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THE SHELL COMPANY OF AUSTRALIA LIMITED

METALS DIVISION

E.L. 8/77 - RIANA

Progress Report on Exploration During the Period 2/9/83 - 1/3/84

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SUMMARY

This report summarizes exploration activities on the Riana Licence E.L. 8/77 from August, 1977 to March, 1984 - by Comalco (Aug. 1977 to Dec. 1979) and Shell/Commonwealth Aluminium Corporation Limited (a wholly owned subsidiary of Comalco) (Jan. 1980 to Mar. 1984).

Work completed between 1-9-83 and 1-3-84 is outlined in the second half of the report.

During the 6½ years duration of the licence aeromagnetic/radiometric and stream sediment sampling surveys have been completed with part coverage by INPUT and regional gravity. Despite the location of magnetite skarns at the contact of the Housetop granite and Gordon Limestone in the southern part of the licence, anomalous Pb/Zn in Cambrian stratigraphy south of Gunns Plains and the Natone pyrrhotite/magnetite skarn at the NW margin of the Housetop granite in the Precambrian/Cambrian Oonah Formation, no economic mineralization has been located. The exploration carried out to date in this area has been thorough and the potential for discovery of an economic deposit considered poor. The ground is therefore recommended for relinquishment.

1.0 INTRODUCTION

Exploration Licence 8/77, Riana, covering an area of 197 sq. km. south and southwest of Penguin, was granted to Comalco Limited on 5th August, 1977. In April, 1979, two extensions of 52 sq. km. and 67 sq. km. were granted bringing the area covered by E.L. 8/77 to 316 sq. km. During 1979, the title of the E.L. was transferred to the Commonwealth Aluminium Corporation Limited, a wholly owned subsidiary of Comalco.

In January, 1980 an agreement was made with the Commonwealth Aluminium Corporation Limited to enter the Housetop Joint Venture which included the Riana E.L. 8/77, Hayes Peak E.L. 14/80, Guildford E.L. 1/76 and Highclere E.L. 4/77 licences. Shell took over as managing partner at this time.

This report summarizes the search for tin, tungsten and base metals in the Riana E.L. 8/77 licence.

2.0 TOPOGRAPHY & ACCESS

E.L. 8/77 Riana is composed of undulating basalt hills, dissected by north flowing rivers confined to deep valleys and gorges. Most of the area (particularly the Tertiary basalt) is cleared to semicleared private land. Those areas which are covered by bush are services by many 4WD tracks. (Location map, Fig. 1). Loyetea Peak (Ordovician conglomerate) is the highest peak at 700 metres above sea level. Basal Ordovician rocks form ridges elsewhere in the licence, but they do not project much above the high basalt plateau of 400 metres above sea level. Sealed roads are numerous and access is easily gained from Burnie and Devonport.

3.0 REGIONAL GEOLOGY

E.L. 8/77, Riana is partially covered by three one mile Geology sheets, viz., Sheffield (Jennings, 1959), Devonport (Burns, 1963) and Burnie (Gee, 1967). A fourth one mile sheet covering the rest of the licence, St. Valentines, is in preparation. The St. Valentines area is covered by a composite one mile sheet prepared by Comalco. Discussion of the regional geology of the licence has been adequately covered by many authors including Twelvetrees (1903, 1909); Burns (1964); Jennings (1959, 1979); Gee (1977) and Williams and Turner (1974). (Summary Geology Fig. 2).

The oldest rocks on the licence are the Proterozoic Ulverstone Metamorphics, which form part of the Forth Nucleus (Williams and Turner, 1974), and are comprised of quartzite, schist and conglomerate. These rocks outcrop along the coast in the eastern most extension of the licence. At the margin of the Forth Nucleus on the eastern side of the Dial Range outcrop sandstones and mudstones of the Rocky Cape Group. These are unconformably overlain by the north-south trending belt of Cambrian sediments and acid to basic volcanics deposited in the Dial Range Trough (Burns, 1964). Iron, copper and cobalt mineralization is associated with the early volcanics in the Penguin area.

To the west of the Dial Range the oldest rocks belong to the Precambrian Burnie Formation which comprises of a sequence of turbidite sandstones, siltstones and shales inpart containing intrusive basic igneous rocks (Gee, 1977). These rocks are folded and deformed by at least two phase of deformation with NE trending folds dominant.

This turbidite sequence is unconformably overlain by silicified and ferruginized sandstones and siltstones, dolomites and iron-stones of the Cambrian/Precambrian Oonah Formation. (Fig. 3).

The Oonah Formation is gently dipping and forms a NE outcrop trend from a contact with the Housetop granite near Natone across the Blythe River to Cuprona but pinches out before reaching the north coast. Dolomites of the Oonah Formation host the Natone Skarn.

Cambrian acid/intermediate volcanics and sediments which form the northern correlates of the Mt. Read Volcanics outcrop in the southern portion of the licence. Anomalous Pb/Zn is associated with trachytic intrusions/extrusions within a predominantly sedimentary succession.

Ordovician conglomerates, sandstones and limestones overly the Cambrian stratigraphy, outcropping in the southern part of the licence near Gunns Plains and are inferred as subcrop beneath Tertiary basalt cover in the Camena/Midgley Falls areas north of Riana.

Sediments of Silurian age may occur in the axis of the Gunns Plains synform.

This succession is passively intruded by the Devonian Housetop granite generally a medium to coarse grained pink adamellite. Porphoritic and fine grained variants have been identified south of Natone and in the Redwater area. The Housetop granite contains Sn-bearing greisen veins at Crane's Tin prospect to the west of the Riana licence and is associated with the magnetite/scheelite skarns of Kara. Geophysical (gravity) data suggests that the granite is laccolith shaped with a feeder zone located towards it's SE/E margin. (Sheehan, 1969; Oakes, 1983). The roof zones have been removed by Tertiary erosion.

During Tertiary times the region was exposed with weathering producing pockets of sediment. Major basaltic flows covered the area infilling valleys - producing a highly variable lava thicknesses.

4.0 PREVIOUS INVESTIGATIONS

Previous investigations in the Riana licence include:

Twelvetrees (1903,1909)
Bureau of Mineral Resources (1950's and 1960's)
Quest Exploration (1966)
B.H.P. (1968)
Minops (1969)
Tasminex (1970,1974)
Conzinc Rio Tinto of Australia (CRAE) (1972)
Australian & New Zealand Exploration (ANZECO) (1972 - 1974)
Comalco (1977 -)

Further details of previous work are summarized in Banwell (1981).

5.0 EXPLORATION - COMALCO 1977 to 1980

Exploration by Comalco was dominated by a stream sediment sampling programme which covered the entire Riana licence except areas of granite outcrop. Several anomalies were located but few were resampled and checked. Reconnaissance was carried out over areas of known mineralization e.g. Redwater, Penguin and Neptune mines, Tasmanian Iron Mines, Copper King, Blythe Iron and Natone Iron. Detailed followup was undertaken on the Redwater prospect involving gridding, ground magnetics, IP and finally drilling. Three diamond holes were drilled intersecting magnetite skarn, wrigglite and garnet-biotite-actinolite skarn with maximum values of 760 ppm WO_3 and 430 ppm Sn. The skarn bodies form a skin at the Gordon Limestone/Housetop granite contact.

Details of Comalco exploration are outlined in Weste, (1979).

6.0 EXPLORATION - SHELL/COMALCO 1980 to 1984

6.1 Aeromagnetic Followup

In March 1980 Shell flew an aeromagnetic and radiometric survey across the entire licence. Numerous anomalies were outlined. (Refer Plan D/MQ 04/080). The followup of each aeromagnetic anomaly is summarized in Table 1. (D/MQ 04/164).

6.1.1 Magnetite Skarns

Initial work by Shell centred on the magnetic anomalies in the Redwater/Laurel Creek area. Two further holes were drilled to test magnetic anomalies at Redwater itself intersecting magnetite-bearing skarn assemblages at the limestone/granite contact with low order Sn - WO_3 values. A further percussion hole was drilled at the Laurel Creek West anomaly (4042/1) which intersected ten metres of barren magnetite skarn (maximum 310 ppm Sn) at the granite/limestone contact (Ruxton, 1982).

Subsequent ground followup (magnetics, gravity and geochemistry) of the numerous aeromagnetic anomalies in the Redwater/Laurel Creek area led to the identification of magnetite-bearing Cambrian volcanic rocks (magnetic susceptibilities of 15,000 x 10^{-6} cgs units) (e.g. Loyetea West 4142/11), magnetic Tertiary basalt (e.g. Loyetea East 4142/2) and magnetite-bearing Housetop granite (e.g. Housetop anomaly 4042/2 - this report).

Exploration was discontinued in this area due to the low grade and low tonnage potential of the magnetite-bearing skarns. Aeromagnetic anomalies are attributed to magnetite skarns, Tertiary basalt, magnetite-bearing

Cambrian Volcanics and Housetop granite (Table 1 - details Banwell, 1981; Ruxton, 1982).

6.1.2 Tertiary Basalt

Several anomalies in the northern part of the Riana licence were investigated and have been attributed to basalt hills/valleys. It has been recognised that several units within the Tertiary basalts of this area carry extremely high remanent magnetism. The Cuprona anomaly (4144/1) is a good example of this with magnetic susceptibility values of only 400 x 10^{-6} cgs units but a Koenigsberger ratio of 41 (Banwell, 1981; Ruxton, 1982). Basalts in the Housetop Joint Venture area have Koenigsberger ratios from 1 to 71 (Oakes, 1983). The Cuprona anomaly was drilled yielding 132m of basalt overlying 14m of Tertiary sediment and Precambrian Burnie Formation shales. Modelling of a subsequent gravity traverse indicated a surficial tabular source suggesting a basalt slab/hill (Ruxton, 1982; Fig. 5).

In basalt covered areas anomalies associated with basalt thickness or remanent magnetism are difficult to pick. However, they are often associated with topographic highs and can be graded on predictions of sub-basalt geology. Further geophysical information may be useful in defining such anomalies. Examples of this anomaly type are Midgley Falls (4144/3), Wattle Grove (4143/2) and Castra (4142/4) (documented in this report).

The Camena anomaly (4144/1) is a large feature with a source greater than 500m (Ruxton, 1982). It has been interpreted as a basalt/dolerite plug on the

grounds of high susceptibilities (upto 20,000 x 10^{-6} cgs units), deep source and radiating (stellate) basalt ridges of anomalously high magnetic values. Wattle Grove (4143/2), Stotts Road (4143/3) and Ellis Creek North (4043/2) and South (4043/3) lie on these ridges. (Refer Plan D/MQ 04/080).

6.1.3 Pyrrhotite Skarn

The Natone anomaly (4044/2) was allocated a priority 1 aeromagnetic and INPUT anomaly for followup. It lies on the NW margin of the Housetop granite close to the contact of granite and rocks of the Precambrian/Cambrian Oonah Formation (Fig. 4). After initial groundwork had been completed on this anomaly it was discovered that Minops had drilled three diamond holes into a disseminated pyrrhotite/magnetite skarn body. The three holes were drilled on a broad magnetic feature and followed by an IP survey, the results of which were not pursued. The Shell grid was extended to fully define the feature and mapping plus various ground geophysical techniques were used (magnetics, max-min EM, VLF, SP, gravity, IP and Sirotem TEM) (Ruxton, 1983b). Various anomalies were defined and related to the following sources:

Magnetics	-	1. Magnetic basalt. 2. Magnetite-bearing Precambrian Dolerites of the Burnie Formation. 3. Skarn.
Conductors	-	1. Graphitic schists - Burnie Formation 2. Clay bands - associated with Tertiary basalt. 3. Skarn.
Density Contrasts		1. Lithological Variations. 2. Thickness variation of basalt (valleys). 3. Skarn.

Interpretation of geophysical results was therefore complex. Three drill holes were collared by Shell, two of which intersected skarn (NT 3, NT 1) and one (NT 2) which remained in Burnie Formation shales. These results suggested that a combination of magnetics and max-min EM/IP were necessary to identify skarn bodies beneath basalt cover.

The skarn has no geochemical expression with low order Sn/WO_3 values. A consultants' report by Dr. Teunis Kwak (La Trobe University, Melbourne) downgrades the possibility of an economic Sn/WO_3 deposit on the grounds of: (Appendix 5).

1) The general lack of secondary alteration coupled with the very low Sn values in the primary skarn.
2) The fact that high Sn areas produced by secondary alteration usually forms above altered skarn. If such areas occurred at Natone they would now be eroded away above NT 1 and 3 and do not apparently exist in some other parts.
3) If the ironstones are gossans, as I suggest, then no high Sn areas ever occurred in skarn now eroded. The general lack of alluvial Sn in the area also supports this veiw.
4) Sulphide skarn, where present, is also low Sn. If high Sn areas occurred, these should occur in sulphide skarn (in most, but not all, deposits).

6.2 INPUT Followup

An INPUT survey was flown in January 1982 across the northern margin of the Housetop granite in an attempt to locate conductive (pyrrhotite) skarn bodies in the Oonah Formation stratigraphy (Appendix 6). Six anomalies were defined (Fig. 5) with Natone ranking as priority followup. Details

of work on INPUT anomalies within the Riana licence are summarized in Table 2. The survey located four kinds of anomaly source - a) graphitic shales of the Burnie Formations (IR 2 and 4); b) clay bands associated with Tertiary basalt (IR 1 and 6); c) cultural interference (IR 5) and d) the Natone pyrrhotite/magnetite skarn (IR 3). No further skarn bodies were located.

A further 9 anomalies (IR 7 to 15) were selected on a re-evaluation of the INPUT data but were subsequently downgraded as being due to clay horizons within Tertiary basalt flows following results from IR 1 (Knob Park) and IR 11 (Midgley Falls) followup (this report).

6.3 Regional Gravity Survey

The northern half of Riana was covered by a regional gravity survey in early 1982. The purpose of this survey was to detect granite cupolas (and subsequently mineralization) related to the Housetop granite within areas of prospective carbonate stratigraphy. Detailed followup defined four gravity lows on the Riana licence (Refer Plans D/MQ 04/164 and MQ 00/1014). Anomalies GL 8, 9 and 10 were defined as 1 - 5 mgal features with ambiguous sources and GL 11 a 10 mgal low interpreted as a granite cusp. The location of GL 11 upgraded the Midgley Falls aeromagnetic (4144/3) and Knob Park INPUT (IR 1) anomalies which are located over a Tertiary basalt covered Ordovician synclinorium (with a Gordon Limestone core?). Ground magnetic, IP and remanent magnetic data suggest a basalt-related and Tertiary conductive clay anomaly origin respectively (This report).

6.4 Stream Sediment Sampling

Stream sediment sampling by Comalco and CRAE outlined five anomalous areas in the Riana licence. (Refer Plan D/MQ 04/164).

1) Loyetea Peak (Pb/Zn) - Attributed to Mn and Fe enrichment of slightly anomalous Pb/Zn draining from Cambrian sediments and minor volcanics (Appendix this report).

2) Tungsten anomaly (N and S Loyetea) (WO_3) - Attributed to contamination effects during sample grinding. (This report).

3) Redwater Granite (Sn/WO_3) - Related to spaced greisen veining and fine grained granites on the southern margin of the Housetop granite (Appendix 1 this report).

4) Natone - Cuprona (Cu) - Anomalous copper values draining from chalcopyrite/pyrite-bearing quartz veins in Burnie Formation shales of the Rutherford copper prospect and Copper King mine workings respectively. (Ruxton, 1983a).

5) Penguin (WO_3) - Presumed related to drainage from ironstone bodies slightly elevated in WO_3 at the Tasmanian Iron Mines (Ruxton, 1983a).

Spasmodic Cu (110 ppm max.) and Zn (290 ppm max.) values are related to Fe and Mn scavenging of slightly elevated Cu/Zn in Tertiary basalts. Pb values of upto 40 ppm occur over Gordon Limestone stratigraphy in the Gunns Plains area. Similarly slightly elevated values of Sn (with minor Zn and Mo) are recorded spacially related to the Housetop granite (680 ppm Sn, 60 ppm Zn and 55 ppm Mo). These values are derived from Tertiary gravels at the base of the basalt and are related to the erosion of the top levels of the Housetop granite during Tertiary (pre-Tertiary?) times.

7.0 CONCLUSIONS

The Riana licence has been covered by aeromagnetic/radiometric and stream sediment surveys and input by regional gravity and airborne INPUT methods. Despite the location of pyrrhotite/magnetite and magnetite skarns in addition to Pb/Zn in Cambrian volcanics no potential sites for economic mineralization have been discovered. It is therefore recommended that the licence be dropped.

8.0 WORK COMPLETED BETWEEN 1-9-83 and 1-3-84

8.1 Summary

The Redwater Granite (Sn/WO_3), Loyetea Peak (Pb/Zn) and Tungsten anomaly (N and S Loyetea) (WO_3) stream sediment anomalies were followed up with no success.

Six aeromagnetic anomalies (Housetop - 4042/2; Castra - 4142/4; Midgley Falls - 4144/3; Stotts Road - 4143/3; Wattle Grove - 4143/2; South Riana - 4143/4) were followed up with ground magnetics and remanent magnetic studies. One line of IP was located on Midgley Falls. All anomalies have a basalt source.

One INPUT anomaly (Knob Park - IR 1) was followed up with magnetics and IP and explained as conductive clays within/beneath basalt of Tertiary age. IR 11 fell on the Midgley Falls grid and was explained as a similar Tertiary basalt source to IR 1.

Teunis Kwak (La Trobe University, Melbourne) spent two days examining the Natone information. Little prospect of an economic Sn/WO_3 skarn was concluded.

It is recommended that the licence be dropped.

8.2 Stream Sediment Sampling

8.2.1 Redwater Granite (Sn/WO_3) (Appendix 1)

Stream sampling by Comalco recorded elevated Sn/WO_3 values on the SE portion of the Housetop granite close to Redwater. Values of 0.24% and 680 ppm Sn were recorded in Bony Creek and is here termed the Redwater Granite Prospect.

Resampling of the streams (4 samples) and rocks (7 samples) (see Appendix 1) yielded low order results. The rocks consist of medium, fine grained and aplitic variants of the Housetop granite which are extensively greisenized (sericite/chlorite/quartz greisen) (Fig. 3 in Appendix 1). Greisenization occurs over an area of 400m by 150m. Rock samples of greisenized material gave values of 180 ppm Sn and 55 ppm WO_3. Tourmaline/quartz veins and tourmaline/quartz/feldspar pegmatitic clots (miarolitic cavity fills) were recognized suggesting with the finer grained granite variants, a position close to the top of the Housetop granite.

Rock chip geochemical results were not sufficiently encouraging to warrant further work.

A few extra samples were collected to the west of the Redwater Granite Prospect. Rock samples of fine grained granite with tourmaline/quartz/feldspar pegmatitic miarolitic cavity fills, euhedral drusy quartz and quartz/sericite greisen plus quartz/tourmaline veins were collected near Comalco sample site 114 (Appendix 1 see Figs. 1 and 2). Geochemical results were discouraging (44 ppm Sn, 70 ppm WO_3 max. but elevated base metal values were recorded 690 ppm Pb, 560 ppm Zn) (Appendix 1). No further work is necessary in this area.

8.2.2 Cambrian Volcanics (Appendix 2A and B)

a) Loyetea Peak (Pb/Zn)

Values of upto 190 ppm Pb and 600 ppm Zn with a good dispersion trail were recorded in an easterly flowing creek SE of Loyetea Peak by Comalco. Re-sampling of this anomaly didn't repeat the Pb values but a reasonable Zn tail was repeated (Appendix 2A). Rock samples of black siltstones/shales of Cambrian age gave Zn values between 200 and 370 ppm. The Cambrian rocks are overlain by Ordovician conglomerates in this locality.

With no volcanics present in this area the Zn values are attributed to "high background" values in black Cambrian sediments and a degree of Mn and Fe oxide enrichment. No further work is proposed.

b) Tungsten Anomaly (Loyetea N & S) (WO_3)

Tungsten values of upto 300 ppm were recorded by CRAE in the vicinity of N and S Loyetea prospects. No anomalous tungsten values were recorded during the resampling programme. Initial anomalies were attributed to grinding problems associated with tungsten crushing devices (Appendix 2B). The rocks of this area consists of Cambrian sediments with minor intrusive and extrusive mafic material.

c) Summary

A summary of work on the Cambrian volcanics of southern Riana by both CRAE and Shell is presented in Appendix 2B. The area is not thought prospective for massive sulphide Zn/Pb/Ag/Au deposits.

8.3 Aeromagnetic & INPUT Anomaly Followup

Six aeromagnetic and two INPUT anomalies were followed up in the report period. All followup of aeromagnetic and INPUT anomalies is summarized in Tables 1 and 2. For anomaly locations see Plan D/MQ 04/164.

8.3.1 Southern Margin of the Housetop Granite

Housetop Aeromagnetic Anomaly (4042/2) (Alias Laurel Creek North)

The Housetop anomaly has been covered by one line of ground magnetics along a logging track (diagram Appendix 3) which records an anomaly of 3000 nT at 400E. Rock samples and mapping indicate that the anomaly is related to medium grained, pink, magnetite-bearing Housetop granite with magnetic susceptibility measurements of 10,000 x 10^{-6} cgs units. Rock chip samples (see geochemical results in Appendix 1) yield low order Sn (6 ppm) but slightly elevated WO_3 (115 ppm). Scheelite was panned in the tributary draining this prospect (sample No. 9405, Appendix 3 and 1).

The anomaly is attributed to magnetite-bearing unaltered Housetop granite which may represent a "feeder zone" for fluids which led to the development of magnetite skarns in the Redwater area.

Approximately 500m NNE of the Housetop anomaly a costean was discovered containing narrow (0.5m or less) tourmaline/quartz and tourmaline veins of highly irregular thickness. These veins cross-cut medium grained weathered biotite granite. Assay results indicate values of 0.14% Sn, 25 ppm WO_3 max. (Appendix 1 geochemistry). Two veins were located - there is clearly no tonnage potential here.

Castra Aeromagnetic Anomaly (4142/4)
(Alias Preston Anomaly)

The Castra anomaly is a broad feature with a maximum amplitude of 400 nT. Ground magnetic data indicates a broad source with a very noisey profile (Appendix 3) and a maximum amptitude of 1200 nT. Ground inspection showed the anomaly to be entirely basalt covered with two flow units recognized with susceptibilities upto 950×10^{-6} cgs units and $5,100 \times 10^{-6}$ cgs units respectively (Fig. in Appendix 3). The magnetic anomaly is related to a broad magnetic basalt flow which lies beneath a capping of less magnetic basalt forming the highest point on the hill. One sample was measured for magnetic remanence and was found to be highly remanently magnetized (Appendix 4). Reconnaissance in the area around the Castra grid suggests a thickness of at least 200m of basalt probably underlain by Gordon Limestone or Silurian sediment.

There is considered no potential for economic mineralization related to the unaltered Gordon Limestone in this area.

8.3.2 Northern Margin of the Housetop Granite

Wattle Grove Aeromagnetic Anomaly (4143/2)

The Wattle Grove, Stotts Road and South Riana aeromagnetic anomalies lie on a ridge of highly magnetic basalt which originates in the NNW at the Camena volcanic plug. These anomalies are considered to represent high remanence basalts.

The Wattle Grove anomaly was gridded and mapped (Appendix 3). It consists of a 2,500 nT anomaly located on a basalt hill adjacent to a window of Housetop granite. An assay on the granite gave low order Sn/WO_3 (map Appendix 3, geochemistry Appendix 1).

South Riana Aeromagnetic Anomaly (4143/4)

One line of ground magnetics was run over the south Riana anomaly yielding a sharp peak of 2500g. One sample was selected for remanent magnetism analysis (Appendix 4) and was found to be highly remanently magnetized. A basalt source is proposed on the grounds of the high remanence of the basalt and the magnetic profile which mirrors the basalt hill topography.

Stotts Road Aeromagnetic Anomaly (4143/3)

The Stotts Road anomaly is located over a basalt hill with magnetic susceptibilities of upto 600 x 10^{-6} cgs units. The anomaly has a maximum amplitude of 600 nT and mirrors topography. A basalt source is proposed.

Midgley Falls Aeromagnetic Anomaly (4144/3) & INPUT Anomaly (IR 11)

The Midgley Falls anomaly is of particular interest since it lies adjacent to gravity low GL 11 and has a coincident INPUT anomaly IR 11. The grid is entirely basalt covered. There is a possibility of Gordon Limestone at depth since the anomalous zone occurs over an Ordovician synform. A line of reconnaissance ground magnetics gave a spikey profile

(Banwell, 1981). The magnetic signature is extremely high and would require a basalt susceptibility of 47,000 x 10^{-6} cgs units or a magnetic remanence of some magnitude (Koenigsberger ratio 40). Recent ground work has outlined an anomaly with two peaks (maximum value of 4,500 nT) which is coincident with a basalt hill (Appendix 3). A line of IP was completed on 200 N from 400 W to 600 E.

No anomaly was detected (Appendix 3). Three samples were measured for magnetic remanence giving a maximum Koenigsberger ratio of 27 (Appendix 4). The lack of IP response and the high remanent magnetism of the basalt samples is suggestive of a basalt anomaly source. Anomaly IR 11 is considered to be due to conductive clay bands in the basalt.

Knob Park INPUT Anomaly (IR 1)

IR 1 is located 1.5 km NNE of Midgley Falls, is entirely basalt covered and occurs in a similar geological setting. The anomaly has been covered by ground magnetics and one line of IP. (Appendix 3). The magnetics results are extremely noisy and the line of IP on 00 N from 800 W to 400 E indicates surficial conductors only.

The conductor is considered to be related to conductive Tertiary sediments associated with basalt.

8.4 Natone Skarn (4044/1; IR 3)

Dr. Teunis Kwak (La Trobe University, Melbourne) was approached and spent two days examining drill core and on field visits (Consultant's report, Appendix 5). His conclusions were that the skarn is an unusual deposit

similar to Russian examples but is located in an unfavourable geological position to host mineralization. This conclusion agrees with previous thinking and it is proposed that the prospect be dropped.

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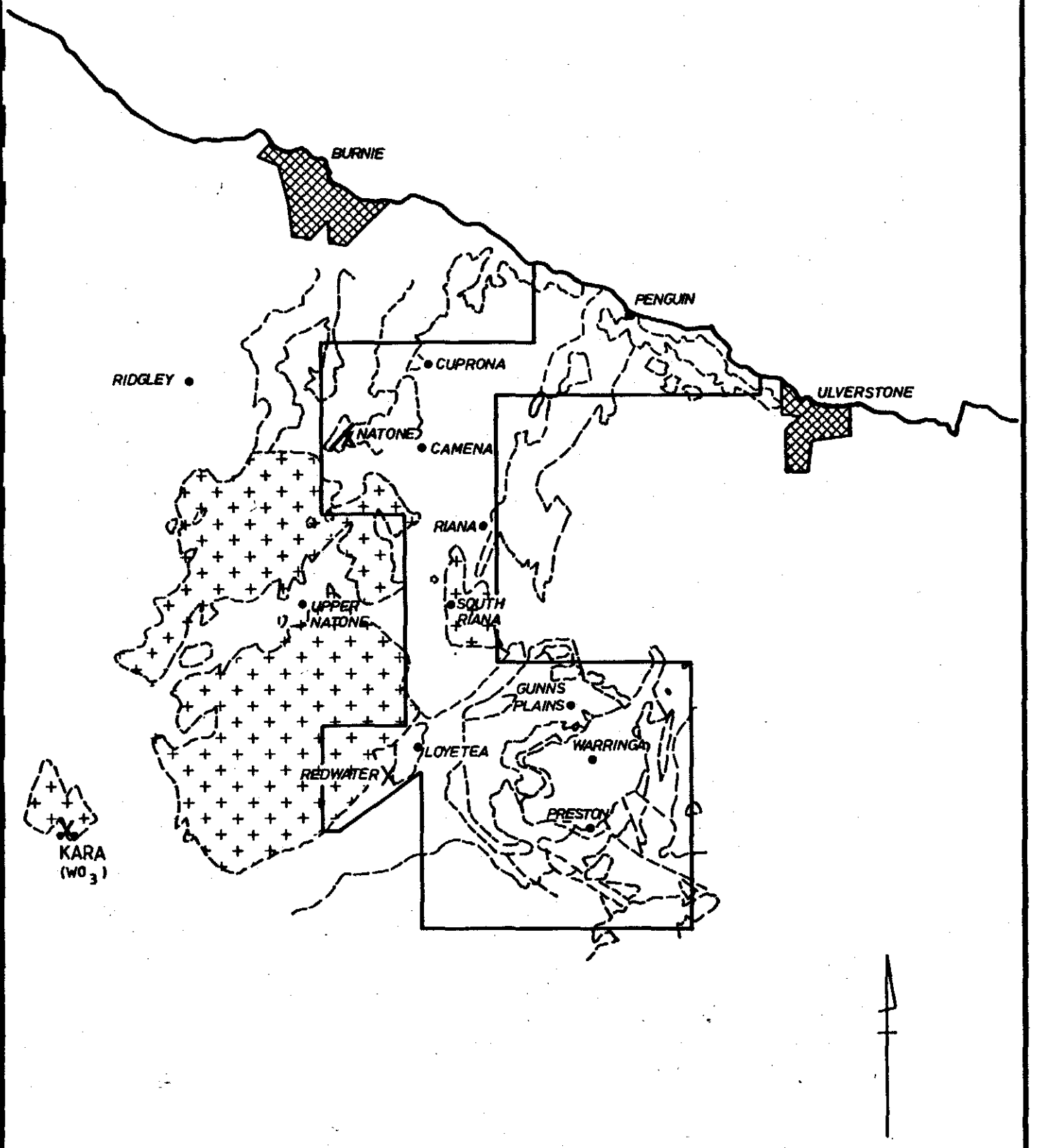
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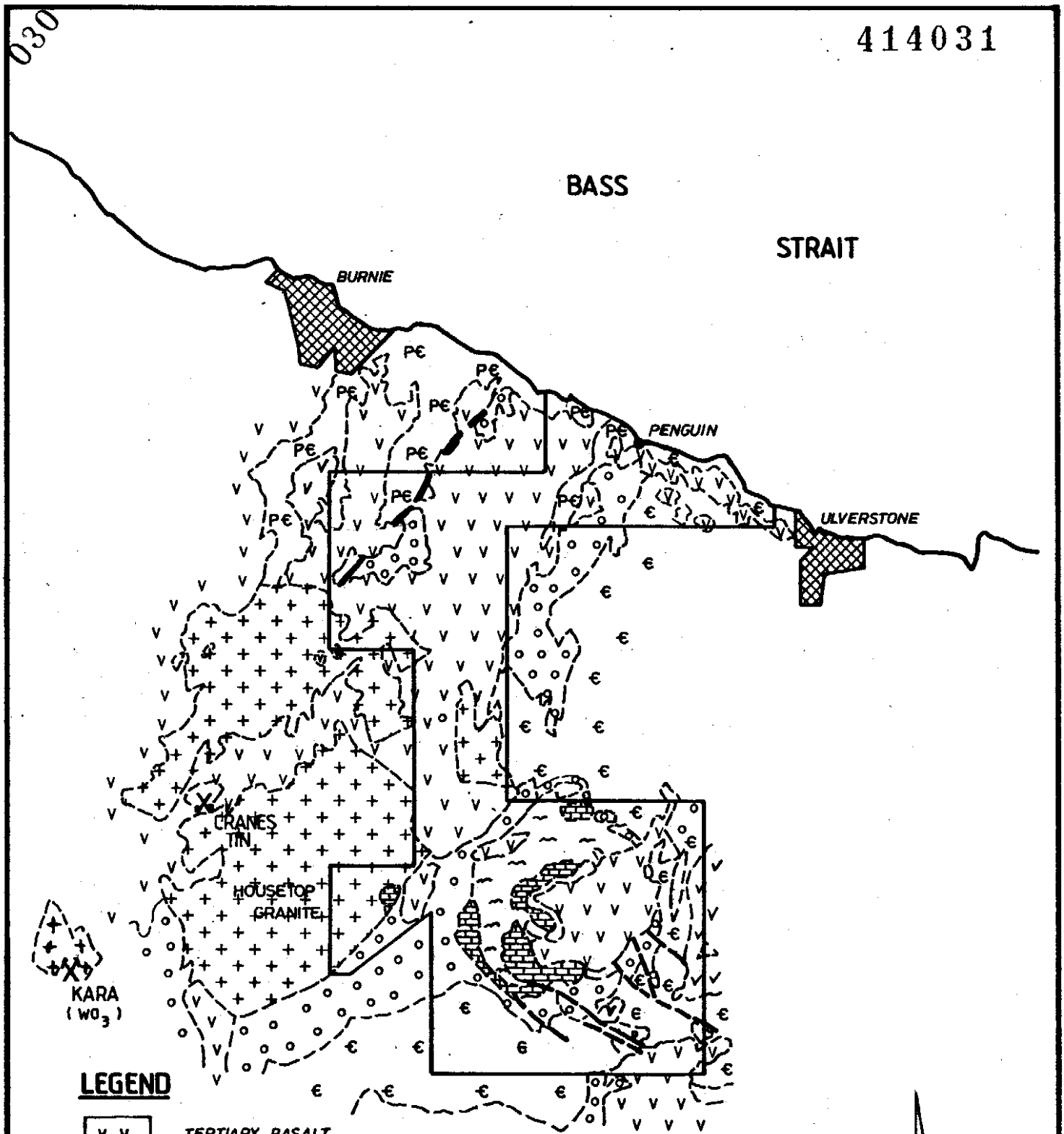
E.L. 8/77 RIANA

LOCATION PLAN

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AUTHOR P.A.R.	DRAWN J.L.L.
OFFICE D'PORT	REP.No.
DRG.No. D/M004/184	FIG.No. 1

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LEGEND

- V V — TERTIARY BASALT
- ALLUVIUM
- + + — HOUSETOP GRANITE
- GORDON LIMESTONE
- ORDOVICIAN SANDSTONE CONGLOMERATE
- ϵ — CAMBRIAN
- OONAH FORMATION
- Pϵ — PRECAMBRIAN

5 cm

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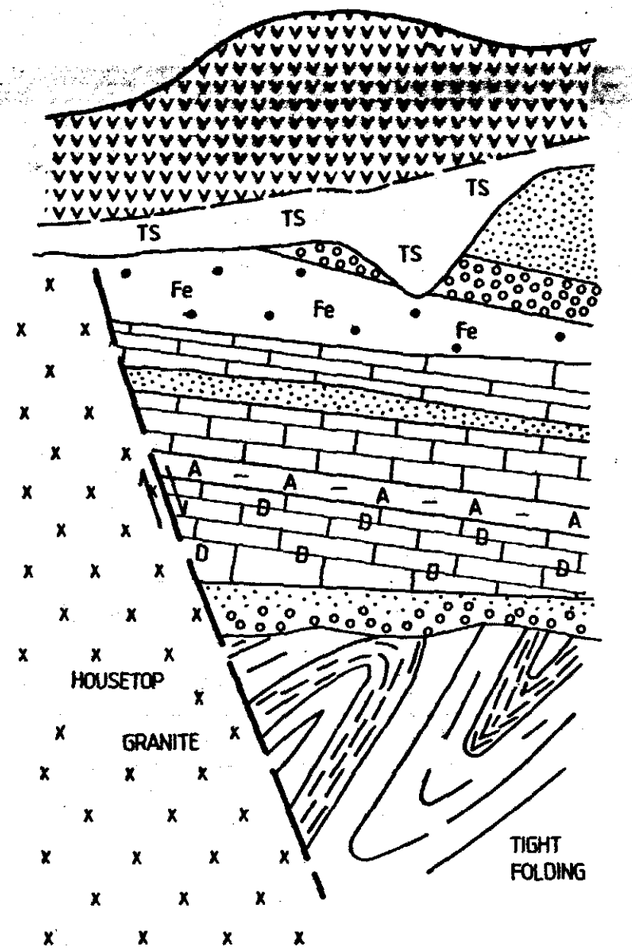
E.L. 8/77 RIANA
GEOLOGY

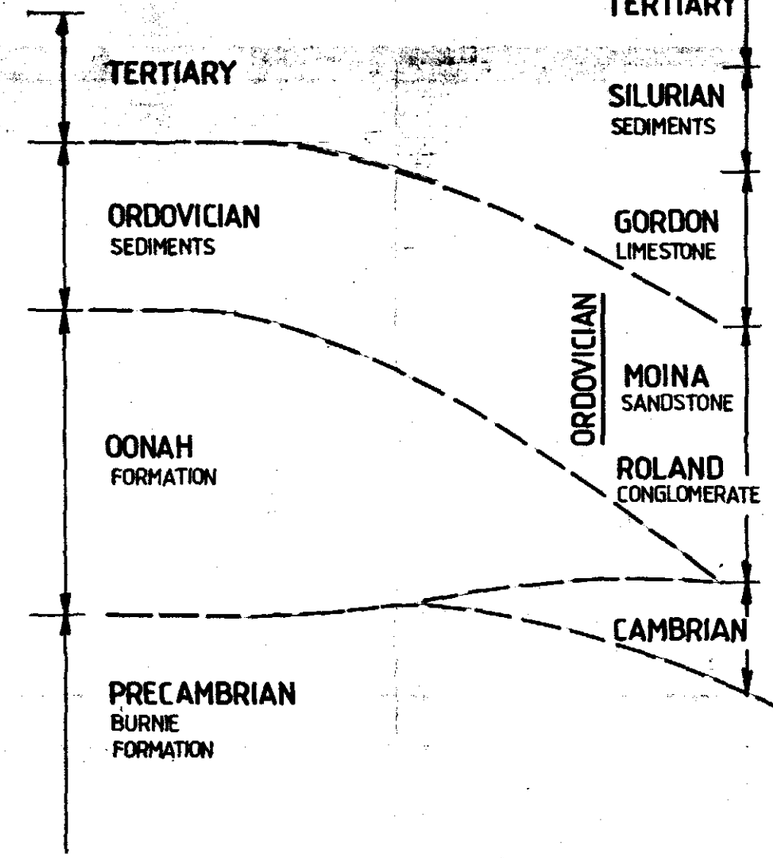
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AUTHOR P.A.R.	DRAWN J.L.L.
OFFICE D'PORT	REP.No.
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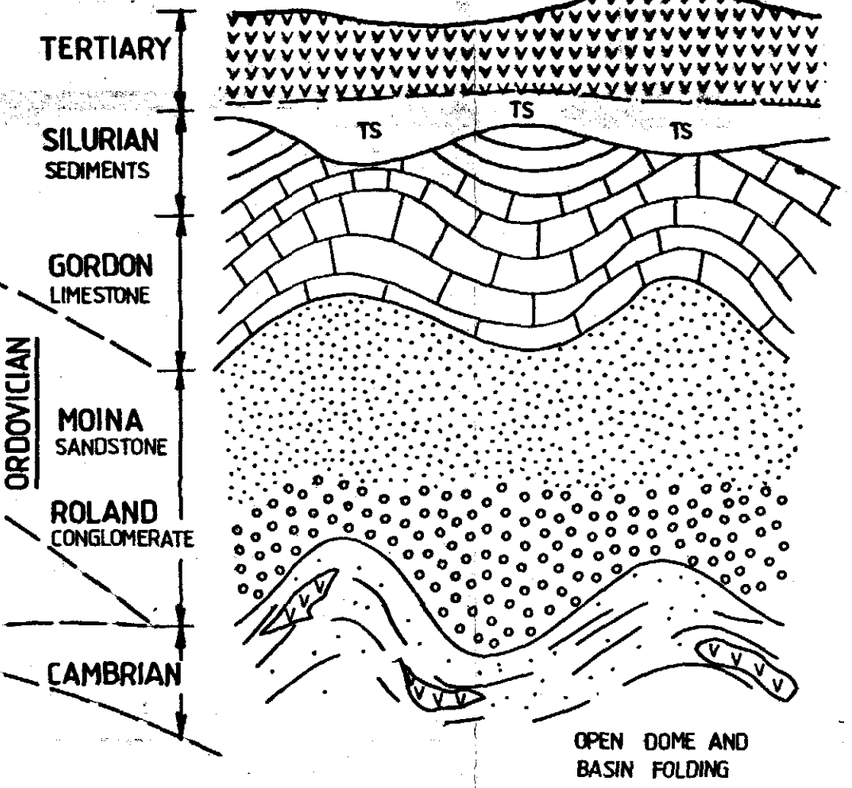
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NATONE STRATIGRAPHY







