION	SAMPLE	FROM	TO	INT	Mag Susc SI/100000	cps
AC95MH25	315620	7107500	Red sandy soil		0	3	3	1000	70
			Red sandy soil and calcrete	3330768	3	4	1	1000	70
			Fresh Dolerite	3330769	4	5	1	S	70
AC95MH26	315630	7107600	Red sandy soil		0	1	1	400	70
			Red sandy soil and calcrete	3330770	1	4	3	150	70
			Fresh Dolerite	3330771	4	6	2		
AC95MH27	315640	7107700	Red sandy soil		0	2	2	50	70
			Red sandy soil and calcrete	3330772	2	6	4	100	70
			Fresh Dolerite	3330773	6	9	3	10	70
AC95MH28	315650	7107800	Red sandy soil		0	1	1	400	70
			Red sandy soil and calcrete	3330774	1	6	5	150	70
			Fresh Dolerite	3330775	6	9	3	5	70
AC95MH29	315660	7107900	Red sandy soil		0	1	1	0	70
			Red sandy soil and calcrete	3330776	1	2	1	100	70
			Paler calcrete	3330777	2	3	1	300	70
			Brown calcrete	3330778	3	6	3	5	70
			Dolerite and granodiorite	3330779	6	9	3	1800	70
AC95MH30	315670	7108000	Red sandy soil					100	70
			Red sandy soil and calcrete	3330780	1	4	3	100	70
			Granodiorite	3330781	4	6	2	200	70
AC95MH31	315680	7108100	Red sandy soil		0	1	1	500	70
			Red sandy soil and calcrete	3330782	1	3	2	500	70
			Granodiorite	3330783	3	6	3	100	70
AC95MH32	315690	7108200	Red sandy soil		0	1	1	150	70
			Red sandy soil and calcrete	3330784	1	3	2	30	70
			Granite	3330785	3	6	3	0	70
AC95MH33	315700	7108300	Red sandy soil		0	1	1	20	70
			Red sandy soil and calcrete	3330786	1	3	2	20	70

APPENDIX I

LINE 15700 E

SAMPLE	From	To	Int	Au	Pt	Pd	Ag	S	Co	Cr	Cu	Fe	Mn	Mg	Mo	Ni	Pb	Zn
	0	3	3															
3330768	3	4	1	0.7	0.8	1.2	<1	<500	16	63	23	31800	420	7400	6	15	25	29
3330769	4	5	1	0.7	2.2	3.4	3	<500	20	92	57	60800	440	11100	6	48	25	37
	0	1	1															
3330770	1	4	3	0.4	0.6	1	<1	<500	11	46	20	27400	320	11000	4	15	15	38
3330771	4	6	2	0.9	5.2	6.2	<1	600	39	640	77	44700	800	31900	<3	170	10	59
	0	2	2															
3330772	2	6	4	0.2	0.8	1.2	<1	<500	9	55	25	30700	320	8300	4	13	10	33
3330773	6	9	3	<0.1	0.6	1.4	<1	<500	10	49	39	27400	360	8300	<3	15	10	35
	0	1	1															
3330774	1	6	5	0.2	0.6	1	<1	<500	8	63	23	35500	300	7900	4	14	15	31
3330775	6	9	3	1.2	2.6	5.6	<1	<500	26	87	61	45600	780	22700	<3	65	<5	58
	0	1	1															
3330776	1	2	1	0.7	0.4	0.6	<1	<500	5	40	12	24000	200	8200	4	10	10	25
3330777	2	3	1	<0.1	0.8	1.2	<1	<500	12	54	22	33700	480	18400	<3	14	10	38
3330778	3	6	3	0.8	0.8	1.2	<1	<500	11	65	30	38000	380	12000	4	15	10	40
3330779	6	9	3	0.7	1.2	1.6	2	<500	12	55	62	32300	540	8800	<3	22	20	45
3330780	1	4	3	0.2	0.8	1.6	<1	<500	9	45	22	24300	360	7400	4	9	10	26
3330781	4	6	2	0.2	0.8	2	<1	<500	10	33	29	30300	360	16600	4	9	10	30
	0	1	1															
3330782	1	3	2	0.4	0.4	0.4	<1	<500	5	33	29	19400	300	5600	4	6	15	28
3330783	3	6	3	<0.1	0.8	2	<1	<500	10	33	99	28700	420	6700	4	9	10	40
	0	1	1															
3330784	1	3	2	0.3	0.6	1	<1	<500	9	35	18	19100	380	7300	4	15	15	43
3330785	3	6	3	0.3	0.2	1.2	<1	<500	9	22	33	25800	500	6600	4	6	20	60
	0	1	1															
3330786	1	3	2	0.3	0.6	1	<1	<500	9	39	20	26300	360	13200	4	15	15	38

LINE 15700 E

SAMPLE	From	To	Int	Au	Pt	Pd	Ag	S	Co	Cr	Cu	Fe	Mn	Mg	Mo	Ni	Pb	Zn
	0	3	3															
3330768	3	4	1	0.7	0.8	1.2	<1	<500	16	63	23	31800	420	7400	6	15	25	29
3330769	4	5	1	0.7	2.2	3.4	3	<500	20	92	57	60800	440	11100	6	48	25	37
	0	1	1															
3330770	1	4	3	0.4	0.6	1	<1	<500	11	46	20	27400	320	11000	4	15	15	38
3330771	4	6	2	0.9	5.2	6.2	<1	600	39	640	77	44700	800	31900	<3	170	10	59
	0	2	2															
3330772	2	6	4	0.2	0.8	1.2	<1	<500	9	55	25	30700	320	8300	4	13	10	33
3330773	6	9	3	<0.1	0.6	1.4	<1	<500	10	49	39	27400	360	8300	<3	15	10	35
	0	1	1															
3330774	1	6	5	0.2	0.6	1	<1	<500	8	63	23	35500	300	7900	4	14	15	31
3330775	6	9	3	1.2	2.6	5.6	<1	<500	26	87	61	45600	780	22700	<3	65	<5	58
	0	1	1															
3330776	1	2	1	0.7	0.4	0.6	<1	<500	5	40	12	24000	200	8200	4	10	10	25
3330777	2	3	1	<0.1	0.8	1.2	<1	<500	12	54	22	33700	480	18400	<3	14	10	38
3330778	3	6	3	0.8	0.8	1.2	<1	<500	11	65	30	38000	380	12000	4	15	10	40
3330779	6	9	3	0.7	1.2	1.6	2	<500	12	55	62	32300	540	8800	<3	22	20	45
3330780	1	4	3	0.2	0.8	1.6	<1	<500	9	45	22	24300	360	7400	4	9	10	26
3330781	4	6	2	0.2	0.8	2	<1	<500	10	33	29	30300	360	16600	4	9	10	30
	0	1	1															
3330782	1	3	2	0.4	0.4	0.4	<1	<500	5	33	29	19400	300	5600	4	6	15	28
3330783	3	6	3	<0.1	0.8	2	<1	<500	10	33	99	28700	420	6700	4	9	10	40
	0	1	1															
3330784	1	3	2	0.3	0.6	1	<1	<500	9	35	18	19100	380	7300	4	15	15	43
3330785	3	6	3	0.3	0.2	1.2	<1	<500	9	22	33	25800	500	6600	4	6	20	60
	0	1	1															
3330786	1	3	2	0.3	0.6	1	<1	<500	9	39	20	26300	360	13200	4	15	15	38

CRA EXPLORATION PTY LIMITED
Aircore/Reverse circulation/Diamond drill log
EL 2020 MT HOWE

19200 EAST

CONTRACTOR Budd Drilling		Date: 6th November 1995	DRILLING RIG UDR 600
DRILLERS	Craig Burgess, Rob Budd	Geologist Alan Hughes	PROSPECT Bruces Bore magnetic anomaly
LOCATION	Alberga 1:250000 Sheet	DPO 57704, 57705, 57706	

HOLE	Local EAST	Local NORTH	DESCRIPTION	SAMPLE	FROM	TO	INT	Mag Susc SI/100000	cps
AC95MH14	19200	9400	Red sandy soil		0	1	1	700	70
			Weathered dolerite and calcrete	3330757	1	3	2	200	70
AC95MH15	19200	9500	Red sandy soil		0	1	1	700	70
			Qtz and weathered rock fragments		1	2	1	500	70
			Granodiorite	3330758	2	3	1	500	70
AC95MH16	19200	9600	Soil and weathered dolerite		0	2	2	600	70
			Dolerite	3330759	2	3	1	400	70
AC95MH17	19200	9700	Diorite	3330760	2	3	1	100	70
AC95MH18	19200	9800	Red sandy soil		0	2	2	700	70
			Granodiorite	3330761	2	5	3	1800	70
AC95MH19	19200	9900	Red sandy soil		0	2	2	1100	70
			Granodiorite	3330762	2	3	1	2400	70
AC95MH20	19200	10000	Red sandy soil		0	1.5	1.5	3	70
			Granodiorite	3330763	1.5	3	1.5	2000	70
AC95MH21	19200	10100	Red sandy soil		0	2	2	7	70
			Granodiorite	3330764	2	3	1	1800	70
AC95MH22	19200	10200	Red sandy soil and weathered dolerite		0	1	1	900	70
			Granodiorite	3330765	1	3	2	1300	70
AC95MH23	19200	10300	Red sandy soil		0	1	1	1000	70
			Granodiorite	3330766	1	3	2	2000	70
AC95MH24	19200	10400	Red sandy soil		0	1	1	1100	70
			Granodiorite	3330767	1	3	2	1400	70

NOTE: Local grid is converted to AMG grid, Zone 53 by adding 300000m to eastings and 7100000m to northings
These AMG coordinates best fit to WGS84 datum.

