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PASMINCO EXPLORATION

TULLAH EL 22/90

ANNUAL REPORT

OCTOBER 1990 – SEPTEMBER 1991

91-3297

MINES
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19 SEP 1991
Doc. Ref.
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91-3297

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DATE: September 1991

REPORT No: T91-11

SUBMITTED TO: Regional Exploration Manager – Tasmania

DISTRIBUTION: Department of Resources & Energy – Division of Mines & Mineral Resources

Pasminco Exploration – Burnie

– Melbourne

SUBMITTED BY:

ACCEPTED BY:

Burnie
September 1991



PLATE 1

View across part of the Tullah EL from the New North Farrell Mine Site.

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1. SUMMARY

Work undertaken on the Tullah EL 22/90 in the period 19 October 1990 to 19 September 1991 has included compilation of data from previous work, diamond drill hole logging, geological mapping and photogrammetry and aeromagnetic surveys. This work is part of a continuing programme.

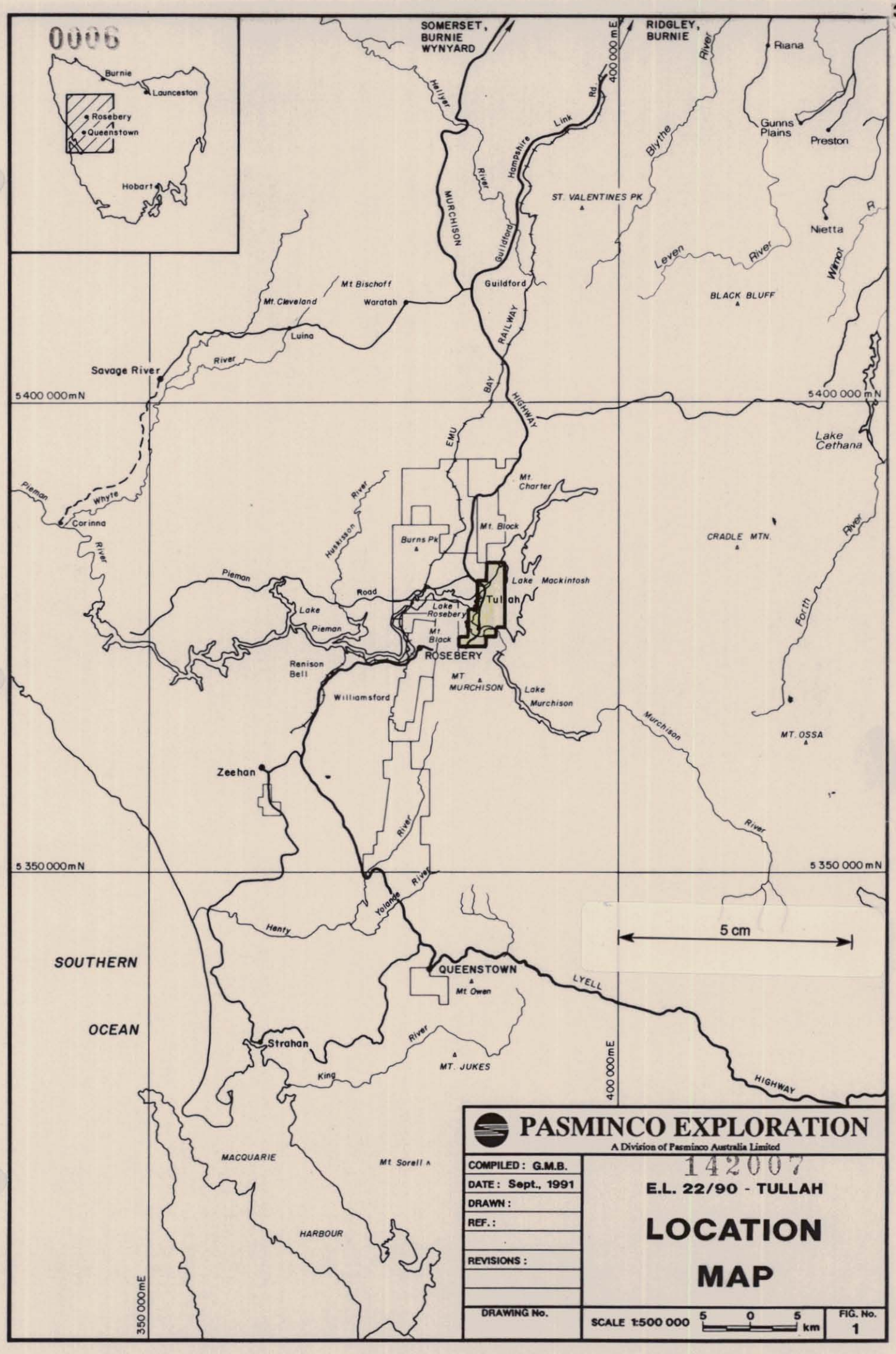
Future efforts will be directed towards gaining a complete picture of the geology and known mineralisation.

The current programme has highlighted the need to pay special attention to the possibility of finding ore outside the known lodes and to locating structures and traps that may have focussed mineralising fluids.

2. INTRODUCTION

The work undertaken for the first year of exploration on EL 22/90 (Tullah) is reported here. It was carried out between 19 October, 1990 and 19 September, 1991.

The initial programme has essentially been one of data accumulation. It was still in progress at the end of the reporting year and will continue into next year. Consequently, very little interpretative material is contained in this report and what there is, is preliminary.



PASMINCO EXPLORATION
A Division of Pasminco Australia Limited

COMPILED : G.M.B.	142007
DATE : Sept., 1991	E.L. 22/90 - TULLAH
DRAWN :	**LOCATION MAP**
REF. :	
REVISIONS :	
DRAWING No.	SCALE 1:500 000 (5 0 5 km)
	FIG. No. 1

3. TENURE

The Tullah exploration licence (EL 22/90) covers an area of 27km^2 extending to the east, north and south of Tullah township, Western Tasmania (Fig 1).

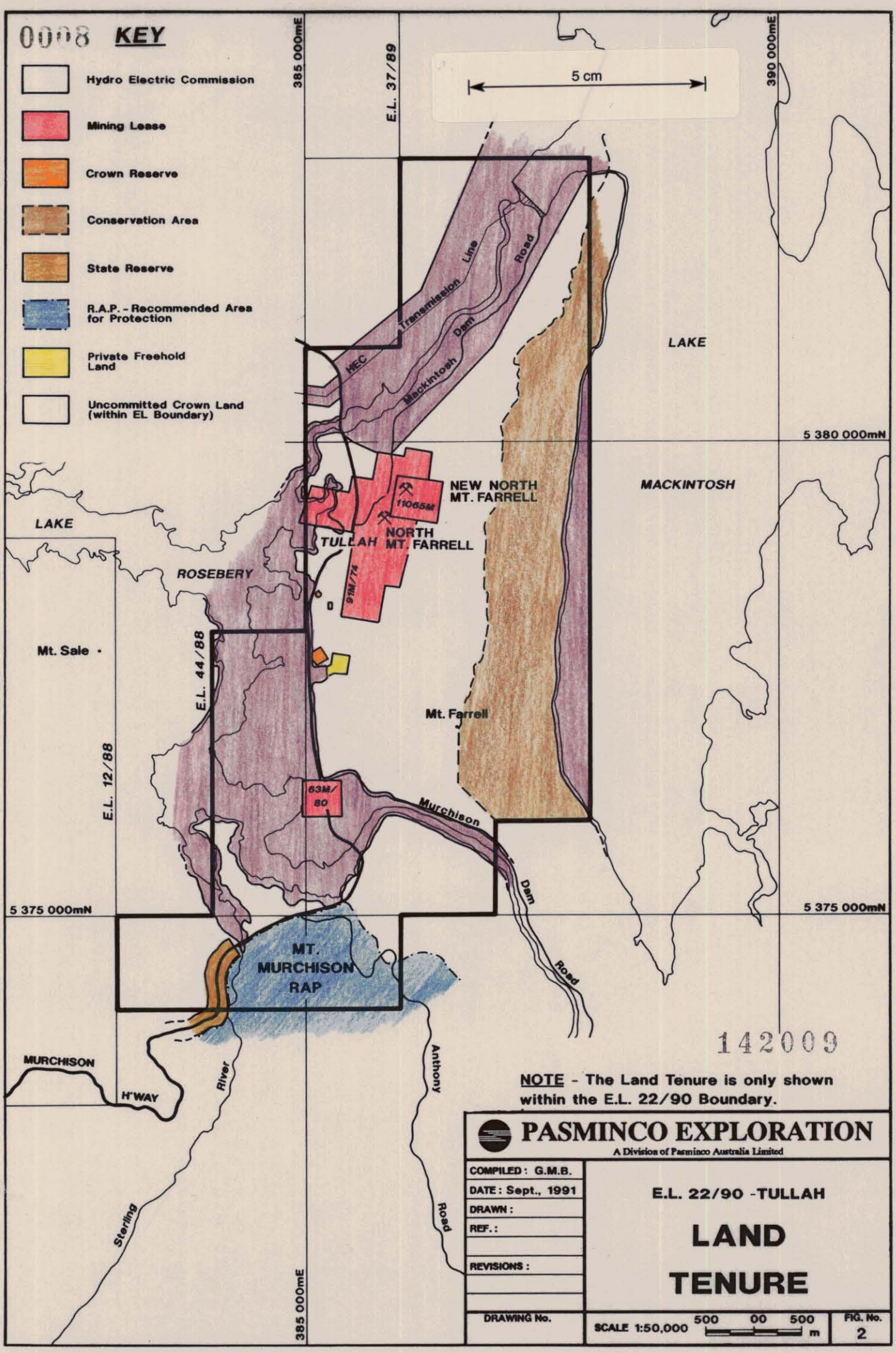
The licence application was originally made by Peko Exploration Limited (a subsidiary of North Broken Hill Limited) in August, 1990. On the 25 September 1990, Pasminco Australia Limited (of which NBH owns 45%) came to an agreement with Peko, whereby the application was transferred to Pasminco. The licence was granted to Pasminco on 20 October 1990.

The following statutory land tenure areas are included in the EL:

South West Conservation Area and Murchison Highway State Reserve (approx. 15%)
Crown Land (approx. 43%)
Private Property (approx. 2%)
Land vested in the HEC (approx. 40%)

A total area of 5.15km^2 has been excluded from the EL. This includes 3.4km^{2}of land vested in the HEC and 1.45km^2 of Mine Leases held by Pasminco Mining (see Fig 2).

Part of the Mt Murchison Recommended Area for Protection is also covered by the EL (approx. 5% of Licence Area).


0008 KEY
Hydro Electric Commission
Mining Lease
Crown Reserve
Conservation Area
State Reserve
R.A.P. - Recommended Area for Protection
Private Freehold Land
Uncommitted Crown Land (within EL Boundary)
385 000mE
390 000mE
E.L. 37/89
5 cm
Transmission Line
Road
HEC
Mackintosh
Dam
LAKE
5 380 000mN
NEW NORTH MT. FARRELL
1106SM
NORTH MT. FARRELL
TULLAH
9TM/74
MACKINTOSH
LAKE
ROSEBERY
Mt. Sale
E.L. 44/88
E.L. 12/88
Mt. Farrell
63M/80
Murchison
Dam
Road
5 375 000mN
MT. MURCHISON RAP
MURCHISON H'WAY
River
Anthony
Road
Sterling
385 000mE
142009
NOTE - The Land Tenure is only shown within the E.L. 22/90 Boundary.
PASMINCO EXPLORATION
A Division of Pasminco Australia Limited
COMPILED : G.M.B.
DATE : Sept., 1991
DRAWN :
REF. :
REVISIONS :
DRAWING No.
E.L. 22/90 -TULLAH
LAND TENURE
SCALE 1:50,000
500 00 500 m
FIG. No. 2

4. REGIONAL GEOLOGY

The Tullah EL covers ground on the eastern margin of the Mt Read Volcanics in Western Tasmania. These rocks consist of acid to mafic lavas, acid intrusives and proximal and distal volcaniclastic deposits. They are of Cambrian age and occur as an arcuate belt which is fault bounded on both sides by sediments of Pre-Cambrian to Devonian age. The nature of these fault boundaries is complex and rocks of different ages have been juxtaposed in a pattern which is not easy to unravel. Cambrian granite intrudes the belt along its eastern side.

The Mt Read Volcanics host the base metal deposits of Hercules, Farrell, Que River, Mt Lyell, Rosebery and Hellyer, the latter three all support operating mines.

The licence straddles the Henty Fault Zone, a major north east – south west trending structure, which in most places, transects the Mt Read Volcanics but locally forms their eastern boundary. In the southern half of the licence the fault separates massive lavas on its eastern side from volcaniclastic sediments, black shales and sandstones (Farrell Slates) to the east. Further north the Farrell Slates become part of the fault zone and occur in a narrow, faulted, band between the same massive lavas in the west and Ordovician conglomerate east of the fault.

Numerous old mines and workings occur within the sediments on the eastern side of the Henty Fault and within the fault zone itself. They define a trend which is parallel to the fault. Included in them are the North Farrell and New North Farrell mines, which between them produced a total of 730 700t @ 13% Pb, 434g/t Ag and 2% Zn (Purvis, 1986).

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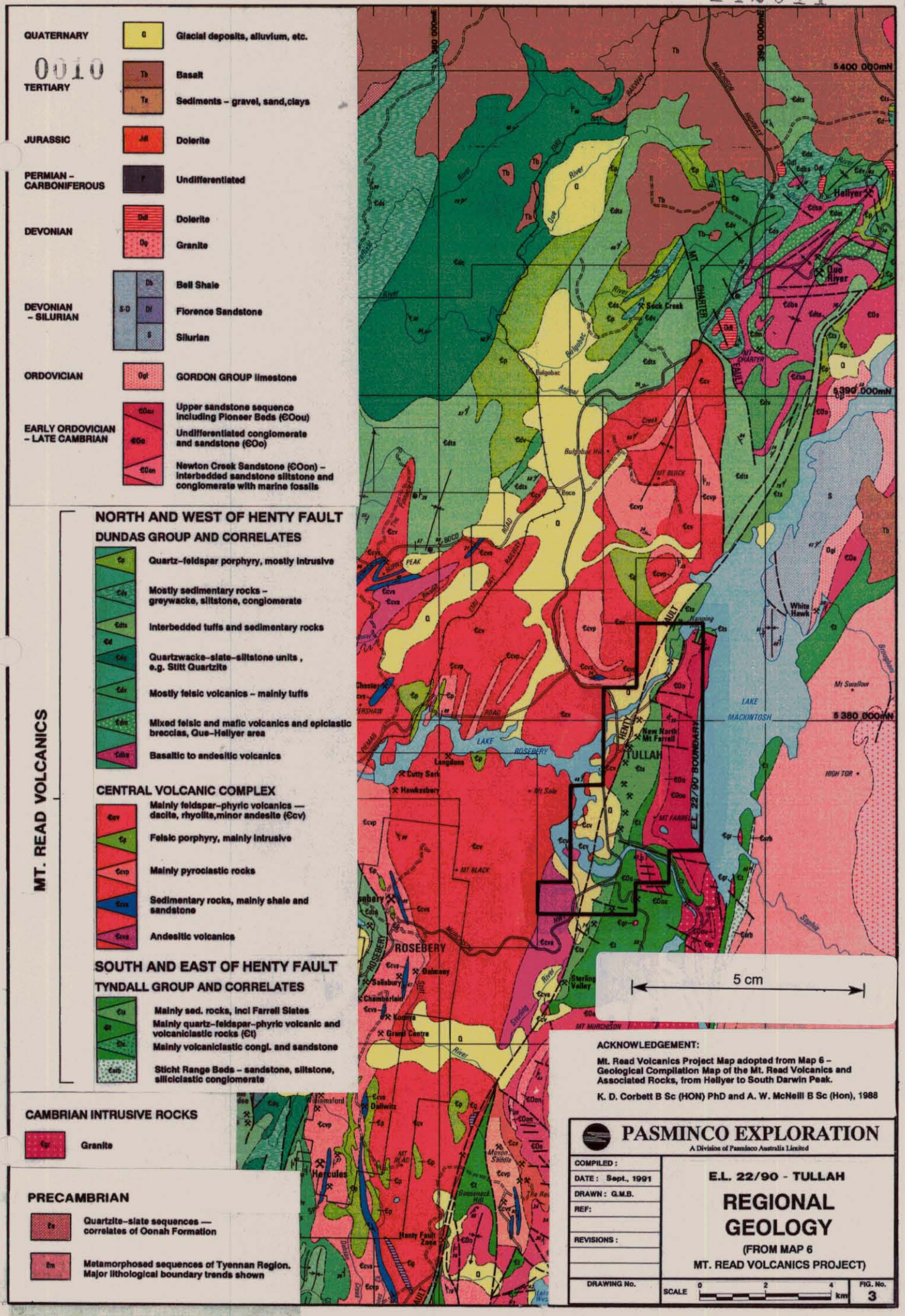
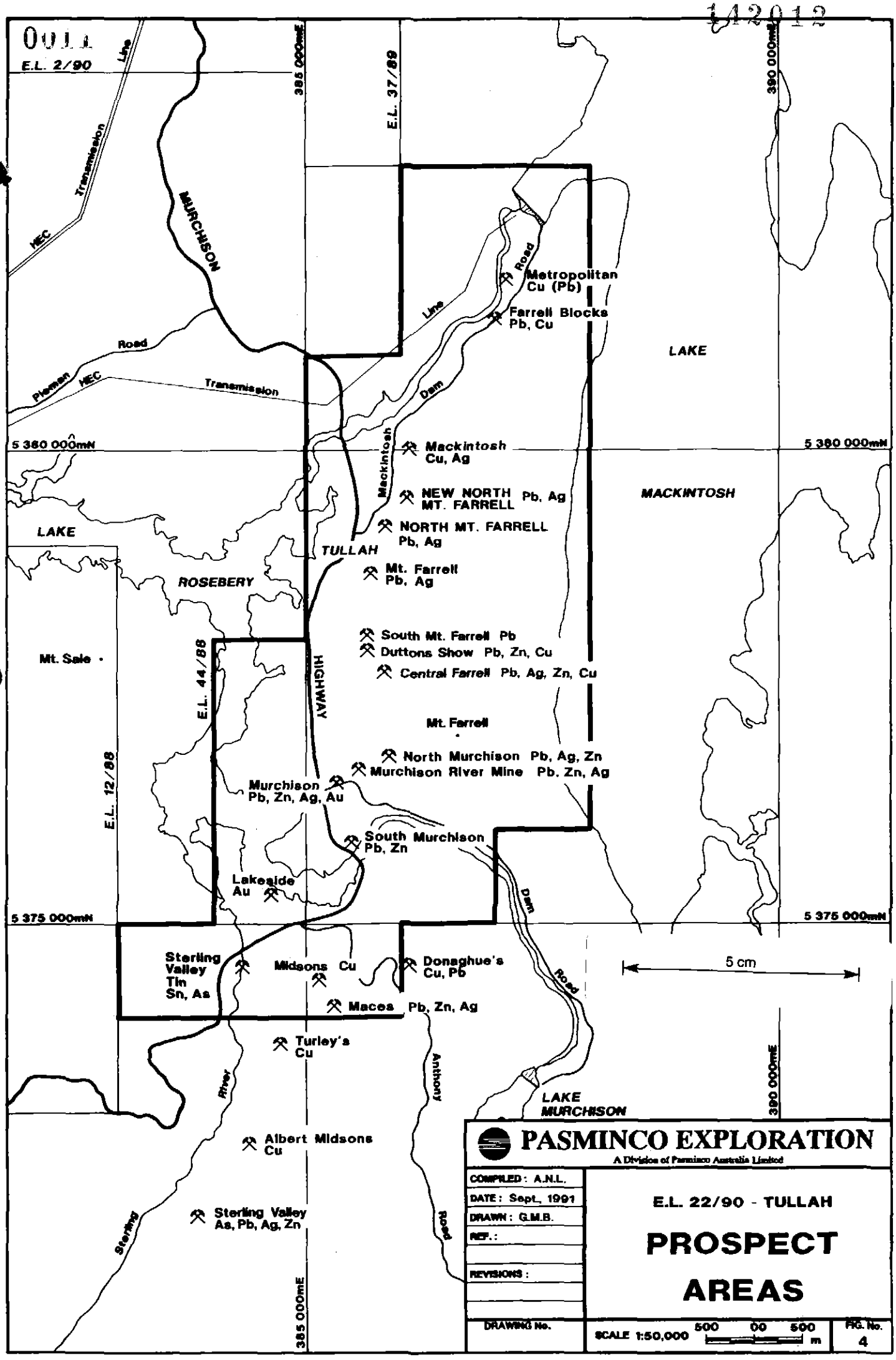

