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EL 26/85 - NARRAWA

ANNUAL REPORT 1987/1988

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October, 1988.

Distribution: Department of Mines
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SUMMARY

EL 26/85 is held by Mr. C.H. Whitehead, and was issued to him on 20th November, 1985. Under an Agreement with Mr. C.H. Whitehead, RGC Exploration Pty. Limited (RGCE) has been carrying out exploration on the licence since April 1986.

Work during the last twelve months has concentrated on reviewing early reports and literature. The old workings have highlighted the structural control on mineralisation in the area. Most lodes are vuggy quartz veins containing embedded wolframite, cassiterite, molybdenite and bismuth minerals. Sulphides are variable and gold appears to be widespread in low concentrations. The lodes are hosted by a variety of lithologies, all of which appear to have undergone some type of alteration.

Mt. Lyell Mining & Railway Co. Ltd. included this area in programmes conducted over EL 8/65. They concluded the area had no potential to host an economic deposit of Sn, W, Mo or Bi.

A review of the Dolcoath Grid data has highlighted several features. A drill target has been defined based on the intersection of major feed structures (e.g. the shears in the Higgs workings) and certain lithologies which could act as a favourable host. Also, the gold geochemical trend parallelling Narrawa Creek requires further investigation. It is linked with the known gold occurrences and correlates with a noisy magnetic zone. The magnetic highs occurring within this zone would correlate with the presence of a magnetite-bearing skarn rock. It is suggested that these rocks form the altered base of the transitional zone between Gordon Limestone and Moina Sandstone. They have no depth extent, and therefore, no potential exists for a gold-bearing skarn deposit with the Dolcoath Grid.

Data acquired on the Wilmot Tunnel was compiled. No significant assay results were obtained. An interesting geological feature is the intersection of Cambrian rocks. They also display a definitive magnetic susceptibility response.

A report on the mineralisation styles in the area by D.G. Morrison indicated a strong structural control on the Higgs and Narrawa Reward workings. Also, examination of geochemical associations in the drill holes supported the suggestion that a number of discrete periods of veining occurred.

A report on the gold-bearing skarn potential of the area suggested a more mafic oxidised pluton was necessary to form significant deposits. Larry Meinert concluded that the Stormont Bismuth Mine skarn had some of the minerqlogical features necessary to be gold-bearing.

The regional magnetics study completed by Dr. D. Leaman indicates a number of structural trends. The intersection of these trends correlates with known mineralisation. An extensive concealed Cambrian mafic sequence is interpreted and the Tertiary basalt is considered to be patchy and thin generally (<50 metres). Most known deposits appear to have an expression on the raw magnetic data profiles.

Further drilling is planned and regional reconnaissance outside the Dolcoath Grid will be undertaken in the next twelve months. Expenditure for the last twelve months is expected to reach $33000. Planned expenditure for 1989 is $50000.

CONTENTS

APPENDICES

Appendix 1	Expenditure
Appendix 2	Wilmot Tunnel Assay Results
Appendix 3	Wilmot Tunnel Magnetic Susceptibility Readings
Appendix 4	Dr. G. Morrison's Report - An Overview of Gold Occurrences in Northern Tasmania
Appendix 5	Lawrence D. Meinert's Report - Observations on Skarns in Western Tasmania 88-2852B duplicate
Appendix 6	Dr.D.E. Leaman's Report - Gravity & Magnetic Evaluation. Moina Region. Magnetic Data: Initial Review.
Appendix 7	Infill Gravity Data

LIST OF FIGURES

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NARRAWA ANNUAL REPORT 1987/88

1. INTRODUCTION

EL 26/85 covers an area of 11 sq. km. on the western side of Lake Cethana (Figure 1). The Cethana Road traverses the northern limits of the licence. The Wilmot Power Station is in the northeast corner. The Narrawa and Dolcoath Creeks drain from west to east into Lake Cethana. The central and southern parts of the licence are reached via the Dolcoath Hill Road. The Narrawa Reward-Higgs gold mining area is accessed by a dirt road which leaves the Cradle Mountain Road and runs along the north side of Narrawa Creek.

The regional geology is shown at 1:25,000 scale in Figure 2. Undifferentiated Cambrian volcanics (Bull Creek Volcanics) dominate in the south of the licence. These are overlain unconformably to the north by Ordovician conglomerate (Roland Conglomerate) and sandstone (Moina Sandstone) sequences. The Cambrian and Ordovician rocks have been folded and then intruded during the Devonian. Folds trending east-west, open and symmetrical, with smaller dragfolding trending northwest. Intrusion by the Dolcoath Granite and a series of associated quartz-feldspar dykes. Tertiary sediment, greybilly and basalt are common in the region. Little Tertiary cover is evident in the northern part of the licence.

Many old mines occur in the district (Figure 2). Most deposits appear to be spatially and genetically related to the Dolcoath Granite. A metal zonation around the granite is postulated. Tungsten, bismuth, molybdenum deposits occur within or at the margins of the granite. Gold and tin mineralisation further away and an outer zone of silver-lead represented by the Round Hill deposits. The Dolcoath Granite is thought to dip shallowly to the west; Cupola-like projections being responsible for the skarn occurrences at Moina, Tea-Tree Creek and Stormont.

Mining commenced in the district around the 1880's. The first major report on mineral deposits in the Moina and Round Mount districts was written by Twelvetrees (1913). A second major report was written by Reid (1919). Collins in Jennings (1979) gives a brief summary of deposits in the area. Two old gold mines, Narrawa Reward and Higgs, occur within EL 26/85. The Narrawa Reward Mine was worked prior to 1913, with values of up to 6 g/t Au being reported in the sulphide ore. Mining at Higgs did not begin until 1934, and continued intermittantly to 1947. A total of 28.35 kg of gold is estimated to have been recovered during this period.

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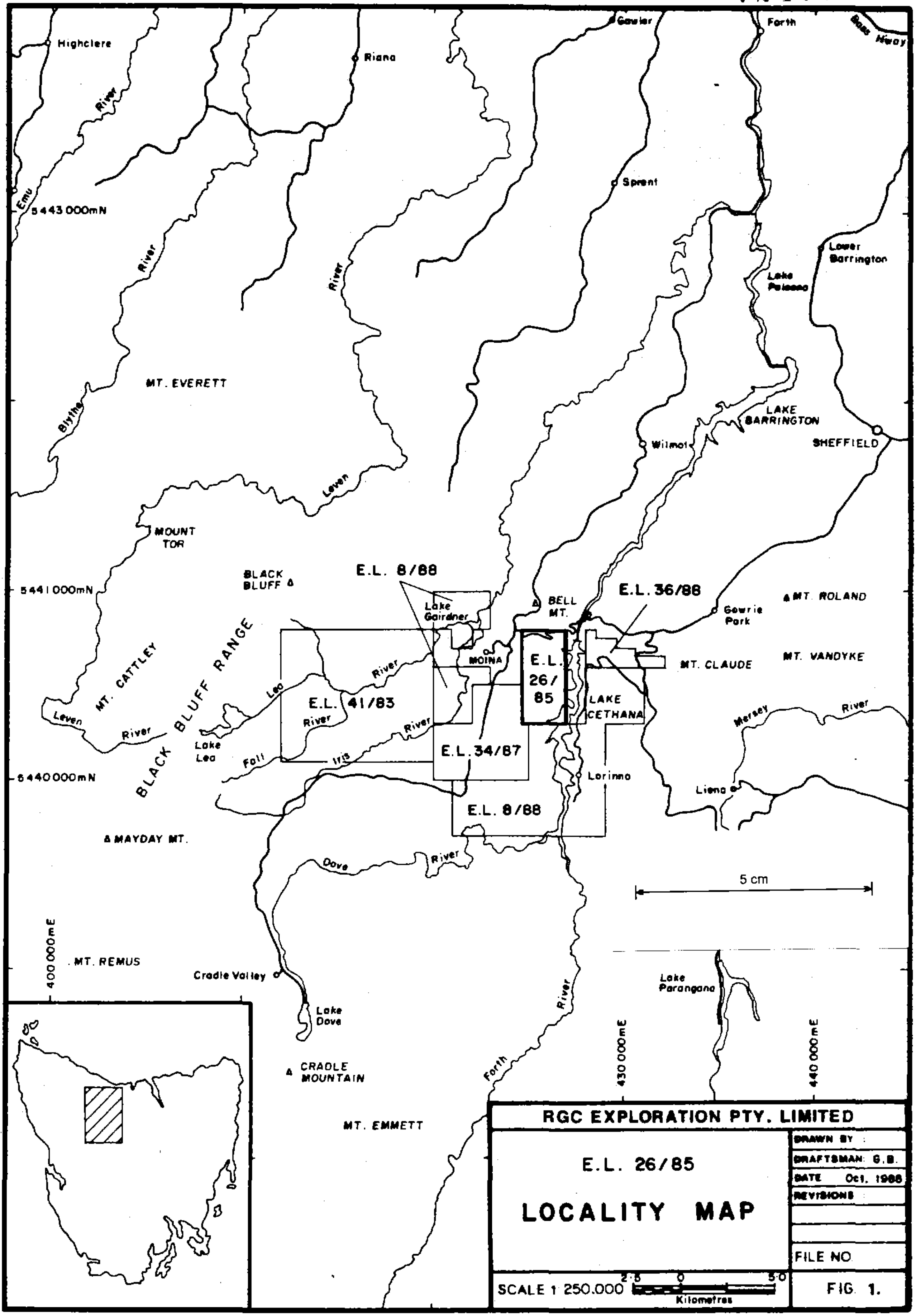

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E.L. 26/85

LOCALITY MAP

DRAWN BY :	
DRAFTSMAN: G.B.	
DATE	Oct. 1988
REVISIONS :	
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SCALE 1:250.000 2·5 0 5·0 Kilometres

FIG. 1.

The present licence area was previously part of EL 8/65. It was explored until 1973 by the Mt. Lyell Mining & Railway Co. Ltd. In March 1973 the area became part of EL 7/73 applied for by Ararco (Aust) Pty. Ltd. Joint ventured in 1976 to CRA Exploration Pty. Limited. Title was transferred to them in 1977. During 1981/82 extensive exploration was carried out over the northern part of what now is EL 26/85. They focussed their exploration on locating tin and base-metal mineralisation.

RGC Exploration Pty. Limited (hereafter referred to as RGCE) is actively testing the gold potential of EL 26/85. RGCE (formerly Gold Fields Exploration Pty. Limited) commenced work on the EL in 1986. Compilation of the previous CRA data, plus reconnaissance rock sampling were outlined in the 1985/86 Annual Report (Roberts, 1986). The 1986/87 Annual Report (Roberts, 1987) details mapping and sampling of the Dolcoath Grid by RGCE. A review of CRA's geophysical data and results from three diamond drill holes were reported. The aim of this report is to describe the work carried out by RGCE on EL 26/85 since November 1987. Also, to indicate the work planned for the next twelve months.

2. LAND TENURE

EL 26/85 was granted to Mr. C.H. Whitehead on 20th November, 1985. An agreement on EL 26/85 was reached between C.H. Whitehead and Renison Limited (a wholly-owned subsidiary of Renison Goldfields Consolidated Limited) on 17th April 1986. RGC Exploration Pty. Limited (the exploration division of RGC) has carried out exploration on the licence since this date under the terms of the Agreement.

Two mining leases, 13M85 & 22M85, lie partially within EL 26/85. These have been excluded from the exploration area under the terms of the Agreement.

3. EXPENDITURE

Expenditure by RGCE on EL 26/85 within the current renewal year to the end of August 1988 has been $14 493 (Appendix 1). Expenditure to the renewal date is expected to be $33000.

4. WORK UNDERTAKEN 1987/88

Responsibility for exploration over EL 26/85 changed from R.H. Roberts to M.J. Fleming. As a consequence, much of the years work involved reviewing previous reports. The main objective, to define targets for further drilling.

4.1 REVIEW OF OLD WORKINGS

Reports reviewed which describe the mineral field around the Dolcoath Granite included Smith (1898), Twelvetrees (1909, 1913), Reid (1919), Keid (1943), Jennings (1963) and Collins in Jennings (1979).

Mineral deposits were first reported in the early 1890's. They occur within or adjacent to the Dolcoath Granite and are genetically related to it (Figure 2). Most workings are developed on quartz-rich lode veins. These are thought to be fissures produced during the intrusion of the Granite. However, they are more likely to be cracks formed during the deformation of the area which preceded the Granite emplacement. Extensive alluvial shows have also been worked in the area.

Following is a brief description of the deposits that have been worked in the area.

<u>Shepherd & Murphy Mine</u>: A series of parallel lode veins striking east-west for 400 metres and dipping steeply (85°) south. The ore occurs as fairly continuous blebs and bunches in veins 100mm to 900mm thick. Hosted by quartzite and skarn rocks. Mineralisation of the wallrock not uncommon.

The metallic minerals are cassiterite, wolframite and bismuthinite with lesser pyrite, marcasite, magnetite, hematite, pyrrhotite, arsencpyrite, molybdenite, chalcopyrite, sphalerite, galena, sheelite, native bismuth and bismutite. The gangue minerals consist of quartz, fluorite, topaz, phlogopite, muscovite, chlorite, laumontite, calcite, siderite and beryl. Some gold occurs with the pyrite (Twelvetrees, 1913).

Granite has been intersected 200-220 metres below the mine. Postulated to be a cupola-like body. Bismuth ores most common near the surface and cassiterite decreases relative to wolframite with depth.

A resource of 26 x 10^6 tonnes at 18% CaF_2, 0.1% Sn and 0.1% W has been defined within the skarn (Smyth, 1981). Metasomatism and replacement of the limestone by fluids and gases moving along numerous fine fractures pre-dates the lode vein mineralisation. Replacement proceeded outwards from the fractures.

<u>All Nations Mine</u> (Lady Barron): Thought to be the eastern extension of the Shepherd and Murphy lodes. The veins trend 285° and dip steeply (75-80°) south. They vary in width from 10mm to 500 mm and occur in quartzite. Wolframite is the main metallic mineral, with minor bismutite, molybdenite, pyrite and gold. Gangue minerals are quartz, topaz and muscovite.

The veins often contain large water filled vugs with combed quartz and embedded wolframite. They appear to terminate at the quartzite/conglomerate contact. A 25-75mm selvage on the hangingwall contains gold and bismutite. The veins occur in an en echelon pattern with their extremities overlapping. A low angle reverse fault dislocates their eastern extent.

<u>Lawkemlaw Workings</u>: South of the All Nations Mine. Diggings occur over 100 metres bearing 290°. The vein is 75-150mm thick and dips steeply (80-85°) north. Hosted by decomposed Cambrian quartz-feldspar porphyry overlain to the north by Roland Conglomerate. Dominantly a smokey quartz and pale blue topaz vein with wolframite and minor sulphides.

<u>Pig & Whistle Workings</u> (Lawson & Riley): 500 metres southeast of the All Nations Mine. Several veins 75mm to 200 mm thick striking 280-320° and dipping steeply south. Hosted by decomposed Cambrian quartz-feldspar porphyry.

Veins of quartz with wolframite and minor cassiterite, bismuthinite, bismutite, pyrite and arsenopyrite. Accessory topaz, fluorite, tourmaline and muscovite.

Lode minerals also occur on the porphyry/conglomerate contact.

<u>Pochins Adit</u>: To the east, but not an extension of, the All Nations lode (Jennings 1979). A series of rich pockets and short veinlets 50-150mm thick. Quartz veins with wolframite in bleached gritty sandstone.

<u>Higgs Mine</u> (Sunrise): The lode occurs in a crushed zone between two shears trending 300° and dipping 70° north. The crushed zone served as a favourable site for deposition. The lode is 3 metres wide and 46 metres long. It consists of galena, pyrite, arsenopyrite and chalcopyrite impregnated quartzite which is auriferous. Some fine free gold was visible. The gold is apparently contained in pyrite and values decrease with depth. The lode is oxidised. Silicification may be contemporaneous with sulphide mineralisation (Roberts, 1987).

Narrawa Reward Adit: The workings trend 290° through a quartzite heavily impregnated with arsenopyrite, pyrite, chalcopyrite and galena. The lode carries gold and silver. Adjacent to it is a quartz-feldspar porphyry dyke dipping steeply south. Associated shearing occurs along the length of the adit (Roberts, 1987) and appears to be a major control on the mineralisation. Quartz veining contains wolframite and molybdenite.

Packetts Workings: Trenching across and along narrow wolframite bearing quartz veins with minor cassiterite and bismuthinite. At the surface fine gold and pyrite were associated with the veins in a friable sandstone. Pyrite became more abundant with depth. Shearing occurs in thin clay-rich zones parallel to the veins (Roberts, 1987).

Poveys Workings (Povey & Johnson, Sullivans): Quartz veins 75-200mm thick strike 335° and dip 45-60° south. They contain wolframite and minor molybdenite. Hosted by hard quartzite.

Squib Workings (Gurrs): Veins trending 320 and dipping 45 south. Large patches of wolframite occur in the quartz veins with minor bismutite, molybdenite, cassiterite and sulphides. Associated minerals are topaz, fluorite, beryl, monazite and muscovite. Hosted by oxidised, decayed granite on the granite/quartzite contact. The richest ore apparently occurred in the quartzite.

Gold is not abundant, but widely distributed. Sparks Drive and Truscotts diggings are associated workings.

Dolcoath Mine: Vuggy irregular quartz veins in greisenised granite. Veins 75-150 mm thick trend NNW and dip 45 south. Dominantly wolframite with minor cassiterite and molybdenite and with accessory topaz, pyrite and arsenopyrite.
A muscovite selvage exists. The greisenised host has disseminated pyrite arsenopyrite and bunches of cassiterite .

Blacks Workings (Southern Wolfram Lode): Lode veins 125-250mm thick strike 280-305° and dip 50° south. Combed quartz with wolframite, minor molybdenite and variable amounts of sulphides, bismuth minerals, fluorite and mica. Hosted by greisenised granite. Gold has been recorded.

Batemans Shaft: North of Blacks line of lode. The lode strikes 330° and consists of wolframite in quartz veins within greisenised granite.

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Sayers Workings: An east-west lode line extending over 600 metres. A series of sub-parallel quartz veins up to 200mm thick in greisenised granite. They contain wolframite with minor bismuthinite, cassiterite and molybdenite in association with fluorite, beryl, topaz and muscovite. Wolframite content is variable.

Princess Mine (Urquharts): Veins with quartz, topaz, fluorite, wolframite and bismuth minerals. They are 50-200mm thick, strike 310-350° and dip 45-60° south. Enclosed within greisenised granite bearing topaz, fluorite and scattered wolframite.

Falls Mine (Tin Spur Mine): Deeply weathered ferruginous sandstone and siltstone striking 300° and dipping 70° south. The sandstone carries disseminated pyrite and cassiterite, and possibly gold. Cassiterite bearing veins also occur.

Related to the Tin Spur Creek Fault which is 60 metres south. Workings developed on a secondary concentration formed from talus accumulation (Jennings, 1958).

Ashworths and Gorey/Duff Workings: Cassiterite in a soft bleached sandstone on the same line as the Falls Mine. The deposits may have been rich in detrital material at the surface which proved uneconomic at depth. Some sulphides and minor gold (Reid, 1919) also present.

Hidden Treasure Mine: Numerous quartz veins 75-300mm thick trending NW and dipping 60° south. They contain wolframite and molybdenite with bismuthinite, pyrite, chalcopyrite and accessory fluorite, topaz and muscovite. They occur in greisenised granite which contains wolframite, molybdenite and bismuthinite.

Premier Mine (Lewis Syndicate): Numerous quartz veins 75-200mm thick within greisenised pegmatitic dykes. Coarse crystalline quartz with wolframite, molybdenite, bismuthinite, native bismuth, pyrite, chalcopyrite and arsenopyrite. Associated fluorite, topaz and muscovite. Low concentrations of gold and silver occur throughout.

Campbells Reward Workings: The host is weathered Cambrian volcanic rock (Bull Creek Formation). Barbed and wire form gold occurs in a vein of kaolinised feldspar. The vein widens to be barren quartz. Silver is associated.

Coronation Workings (Thomas Section, Old Stag): Two lodes trending NW and dipping 50° south. They are 75mm to 200mm wide and consist of pyrite, cassiterite and gold in a variably silicified sandstone. The sandstone and lode are cut by barren quartz veins. Possibly fault related.

Devonian Workings: Veins of ferruginous quartz bearing 290° and contained within the crushed zone of a NW trending thrust fault. Veins up to 100 mm thick and hosted by tubicolar sandstone. Rich gold values at the surface passing into gold-poor sulphides at depth.

Evendon and Reardon Workings: Contact between Cambrian volcanics and Ordovician rocks. Quartz occurring along the contact contains erratic gold values.

4.2 REVIEW OF EL 8/65 REPORTS

This licence was held by Mt. Lyell Mining and Railway Co. Ltd.. Figures 3 and 4 summarise the geochemical and geophysical data, respectively, that was reported between 1966 and 1973.

Mt. Lyell undertook regional aeromagnetics and stream geochemistry during 1966. Interpretations and results obtained indicated no areas of interest existed within EL 26/85 that required follow-up. The Dolcoath and Narrawa Creeks were locally anomalous for tin. But due to the numerous small workings that existed, they were not regarded as significant targets.

Investigations started around the Dolcoath Granite as exploration in other areas declined. It was recommended (Dandy, 1970) that reconnaissance mapping and an orientation soil geochemistry study be conducted over the western granite/quartzite contact.

A grid was cut and soil sampling at 100 ft intervals was completed (McKibben, 1971). Assay results for Sn, W, Bi and Mo gave partially coincident anomalous zones. Further infill soil geochemistry was recommended to confirm these zones.

The infill lines were soil sampled and assayed (McKibben, 1972). The anomalous responses were enhanced. A detailed examination of the area followed. However, the potential for finding an economic deposit was considered low.

McKibben (1972) also reports on geological mapping over an area of Bull Creek Volcanics outcropping adjacent to the Bismuth Creek Fault (BCF) zone. This outcrop occurs on a tributary of Bull Creek in the southwest corner of EL 26/85.

> "Massive black-green volcanics containing clear rounded quartz phenocrysts outcrop to the northeast of the BCF ..... *Minor patches of coarse pyrite occur as "clusters"* in this rock. To the southwest of the BCF zone, poorly exposed areas of very fine grained acid lavas, quartz-sericite schists and cherts (?) are bounded by typical massive black-green porphyritic volcanics. The fine grained "cherty" rocks are brecciated in places and contain minor pyrite in the broken matrix.
> Lenses of highly sheared quartz-sericite schists occur within the fine-grained acid rocks. The schists may originally have been quartz-rich acid fragmentals. Variable amounts of finely disseminated pyrite are common in the schistose zones. No other sulphide minerals were observed in hand specimen".

Assaying of typical pyritic quartz-sericite schist for Cu, Pb, Zn, Co, Ni, Au and Ag return no significant results. The pyritic bearing schistose rock is restricted in occurrence. The BCF may have caused the locally disseminated pyrite mineralisation.

4.3 REVIEW OF DOLCOATH GRID DATA

The previous EL 26/85 Annual Reports (Roberts, 1986 & 1987) were examined.

An initial assessment of the data highlights a number of features. Known areas of gold mineralisation are associated with shearing (faulting?), silicification, the occurrence of abundant sulphides and, to a lesser extent, fragmentation. The deposits are structually controlled.

Observations made in the Lea River area and descriptions of the transition zone in the Shepherd & Murphy skarn (Smyth, 1981) can be related to the rocks mapped on the Dolcoath Grid. The calc-silicate and skarn rocks mapped by Roberts (1987) on the grid are part of the transitional zone, but have no depth extent. Similar rocks intersected by the drilling are only more limy rich zones in the Moina Sandstone sequence. Therefore, potential for an economic skarn gold deposit on the grid is very low.

The gold soil geochemistry by RGCE shows a strong position and trend association with the "noisey" magnetics zone from CRAE's ground magnetics. CRAE considered the zone to be a region of faulting and shearing associated with near surface mineralisation. However, the magnetic highs in this zone relate to calc-silicate and skarn type rocks with known magnetite occurrences. So the structural interpretation may not be valid. What requires testing is if the rocks below the soil geochemical gold trend reflect the anomalism.

Even though no gold mineralisation occurred in the drill holes that reflected the grades obtained on the surface, broad gold mineralised zones do exist. These do appear to be related to particular lithologies.

Review of the Dolcoath Grid data is ongoing.

4.4 WILMOT TUNNEL

The Wilmot Tunnel passes under EL 26/85 in the north (Figure 5). In February 1988 an examination of the tunnel was completed. An attempt was made to geologically map and chip sample the walls. Magnetic susceptibility readings were taken along its length.

4.4.1 Surface Geology

Detailed surface mapping was undertaken prior to the tunnel's construction. A number of holes were drilled along the proposed path. Several seismic traverses were conducted to help anticipate ground condition problems. A limestone sequence was located which had numerous large voids. The planned path was relocated further to the south to bypass this area. The surface geology covering EL 26/85 has been compiled and plotted at a scale of 1:5000 (Figure 5).

4.4.2 HEC Tunnel Mapping

Mapping of the tunnel by the HEC concentrated on structural features, ground conditions and water seepage. Stratigraphy and mineralisation were only broadly considered. Figure 6 shows the tunnel geology with a possible interpretation to surface. The section of the tunnel in Figure 6 relates to Figure 5.

Only a confirmation of the broad lithological features was able to be accomplished by the RGCE personnel during their inspection. This was due to the time constraint and a brown deposit which covered all of the rock exposure. A significant feature of the tunnel geology is the occurrence of Cambrian rocks. Their western contact would be regarded as a normal stratigraphic succession. However, the eastern contact is faulted. Mineralisation in the area is known to be related to structures.

4.4.3 Tunnel Sampling

Sample locations and assay results are in Appendix 2. No results of any significance were returned. An effective chip sample coverage was afflicted with the same problems that the geological mapping had. Samples were taken where abundant sulphides were observed & where calc-silicate minerals and/or more hornfelsic or shaley units were encountered. Also where a strong magnetic susceptibility reading was recorded.

Figure 6 shows sample locations for the tunnel path in Figure 5.

4.4.4 Magnetic Susceptibility

A Geoinstruments Susceptibility Meter JH-8 was used. This gives values at $x10^{-5}$ S.I. units. See Figure 6 for a profile of the readings. They are listed in Appendix 3. Readings were taken on the southern wall at 10 metre intervals from chainage points (every 100 feet). Spikes in the quartzite may relate to magnetite bearing calc-silicate zones which are known to occur in this sequence. Spikes in the conglomerate may be related to Cambrian fragments, or disseminated pyrrhotite or magnetite. The Cambrian rocks show definitive high magnetic susceptibilities. Possibly related to magnetite disseminated throughout.

5. OVERVIEW OF MINERALISATION STYLES

Dr. Gregg W. Morrison, from James Cook University in Queensland, spent two weeks in Northern Tasmania examining gold occurrences. He was to give an overview of the mineralisation styles observed at each occurrence. Then to evaluate the bulk tonnage gold mineralisation potential.

A copy of his report is given in Appendix 4.

The Higgs and Narrawa Reward Workings were among those that were examined in the area. From reconnaissance of the workings Dr. Morrison concluded the simple process of surface oxidation and gold enrichment is not entirely applicable here. Many previous workers had suggested this as an explanation for the grade drop-off with depth. He considered a structural explanation was suggested due to observations of ore shoot geometry and surface grade distribution. This involves the formation of small, shallow plunging ore shoots being formed where the shear zone is refracted when intersecting beds of varying competence at low angles.

Plotting of assay data for holes ND1 & DG1 shows a strong overall element zoning pattern. (Figure 7 for ND1). Examining the core in relation to the geochemical associations generated suggested distinct controls on gold distribution existed. This may lead to the identification of a "gold corridor" in space and time. Geochemical associations returned for drill holes ND2 and ND3 (Figures 8 & 9 respectively) do not display such a clear cut metal zonation. These holes were examined later by RGCE, and there appears to be a much greater overprinting character. What can be concluded from these, however, is that there has been more than one style of mineralisation over time.

If the suggested structural control or something similar exists, exploration for these type of deposits will be difficult.

For the Moina area, Dr. Morrison concludes the best targets are in situations where Pb-Zn-Ag vein/replacement deposits are overprinted by Au-bearing greisen veins. He considers the locus of these deposits to be adjacent to NW trending shears and faults cutting carbonate rocks and intruded by F-poor plugs or dykes.

6. GOLD-SKARN POTENTIAL

A report was submitted by Lawrence D. Meinert of Washington State University. (Appendix 5). He spent a couple of days looking at skarns in the Renison and Moina regions.

Larry has undertaken detailed examinations of gold skarns in North America. He considers that the Stormont Bismuth Mine skarn has the mineralogical features which reflect the greatest potential for producing an economic gold deposit. However, he believes the composition of the associated pluton is a limiting factor in locating large deposits. The plutons should be more mafic and oxidised.

7. REGIONAL GEOPHYSICAL APPRAISAL

Dr. D. Leaman of Leaman Geophysics in Hobart is currently studying the magnetics and gravity data over the Moina area.

The first phase report on the magnetics has been received (Appendix 6).

The magnetics data offers a good deal of information on the structure in the area. A conjugate set of NW-SE and NE-SW structures have been identified. The northern wedge intersection zones caused by these structures relate to known mineralised locations when associated with an E-W trend. The E-W trend is thought to represent transform faulting in an old rift environment.

The data infers the presence of a concealed Cambrian mafic suite that appears to be widespread throughout. The Tertiary basalt is variable in character. The suggestion is that it may only be patchy and thin. Generally less than 50 metres thick.

Little evidence of alteration is apparent. The interpreted Cambrian mafics could be contact metamorphosed Cambrian felsics.

Known mineralisation appears to be concentrated on reactivated (Devonian) boundaries or structural trends. Many deposits have a possible magnetic expression. Also, a number of unexplained expressions have been noted.

The next phase report will be on the gravity data. To enhance this study, the Department of Mines took gravity readings in the area at 250 locations for RGCE. A listing of the data obtained is in Appendix 7.

Figure 10 shows the new gravity stations and Shell's aeromagnetic coverage on the 1:25000 Cethana Sheet.

8. CONCLUSIONS AND WORK PROPOSED 1988/89

The old workings in the area have highlighted the structural control on mineralisation in the area. Most lodes are quartz veins containing wolframite, cassiterite, molybedenite and bismuth minerals with sulphides and gold being widespread. These are the brittle greisen veins referred to by Roberts (1987).

The drill holes completed to date have identified broad gold mineralised zones which are not readily correlateable with the known high grade gold values obtained from the Higgs Workings. Figure 11 gives an impression of controls on the formation of a high grade gold mineralised zone. Certain lithologies appear to have an affinity for gold. The intersection of these lithologies with a major feed structure may localise mineralisation in a shallow plunging reef. Drilling is planned to test this interpretation.

Continued assessment of the data accrued in the previous Annual Reports is ongoing. The gold geochemistry trend parallelling Narrawa Creek requires follow-up. As does its relationship to the noisey magnetics zone identified in the ground survey. All of the drill hole information and the Wilmot Tunnel geology needs to be combined to enhance any new interpretation.

The geophysical target recommended by Dr. J. Bishop (Roberts, 1987) requires drill testing. The regional geophysical appraisal is ongoing. It is hoped to be completed by the end of the calendar year so that interesting areas highlighted can be investigated during the current field season.

Reconnaissance exploration of the southern portion of the licence will commence this field season. Regional mapping, rock sampling and stream sediment sampling will be carried out. Areas requiring more detailed study will then be identified.

Expenditure for 1988/89 is expected to be $50000.

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APPENDIX 1

Expenditure

APPENDIX 1

RGCE Expenditure from December 1987 to August 1988

Item	Cost
Salaries, wages & on costs	6285
Consultants & contractors	857
Assays	423
Stores	429
Vehicle/Plant hire	506
Tenement Costs	5000
Office Costs	993
TOTAL	$14493

APPENDIX 2

Wilmot Tunnel Assay Results

628

GOLDFIELDS EXPLORATION PTY. LTD. DATA SHEET

PROJECT:NARRAWA

MAP-PHOTO:CETHANA 2-SCALE:5000 CODE:5518 DATE:1988 211
GRID:AUST. MAP GRID SAMT:ROCK OUTCROP
REF.:WILMOT TUNNEL SAMPLER:M.J.FLEMING

SAMPLE IDENT.	NORTH	EAST	AU PPM	AUCHK PPM	CU PPM	PB PPM	ZN PPM	AG PPM	BI PPM	AS PPM	SN PPM	W PPM
10220	408142	422640	-0.008		200	85	200	-0.5	-10	14	-3	-10
10221	408101	422722	-0.008		575	205	575	-0.5	-10	21	7	-10
10222	408075	422777	-0.008		180	50	180	-0.5	-10	5	-3	-10
10223	408020	422888	-0.008		215	75	215	-0.5	-10	9	3	-10
10224	407773	423379	-0.008		50	35	50	0.5	-10	52	-3	-10
10225	407762	423397	-0.008		120	60	120	-0.5	-10	6	8	-10
10226	407640	423846	-0.008		40	30	40	-0.5	10	160	10	-10
10227	407617	423966	-0.008		148	50	148	-0.5	-10	6	75	-10
10228	407569	424210	-0.008		45	70	45	-0.5	-10	8	9	25
10229	407483	424650	-0.008		35	60	35	-0.5	-10	3	9	-10
10230	407240	425876	-0.008		120	40	120	-0.5	-10	10	8	-10
10231	407216	425998	-0.008	-0.008	25	30	25	-0.5	30	2	8	-10
10232	407211	426026	-0.008		25	25	25	-0.5	-10	2	7	13
10233	407205	426059	-0.008		20	35	20	-0.5	-10	3	9	14
10234	407182	426178	-0.008		20	40	20	-0.5	-10	12	37	-10
10235	407170	426237	-0.008		35	30	35	-0.5	-10	170	52	37

Laboratory:	ANALAB	ANALAB	ANALAB	ANALAB	ANALAB	ANALAB	ANALAB	ANALAB	ANALAB	ANALAB
Instrument:	309	309	101	101	101	101	101	114	401	401
Det. Limit:	0.008	0.008	5.000	5.000	5.000	0.500	10.000	1.000	3.000	10.000

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APPENDIX 3

Wilmot Tunnel Magnetic Susceptibility Readings

APPENDIX 3

WILMOT TUNNEL MAGNETIC SUSCEPTIBILITY READINGS

CHAINAGE (x 100 ft)	METRES FROM CHAINAGE	READING (x 10^{-5} SI units)
133	0	180
133	+10	220
133	+20	150
132	0	160
132	+10	150
132	+20	150
131	0	160
131	+10	140
131	+20	150
130	0	150
130	+10	160
130	+20	130
129	0	140
128	0	140
128	+10	140
128	+20	140
126	+24	210
125	0	190
125	+10	60
125	+20	50
124	+20	60
123	0	30
123	+10	50
123	+20	27
122	0	12
122	+10	40
122	+20	45
121	0	16
121	+10	71
121	+20	9
120	0	10
120	+10	7
120	+20	6
119	0	8
119	+10	1
119	+20	10
118	0	2
118	+10	3
118	+20	8
117	0	11
117	+10	4
117	+20	9
116	0	7
116	+10	7
116	+20	39
115	0	134
115	+10	25

CHAINAGE (x 100 ft)	METRES FROM CHAINAGE	READING (x 10^{-5} SI units)
115	+20	15
114	0	13
114	+10	50
114	+20	12
113	0	10
113	+10	45
113	+20	8
112	0	39
112	+10	7
112	+20	11
111	0	27
111	+10	45
111	+20	44
110	0	11
110	+10	26
110	+20	13
109	0	6
109	+10	5
109	+20	8
108	0	27
108	+10	35
108	+20	14
107	0	21
107	+10	29
107	+20	19
106	0	37
106	+10	200
106	+20	57
105	0	170
105	+10	140
105	+20	20
104	0	200
104	+10	190
104	+20	40
103	0	32
103	+10	13
103	+20	35
102	0	20
102	+10	75
102	+20	300
101	0	53
101	+10	87
101	+20	170
100	0	900
100	+10	25
100	+20	53
99	0	91
99	+10	68
99	+20	86
98	0	54
98	+10	48

CHAINAGE (x 100 ft)	METRES FROM CHAINAGE	READING (x 10^{-5} SI units)
98	+20	850
97	0	12
97	+10	64
97	+20	130
96	0	15
96	+10	84
96	+20	151
95	0	58
95	+10	61
95	+20	45
94	0	39
94	+10	33
94	+20	93
93	0	200
93	+10	22
93	+20	21
92	0	210
92	+10	150
92	+20	91
91	0	52
91	+10	48
91	+20	24
90	0	22
90	+10	37
90	+20	65
89	0	28
89	+10	94
89	+20	82
88	0	82
88	+10	170
88	+20	39
87	0	22
87	+10	170
87	+20	78
86	0	63
86	+10	70
86	+20	72
85	0	49
85	+10	25
85	+20	33
84	0	26
84	+10	24
84	+20	89
83	0	34
83	+10	25
83	+20	22
82	0	23
82	+10	26
81	+14	31
81	+20	28
80	0	25
80	+10	27

CHAINAGE (x 100 ft)	METRES FROM CHAINAGE	READING(x 10^{-5} SI units)
80	+20	23
79	0	39
79	+10	22
79	+20	24
78	0	25
78	+10	13000
78	+20	449
77	0	1300
77	+10	20
77	+20	47
76	0	73
76	+10	19
76	+20	25
75	0	31
75	+10	48
75	+20	190
74	0	24
74	+10	12
74	+20	60
73	0	20
73	+10	7
73	+20	16
72	0	17
72	+10	18
71	+20	17
70	0	25
70	+10	12
70	+20	40
69	0	21
69	+10	27
69	+20	23
68	0	180
68	+10	160
68	+20	610
67	0	136
67	+10	80
67	+20	1900
66	0	58
66	+10	84
66	+20	40
65	0	35
65	+10	8
65	+20	28
64	0	30
64	+10	49
64	+20	35
63	0	78
63	+10	12
63	+20	25
62	0	700
62	+10	69
62	+20	14

CHAINAGE (x 100 ft)	METRES FROM CHAINAGE	READING (x 10^{-5} SI units)
61	0	61
61	+10	24
61	+20	29
60	0	16
60	+10	69
60	+20	21
59	0	30
59	+10	50
59	+20	17
58	0	19
58	+10	36
58	+20	22
57	0	25000
57	+10	34
57	+20	10
56	0	230
56	+10	40
56	+20	38
55	0	5
55	+10	33
55	+20	48
54	0	17
54	+10	20
54	+20	26
53	0	185
53	+10	3500
53	+20	74
52	0	110
52	+10	24
52	+20	18
51	0	24
51	+10	8
51	+20	15
50	0	53
50	+10	17
50	+20	470
49	0	55
49	+10	490
49	+20	5
48	0	4200
48	+10	24
48	+20	18
47	0	12
47	+10	23
47	+20	16
46	0	13
46	+10	34
46	+20	10
45	0	11
45	+10	57
45	+20	8
44	0	55

CHAINAGE (x 100 ft)	METRES FROM CHAINAGE	READING (x 10^{-5} SI units)
44	+10	35
44	+20	42
43	0	19
43	+10	45
43	+20	50
42	0	32
42	+10	14
42	+20	12
41	0	10
41	+10	11
41	+20	13
40	0	63
40	+10	28
40	+20	160
39	0	110
39	+10	88
39	+20	82
38	0	160
38	+10	51
38	+20	55
37	0	160
37	+10	120
37	+20	290
36	0	32
36	+10	62
36	+20	530
35	0	58
35	+10	440
35	+20	210
34	0	340
34	+10	270
34	+20	260
33	0	53
33	+10	2200
33	+20	54
32	0	33
32	+10	35
32	+20	36
31	0	33
31	+10	200
31	+20	38
30	0	39
30	+10	47
30	+20	30
29	0	39
29	+10	160
29	+20	30
28	0	47
28	+10	45
28	+20	420

CHAINAGE (x 100 ft)	METRES FROM CHAINAGE	READING (x 10^{-5} SI units)
27	0	38
27	+10	87
27	+20	25
26	0	32
26	+10	84
26	+20	35
25	0	46
25	+10	110
25	+20	148
24	0	91
24	+10	184
24	+20	49
23	0	38
23	+10	45
23	+20	57
22	0	150
22	+10	90
22	+20	28
21	0	59
21	+10	34
21	+20	220
20	0	45
20	+10	61
20	+20	62
19	0	1900
19	+10	5400
19	+20	46
18	0	1800
18	+10	5700
18	+20	14000
17	0	9200
17	+10	4500
17	+20	16000
16	0	4900
16	+10	7700
16	+20	2300
15	0	1300
15	+10	300
15	+20	8200
14	0	15500
14	+10	5500
14	+20	150
13	0	140
13	+10	20
13	+20	2800
12	0	750
12	+10	55
12	+20	34000
11	0	6900
11	+10	120
11	+20	510
10	0	40

APPENDIX 4

Dr. G. Morrison's Report - An Overview of Gold Occurrences in Northern Tasmania.

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AN OVERVIEW OF GOLD OCCURRENCES IN NORTHERN TASMANIA

for Goldfields Exploration

Dr G.W. Morrison
28 Park St
PIMLICO, Qld 4812

November, 1987

Table of Contents

SUMMARY

Two weeks were spent on field visits and data review of the Moina, Lisle-Golconda, Mount Horror, Henty, Beaconsfield, Lefroy and Mathinna gold occurrences of northern Tasmania. The objective was an overview of mineralisation styles and an evaluation of potential, particularly for bulk tonnage gold mineralisation.

The Moina field is a zoned, polymetallic, deep subvolcanic intrusive system with wrigglite Sn skarns (Moina), garnet-Cu-Bi-Au skarns (Stormont), structurally controlled vein-replacement style Pb-Sn-Ag massive sulphides (Round Mount) and greisen-type quartz veins with Sn-Mo, Mo-W-Bi and Cu-Bi-Au variants (Higgs-Narrawa). The most immediate potential for gold mineralisation is in the garnet skarn at Stormont and in the area between Stormont and Fletchers Adit. Deposits of this type are localised in Gordon Limestone adjacent to F-poor cupolas of Dolcoath granite and are not clearly related to regional or local structures. For the field as a whole the best grass-roots target is the situation in which Pb-Zn-Ag vein/replacement deposits are overprinted by Au-bearing greisen veins. The locus of these deposits is adjacent to major NW trending shears and faults cutting carbonate rocks and intruded by F-poor plugs or dykes. The best analogy is with the Leadville District of Colorado and the best target areas are near Round Mount and the Bismuth Creek Fault at Moina.

The Lisle-Golconda field is also a deep subvolcanic porphyry system but developed entirely in a clastic sediment host. The gold occurrences are poorly developed low sulphide quartz veins associated with molybdenite, tourmaline and greisen style veins. The field as a whole may have some potential for stockwork and breccia-hosted gold mineralisation.

The Mount Horror area contains a number of discrete plutonic quartz veins anomalous in W-Sn-As-Bi-Ag-Au. They are interpreted to be related to the Blue Tier batholith and as plutonic level equivalents of some of the Moina veins. Such an environment has little potential for bulk tonnage gold mineralisation.

A brief reconnaissance of the data and drill core suggest the Henty occurrence is polymetallic semi-massive sulphide formed, at least in part, by replacement of carbonate units that have been incorporated in a major shear zone. The style of mineralisation and the element association do not require precursor volcanogenic mineralisation or imply a significant intrusive input. The best analogy is probably with Thompson-Bousquet or Hemlo and the Archean 'break' environment in general. The Henty Fault is considered a crustal scale structure with good potential for more discoveries of Henty style or more typical 'break' style mineralisation.

Beaconsfield is a quartz-ankerite-sulphide vein associated with quartz-ankerite replacement

bodies in a flexure between two major shears. A surprising feature of the veins is the abundance of banded chalcedonic silica and euhedral quartz crystals exhibiting explosion texture. These textures suggest formation at shallow crustal levels from a boiling hydrothermal fluid. The mineralisation could represent an epithermal level expression of deep crustal metamorphic fluid escaping up major structures of Taberraberan or younger age. Analogy with active warm springs on the Alpine Fault of New Zealand suggests even the Tamar Fracture Zone could be the major fluid conduit. If this could be established in fact then a new exploration model might be appropriate.

Lefroy is a fairly typical example of a turbidite hosted, intermediate level, metamorphic gold-quartz vein deposit. The ore controlling structures are tension gashes between zones of axial planar shear on Taberraberan folds. The best analogy is with the Hodgkinson Goldfield of North Queensland where numerous small scale oreshoots are characteristic and alluvial production far outweighs hard rock production.

Mathinna has a similar host sequence, vein character and origin to Lefroy but is centred on a crustal scale structure that gives it a potential for larger orebodies or groups of high grade ore shoots that might be mined in a bulk tonnage open cut. An analogy with the Jamestown and Carson Hill developments in the Mother Lode District of California is warranted for Mathinna and the concept may be applicable elsewhere along the Manganna-Forester belt.

The overall impression of northern Tasmania is of a wide range of deposit styles all formed as part of the Taberraberan orogeny. The most important controls on the orefields are the long lived crustal scale structures or 'breaks' (Henty, Mathinna, Tamar) and intrusions emplaced at subvolcanic levels. Smaller scale structures, particularly NW trending folds and shears and associated tension frctures localise mineralisation in many of the fields but the best potential is where combinations of structures, intrusions and host rocks with potential for replacement co-exist.

MOINA DISTRICT

Moina is one of the principal mineral districts in north-central Tasmania better known for its tin-fluorite occurrences than for its gold occurrences. Five days were spent visiting representative occurrences in the district and graphic logging drill core from Higgs-Narrawa in an effort to establish the distribution and timing of the various styles of mineralisation.

HIGGS - NARRAWA REWARD

An evaluation of bulk tonnage potential based on a reconnaissance of surface and underground workings and graphic logging of two representative drill holes.

The Higgs and Narrawa Reward workings have produced approximately 28 kg of gold from quartz veins and disseminations in sheared sandstone, siltstone, calc-silicates and porphyry dykes. The old workings were limited in depth by a rapid fall off in grade that has been interpreted as the transition from surface enriched to primary mineralisation. Similarly in the recent exploration programme encouraging results from rock chip sampling have not been duplicated in drilling intersecting the shear zone approximately 100 m below the workings. There are two possible explanations for the grade drop off:

1. Surface enrichment due to oxidation as suggested by most previous workers
2. Structure controlling small shoots with shallow plunge so that drill intersections below old workings intersect the structure but not the ore shoot.

For the explanation based on surface enrichment there is strong support in the nature of the workings the available assay data and the fact that similar features have been noted in many other goldfields of northern Tasmania. However there are some puzzling observations:

1. Fresh sulphides are exposed near surface or within a few centimetres of surface in many places suggesting oxidation is incomplete.
2. In all the drill holes there is strong depletion of all elements analysed including gold down to approximately 30 m. The cutoff to anomalous grades is sharp and in ND1 and DG1 at least, below the level of even partial oxidation and distinctly below the level of complete oxidation (<10 m).
3. Good surface gold grades are restricted to discrete patches (eg. main Higgs workings, West Higgs) with only occasional good grades between.

These features suggest the simple process of surface oxidation and gold enrichment typical of the arid environment in Western Australia is not entirely applicable here.

A structural explanation is suggested by observations of ore shoot geometry and surface grade distribution. In the Higgs and Narrawa Reward workings the principal 'reef' is an irregular shear zone striking NW and dipping approximately 70°NE and hence cutting bedding which has a similar strike but shallower dip. The orientations of the walls of the workings and the distribution of ore shoots suggest the low angle intersection causes refraction of the shear zone where it intersects beds of varying competence at low angles. The geometry is consistent with the process of Reidel Shear that gives rise to a complex of small, shallow plunging ore shoots. This model is well documented for the Far Fanning deposit in North Queensland (Roy Kidd, BSc Hons thesis, JCUNQ, 1985) where moderately plunging ore zones have been shown to consist of numerous shallow plunging ore shoots with dimensions of a few metres by 10's of centimetres. Definition of ore reserves at Far Fanning was so difficult that eventually 5000 tonne bulk samples were taken to establish overall grade and leachability (Elliot and Houtgraaf, 1986).

Plotting of all the assay data and features of the drill core on graphic logs for holes ND1 and DG1 has demonstrated a strong overall element zoning pattern and distinct controls on gold distribution. Although there is some duplication in DG1 there is a strong single pass zoning pattern in ND1 from shallow Pb-Zn-Ag through Cu-Bi-Au (As, W) to Mo-W-Bi and Sn-Mo (As) at depth. This is similar to the zoning pattern for the whole Moina field relative to the Dolcoath granite and suggests that even dykes that are part of the system may telescope the whole zoning pattern. In DG1 the dykes themselves are sheared, and mineralised with the whole element assemblage, suggesting deformation, intrusion and mineralisation are broadly contemporaneous. Overprinting relationships suggest the deeper zones are younger and that the gold mineralisation is most closely linked to the earliest stage of greisen alteration overprinting the Pb-Zn-Ag mineralisation. If the zoning pattern and time sequence are more generally applicable then there may be a distinct 'gold corridor' in space and time and on a variety of scales that may help focus exploration.

For Narrawa and Higgs the complexities of variable surface grades, ore shoot geometry and element zoning make definition of deep exploration targets difficult. The fundamental problem at this stage seems to be the depth extent of the good surface grades. This could be tested with a programme of detailed surface rock chip sampling and drill hole sampling to a few metres or tens of metres. Confidence in these results might justify a programme of shallow ore reserve definition.

STORMONT-FLETCHERS ADIT

Surface and adit reconnaissance to evaluate potential for skarn orebodies.

The Stormont Mine and Fletchers Adit have produced approximately 3.6 t Bi, 3 kg Au and 1.8 kg Ag from garnet and magnetite skarns and basemetal veins in transition beds between the

Moina Sandstone and Gordon Limestone. At the Stormont Mine mineralised garnet skarn is a trough-shaped, bedding conformable band underlain by shallow dipping magnetite-amphibole skarn and dragged up against a fault which is at a low angle to bedding strike. The magnetite-amphibole skarn is barren, banded and conformable to the underlying sandstone. It is interpreted as a pre-mineralisation reaction skarn formed by exchange of components between thinly bedded limey siltstones and sandstones. The magnetite-amphibole skarn is variably overprinted by light coloured garnet skarn close to its contact with the mineralised dark garnet (andradite) skarn. The andradite skarn is coarse grained and granular with interstitial cavities with quartz, chalcopyrite, bismuthinite and minor carbonate, epidote and amphibole. It contains relics of amphibole-magnetite skarn which have been strongly overprinted by garnet. The andradite skarn is interpreted as a high temperature (+450°C) metasomatic infiltration skarn replacing massive limestone and some adjacent interbeds. The lack of significant retrograde overprint or greisenisation suggests the skarn formed close to a pluton and not adjacent to a pre or syn-mineral fault.

At Fletchers Adit old reports suggest the tested mineralisation is largely restricted to veins and fault fillings cutting amphibole-magnetite skarn. In the wall of the adit bismuthinite is associated with garnet and pyroxene skarn whereas amphibole-magnetite reaction skarn contains pyrrhotite but no bismuth or gold. Geometric relationships suggest that if garnet skarn comparable to that at Stormont is present here then it is higher up the hill above the adit but possibly near the open cut from which Burns (1959, TDM Technical Notes p. 36) reports 3 m at 2.52% Bi and 7.1 g/t Au.

The excellent rock chip assays and the disseminated nature of the ore make the Stormont-Fletchers area an attractive exploration target for gold. The historic production grade of 7-10 g/t Au for 1% Bismuth is comparable to surface assays across the zone and the continuity of grade at surface suggests good overall grade in the zone. Detailed mapping at the mine should establish the exact geometry of the favourable skarn so that drilling can be optimised. Mapping and a magnetetic survey should be able to pinpoint other skarn pendants in the Stormont-Fletchers area.

MARINER GRIDS

On the Mariner 4 grid the principal rock type is K-feldspar-biotite-quartz porphyry interpreted as an equivalent of the Cambrian Mount Read volcanics. Locally the porphyry is strongly sheared and altered to sericite or silica-corundum-white mica/clay (pyrophyllite?, Kaolinite?) and cut by plutonic? buck-coarse comb quartz-pyrite-chalcopyrite veins. Work by Geopeko on Mariner 1 & 3 grids has identified similar porphyry with sericite-clay and greisen alteration and medium-fine comb quartz-pyrite-chalcopyrite-chlorite veins that are anomalous in Cu, Pb, Zn, Bi, As, Sn and Au. This geochemistry and the petrology done by Geopeko suggest the mineralisation is of Devonian granite affiliation and that the porphyry itself might even be of this age.

There is no clear evidence for the intrusive or extrusive origin of the porphyry, but the alkaline character suggested by the high biotite and K-feldspar phenocryst content and low quartz and the paucity of volcanogenic mineralisation suggest this unit differs from typical Mount Read volcanics. In most volcanic successions potassic, near-saturated volcanics (ie. shoshonites) post date calc-alkaline volcanics, are more often subaerial and more typically contain epithermal rather than volcanogenic mineralisation (eg. Emperor Mine in the Mba Volcanics Fiji). Independent of the actual age of the porphyry there may be a potential in the unit for porphyry and epithermal styles of mineralisation. This is reinforced by the presence of advanced argillic alteration in some shear zones suggesting high temperature interaction of magmatic and meteoric waters. This type of alteration and the alkaline volcanic association are typical of some important gold districts (eg. Goonumbla-Peak Hill-Temora NSW) where early low grade gold mineralisation is part of a porphyry Cu-Au system and higher grade Au-Ag mineralisation is associated with silica and often enargite in zones of advanced argillic alteration.

OTHER STYLES OF MINERALISATION IN THE MOINA DISTRICT

At least three other styles of mineralisation are known in the Moina District:

1. Sn-rich veins and wrigglite skarns such as Tin Spur and Shepherd & Murphys.

2. W-Mo-Bi veins such as Squibs and Poveys.

3. Ag-Pb infill and replacement lodes such as Round Mount.

At Shepherd and Murphys granular garnet, pyroxene and wollastonite skarns and fluorite-magnetite-vesuvianite wrigglite skarn with anomalous Sn, W, F, Be is cut by retrograde amphibole-sulphide skarn with anomalous Zn, Cu, In, Cd, and Au, and by greisen type quartz veins with anomalous Sn, W, F, Bi, and minor As, Mo, Cu, Pb, Zn. The skarn is essentially conformable to stratigraphy but attenuated along major fractures. The primary skarn is considered the equivalent of the Stormont skarn but has developed from an F-rich rather than H_2O-rich fluid. The greisen veins occupy E-W tension fractures adjacent to a major NW trending shear. This geometry and vein style is comparable to that of the gold veins in the Lefroy field and suggest that similar regional structural processes were in operation during metamorphism and granitoid emplacement. Potential gold mineralisation in this environment is not in the primary skarn, but in shallow Bi-rich portions of the greisen vein system, in strongly retrograded skarn, and in possible replacement bodies adjacent to syn-mineral faults. It has been suggested that the Hugo skarn along the Bismuth Creek Fault might represent such a setting.

The W-Mo-Bi occurrences are single or multiple greisen-quartz veins with coarse crystalline *wolframite, molybdenite and bismuthinite* and locally anomalous W, As, Cu, Zn, Pb, Au, Sn. The veins typically occupy NW trending axial planar shear zones and cut Dolcoath granite as well as Moina sandstone. The quartz is always milky and vitreous with medium to fine comb texture and relatively tight packing. This texture, element association and geologic setting is consistent with a moderate to deep subvolcanic environment that is the logical depth extension of the Narrawa-Higgs greisen mineralisation and more granite proximal.

Although not visited as part of this reconnaissance the Round Mount Ag-Pb occurrences are an important extension of the conceptual model of the Moina District. Round Mount has produced virtually all the Ag and Pb of the district as well as 1300 oz. Au and 71.3 t Bi from a series of massive sulphide bodies and veins hosted in Moina sandstone. The massive sulphide bodies are bedding plane gapes and partial replacements of silty horizons within tightly folded and thrust faulted sandstone/siltstone sequences localised along NW trending axial planar shear zones. The orebodies are a complex series of shallow plunging shoots consisting of pyrite and argentiferous galena with sphalerite, chalcopyrite and bismuthinite in a gangue of milky quartz and siderite. The best gold is associated with Bi-Mo and muscovite in the Ag rich ore suggesting it may in part be a greisen overprint of the basemetal mineralisation. The interpretation is that these bodies are essentially larger scale versions of the basemetal pods observed in the Narrawa and Higgs drill core that were also overprinted by greisen style gold veins. The logical extension of this hypothesis is that basemetal replacement bodies with overprinting greisen gold mineralisation may be present in the Round Mount district where major NW trending faults cut transition beds or Gordon Limestone. Favourable structures and stratigraphy may be present in the vicinity of the Cockatoo Road and Machinery Creek or near Tin Spur Creek NW of the Hidden Treasure workings. In the general model Tin Spur (Sn, Au) is the deeper portion of the greisen part of the system and the Devonian gossan is an example of the Round Mount Ag Pb Au mineralisation style.

OVERVIEW OF THE MOINA DISTRICT

The Moina District is a classically zoned polymetallic deep subvolcanic system that is somewhat unusual for its combination of Sn-W-Mo-Bi, Cu-Bi-Au and Ag-Pb-Zn element associations. All of the mineralisation, possibly even including that on the Mariner grids, is associated with cupolas of the Devonian Dolcoath granite. Emplacement of at least early dyke phases of the granite overlaps axial planar shear on NW trending anticlines that is considered part of the Taberraberan Orogeny. The NW trending structures are the principal locus of mineralisation but NE and E trending tension structures formed by shear movement on the NW structures also host minerlisation. Greisen veins, the most common style of mineralisation, cut granite, porphyry, Moina sandstone, conglomerate, skarns and massive sulphides. The skarns are developed in transition beds as well as massive Gordon Limestone whereas the massive sulphide occurrences are gapes in siltstone beds, partial replacements of sandstone and pods of retrograde skarn. There are no well documented occurrences of greisen stockworks or hydrothermal breccias which might be expected in such a system.

The overall element zoning pattern away from the granite is also the general mineralisation sequence from youngest to oldest:

Sn–W → W–Mo–Bi → Cu–Bi–Au → Ag–Pb–Zn

In detail however, there are several stages of mineralisation in particular early? high temperature skarns related to F-bearing cupolas (Moina Sn) and OH-bearing cupolas (Stormont Au-Bi) are likely overprinted by retrograde assemblages (including Round Mount type Pb-Zn-Ag massive sulphides) and greisen veins with a Sn-W or W-Mo-Bi character. Gold mineralisation is in two distinct associations - early high temperature Cu-Bi-Au skarns (Stormont) and later moderate temperature greisen veins also with a Cu-Bi-Au signature (Narrawa-Higgs). There is immediate exploration potential at the Stormont mine and in the Stormont-Fletchers Adit area for moderate tonnage skarn gold mineralisation. In the greisen association, veins are dominant and many of the occurrences are likely to be small high grade pods. However the coincidence of greisen veins in major structures with podiform sulphide bodies as suggested for the Round Mount area holds a potential for high grade moderate to large tonnage orebodies. The ideal situation would be to have a small greisen type cupola emplaced near a major structure that juxtaposed clastic and carbonate sediments. The best analogue for this environment is the Leadville District Colorado (Thompson, 1981; paper attached).

LISLE-GOLCONDA

Evaluation of granitoid-porphyry models and bulk tonnage potential based on brief visits to the Panama vein deposits and Lisle alluvials.

In the Lisle-Golconda area workings were predominantly alluvial-eluvial but sourced in the contact aureole of a Devonian biotite granodiorite intruding sandstone and siltstone of the Mathinna Beds. Brief reports in the literature emphasise the following features.

1. Veins occur in the granodiorite and sediments but are concentrated in the contact aureole.

2. The veins were typically narrow, isolated and discontinuous.

3. Ore shoots were high grade but so small and irregular as to be generally uneconomic.

4. Veins were predominantly barren white buck quartz with cross-cutting fine comb quartz and fractures containing sulphides and gold.

5. Sulphides were generally sparse but dominated by pyrite, arsenopyrite and chalcopyrite with minor local galena and sphalerite.

6. Quartz-tourmaline-molybdenite veins occur in the granite. Greisen alteration and vein fill were seen in quartz samples at Lisle and kaolinite alteration (?weathered greisen) is also referred to.

7. Reports of sandstone hosted gold mineralisastion may represent fracture fillings in brittle or permeable beds adjacent to veins.

8. Gold fineness is reported as low or around 750 for quartz samples but very high for alluvial gold. Texture and distribution of the alluvial gold suggest it may have been derived from surface reprecipitation following breakdown of sulphides in quartz veins (Marshall, 1969, Pipers River Explanatory Notes, p. 106)

This combination of features is suggestive of a porphyry to shallow plutonic environment and a magmatic source of mineralisation. Some analogy might be made with the general environment of the Moina district. The possibility of sandstone or granodiorite hosted stockworks similar to Salave Spain has already been suggested by Mel Jones. Ground checks of the reported disseminated mineralisation particularly Bessells Reward may be worthwhile. The possibility of hydrothermal breccia hosted mineralisation (c.f. Kidston) might also be entertained. The overall feeling from the descriptions and field visit is that the hydrothermal system as a whole is poorly developed and that the intrusive body is a shallow pluton rather than a porphyry plug.

MOUNT HORROR AREA

An evaluation of the potential for bulk mineable gold mineralisation related to intrusive rocks based on a field reconnaissance of the Gorge Creek Tungsten prospect and Mount Horror arsenopyrite occurrence.

At the Gorge Creek Tungsten prospect widely spaced discrete quartz veins 20-120 mm thick cut hornfelsed sandstone, siltstone and shale in the contact aureole of the Blue Tier Batholith. The mapped width of the contact aureole (approx. 2 km), the spotted nature of some hornfels and the lack of obvious hydrothermal alteration suggest the area is underlain at moderate depth (approx. 500 m?) by the shallow dipping surface of a pluton. The veins themselves consist of tightly packed coarse euhedral-subhedral glassy-milky quartz grains with coarse oriented laths of wolframite and minor interstitial pyrite, arsenopyrite and chalcopyrite. Assayed high grade samples (Hermann, 1987, GFEL report EL17/86) are also anomalous in Sn, Bi, Au but not in Mo, Ag.

The Mount Horror arsenopyrite prospect is a prominent lode up to 2 m wide of silicified sheared and brecciated metasediment with patches, infill and veins of euhedral buck quartz with scattered euhedra of arsenopyrite and minor pyrite. Assayed chip samples (Hermann, 1987) have anomalous As, Sn, Ag, Au and variable W, Bi.

The geologic setting, vein style, plutonic buck character of the quartz and element assemblage are consistent with a magmatic-plutonic origin for the mineralisation and a genetic relationship to the Blue Tier Batholith. In similar systems elsewhere (eg. Chillagoe tin deposits) veins, shear zones and high temperature skarns are the only common mineralisation styles and gold is a minor component associated with bismuth sulphides and chalcopyrite. Consequently it is considered that the Mount Horror area has limited potential for bulk tonnage gold mineralisation.