LINE 19200 E

HOLE	SAMPLE	FROM	TO	INT	Au	Pt	Pd	Ag	S	Co	Cr	Cu	Fe	Mn	Mg	Mo	Ni	Pb	Zn
AC95MH14		0	1	1															
	3330757	1	3	2	1.1	1.4	2.4	<1	<500	15	62	41	28100	660	11900	<3	20	<5	52
AC95MH15		0	1	1															
		1	2	1															
	3330758	2	3	1	0.4	<0.2	0.4	<1	<500	4	89	29	25200	280	4700	<3	6	35	27
AC95MH16		0	2	2															
	3330759	2	3	1	0.5	1	1.6	<1	<500	13	82	53	30500	740	9300	<3	13	15	52
AC95MH17	3330760	2	3	1	0.5	0.8	1.6	<1	<500	12	82	36	28500	660	7700	<3	12	15	44
AC95MH18		0	2	2															
	3330761	2	5	3	0.3	0.6	0.8	<1	<500	13	99	53	34400	800	8800	<3	11	15	80
AC95MH19		0	2	2															
	3330762	2	3	1	0.3	0.6	0.6	<1	<500	15	64	85	41200	700	8300	<3	9	10	59
AC95MH20		0	1.5	1.5															
	3330763	1.5	3	1.5	0.8	0.8	1.2	<1	<500	12	100	43	31200	680	7800	<3	10	10	61
AC95MH21		0	2	2															
	3330764	2	3	1	0.4	0.8	1.2	<1	<500	14	28	57	34800	760	9000	<3	11	10	54
AC95MH22		0	1	1															
	3330765	1	3	2	0.8	0.8	1.2	<1	<500	9	33	70	24400	420	4400	4	8	15	34
AC95MH23		0	1	1															
	3330766	1	3	2	0.8	0.8	1.8	<1	<500	12	25	105	28000	760	8900	<3	11	10	44
AC95MH24		0	1	1															
	3330767	1	3	2	0.8	0.4	0.6	<1	<500	9	41	56	26400	420	3200	4	11	20	36
	SCHEME				FA3M	FA3M	FA3M	IC3E	IC3E	IC3E	IC3E	IC3E	IC3E	IC3E	IC3E	IC3E	IC3E	IC3E	IC3E
	DL				0.1	0.2	0.2	1	500	2	2	2	100	5	10	3	2	5	2
	UNITS				PPB	PPB	PPB	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM

CRA EXPLORATION PTY LIMITED

Aircore/Reverse circulation/Diamond drill log

EL 2020 MT HOWE

22000 EAST

CONTRACTOR Budd Drilling		Date: 6th November 1995	DRILLING RIG UDR 600
DRILLERS	Craig Burgess, Rob Budd	Geologist Alan Hughes	PROSPECT Bruces Bore magnetic anomaly
LOCATION	Alberga 1:250000 Sheet	DPO 57704, 57705, 57706	

HOLE	Local EAST	Local NORTH	DESCRIPTION	SAMPLE	FROM	TO	INT	Mag Susc SI/100000	cps
AC95MH02	22000	10000	Red sandy soil with calcrete nodules		0	2	2		120
			Diorite		2	4	2	1570	120
			Diorite	3330734	4	6	2	2420	120
AC95MH03	22000	10100	Red sandy soil with calcrete nodules	3330735	0	3	3	1800	120
			Diorite	3330736	3	6	3		120
AC95MH04	22000	10200	Red sandy soil with calcrete nodules	3330737	0	3	3	1200	120
			Diorite	3330738	3	6	3	1800	120
AC95MH05	22000	10300	Red sandy soil with calcrete nodules	3330739	0	3	3	1200	120
			Diorite with some foliation evident	3330740	3	6	3	4100	120
AC95MH06	22000	10400	Red sandy soil with calcrete nodules		0	1	1		
			Red sandy soil with calcrete nodules	3330741	1	3	2	800	120
			Diorite with some foliation evident, some quartz	NO SAMPLE	3	6	3	2200	120
AC95MH07	22000	10500	Red sandy soil		0	1	1	1340	120
			Red sandy soil with calcrete nodules	3330742	1	3	2	700	120
			Granodioritic to dioritic felds,quartz, magnetite	3330743	3	6	3	900	120
			Diorite with ferruginous veining	3330744	6	9	3	3200	120
		PETROGRAPHIC SAMPLE 3336560 ON AIR CORE FROM THIS INTERVAL							
AC95MH08	22000	10600	Red sandy soil		0	1	1	1000	120
			Red sandy soil with calcrete nodules	3330745	1	3	2	700	120
			Diorite and calcrete	3330746	3	6	3	500	
AC95MH09	22000	10700	Red sandy soil		0	2	2	700	120
			Red sandy soil with calcrete nodules	3330747	2	4	2	1100	120
			Diorite	3330748	4	6	2	700	120
AC95MH10	22000	10800	Red sandy soil		0	2	2	0	120
			Red sandy soil with calcrete and minor opaline fine veins	3330749	2	3	1	40	120
			Diorite	3330750	3	6	3	300	120
AC95MH11	22000	10900	Red sandy soil		0	2	2	15	120
			Red sandy soil with calcrete nodules	3330751	2	5	3	400	120

CRA EXPLORATION PTY LIMITED

Aircore/Reverse circulation/Diamond drill log

EL 2020 MT HOWE

22000 EAST

CONTRACTOR Budd Drilling	Date: 6th November 1995	DRILLING RIG UDR 600	
DRILLERS Craig Burgess, Rob Budd	Geologist Alan Hughes	PROSPECT Bruces Bore magnetic anomaly	
LOCATION Alberga 1:250000 Sheet	DPO 57704, 57705, 57706		

HOLE	Local EAST	Local NORTH	DESCRIPTION	SAMPLE	FROM	TO	INT	Mag Susc SI/100000	cps
			Diorite and calcrete	3330752	5	6	1	400	120
AC95MH12	22000	11000	Red sandy soil		0	2	2	30	120
			Red sandy soil, calcrete and fine grained mafic and quartz	3330753	2	3	1	600	120
			probably as detrital material in soil		3	4	1	600	120
			Biotite rich diorite to granodiorite	3330754	4	6	2	600	120
		PETROGRAPHIC SAMPLE 3336561 ON AIRCORE							
AC95MH13	22000	11100	Red sandy soil		0	2	2	6	120
			Red sandy soil with calcrete and minor quartz	3330755	2	5	3	300	120
			Clay and granodiorite	3330756	5	6	1	200	120

NOTE Local grid is converted to AMG grid, Zone 53 by adding 300000m to eastings and 7100000m to northings

These AMG coordinates best fit to WGS84 datum

LINE 22000 E

HOLE	SAMPLE	FROM	TO	INT	Au	Pt	Pd	Ag	S	Co	Cr	Cu	Fe	Mn	Mg	Mo	Ni	Pb	Zn
AC95MH02		0	2	2															
		2	4	2															
	3330734	4	6	2	0.3	<0.2	0.6	<1	<500	33	60	55	132000	1700	17500	<3	51	20	190
AC95MH03	3330735	0	3	3	0.8	1	1	<1	<500	9	92	14	63600	460	30100	<3	47	10	51
	3330736	3	6	3	0.8	0.4	1	<1	<500	23	35	34	85800	1300	37400	<3	28	15	135
AC95MH04	3330737	0	3	3	0.5	0.4	0.6	<1	<500	8	110	14	52700	620	7000	<3	30	20	60
	3330738	3	6	3	0.4	<0.2	0.6	<1	<500	24	36	31	67300	1300	24400	<3	21	20	140
AC95MH05	3330739	0	3	3	1	0.8	0.8	<1	<500	8	100	16	49200	640	7000	<3	32	15	61
	3330740	3	6	3	0.8	<0.2	0.8	<1	<500	24	34	22	87300	1400	22700	<3	20	25	175
AC95MH06		0	1	1															
	3330741	1	3	2	0.6	0.6	1	<1	<500	9	75	13	38100	540	12100	<3	26	20	49
	NO SAMPLE	3	6	3															
AC95MH07		0	1	1															
	3330742	1	3	2	1	0.6	0.8	<1	<500	9	66	14	32300	400	10100	<3	34	15	43
	3330743	3	6	3	0.4	0.4	1	<1	<500	19	81	17	49600	1100	20100	<3	29	25	100
	3330744	6	9	3	0.6	<0.2	1.4	<1	<500	27	37	26	91200	1500	14400	<3	25	20	130
AC95MH08		0	1	1															
	3330745	1	3	2	0.9	0.8	1.4	<1	<500	12	55	18	47300	540	14000	<3	32	10	50
	3330746	3	6	3	0.8	0.4	1.6	<1	<500	26	24	21	93200	1500	15100	<3	22	10	155
AC95MH09		0	2	2															
	3330747	2	4	2	1.1	0.6	1.2	<1	<500	8	66	15	35300	380	9200	<3	26	10	40
	3330748	4	6	2	0.8	0.2	1.6	<1	<500	35	34	47	89200	1100	16000	<3	47	<5	91
AC95MH10		0	2	2															
	3330749	2	3	1	1.4	0.8	1.2	<1	<500	11	105	18	44400	440	10400	<3	35	20	48
	3330750	3	6	3	0.9	0.6	1.6	<1	<500	9	68	13	27800	360	10300	<3	19	10	26
AC95MH11		0	2	2															
	3330751	2	5	3	1.4	0.6	1	<1	<500	7	91	16	35900	380	6400	<3	25	20	40

LINE 22000 E

HOLE	SAMPLE	FROM	TO	INT	Au	Pt	Pd	Ag	S	Co	Cr	Cu	Fe	Mn	Mg	Mo	Ni	Pb	Zn
	3330752	5	6	1	0.4	0.8	1.4	<1	<500	9	78	15	27400	480	9600	<3	22	15	34
AC95MH12		0	2	2															
	3330753	2	3	1	0.7	0.6	0.8	1	<500	8	110	16	37900	460	6300	<3	20	20	44
		3	4	1															
	3330754	4	6	2	<0.1	2	2.2	1	<500	23	200	73	60900	980	21500	<3	43	15	67
AC95MH13		0	2	2															
	3330755	2	5	3	0.4	1	0.8	<1	<500	6	105	15	35600	420	8600	<3	19	15	44
	3330756	5	6	1	0.7	1.2	2.2	<1	<500	10	91	25	44100	440	9000	<3	20	20	55
	SCHEME				FA3M	FA3M	FA3M	IC3E	IC3E	IC3E	IC3E	IC3E	IC3E	IC3E	IC3E	IC3E	IC3E	IC3E	IC3E
	DL				0.1	0.2	0.2	1	500	2	2	2	100	5	10	3	2	5	2
	UNITS				PPB	PPB	PPB	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM

Appendix 7

Soil & Rock Sample Assays

DPO	Sample	Sample Type	East	North	Zone	EL Number	Comments	Ag	As	Au	Bi	Ca	Co	Cr	Cu	Fe
54326	5243401	-20+40#	321950	7083600	53	2020	Dep, rb Soil	1.1	1.5	0.0007	0.2	1000	3	25	8	25200
54326	5243402	-20+40#	321900	7083600	53	2020	Dep, rb Soil	0.1	1.5	0.0003	-0.1	1300	5	28	8	38700
54326	5243403	-20+40#	321850	7083600	53	2020	Dep, rb Soil	-0.1	1.5	0.0003	-0.1	1300	4	25	8	27000
54326	5243404	-20+40#	321800	7083600	53	2020	Dep, rb Soil	0.1	1.5	0.0003	-0.1	1150	5	25	7	34300
54326	5243405	-20+40#	321750	7083600	53	2020	Dep, rb Soil	0.1	-0.5	0.0002	-0.1	1900	5	26	8	34300
54326	5243406	-20+40#	321700	7083600	53	2020	Dep, rb Soil	0.1	-0.5	1E-04	-0.1	1750	5	31	8	39200
54326	5243407	-20+40#	321650	7083600	53	2020	Dep, rb Soil	-0.1	-0.5	0.0002	-0.1	2100	5	26	9	29800
54326	5243408	-20+40#	321600	7083600	53	2020	Dep, rb Soil	-0.1	-0.5	-1E-04	-0.1	2900	5	30	9	30800
54326	5243409	-20+40#	322000	7083600	53	2020	Dep, rb Soil	-0.1	2.5	0.0002	-0.1	980	5	32	7	35000
54326	5243410	-20+40#	322050	7083600	53	2020	Dep, rb Soil	0.3	13.5	0.0005	0.1	3250	5	33	51	31200
54326	5243411	-20+40#	322100	7083600	53	2020	Dep, rb Soil	0.1	1	0.0003	-0.1	1000	4	30	8	29300
54326	5243412	-20+40#	322150	7083600	53	2020	Dep, rb Soil	0.4	-0.5	1E-04	-0.1	1000	4	26	7	38400
54326	5243413	-20+40#	322200	7083600	53	2020	Dep, rb Soil	0.2	1.5	0.0002	-0.1	1250	4	33	9	42700
54326	5243414	-20+40#	322250	7083600	53	2020	Dep, loose sand	0.1	-0.5	0.0003	-0.1	1300	4	30	8	37100
54326	5243415	-20+40#	322300	7083600	53	2020	Dep, loose sand	-0.1	-0.5	0.0002	-0.1	760	-2	16	6	21300
54326	5243416	-20+40#	322350	7083600	53	2020	Dep, rb Soil	0.1	2.5	0.0003	-0.1	880	5	24	8	27100
54326	5243417	-20+40#	330100	7086300	53	2020	Dep, loose sand	0.1	-0.5	-1E-04	-0.1	300	-2	11	5	12800
54326	5243418	-20+40#	330050	7086300	53	2020	Dep, loose sand	0.1	2.5	0.0008	-0.1	240	-2	14	5	15100
54326	5243419	-20+40#	330000	7086300	53	2020	Dep, rb Soil	0.1	2.5	1E-04	-0.1	290	2	19	7	20800
54326	5243420	-20+40#	329950	7086300	53	2020	Dep, rb Soil	0.1	3	-1E-04	-0.1	560	4	20	9	20700
54326	5243421	-20+40#	329900	7086300	53	2020	Dep, rb Soil	-0.1	2	0.0006	-0.1	500	3	26	9	23400
54326	5243422	-20+40#	329850	7086300	53	2020	Dep, rb Soil	-0.1	1	0.0003	-0.1	960	4	21	11	20500
54326	5243423	-20+40#	329800	7086300	53	2020	Dep, rb Soil	0.2	1	0.0002	-0.1	1150	5	17	11	22800
54326	5243424	-20+40#	329750	7086300	53	2020	Dep, rb Soil	0.1	-0.5	0.0002	-0.1	1450	7	23	11	25000
54326	5243425	-20+40#	329700	7086300	53	2020	Dep, rb Soil	0.1	-0.5	0.0004	-0.1	1950	6	23	11	21700
54326	5243426	-20+40#	330150	7086300	53	2020	Dep, loose sand	0.1	1	0.0003	-0.1	380	4	12	6	16300
54326	5243427	-20+40#	330200	7086300	53	2020	Dep, loose sand	-0.1	0.5	-1E-04	-0.1	350	3	8	4	13000
54326	5243428	-20+40#	330250	7086300	53	2020	Dep, loose sand	0.2	4	-1E-04	-0.1	450	2	10	4	12900
54326	5243429	-20+40#	330300	7086300	53	2020	Dep, loose sand	-0.1	1.5	-1E-04	-0.1	210	2	8	5	10000
54326	5243430	-20+40#	330350	7086300	53	2020	Dep, loose sand	0.1	1	-1E-04	-0.1	360	3	15	4	11300
54326	5243431	-20+40#	330400	7086300	53	2020	Dep, loose sand	0.2	1.5	-1E-04	-0.1	340	2	11	4	14100
54326	5243432	-20+40#	330450	7086300	53	2020	Dep, loose sand	-0.1	1	-1E-04	-0.1	320	3	15	5	11600
54326	5243433	-20+40#	330500	7086300	53	2020	Dep, loose sand	0.2	2	-1E-04	-0.1	350	3	17	6	13000
54326	5243401	-40+80#	321950	7083600	53	2020	Dep, rb Soil	0.3	2.5	0.0006	0.1	2050	8	60	14	58600
54326	5243402	-40+80#	321900	7083600	53	2020	Dep, rb Soil	0.2	1.5	0.0003	-0.1	3000	9	64	12	64500
54326	5243403	-40+80#	321850	7083600	53	2020	Dep, rb Soil	0.2	2.5	0.0005	0.1	3100	9	54	16	53200
54326	5243404	-40+80#	321800	7083600	53	2020	Dep, rb Soil	0.1	4.5	0.0003	-0.1	2550	9	54	10	57300

DPO	Sample	Sample Type	East	North	Zone	EL Number	Comments	Ag	As	Au	Bi	Ca	Co	Cr	Cu	Fe
54326	5243405	-40+80#	321750	7083600	53	2020	Dep, rb Soil	0.2	-0.5	0.0004	-0.1	3250	9	58	12	53700
54326	5243406	-40+80#	321700	7083600	53	2020	Dep, rb Soil	0.1	1.5	0.0004	-0.1	3350	10	67	32	65200
54326	5243407	-40+80#	321650	7083600	53	2020	Dep, rb Soil	0.2	1	1E-04	-0.1	3900	10	65	13	62500
54326	5243408	-40+80#	321600	7083600	53	2020	Dep, rb Soil	0.2	2	0.0002	-0.1	4400	10	70	16	55400
54326	5243409	-40+80#	322000	7083600	53	2020	Dep, rb Soil	-0.1	1.5	0.0003	-0.1	540	-2	10	-2	8700
54326	5243410	-40+80#	322050	7083600	53	2020	Dep, rb Soil	0.2	3	0.0009	-0.1	5900	7	50	11	48200
54326	5243411	-40+80#	322100	7083600	53	2020	Dep, rb Soil	0.2	3.5	0.0004	0.1	2150	9	63	13	57600
54326	5243412	-40+80#	322150	7083600	53	2020	Dep, rb Soil	0.3	4	0.0002	-0.1	2350	10	86	13	77800
54326	5243413	-40+80#	322200	7083600	53	2020	Dep, rb Soil	0.3	4.5	0.0003	-0.1	2400	8	70	13	72200
54326	5243414	-40+80#	322250	7083600	53	2020	Dep, loose sand	0.3	4.5	0.0004	0.2	2500	9	67	13	67800
54326	5243415	-40+80#	322300	7083600	53	2020	Dep, loose sand	0.2	-0.5	0.0004	-0.1	2250	8	53	10	51400
54326	5243416	-40+80#	322350	7083600	53	2020	Dep, rb Soil	0.2	3	0.0003	-0.1	2150	8	49	14	53900
54326	5243417	-40+80#	330100	7086300	53	2020	Dep, loose sand	0.2	-0.5	0.0003	-0.1	680	6	45	10	46900
54326	5243418	-40+80#	330050	7086300	53	2020	Dep, loose sand	0.3	1	0.0003	-0.1	460	5	51	11	52800
54326	5243419	-40+80#	330000	7086300	53	2020	Dep, rb Soil	0.2	-0.5	0.0004	-0.1	580	6	53	12	48600
54326	5243420	-40+80#	329950	7086300	53	2020	Dep, rb Soil	0.2	4.5	0.0002	-0.1	1150	6	41	14	44000
54326	5243421	-40+80#	329900	7086300	53	2020	Dep, rb Soil	0.2	1.5	0.0003	-0.1	920	6	37	14	40400
54326	5243422	-40+80#	329850	7086300	53	2020	Dep, rb Soil	0.2	1	0.0005	0.1	1850	10	44	19	49300
54326	5243423	-40+80#	329800	7086300	53	2020	Dep, rb Soil	0.3	1.5	1E-04	-0.1	2100	8	33	19	44800
54326	5243424	-40+80#	329750	7086300	53	2020	Dep, rb Soil	0.2	2	0.0002	-0.1	2400	10	41	18	49200
54326	5243425	-40+80#	329700	7086300	53	2020	Dep, rb Soil	0.2	4.5	0.0002	-0.1	3200	12	64	23	49000
54326	5243426	-40+80#	330150	7086300	53	2020	Dep, loose sand	0.3	-0.5	-1E-04	-0.1	800	8	43	12	57400
54326	5243427	-40+80#	330200	7086300	53	2020	Dep, loose sand	0.3	1.5	-1E-04	-0.1	680	7	35	8	47600
54326	5243428	-40+80#	330250	7086300	53	2020	Dep, loose sand	0.3	1	0.0008	-0.1	860	6	40	8	49500
54326	5243429	-40+80#	330300	7086300	53	2020	Dep, loose sand	0.3	0.5	-1E-04	-0.1	490	5	33	8	40600
54326	5243430	-40+80#	330350	7086300	53	2020	Dep, loose sand	0.3	2	0.0002	-0.1	720	7	45	8	43500
54326	5243431	-40+80#	330400	7086300	53	2020	Dep, loose sand	0.6	2	1E-04	-0.1	700	5	47	9	46600
54326	5243432	-40+80#	330450	7086300	53	2020	Dep, loose sand	0.3	4	-1E-04	0.1	660	6	46	9	46100
54326	5243433	-40+80#	330500	7086300	53	2020	Dep, loose sand	0.2	3	-1E-04	-0.1	620	7	37	10	49500
54326	5243401	-80#	321950	7083600	53	2020	Dep, rb Soil	0.2	2.5	0.0009	0.1	1850	6	50	16	44700
54326	5243402	-80#	321900	7083600	53	2020	Dep, rb Soil	0.3	2	0.0004	0.1	2500	9	57	17	43300
54326	5243403	-80#	321850	7083600	53	2020	Dep, rb Soil	0.1	2	0.0005	0.2	2800	10	51	26	45200
54326	5243404	-80#	321800	7083600	53	2020	Dep, rb Soil	0.2	1	0.0005	0.1	2200	8	52	16	46400
54326	5243405	-80#	321750	7083600	53	2020	Dep, rb Soil	0.1	2	0.0006	0.1	2800	8	47	20	44900
54326	5243406	-80#	321700	7083600	53	2020	Dep, rb Soil	0.2	-0.5	0.0002	0.1	2950	9	57	18	47000
54326	5243407	-80#	321650	7083600	53	2020	Dep, rb Soil	0.2	3	0.0003	0.1	2750	9	55	19	45600
54326	5243408	-80#	321600	7083600	53	2020	Dep, rb Soil	0.2	4.5	0.0004	0.1	2600	9	56	22	41300