QUATERNARY
Q
Glacial deposits, alluvium, etc.
TERTIARY
Tb
Basalt
Ts
Sediments – gravel, sand, clays
JURASSIC
Jdl
Dolerite
PERMIAN – CARBONIFEROUS
P
Undifferentiated
DEVONIAN
Ddl
Dolerite
Dg
Granite
DEVONIAN – SILURIAN
S-D
Db
Bell Shale
Df
Florence Sandstone
S
Silurian
ORDOVICIAN
Ogl
GORDON GROUP limestone
EARLY ORDOVICIAN – LATE CAMBRIAN
€Oou
€Oo
€Oon
Upper sandstone sequence including Pioneer Beds (€Oou)
Undifferentiated conglomerate and sandstone (€Oo)
Newton Creek Sandstone (€Oon) – interbedded sandstone siltstone and conglomerate with marine fossils
MT. READ VOLCANICS
NORTH AND WEST OF HENTY FAULT
DUNDAS GROUP AND CORRELATES
Qp
Quartz–feldspar porphyry, mostly intrusive
Cds
Mostly sedimentary rocks – greywacke, siltstone, conglomerate
Cdts
Interbedded tuffs and sedimentary rocks
Cd
Cdq
Quartzwacke–slate–siltstone units, e.g. Stitt Quartzite
Cdv
Mostly felsic volcanics – mainly tuffs
Cdm
Mixed felsic and mafic volcanics and epiclastic breccias, Que–Hellyer area
Cdba
Basaltic to andesitic volcanics
CENTRAL VOLCANIC COMPLEX
Ccv
Mainly feldspar–phyric volcanics — dacite, rhyolite, minor andesite (€cv)
Cp
Felsic porphyry, mainly intrusive
Ccvp
Mainly pyroclastic rocks
Ccvs
Sedimentary rocks, mainly shale and sandstone
Ccva
Andesitic volcanics
SOUTH AND EAST OF HENTY FAULT
TYNDALL GROUP AND CORRELATES
Cts
Mainly sed. rocks, incl Farrell Slates
Ct
Mainly quartz–feldspar–phyric volcanic and volcaniclastic rocks (€t)
Ctc
Mainly volcaniclastic congl. and sandstone
Cstb
Sticht Range Beds – sandstone, siltstone, siliciclastic conglomerate
CAMBRIAN INTRUSIVE ROCKS
Cgr
Granite
PRECAMBRIAN
Pe
Quartzite–slate sequences — correlates of Oonah Formation
Pm
Metamorphosed sequences of Tyennan Region. Major lithological boundary trends shown
5 400 000mN
5 390 000mN
5 380 000mN
380 000mE
390 000mE
Hellyer
Que River
Sock Creek
Bulgobac
Mt Charter
Eagle
Boco
Road
Tullah
Lake Rosebery
Lake Mackintosh
New North
Mt Farrell
Mt Swallow
High Tor
Mt Black
Mt Sale
Mt Farrell
Rosebery
Hercules
Henty Fault Zone
Fault
Hanging
Mt Read
Mt Murchison
Sterling Valley
Dalmeny
Salisbury
Chamberlain
Kodyna
Grand Centre
Dalliwitz
Williamsford
Mt Black
Mt Read
Mt Farrell
Mt Murchison
Mt Sale
Mt Black
Henty
Fault
Hanging
Wall
Footwall
Block
Eagle
Mt Charter
Bulgobac
Anomal
Creek
Road
Boco
Peak
Lake
Rosebery
Tullah
Langdons
Cutty Sark
Hawkesbury
Chester
Pershaw
Newman
Stitt
Railway
Highway
Que
River
Sock Creek
Bulgobac
Anomal
Creek
Mt Charter
Eagle
Fault
Hanging
Wall
Footwall
Block
Boco
Road



PASMINCO EXPLORATION
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COMPILED : A.N.L.	E.L. 22/90 - TULLAH
DATE : Sept., 1991	**PROSPECT AREAS**
DRAWN : G.M.B.	
REF. :	
REVISIONS :	
DRAWING No.	SCALE 1:50,000 (500 00 500 m) — FIG. No. 4

5. PREVIOUS WORK

The Tullah EL covers an area that is littered with old mines and workings, it has a history of prospecting and exploration that spans 94 years. Early work on the field was restricted to small claims and reflected the boom and bust periods of the past. As time went on, larger companies become involved and were inclined to adopt a more regional approach.

The history of work on this EL is an interesting case study in the evolution of prospecting and exploration philosophies and methods.

The first record of prospecting on the Mt Farrell field was the commencement of work on the Mackintosh sections by C P Smith in 1896. (Whitham in McKibben, 1967).

The most significant discovery came in 1899 with the detection of ore at North Farrell. This deposit was mined until 1933, when low metal prices resulted in the mine's closure. A total of 423 000t of ore at 11.4%Pb and 369g/t silver had been removed.

In 1933 prospectors financed by a government relief fund subsidy, discovered a 6 inch lode of galena on the company's leases north of the closed mine. This discovery became the New North Farrell Mine, which operated until 1973 and produced 298 682 tonnes at 14.9%Pb and 506g/t Ag. The EZ Company of Australasia bought the mine from the Farrell Mining Company in 1964.

Exploration outside the Farrell Mine leases was carried out by numerous prospectors, some of whom discovered small lodes along the "Farrell Line" in the years 1896–1947. (Ward, 1908 and Brooks, 1962).

In 1947, the EZ Company was granted a special Prospecting licence (SPL) over most of the Tullah area and systematic exploration had its' beginnings. Although the first licence expired in 1948, EZ retained control of the ground under a series of SPL's, the last of which, SPL 3, expired in 1978. During the mid-late 1950's the SPL's extended south into the Sterling Valley area and at least some exploration was carried out in partnership with Rio Tinto Australia Exploration Pty Ltd (RTAE).

EZ carried out a self potential survey in 1951 and in the years 1946–1957, drilled a number

of holes at Duttons Workings, Murchison Mine and north of New North Farrell. The latter holes were targeted on SP anomalies. (Groves and Noldart, 1964). In 1957, the Bureau of Mineral Resources undertook an electromagnetic survey on one of the SPL's. Anomalies detected by this method were sampled by EZ. These anomalies also appear on a regional geological map of the Mt Farrell-Sterling Valley Area, produced by M Solomon for RTAE in 1958.

BY 1978, EZ had adopted a regional approach to exploration and held a number of large EL's. To simplify reporting and accounting procedures, SPL 3 was amalgamated with one of these, EL 1/62. From then on, all work undertaken in the Tullah area (outside the Mine Leases) was reported regularly to the Mines' Department. The records of work done since 1978 are thus, more complete than those of earlier investigations.

The current Tullah EL (22/90) also covers some ground that was once held under EL 4/73. This licence was granted to Cominco, who later Joint Ventured it to EZ and subsequently, to Getty Oil Development Company. Cominco transferred their interest to Aberfoyle, who ultimately withdrew from the Joint Venture. When Getty were sold, EZ resumed sole title to the EL before signing a final Joint Venture with Billiton Australia Limited in 1986. The portion of ground that now occurs within EL 22/90 contains a small gold deposit (Lakeside) found by Billiton. It was amalgamated with EL 1/62 in 1988 at a time when Billiton was exploring the length of the Henty Fault for gold.

Tables I and II list all the annual reports, relevant to EL 22/90, for the 1/62 and 4/73 ELs. In each there is a column which summarises the work covered by respective reports.

TABLE 1

REPORTS FOR 1/62 EL WHICH PERTAIN TO PAST WORK UNDERTAKEN ON CURRENT EL 22/90

MINE DEPT.No	PASMINCO No.	TITLE	AUTHOR, COMPANY	WORK COVERED (PERTAINING TO CURRENT EL 22/90)
80-1411	MTB 20	Exploration Licence No. 1/62 Report on work undertaken to 30 June 1979	J Mills. EZ	Review of past work.
80-1468	MTB 27	Exploration Licence No. 1/62 Report on work undertaken 30 June 1979-30 June 1980	J Mill et al., EZ	Murchison River Area. Ground Mag., IP., *MRP 212*
82-1738	MTB 28	Exploration Licence No.1/62 Progress Report on Activity July 1980-June 1981	I McDonald, EZ	Stream Seds, C-Hor. soils, grid. mapping, Ground mag., *MRP's 219, 226, 227*
82-1840	MTB 29	Exploration Licence No. 1/62 Progress Report on activity, 1 July 1981-15 December 1981	I McDonald et al., EZ	MRP 233 with Mag. sus. readings.
	MTB 34	Exploration Licence No. 1/62 Progress Report on Exploration Activity 21 November 1983-3 May 1983	I Mathison, I McDonald, EZ	Review of Mt Read Volcanics Lineament Analysis.
85-2313	RJV 1	Rosebery East Exploration Progress Report August 1983-June 1984	F FitzGerald et al. G.O.D.C	DIGHEM survey, gridding, ground mag. Geol. mapping, rock chip geochem, maxmnt, VLF EM., costeaning, soil sampling. *MR1, MR2*
85-2516	RJV9	Rosebery East Exploration Progress Report July 1984-December 1984	F FitzGerald et al. G.O.D.C	Gold Study (J G Purvis) Additional sampling *MR1 & MR2*
86-2622	Microf.	Progress Report on Exploration for the period ending 22 December 1986	J Randell et al. B.Aus	Target Model Henty Fault Zone core sampling. UTEM
	N/A	Farrell Joint Venture Report on Activities to 30 September 1987	J G Purvis for B. Aus	Sampling, *F46, F48, 1F, 3F* Compilation of Farrell Mines Data.
87-2751	Microf.	EL 1/62 Murchison River Annual Report January 1987-January 1988	D Hall et al. B. Aus	*Lakeside Drilling:* *RED 87-2, 87-3, 87-5, 87-6, 87-7, 87-8, 87-10* Down hole IP and Resistivity. *Duttons;* IP, *RED 87-4*, BCL, Drill core re-assay, Gravity, MAXMIN EM, ground Mag. *Farrell-Mackintosh;* Mapping, Rock chip sampling re-assaying drill core, *RED 87-11* *Murchison Mine;* Re-assay core, Rock chip BCL sampling, IP.

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EL 22/90

88-2895	Microf.	EL 1/62 Annual Report to 22 January 1989	D Hall B. Aus	*Lakeside;* RED 88-1, 88-2, 88-4, down hole EM, Resource estimate. UTEM. *N. Lakeside; RED 88-3* *Tullah Flats;* ground Mag., MAXMIN EM. *Murchison Mine;* Gridding, mapping, C-horizon soil, ground mag., IP., MAXMIN EM.
89-3034	N.C	Relinquishment Report for remaining areas of EL 1/62 September 1989	J Randell	Indicated resources for Lakeside.

Microfiche - Microfiche copy only.
N.C - No copy in library.
N.A - Not available.
G.O.D.C - Getty Oil & Development Company.
B.Aus - Billiton Australia.

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TABLE 2

REPORTS FOR EL 4/73 PERTAINING TO AREAS COVERED BY CURRENT EL 22/90

MINES DEPT No.	PASMINCO No.	TITLE	AUTHOR/COMPANY	WORK COVERED
74-1037	N.C	EL 4/73 Preogress Report to June 1974	ASARCO	Stream sediments
76-1154	N.C	Progress Report on EL 4/73, Sterling Valley, for 6 months ending 6 March 1976 (and Summary of work carried out in previous 6 months)	Cominco Explortion Pty Ltd	Bedrock Augur, magnetics, I.P, E.M.
78-1254	N.C	Report on Diamond drilling programme, EL 4/73 September-November 1977	Cominco.	Drill Hole *SV1*
80-1462	N.A	EL 4/73 - Progress Report on Activity 1979-June 1980	Mollison, EZ.	Gridding, mapping, C-Hor. soils, Ao soils, IP, Ao soils, IP, ground mag. *STP 217 STP 218*
82-1736	N.A EZ 143	EL 4/73 - Progress Report on Activity July 1980-June 1981	McDonald EZ	Ground mag., *STP 220, 221, 231*
82-1845	N.A EZ 146	Sterling Valley J.V. EL 4/73 6 monthly Project review as at December 1981	EZ	Gridding, mapping, *STP 232A1, 234* mag. sus., down hole IP.
82-1846	N.A EZ 150	EL 4/73. Progress Report on activity 15 December 1981-4 May 1982	R Sainty EZ	Mapping, C-Hor. soils, ground mag., petrology.
83-1922	N.A EZ 161	EL 4/73 Progress Report on activity May 1982-November 1982	EZ	Soil and costean sampling for gold
	N.A EZ 162	Assessment of Tin exploration Murchison River-Sterling Valley	I McDonald EZ	
83-2006	N.A EZ 167	Progress Report on exploration activity 21 November 1982-3 May 1983	I McDonald EZ	Review of data Costean sample analysis.
	N.A EZ 176	Arsenic Potential of Murchison River-Sterling Valley	I McDonald EZ	
84-2184	N.A EZ 181	EL 4/73 Progress Report on Exploration Activity 16 November 1983-1 May 1984	I McDonald EZ	Review of arsenic and gold potential. Polished sections
85-2347	N.A EZ T202	EL 4/73 Annual Report on Exploration Activity 2 May 1984-6 March 1985	I McDonald EZ	DIGHEM, Grid mapping, Re-assay of *STP 218, 232, 221, 234, 217, 331, 220*

86-2522	N.A EZ T214	EL 4/73 Annual Report on Exploration Activity 7 March 1985-6 March 1986	I McDonald EZ	*STP 284*
	N.A EZ T210	A geological review of EL 4/73, with special emphasis on the potential for Au-As mineralisation	EZ	Review of work done so far.
	N.A EZ T223	EL 4/73 Annual Report on Exploration Activity 7 March 1986-6 March 1987	S Taylor EZ	Metallurgical testing of Arsenic zones. Re-assay of *SV1, STP 232, STP 4,* Fire Assay, Rock chip analysis.
88-2772	Microfiche	EL 4/73 Report on Exploration to March 1988	D Hall et al. A.ALLS	*SVD 87-1*, Gravity, IP. Re-assays *STP 217, 221* metallurgical testing.
88-2785	N.C	EL 4/73 Sterling Vallay Final Report		Review of previous work.

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6. EXPLORATION 19 October 1990 - 19 September 1991

6.1 Photogrammetry

As part of a survey covering all of Pasminco's ground in Western Tasmania, high level, black and white photographs were taken over the Tullah area in December 1990. These were used by the HEC photogrammetry service to produce topographic maps at 1:2 500, 1:5 000 and 1:10 000 scales.

In January 1991, colour air photographs at 1:10 000 scale were taken. These have been used to locate old mines, define access routes and for geological interpretation.

6.2 Aeromagnetic Survey

A high resolution aeromagnetic survey was undertaken by GeoInstruments in February - March, 1991. Rapid changes in elevation within the Tullah areas created difficulties in adhering to terrain clearance specifications. This problem was compounded by the type of corrections applied.

The data has since been re-processed and corrected drape at 120m clearance and upward continued (to 1300m) total magnetic intensity contour maps have been produced at the Tasmanian Department of Energy and Resources, Division of Mines.