BEACONSFIELD

A reconnaissance of reef intersections in holes B11, 10, 12B and 15 to interpret the mineralisation style and evaluate the possibility of replacement style ore elsewhere in the field.

The Beaconsfield deposit produced 26.15 tonnes of gold at an average grade of 24.7 g/t from quartz-carbonate veins hosted in Ordovician siltstone and limestone. The reef structure is a sinusoidal flexure partly bound by shears cross-cutting a thrust faulted sequence that includes ultramafic rocks as well as Cambrian and Ordovician sediments. There are no significant late intrusives in the sequence and quartz-ankerite-sericite-pyrite alteration appears limited to the reef structure. The reef structure includes crystalline ankerite-quartz that is at least in part a replacement of the host rocks. It is cut by quartz-ankerite sulphide veins and vein breccias that host essentially all the ore. The sulphide assemblage is dominated by pyrite and arsenopyrite with minor galena, chalcopyrite, low Fe sphalerite and tennantite. The gold is predominantly free and occurs as pale fine inclusions in pyrite or as orange coarse grains in fractured pyrite and quartz.

The distinctive feature of ore intersections studied is the nature of the quartz veins. The veins are irregularly distributed and quite variable in thickness, orientation and carbonate content. Only two varieties of quartz are evident - massive tightly packed fine to coarse euhedra characterised by 'explosion texture' and microcrystalline, almost chalcedonic, banded quartz. The 'explosion texture' consists of alternating zones that are white and fluid inclusion-rich or clear and inclusion poor disposed both concentrically and radially relative to crystal centres. This texture is only reported from epithermal systems where it is interpreted as a product of fluctuating boiling conditions. This quartz occurs in discrete veins which host much of the coarse free gold, as patches within replacement ankerite and as bands within the microcrystalline quartz.

The overall interpretation based on the quartz texture, sulphide assemblage, gold distribution, alteration and structural controls is that Beaconsfield formed at shallow crustal levels from a boiling hydrothermal fluid. Given the lack of evidence for intrusive activity and the overall structural environment it seems possible Beaconsfield represents a very shallow expression of a dominantly metamorphic system possibly similar to the modern warm springs on the Alpine Fault of New Zealand (Dave Craw, paper in Proceedings of Pacrim Conference, 1987). One suggestion based on the New Zealand experience is that the mineralisation could be any age Taberraberan or younger - possibly even related to fluid escape up the Tamar Fracture Zone. A survey of fluid inclusions, dating of alteration sericite and a review of the New Zealand metamorphic-epithermal story may help confirm this somewhat unusual interpretation of Beaconsfield and open up new possibilities for exploration in this area. For example, a Tamar Fracture Zone age would open up possibilities of vein, stockwork, breccia replacement and even hotspring style mineralisation in the Permo-Triassic sedimentary rocks.

MATHINNA

An evaluation of the concept that the 'zone of close folding' is a regional scale 'break' with a bulk tonnage potential where stockworked quartzite and high grade shale hosted veins occur together. Based on a reconnaissance of the Jubilee and New Eldorado workings.

The Mathinna Goldfield produced 270,895 oz of gold at an average grade of 0.856 oz/t from quartz veins hosted in siltstone and sandstone of the Mathinna Beds. The host rocks are folded with axial planes striking NW, and a strong cleavage striking NW and dipping SW. The mineralisation is localised around and partly in 400 m wide 'zone of close folding' characterised by numerous tight folds and strong, crudely axial planar shears. The field is characterised by small discontinuous reefs with an overall random orientation but local preferred orientation crudely parallel to shearing (eg. Jubilee), in late NE trending faults (eg. Golden Gate) and in other cross faults (eg. City of Hobart). The impression gained from the Jubilee and New Eldorado is that the latest and most brittle stage of deformation was the mineralising event, that intersections of such structures often localised shoots and that such mineralisation could overprint sheared siltstone, silicified and brecciated sandstone and early saddle reef type quartz veins. The apparent randomness of the mineralised structures and the generally small size of the shoots (approx. 100-1000 tons) made underground exploration extremely difficult.

The quartz veins themselves consist of white to glassy crystalline buck quartz cut by veins of very fine delicate fibre quartz, networks of millimetre scale spider veinlets and sulphide-bearing fractures. The impression from the literature is that most of the gold was free but associated with the sulphides which made up 1-1.5% of the quartz sent for crushing. Arsenopyrite and pyrite were the principal sulphides but chalcopyrite, galena and sphalerite were also present and considered the best indicators of grade. Gold fineness estimated from assays presented by Finucane 1935 (TGS Bull. 43) is probably 820-920 which is typical of the Mother Lode-Charters Towers type orogenic deposits in the classification of Morrison & Rose 1987 (AMIRA NQ Gold Project Final Report).

The overall characteristics of the field are consistent with the orogenic model recently developed for the Charters Towers, Mother Lode and some Archean deposits. The concept is one of deep crustal metamorphic and mantle derived fluids channelling up crustal scale sutures and precipitating largely in the brittle and brittle-ductile regimes in response to wall rock interaction, overall declining temperature and the development of structural traps. Granitoid plutons may be broadly contemporaneous with mineralisation in this setting and may provide heat that concentrates and focuses fluid flow, but they are neither essential to mineralisation nor the major source of ore components. In a situation like Mathinna where the only host rocks are clastic sediments structural rather than chemical controls are of prime importance.

Historically this class of deposit is characterised by single quartz veins with high grade shoots rather than bulk minable styles of mineralisation. However, the recently developed Carson Hill and Jamestown open pit mines in the Mother Lode district are attempting to bulk mine groups of widely spaced high grade quartz veins localised in a major structure containing sheared rocks with low grade gold (see attached papers). Such a model may be applicable in the zone of close folding at Mathinna and elsewhere along the Manganna-Forester belt. Attractive sites are zones of intersection between the major structure and cross-structures (eg. intersection of NW and NE structures south of Golden Gate) particularly where a combination of shale hosted high grade veins and sandstone hosted stockwork veins may be present.

LEFROY

Attempted classification of mineralisation type based on a brief reconnaissance of dump material and a literature review.

The Lefroy Goldfield produced 172,075 oz Au at an overall grade of 1 oz/ton from a series of quartz reefs hosted in sandstones and siltstones of the Mathinna Beds. The sediments strike 330° and dip 30-45°W and have generally open folds with axial planes parallel to strike. The reefs are within a north-northwest trending corridor of soft ground and occupy a series of parallel fractures striking east and dipping south. Ore shoots have a predominantly shallow westerly plunge. The reef geometry is consistent with formation in tension gashes formed by axial planar shear. Massive vitreous white buck quartz occurs in the fractures and shear zones but is barren. Mineralised quartz is localised in the fractures particularly footwall or hangingwall adjacent to and cutting buck quartz. The mineralised quartz is vuggy holocrystalline fine to medium comb with fine fractures and infill of stibnite and pyrite rarely with chalcopyrite and arsenopyrite.

Although detailed information is sparse the structural controls, quartz types, element association, apparent scarcity of basemetal sulphides and silver, and high but variable gold fineness are consistent with the orogenic class of deposits typified by the Mother Lode, California; Bralorne, British Columbia; and Charters Towers, Queensland deposits. The low sulphide, low basemetal Sb-As-Cu association is typical of some sediment-hosted orogenic vein deposits in the Hodgkinson Field, Queensland and Otago Schist, New Zealand. A derivation from predominantly metamorphic fluids at intermediate crustal levels seems likely for these deposits. Such deposits are generally best known as sources of major alluvial fields and few have developed bulk tonnage deposits.

HENTY

An attempt at classification of deposit style and origin based on brief discussions concerning regional and deposit geology, a reconnaissance of the fault zone in hole HP4 and a reconnaissance of the ore zone in several drill holes.

The Henty Fault Zone is likely a crustal scale structure with significant strike-slip displacement. The lithologies included in the Henty River Sequence (ultramafics-gabbro-mafic volcanics-greywacke-siltstone), their attenuation along the Fault Zone and the possibility of a partial correlation with the Farrell Slate suggest the Henty Fault Zone could originally have been a major suture with oceanic crust separating two continental blocks capped with volcanics. The likely deformation history in such a sequence would be:

* Early isoclinal folding and thrusting possibly partly overlapping with sedimentation and volcanism.
* Strike-slip faulting following closure of the suture, deep erosion and formation of fault-controlled conglomerates.
* Tensional faulting following relaxation of stress.

In this model the strike-slip faults might be expected to cut at least the lower part of the Owen Conglomerate sequence and hence may be comparable to the Great Lyell Fault.

The fault rocks in hole HP4 have crush, shear and weak mylonitic fabrics suggesting multiple reactivation in the brittle-ductile transition and brittle deformation regimes. In the majority of shear related ore deposits this is the mineralised zone. For example at Hemlo, mylonites of the ductile zone are not mineralised whereas the brittle-ductile transition is. At Henty the weak mylonitic fabric is overprinted by the shear and crush zone fabrics. In the ore zones pyrite-silica and vein mineralisation is overprinted by barren yellow sericite-green (Cr?) mica alteration with shear fabric. This suggests the mineralisation timing is between the mylonite and shear events.

The massive pyrite of the ore zone has two textural varieties. The more common variety is massive to weakly banded fine crystalline pyrite with a vague rectilinear pattern of prismatic clots of quartz-carbonate (eg. T8945). The other variety is well laminated or banded with alternating fine pyrite layers and clastic silica-sericite layers (eg. T8948). Observations on samples of semi-massive pyrite and weakly pyritic rocks suggest the more massive blocky pyrite is a replacement of partly silicified carbonate rocks (eg. T8946) and the banded pyrite is a replacement of the volcaniclastic rocks. The extension of this idea is that the thick carbonate unit in HP13 is in fact the precursor of both the massive blocky silica-carbonate rock ('chert') and the massive blocky pyrite in the ore zone. It is thus possible that the ore is related to deformation and replacement rather than to pre-existing volcanogenic mineralisation.

Gold is reported from a variety of settings within the ore zone. The main styles noted in the core and accompanying mineragraphic reports were:

* 5-10 μm particulate gold associated with chalcopyrite and to a lesser degree galena, sphalerite, tetrahedrite and bismuth/bismuthinite and interstitial to massive granular pyrite (eg. T8819).

  3-5 μm gold associated with chalcopyrite in carbonate-quartz-chalcopyrite- pyrite-sphalerite-tetrahedrite veins cutting network pyrite veinlets in partly silicified dolomite (T8946)

* 2-7 μm free gold grains imbedded in quartz-sericite shears cutting silicified dolomite? (T5880). The same rock also contains stringy shears with chalcopyrite-pyrite-galena (T5879) and gash veins and breccias with purple fluorite or calcite-fluorite-sphalerite (T5880) but these do not appear to contain gold.

While this review may not be complete there is a suggestion of the following sequence of events in the Henty Fault Zone.

1. A brittle-ductile shear zone juxtaposing volcaniclastic rocks with a lens of shale-carbonate-jasper.

2. Variable silicification of the carbonate accompanying shearing of all rock types.

3. Shattering of silicified rocks and shearing of unsilicified rocks leading to gash vein infill and replacement by quartz-carbonate-pyrite-chalcopyrite - galena-sphalerite-tetrahedrite-bismuth-bismuthinite-gold. Late fluorite-carbonate-sulphide veinlets and chalcopyrite-pyrite-galena shears.

4. Shear overprint with yellow sericite-green Cr mica $\pm$ carbonate, pyrite.

This sequence of events, the styles of mineralisation and the element associations require neither precursor volcanogenic-exhalative mineralisation nor late intrusive input to account for gold mineralisation. An analogy to Archean 'break' type mineralisation (eg. Thompson-Bousquet, Hemlo) is probably more valid conceptually and is supported by the restriction of mineralisation to strongly deformed rocks, the regional significance of the Henty Fault Zone, and the presence of Cr mica-sericite alteration. The paucity of crystalline quartz does not allow a classification of the deposit by the quartz method but microprobe analysis of gold composition and a reconnaissance of fluid inclusions may be of interest. For example, the combination of high gold fineness (+900) and low salinity CO_2-bearing fluid inclusions would favour a metamorphic-break model, moderate gold fineness (400-800) and moderate salinity low CO_2 fluid inclusions would favour a volcanogenic model (cf. Morrison & Rose, 1987 AMIRA NQ Gold Final Report.)

OTHER OCCURRENCES NOT VISITED

The Cygnet occurrences on the south coast are interesting for their association with Cretaceous alkaline (shoshonitic?) intrusions and for reports of dykes and sills, tuffaceous breccia (diatreme? at the Mt Mary Mine) and chalcedonic or opaline silica (Martins Show). The suggestion is of a very shallow porphyry-epithermal environment that might have bonanza or bulk tonnage potential. It is also of interest that other occurrences associated with post tectonic alkaline subvolcanic intrusions (eg. Coronation Hill, NT and Allard Stock, Colorado) have notable platinoids associated with gold.

There is an interesting note in Reid's Bulletin on the Golconda District (TSG Bull 37, 1926, p.53) concerning the Whiting Prospect in the St. Patricks River area. Reid describes altered porphyry dykes hosting pyrite-arsenopyrite mineralisation and brecciated quartz bodies cutting porphyry dykes with muscovite, pyrite, chalcopyrite, arsenopyrite and rich ruby silver ore. There is a strong suggestion again of a shallow porphyry-epithermal mineralisation environment that may have bulk tonnage potential.

OVERVIEW OF NORTHERN TASMANIA GOLD MINERALISATION

The review of the known styles of gold mineralisation in northern Tasmania has allowed definition of some specific exploration targets but there are some general concepts that suggest other possible styles and areas of mineralisation.

1. On the metallogenic map of Tasmania there is a distinct lack of gold occurrences within all the Precambrian blocks and in the Paleozoic rocks adjacent to the Rocky Cape Block. In fact, with the exception of the reported occurrence near Corinna and the by-product gold in the Cambrian VMS deposits, there are no gold occurrences reported from rocks older than Ordovician. The simplest explanation is that the bulk of gold mineralisation is related to the Taberraberan Orogeny, that thinner crustal segments with more younger Paleozoic strata are most effected, and that some crustal segments (eg. West of the Rosebery Fault) are less amenable to gold mineralisation.

2. Many of the occurrences, particularly those with a metamorphic chacter are associated with crustal scale breaks or lineaments (eg. Henty Fault, Beaconsfield area, Manganna-Lyndhurst). Such structures are increasingly being recognised as the fundamental control on much Archean (eg. Kalgoorlie, Hemlo) and Phanerozoic (eg. Mother Lode) gold mineralisation. The distinctive features are: a broad zone with heterogeneous strain; evidence of multiple reactivation in ductile and brittle regimes; dominant brittle or brittle-ductile deformation regime during a major orogenic episode; juxtaposition of vastly different lithofacies or ages; zones of concentration of mafic and felsic intrusions; and local pervasive but often subtle alteration. The current interpretation is that such structures are zones of concentration of the deep crustal-mantle fluid which is responsible for mineralisation (Colvine et al., 1984, paper attached). Possible structures of this type in northern Tasmania include:

   * the Henty-Great Lyell-Linda Fault System and extensions

   * the Rosebery Fault System

   * the Arthur Lineament

   * the Tamar Fracture Zone and offshoots of thrusts at Beaconsfield and elsewhere adjacent to the Badger Head Block

   * the Manganna-Lyndhurst zone of close folding and possibly similar NW trending shear zones or sediment enclaves in granite as near Lefroy, Lisle-Golconda and approx. 15 km NE of the Anchor tin mine.

   Mineralisation in such structures can have the form of quartz veins, stockworks or sulphide bodies. There are numerous examples, particularly in the Archean literature describing regional to local scale exploration in this environment.

3. An interesting feature of northern Tasmania is the apparent association of porphyry and pluton level gold mineralisation with Sn-W-Mo granite systems. The concept of a distinction between gold and tin granites in northern Tasmania (Klominsky and Groves, 1970) may be partly applicable in that the tin occurrences are associated with granites and some gold occurrences (Golconda, Lisle) are associated with granodiorites. However, there are gold occurrences associated with tin granites (eg.

Mt Horror) gold production from tin deposits (Aberfoyle, Storeys Creek) and intimately associated Au and Sn-W-Mo occurrences (Moina). The critical factor here which is also evident in a review of world literature is that significant gold mineralisation only seems to be developed in subvolcanic porphyry systems and not in plutonic systems. Plutons may host gold mineralisation but they are rarely genetically related (Golding & Peters, 1987, Pacrim Paper on Charters Towers)

At Moina, high temperature skarns have tin mineralisation adjacent to fluorine-rich cupolas (Shepherd & Murphy's) and gold mineralisation adjacent to fluorine-poor cupolas (Stormont). Lower temperature greisen style mineralisation seems to have Pb-Zn-Ag, Cu-Bi-Au and Sn-W-Mo variants (Higgs-Narrawa). Clearly there are some areas with an overall polymetallic character and some that are Sn or Au dominant. This is explained in the newer granite literature by the suite concept in which different basement types melt to give different major and metallic element associations. Consequently gold granites are localised in specific basement terranes that may or may not have associated tin mineralisation.

Of additional interest in northern Tasmania intrusive-related gold systems is the observation that no stockwork, subvolcanic breccia diatreme or epithermal style occurrences have been identified. There seems to be no good reason why they should not be.

I. HIGGS ND1 DIAMOND DRILL HOLE GRAPHIC LOG AND NOTES

Methodology

Given good assay data for Pb Zn Cu Ag Bi Mo W Sn As Au identify element associations based on coincident anomalies then test if these correspond to visible features in core. See accompanying graph paper log.

Identified element associations (purely emperical)

1. Pb-Zn-Ag (Sn), Pb-Zn (Ag, Cu)
2. Cu-Bi-As
3. Cu-Bi-W
4. Au
5. Mo-W-Bi (Sn, As)
6. Sn-Mo (As)

Notable zoning for hole in order listed where 1 is shallow and 6 is deep. This is similar to many classic zoning models and to the overall pattern relative to granite of the Moina field. Actual relationship of gold however is a little unclear.

Styles of mineralisation and mineral assemblages

1. Pyrite fracture fillings and anastomosing veinlet network
2. Pyrite-galena-sphalerite-quartz (chalcopyrite) pods formed on bedding plane partings in peletic rocks and as tension gash type climbing veins in sandstones.
3. Quartz-phlogopite-pyrite-chalcopyrite (bismuthinite?, scheelite?, arsenopyrite?) tension gash climbing veinlets.
4. Fluorite (pale purple)-phlogopite-pyrite-chalcopyrite-quartz irregular branching veinlets.
5. Quartz-fluorite (purple)-molybdenite veinlets in quartzite and disseminations associated with phlogopite in gritty quartzite.
6. Quartz-wolframite-siderite-fluorite (dark purple-green)-pyrite 1-2 cm thick comb quartz veins
7. Pyrite ± molybdenite (arsenopyrite?) fracture fillings or veinlets

Style 1 is fairly common in the upper part of the hole and particularly near the broken zone (approx. 60 m) where the Cu-As (Bi) association is developed.

Style 2 is recognisable wherever the Pb-Zn-Ag association is present.

Styles 2, 3, 4, co-exist in the Au interval (92-103 m) where Pb-Zn and Cu-Bi-W associations are also present. Given that Style 2 has no Au elsewhere best guess is that Style 3 and 4 are gold-bearing.

Styles 5 & 6 co-exist in the Mo-W-Bi zone whereas Styles 6 & 7 co-exist in the Sn-Mo zone

Cross-cutting relationships are fairly poor but the interpreted time sequence is:

1 → 2 → 3 + 4 → 5 + 6 + 7

Relationship to Lithology

There is a suggestion of upward coarsening graded units of siltstone → fine sandstone → interbedded siltstone/sandstone locally tubicular → massive sandstone → gritty sandstone → conglomerate. There is no clear element association relationship to specific units but styles differ with host rock grain size in particular:

* basemetal pods occur only as partings in silty rocks
* massive sandstones have veins and fractures
* gritty sandstones have disseminations due to matrix replacement
* climbing veins are common in interbedded units and at massive-bedded host contacts.

Relationship to Alteration

Silty rocks are locally dark brown due to hornfels biotite and bleached yellow to buff with some amphibole or clinopyroxene along vein margins. Massive sandstones are naturally white-yellow due to low mica content. Down to 94 m there is variable bleaching of silty rocks and no particular relationship between the basemetal styles of mineralisation and alteration. Below 94 m there is complete bleaching and local development of phlogopite-fluorite suggesting pervasive greisen alteration in the Sn-W-Mo vein area.

Relationship to Structure

The only prominent fault zone in the hole is around 60 m. There is strong development of pyrite veinlets and fractures in this area and a Cu-Bi-As association but the exact timing relationships are unclear.

The Pb-Zn-Ag bedding plane pods correspond to gaps created by deformation in interbedded sandstone-siltstone. In many places (eg. 91-95 m) they occupy the short limbs of meso-scale 'Z' folds. The overall relationships of the pods suggest Reidel Shear where the shear plane and bedding strikes are at low angle and the differing competence of the beds causes gaping.

Apart from the minor crumple folds there appear to be no significant variations in bedding orientation in this hole.

Overall Feeling

Somewhat surprising suggestion from the phlogopite-fluorite association in the inferred gold stage that gold is rather more closely linked to the Sn-W-Mo greisen than to the basemetal assemblage. This in turn suggests that the porphyry dykes and related steep structures may be more important controls on gold distribution than the Reidel-type shears evident from surface mapping and basemetal distribution.

The consistency of the zoning pattern in this hole with the overall zoning of the Moina field (Sn-W → Mo-W-Bi → Bi-Cu-Au? → Pb-Zn-Ag) suggests a 'gold corridor' may be able to be defined as a target for broader exploration. The position of gold within the zoning pattern needs to be checked for the other Higgs and Narrawa holes before this model is applied.

II. NARRAWA REWARD HOLE DG1

Plotted using a geochemical base then looking for controls and relationships of gold mineralisation for comparison with Higgs ND1. See accompanying graph paper log.

Geochem plot identifies four mineralised zones with combinations of Pb-Zn-Ag, Sn-W-Mo and Au partly in a broad zone of weak greisen Mo-W mineralisation.

The upper two zones near 30 and 40 m have Pb-Zn-Ag and Sn anomalies related to fine quartz-sulphide climbing veins and quartz-feldspar greisen veins respectively. The lower zone is in part hosted in a strongly sheared and altered porphyry dyke.

The main mineralised zone at 94-104 m is hosted in fine sandstone and siltstone. Mineralisation styles include:

1. basemetal climbing veins in siltstone and sandstone
2. basemetal replacement of matrix in gritty sandstone
3. narrow quartz-mica-sulphide-gold? veins
4. wolframite-molybdenite-quartz greisen veins

These styles are comparable to those in the polymetallic zone in ND1.

The lower ore zone (140-150 m) is largely hosted by strongly foliated porphyry dykes and includes

* basemetal climbing veins
* basemetal-pyrite replacement of feldspar phenocrysts
* quartz-molybdenite-mica greisen veins

Overall the styles of mineralisation and broad zoning pattern are comparable to Higgs ND1 but there are multiple gold zones and porphyry host to mineralisation. Of particular interest is the fact that the deformed porphyry dykes host basemetal, gold and greisen type mineralisation. If the dykes are Devonian the implication is that all the mineralisation styles post date emplacement of the dykes and that deformation was ongoing during dyke emplacement. These close timing relationships give encouragement to the idea that mineralisation could be more extensively developed in carbonate replacement bodies elsewhere.

THE GEOLOGY AND DEVELOPMENT OF THE FAR FANNING GOLD DEPOSIT

by M. Elliott[1] and M. Houtgraaf[2]

1. Elliott Exploration Co. Pty. Ltd.

2. The Northern Queensland Co. Ltd.

Introduction

The Far Fanning gold deposit is situated 60 kilometres south-west of Townsville (Fig. 1). Previous recorded production is 3756 tonnes returning about 1600 ounces of gold. This has been taken from surface and shallow underground workings scattered over the strike length of the deposit of 1700 metres. The main production period was from 1895 to 1908.

Previous exploration involving extensive trenching and sampling has been carried out intermittently since the 1930's, by Gold Mines of Australia (1932), Placer (1974), Anaconda (1975), Marathon (1980-81), Aberfoyle (1981-82), and The Northern Queensland Company (NQC) (1983-present).

In 1980 Marathon undertook an extensive drilling programme to test the oxidised mineralisation. Over 200 percussion holes and 7 diamond holes were drilled along traverse lines spaced 29 to 103 metres apart covering a strike length of around 1800 metres.

Marathon estimated a resource of 1 million tonnes averaging 1 gram per tonne Au, using a 0.5 gram per tonne cut-off.

NQC Evaluation

NQC reviewed all the available data and calculated geological reserves of oxidised ore based on a 0.5 gram per tonne Au cut-off at just over 500,000 tonnes averaging 2.3 gram per tonne Au. The base of oxidation is between 16 to 24 metres below the surface.

1600 oz/mth prod -

Further diamond drilling, trenching, sampling, mapping geophysics, and bulk sampling (for metallurgical test work) were carried out by NQC in 1985. By mid 1985, NQC management were satisfied that a potentially economic gold deposit had been outlined and commenced a more detailed evaluation programme.

This programme mainly involved closely spaced shallow airtrack drilling and trenching to prove up ore over the entire deposit for the first two 3 metre benches and to assist in the design of the open pits. This work started in November 1985 and was completed in February 1986. During this time over 2900 metres of trenching, 1200 drill holes, and 4000 assays had been completed.

Geology and Mineralisation

The Far Fanning gold deposit is hosted by an alternating sequence of feldspathic sandstone, arkose, minor quartzite, with grey-green and purple siltstone of upper Devonian age belonging to the Dotswood Formation (Fig. 2). It was deposited in the Burdekin Basin, in a fluctuating continental shallow marine environment. Sedimentation in the Burdekin Basin unconformably overlies an older granitoid basement (Ravenswood Granodiorite Complex).

The deposit occurs near the intersection of an axial trace of a broad regional open anticline and an east-west trending lineament which links two Permo-Carboniferous aged plutons set 26 kilometres apart.

Mineralisation at Far Fanning is controlled by tensional fractures and breccias generated by drag folding. Folding has resulted from movements along the regional lineament. This has produced a structurally disrupted zone up to a few hundred metres wide. At Far Fanning the disrupted sequence trends west to north-west and is characterised by open fold structures at the eastern end of the deposit (zones 7 and 8) and monoclines throughout the rest of the deposit (Fig. 3).

The deposit is delineated over a strike length of 1700 metres and is arbitrarily divided into 8 zones (Fig. 4). The deposit consists of a number of ore lenses. These ore lenses parallel and cross cut bedding and vary in width from 2 metres to over 20 metres. They can be traced along strike for distances of 10 to 200 metres. The overall dip of the ore lenses is roughly normal to the direction of maximum steepening of the fold. Therefore although the beds in the fold flexure mainly dip to the south (60 to 80 degrees), the ore lenses dip to the north (35 to 50 degrees).

In detail ore lenses consist of:

* discontinuous mineralised fracture sets
* metric size clast supported breccia pods (Fig. 5).

An increase in the density of fracturing is evident approaching the ore lenses. Sericite alteration and silicification are most evident in the highly fractured lenses, elsewhere alteration is weak to absent.

The highest grade and thickest individual mineralised veins and breccias within the ore lenses tend to be parallel to bedding. This is explained by bedding planes opening more than any other plane of weakness during folding to form a favourable and preferred site for ore deposition.

Mineralisation consists of gold set in vuggy, translucent to milky coloured quartz and iron rich veins and breccias in the oxidised zone. Gold is associated with pyrite and minor arsenopyrite, galena, and chalcopyrite in the sulphide zone. Gold is not readily visible and is commonly smaller than 200 microns which will assist the dissolution of the gold by cyanidation and assist in high recoveries (70 to 80%). A genetic model is shown in Figure 6. The fracture controlled vein style of mineralisation supported by the open space textures in the veins, and the limited extent of alteration, suggests the gold was deposited at high levels in the earth's crust by a fluid-poor mineralising system. The temperature of the mineralising fluid is unknown, but the style suggests an epithermal origin. The mineralising event probably occurred during the waning stage of the emplacement of the Permo-Carboniferous pluton in the region.

Selective Mining Method

The selective open pit mining method used at Far Fanning is similar to that used in many other recently commissioned gold mines in Western Australia.

For mine planning purposes, the ore lenses are described as having intermediate to weak ore outlines. This style of mineralisation contains significant low grade and waste material between high grade veins and breccia pods (Fig. 7). This necessitates using small bench heights (three metres) and close spaced sampling to control grade. Internal dilution and edge dilution is a major problem for grade control. Internal dilution is included in reserve calculations and an overall mining dilution of 10% is used to allow for edge dilution.

Grade control in the pit is based on assay data and geology. Ore is mined by excavator under the supervision of the grade control geologist. Ore from the pit grading better than two grams per tonne gold is nominated high grade ore and directed to the crusher. Material in the one to two grams per tonne gold range is directed to a low grade stockpile. While in the process of mining, material of uncertain ore to waste category may be mined. In this case the grade control geologist will direct the material to a seperate stockpile for further sampling to determine its status.

The ore is non-rippable and hence has to be drilled and blasted. Waste is also drilled and blasted but its suitability for ripping is currently under investigation. A drill pattern of 2 metres by 3 metres with holes drilled at minus 70 degrees to a depth of 3 metres is used. Holes from every second drill line are sampled over the length of the hole for grade control purposes. The effectiveness of the grade control method is still under review while pit grades are reconciled with later processed samples taken from the crusher and the agglomerator.

Samples are prepared on site and the pulps sent to NQC's laboratory in Townsville. Samples undergo aqua regia digest, solvent extraction, and are determined for gold by AAS. A two day turn around is possible for urgent samples.

Eight open pits were designed to remove ore to the base of oxidation, which varies from 16 metres to 24 metres below the surface. All mine plans are prepared at 1:250 scale. The mine layout is shown in Figure 8.

Mine Construction

Construction of the treatment plant commenced in January 1986 and was completed in June 1986. The plant is designed to treat 300,000 tonnes of ore per annum. The ore is crushed to minus 12 millimetres and treated by NQC's cyanide agglomeration heap leaching technique. The first batch of gold from the plant was sent to NQC's refinery at Ravenswood on the 12th of June.

The mine employs approximately 45 people of which 30 are contractors who carry out mining, crushing, and leach pad loading and unloading. NQC manages grade control and the leaching operation. Mining operates on two ten-hour shifts, five days per week. Mining ore is restricted to the day shift.

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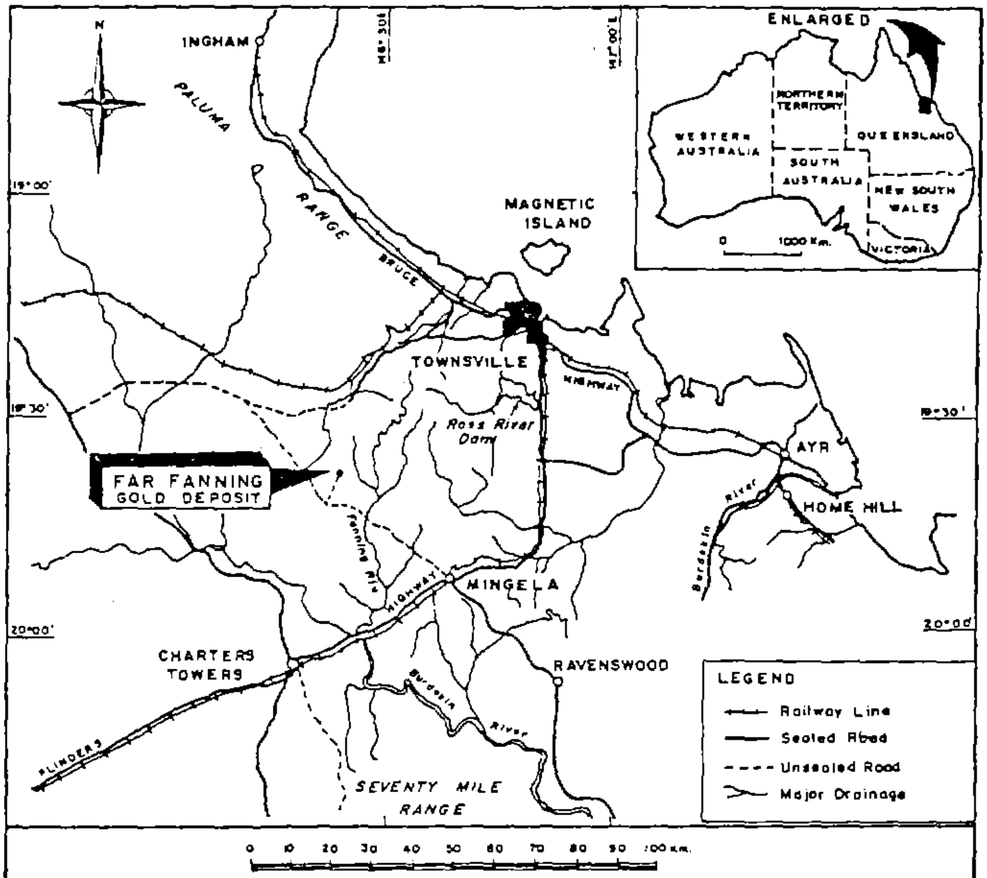

LOCATION MAP

FIG. 1

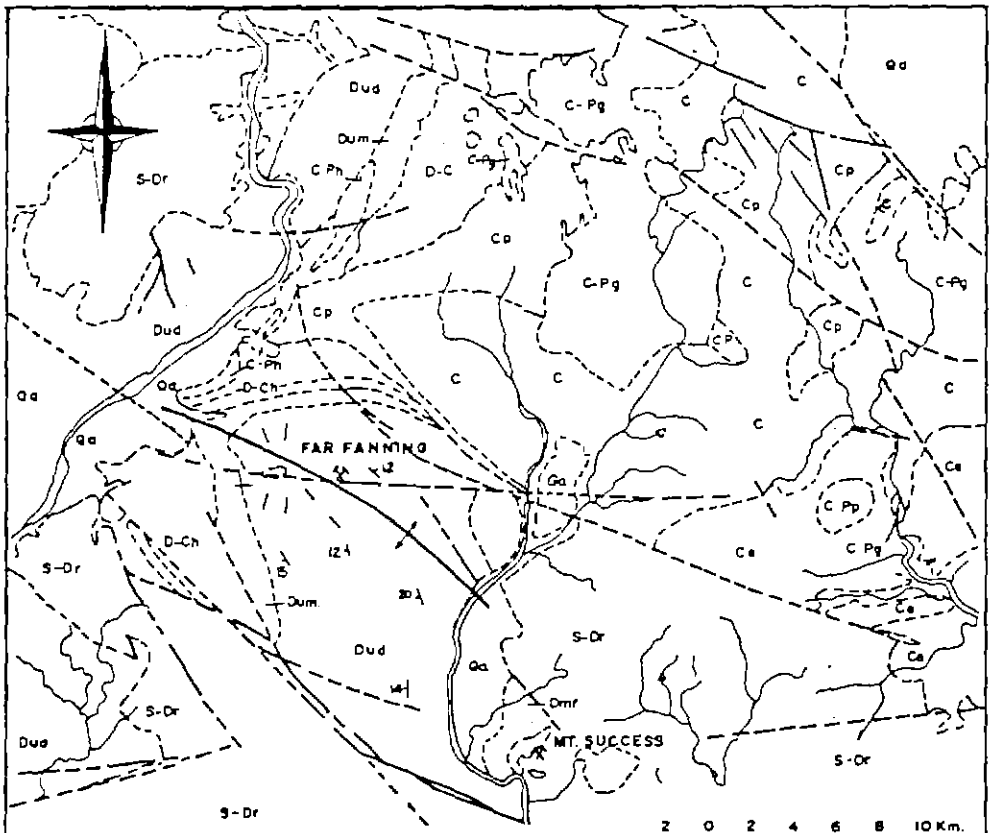

FIG. 2 REGIONAL GEOLOGY

LEGEND-

PERMIAN/CARB.	C-Ph	Pall Mall Adamellite
U. CARB.	C	Volcanics & Sediments
U. DEV. TO L. CARB.	D-C	Sst, shale, limestone & conglo.
U. DEV.	Dum	Sst. silst. shale
	Dud	Sst, conglo, shale, tuff
MIDDLE DEV.	Dmf	Limestone shale
SIL. / L. DEV.	S-Dr	Granod. to diorite

5 cm

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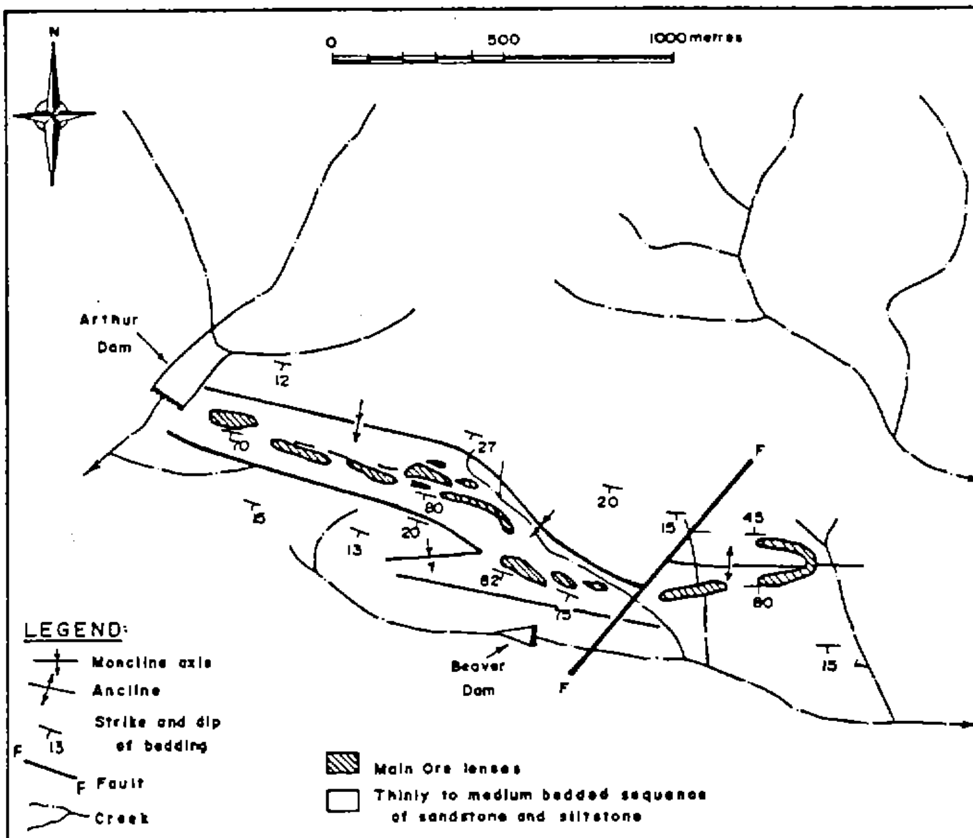

GEOLOGICAL INTERPRETATION
OF THE MINE AREA

FIG. 3

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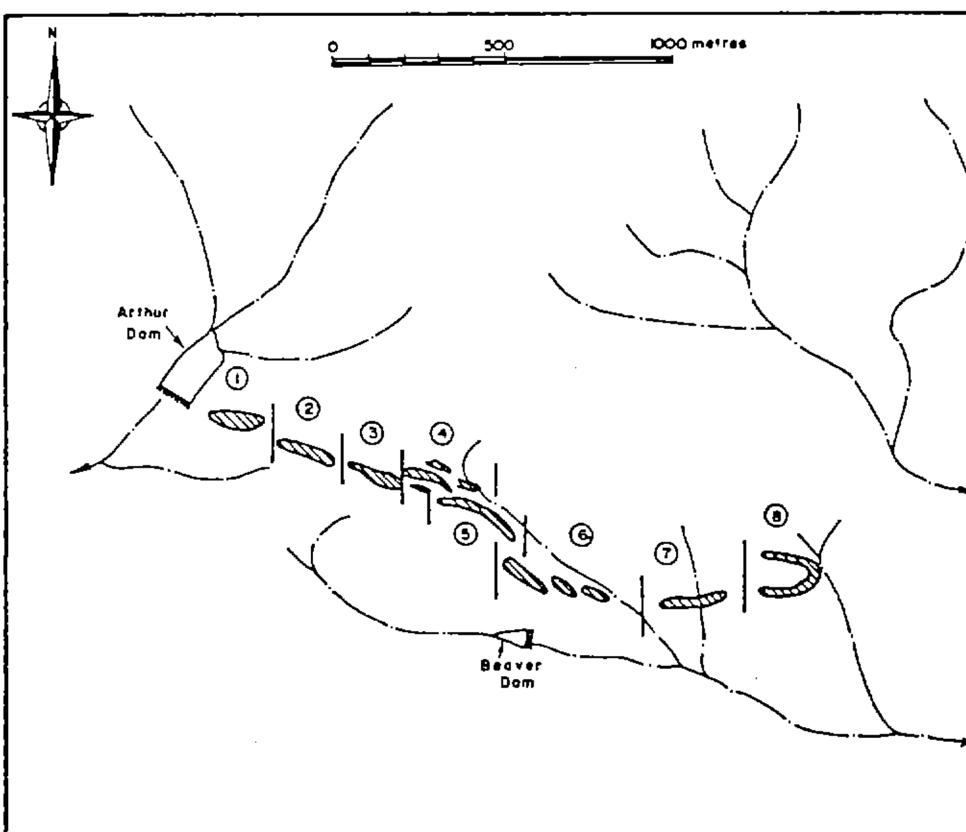
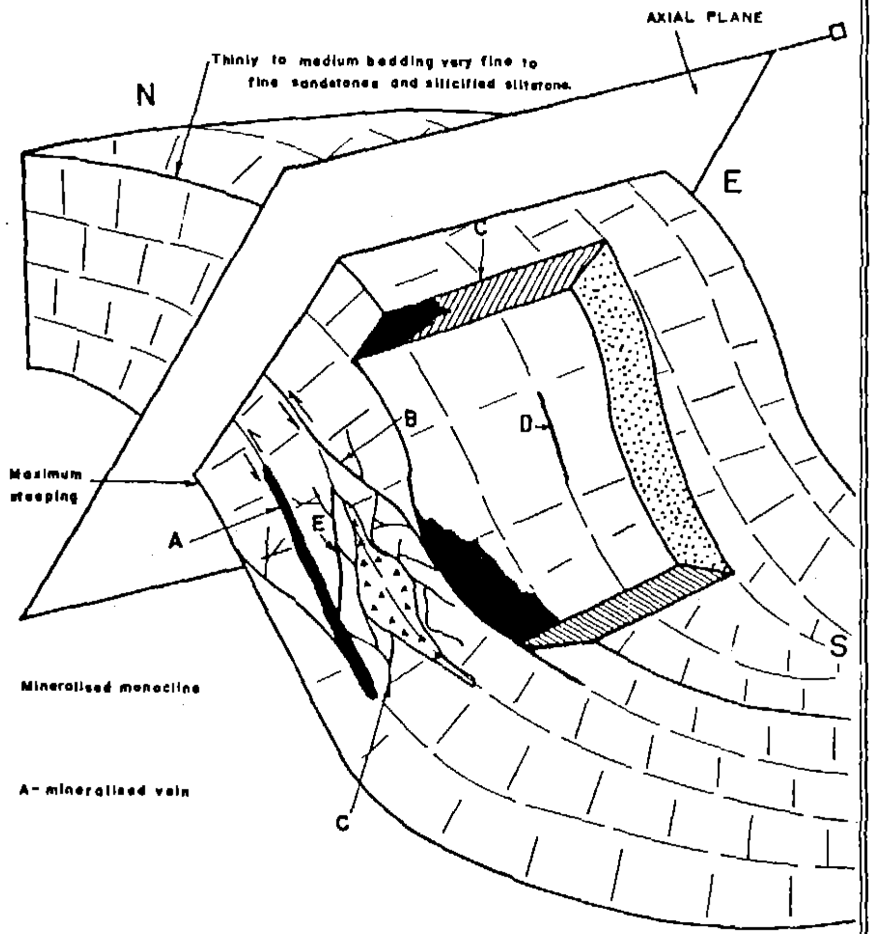


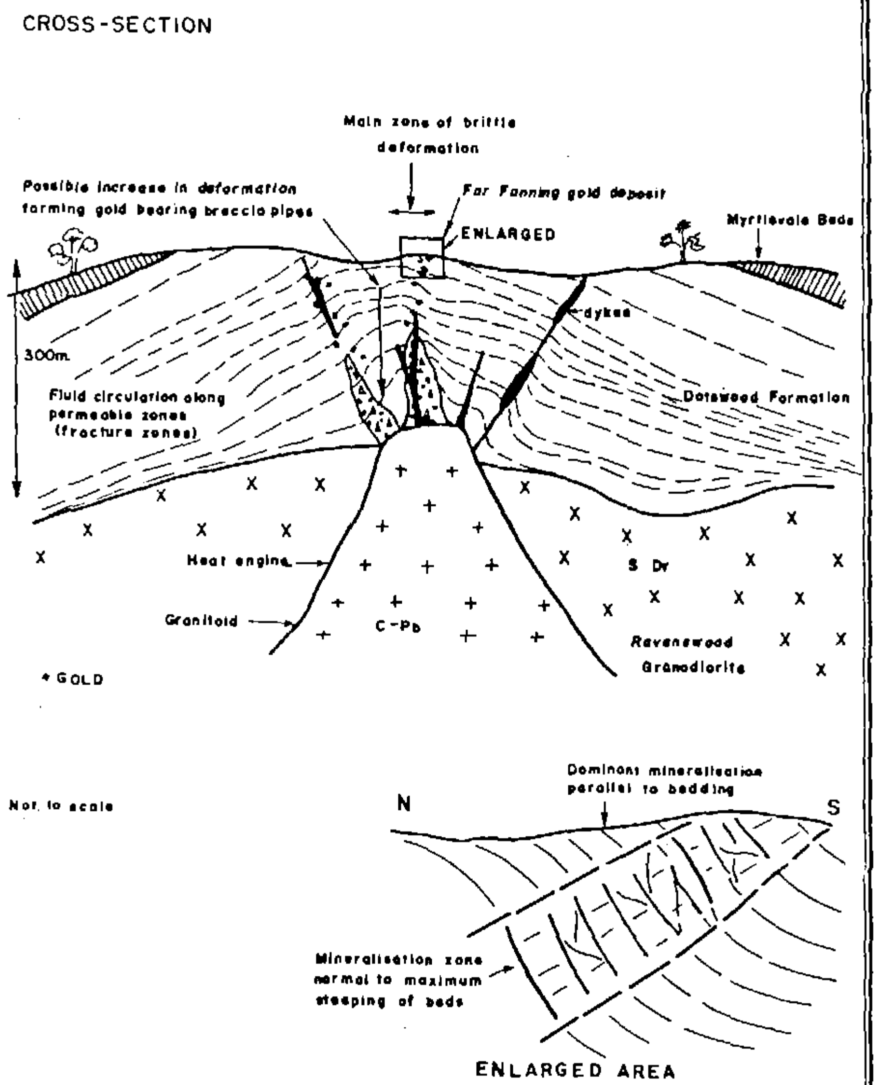
LEGEND:
2 Number and extent of zone.
Ore lens

FIG. 4 PLAN OF ORE LENSES



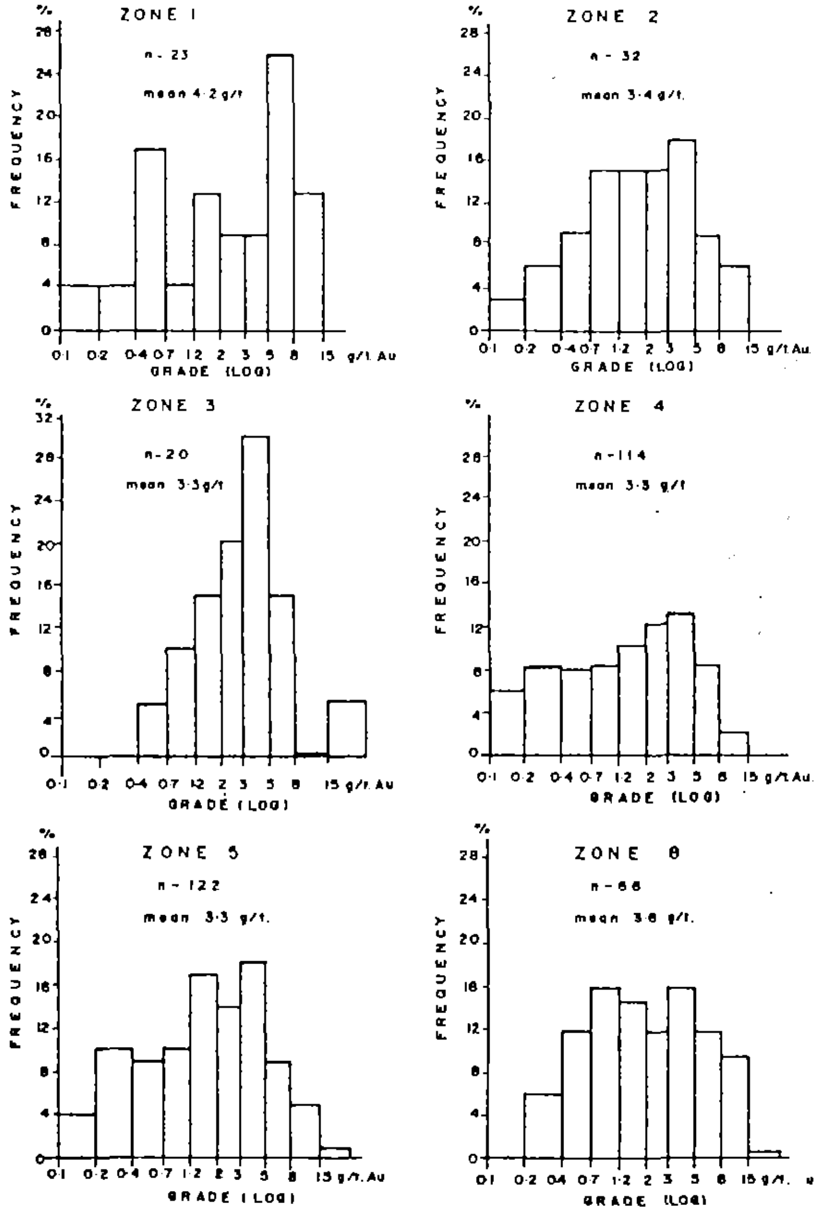
SCHEMATIC SKETCH OF MINERALISED FRACTURE AND VEIN SETS.

FIG. 5



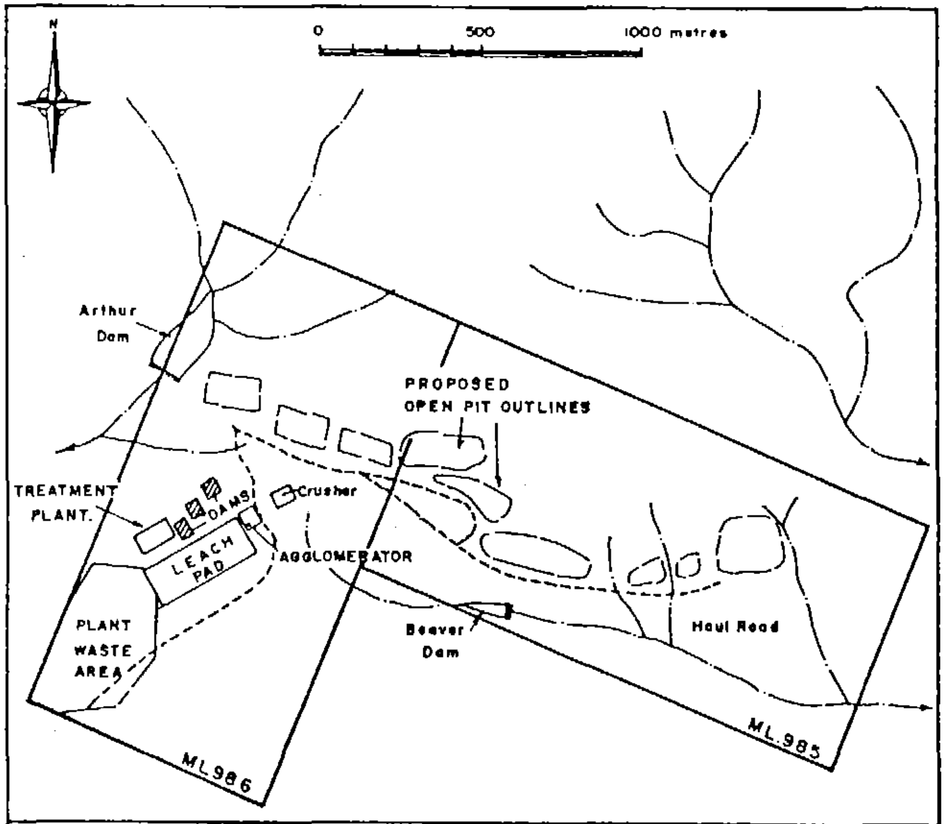
MINERALISATION MODEL FOR FAR FANNING GOLD DEPOSIT.

FIG. 6



HISTOGRAMS OF ASSAYS
OF ORE LENSES IN SELECTED OPEN PITS.

FIG.7



MINE LAYOUT

FIG. 8

5 cm

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GEOLOGY OF THE JAMESTOWN MINE AREA
MOTHER LODE GOLD BELT
TUOLUMNE COUNTY, CALIFORNIA

By

P. H. Dohms, R. D. Hoagland
Condor Minerals Management, and
G. M. Algood
Sonora Mining Corp.

INTRODUCTION

This paper has been prepared as an introductory document for participants in the Society of Economic Geologists field trip to the California Mother Lode, March 1 - 5, 1984. As such, it is meant to present an overview of the deposits at Jamestown and to offer up some ideas for discussion. It is not meant to be a definitive treatise on the origin of the Mother Lode ores, which is a discussion we anticipate will continue for some years to come.

The visit to the Jamestown Mine will involve stops at two of the four principal deposits, the Harvard and the Dutch-App orebodies. Since exposures are somewhat restricted at the Harvard, rather less time is planned there than at the Dutch-App. Figure 1 shows the relative positions of these two deposits with respect to the Crystalline and Jumper properties of the Project, which will not be seen.

We would like to express our appreciation to the management of the Sonora Mining Corp. for giving us the opportunity to bring the Society to these deposits. It is through exposure to orebodies in the field that the Society gives its greatest service to its membership.

PROJECT HISTORY

The Project began in 1977 with literature research by staff of the Western Exploration office of the New Jersey Zinc Exploration Company in Tucson, Arizona. Field reconnaissance began in January, 1978 and the properties in the Jamestown district were first visited in July of that year. Geologic investigations and initial property acquisition consumed the following year. Drilling began on August 1, 1979 and continued until early November, 1981. During that time, some 116,349 feet of cuttings and core were drilled in 1137 holes.

Project engineering and feasibility studies continued through 1982. Environmental baseline studies continued concurrently and eventually lead to the preparation of an Environmental Impact Report.

In June of 1982, Gulf + Western, the parent company of New Jersey Zinc Exploration, embarked upon a course that eventually lead to the divestiture of all Natural Resource operations, including the Jamestown Project. Agreement in principal was reached with the ABM Group, the parent company of Sonora Mining Corp., in late May, 1983 and the project formally changed hands in mid-September of that same year. Since that time, engineering work and environmental and permitting reviews have proceeded at an accelerated pace.

GEOLOGY

The regional geologic picture has been well covered by Schweickert & Bogen (1983), by Albers (1981) and by Dodge, et al (1983) and will not be repeated here. Suffice to say that the Jamestown district lies along the historic Mother Lode, a major crustal suture over 200 miles in length. This feature is coincident, more or less, with the Melones Fault Zone. In the vicinity of the mines, the Lode separates essentially Paleozoic argillites of the Calaveras complex on the east from a Mesozoic island arc/ ocean floor crust complex on the west.

The deposits themselves present an east-dipping strataform appearance. The typical hanging wall rock is black Calaveras phyllite with a strong slaty cleavage. Locally, the phyllites are strongly graphitic. Moving down-section through the zone of mineralization and alteration, a footwall of metavolcanics and/or serpentinitic rock is eventually encountered. Regional strike in the Harvard - Dutch-App area is about N 30 W and dips average about 55 degrees east at depth. Dips at or near the surface within the weathering zone are somewhat steeper. Although they are intimately associated, mineralization and alteration features differ from property to property and will, therefore, be discussed separately for each mine.

HARVARD MINE

Two zones of mineralization are present at the Harvard Mine. The Footwall zone lies below and in contact with the prominent "Bull quartz vein". This zone was the higher grade of the two and has, therefore, been essentially mined out. It is associated with chloritic and ankeritic metavolcanics and generally contains moderate quantities of quartz-carbonate veining. Specimens from this zone can easily be collected on the dump of the #1 Shaft at the Harvard.

A second, lower grade, zone lies on the hanging wall of the "Bull quartz". It is from this zone that the majority of the recently discovered ore at the Harvard has been developed. Here the mineralization is closely associated with a fine grained to dense siliceous pyritic carbonate rock which was given the field name of "ankerite" (Knopf's "Grey Ore"). This rock also is commonly laced with late white veinlets of coarse, euhedral quartz and carbonate. Specimens of this material are rarely found on the #1 Shaft dump.

Gold has been observed both megascopically and microscopically to occur in its native form. In virtually every case, when gold is observed megascopically at the Harvard, it is associated with one of the late white quartz-carbonate veinlets mentioned above. In its finer state (<300 microns), gold has been observed both in finely divided free particles in a variety of rock types and, to a greater extent, in intimate association with pyrite.

Pyrite is the only megascopic sulfide identified to date at the Harvard. Minor amounts of sphalerite and chalcopyrite have been identified during microscopic examination. The gold-bearing pyrite is commonly euhedral and fairly fine grained. Ore zone sulfide contents vary up to 10% but average nearer to 2%. Interestingly, pyrite appears lacking in the late quartz-carbonate veinlets.

No correlation has been recognized between pyrite content and gold content. Similarly, attempts to definitively correlate gold content with any particular feature have failed and the old saw, "gold is where you find it", turns out to have a great deal of truth.

DUTCH-APP MINE

In order to save space, this section of the paper will dwell on the differences between the Harvard and Dutch-App deposits and only touch lightly on the similarities. As can be seen from the illustrations, the most evident difference is in the composition of the principal alteration zone. At the Dutch-App, rock alteration is marked by enormous zones of a peculiar rock termed "Quartz-Ankerite-Mariposite", or QAM. Good examples of this material can be collected from the dump at the App shaft and in the rock faces immediatly south of that shaft.

The first stop here will be at the old Dutch Shaft. While some interesting rocks and artifacts can be found here and many picturesque photos can be taken, this stop is of more historic interest than geologic. Most of the time available will be spent in the vicinity of the App shaft where three distinct ore zones are well exposed in outcrop.

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G75

At Quartz Mountain a highly graphitic phyllite of the Calaveras complex lies to the east of the deposits. As the uppermost of the three separate mineralized zones (the Heslep Zone) is approached this phyllite becomes siliceous while still retaining its graphitic nature. Within the Heslep zone itself, "ankerite" similar to that found in the hanging wall ore zone at the Harvard Mine appears common. As can be seen by the substantial surface workings, this zone received considerable attention from the early day miners. The western boundary of the Heslep ore zone is marked by the contact with the great Quartz-Ankerite-Mariposite alteration zone of Quartz Mountain.

Quartz Mountain itself owes it existence to the presence of this wide Quartz-Ankerite-Mariposite body. This body has been mapped to be in excess of 1000 feet wide, while massive quartz veins within it have been found in widths of up to 80 feet. Although most of this volume comprises very low grade mineralization, within it is found the Middle ore zone.

The typical appearance of Quartz-Ankerite-Mariposite is of a medium to coarsely crystalline light green rock laced with white veinlets of late quartz-carbonate. The color is derived from Mariposite, a chromium mica. The other major constituients of this rock are a medium to coarse crystalline white to light grey carbonate, again termed "ankerite". This "ankerite" is distinguished from the ankerite at the Harvard by its color and grain size. Pyrite is nearly ubiquitous, though at a somewhat lower concentration than at the Harvard.

The westernmost or App ore zone is localized within and adjacent to a sliver of graphitic phyllite lying immediately on the footwall of the prominent App quartz vein. Immediatly south of the App shaft, the ore expands into a Quartz-Ankerite-Mariposite zone exposed on the footwall of the App vein. The footwall of the App ore zone is the serpentinite exposed at the App Millsite located to the west of the shaft.

At the Dutch Shaft (approximately 1200 feet North of the App Shaft) the App ore zone apparently pinches out. Here one large ore zone, a continuation of the Heslep and Middle ore zones, occurs within a Quartz-Ankerite-Mariposite body.

The graphitic ore comprises a significant percentage of the reserves at the Dutch-App. This is in marked contrast to the Harvard where graphitic ore is very limited. At the Dutch-App, lesser ore grade mineralization has also been found associated with zones of sericite schist, chlorite schist and, rarely, talc schist. As at the Harvard, precise correlations of gold content with observed geologic features is difficult except on the broadest scale. Indeed, the exposures of Quartz-Ankerite-

Mariposite near the App shaft are by no means uniformly mineralized and some of the most striking outcrops are quite deficient in gold content.

ORIGIN OF THE ORES

Any genetic model of the Mother Lode type of gold deposit is going to have to be able to satisfy a number of compelling questions. This section is intended to raise some of these questions, based on our observations and those of others.

Ore grade gold mineralization has been found in rocks considered to be alteration products of both hanging wall assemblage argillic rocks and footwall assemblage serpentines. Knopf (1929) noted that the alteration zones gradually cross the stratigraphic section downdip. Unfortunatly, the areas he studied are not accessible and the scale of this feature (several thousand feet) precludes easy testing by surface drilling.

The geometry of the deposits is also interesting. Ore shoots mined in the past show similarities throughout the Lode in that the longest dimension is steeply down dip. Mineralogies and grades of ores mined from depths past 6000 feet are virtually identical with exposures at surface where several thousand feet of erosion since the Miocene has been documented.

Ore grade mineralization occurs within envelopes of large zones showing late white quartz-carbonate veining thought to represent crackle and rubble brecciation. While visible gold is known to be associated with these veinlets, pyrite is absent from them in a very striking manner. Since most of the finely disseminated gold values are associated with pyrite, this lack is peculiar.

SUGGESTIONS FOR FUTURE STUDY

A number of avenues of investigation that would lead to greater understanding of these deposits lie open. This section of the paper will attempt to list some of these and outline how their evaluation will be helpful.