DPO	Sample	Sample Type	East	North	Zone	EL Number	Comments	Ag	As	Au	Bi	Ca	Co	Cr	Cu	Fe
54326	5243409	-80#	322000	7083600	53	2020	Dep, rb Soil	0.2	3	0.0004	0.1	2300	6	45	16	43700
54326	5243410	-80#	322050	7083600	53	2020	Dep, rb Soil	0.4	4	0.0006	1.2	13800	8	43	20	40400
54326	5243411	-80#	322100	7083600	53	2020	Dep, rb Soil	0.3	1.5	0.0002	0.1	680	6	53	15	40000
54326	5243412	-80#	322150	7083600	53	2020	Dep, rb Soil	0.2	1.5	0.0003	0.1	1950	8	54	14	49900
54326	5243413	-80#	322200	7083600	53	2020	Dep, rb Soil	0.2	0.5	0.0003	0.1	2000	7	48	16	49400
54326	5243414	-80#	322250	7083600	53	2020	Dep, loose sand	0.3	9	0.0004	0.2	1900	7	61	15	49600
54326	5243415	-80#	322300	7083600	53	2020	Dep, loose sand	0.2	-0.5	0.0003	0.1	2400	7	53	17	52700
54326	5243416	-80#	322350	7083600	53	2020	Dep, rb Soil	0.2	4.5	0.0004	0.2	1600	6	50	17	40400
54326	5243417	-80#	330100	7086300	53	2020	Dep, loose sand	0.2	0.5	0.0002	0.1	920	7	44	14	40400
54326	5243418	-80#	330050	7086300	53	2020	Dep, loose sand	0.2	3	0.0004	0.1	540	6	41	14	43100
54326	5243419	-80#	330000	7086300	53	2020	Dep, rb Soil	0.2	7	0.0002	0.1	720	4	46	17	35600
54326	5243420	-80#	329950	7086300	53	2020	Dep, rb Soil	0.2	6.5	0.0003	0.2	1450	6	41	20	35300
54326	5243421	-80#	329900	7086300	53	2020	Dep, rb Soil	0.1	-0.5	0.0004	0.1	1050	6	39	20	36600
54326	5243422	-80#	329850	7086300	53	2020	Dep, rb Soil	0.3	5	0.0006	0.2	2300	9	42	28	43100
54326	5243423	-80#	329800	7086300	53	2020	Dep, rb Soil	0.3	1	0.0005	0.2	2550	10	41	30	41100
54326	5243424	-80#	329750	7086300	53	2020	Dep, rb Soil	0.3	8.5	0.0002	0.2	2550	14	64	33	49400.
54326	5243425	-80#	329700	7086300	53	2020	Dep, rb Soil	0.2	5.5	0.0006	0.2	2800	19	78	41	51100
54326	5243426	-80#	330150	7086300	53	2020	Dep, loose sand	0.2	0.5	1E-04	0.1	1000	6	41	13	45000
54326	5243427	-80#	330200	7086300	53	2020	Dep, loose sand	0.4	4	-1E-04	0.2	1150	7	51	14	52000
54326	5243428	-80#	330250	7086300	53	2020	Dep, loose sand	0.3	4.5	-1E-04	0.2	1450	7	44	14	47100
54326	5243429	-80#	330300	7086300	53	2020	Dep, loose sand	0.3	2.5	0.0003	0.2	860	7	62	16	51800
54326	5243430	-80#	330350	7086300	53	2020	Dep, loose sand	0.4	4.5	0.0003	0.1	1200	7	46	13	43600
54326	5243431	-80#	330400	7086300	53	2020	Dep, loose sand	0.5	2.5	-1E-04	0.1	1100	8	48	14	47700
54326	5243432	-80#	330450	7086300	53	2020	Dep, loose sand	0.3	3	0.0003	0.2	1150	7	50	17	46400
54326	5243433	-80#	330500	7086300	53	2020	Dep, loose sand	0.3	3.5	-1E-04	0.1	940	6	46	15	48200
54326	5243434	RKCHIP	330230	7086320	53	2020	Fe Lag (Lat Silcrete)	0.3	23.5	0.0002	0.2	1000	-2	460	58	315000
54326	5243435	RKCHIP	329960	7086920	53	2020	Fe Lag (Lat Silcrete)	0.2	12.5	0.0008	-0.1	1850	-2	580	115	473000
54326	5243436	RKCHIP	326060	7087025	53	2020	Fresh cg Mafic O/C	0.1	3	0.0012	-0.1	79600	60	620	100	76300
54326	5243437	RKCHIP	322065	7083850	53	2020	Fe Silcrete O/C	0.3	16	0.0005	0.2	1150	-2	100	38	267000
54326	5243438	RKCHIP	322200	7083685	53	2020	Mafic/ Felsic Gniess	0.2	1	0.0006	-0.1	20400	17	12	16	43400
54326	5243439	RKCHIP	322200	7083685	53	2020	Fe As Above	0.3	23.5	0.0045	-0.1	6200	19	70	360	289000

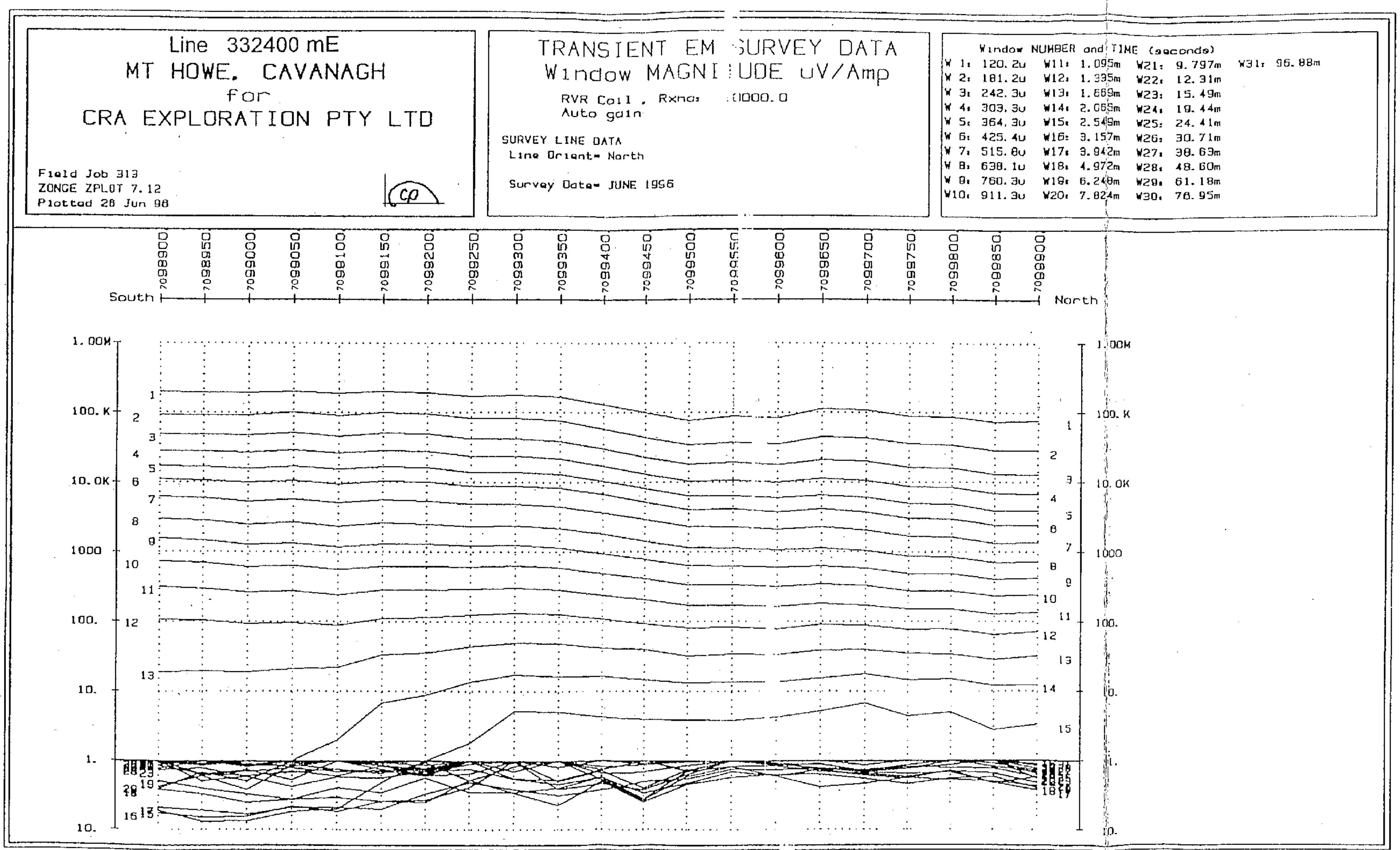
DPO	Sample	Sample Type	Mg	Mn	Mo	Ni	Pb	Pd	Pt	Th	Ti	U	Zn
54326	5243401	-20+40#	490	165	0.4	6	20	-0.0002	0.0002	4.2	5250	0.15	32
54326	5243402	-20+40#	640	290	0.3	10	23.5	-0.0002	-0.0002	2.5	7950	0.16	27
54326	5243403	-20+40#	800	230	0.3	9	16	-0.0002	-0.0002	3.2	5800	0.21	26
54326	5243404	-20+40#	520	240	0.4	10	14	-0.0002	-0.0002	2.3	6500	0.15	25
54326	5243405	-20+40#	720	270	0.3	11	14	-0.0002	-0.0002	2.1	7300	0.17	26
54326	5243406	-20+40#	680	290	0.4	10	14.5	-0.0002	-0.0002	2.5	8000	0.16	29
54326	5243407	-20+40#	780	250	0.2	9	15.5	-0.0002	-0.0002	1.95	5950	0.17	26
54326	5243408	-20+40#	1150	270	0.2	11	16	-0.0002	-0.0002	2.4	6050	0.17	28
54326	5243409	-20+40#	520	220	0.5	10	13.5	-0.0002	-0.0002	2.4	7650	0.16	27
54326	5243410	-20+40#	1300	270	1.1	13	21	-0.0002	-0.0002	4.7	5150	0.66	36
54326	5243411	-20+40#	500	220	0.4	10	19.5	-0.0002	-0.0002	11.5	6700	0.6	24
54326	5243412	-20+40#	480	280	0.3	9	17	-0.0002	-0.0002	3.2	8850	0.17	29
54326	5243413	-20+40#	640	330	0.5	12	16.5	-0.0002	-0.0002	3.3	9900	0.19	39
54326	5243414	-20+40#	540	290	0.3	10	17.5	-0.0002	-0.0002	2.9	8450	0.19	31
54326	5243415	-20+40#	400	170	0.4	6	16	-0.0002	-0.0002	1.7	4500	0.14	17
54326	5243416	-20+40#	580	200	0.4	9	17	-0.0002	-0.0002	2.6	5650	0.23	23
54326	5243417	-20+40#	250	170	-0.1	6	10.5	-0.0002	-0.0002	1.15	3000	0.12	13
54326	5243418	-20+40#	240	175	0.2	5	10	-0.0002	-0.0002	1.55	3400	0.13	19
54326	5243419	-20+40#	330	260	0.2	7	12.5	-0.0002	-0.0002	2.1	5400	0.13	21
54326	5243420	-20+40#	440	280	0.2	8	14	0.0002	-0.0002	3.5	4800	0.19	21
54326	5243421	-20+40#	460	280	-0.1	9	16	0.0002	0.0002	2.7	5300	0.21	23
54326	5243422	-20+40#	900	280	-0.1	10	12	-0.0002	-0.0002	2.8	4400	0.18	23
54326	5243423	-20+40#	680	320	0.2	9	16	0.0002	0.0002	4	5100	0.28	25
54326	5243424	-20+40#	700	390	0.2	11	13	0.0002	0.0002	3.1	5600	0.25	26
54326	5243425	-20+40#	1200	340	0.1	13	11	0.0004	0.0004	2.1	4800	0.18	21
54326	5243426	-20+40#	320	210	-0.1	5	12	0.0002	-0.0002	1.65	3550	0.14	15
54326	5243427	-20+40#	280	175	-0.1	4	18.5	-0.0002	-0.0002	1.85	2850	0.11	13
54326	5243428	-20+40#	280	165	0.1	5	16	-0.0002	-0.0002	2.2	2850	0.14	12
54326	5243429	-20+40#	250	90	-0.1	6	8	-0.0002	-0.0002	1.25	1750	0.1	9
54326	5243430	-20+40#	290	140	0.1	6	11.5	-0.0002	-0.0002	1.45	2200	0.12	10
54326	5243431	-20+40#	270	175	-0.1	8	11	-0.0002	-0.0002	1.4	3000	0.12	16
54326	5243432	-20+40#	270	155	-0.1	5	17	-0.0002	-0.0002	1.45	2350	0.11	11
54326	5243433	-20+40#	320	175	-0.1	5	14.5	-0.0002	-0.0002	2	2750	0.13	21
54326	5243401	-40+80#	900	450	0.5	15	19	-0.0002	0.0002	11	12700	0.29	59
54326	5243402	-40+80#	1200	580	0.4	17	21	-0.0002	0.0002	6.5	14100	0.29	57
54326	5243403	-40+80#	1800	500	0.4	18	21	0.0004	0.0004	10.5	10700	0.45	57
54326	5243404	-40+80#	880	480	0.3	16	15	-0.0002	-0.0002	6	11500	0.2	50