Prior to these maps being available, a preliminary interpretation of the data was undertaken by Dr D Leaman, who noted the short comings of the presentation and initiated the new corrections.

The most significant information that arises from the preliminary interpretation is structural. Dr Leaman has identified two features which may be associated with alteration where they intersect the Henty Fault. One of these is E-W trending and occurs along 5380 500N, the other occupies a wedge between two EWE and ESE trending structures at about 5377 000N.

The preliminary interpretation referred to is presented as Appendix I.

6.3 Geology

The geological work done within the reporting period was essentially data collection. It involved geological mapping at 1:2 500 scale and diamond drill core logging.

The long term aim of this work is to build up an acceptable geological data base, so that worthwhile interpretations can be made. At present the data collection is approximately one third complete.

In gathering the data, particular attention has been paid to the following aspects of the geology:

1. Structural Information

In a structurally complex area such as the Henty Fault zone any ore is going to be structurally controlled in distribution. Even that which may have been primarily formed by syngenetic processes.

One of the key factors in identifying possible zones of ore emplacement, is establishing the combination of structures which would have caused dilation during migration of ore fluids. These dilational zones would have made room for significant volumes of ore, provided that the ore fluids were adequately trapped. There is some evidence, from early accounts of the Farrell Mine, that the better ore tonnages came from points where two shear zones intersected (Groves and Noldart 1967).

2. Distribution of the Black Shales

Much of the ore in the Farrell Mines occurs in, or near the boundary of, a highly graphitic black shale unit.

This unit has probably acted as a good chemical and physical trap. For this reason, its distribution has to be carefully mapped. The combination of a dilational structural zone and a black shale trap would make a good drill target.

3. To identify zone of mineralisation outside them main Farrell orebodies.

The Farrell area has long been regarded as a limited exploration target. This is because the mined ore came from narrow shear zones (3-4 ft wide), was lead-silver rich (low in gold and zinc) and had a small volume (730 700t). Within the current programmes, the truth of this assumption is being tested and challenged. Although Farrell itself was a silver-lead mine, other, smaller workings to the south such as the Murchison Mine worked zinc and gold. In other places copper was mined. Fig.3 shows the location of the various mines and the types ore that was won from them.

The current work will also investigate the possibility of lower grade ore existing outside the known lodes and shears. Some progress has been made in this area and is mentioned in Section 6.4.

As discussed earlier, the geological work is being directed towards locating structural zones which may be favourable for larger tonnages of ore.

Finally, it must be said, that for an area so mineralised, the Tullah EL, especially in the region of the Farrell mines, has been under-explored. Because of glacial cover and because most drill holes have been short and drilled from the western side of the Farrell Lode, there is a vast area of untested ground on the footwall side of the above mentioned Lode.

The area north of New North Farrell Mines is also largely untested, although Billiton did some exploration for gold. An E-W structure (one of those highlighted by the aeromagnetic survey) occurs in this region, through Buttress Hill it may present opportunities for structural dilation.

6.3.1 GEOLOGICAL MAPPING

Detailed mapping (1:2 500 scale) of the Henty Fault Zone between Tullabardine Dam and North Mackintosh mine has been completed. Some mapping of the Ordovician Owen Conglomerate, east of the fault has also been undertaken.

The following rock types have been identified:

CAMBRIAN

i. Central Sequence Volcanics

Strongly feldspar-phyric rocks, amygdaloidal in places. They exhibit mottled, pink and green chlorite/albite alteration. They are interpreted as dacite or andesite lavas.

ii. Sandstones

Bedded sediments with sand-size quartz and volcanic fragments. Well sorted.

iii. Siltstones and Grey Mudstones

Finely bedded clay rich, light grey sediments, mud to silt-sized particles. In places they are quartz bearing and have a saccharoidal texture.

iv. Black Shales

Bedded, dark, highly graphitic sediments with mud-sized particles.

v. Quartz Crystal Sandstones

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These resemble iii, but contain black shale clasts and large quartz crystals that resemble volcanic quartz.

vi. Sericitic Volcaniclastics (?)

The primary rock type is unknown. Bedding is not visible. The rocks are highly sericitic and in places they are also siliceous. They may be altered and deformed lavas.

ORDOVICIAN

i. Sandstones

Well bedded, sorted, quartzite sandstone. Has a pinkish colour. Composed mostly of quartz and quartzite clasts, though there are occasional volcanic and mica-rich clasts.

ii. Conglomerate (Owen Conglomerate)

Poorly sorted, poorly bedded deposits of quartz and quartzite pebbles, with some volcanic and mica-rich clasts. Pinkish to green in colour.

The distribution of these rock types is shown in Fig.5 to 9, the 1:2 500 outcrop maps.

The Central Sequence Volcanics occur west of the Henty Fault, where they are relatively undeformed, except immediately adjacent to the fault contact. There are, however, lozenges of highly deformed volcanics within the fault zone, although they are close to its Western Boundary.

The Cambrian rock types ii - v (above) comprise what is known as the Farrell Slates (Corbett and McNeill, 1984). They occupy the Henty Fault zone in the area mapped. They are highly deformed and are sandwiched between the Volcanics to the west and the Ordovician rocks to the east.

The Ordovician sandstones and conglomerates are cleanly faulted against the Farrell Slates in places. In other places there appears to be a transition from the Cambrian Sediments through to the Ordovician sandstone. This occurs on the eastern side of the fault zone. In such circumstances, the sandstone exhibits strong deformation features.

The structures within the Farrell Slates and the Ordovician rocks are extremely complex and

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Plate 2
Looking south down the valley of the Henty Fault from Mackintosh Dam
Ordovician conglomerate & sandstone form the hills to the east,
the Central Sequence Volcanics form hills to the west.
The Farrell Slates are sandwiched between them.



Plate 3
Chevron-style folds, associated with minor N-dipping faults
in siltstones of the Farrell Slates.

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PLATE 4

Complex structure in the Ordovician rocks. A syncline of bedded sandstones apparently sits on top of massive conglomerate.

much effort has been put into recording them accurately on the outcrop maps. Within the Farrell Slates there are three main structural elements. These are described below, in what is thought to be the order in which they were active.

Starting from the oldest:

1. North-South striking faults with very tight, associated, drag folding. Most of these have a steep Westerly dip, although some dip steeply to the east. These have an anastomosing character which is apparent in cross-section. Initial movement appears to have been in a direction that shows on some of the fault plans as a lineation, plunging at between 30 and 80° to the north (usually steeper than 60°).

   These structures are by far the most common. They define the shape of the Henty Fault Zone. There is a widespread cleavage associated with them and there is evidence that they have been active through later periods.

2. Two sets of faults, one striking NE-SW, the other NE-SW. Both sets dip north at between 40 and 70°. They have caused chevron-style folds, the axes of which are small faults, parallel to the larger structures.

   Where these faults intersect the structures in 1. especially the larger structures, alteration and sulphide mineralisation (mostly pyrite in the area mapped) occur.

3. Late E-W striking faults. The effect of these is best seen in the Ordovician rocks, although they do penetrate the Farrell Slates. They appear to have a steep, near vertical dip. Offset in the sandstone units suggests a dextral movement. One of these coincides with the magnetic lineament along 85 500N.

More mapping is required to define the structures in the Ordovician rocks. Some very odd features occur in them (see plate 4) and the mapping available at present does not come to grips with these at all.

Structures defined in the sandstone and conglomerate may well prove to be important in finding alteration zones in the Farrell Slate.

6.3.2 DIAMOND DRILL CORE LOGGING

Re-logging of all the available EZ Mine Lease core commenced during the reporting period at the time of writing, 12 holes had been logged, this represents about 50% of the stored core. This programme had two purposes. One was to establish a clear picture of the geology in the mine area and to identify areas which may have potential for low grade, higher tonnage mineralisation. The other was to gain information on the nature of the rock types in the area, by looking at relatively fresh rock.

Until the information from all the logs has been compiled onto cross sections it is difficult to achieve the first objective. However, it is apparent from holes logged already, that at least in the mine areas, the rocks have a predictable distribution, in spite of them being so deformed. It is also apparent that the rocks are far too folded and deformed to allow accurate facing information to be gained.

The "stratigraphy" observed in the drill holes is:

Hangingwall to Lodes (west)	Felsic Volcanics with some basaltic dykes.
	Highly deformed and altered Felsic Volcanics.
	Grey quartz-graphite, meta siltstones with a saccharoidal texture.
	Black Shale and Farrell Lode.
Footwall to Lode (east)	Grey quartz-graphite, meta siltstones

None of the holes logged penetrate more than 10m into the footwall. The drill logs are presented in appendix 2.

6.4 Drilling Database

Early in 1991, Pasminco Exploration acquired the Techbase software package. This is designed for storing, manipulating and plotting technical data sets. It has been used successfully in producing plans and cross sections which show drill hole traces, topography, grids and assay data.

At present, work is underway to enter collar co-ordinates, down hole surveys and assays for each hole drilled on the Tullah EL and the Tullah Mine Leases in a Techbase database. This will enable drilling information to be readily available for geological interpretation.

All the collar information has now been entered and the northing, easting and RL of each hole is listed in Appendix 3.

The process of bringing together all of the drill holes has been beneficial in terms of understanding the geology of the area. From initial investigations, it appears that there is very little information available on the geology east of the Farrell Mines (on their footwall side). Where holes have been drilled into the footwall, some have intersected low grade zinc mineralisation.

Fragments of information such as this provide an incentive to get all information into the database, so that an overall picture of the geology (and what is known about it) can be gained.

7. CONCLUSIONS

No attempt has been made to draw major geological conclusions in this report. At this stage the information is too incomplete and any interpretation would be largely guesswork. A number of useful observations, however, do arise. These are:

1. Any mineralisation in such a deformed geological setting would have to have some structural control;
2. Potential for finding ore is probably best where a dilational structural environment coincides with a shale trap;
3. Little is known about the Farrell Slates on the footwall side of the Farrell Lode;
4. There is some evidence that lower grade mineralisation may exist outside the Farrell Lode and that zinc, gold and copper ore may be found elsewhere in the Farrell Slates;
5. Clues to the structural geology of the Henty Fault zone may be obtained from the structurally complex Ordovician sandstones and conglomerates.

8. RECOMMENDATIONS

The following proposed work should be undertaken during the next twelve months:

1. Complete drill hole data base (including all down hole surveys);
2. Complete 1:2 500 mapping with emphasis on structural geology. Include mapping of Ordovician rocks;
3. Undertake a Semi-regional gravity survey to assist in geological interpretation;
4. Complete any logging required for geological interpretation. Specific gravity and magnetic susceptibility readings and lithogeochemical sampling of old core should accompany this work;
5. Construct geological cross-sections at 500m intervals using information gained from above; Closer spaced sections should be made where better information is available (in old mine and prospect areas);
6. Based on the above work, and on conceptional models, define the best Zn, Pb targets;
7. Diamond drill test these targets. Initially 500m (it is probable that shallow targets will be found, so meterage should spin out well).

9. EXPENDITURE

Expenditure Statement

Tullah EL 22/90, Tasmania

for the period 20 October 1990 – 19 September 1991

Expenditure	**$**
Personnel Costs	8 445
Travel and Accommodation	249
Consultants and Contractors	32 758
Drilling	131
Stores and Supplies	251
Vehicles Plant and Equipment	700
Land Acquisition and Maintenance	1 001
Computing	245
Office Costs	2 970
Management Fee	4 524
TOTAL	**51 274**

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11. KEYWORDS AND LOCALITY

KEYWORDS

ZINC, SILVER, LEAD, SHALE, FAULT, SHALE HOSTED TYPE, CAMBRIAN, ORDOVICIAN, DATA REVIEW, DRILL LOGS, GEOLOGICAL MAPPING DETAILED, GEOPHYSICS MAGNETICS

LOCALITY

1:100 000 SHEET SOPHIA

TENEMENT: TULLAH EL 22/90

DISTRICT: WEST COAST TASMANIA

MT READ VOLCANICS

HENTY FAULT ZONE

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APPENDICES

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APPENDIX 1

Aeromagnetic Survey, EL 22/90 Tullah Acquisition Report Including Preliminary Interpretation, D.E. Leaman

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LEAMAN GEOPHYSICS
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AEROMAGNETIC SURVEY
EL 22/90 TULLAH

ACQUISITION REPORT
INCLUDING PRELIMINARY INTERPRETATION
for
PASMINCO EXPLORATION

by
Dr. D.E. Leaman

August 1991

TULLAH

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FIGURES

1A EL 22/90 Regional location
1B Specific location
2A Geological base map, N part of EL 22/90
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3 Mines Department regional magnetic survey
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4B S part of EL 22/90
4C Magnetic field and geological base, N area (contractor)
4D S area
5A Magnetic field Tullah area (Division Mines correction)
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6 Trends and lineaments inferred from current compilations
7 Location of modelled sections
8 2D magnetics models 5375 and 5377 000 mN
9 2D magnetics models 5379 and 5381 000 mN

MAPS (in pockets)

1. Line location maps and fiducial references
2. Stacked profiles of residual magnetic data (as observed)
3. Contours of residual magnetic field (contractor)
4. Contours of residual magnetic field (corrected)

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SUMMARY

High resolution aeromagnetic data has been acquired across the Tullah area and it has been shown, some failure to maintain clearance specifications notwithstanding, that this provides an enormous advance on previous data sets. It has also been demonstrated that this data must be properly corrected, and not simply made to look right using filters, if detailed responses are to be retained.
The benefits of such care are evident in recovered field character across the Farrell Slates where moderate perturbations, previously obscured or not recorded, can be associated with mineralised sites. Modelling has also shown these units to be slightly magnetic overall.

Correction and final processing of the Tullah data set, and its integration with surrounding surveys, had not been completed at time of writing but the available fragments indicate that corrected drape, image and continued data will enrich exploration of the area.

Preliminary structural interpretation confirms the west-dipping nature of the Henty Fault Zone, the Farrell Slates and the eastern volcanics. The latter have been intruded by a small volume granitoid (Murchison Granite). A body of andesites west of the fault also dips west and it may be that their western face represents an ancient position for the fault. The Mt Read Volcanics of the Mt Sale and north Tullah regions dip east to the fault. Many units are subtly, but usefully magnetised. The cover of Lower Ordovician rocks on the Farrell Range is irregular, partly faulted, and folded.

Trend and lineament analysis has been limited by the current data presentations and size of the Tullah EL but a suite of trends can be identified, if not always accurately located. Dominant trends are NW, NE, sub E-W and NNW. Two zones have been identified as strongly anomalous; approx 5380 500 mN, and a wedge between ENE and ESE structures at about 5377 000 mN. The anomalous character is west of the Henty Fault within volcanics at the first and within the materials east of the fault (and perhaps its ancient location) at the second. The junctions of these features with the Henty Zone must be carefully examined.

Review of the structural implications after integration of magnetic data sets and coverage by a second structural method (e.g., gravity) should refine inferences about nodal positions.

More detailed analysis of the magnetic and gravity data near such nodes is then advised in order to assess possible alteration patterns. Other methods may also be required and some review of extant electrical data within the slates may also be worthwhile given the identification of two major zonal effects and several minor variations which are related to mineralised sites.

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INTRODUCTION

EL 22/90, Tullah, is centred near the township of Tullah in central western Tasmania and extends across the Farrell Range west from Lake Mackintosh to Lake Rosebery and south from the Mackintosh Dam into the Sterling Valley (Figures 1A, 1B).
This small, but important, area has had a long history of exploration and production; the Mt Farrell Mines being the most important.

The geology of the area is shown in Figures 2A, B (reproduced from Corbett & McNeill, 1986).
The licence area lies adjacent to the eastern margin of the Mt Read Volcanics and includes a small portion of them but it is the Henty Fault Zone which dominates the area - and the Farrell Slates associated with it. Most known mineralisation lies within these units. A sequence of predominantly felsic volcanics is exposed to the east and these have been intruded by the Cambrian Murchison Granite. The granite is exposed along the Murchison Gorge and in the surrounding hills. Both granite and volcanics have been covered by basal Ordovician siliceous rocks. Although elements of the contacts are faulted other portions reveal unconformable deposition upon both volcanics and granite. Contacts with the Farrell Slates are fault bounded.
The Mount Read Volcanics of the Mt Sale area include massive lavas and, near Lake Rosebery, andesites. In the Sterling Valley the Henty Fault Zone and the thickness of Farrell Slates is less than 200 m and the andesites abut the eastern felsic volcanics.

Airborne magnetic surveys of the Tullah area have been completed recently. This report describes the data acquired and provides an initial interpretation with the specific objectives of provision of a basic geological and structural understanding of the setting of mineralisation and an improved appraisal of the prospectivity of the region.

Gravity and magnetic data in the area have only been reviewed in the grossest regional terms previously (Leaman, 1986a, b; 1988). Results have indicated that these data sets could reveal much information about structural setting and control within the area. The regional data available were shown , however, to lack resolution due to line spacing or terrain clearance excesses.
(Gravity data, however, demonstrate the presence of a Devonian granitoid at relatively shallow depths, < 2 - 3 km, in the Tullah area and this element of the setting must always be inserted in any appreciation of the area)

Detailed magnetic surveys undertaken by Pasminco Exploration in adjacent areas have demonstrated the value of such data sets and led to review of many elements of the region. The survey reported here represents an extension of this work and findings designed to upgrade the regional data base.

This report outlines survey specification, presents the results of survey and provides a preliminary interpretation.

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MAGNETIC SURVEY

SPECIFICATION

Specifications for the survey were determined by the previous experience provided by the Mines Department survey (Leaman, 1986a) and other recent (1990) surveys for Pasminco Exploration and the need to resolve possible alteration features, subtle trends, and the contribution due to various parts of the Cambrian volcanic pile. Leaman (1986a) has established the general viability of magnetic methods for assessment of alteration and mineralised sites in areas free of strong interference effects such as introduced by Tertiary basalt or Cambrian ultramafics.