Whole rock and trace element chemistry of the following rock types needs investigation:

1. Unaltered, unmineralized hanging wall and footwall assemblage rocks.

2. Mineralized rocks of the various alteration zones.

3. Unmineralized rocks of the various alteration zones.

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4. Late quartz-carbonate veinlets, both gold-bearing and barren.

5. The massive "bull quartz" veins.

Tihor and Crockett (1977), in a report of this type of work at the mineralogically similar Kerr Addison-type deposits in Canada, were able to draw some fascinating conclusions regarding the origin of the quartz-carbonate alteration.

Fluid inclusion work should be done, particularly in the "bull quartz" and the late white quartz-carbonate veinlets. Temperatures of formation of these rock types are needed before conclusions regarding their origin can be drawn. This work could also reveal data on the chemistry and origin of these ores.

Oxygen, carbon and sulfur isotope investigations are needed. The oxygen data can provide leads on the environment of origin of the ores. The sulfur, especially in comparisons of ore-zone and "country rock" pyrites, will be extremely useful given the intimate association of gold with pyrite in the deposits. The carbon isotope studies, in conjunction with the chemical work described below, will indicate whether the carbon was introduced into the system during mineralization, whether it was already present in the form of graphite, or some combination of the two.

Information regarding the chemical compositions of the three recognized principal carbonates is necessary. Slight chemical differences between the "grey ore" fine carbonate, the white, crystalline carbonate of the Quartz-Ankerite-Mariposite and the coarse, euhedral carbonate of the late white veinlets could have profound implications.

RESERVES

The total measured and potential reserves (Patton, 1983) total 24,762,500 undiluted tons of ore averaging 0.065 oz. Au/ton. Additional underground potential reserves total 12,920,000 tons of 0.136 oz. Au/ton average grade.

In addition, a coarse gold factor of +17% will be added to approximate gold not recovered by drilling. The coarse gold varies from mine to mine and the 17% is an average for the overall project. It was derived from Sonora Mining Corporations bulk metallurgical test work.

ORE DEVELOPMENT

Mining of these orebodies will be by standard open pit mining procedures. Initial development will be pioneered by bulldozers using hydraulic rippers. Standard drilling and blasting will be employed for the more competent rock. The broken rock will be loaded by front-end loaders and power shovels into 80 yd. dump trucks. Ore will then be hauled to the mill site west of the Harvard mine area.

The mill will be sized to process 5000 t.p.d. The ore will be crushed and screened before grinding. Most of the gold values are within auriferous pyrite which will be concentrated by flotation. Any coarse gold will be recovered in a jig. Metallurgical test work by Sonora Mining Corp. resulted in a 94% recovery of precious metal values. The gold-bearing concentrates will be shipped out of state for smelting.

Once the Dutch-App and Jumper mines are brought on line, there will be a crushing plant constructed at the Dutch-App site. The crushed ore from here will be moved by conveyer across Woods Creek and Highway 49/108 to the mill site at the Harvard.

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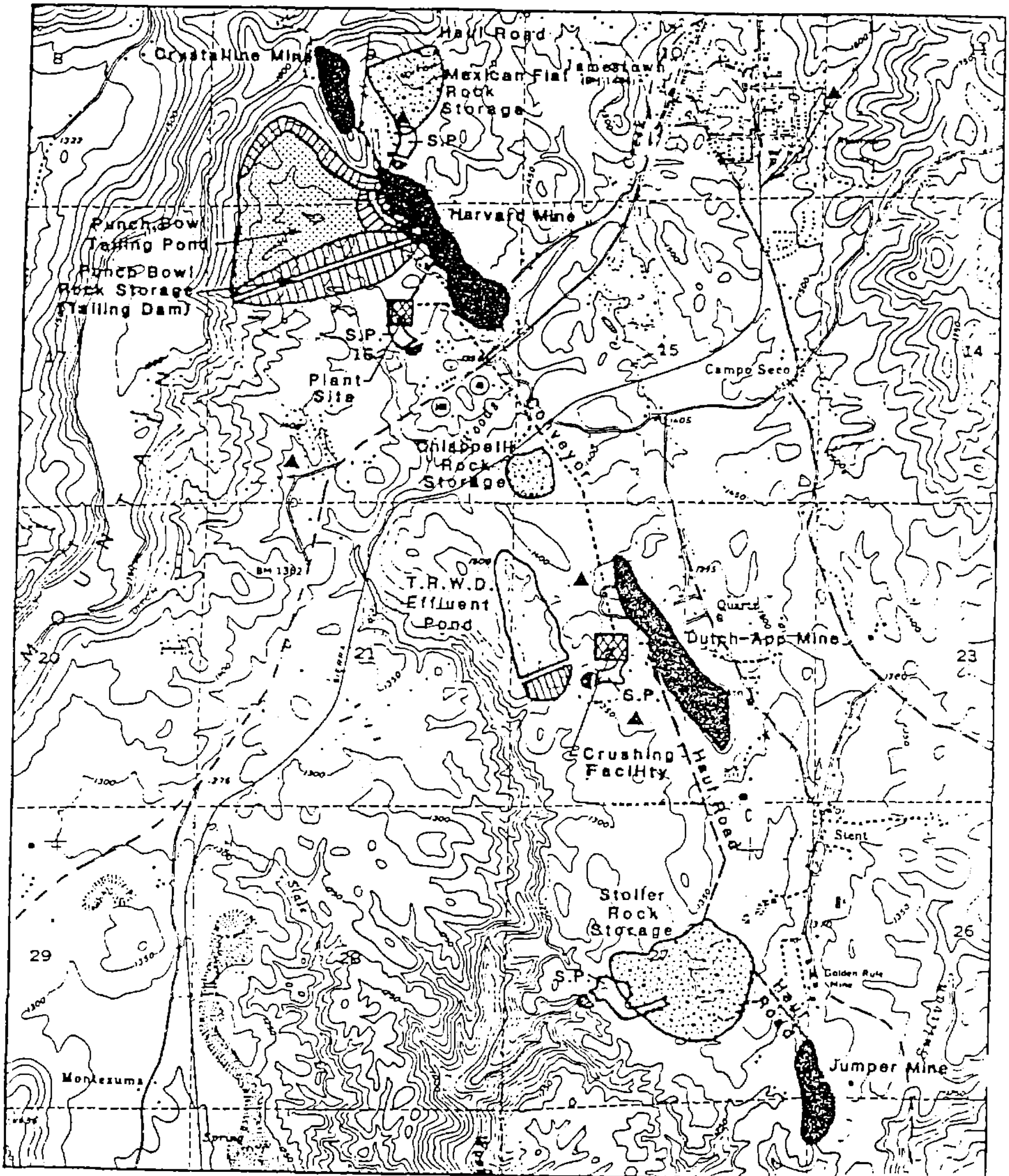


S.P. = Sedimentation Pond

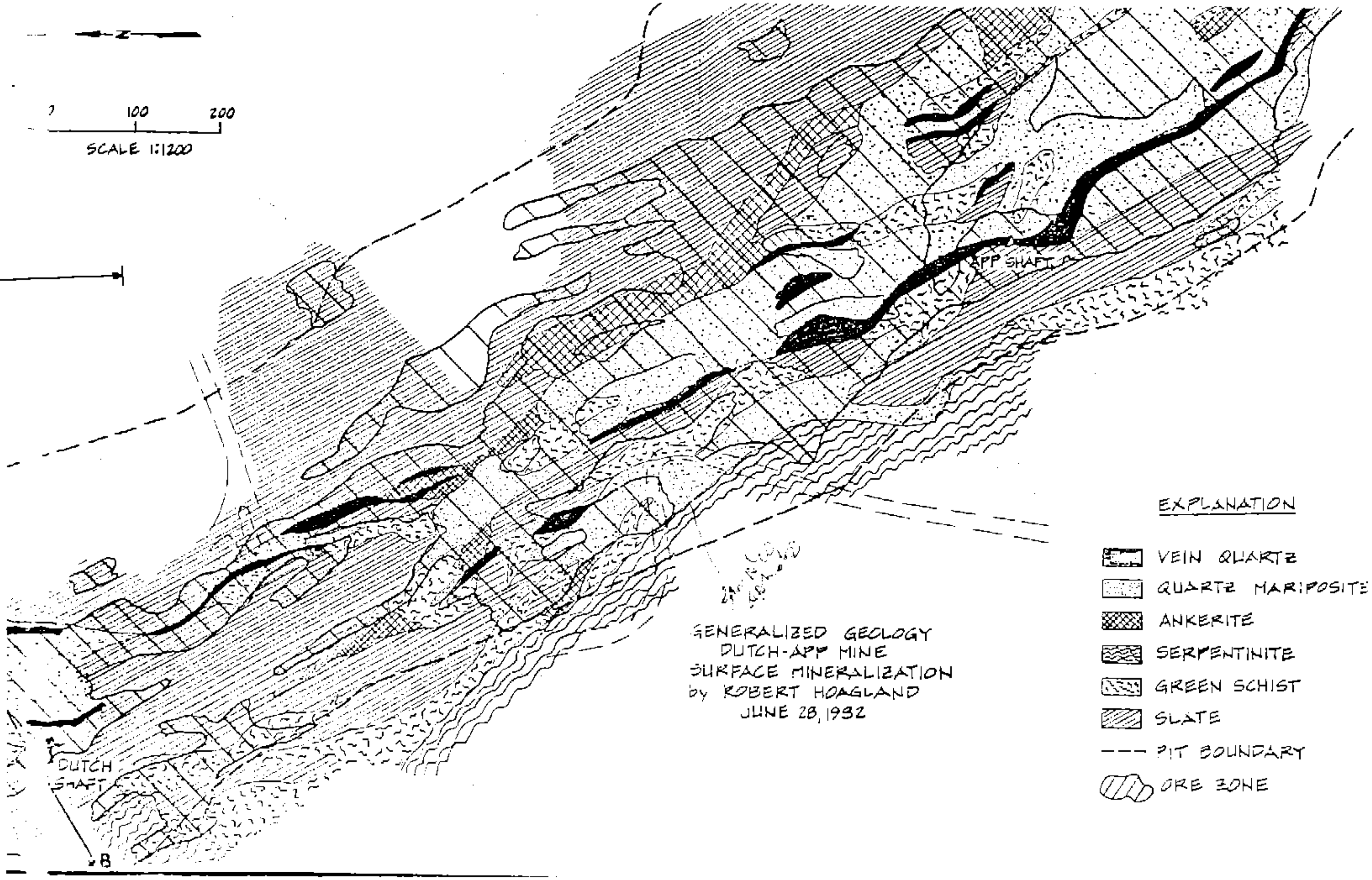
▲ Air Quality Monitoring Station

N

Scale 1:30,000

5 cm

Figure 1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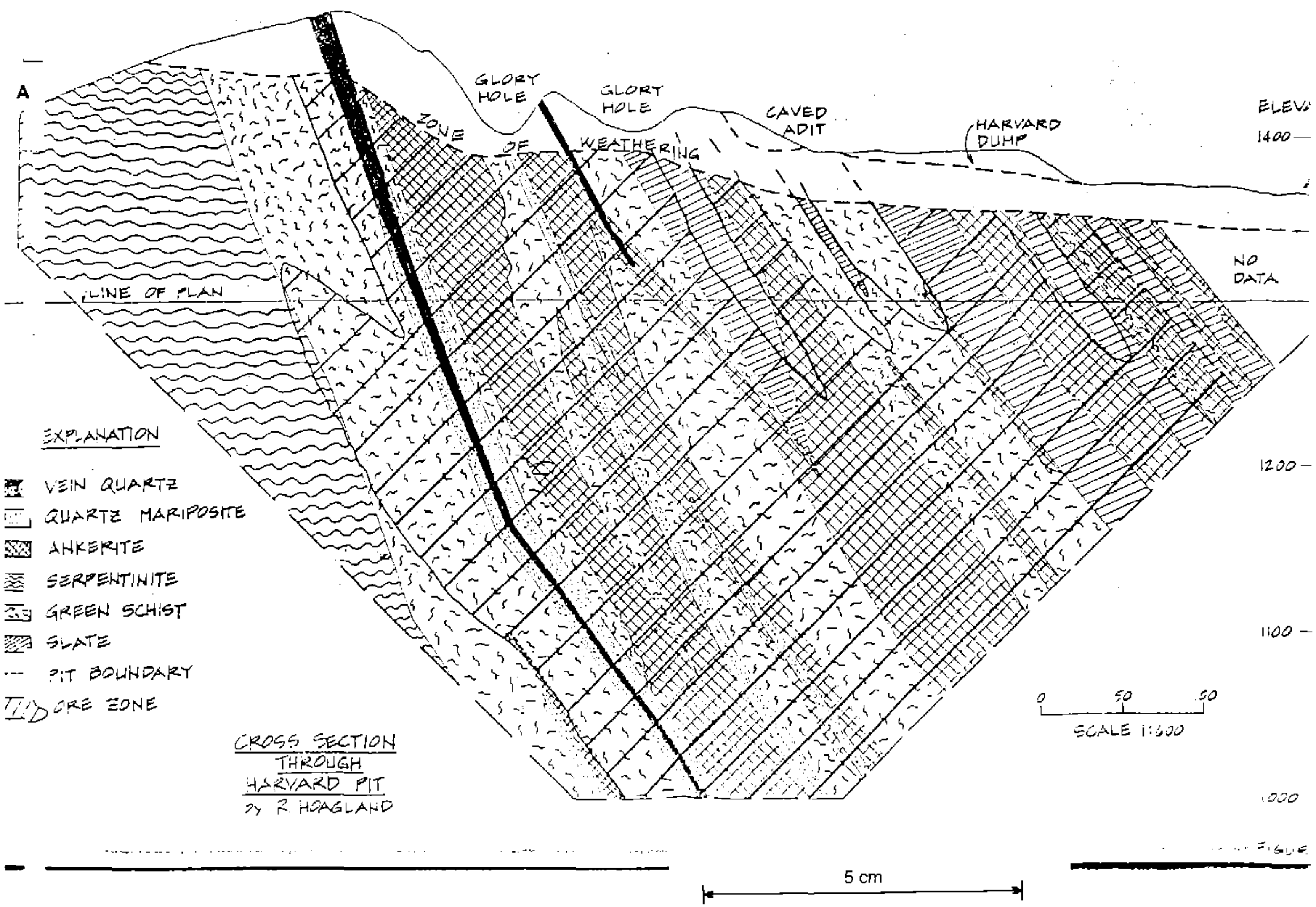
APP SHAFT
DUTCH SHAFT
B
GENERALIZED GEOLOGY
DUTCH-APP MINE
SURFACE MINERALIZATION
by ROBERT HOAGLAND
JUNE 28, 1932
EXPLANATION
VEIN QUARTZ
QUARTZ MARIPOSITE
ANKERITE
SERPENTINITE
GREEN SCHIST
SLATE
PIT BOUNDARY
ORE ZONE

5 cm


A
GLORY HOLE
GLORY HOLE
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ZONE OF WEATHERING
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1400 —
1200 —
1100 —
1000
NO DATA
LINE OF PLAN
EXPLANATION
VEIN QUARTZ
QUARTZ MARIPOSITE
ANKERITE
SERPENTINITE
GREEN SCHIST
SLATE
PIT BOUNDARY
ORE ZONE
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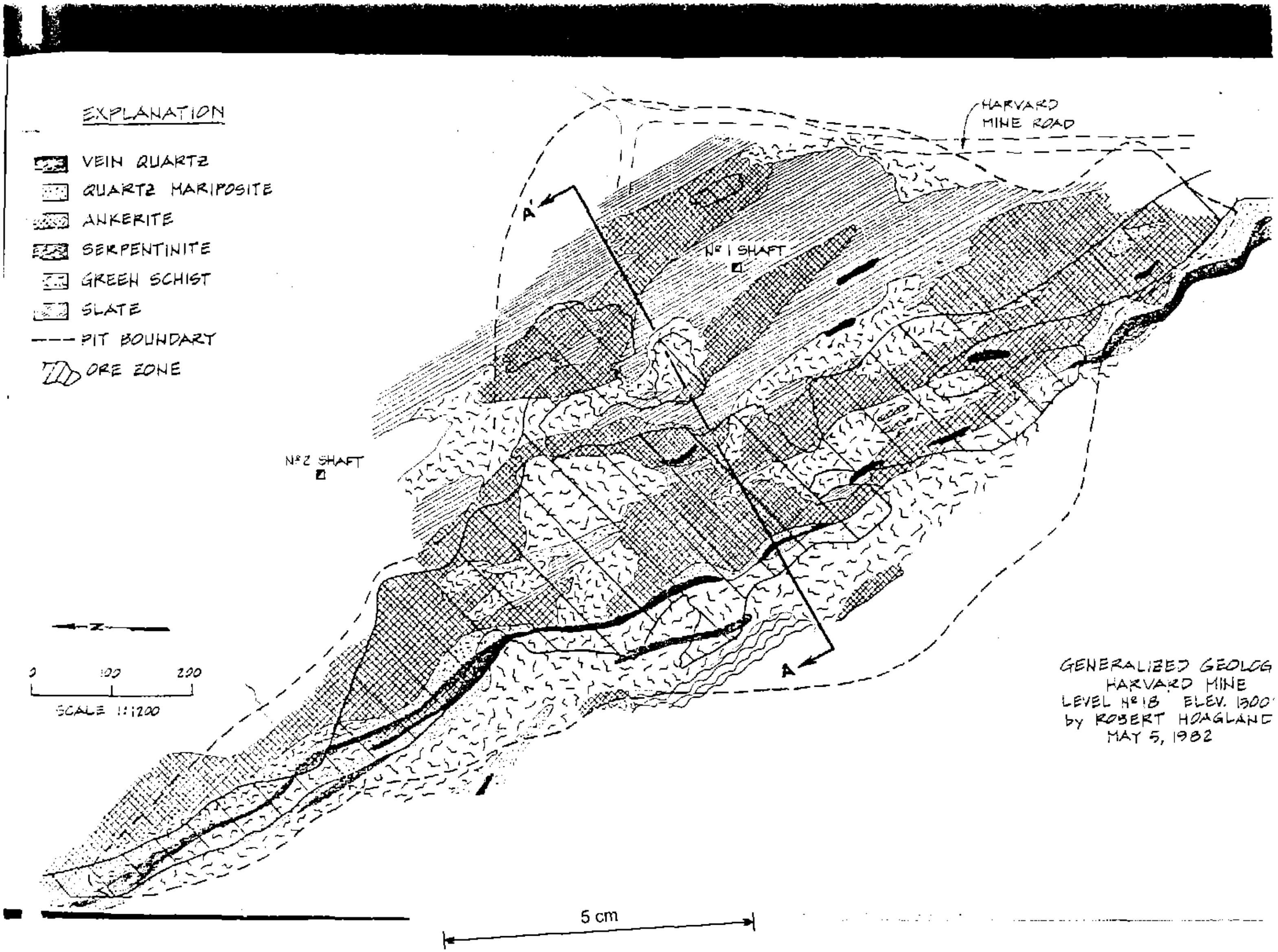
CROSS SECTION THROUGH HARVARD PIT
by R. HOAGLAND
5 cm


EXPLANATION
VEIN QUARTZ
QUARTZ MARIPOSITE
ANKERITE
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GREEN SCHIST
SLATE
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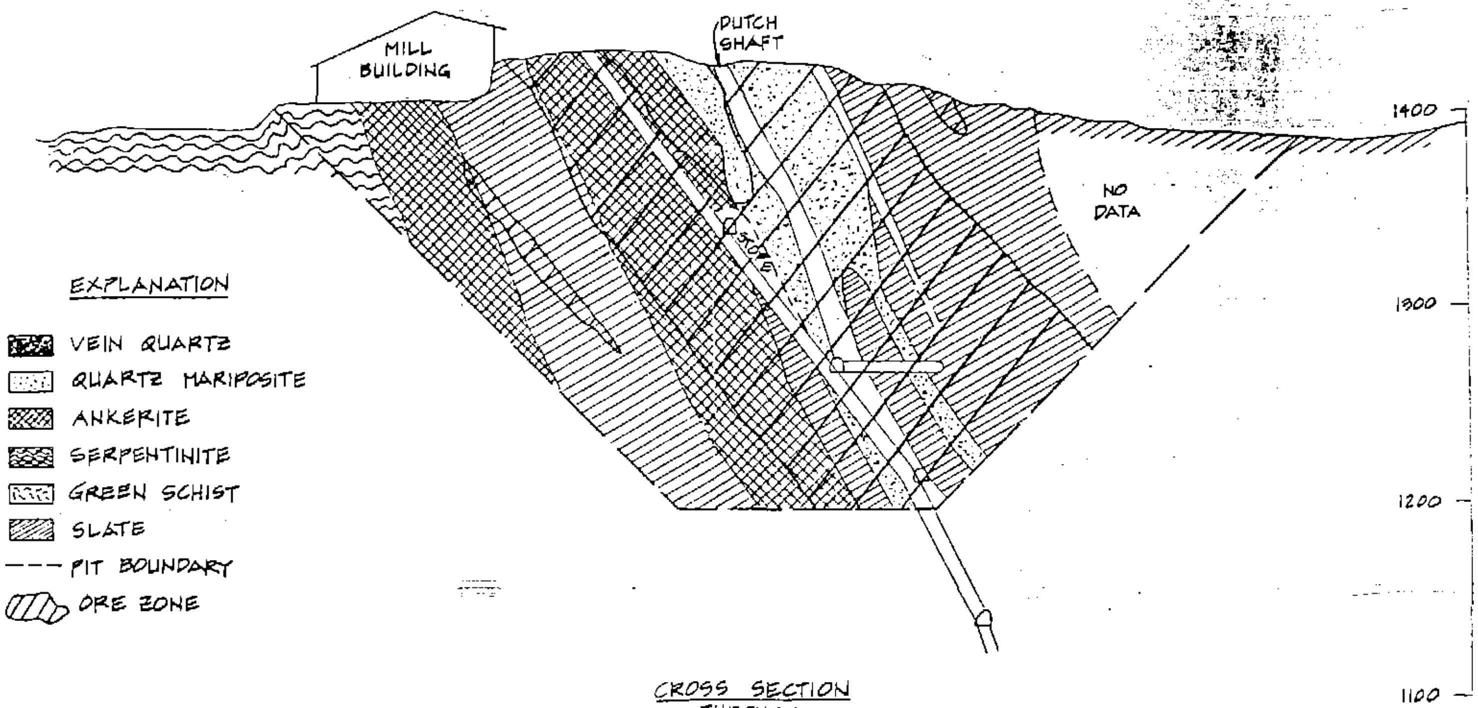
0 100 200
SCALE 1:1200
HARVARD MINE ROAD
A'
A
Nº 1 SHAFT
Nº 2 SHAFT
GENERALIZED GEOLOG
HARVARD MINE
LEVEL Nº 18 ELEV. 1300'
by ROBERT HOAGLANE
MAY 5, 1982
5 cm



CROSS SECTION THROUGH DUTCH SHAFT
by G. ALLGOOD

FIGURE

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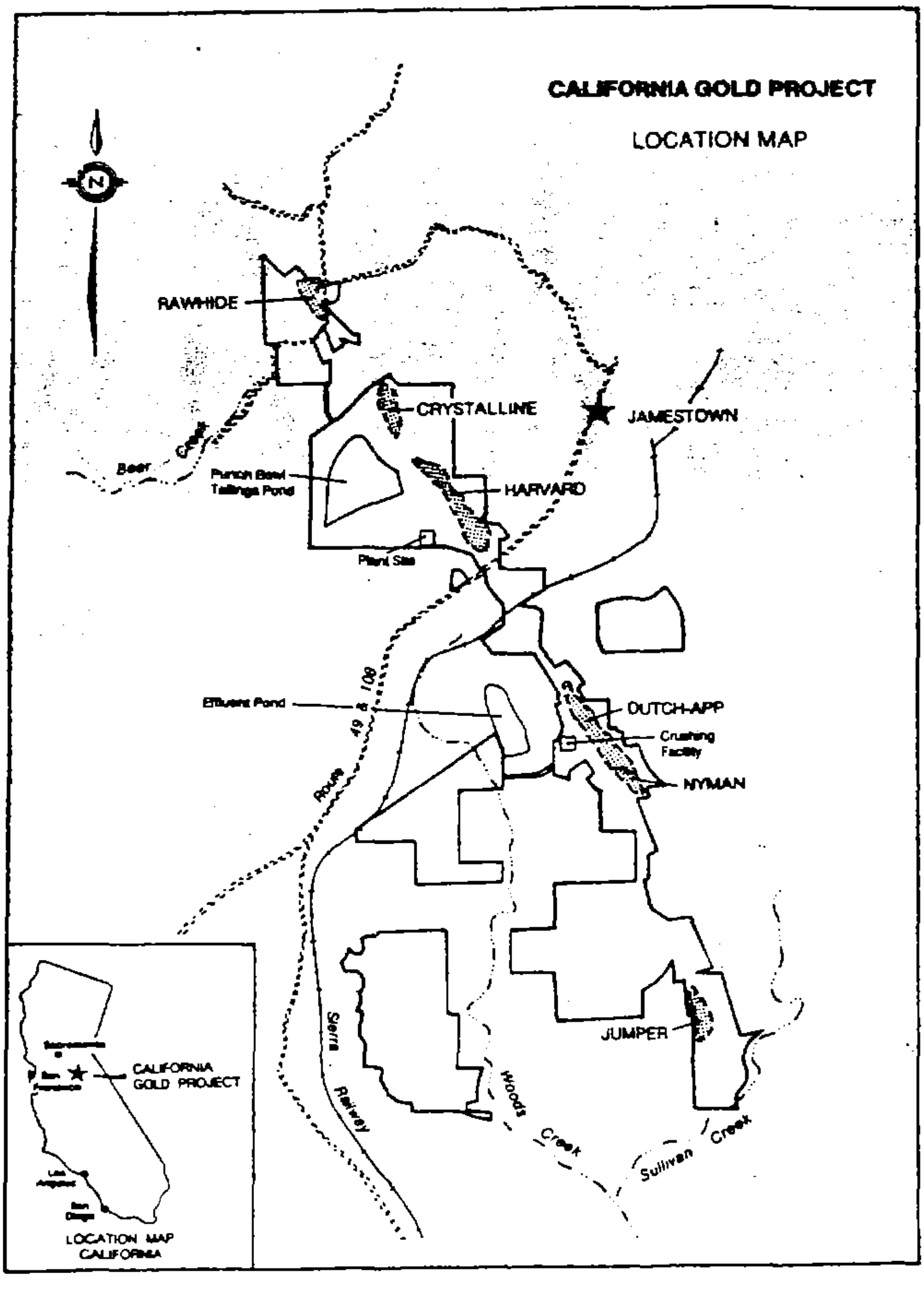
006

Sonora Gold Corp
Start Up

Open pit mine and proc
100,000/125,0



IN THE MOTHER LODE C central California, Sonora Go Corp. is conducting a project r quiring a capital expenditure (about $32.4 million near Jamestow in Tuolumne county to develc precious metals deposits by open p methods and construct an ore pr cessing complex for start up in O tober. During the first year operation, production of gold estimated at 125,000 oz., and tl processing facilities are believed be capable of producing more tha 300,000 oz. of gold annually wi costs running at $181 per ounce rank Sonora among the lower co producers in North America.

At the site, which is 125 miles ea of San Francisco and 70 mil southeast of Sacramento, 5000 to of ore per day will be processed the concentrating facilities and lat will be expanded to 7000 tons p day. On Sept. 21, 1983, the minir properties were acquired for $ million plus a 15% net operatir profits interest from The Ne Jersey Zinc Co., a subsidiary Gulf & Western Industries In Sonora Gold is part of ABM Minir Group Inc., a Canadian firm hea quartered in Vancouver that conducting through subsidiaries e ploration and preproductic development programs at sever gold/silver prospects in the weste U.S.

Mining properties bein developed by Sonora Gold inclu 1826 acres purchased from Ne Jersey Zinc plus additional acrea acquired by the company just we of Jamestown. Contiguous pro erties include the Rawhid

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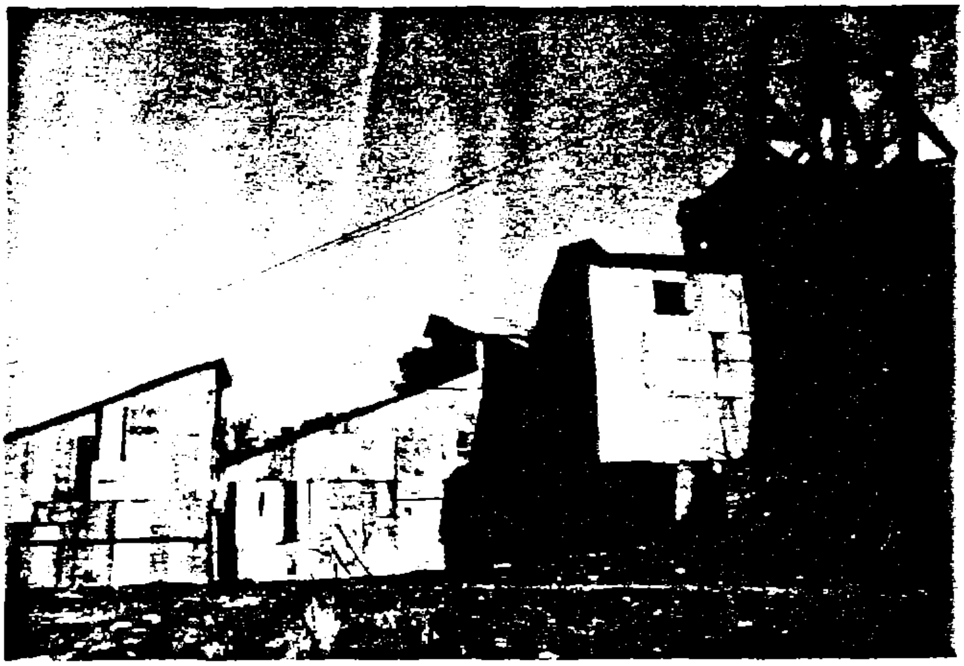
Project for Oct. 1984 Mother Lode

acilities with extraction of of gold annually

Crystalline, Harvard, Dutch-App, Nyman and Jumper deposits extending over a five-mile long by one-half mile wide trending belt.

In the Jamestown district, the first major ore deposit developed was the Harvard mine followed by the Dutch, Sweeney and App-Hestep. The properties were mined to depths ranging from 600 ft. at the Crystalline to 2300 ft. at the Dutch-App deposit. Mining ceased at the beginning of World War I but resumed in 1934 when an increase in the gold price brought renewed activity to the district.

Production continued until World War II when a government executive order terminated gold mining operations, and the Jamestown district was dormant until the mid-1970s when higher gold prices spurred renewed exploration and evaluation of the entire Mother Lode. Total reported gold production of Tuolumne county is 10,131,000 oz.



Old mine buildings dating from the 1915 to 1931 period at the Dutc App property situated in the future open pit mining area of Sonora Gc Corp.

Activity of NJZ Starts in 1978

In 1978, the property acquisition was commenced by New Jersey Zinc in the Jamestown district and was followed by initial ground reconnaissance and a detailed geochemical sampling program in 1978 and 1979. Surface drilling began in Aug. 1979, and by Dec. 1981 a total of 116,349 ft. had been drilled in 1137 holes principally on 50 and 100-ft. centers. Presently more than 1250 drill holes have been completed. Most of the drilling was on the Harvard and somewhat less on the Dutch-App, with the remainder split among the other four properties.

Exploration conducted by New Jersey Zinc identified lower grade bulk tonnage deposits of auriferous schists interlaced in places with quartz stockwork. Gold occurs in its native state and also is associated with pyrite. By early in 1981, continuing work included proving additional ore reserves and conducting engineering studies. About $9 million were spent by New Jersey Zinc on exploration, feasibility and development on these gold properties.

About 16,000 samples representing 5 or 10-ft. drill intervals were assayed for gold principally by the atomic absorption method. Fire assaying checks were performed on all values over 0.06 oz. of gold per ton by two laboratories.

Majority of the exploration was by rotary drilling and assaying the recovered chips, with some core drilling also conducted. Ore reserves were calculated using a tonnage factor of 12 and a cutoff of 0.03 oz. of gold per ton for sulfide ore and a tonnage factor of 15 and cutoff of 0.02 oz. of gold per ton for oxidized ore. A 0.025 oz. per ton cutoff grade was used to calculate reserves at the smaller Rawhide and Jumper mines.

Proven ore reserves for open pit mining are estimated at 24,762,500 tons averaging 0.065 oz. of gold per ton, with an overall stripping ratio of 3.48-to-1. Ore reserves suitable

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Old headframe at the Harvard mine situated in the middle of the open pit area being developed initially by Sonora Gold Corp. in the Mother Lode.

for mining by the underground method are calculated at 12,920,000 tons averaging 0.136 oz. of gold per ton. Contained gold is calculated at 1,609,560 oz. and 1,757,120 oz. from the open pit and underground reserves, respectively.

Further potential exists along strike, laterally and at depth in all of the deposits. Ore reserves are based on drill results conducted by New Jersey Zinc that included many holes stopped in mineralization at an average depth of 250 ft. Mining plans call for ultimate pit depth of 900 ft. in each of the deposits that contain 100,000,000 tons of possible open pit ore reserves. Proven open pit reserves are sufficient for 13 years at the projected initial milling rate of 5000 tons of ore per day. It is considered likely that the production rate could be doubled at some future stage of the mining operation.

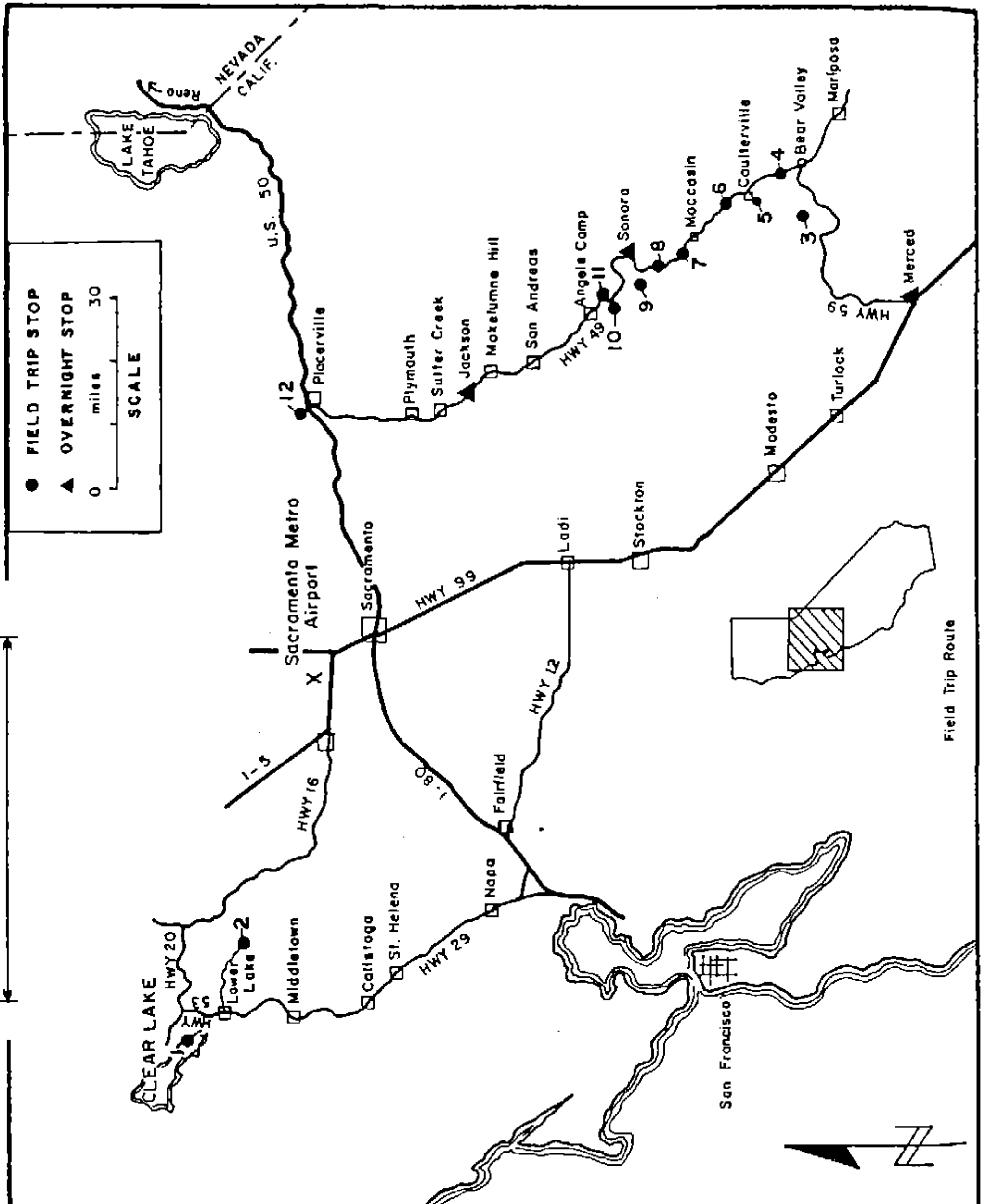
Harvard First Deposit Developed

The lease agreement requires that the Harvard deposit be developed initially by Sonora, and the ultimate pit covering the Harvard and Crystalline orebodies is expected to provide adequate reserves for a mine production rate of 5000 tons per day on a seven-day per week schedule over a five to 10-year period. Further ore to feed the 5000-ton per day concentrator at capacity would originate from the Dutch-App orebody during the same period and extend two to five years beyond. Additional feed would then be required from the Jumper and Rawhide deposits.

The preliminary pit outlines are based on a 45° mining slope to an average depth of 250 ft. If this can be increased to the planned 50° to 55°, the ore reserve will be expanded substantially without seriously affecting the ore-to-waste production ratio. Just to a depth of 375 ft., there would be a 50% increase in mineable open pit ore reserves. Blast hole drilling will be with large rotary machines, and broken ore and waste will be loaded with diesel-powered shovels and large rubber-tired front-end loaders into 85-ton capacity trucks.

Ore will be hauled to the 5000-ton per day capacity flotation concentrator situated on the west side of the Harvard mine that will operate on a 360-day per year basis. Flotation concentrate containing 2 oz. of gold per ton and 2.4 oz. of silver per ton will be leached, with gold in the resulting solution recovered by electrolysis to extract 99.9% gold bullion. At an annual processing rate of 1,800,000 tons of ore, between 100,000 and 125,000 oz. of gold and 120,000 and 140,000 oz. of silver will be produced by Sonora.□

Geol Soc Nevada Fieldguide 1987



FIELD TRIP 4
PRECIOUS METAL DEPOSITS OF THE CENTRAL CALIFORNIA COAST RANGE AND SIERRA NEVADA FOOTHILL REGION

Tim K. Smith
Consultant

Ralph C. Loyd
California Division of Mines and Geology

H. Walter Schull
Consultant

FIELD TRIP PROGRAM

DAY 1 - APRIL 2, 1987

Leave Sacramento Metropolitan Airport 7:00 a.m.
STOP 1 - Sulfur Bank Mine, Clear Lake
STOP 2 - McLaughlin Mine, Knoxville
Night 1 - Merced

DAY 2 - APRIL 3, 1987

STOP 3 - Blue Moon Mine, Hornitos
STOP 4 - Pine Tree-Josephine Mine, Bear Valley
STOP 5 - Roadcut Exposure - Mariposite, Coulterville
STOP 6 - Stratigraphic Section, Coulterville
STOP 7 - Stratigraphic Section, Moccasin
STOP 8 - Roadcut Exposure - Pillow Basalt, Jamestown
Night 2 - Sonora

DAY 3 - APRIL 4, 1987

STOP 9 - Jamestown Mine, Jamestown
STOP 10 - Roadcut Exposure, Carson Hill
STOP 11 - Carson Hill Mine, Carson Hill
Night 3 - Jackson

DAY 4 - APRIL 5, 1987

STOP 12 - Melones Fault Zone Traverse, Placerville
END OF FIELD TRIP

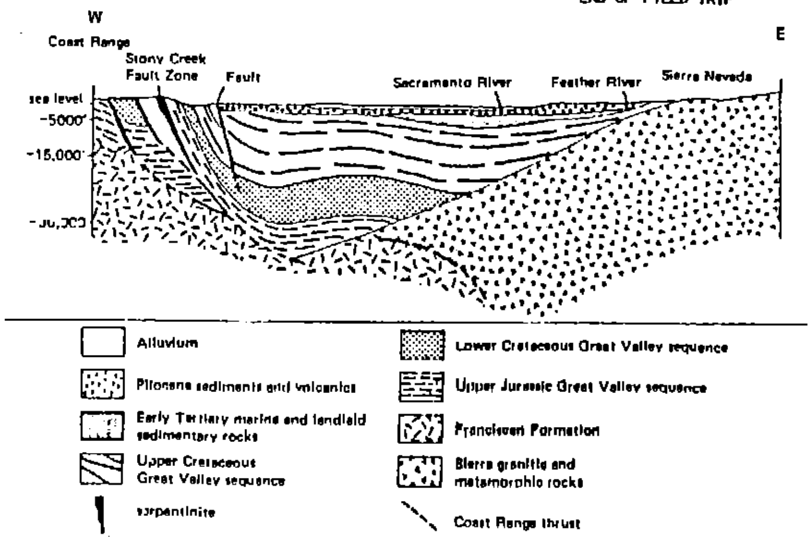


FIGURE Generalized geologic section across the Sacramento Valley showing inferred relationships of the Coast Range thrust in the northern part of the Great Valley.

DAY 1 – THURSDAY, APRIL 2

Depart Sacramento Metropolitan Airport 7:00 a.m. Bus will be boarded near PSA terminal.

Mileage Cum.	Inc.	
0.0	0.0	Junction of airport exit road and Interstate Hwy 5 North. Road log odometer reading begins at point where vehicle merges into right lane of freeway.
8.0	8.0	Take Woodland exit (Business Loop 5 and State Hwy 113 offramp). Turn left at offramp traffic light onto East Main Street and proceed through downtown Woodland.
11.3	3.3	Leaving Woodland. Main street becomes State Hwy 16 at this point. Continue on Hwy 16 West through Madison and Esparto.
27.4	16.1	Entering foothill region of the Coast Range.
39.6	12.2	Entering Guinda.
44.4	4.8	Entering Rumsey.
46.9	2.5	Entering into lower foothill region of the California Coast Range. Bedded sedimentary deposits exposed along road are units of the Great Valley Sequence of Cretaceous age.
57.9	11.0	Serpentinite exposed on slopes to west mark trace of the Coast Range thrust fault.
59.0	1.1	Junction of State Hwys 16 and 20. Turn left onto State Hwy 20 West toward Clear Lake.
59.6	0.6	Note thermal hot spring deposit on slope to right.
60.3	0.7	Another hot spring on right.
62.4	2.3	Abbott mercury mine on right.
70.6	5.9	Flat lying Tertiary conglomerates (terrestrial and lacustrine) on left.
73.1	2.5	Lange Bros Aggregate operation on right.
77.3	4.2	Junction of State Hwys 20 and 53. Continue west on 20. We will return to this point after visiting the Sulfur Bank mine.
78.3	1.0	Quarry on right is producing decorative rock from cinder cone. The product has been marketed as far away as southern California.
79.4	1.1	Turn left onto Sulfur Bank Road.
80.7	1.3	Enter dirt road heading west along southern edge of water-filled pit of the Sulfur Bank mercury mine.
80.9	0.2	STOP 1. SULFUR BANK MERCURY MINE.

At this stop, we will be able to observe an active hydrothermal system similar in nature to the older system which governed mineralization at the McLaughlin mine some 20 miles to the southeast. The following description is taken from Volume 43 of the California Journal of Mines and Geology (Charles Averill, 1947):

"Sulphur Bank is a low, rounded hill on the shore of Clear Lake. It is situated in an area of Franciscan rocks overlain by a series of freshwater sediments of Plio-Pleistocene age capped by a Pleistocene basalt flow. The sediments consist of flat-lying sands and conglomerates deposited on a series of horizontal Franciscan shales and sandstone. A basalt extrusion broke through the overlying sedimentary strata, possibly at a point near the shore of Clear Lake, and spread out in a sheet over the sediments. Upon cooling, the basalt developed shrinkage cracks and formed the well known pillow structure commonly found in extrusive rocks which have been cooled under water.

Solfataric action has altered the rock to a great extent, with concentric weathering of the basalt common throughout the deposit. A thrust fault strikes approximately eastward across the southern extent of the mine workings. Through rifts in the hanging or north wall, hot sulfurous waters and steam now escape. The mineralizing solutions that probably rose through these rifts were to a certain degree trapped by the overlying basalt and deposited cinnabar at this point. The basalt sheet is not very extensive, being bound on the north and west by the waters of Clear Lake. To the south it may be faulted off and the faulted section eroded away, or it may have stopped in its flow before reaching the fault zone. Ore was found in commercial quantities from a depth of 30 or 40 feet below the surface to the lowest workings, which are more than 150 feet deep. The upper horizon contained sulfur in commercial quantities and was mined during the first years of operations (mining began here in 1865). Boiling hot springs are numerous throughout the mine area, and in one case action is of sufficient violence to throw a continual spray of mud and water into the air. It is quite certain that mineralization is proceeding at the present time in many of the springs and steam vents."

After mine tour return to Junction of State Hwys 20 and 53. Reset odometer.

0.0	0.0	Junction of State Hwys 20 and 53. Turn right on Hwy 53 heading south and proceed to Lower Lake.
4.4	4.4	Entering community of Clear Lake. Mount Konocti, a composite cone of andesitic composition, visible to right.
7.0	2.6	Entering community of Lower Lake.
7.4	0.4	Turn left onto Morgan Valley Road toward Knoxville.
12.3	4.9	Old mercury mine on slope to left.
20.2	7.9	STOP 2. Turn right into Homestake's Mclaughlin mill entrance — check in at security office. Refer to articl on the McLaughlin mine at back o field guide.

After mill tour return to Morge Valley Road and reset odometer.

0.0	0.0	Turn right onto Morgan Valley Roe toward Mclaughlin mine site.
4.3	4.3	STOP 3. Turn left into McLaughli mine entrance immediately after pass ing through tunnel.

After mine tour return to Morga Valley Road and reset odometer.

0.0	0.0	Turn right onto Morgan Valley Roe and return to Lower Lake.
17.1	17.1	Junction of Morgan Valley Road an State Hwy 29 in Lower Lake. Tur left on Hwy 29 toward Napa.
31.2	14.1	Entering Middletown.
37.5	6.3	Napa County Line.
48.1	10.6	Entering Calistoga.
56.3	8.2	Entering St. Helena, home of Christian Brothers, Sutter Home, BV. Mondavi, Inglenook and other famou Napa Valley wineries.
66.0	9.7	Entering Yountville.
72.3	6.3	Entering Napa.
81.4	9.1	Junction of State Hwys 29 and 12. Turn left onto Hwy 12 east.
87.5	6.1	Merger of State Hwy 12 and Interstat Hwy 80 east. Proceed east.
92.3	4.8	Take State Hwy 12 exit to Suisun. Continue east to Lodi.
138.2	45.9	Entering Lodi.
140.9	2.7	Junction of State Hwys 12 and 99. Turn right onto Hwy 99 South on-ramp to Merced.

216.9 76.0 Take State Hwy 140 exit in Merced. We will be staying at the Pine Cone Inn Motel located at the base of the offramp.

END OF DAY 1

DAY 2 – Friday, April 3

Depart Pine Cone Inn 7:45 a.m.

0.0 0.0 Junction of State Hwys 59 and 140 at Pine Cone Inn. Proceed north on Hwy 59 to Snelling.

8.1 8.1 Keep to right at Y intersection in road. Continue on to Snelling.

12.2 4.1 Genstar aggregate operation along Merced River on right.

16.1 3.9 Note dredge tailings in Merced River plain.

17.9 1.8 Entering Snelling. Note: Hwy 59 terminates in Snelling but road continues east as Merced Falls Road (J16).

24.8 6.6 Turn right onto Hornitos Road.

24.7 0.2 First observed exposures of Sierra Nevada Bedrock. Here, the bedrock consists of Late Jurassic black slates.

24.9 0.2 Turn left and proceed across bridge to Hornitos.

28.5 3.6 Entering into metavolcanic island arc sequence of Late Jurassic age. Here, the sequence consists mainly of felsic volcanic rocks with some quartz porphyry intrusions.

32.0 3.5 Historic mining town of Hornitos, Continue on J16 East. Presently passing through the Hornitos gold mining district.

33.3 1.3 STOP 3. BLUE MOON MASSIVE SULFIDE DEPOSIT.

Turn left onto dirt road leading to Westmin Resources field office located 3.5 miles to the north. Company representatives will meet group at J16 turnoff point.

After tour of the Blue Moon site, return to J16 and reset odometer.

STOP 1: Blue Moon No. 2 shaft site: This stop will provide the opportunity to see a surface cross-section of the stratigraphy hosting the Blue Moon deposits.
— time required 1 1/2 – 2 hours

STOP 2: American Eagle hill: Exposures of massive barite on the West Zone horizon will be examined. Immediate host rocks and alteration can also be compared to stop 1.
— time required 45 minutes

STOP 3: Field site: Massive sulfide intersections will be examined in drill core from the West Zone horizon (B33) and Main Zone (B40). A condensed section of drill hole stratigraphy will be examined if time permits.
— time required 1 1/2 hours

STOP 4: Mangela's bar, Hornitos: This stop is a necessity at the end of the trip. You can play "When the Blue Moon turns to gold" on the juke box.

0.0 0.0 Turn left on J16 east to Bear Valley.

4.5 4.5 Entering into Penon Blanco volcanics. The Penon Blanco volcanics are predominantly basaltic to intermediate volcaniclastics, with coarse breccia and flow units common in some locals. Pyroxene predominates over amphibole and has commonly been uralitized.

9.0 4.5 Junction of J16 and State Hwy 49 at Bear Valley. Turn left on Hwy 49 North toward Coulterville. Now passing through the Bagby gold mining district of the Mother Lode.

10.3 1.3 STOP 4. PINE TREE-JOSEPHINE GOLD MINE PROJECT, GOLDENBELL RESOURCES. Turn left into Goldenbell Resources field office entrance.

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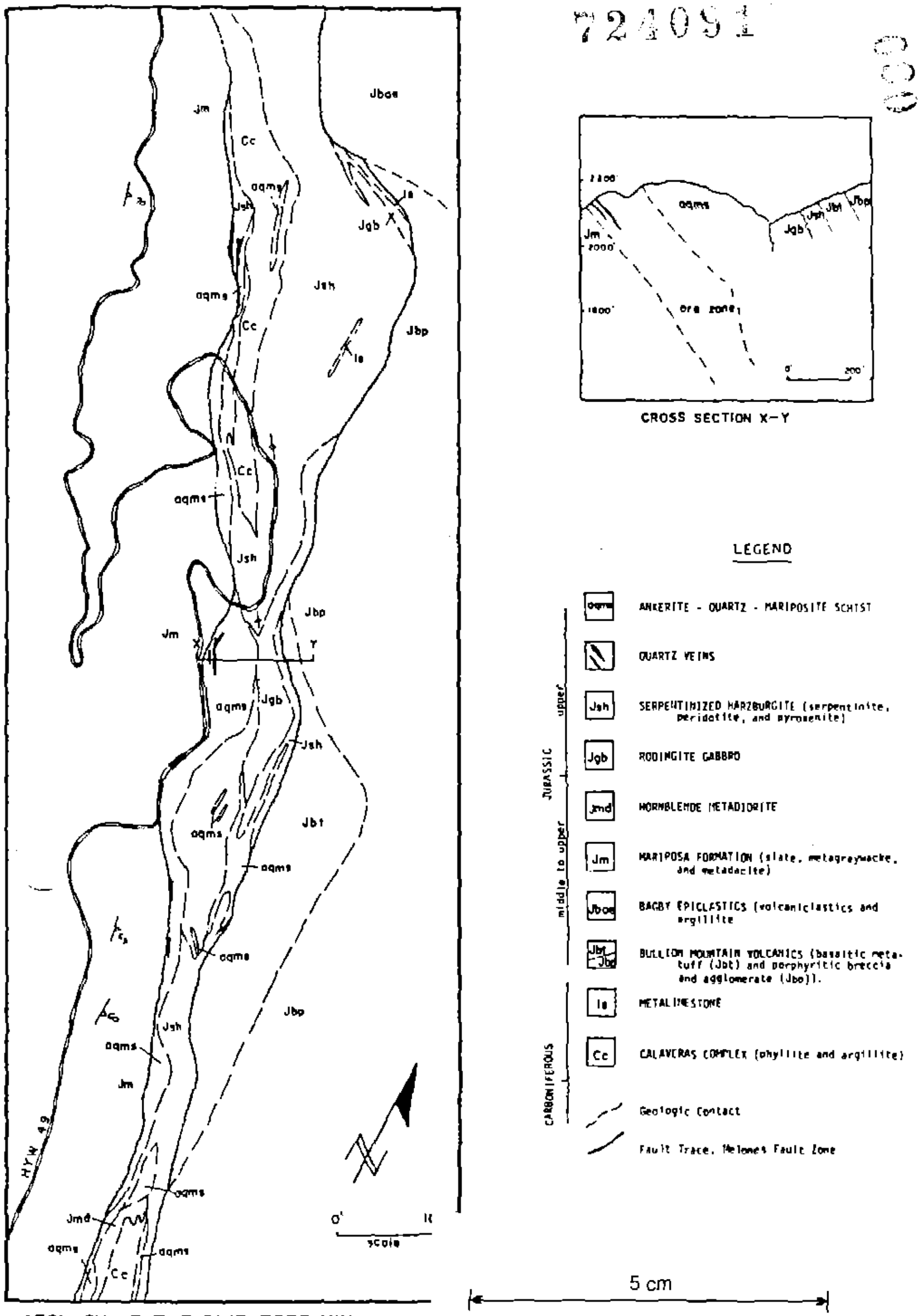
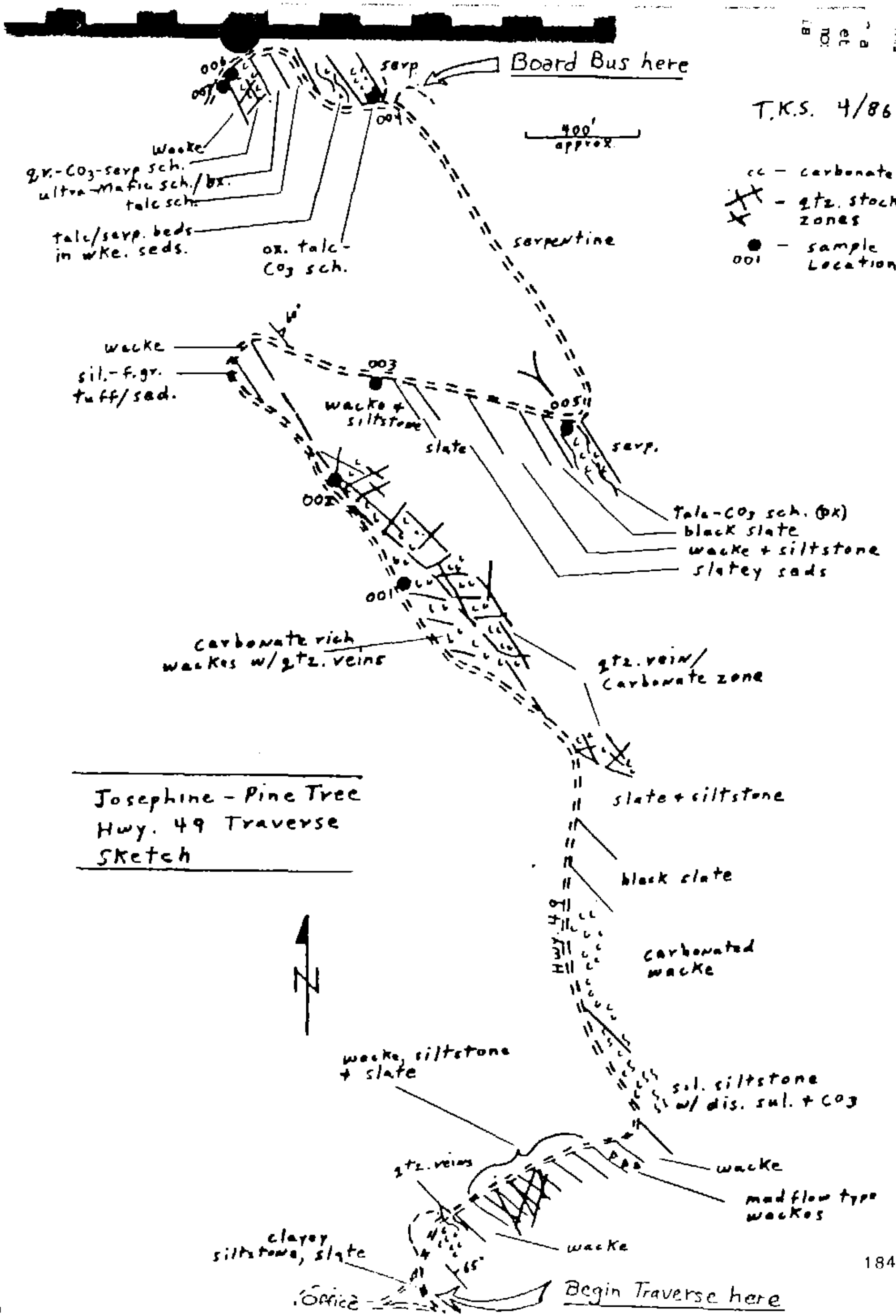


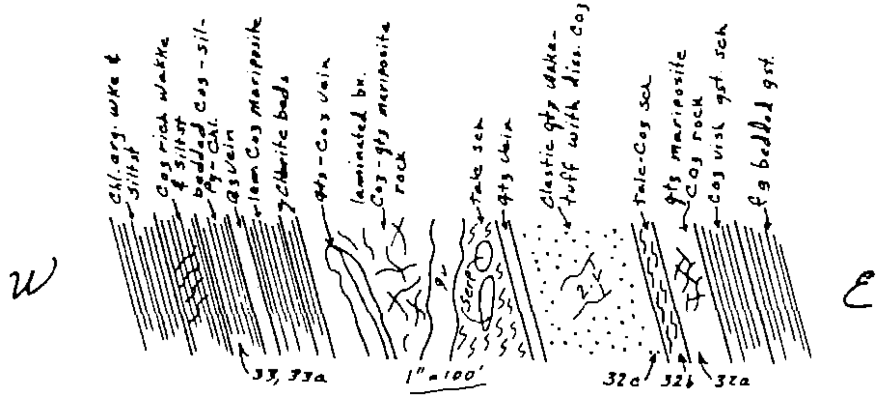
GEOLOGY OF THE PINE TREE MINE AREA



The Pine Tree-Josephine mine area is located near the southern terminus of the Mother Lode belt. The property consists of over 3300 acres of land acquired by Goldenbell Resources in late 1984. The company is presently pursuing the required permits from Mariposa County in order to develop an open pit mine and to construct a processing mill. The Pine Tree and Josephine mines were active almost continuously between the early 1850s and the early 1870s, and periodically until 1944. Their total combined production amounted to over 124,000 ounces of gold.

Exploration drilling by Goldenbell Resources has defined a mineralized zone having a strike length of some 2,700 feet, a width of 100 to 200 feet and a depth exceeding 800 feet. The company estimates its resources at about 25,000,000 tons grading about 0.06 ounces per ton. Within this zone, the gold occurs in disseminated form in association with ankerite-quartz-mariposite schist present in a sequence of metavolcanic and sedimentary deposits which have been intruded by ultramafic rock (serpentinite), gabbro and diorite. These rocks are bounded on the east and west by splays of the Melones fault (see geology map and cross section).

0.0	0.0	After a presentation at the field office, the group will make a roadcut traverse of the property by walking along Hwy 49 to a point located 1.2 miles north (see Josephine-Pine Tree Hwy 49 traverse sketch).
1.2	1.2	Board Bus
3.9	2.7	Merced River crossing. The old mining town of Bagby is now inundated by Lake McClure.
5.3	1.4	Dirt road leading off to left is entrance to the Gold Specimen mine. Entering into the Coulterville mining district.
9.9	4.6	Visible to the left is the Virginia Mine property. The Virginia mine is one of the oldest patented mine claims in Mariposa County. Note the large quartz vein exposure capping Virginia Point.
13.9	4.0	Entering Coulterville. Turn left onto State Hwy 132 West toward Modesto.
14.1	0.2	STOP 5. MARIPOSITE EXPOSURE. Refer to accompanying Coulterville "Mother Lode" section and rock sample analyses. After stop is complete, return to Hwy 49 and reset odometer.
0.0	0.0	Junction of State Hwys 49 and 132. Turn left onto Hwy 49 North toward Moccasin.
3.0	3.0	STOP 6. HAIGH RANCH MOTHER LODE TRAVERSE. Note the thick section of water washed laminated silica-carbonate-green mica rock cut by numerous quartz veins. Two assays of the laminated rock ran 5 to 65 ppm gold.
4.2	1.2	Tuolumne County Line. Penon Blanco Peak visible to the east.
5.4	1.2	Haigh quarry on right. Mariposite-bearing carbonate rock has been quarried here for decorative rock. Mariposite from this quarry has been dated at 116 ± 3 m.y. by K-Ar and 155 ± 3 m.y. by Rb-Sr.
8.7	3.3	Moccasin Creek. Entering the Jacksonville gold mining district. Note indications of placer mining along Moccasin Creek.
10.0	1.3	Community of Moccasin on right. Hetch Hetchy aqueduct and power plant and a State fish hatchery in foreground.
10.6	0.6	Junction of State Hwys 49 and 120. Turn left.
12.7	2.1	Turn right onto Jacksonville Road north.
13.3	0.6	Stevens Bar Bridge. Town of Jacksonville now inundated by Don Pedro



"Mother Lode Structure"
Geologic Section - Coulterville 1" ≈ 100'

SAMPLE	AU.ppb	AG.ppm	AS.ppm	SB.ppm	MO.ppm
COULTERVILLE SECTION					
CV13-32	80	.1	63	.8	NR*
CV13-32A	-5	.1	9	.8	4
CV13-32B	-5	.1	230	3.4	NR
CV13-32C	-5	.1	19	.4	NR
CV13-33	275	.1	35	.8	2
CV13-33A	50	.4	150	11	NR
STEVENS BAR/MOCCASIN PT. SECTION					
MOC14-1	250	.1	33	.4	1
M.P.14-1A	20	.2	23	.2	NR
MOC14-2	80	.1	29	2	NR
M.P.14-2B	5	.2	24	.2	NR
HARVARD/HWY. 120 SECTION					
JT-10	825	.7	NR	NR	NR

Reservoir. The Eagle-Shamutt mine is situated just to the north adjacent to the reservoir. The mine yielded about 300,000 ounces of gold, about half of which was produced from open pit mining.

13.5 0.2 STOP 7. Stratigraphic section along the Mother Lode gold belt. Pull off on dirt road on left side of Jacksonville Road at north end of Stevens Bar Bridge. Refer to sketch and rock sample assays of the Moccasin/Stevens Bar section.