DPO	Sample	Sample Type	Mg	Mn	Mo	Ni	Pb	Pd	Pt	Th	Ti	U	Zn
54326	5243405	-40+80#	1150	490	0.3	16	19.5	0.0002	0.0002	4.6	11400	0.27	48
54326	5243406	-40+80#	1100	540	0.4	61	16.5	-0.0002	0.0002	4	13300	0.2	52
54326	5243407	-40+80#	1350	540	0.4	21	21	-0.0002	-0.0002	6	12600	0.23	56
54326	5243408	-40+80#	1750	560	0.3	19	34.5	0.0002	0.0002	5	12100	0.28	55
54326	5243409	-40+80#	190	70	-0.1	2	2	-0.0002	-0.0002	2.4	1900	0.05	4
54326	5243410	-40+80#	1700	430	0.5	13	19	-0.0002	0.0002	6	11800	0.26	48
54326	5243411	-40+80#	840	520	0.6	16	18	-0.0002	-0.0002	5	13200	0.29	51
54326	5243412	-40+80#	880	660	0.6	19	24	-0.0002	-0.0002	6.5	18100	0.27	66
54326	5243413	-40+80#	960	640	0.8	19	21	-0.0002	-0.0002	7.5	16900	0.38	68
54326	5243414	-40+80#	880	620	0.7	18	31	-0.0002	0.0002	7.5	16000	0.75	67
54326	5243415	-40+80#	760	480	0.5	15	19	-0.0002	-0.0002	3.7	12300	0.25	48
54326	5243416	-40+80#	1050	500	0.6	17	20	-0.0002	-0.0002	5	11900	0.29	51
54326	5243417	-40+80#	520	800	0.4	11	22	-0.0002	-0.0002	4.3	14700	0.23	47
54326	5243418	-40+80#	500	860	0.5	13	19	-0.0002	-0.0002	5.5	16000	0.24	50
54326	5243419	-40+80#	600	780	0.5	12	18.5	0.0002	0.0002	6.5	14700	0.27	49
54326	5243420	-40+80#	800	740	0.4	15	19	0.0006	0.0004	7.5	12100	0.37	46
54326	5243421	-40+80#	720	660	0.3	14	18.5	0.0006	0.0004	7	11400	0.44	44
54326	5243422	-40+80#	1650	700	0.4	17	37.5	0.0006	0.0004	10.5	11900	0.49	53
54326	5243423	-40+80#	1300	680	0.2	15	21.5	0.0006	0.0004	7	10200	0.45	50
54326	5243424	-40+80#	1200	820	0.5	17	19	0.0004	0.0004	9	12600	0.42	54
54326	5243425	-40+80#	2250	800	0.4	26	16	0.0008	0.0008	7	12100	0.41	54
54326	5243426	-40+80#	600	920	0.4	14	43	0.0004	-0.0002	6.5	14600	0.31	57
54326	5243427	-40+80#	540	800	0.4	11	21	-0.0002	-0.0002	7	14300	0.2	46
54326	5243428	-40+80#	540	800	0.3	11	17.5	0.0002	0.0002	6	15000	0.25	47
54326	5243429	-40+80#	480	660	0.3	10	19.5	-0.0002	-0.0002	4.8	12100	0.24	38
54326	5243430	-40+80#	560	760	0.3	11	20	-0.0002	-0.0002	7	13200	0.23	42
54326	5243431	-40+80#	520	860	0.4	13	22.5	-0.0002	-0.0002	5.5	13800	0.21	46
54326	5243432	-40+80#	540	840	0.4	11	24.5	-0.0002	-0.0002	4.5	14200	0.38	48
54326	5243433	-40+80#	560	800	0.2	13	19.5	-0.0002	-0.0002	6	9600	0.22	51
54326	5243401	-80#	1550	430	0.9	17	15.5	0.0004	0.0004	11.5	9000	0.62	49
54326	5243402	-80#	1700	560	0.3	17	43.5	0.0004	0.0004	17	9800	0.83	49
54326	5243403	-80#	3050	540	0.5	22	23.5	0.0006	0.0006	11	8250	0.91	68
54326	5243404	-80#	1400	540	0.5	18	18	0.0004	0.0004	13.5	9750	0.63	52
54326	5243405	-80#	1850	560	0.5	21	18	0.0004	0.0004	11.5	8950	0.73	50
54326	5243406	-80#	1550	600	0.3	18	22	0.0002	0.0004	15	10100	0.75	51
54326	5243407	-80#	1800	580	0.5	20	16.5	0.0004	0.0004	19	9900	0.72	56
54326	5243408	-80#	2150	540	0.4	21	17	0.0004	0.0004	16.5	8850	0.68	58