Many of the features sought are known to be subtle and all previous regional data have lacked the necessary data resolution - in terms of low clearance, close sampling and line density. Detail, once lost due to variable or excessive clearances, is not recoverable. Since the reliability of the regional data set was not known, and there is limited information available on the variability of contrasts within the volcanics it was important to ensure that the best practicable specification was defined.

The compilations of magnetic field intensity displayed in Figures 4A-D, 5A-B derive from different presentations of the new data acquired by Pasminco Exploration in the Tullah area.

Specifications were as follows.

Line spacing:	100	metres E-W
Tie line spacing:	1000	metres N-S
Nominal terrain clearance:	80	m.
Sample interval:	< 10	m.
Magnetometer sensitivity:	< 0.01	nT.

The line balance and orientation reflects a general compromise in order to obtain cost effective coverage, the general form of the terrain and the need to define sub E-W or NW-SE and SW-NE trends as suggested by regional analysis of the Mines Department survey. Rigorous draping necessitated use of a helicopter. Use of fixed wing aircraft, a higher nominal clearance and general wide variation in that clearance effectively destroyed much of the resolving power of the Mines Department across significant parts of the Cambrian volcanics and adjacent Dundas Group. Only high relief features were defined by that survey in this area.

Multichannel radiometric data were also specified but no commitment was made toward processing of that data pending inspection of the raw data.
(This data has not yet been fully processed and it is possible that no further analysis will be undertaken).

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SURVEY

The survey was flown between February 1 and 8, 1991 by Geo Instruments Pty Ltd under the supervision of Zoltan Beldi using a G833 helium vapour magnetometer in a towed bird and a Geometrics GR800 spectrometer. The survey was flown using an Aerospatiale Squirrel helicopter. Some correction flights were also required.

An equivalent magnetometer was used as base station and the survey was completed over several days.

Survey tracking was visual supported by colour video using topographic basemaps and aerial photographs with a recovery scale of 1: 10000. Data pickup was undertaken by D. Morrison.

Line coverage details have been provided in Map 1.
The gap in survey which corresponds to the township of Tullah was not specified, nor known to exist, until after completion of survey and presentation of draft preliminary plots by the contractor.
(This break in survey, which could have been partially redeemed by elevation change - as occurred at Rosebery - was not advised by the contractor, and was surprising from air navigation rules - if the reason - in view of the scale of Tullah)

PROCESSING

Flight path digitising, processing, gridding and mapping were performed by Kevron Geophysics and D. Morrison.
IGRF 1985 suitably updated was removed from the data and a scalar of 62000 nT was added to the residual data. (There seems no way of preventing this poor practice of confusing the residual values and generating uneccesary problems at survey boundaries)
The stability of gridding and acquisition was tested by the many cross ties adjusted by spline interpolations in both directions.

A contour interval of 2 nT was selected for the primary presentation (Figures 4A, B., Map 3).
Although the specifications were closely approximated for the bulk of the survey, based on review of analogue records, inspection of the contour presentation (and, indeed, the period taken for the contractor to produce it) shows that there were many problems. The maps produced by the contractor show ghosts of herring bones and generally lack fine detail of the type seen in adjacent surveys. The maps themselves have the appearance of forced filtering.

These problems are not easily assessed or recovered. However, as part of a process in which all Pasminco's surveys have been unified and integrated, these issues have been evaluated. This secondary processing was contracted by the Division of Mines and supervised by Dr. R. Richardson and myself.

Reprocessing has revealed that the survey specifications were not met in the region of the Farrell Range and that clearances regularly exceeded 100 m. While this is perhaps understandable it was not declared and led to variable results. (The contractor resolved these by applying an insensitive and powerful filter.) The data were found to be unstable if inferred at clearances of less than 120 m and the new compilations (e.g., Figure 5) use this clearance.
Proper compensation of the data set and presentation of a true drape, as specified, has recovered all the detail actually observed and represents a marked improvement over the contractor presentation. It is clear that many terrain-induced effects have been either removed or minimised (see interpretation, below).

There are some lessons in this experience. It is not possible to appraise the quality of specification keeping from the analogue records alone, nor is it really possible to control the processing by contractors without a located data tape - not usually supplied until job completion. The problems have been exacerbated by the difficult terrain but the implications for non helicopter surveys are self evident if a helicopter survey should also present such difficulties.

The data is to be presented in an upward continued fixed-level form but processing (by Division of Mines) was incomplete when this report was prepared.

Note that the discussion of problems relates only to flight clearance specification. While this specification was met for some 90% of the survey, to place even this in perspective, other specifications (precision, sampling, line location and repeats) were fully met or exceeded.

Radiometric data have not been corrected, levelled or compiled.

DATA PRESENTATION

Currently available compilations are shown in Figures 4A-D (contractor) and Figures 5A, B (Mines Div. correction). Maps used as bases have been derived from Corbett & McNeill (1986). See Figure 4A.

Maps 1, 2, 3 and 4 (pockets) present the line coverage, stacked profiles, contractor contours, and corrected contours respectively.

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COMPARISON WITH PREVIOUS DATA

The previous regional survey described by Corbett et al (1982) and Leaman (1986a) has been reproduced as Figure 3 and may be compared with the new compilation (Figures 4A, B, 5A). Contour intervals are generally 2 or 5 nT for the new survey and 5 or 10 for the old.

The regional survey can be seen to provide a reasonably reliable view of the magnetic field in terms of the location and identification of all significant responses but there was clearly considerable loss of resolution and definition in many areas. Specific examples relate to the detailed patterns observed within exposures of the volcanics on Mt Farrell and Mt Black, and near the Murchison Granite.
The lower clearance, higher resolution and better constrained flight path with closer line spacings has considerably improved feature recognition and location. The significance of some of this detail is discussed below.

It is also clear that the contractor's representation of the magnetic field, for all the shortcomings described above, represents a considerable improvement on previous data. Most of this improvement is related to the generally lower clearance (if not as low as specified) and the more rigorous line coverage and sampling (fully met specifications).
The revised compilation (Figure 5) provides a much truer representation of what was actually observed in terms of a true drape and demonstrates an increase in detail and character which is striking and shows the value of a good survey properly processed. The difference in quality between the 1981 regional survey and this version is evident.

Character correlation of the older data was used to suggest possible sub E-W alteration corridors (approx 5374 000, 5379 000 mN) and many NE-SW and NW-SE fractures generally (see Leaman, 1987). The validity of many of these was unknown. Alteration responses had not been recognised previously.

PRELIMINARY INTERPRETATION

COMMENTS

The following comments outline possible correlations and implications within the magnetic data set (in the various forms available) with respect to the exposed geology and mineralised sites.

The magnetic data is considered in two parts; north and south of Tullah. This division corresponds to the presentation provided by Figures 4A-D and Maps 1-3.

North of Tullah:

A marked anomaly is associated with the Mackintosh Dam (see Figure 4C) and can be rejected from analysis.

Figures 4A and C show no obvious or systematic correlations between the magnetic field and the location of the Henty Fault, although there are some very subtle suggestions of position.
Local variations within the Mt Read Volcanics may be contrasted with the smoother field across the Farrell Slates. The latter are clearly more uniform in properties, if magnetised at all. There is a strong correlation between the felsic volcanics of the range east of Tullah and the magnetic field. The magnetic field is irregular and probably poorly defined across the Ordovician rocks from the crest of the range to the lake.
A trough in magnetic field intensity occurs adjacent to the Henty Fault between 5378 500 and 5380 500 mN. This opposes all shows from "Sth Mt Farrell" to "Nth Mackintosh". No such correlations are evident near "Farrell Blocks" or "Metropolitan".

Figure 5B confirms and clarifies some of these observations.
The corrected field across the Ordovician rocks is seen to be more systematic showing that uncompensated clearance effects were significant. Similarly, the field across the slates is found not to be uniform and there are sizeable excursions from background near "Mt Farrell Mine", "Sth Mt Farrell" and near "Nth Mt Farrell".
The character of the magnetic field west of the Henty Fault, across the Mt Read Volcanics, is not unlike that observed across the felsic rocks of the Farrell Range - or impressed in slightly muted form through the Ordovician cover near Lake Mackintosh.

North of 5380 000 mN several cross trends can be seen to extend across the range, and Henty Fault Zone, near "Farrell Blocks" (NW-SE) and "Metropolitan " (WNW-ESE). These are also shown in Figure 6. Similar trend orientations are also evident both east and west of the Henty Fault Zone elsewhere.

The gap in survey at Tullah itself is frustrating in this respect since two such features can be traced into this zone and it may be that the arm of the Pieman River (Lake Rosebery) from 380 000 mE, 5380 000 mN may be controlled by some WNW structuring (but see

below).

South of Tullah:

Figures 4B and D, primary presentation, indicate a negative correlation between magnetic field and the Ordovician cap of the Farrell Range although the field is ill defined further east, across these same lithologies. Calculation, see below, suggests a terrain effect.
There is a marked correlation between magnetic field intensity and the felsic volcanics extending south into the Sterling Valley. The character of the field in association with these materials is comparable with that on the east face of Mt Black.
Andesites along the lower slopes of Mt Black are much less magnetic although the magnetic field may be poorly defined - as suggested by the contour pattern and character - due to survey clearance factors.
The largest anomaly in the surveyed area occurs above the Murchison Gorge and Return Ridge between it and Lake Mackintosh. On the basis of previous studies (Leaman & Richardson, 1989) this is assigned to the Murchison Granite.
Strong gradients obscure relationships but there does not seem to be any clear association between the features of this presentation and the Henty Fault or mineralised prospects such as "Sth Murchison", "Donoghoes", etc.

Figure 5B confirms many of these associations, including those between Murchison Granite, Mt Read Volcanics, felsic volcanics and Ordovician cover. But the conclusions with respect to the slates must be transformed.
The magnetic field across the Farrell Slates is shown to be far less disturbed than that across the andesites west of the fault and substantial distortions have been observed at "Murchison Extended", "Murchison River Mine", "Nth Murchison", "Sth Murchison" and possibly "Thomas Blocks".
The offset pattern of the magnetic field near 384 500 mE, 5376 500 mN suggests a splay from the Henty Fault Zone which extends further west than mapped. The elbow in the gradient is aligned along a WNW axis which can be traced eastward into the gorge.

Most anomalies appear to be sourced within the terrain at shallow depths depending on the presumption that the magnetometer was about 100 m above ground. (This is true of the corrected data) It would appear that many effects are caused by units that are exposed or virtually exposed and are not simply generated at substantial depths.

The trend compilation shown in Figure 6 has been compiled from inspection of available maps and is not exhaustive. The possible significance of some of these features, and the setting of the mineralisation, is considered after some appraisal of the origin of elements in the field and the indicated properties of the materials present.

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QUANTITATIVE EVALUATION

The nature and origin of the magnetic data sets and the issues raised in general discussion have been reviewed by considering a series of sections across the Tullah licence area.

Each section was selected from the viewpoint of sampling the various features of the fields recognised as well as the various structures known to exist; Henty Fault, Farrell Slates, andesites, Mt Read and other volcanics and the nature of the Ordovician cover. Two dimensional modelling was directed at general evaluation of structure, property implications and recognition of those features which are abnormal.

Reference profiles have been derived from upward continuation of the data sets in order to reliably include the effect of the high relief terrain. The location of all profiles is shown in Figure 7.

Figures 8 and 9 represent sample results of the analysis and have been selected to show the types of ambiguity involved in the present interpretation as well as its significance for structural setting and assessment of rock properties.
The geological basis for each section was derived initially from Corbett & McNeill (1986).

It is clear from inspection of the magnetic field that considerable variations in properties exist. The Murchison Granite and the various volcanics are variably and often strongly magnetised.
Few direct property measurements are available for the Tullah area at this time but the Murchison Granite is known to possess susceptibilities of the order of 0.001 - 0.003 cgs and the Mt Read Volcanics of generally 0.0001 or less, although some zones and units may average in excess of 0.0003 cgs. These value ranges have been used to constrain models although the modelling process has also been used to directly infer bulk properties.

Line 5 375 000 mN, 383 - 388 000 mE

This line extends from the foothills of Mt Black, across the andesites adjacent to the Henty Fault and then across the Murchison Gorge. The "Thomas Blocks" prospect occurs at this northing.
The upper part of Figure 8 presents a solution for this observed profile. Note that the reference level for the data, after compensation, is 800 m ASL.
At this level the profile is slightly smoothed and allows the regional elements of the structure and bulk contrasts to be assessed. These show that the Henty Fault Zone and the associated Farrell Slates are slightly magnetised while the adjacent andesites are virtually non magnetic. The fault zone and block of andesites dip steeply to the west.

These properties may be contrasted with the highly magnetised volcanics on Mt Black and Mt Farrell. The properties implied lie near the upper range of measurements on these rocks. While the inferred properties can account for the general responses on the eastern face of Mt Black they are quite inadequate to account for the main anomaly along the Farrell Range. No adjustment of contrast or geometry of exposed materials - which clearly generate responses on their own account - can provide the amplitudes observed.
Murchison Granite is exposed in the river and this is reflected in the model. Typical contrasts for this lithology readily yield both the amplitude and distribution of effect required and the model suggests the general volume and distribution of granite. Although there is some ambiguity about the deeper form of this granite and the relative contributions from volcanics and granite - since the anomaly is compound - the volume of granite is quite small.

It should also be noted that the modelled section is as deep as a magnetic section should be drawn in this area given the gravimetric implication of Devonian granite at depths of less than 3 km (Leaman & Richardson, 1989). Insertion of the best current model based on this data slightly truncates the magnetic interpretation offered but does not in any way alter its conclusion. All materials are thus depth limited and limited in volume.

The irregular form of the magnetic field near the crest of the Farrell Ridge is not so easily explained. The model shows a cap of Ordovician rocks with a form consistent with available mapping. Deep fault wedges are not implied at this northing and could not be readily accomodated by the mapped distribution and relative relief of formation boundaries. Marked changes in thickness cannot account for the depression in anomaly. These effects tend to be localised and critically located with respect to the ridge (see also section 377 N) and may be assigned as terrain effects not adequately compensated even after correction due to data loss during observation.

Line 5 377 000 mN, 383 - 388 000 mE

This line is shown in the lower part of Figure 8. It traverses the crest of Mt Farrell and samples the widest zone of the Farrell Slates.
The solution offered is wholly consistent with the previous line.
The model presented shows a variation in which volcanics on Mt Black are shown to dip west, or the eastern limit, dips west. The profile shape and preferred solution shows that these dip east (see section 5379N below).
The comments concerning the erosion of anomaly form near the crest of the ridge may be stressed at this northing. The effect is very marked and unrelated to materials. Deficient data are implied. It may also be commented that these effects are only apparent due to the high general quality of the data set and would be wholly concealed in previous or normal quality surveys (such as in Figure 3) leading to false interpretations.
The model suggests, consistent with exposures to the south-east, that the Ordovician rocks lie directly on both volcanics and granite.

This model also represents the maximum depth range allowable for magnetic models in this area due to the Devonian Tor Granite.
The model also indicates that a large part of the Mt Read Volcanics exposed west of the Henty Fault is non magnetic. This zone lies immediately north of the andesites shown in section 5375N and may reflect their presence at shallow depth.

Line 5 379 000 mN, 383 - 388 000 mE

This line is shown in the upper part of Figure 9.
It samples the increased exposure of the Mt Read Volcanics west of the Henty Fault and a substantial thickness of Farrell Slates.
The general constitution of the model is consistent with those of Figure 8 but the zonations within the Mt Black volcanics clearly dip east until truncated by the Henty Fault.
The structure of the Farrell Range is also similar but the volume of Murchison Granite is less and the body is slightly deeper. Terrain effects are not evident at this northing.

Line 5 381 000 mN, 383 - 388 000 mE

This profile is shown in the lower part of Figure 9.
The structures are similar to those for the previous line but the form of the profile requires some variation in the form of the Ordovician cover. Local, and extensive, faulting is indicated and the succession must also be folded. This explanation is not possible at 5 379N. The Murchison Granite is more confined and deeper.

The models present a consistent structural setting for the Tullah region. This includes a sequence of east dipping volcanic units on Mt Black, west dipping Henty Fault Zone and Farrell Slates and andesitic units of similar attitude within the volcanics. Mineralised sites doe not appear to possess special locations. The volcanics east of the fault are intruded by the Murchison Granite and apart from some faulted irregularities in the Ordovician cover on this sequence there is little which could not be predicted from the exposed geology.
Or is there?

The significant element of the models presented is disguised by the use of consistent properties, along-strike structures, and the two dimensional form of the main units. It is displayed by the shift parameters required to make the observed and calculated curves fit. For lines 375, 377 and 379 N the differential is between 60 and 70m nT representing the base offset in the data. For some of the survey fragments acquired by Pasminco Exploration this value is 20 nT, but the older survey set has an offset of an additional 45 nT approximately - total about 65 nT. This value is consistent with all recent modelling of the Mt Black and Burns Peak areas when the same base is applied. (Integration of all surveys will remove this uncertainty in future interpretation).
But notice line 5381N; the shift differential is only 5 nT!
This cannot be explained by juggling of geometries or property assumptions and must reflect some truly anomalous feature.

Close inspection of the data reveals the existence of a localised and marked trough edge of anomaly at about 5 380 000 mN. Examination of the fragments of survey available for this licence area does not enable precise location of the fundamental feature but two limits can be suggested; between 5 379 500 and 5 381 500 mN approximately. A compound step occurs in the magnetic field between these northings with a resultant amplitude of at least 60 nT. This change is generated at moderate depth and is not related to any exposed materials. (The coverage of the Tullah unit survey is not sufficient to allow more precise location of the feature although some of the trends shown in Figure 6 might well act as discriminators and the full effect is evident at about 5 381 000 mN - Figure 9. Integration of Pasminco's surveys will resolve much of this problem).
More important perhaps, this feature does not cross the Henty Fault. Review of the field intensity along the western shore of Lake Mackintosh shows that the observations are not stepped although there are local cross cutting gradients. Assuming that the source of the effect is a sub E-W fault or fracture set then most of its displacement and alteration is confined to the area west of the Henty Fault.