GUNNS PLAINS STRATIGRAPHY

OPEN DOME AND
BASIN FOLDING

5 cm

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METALS DIVISION

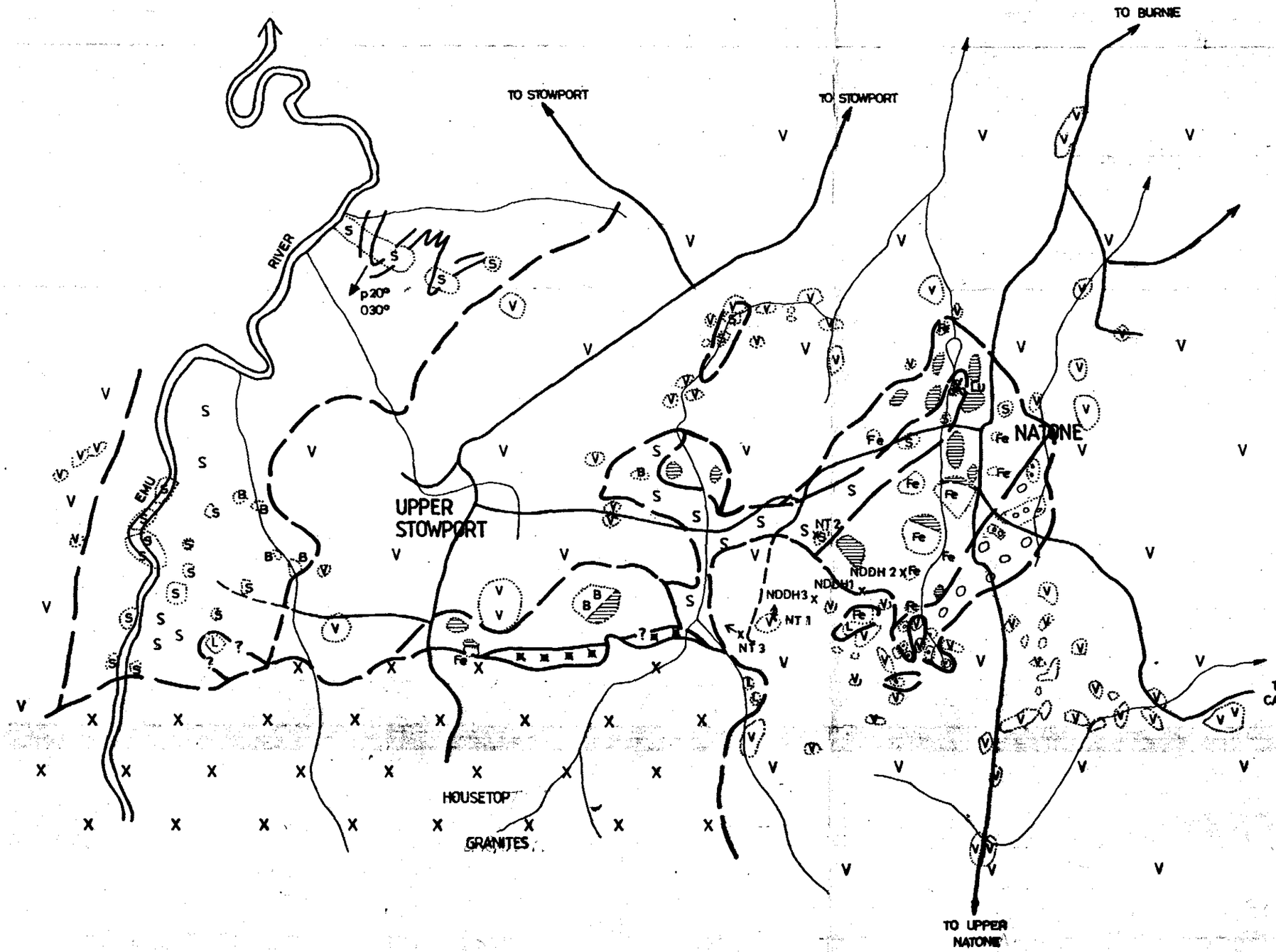
E.L. 8/77 RIANA

STRATIGRAPHY OF RIANA LICENCE

SCALE	N.T.S.	DATE	29 - 2 - 84
AUTHOR	P.A.R.	DRAWN	J.L.L.
OFFICE	D'PORT	REP.No.	
DRG.No.	D/MQ04/186	FIG.No.	3

032

414033



LEGEND

V	TERTIARY BASALT	
X X	DEVONIAN GRANITE	
o o	ORDOVICIAN CONGLOMERATE	
Fe	IRONSTONE	OONAH FORMATION (CAMBRIAN)
L	LIMESTONE / DOLOMITE	
	SILICIFIED SEDIMENT	
	SILICIFIED CONGLOMERATE	
B	VOLCANICS/INTRUSIVES	BURNIE FORMATION (PRECAMBRIAN)
S	SHALES	

Cu RUTHERFORDS COPPER PROSPECT

x NDDH 1 MINOPS DRILL HOLE

x NT1 SHELL DRILL HOLE

5 cm

TN

0 1 km

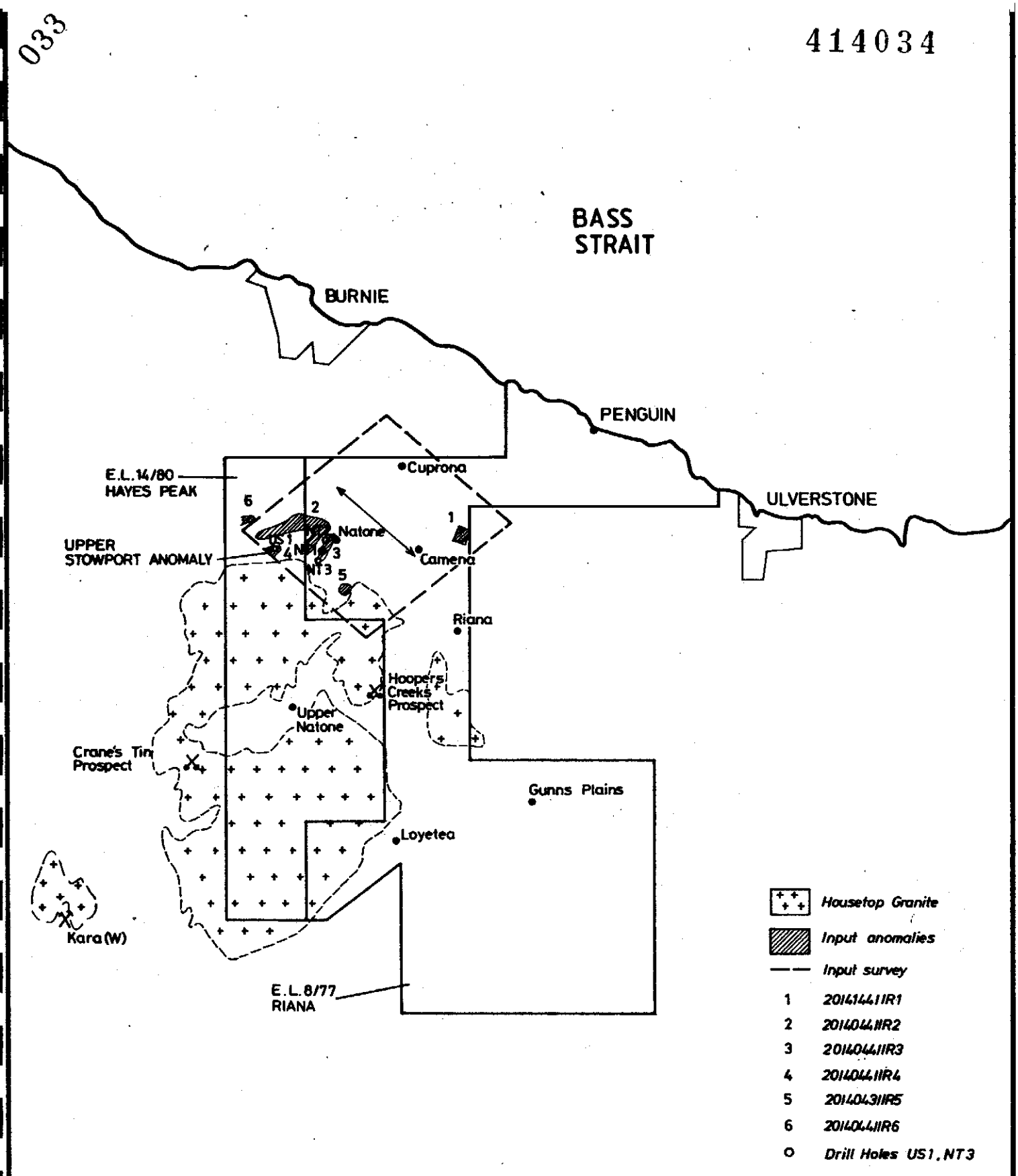
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E.L. 8/77 RIANA
NATONE / UPPER STOWPORT AREA
GEOLOGY

SCALE	1:20000	DATE	28-8-83
AUTHOR	P.A.R.	DRAWN	J.L.L.
OFFICE	DEVONPORT	REP.No.	
DRG.No.	D/MQ04/175	FIG.No.	4

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The Shell Company of Australia Limited METALS DIVISION	
E.L. 8/77 RIANA AND E.L. 14/80 HAYES PEAK INPUT SURVEY AND ANOMALIES PLUS DRILL HOLE INFORMATION	
SCALE 1: 250000	DATE 21-12-82
AUTHOR P.R.	DRAWN H.L.H.
OFFICE DEVONPORT	REP.No.
DRG.No. D/MD04/109	FIG.No. 5

TABLE 1

AIRBORNE ANOMALY LIST

PROSPECT : RIANA SURVEY : AEROMAG UPDATED 21/2/84

Anomaly Number	Line and Fiducial	Name	Location (AMG)	Description	Follow-up to Date	Modelling and Interpretation	Geology	Future Work
4042/1	6.02869 5.03485	Laurel Creek W.	409000E 5425200N	Large, narrow anomaly	Mag, geochem, Drill	Skarn (narrow)	Granite-magnetite Skarn	None
4042/2	8.01578	Laurel Creek N. (Housetop)	409500E 5427300N	- Small and Broad - Look formational	Mag, geochem, geol.		Magnetite-bearing Granite	None
4042/8			407000E 5424000N	N of Laurel Creek S.			Granite	Depends on 4042/2 - None
4042/9			408100E 5423600N	E of Laurel Creek S.			Granite	Depends on 4042/3 - None
4042/10			407500E 5429800N	W of Laurel Creek W.				None
4042/11			409000E 5424400N	Group of anomalies to S of Laurel Creek W.			Minor magnetite Skarn?	None
4042/12			407700E 5425800N	NW of Laurel Creek W.			Granite	Depends on 4042/2 - None
4042/13			408300E 5425700N	NW of Laurel Creek W.			Granite	Depends on 4042/13 - None
4042/14			409800E 5425500N	Large low to W of Peak Hill Farm	Mag.	Remanence?	Basalt?	None
4043/1	248.53365	Ellis Creek	409500E 5438200N	High amplitude 900r T		Possible basalt hill	Basalt over granite?	Ground Check-None
4043/2	243.5119	Ellis Creek N.			Recce. line?	Possible basalt hill	Basalt over granite contact	Depends on 4043/IR5-None
4142/2	21.9253	Loyettea E	412800E 5427700N		Mag., Gravity		Basalt	None
4142/3		Lowana Ck.	415400E 5429600N		Ground Check	Basalt cap?	Basalt on Θm?	None
4142/4	46.2615	Castra (Preston)	419600E 5425700N	Mag., high with elevated K	Mag, remanence	Basalt source	Basalt on Θg	None
4142/5	44.2717		418700E 5421200N	Broad mag (with good shape) + elevated K		€ volcs.	Cambrian	None
4142/6	41.6452		418000E 5421500N	Broad, weak Mag, & elevated K		€ volcs.	Cambrian	None
4142/7	36.6749		416600E 5421300N	Mag to K high - possibly topographic		€ volcs.	Cambrian	None
4142/8	34.6868		416000E 5421300N	Mag., to K high - possibly topographic		volcs.	Cambrian	None
4142/9	22.9218	Redwater North	412800E 5426500N		Ground Check		Basalt??? over Θm	None
4142/10	27.7277	Gunn's Plain	414400E 5423700N			volcs.	Cambrian Volcanics?	None
4142/11	19.938	Loyettea W.		Mag and elevated radiometrics	Mag. Geochem	volcs.	Cambrian Volcanics? on Granite contact	None
4142/12	16.9617	Peak Hill		Moderate K' for source at 60m depth				None

414035

AIRBORNE ANOMALY LIST

TABLE 1 (cont.)

PROSPECT : RIANA

SURVEY : AEROMAG

UPDATED 21/2/84

Anomaly Number	Line and Fiducial	Name	Location (AMG)	Description	Follow-up to Date	Modelling and Interpretation	Geology	Future Work
4142/13			410900E 5426800N	Northern extension of Redwater anomaly			Minor skarn?	None
4142/14			412000E 5426000N	E of Redwater			Basalt	None
4142/15			413600E 5429500N	NE of Loyet ea			Basalt over € volcs?	None
4142/16			413100E 5429800N	NE of Loyet ea			Basalt/granite	None
4143/1	33.6907		415800E 5431700N	Strong, mag., but poorly Shaped		Basalt hill	Basalt on Ord. or Cambrian?	None
4143/2	258.57115	Wattle Grove	413400E 5435700N	Strong isolated mag	mag, geochem, geol.	Basalt hill	Basalt over Granite	None
4143/3	243.51275	Stotts Rd.	412800E 5439500N	Strong mag	Ground Check mag,	Basalt hill	Basalt	None
4143/4	261.4908	S. Riana	413300E 5434900N		mag, remanence	Basalt hill	Basalt	None
4144/1	221.3069	Cuprona	412300E 5445200N	Strong mag., over large hill	Mag gravity drill	Basalt hill	Basalt and Ironstone	None
4144/2	236.4744	Camena	412100E 5441700N	V. large mag anomaly - inferred deep source	Ground Check	Possible Basalt Plug	Basalt/alluvium	None
4144/3	237.4793	Midgley Falls	415100E 5441000N	Related to topography? V. high K	Ground Check mag, remanence IP	Basalt capping	Basalt	None
4244/1	212.36765	Penguin	423500E 5447300N		Ground Check	Fe-rich seds	North margin of Penguin Ag-Pb, €. Volc.	None
4244/2	212.36800	Neptune	424500E		Ground Check	C Volcs,	West margin of Penguin Ag-Pb, €. Vocl.	None
4244/3	205.38460	Dial Pt	420600E 5449100N	300 nT	Ground Check	Basalt hill	Basalt?	None
4044/3		East Natone		Mag, high // = to E of Natone mag. (Slightly broader) - possible INPUT, but destroyed by Hz response	- Ground check (mag, VLF) - IP/max-min U/s Due to powerline	Basalt ridge?	Basalt over Om?	Access problems - None
4044/1	234.47845	Natone	408800E 5441750N	Also priority 1 INPUT 900m Taeromag	Mag., gravity, see separate report IP, SP, Max-Min, drill, SIROTEM	Magnetite/pyrrhotite skarn	Massive sulphides & black shales & ironstones beneath basalt	No further or
4044/2		Upper Stowport						

AIRBORNE ANOMALY LIST

TABLE 2

PROSPECT . RIANA

SURVEY : INPUT

UPDATED 21/2/84

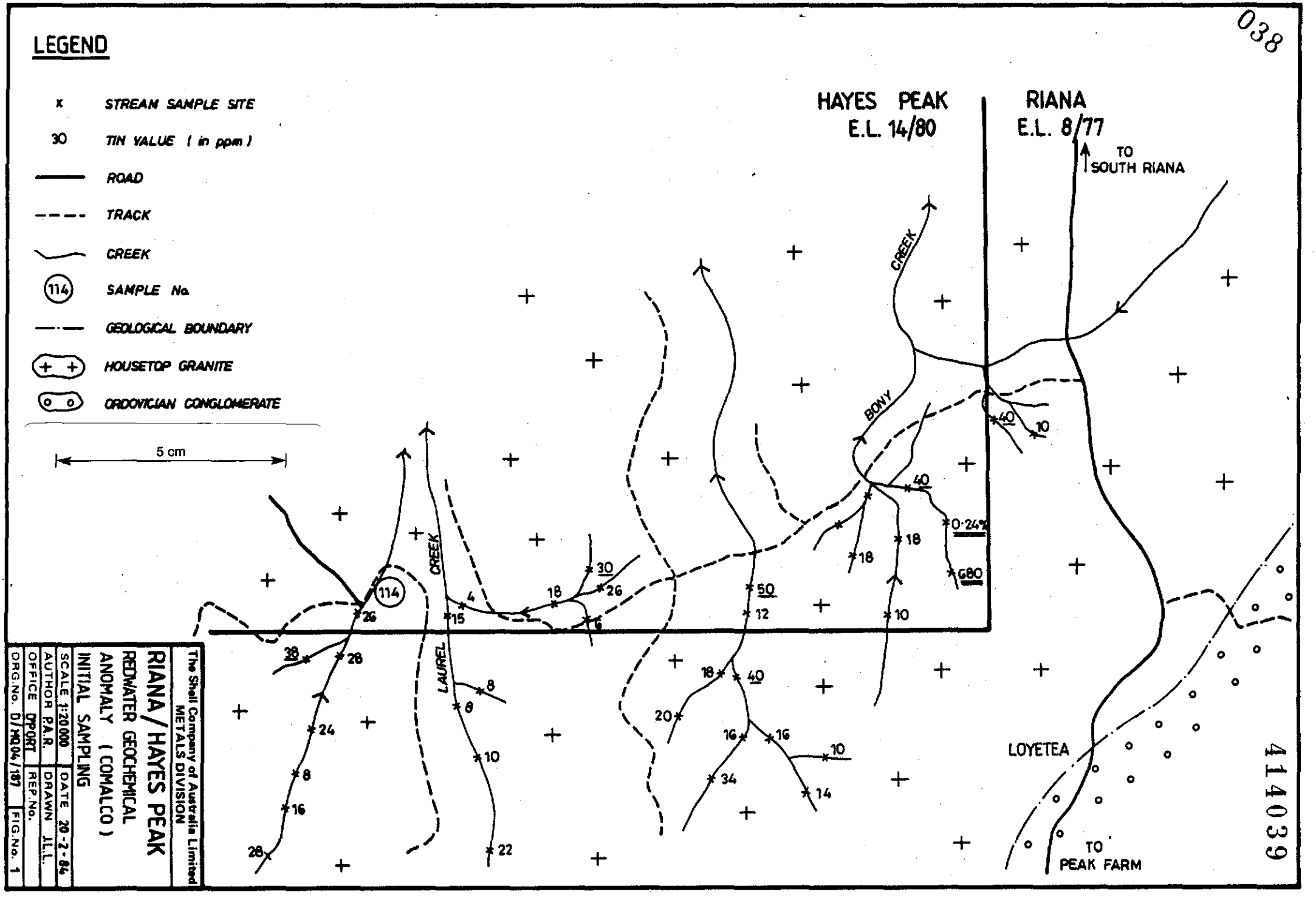
Anomaly Number	Line and Fiducial	Name	Location (AMG)	Description	Follow-up to Date	Modelling and Interpretation	Geology	Future Work
4144/IR1	1251.38141 - 1221?		415400E 5442900N	- 6 Channel response in conductive surficial zone - Priority 3	Ground Check Mag, IP	Basalt hash (conductive clays)	- Near gravity low GL 11 Basalt over θ	None
4044/IR3	1101.58443 -1061.57055	Natone	408800E 5441800N	- Priority 1 INPUT and mag.	Max-min, mag., IP, gravity, SP, VLF, drilling	Magnetite/pyrrhotite skarn (NT-1,2,3)	Massive Sulphides & Carbonaceous Shales	None
4043/IR5	1042.35424		409800E 5439800N	- Priority 3 INPUT - probably cultural mag correl	Ground Check	Cultural? & Topo high?	Basalt on Granite?	None
4044/IR7				- Sth of Natone		Clay band?	Basalt over granite	None
4144/IR8						As for IR5	Basalt over θm?	None
4144/IR9						Basalt	Basalt over θm?	None
4144/IR10							Basalt over θg?	Depends on 4144/
4144/IR11		Midgley Falls		See 4144/3	Mag, IP, Remanence	Magmod. Basalt capping	Basalt over θg?	None
4144/IR12						Basalt	Basalt over θ	None
4144/IR13						Basalt	Basalt over θm?	None
4144/IR14						Basalt	Basalt over θm?	None
4144/IR15						Basalt	Basalt over θm?	None

037

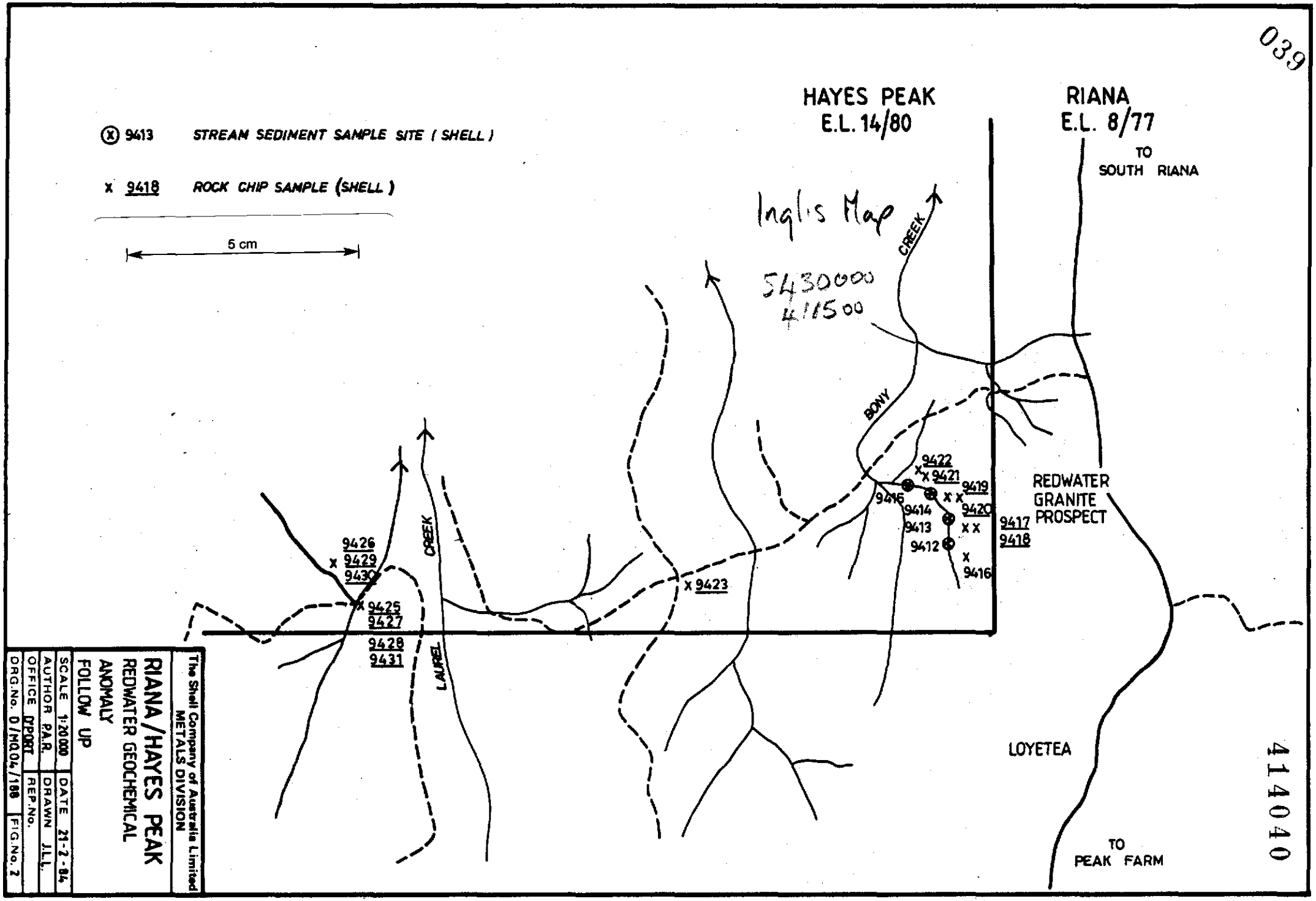
APPENDIX 1

REDWATER AREA

Stream Sediment Follow-up - Geochemistry



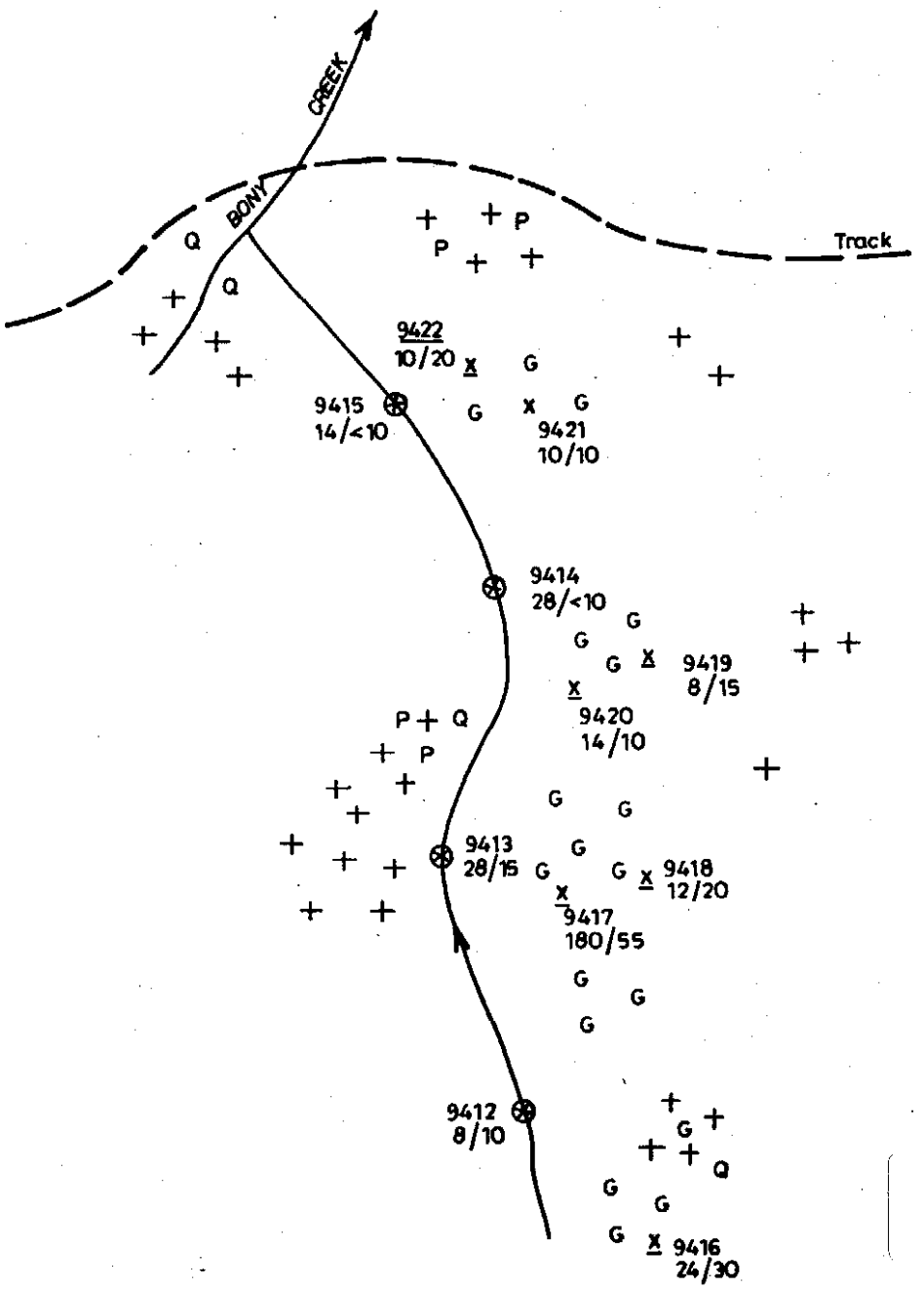
The Shell Company of Australia Limited METALS DIVISION	
RIANA/HAYES PEAK	
REDWATER GEOCHEMICAL ANOMALY (COMALCO)	
INITIAL SAMPLING	
SCALE 1:20 000	DATE 20-2-84
AUTHOR P.A.R.	DRAWN J.L.L.
OFFICE DPORT	REP.No.
DRG.No. D/MQ94/187	FIG.No. 1



The Shell Company of Australia Limited METALS DIVISION	
RIANA/HAYES PEAK REDWATER GEOCHEMICAL ANOMALY FOLLOW UP	
SCALE 1:20000	DATE 21-2-84
AUTHOR P.A.R.	DRAWN J.L.L.
OFFICE PERTH	REP.No.
DRG.No. 01/MQ04/188	FIG.No. 2

040

414041



LEGEND

⊗	STREAM SAMPLES
X	ROCK SAMPLES
20/150	ppm. Sn / ppm WO_3
9415	SAMPLE NUMBER
+	MEDIUM GRAINED EQUIGRANULAR BIOTITE GRANITE
P	FINE GRAINED PORPHYRITIC GRANITE
G	GREISENIZED GRANITE
Q	QUARTZ VEIN/GREISEN

5 cm

0 100 m

SWAMPY AREA
Possible alluvial buildup

The Shell Company of Australia Limited
METALS DIVISION

RIANA / HAYES PEAK

REDWATER GRANITE PROSPECT
GEOLOGY/GEOCHEMISTRY

SCALE AS SHOWN	DATE 21-2-84
AUTHOR P.A.R.	DRAWN J.L.L.
OFFICE D'PORT	REP.No.
DRG.No. D/MQ04/189	FIG.No. 3

041

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ANALYTICAL REPORT

414042

JOB COM831810 O/N : 4187/MQ04/PAR/99

Results in ppm

SAMPLE	Sn	WO3	Mo	Bi	As
9401 rock	<4	115	10	<4	5
9402	<4	65	6	<4	4
9403	6	65	6	<4	3
9404	<4	45	4	4	2
9405 s/s	4	20	6	<4	3
9406 rock	10	30	4	<4	3
9407 rock	14	10	4	<4	2
9408 rock	1000	<10	14	<4	<2
9409	18	25	4	4	8
9410	1450	<10	4	8	46
9411	16	45	4	<4	8
9412 s/s	8	10	<4	4	<2
9413	28	15	<4	<4	<2
9414	28	<10	<4	<4	<2
9415	14	<10	<4	6	<2
9416 rock	24	30	<4	6	<2
9417	180	55	<4	<4	<2
9418	12	20	<4	<4	<2
9419	14	10	<4	<4	2
9420	8	15	4	6	2
9421	10	10	<4	<4	2
9422	10	20	<4	<4	<2
9423	34	40	<4	<4	<2
9424 rock	10	15	<4	<4	<2
9425	55	25	<4	<4	<2

Housetop prospect

Redwater area 114 site.

TM pit / eastern NNE of Housetop anomaly

Redwater Granite prospect.

114 sample site

s/s stream sediment sample.

.../ 2

042

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ANALYTICAL REPORT

414043

JOB COM831810 O/N : 4187/MQ04/PAR/99

Results in ppm

SAMPLE	Sn	WO3	Mo	Bi	As
9426	30	70	4	10	<2
9427	14	10	<4	<4	<2
9428	44	35	10	4	<2
9429	32	30	<4	6	<2
9430	16	<10	<4	10	7
9431	12	20	<4	6	<2
9432	8	25	<4	6	2
9433	<4	10	<4	6	2
9434	<4	10	4	<4	18
9435	4	15	4	<4	28
9436	4	15	<4	<4	16
9437	6	15	6	6	16

Method of Analysis : XRF1

114 single site ledwater area

9426 wk

Wattle Grove Ratone granite

043

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414044

ANALYTICAL REPORT

JOB COM831810 O/N : 4187/MQ04/PAR/99

Results in ppm

SAMPLE	Cu	Pb	Zn	Ag	Au
9401	10	6	10	<1	<0.05
9402	16	10	16	<1	<0.05
9403	8	10	14	<1	<0.05
9404	22	14	20	<1	<0.05
9405	12	10	14	<1	<0.05
9406	16	12	20	<1	<0.05
9407	6	8	8	<1	<0.05
9408	14	8	12	<1	<0.05
9409	8	4	6	<1	<0.05
9410	16	12	14	<1	<0.05
9411	10	6	6	<1	<0.05
9412	8	<4	6	<1	<0.05
9413	10	6	8	<1	<0.05
9414	8	4	6	<1	<0.05
9415	6	<4	6	<1	<0.05
9416	12	6	10	<1	<0.05
9417	6	6	10	<1	<0.05
9418	12	6	12	<1	<0.05
9419	8	6	18	<1	<0.05
9420	10	10	12	<1	<0.05
9421	6	8	28	<1	<0.05
9422	8	8	14	<1	<0.05
9423	8	8	10	<1	<0.05
9424	8	100	10	<1	<0.05
9425	10	170	260	<1	

044

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414045

ANALYTICAL REPORT

JOB COM831810 O/N : 4187/MQ04/PAR/99

Results in ppm

SAMPLE	Cu	Pb	Zn	Ag	Au
9426	10	190	330	<1	<0.05
9427	6	28	50	<1	<0.05
9428	12	690	560	2	<0.05
9429	22	350	220	2	<0.05
9430	8	250	170	1	<0.05
9431	18	14	16	<1	<0.05
9432	8	10	12	<1	<0.05
9433	10	12	14	<1	<0.05
9434	10	6	8	<1	<0.05
9435	12	6	6	<1	<0.05
9436	10	6	8	<1	<0.05
9437	10	10	8	<1	<0.05

Method of Analysis : Cu Pb Zn : AAS1
Ag : AAS3
Au : AAS5A

045

414046

APPENDIX 2

Stream Sediment Follow-up

a) Loyetea Peak (Pb-Zn) Anomaly

b) Tungsten Anomalous Zone Anomaly (WO_3) (N-S Loyetea)

by

W.D. Smyth

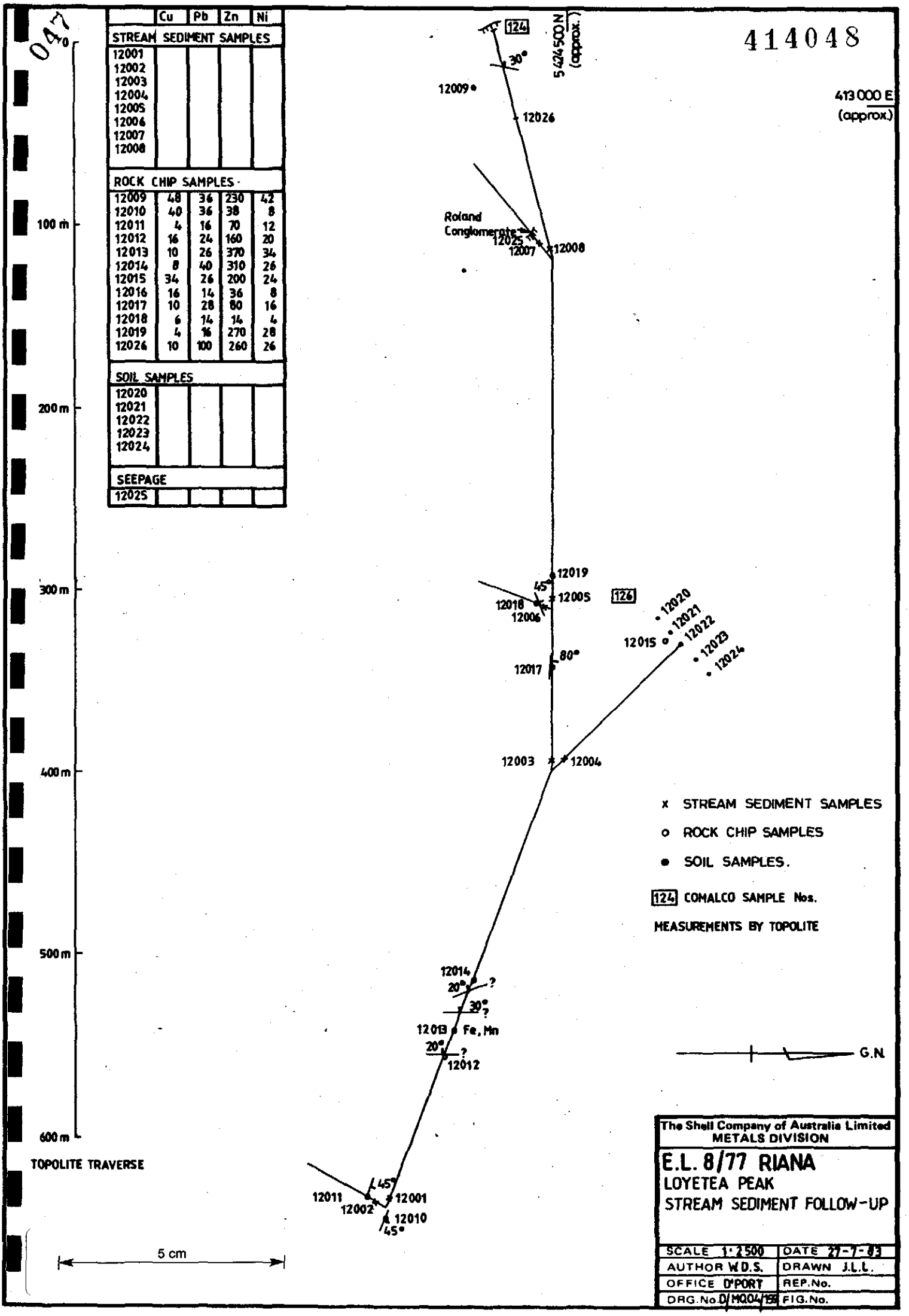
LOYETEA PEAK & TUNGSTEN ANOMALOUS ZONE

Follow-up

Plan No.	Title	Scale
D/MZ 01/314	Cadastral Sheet 4142 - Geology	1:20,000
D/MZ 01/311	Cadastral Sheet 4142 - Stream Sediment Survey : Sample Locations & Analysis	1:20,000
D/MZ 01/310	Cadastral Sheet 4142 - Rock Chip Sampling Sample Locations & Analysis	1:20,000
D/MZ 01/312	Cadastral Sheet 4141 - Stream Sediment Survey : Sample Locations & Analysis	1:20,000

414048

	Cu	Pb	Zn	Ni
STREAM SEDIMENT SAMPLES				
12001				
12002				
12003				
12004				
12005				
12006				
12007				
12008				
ROCK CHIP SAMPLES				
12009	48	36	230	42
12010	40	36	38	8
12011	4	16	70	12
12012	16	24	160	20
12013	10	26	370	34
12014	8	40	310	26
12015	34	26	200	24
12016	16	14	36	8
12017	10	28	80	16
12018	6	14	14	4
12019	4	16	270	28
12026	10	100	260	26
SOIL SAMPLES				
12020				
12021				
12022				
12023				
12024				
SEEPAGE				
12025				



The Shell Company of Australia Limited
METALS DIVISION

E.L. 8/77 RIANA
LOYETEA PEAK
STREAM SEDIMENT FOLLOW-UP

SCALE 1:2,500	DATE 27-7-83
AUTHOR W.D.S.	DRAWN J.L.L.
OFFICE D'PORT	REP.No.
DRG.No.D/MQ04/158	FIG.No.