DPO	Sample	Sample Type	Mg	Mn	Mo	Ni	Pb	Pd	Pt	Th	Ti	U	Zn
54326	5243409	-80#	1350	460	0.7	17	16.5	0.0004	0.0002	15	9650	0.66	49
54326	5243410	-80#	3850	480	0.9	18	29	0.0004	0.0004	14.5	8550	0.72	53
54326	5243411	-80#	1050	450	0.6	15	19	-0.0002	0.0002	4.8	10200	0.57	49
54326	5243412	-80#	1100	620	0.5	15	19	-0.0002	0.0002	15	11800	0.67	56
54326	5243413	-80#	1250	620	0.7	18	20.5	0.0002	0.0002	15	11600	0.72	57
54326	5243414	-80#	1100	620	0.8	18	23.5	-0.0002	0.0002	20.5	11800	0.8	56
54326	5243415	-80#	1400	680	0.8	18	19	-0.0002	-0.0002	12.5	12100	0.66	57
54326	5243416	-80#	1350	490	0.9	17	20	0.0004	0.0004	12.5	8900	0.77	49
54326	5243417	-80#	820	600	0.4	16	18	0.0004	0.0002	14	10600	0.61	48
54326	5243418	-80#	800	560	0.3	14	16	0.0002	0.0002	13.5	11500	0.61	49
54326	5243419	-80#	960	420	0.4	14	23.5	0.0006	0.0004	15.5	9100	0.69	45
54326	5243420	-80#	1200	480	0.2	19	16.5	0.0012	0.0004	11	8100	0.64	47
54326	5243421	-80#	1100	400	0.4	16	18	0.001	0.0006	9.5	7550	0.69	42
54326	5243422	-80#	2600	500	0.4	23	24.5	0.0008	0.0006	15	8100	0.81	57
54326	5243423	-80#	2150	540	0.4	23	19.5	0.001	0.0006	13	8050	0.97	54
54326	5243424	-80#	2050	780	0.5	26	23.5	0.001	0.0006	17.5	9650	0.9	61
54326	5243425	-80#	3200	840	0.5	41	19.5	0.0016	0.0014	13	8850	0.81	65
54326	5243426	-80#	860	600	0.3	15	17.5	0.0006	0.0002	11	10800	0.65	48
54326	5243427	-80#	900	740	0.7	15	22.5	0.0004	-0.0002	19	13300	0.84	55
54326	5243428	-80#	920	640	0.4	14	20	0.0004	0.0002	19	12400	0.8	55
54326	5243429	-80#	1000	700	0.4	18	19.5	0.0004	0.0002	15.5	13100	0.74	59
54326	5243430	-80#	980	600	0.5	14	21.5	0.0004	0.0002	16.5	11000	0.64	48
54326	5243431	-80#	900	660	0.5	16	19.5	0.0002	0.0002	16.5	11700	0.62	57
54326	5243432	-80#	900	640	0.4	16	29	0.0002	0.0002	14.5	11500	0.73	76
54326	5243433	-80#	960	660	0.3	16	18.5	0.0002	-0.0002	15.5	11300	0.71	53
54326	5243434	RKCHIP	520	330	1	26	35.5	0.0026	0.0058	11.5	7300	0.51	21
54326	5243435	RKCHIP	620	270	1	19	25	0.0078	0.0056	10	3400	0.8	33
54326	5243436	RKCHIP	66000	1400	3.3	290	2.5	0.0048	0.006	0.24	5100	0.03	69
54326	5243437	RKCHIP	860	170	3.4	11	15	0.0008	0.0016	7.5	8750	0.59	14
54326	5243438	RKCHIP	13700	660	0.3	12	94	-0.0002	-0.0002	22	4950	1.75	79
54326	5243439	RKCHIP	5150	1600	3.8	65	100	0.0046	0.012	21	3150	6	150

Appendix 8

Surface TEM Traverses



Report No.

* Twin Turn 200m x 200m Transmitter Loop
* 50m Stations
* Tx = ZONGE GGT25
* Rx = ZONGE GDP16
* Antenna = Sirotem RVR
* 2 Hz. Survey Frequency

MT. HOWE EL 2020 - S.A.
SURFACE TEM
Line 332400 mE
Cavanagh Area

Line 333200 mE
MT HOWE, CAVANAGH
for
CRA EXPLORATION PTY LTD

Field Job 313
ZONGE ZPLOT 7.12
Plotted 28 Jun 96

TRANSIENT EM SURVEY DATA
Window MAGNITUDE uV/Amp

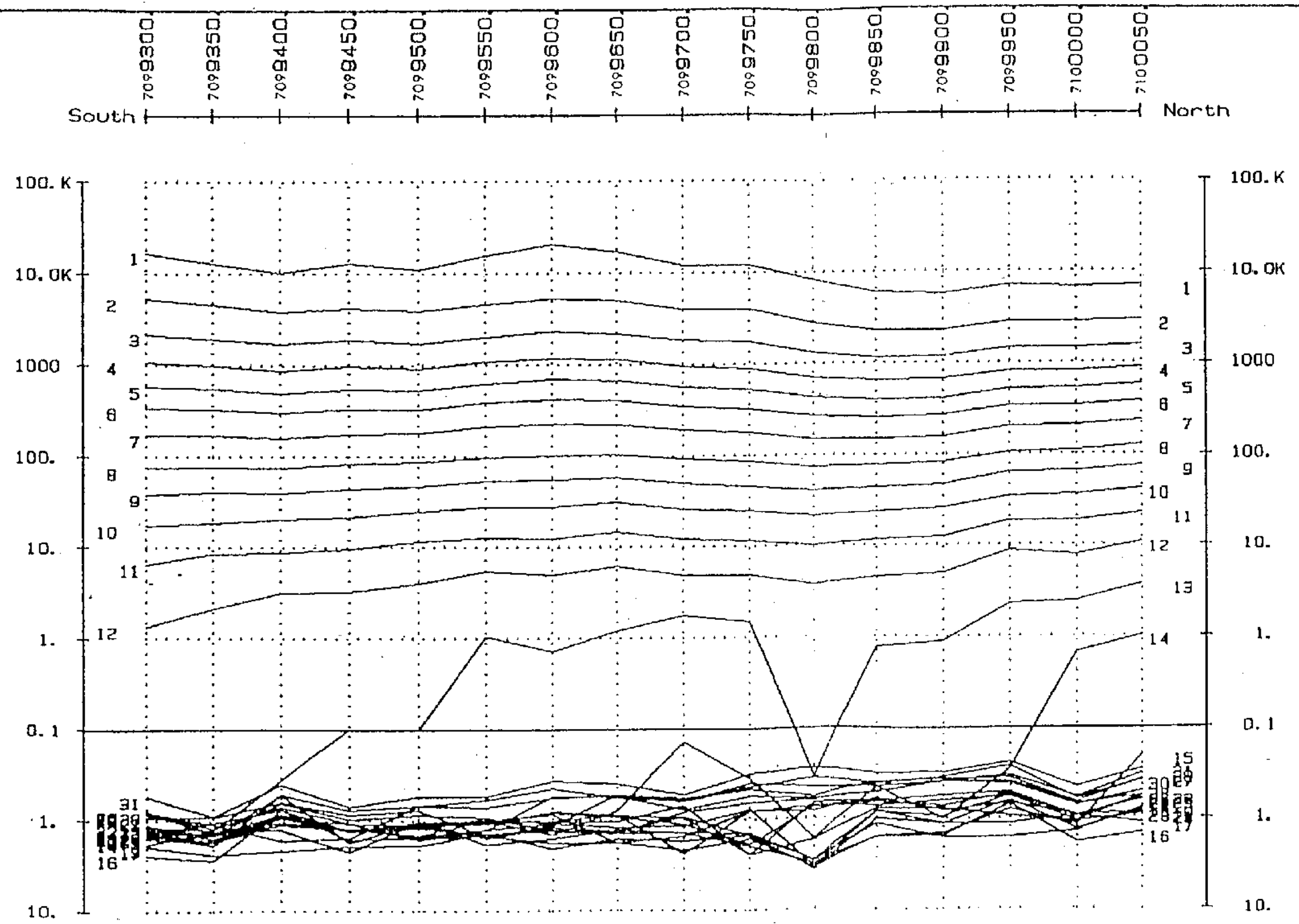
RVR Coil , Rxna: 10000.0
Auto gain

SURVEY LINE DATA
Line Orient= North

Survey Date= JUNE 1996

Window NUMBER and TIME (seconds)

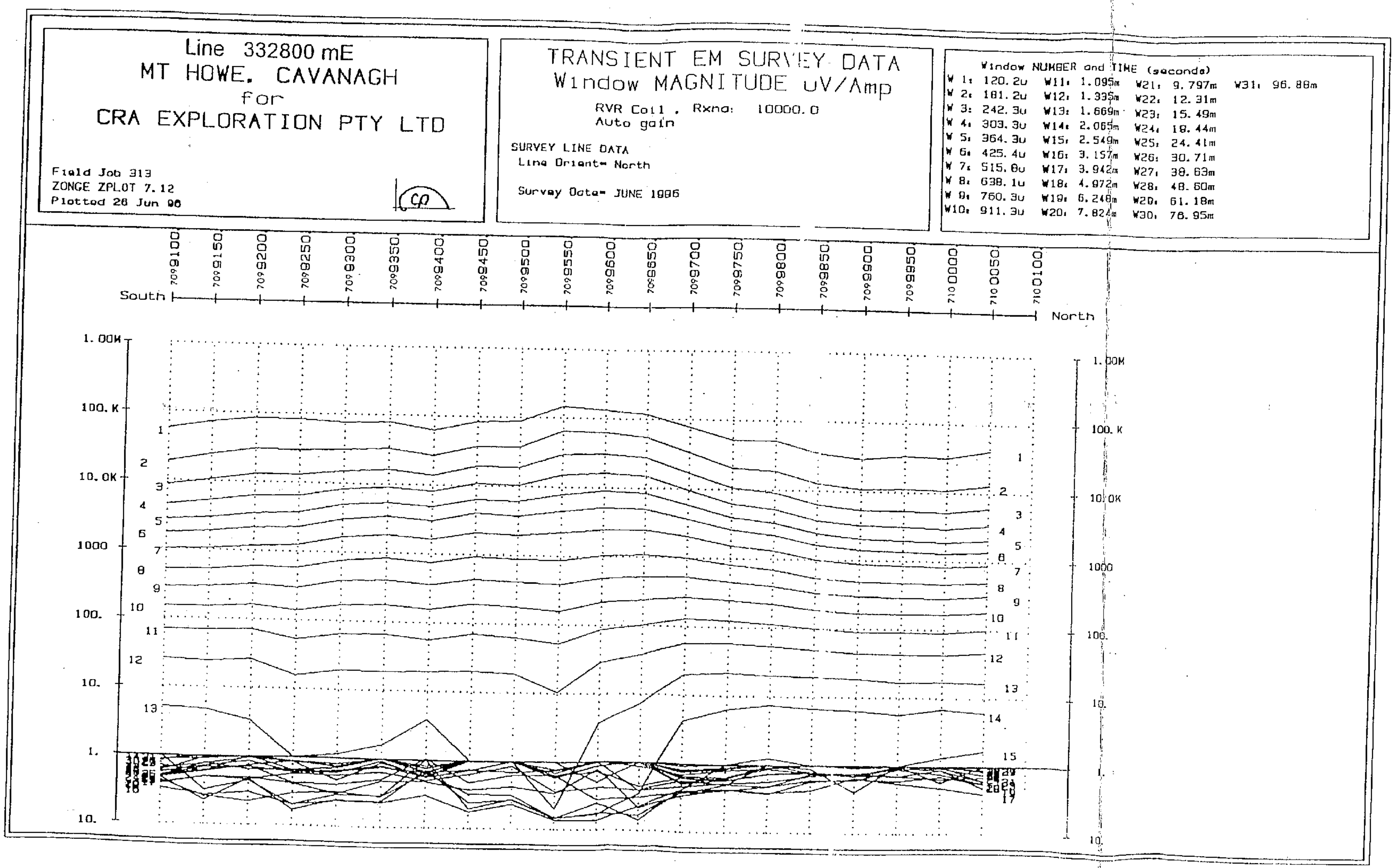
W 1: 120.2u	W11: 1.095m	W21: 9.797m	W31: 96.88m
W 2: 181.2u	W12: 1.335m	W22: 12.31m	
W 3: 242.3u	W13: 1.669m	W23: 15.49m	
W 4: 303.3u	W14: 2.065m	W24: 19.44m	
W 5: 364.3u	W15: 2.549m	W25: 24.41m	
W 6: 425.4u	W16: 3.157m	W26: 30.71m	
W 7: 515.8u	W17: 3.942m	W27: 38.83m	
W 8: 638.1u	W18: 4.972m	W28: 48.60m	
W 9: 780.3u	W19: 6.248m	W29: 61.18m	
W10: 911.3u	W20: 7.824m	W30: 78.95m	



Report No.