EXPLORATION SIGNIFICANCE

The data available, and this analysis of it, have been somewhat limited and restrict the non structural information derived.

The exploration significance of the data derives either from recognition of truly anomalous features or gross structural control. Control will be better assessed when regional, but high resolution compilations of all surveys are available but two zones are definitely indicated. These are hatched in Figure 6 and represent changes in bulk character of many units or the upper crust.
Known mineralisation is essentially restricted to the Farrell Slates or the halo of the Murchison Granite (most of which is SE of the EL). The corrected version of the survey (Figure 5, Map 4) has shown that there are local disturbances within the slates near such sites. The largest isolated variations are associated with the Mt Farrell group of mines; "Nth, Sth, & Mt Farrell" but the predominant anomalous character lies south of Tullah (hatched, Figure 6). Magnetic data clearly distinguish variations, presumably alteration, of economic interest within the slates.

Although the character of the field across the Mt Read Volcanics is more varied there is little of these rocks actually within the EL and further comments are not possible. The anomalous character near 5380 500 to 5381 000 immediately west of the Henty Fault is noted, however.

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CONCLUSIONS

Although the present work is preliminary and partly restricted by the current data coverages or compilations a number of important conclusions and inferences can be drawn.

1. Some distinctive trend patterns can be defined. While NW, NNW, NE and sub E-W features can be recognised and approximately located in all data sub sets (location accuracy is presently limited by the coverage of surveys of data detail) the most important appear to be NW, NNW and near E-W.
   Mineralised sites cannot be linked with these or their intersections at present.

2. Structural analysis of the Tullah area confirms the general view of the area in which the Henty Fault Zone dips steeply to the west in association with a mass of andesites along the western side of Sterling Valley and the Farrell Slates and volcanics to the east of the fault. Mt Read Volcanics west of the fault, north and west of Tullah, dip east and the principal change is associated with either the west face of the andesites or the the Henty Fault Zone. The Ordovician cover on the Farrell Range is a faulted and folded slab and some of the faults may be primary deposition controls. The Cambrian units east of the fault have been intruded by a small volume granitoid SE of Tullah.

3. The magnetic interpretation is consistent with regional estimates of the thickness of many units based on published gravity interpretations of underlying Devonian granites. The general thickness of volcanics and other rocks at Tullah is unlikely to exceed 2 or 3 km.

4. No evidence of alteration responses has yet been seen although the data employed were not in an ideal format for judgments. The observation of abnormalities in the usually smooth gradients along the strike of the Farrell Slates may reflect alteration but comparable variations have not been noted in other units. These effects are only evident in data of highest resolution - after drape correction - and mineralisation is associated.

5. Some of the magnetic anomalies observed across Mt Farrell are due to interactions between slightly magnetic terrains and the shape of the land surface itself. Caution is therefore required before accepting any response as an anomaly in the contractor presentations which have been filtered. Some of these persist after full correction due to data loss but full drape correction has been shown to recover most of the detail present in the magnetic field.

6. Regional gravity is required to support definition and location of, and within, structurally anomalous zones near 5381 000 and 5377 000 mN. The former does not appear to cross east of the HFZ while the latter is more evident on the eastern side.

RECOMMENDATIONS

The preliminary work reported here and the conclusions drawn from it indicate that some further work is justified.

A substantial improvement in evaluation, and setting, of the area will be possible upon completion of full drape correction and integration of all surveys. A part of this work was available during preparation of this report (e.g., Figure 5) and its importance, locally, is evident. Some regional impact is to be expected as well and the area should be re-examined after the data becomes available in drape, image, and high level processed forms.
The drape presentation should help identify abnormal character within units (as in the Farrell Slates) while the image and high level forms should identify the grid of lineaments (image) and allow crustal weighting of their significance (high level).

The magnetic coverage should be supported by a reasonable coverage by another structural method; gravity methods are the only feasible and cost effective possibility. This will help focus on those elements which may control mineralisation. There is also scope for use of a range of methods on the zones already identified as anomalous within the Farrell Slates.

Important structural junctions may only be assessed using a second method due to the established nature of the surface geology which either obscures key features or does not allow sufficient unit discrimination. The magnetic data remain very useful in terms of mapping and structural assessment since many units have now been shown to offer a subtle, but real, range in properties.

Some explanation must be sought for the generally anomalous character of the Farrell Slates immediately south of Tullah (about 5377 000 mN) which distinguishes this zone from the patchily anomalous character further north. Given that there is a prima-facie association with mineralisation for the lesser features this zone may flag more major effects.
The nature, including alteration and mineralisation, of the volcanics west of the Henty Fault near 5381 000 mN must also be reviewed. If the Henty Fault is old, and the cross structure is crustal and primary, then the intersection must have been an important carrier of fluids.

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142052

Report submitted on behalf of Leaman Geophysics

by



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

Date: 26/8/91

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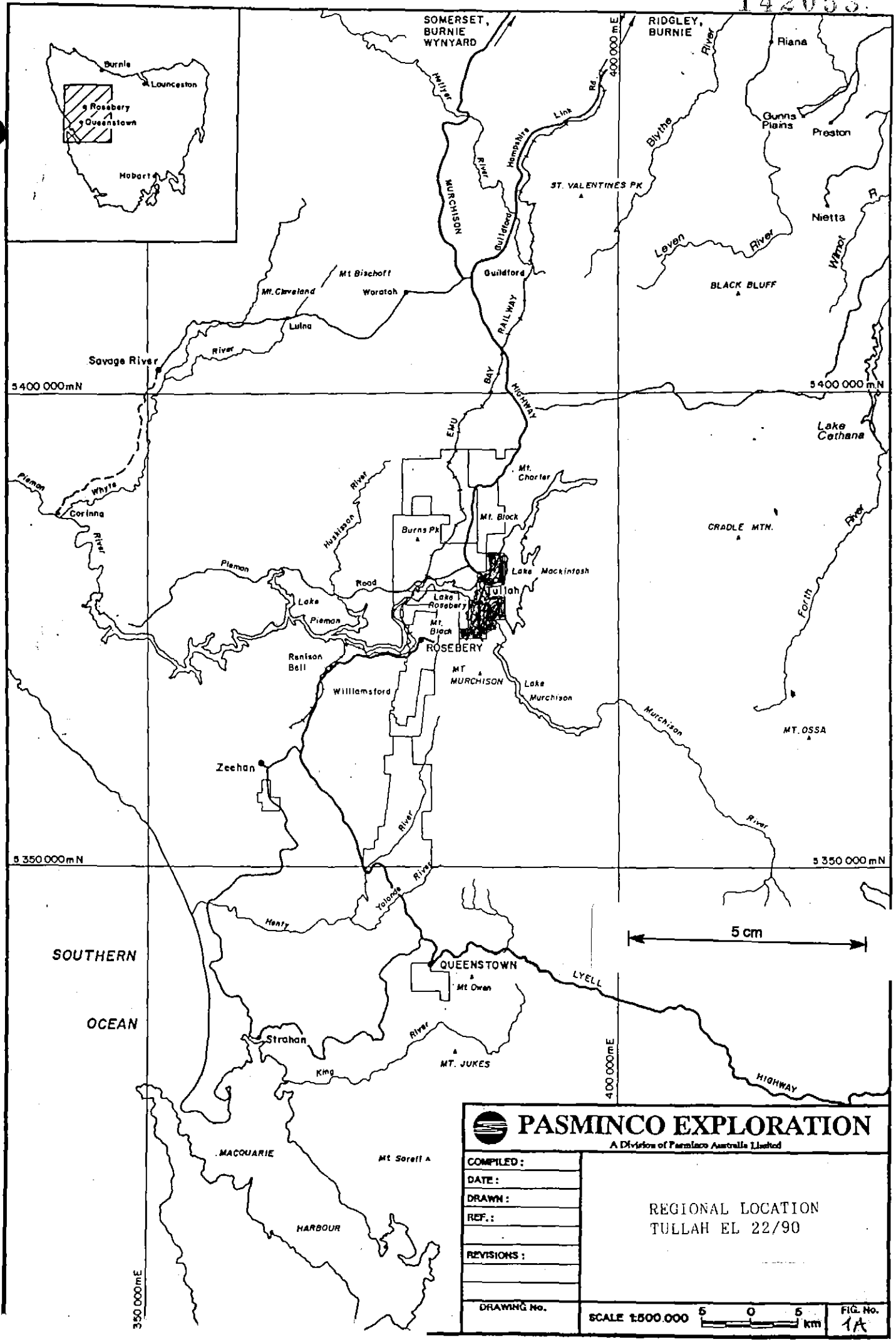


PASMINCO EXPLORATION

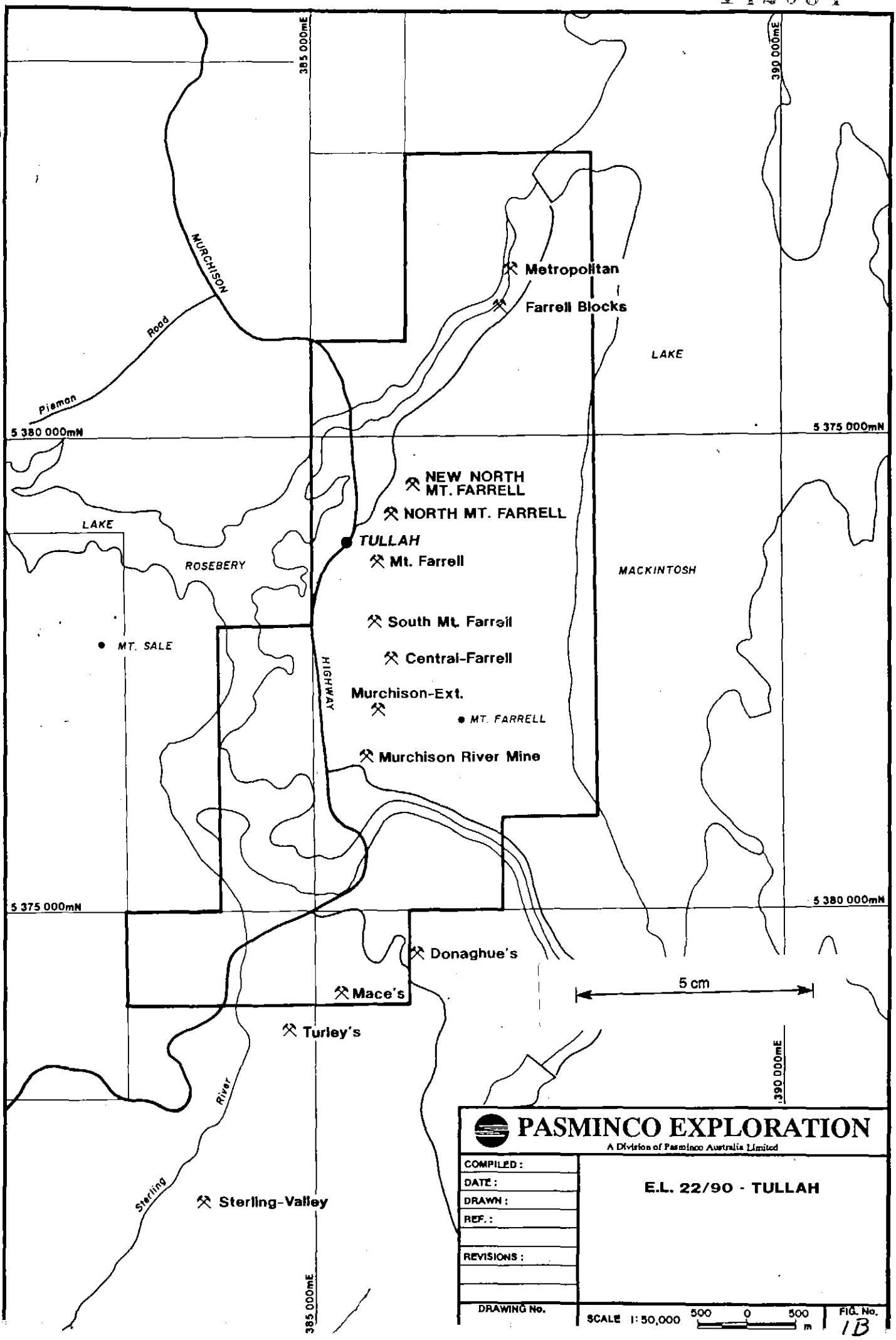
A Division of Pasminco Australia Limited

COMPILED :	
DATE :	
DRAWN :	
REF. :	
REVISIONS :	
DRAWING No.	

REGIONAL LOCATION
TULLAH EL 22/90

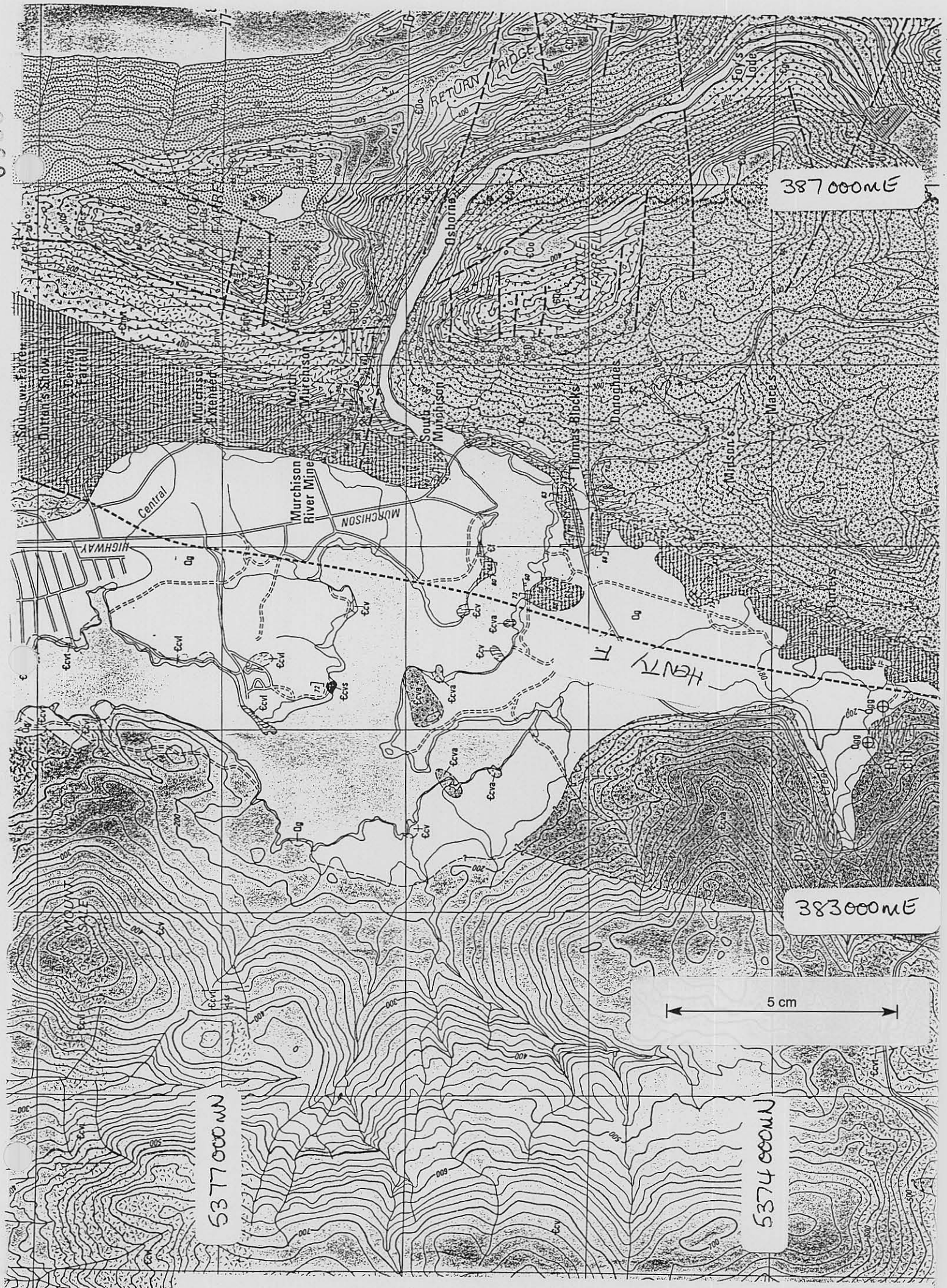
SCALE 1:500.000 5 0 5 km

FIG. No. 1A


385 000mE
390 000mE
MURCHISON
Road
Pieman
5 380 000mN
5 375 000mN
Metropolitan
Farrell Blocks
LAKE
NEW NORTH MT. FARRELL
NORTH MT. FARRELL
TULLAH
Mt. Farrell
LAKE
ROSEBERY
MACKINTOSH
South Mt. Farrell
MT. SALE
Central-Farrell
HIGHWAY
Murchison-Ext.
MT. FARRELL
Murchison River Mine
Donaghue's
Mace's
5 cm
Turley's
River
Sterling
Sterling-Valley
PASMINCO EXPLORATION
A Division of Pasminco Australia Limited
COMPILED :
DATE :
DRAWN :
REF. :
REVISIONS :
DRAWING No.
E.L. 22/90 - TULLAH
SCALE 1:50,000
500 0 500 m
FIG. No. 1B



GEOLOGY N PART
TULLAH EL 22/90
after Corbett & McNeill (1986)
FIGURE 2A



GEOLOGY TULLAH STH EL 22/90
after Corbett & McNeill (1986)