19.2 5.7 STOP 8. Pillow basalts exposed along Jacksonville roadcut. Pull off on wide shoulder area to right. Entering the Jamestown gold mining district.

20.8 1.6 Turn left onto Jamestown-Jacksonville Road.

21.2 0.4 South slope of Quartz Mountain on left. Most of Quartz Mountain is controlled by Sonora Mining Corp. Long term mining plans call for the development of a pit site here.

22.2 1.0 Turn right and continue to Jamestown.

22.7 0.5 Keep left at Y intersection.

23.4 0.7 Keep left at Y intersection, entering Jamestown.

23.8 0.4 Turn right onto Main Street, Jamestown.

24.0 0.2 Turn right onto State Hwys 49/108 East toward Sonora.

27.1 0.2 Turn right onto Main Street Sonora (State Hwy 108).

27.3 0.2 Turn right into Sonora Townhouse Motel.

END OF DAY 2

DAY 3 - Saturday, April 4

0.0 0.0 Junction of State Hwys 108 west and 49 south (Main Street Sonora). Turn right and proceed west toward Jamestown.

4.2 4.2 To right is Sonora Mining Corp.'s Jamestown mine pit site now just under initial stages of development. The headframe of the famous Harvard mine was located at the top of the hill until dismantled last fall.

5.0 0.8 STOP 9. JAMESTOWN MINE, Sonora Mining Corp. Turn right onto High School Road. Proceed to offices of Sonora Mining Corp.

The Jamestown mine lies along the historic Mother Lode gold belt about one mile west of the community of Jamestown, Tuolumne County. Here, the Mother Lode belt lies along the trace of the Melones fault zone. Gold mineralization at the site has occurred in disseminated form in association with altered Mesozoic volcanic and sedimentary rocks which have been metamorphosed to the lower greenschist facies. Stratigraphic units exposed on the property include serpentinite, cherty sedimentary rocks, carbonaceous slates, meta tuffaceous rocks, and quartz-carbonate rocks, including mariposite. In addition a massive bull quartz vein is exposed along the prominent ridge line (see geologic map and cross section). The volcanic and sedimentary rocks are characterized by the presence of chlorite and sericite. The units form a layered sequence which strikes north/northwest and dips steeply to the east. The serpentinite body exposed along the western margin of the ore zone is thought to form the base of the sequence.

Exploration drilling conducted by New Jersey Zinc in the early 1980s as well as earlier work on the property, formally known as the Harvard mine, has outlined 14 million tons of ore averaging 0.072 ounces of gold per ton. Gold-bearing ore is often encountered within, but not confined to the zones of pronounced alteration. Computer projections from the drilling data indicate that some nine distinct mineralized zones are spaced along

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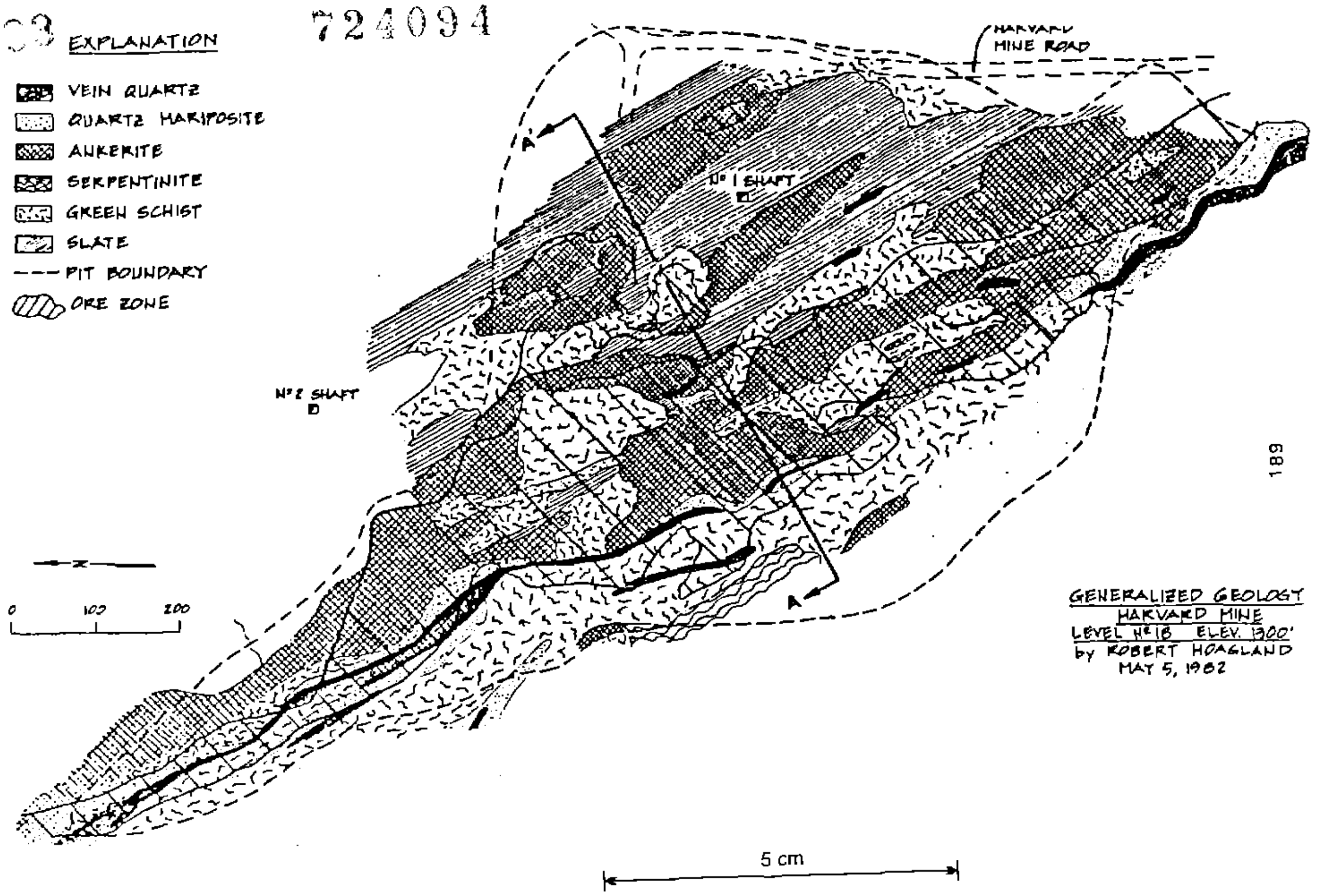
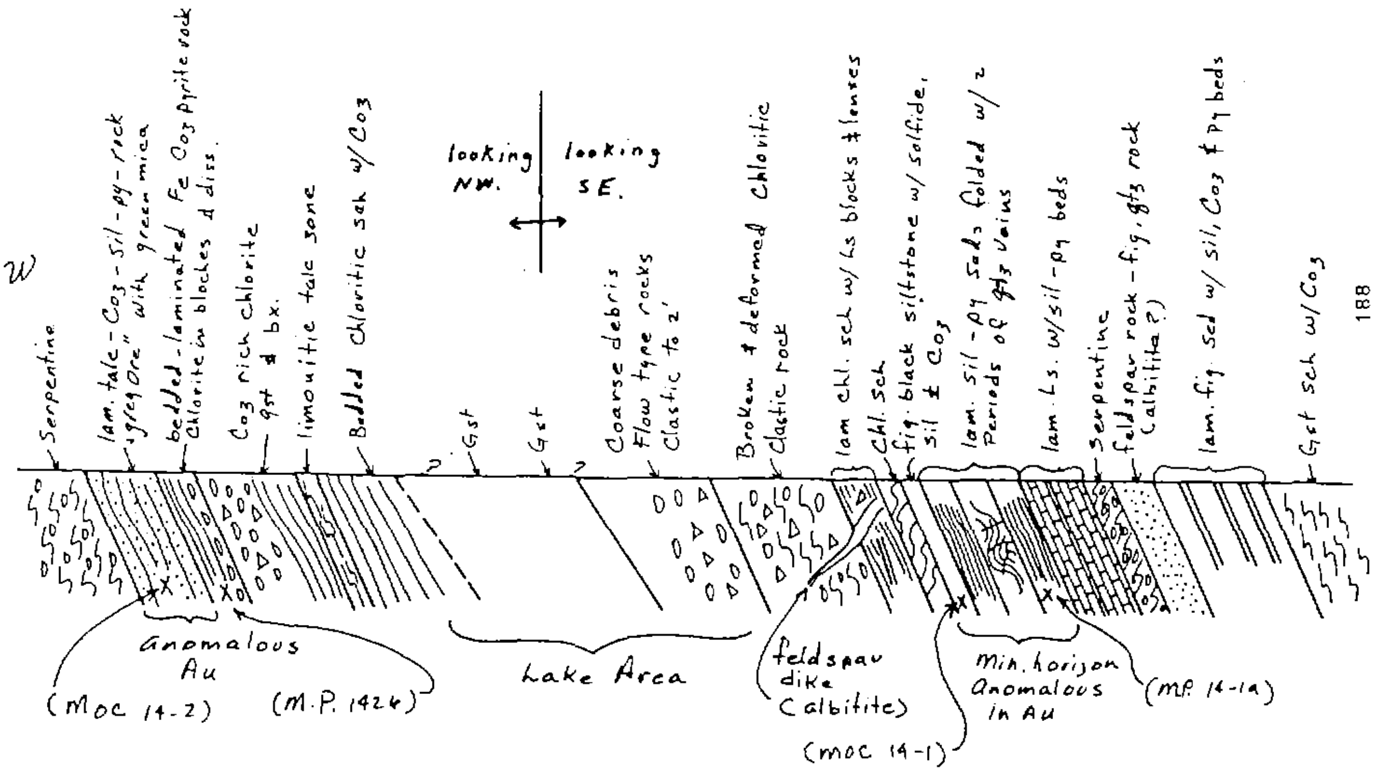
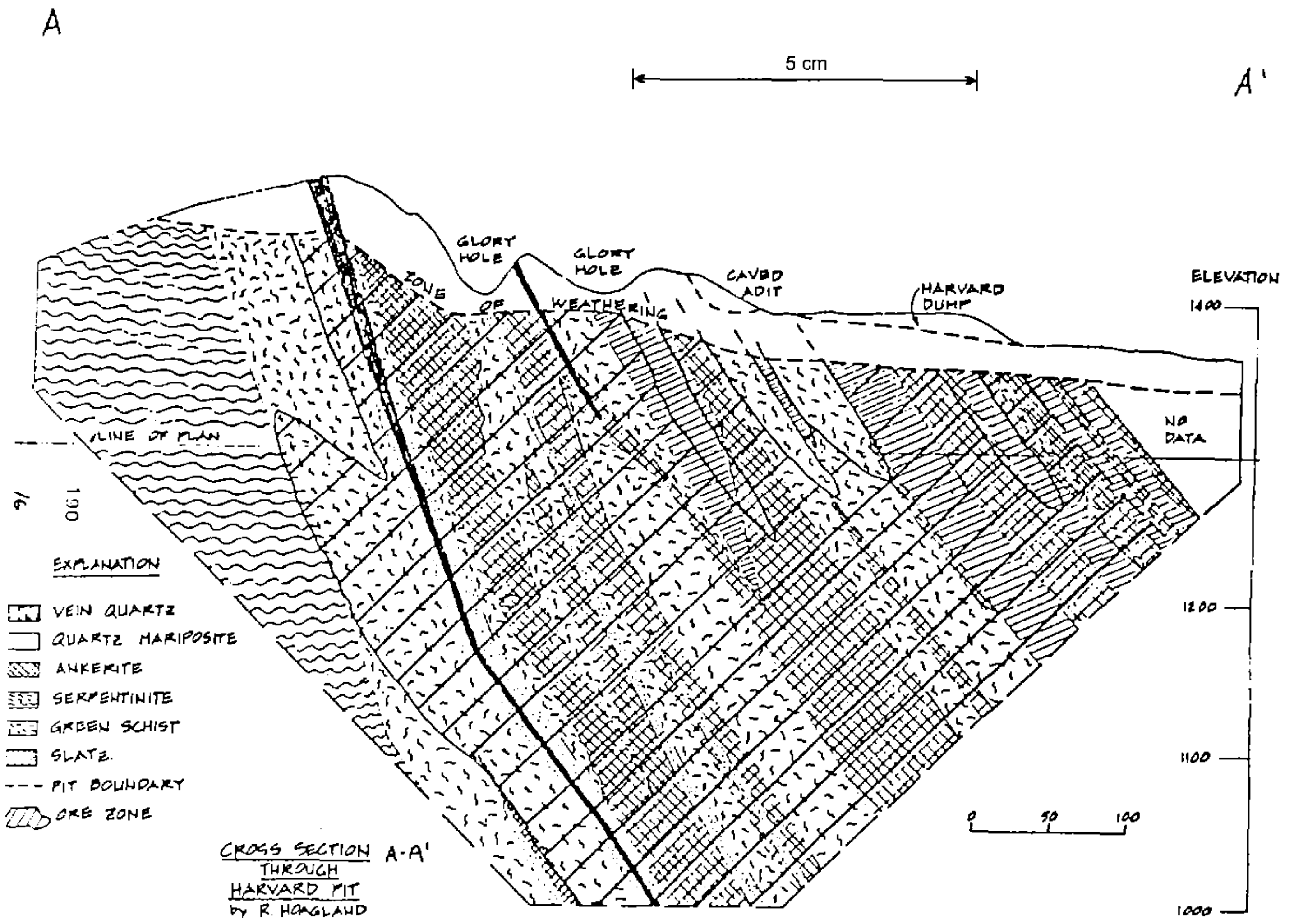


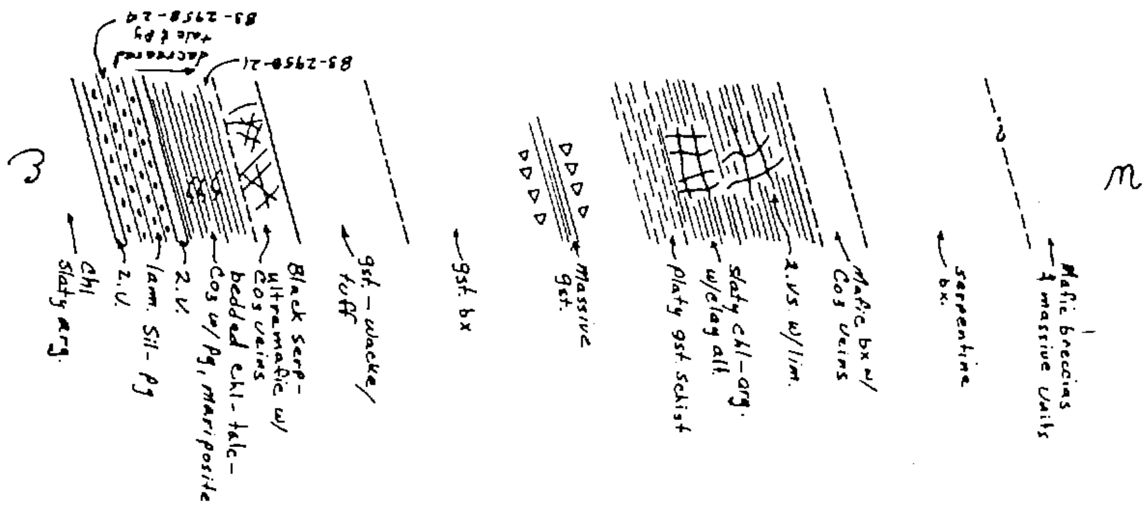
Moccasin Point Section - Jacksonville Road, Tuolumne Co. Calif

Scale approx. 1" = 100'



Sample assay results are listed with Coulterville section samples (STOP # 5)





"Mother Lode Structure" Traverse 1000' South of Harvard Mine Hwy. 120. 1" = 100'

Sample assay results are listed with Coulterville section sample (STOP #5) the footwall and hanging wall. Within these zones, the gold occurs mainly as 5-25 micron blebs of native gold associated with pyrite along with a small percentage of free milling gold. The overall ore zone strikes northerly and dips about 60 degrees to the east. It varies in width from 20 to 220 feet over a length of several thousand feet. The ultimate pit depth could extend to about 500 feet below Woods Creek. Output is expected to exceed 130,000 ounces of gold per year from the 6000 tons per day operation. Under current reserves, the project is expected to have a 14-year life.

After mine tour return to Hwy 49/108 and reset odometer.

0.0 0.0 Turn left onto Hwy 49/108 from High School Road back toward Jamestown.

1.8 1.8 Turn left onto Rawhide Road (north).

3.2 1.4 Table Mountain andesite exposed in road and railroad cuts. Table Mountain is a sinuous ridge formed from late Tertiary lava which filled a meandering river channel. Resistance to erosion has caused an inverted valley geomorphic feature.

3.9 0.7 Rawhide mine site to left.

5.8 1.9 Turn left onto State Hwy 49 North. Entering Tuttletown gold mining district.

9.7 3.9 Melones Reservoir bridge - Calaveras County line. Entering Carson Hill gold mining district.

10.8 1.1 STOP 10. ROADCUT EXPOSURE OF MOTHER LODE SECTION. Silicified conglomerate on edge is exposed on west side of Hwy 49 while fine-grained sediments are exposed on the east side. Exposed along the old route of Hwy 49 to the east is a thick section of fine-grained felsic and mafic volcanics. The Carson Hill mine is situated within this section of rock about 2000 feet to the east. Refer to the geologic map of the Carson Hill mine (STOP 11).

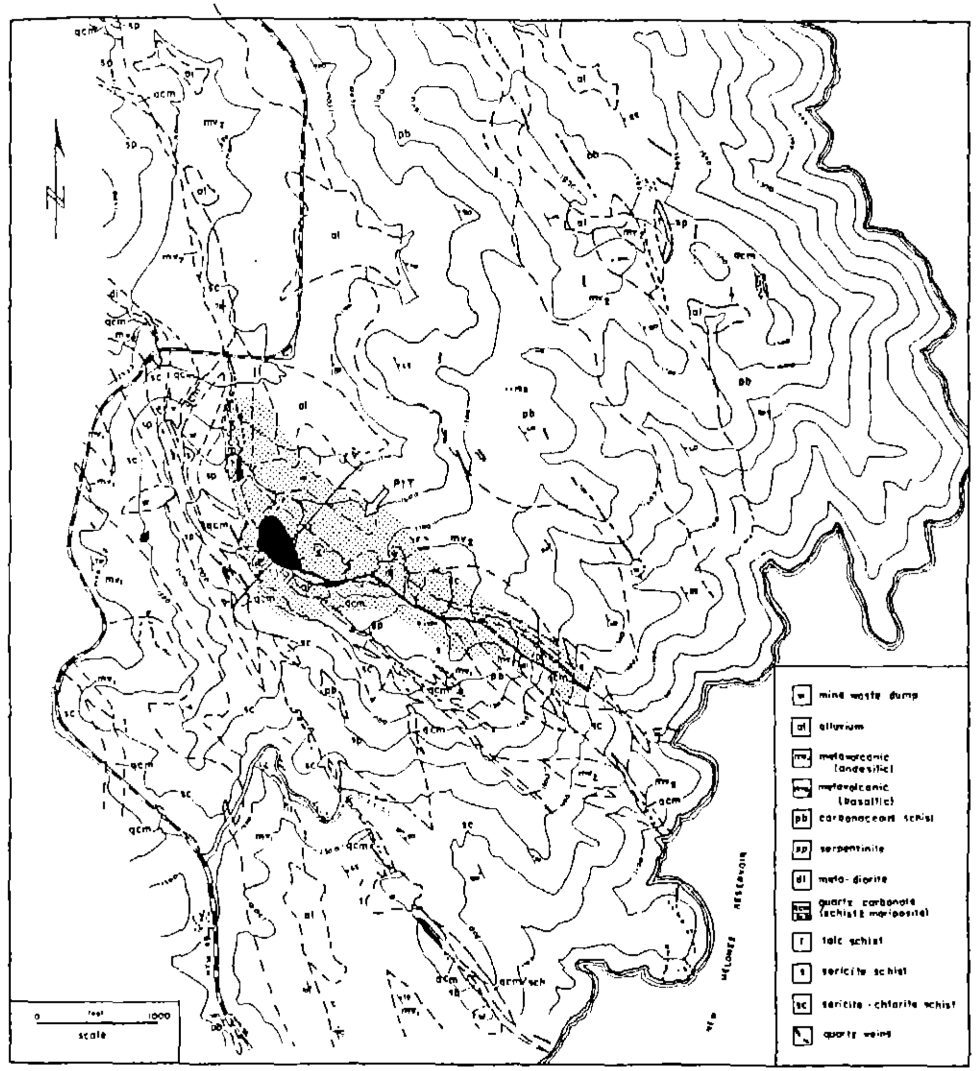
12.0 1.2 STOP 11. CARSON HILL MINE, Carson Hill Gold Mining Corporation.

The Carson Hill mine site includes about 550 acres of land located along the Mother Lode gold belt just south of the historic mining community of Carson Hill, Calaveras County. Here, gold mineralization has occurred along and in close proximity to a splay of the Melones fault which cuts metavolcanic and metasedimentary rock (see geologic map and cross section). Traditionally, rock units exposed west of this mineralized fault have been considered to be Jurassic in age while those exposed to the east have been considered to be of Paleozoic age. Recently, however, it has been suggested that all layered rocks in this area are Late Jurassic in age with those exposed on the east being more highly deformed and recrystallized correlatives of those to the west.

Stratigraphic units exposed on the property generally strike northwesterly and dip steeply to the east. Foliation trends vary from N10W to N40W with steep dips to the east. Major rock units include hornblende andesite, metavolcanic rock of a more mafic composition, carbonaceous schist, talc schist, sericite schist, sericite chlorite schist, serpentinite, quartz-carbonate rock, including mariposite, and massive milky white quartz vein. In addition to the massive vein exposures, there are a number of economically significant, gently dipping quartz veins "flat veins" that occupy a series of thrust faults exposed on the property and numerous northeast striking, northwest dipping veins. It has been observed at the Carson Hill mine that the richer ore zones are present in rocks cut by numerous quartz stringers and that the ore grade in these zones tend to increase nearer the mineralized fault splay occupied by the massive quartz vein. Within these ore zones, gold occurs in disseminated form, both in association with iron sulfide and in microscopic native form.

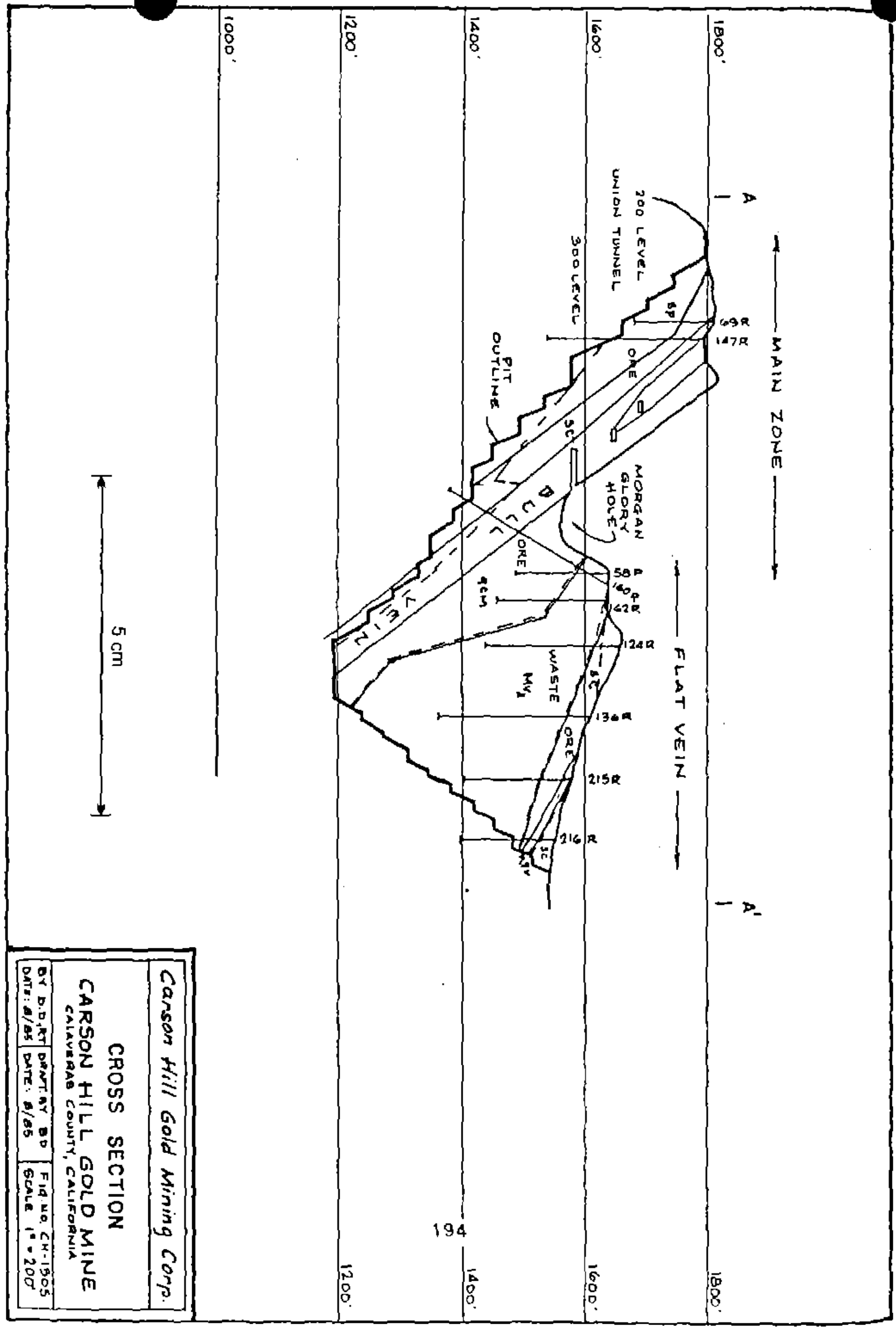
Carson Hill Gold Mining Corporation has mineable ore reserves of about 16 million tons grading at 0.046 ounces of gold per ton. 30,000 tons of rock per day are being mined by private contractor. The ore is processed using cyanide heap leach with a 75% recovery rate.

After mine tour return to Hwy 49 and reset odometer.



GEOLOGIC MAP - CARSON HILL MINE

Source: GRANDVIEW RESOURCES INC. - CARSON HILL GOLD MINING CORP.



0.0	0.0	Turn right onto Hwy 49 North toward Angels Camp.
1.5	1.5	Entering Angels Camp gold mining district.
3.4	1.9	Entering Angels Camp.
4.0	0.6	Utica and Lightner mine sites on left. Depression due to mine workings collapse.
10.0	6.0	Entering San Andreas gold mining district.
15.1	5.1	Entering San Andreas.
17.0	1.9	Junction of State Hwys 49 and 12. Keep right at Y intersection and continue north to Mokelumne Hill.
17.6	0.6	Serpentinite marking trace of Melones fault zone exposed in roadcut.
20.2	2.6	Fluvial deposits of ancient Mokelumne River channel overlain by tuffs and gravels of the Valley Springs and Mehrten Formations exposed in road cut.
23.0	2.8	Chili Gulch placer diggings. During World Wars I and II, optical grade quartz was recovered here. Entering Mokelumne Hill gold mining district.
24.3	1.3	Entering Mokelumne Hill.
27.3	3.0	Mokelumne River bridge -- Amador County line.
28.8	1.5	Entering the Jackson-Plymouth gold mining district, the most productive district along the Mother Lode belt.
30.4	1.6	Entering Jackson.
31.0	0.6	Turn right into the Amador Inn.

END OF DAY 3

DAY 4 - Sunday, April 5

0.0	0.0	Junction of State Hwys 49 North and 88. Proceed north on Hwy 49 toward Sutter Creek.
1.2	1.2	Kennedy mine on right, Argonaut mine on left.
3.0	1.8	Sutter Hill. View of headframes and dumps of the Central and South Eureka mines to right. The Central Hill was the last major mine operating along the Mother Lode, closing in 1953.
4.1	1.1	Old Eureka mine dump on right.
4.4	0.3	Entering Sutter Creek.
5.1	0.7	Lincoln Mine on left. Exploration work is currently being conducted in a joint venture between Callahan Mining and Pancana on this property.
6.4	1.3	Entering Amador City.
6.7	0.3	Headframe, foundations, and mine dumps of the Keystone mine on left.
6.8	0.1	Turn right onto Water Street.
6.85	0.05	Turn left onto East School Road.
6.9	0.05	Original Amador mine site on right.
7.1	0.2	Turn right at T intersection.
7.2	0.1	Keep left at T intersection. Bunker Hill mine on right.
7.8	0.6	Treasure mine site on right.
8.2	0.4	Headframe of the Fremont mine on right.
8.4	0.2	Gover mine site ahead. Turn left at T intersection heading west to Drytown.

9.7 1.3 Drytown, once the home of 26 saloons. Turn right on Hwy 49 North.

10.9 1.2 Junction of State Hwys 49 and 16. Turn right and continue on Hwy 49 to Plymouth.

12.5 1.6 Plymouth City limits.

13.0 0.5 Eureka shaft headframe of Plymouth Consolidated Mines on right.

18.3 5.3 Cosumnes River bridge — El Dorado County line.

20.3 2.0 Entering the Nashville gold mining district.

25.0 4.7 Entering El Dorado gold mining district. Main quartz vein system of the Mother Lode belt is located about a mile east of here. The Ophir, Minihaha and Pocahantos mine sites are located along the ridge on left side of road.

25.4 0.4 Church-Union mine sites are located about one mile east of here. Parts of these properties are now occupied by the county refuse disposal site.

28.4 3.0 Entering the community of El Dorado. Turn right following Hwy 49.

30.3 1.9 Entering Diamond Springs.

30.5 0.2 Turn left to continue on Hwy 49.

32.7 2.2 Entering Placerville.

33.4 0.7 Turn right on main street.

33.6 0.2 Turn left on Bedford Avenue. Note vertically dipping, highly foliated and sheared rocks exposed behind the pizza parlor on the right. The rocks, composed mainly of talc-ankerite schists, mark the trace of the Melones fault zone.

33.7 0.1 Cross Interstate Hwy 50 and continue north on Bedford Avenue.

34.5 0.8 STOP 12. MELONES FAULT ZONE TRAVERSE. Turn right into entrance of Bedford Park.

We will first tour the adit of the Goldbug mine and then cross the street to make a traverse of the Melones fault zone. The fault zone is exceptionally well exposed here and shows almost all the typical alteration features found associated with Mother Lode gold mineralization.

After Stop 12 is complete, return to Hwy 50 and travel to Reno.

END OF FIELD TRIP

Reprinted from Nevada Bureau of Mines and Geology Report 41.

THE McLAUGHLIN MINE NAPA AND YOLO COUNTIES, CALIFORNIA

by Norman J. Lehrman
Chief Geologist, Homestake Mining Co., Lower Lake, California

INTRODUCTION

The McLaughlin gold mine, discovered by Homestake Mining Company in 1978, is a preeminent example of a hot-springs type epithermal precious metals deposit. Utilizing a cutoff grade of 0.06 oz gold per ton, ore reserves of approximately 19,300,000 tons at 0.152 oz gold per ton are indicated. The present operation began producing dore bullion in March, 1985, after a capital outlay of about 280 million dollars. Known reserves will sustain the 3,000 ton per day processing facility for 15 to 20 years.

The deposit was discovered at the site of the historic Manhattan quicksilver mine as a result of a concept-oriented exploration program focused on a hot-spring model. Prominent exposures of chalcedonic hot-spring sinter and numerous chalcedony-quartz veins containing gold in quantities of up to several ounces per ton were present in natural outcroppings and old mine workings over a strike-length of nearly one mile and a width of about 300 ft.

GEOLOGICAL SETTING

The McLaughlin system was localized within the major regional fault boundary which divides the Franciscan ophiolite melange of the Coast Ranges accretionary prism from the upper Jurassic marine sedimentary rocks of the Great Valley forearc basin. This complex northwest trending structure, probably the Stony Creek fault, is interpreted as the oldest and easternmost of the Coast Ranges subduction faults. Because of progressive underwedging by younger accretionary packets to the west, the fault has been rotated into a steeper dip orientation, ranging from about 45° northeastward in the mine area to near-vertical or overturned a few miles farther to the northwest.

In the immediate mine area, the footwall lithology is an ophiolite melange, consisting dominantly of serpentinite with scattered large knockers of greenstone and Franciscan graywacke. The hanging wall is made up of mudstone, siltstone, and minor conglomerate of the Great Valley Group Knoxville Formation. The fault consists of a 300- to 800-ft-wide zone of cataclasite and slickentite derived from both hanging wall and footwall lithologies. Included within the cataclasite are relatively coherent rootless lithons of pillowed sea-floor basalt with maximum dimensions of thousands of feet.

Beginning about 20 m.y. ago in the San Francisco Bay area, and stepping northward through time, a wave of volcanism affected the region roughly synchronous with the northward transit of the Mendocino triple junction along the coast. At about the time when the triple junction is thought to have been at the latitude of the McLaughlin Mine, a cluster of small andesitic basalt plugs was emplaced in and near the fault zone, probably in response to dilation triggered by strike-slip reactivation of the old subduction thrust.

FORMATION AND CHARACTER OF THE McLAUGHLIN DEPOSIT

The initial manifestation of this magmatic activity in the mine area was a period of phreatomagmatic eruptions that excavated a series of small maar-like craters typically a few hundred feet in diameter and of similar depth. Surrounding ejecta blankets contain angular clasts of all underlying rock types plus basalt (sometimes milled (?) into subangular to rounded forms) and volumetrically minor amounts of pumice, none of which is welded. Significantly, a few auriferous chalcedony vein fragments have been observed in these volcanoclastics, suggesting that the initiation of the hydrothermal system at least slightly predates the earliest eruptive phenomena. The mine area basalts have been K-Ar dated at 2.2 m.y. Basaltic magmas invaded the craters, forming mushroom shaped domes squatting directly above the vents. Gold mineralization is spatially coincident with the diatreme complex.

By far the most intense phase of hydrothermal activity occurred following lithification of these extrusive olivine-pyroxene basalts and was probably driven by the heat of the retreating magma at depth. Hypogene alunite found within the basalts and underlying agglomerate yields K-Ar dates as recent as 750,000 years. The agglomerate is typically pervasively silica-flooded, and auriferous veins cut both the silicified agglomerate and the overlying basalts.

At the ground surface, two or more siliceous sinter terrances formed. These consist of porcelaneous, porous, white chalcedony showing unmistakable features of subaerial deposition, such as fossil filamentous bacteria, algae, rimstone terracettes, geyserite "pearls", and syneresis polygons. The preserved sinter pile in the main central terrace (the San Quentin sinter) was about 400 ft in diameter, and locally was at least 100 ft thick. Interbedded with the sinter are numerous hydrothermal explosion breccias containing blocks of sinter up to 15 ft in diameter together with clasts of all underlying rock types. The sinters are generally not anomalous with respect to epithermal elements with the exception of mercury, which is present both as diffuse cinnabar pigmentation pervading the chalcedony and as cinnabar "paint" on crosscutting fractures. Most historical Manhattan Mine quicksilver production (about 17,000 flasks) was derived from such material located within 60 ft of the ground surface.

The mineralized zone beneath the sinters consists of a multiple stage chalcedony-quartz vein stockwork together with pervasively silica-flooded cataclasite, agglomerate, and breccia lithologies. The veins strike transverse to the overall orebody trend, which is essentially conformable with the fault. This ladder-vein configuration suggests continued dilation by strike-slip reactivation of the older thrust zone. Locally, sheeted veins up to 100 ft wide made up of 1-inch to 2-ft wide bilaterally symmetrical vein components reinforce the idea that conduits were opened and repeatedly reopened by episodic fault movement. Gold mineralization is closely tied to silicification, and in particular to multiple stage veining. All rock types in the deposit area locally host ore-grade concentrations, although rheological properties of the various rock types are reflected in vein size, geometry, and abundance.

The orebody is wedge-shaped in sectional view, and dips conformably with the host fault to the northeast. As presently defined, the mineralization dies out at a depth of slightly less that 1,000 ft. In plan view, the deposit trends

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AMIRA
NQ GOLD PROJECT

ONTARIO GEOLOGICAL SURVEY

Open File Report 5524

An Integrated Model for the Origin of Archean Lode Gold Deposits

by

A.C. Colvine, A.J. Andrews, M.E. Cherry, M.E. Durocher, A.J. Fyon, M.J. Lavigne, Jr., A.J. Macdonald, Soussan Marmont, K.H. Poulsen, J.S. Springer and D.G. Troop

1984

Ontario

Ministry of Natural Resources

Hon. Alan W. Pope
Minister

John R. Sloan
Deputy Minister

ABSTRACT

Archean gold deposits occur in many forms, including discrete quartz veins, pervasive microveining, sulphidic haloes to veins and tabular sulphide disseminations. Host lithologies include virtually every rock type of greenstone terrains. These differences are superceded in importance by other aspects of the geology of the deposits, described below, which are generally consistent from one deposit to another, thereby indicating the involvement of a single fundamental genetic process.

In many documented examples, we can define the sequence of events which affected areas of mineralization, prior to, during and following the mineralizing event. It is critical to note that the episode of mineralization and wallrock alteration is relatively late, post-dating volcanism, sedimentation, some metamorphism, episodes of intrusion and at least one episode of tilting or folding. In most instances only minor deformation and limited intrusive activity post-dates mineralization and alteration. The alteration temporally associated with the mineralizing event required introduction of large volumes of hydrothermal fluid, in excess of the volume of the altered rock. Structurally induced permeability provided the main access for the hydrothermal fluids which were derived from a source external to the immediate environment of deposition.

Gold deposits occur within linear tectonic zones in which relatively high strain magnitudes and available kinematic indicators attest to shearing in transcurrent or thrust systems. These zones contain fault rocks and discrete ductile shears as well as relatively undeformed megalithons; they are also marked by transposition of stratigraphy into rough parallelism with the deformation zone. Within the zones, many conduits for fluid flow were generated, dependent on variable competency response to prevailing strain. The systems were dynamic and evolved to produce several forms of permeability and styles of mineralization in any one location.

Alteration varies considerably in extent and expression primarily as a function of host lithology. Carbonatization is most prominent. Preceding and synchronous with gold deposition, it is best developed in more mafic lithologies where the reactivity of precursor mineral assemblages is high. Silicification, sulphidation and alkali metasomatism are more directly associated with gold deposition and for the most part do not form broad alteration haloes. The zonation of alteration is consistent between most deposits, but variable in scale.

Intravolcanic felsic intrusions are present close to most deposits, but have variable compostion. This spatial association does not necessarily imply a genetic association; however these intrusions are temporally related to the late plutonic event which terminated the Archean. Furthermore deformational response and metamorphic-alteration relationships show that gold concentration took place during this event.

Fluid inclusion and light stable isotope data, compiled from Archean gold deposits throughout the world, show a remarkable degree of internal consistency; they indicate the involvement of a unique fluid, distinct from those involved in the formation of other deposit types. The mechanism of gold deposition from the hydrothermal fluid involved a combination of factors including: (i) supersaturation caused by changing intensive variables, (ii) supersaturation through fluid evolution resulting from wall rock interaction, (iii) extraction by pre-existing and introduced sulphide and carbon species.

The fundamental requirements leading to the generation of an Archean gold deposit are (i) source of fluid and gold, (ii) a conduit to permit focussed transportation; (iii) a mechanism to induce localized deposition and concentration of gold. In the depositional environment lithology exerted a primary control in the siting of mineralization and the expression of alteration; most variability results from variable mechanical response to deformation of host lithologies and their heterogeneous mineralogy. Transportation of fluid and gold was achieved through major crustal structures which focussed fluid ascent. The source of the unique fluid has not, yet, been conclusively established. The major crustal structures represent a change in tectonic style temporally related to the major event of batholith emplacement which represents the termination of the Archean. Fluids and gold were most probably derived from either large areas of lower crust (undergoing granulitization) or upper mantle as an integral part of this period of crustal stabilization.

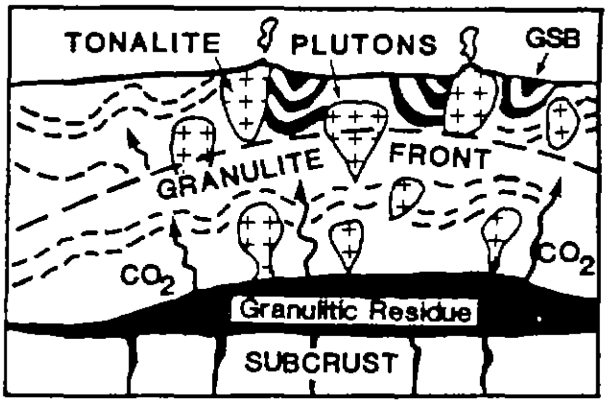

Figure 52: Model of crustal growth and granulite metamorphism - A granulite front develops from carbonic metamorphism caused by CO_2 influx. Granulitic residue and tonalitic plutons invade the upper crust including greenstone belts (GSB)(Newton et al. 1980).

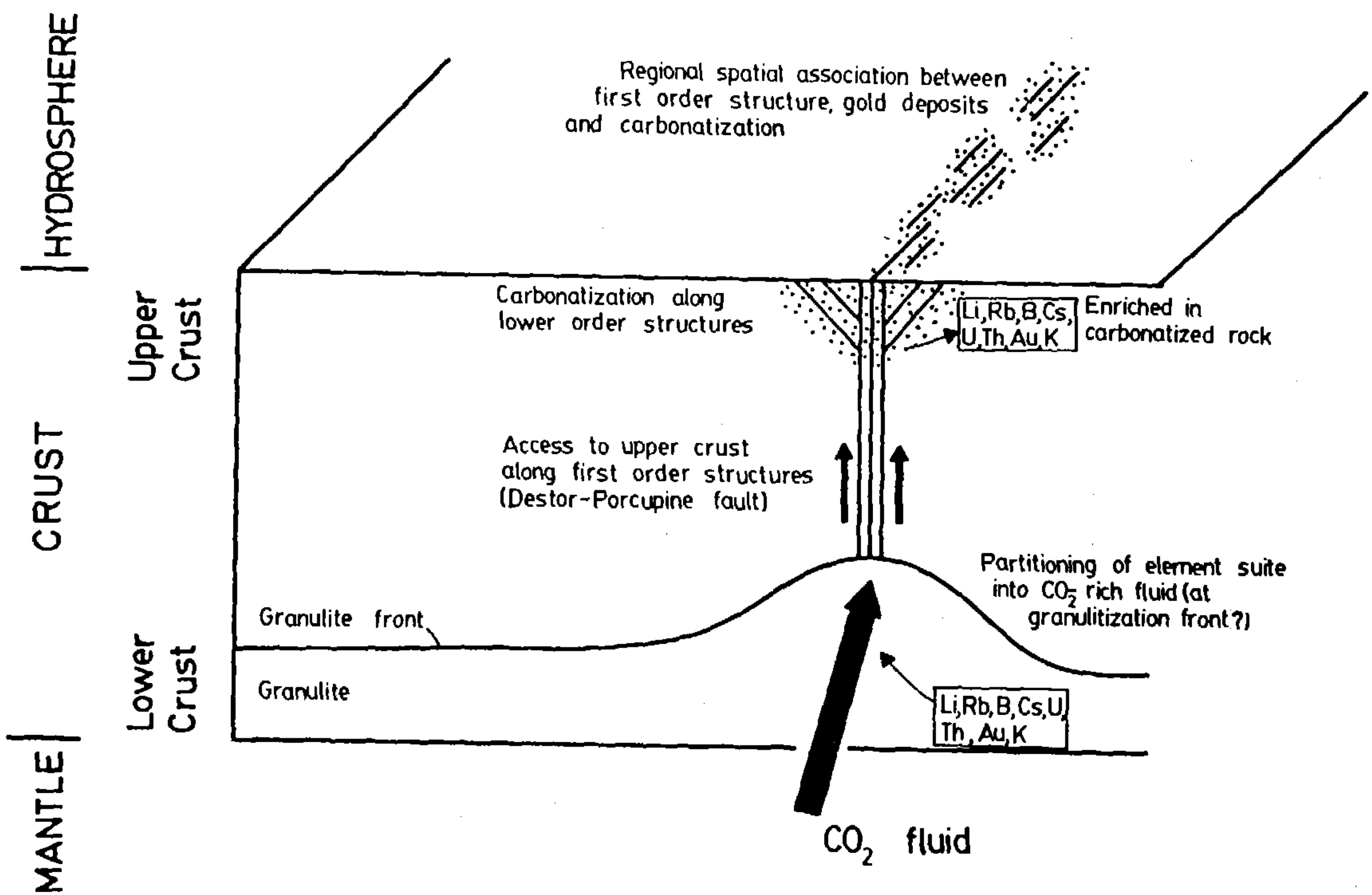

Figure 53: Influx of CO_2 into lower crust promoting upward progression of granulite front, extraction of species such as Li, B, Au, K, chanelling of fluids in first order carbonatization and mineralization in the upper crust.

APPENDIX 5

Lawrence D. Meinert's Report - Observations on

Skarns in Western Tasmania

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(ie 88-2852B)

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Observations on skarns in Western Tasmania - with particular reference to gold

Submitted to Renison Goldfields Corporation

1 August, 1988

by

Lawrence D. Meinert
Washington State University
Pullman, WA 99164
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Executive Summary

Skarns at Pine Hill, Moina, Fletcher's Adit, and Stormant are systematically zoned relative to their associated plutons. Highest gold grades occur in distal low temperature zones associated with high pyroxene:garnet ratios and distinctive garnet, pyroxene, and amphibole compositions. Stormant has the most potential and has some of the mineralogical features of large producing gold skarns. However, it appears to be limited in size by the composition of the associated pluton. More prospective skarns should be sought associated with more mafic, oxidized plutons.

Introduction

The skarn-associated plutons in Western Tasmania are high silica, leucocratic, "S-type" intrusions that appear to represent a range of intrusion depths of 2-8 km. Such intrusions are associated worldwide with skarns containing Sn, F, and other incompatible elements. The deeper examples tend to contain more tungsten. Skarns with this plutonic association are not known to contain large quantities of gold. The gold that does occur with these skarn systems should follow the general pattern of known gold skarns elsewhere in the world (Meinert, 1987). That is, gold-rich portions of Tasmanian skarn systems should occur in distal regions with low temperature retrograde alteration of high iron pyroxene-rich skarn. Bismuth and arsenic will likely be anomalous in high sulfide rocks. Skarns in four locations in Western Tasmania were examined during my visit, listed in approxiamate order of proximity to their respective igneous sources (and thus in inverse order of their gold potential): 1) Pine Hill near Renison Bell, 2) Moina, 3) Fletcher's Adit, and 4) Stormant.

Pine Hill - Renison Bell system

Skarn at Pine Hill was observed in drill hole #651 which intersected the Pine Hill granite at a depth of 602 meters. The pluton is a coarse-grained, equigranular, quartz-rich granite consistent with a lower crustal petrogenesis. Such plutons are typically associated with tin skarns (Meinert, 1983). At the granite contact the carbonate-poor sedimentary rocks have been converted to a biotite-pyroxene hornfels. From about 590 to 575 meters, this hornfels is overprinted by a pyrrhotite-magnetite-amphibole retrograde alteration. From about 562 to 556 meters, a more calcareous layer has been converted to pinkish-tan garnet skarn. The high garnet:pyroxene ratio and the garnet color are both consistent with a relatively high temperature, proximal skarn occurrence. The garnet is likely to be slightly sub-calcic with minor almandine-spessartine, although largely grossularite. This would be consistent with a tin-bearing skarn system (e.g. Einaudi et al., 1981). Such skarns are not known to contain much gold.

A sample of the retrograde alteration at 586 meters was selected for analysis to compare with the gold-bearing retrograde alteration at Stormant. In thin section, the sample consists of 0.01-0.5mm green pleochroic hornblende with associated pyrrhotite>arsenopyrite=chalcopyrite>cassiterite. The hornblende has probably replaced pyroxene and biotite grains but no remnants are left. Analysis of the hornblende with electron microprobe indicates a typical iron rich variety with high fluorine (0.47 wt. %) and high chlorine indicative of a proximal location in a tin skarn system (Table 1). Other features indicative of generally high temperatures are the high TiO_2, Al_2O_3, Na_2O, and K_2O contents. This is not the type of amphibole usually associated with economic gold grades and is in clear contrast to the more distal type of ampibole formed in the Stormant system. Based on igneous petrology, skarn mineralogy, and a single amphibole composition, little potential is indicated for either high gold grades or tonnage within the Pine Hill - Renison Bell system.

Skarns associated with the Dolcoath Granite

A series of skarns are associated with the shallow westernly dipping contact of the Dolcoath Granite. Like the Pine Hill granite, the Dolcoath pluton is a coarse-grained, equigranular, quartz-rich granite consistent with a lower crustal petrogenesis. The granite is locally greisenized and cut by quartz-tourmaline veins. Tin has been mined from such veins in the granite as well as surrounding altered sedimentary rocks. Total production appears to have been small. Nowhere does limestone come into direct contact with the granite, thus all the skarns in the district have formed at varying distances from the plutonic contact. The most proximal of these occurs at Moina where Kwak and Askins (1981) estimated 200 meters of unaltered (?) Moina sandstone separates skarn from granite. Skarns at Fletcher's Adit and Stormant are further west from the main Dolcoath contact than Moina and thus, presumably represent even more distal occurrences. From this relationship, one would predict progressively higher pyroxene:garnet ratios, pyroxene iron and manganese content, and gold grade. However, the total gold content is likely to be small due to the associated igneous rocks.

Moina

Surface exposures at Moina are small but descriptions of general geology and skarn mineralogy are reported by Kwak and Askins (1981) based upon limited drill core study (skarn mineral compositions are only reported in holes #5 and 12 west of the main Moina showing). Garnet from the Moina area contains 50-60 mole % andradite and up to 7 mole % almandine; the almandine content increases from core to rim indicating a general increase in sub-calcic component with time (Table 1). The composition and enrichment trend of this garnet is typical of tin skarns.

Pyroxene at Moina appears to be compositionally zoned, consistent with the apparent distance to the source intrusion. In hole #5 (interpretted as closest to the fluid conduit by Kwak and Askins, 1981), pyroxene is $Hd_{15}Jo_{0.5}$ whereas in hole #12 (interpretted as furthest from the fluid conduit by Kwak and Askins, 1981), pyroxene is $Hd_{62}Jo_{8}$ (Table 1). This is the typical enrichment trend which occurs as a hydrothermal fluid travels away from its source (e.g. Meinert, 1987). That such a pronounced enrichment trend is developed over a distance of about 100 meters indicates that the overall hydrothermal system is of limited size and that any potential for gold enrichment in distal zones is also likely to be of limited size.

Amphibole compositions at Moina are consistent with the garnet and pyroxene. Furthermore, amphibole at Moina is TiO_2 poor and MnO rich compared to that at Pine Hill. This indicates that skarn at Moina is lower temperature and further from the source than that at Pine Hill. However, the consistently high fluorine content (0.5-0.6 wt % F) of the amphibole at Moina indicates quite clearly that this is a tin skarn system and that it is related to the Dolcoath granite.

Fletcher's Adit

Skarn at Fletcher's Adit was observed briefly in drill core. The skarn is characterized by high garnet:pyroxene ratios relative to Stormant. The relative lack of pyroxene and amphibole alteration indicates that this skarn is very unlikely to contain significant gold mineralization. Because of this limited gold potential, no samples were taken for further study. It probably is not a productive exercise to mineralogically quantify this lack of gold potential.

Stormant

Skarn at Stormant is characterized by high pyroxene:garnet ratios with abundant amphibole alteration and visible bismuth minerals. All of these features are typical of gold-bearing skarns. The details of the skarn mineralogy are consistent with this being the most gold rich part of the skarn hydrothermal system related to the Dolcoath granite. However, even though locally high gold grades are predicted, size potential is still limited by the fundamental igneous petrogenesis.

Average garnet:pyroxene ratios range from a high of 3:1 in samples in the trench outside of the adit to a low of 1:4 in the samples from the face at the end of the adit, a distance estimated at about 50 meters. This indicates an overall fluid flow up the stratigraphic section, consistent with fluids feeding from underneath the limestone-sandstone contact. Garnet is present as veins cutting fine grained pyroxene skarn. Garnet veins contain quartz, amphibole, and native bismuth and typically have an envelope of coarser grained more iron rich pyroxene. The garnets are zoned with the rims more iron but less manganese rich than the cores (Table 1). Some of the cores contain a minor almandine component indicating that this is still part of tin skarn system.

The pyroxene at Stormant is consistently iron rich with minor manganese enrichment. Pyroxene compositions are similar to those of major gold skarn systems (Figure 1) but lack the high aluminum content characteristic of large tonnage gold skarn systems (Meinert, 1987). The relatively small manganese enrichment in samples spanning about 50 meters indicates that the gold mineralized part of this skarn system should extend for at least 2-3 times the length of the present exposures. However, the exposed stratigraphic thickness appears to be at most about 10 meters.

Gold and bismuth mineralization appears to be strongly associated with amphibole retrograde alteration of pyroxene. At the thin section level, amphibole-quartz veins contain native bismuth, gold, and minor arsenopyrite where they cut pyroxene skarn. Many of the amphibole veins contain euhedral garnets along the vein walls. It would appear that gold is being deposited during the crossover from pyroxene stability to garnet-amphibole stability and then continues on to lower temperature where only amphible is stable. Some of the amphibole alteration is quite massive and it is predicted that drilling will encounter rock in which no garnet or pyroxene remains and even some of the amphibole is being altered to chlorite and/or clay. The amphibole is compositionally distinct from that at either Pine Hill or Moina. Stormant amphibole has lower titanium and alkaliis but much higher manganese. All of these features are consistent with Stormant being the lowest temperature and most distal of the three skarn occurrences. However, the relatively high fluorine content (0.46 wt % F) clearly indicates that although Stormant is distal, it is the distal part of a tin skarn system.

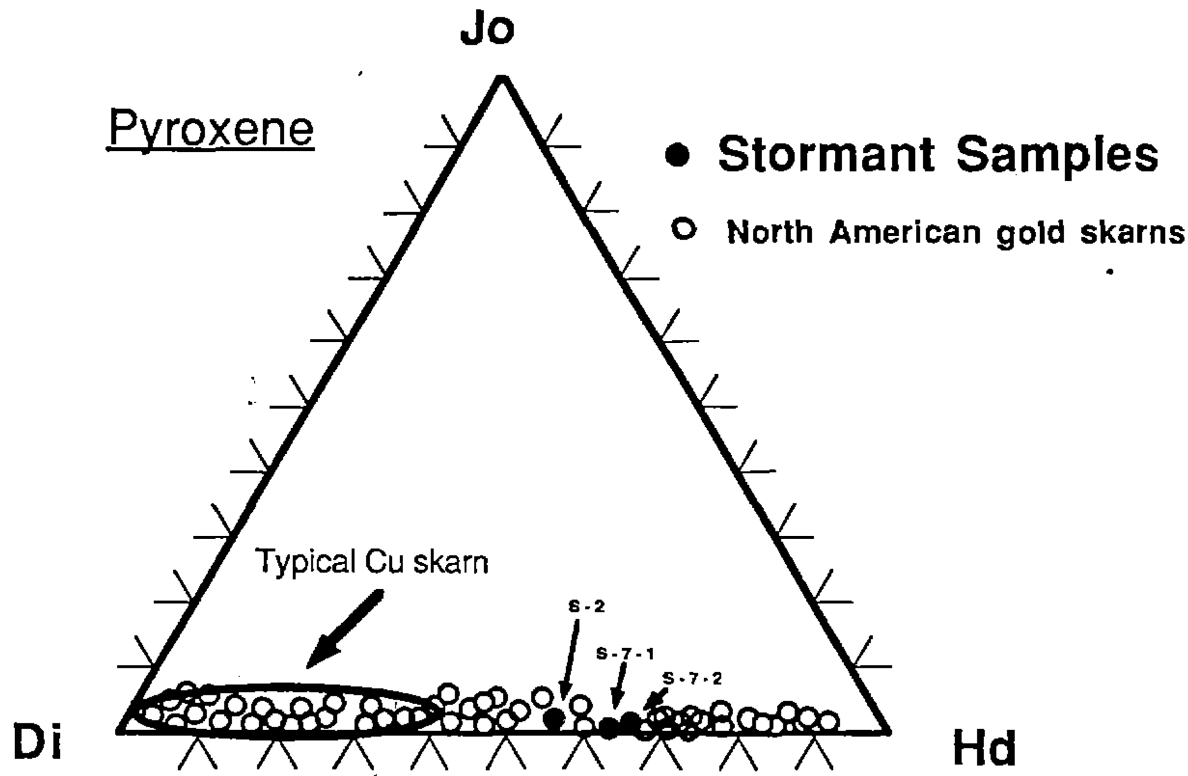
Conclusions and Recommendations

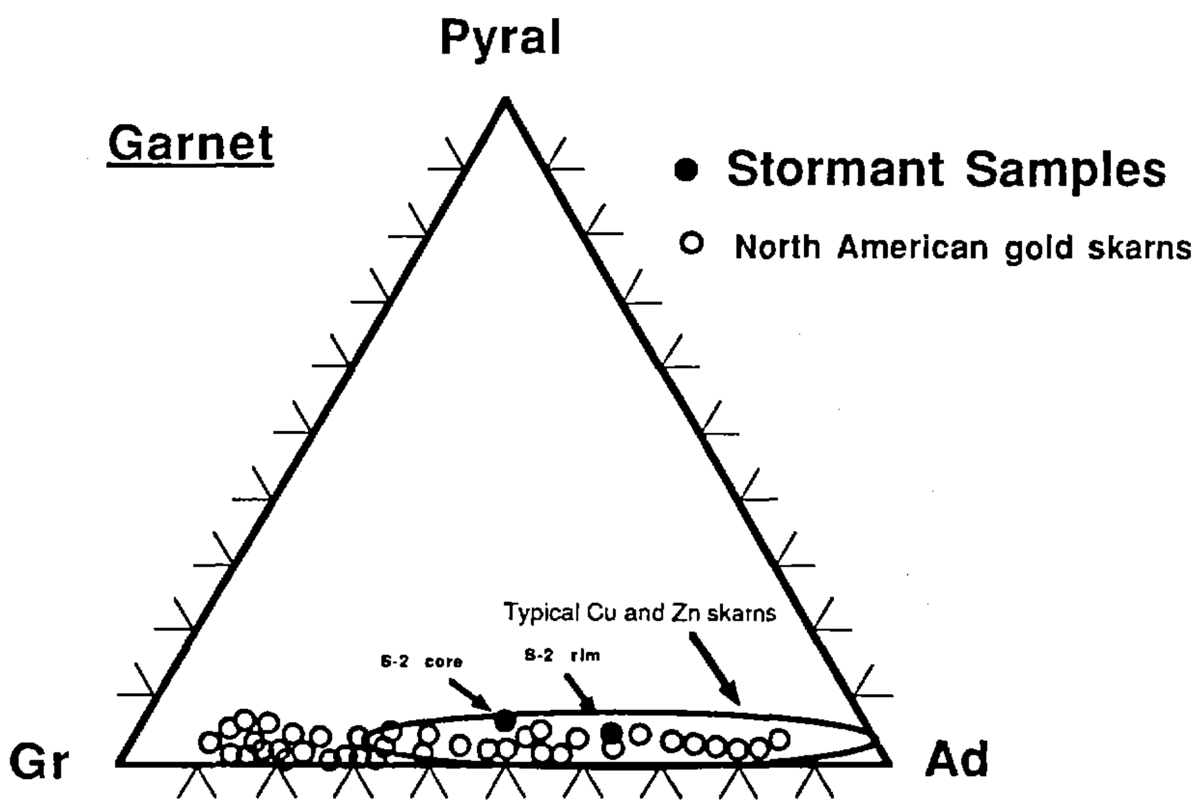
All the skarns examined in western Tasmania are related to high silica, coarse grained granites which may be broadly characterized as "S-type". Such plutons are well known for their association with Sn and W systems, and associated skarn in carbonate rocks, but are not very prospective for gold. There are good petrologic reasons for this including the reduced nature of such plutons, their overall low water content, and the lack of large vertically zoned magma chambers. However, within a given petrologic province the occurrence of the highest gold grade within the available skarn is relatively predictable. The four skarn systems described in this report, Pine Hill, Moina, Fletcher's Adit, and Stormant represent a range of skarn environments, from most proximal to most distal, respectively. For each of these, I have described the characteristic skarn mineralogy and typical mineral compositions. Gold occurs with iron-rich pyroxene in distal zones of abundant amphibole alteration. Systematic changes in garnet:pyroxene ratio combined with the extent of iron and manganese enrichment in pyroxene are good indicators of distance from the source intrusion. The size of the pyroxene dominant zone is a good indicator of the potential size of gold mineralization. Based upon these criteria, Stormant is by far the most prospective of the skarns I observed in Tasmania. However, I would characterize Stormant as the most gold-rich part of a relatively gold poor system. It is probably worth testing Stormant as a potential small ore body, however I would not place the Dolcoath granite high on a list of plutons likely to form major gold deposits.