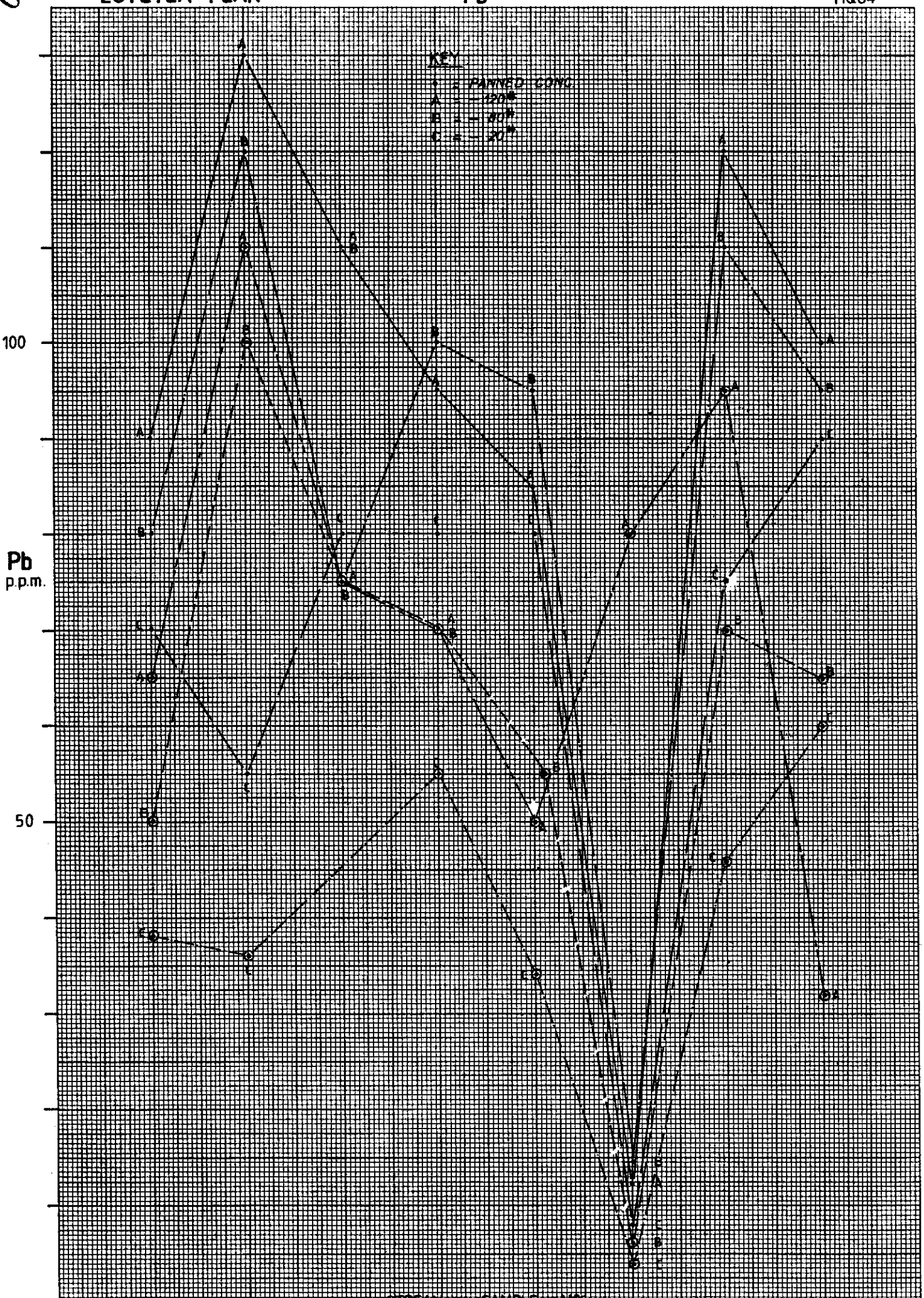
048

414049

LOYETEA PEAK

Pb

MQ04



AARQUE A4 1mm.
12001

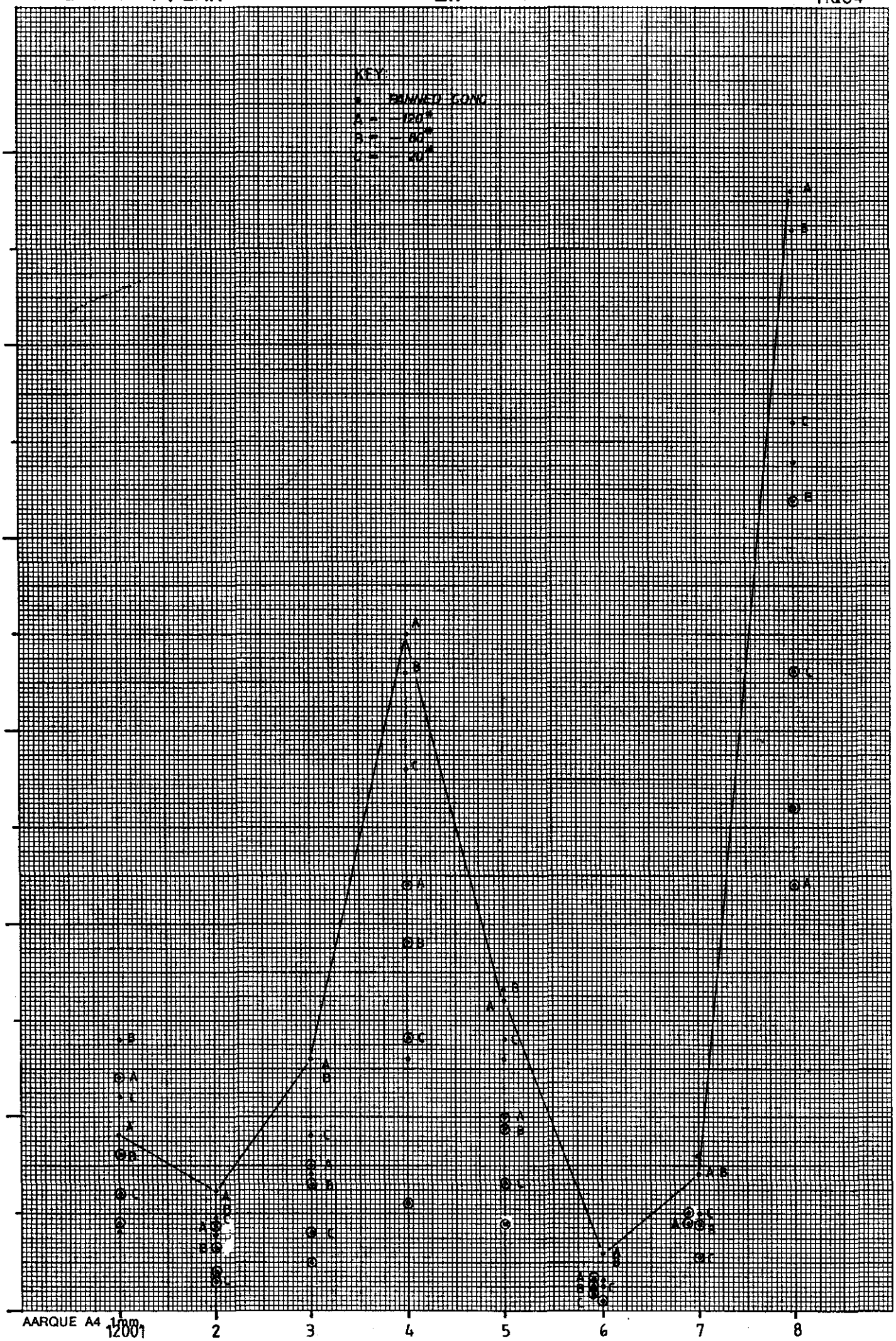
049

LOYETEA PEAK

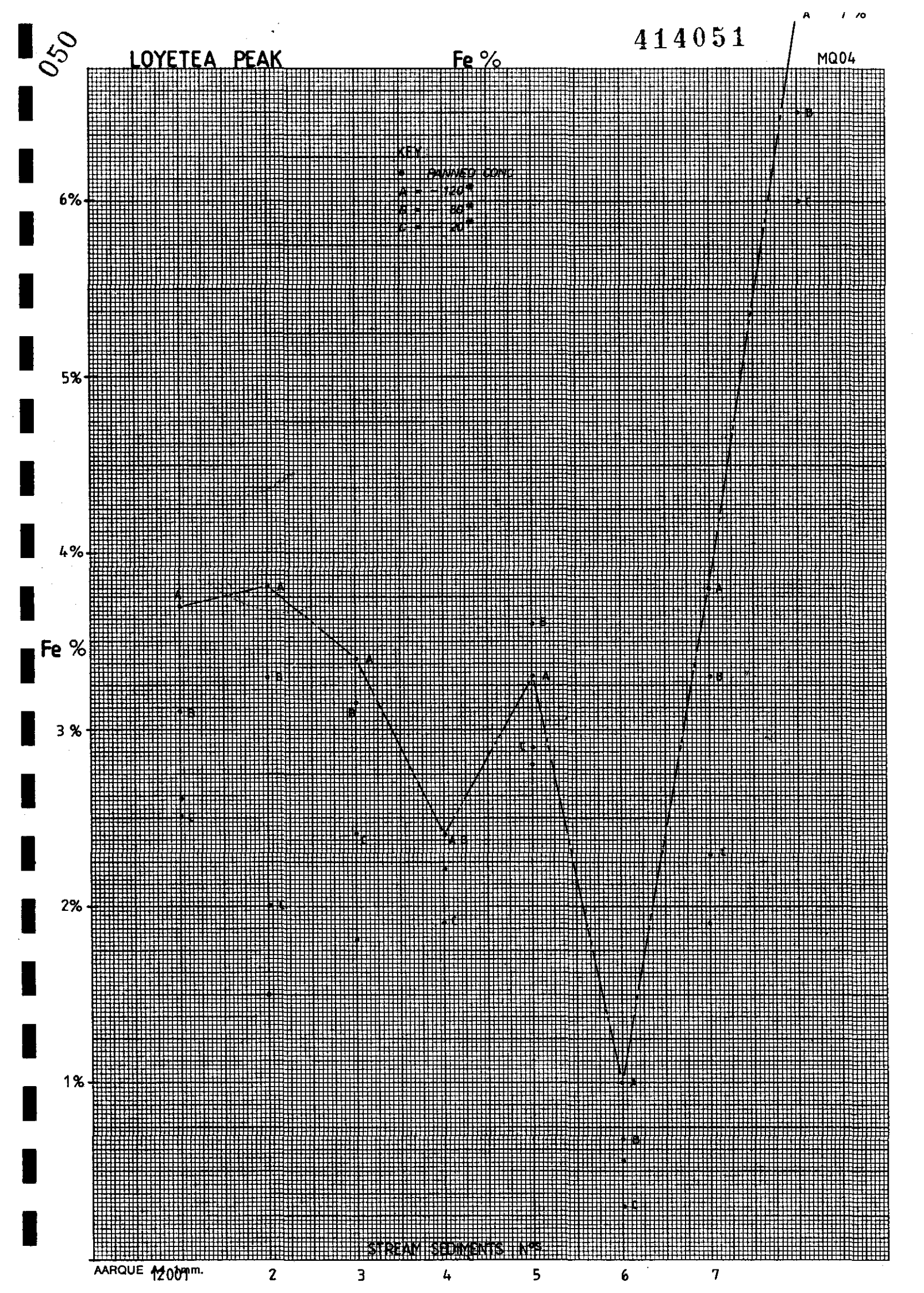
Zn

414050

MQ04



AARQUE A4 1mm 12001


050
LOYETEA PEAK
Fe %
414051
MQ04
KEY
* PANNED CONC
A = -120*
B = -80*
C = -20*
6%
5%
4%
3 %
2%
1%
Fe %
STREAM SEDIMENTS N°S
AARQUE 1:12001
2
3
4
5
6
7

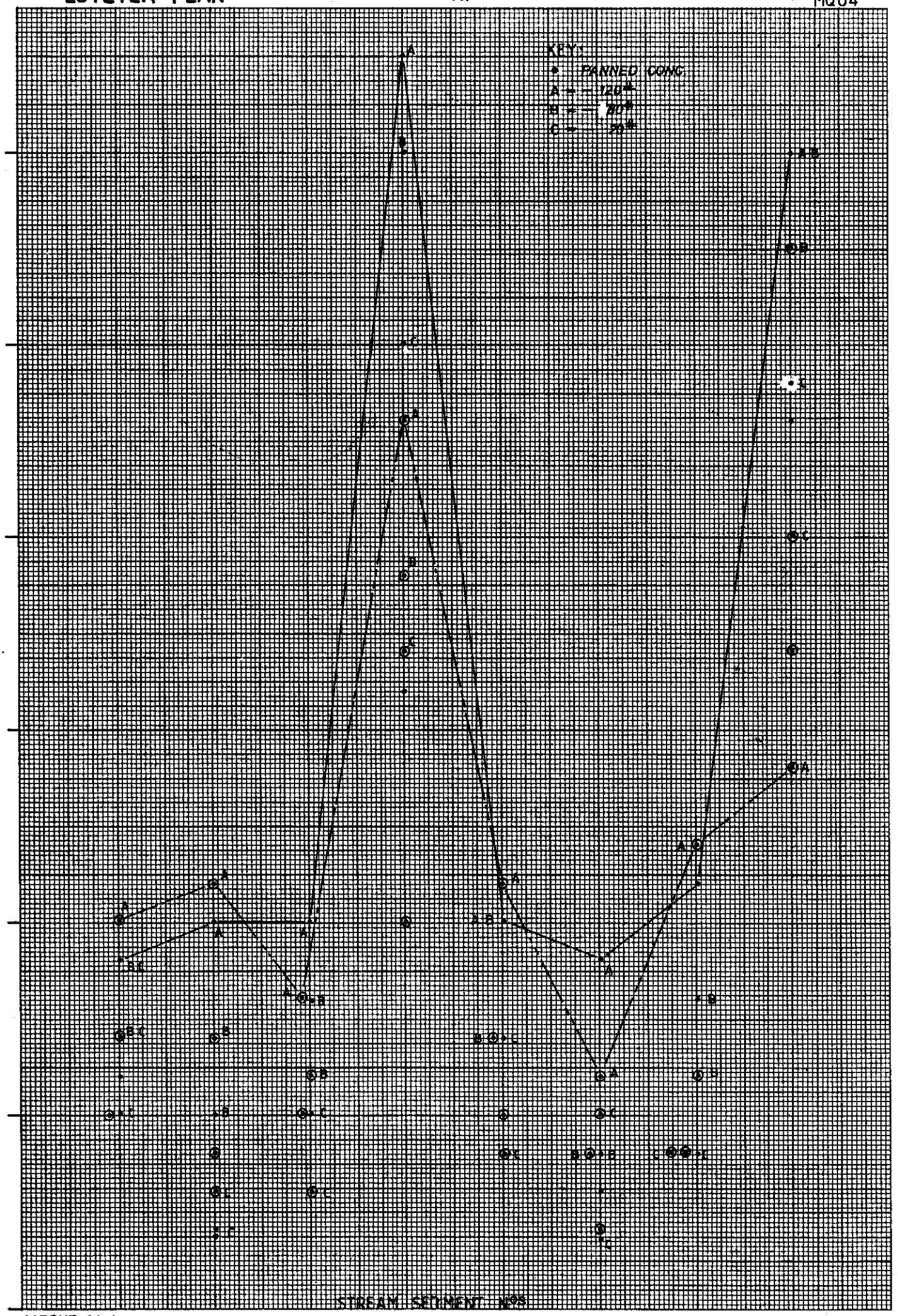
051

414052

LOYETEA PEAK

Ni

MQ04



AARQUE 44 1mm.

12001

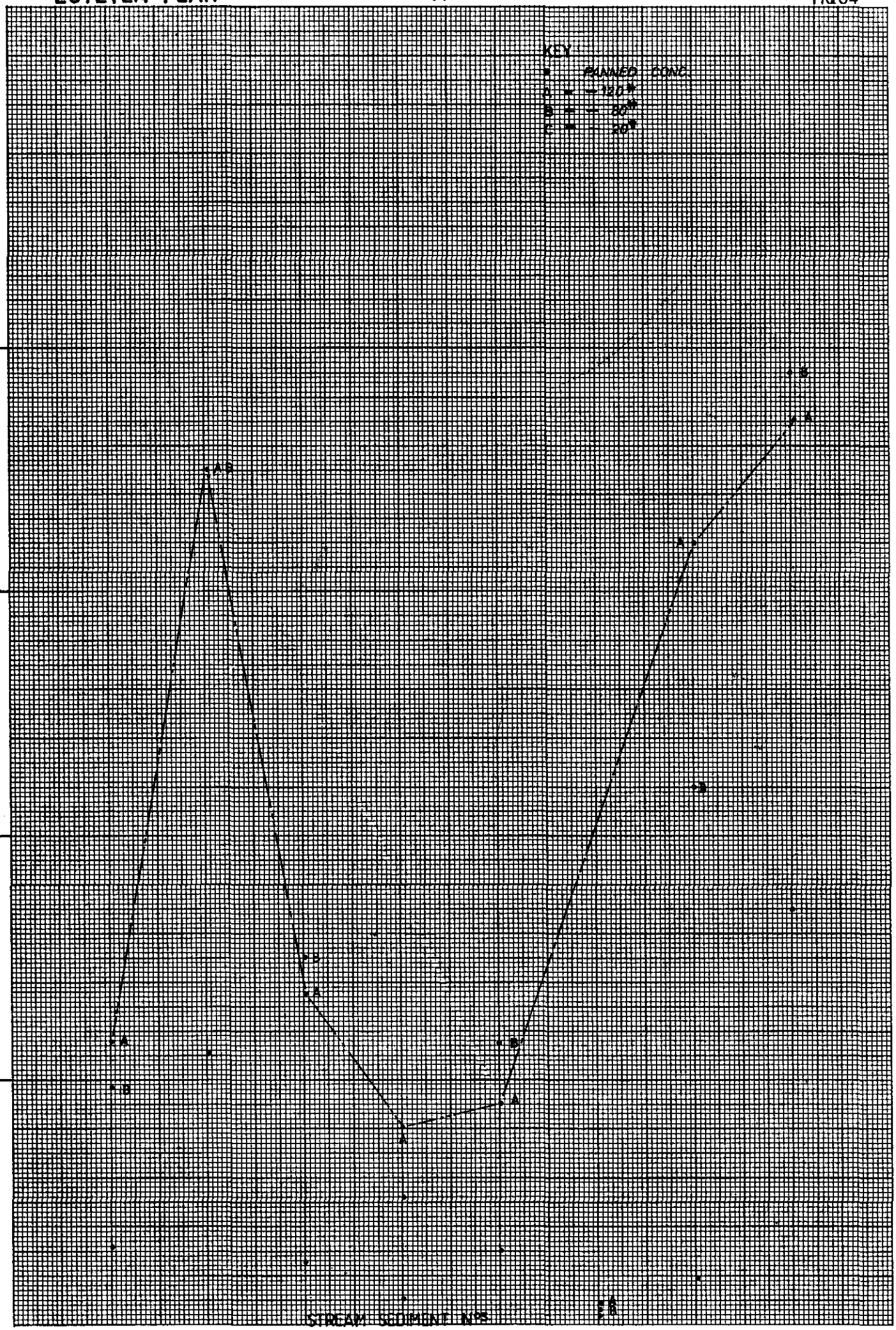
052

LOYETEA PEAK

Mn

414053

MQ04



AARQUE AA 1mm.

053

414054

Central Mineralogical Services

39 Beulah Road
Norwood, S.A. 5067
Telephone 42 5659

Mr. W.D. Smyth
Exploration Geologist
The Shell Co. of Aust. Ltd.
Metals Division
P.O. Box 860
DEVONPORT / TAS. 7310

31st January, 1984

REPORT CMS 84/1/3

YOUR REFERENCE:	Sample Despatch No. 4471/MQ04/WDS/225
DATE RECEIVED:	3rd January, 1984
SAMPLE NOS.:	6 Samples
SUBMITTED BY:	W.D. Smyth
WORK REQUESTED:	Petrology

for

H.W. Fander, M. Sc.

054

414055

REPORT CMS 84/1/3

Six rock samples were received for identification and petrological description. Representative thin-sections were prepared and examined together with their respective cobaltinitrite-stained offcuts. Brief tabulated petrological descriptions are attached. These incorporate data from oblique incident and transmitted light microscopy and include interpretative comments.

D. Cowan, B. Sc.

Sample No.	Classification - Composition	Fabric	Accessories	Comments
12028 (T.S. 48574)	Felsitic Rhyolite. Disseminated quartz, sericitised feldspar, minor sericitised biotite phenocrysts, sporadic quartz-sericite amygdales in an extensively sericitised felsitic quartzofeldspathic groundmass.	Evenly disseminated phenocrysts, amygdales, homogeneous felsitic (devitrified) groundmass.	Leucoxenised opaques. Minor relics of microspherulitic K-feldspar in groundmass.	Devitrified, extensively sericitised/ partly silicified rhyolitic pitch-stone. Conceivably chilled minor intrusive, dependant on field evidence.
12551	Porphyritic Basalt. Thinly disseminated saussurite-stained/albitised plagioclase phenocrysts in a groundmass of similarly altered feldspar laths, interstitial chlorite-carbonate-pseudomorphed pyroxene; pervasive quartz mesostasis.	Weakly porphyritic "basaltic" trend, medium-grained, sub-ophitic ("doleritic").	Conspicuous fine opaques/leucoxenic semi-opaques. Traces K-feldspar, apatite.	Tholeitic characteristics. The fabric is consistent with a marginal or minor intrusive, but dependant on field relationships. Deuteric style of alteration.
12552	"Albitite". Frequent incipiently chlorite-sericite-stained albite phenocrysts in a groundmass of semi-felted albite microlaths with a chloritic mesostasis. Sparse quartz-chlorite-sericite amygdales.	Strongly porphyritic, weakly cognate xeno-lithic, weakly stressed.	Primary magnetite. Sporadic weakly stressed quartz vein-lets with traces apatite, albite, ferruginised carbonate.	Porphyritic sodic microsyenite; minor intrusive, alkali differentiate of obscure affinities. Mildly chlorite-sericite-quartz-altered, quartz-veined, mildly stressed.
12553	Porphyritic Microsyenite. Disseminated weakly sericite-stained albite phenocrysts/pheno-crystal clusters in a groundmass of weakly felted albite and K-feldspar laths with a felsic mesostasis, disseminated quartz micro-amygdales.	Weakly glomero-porphyritic, homogeneous, medium-grained groundmass.	Fine to ultrafine leucoxenic Ti-magnetite.	Sodi-potassic microsyenite with differentiated basic-intermediate textural characteristics. Only incipiently altered; unstressed.
12554	Altered Tuff. Albitised/carbonate-stained plagioclase crystals/crystal fragments, chlorite-carbonate-altered lithic (lava) clasts in a sericite-chlorite-carbonate-stained microcrystalline feldspathic matrix.	Poorly sorted, weakly flow-structured psammitic to lapilli grade fragmental, vaguely shardy matrix, weakly sheared.	Oxidised/leucoxenised opaques, disseminated chloritised ferromag crystal fragments (?amphibole).	Compositional, textural detail obscured by alteration, shearing. Basic-intermediate ("andesitic") characteristics; relict fabric consistent with subaerial mode of deposition.
12556 (T.S. 48579)	Volcanomict Lithic Sandstone. Framework of subangular to subround quartz grains, clasts of metaquartzite "grading" into metapelite, impure (argillaceous) chert, minor silicified felsitic rhyolite. Matrix of sericite and fine to microcrystalline quartz.	Poorly to moderately sorted (fine to medium) sandy clastic. Essentially massive (unbedded). Stressed.	Conspicuous detrital leucoxenic semi-opaques, minor zircons, rare apatite, schorl.	Weakly acid-volcanomict lithic sandstone; devoid of primary pyroclastic features. Bulk of clasts are low-grade metasediment-derived, including carbonaceous shale.

414056

056

414057

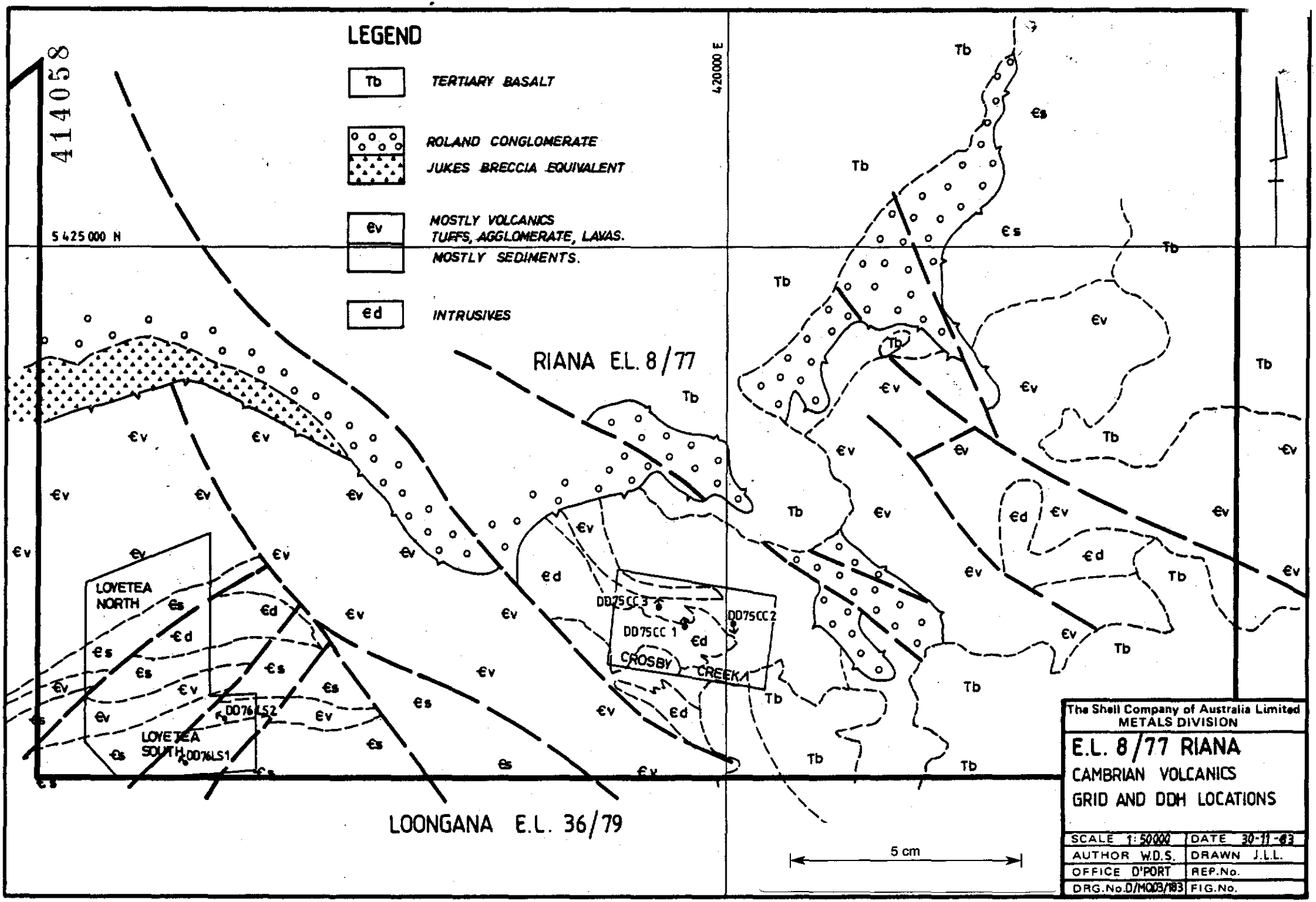
APPENDIX 2b

RIANA LICENCE

Cambrian Volcanics Synopsis

by

W.D. Smyth


LEGEND
Tb
TERTIARY BASALT
ROLAND CONGLOMERATE
JUKES BRECCIA EQUIVALENT
€v
MOSTLY VOLCANICS
TUFFS, AGGLOMERATE, LAVAS.
MOSTLY SEDIMENTS.
€d
INTRUSIVES
414058
5 425 000 N
420000 E
RIANA E.L. 8/77
LOONGANA E.L. 36/79
LOYETEA NORTH
LOYETEA SOUTH
DD76LS2
DD76LS1
DD75CC3
DD75CC1
DD75CC2
CROSBY CREEK
5 cm
The Shell Company of Australia Limited
METALS DIVISION
E.L. 8/77 RIANA
CAMBRIAN VOLCANICS
GRID AND DDH LOCATIONS
SCALE 1:50000
DATE 30-11-83
AUTHOR W.D.S.
DRAWN J.L.L.
OFFICE D'PORT
REP.No.
DRG.No.D/MQ03/183
FIG.No.

057

058

1.5 RIANA E.L. 8/77

1.5.1 Crosby Creek

The Crosby Creek area was located by CRAE by a stream sediment survey.

The stratigraphic column consists of interbedded tuffs, tuffaceous shales and lesser tuffaceous sandstones overlain by altered acid pyroclastics consisting of agglomeratic ashflow tuff vitric tuffs and crystal tuffs. These are intruded by a rhyodacite and a porphyritic microdiorite which occupies most of the gridded area.

A grid covering an area of 2.1 km x 1 km was established and soil samples taken at 100m x 20m intervals. One anomaly of > 400 ppm Pb extended over 1.5 km. Other smaller anomalies were also located.

A self potential survey was done over several lines. No definite anomalies were detected. A magnetic survey was done which was useful in lithological mapping. Several lines of IP were done using a dipole-dipole electrode array with 25m and 50m separation. No pronounced definite anomalies were detected.

Gradient array IP was done over several of the lines.

Three diamond drill holes were completed. DD 75 CC1 was drilled to test a geochemical and minor IP target. Diorite was intersected from 0 - 111m and from 111m to EOH at 293m was mainly fine grained tuffaceous shales. Minor pyrite, sphalerite and traces of galena and chalcopyrite were noted from 115.5 - 119.5m (best 0.31% Pb, 1.16% Zn, 0.026% Cu, 3 ppm Ag over 1.2m).

DD 75 CC2 was drilled to test a geochemical anomaly. This intersected fine grained tuffs and tuffaceous shales from 0 - 33.6m then into diorite to EOH at 199.7m Minor pyrite, sphalerite, galena and chalcopyrite was intersected from 25.9 - 32.6m (best 0.195% Pb, 0.42% Zn, 0.240% Cu, 3 ppm Ag over 2.4m).

DD 75 CC3 was drilled into a geochemical and low order IP target. Diorite was intersected from 0 - 70.3m and fine grained tuffs and tuffaceous shales to EOH at 142.12m. Traces of pyrite, sphalerite, galena and chalcopyrite were reported from 72.9 - 74.5m

The soil geochemical anomalies appear to flank the diorite intrusive (as mapped from soil sample chips) and mineralization intersected by the drill holes is located immediately adjacent to the diorite contact.

It is thought the soil anomaly and mineralization is related to the diorite intrusion by remobilization of minor amounts of base metals in the fine grained sediment. The area is of no further interest.

1.5.2 Loyetea South

The Loyetea South area was located by CRAE by a stream sediment survey.

The gridded area of approximately 1.5 km x 800m contains mainly tuffaceous shales, shale, fine vitric tuff, sandstone, lapalli and crystal tuffs. These are intruded by diorite and rhyodacite bodies.

Soil sampling on a 100 x 20m grid located an anomaly approximately 900m in strike length with greater than 300 ppm Pb upto 2900 ppm Pb.

A gradient array survey was done over 10 lines of the grid. Two primary anomalies were located.

Two diamond drill holes were subsequently completed which tested the most significant IP anomalies supported by substantial geochemical anomalies. DD 76 LS1 intersected a series of interbedded tuffaceous shales, crystal tuffs, fine sericitic tuffs and lapalli tuffs from 0 to EOH at 300.2m.

Minor thin dacite lava horizons are recorded. The major component is tuffaceous shale. No mineralization other than fine dispersed pyrite and a few blebs of chalcopyrite were observed. Sericitic and siliceous alteration was obvious in the last 170m of the hole. DD 76 LS2 intersected lapalli and crystal tuffs and minor tuffaceous shales from 0 to 90.6m and then porphyritic diorite from 90.6m to EOH at 200.1m. No mineralization other than trace amounts of pyrite was observed. Sericitic and siliceous alteration was readily observed from 40 - 90m.

The major soil geochemical anomaly may be related to a major NNE striking fault in the area as may be the silicification and sericitization. Part of the soil anomaly may again be related to the diorite intrusive intersected in DD 76 LS2.

The area consists mainly of sediments and would appear to have low prospectivity for a volcanogenic deposit. The presence of sericitization and silicification are positive features but may be related to structure. The area is of no further interest.

1.5.3 Loyetea North

The Loyetea North anomaly was located by CRAE by a stream sediment survey.

This area adjoins the Loyetea South prospect to the south and has common grid lines. The sequence appears to be facing north with a change from mainly sediments in the Loyetea South area to a mixed sequence of coarse, intermediate dacitic tuffs to agglomerate and sediment in the north. Minor thin dacitic lavas and diorite intrusive are included in an area of 1.5 km x 500m,

Soil sampling on a 100m x 20m grid gave several patchy Pb/Zn anomalies of better than 400 ppm Pb spread over the strike length of the grid.

A blanket gradient array IP survey was done. Several minor anomalies are reported, the better ones being confined to the south west corner of the grid, and all are thought to be very shallow (less than 50m).

No further work was done.

The volcanics in the area appear to be the beginning of a major pile of volcanic agglomerates although a substantial portion of the area consists of sediment. No zones of alteration have been noted, most of the rock appearing very fresh except for minor chlorite alteration of mafics. The area is not thought highly prospective.

1.5.4 Tungsten Anomalous Zone

As part of the North and South Loyetea stream sediment investigation, samples were analysed for Sn and W. Several high, up to 330 ppm W, stream. tungsten values were returned. Follow up ~~soil~~ sampling, to close spacings, has been done. Results have not yet been received.

061

RIANA CAMBRIAN

The Cambrian in Riana has been previously investigated by CRAE. They did a patchy stream sediment survey and covered quite a large area by regional soil sampling at 400m and some regional IP. Stream sediment anomalies were located at Crosby Creek, Loyetea North and Loyetea South. Soil geochemical anomalies were located at Nietta. Regional mapping showed zones of acid volcanics and sediments with a few minor intrusives. The major portion appears to be fine grained sediments, often with some volcanic component.

WORK DONE

1. Loyetea Peak Stream Sediment Anomaly

Numerous fractions analysed, plus cold extrable Pb, Zn, Ni, Cu (-120#, -80#, -20#, panned conc.). All results from different fractions were similar with -120# and -80# giving the highest absolute values and good contrast between high and low values.

There is no down stream Pb tail (over 600m). All results with the exception of one appear very similar. Lowest value is (-80#) 14 ppm Pb with 70 ppm Mn, 0.7% Fe. All other samples are around 100 ppm Pb with 1000 ppm Mn or greater and Fe around 3%. Rock chip samples are generally low in Pb except one at the head of the catchment which had 100 ppm Pb.

Values for Zn define a good down stream tail. High Zn values are recorded for numerous rock chips (200 - 370 ppm Zn).

Reasonable outcrop was available through the length of the stream sampled. It consisted extirely of black siltstone shales with overlying Roland Conglomerate.

2. Tungsten Anomaly Loyetea North/South Area

Follow up stream sediment sampling on areas which had previously reported tungsten values upto 300 ppm was carried out. This was

extended to cover in detail a segment of agglomerates (andesitic?) which outcrop in the area. No anomalous tungsten values were recorded. One anomalous gold value was reported (0.15 ppm Au) draining from Query Road to the north and an elevated Pb value (90 ppm Pb) was reported in another sample from the same area. Geopeko had previously investigated this area by soil sampling along Query Road. The stream drain a zone of laminated siltstones which are not thought prospective. Soil sample results ranged from 30 - 260 ppm Pb, 30 - 300 ppm Zn.

Another anomalous drainage, draining south from Query Road to Tulip Tree Creek, had been previously covered by soil sampling by CRAE.

3. Leven River Traverse

A traverse was made along the Leven River. No anomalous stream sediment values were reported. The traverse confirmed the major section of sediments, fine grained siltstone/sandstones with an east-west trend and a southerly dip. The major section of fine grained sediments includes volcanics in the north (andesitic tuffs) and is intruded by at least two alkali intrusives (micro syenites). These appear to be similar to those at Crosby Creek (CRAE) and at Loyetea South (CRAE).

CONCLUSIONS

The area of Cambrian in the south of Riana and possibly the whole Loongana window consists mostly of fine grained sediments often with volcanic detritus reworked pyroclastics with a small component of true pyroclastics or lavas. The main section of volcanics appears to be in the north east corner of the Loongana section of the window. In all holes drilled from Crosby Creek to Challenger II the major component is siltstone/tuffaceous siltstones. At Challenger II, Crosby Creek, Loyetea South (CRAE) and also at Winterbrook (Moina) anomalous Pb, Zn values have been associated with an alkali intrusive

(called a diorite at Crosby Creek but looks like coarser grained version of other intrusives). No major zones of sericitic or siliceous alteration have been found, except where associated with possible shearing. No pyritic mineralization of note has been located. The area has been well tested geochemically. No further targets remain and geologically the area appears to be uninteresting.