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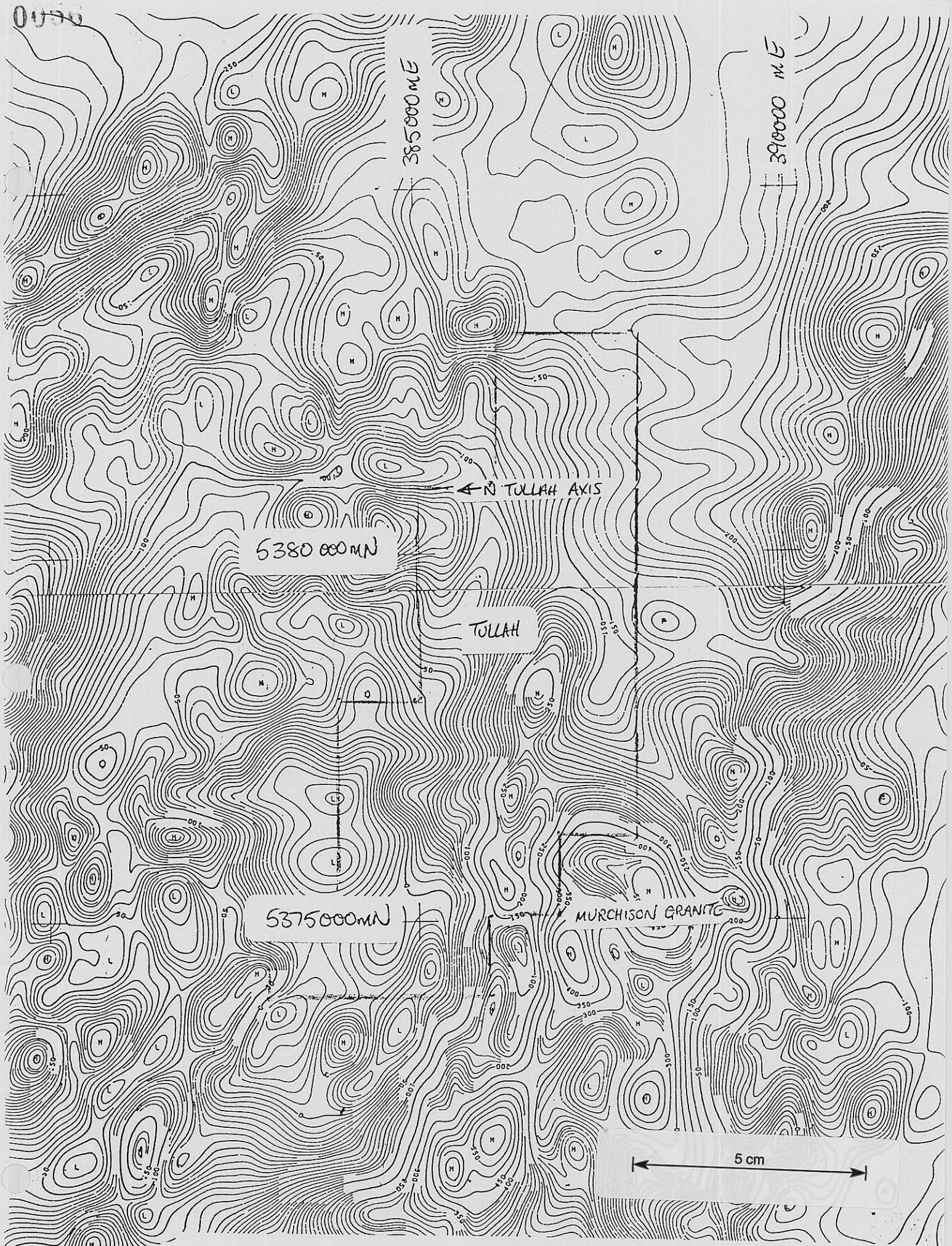
FIGURE 2B



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EXTRACT OF 1981 MINES DEPARTMENT REGIONAL SURVEY IN TULLAH AREA
FIGURE 3

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5 cm



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CONTOURS OF RESIDUAL MAGNETIC FIELD
(contour interval 2 nT)

EL 22/90 TULLAH NORTH

FIGURE 4A

SCALE 1:10,000

PASMINCO EXPLORATION

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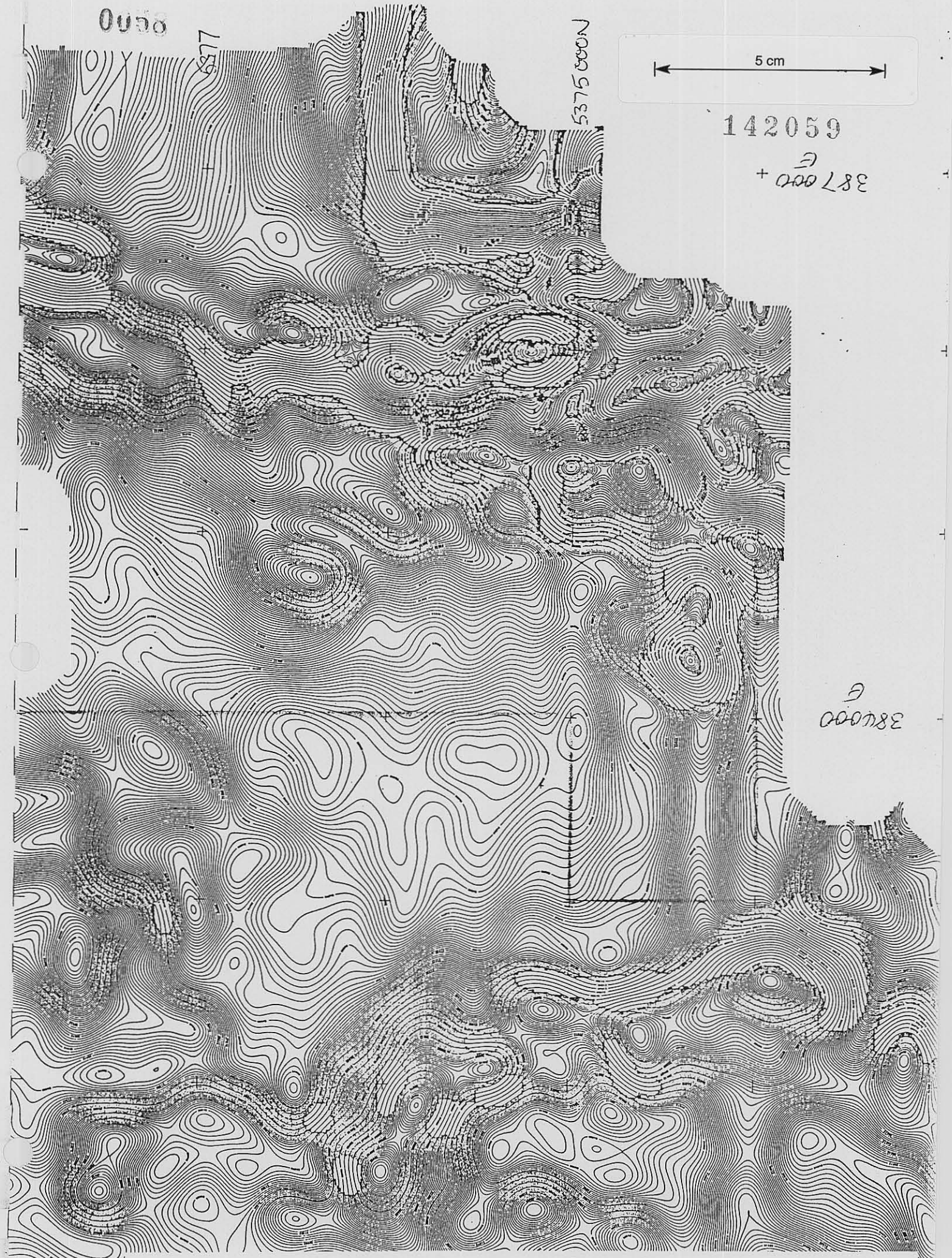
EL22/90 – Tullah

Magnetic Intensity Contou

PRELIMINARY

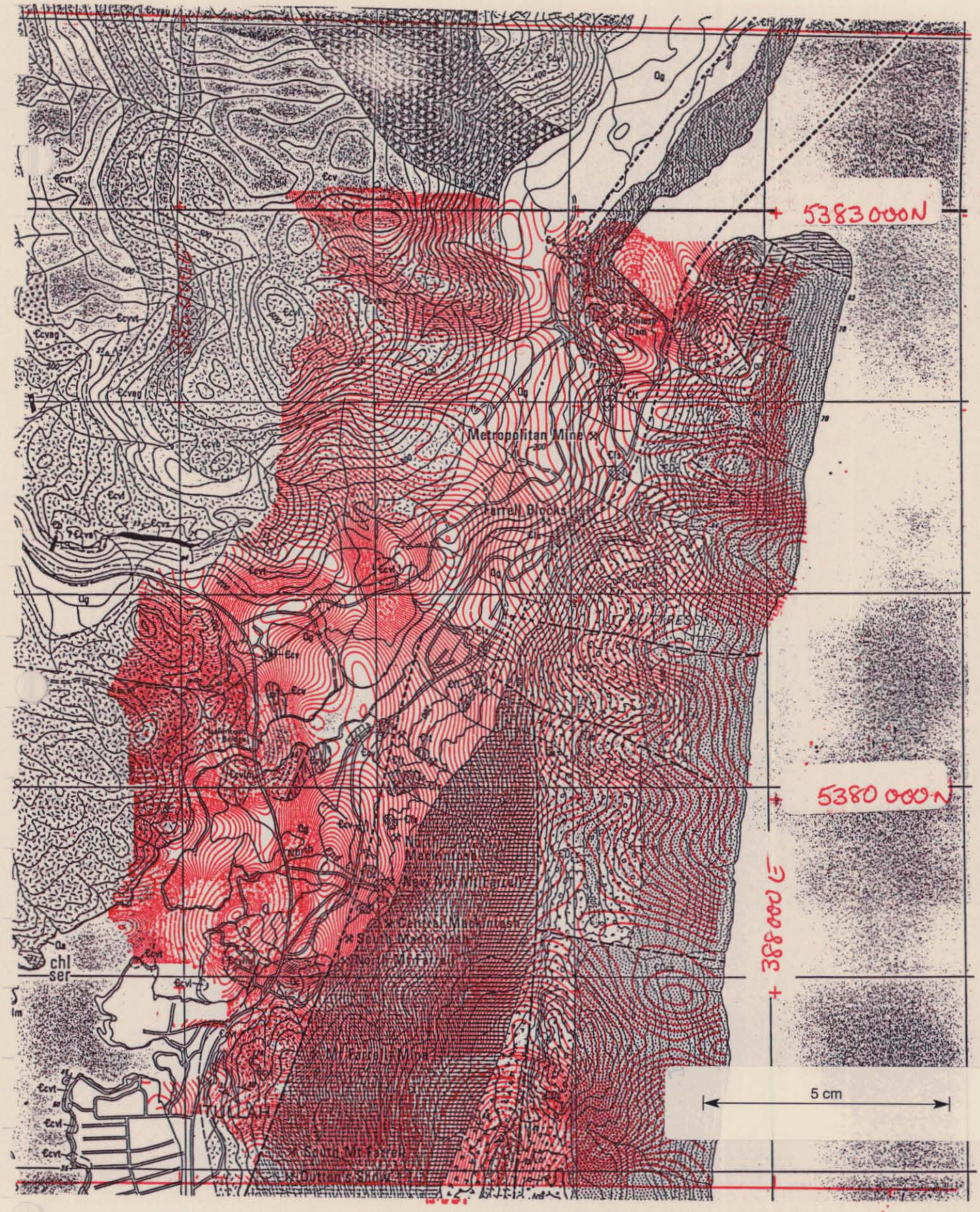
1



CONTOURS OF RESIDUAL MAGNETIC FIELD
(Contour interval 2nT)

EL 22/90 TULLAH SOUTH
FIGURE 4B

0059



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CONTOURS OF MAGNETIC FIELD EL 22/90 TULLAH NORTH
Basemap after Corbett & McNeill (1986)

FIGURE 4C

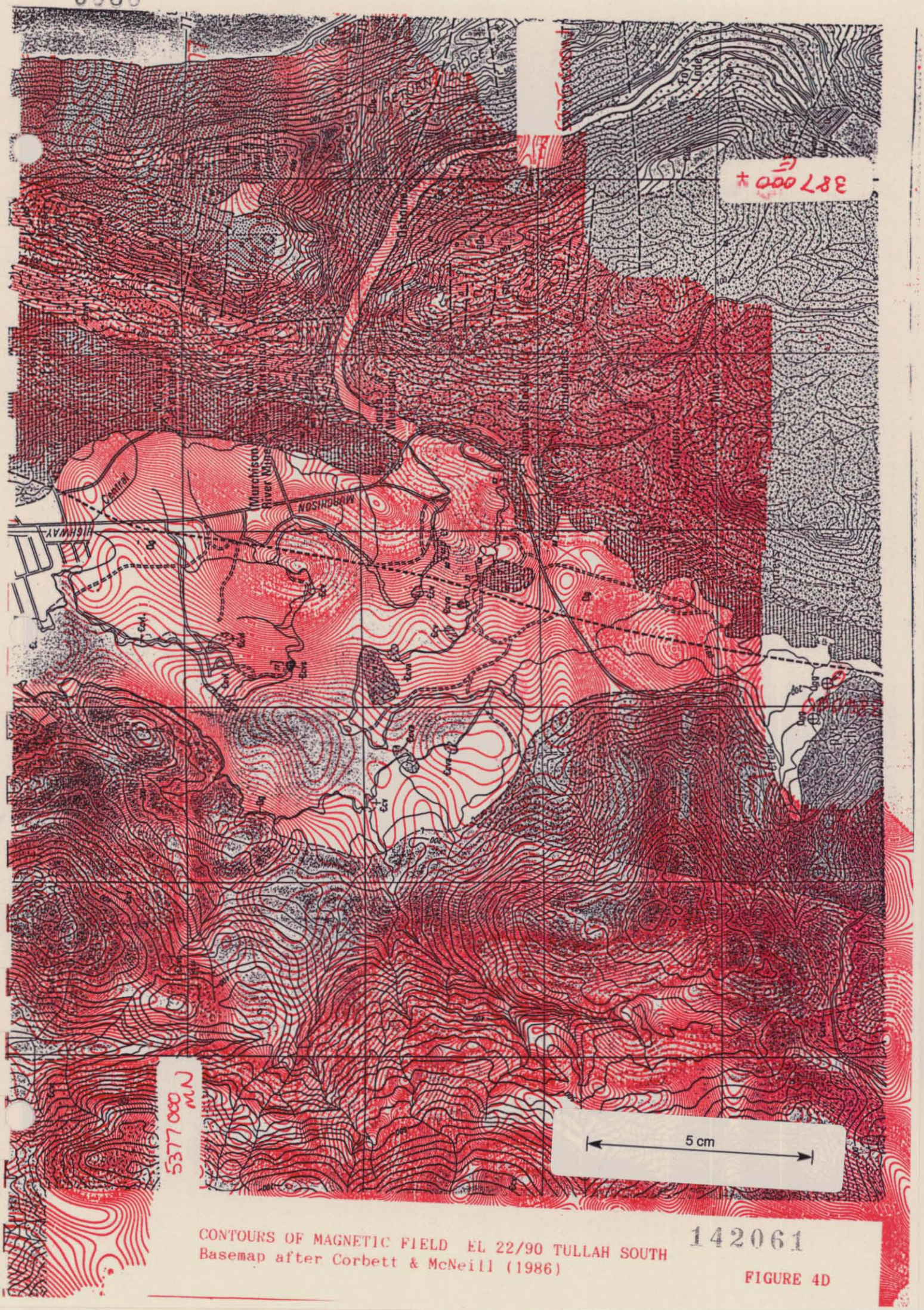
SCALE 1:10,000

PASMINCO EXPLORATION
A Division of Pasminco Australia Limit

EL22/90 – Tullah
Magnetic Intensity Conto

1

0060



CONTOURS OF MAGNETIC FIELD EL 22/90 TULLAH SOUTH
Basemap after Corbett & McNeill (1986)