Tasmanian Skarn Electron Microprobe Data

Sample #	S-2	S-2	K&A 6	K&A 7	K&A 8	K&A 9	S-2	S-7	S-7
Analysis	pt 2 core	pt 2 rim	wrig rim	wrig core	c.s. sk	u. cs sk	pt 1	pt 2	pt 1
Mineral	Gar	Gar	Gar	Gar	Gar	Gar	Pyx	Pyx	Pyx
SiO2	36.64	35.70	37.62	37.21	36.89	37.01	49.75	48.33	49.56
TiO2	0.12	0.16	0.17	0.20	0.22	0.56	0.00	0.06	0.00
Al2O3	9.56	7.35	5.97	6.09	6.97	8.29	0.57	0.35	0.24
FeO*	19.06	21.52	22.02	21.12	22.29	20.64	17.85	19.55	19.15
MnO	2.71	1.66	1.79	1.00	1.86	2.41	2.58	3.08	1.57
MgO	0.06	0.00	0.09	0.08	0.00	0.01	5.73	3.53	5.16
CaO	31.56	32.16	31.78	32.51	31.35	31.25	23.71	23.16	23.90
Na2O	0.14	0.00	0.05	0.09	0.00	0.01	0.05	0.00	0.00
K2O			0.02	0.02	0.00	0.02	0.00		
F			0.23	0.31	0.31	0.32	0.40		
Cl			0.02	0.06	0.00	0.05	0.00		
P2O5							0.02		
Total	99.85	98.55	99.76	98.69	99.89	100.57	100.66	98.06	99.58
Cations	12	12	12	12	12	12	6	6	6
Si	2.966	2.958	5.987	6.104	5.992	5.943	1.886	1.98	1.98
Ti	0.008	0.01	0.02	0.025	0.027	0.068	0.000	0.002	0
Al	0.912	0.718	1.118	1.178	1.335	1.569	0.026	0.017	0.012
Fe	1.162	1.342	3.015	2.607	2.7525	2.491	0.566	0.67	0.64
Mn	0.186	0.116	0.241	0.139	0.256	0.312	0.083	0.107	0.053
Mg	0.006	0	0.021	0.02	0	0.002	0.324	0.216	0.307
Ca	2.738	2.856	5.411	5.714	5.457	5.377	0.963	1.017	1.023
Na	0.022	0	0.015	0.014	0	0.003	0.004	0	0
K			0.004	0.002	0	0.002	0.000		
Hd							58.2	67.5	64.0
Di							23.6	16.1	22.2
Jo							6.4	8.7	4.0
Ad	49.8	61.7	61.8	60.6	56.9	51.2			
Gr	40.4	33.0	25.6	30.0	30.7	35.9			
Sp	8.2	5.3	5.5	3.5	5.9	7.1			
Alm	1.6	0.0	7.2	5.9	6.4	5.8			

Sample #	K&A 4	K&A 5	RB-651-586	S-2	K&A 10	K&A 11	K&A 12	S-7
Analysis	c.s. sk	wrigglite	pt 1	pt 2	wrigglite	l. cs sk	u. cs sk	pt 2
Mineral	Pyx	Pyx	Amph	Amph	Amph	Amph	Amph	Carb.
SiO2	53.07	48.94	44.30	48.36	36.80	36.55	39.14	0.00
TiO2	0.00	0.07	0.62	0.09	0.20	0.25	0.34	0.00
Al2O3	0.19	0.37	6.54	3.05	11.54	13.23	14.44	0.08
FeO*	4.97	18.33	28.19	27.19	27.14	26.16	23.83	0.72
MnO	0.27	2.83	0.90	3.01	0.83	1.42	1.26	1.42
MgO	15.01	4.74	3.81	4.71	3.39	2.62	2.00	0.15
CaO	24.86	22.68	10.15	11.10	11.22	9.64	11.05	54.18
Na2O	0.04	0.15	1.32	0.46	1.53	1.49	0.28	0.00
K2O	0.01	0.00	0.76	0.14	2.22	2.93	2.25	
F	0.11	0.22	0.47	0.46	0.60	0.45	0.29	
Cl	0.02	0.00	0.38	0.03	0.52	0.61	0.62	
P2O5			0.02	0.04				
Total	98.55	98.33	97.46	98.64	95.99	95.35	95.50	56.55
Cations	6	6	24	24	24	24	24	6
Si	1.986	1.976	7.086	7.563	6.288	6.268	6.608	0
Ti	0	0.002	0.074	0.01	0.026	0.032	0.026	0
Al	0.002	0.018	1.232	0.562	2.326	2.675	2.975	0.009
Fe	0.156	0.619	3.771	3.557	3.878	3.752	3.878	0.06
Mn	0.009	0.097	0.122	0.399	0.12	0.206	0.12	0.12
Mg	0.837	0.285	0.909	1.098	0.863	0.67	0.863	0.022
Ca	0.997	0.981	1.74	1.86	2.054	1.771	2.054	5.784
Na	0.003	0.006	0.41	0.141	0.507	0.495	0.507	0
K	0.0	0	0.155	0.027	0.484	0.641	0.484	
Hd	15.6	61.8						
Di	45.4	20.9						
Jo	0.5	7.6						


Jo
Pyroxene
● Stormant Samples
O North American gold skarns
Typical Cu skarn
S-2
S-7-1
S-7-2
Di
Hd


Pyral
Garnet
● Stormant Samples
O North American gold skarns
Typical Cu and Zn skarns
S-2 core
S-2 rim
Gr
Ad

APPENDIX 6

Dr. L. Leaman's Report - Gravity & Magnetic Evaluation.

Moina Region. Magnetic Data: Initial Review.

134 724115

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GRAVITY AND MAGNETIC EVALUATION
MOINA REGION

1. MAGNETIC DATA: INITIAL REVIEW

for
RGC EXPLORATION PTY LTD

by
Dr. D.E. Leaman

August 1988

MOINA1

CONTENTS

FIGURES

Note: transparent overlay for Figures 14 to 17 in pocket
Diagram original included as Figure 18

SUMMARY

Preliminary review of the available magnetic data for the Moina region of north west Tasmania indicates that most mineralised sites possess a recognisable response. That response may be clear cut or subtle depending on the style or mineralisation or, more importantly, on the changes induced in the host rocks. Recognition of any magnetic response or association of any feature inferred to be associated with new prospects as an exploration aid may be a tenuous exercise unless those factors which may modify the field responses are appreciated. Proper specification, observation and compensation of the survey are critical to the success of such direct exploration usage. The present review indicates that the Shell data is adequate for this purpose but that the Mines Department data probably is not. Many of the more subtle effects may be clarified by full drape correction which has not been undertaken.

The aeromagnetic data offer other forms of indirect exploration assistance. Although only a subset of the available data has been examined this is sufficient to define regional trends and gross elements of lithological continuity within the region. Units to be correlated with the Lorinna Greywacke are identifiable and quite widespread, if relatively thin. Substantial volumes of mafic rocks are present within the region north of Stormont and south of Oliver Hill and none of this material is exposed. The material is clearly folded and blocked, however, and is almost certainly truncated by base Ordovician unconformities.

Most major trends affecting pre-Ordovician rocks are NW-SE or NE-SW although some N-S elements can be recognised. One major and one minor belt of E-W structuring is also evident. Structures identified by surface mapping can be correlated with these features and there is little doubt that most are re-activations of various magnitudes. Some mineralised sites can be related to these features, for example the gold deposits at the headwaters of Devonport Creek. Most other mineralised sites in the Moina and Lorinna region are clustered within the volume enclosed by the northern aspect of the intersection of the conjugate trend pattern and lie either on or adjacent to an E-W axis.

Much of the structural information is only accessible after comprehensive compensation for terrain and flight path factors but it is now in a form which can be modelled and correlated with gravity data.

The issue of Tertiary basalt has also been assessed. Although there are some problems with definitive assessment in the absence of control drilling the cover appears to be very patchy and generally quite thin (<50 m) although some thick pockets which may comprise several flows are also present.

INTRODUCTION

Aeromagnetic data from the mineralised Moina-Cethana region of NW Tasmania has been reviewed. The area examined, and relevant licence holdings, are shown in Figure 1. This diagram also indicates a provisional interpretation of the form of the Devonian Dolcoath Granite (after Leaman, 1988) based on gravity data. Refinement of this interpretation will be reported separately.

Figure 1 also displays many established mineralised sites and it appears likely that there is some fundamental relationship between the granite - or its form and structural control - and much of the mineralisation. The nature of basement or Cambrian controls are not obvious in surface mapping. Skarns and various vein style deposits occur in the region. The total value of recovered mineralisation has been substantial (see Bamford and Green, 1988).

Magnetite is associated with many prospects and the magnetic method is an obvious choice for exploration on this account but many of the local rocks, including Tertiary basalt, are also magnetic. Basalt cover, or derived material, is extensive and much exploration interest may be concealed.

The review of aeromagnetic data described in this report takes the form of a feasibility and regional assessment. The study was directed toward description of

1. relationships between magnetic field and particular lithologies in order to assess normal response patterns and identify abnormalities,
2. unit continuity and/or distribution beneath basalt or other cover,
3. basalt contributions to the field and estimates of thickness and flow forms,
4. mineralisation responses (including associated skarns),
5. gross structural features.

This initial work was not intended to be exhaustive or ultimately definitive with respect to the available data or the topics listed. The basic aims of the present study (reported here as stage 1) was provision of regional indications, method application potential and feasibility, and supply of feedstock information for an expansion and integration with gravity and geological data.

DATA USED

Two aeromagnetic surveys exist. Both are available in digital forms. Each was flown as a nominal drape and essentially N-S lines.

The first survey, by Shell (refer to Mines Department open file records 82/1728), is of higher quality but somewhat fragmental and does not offer complete coverage of the area of interest (see Figure 1). The important Cethana area, for example, was not flown. The nominal line spacing was 250 m with a specified clearance of 100 m. The actual clearance varies within a general envelope of 80 to 160 m with important exceptions. The effective sample interval was about 40 m.

The second survey, by the Mines Department in 1985, was flown with a line spacing of 500 m and a specified clearance of 150 m. It covers the entire area of interest with a comparable sample spacing but the clearance condition was rarely approached across those parts of the area where the Shell coverage was broken.

For this review the more resolving Shell survey was used wherever possible in order to avoid loss of spectral information. In order to mate surveys and provide a reasonable feasibility evaluation promptly each second line was used. Considerable data thus remains for evaluation in those areas which may be deemed of interest from present work. A single compilation was generated from the two surveys by matching positions and continuation to equivalent levels. Lines wholly sourced from the Shell survey retain their 5xxx number code while those that included Mines Department data are numbered 106x. Lines east of Oliver Hill which carry the Shell designator do not cover the area north of the Round Mt. escarpment. In this area it was not feasible to combine the Mines Department data without an effort which could not be justified for such preliminary study.

The raw profile data as used from either source is presented in Figures 2 to 8. The contour presentation given in Figures 9 and 10 (9A and 10A with geology) is the contractor's compilation for the Mines Department.

METHODS

In order to provide basic evaluation of the data with respect to the several topics and objectives defined in the Introduction, the aeromagnetic data has been considered in both raw and various processed forms.

The raw data (Figures 2 to 8) are potentially deceptive due to an array of terrain effects but carry the highest resolution of local features - especially the Shell source data with nominal clearance of 100 m. Source and prospect signatures have been reviewed using this data.

In order,however, to obtain a broader perspective on structure, lithological units (continuity, characteristics) and minimise misleading terrain aspects the data have been continued from the approximate drape as observed to a fixed level. Such presentation improves definition of deep or gross sources, allows reliable modelling but excludes small or shallow sources.

Terrain compensation and continuation was undertaken by first matching the level of surface topography at the located sampling positions with the recorded height difference to obtain the spatial location of the magnetometer. An observed file relating position, magnetic field (IGRF residual value) and absolute elevation was constructed. (This file can be used to calculate the magnetic field on any surface - terrain parallel/drape or fixed level) Due to the quantity of data involved and the limited, essentially regional and feasibility objectives of this phase of the project only each second line was used. (This means that ample scope exists for superdetailing where this is judged necessary)
Some problems were encountered in this process which reflect survey location errors. Fiducial markers used for position control are, erratically distributed and it was evident that the aircraft position, as defined by the stated coordinates and clearance information, could not always have been recovered correctly. The flight path was often too irregular or too elevated and not consistent with a flight trajectory. In such cases a smooth function based on reliable segments and trends in the flight path was used instead but it would be possible to fully and accurately recover the actual flight path from the indicated flight trajectory and height difference (radar altimeter) records. This was not warranted by the present study which emphasized upward continuation processing but it would be essential if a low level drape correction was to be made.

Due to the gappy nature of the Shell survey near Lake Cethana infill using the Mines Department survey was attempted. This was essential across the Lake and near Lorinna but north and east of Cethana it was not generally justified due to the magnitude of the problems and the quality of the Mines Department data immediately north of the Round Mt. escarpment. The two surveys involve different specification and produce a step in raw profile form (see 1060 at 403500, Figure 6 for example). Proper justification can only occur when the two surveys are adjusted to the same spatial position. A smooth function then results. The continuation procedure based on absolute height corrected records (above) effects this. Mating the Shell survey was, however, awkward since the pilot had begun manoevres for the next line well before data recording ceased and, in a region with extreme topography, large anomalies and imperfect position control, some mismatches are inevitable unless precise location is recovered and the profiles of each survey are in the same vertical plane. This does not occur.

An elevation of 1200 m was required for a regional presentation of the magnetic field and this level will form the basis for modelling and reference. Assembly of the transfer calculations from the observed levels (500 to 1300 m ASL) to 1200 m involved some nasty juxtapositions between the observed gradients and the terrain and some blemishes have persisted (e.g., line 1063 - Figure 13 and plot - Figure 14). Each spike reflects a critical terrain or position condition. Most were checked and the flight path corrected, edited or compensated where such a problem had affected the stability of the continuation process. This selective, manual filtering yielded Figure 15 and a data set for derivative calculation. Note that it still contains some apparent imperfections which may or may not be real; further and more detailed evaluation would be required to establish the reasons.

First and second vertical derivatives are shown in Figures 16 and 17. There is some suggestion of line bias but most large features are independent and several N-S effects are certainly real.

The magnetic field south of Moina and across the Daisy Dell - Middlesex Plains area has been especially examined in order to provide some assessment of the Tertiary basalt. An original tuned, auto-correlated spectral analysis followed by weighted adjustment of the energy spectrum has been used. All such methods require at least one or two control points but none exist here. Figures 19 to 30 present output from this procedure with some interpretation. An indication of the scaling problem can be obtained from comparison of Figures 28 and 30 using quite different property/spectral functions. Until at least one hole has been drilled in a substantial patch of basalt fine tuning and depth description must remain formal rather than definitive; the shape of sources is suggested but their depth is only crudely estimated.

All presentations of the field from either data set have been reduced by 1750 nT from the stated IGRF plus constant generated by the contractors.

DISCUSSION OF OBSERVATIONS AND RESULTS

The following comments are grouped in terms of the first order objectives of the evaluation. Since the present study has extracted only the fundamental implications of the magnetic data, implications which may be refined by further work or varied after correlation with gravity data or model study, the notes must be considered interim.

The implications and observations are, however, elemental to further evaluation and many may possess exploration significance.

UNIT CHARACTER AND RESPONSES

Indications of the magnetic character of rock units can be derived from the contour maps (e.g. Figures 9 and 10) or, more reliably from the observed profiles and modelling studies (e.g., Figures 2 to 8 and 33 to 34). Detailed modelling has been beyond the brief for this first phase of data review.
The possible distortions induced by terrain or flight path effects must be considered separately where any deviation from implied patterns has been inferred. This has not yet been done and would involve precise conversion of the profiles to pure drape form.

Limited deductions are possible from the contour maps.
The Dove Schist is not sufficiently sampled but appears non magnetic.
The Lorinna Greywacke presents no reliable pattern but limited modelling shows it to possess a significant magnetic contrast (e.g., Figures 30 and 34).
The felsic Cambrian rocks also do not offer a consistent pattern. The unit, as mapped, is clearly variable and may consist of at least two gross members. See the profile discussion below. One of these is non magnetic, as north of Oliver Hill but south of Oliver Hill part appears strongly magnetic. (This may be due to a mafic unit at shallow depth - see models, Figures 33 and 34)
The Dove Granite offers ambiguous indicators. It is relatively uniform in properties but apparently non magnetic. Modelling indicates that its surface skin or metamorphic aureole may be reverse magnetised and that this contrast generates the negative field in the region of the Dove Granite.
The Ordovician rocks offer no pattern and it is clear that variations in the field across Ordovician exposures are produced by concealed Cambrian units. Some minor anomalies may be related to faults. Note that even the Gordon Limestone at Lorinna is

associated with a large anomaly. This reflects an intense source at shallow depth since the limestone is non magnetic.
The Dolcoath Granite is also non magnetic and generates a subtraction in field intensity although the response is modified by the combined effects of thermal alteration at the contacts and the intruded Cambrian rocks.
The Tertiary basalt is strongly but variably magnetised and the response pattern is modified by sizeable geometric terrain effects.

The profiles demonstrate that many responses are overprinted. The dominant character is that of the Tertiary basalt due to its extensive exposure. Yet, it is not the most magnetic material. Basalt effects tend to be relatively low amplitude but high frequency and more significant deeper sources control the magnetic field (e.g., line 5480 and 5500 - Figure 4). In many cases the basalt response is very subtle or absent. Most basalt features are suggestive of either multiple flows nearly equally magnetised in normal and reverse senses or very thin (<<50 to 100 m) cover. (see also discussion on basalt thickness below)
The Precambrian rocks generate smooth anomaly tails from other sources and these are slightly negative overall with respect to the reference field (5320 to 5480; 5620 to 1064). The controlling regional influence of the basement is best seen in the line groups of Figures 5 to 7.
The response due to the Dove Granite is not markedly different unless the Lorinna Greywacke is present (lines 5460 to 5540).
The Lorinna Greywacke , however, is shown to be a significant magnetic unit although outcrop limitations and contouring approximations limit display of this character in plan. Relatively subtle expressions on major gradients illustrate this property. For example, the bulge on the gradient at 5399 N on lines 5660 to 1060 and 5401 N on 1062 and 1063 near Lorinna.

The major increase in field intensity north of 5409 N on lines 5240 to 5490 is directly related to Cambrian rocks. Although it would be easy to relate this to the felsic rocks this is simply impossible. The magnitude of the response exceeds 500 to 600 nT but carries a superimposed sub-effect with amplitude of 50 to 100 nT. These values may be contrasted with the Tertiary basalt which induces amplitudes of 50 to 200 nT generally and rarely up to 500 nT. The response noted north of 5409 N and west of 419500 E is due to Cambrian mafic rocks which are not exposed and that the subsidiary anomalies are due to felsic tuffs and volcanics.

The large anomaly at about 5407 N (lines 5420 to 5540 especially), but which trails ENE north of Lake Gairdner, is of comparable amplitude and certainly of the same origin. Its regional extent and scale implies a major mafic unit and is not related in any way to the exposed Ordovician rocks.
Anomalies of comparable magnitude and scale occur near 5401 N (lines 5640 to 5660) and 5401-2 N (lines 1063 to 5900) with the effect increasing but persistent to the ENE south of Oliver Hill

(to line 5820). Much smaller (200 to 300 nT) anomalies of comparable type can be recognised on lines 5700 (5403400 N) and 1061 (5404200 N) which are not due to basalt and are larger than any mineralisation response (see section on prospect signatures) due to contact metamorphism around the crest of the Dolcoath Granite. This form of alteration may account for the local variation from the normal subdued response due to felsic rocks and is restricted to the Oliver Hill, SW Dolcoath Hill region where these rocks are in contact with the granite. There is no other direct evidence of contact metamorphic effects in the surveyed area and if this inference is correct then the anomaly/unit is terminated unconformably to both east and west near the granite roof.
No consistent patterns have been recorded for the Ordovician rocks although shallow-sourced anomalies can be associated with fold axes (near 5404 N on lines 5340 to 5360), a fold limb (5405 N lines 5520 to 5580) and contact anomalies between Cambrian and Ordovician rocks at 54028 N (line 1060) and 54018 N (line 1061).
Some topographic anomalies may also be listed; e.g., 5405 N (line 5380) and south of 5402 N on lines 5820 to 5840.

Property contrast perspective is best summarised by line 5820. The low field region from 5405 to 5407 N represents Devonian granite and a neutral response. The surrounding rocks are more magnetic but the effect is localised and this scales the possible metamorphic effect. It will be noted that the response due to Gordon Limestone and Dove Granite is positive and signficantly negative with respect to this pattern. These properties suggest penetration responses for underlying materials and/or negative magnetisation for the granite. The latter option is not generally acceptable and gross geometric effects due to a deeply buried unit are implied. The contact of the Dove Granite is evident to both north and south and the response is not markedly different from that of the Dolcoath Granite. No stabilised level is available for the Precambrian rocks but lines 1062 to 5820 would indicate levels comparable with the Dqlcoath Granite. Underlying mafics must generate the very large anomaly on the line while the covering basalts are best seen in lines 5880 and 5900 and are inconsequential by comparison. This implies either lower contrasts or smaller volumes for the Tertiary pile.

Inspection of Figures 2 to 8 indicates that much of the character of either exploration interest or nuisance is low-moderate amplitude and relatively high frequence and super-imposed on larger, longer wavelength features.
It is instructive to compare Figures 11 to 13 since these present the primary structural units. The profiles, as would be seen at 1200 m, are generally at least 400 m clear of the terrain and free of major terrain effects. Tertiary basalts do not contribute significantly indicating that these are quite thin (below) and the balance of gross contrasts is more reliably recognised.

Reversely magnetised units occur adjacent to basement or beneath basalt on lines 5260, 5380, 5400, 5480 and 5500. The contrast is of similar intensity to that producing the positive responses in the Mt Jacob or north Tiger Plains regions. A mafic suite is implied. The effect is generally too wide to be due to thermal or boundary conditions. The form of profiles 1060 to 1064 suggest a thick wedge of mafic rocks adjacent to the basement margin, enclosing the Dove Granite, but none are exposed unless components of the Lorinna Greywacke are outer members.

TERTIARY BASALT

Reference has been made throughout the previous qualitative discussion that the basalt cover in this region is either thin or patchy or both. Several profiles across the basalt area from Moina to Daisy Dell and Middlesex Plains were analysed. The examined profiles were selected to provide a general sampling but also allow a lower (than 1200 m) reference level to be used. Each profile analysed was recalculated to a level of either 900 or 1000 m from the absolute height observations (see methods). The results are presented in Figures 19 to 30. Most lines were calculated for the region south of Stormont but three lines extend across the entire area (5600, 5620, 5640 - Figures 27 to 29) and line 5620 has been recalculated using an extreme property conditioner.
In the absence of any control on the thickness of basalt in the region studied the reliability of the interpretation is unknown. Problems were experienced in definition of an appropriate scale for the analysis or even selecting which estimates represent the base of the basalt. Once some control exists a more comprehensive analysis will be possible but the present provisional outline does suggest flow forms and that the basalt is very patchy. Comparison of the 15 km profiles for line 5620 (Figures 28 and 30) using differing parameters illustrate the difficulty although there is sufficient consistency to suggest and interpretation. The operator designated 128/3 more satisfactorily outlines the source skin (land surface) form and is more believable with respect to outcrop limits and landform relationships. This presumes, of cours, that mapping is accurate and it is apparent that this is not the case in many areas; talus has been included in the basalt distribution. This may also be the case on line 5620.
Irrespective of current scaling problems due to absence of control the analysis suggests the form of the magnetic sources and in all cases basalt cover would appear to be generally less than 50 to 70 m thick and often absent.

SIGNATURES FOR MINERALISED SITES

The subset of available data examined in this review has been inspected for suggestions of any patterns associated with known mineralisation. Note that the entire data set has been used between 425500 and 427500 mE since on 500 m spaced Mines Department data exists in this zone but at greater clearance than the Shell data.

If patterns can be recognised, with or without full drape correction, and other like effects can be noted then the entire data set should be comparably processed and re-examined. The data has been considered as an observed implied drape. The effect of this assumption is discussed at the end of this sub-section.
It must also be recognised that the mineralised zones contain many prospects and it is unlikely that many have been adequately sampled or defined. The family response, however, may be of value. The data has been reviewed within these admitted constraints and in full appreciation that changes in the host rock volume are more likely to produce recognisable effects in the magnetic field at 100 to 200 m than any changes which directly mirror ore.

Examination of plots of the contoured magnetic field (e.g., Figures 9 or 10) and geology/prospects reveals that a particular wedge immediately west of the Dolcoath Granite displays an odd high frequency E-W lamination (see also structural blocks) but no individual character is identifiable. Comparable character is not evident at other clusters of prospects. It must be concluded that the contoured forms offer few indications of magnetic signatures in this terrain. It is not clear whether the effort of full drape correction would make a difference. I suspect not.

The profiles, however, offer a different view. Virtually every site sampled by a profile offers a characteristic and comparable response. Prospect/site numbers refer to Bamford and Green (1988) and Figures 9A and 10A.

Line	Prospect number	comment	amplitude	element
5380	007	on broad rise crest		Au
5400	097	local spike	100 nT	Au
5460	009	sharp spike	50-70	Au
5480	076	beside basalt crest		
	010	confused by basalt	25	Au
5500	083	small local spike	40	Au
5540	014	step on gradient	30	
	077/078	bulge near crest peak	30 on 180	
5580	095	not recognised		
5600	061	small rise	20	Au
	054	nick point on profile	30	Au
5620	011/012	large spike	600	
5640	094	very subtle		

Line	Prospect number	comment	amplitude	element
5640	011/012/013/098	spike	300 nT	
	003	crest		
	006 suggested on 5620/5640			
5660	062/089	not recognised		
	086	spike	150	
	015?	small peak	50	
5680	090	small bulge	20	Au
	019/020/028	spike	>100	
	015		50	
5700	055/056	gradient bulges	20-30	Au
	021	peak	100	
1060	027/029	spike	50+	Au+
	023/024/026	gradient bulge	20	Au
1061	058	very subtle	<20	Au
	030	small local peak	30	
1062	059	very subtle evidence of alteration		Au
	057	not recognised		
	038/034	resolution too low		
1063	060	step in gradient	100	
	064	small gradient variation	25	Au
	040/090	resolution too low		
1064	096	spike	700	
	064	spike	100	Au
	093/039	resolution too low		
5820	042/043	small peak	50	
	072	no data		
5840	044/088	not recognised		
5860	044	small gradient change	30	
	008/063	no data		
5880	050/043	small ill-defined crest		
	048	no data		

These notes indicate that identifiable responses exist in real and imperfect data but whether many would be reviewed without the known association is a moot point. All gold-bearing sites generate relatively small deviations at 100 m clearance but the gradient or peak changes are consistently present. Note that a comparable response appears to be present in the region of 097 - an alluvial deposit. This would imply a source nearby, or that the magnetic response is mapping a structure nearby. It is unfortunate that clearances around the northern part of Lake Cethana are extreme and survey patching and compensation cannot recover what has been lost. Comparison of observed and 1200 m level profiles illustrates the importance of highly resolving data at low elevations.

An attempt has been made, based on the implied nature of the responses listed above, to infer other possibly mineralised sites. Some extraneous sources, such as minor basalt contacts, may be confused but all are considered abnormal in some way.

Sites of poosible exploration interest

Line	Easting	Northing	comment
5380	417000	5408500	compare 097 (even if alluvial)
5400			check 097 and headwaters of Devonport Creek
5480	4195	54025	mineralised fault zone?
		54017	check Paddock Creek
5520	4205	54064	basalt??
5540	421	54035	inferred fault axis
5560	4215	5407	other than edge of basalt at Iris River?
5580	422	54055	peak unlikely to be Tb
		54062	Tb?
		54085	review fault zone
5600	4225	5406	Tb effect?
		54076	fault zone beneath L Gairdner
		5408	fault zone on shore
5660	424	5408	check not basalt contact
		54088	along fault in Bell Creek
		5410	in felsic volcanics
5700	425	54069	
		54075	?
		54097	
1060	4255	53993	
		53996	gold style?
1061	426	5403	contact zone above mafics
		5404	contact with mafics
		54072	?
1063	427	54032	?in felsics
1064	4275	54034	fault zone/contact
5820	428	54045	near granite in felsics
		54025	? large spike
		54074	fold axis
5840	4285	54001	Tb contact?
5880	4295	5403	possible fault contact/edge Tb?

The discussion above has presumed a drape relationship with the geology, i.e., an equal representation with respect to the surface at least. Where this assumption fails due to landform or clearance conditions, or the sources are more deeply buried or located, then the response may be modified. The Shell data carries a typical clearance of 80 to 150 m but may exceed 300 m locally. The Mines Department clearances are greater. Figure 31 shows the effect of changing sensor - source range. The green profile is as observed (and may be misleading) while the others show the smoothing effect of increasing distance. Note that an extra 100 m beyond observed levels reduces many distinct features to the gradient "bumps" so often seen in other profiles. Such distortions may be important. Note also that the observed profile may not have been obtained at a regular clearance and many described features may already have been modified by this process.

STRUCTURAL NOTES

Structural features determined at the present level of analysis have been summarised in Figure 32.

Some N-S features are indicated and are unrelated to any aspects of line bias. Some features have been mapped, as near Tiger Plain, west of the Dove River and along the Mersey River. More persistent structures are either NW-SE or NE-SW. E-W elements are also present but less obvious. The NW-SE set is presumably related to the Claude-Roland thrust sheets but there is little surface evidence for the NE-SW set. Several E-W features are evident in surface mapping (including the alignment of mineralisation west of the Dolcoath Granite).

While there is no obvious relationship between magnetic field and mineralisation at low levels (100 to 150 m nominal) there is at high level. All sites from Mt Claude to the Lea River lie on a single trend evident at 1200 m. It is a band of perhaps two structures about 1 km wide. Other groups have loci on comparable E-W (actually EENE trends). This possible relationship does not account for all sites. Inspection of identified trend relationships, inferred section composition and known sites suggests that mafic rocks are either thick or relatively shallow beneath mineralised areas, especially gold-bearing areas, and that most lie in the extensional stress field in the northern face of the intersection of the conjugate set. Most mineralisation appears to be related to this "V" corner where it is in an E-W band. Several other such features exist.

Surface mapping has indicated an array of apparently minor or relatively discontinuous faults and structures. Most can be directly correlated with underlying implied gross fractures. This would indicate Tabberabberan re-activation at least.

Figure 32 attempts to show the distribution of thick accumulations of mafic rocks within the Cambrian sequences. These appear to be close to basement and may be generally present but thin due to form, folding or truncation. The greatest accumulation lies east of Lake Cethana. The Dolcoath Granite may have removed much of this material.

Two profiles have been modelled to test some of the implications of this interpretation (Figures 33 and 34). It is not claimed that this simple assessment is adequate but Figure 33 does prove that thick mafic units are present; that near the Dove Schists in the south being either overturned or reversely magnetised. Line 1063 presented more problems and these have not been resolved. It is possible to obtain a solution of the type shown for line 5500 but the shift differentials are not consistent. The option shown accounts for the salient features and implies thick, fault-sliced, compound mafic sources. These issues will be examined in later study in association with gravity data.

CONCLUSIONS

As this is a stage or progress report, and further work is in train, the conclusions offered are general and interim but do summarise present achievements.

1. Magnetic data offer much structural information relevant to understanding of the area and its history. This topic to be studied in association with gravity data.

2. Cambrian mafic suites are concealed and appear block bounded. Many marginal structures have been re-activated and surface expressions exist.

3. Mineralisation is concentrated on such re-activated boundaries or along major crustal trend systems and stress release corner. The northern side of the conjugate appears frequently and most sites occur when this is close to E-W features.

4. Many deposit styles have expression in magnetic data at about 100 m clearance. Gold deposits display very subtle expressions while tin or tungsten deposits are more definitive. Effects are modified by clearance variations and exploration appraisal may well require checking of the clearance envelope.

5. Many regional/signature features or controls are not identified in low level contour maps and a best seen in profile forms. High level presentations able to yield structural settings and controls can be modelled.

6. Tertiary basalts are variable in character but may be resolved. There is need for some control. The basalts are generally thin but several flows are indicated in some areas.

7. A number of unexplained signature style features have been noted and are worthy of immediate review. Exploration may need to be based on presumptions of major structures and alteration of materials above boundaries of underlying mafic rocks.

8. Little evidence for alteration effects has been noted but this may be due to the erratic nature of the magnetic field and poor definition of rock properties in this area. Another key element is the dominance of the mafic suites on the magnetic field. Virtually every feature in the northeastern two thirds of the area studied contains a significant contribution from this source.

RECOMMENDATIONS

1. Some discussion and review of the implications of this early work is required. Are mineralisation concepts implied feasible and useful? What roles could the granite and the mafic suite have? Are there major internal thrust boundaries and do these control loci for mineralisation? Are these reflected in some E-W features?

2. The anomalous sites should be reviewed and visited. The coordinates offered may carry a precision of +/- 200 m so an area of 400 x 400 m should be checked. Geochemistry is advised for independent checking. In each case the effects of basalt boundaries, previously unmapped pods of basalt or fault oxidation effects need to be assessed.

3. Some drilling control on the thickness of basalt is required in order to finally remove this variable. Magnetic analysis can provide the regional stripping once this is done.

4. Magnetic property analysis is recommended for all units but special attention should be directed at Dove Granite, Lorinna Greywacke contents and the felsic rocks since there are suggestions that these contain a range of lithologies. Some remanence determinations will be essential but I suggest all determinations use field magnetometer methods. This is cheaper, more representative and permits more samples to be measured.

5. Second stage work should review the known or suspected mineralised zones for drape imperfections. It may be that some aspects of mineralisation signatures have already been modified by the survey and its relation to the land surface.

6. Where structures appear favourable, or other information indicates interest the alternate lines not used in this study should be reviewed. These areas may be advised.

7. More comprehensive structural analysis using both gravity and 1200 m data sets can be constrained by the implications of this work.

Note that the compensations and corrections for the lines examined do not need to be repeated unless line position problems are to be removed completely. Most parts of most lines are free of this problem and the corrected data sets can be used to calculate or examine the field on any surface.

REFERENCES

Bamford, A.L., and Green, G.R., 1988. Cethana. Metallic mineral deposits map 8114(1V)-8115(III). Mines Department Tasmania.

Leaman, D.E., 1988. Granites of W and NW Tasmania. Part 9. The Dolcoath Granite. Mt Read Volcanics Project Report, Mines Department Tasmania.

Report submitted on behalf of
Leaman Geophysics
by

D. Leaman

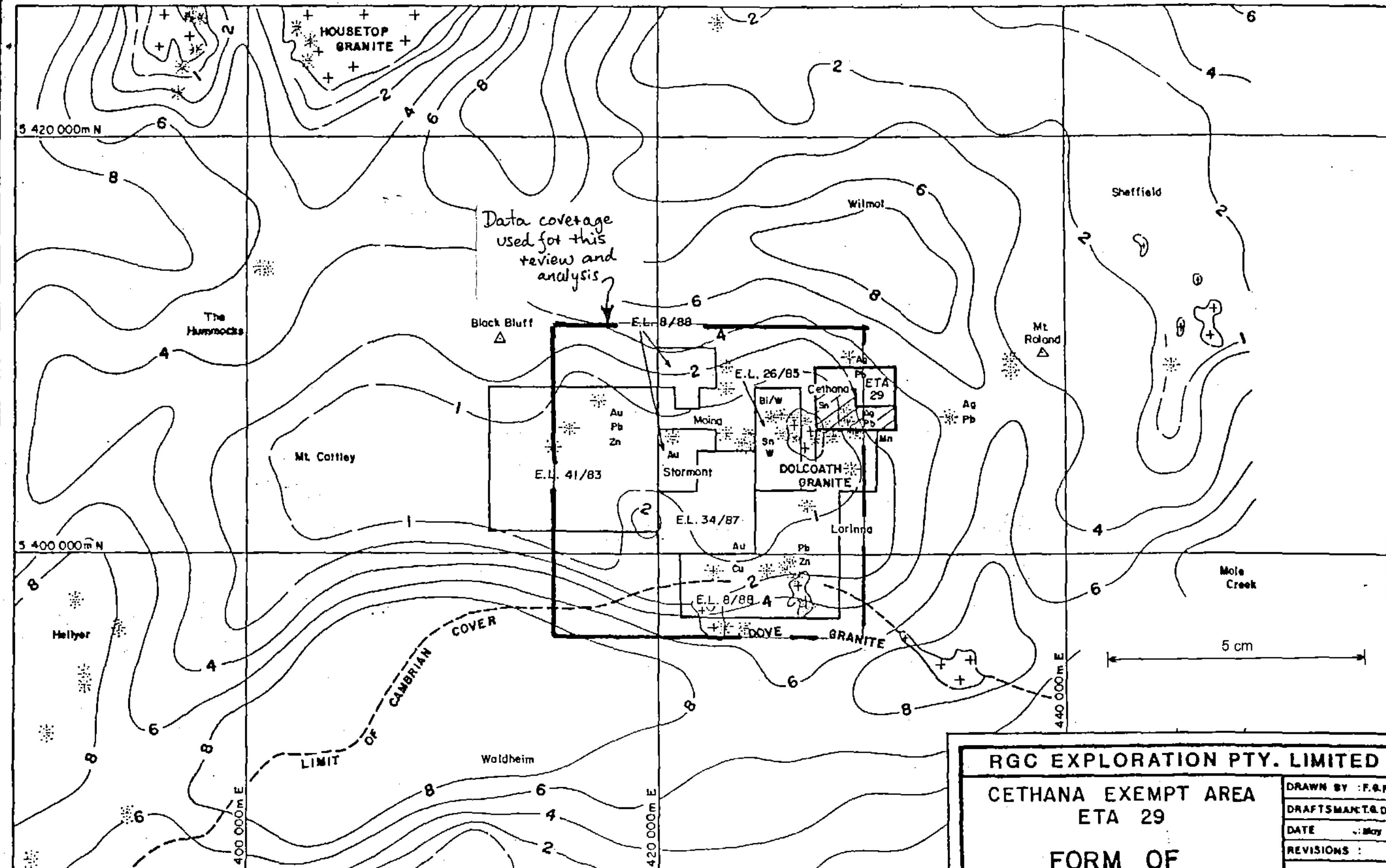
Dr. D.E. Leaman, B.Sc., Ph.D
M.Aus.I.M.M., M.M.I.C.A

22-8-88

724135

FIGURES

Note: transparent overlay for Figures 14 to 17 in pocket
Diagram original included as Figure 18



RGC EXPLORATION PTY. LIMITED

CETHANA EXEMPT AREA
ETA 29

FORM OF
DOLCOATH GRANITE

DRAWN BY : F.G.F.
DRAFTSMAN T.G.D.S.
DATE : May '88
REVISIONS :

FILE NO.

SCALE 1:250,000 (2.5 0 2.5 5.0 Kilometres)

FIG. 1

MINERALISED SITES

Provisional Interpretation : contours showing top of granite below surface in km. (Leaman, Jan. 1988)

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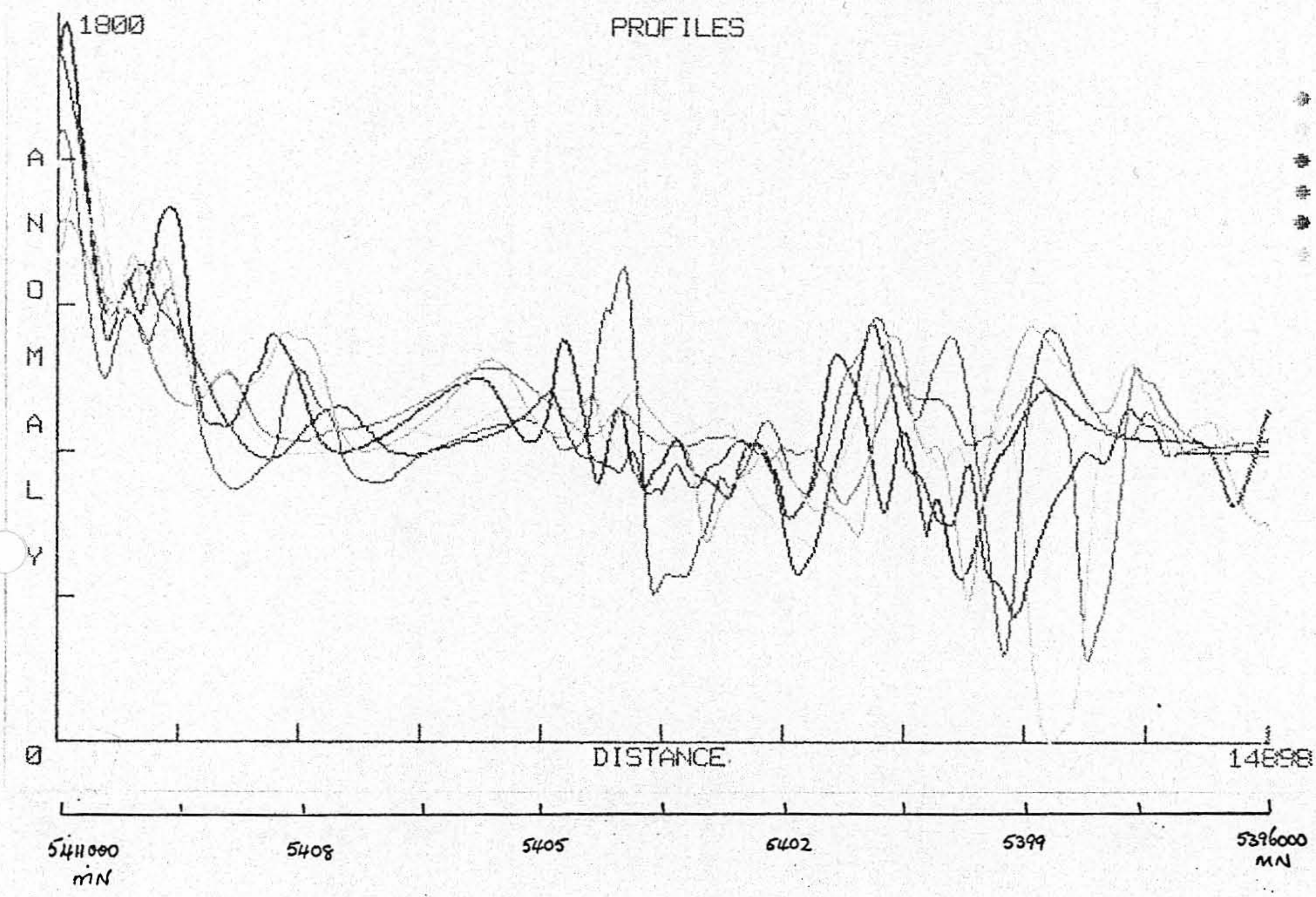

			nominal easting
1	B:M5240	MOINA PROJECT LINE 5240	413 500
2	B:M5260	MOINA PROJECT LINE 5260	414 000 mE
3	B:M5280	MOINA PROJECT LINE 5280	414 500
4	B:M5300	MOINA PROJECT LINE 5300	415 000
5	B:M5320	MOINA PROJECT LINE 5320	415 500
6	B:M5340	MOINA PROJECT LINE 5340	416 000

ZERO SHIFT : 780.2

AEROMAGNETIC PROFILES nominal clearance 100m

FIGURE 2

137 724138

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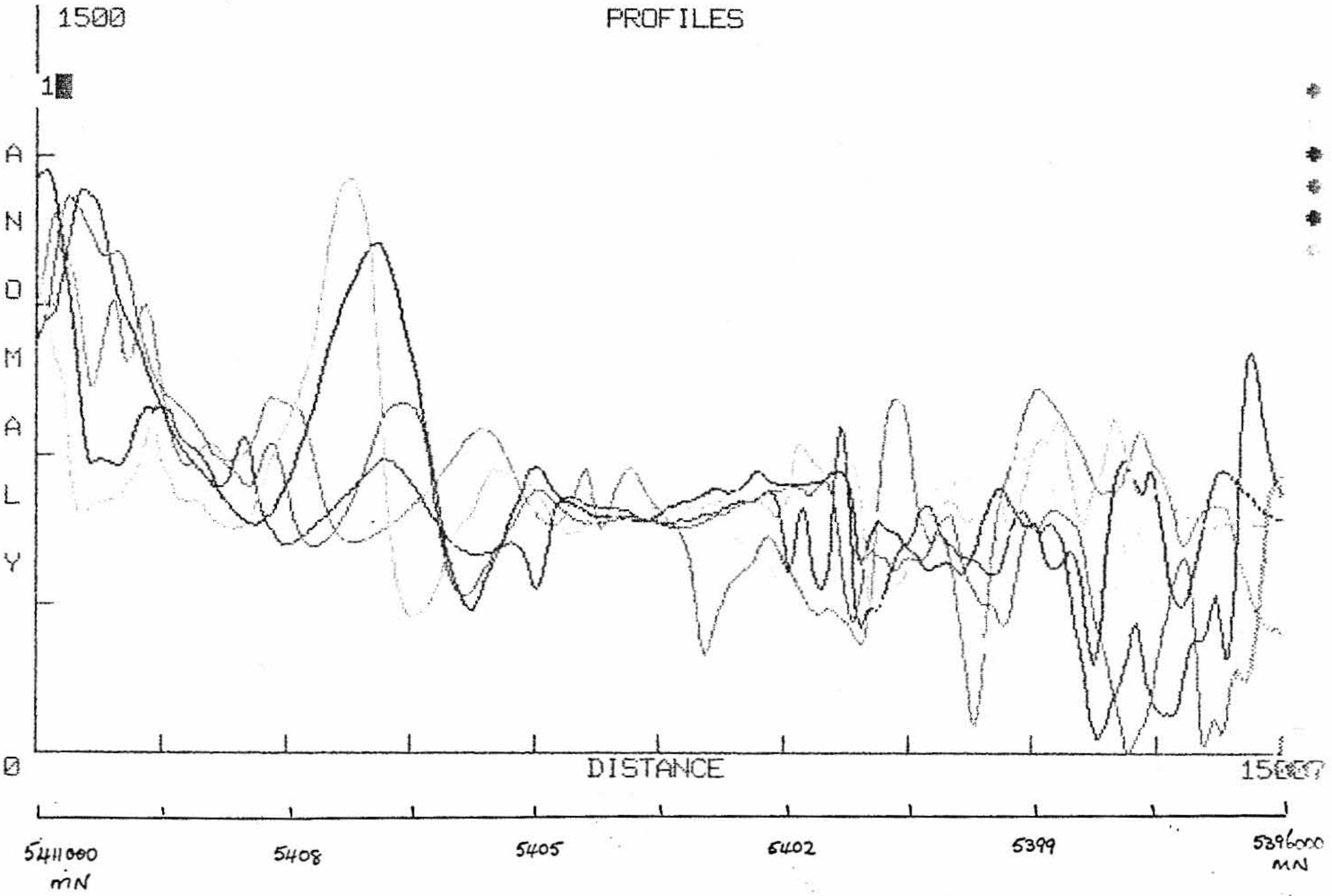

			nominal easting
1	B:M5340	MOINA PROJECT LINE 5340	416000 mE
2	B:M5360	MOINA PROJECT LINE 5360	416500
3	B:M5380	MOINA PROJECT LINE 5380	417000
4	B:M5400	MOINA PROJECT LINE 5400	417500
5	B:M5420	MOINA PROJECT LINE 5420	418000
6	B:M5440	MOINA PROJECT LINE 5440	418500

ZERO SHIFT : 483

AEROMAGNETIC PROFILES nominal clearance 100m

FIGURE 3

138

724139

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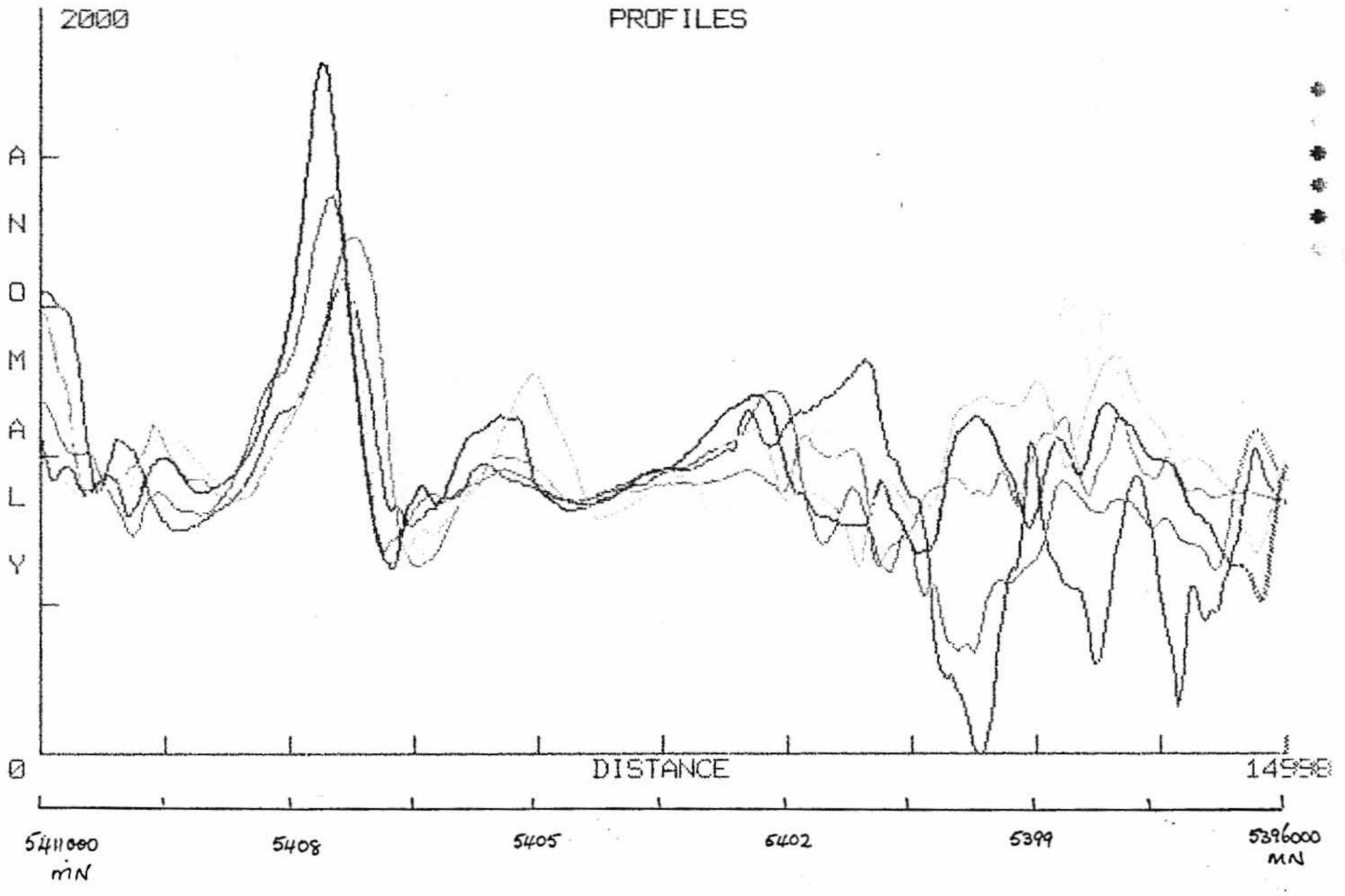

1	B:M5440	MOINA PROJECT LINE 5440	nominal easting 418500 mE
2	B:M5460	MOINA PROJECT LINE 5460	419000
3	B:M5480	MOINA PROJECT LINE 5480	419500
4	B:M5500	MOINA PROJECT LINE 5500	420000
5	B:M5520	MOINA PROJECT LINE 5520	420500
6	B:M5540	MOINA PROJECT LINE 5540	421000

ZERO SHIFT : 713.4

AEROMAGNETIC PROFILES nominal clearance 100m

FIGURE 4

109

724140

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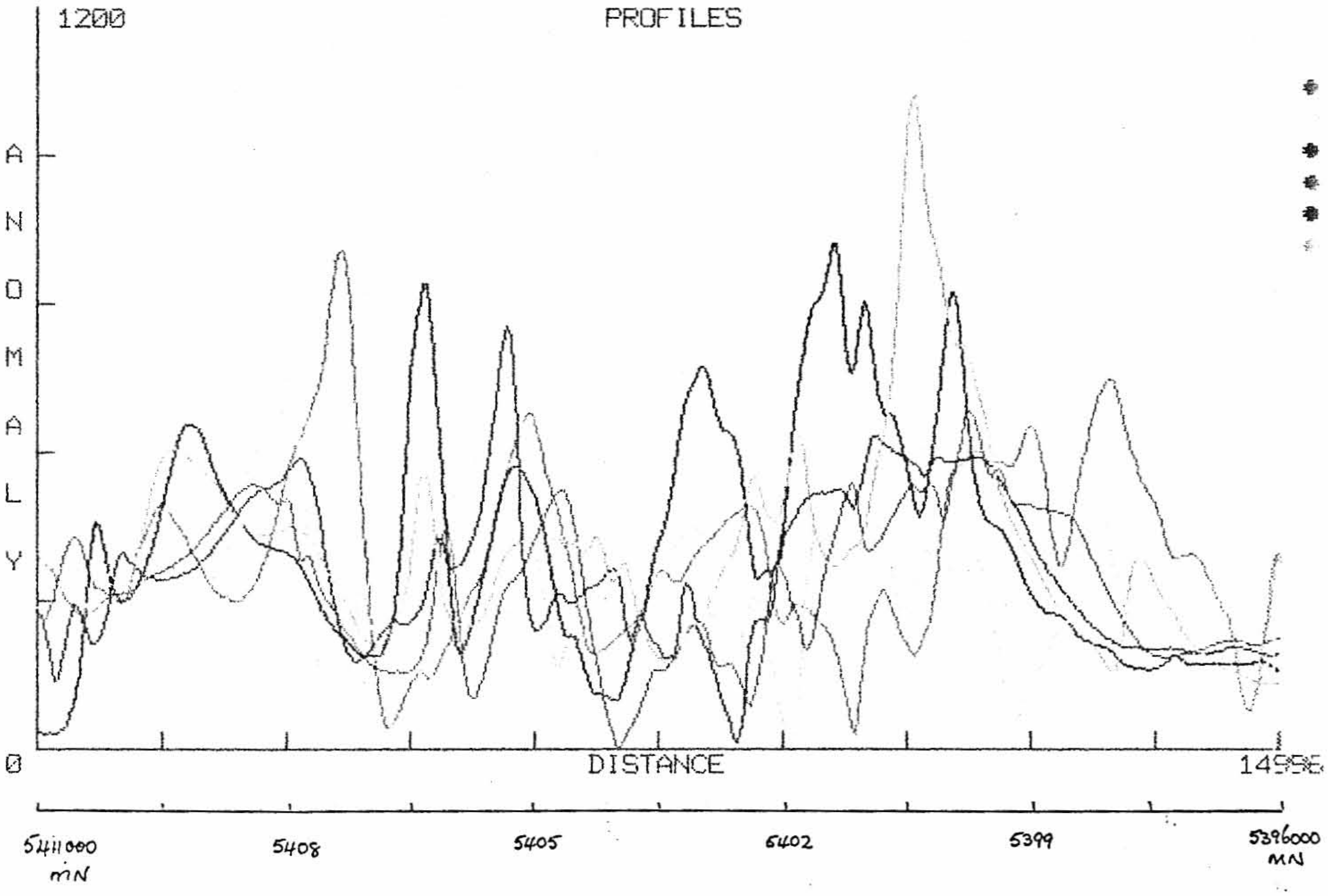

			Nominal easting
1	B:M5540	MOINA PROJECT LINE 5540	421 000 ME
2	B:M5560	MOINA PROJECT LINE 5560	421 500
3	B:M5580	MOINA PROJECT LINE 5580	422000
4	B:M5600	MOINA PROJECT LINE 5600	422500
5	B:M5620	MOINA PROJECT LINE 5620	423000
6	B:M5640	MOINA PROJECT LINE 5640	423500

ZERO SHIFT : 239.3001

AEROMAGNETIC PROFILES nominal clearance 100m

FIGURE 5

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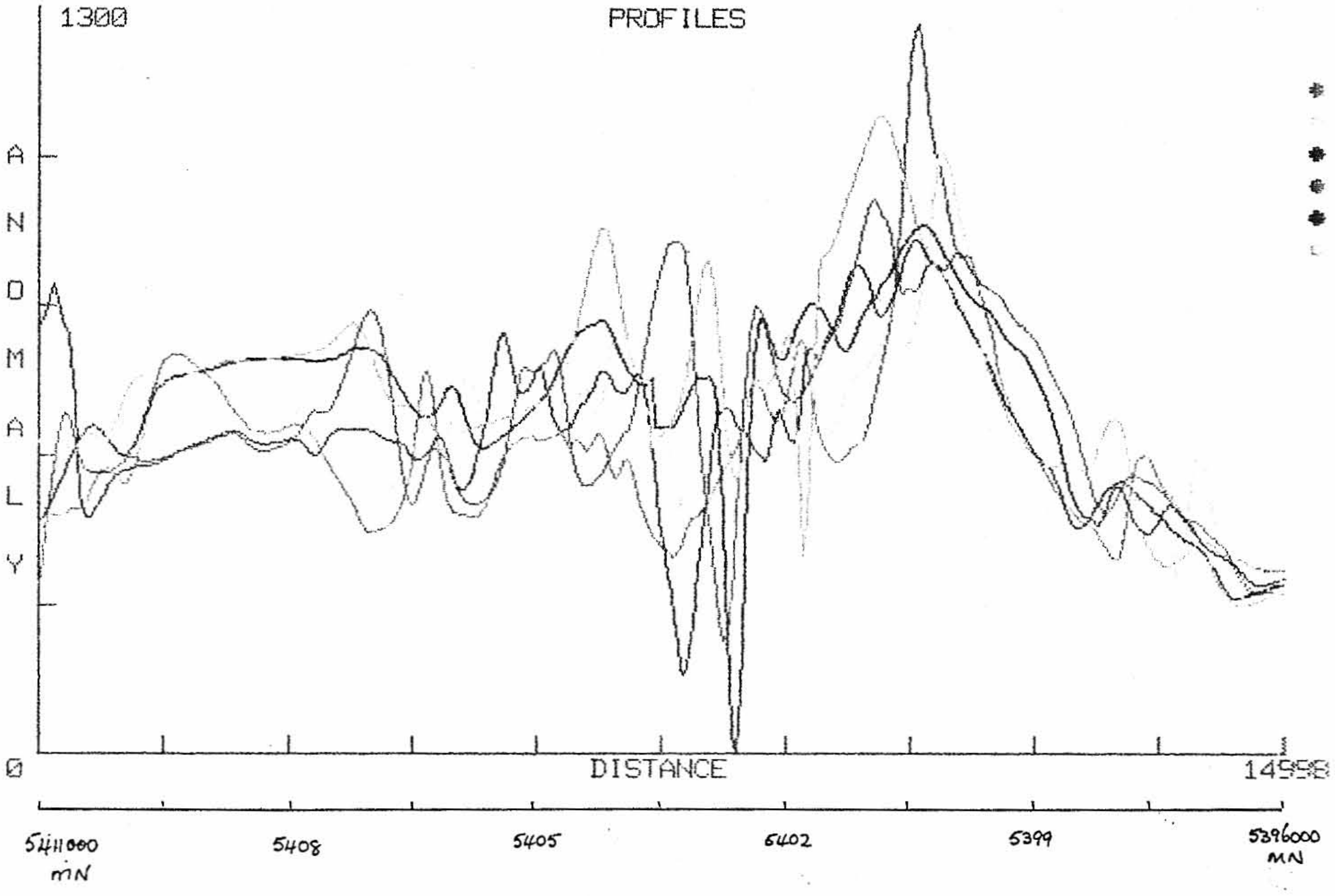

			nominal easting
1	B:M5640	MOINA PROJECT LINE 5640	423500
2	B:M5660	MOINA PROJECT LINE 5660	424000
3	B:M5680	MOINA PROJECT LINE 5680	424500
4	B:M5700	MOINA PROJECT LINE 5700	425000
5	B:M1060	MOINA PROJECT LINE 1060	425500
6	B:M1061	MOINA PROJECT LINE 1061	426000

ZERO SHIFT : 452.3001

AEROMAGNETIC PROFILES nominal clearance 100m (150m for 1060-1061)

FIGURE 6

724142

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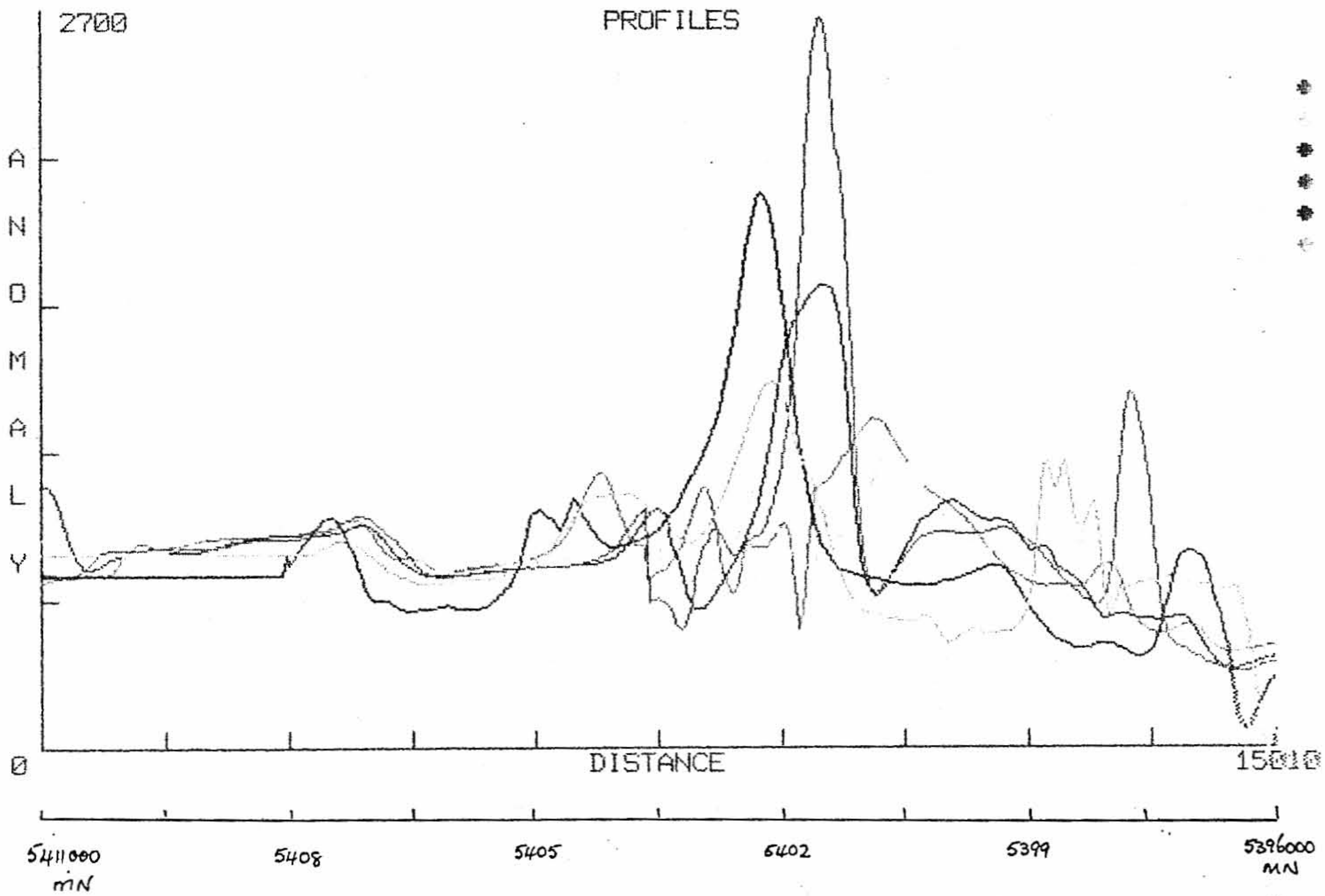

			nominal easting
1	B:M1061	MOINA PROJECT LINE 1061	426 000 mE
2	B:M1062	MOINA PROJECT LINE 1062	426500
3	B:M1063	MOINA PROJECT LINE 1063	427000
4	B:M1064	MOINA PROJECT LINE 1064	427500
5	B:M5820	MOINA PROJECT LINE 5820	428000
6	B:M5840	MOINA PROJECT LINE 5840	428500

ZERO SHIFT : 541.7

AEROMAGNETIC PROFILES nominal clearance 100m (150 m for 1061–1064)