064

APPENDIX 3

Aeromagnetic & INPUT Anomaly Followup

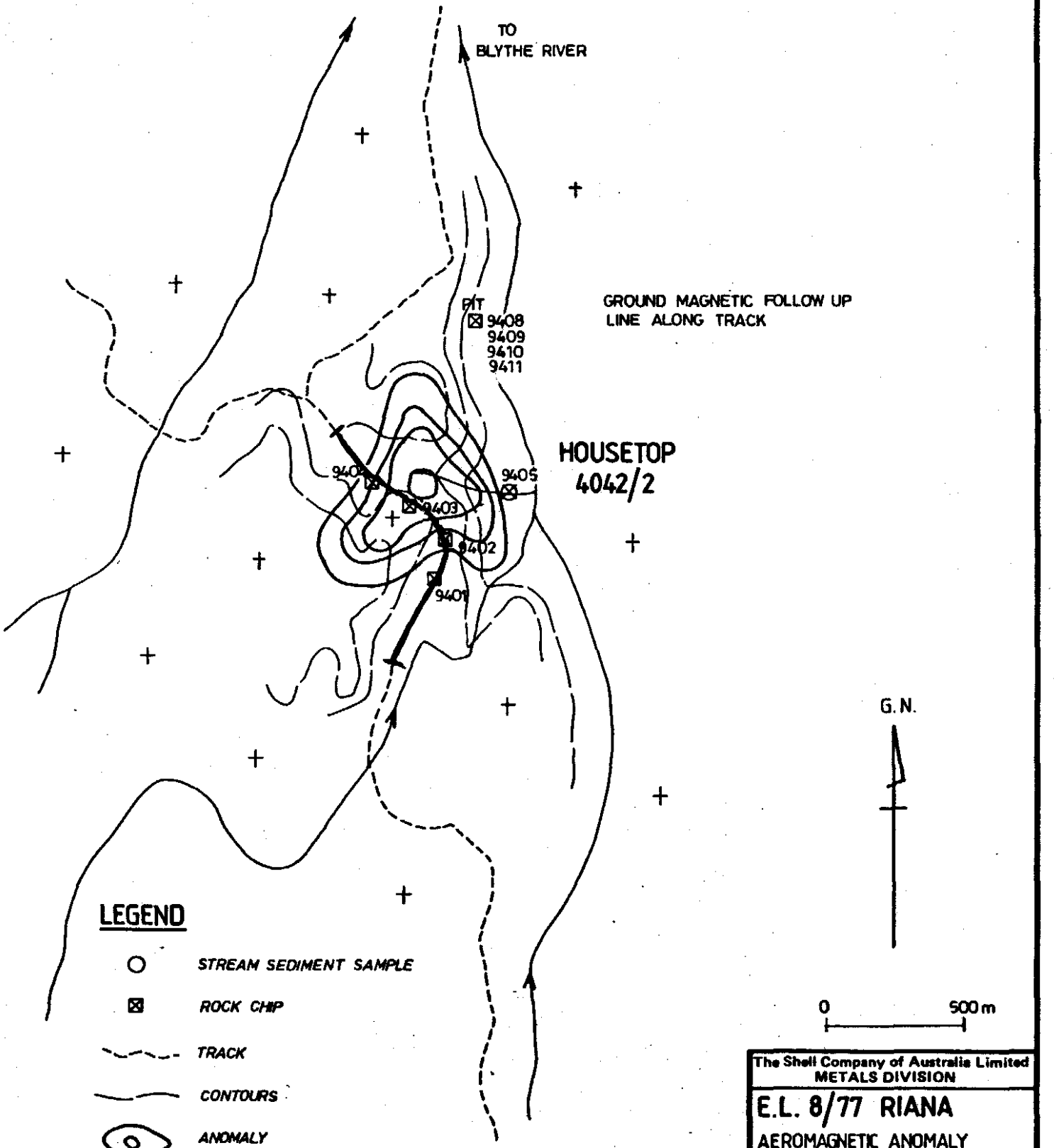
a)	Housetop	(4042/2)
b)	Castra	(4142/4)
c)	Wattle Grove	(4143/2)
d)	South Riana	(4143/4)
e)	Stotts Road	(4143/3)
f)	Midgley Falls	(4144/3)
g)	Knob Park	(IR 1)

HOUSETOP, RIANA E.L., ANOMALY 4042/2

This aeromagnetic anomaly overlies the eastern side of the Housetop Grantite. One line (OOE) of ground magnetics (1km long) recovered the anomaly at 400E with an amplitude of about 3000n T. The source is obviously very shallow and has been attributed to magnetite in the granite. This may imply a somewhat unusual granite phase so geochemical sampling is recommended.

The original name for this anomaly, 4042/2, was Laurel Creek North. In order to avoid future confusion, the above name will be used in future (change on anomaly sheets).

066



The Shell Company of Australia Limited
METALS DIVISION

E.L. 8/77 RIANA

AEROMAGNETIC ANOMALY
LOCATION (4042/2)

SCALE 1:20000	DATE 20-2-84
AUTHOR P.A.R.	DRAWN J.L.L.
OFFICE D'PORT	REP.No.
DRG.No. D/M004/18	FIG.No.

SHELL COMPANY OF AUSTRALIA

METALS DIVISION

RIANA E.L., TAS
HOUSETOP, 4042/27
TOTAL FIELD
MAGNETICS

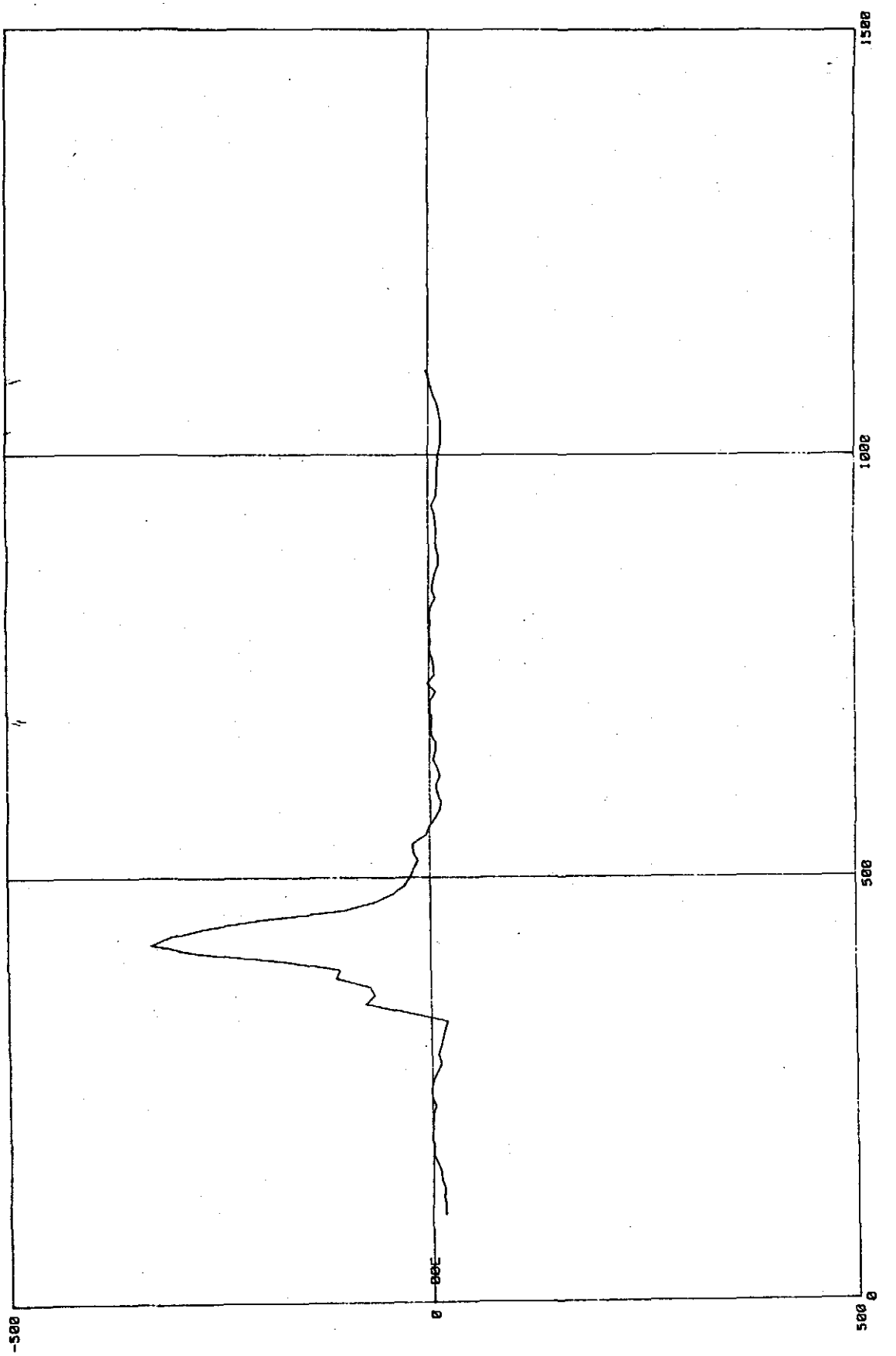
DISTANCE SCALE : 50 M/CM

READING SCALE : 500 /CM

BASE READING : 62000

067

5 cm



414068

068

CASTRA, RIANA E.L. ANOMALY 4142/4

This is a broad and elongated aeromagnetic anomaly with a maximum amplitude of 400n T. The ground magnetics are very noisy presumably due to the basalt cover but a broad anomaly occurs at about 1400N on lines 700E and 900E with maximum amplitude about 1200nT. The edge of this anomaly is picked up on line 1500N.

The ground magnetic anomaly is not coincident with the nearby hill and thus is unlikely to be caused by the latter. Since there is an airborne radiometric anomaly coincident with the aeromag anomaly, the presence of Cambrian volcanics seems likely. This should be carefully checked on the ground.

If no obvious cause is aparent, an IP survey (100m dipole, n = 1 to 4) should be carried out on line 700E, from 800 to 1800N, since the original assumption of underlying Gordon limestone may therefore still be appropriate.

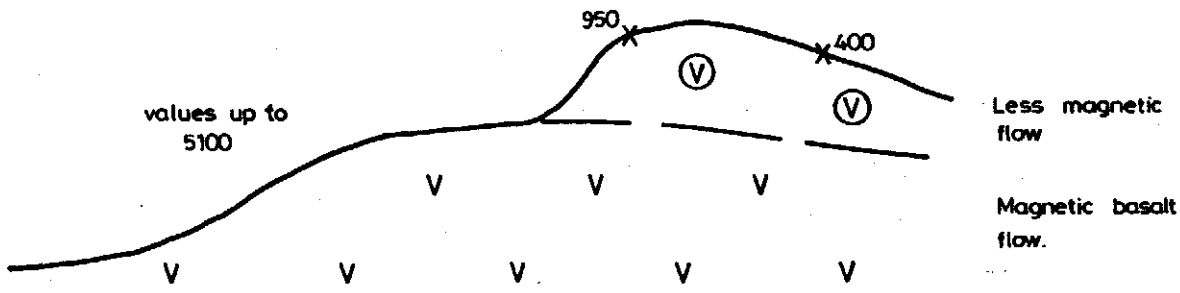
069

414070

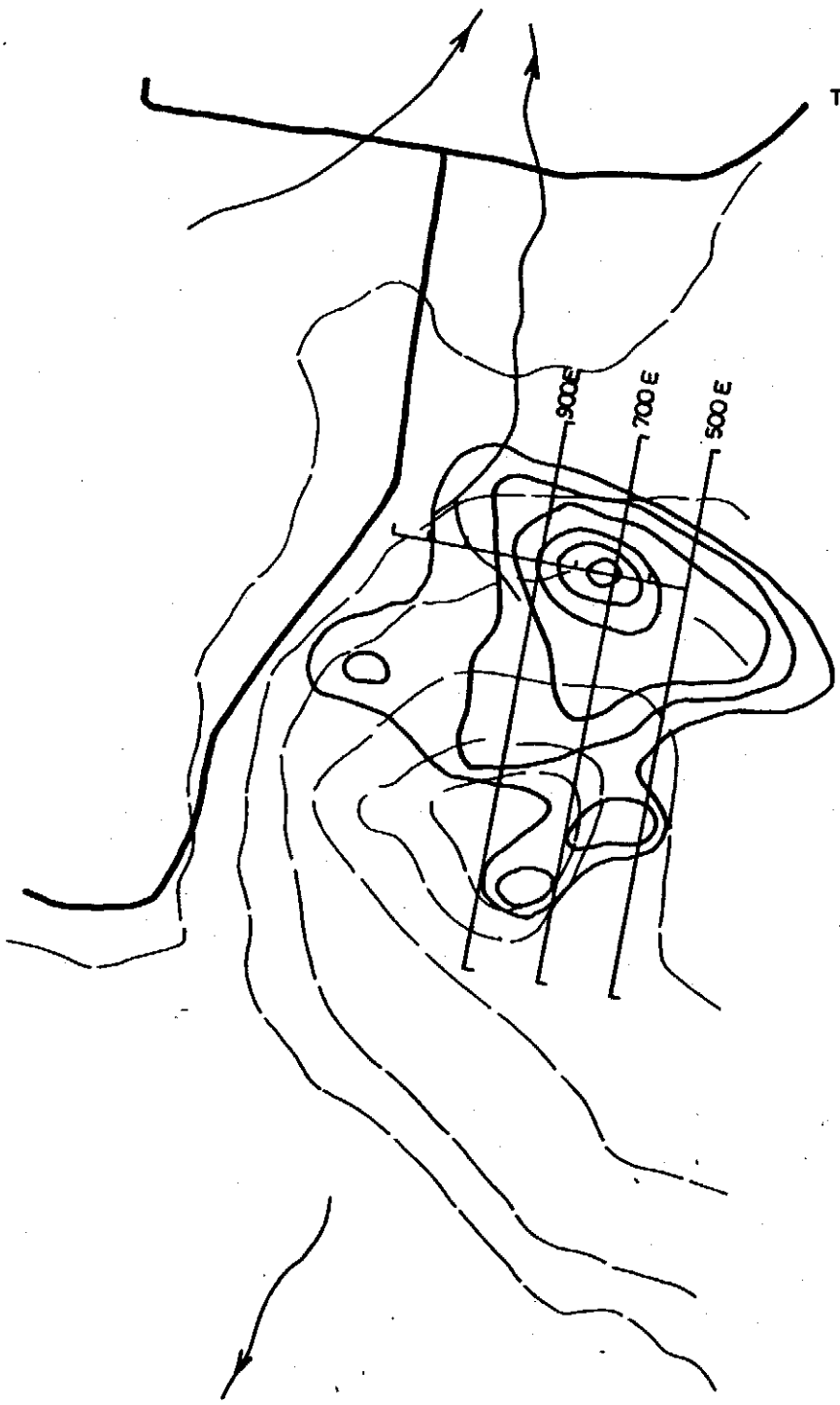
Magnetic Susceptibility = 5100 x 10^{-6} cgs units.

T.S.

LINE 700 E



PLAN



G.N.

CASTRA 4142/4

5 cm

LEGEND

CONTOURS

ROAD

ANOMALY

0 500 m

The Shell Company of Australia Limited
METALS DIVISION

E.L. 8/77 RIANA

AEROMAGNETIC ANOMALY LOCATION (4142/4)

SCALE 1:20000	DATE 20-2-84
AUTHOR P.A.R.	DRAWN J.L.L.
OFFICE D'PORT	REP.No.
DRG.No D/M004/190	FIG.No.

SHELL COMPANY OF AUSTRALIA

METALS DIVISION

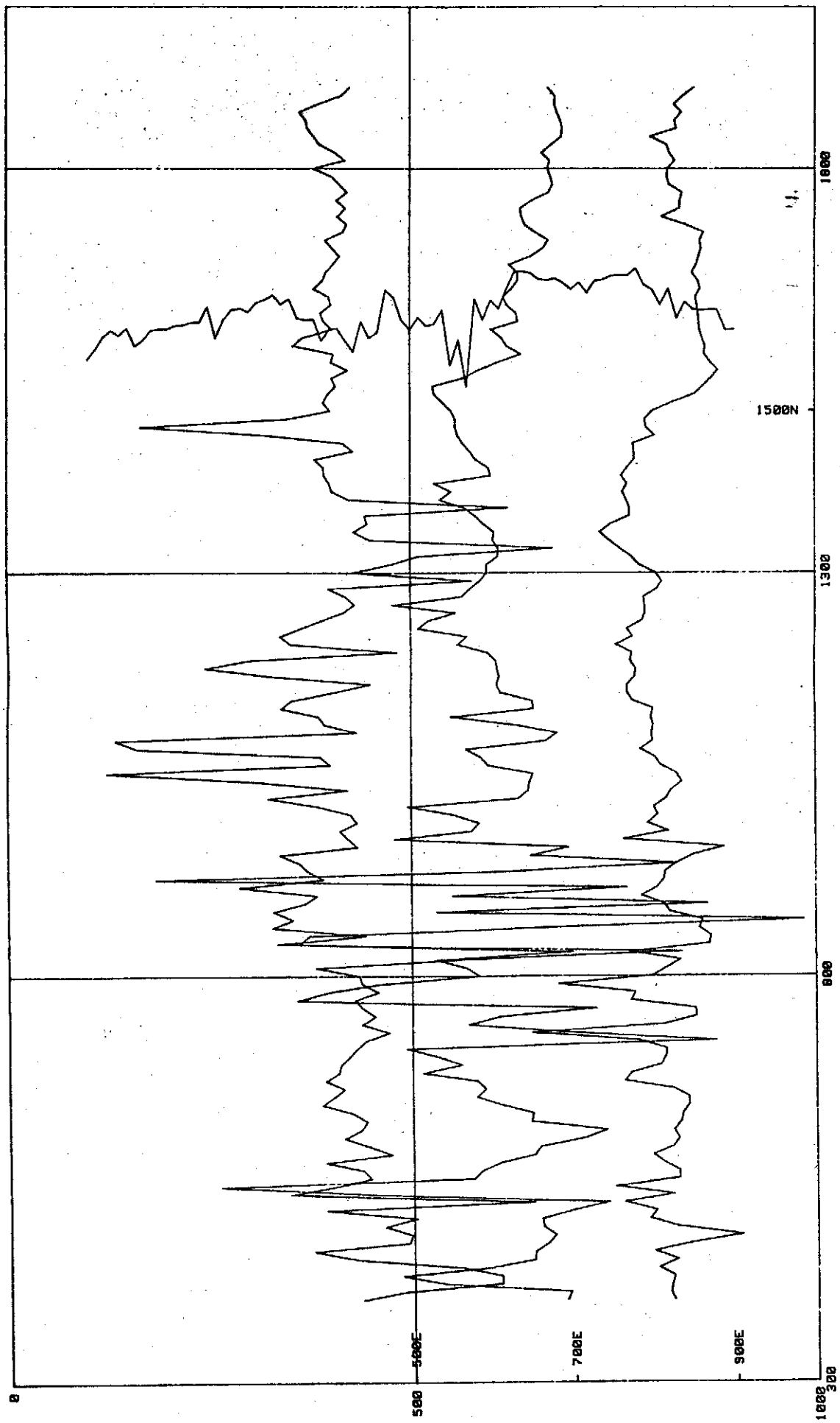
RIANA E.L., TAS
CASTRA 4142/4
TOTAL MAGNETICS

DISTANCE SCALE : 50 M/CM

READING SCALE : 500 /CM

BASE READING : 62000

070



5 cm

4141071

071

414072

WATTLE GROVE, RIANA E.L., ANOMALY 4143/2

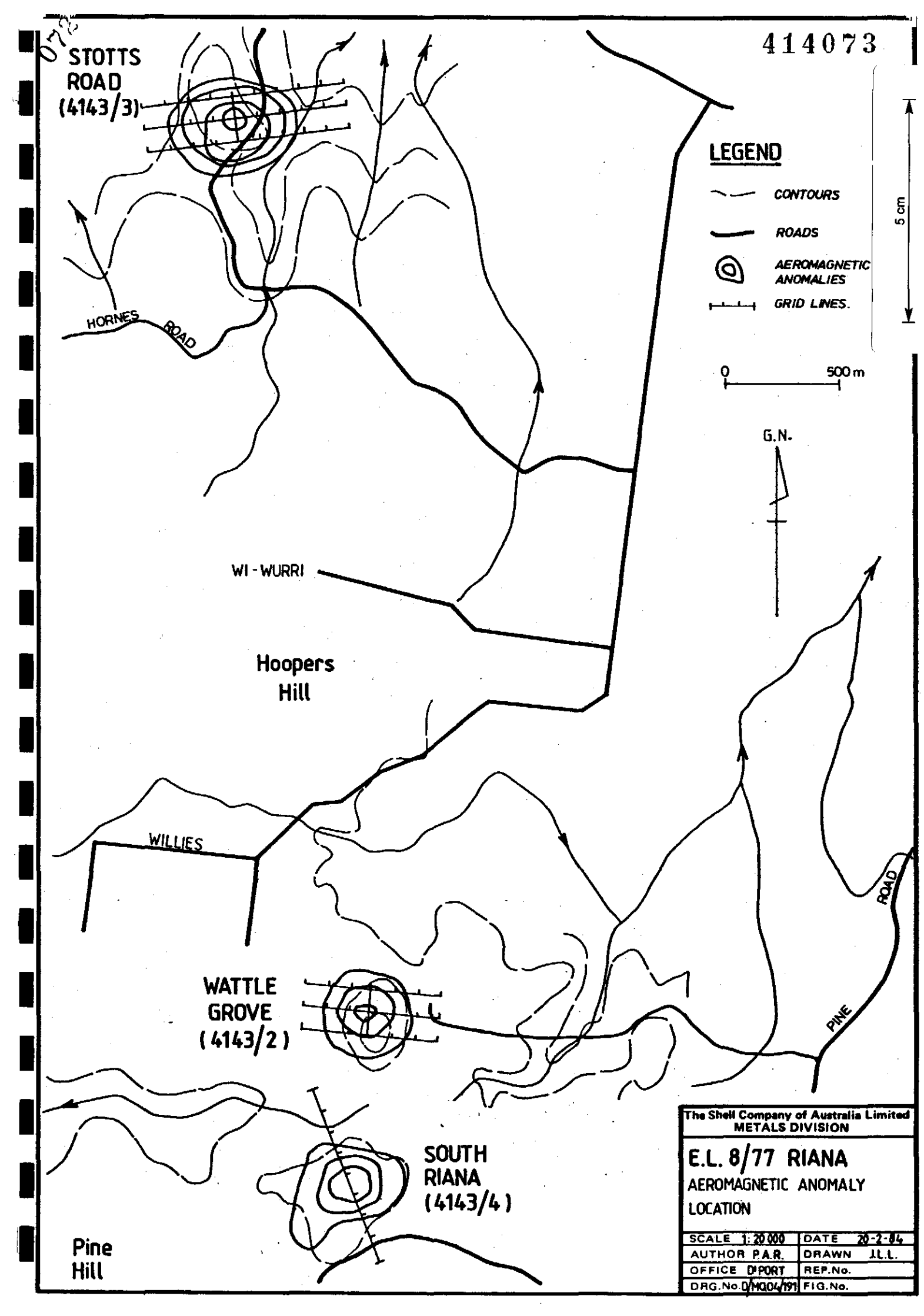
The aeromag anomaly of 450n T has been recovered as a ground manetic anomaly of about 2500n T. The source is highly magnetic and shallow, so that a careful ground check should locate and identify the cause at about 600E on the 3 lines 500N, 600N and 700N.

The anomaly is apparently located on a granite window in the basalt, and is presumably a weathering resistant paleo-high due to the particular mineralogy of the source (c.f. Mt. Bischoff).

Once the cause has been verified and sampled, further work can then be determined as appropriate.

0782

414073



The Shell Company of Australia Limited
METALS DIVISION

E.L. 8/77 RIANA
AEROMAGNETIC ANOMALY LOCATION

SCALE 1:20 000	DATE 20-2-84
AUTHOR P.A.R.	DRAWN J.L.L.
OFFICE D'PORT	REP.No.
DRG.No. D/MQ04/191	FIG.No.

SHELL COMPANY OF AUSTRALIA

METALS DIVISION

WATTLE GROVE, 4143/2

TOTAL FIELD
MAGNETICS

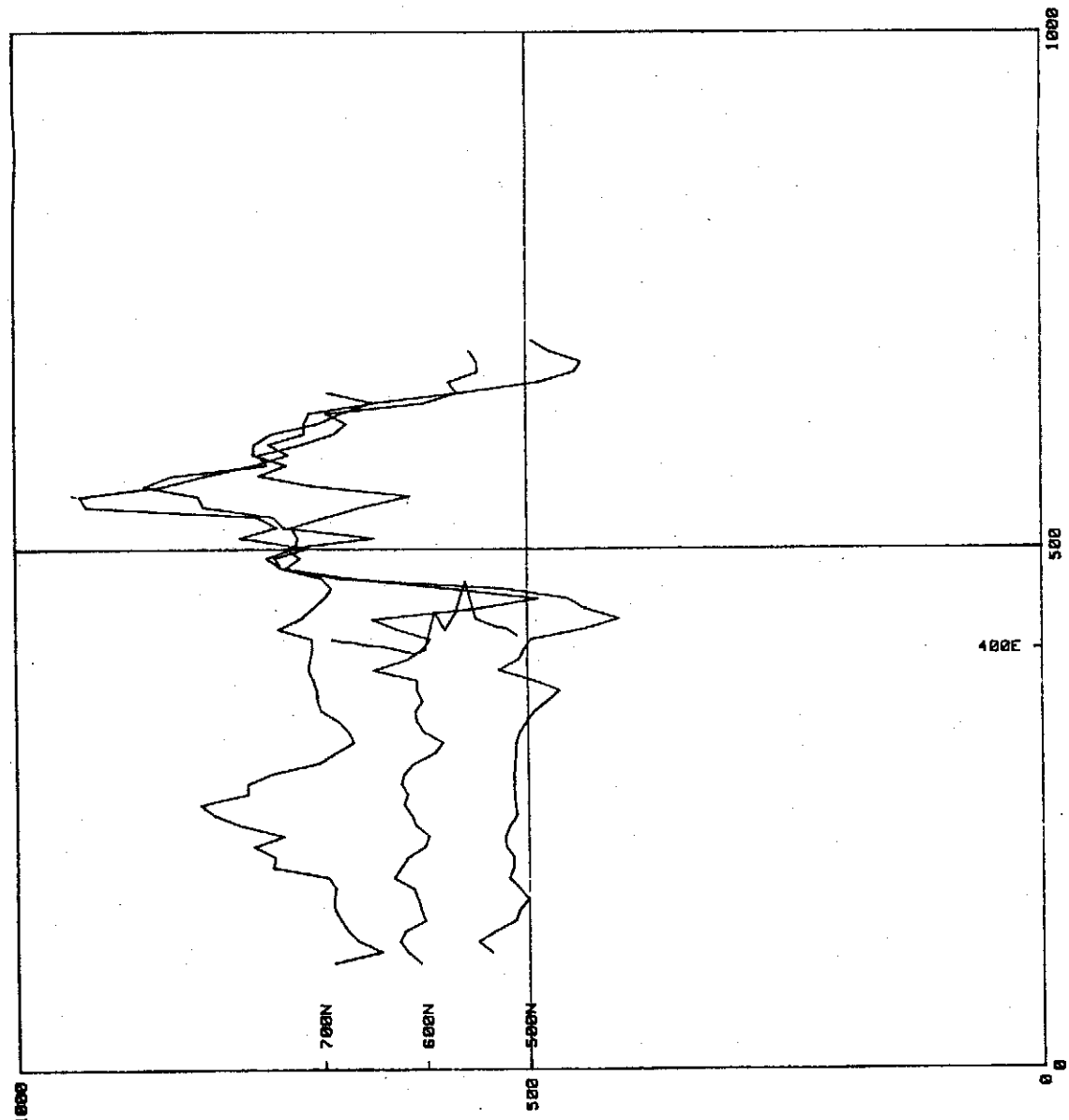
DISTANCE SCALE : 50 M/CM

READING SCALE : 500 /CM

BASE READING : 63000

073

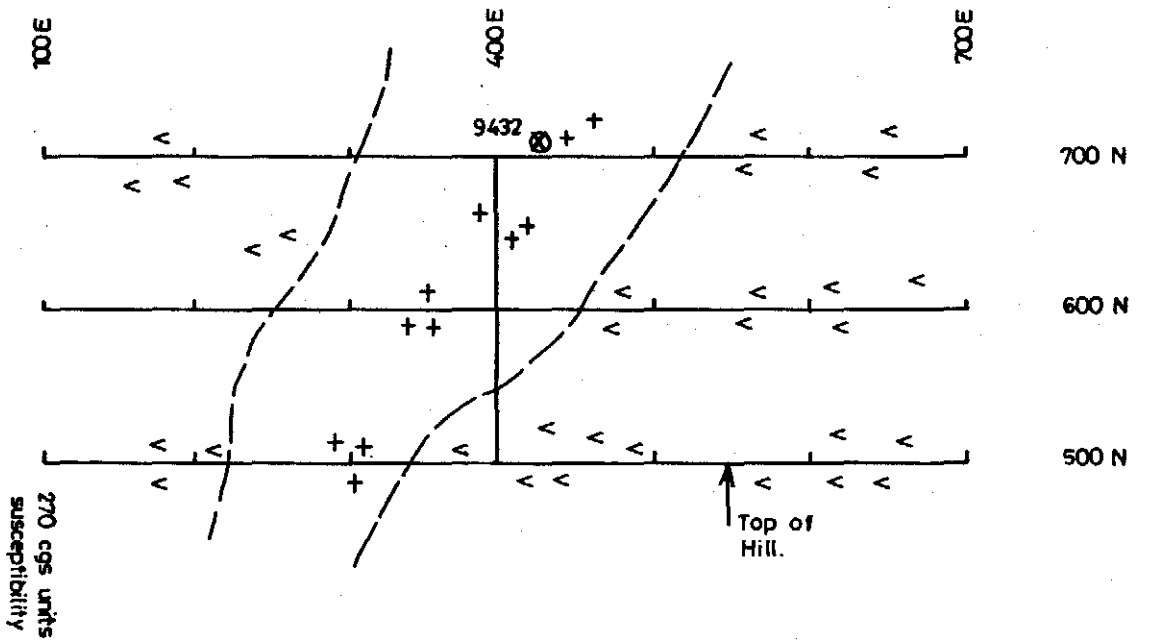
5 cm



4140 74

074

414075



LEGEND

V V *TERTIARY BASALT (mantles hills.)*

+ + *HOUSETOP GRANITE*

⊗ 9432 *ROCK SAMPLE (assay results in Appendix I)*

5 cm

0 10 20m

The Shell Company of Australia Limited METALS DIVISION	
E.L. 8/77 RIANA WATTLE GROVE GRID GEOLOGY	
SCALE 1:500	DATE 20/2/84
AUTHOR P.A.R.	DRAWN I.L.L.
OFFICE D'PORT	REP.No.
DRG.No D/1004/192	FIG.No.

SOUTH RIANA, RIANA E.L., ANOMALY 4143/4

The aeromagnetic anomaly is sharp with an amplitude of 350n T, and is readily apparent on the single line of ground magnetics (200E) at about 500N, with a sharp peak of 2500n T.

The anomaly is shallow and appears to correlate directly with a basalt hill whichis therefore its probable cause. However this may be related to the Wattle Grove anomaly so further work is dependant on the work there.

SHELL COMPANY OF AUSTRALIA

METALS DIVISION

RIANA E.L., TAS
SOUTH RIANA, 4143/4
TOTAL FIELD
MAGNETICS

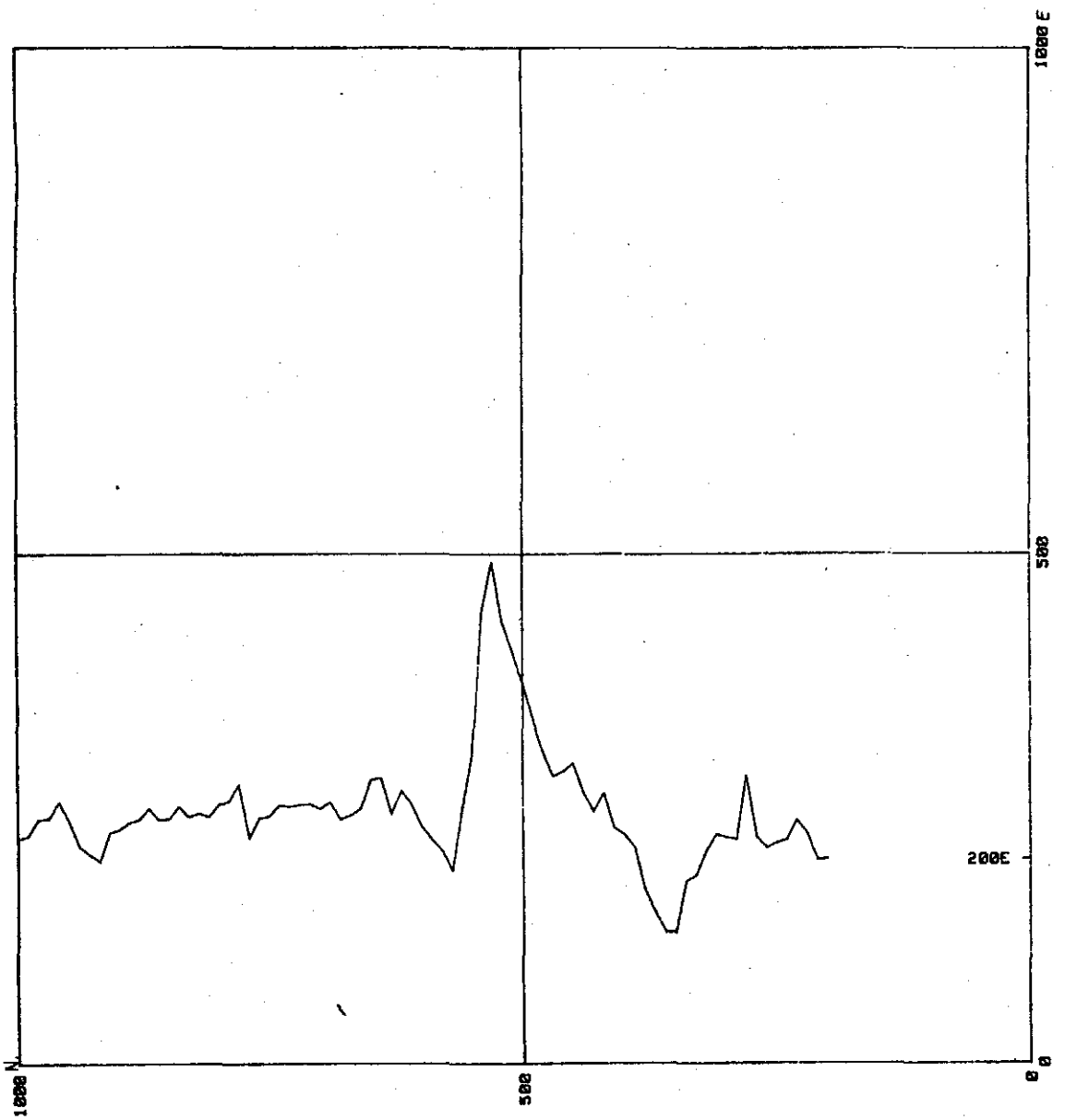
DISTANCE SCALE : 50 M/CM

READING SCALE : 500 /CM

BASE READING = 60000

076

5 cm



414077

077

STOTTS ROAD, RIANA E.L., ANOMALY 4143/3

This strong aeromag anomaly of maximum amplitude 600 nT has been recovered on the ground on lines 200N and 100N (amplitude up to 2000n T.). The anomaly is broad and noisy but well distinguishable, and appears to be deep with a possible west dip.

The anomaly could be due to a basalt hill but this is not at all certain. If fresh outcrop is present, basalt samples should be obtained and sent for remanence measurements. If these measurements do not account for the high amplitude anomaly, then a line of IP (100 m dipole, n = 1 to 4) is recommended along 100N fom 0 to 1000 E.

SHELL COMPANY OF AUSTRALIA

METALS DIVISION

RIANA E.L.,TAS
STOTTS RD.,4143/3
TOTAL FIELD
MAGNETICS

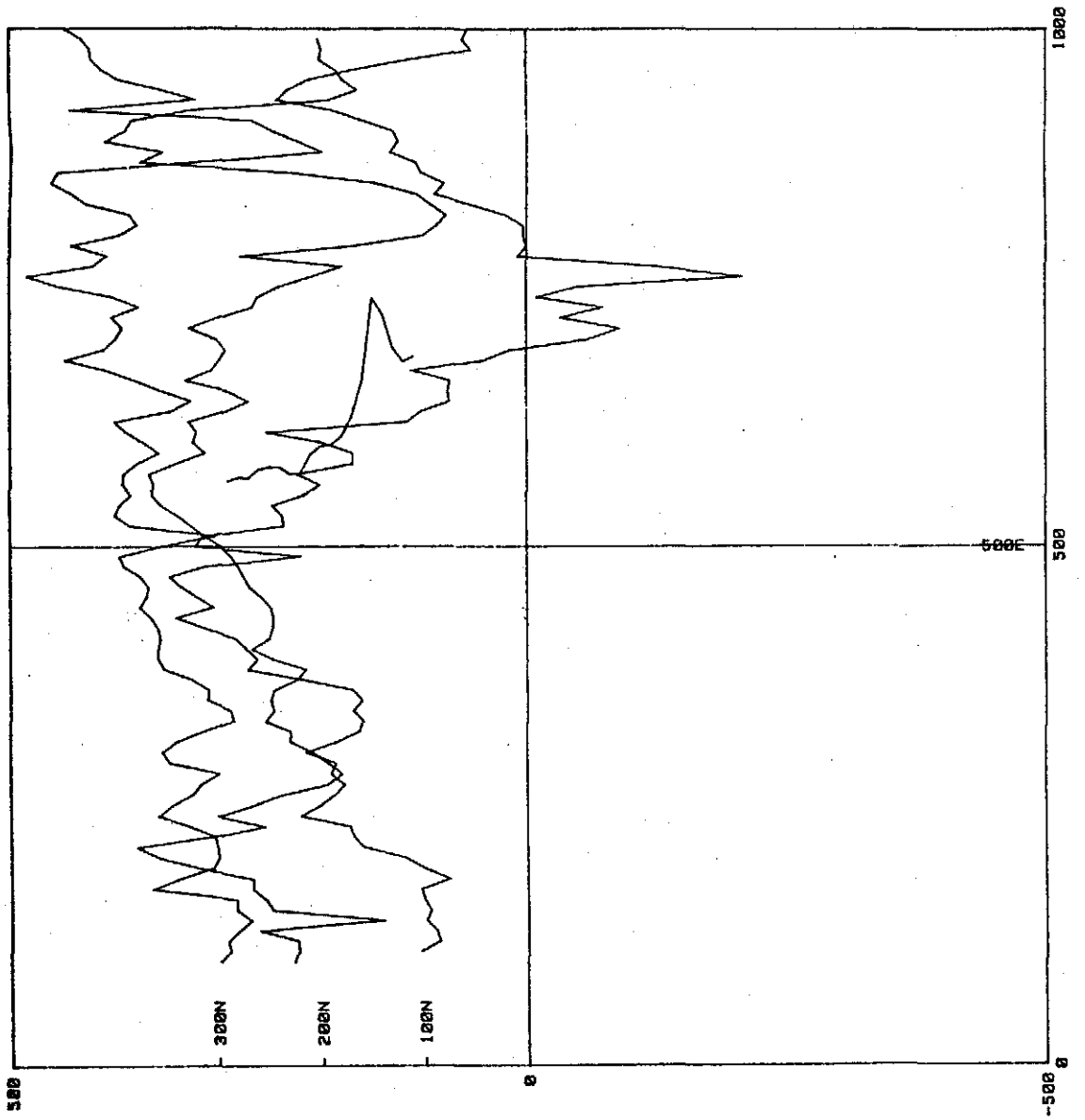
DISTANCE SCALE : 50 M/CM

READING SCALE : 500 /CM

BASE READING : 62000

078

5 cm



414079

079 **Memorandum**

PAR 414080

NPO4-7144

Date 1 August, 1983

From BXN:NH:AJD

To BXH/Devonport (D.W. & P.R.)

MIDGELEY FALLS ANOMALY 4144/3

Herewith the ground magnetic data over this anomaly as follows:

1)	Stacked profiles (unfiltered)	1:5,000, 1000 nT/cm
2)	" " (")	1:5,000, 2000 nT/cm
3)	" " (filtered)	1:5,000, 1500 nT/cm
4)	HP9845 Contours (filtered)	1:5,000, CI = 100 nT
5)	Hand contours (filtered)	1:5,000, CI = 500 nT

The filtered data indicates 2 main anomalies, one in the centre of the grid and one to the east. The former has not been completely closed off to the south. Both these ground anomalies are situated very close to where the aeromag anomalies were plotted so they have been well recovered. The ground mag anomalies are not precisely coincident with the hills in the area, at least as indicated by the topo map, so there is a good likelihood they are not actually caused by basalt hills. The maximum amplitude of the eastern anomaly is greater than 4500 nT on Line 200N which is extremely high even for basalt with remanence. As mentioned by Graham Oakes (memo 4/3/83) modelled susceptibilities are of the order of 50 to 150 x 10^{-3} cgs units which require high remanence values (Q greater than 40).