* Twin Turn 200m x 200m Transmitter Loop
* 50m Stations
* Tx = ZONGE GGT25
* Rx = ZONGE GDP16
* Antenna = Sirotem RVR
* 2 Hz. Survey Frequency

MT. HOWE EL 2020 - S.A.
SURFACE TEM
Line 333200 mE
Cavanagh Area



* Twin Turn 200m x 200m Transmitter Loop
* 50m Stations
* Tx = ZONGE GGT25
* Rx = ZONGE GDP16
* Antenna = Sirotem RVR
* 2 Hz. Survey Frequency

Report No

MT. HOWE EL 2020 - S.A.
SURFACE TEM
Line 332800mE
Cavanagh Area

Line 7098600 mN
MT HOWE, AREA 3
for
CRA EXPLORATION PTY LTD

Field Job 313
ZONGE ZPLOT 7.12
Plotted 27 Jun 96

TRANSIENT EM SURVEY DATA
Window MAGNITUDE uV/Amp

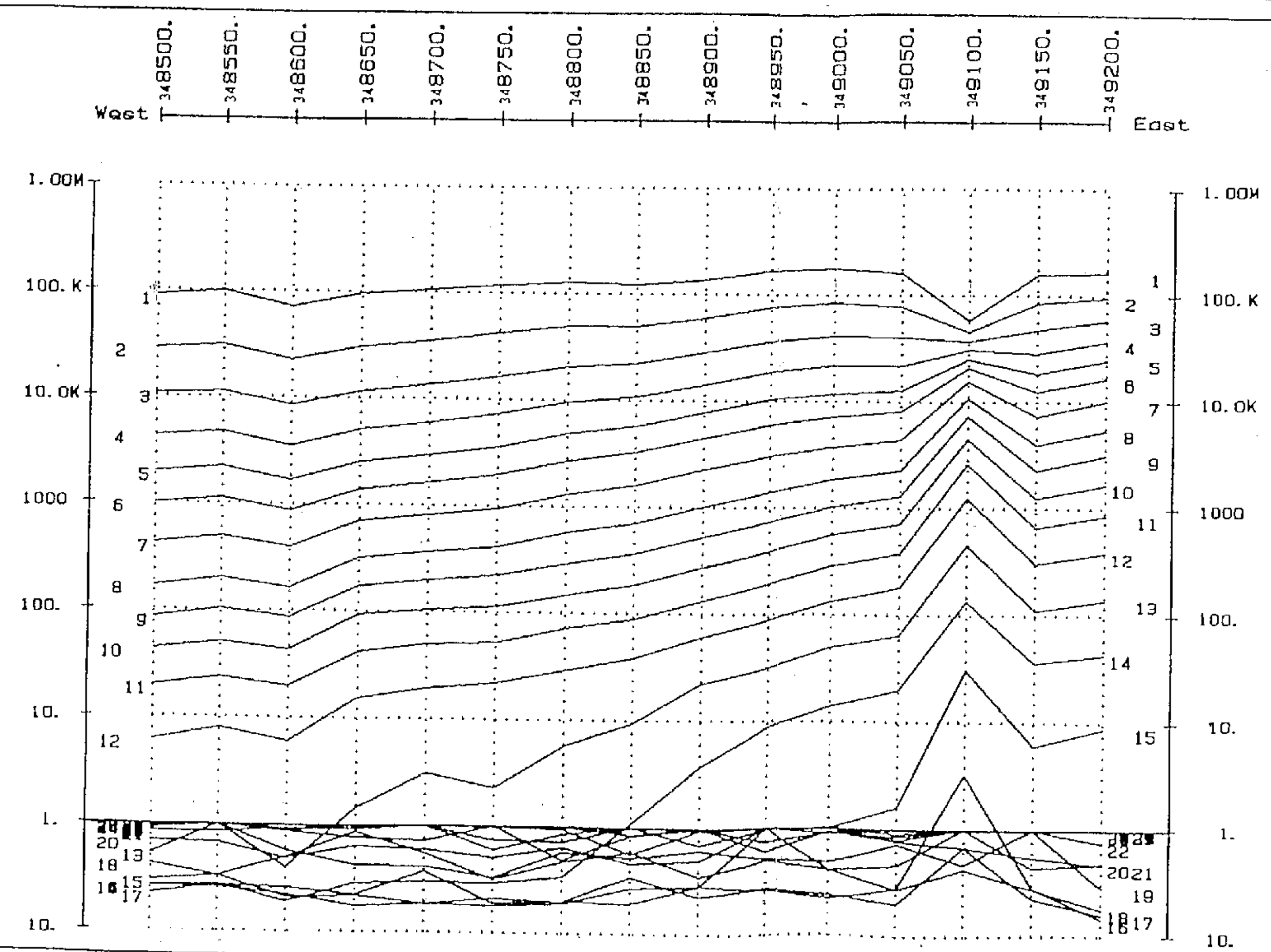
RVR Coil . Rxno: 10000.0
Auto gain

SURVEY LINE DATA
Line Orient= East

Survey Date= JUNE 1996

Window NUMBER and TIME (seconds)

W 1: 120.2u	W11: 1.095m	W21: 9.797m	W31: 96.88m
W 2: 181.2u	W12: 1.335m	W22: 12.31m	
W 3: 242.3u	W13: 1.669m	W23: 15.49m	
W 4: 303.3u	W14: 2.065m	W24: 18.44m	
W 5: 364.3u	W15: 2.549m	W25: 24.41m	
W 6: 425.4u	W16: 3.157m	W26: 30.71m	
W 7: 515.8u	W17: 3.942m	W27: 38.63m	
W 8: 638.1u	W18: 4.972m	W28: 48.60m	
W 9: 780.3u	W19: 6.248m	W29: 61.18m	
W10: 911.3u	W20: 7.824m	W30: 78.95m	



* Twin Turn 200m x 200m Transmitter Loop
* 50m Stations
* Tx = ZONGE GGT25
* Rx = ZONGE GDP16
* Antenna = Sirotem RVR
* 2 Hz. Survey Frequency

Report No.

MT. HOWE EL 2020 - S.A.
SURFACE TEM
Line 7098600 mN
Area 3

Line 7098800 mN
MT HOWE. AREA 3
for
CRA EXPLORATION PTY LTD

Field Job 313
ZONGE ZPLOT 7.12
Plotted 05 Jul 98

TRANSIENT EM SURVEY DATA
Window MAGNITUDE uV/Amp

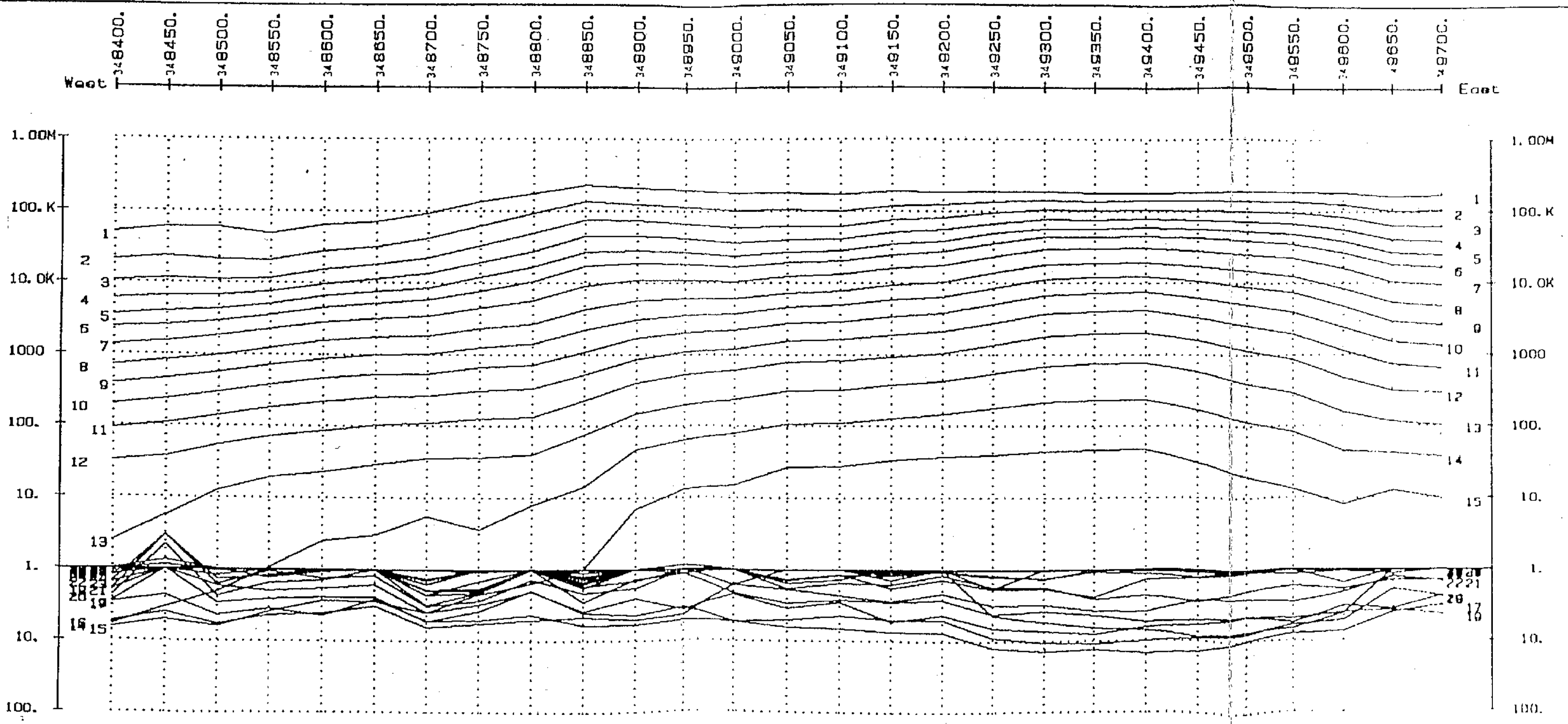
RVR Coil, Rxnd: 10000.0
Auto gain

SURVEY LINE DATA
Line Orient= East

Survey Date= JUNE 1998

Window NUMBER and TIME (seconds)