FIGURE 7

724143

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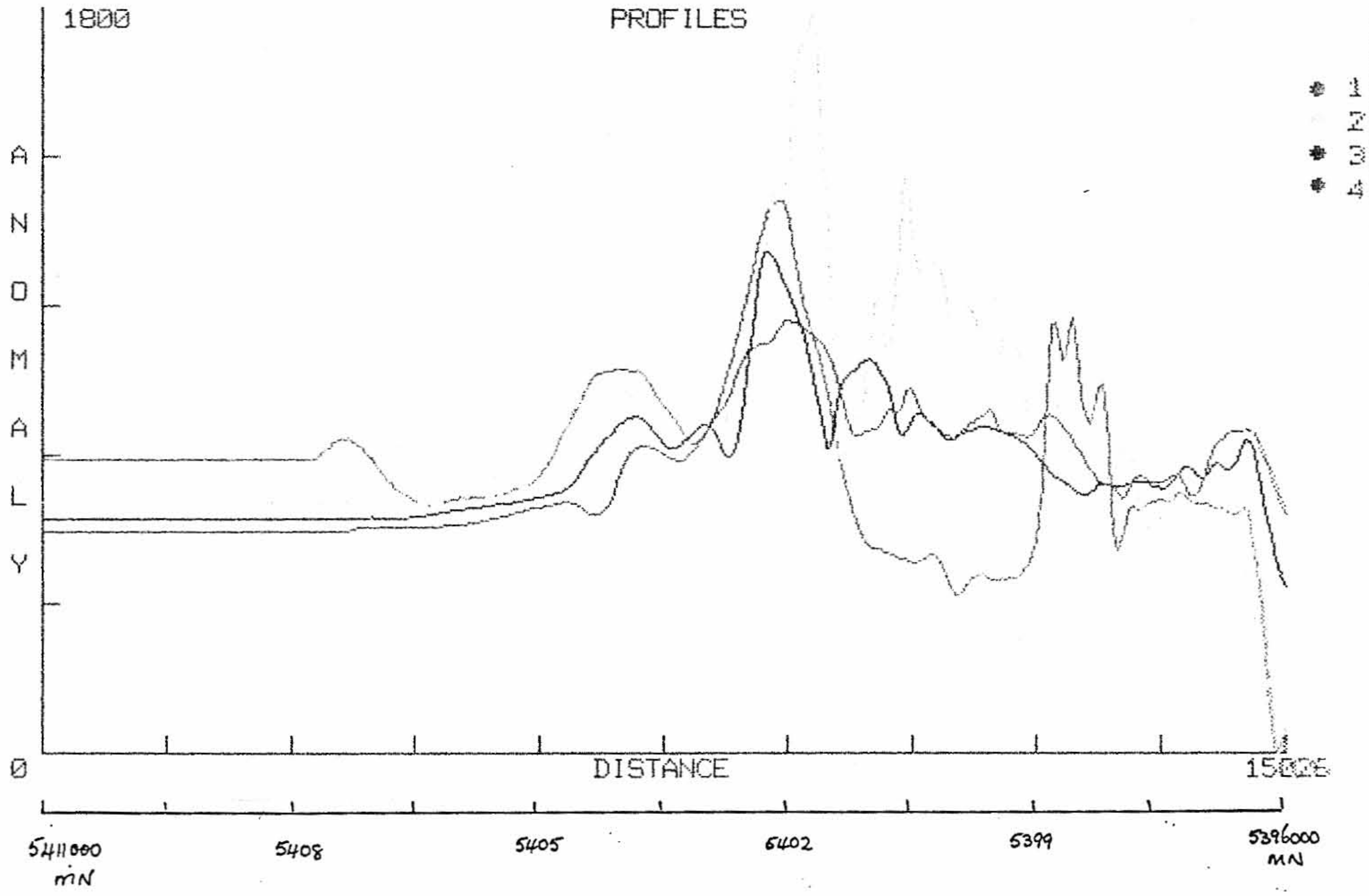
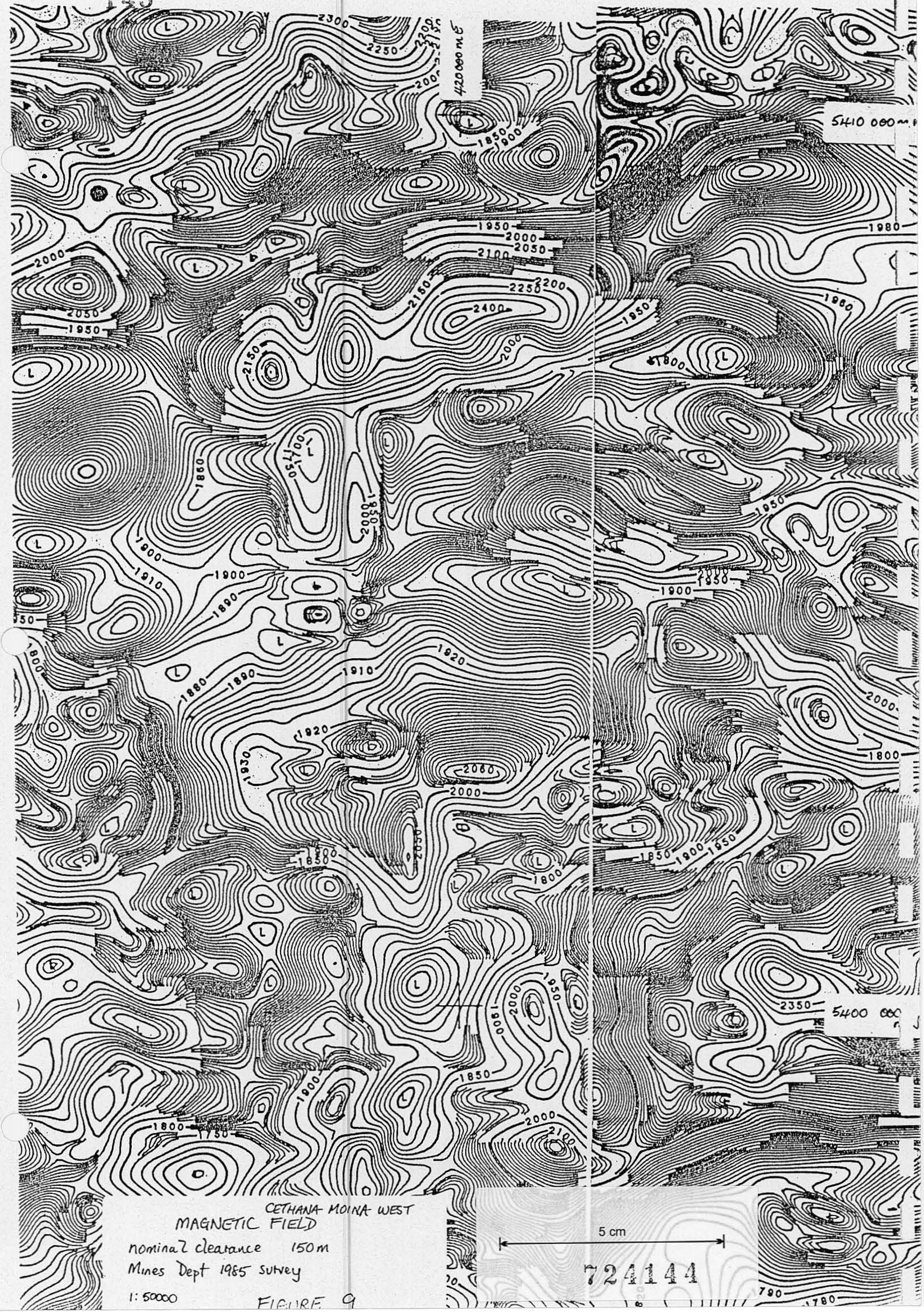


1	B:M5840	MOINA PROJECT LINE 5840	428500 mE
2	B:M5860	MOINA PROJECT LINE 5860	429000
3	B:M5880	MOINA PROJECT LINE 5880	429500
4	B:M5900	MOINA PROJECT LINE 5900	430000

ZERO SHIFT : 541.7

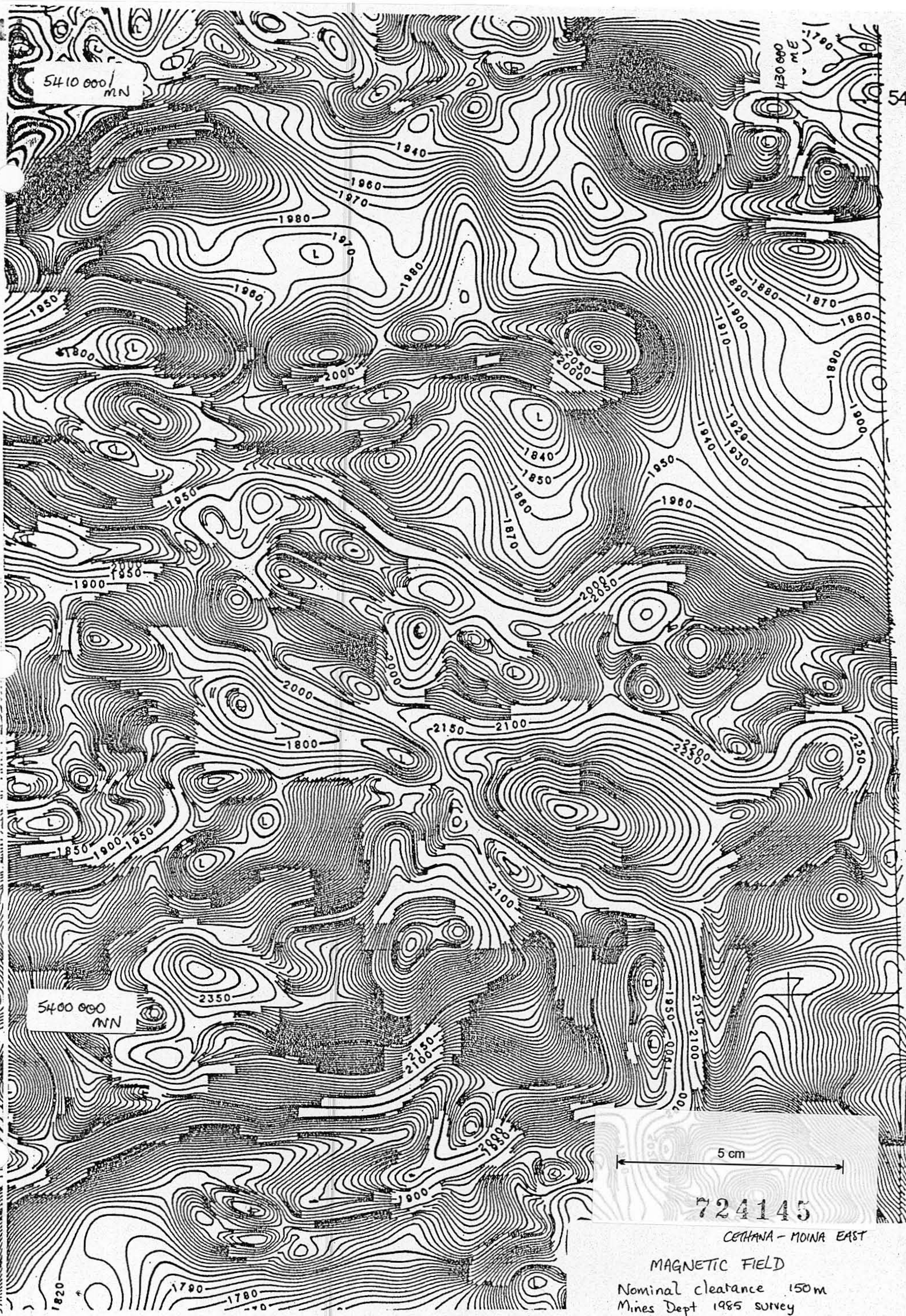
AEROMAGNETIC PROFILES nominal clearance 100m

FIGURE 8



CETHANA MOINA WEST
MAGNETIC FIELD
nominal clearance 150m
Mines Dept 1985 survey
1: 50000

FIGURE 9



CETHANA - MOINA EAST

MAGNETIC FIELD

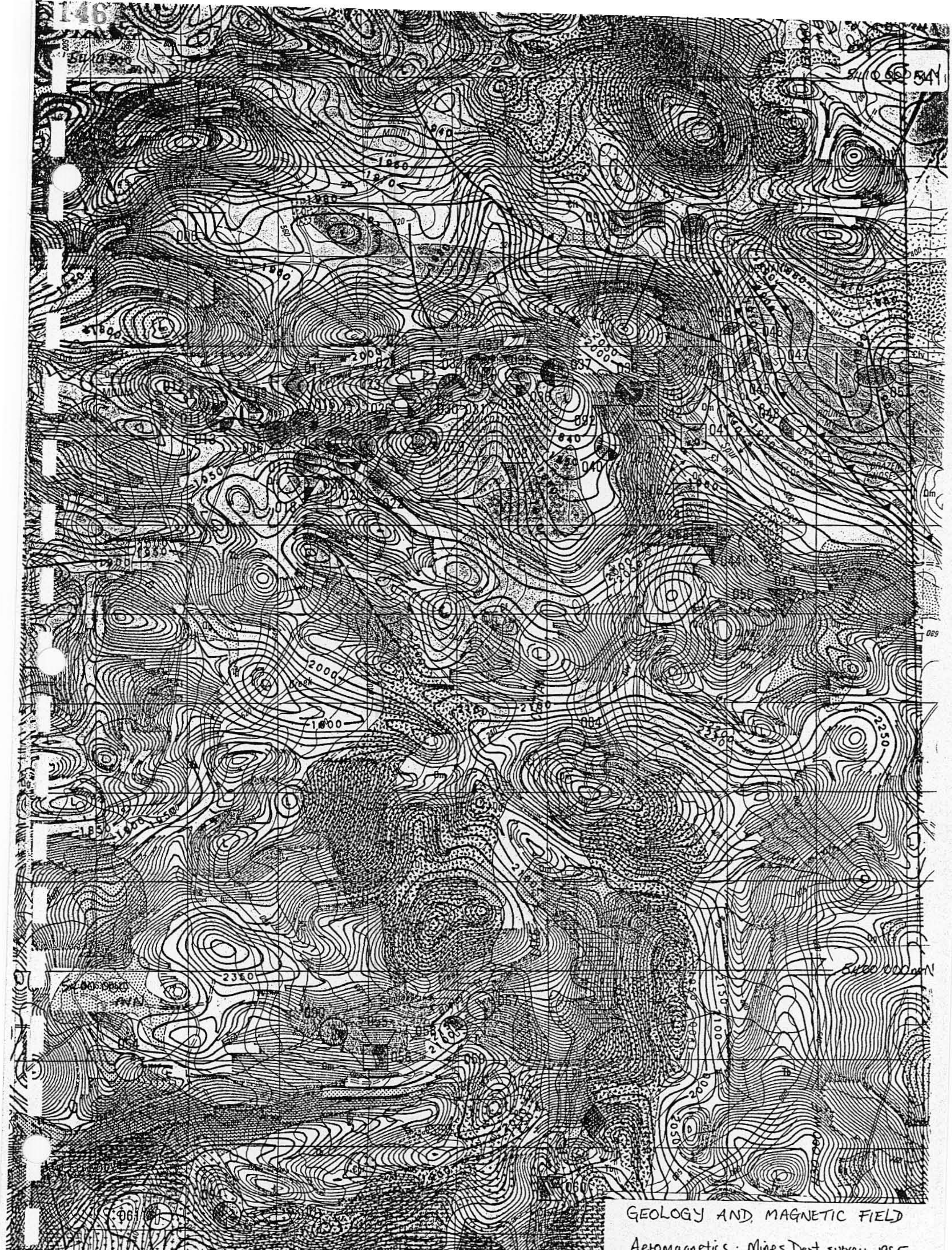
Nominal clearance 150m

Mines Dept 1985 survey

1:50000 FIGURE 10

GEOLOGY AND MAGNETIC FIELD
Aeromagnetics: Mines Dept survey 1985
Basemap: Bamford & Green (1988)

FIGURE 9A



GEOLOGY AND MAGNETIC FIELD

Aeromagnetics: Mines Dept survey 1985
Basemap: Bamford & Green (1988)

FIGURE 10A

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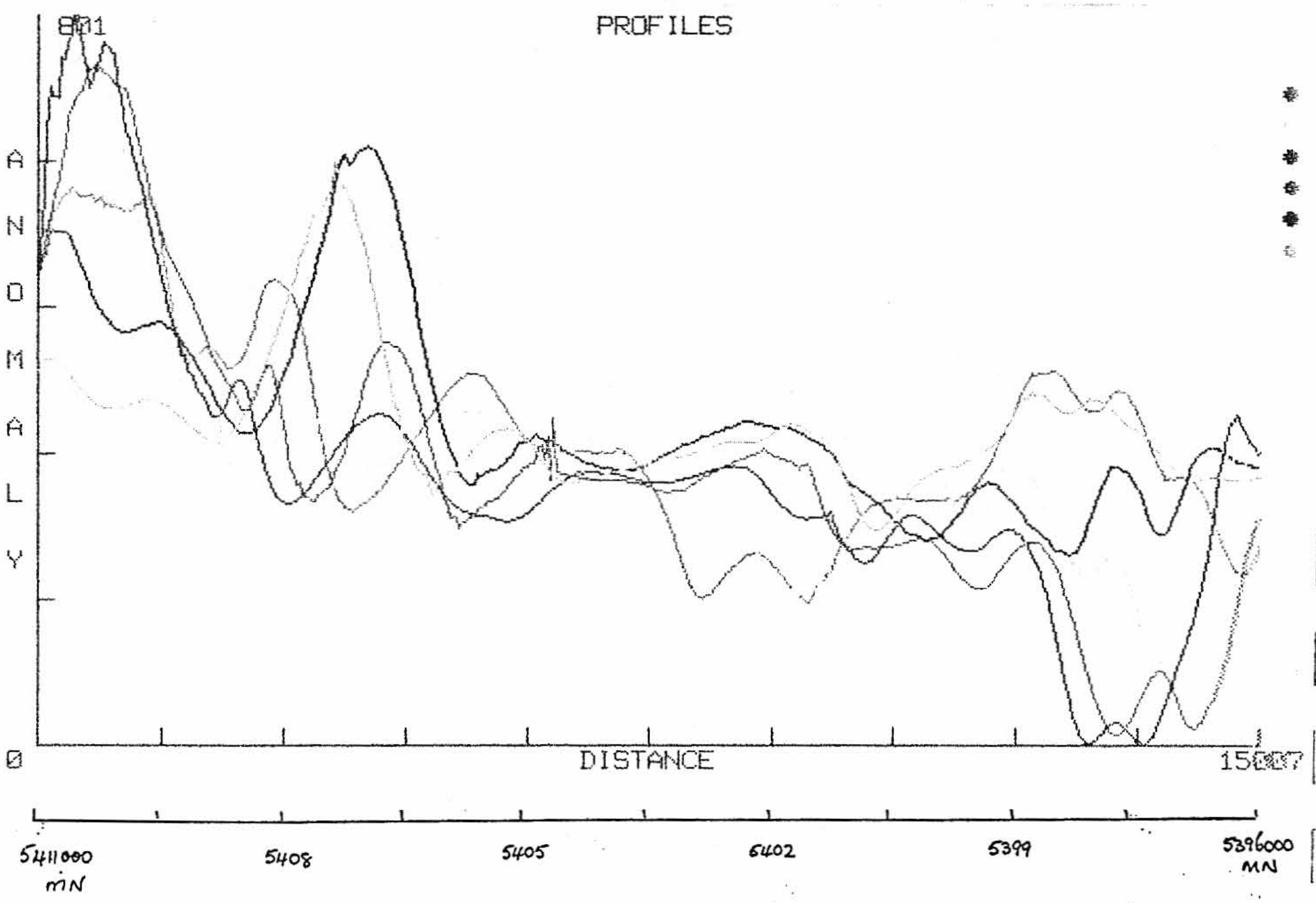

1	B:M12L5340	MOINA MAGNETICS 5340 AT 1200 M	416000 mE
2	B:M12L5360	MOINA MAGNETICS 5360 AT 1200M	416500
3	B:M12L5380	MOINA MAGNETICS 5380 AT 1200M	417000
4	B:M12L5400	MOINA MAGNETICS 5400 AT 1200 M	417500
5	B:M12L5420	MOINA MAGNETICS 5420 AT 1200 M	418000
6	B:M12L5440	MOINA MAGNETICS 5440 AT 1200 M	418500

ZERO SHIFT : 300.9977

COMPENSATED AEROMAGNETIC PROFILES : CALCULATION FOR 1200m LEVEL ASL

FIGURE 11

724149

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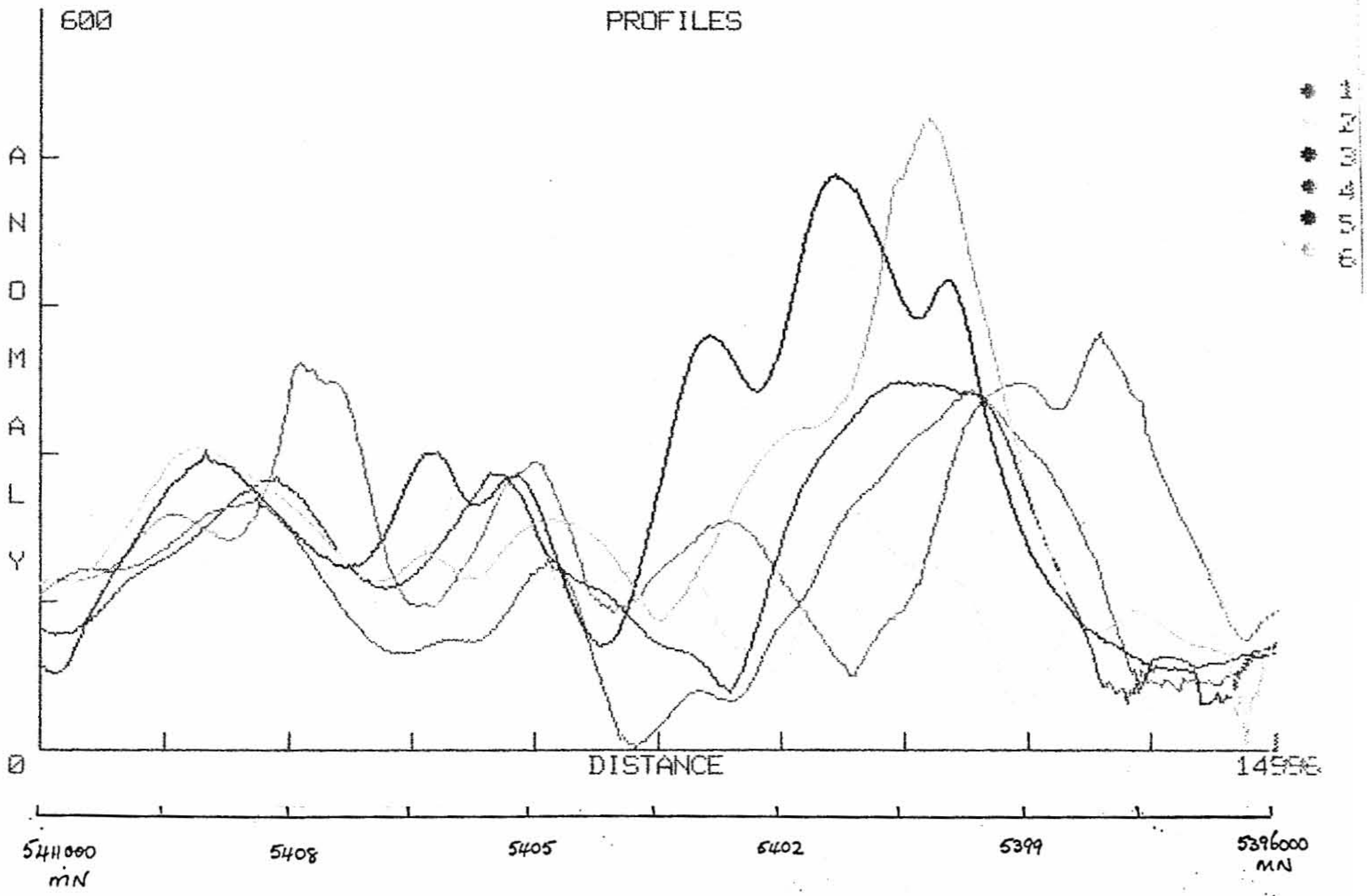

			nominal easting
1	B:M12L5540	MOINA MAGNETICS 5540 AT 1200 M	421 000 mE
2	B:M12L5560	MOINA MAGNETICS 5560 AT 1200 M	421 500
3	B:M12L5580	MOINA MAGNETICS 5580 AT 1200 M	422 000
4	B:M12L5600	MOINA MAGNETICS 5600 AT 1200 M	422 500
5	B:M12L5620	MOINA MAGNETICS 5620 AT 1200 M	423 000
6	B:M12L5640	MOINA MAGNETICS 5640 AT 1200 M	423500

ZERO SHIFT : 110.4018

COMPENSATED AEROMAGNETIC PROFILES : CALCULATION FOR 1200m LEVEL ASL

FIGURE 12

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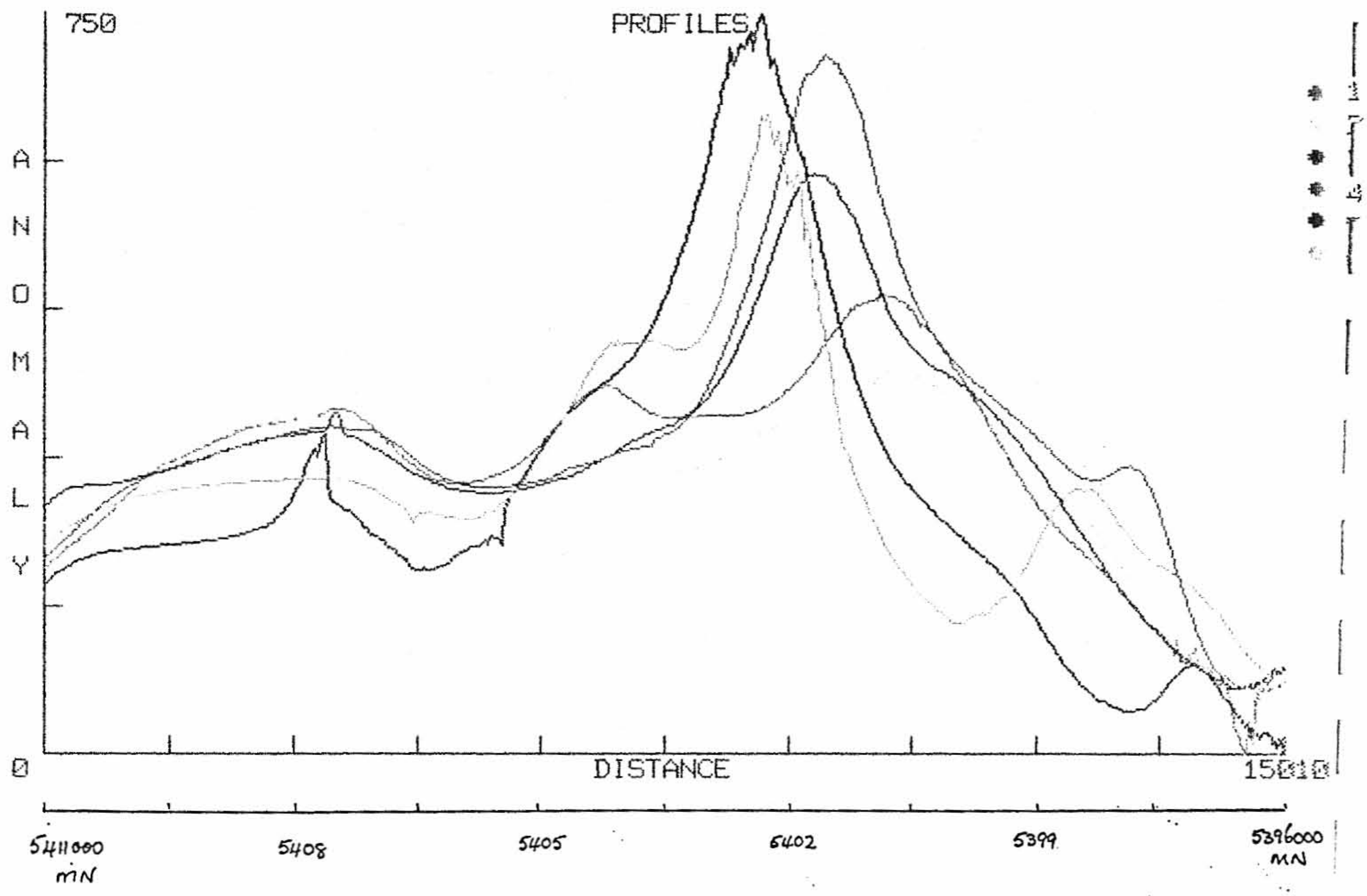

			Nominal easting
1	B:M12L1061	MOINA MAGNETICS 1061 AT 1200 M	426000 mE
2	B:M12L1062	MOINA MAGNETICS 1062 AT 1200 M	426500
3	B:M12L1063	MOINA MAGNETICS 1063 AT 1200 M	427 000
4	B:M12L1064	MOINA MAGNETICS 1064 AT 1200 M	427 500
5	B:M12L5820	MOINA MAGNETICS 5820 AT 1200 M	428 000
6	B:M12L5840	MOINA MAGNETICS 5840 AT 1200 M	428500

ZERO SHIFT : 120.744

COMPENSATED AEROMAGNETIC PROFILES : CALCULATION FOR 1200m LEVEL ASL

FIGURE 13

150

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Specialties:- Gravity, Magnetics, Seismic Methods

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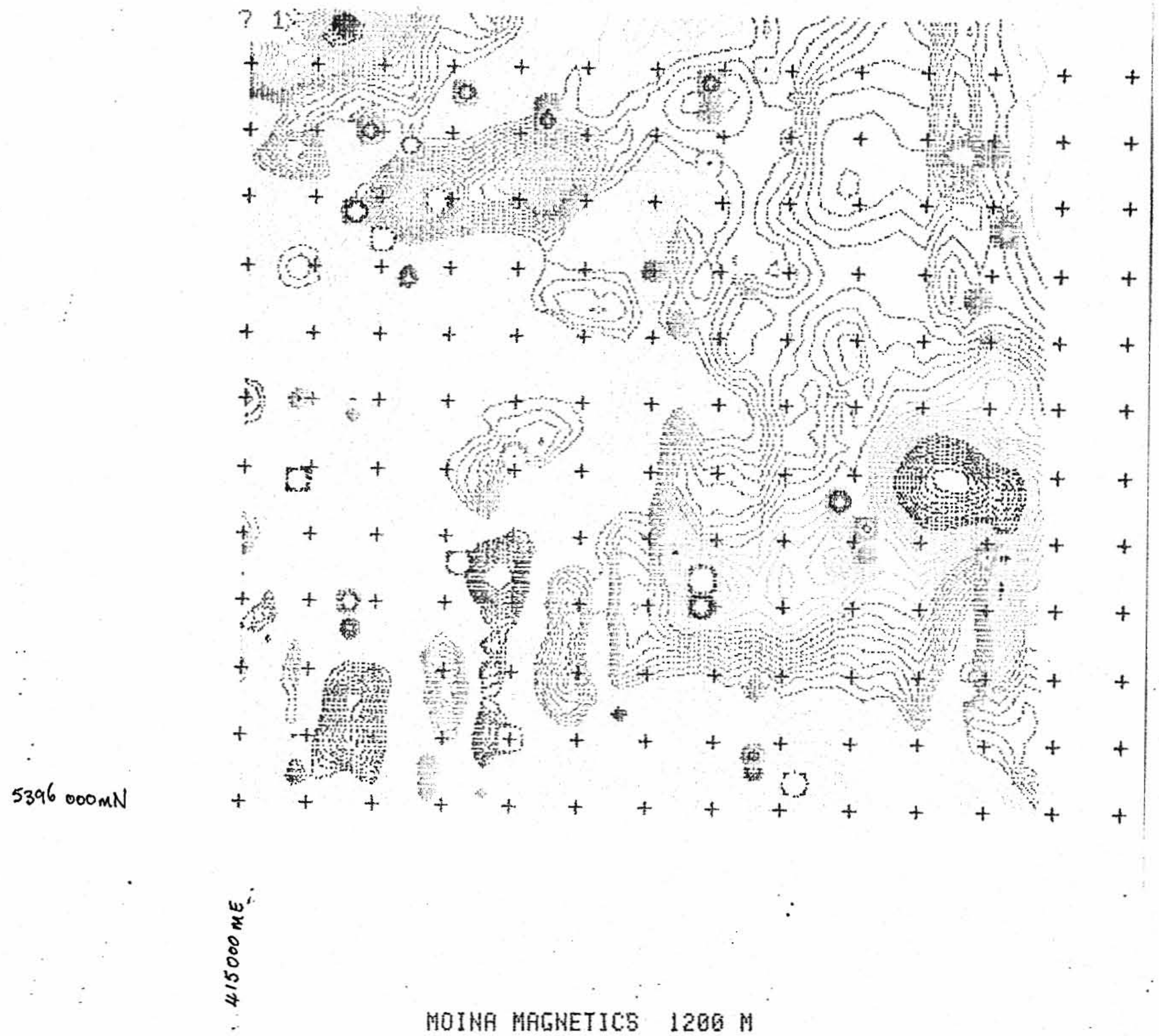
724151



MOINA MAGNETICS 1200 M
MOINA MAGNETICS COMPENSATED DATA LEVEL 1200 M
SCALE 125000
SAMPLE SPACING 250

(UNFILTERED)

Aug 88

Use geographic overlay (Fig 18 – in pocket)

Colour code:
nT
- −300 to −140 mauve
- −140 to 40 blue
- 40 to 220 green
- 220 to 400 yellow
- 400 to 580 red
- 580 to 700 pink

20nT interval

Figure 14

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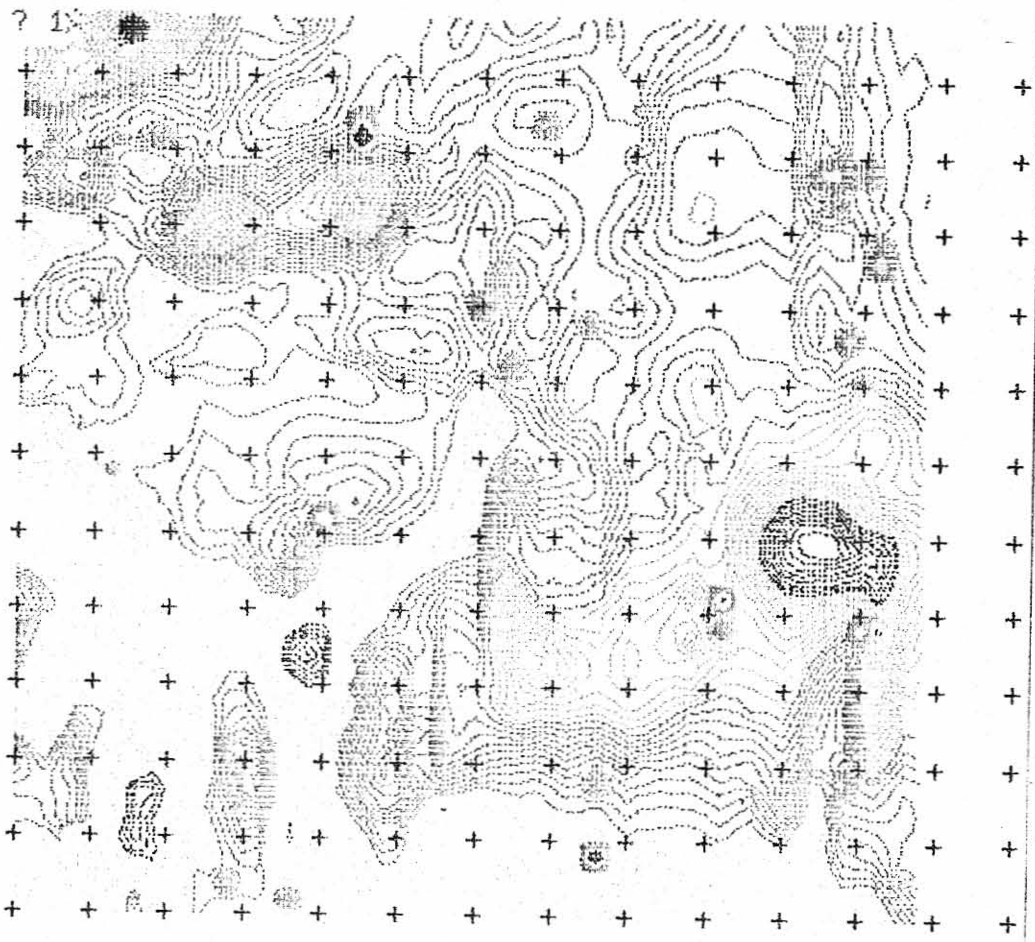

5396 000mN

415000mE

MOINA MAGNETICS 1200 M
MOINA MAGNETICS COMPENSATED DATA LEVEL 1200 M
SCALE 125000
SAMPLE SPACING 250

(FILTERED VERSION)

Aug 88

Use geographic overlay (Fig 18 – in pocket)

Colour code : −440 to −240 purple
to −20 blue
to 200 green
to 420 yellow
to 640 red
to 820 pink

20nT interval

Figure 15

152

724153

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Wide Experience Most Methods
Specialties:- Gravity, Magnetics, Seismic Methods

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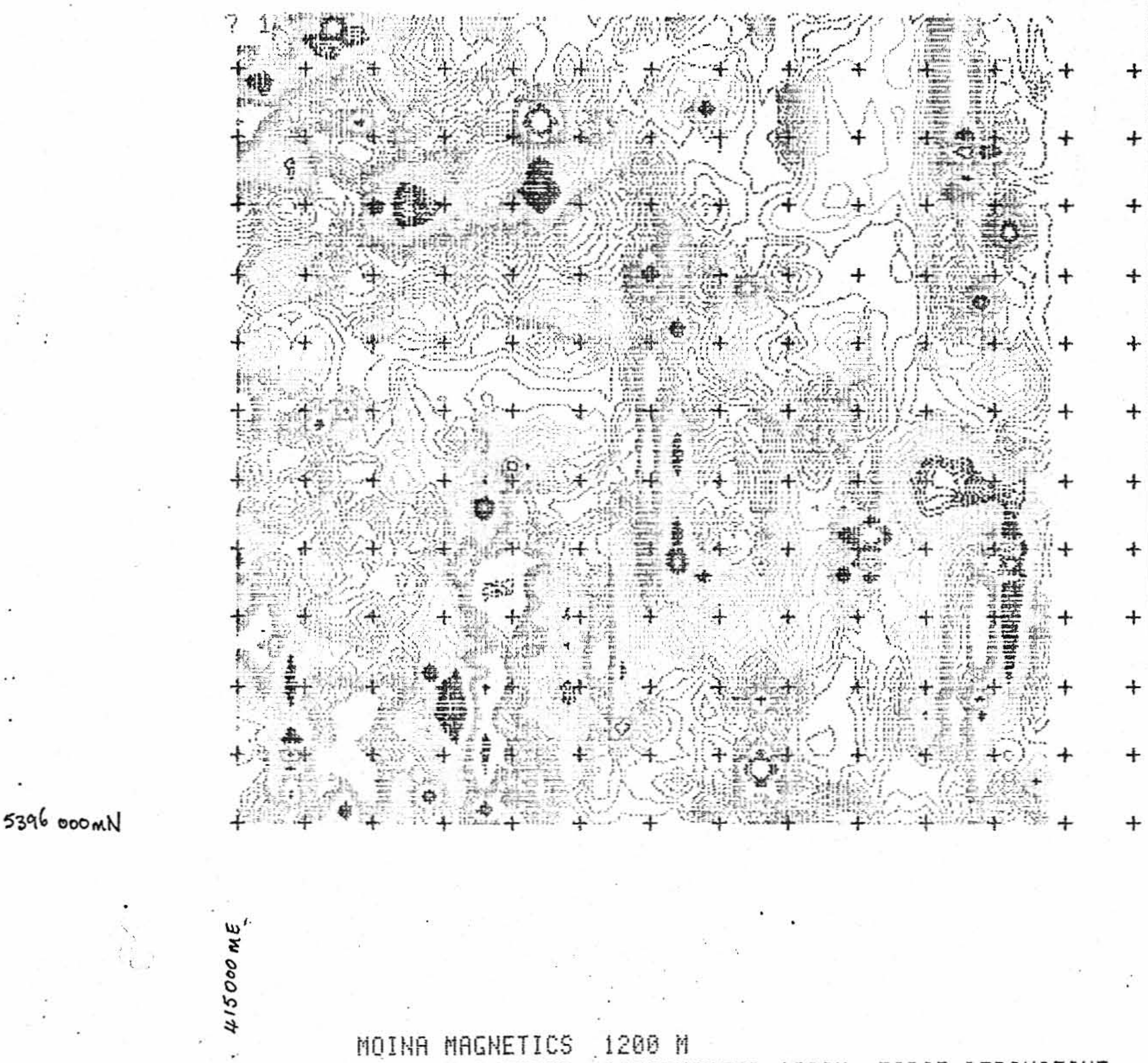

MOINA MAGNETICS 1200 M
MOINA MAGNETICS COMPENSATED 1200M FIRST DERIVATIVE
SCALE 125000
SAMPLE SPACING 250

Colour code: -250 to -170 nT/m purple
to -80 blue
to 10 green
to 100 yellow
to 190 red
>190 pink

10 unit contour interval

Use geographic overlay (Fig 18 – in pocket)

Aug 88

Figure 16

153 24164

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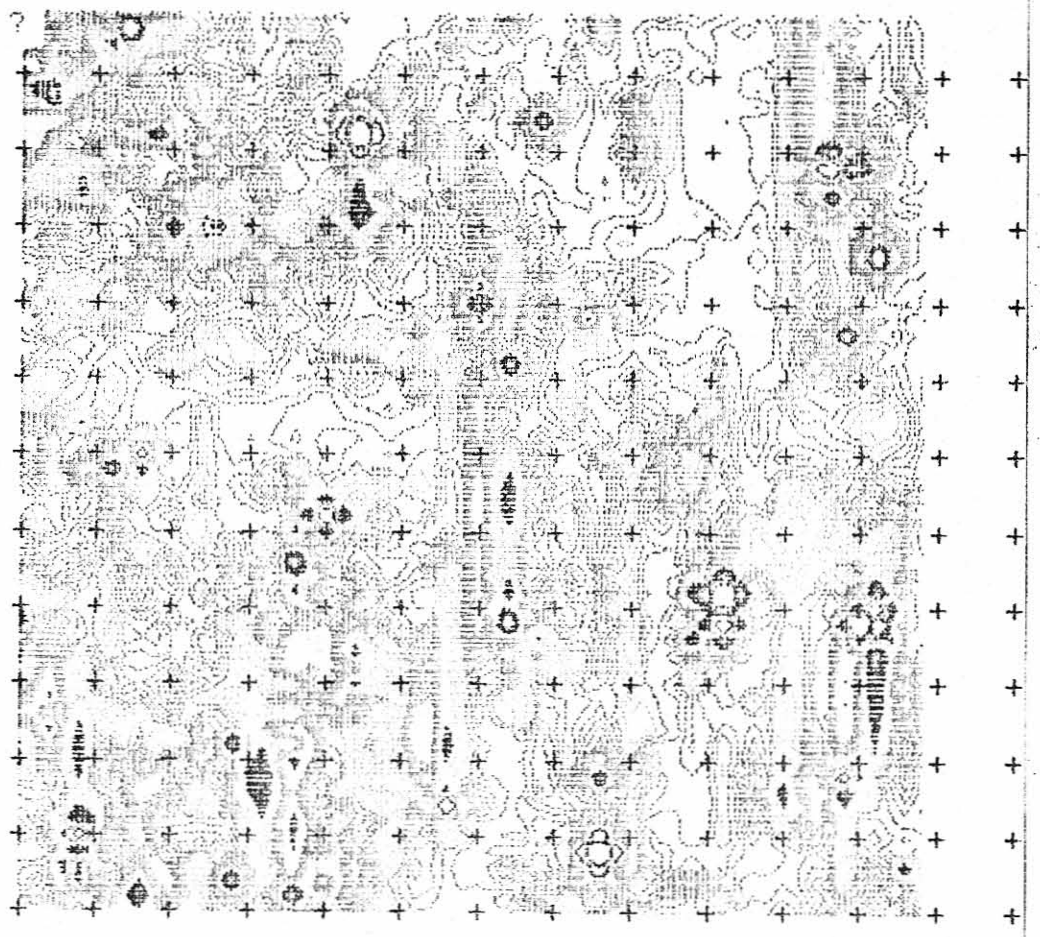


5396 000mN

415000 mE

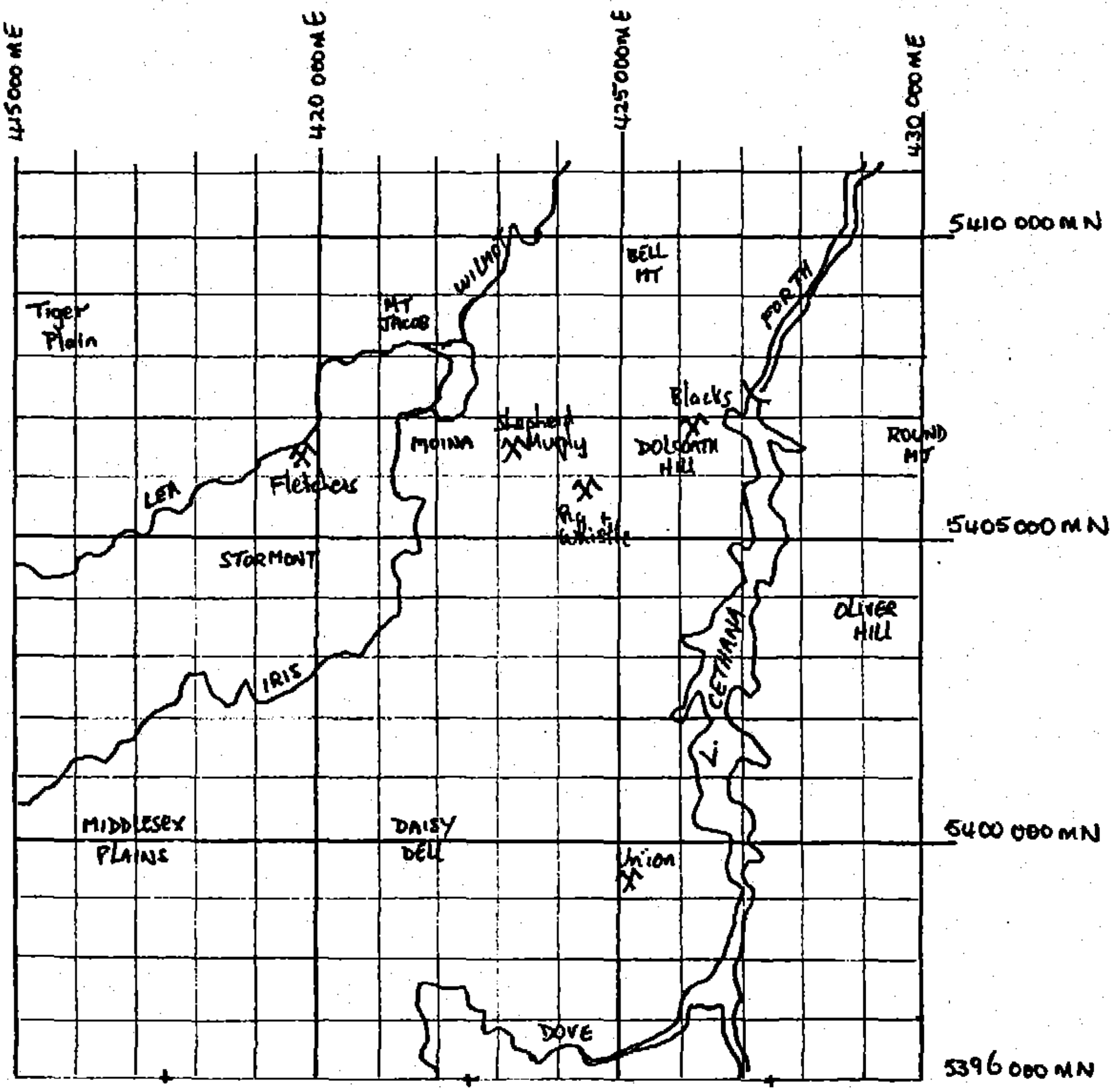
MOINA MAGNETICS 1200 M
MOINA MAGNETICS COMPENSATED 1200M SECOND DERIVATIVE
SCALE 125000
SAMPLE SPACING 250

Colour code: -250 to -170 purple nT/m²
to -80 blue
to 10 green
to 100 yellow
to 190 red
>190 pink
10 unit contour interval

Use geographic overlay (Fig 18 – in pocket)

Aug 88

Figure 17



OVERLAY

MOINA MAGNETICS – COMPENSATED FIELD

For diagrams : Intensity at 1200m
First, Second derivatives at 1200m.

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Hobart, Tasmania 7001

FIGURE 18

135

724156

LEAMAN GEOPHYSICS

Survey Review, Specification, Reduction, Interpretation
Wide Experience Most Methods
Specialties:- Gravity, Magnetics, Seismic Methods

Registered Office:
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All Correspondence to:
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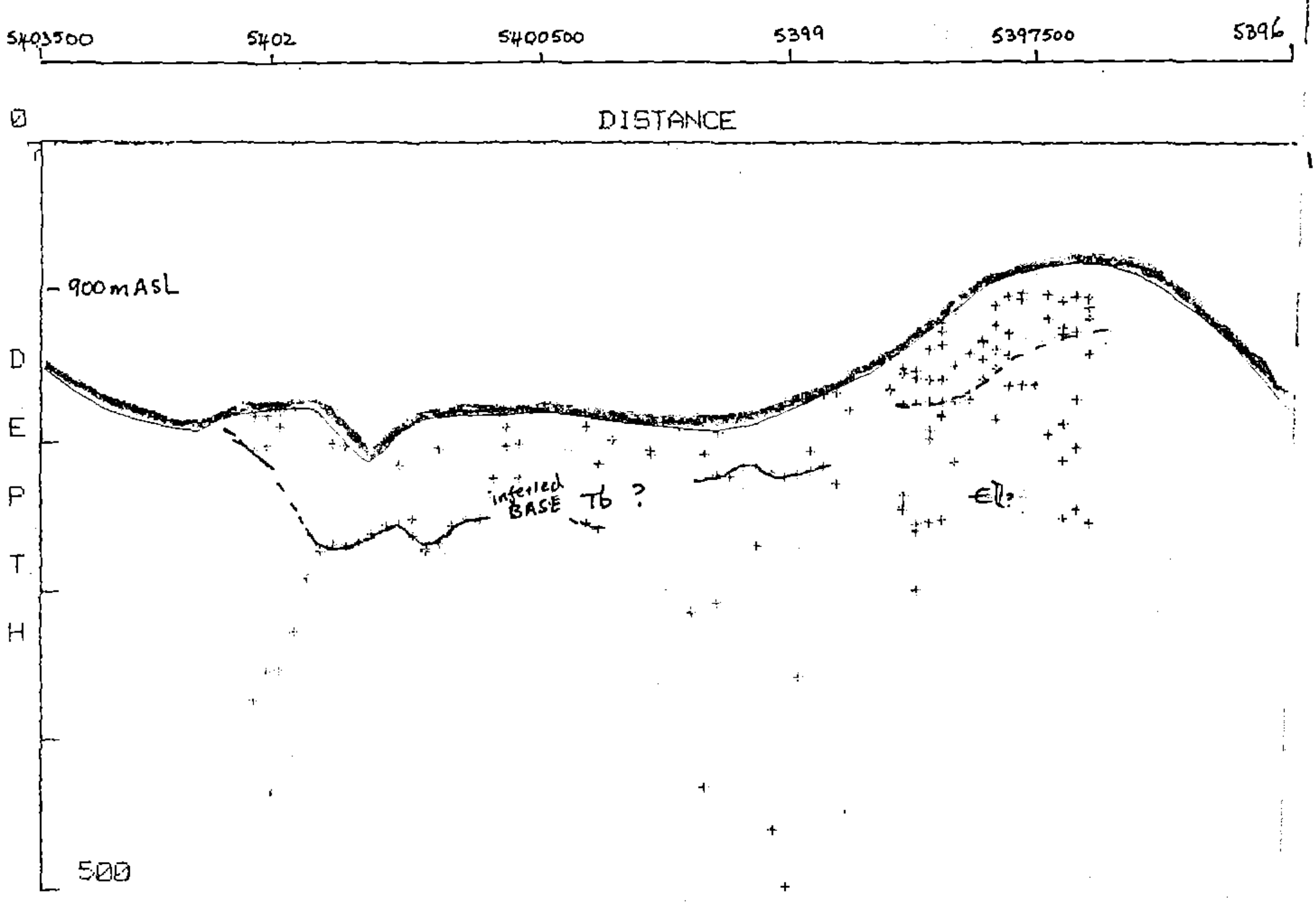
TELEPHONE: (002) 24 0319

Nominal easting: 416500 mE



MAGNETIC DEPTH ESTIMATE PLOT

B:D5360H64
BASALT DEPTH ESTIMATES LONG PROPERTY OPERATOR (64) 5360

Aug 88

FIGURE 19

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Survey Review, Specification, Reduction, Interpretation
Wide Experience Most Methods
Specialties:- Gravity, Magnetics, Seismic Methods

Registered Office:
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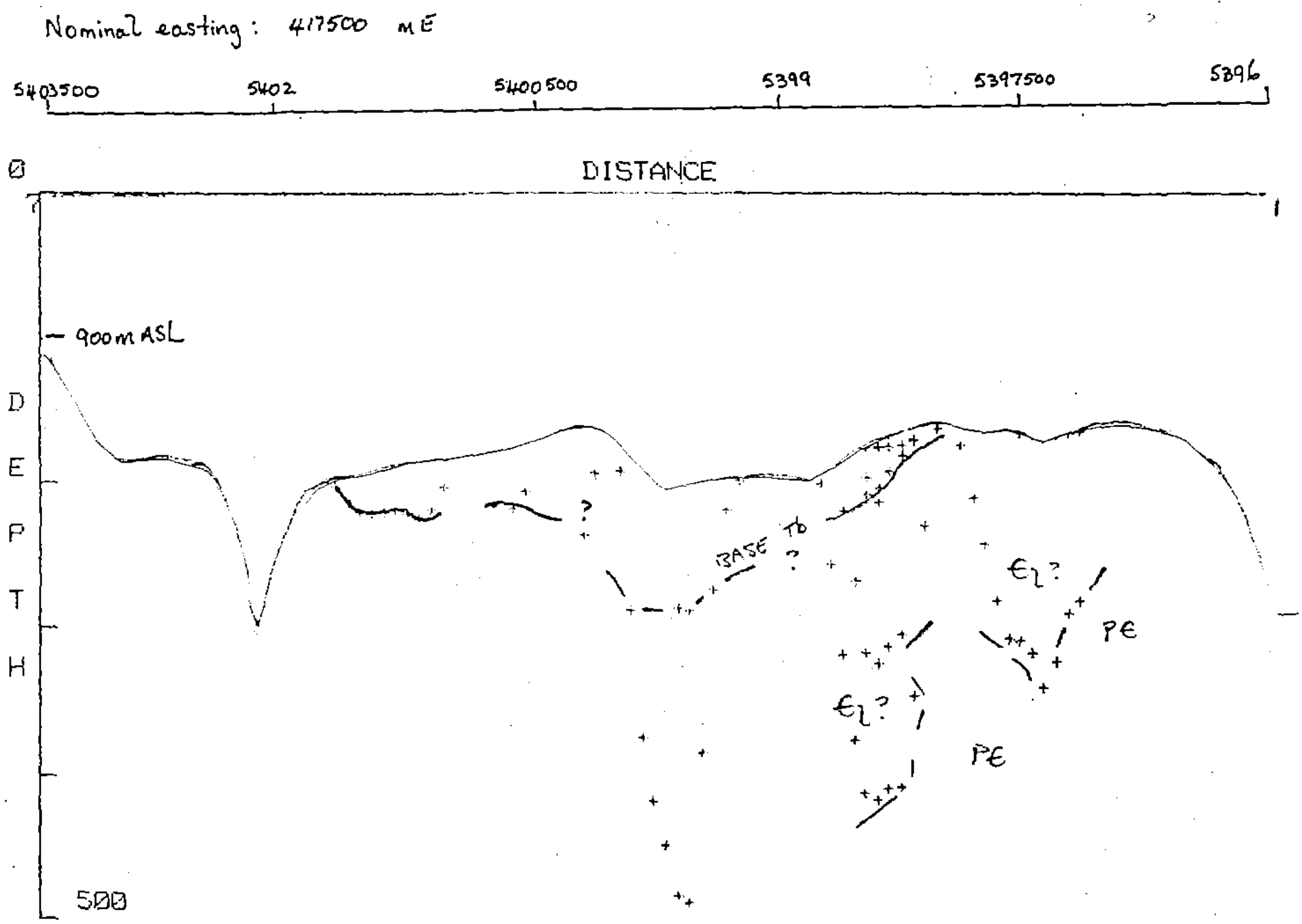
All Correspondence to:
G.P.O. BOX 320 D, HOBART, TAS. 7001.
TELEPHONE: (002) 24 0319



MAGNETIC DEPTH ESTIMATE PLOT

B:D5400H64
BASALT DEPTH ESTIMATES LONG PROPERTY OPERATOR (64) 5400

Aug 88

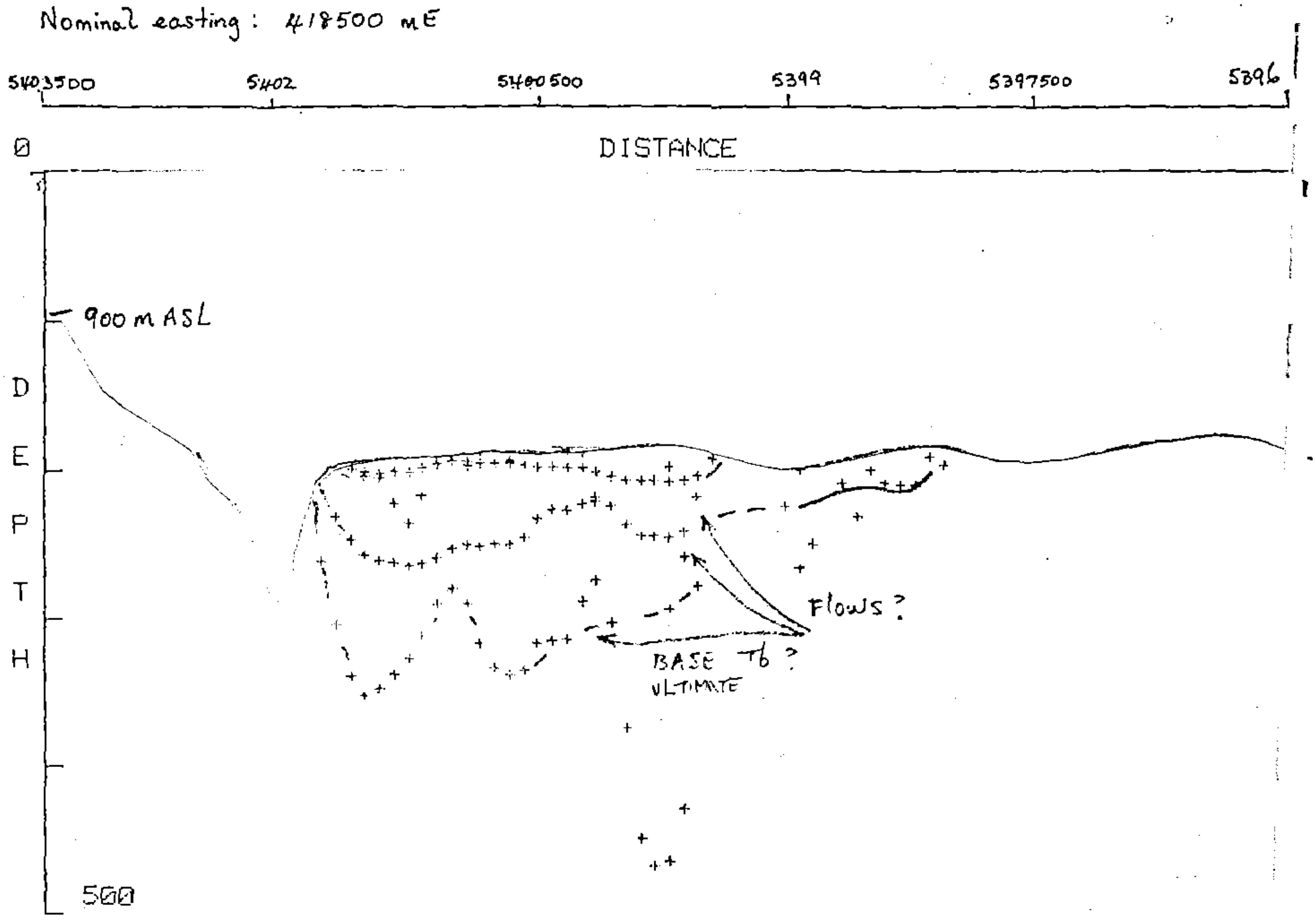
FIGURE 20

724158

LEAMAN GEOPHYSICS

Survey Review, Specification, Reduction, Interpretation
Wide Experience Most Methods
Specialties:- Gravity, Magnetics, Seismic Methods

Registered Office:
21 Zomay Ave, Dynnyrne, Tas 7005
All Correspondence to:
G.P.O. BOX 320 D, HOBART, TAS. 7001.
TELEPHONE: (002) 24 0319



illustrates need for some control
multiple flows are, however, possible

MAGNETIC DEPTH ESTIMATE PLOT

B:D5440H64
BASALT DEPTH ESTIMATES LONG PROPERTY OPERATOR (64)