Remanence and susceptibility of the local basalt is to be measured by the CSIRO, and results are presently awaited. If the results do not suggest basalt can be the cause of the anomaly, then a line of dipole-dipole IP is recommended along Line 200N from 600E to 400W (100 m dipoles, n = 1 to 4). This should indicate the presence of magnetite or pyrrhotite skarn beneath basalt.

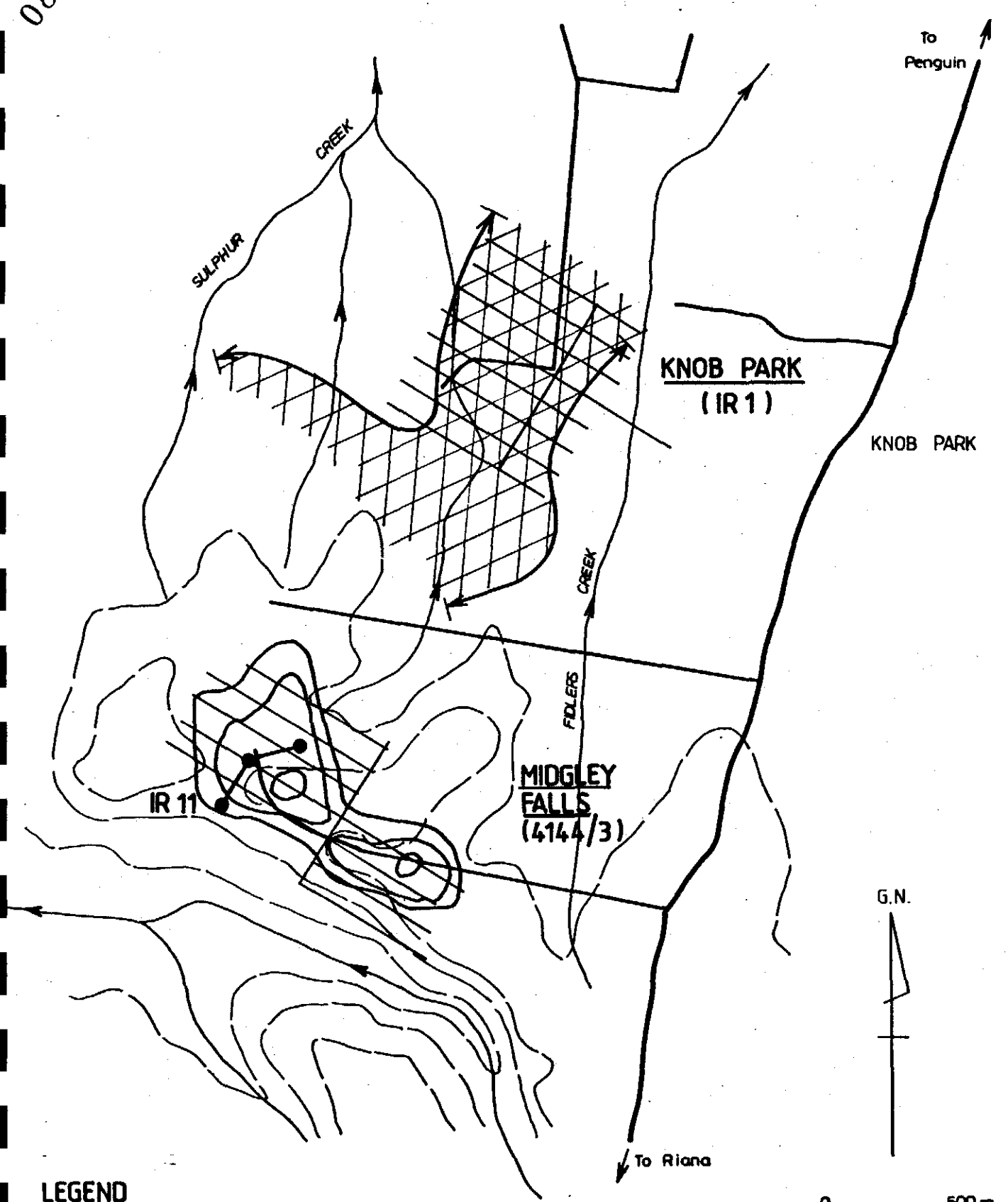
N.H.

N. HUNGERFORD

Enc.

080

414081



LEGEND

- CONTOURS
- ROADS
- AEROMAGNETIC ANOMALY
- INPUT ANOMALY

5 cm

The Shell Company of Australia Limited
METALS DIVISION

E.L. 8/77 RIANA

AEROMAGNETIC / INPUT ANOMALY LOCATION

SCALE 1:20000	DATE 20-2-83
AUTHOR P.A.R.	DRAWN J.L.L.
OFFICE D'PORT	REP.No.
DRG.No. D/M004/83	FIG.No.

SHELL COMPANY OF AUSTRALIA

METALS DIVISION

MIDGELY FALLS 4111/3

TOTAL FIELD
MAGNETICS

DISTANCE SCALE : 50 M/CM

READING SCALE : 1000 /CM

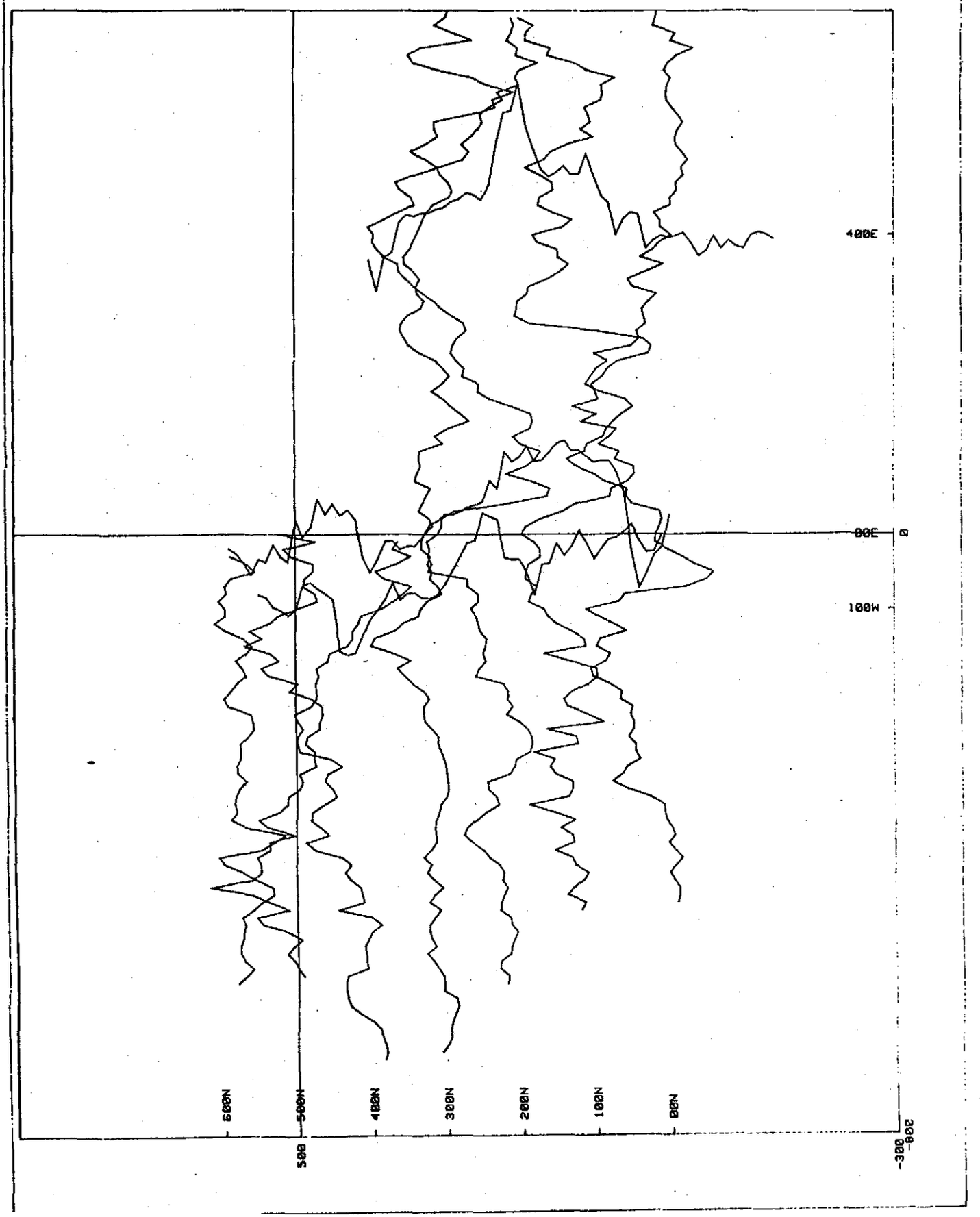
BASE READING : 62500

DRWG NO. 1032

4114082

081

5 cm



SHELL COMPANY OF AUSTRALIA

METALS DIVISION

MIDGLEY FALLS 4144/5
TAS
TOTAL FIELD
MAGNETICS

DISTANCE SCALE : 50 M/CM

READING SCALE : 2000 /CM

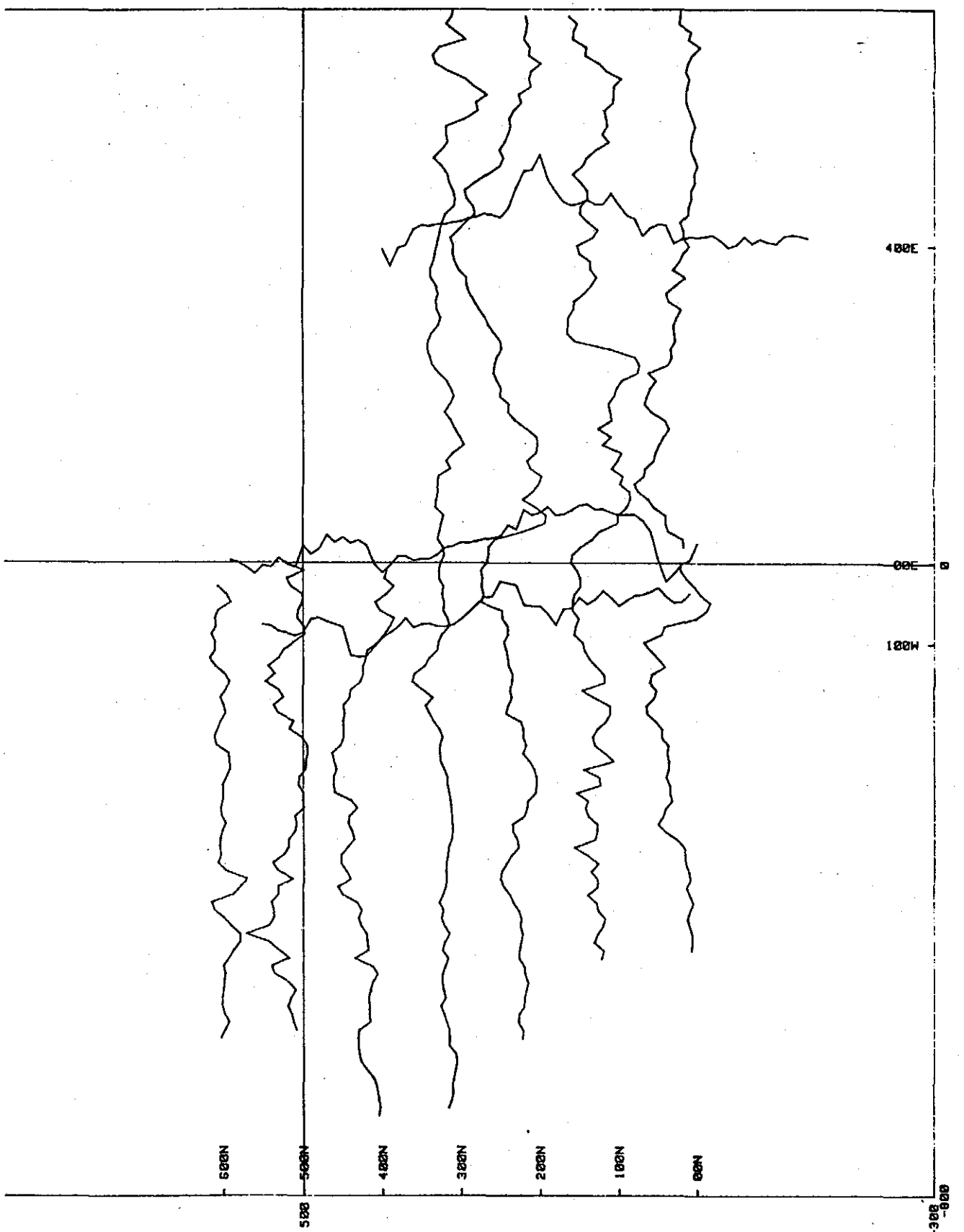
BASE READING : 62000

DRWG NO. 1633

414083

082

5 cm



SHELL COMPANY OF AUSTRALIA

METALS DIVISION

RIANA E.L., TAS
MIDDLEY FIELD 4/44/3
TOTAL FIELD
MAGNETICS
(FILTERED)

BASE LEVEL = 60000
C.I. = 100
SCALE 1: 5000

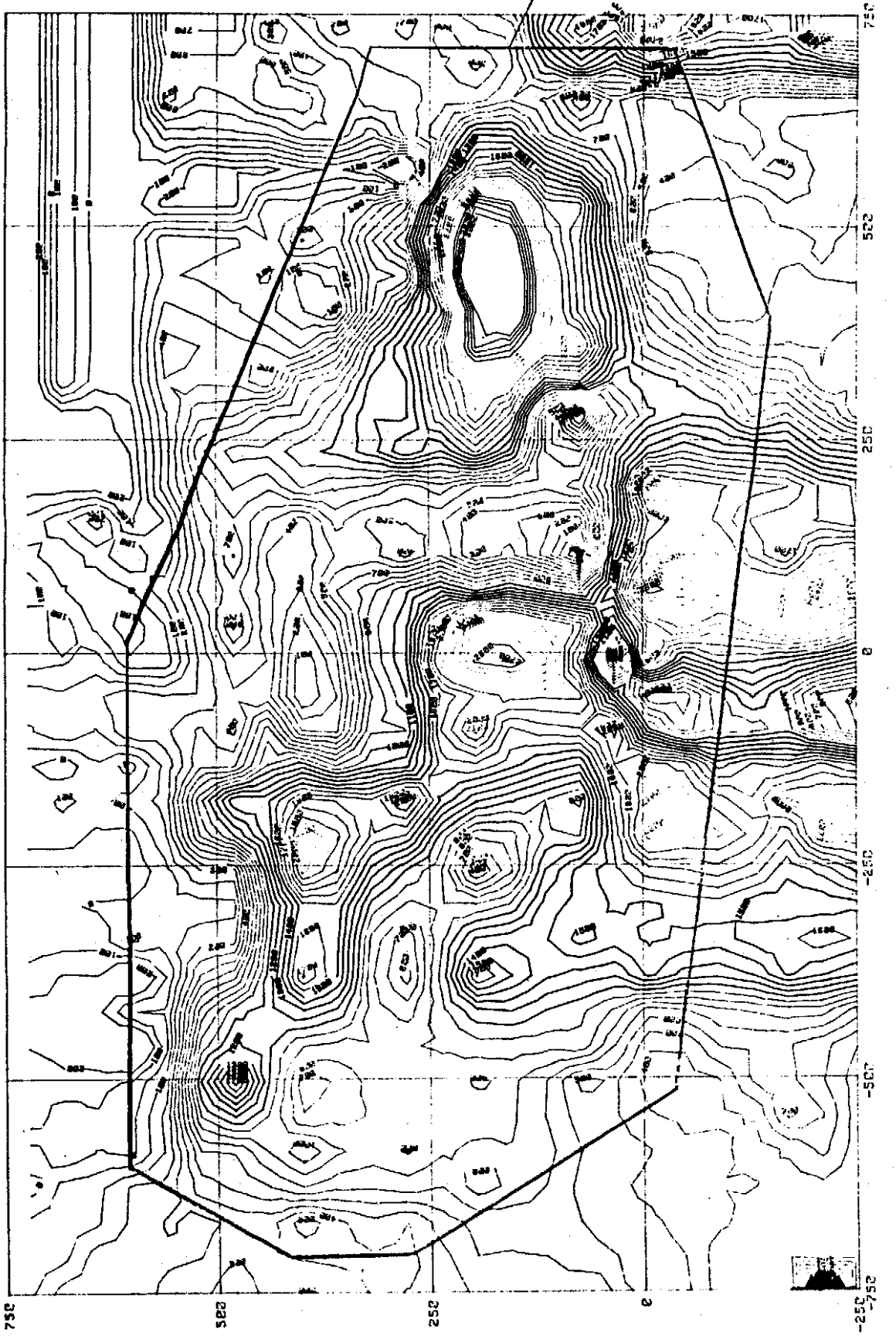
DRWG NO. 1035

4114084

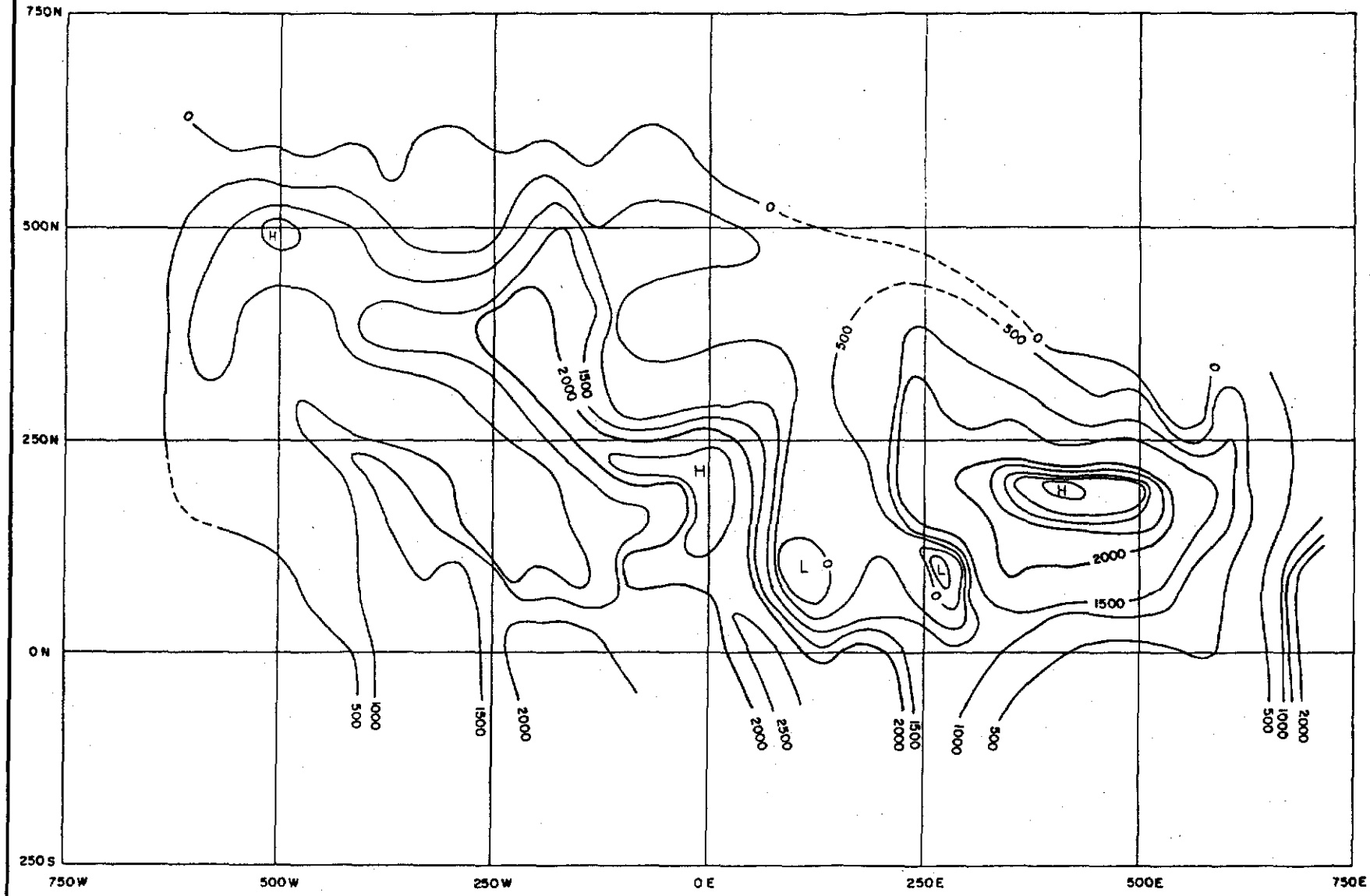
083

5 cm

DATA INVALID OUTSIDE THIS AREA



084



BASE LEVEL = 62 000

C.I. 500 nt

5 cm

The Shell Company of Australia Lim
METALS DIVISION

RIANA - E.L. 8/77
TASMANIA
MIDGLEY FALLS, 4144/3
TOTAL FIELD
MAGNETIC CONTOURS
(FILTERED)

SCALE 1:5000	DATE JULY 19
AUTHOR N.H.	DRAWN O.L.
OFFICE A.H.O.	REP No
DRG.No. M004/1031	FIG No

4144085

AIRBORNE GEOPHYSICS
(EM, MAG, etc)

085 4140 86

GEOLOGY
& TOPOGRAPHY

400 W 200W 00 200 E 400 E 600 E

APPARENT CHARGEABILITY.

APPARENT RESISTIVITY.

Contractor : SCINTREX
Date : 23-8-69
Timing : 2 Sec .
Transmitter : 1 PTAA 2kw
Receiver : 1 PR6 (305122)
Integration time :
Array : DIPOLE - DIPOLE
Dipole length : 100 m

5 cm

The Shell Company of Australia Limited
EXPLORATION DIVISION

E.L. 8/77 RIANA
MOSELY FALLS
I.P. / RESISTIVITY SURVEY
200N LINE

SCALE	DATE
AUTHOR	DRAWN J.L.L.
OFFICE SYMBOL	REP. No.
DWG. No.	FIG. No.

086

KNOB PARK, RIANA E.L., ANOMALY 4144/4

Note the number allocated to this anomaly. The aeromagnetic anomaly of 200n T has not been properly recoveed on the ground, since the grid was not located correctly over it. However anomalies are apparent at the western end of lines 100N and 200N, with amplitudes up to 1000 nT, despite the noisy character of the profiles.

It appears that the anomaly is not caused by the nearby basalt hill, so that the following grid extensions are recommended.

Line 100N - extend west 400m to 1000W
Line 200N - extend west 400m to 1000W
Line 300N - grid 300W to 1000W

These lines should all then be surveyed with ground mag. and a line of IP (100m dipole, n = 1 to 4) is then advisable.

087

SHELL COMPANY OF AUSTRALIA

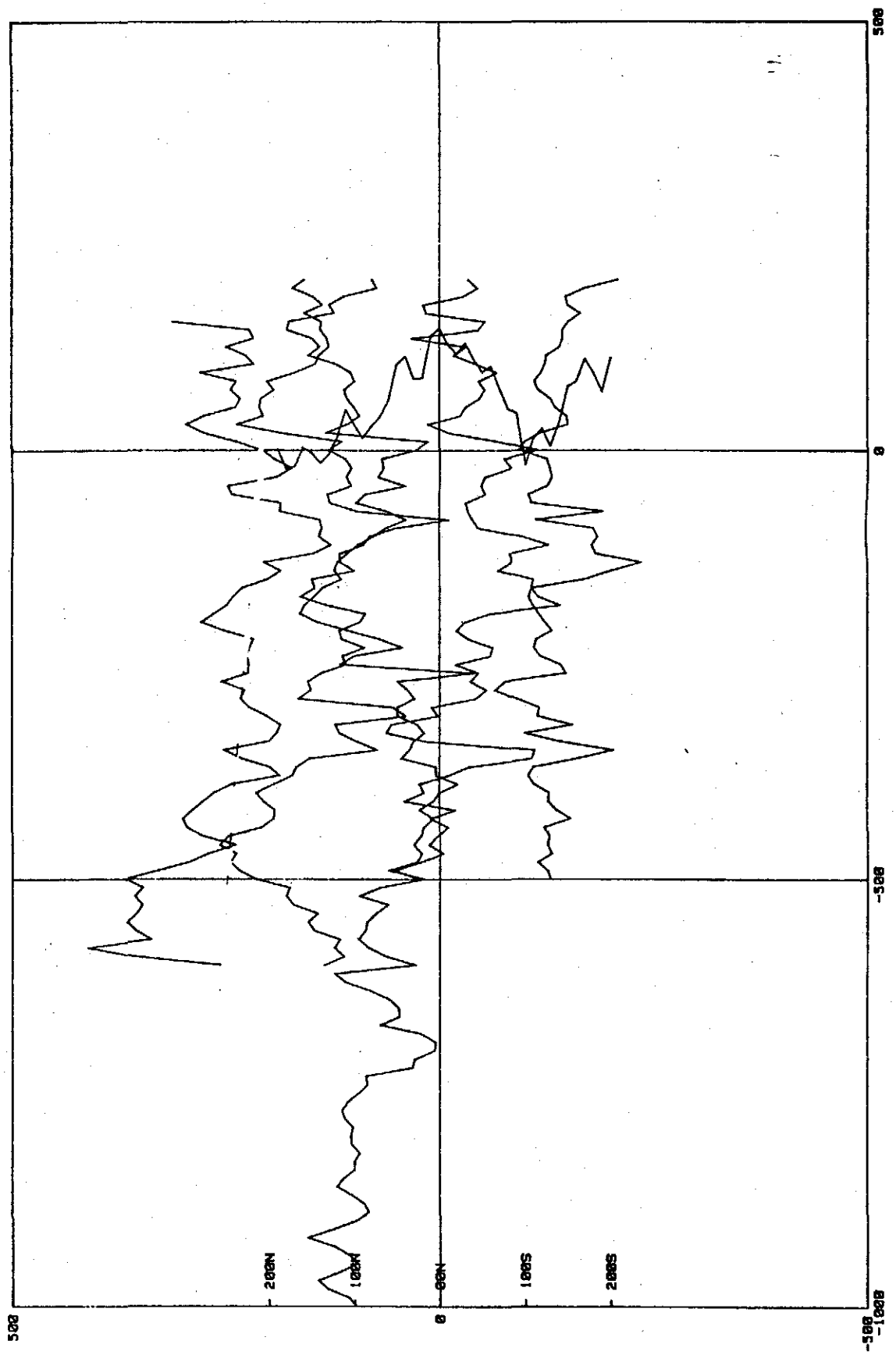
METALS DIVISION

RIANA E.L., TAS
KNOB PARK 4144/47
TOTAL FIELD
MAGNETICS

DISTANCE SCALE : 50 M/CM
READING SCALE : 500 /CM
BASE READING : 62000

414088

5 cm

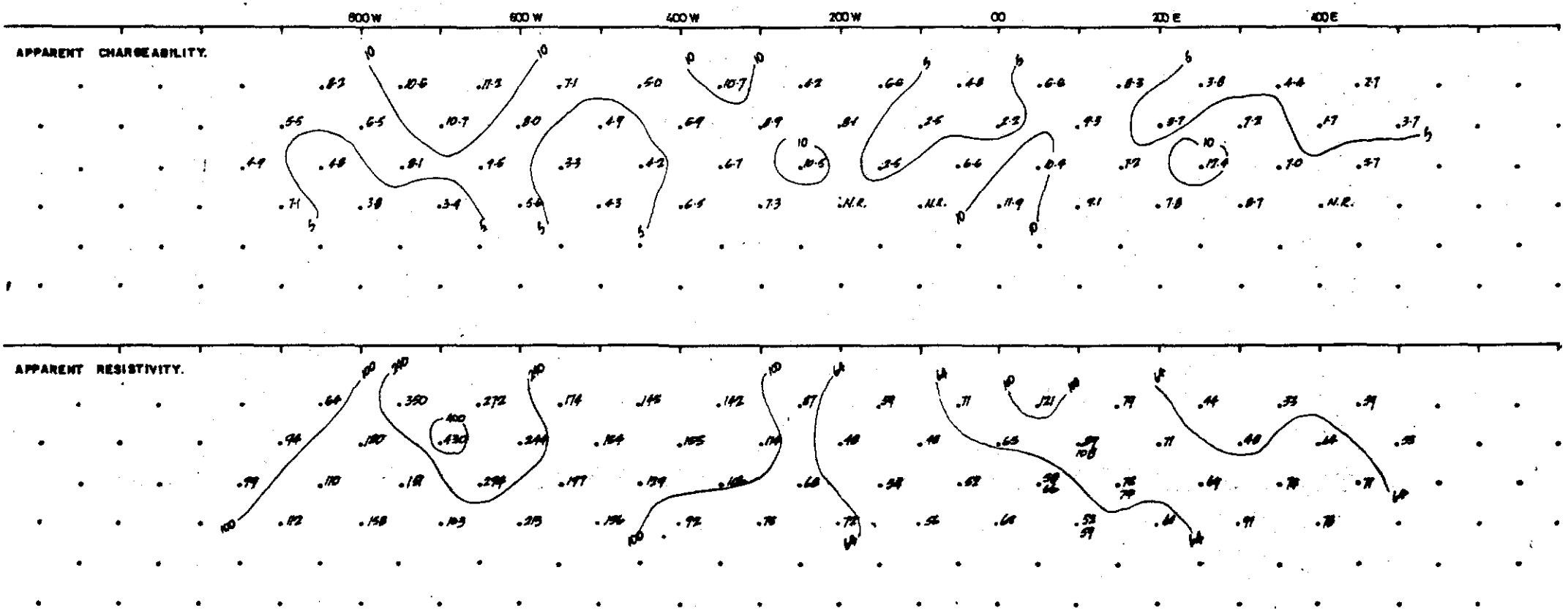


AIRBORNE GEOPHYSICS
(EM, MAG, etc)

088

4140089

GEOLOGY
& TOPOGRAPHY



Contractor : SCINTREX PTY. LTD.
Date : 22-8-69
Timing : 2 Sec.
Transmitter : 1 PTAA 3kw
Receiver : 1 PRS (308122)
Integration time :
Array : DIPOLE - DIPOLE
Dipole length : 100 m

5 cm

The Shell Company of Australia Limited
METALS DIVISION
E.L. 8/77 RIANA
KNOB PARK
I.P. / RESISTIVITY SURVEY
OON
SCALE
DATE
AUTHOR
DRAWN
GRAPHS
REP. No.

089

414090

APPENDIX 4

Magnetic Remanence Measurements of Tertiary Basalt

by

D. Clark - CSIRO

090

414091

CSIRO

Division of Mineral Physics
Delhi Road, North Ryde, NSW, Australia

A Division of the Institute of Energy and Earth Resources

PO Box 136, North Ryde, NSW, Australia 2113
Telephone (02) 887 8666
Telex AA25817

September 1, 1983

Mr. P.A. Ruxton,
Shell Company of Australia Limited,
P.O. Box 860,
Devonport,
TASMANIA 7310

Dear Peter,

The results of measurements of the magnetic properties of your Tasmanian basalt samples are as follows:

Sample	K	J	Q
Midgely 50N/50W	390	2,640	10.7
Midgely 100N/600E	1,370	15,580	18.1
Midgely ON/OE	330	4,830	23.2
Preston 900N/700E	4,760	81,800	27.2
S. Riana 550N/200E	1,530	6,010	6.2

K = cgs (emu) susceptibility X 10^6

J = NRM intensity in microgauss (10 microgauss = 1 gamma)

Q = Koenigsberger ratio = NRM/induced magnetization
= J/KH, where H = 0.63 oe

The samples all bear substantial remanence and the results indicate that remanence overwhelmingly dominates induction in these basalts. Because the samples are unoriented and no palaeomagnetic cleaning has been carried out, the possibility that some of the samples are affected by lightning strikes (and therefore unrepresentative) cannot be ruled out. However the Q values are quite compatible with other Tasmanian Tertiary basalts.

Assuming the NRM is representative of the bulk of the rock it will be either approximately parallel or approximately antiparallel to the present Earth's field, as the rocks are relatively young. Thus interpretation can proceed by assuming magnetization by induction, but with a considerably enhanced susceptibility (if the NRM is normal) or a strong negative susceptibility (if the NRM is reversed).

I hope these results are useful to you.

Yours sincerely,

Dave Clark

David Clark
Division of Mineral Physics

091

414092

APPENDIX 5

NATONE SKARN

Consultants Report

by

Dr. T. Kwak (La Trobe Univ., Melb.)

092

414093

The Natone Pyrrhotite-Magnetite Skarn, N.W. Tasmania,

Consultant's Report to Shell Metals Australia Pty.Ltd.,

P.O. Box 860, Devonport, Tasmania.

T. KWAK 1983.

Introduction

This report concerns my evaluation of the Natone Pyrrhotite-Magnetite skarn located at the northern tip of the Housetop granite, in north western Tasmania, near the "town" of Natone, 12 kilometres south of Burnie, Tasmania. I spent two days investigating both the drill core and field relationships on November 15 and 16. My brief was as follows:

1. Investigate the skarn in the field, core samples at Shell's exploration office at Spreyton and limited laboratory investigations in Melbourne.
2. Assess whether the skarn had any potential for significant Sn mineralization in areas not presently tested, particularly in areas where Sn may have been concentrated by leaching from early skarn types.
3. Recommend what future work might be warranted.

Although a detailed petrographic study was not asked for, to enable me to properly assess the skarn I had 20 polished thin sections made, this is in addition to the numerous sections made by others, and available to me. I do not believe additional petrological sections will greatly enhance the understanding of where potential ore grade mineralization could occur, as will be discussed.

General features - field relations

The skarn occurs within a 1200m by 500m ground magnetic anomaly (elongate NE-SW). Skarn occurs to a thickness of 210m, although a significant proportion of this is contact metamorphic in origin and subsequently not, potentiall, Sn bearing. The field relations are difficult to use in assessing the skarn because of the restricted outcrop. The skarn itself does not appear to outcrop, rather a hematite-rich unit with subsidiary amounts of amorphous silica, including jasper, and friable white material. Both the hematite and some silica, including jasper, occur in veinlets cutting the white friable matrix. The latter is relatively hard in places. The unit called "the Natone and Cuprona" ironstones in Dr.Ruxton's report (No.08.2060 Internal Shell report dated 12/9/83), has been interpretted to be spacially related to quartz-vein hosted copper mineralization in the Burnie formation. To conclusively define how the ironstone seen at Natone formed, is not possible due to the extreme weathering. However, despite the conclusions of Dr.Ruxton and a consultants report by A.W.G. Whittle and Associates (Shell 6/81), I believe the ironstones I saw to be gossans produced at Natone from the rather peculiar skarn at depth. Those in other areas I can't comment on. "False" gossans and other anomalous ferriginous concentrations are common in carbonate terrains. It is always tempting to assume these areas are erosion remnants of a once continuous unit. It is possible that because the Natone skarn is highly unusual, other workers would find the gossan of such a deposit to be essentially uninterprettable. The features suggesting the above are (a) the obvious close spatial relationship between the skarn and at least most of the ironstones, and (b) structural and textural features of the ironstone, which are very similar to features seen in the unaltered skarn in NT-3.

Gossans formed from many skarns are usually difficult to interpret because the skarns themselves are peculiar rocks. The economic importance of this is that if the ironstones are indeed gossans, then the tin grades to be expected in unaltered skarn equivalent to the ironstones would also be low. Tin is not chemically transported readily in surface environments.

The other breccia-like units observed in this area may be silicified equivalents to the ironstones. Further work is needed to define this point, but again, surface silicate type replacement of skarn or skarn gossan are not uncommon.

The granite observed adjacent to the skarns is highly variable in grain size and the grain size distribution of individual minerals in different samples is highly variable. In this, the occurrence of much red K-feldspar occassionally having rapakivi (plagioclase) rims on the feldspars, and the total lack of any indication of greisenization in the granite it is very similar to that found near the Kara W-skarn. This skarn, located at the southern extent of the same Housetop granite contains significant Sn values in a few places (near 0.1%?) but is generally low in Sn.

General features - drill core

A relatively large number of thin sections have been prepared and described by Central Mineralogical Services. The accompanying Table (I) is a condensed summary of thin section data done by myself on existing and new thin sections. Also, to try to clarify some of the features, a number of photos at the end of this report are included to illustrate the appearance of the various skarn types in the core.

Like all skarns, the Natone skarn consists of part which is metamorphic in origin and part which is metasomatic. Ore can only be expected in the latter. Metamorphic skarn occurs where dolomitic units occur adjacent to more siliceous units (Figure 1), where a typical "Bimetasomatic" skarn occurs. The skarn is zoned dolomite→ calcite→talc→(serpentine after) forsterite→pyroxene→hornfels over about ½cm. The other metamorphic skarn is found in many areas of NDDH 2 (Figure 2), between quartz pebbles. The main skarn mineral is epidote with green amphibole, calcite and minor sulphides. A limited amount of interbedded chiastolite-bearing and chiastolite-free hornfels occurs (Figure 3).

The metasomatic skarn is superimposed on the metamorphic skarn where carbonate was available.

The skarn generally, is similar to ones commonly described from the U.S.S.R., but rather rare in Australia. In most parts of the core in NT-3 and NT-1, it replaced dolomite as is evident from the very common occurrence of forsterite olivine or diopsidic pyroxene and lesser amounts of humite with limited superimposed serpentine etc. (see Table). The skarn present in NT-3 and NT-1 is very different to that observed in NDDH1, 2 and 3. NT-1 and 3 contain varying amounts of diopside, forsterite, humite, phlogopite and magnetite, with less common areas of sulphides - pyrrhotite and chalcopyrite.

Garnet skarn (type 5 - Figure 10) is very rare. It probably represents the replacement of calcite marble, rather than dolomitic marble. Any tin present would be in solid solution in the garnet and would not be released until low temperature chloritic alteration would occur. The only minerals which may contain measureable tin are magnetite and sphene. Magnetite may contain up to 0.3 weight percent while sphene can have any amount, right up to the tin analog of sphene, malayarite.

The secondary skarn types (5) to (8), do not volumetrically make up a large proportion of the total skarn observed, although minor amounts commonly occur in every sample. Forsterite invariably has serpentine alteration, in fact, serpentine pseudomorphs after forsterite are common. Pyroxene usually reacts to tremolite; garnet, to epidote and hedenbergite pyroxene, to ferrohastingsite. Phlogopite and/or talc, overprints all the Mg-rich minerals, while chlorite overprints Fe + Mg-rich minerals like ferrohastingsite. Little chlorite occurs, however.

In some cases, secondary skarn occurs along thin fractures but, again, zones thicker than 1cm are unusual.

DDH1, 2 and 3, however, consist mainly of calc silicate units in which forsterite, phlogopite etc. were not observed. Areas of sulphide and magnetite are equally rare and irregularly distributed in these drill cores. In fact, although no magnetite susceptibility measurements on this core was available, I would judge that the ground magnetic profile measured could not be produced by the small amount of magnetic material observed in the core. In DDH1, 2 and 3, there are significant areas of what were probably polymict conglomeratic units having carbonate matrix (e.g. upper part of NDDH1). These areas probably formed calc silicate (metamorphic) skarn before solutions which produced magnetite-sulphide ("ore") skarn were introduced.

Subsequently, the latter skarn only formed in areas where unreplaced carbonate was still retained.

The change of (interpretted) pre-skarn lithology going from NT-1 and -3 to DDH1, 2 and 3, suggests the structure in the unit interpretted to be Oonah formation is not simply flat lying - as shown in Dr.Ruxton's report, but much more complex. The accompanying diagram shows a possible interpretation of the above features.