W 1: 120.2u	W11: 1.095m	W21: 9.797m	W31: 96.88m
W 2: 181.2u	W12: 1.335m	W22: 12.31m	
W 3: 242.3u	W13: 1.669m	W23: 15.49m	
W 4: 303.3u	W14: 2.065m	W24: 19.44m	
W 5: 364.3u	W15: 2.540m	W25: 24.41m	
W 6: 425.4u	W16: 3.157m	W26: 30.71m	
W 7: 515.9u	W17: 3.942m	W27: 38.63m	
W 8: 638.1u	W18: 4.972m	W28: 48.60m	
W 9: 760.3u	W19: 6.248m	W29: 61.16m	
W10: 911.3u	W20: 7.824m	W30: 76.95m	



Report No

* Twin Turn 200m x 200m Transmitter Loop
* 50m Stations
* Tx = ZONGE GGT25
* Rx = ZONGE GDP16
* Antenna = Sirotem RVR
* 2 Hz. Survey Frequency

MT. HOWE EL 2020 - S.A.
SURFACE TEM
Line 7098800 mN
Area 3

Appendix 9

Airborne TEM Profiles

Report No.

MT. HOWE
EL 2020 - S.A.
AIRBORNE TEM
Line 40590

9513-7

AERODATA QUESTEM SYSTEM
Base frequency 75 Hz.

line no. 40590
flight no. 14
direction 90
date flown 23jan96
time flown 09:50:55.00 10:02:47.75
fiducial no. 989 1702
line location 309233 7095155 350396 7094991
client CRA EXPLORATION PTY LIMITED
job 1134.4
area VERNON HILL PROJECT
scale 1:50000

Report No.

MT. HOWE
EL 2020 - S.A.
AIRBORNE TEM
Line 40583

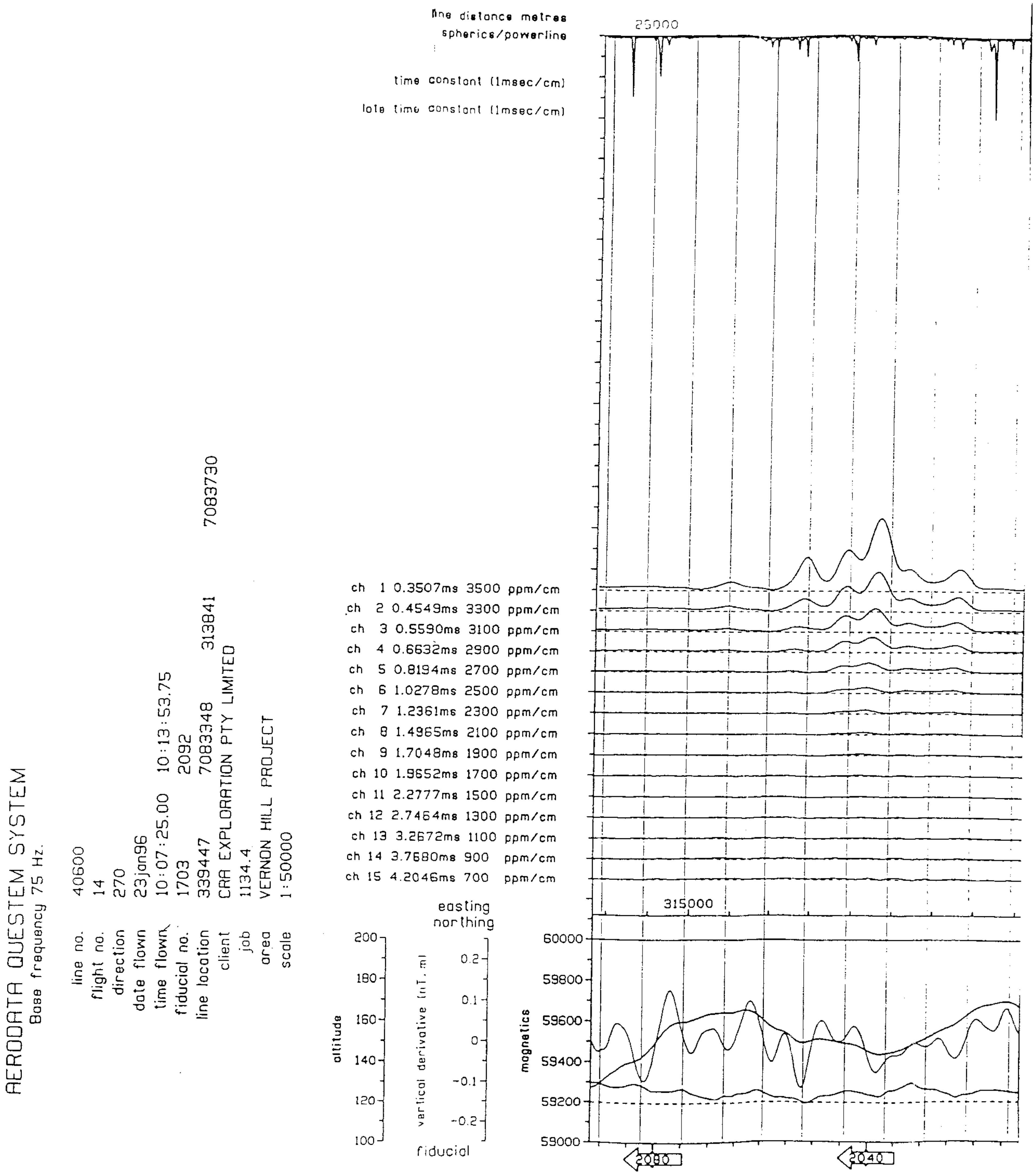
9513-8

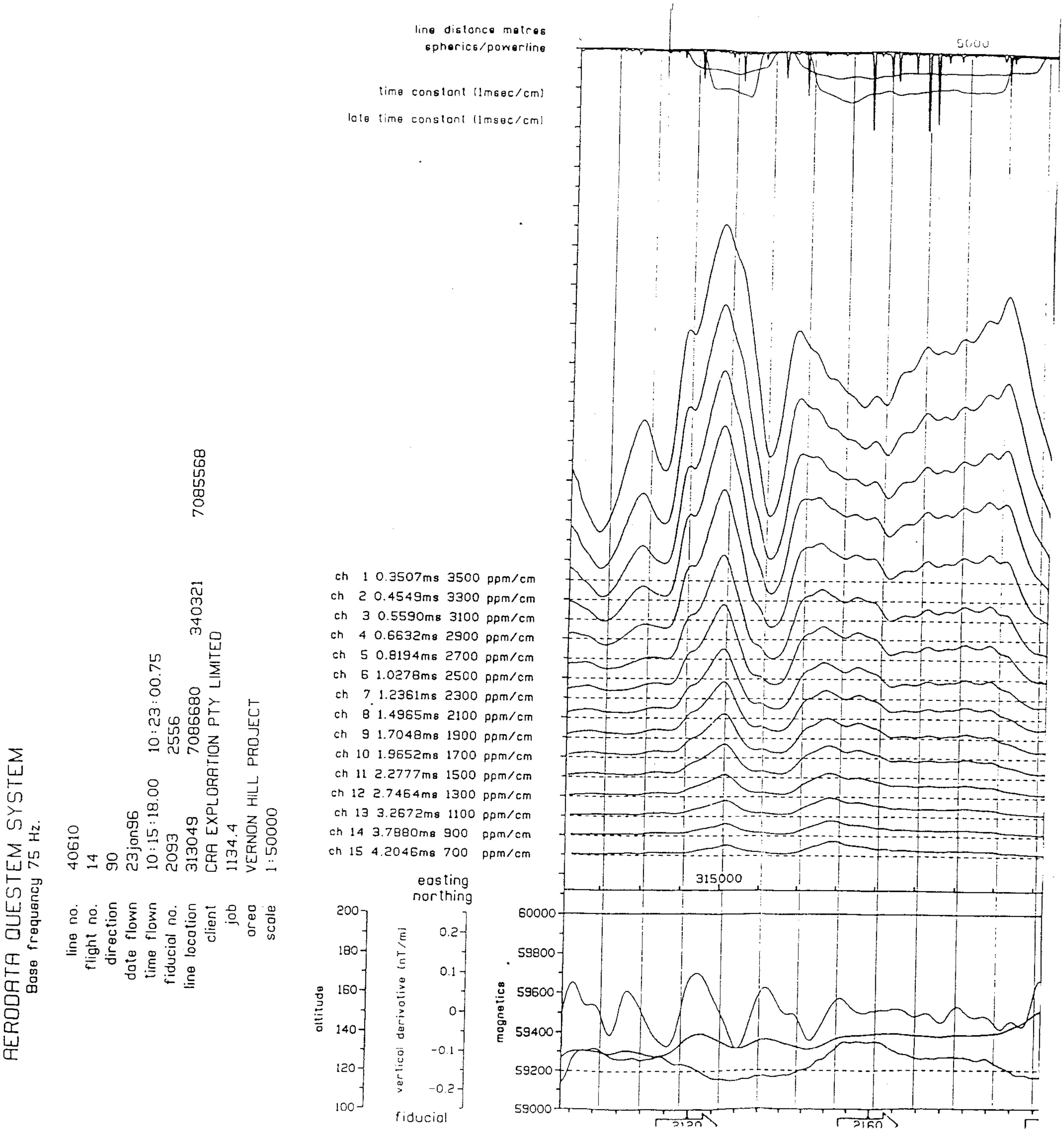
AERODATA QUESTEM SYSTEM
Base frequency 75 Hz.

line no.	40583
flight no.	14
direction	270
date flown	23jan96
time flown	09:38:40.00 09:49:10.75
fiducial no.	357 988
line location	353601 7098875 311916 7099082
client	CRA EXPLORATION PTY LIMITED
job	1134.4
area	VERNON HILL PROJECT
scale	1:50000

MT. HOWE
EL 2020 - S.A.
AIRBORNE TEM
Line 40600

9513-9





MT. HOWE
EL 2020 - S.A.
AIRBORNE TEM
Line 40610

9513-10