Aug 88

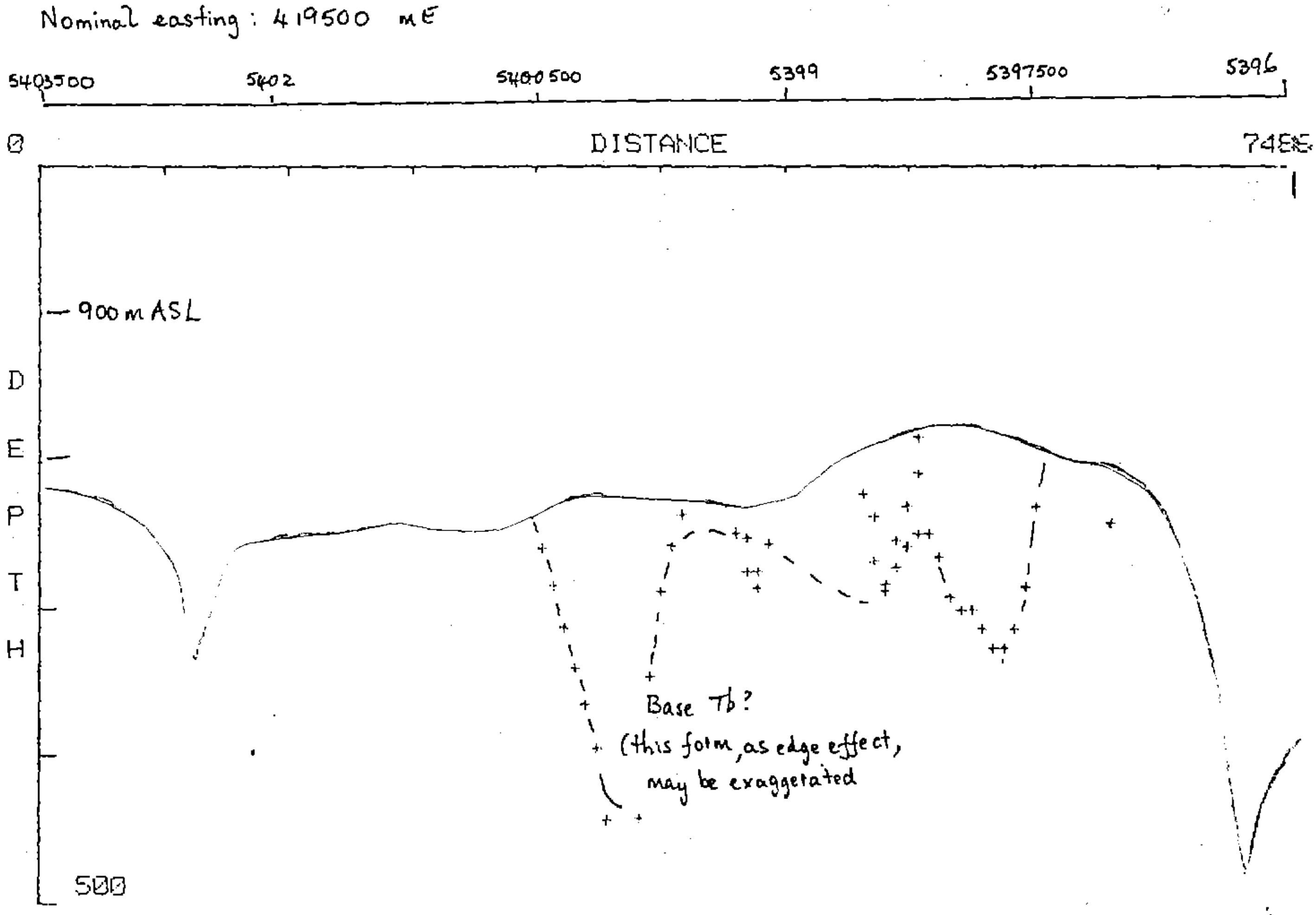
FIGURE 21

724159

LEAMAN GEOPHYSICS

Survey Review, Specification, Reduction, Interpretation
Wide Experience Most Methods
Specialties:- Gravity, Magnetics, Seismic Methods

Registered Office:
21 Zomay Ave, Dynnyrne, Tas 7005
All Correspondence to:
G.P.O. BOX 320 D, HOBART, TAS. 7001.
TELEPHONE: (002) 24 0319



MAGNETIC DEPTH ESTIMATE PLOT

B:D5480H64
BASALT DEPTH ESTIMATES LONG PROPERTY OPERATOR (64) 5480

Aug 88

FIGURE 22

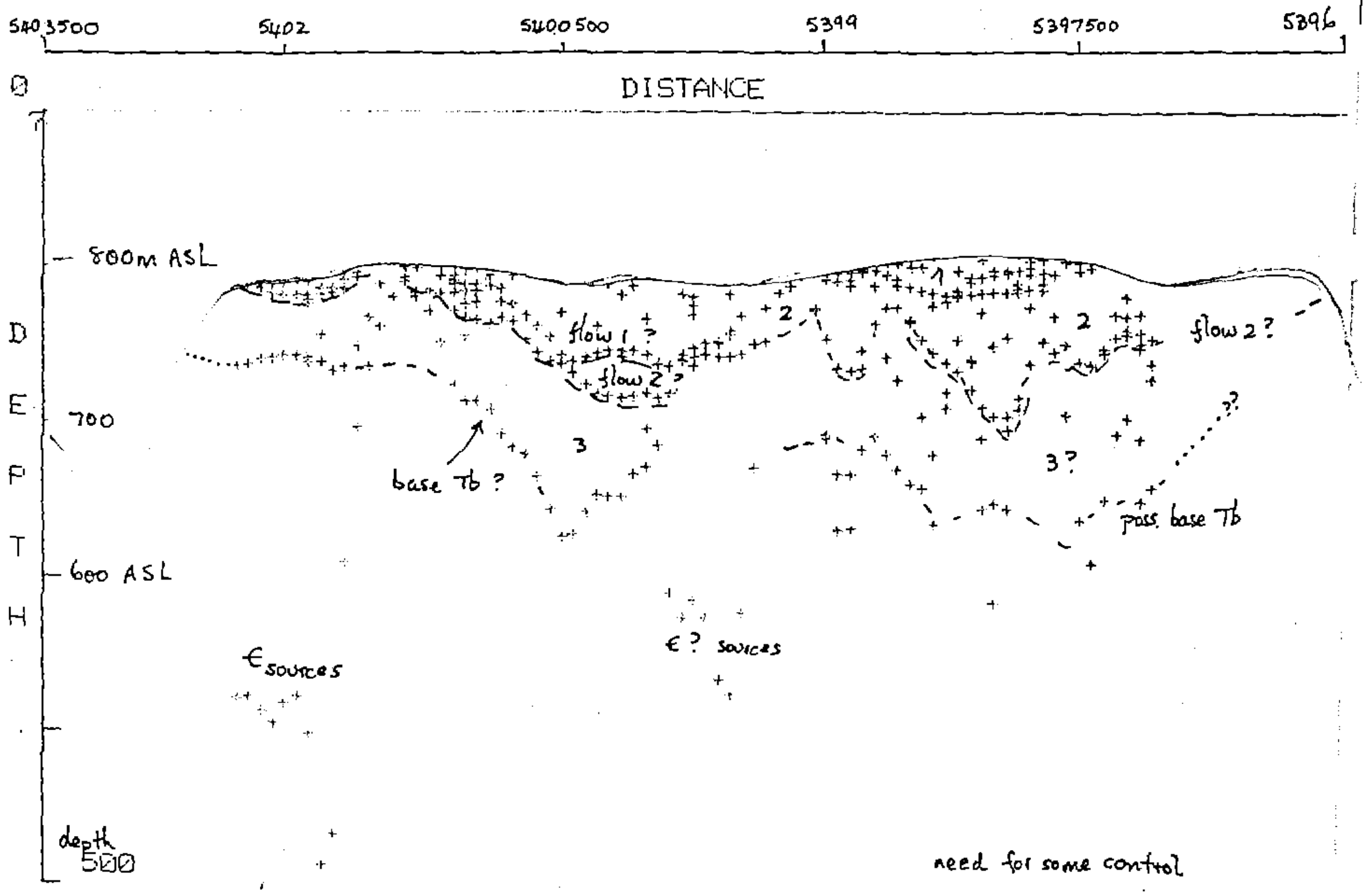
159

724160

LEAMAN GEOPHYSICS
Survey Review, Specification, Reduction, Interpretation
Wide Experience Most Methods
Specialties:- Gravity, Magnetics, Seismic Methods

Registered Office:
21 Zomay Ave, Dynnyrne, Tas 7005
All Correspondence to:
G.P.O. BOX 320 D, HOBART, TAS. 7001.
TELEPHONE: (002) 24 0319

Nominal easting: 420 500 mE



MAGNETIC DEPTH ESTIMATE PLOT

B:D5520H64
BASALT DEPTH ESTIMATES LONG PROPERTY OPERATOR (64) 5520

Aug 88

FIGURE 23

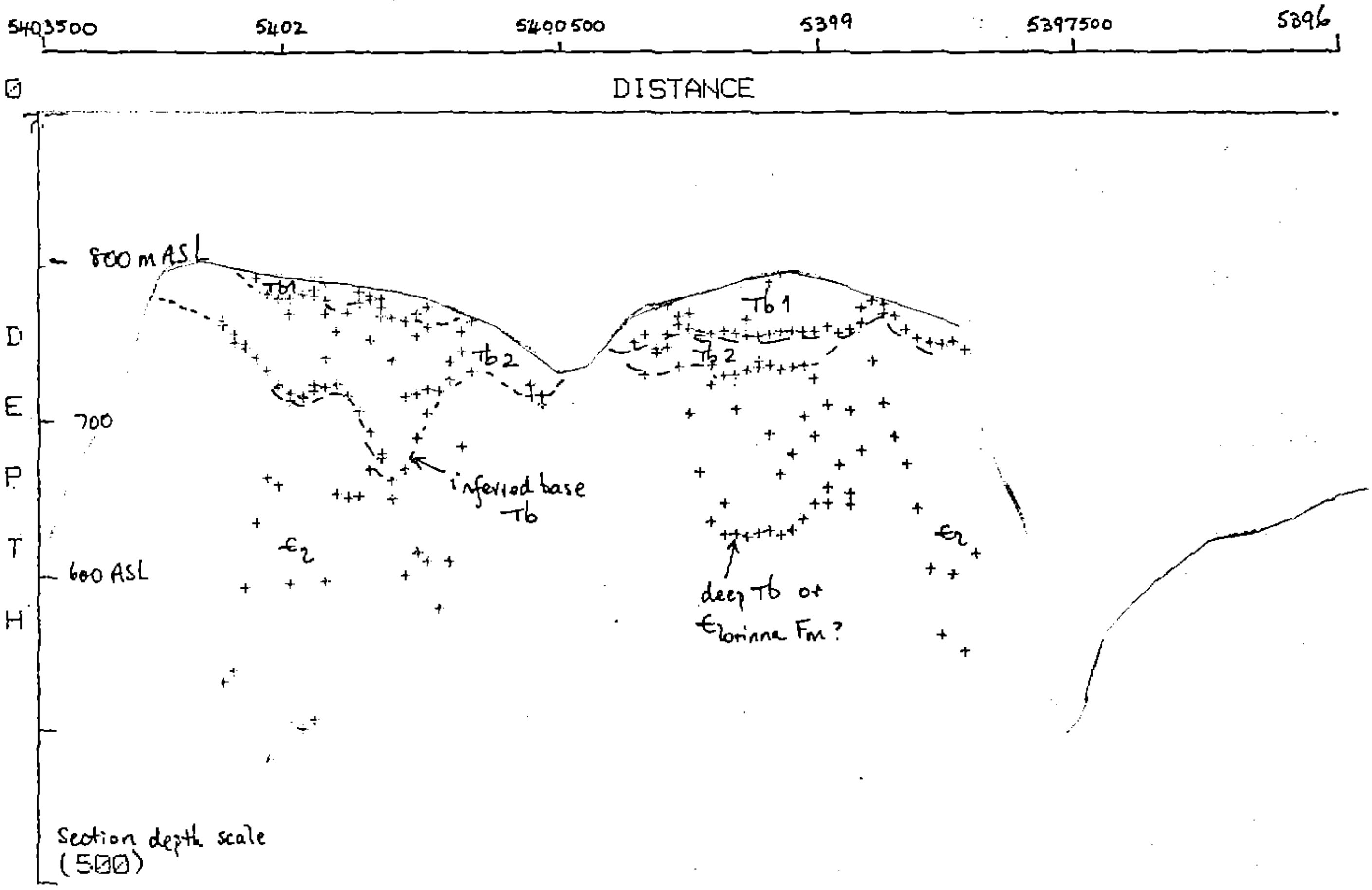
724161

LEAMAN GEOPHYSICS

Survey Review, Specification, Reduction, Interpretation
Wide Experience Most Methods
Specialties:- Gravity, Magnetics, Seismic Methods

Registered Office:
21 Zomay Ave, Dynnyrne, Tas 7005
All Correspondence to:
G.P.O. BOX 320 D, HOBART, TAS. 7001.
TELEPHONE: (002) 24 0319

Nominal easting: 421500 mE



MAGNETIC DEPTH ESTIMATE PLOT

B:D5560H64
BASALT DEPTH ESTIMATES LONG PROPERTY OPERATOR (64)

Aug 88

FIGURE 24

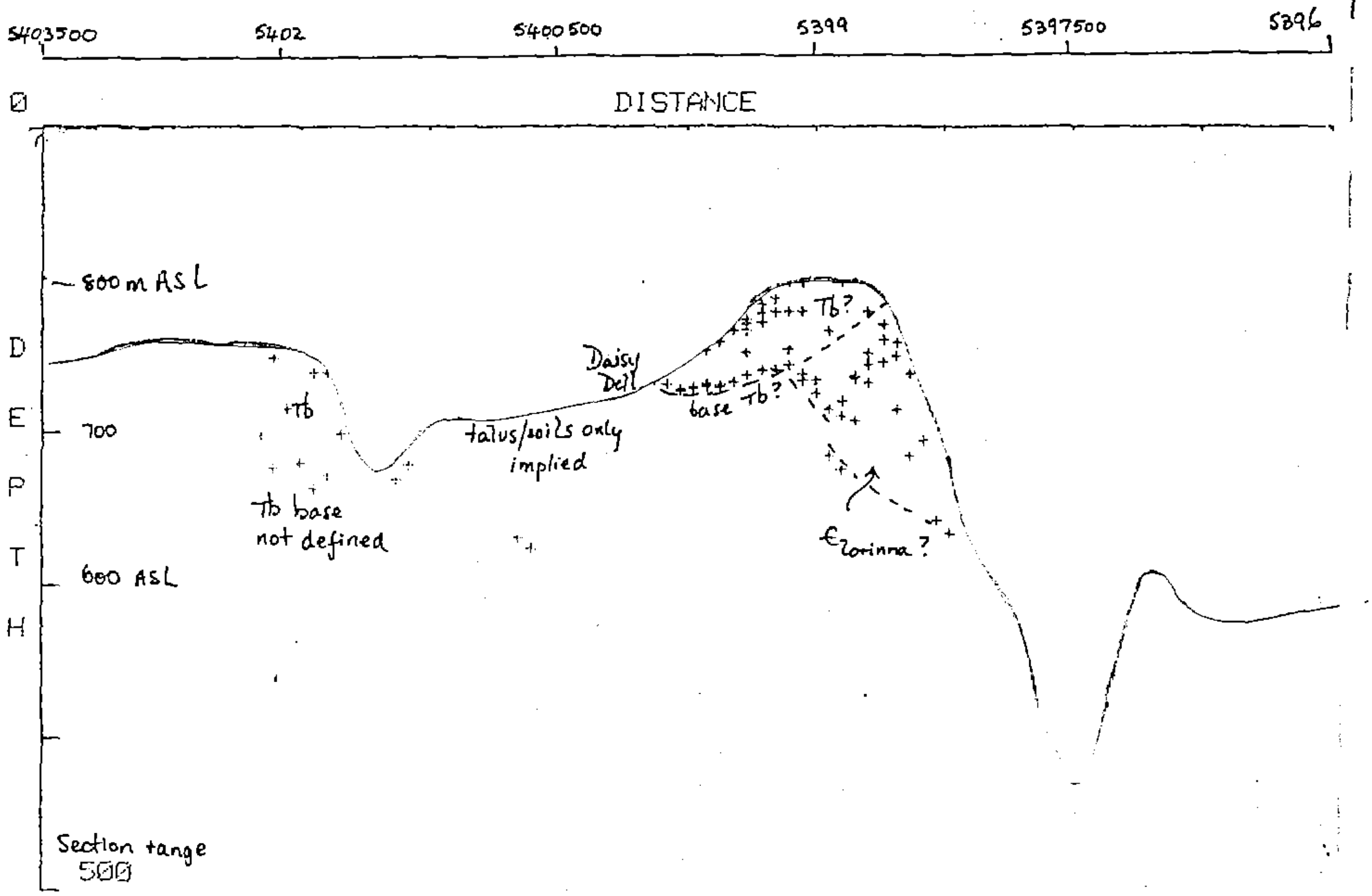
724162

LEAMAN GEOPHYSICS

Survey Review, Specification, Reduction, Interpretation
Wide Experience Most Methods
Specialties:- Gravity, Magnetics, Seismic Methods

Registered Office:
21 Zomay Ave, Dynnyrne, Tas 7005
All Correspondence to:
G.P.O. BOX 320 D, HOBART, TAS. 7001.
TELEPHONE: (002) 24 0319

Nominal easting: 422500 mE



MAGNETIC DEPTH ESTIMATE PLOT

B:D5600H64
BASALT DEPTH ESTIMATES LONG PROPERTY OPERATOR (64) 5600

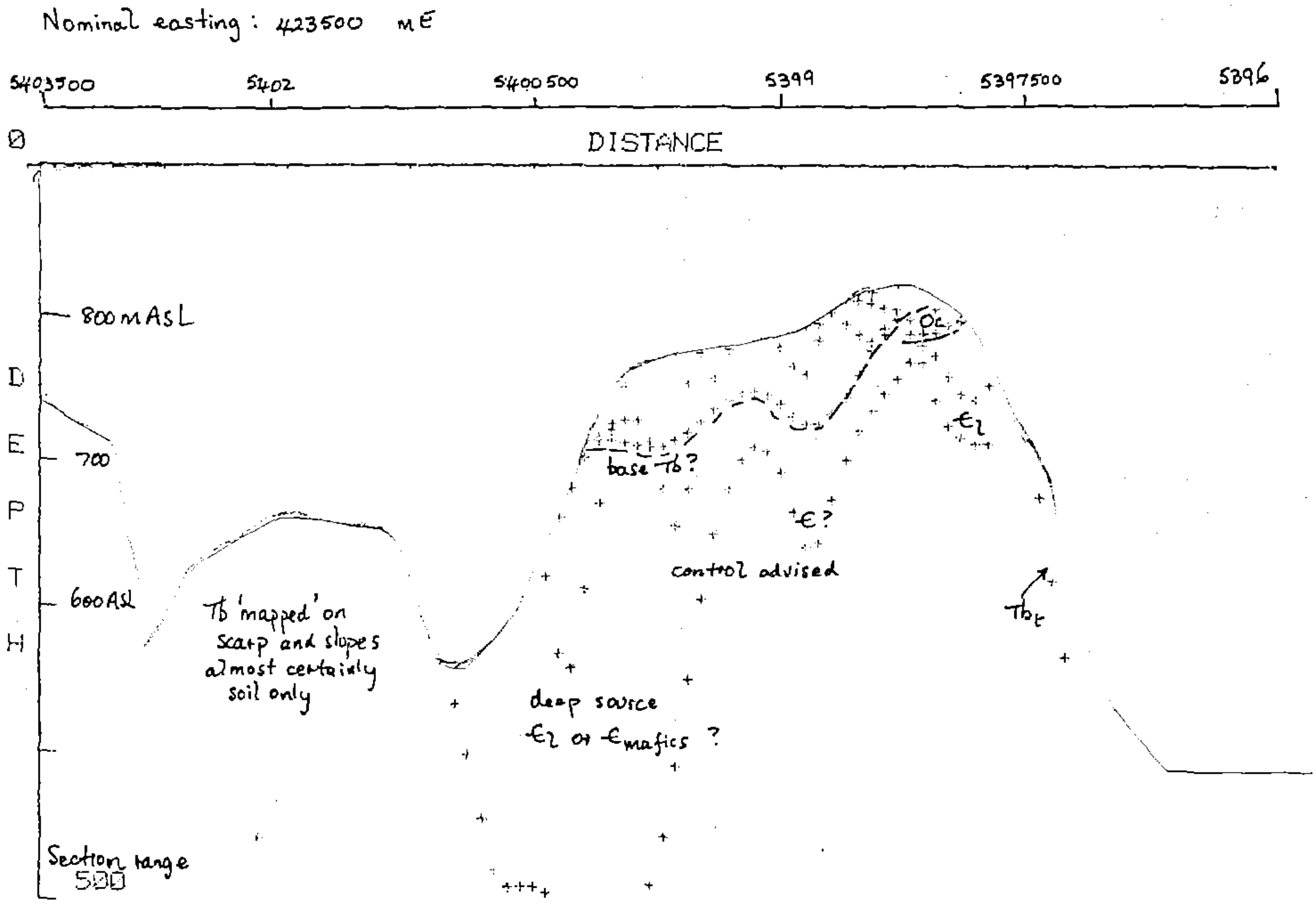
Aug 88

FIGURE 25

724163

LEAMAN GEOPHYSICS
Survey Review, Specification, Reduction, Interpretation
Wide Experience Most Methods
Specialties:- Gravity, Magnetics, Seismic Methods

Registered Office:
21 Zomay Ave, Dynnyrne, Tas 7005
All Correspondence to:
G.P.O. BOX 320 D, HOBART, TAS. 7001.
TELEPHONE: (002) 24 0319



MAGNETIC DEPTH ESTIMATE PLOT

B:D5640H64
BASALT DEPTH ESTIMATES LONG PROPERTY OPERATOR (64) 5640

Aug 88

FIGURE 26

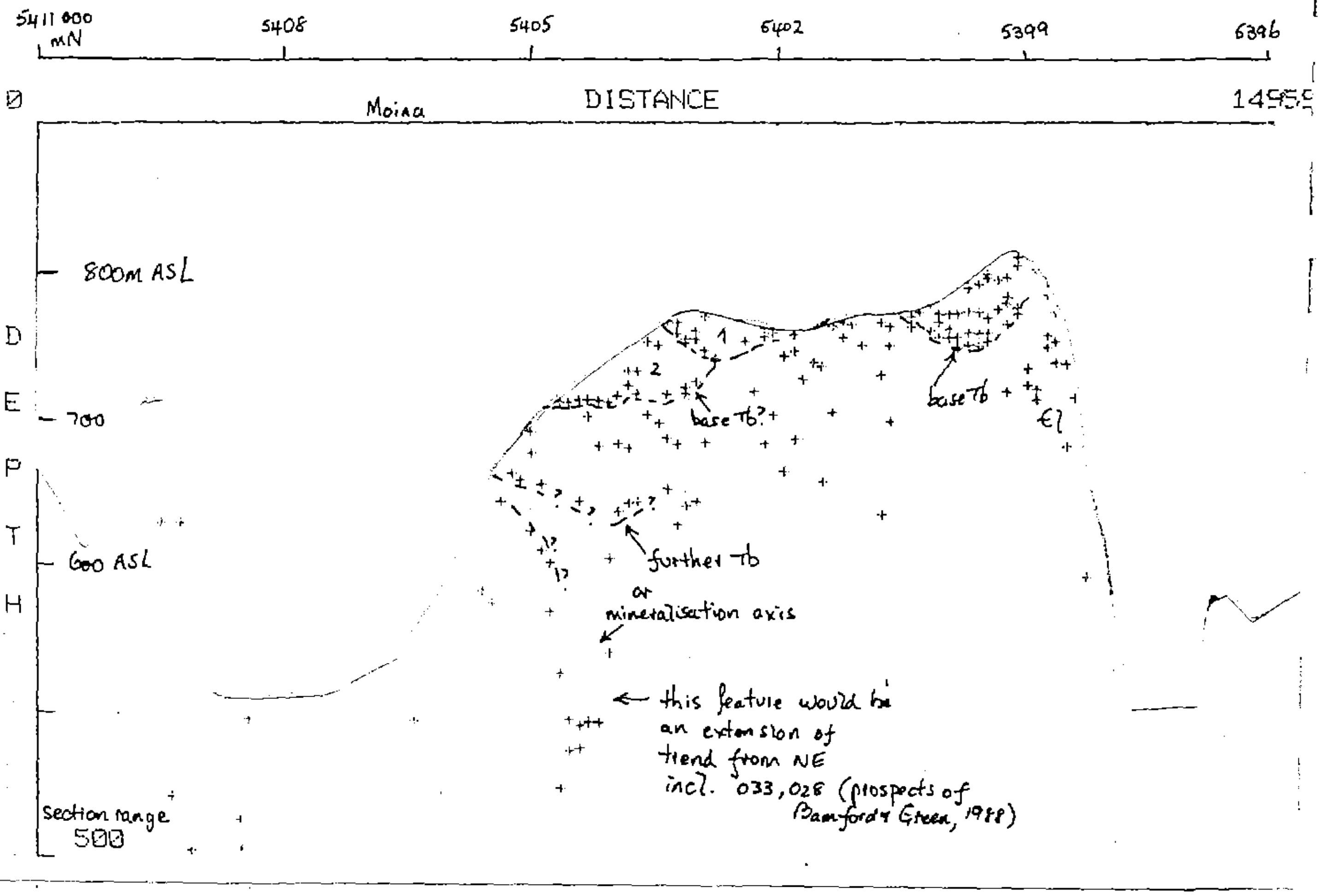
103 724164

LEAMAN GEOPHYSICS

Survey Review, Specification, Reduction, Interpretation
Wide Experience Most Methods
Specialties:- Gravity, Magnetics, Seismic Methods

Registered Office:
21 Zomay Ave, Dynnyrne, Tas 7005
All Correspondence to:
G.P.O. BOX 320 D, HOBART, TAS. 7001.
TELEPHONE: (002) 24 0319

Nominal easting: 422500 mE



MAGNETIC DEPTH ESTIMATE PLOT

B:BD9L5600
BASALT DEPTH ESTIMATES 5600 LONG OPERATOR 64BY3

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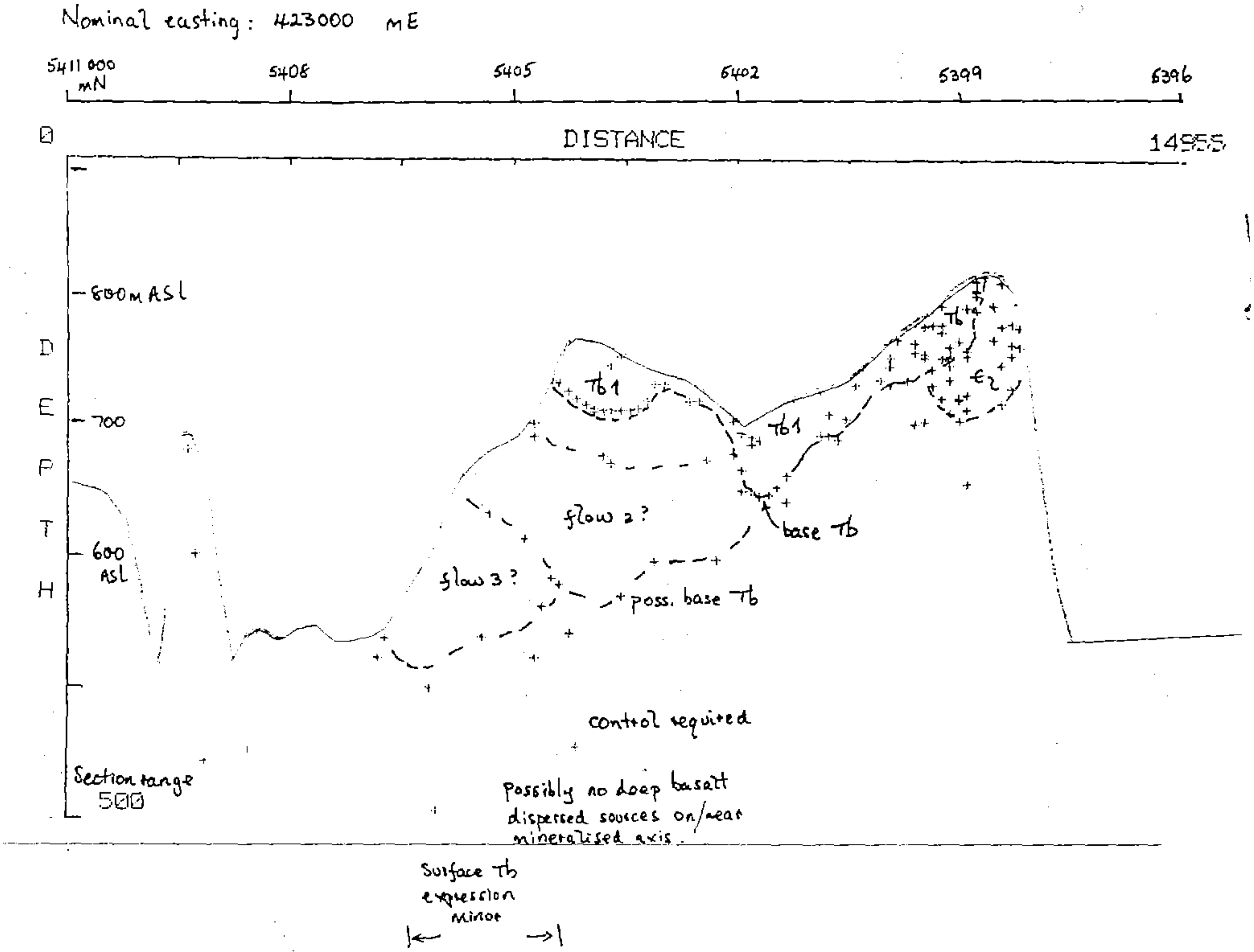
FIGURE 27

104 724165

LEAMAN GEOPHYSICS

Survey Review, Specification, Reduction, Interpretation
Wide Experience Most Methods
Specialties:- Gravity, Magnetics, Seismic Methods

Registered Office:
21 Zomay Ave, Dynnyrne, Tas 7005
All Correspondence to:
G.P.O. BOX 320 D, HOBART, TAS. 7001.
TELEPHONE: (002) 24 0319



MAGNETIC DEPTH ESTIMATE PLOT

B:BD9L5620
BASALT DEPTH ESTIMATES 5620 LONG OPERATOR 64/3

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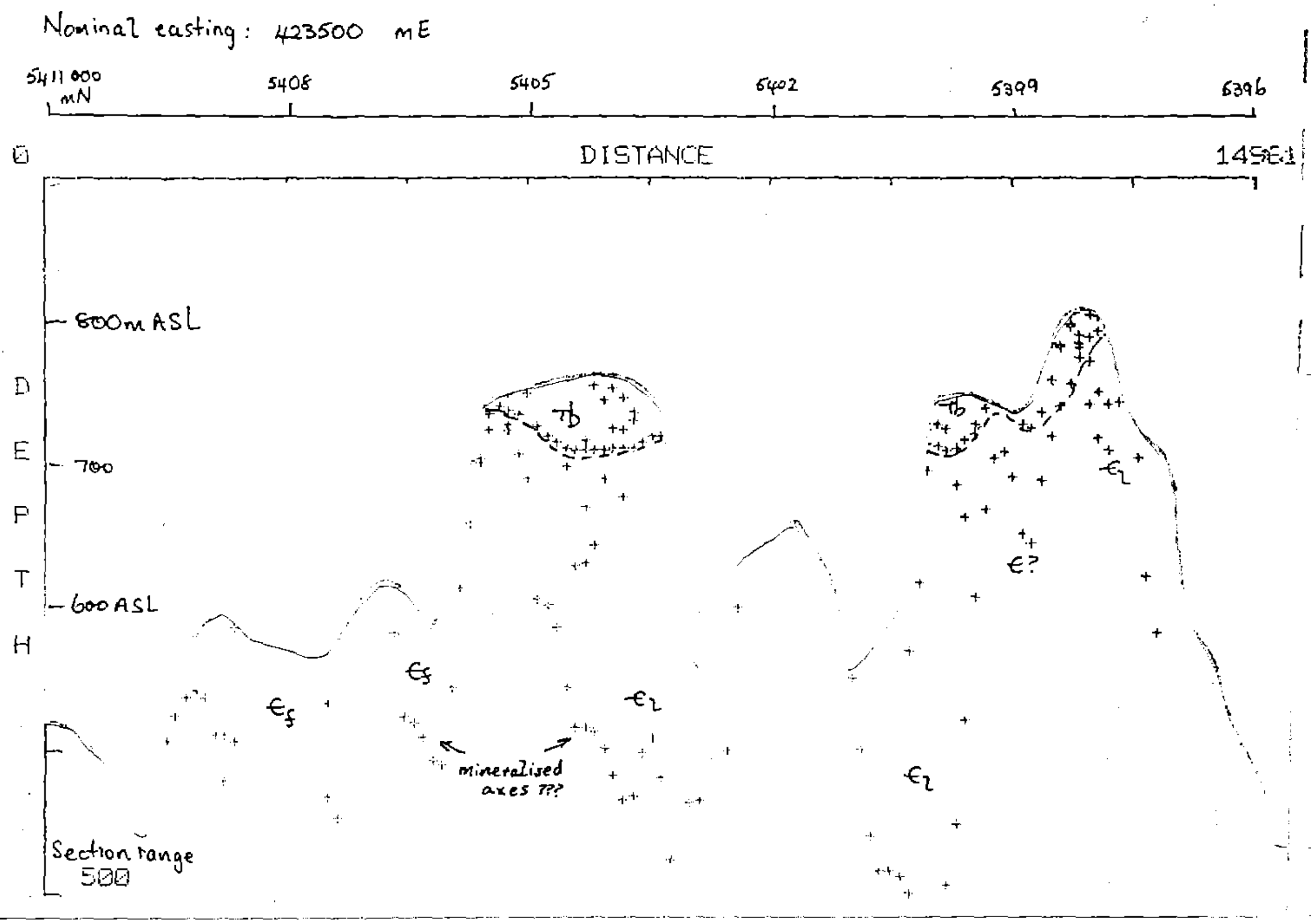
FIGURE 28

724166

LEAMAN GEOPHYSICS

Survey Review, Specification, Reduction, Interpretation
Wide Experience Most Methods
Specialties:- Gravity, Magnetics, Seismic Methods

Registered Office:
21 Zomay Ave, Dynnyrne, Tas 7005
All Correspondence to:
G.P.O. BOX 320 D, HOBART, TAS. 7001.
TELEPHONE: (002) 24 0319



MAGNETIC DEPTH ESTIMATE PLOT

B:BD9L5640
BASALT DEPTH ESTIMATES 5640 LONG OPERATOR 64/3

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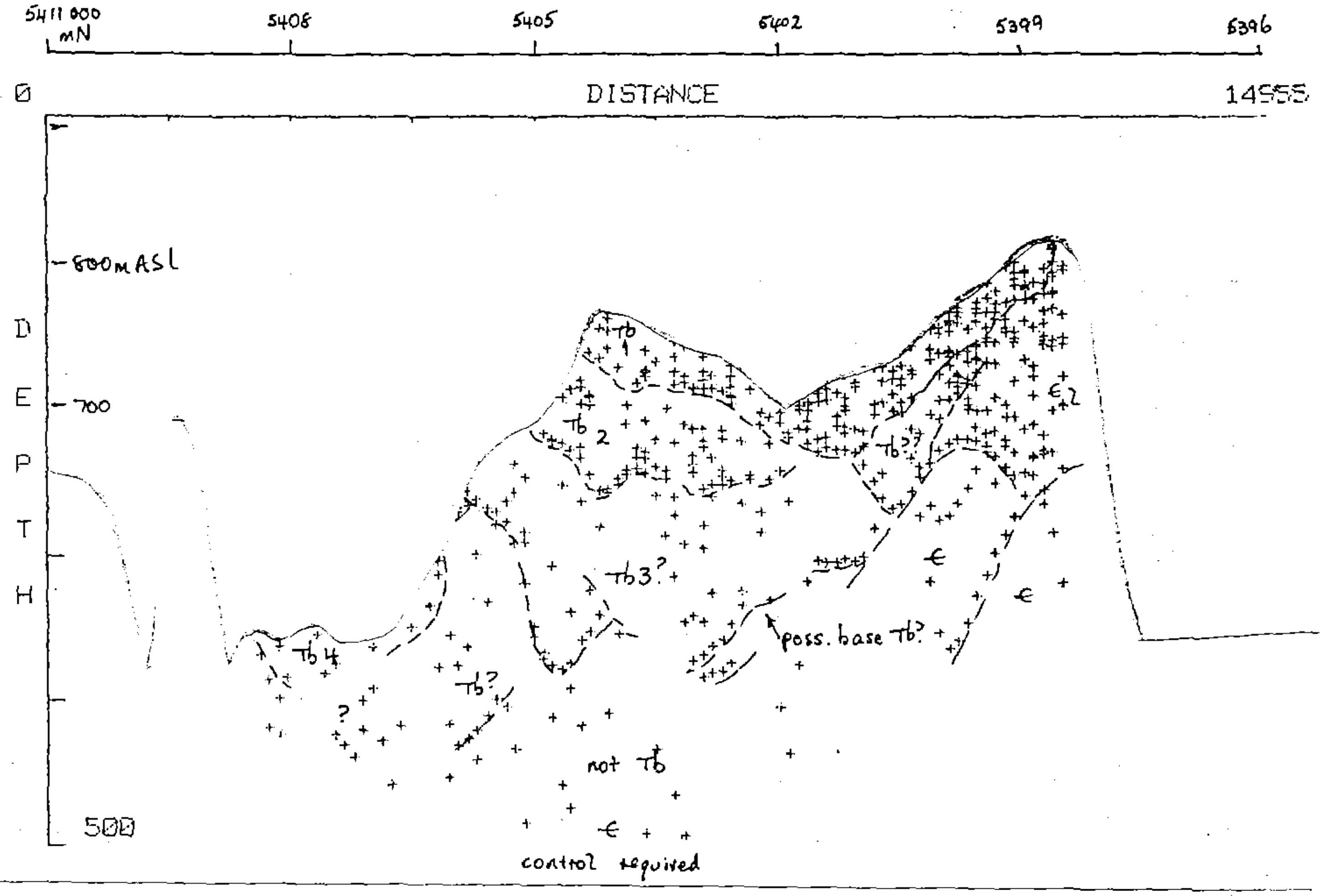
FIGURE 29

LEAMAN GEOPHYSICS

Survey Review, Specification, Reduction, Interpretation
Wide Experience Most Methods
Specialties:- Gravity, Magnetics, Seismic Methods

Registered Office: 21 Zomay Ave, Dynnyrne, Tas 7005
All Correspondence to: G.P.O. BOX 320 D, HOBART, TAS. 7001.
TELEPHONE: (002) 24 0319

Nominal easting: 423000 mE



MAGNETIC DEPTH ESTIMATE PLOT

B:BD9L5620
BASALT DEPTH ESTIMATES 5620 VERY LONG OPERATOR 128/3

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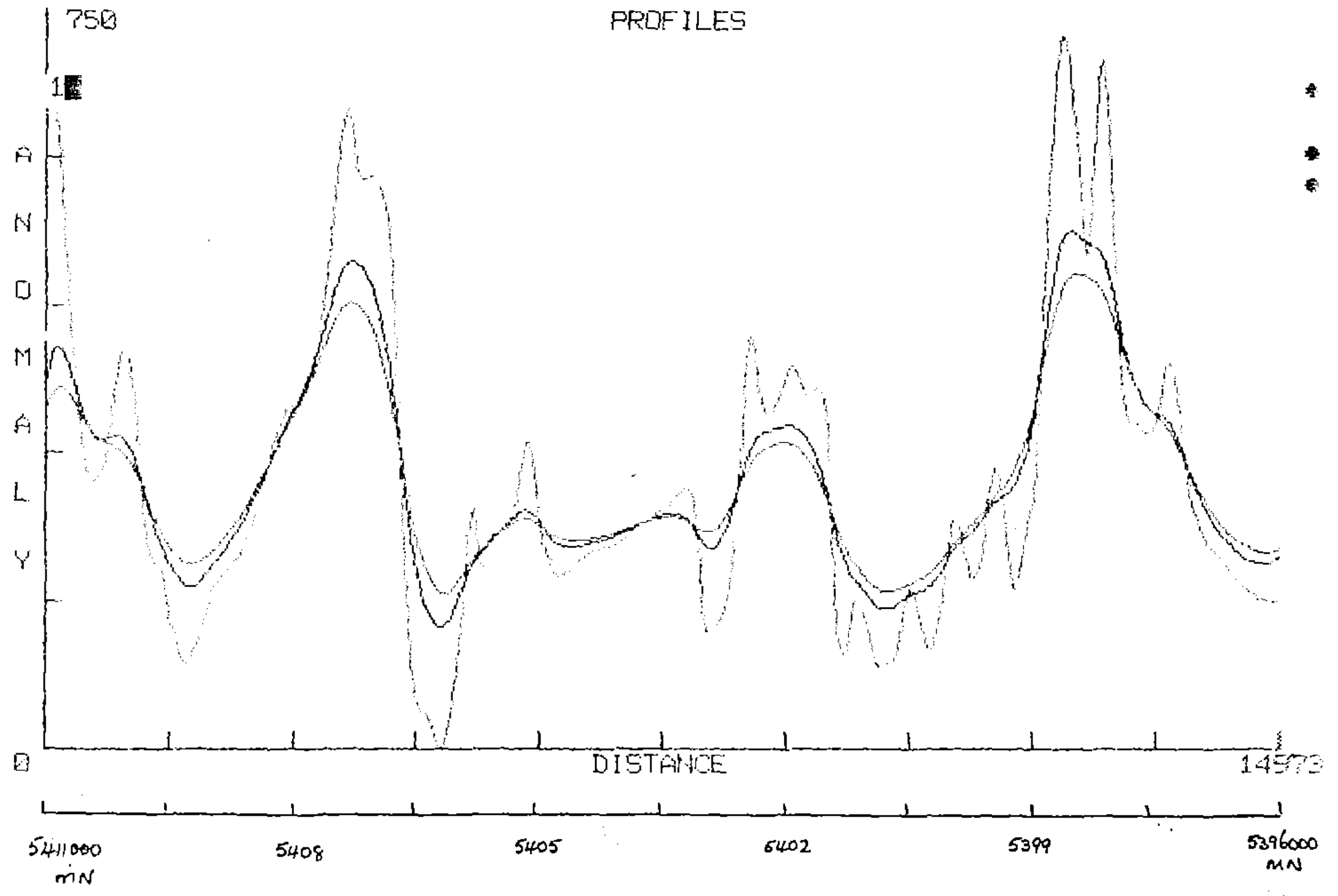
FIGURE 30

LEAMAN GEOPHYSICS

Survey Review, Specification, Reduction, Interpretation
Wide Experience Most Methods
Specialties:- Gravity, Magnetics, Seismic Methods

Registered Office:
21 Zomay Ave, Dynnyrne, Tas 7005
All Correspondence to:
G.P.O. BOX 320 D, HOBART, TAS. 7001.
TELEPHONE: (002) 24 0319



1	B:M5460	MOINA PROJECT LINE 5460
2	B:M5460C1	MOINA MAGNETICS 5460 CONTINUED 100 M
3	B:M5460C2	MOINA MAGNETICS 5460 CONTINUED 200 M
4	B:M5460C3	MOINA MAGNETICS 5460 CONTINUED 300 M

ZERO SHIFT : 211.3001

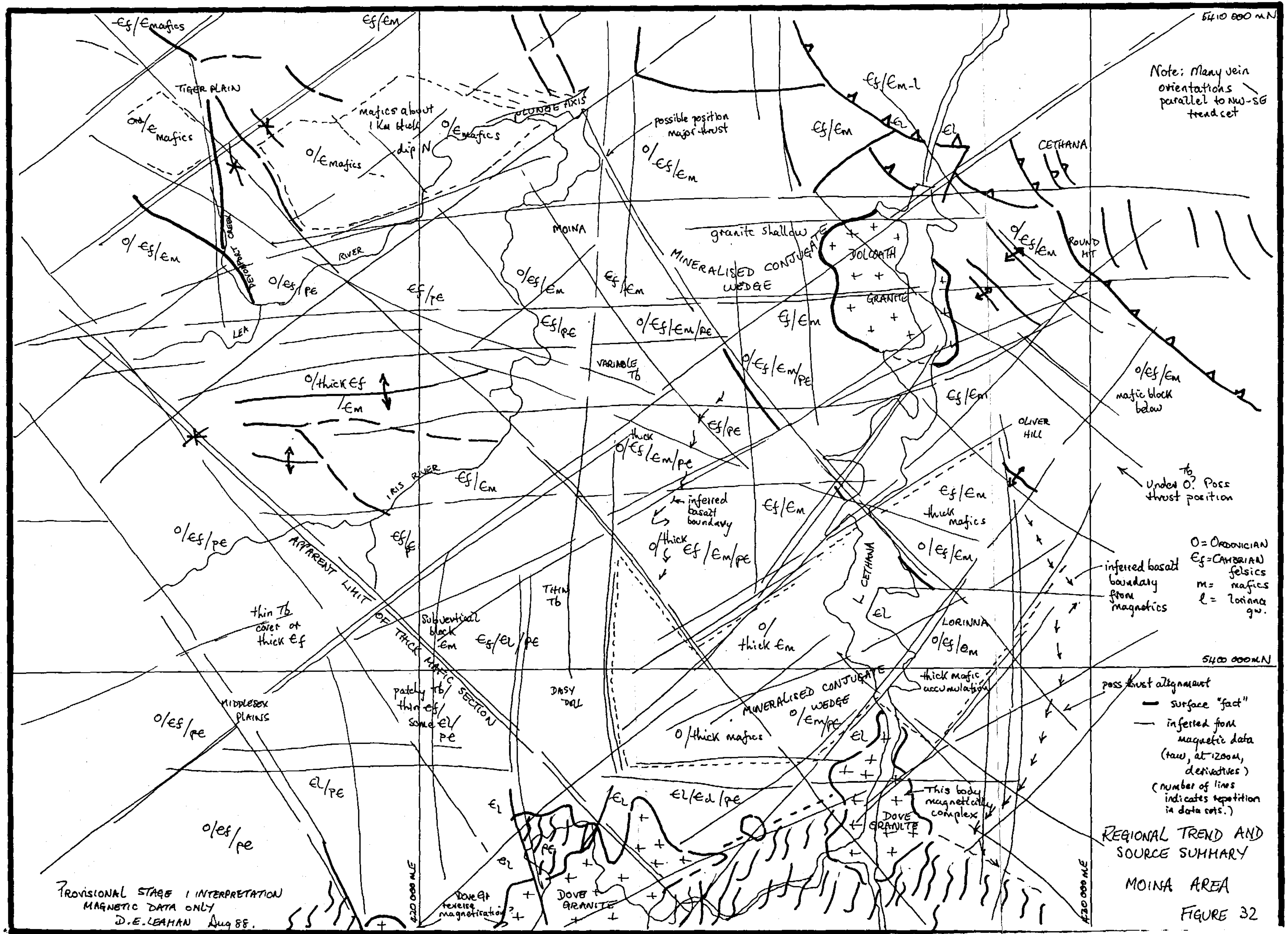
Aug 88

5460 : nominal easting 419000 mE

AEROMAGNETIC PROFILES based on 5460 with nominal clearance 100m

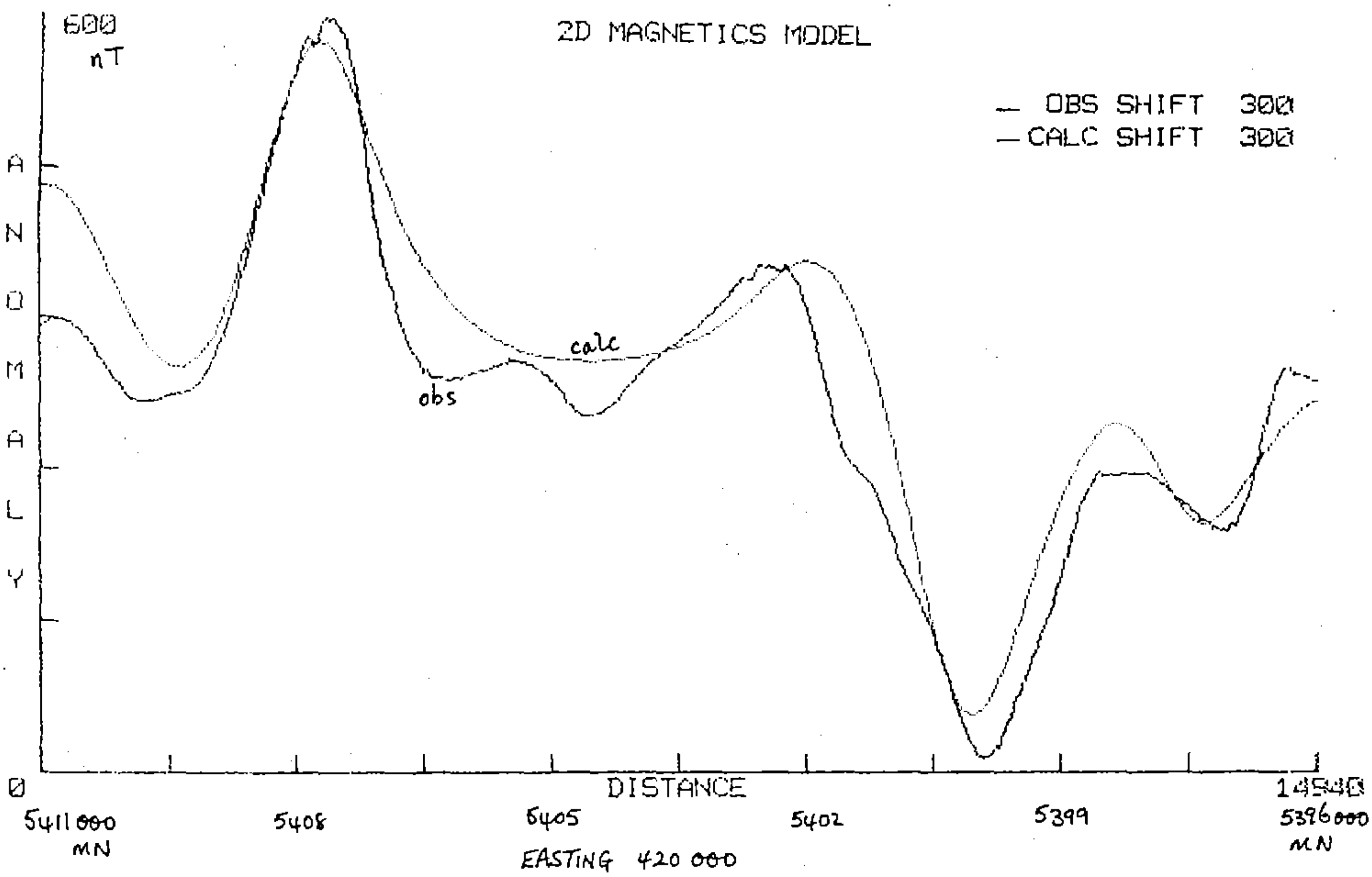
FIGURE 31

724169

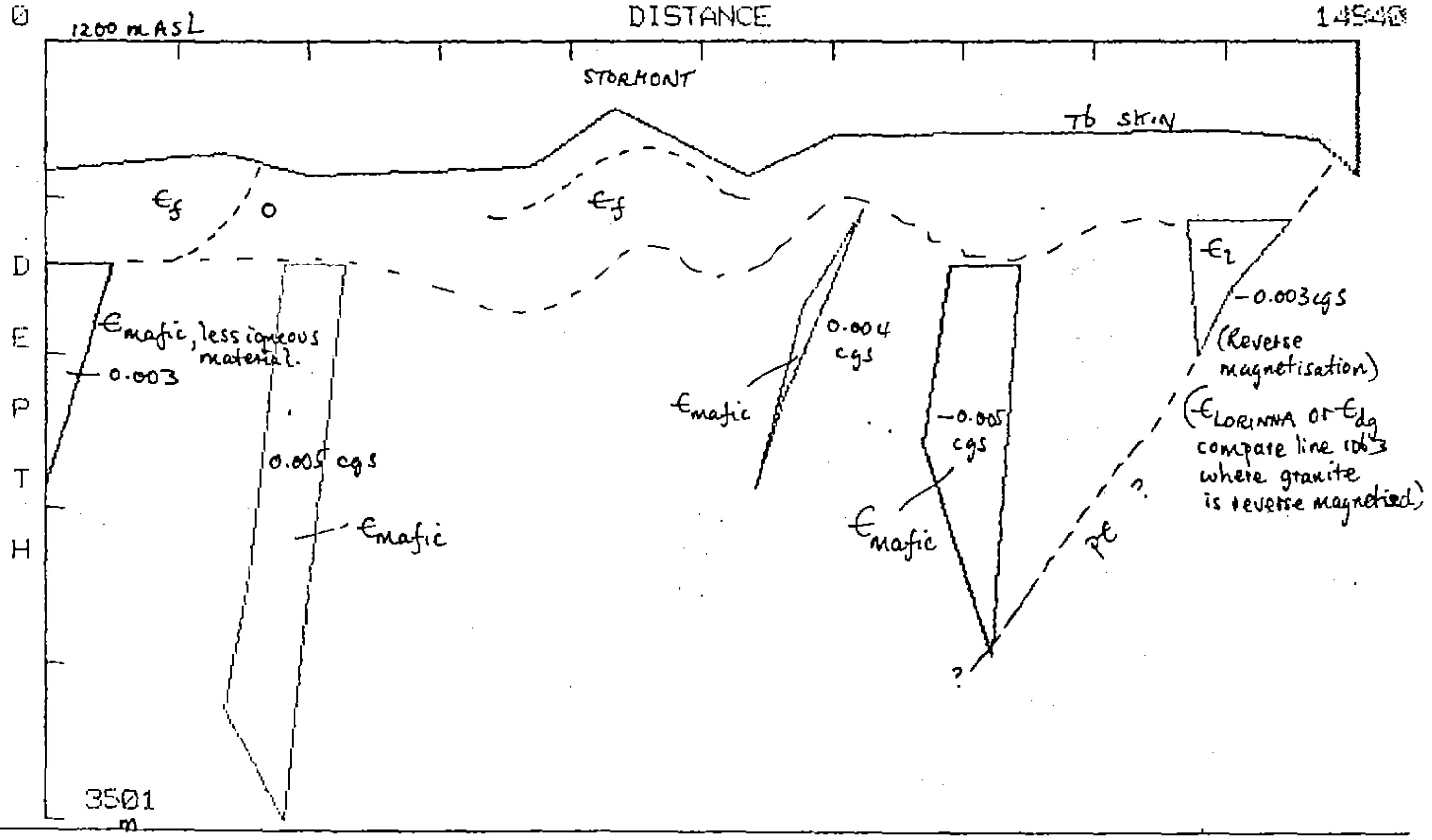

5410 000 mN
Note: Many vein orientations parallel to NW-SE trend set
Ef/Emafics
Ef/Em
TIGER PLAIN
mafics about 1 km thick
dip N
0/Emafics
PLUNGE AXIS
possible position major thrust
0/Ef/Em
Ef/Em-l
Ef/Em
El
CETHANA
DEVONPORT CREEK
0/Ef/Em
RIVER
MOINA
granite shallow
MINERALISED CONJUGATE WEDGE
DOLCOATH GRANITE
ROUND HILL
0/Ef/pE
Ef/pE
0/Ef/Em
Ef/Em
Ef/pE
0/Ef/Em/pE
Ef/Em
LEA
VARIABLE Tb
0/Ef/Em/pE
0/thick Ef/Em
Ef/pE
thick 0/Ef/Em/pE
Ef/Em
mafic block below
OLIVER HILL
IRIS RIVER
Ef/Em
inferred basalt boundary
Ef/Em
thick mafics
Tb Under 0? Poss thrust position
0/Ef/pE
APPARENT LIMIT OF THICK MAFIC SECTION
Ef/E
0/thick Ef/Em/pE
L CETHANA
0/Ef/Em
inferred basalt boundary from magnetics
O = ORDOVICIAN
Ef = CAMBRIAN felsics
m = mafics
l = Lorinna gw.
thin Tb cover or thick Ef
Subvertical block Em
Ef/El/pE
THIN Tb
0/thick Em
El
LORINNA
0/Ef/Em
5400 000mN
thick mafic accumulation
poss thrust alignment
surface "fact"
inferred from magnetic data (raw, at 1200m, derivatives)
(number of lines indicates repetition in data sets.)
MIDDLESEX PLAINS
0/Ef/pE
patchy Tb/ thin Ef/ some El/ pE
DASY DELL
MINERALISED CONJUGATE WEDGE
0/Em/pE
0/thick mafics
El
El/pE
El
El
El/Ed/pE
This body magnetically complex
DOVE GRANITE
0/Ef/pE
El
pE
Dove Gt reverse magnetisation?
DOVE GRANITE
420 000 mE
430 000 mE
PROVISIONAL STAGE 1 INTERPRETATION MAGNETIC DATA ONLY
D.E. LEAMAN Aug 88.
REGIONAL TREND AND SOURCE SUMMARY
MOINA AREA
FIGURE 32

LINE PARAMETERS - ORIGIN,LIMIT,INCR : 0 14940 35.65633

724170



MOINA 1200 M MAGNETICS LINE 5500 420E
ADJ K4=003 ADJ K6=-003 VAR 3 500M S



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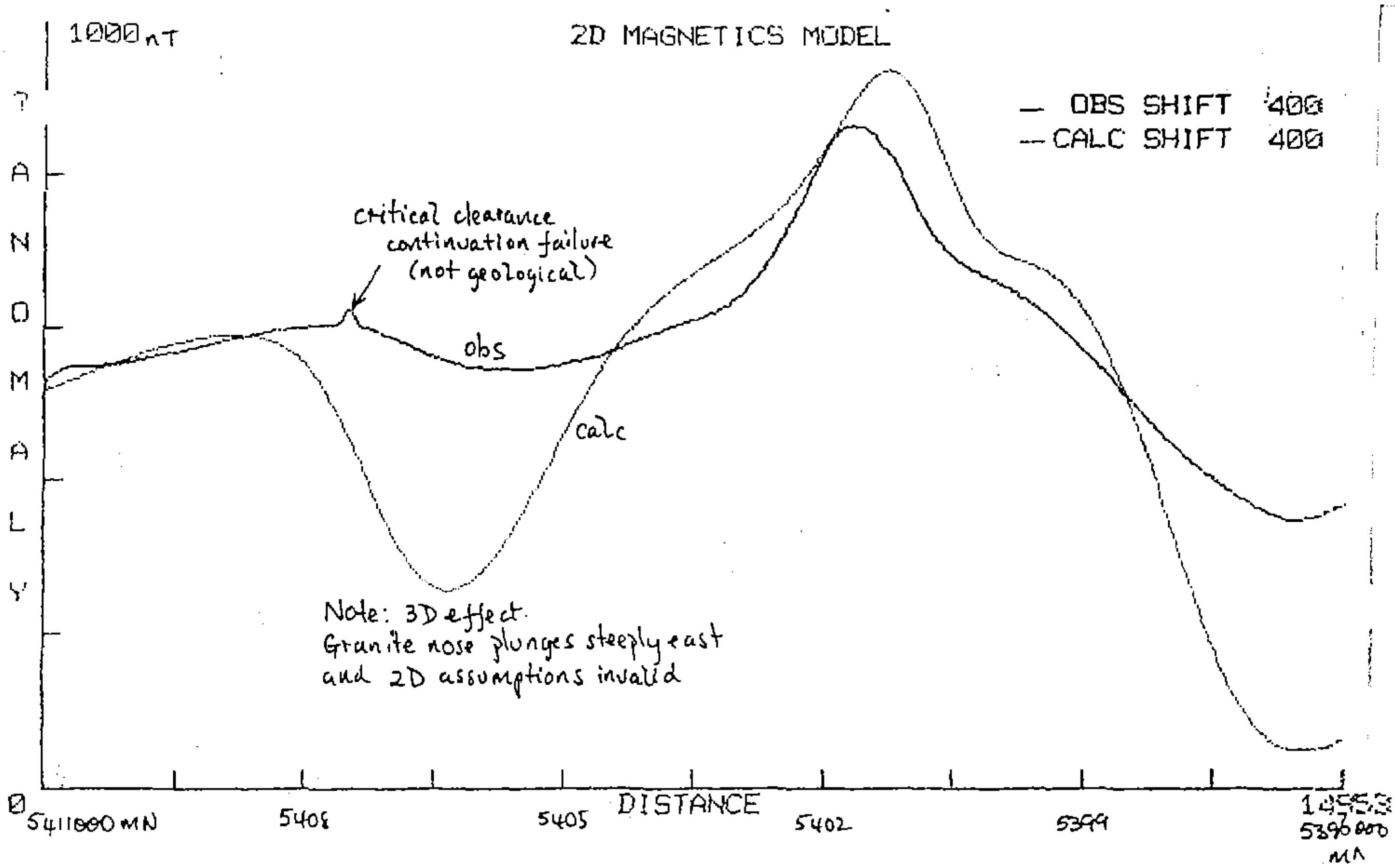
Hobart, Tasmania 7001

Aug 88

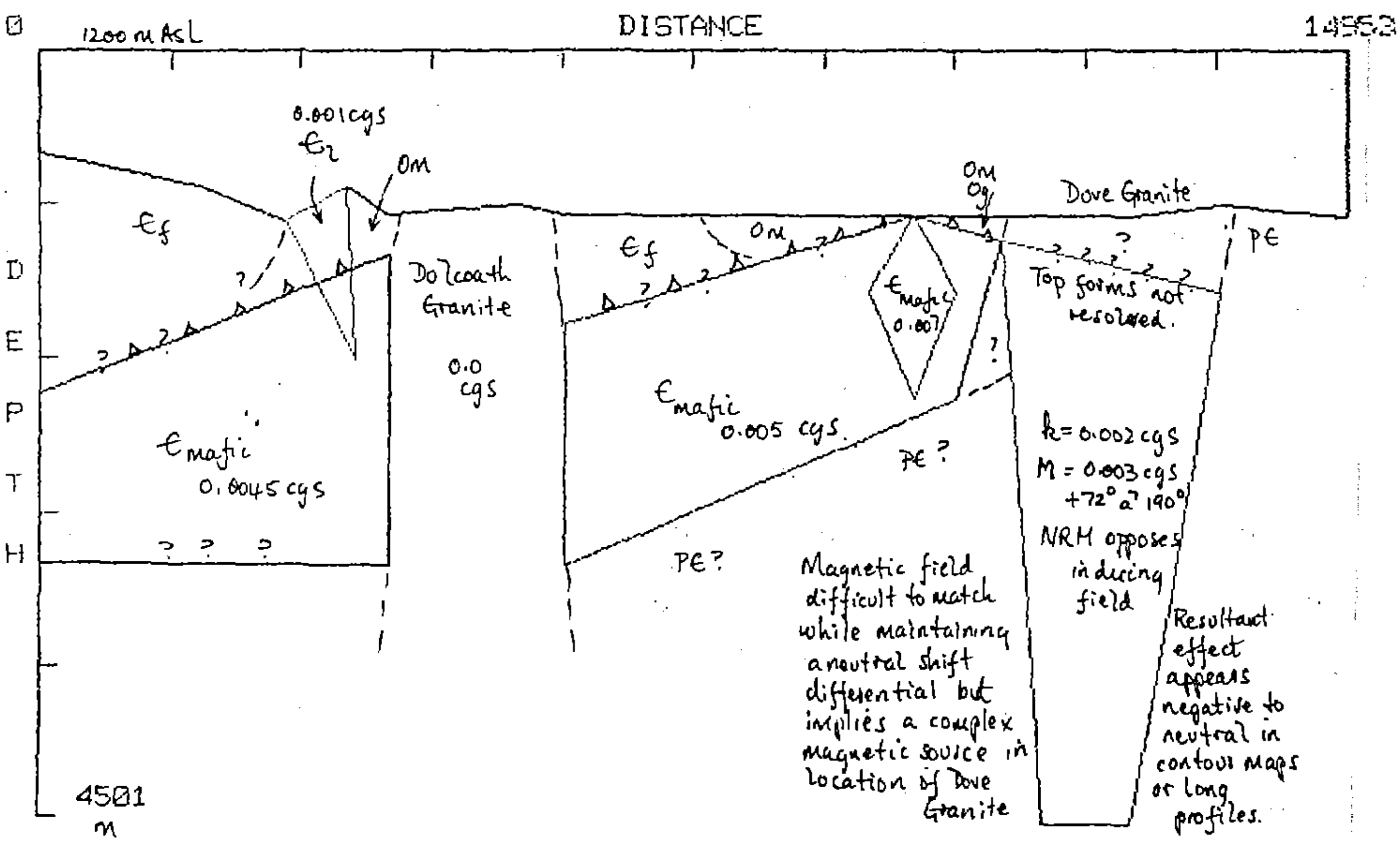
TEST MODEL : LINE 5500

FIGURE 33

170 LINE PARAMETERS - ORIGIN,LIMIT,INCR : 0 14953 37.7601 724171



MOINA 1200 M MAGNETICS LINE 1063 427E
NRM7=0025



Aug 88

STRUCTURAL STYLE : LAKE CETHANA

LEAMAN GEOPHYSICS
G.P.O. Box 320 D,
Hobart, Tasmania 7001

TEST MODEL : LINE 1063

FIGURE 34

APPENDIX 7

Infill Gravity Data

172

724173

DEPARTMENT OF MINES

TASMANIA

Head Office:
Gordons Hill Road,
P.O. Box 56,
ROSNY PARK 7018

Enquiries: Dr R.G. Richardson
Phone: 30 8324
Your ref.:
Our file: 620.1
RGR1(7):AT

21 SEP 1988

DATE:	23 September 88
FILE No.:	9525 - 3.
INITIALS:	

RGC Exploration Pty Ltd,
P.O. Box 835,
BURNIE.
Tasmania. 7320

Attention: Mr M.J. Fleming

Dear Mark,

CETHANA GRAVITY DATA

I have completed processing the data and I enclose a station plot at 1:25 000 and a listing of the data. The columns on the listing are station number, easting (A.M.G., metres), northing (A.M.G., metres), elevation (metres), observed gravity, theoretical gravity, terrain correction (milligals for a density of 2.67) and Bouguer anomaly (milligals for a density of 2.67). I have given Leaman Geophysics the same data on floppy disc.