142061

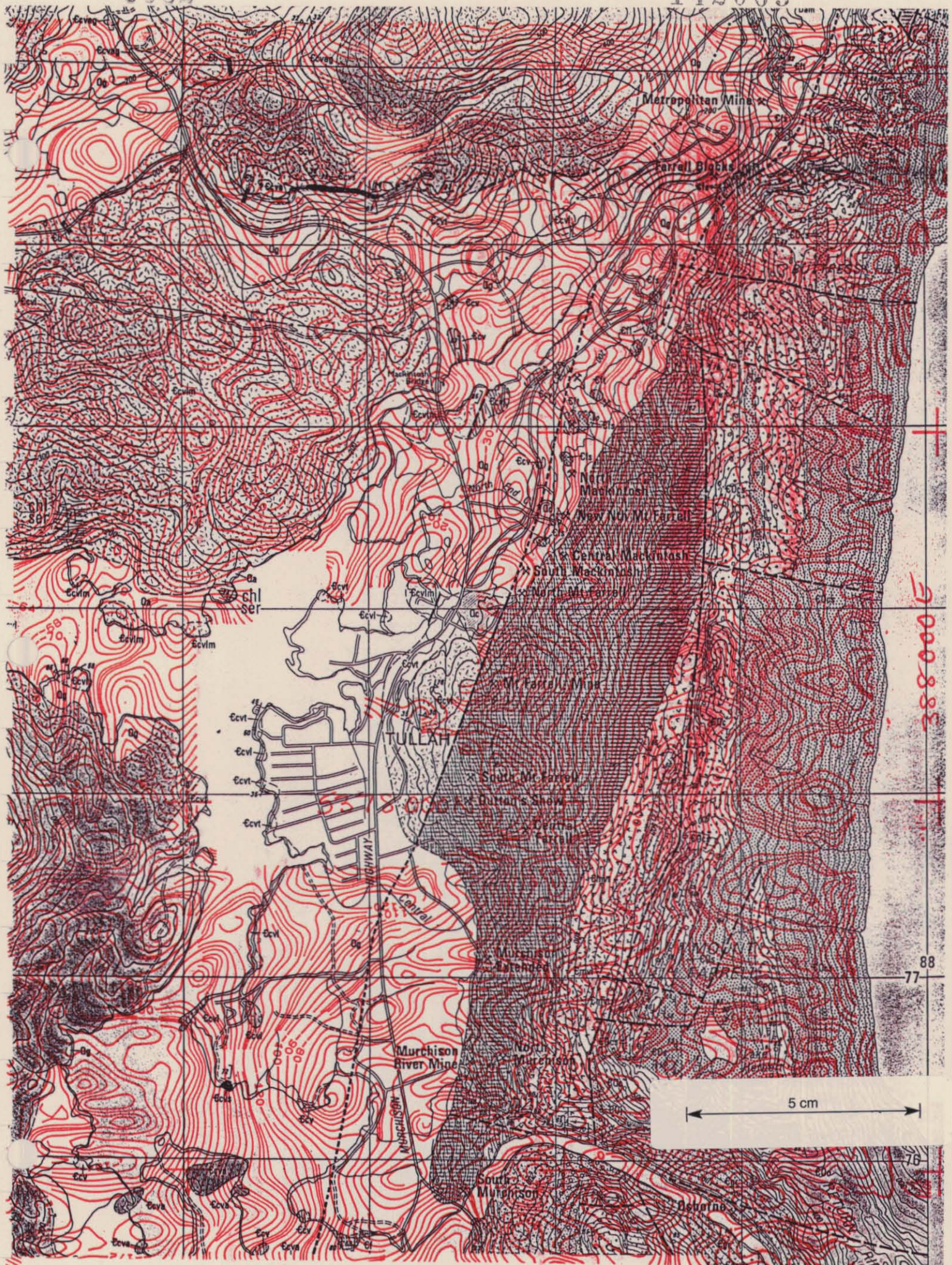
FIGURE 4D



CONTOURS OF MAGNETIC FIELD EL 22/90 TULLAH
Corrected to true drape at 120 m clearance

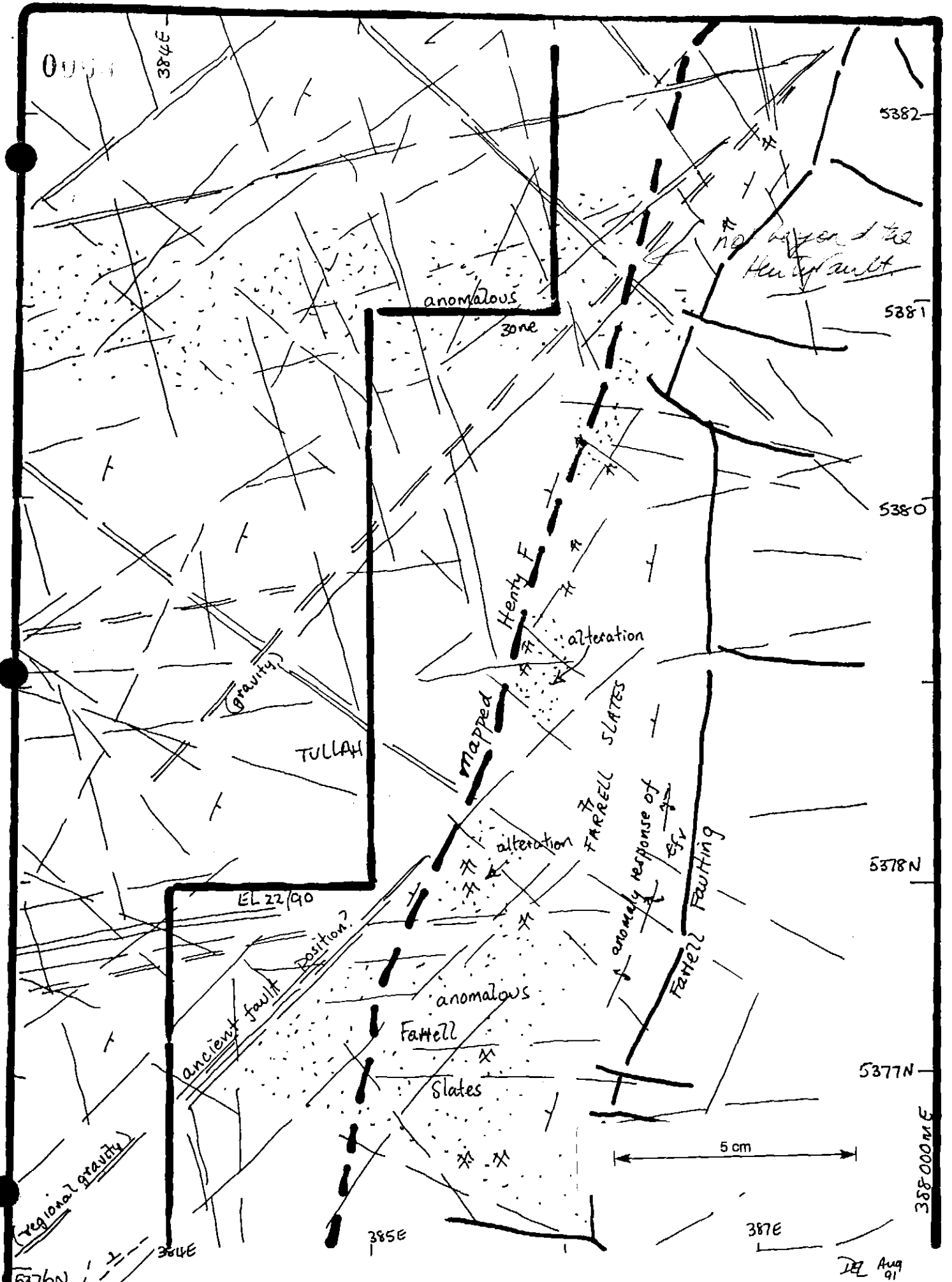
142062

FIGURE 5A



CONTOURS OF MAGNETIC FIELD EL 22/90 TULLAH figure 5B

Basemap after Corbett & McNeill (1986). Drape 120m corrected



TRENDS AND LINEAMENTS INFERRED FROM MAGNETIC COMPILATIONS
TULLAH EL 22/90

FIGURE 6

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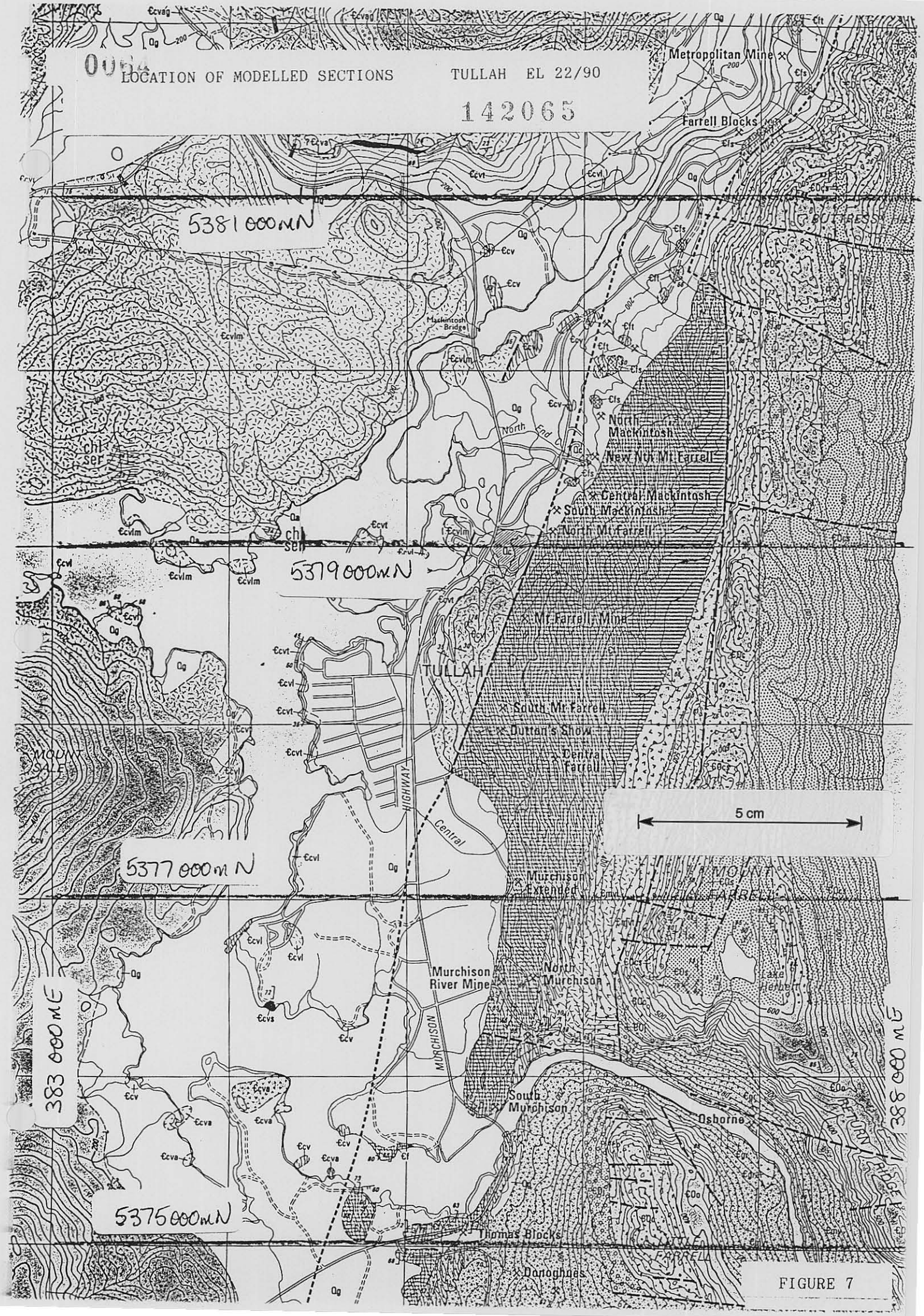
LOCATION OF MODELLED SECTIONS TULLAH EL 22/90
142065
5381000mN
5379000mN
5377000mN
5375000mN
383 000mE
388 000mE
Metropolitan Mine
Farrell Blocks
Mackintosh Bridge
North Mackintosh
New Nth Mt Farrell
Central Mackintosh
South Mackintosh
North Mt Farrell
Mt Farrell Mine
TULLAH
South Mt Farrell
Dutton's Show
Central Farrell
HIGHWAY
Central
MOUNT SAFE
Murchison Extended
MOUNT FARRELL
Murchison River Mine
North Murchison
Lake Herbert
MURCHISON
South Murchison
Osborne
Thomas Blocks
Donoghues
5 cm
FIGURE 7

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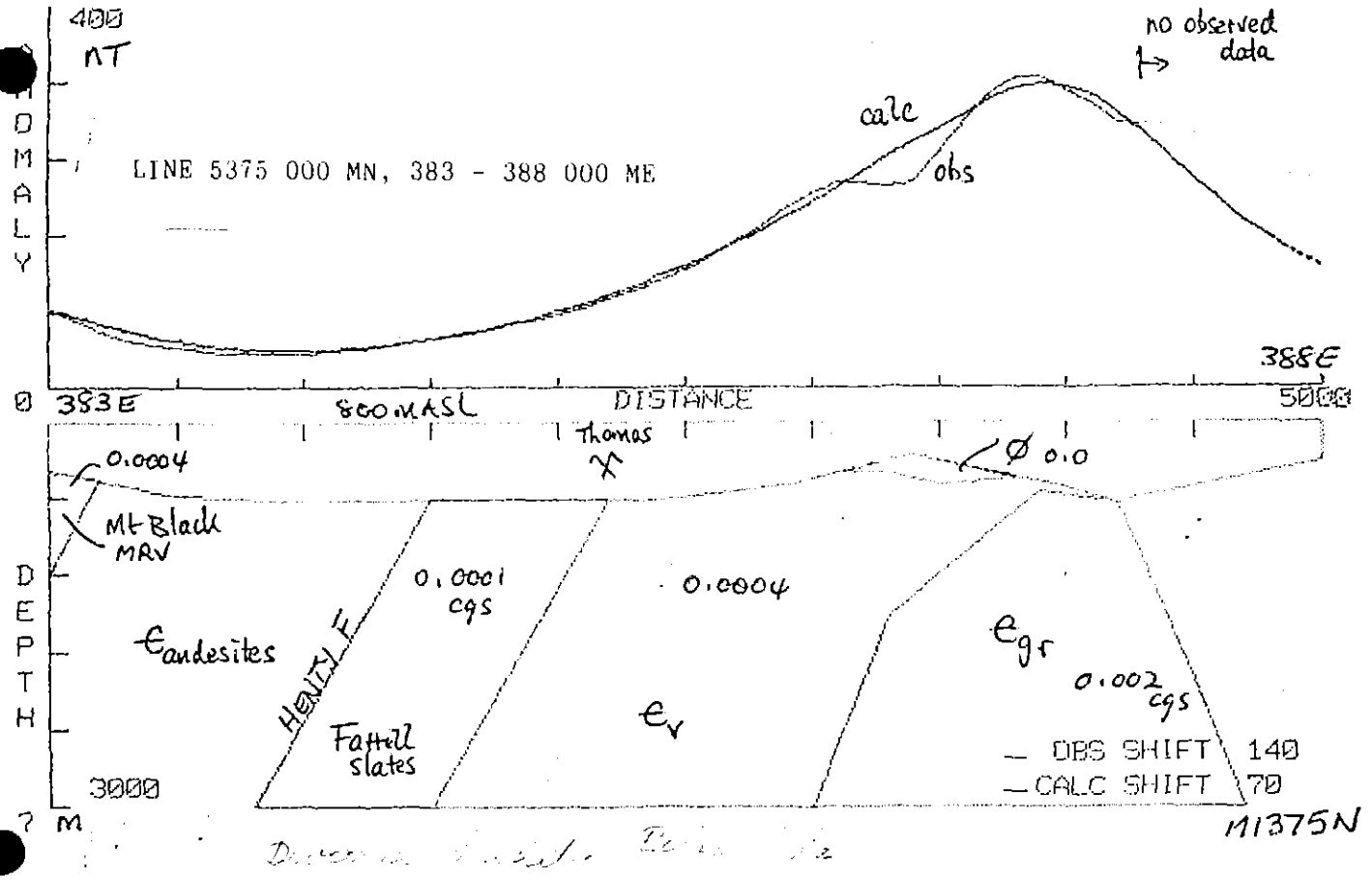