Tin mineralogy

No tin minerals were observed in the core or in the many thin sections examined. In a few small areas in NT-3, a nearly opaque brown fibrous mineral occurred in fractures associated with limited serpentine alteration. No detailed work was done on this mineral, but the characteristics are similar to some Sn-borates (e.g. hulšite) and hydroxides (wickmanite). Green spinel, probably hercynite, and limited amounts of sphene were observed having a fairly regular distribution. As well as this, very limited amounts of what is probably andradite garnet occur.

These minerals should be analyzed for Sn contents to see if the system does contain some Sn in specific minerals. The fact that no cassiterite occurs in view of the fact that magnesian silicates can contain almost no Sn in solid solution, strongly suggests the environment is Sn-poor.

Possibility of significant Sn mineralization

In most of the core observed, the relative amount of alteration of primary magnesian skarn to secondary (hydrothermal overprint) skarn is very minor. Limited tremotite, serpentine etc. alteration of primary magnesian silicates like forsterite, diopside

and humite occurs. Some of the alteration is found throughout the matrix, while a limited amount occurs in and marginal to later fractures. Most sulphides postdate the early magnesian silicate minerals, but occur both before and with the secondary alterations. No, or little, Sn accompanies this event, although late sulphide skarn genesis generally is the main source of Sn in other deposits such as Cleveland. If one uses the model that the secondary alteration of primary high temperature skarn would release significant Sn which will be trapped in chemical traps such as late faults and fractures, then the Natone skarn is not very prospective.

This is suggested by the following:

(1) The general lack of secondary alteration, as mentioned coupled with the very low Sn values in the primary skarn.

(2) The fact that high Sn areas produced by secondary alteration usually forms above altered skarn. If such areas occurred at Natone they would now be eroded away above NT-1 and 3 and do not apparently exist in some other parts.

(3) If the ironstones are gossans, as I suggest, then no high Sn areas ever occurred in skarn now eroded. The general lack of alluvial Sn in the area also supports this view.

(4) Sulphide skarn, where present, is also low Sn. If high Sn areas occurred, these should occur in sulphide skarn (in most, but not all, deposits).

The high magnetic anomaly above areas drilled near NDDH2 and 3 would, in my opinion, not be produced by the limited volume of magnetic minerals observed in the core. It is thus possible that more magnetic ("ore") skarn exists at depth in areas not presently tested. Whether such skarn would be Sn-rich or not is unknown, by by present indications, it is not likely to be.

Comparison of the Natone skarn to other Sn areas in Tasmania

The Natone skarn is a near-contact ("proximal") magnesian skarn type and as such, is similar to skarns at St.Dizier and Tenth Legion. From a mineralogical point of view, the silicates, oxides and sulphides are very similar, but the low levels of hydrothermal alteration at Natone compared to the other two is striking. St.Dizier and Tenth Legion are marginal to a batholith (the Hemskirk granite) in which large areas of other styles of Sn mineralization occur (e.g. the Federation greisen-tourmaline breccia system).

In spite of this, these deposits are still not economic at the present time and are unlikely to be in the near future. There is a Sn alluvial field in the Housetop granite (Crane's deposit) but it was small and is spacially well removed from the Natone skarn. Thus, the general lack of significant Sn mineralization in other styles in the Housetop granite pluton environment renders it not very prospective. High W areas may exist similar to the Kara deposit, but these are not evident in the skarns tested, including the Natone skarn.

In a comparison of the Natone skarn with other deposits in Oonah formation dolomite (e.g. Mt.Bischoff; Renison), or similar deposits (e.g. Razorback), it is immediately obvious that the geological relationships at Natone are wrong. Economic Sn sulphide replacement deposits characteristically occur above granite cupulas often related to acid porphyry dykes not marginal to steeply dipping granite/sediment contacts. The general lack of any greisenization at Natone also suggests low Sn values.

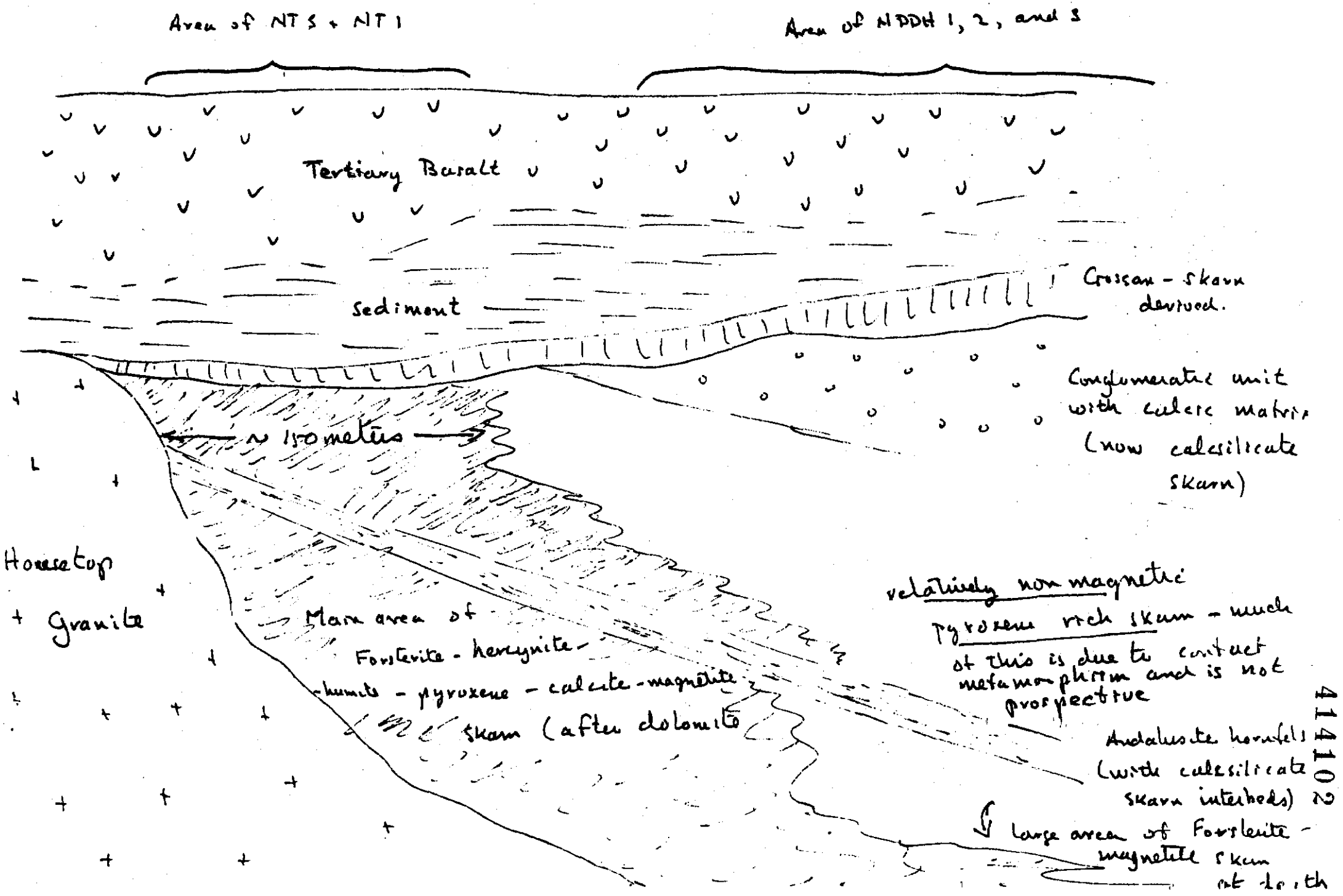
Recommendations

I do not consider the presently tested parts of the Natone skarn to be prospective for Sn mineralization and would not recommend additional work here.

What the cause of the magnetic anomaly is in the NDDH2 and 3 areas should be evaluated by determining the magnetic susceptibility of drill core from these holes. Whether Shell should put in a deep hole here depends on moneys available but I do not expect significant Sn values there.

In many skarns, high Sn (and W) values occur at the outer edge of the skarn. This area has not been tested at Natone due, I am told, by an uncooperative farmer. If access could be arranged, then this area could be tested.

Diagramatic Representation of Longitudinal Section through the Natone Skarn

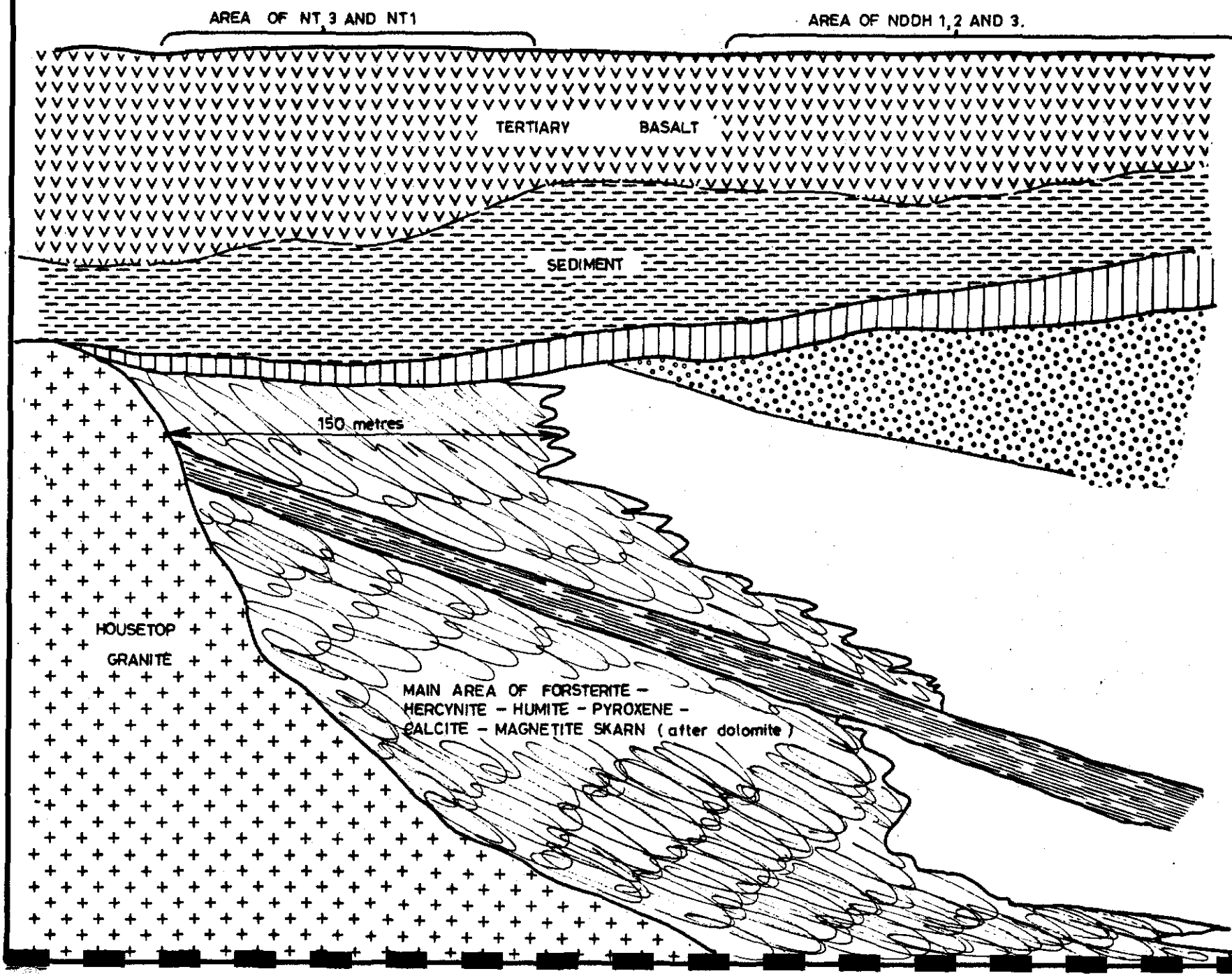


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DIAGRAMATIC REPRESENTATION OF LONGITUDINAL SECTION THROUGH THE NATONE SKARN



G

GOSSAN – SKARN DERIVED

CONGLOMERATIC UNIT WITH CALCIC MATRIC (NON CALCSILICATE SKARN)

RELATIVELY NON MAGNETIC PYROXENE ROCK SKARN – much of this is due to contact metamorphism and is not prospective

ANDALUSITE HORNFELS (with calcsilicate skarn interbeds)

LARGE AREA OF FORSTERITE MAGNETITE SKARN AT DEPTH

The Shell Company of Australia Limited
METALS DIVISION

E.L. 8/77 RIANA

NATONE SKARN

LONGITUDINAL SECTION

SCALE N.T.S.	DATE 1983
AUTHOR T.K.	DRAWN J.L.L.
OFFICE REPORT	REP.No.
DRG.No. D1400-194	FIG.No.

Table 1.

Primary skarn types - after dolomite marble.

1. Forsterite olivine + calcite ± hercynite spinel + magnetite (e.g. NT3-98m).
2. Diopside ± magnetite (NT-3, 265m).
3. Chondrodite - chrohumite + forsterite olovine + calcite ± phlogopite (late) (e.g. NT-3, 56.8m).
4. Diopsidic pyroxene + pyrrhotite + chalcopyrite (e.g. NT3-168) after calcite marble.
5. Andraditic garnet, hedenbergitic (?), pyroxene + late calcite (e.g. NT3-178m).

Secondary skarn types

6. Phlogopite or talc ± serpentine after (1) and (3).
7. Tremolite ± phogopite after (2).
8. Ferrohastingsite ± epidote ± calcite ± sulphides (mainly pyrrhotite) after (5); chlorite may occur later (e.g. NT-2 - 303'9").

N.B.

Very few accessory minerals occur: of these, sphene and apatite are most common.

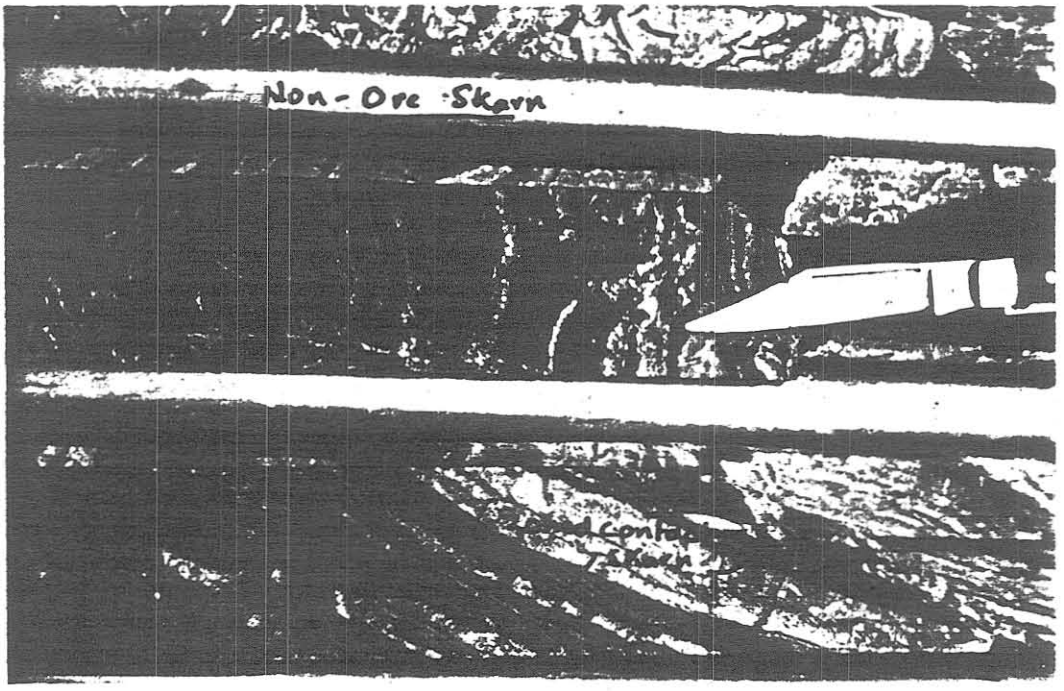


Figure 1. "Bimetasomatic" zoned skarn at dolomite/hornfels interfaces (NT-1, 167.4m). This is purely a metamorphic effect and not a metasomatic/ore skarn effect.

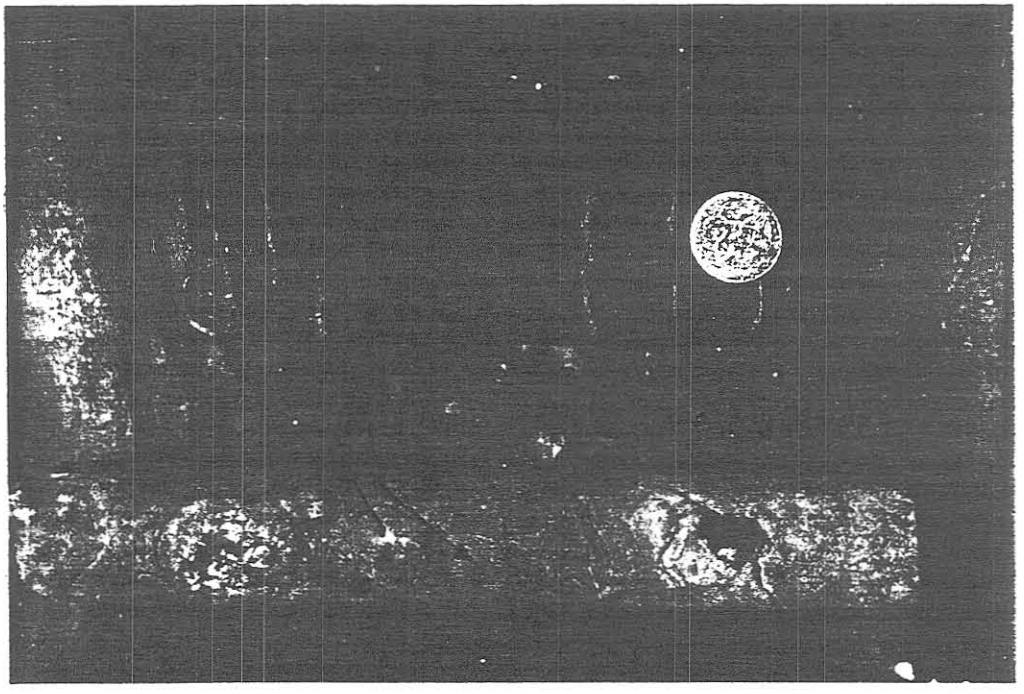


Figure 2. Conglomeratic-skarn (lower). The skarn, mainly epidote and pyroxene, is again mainly metamorphic in origin (DDNT 2 - 486.6').

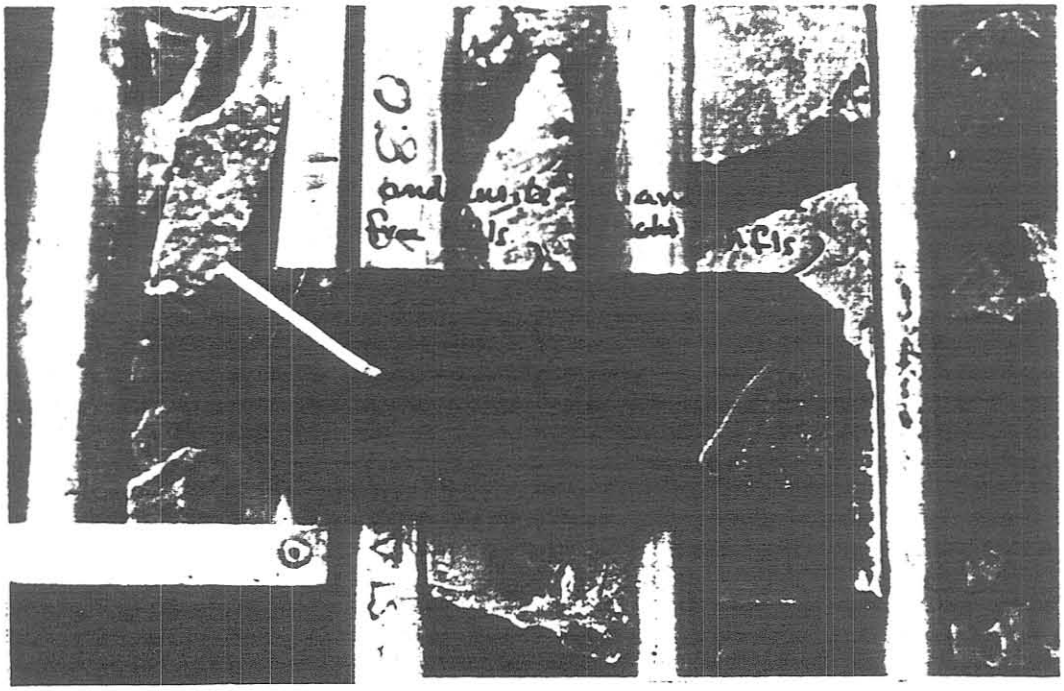


Figure 3. Andalusite (chiastolite) hornfels occurs interbedded with chiastolite-free hornfels (NT-3 = 48.5m).

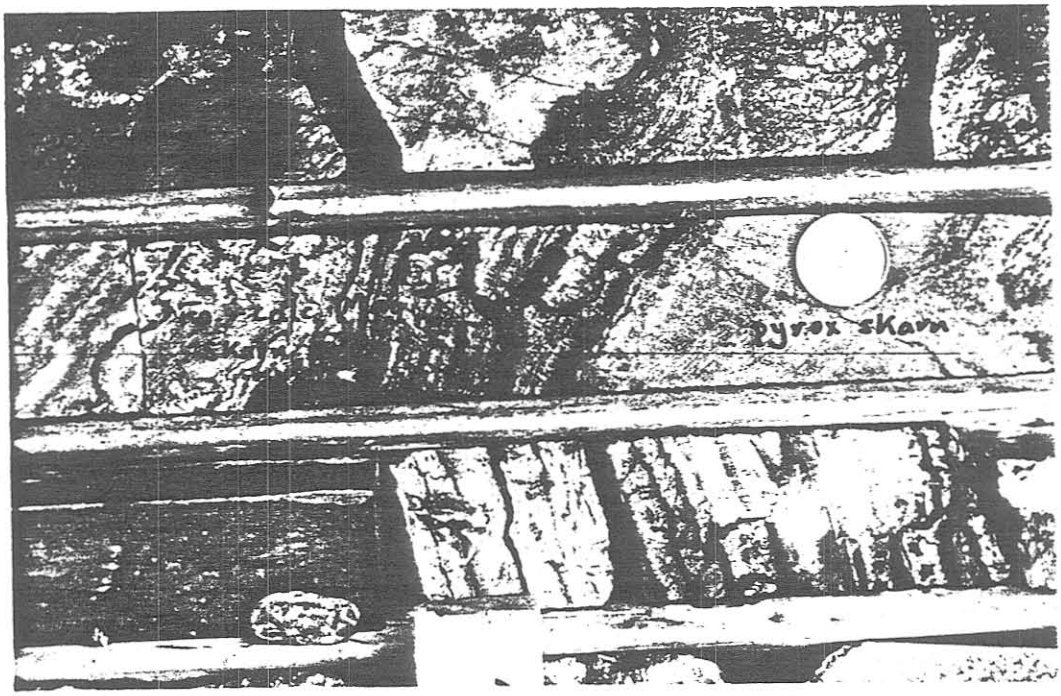


Figure 4. Boundary between pyroxene skarn (type 2) and forsterite - calcite - magnetite skarn (type 1). These are metasomatic/ore skarns.

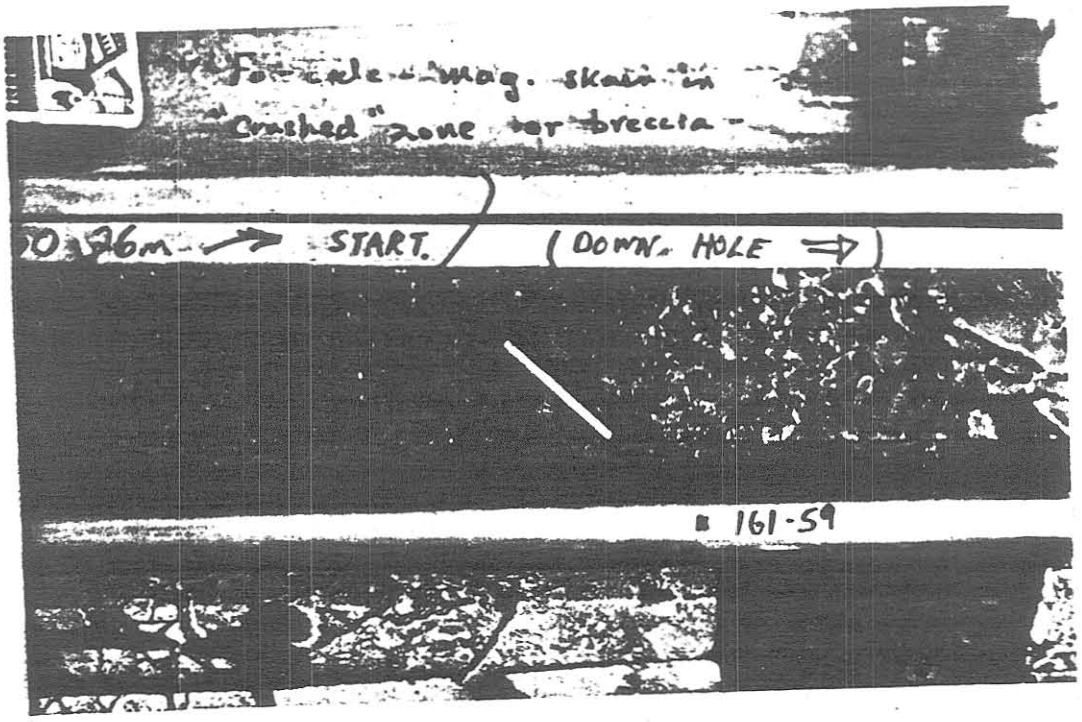


Figure 5. Forsterite - calcite - magnetite skarn occurring between dolomite fragments in a breccia (NT3 - 161m).



Figure 6. Boundary between type (1) and (2) skarn, showing serpentine-rich interface (NT3 - 265.8m).

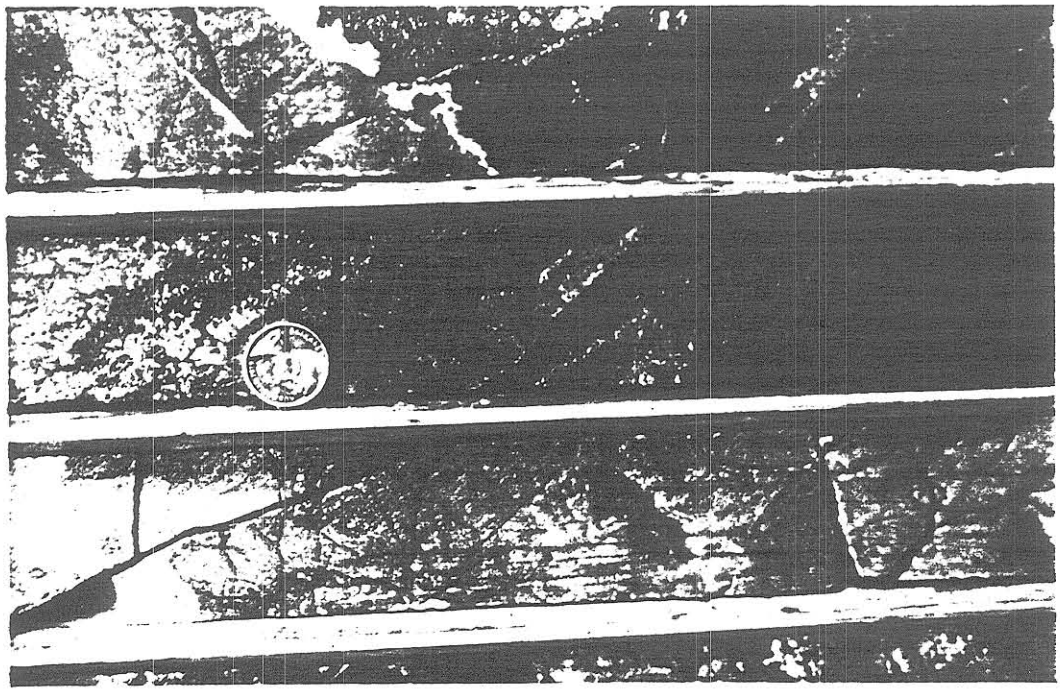


Figure 7. Pyrrhotite-rich rock (type 4 skarn) overprinting pyroxene skarn (NT3 - 199m).

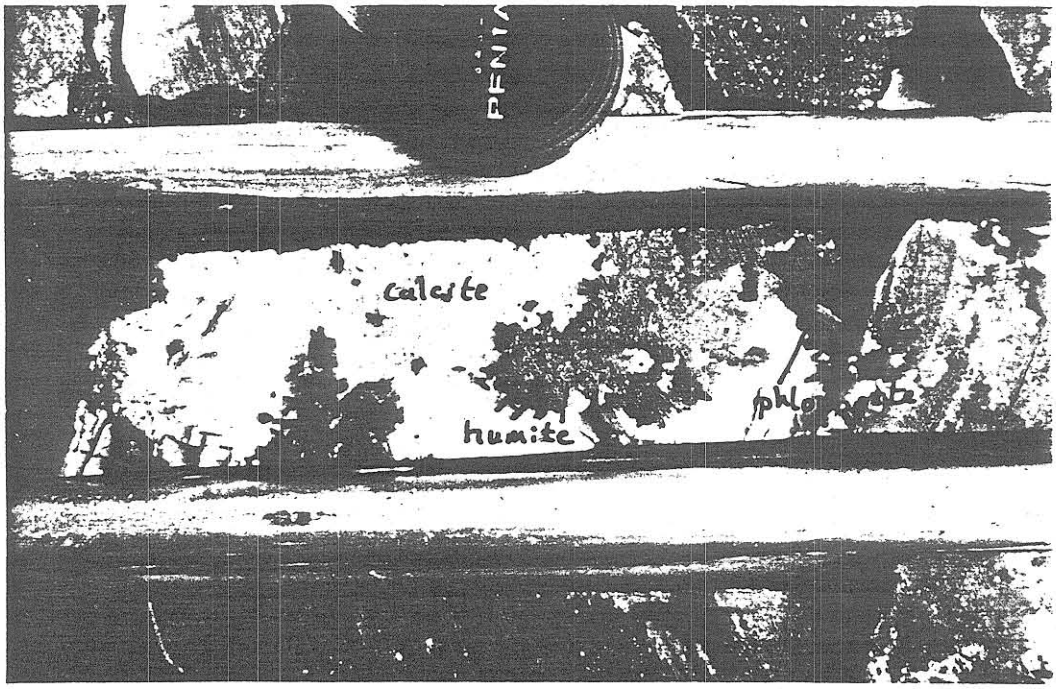


Figure 8. Vein or vug-like humite mineral - phlogopite-calcite rock (type 3 skarn) (NT3 - 54.8m).

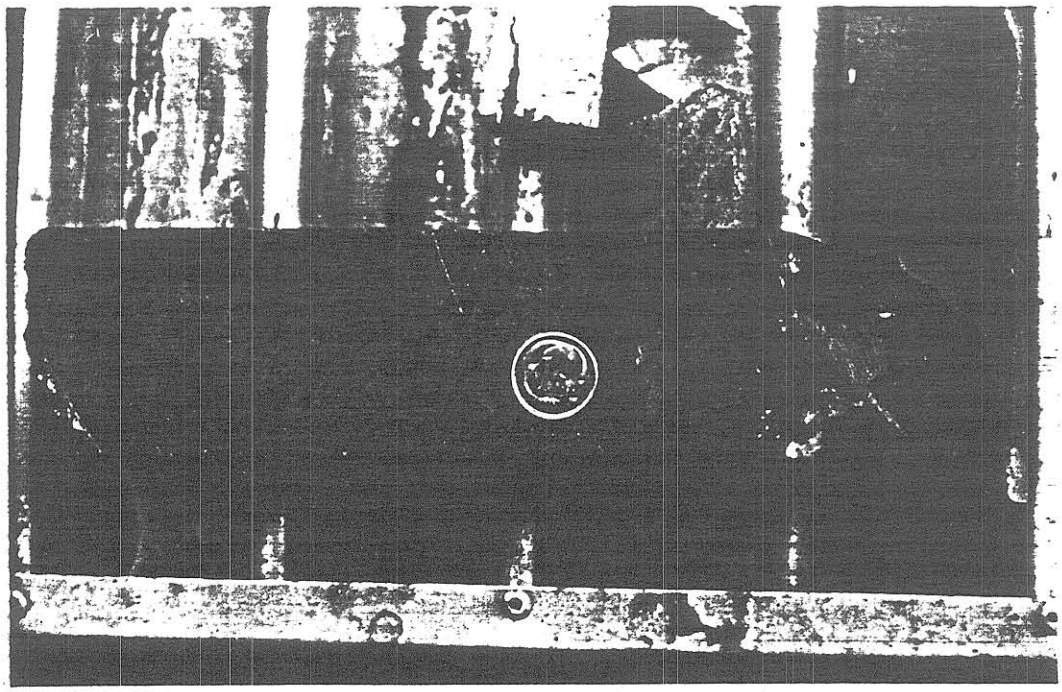


Figure 9. Pyrrhotite-chalcopyrite-pyroxene (type 4) skarn.

Note the large pyroxene crystals (NT3 - 168.7m).

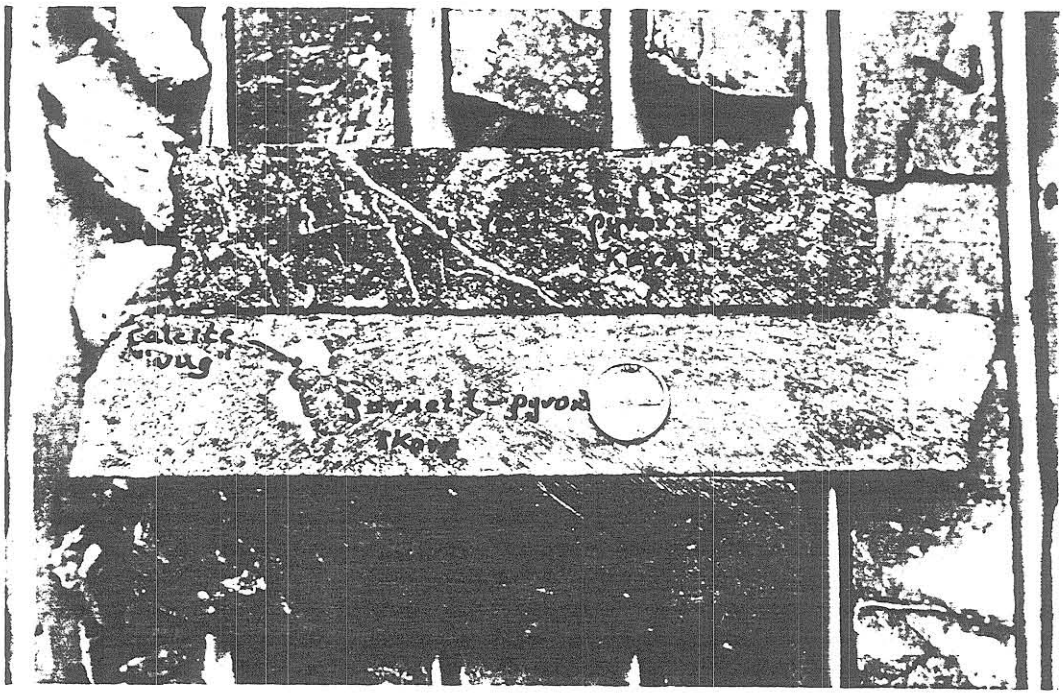


Figure 10. Garnet-pyroxene skarn and tourmaline altered hornfelsic rock (NT3 - 178m).

Memorandum

M904 - 643 109

414110

Date 29th November, 1983.

From P.A. Ruxton

To Dick Wright

Re: NATONE SKARN

Teunis Kwak (La Trobe University) was contracted to study the Natone Skarn. The Natone Skarn report was read, drillcore was examined and sampled and a brief field visit was made. Tuenis will examine prepared slabs of rock from the drillcore and write a short report before Christmas.

Preliminary discussions with Teunis tend to confirm that the Natone Skarn is barren:

1. The tin-bearing skarns of the West Coast lie above stanniferous/ altered granites -

   a) Mt. Bischoff - associated with high level porphyry dykes,
   b) Cleveland lies above the Foleys Zone Granite,
   c) Mt. Lindsay is underlain by a granite tongue,
   d) Renison includes the Federal Basalt Fault which taps a tin-bearing granite at depth (it's interesting to note that Teunis has heard of Renison-style deposits in North China with 30 - 40 mt at 1%+ Sn!).

   The Natone Skarn is located at the northern margin of the Housetop Granite - not related to the top of a stanniferous granite.

2. Teunis has seen similar barren skarns at the contact of the Heemskirk granite west of Zeehan.

3. The fact that there are no elevated tin/tungsten values in the skarn is downgrading. The Natone skarn replaces dolomitic beds of the Oonah Formation and contains both calc-silicates and Ca-Mg silicates. Calc-silicates (namely garnet and pyroxene at Natone) generally contain a degree of substitution of Sn for Ca in stanniferous skarns - this generally leads to metallurgical complications - e.g. Moina. Ca - Mg silicates have no capacity for the substitution of Sn in their crystalline structure and tin is free to form cassiterite. Unusually large crystals of humite (the Chondrodite group - humite, clinohumite etc. - Ca - Mg silicates formed only in metasomatized dolomitic units - skarns) were recognised by Teunis in the Natone core (NT 3).

   The low assay results suggest the lack of free cassiterite or combined tin in calc-silicates indicating that the hydrothermal fluids which formed the Natone skarn were probably barren with respect to tin and tungsten. Teunis will confirm that with petrological and probe work.

FORM 32/6000

4. The lack of alteration (greisenization dominantly) and tin/tungsten values in the marginal Natone granite is downgrading. Fine grained and porphyritic variants occur but no alteration is evident, no tourmaline is present - no evidence of endogranitic alteration/ mineralization. The only points of interest in the source granite are: a) it is texturally and mineralogically similar to the Kara granite, b) and there is a slightly elevated WO_3 in stream anomaly SW of the Natone Skarn.

Teunis generally agreed with the local geology of the area (after some coersion - he wanted to place the ironstone in the skarn assemblage). The general replacement sequence defined by core logging also withstood his scrutiny however further divisions of a minor nature may be suggested following petrological studies.

He commented that the Natone Skarn was unique but I suggest purely in an academic sense. His comment was derived from the abundance of minerals from the Chondrodite Group - these minerals are generally rare even when present.

CONCLUSIONS

The general feeling was that Natone is a barren skarn.

Teunis questioned that the drilling of NDDH 1, 2 and 3 intersected the magnetic anomaly and implied a deep magnetic source - i.e. deeper skarn perhaps at the base of the dolomitic unit.

Teunis agreed that a deep hole to test the possibility of a further skarn at depth was a good idea but suggested that the money was better spent drilling Loila Tier (Scamander).

Natone probably represents a good farmout proposition at this stage with the possibility of mineralization in a second skarn at depth.