A summary of the operation is as follows:

08.08.88 - 12.08.88	88 stations	27 h 35 m on site
15.08.88 - 19.08.88	109 stations	28 h 05 m on site
22.08.88 - 24.08.88	62 stations	17 h 20 m on site

Travelling time	Hobart-Cethana-Hobart	24 h
Travelling allowances	$1,595	
Terrain corrections	$1,320	
Vehicle (4WD) not costed		

I enclose an invoice for $2,190 being calculated at $15.00 per hour per person for the times on the attached list.

Yours sincerely,

R. Richardson

R. Richardson
GEOPHYSICIST

Encl.

CETHANA GRAVITY SURVEY TIMESHEET

DATE	TIME START	TIME STOP	LUNCH	CHARGE TIME
08.08.88	1525	1735	0	2 h 10 m
09.08.88	0840	1745	1 h	8 h 5 m
10.08.88	0840	1625	30 m	7 h 15 m
11.08.88	0825	1735	30 m	7 h 50 m
12.08.88	0850	1035	0	1 h 45 m
16.08.88	0840	1800	45 m	8 h 35 m
17.08.88	0935	1805	40 m	7 h 50 m
18.08.88	0835	1800	40 m	8 h 45 m
19.08.88	0825	1120	0	2 h 55 m
23.08.88	0830	1805	30 m	9 h 5 m
24.08.88	0830	1725	40 m	8 h 15 m
			TOTAL	73 h 0 m

R.G. Richardson

GEOPHYSICIST

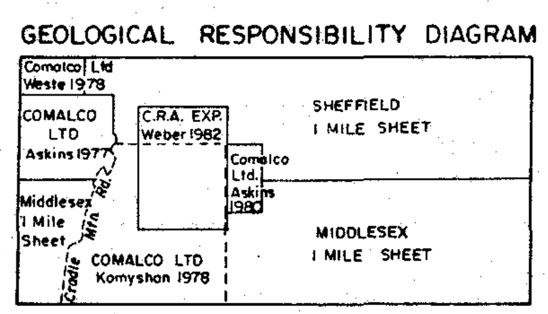
8851.5999	424370.0	407907.0	577.20	980.163660	980.312216	1.27	-33.74CETH913A
8851.6237	424180.0	407400.0	607.00	980.156500	980.312623	1.24	-35.47CETH913A
8851.6238	423970.0	407040.0	608.00	980.154475	980.312911	1.19	-37.64CETH913A
8851.6239	423320.0	407340.0	578.00	980.160877	980.312664	1.08	-37.00CETH913A
8851.6240	423200.0	406620.0	532.00	980.168882	980.313243	1.45	-38.26CETH913A
8851.6241	422780.0	406900.0	518.00	980.172078	980.313014	1.13	-37.91CETH913A
8851.6242	422500.0	406760.0	491.00	980.177702	980.313125	1.09	-37.74CETH913A
8851.6243	421940.0	406470.0	506.00	980.174093	980.313354	1.07	-38.65CETH913A
8851.6244	421400.0	406150.0	497.00	980.175405	980.313607	1.27	-39.08CETH913A
8851.6245	421610.0	406630.0	514.00	980.173009	980.313222	1.20	-37.90CETH913A
8851.6246	421300.0	407010.0	475.00	980.180111	980.312912	1.11	-38.25CETH913A
8851.6247	421550.0	407400.0	494.00	980.179046	980.312600	1.01	-35.37CETH913A
8851.6248	421690.0	407710.0	514.00	980.175744	980.312351	1.08	-34.41CETH913A
8851.6249	422020.0	407930.0	472.00	980.184210	980.312177	1.00	-34.12CETH913A
8851.6250	420980.0	407240.0	557.00	980.167087	980.312724	1.09	-34.97CETH913A
8851.6252	420430.0	407130.0	634.00	980.150905	980.312808	1.60	-35.58CETH913A
8851.6253	420340.0	406600.0	632.00	980.150684	980.313235	1.95	-36.27CETH913A
8851.6254	420000.0	406170.0	648.00	980.147305	980.313578	1.63	-37.16CETH913A
8851.6255	420150.0	407280.0	548.00	980.169189	980.312685	1.80	-33.89CETH913A
8851.6256	420990.0	406690.0	534.00	980.170245	980.313168	1.77	-36.10CETH913A
8851.6257	422550.0	407400.0	472.00	980.182386	980.312609	1.23	-36.14CETH913A
8851.6258	423940.0	406650.0	663.00	980.143399	980.313226	1.67	-37.72CETH913A
8851.6259	423930.0	406050.0	683.00	980.138600	980.313709	2.24	-38.50CETH913A
8851.6260	423500.0	405760.0	725.00	980.128906	980.313940	1.61	-40.79CETH913A
8851.6261	423380.0	405450.0	735.00	980.127658	980.314189	1.13	-40.80CETH913A
8851.6262	423220.0	404990.0	729.00	980.129175	980.314558	1.32	-40.64CETH913A
8851.6263	423050.0	404180.0	757.00	980.123569	980.315210	1.36	-41.35CETH913A
8851.6264	422930.0	403630.0	761.00	980.121554	980.315653	1.52	-42.86CETH913A
8851.6265	422830.0	402800.0	769.00	980.119826	980.316321	2.31	-42.89CETH913A
8851.6266	422720.0	402300.0	753.00	980.123358	980.316724	1.84	-43.38CETH913A
8851.6267	422430.0	401950.0	733.00	980.128301	980.317003	1.76	-42.74CETH913A
8851.6268	422100.0	401410.0	707.00	980.135596	980.317436	1.19	-41.56CETH913A
8851.6269	421980.0	400990.0	692.00	980.140260	980.317774	1.06	-40.31CETH913A
8851.6270	421980.0	400360.0	719.00	980.137083	980.318282	1.04	-38.71CETH913A
8851.6271	421800.0	399900.0	729.00	980.135692	980.318652	1.21	-38.33CETH913A
8851.6272	421820.0	399390.0	757.00	980.131680	980.319063	1.12	-37.33CETH913A
8851.6273	421620.0	399100.0	774.00	980.129011	980.319295	1.27	-36.74CETH913A
8851.6274	422220.0	398870.0	823.00	980.118598	980.319486	2.04	-36.93CETH913A
8851.6275	424250.0	406360.0	701.00	980.136488	980.313462	1.70	-37.36CETH913A
8851.6276	424710.0	406250.0	705.00	980.134444	980.313555	2.27	-38.14CETH913A
8851.6277	425230.0	406300.0	680.00	980.138475	980.313519	3.05	-38.22CETH913A
8851.6278	425270.0	405910.0	624.00	980.147881	980.313834	3.83	-39.36CETH913A
8851.6279	424990.0	405260.0	567.00	980.160032	980.314356	3.40	-39.38CETH913A
8851.6280	425450.0	404960.0	564.00	980.161011	980.314601	3.67	-38.97CETH913A
8851.6281	425800.0	404450.0	519.00	980.171012	980.315016	2.93	-38.98CETH913A
8851.6282	425330.0	404360.0	508.00	980.173325	980.315084	3.73	-38.10CETH913A
8851.6283	424850.0	404000.0	458.00	980.182069	980.315371	4.24	-38.97CETH913A
8851.6284	424850.0	403510.0	449.00	980.187406	980.315766	2.57	-37.47CETH913A
8851.6285	424700.0	402950.0	459.00	980.184488	980.316216	1.91	-39.53CETH913A
8851.6286	424500.0	402250.0	433.00	980.188701	980.316779	2.36	-40.54CETH913A
8851.6287	424210.0	401970.0	428.00	980.188961	980.317003	2.85	-41.00CETH913A
8851.6288	424300.0	401560.0	424.00	980.190880	980.317334	2.50	-40.55CETH913A
8851.6289	424640.0	401120.0	418.00	980.193548	980.317692	1.97	-39.95CETH913A
8851.6290	424780.0	400860.0	428.00	980.192330	980.317903	1.99	-39.39CETH913A
8851.6291	425220.0	400670.0	415.00	980.195766	980.318060	1.73	-38.93CETH913A
8851.6292	425470.0	401170.0	372.00	980.204557	980.317659	1.75	-38.18CETH913A
8851.6293	425630.0	401530.0	358.00	980.205700	980.317369	1.63	-39.62CETH913A
8851.6294	426420.0	400230.0	221.00	980.235060	980.318425	2.17	-37.72CETH913A
8851.6295	424500.0	400540.0	476.00	980.184680	980.318159	2.76	-37.08CETH913A
8851.6296	424210.0	400940.0	502.00	980.176570	980.317833	2.35	-40.16CETH913A
8851.6297	424430.0	402840.0	510.00	980.172202	980.316303	2.17	-41.60CETH913A

8851.6298	423820.0	402450.0	612.00	980.151404	980.314612	3.08	-41.73	CETH913A
8851.6299	423500.0	402090.0	659.00	980.142161	980.316900	3.53	-41.56	CETH913A
8851.6300	423010.0	401580.0	698.00	980.133993	980.317307	2.85	-43.14	CETH913A
8851.6301	422570.0	401420.0	727.00	980.129501	980.317432	1.16	-43.75	CETH913A
8851.6302	422730.0	401010.0	758.00	980.123963	980.317766	2.76	-41.92	CETH913A
8851.6303	424160.0	405690.0	764.00	980.122792	980.314002	1.81	-39.09	CETH913A
8851.6304	423420.0	404530.0	755.00	980.124308	980.314931	1.47	-40.62	CETH913A
8851.6305	423780.0	404880.0	749.00	980.126123	980.314652	1.47	-39.70	CETH913A
8851.6306	424080.0	405190.0	748.00	980.126737	980.314404	1.63	-38.88	CETH913A
8851.6307	422200.0	403350.0	747.00	980.124644	980.315872	1.48	-42.79	CETH913A
8851.6308	422230.0	402710.0	753.00	980.123886	980.316389	1.17	-43.19	CETH913A
8851.6309	421540.0	402700.0	753.00	980.122638	980.316391	1.91	-43.70	CETH913A
8851.6310	421100.0	402250.0	777.00	980.119721	980.316750	1.07	-43.09	CETH913A
8851.6311	421190.0	399390.0	758.00	980.131430	980.319058	0.68	-37.82	CETH913A
8851.6312	420590.0	399510.0	757.00	980.131267	980.318956	0.56	-38.20	CETH913A
8851.6313	420490.0	399010.0	765.00	980.130789	980.319358	0.60	-37.27	CETH913A
8851.6314	420290.0	398650.0	786.00	980.127361	980.319647	0.63	-37.02	CETH913A
8851.6315	420800.0	398700.0	784.00	980.127073	980.319611	0.77	-37.53	CETH913A
8851.6316	420800.0	398140.0	762.00	980.133715	980.320063	1.53	-34.90	CETH913A
8851.6317	420780.0	397750.0	754.00	980.134847	980.320377	2.31	-34.88	CETH913A
8851.6318	420730.0	396960.0	745.00	980.138677	980.321016	1.67	-34.10	CETH913A
8851.6319	423840.0	407830.0	538.00	980.171224	980.312273	0.84	-34.37	CETH913A
8851.6320	423380.0	407740.0	534.00	980.171991	980.312342	0.91	-34.39	CETH913A
8851.6321	422900.0	407710.0	514.00	980.176166	980.312201	0.84	-34.08	CETH913A
8851.6322	422540.0	407960.0	472.00	980.182943	980.312157	0.79	-35.57	CETH913A
8851.6323	422500.0	408440.0	478.00	980.183816	980.311770	1.00	-32.92	CETH913A
8851.6324	423040.0	408300.0	494.00	980.181628	980.311887	0.92	-32.16	CETH913A
8851.6325	422150.0	408630.0	515.00	980.177040	980.311613	1.29	-31.97	CETH913A
8851.6326	424260.0	408560.0	609.00	980.159236	980.311688	0.93	-31.72	CETH913A
8851.6327	424730.0	408690.0	616.00	980.157182	980.311587	1.79	-31.43	CETH913A
8851.6328	425190.0	408870.0	626.00	980.155281	980.311446	2.28	-30.73	CETH913A
8851.6329	425680.0	409130.0	636.00	980.151404	980.311240	4.05	-30.67	CETH913A
8851.6330	425440.0	409890.0	617.00	980.160224	980.310625	1.61	-27.41	CETH913A
8851.6331	424950.0	409710.0	605.00	980.163862	980.310766	1.24	-26.65	CETH913A
8851.6332	424460.0	409870.0	617.00	980.161510	980.310633	1.74	-26.00	CETH913A
8851.6333	424080.0	410070.0	533.00	980.177683	980.310469	1.76	-26.17	CETH913A
8851.6334	425870.0	410000.0	553.00	980.173181	980.310540	1.68	-26.89	CETH913A
8851.6335	426610.0	409790.0	436.00	980.196581	980.310716	1.69	-26.68	CETH913A
8851.6336	426930.0	409230.0	406.00	980.201246	980.311170	1.75	-28.31	CETH913A
8851.6337	427450.0	409050.0	298.00	980.222957	980.311319	2.08	-27.66	CETH913A
8851.6338	427130.0	409690.0	363.00	980.211583	980.310801	1.65	-26.16	CETH913A
8851.6339	427330.0	410000.0	325.00	980.218388	980.310552	1.96	-26.27	CETH913A
8851.6340	427880.0	409960.0	334.00	980.217803	980.310589	1.99	-25.10	CETH913A
8851.6341	424000.0	409050.0	611.00	980.160503	980.311291	1.08	-29.51	CETH913A
8851.6342	423100.0	408990.0	549.00	980.172356	980.311331	1.20	-29.77	CETH913A
8851.6343	423550.0	408950.0	590.00	980.163737	980.311367	1.25	-30.31	CETH913A
8851.6344	425620.0	406440.0	614.00	980.150761	980.313409	2.97	-38.89	CETH913A
8851.6345	426350.0	406700.0	483.00	980.176234	980.313205	2.80	-39.16	CETH913A
8851.6346	426610.0	406610.0	433.00	980.186398	980.313280	3.20	-38.51	CETH913A
8851.6347	426580.0	406120.0	321.00	980.205748	980.313675	3.53	-41.26	CETH913A
8851.6348	427010.0	406000.0	246.00	980.221440	980.313775	2.93	-41.02	CETH913A
8851.6349	426900.0	405300.0	267.00	980.217918	980.314339	2.01	-41.89	CETH913A
8851.6350	426820.0	404330.0	266.00	980.219261	980.315121	2.44	-41.10	CETH913A
8851.6351	426700.0	404770.0	241.00	980.222477	980.314765	2.97	-41.91	CETH913A
8851.6352	425530.0	406750.0	504.00	980.172999	980.313158	2.89	-38.12	CETH913A
8851.6353	424950.0	407180.0	614.00	980.154840	980.312807	1.55	-35.63	CETH913A
8851.6354	425390.0	407260.0	671.00	980.140798	980.312746	3.70	-36.24	CETH913A
8851.6355	426060.0	407190.0	596.00	980.154369	980.312808	4.93	-36.26	CETH913A
8851.6356	424850.0	407560.0	528.00	980.172327	980.312499	2.51	-33.79	CETH913A
8851.6357	425410.0	407750.0	474.00	980.183019	980.312351	2.89	-33.20	CETH913A
8851.6358	425950.0	407610.0	414.00	980.192320	980.312468	5.06	-33.65	CETH913A
8851.6359	426520.0	407760.0	321.00	980.211804	980.312352	2.64	-34.77	CETH913A
8851.6360	426850.0	407040.0	233.00	980.224080	980.312935	5.46	-37.56	CETH913A
8851.6361	427010.0	407380.0	437.00	980.186177	980.312662	4.64	-35.88	CETH913A
8851.6362	427050.0	407930.0	263.00	980.224128	980.312219	3.19	-33.17	CETH913A
8851.6363	427500.0	407800.0	209.00	980.233025	980.312328	4.88	-33.31	CETH913A

8851.6364	427600.0	408160.0	158.00	980.244744	980.312038	3.86	-32.36CETH913A
8851.6365	427950.0	407570.0	297.00	980.217831	980.312517	3.05	-33.21CETH913A
8851.6366	428100.0	406800.0	281.00	980.217380	980.313139	4.04	-36.45CETH913A
8851.6367	427630.0	407040.0	220.00	980.228812	980.312942	3.46	-37.40CETH913A
8851.6368	428160.0	408970.0	194.00	980.241030	980.311389	4.45	-27.75CETH913A
8851.6369	428230.0	408410.0	256.00	980.228428	980.311842	2.53	-30.53CETH913A
8851.6370	428760.0	408290.0	367.00	980.208828	980.311943	1.92	-29.00CETH913A
8851.6371	429260.0	408210.0	402.00	980.203617	980.312011	1.72	-27.60CETH913A
8851.6372	429780.0	407940.0	436.00	980.197426	980.312233	1.25	-27.79CETH913A
8851.6373	430460.0	408020.0	500.00	980.185189	980.312174	2.87	-25.76CETH913A
8851.6374	430930.0	408800.0	552.00	980.175063	980.311548	1.61	-26.29CETH913A
8851.6375	430280.0	408710.0	574.00	980.169477	980.311616	1.71	-27.51CETH913A
8851.6376	429840.0	408440.0	525.00	980.178921	980.311830	2.15	-27.48CETH913A
8851.6377	429310.0	409220.0	357.00	980.213311	980.311197	1.95	-25.71CETH913A
8851.6378	429400.0	409820.0	362.00	980.211804	980.310714	2.27	-25.43CETH913A
8851.6379	429460.0	408630.0	425.00	980.199029	980.311674	2.01	-27.03CETH913A
8851.6380	430270.0	409080.0	559.00	980.172423	980.311317	1.83	-27.10CETH913A
8851.6381	430150.0	409640.0	540.00	980.175504	980.310865	2.60	-26.53CETH913A
8851.6382	431020.0	409400.0	570.00	980.172711	980.311065	0.97	-25.25CETH913A
8851.6383	431320.0	410040.0	564.00	980.174813	980.310551	1.20	-23.59CETH913A
8851.6384	430540.0	407680.0	403.00	980.204289	980.312449	1.56	-27.33CETH913A
8851.6385	430570.0	407200.0	504.00	980.184977	980.312836	2.35	-26.36CETH913A
8851.6386	431170.0	407830.0	377.00	980.209740	980.312332	1.44	-26.99CETH913A
8851.6387	431680.0	407900.0	370.00	980.212034	980.312280	1.75	-25.71CETH913A
8851.6388	431420.0	407400.0	417.00	980.201803	980.312681	1.93	-26.92CETH913A
8851.6389	431080.0	407230.0	456.00	980.194038	980.312816	2.84	-26.24CETH913A
8851.6390	431730.0	406860.0	542.00	980.175322	980.313119	4.45	-26.72CETH913A
8851.6391	431160.0	406770.0	602.00	980.161549	980.313187	4.35	-28.86CETH913A
8851.6392	430600.0	406620.0	693.00	980.141393	980.313304	5.80	-29.78CETH913A
8851.6393	431400.0	406330.0	836.00	980.108529	980.313544	9.85	-30.69CETH913A
8851.6394	431130.0	405460.0	637.00	980.157182	980.314244	2.05	-29.70CETH913A
8851.6395	430960.0	406050.0	609.00	980.161194	980.313766	2.01	-30.76CETH913A
8851.6396	431300.0	404920.0	629.00	980.157853	980.314680	1.75	-31.34CETH913A
8851.6397	431500.0	404480.0	630.00	980.159332	980.315037	1.11	-30.46CETH913A
8851.6398	431030.0	404570.0	637.00	980.157498	980.314961	1.08	-31.07CETH913A
8851.6399	430760.0	404910.0	648.00	980.154158	980.314684	0.81	-32.24CETH913A
8851.6400	430380.0	405230.0	636.00	980.155070	980.314423	1.03	-33.20CETH913A
8851.6401	429950.0	405550.0	606.00	980.159053	980.314162	1.83	-34.06CETH913A
8851.6402	429590.0	405990.0	545.00	980.170571	980.313804	2.44	-33.58CETH913A
8851.6403	429250.0	406320.0	490.00	980.180793	980.313535	3.15	-33.20CETH913A
8851.6404	428970.0	406630.0	445.00	980.190631	980.313283	1.69	-33.42CETH913A
8851.6405	428610.0	407100.0	429.00	980.192694	980.312901	3.03	-32.79CETH913A
8851.6406	428550.0	406330.0	427.00	980.191111	980.313522	3.24	-35.17CETH913A
8851.6407	428720.0	405960.0	416.00	980.192320	980.313821	2.89	-36.78CETH913A
8851.6408	427970.0	406160.0	408.00	980.191053	980.313654	4.71	-37.63CETH913A
8851.6409	427940.0	405670.0	412.00	980.187838	980.314049	5.41	-39.76CETH913A
8851.6410	428220.0	405190.0	384.00	980.192867	980.314438	5.94	-40.09CETH913A
8851.6411	428140.0	404630.0	365.00	980.193145	980.314890	6.53	-43.42CETH913A
8851.6412	428090.0	404090.0	358.00	980.196341	980.315325	7.08	-41.48CETH913A
8851.6413	427960.0	403660.0	346.00	980.199806	980.315670	7.03	-40.77CETH913A
8851.6414	427630.0	403200.0	336.00	980.206304	980.316039	5.80	-37.84CETH913A
8851.6415	427650.0	402660.0	317.00	980.211794	980.316475	4.11	-38.21CETH913A
8851.6416	427480.0	401990.0	295.00	980.220768	980.317014	1.85	-36.37CETH913A
8851.6417	427170.0	403000.0	223.00	980.229973	980.316196	3.11	-39.25CETH913A
8851.6418	428020.0	401970.0	352.00	980.208281	980.317034	2.41	-37.10CETH913A
8851.6419	428500.0	402150.0	404.00	980.198530	980.316893	3.43	-35.46CETH913A
8851.6420	429150.0	402020.0	478.00	980.184411	980.317003	3.17	-35.39CETH913A
8851.6421	429330.0	402520.0	600.00	980.161750	980.316601	2.53	-34.29CETH913A
8851.6422	430020.0	402780.0	737.00	980.133791	980.316397	1.76	-35.85CETH913A
8851.6423	431480.0	403080.0	736.00	980.135385	980.316166	0.79	-35.19CETH913A
8851.6424	430870.0	402770.0	736.00	980.135404	980.316411	0.69	-35.52CETH913A
8851.6425	430490.0	402950.0	726.00	980.137064	980.316263	0.84	-35.53CETH913A
8851.6426	431850.0	403500.0	712.00	980.141546	980.315830	0.95	-33.26CETH913A
8851.6427	431470.0	403900.0	655.00	980.153323	980.315504	1.08	-32.24CETH913A
8851.6428	430030.0	404820.0	634.00	980.154945	980.314751	1.24	-33.84CETH913A
8851.6429	429770.0	404400.0	685.00	980.144839	980.315088	1.45	-34.04CETH913A

8851.6430	429300.0	404600.0	674.00	980.144675	980.314923	2.43	-35.22CETH913A
8851.6431	428910.0	404810.0	715.00	980.133743	980.314750	3.43	-36.91CETH913A
8851.6432	429800.0	403940.0	718.00	980.139224	980.315459	1.40	-33.58CETH913A
8851.6433	429290.0	404000.0	750.00	980.131545	980.315407	1.96	-34.35CETH913A
8851.6434	427810.0	401480.0	267.00	980.225529	980.317428	2.19	-37.19CETH913A
8851.6435	428280.0	401160.0	285.00	980.221680	980.317690	2.43	-37.52CETH913A
8851.6436	427920.0	401000.0	245.00	980.230098	980.317816	1.75	-37.78CETH913A
8851.6437	427730.0	400510.0	273.00	980.225865	980.318210	1.59	-37.05CETH913A
8851.6438	428130.0	400290.0	327.00	980.215470	980.318390	1.85	-36.75CETH913A
8851.6439	428410.0	399850.0	391.00	980.203319	980.318747	1.68	-36.83CETH913A
8851.6440	428840.0	399560.0	459.00	980.191418	980.318985	2.04	-35.23CETH913A
8851.6441	428960.0	400320.0	460.00	980.189959	980.318373	2.23	-35.69CETH913A
8851.6442	428820.0	398940.0	471.00	980.189700	980.319485	2.64	-34.49CETH913A
8851.6443	428740.0	398470.0	491.00	980.185563	980.319863	2.69	-35.02CETH913A
8851.6444	428090.0	398260.0	434.00	980.199336	980.320028	1.81	-33.51CETH913A
8851.6445	427540.0	397870.0	509.00	980.185083	980.320338	3.27	-31.85CETH913A
8851.6446	427990.0	397160.0	567.00	980.176387	980.320914	2.69	-30.30CETH913A
8851.6447	427720.0	396910.0	606.00	980.167403	980.321114	3.33	-31.16CETH913A
8851.6448	428480.0	397020.0	649.00	980.155329	980.321031	3.67	-34.35CETH913A
8851.6449	427430.0	398950.0	303.00	980.224272	980.319466	1.99	-33.60CETH913A
8851.6450	427800.0	399440.0	272.00	980.228907	980.319073	1.60	-35.06CETH913A
8851.6451	427750.0	400120.0	266.00	980.228552	980.318524	2.00	-35.65CETH913A
8851.6452	427280.0	400100.0	224.00	980.236116	980.318537	1.37	-36.99CETH913A
8851.6453	427230.0	398640.0	311.00	980.221219	980.319714	3.16	-34.16CETH913A
8851.6454	427040.0	398100.0	289.00	980.225183	980.320148	4.13	-33.99CETH913A
8851.6455	427020.0	397530.0	263.00	980.230904	980.320608	5.01	-32.96CETH913A
8851.6456	426880.0	396900.0	256.00	980.234119	980.321115	4.21	-32.43CETH913A
8851.6457	427200.0	395980.0	255.00	980.235770	980.321860	3.80	-32.13CETH913A
8851.6458	430190.0	396580.0	753.00	980.137256	980.321400	1.63	-34.37CETH913A
8851.6459	429640.0	397040.0	770.00	980.130969	980.321024	2.40	-36.17CETH913A
8851.6460	429200.0	397060.0	757.00	980.132092	980.321005	3.77	-36.21CETH913A
8851.6461	429670.0	397530.0	764.00	980.131536	980.320629	2.19	-36.60CETH913A
8851.6462	430840.0	396540.0	755.00	980.139397	980.321437	1.56	-31.94CETH913A
8851.6463	431050.0	397040.0	733.00	980.143313	980.321035	1.31	-32.21CETH913A
8851.6464	431050.0	397440.0	703.00	980.146854	980.320712	1.53	-34.03CETH913A
8851.6465	430350.0	397210.0	757.00	980.136613	980.320893	1.56	-33.79CETH913A
8851.6466	430490.0	397700.0	747.00	980.137314	980.320498	1.47	-34.75CETH913A
8851.6467	430590.0	398090.0	767.00	980.130779	980.320185	1.36	-36.95CETH913A
8851.6468	430720.0	398600.0	755.00	980.131699	980.319774	1.49	-38.05CETH913A
8851.6469	430800.0	399150.0	712.00	980.139205	980.319331	1.61	-38.44CETH913A
8851.6470	430970.0	399640.0	718.00	980.138158	980.318937	1.32	-38.20CETH913A
8851.6471	431140.0	400180.0	740.00	980.134837	980.318503	1.29	-36.79CETH913A
8851.6472	431650.0	400560.0	732.00	980.137525	980.318200	0.92	-35.75CETH913A
8851.6473	431700.0	401670.0	728.00	980.137371	980.317305	0.89	-35.82CETH913A
8851.6474	431180.0	401650.0	728.00	980.136719	980.317317	0.87	-36.51CETH913A
8851.6475	430970.0	402210.0	730.00	980.135922	980.316864	0.80	-36.53CETH913A
8851.6476	422170.0	399670.0	736.00	980.136306	980.318840	1.15	-36.59CETH913A
8851.6477	422580.0	399310.0	753.00	980.133619	980.319134	1.31	-36.06CETH913A
8851.6478	423070.0	399200.0	806.00	980.122408	980.319227	1.59	-36.66CETH913A
8851.6479	423070.0	398620.0	821.00	980.118060	980.319695	4.01	-36.10CETH913A
8851.6480	423510.0	398450.0	853.00	980.111342	980.319836	5.20	-35.47CETH913A
8851.6481	424160.0	398580.0	736.00	980.137391	980.319737	3.37	-34.18CETH913A
8851.6482	424720.0	398770.0	671.00	980.150396	980.319588	3.17	-34.02CETH913A
8851.6483	425360.0	398820.0	592.00	980.165887	980.319553	3.32	-33.89CETH913A
8851.6484	425900.0	398800.0	544.00	980.175216	980.319574	3.60	-33.74CETH913A
8851.6485	424160.0	397460.0	736.00	980.138149	980.320640	6.49	-31.20CETH913A
8851.6486	424780.0	397330.0	697.00	980.145155	980.320751	6.04	-32.43CETH913A
8851.6487	423480.0	397850.0	770.00	980.129482	980.320320	5.55	-33.80CETH913A
8851.6488	421280.0	400470.0	705.00	980.138312	980.318187	0.76	-40.42CETH913A
8851.6489	421160.0	401000.0	717.00	980.133868	980.317759	0.71	-42.12CETH913A
8851.6490	421170.0	400280.0	725.00	980.135212	980.318340	0.95	-39.55CETH913A
8851.6491	419970.0	399750.0	766.00	980.128484	980.318756	0.69	-38.88CETH913A
8851.6492	420000.0	400150.0	769.00	980.126017	980.318434	0.57	-40.56CETH913A
8851.6493	420540.0	400840.0	740.00	980.129808	980.317882	0.53	-41.96CETH913A
8851.6494	420200.0	401430.0	790.00	980.120181	980.317403	0.47	-41.33CETH913A
8851.6495	420400.0	401850.0	778.00	980.121122	980.317066	0.55	-42.33CETH913A

GEOLOGICAL RESPONSIBILITY DIAGRAM



88-2872

LEGEND

TERTIARY

Tb Basalt, Basalt scree & Greybilly

DEVONIAN

Dg Dolcoath Granite

Dpq Quartz-porphyry dykes

ORDOVICIAN

Og Gordon Limestone

Og Skarn

Om Moina Sandstone

Oc Owen Conglomerate Equivalents

CAMBRIAN

€ Undifferentiated Volcanics

Strike & Dip (30°)

Anticline

Syncline

Cut Grid

Geology Contact

Fault

HIGGS Au — Old Mines & contained metals

Unconformity Surface

GN, TN, MN

GRID CONVERGENCE 1.0°

GRID/MAGNETIC 11.6°

INDEX TO ADJOINING SHEETS

LOONGANA	WILMOT	SHEFFIELD
LAKE LEA	CETHANA	GOG
PENCIL PINE	LIENA	MOLE CREEK

RGC EXPLORATION PTY. LIMITED
(INC. IN N.S.W.)
724179

COMPILED	R.R.
DRAWN	S.F
DATE	OCT. 1988
CHECKED	
1:25,000 REFERENCE	CETHANA

CETHANA 7735

GEOLOGICAL INTERPRETATION

BASE PLAN No.

OVERLAY PLAN No.

SCALE 1:25000 (100 50 0 50 100 150 200 METRES)

FIG. 2

KEY

S270 Sample No.
>145 Zinc
>26 Copper
>25 Tin

PROGRESS REPORT TO JUNE 1967
K.O. REID

Zn and Cu -80 mesh Hot 0.5N HCl acid extractable
Sn -35+80 mesh Colorimetric analysis

(2) Areas designated for follow-up work. ¼ mile (~400m) sample interval.

PROGRESS REPORT ON ACTIVITIES TO MARCH 1969
M.J. FOSTER

MOINA SHEET I - Cu,Zn,Bi B horizon soil geochem over grid. Results affected by basalt cover. Anomalous(?) Bi throughout skarn and related to faults(?) ZN anomalous in skarn. Recommends copious costeaning with sampling; percussion holes to define extent of skarn; and DDH's to test anomalies and faults.

MOINA SHEET 2 - Cu,Zn,Bi soil geochem. of little value due to contamination and basalt cover. Bi overall erratic - may relate to it's occurrance in lode veins. Recommends further Bi geochem. and some DDH's. (Reid '67)

ANOMALY F - Soil geochem. started. Related to older skarn anomalies and an occurrance of cpy in Om.

ANNUAL REPORT MOINA AREA 1969 - 70
B.C. DANDY

Four new lines were cut (blue) on main skarns I & 2 (recommended CGG). Soil sampling detected no new anomalies.

Recommendations:
i. follow-up mag. and IP anomalies W of Iris river.
ii. Follow-up 1300ppm Bi value N of i.
iii. Drill 3 hole at S & M designed by LAN.

ANOMALY F - no work. Geochem. thought to be of limited value - low priority target.

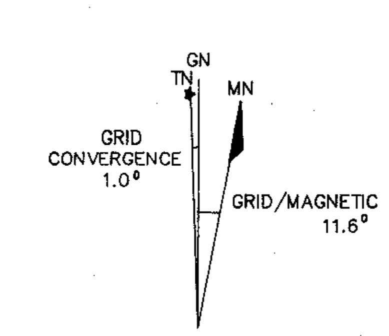
ANNUAL REPORT MOINA AREA 1970 - 71
J.P. McKIBBEN

Albite veins recognised at S & M (pink?)
3 holes drilled - did not reveal any lateral or depth extensions to lode system.
- granite in holes I & 2.
No further work recommended on S & M area.

MOINA SHEET I - chip sample identified several anomalous Bi intervals in magnetiferous skarn. Only tr Au & Ag detected. Further work recommendedto look for S & M type lodes or Stormont type Bi.

ANNUAL REPORT MOINA AREA 1971 - 72
J.P. McKIBBEN

Drilling planned for the Tea-Tree Ck. area was abandoned. A report by K.O. Reid indicated the area around the Dolcoath Granite across to the Lea River has potential for small operations, which are of no interest to Mt. Lyell. The E.L. was relinquished in May 1972.



INDEX TO ADJOINING SHEETS

LOONGANA	WILMOT	SHEFFIELD
LAKE LEA	CETHANA	GOG
PENCIL PINE	LIENA	MOLE CREEK

RGC EXPLORATION PTY. LIMITED
(INC. IN N.S.W.) 724180

COMPILED	M.F.
DRAWN	T.G.D.S.
DATE	Oct. 1988
CHECKED	
1:25,000 REFERENCE	CETHANA

CETHANA 7736

E.L. 8/65

GEOCHEMISTRY COMPILATION

BASE PLAN No.

OVERLAY PLAN No.

SCALE 1:25000 100 50 0 50 100 150 200 METRES

FIG. 3

KEY

- •32 Magnetic anomaly high
- ■28 Magnetic anomaly low
- A+ Residual magnetic anomalies
- ▬ ▬ Magnetic trends
- ▬▬ Trend A from early 1968 ground mag. – interp. J.Webb July 1968.

PROGRESS REPORT TO MARCH 1969
M.J. FOSTER

Anomalies interpreted by Mr. J. Webb of AES from the aero–mag. survey by AMEG P/L.
The total mag. intensity values were statistically reduced to 7 residual anomalies (A to F) and a number of trends which reflected structure.
The original data is subject to considerable error.

Recommendations:
(Moina sheet 2)

1. Infill VHEM
2. Extend mag. and EM north on 6E,7E,8E & 9E.
3. Drill 2 ddh's as recommended by Reid '67.

K.O.Reid recommends selected IP and/or Turam, selected re–mag. surveys and grid extensions.

ANNUAL REPORT MOINA AREA 1969 – 70
B.C. DANDY

8 main anomalies (IP) detected.
A1,A4, & A2 assoc. with conductive axes.
A2,A5 & A6 assoc. with resistive axes (dissem. sulphides).
A3,A7 & A8 not related to anything.

Recommendation Oliver's Hill area – 2 ddh's in A1, 1 ddh in A2.

S & M – ground mag. revealed 3 strong anomalies (1968–69)
1. W of Iris River with coincident Bi (10W to 8W)
2. S & M mine area
3. NE of BCF

Four additional lines cut (blue). IP – double pole–dipole array.

ANNUAL REPORT MOINA AREA 1970 – 71
J.P. McKIBBEN

Reinterp. of regional magnetics by CGG
– poss. to distinguish between basalt and bedrock.
– discontinuities coincide with known faults.
– near surface N–S axes defined NE Lorinna & N of Daisy Hill, Cambrian rocks? Follow–up revealed magnetic, ferrous basalt horizons.

GN TN MN
GRID CONVERGENCE 1.0°
GRID/MAGNETIC 11.6°

INDEX TO ADJOINING SHEETS

LOONGANA	WILMOT	SHEFFIELD
LAKE LEA	CETHANA	GOG
PENCIL PINE	LIENA	MOLE CREEK

RGC EXPLORATION PTY. LIMITED
(INC. IN N.S.W.)

COMPILED	M.F.
DRAWN	T.G.D.S.
DATE	Oct. 1988
CHECKED	
1:25,000 REFERENCE	CETHANA

CETHANA 7737
E.L. 8/65
GEOPHYSICAL COMPILATION

BASE PLAN No.
OVERLAY PLAN No.
SCALE 1:25000 100 50 0 50 100 150 200 METRES
FIG. 4

LEGEND

V v	Tertiary Basalt
Om	Ordovician Moina Sandstone
Or	Ordovician Roland Conglomerate
Є	Cambrian Undifferentiated

- Geological Contact
- Fault
- Bedding - strike & dip direction
- Jointing - strike & dip direction
- Fold - direction of axis plunge

GEOLOGY BY- : G.E. Hale, K.D.Corbett & C.E.Raulings ①
: S.J. Patterson ②

GRID CONVERGENCE 0·6° GRID MAGNETIC ANGLE 12·1°

INDEX TO ADJOINING MAPS

1-1	1-2	1-3
2-1	2-2	2-3
3-1	3-2	3-3

RGC EXPLORATION PTY. LIMITED

CETHANA

HEC REGIONAL GEOLOGY

7738

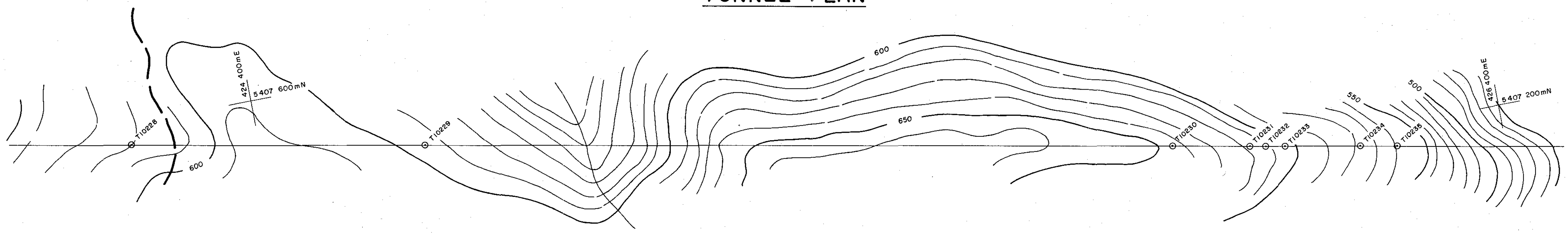
DRAWN BY : M.J.F.
DRAFTSMAN : G.B.
DATE : OCT. '88
REVISIONS :

FILE NO.

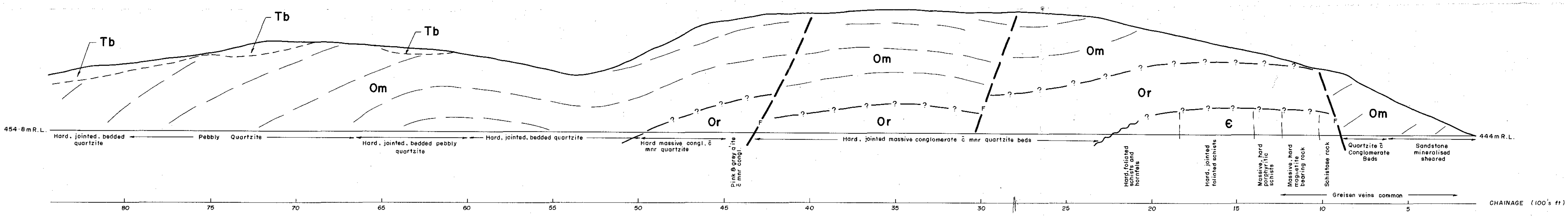
SCALE 1:5000 — 100 50 0 50 100 150 200 METRES

FIG. 5

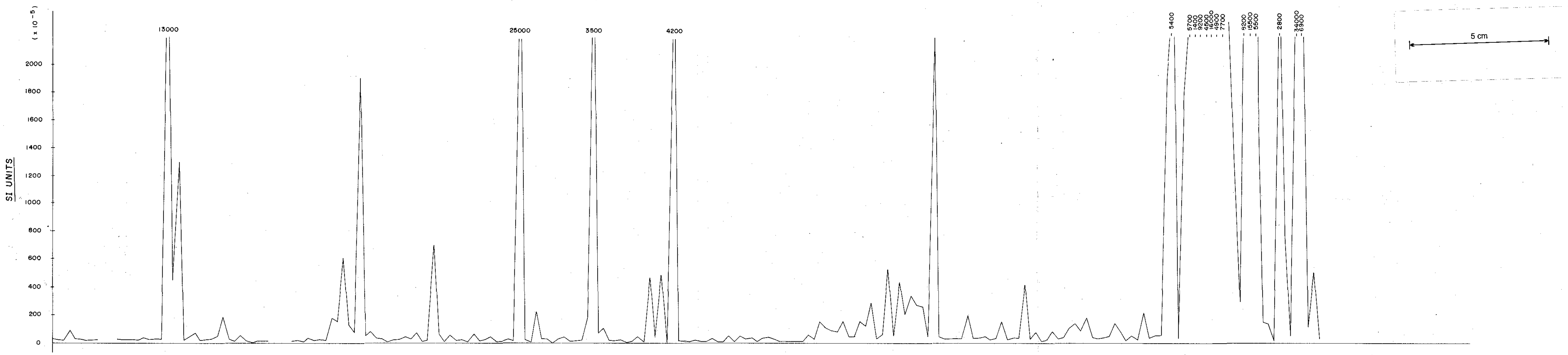
TUNNEL PLAN



SECTION – LOOKING NORTH



MAGNETIC SUSCEPTIBILITY



724183

LEGEND

Tb	Tertiary Basalt
Om	Ordovician – Moina Sandstone
Or	Ordovician – Roland Conglomerate
Є	Cambrian Undifferentiated

Geological Contact
Faults
Unconformity
Bedding

88 - 2872

NOTE – Relates to 1:5000 Cethana 2-2

RGC EXPLORATION PTY. LIMITED
INCORPORATED IN NEW SOUTH WALES

COMPILED	M.J.F.	WILMOT TUNNEL
DRAWN	G.B.	GEOLOGY 7739
DATE	OCT. '88	(AFTER HEC MAPPING)
CHECKED		
1:250,000 Reference		

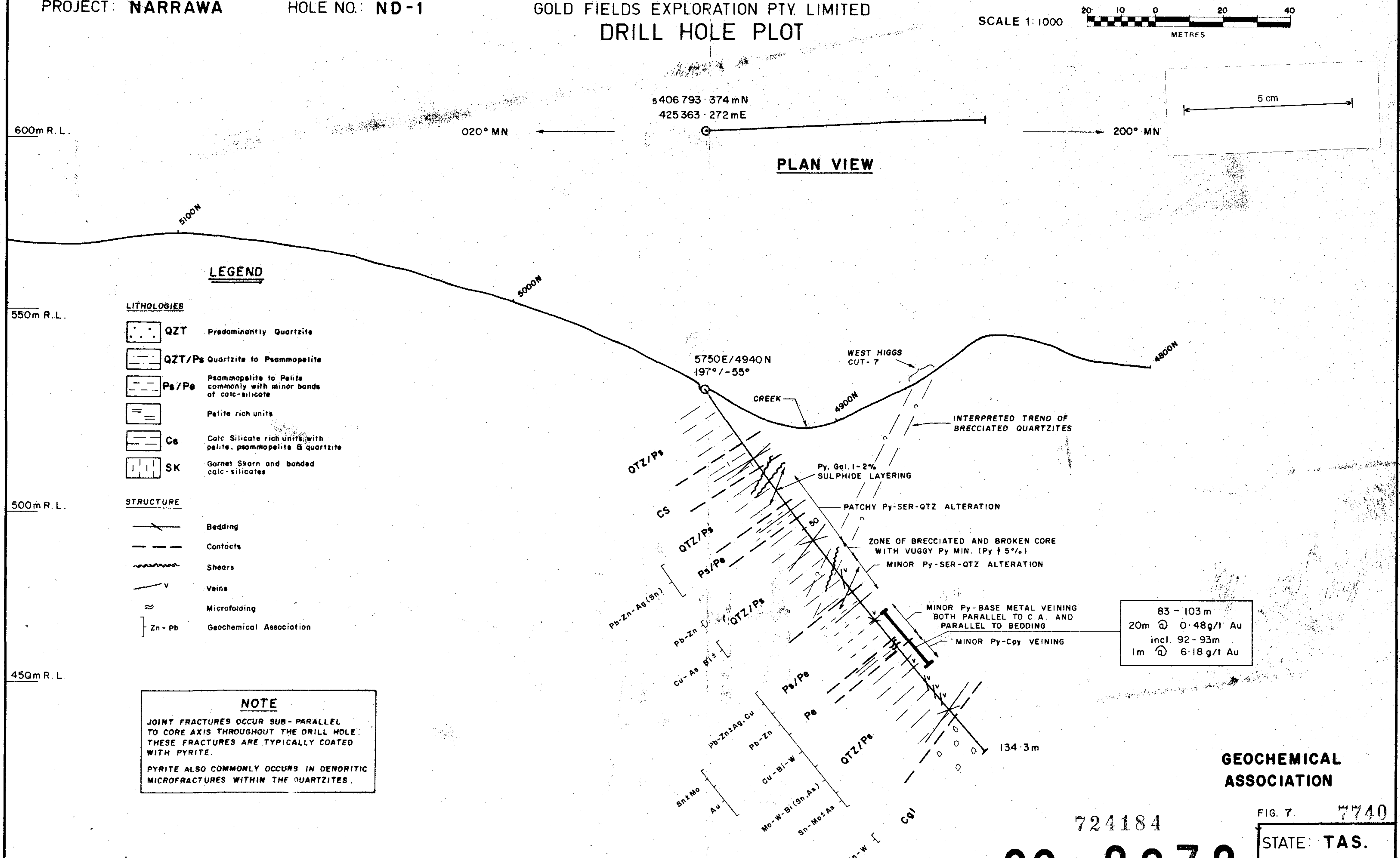
BASE PLAN No.
OVERLAY PLAN No.
SCALE 1:5000 100 50 0 100
FIG. 6

PROJECT: **NARRAWA** HOLE NO: **ND-1**

GOLD FIELDS EXPLORATION PTY. LIMITED

DRILL HOLE PLOT

SCALE 1: 1000



GEOCHEMICAL ASSOCIATION

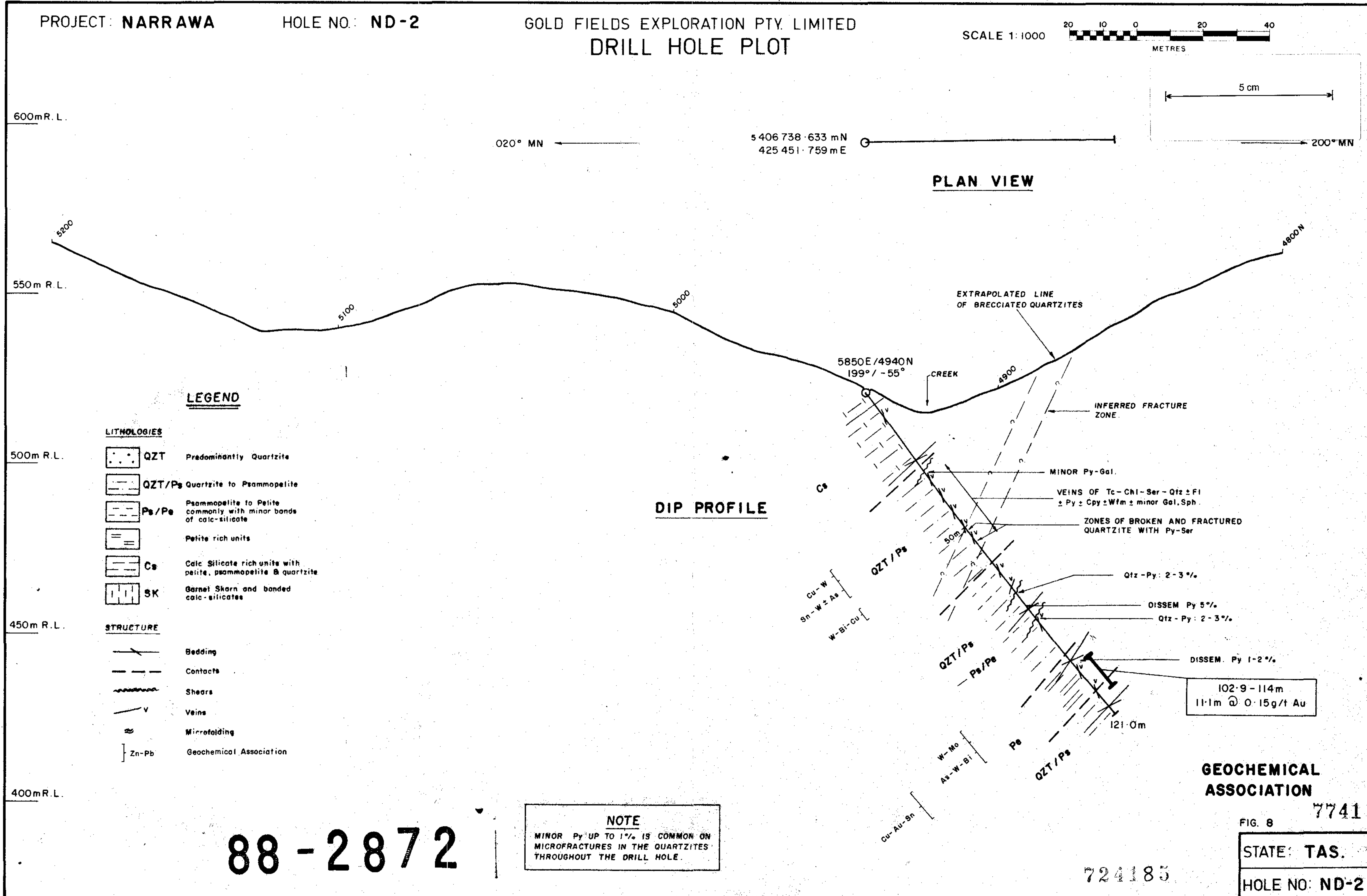
FIG. 7 7740

724184

88-2872

STATE: **TAS.**

HOLE NO: **ND-1**



88-2872

7741

724185

PROJECT: **NARRAWA** HOLE NO.: **ND-3**

GOLD FIELDS EXPLORATION PTY LIMITED

DRILL HOLE PLOT

SCALE 1:1000

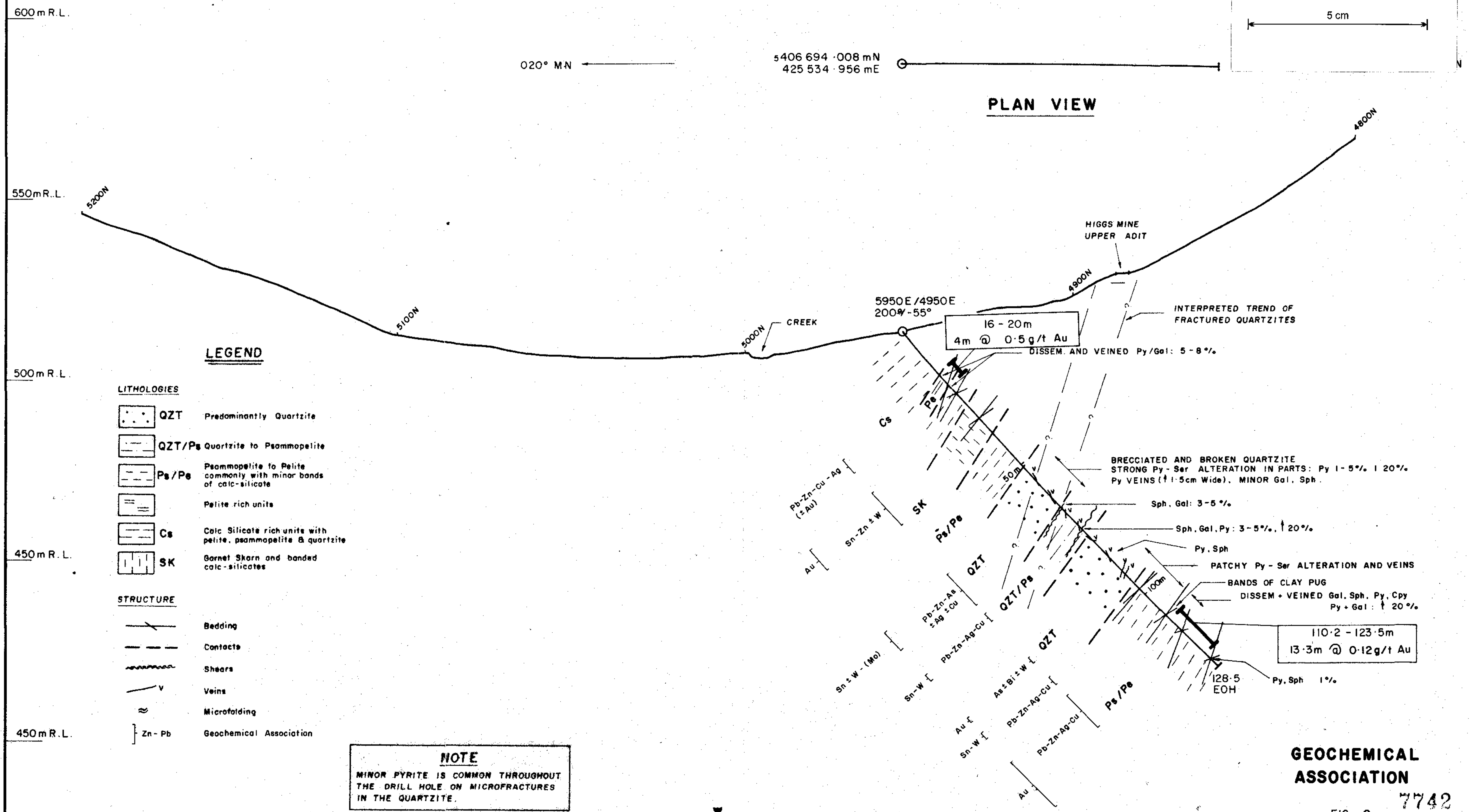


FIG. 9

7742

88-2872

724186

STATE: **TAS.**

HOLE NO: **ND-3**

LEGEND

■ SAMPLE No.
BOUGUER ANOMALY (mgals for density of 2·67)

Limit of Shell Aeromagnetic Coverage

GRID CONVERGENCE 1.0°
GRID/MAGNETIC 11.6°
GN TN MN

INDEX TO ADJOINING SHEETS

LOONGANA	WILMOT	SHEFFIELD
LAKE LEA	CETHANA	GOG
PENCIL PINE	LIENA	MOLE CREEK

88-2872

RGC EXPLORATION PTY. LIMITED
(INC. IN N.S.W.)

724187

COMPILED	
DRAWN	G.B.
DATE	Oct. 1988
CHECKED	
1:25,000 REFERENCE	CETHANA

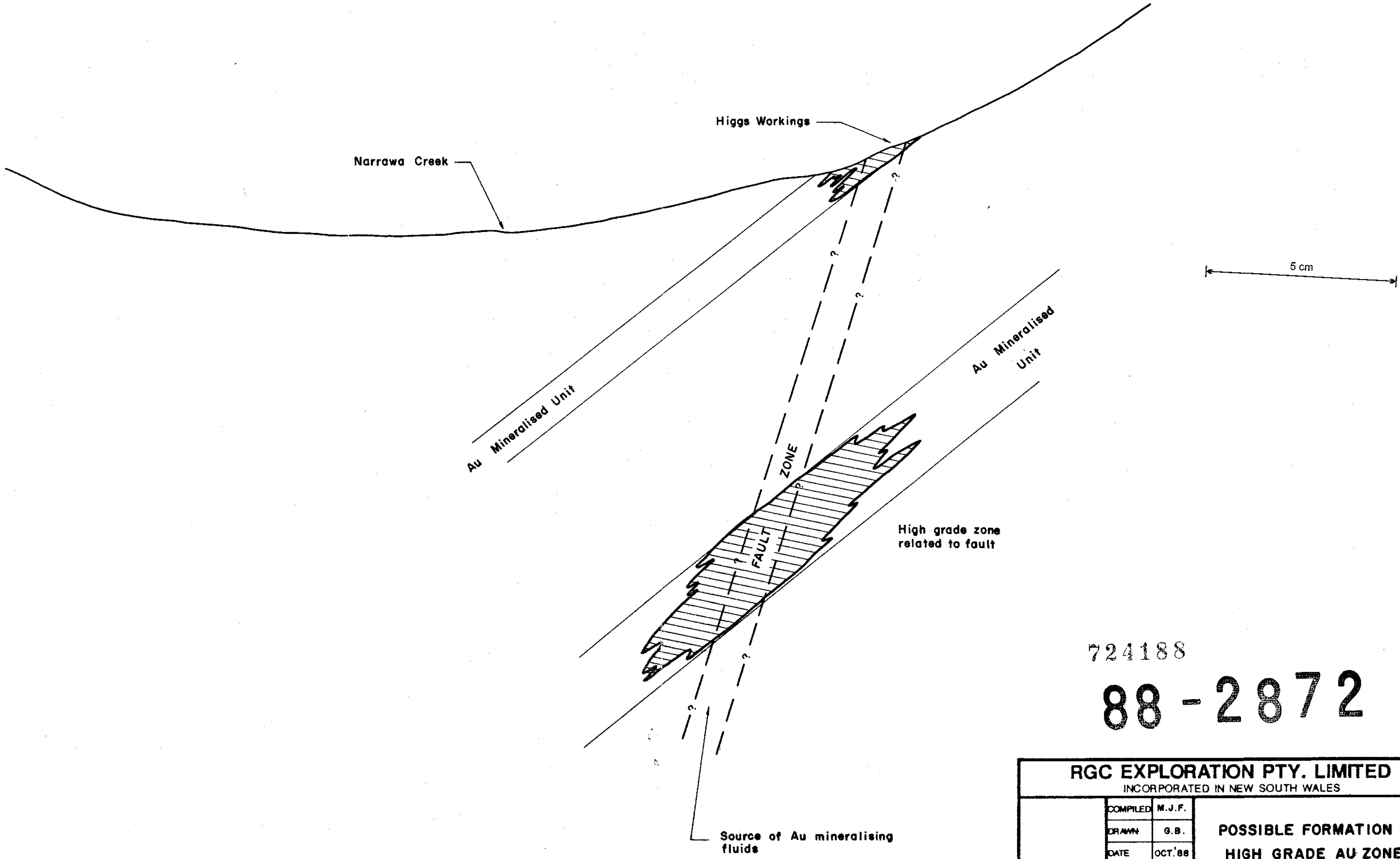
CETHANA

INFILL GRAVITY AND SHELL AEROMAGNETIC COVERAGE

BASE PLAN No.
OVERLAY PLAN No.

SCALE 1:25000 100 50 0 50 100 150 200 METRES

FIG. 10



724188

88-2872

RGC EXPLORATION PTY. LIMITED

INCORPORATED IN NEW SOUTH WALES

COMPILED	M.J.F.	POSSIBLE FORMATION OF HIGH GRADE AU ZONES RELATED TO STRUCTURE
DRAWN	G.B.	
DATE	OCT.'88	
CHECKED		
1:250,000 Reference		7744

BASE PLAN No.	SCALE N.T.S.	FIG. 11
OVERLAY PLAN No.		