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APPENDIX 6

INPUT Survey Report - Geoterrex, April, 1982

DEVONPORT

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INTERPRETATION REPORT

AIRBORNE ELECTROMAGNETIC SURVEY

BARRINGER 'INPUT' SYSTEM

OF THE

RIANA, HIGHCLERE AND LOONGANA AREAS

TASMANIA

FOR

THE SHELL COMPANY OF AUSTRALIA LIMITED

BY

GEOTERREX PTY. LIMITED

(83-548)

Sydney, Australia

April, 1982

M. Schneider

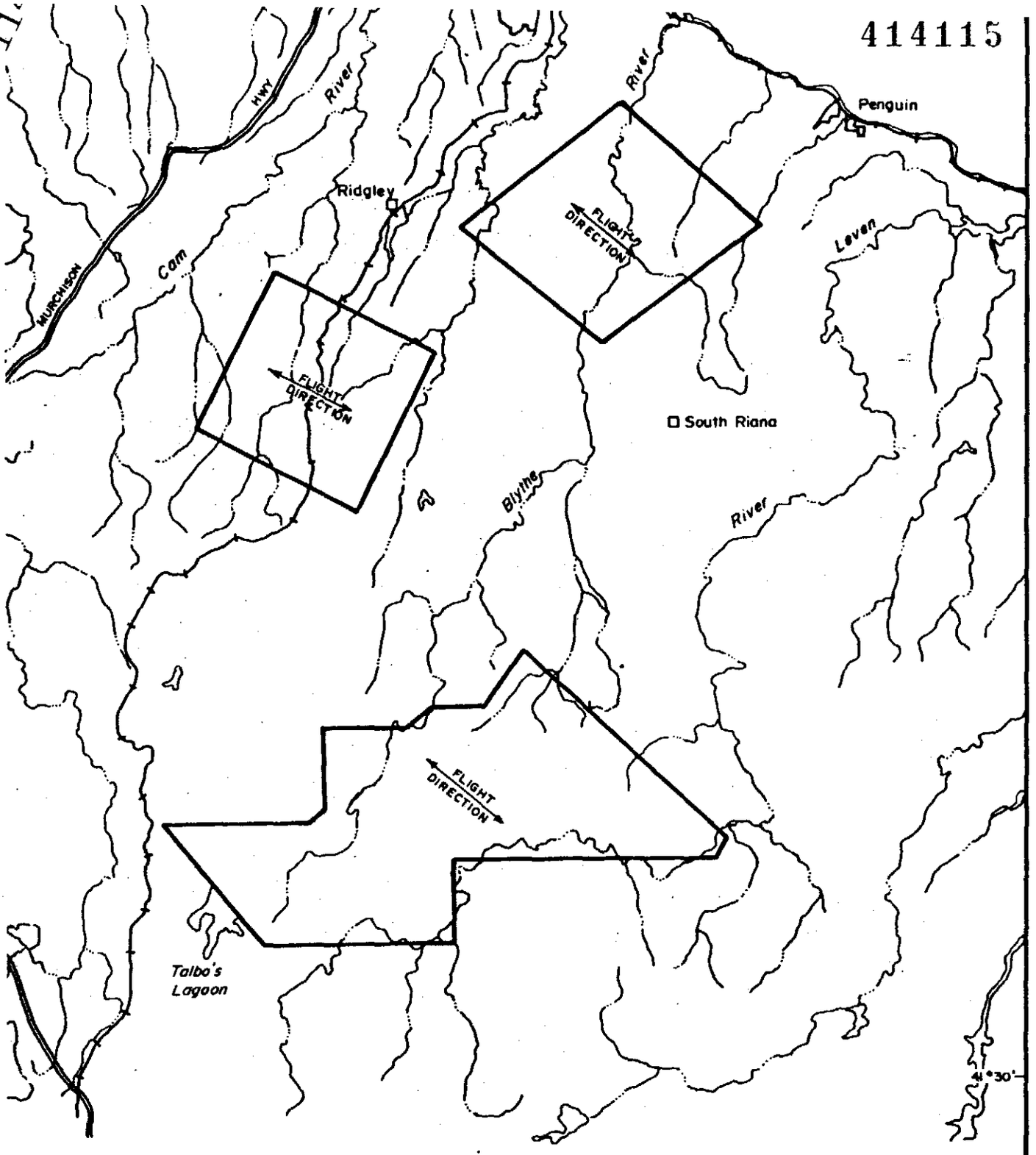
Geophysicist

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APPENDIX A	INPUT EQUIPMENT AND PROCEDURES
APPENDIX B	INPUT INTERPRETATION
APPENDIX C	INSTRUMENT SPECIFICATIONS AND CALIBRATIONS
APPENDIX D	COMPUTER PROCESSING METHODS

414115



5 cm

SURVEY AREA LOCATION MAP

SCALE 1:250 000

0 5 10 15 km

NORTH WEST 1:250 000 SHEET

1. INTRODUCTION

During the period January 7th to January 11th, 1982, Geoterrex Pty. Limited flew a combined electromagnetic and magnetic survey over the Riana, Highclere and Loongana areas of Tasmania on behalf of the Shell Company of Australia Limited. The base for the duration of the survey was Burnie.

A total of 248.0 kilometres was flown at a flight line spacing of 300 metres in a north west direction in the Riana area, 216.0 kilometres were flown at a flight line spacing of 300 metres in a north west direction in the Highclere area, 996.1 kilometres were flown at a flight line spacing of 300 metres in a north west direction in the Loongana area.

The project was conducted with the Super Canso PBY-5A under registration VH-EXC, which is operated by H.C. Sleigh Aviation for Geoterrex Pty. Limited and was equipped with :-

- a Barringer Mark V Input EM System
- a Geometrics G803 nuclear precession magnetometer
- a Geoterrex 'Madacs' digital acquisition system
- a Sperry RT220 radar altimeter
- a 50 Hz monitor
- a Geocam 705 35mm continuous strip tracking camera
- a Honeywell 1912 visicorder

Navigation was by visual means from black and white government photography enlarged to a scale of 1:20,000. The aircraft was operated at a mean terrain clearance of 120 metres.

II. PERSONNEL

414117

The following Geoterrex personnel participated on the field phase of the survey

J. Edwards	Pilot
D. Bowen	Co-Pilot
W. Mitchell	Aircraft Mechanic
L. Williams	Senior Electronics Technician
S. Kiss	Electronics Technician
M. Curtis	Data compiler
G. Butt	Senior Geophisicist
M. Schneider	Geophisicist

The entire project was planned and supervised by G. Butt of Geoterrex Pty. Limited in conjunction with N. Hungerford representing the Shell Company of Australia Limited.

Digital data processing was carried out at Engineering Computer Services Pty. Limited of Bowral, New South Wales.

Drafting was by Geodrafting Pty. Limited of Sydney.

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III. DATA PRESENTATION.

The geophysical data is presented in the following form and all maps are at a scale of 1:20,000.

- EM Anomaly Map (overlay to topagraphic sheet)
- Original Input analogues
- Flight path plotted on Tasmanian 1:20,000 cadastral sheets.

EM ANOMALY MAP

The EM Anomaly Maps which overlay each 1:20,000 cadastral sheet show the INPUT anomalies from the high resolution channels.

The anomalies are plotted in their correct lateral positions (i.e. the 2.0 second lag between the six HRC INPUT* responses and the true ground position has been accounted for) on the flight lines and grouped according to similarity of amplitude and shape from line to line. The boundaries of these anomalouse zones are determined from the halp peak amplitude width on Channel 3. A diamond symbol indicates the anomaly peak and hence whether the anomaly is symmetrical or not. The number at the upper left of the diamond is the ratio of Channel 2 to Channel 5 in 10ths of inches chart deflection. The number at the upper right is the aircraft altitude in metres. Any significant association between an INPUT and magnetic anomaly is indicated by plotting the amplitude of the magnetic response beneath the diamond. If there is any offset between these peak responses an arrow indicating the direction of offset is drawn beneath the amplitude of the magnetic response.

During the course of data evaluation, groups of anomalies are outlined to show our interpretation of the extent of the geologically conductive zones. If any doubt exists, the outlines are dashed. Conductors of

interest are numbered to facilitate reference to the report.

* For the Highclere area only the slow time constant channels were used for picking and plotting anomalies due to the undue amount of 50Hz and cultural interference on the HRC responses. The lag used to plot these anomalies was 40 seconds. Otherwise the procedure was the same as outlined above.

THE RECOVERED FLIGHT PATH is presented on both the recovery photomosaic and the 1:20,000 cadastral sheets for each area. The flight path on the cadastral sheets was used as the base for all processing on EM anomaly maps.

The original visicorder records of the raw INPUT, altitude and magnetic data are presented bound in line number order. All calibration data is included and a copy of the analogue format is shown in Figure 3 of Appendix A.

The 4 rolls of negative 35mm continuous strip tracking film are delivered and labelled according to their flight number.

The aerial photography, bearing all the points, along with the tracking film is provided for accurate location of any followup investigation.

The flight logs which contain all relevant information regarding the collection of geophysical data are presented bound in flight order.

The data was processed at Engineering Computer Services Pty. Limited

in Bowral, New South Wales. Compilation and interpretation of the data was performed in Sydney.

The survey was conducted in consultation with N. Hungerford, representing the Shell Company of Australia Limited.

IV. INTERPRETATION - General

Commonly used interpretation techniques rely mainly on qualitative review of data and refer to anomaly shape, symmetry, strike extent and variability within conductive zones. The apparent conductivity, as determined by the amplitude and rate of decay of the INPUT response, is an important criterion in our analysis of conductors. Other important factors taken into account include:-

- the shape and size of the INPUT anomalies,
- the strike length and degree of isolation of the conductor,
- the form of conductors particularly with respect to direction and dip of geological and cultural structures,
- the associated geophysical parameters such as aeromagnetics,
- variation of response characteristics within a given conductor,
- the geological environment and the response of the system to known mineralization.

Conductors delineated by an EM survey can be separated into categories based on their probable origins, namely bedrock, surficial and cultural.

The term cultural is used for those conductors thought to be due to any man-made construction. These are responses due to fences, telephone and powerlines etc.

Surficial conductors refer to sources in the overburden, in the weathered portion of the bedrock or in those formations not usually considered as host material for sulphide orebodies. In the context of this report the word surficial should not be used in the geological sense but rather as a geophysical term.

fails if there is little or no difference between overburden and target body. This method (Verma 1975*) is useful in areas of extensive high conductivity.

b) Curve matching to theoretical homogeneous half-space response (HHS) curves. Sets of HHS response curves of various transmitter-conductor altitudes are stored in computers for matching the field data. A degree of fit measurement is made. Apparent resistivity and apparent depth are calculated. The mechanism of parameter calculation and plotting are described in the appendix concerning quantitative interpretation of the data.

c) Consideration of average response amplitude, as defined by Dyck et al, 1974**, and decay time-constant can yield a broad definition of the two-layer case solution. It is possible to distinguish between thin and thick layer cases in certain controlled environments.

INPUT CLASSIFICATION

All conductors of interest are classified according to the following priority system:-

Priority 1 zones satisfy most of the criteria associated with a bedrock source which could be due to massive sulphides. They contain responses indicating a highly conductive source, and may be isolated or extensive, bearing in mind the expected size of sulphide deposits in this region.

* Verma. S.K. 1975.
Resolution of responses due to conductive overburden and orebody, through time-domain EM measurements; a field example; G.P. 23 No. 2: 292-299.

** Dyck. A.V., Becker. A., Collett. L.S. : 1974.
Surficial conductivity mapping with the airborne INPUT system. CIM Bulletin, page 104-109, April, 1974.

Priority 2 zones also satisfy most of the criteria associated with bedrock features but anomalies display characteristics such as faster rate of decay or broader width which preclude them being listed as Priority 1.

Zones which are rated as Priority 3 targets are almost certainly of surficial origin, but a small degree of uncertainty is present.

Priorities assigned to zones are made primarily on the merits of the INPUT responses, with some influence from the magnetic data. Geological information must be further analysed to determine the ultimate priority for followup.

The priority rating system refers to the probability that the conductive source of given zones is related to massive sulphide mineralization.

VII. INTERPRETATION OF RIANA SURVEY DATA

The INPUT data from the Riana survey shows a mixture of responses, including extensive broad regions of high conductivity, large highly conductive bedrock features with identifiable structure, potential massive sulphide occurrences and many cultural responses.

As for the Highclere area, geology and aeromagnetic maps indicate that the majority of the area is covered by tertiary basalts. The INPUT data reflects this, as can be seen by the broad conductive areas which extend from the southern to the northern boundary. Within these areas, some of the strongest (and hence most conductive) 6 channel responses have been delineated and discussed (eg zone 20/4144/IR1). Again it must be stressed that no assumption regarding the possible association of sulphides with the most conductive response has been made (as can be seen from the priority usually given to these zones), but should further geological/geochemical evidence be acquired these zones may assume a greater importance.

Unfortunately, there are many cultural responses which interfere with the ground response to an extent where anomaly boundaries become uncertain (eg: 20/4044/IR3) and any source geometry information becomes disguised. Also there are responses which are characteristic of culture but occur just a little to far away from obvious culture on the tracking film to be dismissed outright (eg: 20/4043/IRS).

Zone 20/4044/IR2 is a very interesting area due to its high conductivity and structure inferred from the INPUT data. Whilst INPUT data is certainly not definitive about the absolute magnitude

of conductor dip, it is often possible to gain a firm impression of the dip direction. In the case of this zone it is certain that the conductor has some dip and the inferred directions suggest it may be part of a synformal structure. The major implication of this interpretation is to reduce the likelihood of massive sulphides being the source of the response and to suggest a very conductive unit being responsible such as carbonaceous material.

ZONR 20/4144/IR1 — Priority 3

Line 125.1	Fiducial 381406 to	Ratio 31.0/5.0
Line 122.1	Fiducial -	Ratio ---

Anomalies	Shape	:	Broad and symetric
	Amplitude	:	Large
	Decay Rate	:	Moderate - slow
	Cultural Signs	:	None
	Mag Association	:	None
Conductor:	Dimensions	:	600 metres wide, 1.0 kilometres long, open at both ends
	Strike	:	North East

Location: Cultivated fields

Remarks:

This zone represents the strongest 6 channel response from within the broadly conductive zone related to the basalt cover. The best individual response occurs on line 123.1 at fiducial 375864. This zone broadens considerably to the north east and south west where the 6 channel response no longer stands out strongly against the generally conductive background, hence the open zone boundaries.

Recommendations:

The determination of the source and its geometric/geophysical properties is very difficult in cases such as this where the object is to discriminate between changes in the "overburden" and real bedrock sources. Therefore, ground follow up would require either a deep penetration, discriminatory system or some geochemical techniques.

ZONE 20/4044/IR2 — Priority 2

Line 108.1	Fiducial 575928	Ratio 30.0/9.0
	Fiducial 575890 to	Ratio 29.0/8.0
Line 102.1	Fiducial 559800	Ratio 10.0/1.5

Anomalies:

Shape	:	Dependent on flight direction
Amplitude	:	Moderate
Decay Rate	:	Slow
Cultural Signs	:	None
Mag Association	:	None

Conductor:

Dimensions	:	2.4 kilometres long, horseshoe shaped
Strike	:	North East

Location: Cultivated Plateau

Remarks:

The shape and position of the INPUT anomalies indicates that the source of this zone has discernable structure, which has significant implications when considering the geological nature of the source. The dependence of the plotted peak position upon flight direction (a phenomena well displayed from lines 104 to 106) indicates that both limbs of the zone are dipping. The direction of dip may be found from the channel 1 to 6 peak effect on individual anomalies. The most westerly limb shows strong channel 1 to 6 peak offsets on lines 104.1NW, 106.1 NW and 108.1 NW which suggests that these lines were flown up dip. Lines 107.1SE, 106.2SE, 104.2SE and 103.1SE shows no such peak offsets, suggesting these lines were flown down dip. However, Line 105.1SE has peak offsets akin to an updip response and 105.2NW has no offsets as shown on the other downdip lines.

The easterly limb exhibits very little dip information other than the anomaly plotting position being dependent on direction. The responses on Lines 104.1NW, 105.2NW show no channel 1-6 peak offset, implying a down dip response. Lines 105.1SE, 106.2SE and 107.1SE have responses with channel 1-6 peak offsets implying an updip response. Again, there are two lines which don't fit in with this interpretive scheme; Line 104.2SE shows no channel 1-6 peak offset which is inconsistent with the other lines flown. SE and Line 106.1NW which shows peak offsets when you would not expect to see them if the response is from a down dip direction.

Therefore, the INPUT data suggests that the westerly limb dips towards the south east and the easterly limb dips towards the north west. A plausable geological structure consistent with these dips and the ever decreasing distance between limbs to the north east would be a syncline cut an oblique angle as shown in the figure.

The implication of such a structure are to downgrade the importance of this zone as a high priority sulphide target since the structure implies that the same geological unit is the source of both responses. This being the case, the slow decay and high conductivity is more likely to be representative of a carbonaceous unit rather than sulphides.

Recommendations

Ground follow up is recommended to best determine the structure and the form of the source.

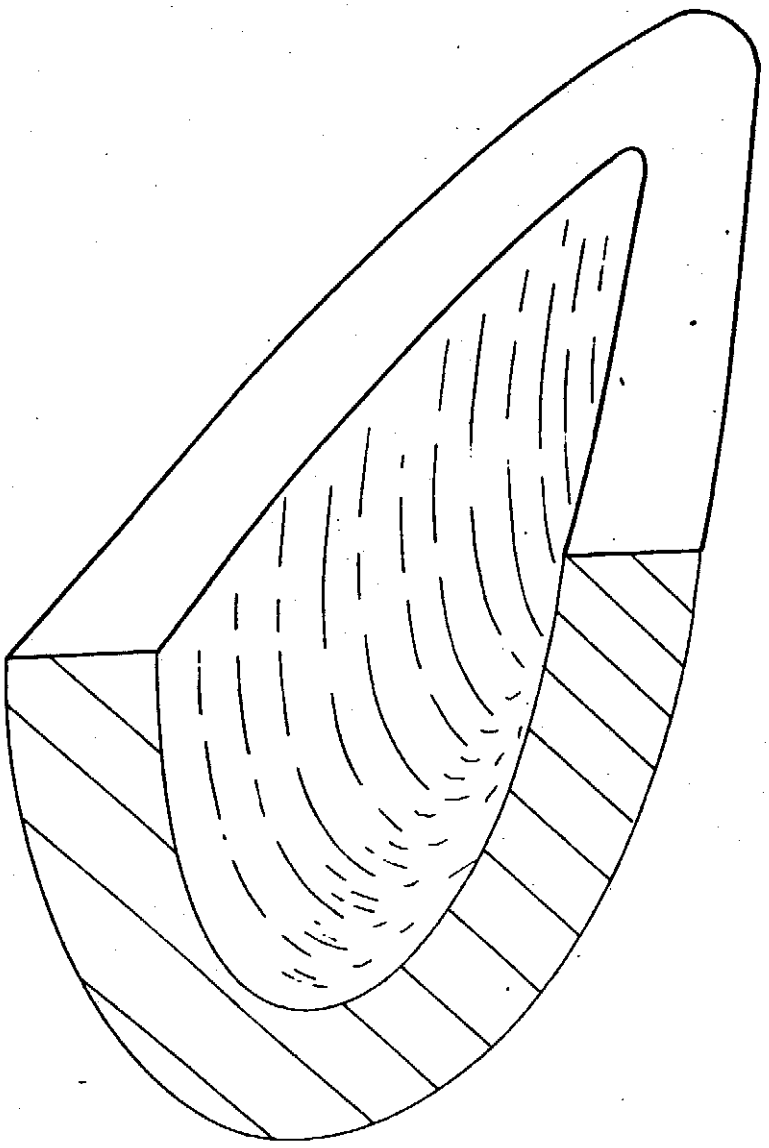


Figure 1 - Possible geometry of 20/4043/IR2

ZONE 20/4044/IR3 Priority 1

Line 110.1 Fiducial 584430 Ratio 17.0/2.0

to

Line 106.1 Fiducial 570546 Ratio 14.0/3.0

Anomalies Shape : Narrow, asymetric often contaminated by cultural interference

Amplitude : Moderate

Decay Rate : Slow

Cultural Signs : Power lines and fences nearby

Mag Association : Large broad anomaly on 106.1 to 108.1

Conductor: Dimensions : 1.6 kilometres long

Strike : North

Location: Cultivated fields

Remarks:

There is come contribution from cultural noise in this zone which casts doubts on to the northerly (dashed outline) extension of this feature. Also, on lines 107.1 and 108.1 there is consistent 6 channel response between this zone and 20/4044/IR2 which may indicate that the two zones could be related. The anomalies are sufficiently contaminated to cloud any dip information that may have been present, however, the culture is too far away to be the direct cause of the anomaly.

Recommendations:

Ground follow up is recommended to establish the source and its geometric parameters.

414131

ZONE 20/4044/IR4 Priority 1

Line 102.1 Fiducial 559652 Ratio 10.0/1.0

to

Line 101.1 Fiducial 556310 Ratio 12.5/1.5

Anomalies:	Shape	:	Relatively broad & symmetric
	Amplitude	:	Small
	Decay Rate	:	Slow - very slow
	Cultural Signs	:	None
	Mag Association	:	Broad dual peaked anomaly
Conductor:	Dimensions	:	300 metres wide x 800 metres +, long
	Strike	:	East
Location:	River		

Remarks:

This zone strikes parallel to zone 20/4044/IR2 and is along strike from the eastern limb of that structure. There is some corrilation with a broad dual peaked magnetic anomaly which becomes less apparent north of line 102.1. The very slow decay rate and small amplitude of the INPUT response would suggest that the conductive source is quite deep as is the source of the magnetic anomaly, but it is unlikely that the same source gives rise to both anomalous geophysical quantities.

Recommendations:

Ground follow up is recommended.

ZONE 20/4043/IR5 Priority 3

Line 1042 Fiducial 354240 Ratio 12.51

Anomalies:	Shape	:	Very narrow & symmetric
	Amplitude	:	Moderate
	Decay Rate	:	Moderate - Fast
	Cultural Signs	:	Farm houses
	Mag Association	:	None
Conductor:	Dimensions	:	200 metres wide
	Strike	:	--

Location: Farmhouses and paddocks

Remarks:

This anomaly appears to be cultural, yet examination of the tracking film places the peak some 100 metres away from the evident culture (houses etc). For this reason there is some doubt as to the source of the anomaly. There does not appear to be any similar anomaly on line 104.1 (which crosses 104.2 near the fiducial range we are looking at.)

Recommendations:

Follow up is required to determine whether the culture is the only source present.

ZONE 20/4044/IR6 — Priority 3

Line 104.1	Fiducial 565780	Ratio 9.0/1.2
	to	
Line 102.1	Fiducial 560128	Ratio 11.0/1.0

Anomalies:

Shape	:	double peak on 104.1 otherwise symmetric
Amplitude	:	Small
Decay Rate	:	Slow
Cultural Signs	:	None
Mag Association	:	Broad 100 mt anomaly

Conductor:

Dimensions	:	300 metres wide x 600 metres long
Strike	:	North east

Location: Outside survey boundary, coincident with heavily wooded section.

Remarks:

This zone falls outside the survey area and the shape of the response on lines 102.1 and 104.1 appear to follow the altimeter record closely. However the anomaly on line 103.1 has similar amplitudes but at an altitude of 160m instead of 120m. The INPUT zone has a plan extent coincident with a heavily timbered topographic feature which is the probable source.

Recommendations:

Ground follow up recommended to establish true nature of the source.

NOTE: - This zone cannot be plotted accurately on the ETI anomaly Map since it is outside the limits of path recovery and therefore was omitted from that map.

VIII. TABLE 2. SUMMARY OF SELECTED CONDUCTORS - RIANA AREA

Priority 1	Priority 2	Priority 3
20/4044/IR3	20/4044/IR2	20/4144/IR1
20/4044/IR4	20/4044/IR6	20/4043/IR5

410 000 E

420 000 E

414135

5 cm

TN

0 1 2 3 km

The Shell Company of Australia Limited
METALS DIVISION

GEOLOGY OF : 01
E.L. 8/77 RIANA
E.L. 14/80 HAYES PEAK
ANOMALY MAP

84-2142

SCALE	1 : 50000
AUTHOR	P RUXTON
OFFICE	DEVONPORT
ENCL No.	
DATE	11 - 7 - 83
DRAWN	H L H
REP No.	
DRG No.	D/MQ04/164

BASS STRAIT

5 450 000 N

5 440 000 N

5 430 000 N

5 420 000 N

SULPHUR CREEK
STOWPORT
CUPRONA
CUPRONA Cu
CUPRONA 4144/1
G.L. 10
IR 14
IR 13
IR 15
G.L. 9
NATONE Cu
G.L. 8
IR 6
I.R. 2
UPPER STOWPORT
NATONE
DEAR CREEK 4044/3
UPPER STOWPORT 4044/2
IR 4
NATONE 4044/1
IR 3
EAST NATONE
IR 8
IR 7
IR 5
ELLIS CREEK NORTH 4043/2
ELLIS CREEK SOUTH 4043/2
UPPER NATONE
E.L. 8/77
CAMENA
CAMENA 4144/2
IR 12
IR 1
MIDGLEY FALLS 4144/3
IR 11
GL 11
IR 10
STOTTS ROAD 4143/3
RIANA
WATTLE GROVE 4143/2
SOUTH RIANA 4143/4
SOUTH RIANA
4143/1
4244/3 DIAL POINT
PENGUIN
PENGUIN 4244/1
NEPTUNE 4244/2
PENGUIN WO 3
BASS HIGHWAY
E.L. 14/80
To Hampshire
REDWATER GRANITE Sn/WO 3
4142/16
4142/15
LOWANA CREEK 4142/3
GUNNS PLAINS
LOYETEA WEST 4142/11
4142/2
LOYETEA EAST
HOUSETOP 4042/2
LOYETEA
REDWATER 4142/1
REDWATER NORTH
PEAK HILL 4142/12
PEAK HILL FARM 4142/12
LAUREL CREEK WEST 40421
LOYETEA PEAK Pb/Zn
GUNNS PLAINS 4142/1
TUNGSTEN ANOMALIES ZONE
4142/8
4142/6
4142/5
WARRINGA
CASTRA 4142/4
NIETTA
To Ulverstone
To Sprent
CENTRAL CASTRA
To Upper Castra
To South Nietta

LEGEND

TERTIARY
Tertiary/Recent cover
Basalt/Volcanics
DEVONIAN
Housetop Granite
SILURIAN
Eldon Group
ORDOVICIAN
Limestone
Sandstone
Conglomerate
Ironstone
CAMBRIAN
Volcanics/Volcanoclastics
PRECAMBRIAN
Burnie Formation - Sandstones/Shales/Dolerites
Magnetic Skarn
Gravity Lows
Aeromagnetic Anomalies
Input Anomalies
Stream Sediment Anomalies

KEY

Roads
Rivers & creeks
Geological boundaries
Fault

12750

410 000 E

420 000 E

414136

5 cm

The Shell Company of Australia Limited
METALS DIVISION

GEOLOGY OF : 02
E.L. 8/77 RIANA
E.L. 14/80 HAYES PEAK
GRID LOCATION MAP

Ru-2142

SCALE	1 50000
AUTHOR	P RUXTON
OFFICE	DEVONPORT
ENCL No.	
DATE	30-8-83
DRAWN	H.L.H
REP No.	
DRG No.	D/MQ04/174

BASS STRAIT

5450 000 N

5440 000 N

5430 000 N

5420 000 N

SULPHUR CREEK

PENGUIN

BASS HIGHWAY

STOWPORT

CUPRONA

BLYTHE RIVER

CUPRONA

SULPHUR CREEK

IR1

UPPER STOWPORT

NATONE

CAMENA

MIDGLEY FALLS

STOTTS ROAD

E.L. 8/77

RIANA

UPPER NATONE

WATTLE GROVE

SOUTH RIANA

E.L. 14/80

To Hampshire

To Ulverstone

GUNNS PLAINS

To Sprent

CENTRAL CASTRA

WARRINGA

CASTRA

To Upper Castra

LOYETEA GRID

HOUSETOP

LOYETEA

REDWATER NORTH

REDWATER GRID

LAUREL WEST GRID

LOYETEA NORTH (CRAE)

LOYETEA SOUTH (CRAE)

CROSBY CREEK (CRAE)

NIETTA

To South Nietta

LEGEND

Tertiary/Recent cover

TERTIARY

Basalt/Volcanics

DEVONIAN

Housetop Granite

SILURIAN

Eldon Group

ORDOVICIAN

Limestone

Sandstone

Conglomerate

Ironstone

CAMBRIAN

Volcanics/Volcanoclastics

PRECAMBRIAN

Burnie Formation - Sandstones/Shales/Dolerites

Magnetic Skarn

Gridded Area

Grid Lines

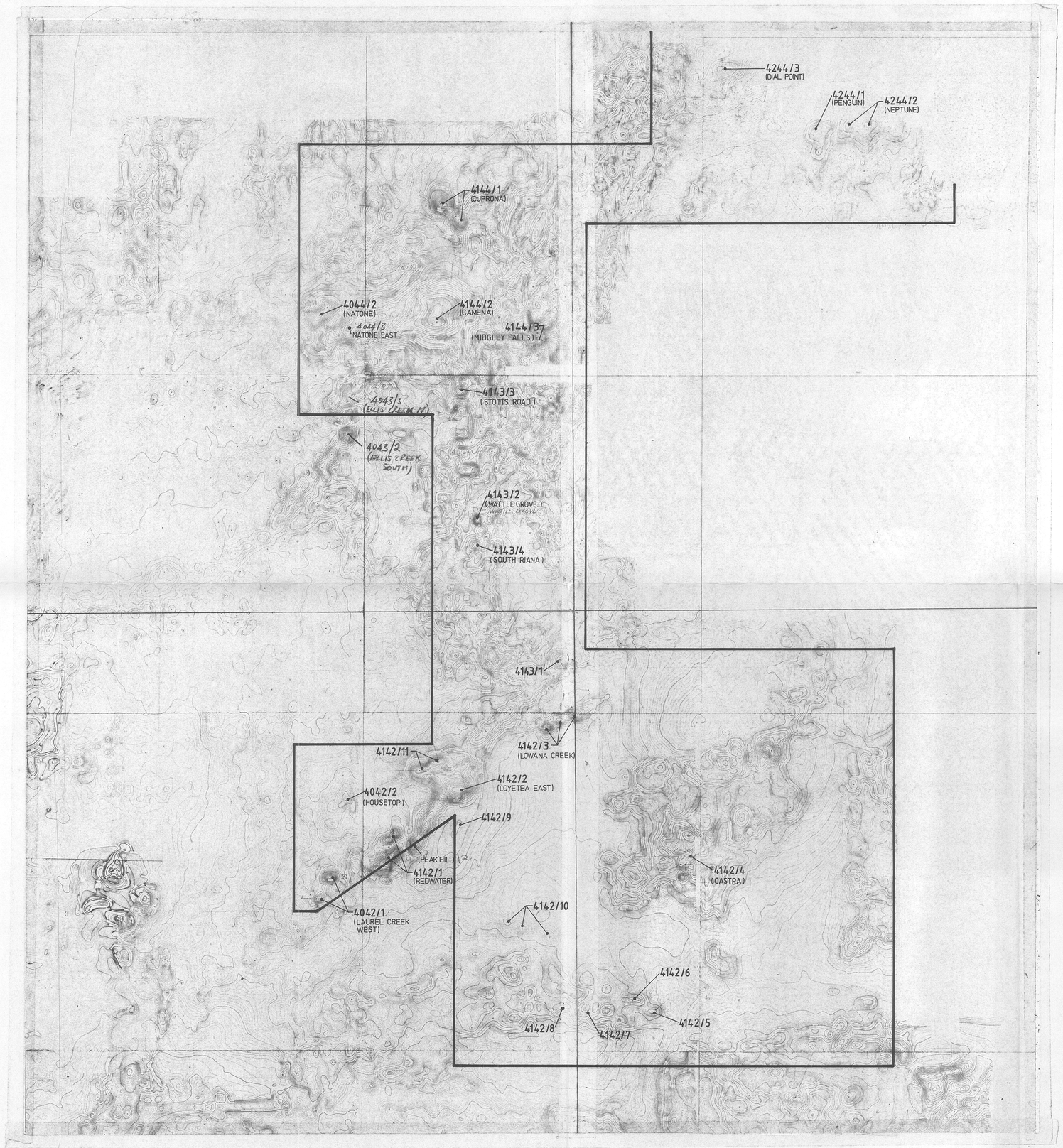
KEY

Roads

Rivers & creeks

Geological boundaries

Fault



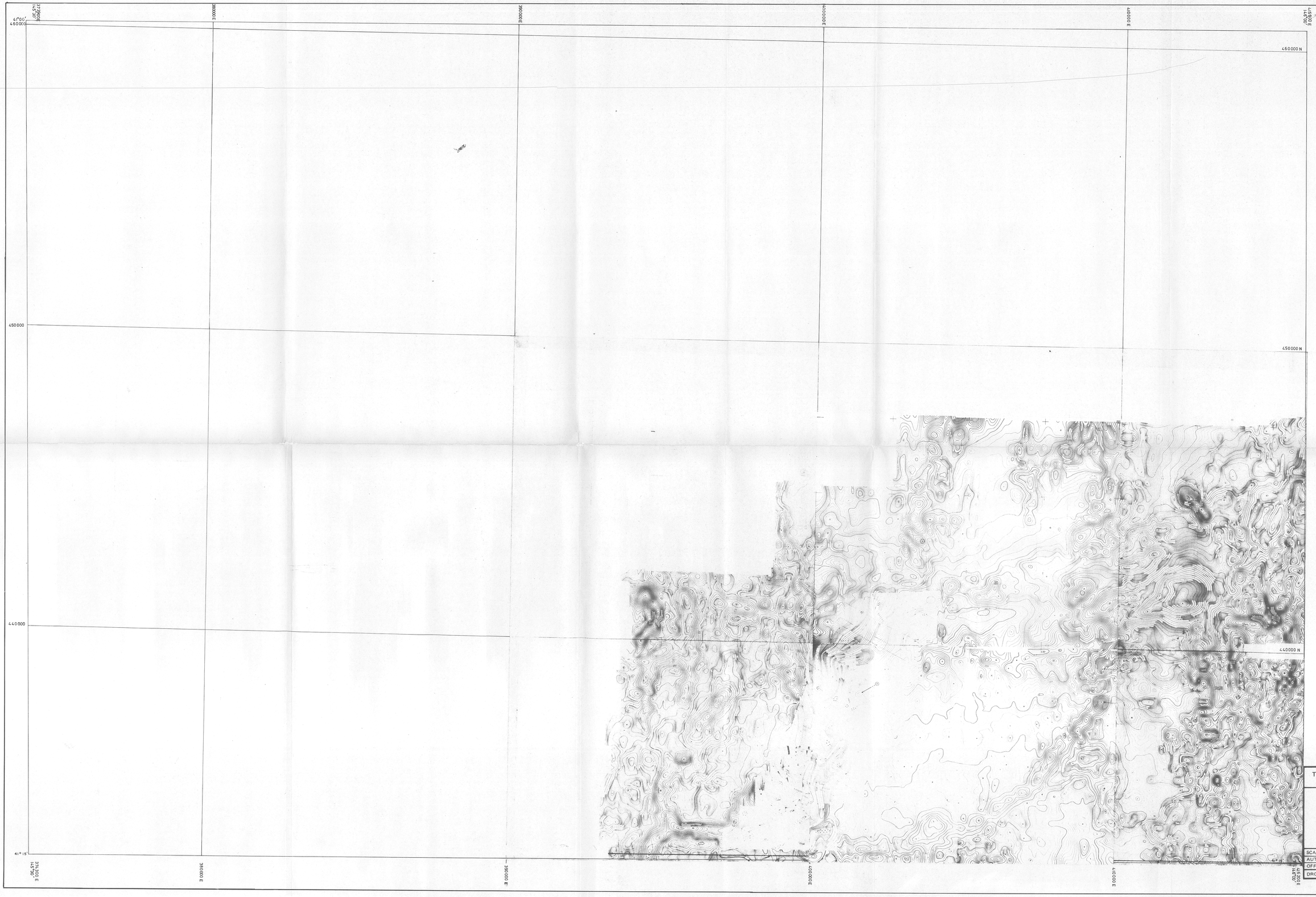
T.N.

1 0 1 2 Miles

5 cm

414137

The Shell Company of Australia Limited METALS DIVISION	
E.L. 8/77 RIANA 03 GEOMETRICS AIRBORNE MAGNETICS SURVEY WITH ANOMALY NUMBERS Scale 1:63360	
FIG. No.	REPORT No.
ENCL. No.	DRG. No. D/MQ04/080
DATE 23-10-81	AUTHOR L.D. BANWELL
DRAWN H.L.H.	OFFICE DEVONPORT



1

2

1. Geometrics/Shell 11/1980
   Line spacing 250m
   Detector MTC 70m
   C.I. = 10 nT
   IGRF removed Datum + 200nT

2. Seigel/Anze 1973
   (Specs unknown)

414138

5 cm

The Shell Company of Australia Limited
METALS DIVISION

N.W. TASMANIA
BURNIE 04

AEROMAGNETIC CONTOUR MAP

RL-2162

SCALE 1:50000	DATE MAY 1983
AUTHOR N H	DRAWN WP
OFFICE AHO	REP. No.
DRG. No. MQOO/1011	FIG. No.

414139

The Shell Company of Australia Limited METALS DIVISION	
N.W. TASMANIA 05 BURNIE AEROMAGNETIC CONTOUR MAP UPWARD CONTINUATION TO 500m	
SCALE 1:50000	DATE MAY 1983
AUTHOR N.H.	DRAWN W.P.
OFFICE AHO	REP.No.
DRG.No. M000/1012	FIG.No.

SL-2142

146° 00'
41° 15'
420 000 E
430 000
440 000
450 000
146° 30'
41° 15'
5 430 000
5 430 000 N
5 420 000
5 420 000
5 410 000
5 410 000
41° 30'
146° 00'
420 000
440 000
450 000
41° 30'
146° 30'

5 cm

414140

The Shell Company of Australia Limited
METALS DIVISION

NORTH WEST TASMANIA

SHEFFIELD 06

AEROMAGNETIC CONTOUR MAP

84-2142

SCALE	1:50,000	DATE	July 1983
AUTHOR	N H	DRAWN	--
OFFICE	AHO	REP No.	
ENCL No.		DRG No.	MZ00/1002

41°00'
374300E
145°30'
380000E
390000E
400000E
410000E
419700E
146°20'E
460000 N
450000 N
440000 N
460700 N
460000
450000 N
440000 N
41°15'
374300 E
145°30'
380000 E
390000 E
400000 E
410000 E
146°20'E
41°15'

414141

5 cm

The Shell Company of Australia Limited
METALS DIVISION

N.W. TASMANIA 07
BURNIE
RADIOMETRIC CONTOUR MAP
TOTAL COUNT

SCALE 1:50 000	DATE MAY 1983
AUTHOR N.H.	DRAWN WP
OFFICE AHO	REP. No.
DRG. No.	FIG. No. M000/1013

84-2142

370000E 145°30'
380000E
390000E
400000E
410000E
415000E 145°50'
460 000 N 41°00'
460 700 N 41°15'
460000 N
450 000
450000 N
440000
440000 N
432500 N 41°15'
370000E 145°30'
380000E
390000E
400000E
410000E
415000E 145°50'
41°15'

Regional Gravity base stations

Gravity Lows

(GL-9) 10·0
(GL-8) 10·0
(GL-7) 15·0
(GL-2)

H
H
H
L

20·0
17·5
15·0
12·5
10·0
7·5
5·0
2·5
0·0

414142

N.B.
1. DATA COLLECTED PRIMARILY AT 0·5 TO 1·0 KM STATION SPACING ALONG ROAD
2. DATA MUCH MORE LIMITED WITHIN TASMINEX EL (KARA)
3. TERRAIN CORRECTIONS HAVE BEEN APPLIED AFTER DIGITISING 1:100 000 TOPO MAPS
4. SODIN GRAVIMETER AND ANEROID BAROMETER USED
5. EXPECTED ACCURACY ± 1mgal

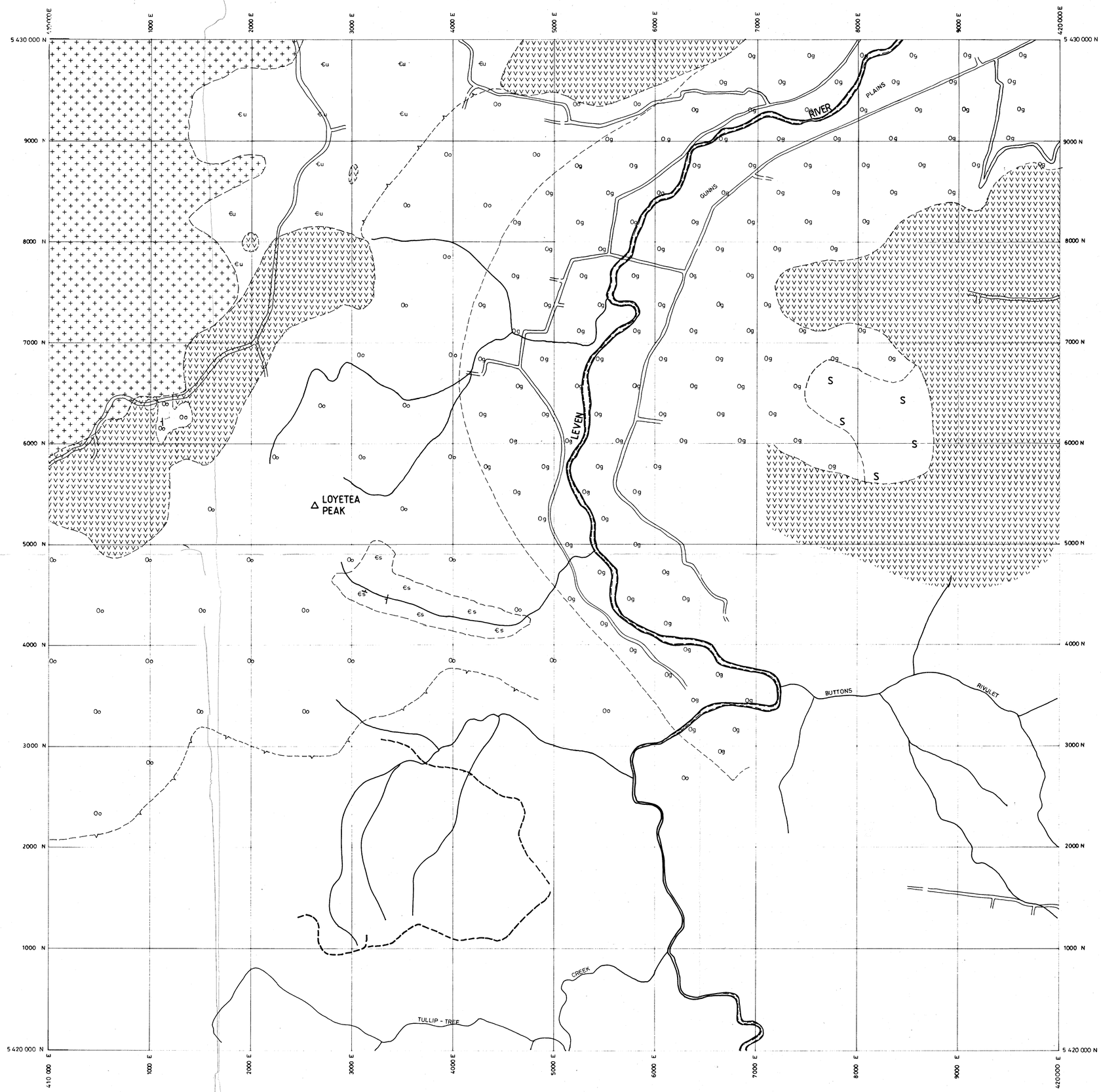
5 cm

The Shell Company of Australia Limited
METALS DIVISION

NW TASMANIA
BURNIE 08
BOUGUER GRAVITY
C.I. = 2·5 mgal

SL-2142

SCALE 1:50 000	DATE MAY 1983
AUTHOR N.H.	DRAWN W.P.
OFFICE AHO	REP. No.
DRG. No. M000/1014	FIG. No.



LEGEND

TERTIARY	V V V V V V V V	BASALT
SILURIAN	S	
ORDOVICIAN	Og	LIMESTONE
	Oo	CONGLOMERATE
CAMBRIAN	€u	UNDIFFERENTIATED
	Cv	PREDOMINANTLY VOLCANICS
	Cs	PREDOMINANTLY SEDIMENTS
DEVONIAN	+ + + + + + + +	GRANITE

5 cm

TN MN

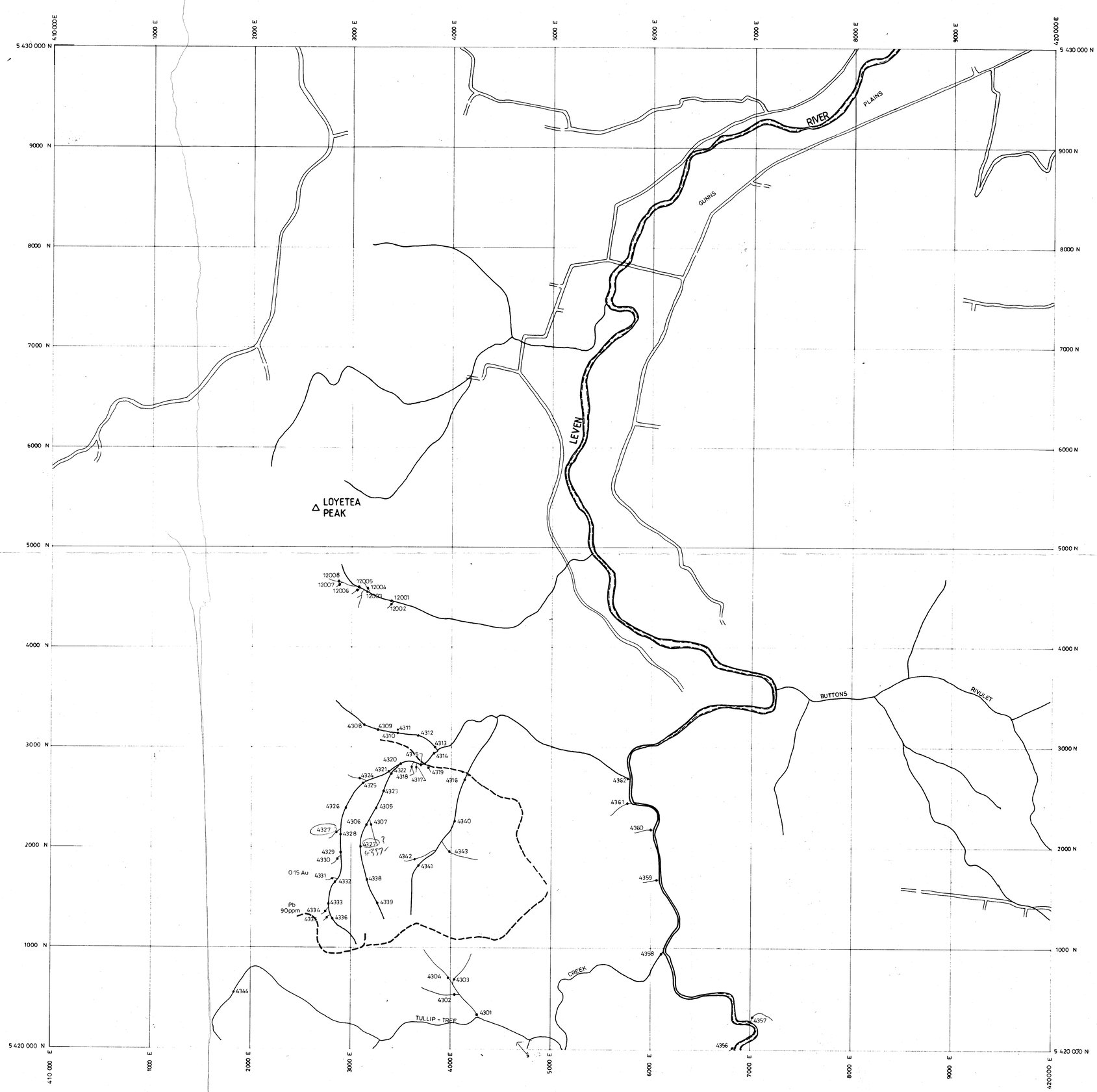
414143

The Shell Company of Australia Limited
METALS DIVISION

E.L. 7/74 MOINA
CADASTRAL SHEET 4142
GEOLOGY
09

Scale 1: 20 000 84-2142

FIG. No.	REPORT No.
ENCL. No.	DRG. No. D/MZ01/314
DATE 16-2-84	AUTHOR W.D. SMYTH.
DRAWN J.L.L.	OFFICE DEVONPORT



PANNED CONCENTRATES

SAMPLE No.	Cu	Pb	Zn	Ni	Co	Bi	Cd	Sn	W	Ba	Au
4356	6	48	100	20	8	< 4	< 1	8	20	260	< 0·05
4357	28	18	190	24	16	< 4	< 1	4	< 10	490	< 0·05
4358	10	22	150	18	10	< 4	< 1	8	< 10	520	< 0·05
4359	6	46	250	8	16	< 4	< 1	6	20	730	< 0·05
4360	2	10	100	6	12	< 4	< 1	< 4	< 10	550	< 0·05
4361	4	10	105	< 4	20	< 4	< 1	6	< 10	710	< 0·05
4362	10	36	105	10	12	< 4	< 1	8	< 10	530	< 0·05

STREAM SEDIMENT SAMPLES

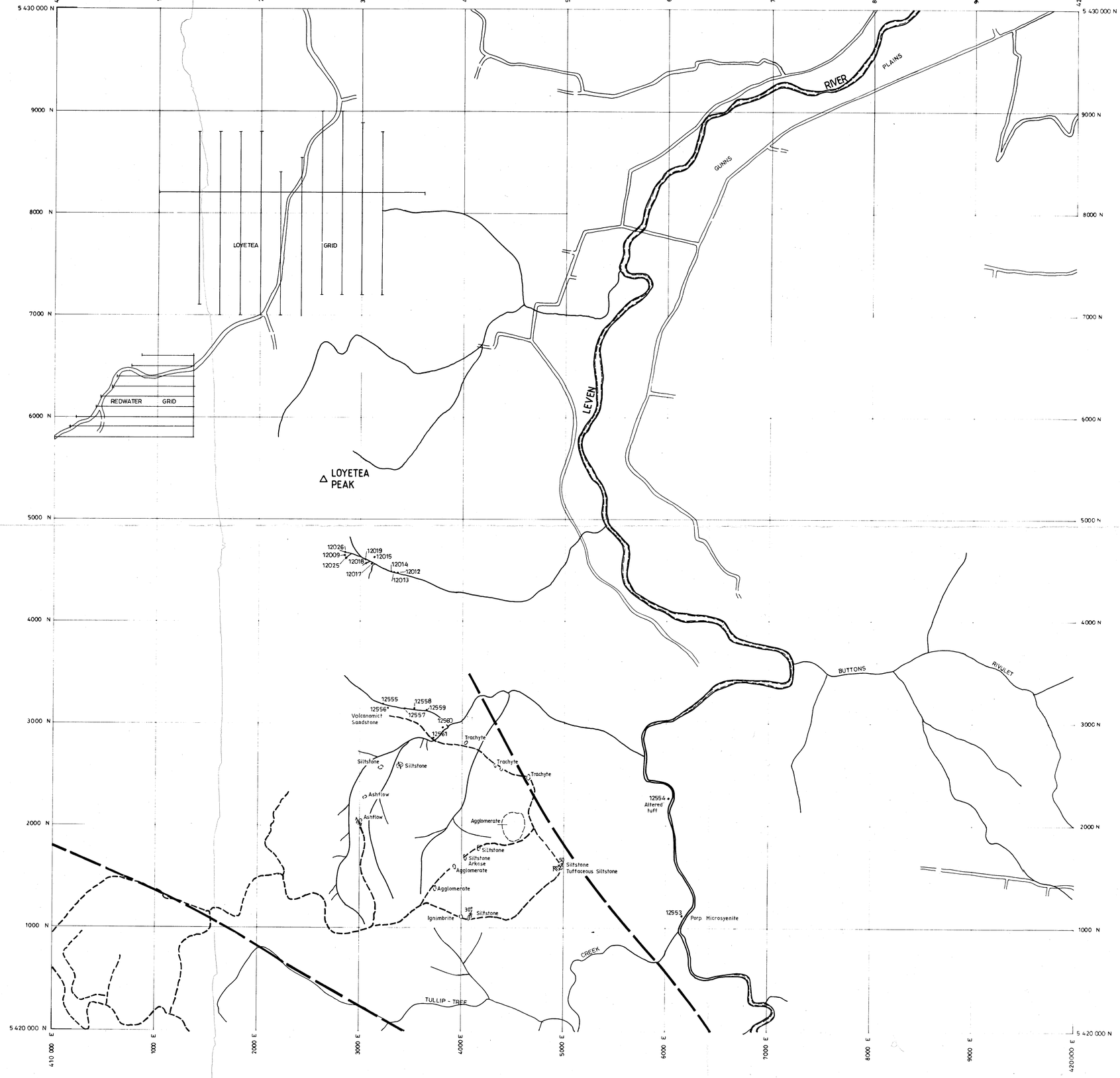
SAMPLE No.	Cu	Pb	Zn	Ni	Ag	Mo	Co	Bi	Cd	% Fe	Mn
4301	16	85	380	16	< 1	< 4	10	< 4	1	3·95	1300
4302	24	80	310	24	< 1	< 4	16	< 4	1	4·40	1600
4303	14	80	310	16	< 1	< 4	16	< 4	1	3·20	1150
4304	14	100	410	16	< 1	6	12	< 4	1	4·30	1800
4305	8	12	38	6	< 1	< 4	< 4	< 4	< 1	0·80	160
4306	10	12	40	12	< 1	< 4	< 4	< 4	< 1	0·90	170
4307	6	8	28	4	< 1	< 4	< 4	< 4	< 1	0·55	90
4308	6	18	14	8	< 1	< 4	< 4	< 4	< 1	0·75	290
4309	8	28	18	4	< 1	< 4	6	< 4	< 1	1·25	1100
4310	8	34	22	12	< 1	< 4	14	< 4	< 1	1·50	1900
4311	8	36	18	6	< 1	< 4	< 4	< 4	< 1	1·00	420
4312	8	40	36	6	< 1	< 4	16	< 4	< 1	1·50	1750
4313	6	24	18	4	< 1	< 4	6	< 4	< 1	0·90	580
4314	6	12	28	6	< 1	< 4	< 4	< 4	< 1	1·20	170
4315	6	14	32	8	< 1	< 4	< 4	< 4	< 1	1·10	210
4316	10	20	80	16	< 1	< 4	24	< 4	< 1	4·70	1000
4317	8	12	32	10	< 1	< 4	10	< 4	< 1	1·35	220
4318	10	14	48	10	< 1	< 4	< 4	< 4	< 1	1·75	240
4319	6	8	28	6	< 1	< 4	< 4	< 4	< 1	0·65	180
4320	6	12	28	6	< 1	< 4	< 4	< 4	< 1	1·45	260
4321	8	16	40	8	< 1	< 4	4	< 4	< 1	2·15	650
4322	6	10	36	8	< 1	< 4	6	< 4	< 1	0·95	230
4323	4	10	26	4	< 1	< 4	< 4	< 4	< 1	0·80	190
4324	8	20	60	12	< 1	< 4	16	< 4	< 1	1·65	1650
4325	4	10	24	10	< 1	< 4	< 4	< 4	< 1	0·95	190
4326	6	12	26	4	< 1	< 4	< 4	< 4	< 1	1·95	460
4327	4	8	16	4	< 1	< 4	< 4	< 4	< 1	0·65	190
4328	6	14	38	6	< 1	< 4	< 4	< 4	< 1	2·25	750
4329	6	18	65	6	< 1	< 4	8	< 4	< 1	2·20	880
4330	6	8	32	6	< 1	< 4	6	< 4	< 1	0·75	590
4331	26	30	50	8	< 1	< 4	12	< 4	< 1	1·55	1150
4332	12	16	60	8	< 1	< 4	8	< 4	< 1	2·10	400
4333	10	22	100	10	< 1	< 4	14	< 4	< 1	2·75	280
4334	14	90	250	18	< 1	< 4	22	< 4	< 1	6·10	500
4335	20	24	100	26	< 1	< 4	20	< 4	< 1	4·10	520
4336	10	14	90	10	< 1	< 4	12	< 4	< 1	2·90	490
4337	6	14	42	4	< 1	< 4	10	< 4	< 1	1·15	270
4338	8	12	70	4	< 1	< 4	10	< 4	< 1	2·25	270
4339	6	10	50	< 4	< 1	< 4	8	< 4	< 1	2·05	230
4340	16	16	80	12	< 1	< 4	20	< 4	< 1	3·65	730
4341	8	16	120	10	< 1	< 4	12	< 4	< 1	4·40	340
4342	8	10	50	10	< 1	< 4	12	< 4	< 1	1·35	130
4343	8	16	90	10	< 1	< 4	14	< 4	< 1	3·20	610
4344	8	34	135	10	< 1	< 4	14	< 4	< 1	2·55	880
12001	16	80	140	18			24	< 4	< 1	3·10	960
12002	14	120	60	10			18	< 4	< 1	3·30	3500
12003	18	110	130	16			22	< 4	< 1	3·75	1150
12004	30	100	330	60			70	< 4	< 1	2·40	810
12005	20	95	165	20			22	< 4	< 1	3·30	900
12006	10	14	28	8			< 4	< 4	< 1	1·00	80
12007	26	110	70	16			26	< 4	< 1	3·80	3200
12008	20	95	560	60			60	< 4	1	7·00	3700
4356	24	46	140	40	< 1	< 4	8	< 4	< 1	1·95	230
4357	36	42	220	50	< 1	< 4	10	< 4	< 1	3·10	570
4358	34	40	190	46	< 1	< 4	10	< 4	< 1	2·80	680
4359	24	50	250	24	< 1	< 4	8	< 4	< 1	3·60	1050
4360	18	16	125	18	< 1	6	8	< 4	< 1	3·60	920
4361	16	14	105	20	< 1	6	8	< 4	< 1	3·30	850
4362	24	48	150	36	< 1	< 4	12	< 4	< 1	2·90	980

TN MN

5 cm

414144

The Shell Company of Australia Limited METALS DIVISION	
E.L. 7/74 MOINA 10 CADASTRAL SHEET 4142 STREAM SEDIMENT SURVEY SAMPLE LOCATIONS AND ANALYSES	
Scale 1:20 000 84-2142	
FIG. No.	REPORT No.
ENCL. No.	DRG. No. D/MZ01/311
DATE 3-2-84	AUTHOR W.D. SMYTH.
DRAWN J.L.L.	OFFICE DEVONPORT



ROCK CHIP SAMPLES

SAMPLE No.	Cu	Pb	Zn	Ni	Co	Bi	Cd	As	Ba	Ag	Au
12009	48	36	230	42	20	< 4	< 1				
12010	40	36	38	8	18	< 4	< 1				
12011	4	16	70	12	< 4	< 4	< 1				
12012	16	24	160	20	14	< 4	< 1				
12013	10	26	370	34	24	< 4	< 1				
12014	8	40	310	26	22	< 4	< 1				
12015	34	26	200	24	8	< 4	< 1				
12016	16	14	36	8	< 4	< 4	< 1				
12017	10	28	80	16	< 6	< 4	< 1				
12018	6	14	14	4	< 4	< 4	< 1				
12019	4	16	270	28	16	< 4	< 1				
12025	12	20	10	4	4	< 4	< 1			1	< 0·05
12026	10	100	260	26	16	< 4	< 1				
12553		NOT	ASSAYED								
12554		"		"							
12555		"		"							
12556		"		"							
12557		"		"							
12558	30	22	220	12	22	6	< 1	8	730	< 1	< 0·05
12559	8	10	60	10	16	< 4	< 1	< 2	220	< 1	< 0·05
12560	4	12	70	6	36	< 4	< 1	3	690	< 1	< 0·05
12561		NOT	ASSAYED								

5 cm

TN MN

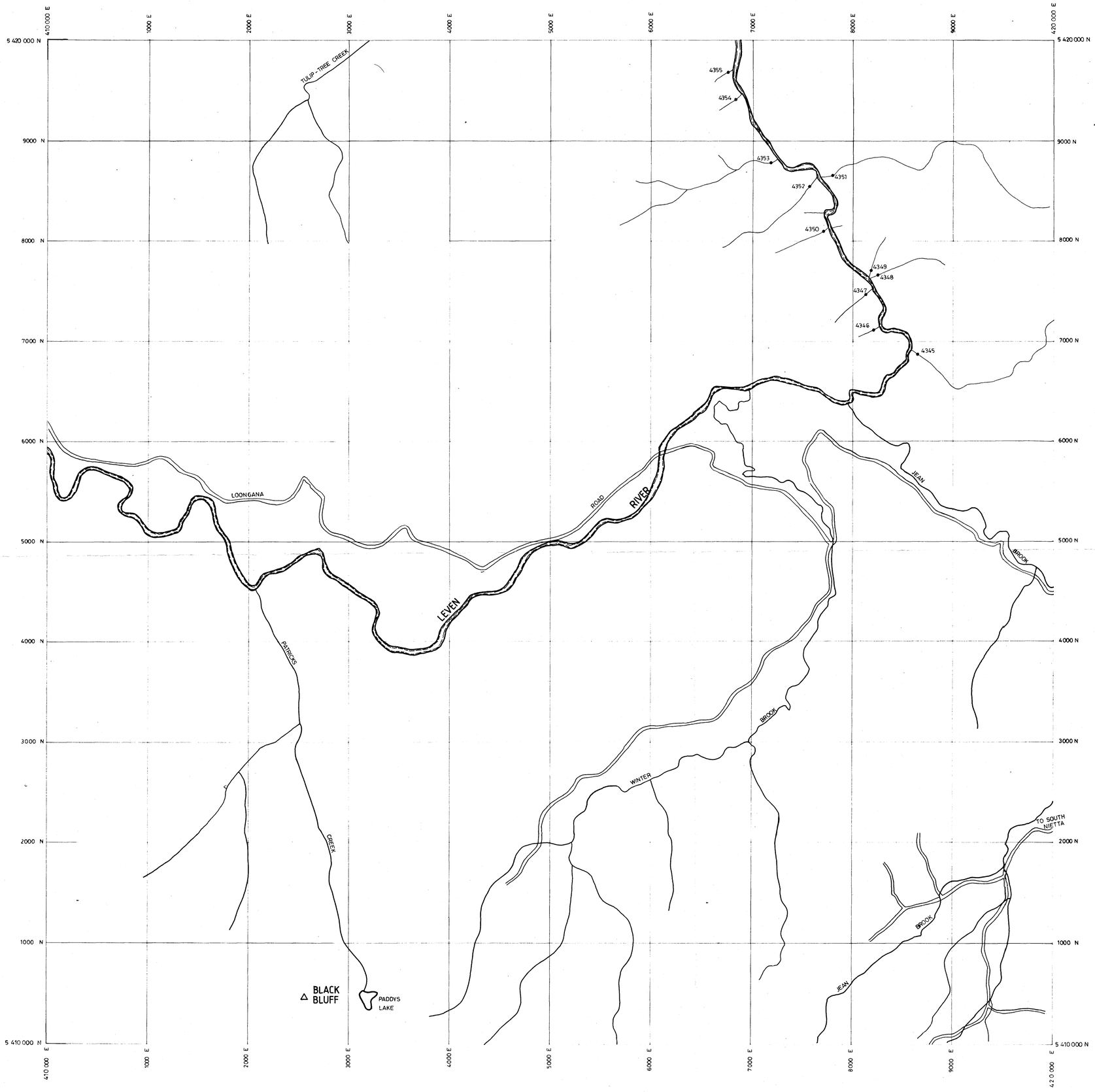
414145

The Shell Company of Australia Limited
METALS DIVISION

E.L. 7/74 MOINA 11
CADASTRAL SHEET 4142
ROCK CHIP SAMPLING
SAMPLE LOCATION AND ANALYSES

Scale 1: 20 000

FIG. No.	REPORT No.
ENCL. No.	DRG. No. D/MZ01/310
DATE 3 - 2 - 84	AUTHOR W.D. SMYTH.
DRAWN J.L.L.	OFFICE DEVONPORT



- 80# STREAM SED. SAMPLES

SAMPLE No.	Cu	Pb	Zn	Ni	Co	Bi	Cd	% Fe	Mn	Ag	Mo
4345	14	14	50	16	< 4	< 4	< 1	1·15	95	< 1	< 4
4346	28	120	150	24	16	< 4	< 1	3·50	1550	< 1	< 4
4347	28	30	160	40	14	< 4	< 1	3·90	870	< 1	< 4
4348	16	16	90	22	4	< 4	< 1	1·45	240	< 1	< 4
4349	46	24	180	60	14	< 4	< 1	3·60	510	< 1	6
4350	24	20	200	50	12	< 4	< 1	2·90	1250	< 1	< 4
4351	40	32	260	55	16	< 4	< 1	4·00	900	< 1	< 4
4352	18	14	120	36	10	< 4	< 1	2·70	470	< 1	< 4
4353	22	20	140	55	12	< 4	< 1	2·50	620	< 1	< 4
4354	12	10	42	28	4	< 4	< 1	1·50	200	< 1	< 4
4355	28	14	120	60	10	< 4	< 1	2·30	320	< 1	< 4

PANNED CONCENTRATES

SAMPLE No.	Cu	Pb	Zn	Ni	Co	Bi	Cd	Sn	W	Ba	Au
4345	6	8	30	8	4	< 4	< 1	< 4	25	105	< 0·05
4346	12	75	100	8	16	< 4	< 1	< 4	< 10	730	< 0·05
4347	18	12	105	14	10	< 4	< 1	4	15	360	< 0·05
4348	6	6	90	10	4	< 4	< 1	< 4	20	270	< 0·05
4349	18	18	160	28	18	< 4	< 1	< 4	15	490	< 0·05
4350	10	12	175	34	16	< 4	< 1	6	< 10	540	< 0·05
4351	24	14	175	24	14	< 4	< 1	8	< 10	390	< 0·05
4352	< 2	10	70	10	10	< 4	< 1	4	15	280	< 0·05
4353	< 2	6	80	20	8	< 4	< 1	< 4	10	330	< 0·05
4354	LNR	LNR	LNR	LNR	LNR	LNR	LNR	LNR	LNR	LNR	LNR
4355	10	4	90	26	8	< 4	< 1	4	20	240	< 0·05

TN
MN

5 cm

414146

The Shell Company of Australia Limited METALS DIVISION	
E.L. 7/74 MOINA CADASTRAL SHEET 4141 STREAM SEDIMENT SURVEY SAMPLE LOCATION AND ANALYSES	12
Scale 1:20 000 84-2147	
FIG. No.	REPORT No.
ENCL. No.	DRG. No. D/MZ01/312
DATE 3-2-84	AUTHOR W.D. SMYTH
DRAWN J.L.L.	OFFICE DEVONPORT

AIRBORNE SURVEY SPECIFICATIONS

EM SYSTEM :	INPUT MARK V Channel centres:500,700,900,1200, 1600 and 2100 microseconds after transmitter switch off.
EM RECORDING INTERVAL :	0.2 sec (approx 13 metres)
MAGNETOMETER :	Geometrics G803 ,sensitivity 1.0nT.
MAG RECORDING INTERVAL :	1.0 sec (approx 60 metres)
DATA RECORDING :	Geoterrex Madacs system,digital to mag tape
NOMINAL SPEED :	mean ground speed 220 km per hour.
NOMINAL TERRAIN CLEARANCE :	Mag and spectrometer in aircraft at 120m. EM transmitter in aircraft at 120m. EM detector in bird at 40m.
FLIGHT PATH RECORD :	Geocam continuous 35mm tracking camera
NOMINAL LINE SPACING :	Traverses 300m SE-NW. tie lines not flown

E.M. ANOMALY MAP

Sheet 20/4044

Grid notation refers to Australian Map Grid

Path recovery digitized from 1:20000 topo maps

Large 6 channel response
6 channel response
5 channel response
4 channel response
3 channel response
2nd & 5th channel amplitudes
Altitudes (metres)
Offset magnetic anomaly
Hertz response
Zone number
Conductor boundary
Inferred boundary

20/4044/IR3

20/4044	20/4144
20/4043	20/4143

5450000 N
5447500 N
5445000 N
5442500 N
5440000 N
400000 E
402500 E
405000 E
407500 E
410000 E

0 1 2 Km
SCALE 1:20000
5 cm

414147

JOB NO : 83-548
Flown by GEOTERREX PTY LTD : JANUARY 1982
Compiled by EXPLORATION COMPUTER SERVICES PTY LTD

THE SHELL COMPANY
OF AUSTRALIA LIMITED

RL-2142

RIANA , TASMANIA 13
E.M. ANOMALY MAP
SHEET 20/4044

PROJ NO. | DATE: 3-MAR-82

5440000 N

5435000 N

5432500 N

5430000 N

543750 E

400000 E

402500 E

405000 E

407500 E

410000 E

2271 2261 2251 2241 2231 2221 2211 2204 2191 2181 2171 2161 2151 2141 2131 2121 2111 2101 2091 2081 2071 2061 2051 2041 2031 2021 2011

20/4043/IH3

20/4043/IH7

1011 1021 1031 1041 1042

20/4043/IR5

AIRBORNE SURVEY SPECIFICATIONS

EM SYSTEM :	INPUT MARK V Channel centres:500.700.900.1200. 1600 and 2100 microseconds after transmitter switch off.
EM RECORDING INTERVAL :	0.2 sec (approx 13 metres)
MAGNETOMETER :	Geometrics G803 ,sensitivity 1.0nT.
MAG RECORDING INTERVAL :	1.0 sec (approx 60 metres)
DATA RECORDING :	Geoterrex Madacs system,digital to mag tape
NOMINAL SPEED :	mean ground speed 220 km per hour.
NOMINAL TERRAIN CLEARANCE :	Mag and spectrometer in aircraft at 120m. EM transmitter in aircraft at 120m. EM detector in bird at 40m.
FLIGHT PATH RECORD :	Geocam continuous 35mm tracking camera
NOMINAL LINE SPACING :	Traverses 300m SE-NW, tie lines not flown

E.M. ANOMALY MAP

Sheet 20/4043

Grid notation refers to Australian Map Grid

Path recovery digitized from 1:20000 topo maps

Large 6 channel response

6 channel response

5 channel response

4 channel response

3 channel response

2nd & 5th channel amplitudes 10/10

Altitudes (metres) 120

Offset magnetic anomaly 25 m

Hertz response

Zone number 20/3943/IH1

Conductor boundary

Inferred boundary

20/3944

20/3943 20/4043

0 1 2 Km

SCALE 1:20000

5 cm

414148

JOB NO. : 83-548

Flown by GEOTERREX PTY LTD : JANUARY 1982

Compiled by EXPLORATION COMPUTER SERVICES PTY LTD

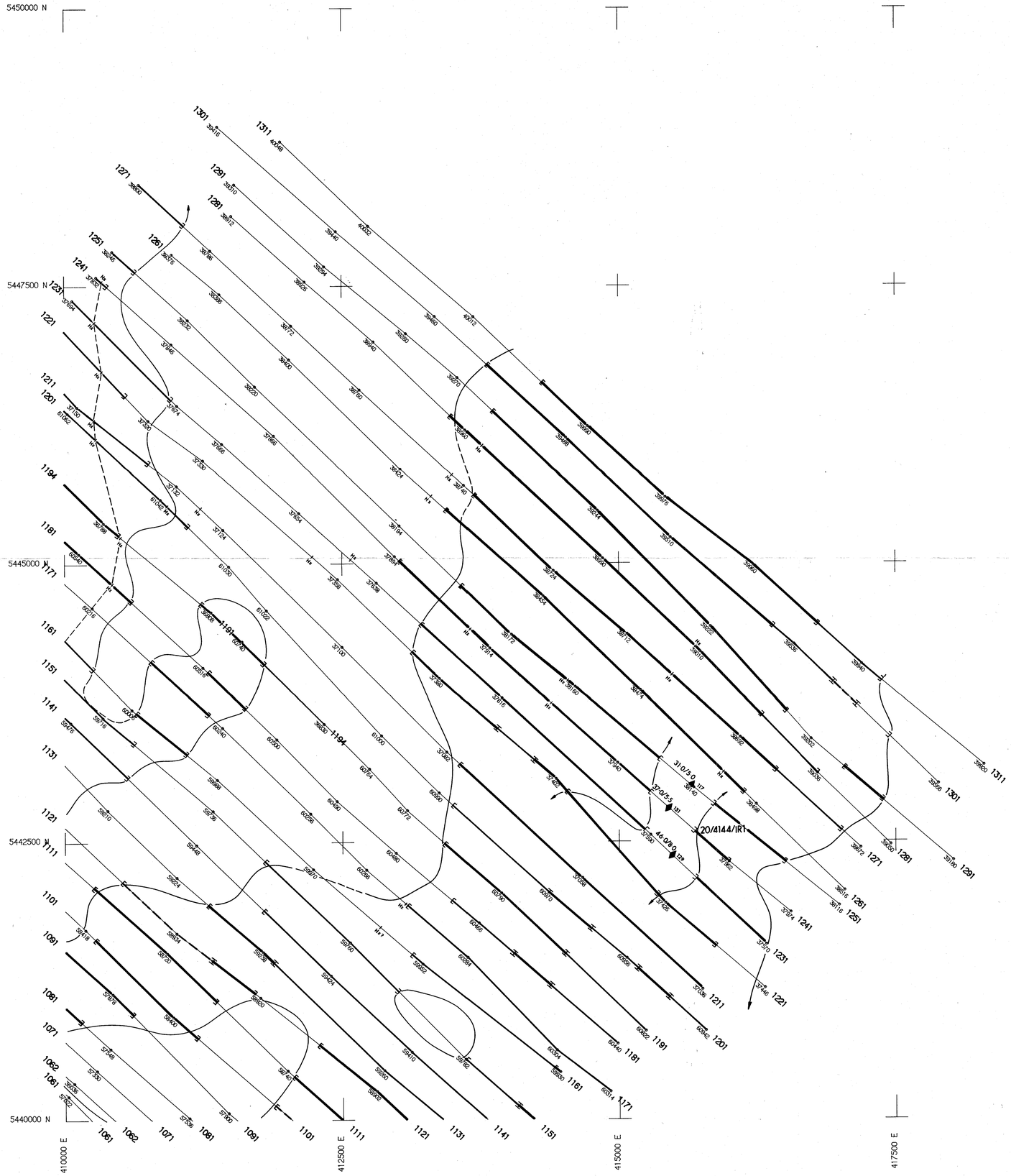
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84-2142

HIGHCLERE , TASMANIA
E.M. ANOMALY MAP
SHEET 20/4043

14

PROJ NO. | DATE: 3-MAR-82



AIRBORNE SURVEY SPECIFICATIONS

EM SYSTEM :	INPUT MARK V Channel centres:500,700,900,1200, 1600 and 2100 microseconds after transmitter switch off.
EM RECORDING INTERVAL :	0.2 sec (approx 13 metres)
MAGNETOMETER :	Geometrics G803 ,sensitivity 1.0nT.
MAG RECORDING INTERVAL :	1.0 sec (approx 60 metres)
DATA RECORDING :	Geoterrex Madacs system,digital to mag tape
NOMINAL SPEED :	mean ground speed 220 km per hour.
NOMINAL TERRAIN CLEARANCE :	Mag and spectrometer in aircraft at 120m. EM transmitter in aircraft at 120m. EM detector in bird at 40m.
FLIGHT PATH RECORD :	Geocam continuous 35mm tracking camera
NOMINAL LINE SPACING :	Traverses 300m SE-NW, tie lines not flown

E.M. ANOMALY MAP

Sheet 20/4144

Grid notation refers to Australian Map Grid

Path recovery digitized from 1:20000 topo maps

- Large 6 channel response
- 6 channel response
- 5 channel response
- 4 channel response
- 3 channel response
- 2nd & 5th channel amplitudes (10/1-0)
- Altitudes (metres) (120)
- Offset magnetic anomaly (25nT)
- Hertz response (H4)
- Zone number: 20/4044/IR3
- Conductor boundary
- Inferred boundary

20/4044	20/4144
20/4043	20/4143

0 1 2 Km

SCALE 1:20000

5 cm

414149

JOB NO : 83-548
Flown by GEOTERREX PTY LTD : JANUARY 1982
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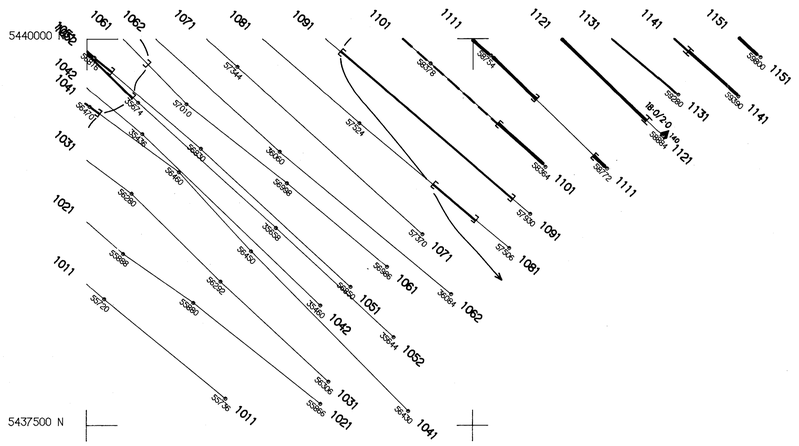
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RH-2142

RIANA , TASMANIA
E.M. ANOMALY MAP
SHEET 20/4144

15

PROJ NO.	DATE: 3-MAR-82



AIRBORNE SURVEY SPECIFICATIONS

EM SYSTEM :	INPUT MARK V Channel centres:500.700.900.1200. 1600 and 2100 microseconds after transmitter switch off.
EM RECORDING INTERVAL :	0.2 sec (approx 13 metres)
MAGNETOMETER :	Geometrics G803 ,sensitivity 1.0nT.
MAG RECORDING INTERVAL :	1.0 sec (approx 60 metres)
DATA RECORDING :	Geoterrex Madacs system.digital to mag tape
NOMINAL SPEED :	mean ground speed 220 km per hour.
NOMINAL TERRAIN CLEARANCE :	Mag and spectrometer in aircraft at 120m. EM transmitter in aircraft at 120m. EM detector in bird at 40m.
FLIGHT PATH RECORD :	Geocam continuous 35mm tracking camera
NOMINAL LINE SPACING :	Traverses 300m SE-NW. tie lines not flown

E.M. ANOMALY MAP

Sheet 20/4143

Grid notation refers to Australian Map Grid

Path recovery digitized from 1:20000 topo maps

Large 6 channel response

6 channel response

5 channel response

4 channel response

3 channel response

2nd & 5th channel amplitudes — 10/10

Altitudes (metres) — 120

Offset magnetic anomaly — 23nT

Hertz response — Hz

Zone number — 20/4044/1R3

Conductor boundary

Inferred boundary

20/4044	20/4144
20/4043	20/4143

0 1 2 Km

SCALE 1:20000

5 cm

414150

JOB NO : 83-548

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84-2142

RIANA , TASMANIA
E.M. ANOMALY MAP
SHEET 20/4143

16

PROJ NO.

DATE: 3-MAR-82