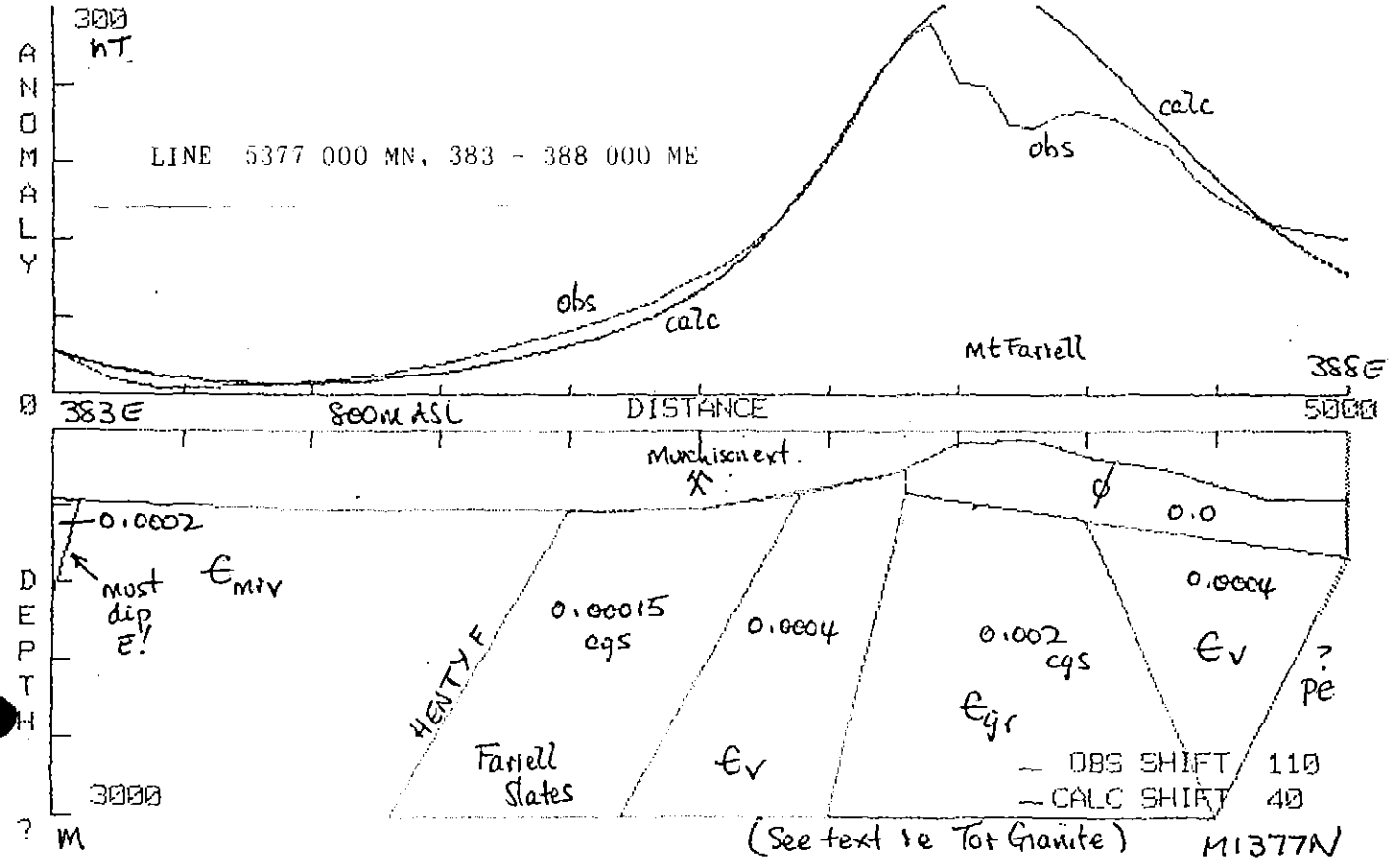

2D MAGNETICS MODELS: FIGURE 8

0050

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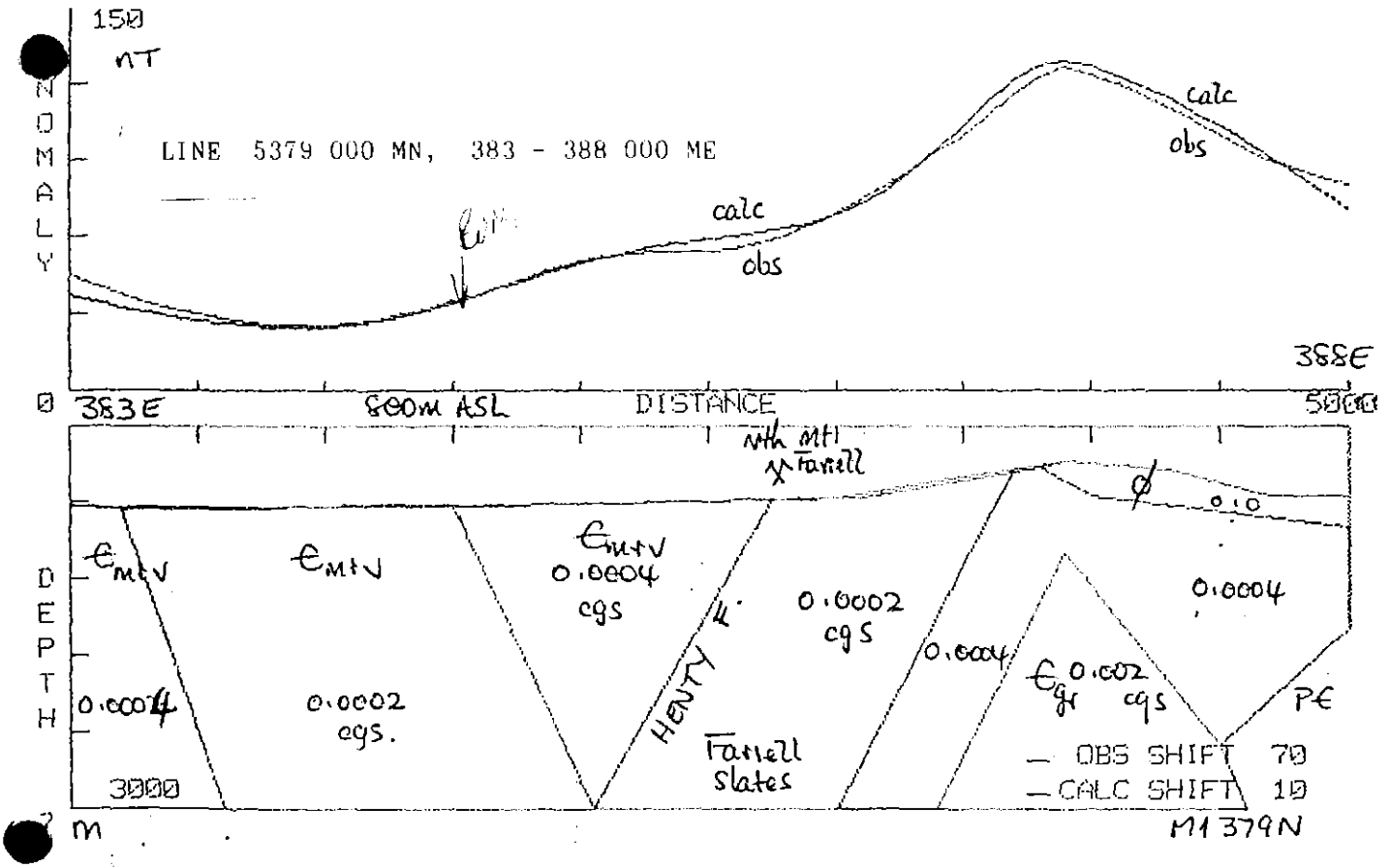

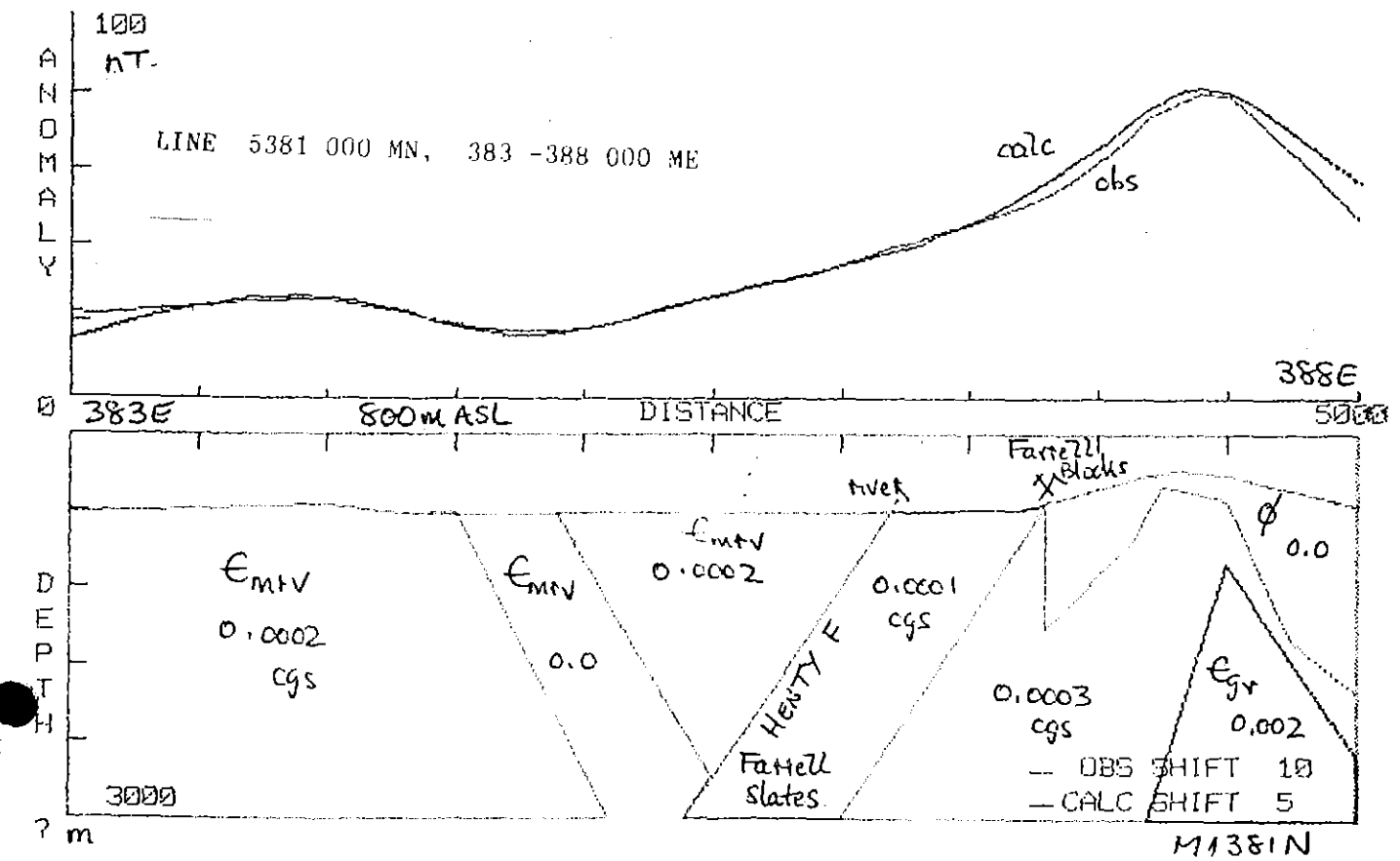

D. Leaman
Aug 91

2D MAGNETICS MODELS: FIGURE 9

APPENDIX 2

Diamond Drill Logs

PASMINCO EXPLORATION

LEGEND FOR DIAMOND DRILL LOGS

PROJECT: TULLAH ~ E.L. 22/90

CORE RECOVERY				DESCRIPTION							CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
						ORDIVICIAN								
						Owen Conglomerate								
						Sandstone								
						CAMBRIAN								
						Feldspar-phyric volcanics								
						(andesite, dacite)								
						amygdales								
						Feldspar + quartz-phyric volcanics								
						Basalt, fine grained + chloritic								
						Sericitic rocks								
						Sandstone								
						Sandstone/Siltstone beds.								
						Conglomerate								
						Black shale								
						volcanic quartz								
						STRUCTURE (with angle to core)								
						Bedding trends			30					
						Foliation trends			25					
						Fault			20					
						Shear zone			35					
						Quartz veins								
						Quartz-Carbonate veins.			cb					
						MINERALISATION								
						pyrite; chalcopyrite; galena; sphalerite				py; cpy; gn; sph				

0068

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PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

Logging: A.N.L. Sept '91.

HOLE No. 2F

PROJECT: Tullah.

Graphic Scale 1: 1:500.

CORE RECOVERY				DESCRIPTION							CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
All depths converted from feet.				0	45.7	Very fine grained, massive, dark green rock with even, crystalline texture. Mafic intrusive or lava	7.6		25					
						From 7.6 – 26.2, broken and bleached, fine grained texture is maintained. A foliation is apparent.	26.2							
						From 34.4 – 35.9, vein brecciation, qtz-carb. 45.1 – 46.0, 1cm qtz vein.	34.4 35.9		25 q, cb. 25 q					
				45.7	45.8	Core missing, probably removed for assay.	45.7 45.8							
				45.8	257.5	Although alteration + colour differs through this zone, the primary rock type appears to be consistant. Porphyritic texture, feldspar phenocrysts (sometimes enhanced ?by albitisation). Quartz-chlorite filled vughs throughout. Some have chlorite rims. They are interpreted as vesicles. Patches of chlorite, varying in colour from black to pale green occur throughout. Some are up to 2cm across. Groundmass commonly has a dark pink (brick colour) tinge ?albitisation.	76.8 79.5		qtz/carb qtz (lat) country rock	Trace of pyrite				

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PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

HOLE No. 2F

PROJECT :

Graphic Scale 1:

CORE RECOVERY				DESCRIPTION							CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
						Feldspar phyric lava, Andesite or Dacite								
						45.7 - 80.2 Broken ground, principle fracturing 10-30° to core	136.5		q-calc.					
						76.8 - 79.5 Brecciation; carbonate-quartz infil, then later quartz filling of vughs.	139.9		chlor.					
						136.5 - 139.9 Brecciation of country rock in some places matrix is chlorite, elsewhere, vein quartz + carbonate	159.1		q 25					
						159.1 - 163.4 Zone of weak shearing, qtz-chlorite veining.	163.4		20					
							240							

0070

142071

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

HOLE No. 2F

PROJECT :

Graphic Scale 1:

CORE RECOVERY				DESCRIPTION							CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
						End of Hole	257							

0071

142072

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

Logging:- ANL Sept. '91

HOLE No. 3F

PROJECT: TULLAH

Graphic Scale 1: 500

Page 1 of 5

CORE RECOVERY				DESCRIPTION							CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
				10.4	12.9	Fine grained, dark green, even textured Intermediate - Mafic ?dyke. Sharp lower contact.	10.4 12.9		contact 30°					
				12.9	90.9	Mottly pink and green rock. Silica-filled bughs are interpreted as amygdales. Strongly feldspar phyric, porphyritic texture. Feldspars are enhanced in size in places by ?albitisation. Pink zones predom. albite alteration between these are zones of chlorite & carbonate alteration. Intermediate Lava. 31.0-41.9 Interval of finer grained, chloritic, dark green rock with definate, but not straight contact. ?Zone of chlorite alteration or a dyke. 41.9-51.5 Zone of quartz-filled vein brecciation. Also shearing	31.0 41.9 51.5 90.9		20	Trace pyrite.				
				90.9	119.4	Fine grained, dark green, even textured ?Intermediate - mafic ?dyke. Quartz-carb-chlorite stringers throughout	119.4 120		q. cb. chl.					

0072

142073

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

HOLE No. 3F

PROJECT :

Graphic Scale 1:

CORE RECOVERY				DESCRIPTION							CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
				119.4	148.4	Mottled, pink and green, strongly feldspar phyric rock with quartz-chlorite amygdales. Intermediate Lava. Colour changes reflect patches of albite + chlorite alteration.	148.4							
				148.4	150.7	Dark green, chloritic ?Mafic Dyke	150.7 / 151.1							
				150.7	157.8	Mottled, pink + green, Intermediate Lava. 150.7-151.1 Zone of intense quartz veining with strong chlorite alt. between veins.	157.8							
				157.8	171.9	Dark green, chloritic ?Mafic Dyke. Some light green patches ?siderite alt. Bottom contact very sharp	171.9		contact 30°					
				171.9	224.1	Mottled, pink + green Intermediate Lava. 205.4-206.6 Deformed quartz veins	205.4 / 206.6		30°					
				224.1	228.1	Dark green, fine grained ?Mafic Dyke	224.1		contact 35°					
				228.1	232.8	Rock type unknown. Zone of strong bleaching. Very broken. Quartz-carb veining & angular chlorite fragments. Strong schistosity.	228.1 / 232.3 / 242		15					

0070

142074

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

HOLE No. 3F

PROJECT :

Graphic Scale 1:

CORE RECOVERY				DESCRIPTION							CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
				232.8	323.4	Feldspar phyric, pink and green, amygdaloidal Intermediate Lava Becomes increasingly deformed and chloritised. Strong schistosity throughout. Quartz veining distributed through the core - 5/m.								
				323.4	325.0	Fine grained, dark green ? Mafic Dyke Schistosity marked by flattened, discrete, chlorite blebs.	323.4 325.0		Contact 65° 55 Contact 75° 55 50					
				325.0	335.0	Mottled Intermediate Lava. Strong schistosity and qtz veining - 8/m	335.0 337.1 334.5		Contact 55° 75					
				335.0	337.1	Fine grained, dark green ? Mafic dyke Partly bleached								
				337.1	354.6	Feldspar phyric, mottled pink + green, amygdaloidal Intermediate Lava	354.6 339.6 360		45 40 75	Trace pyrite				

0074

142075

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

HOLE No. 3F

PROJECT :

Graphic Scale 1:

CORE RECOVERY				DESCRIPTION							CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
						Increasingly altered and deformed down				Trace pyrite				
						hole. Change from predominantly	-365.4		75					
						chlorite to sericite at 341.4m								
						339.5 schistosity deformed on			60					
						small faults.								
						359.6-365.4 Zone of intense sericite			40					
						alteration. Broken ground. Stronger								
						cleavage development								
						378.9-394.1 Very intense sericite	-394.1							
						alteration. Broken ground.								
						Quartz veining parallels schistosity.	-402.6 -404.8		q/c					
						Towards the end of this interval the								
						quartz veining becomes a brecciated				Traces gn+sp				
						schistosity is deformed.				394.1-488.6				
						394.1-488.6. Sharp uphole contact								
						to less altered + deformed rocks								
						402.6-404.8 Zone of intense, white								
						barren qtz-carbonate veining			60					
						453.2 From here, deformation +								
						alteration increase again. Strong								
						sericite alteration to 471.7m. Quartz								
						veins parallel to + cross cutting	-453.2							
						schistosity								
						484.0 From here, dark green,								
						predominantly chlorite alteration								
						Increase in veining. Some veins	-471.7		80					
						carry Chalcopyrite + pyrite. Silicification								
						of wall rock from veins	480							

142076

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

HOLE No. 3F.

PROJECT :

Graphic Scale 1: 500

CORE RECOVERY				DESCRIPTION							CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Graphic Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
						Quartz veining + sil. increase towards contact. Sharp, broken contact	488.6			Cpy + Py in qtz veins 487.0-488.6 3% Cpy				
				488.6	513.6	Dark, grey foliated Mudstone. No primary bedding visible. Foliation is folded in places. Quartz-carb stringers parallel to fol'n. Qveining + py. traces on uphole contact.	513.6			Trace py.				
				513.6	547.8	Quartz/graphite Meta siltstone. Primary layering not visible. Strong foliation developed. Sharp, angular folds throughout (folded foliation). Unmineralised	547.8							
						End of Hole	E.O.H							

0076

142077

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

Logging - Ark Sept. '91

HOLE No. F6.

PROJECT: Tullah

Graphic Scale 1: 500

Page 1 of 1

CORE RECOVERY				DESCRIPTION							CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
				0	18.1	Black Shale Minor quartz veining at top of hole c̄ py + cpy.			9 80	1% py + cpy				
							12.19							
						Sheared contact.								
				18.1	27.7	Foliated quartz-graphite Metasiltstone. Some black shale lenses.	18.1		70	Tr. cpy				
						End of Hole	27.7 E.O.H		80					

0077

142078

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

Logging:- ANK Sept. '91

HOLE No. F7.

PROJECT: Tullah

Graphic Scale 1: 500

Page 1 of 1

CORE RECOVERY				DESCRIPTION							CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Graphic Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
				0	5.8	Quartz graphite Meta siltstone.								
						Bedding clear, becomes brecciated down hole	5.8		10					
									15					
				5.8	57.6	Black Shale. Some quartz/carb				5.8-57.6 Tr py, cpy				
						veining. Strong foliation developed.			70					
						Trace pyrite, chalcopyrite. Sharp			25					
						angular folds in foliation								
						End of Hole								
									50					
									50					
							57.6							
							E.O.H							

0070

142079

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

Logging - ANL, Sept. '91

HOLE No. F8.

PROJECT: Tullah

Graphic Scale 1: 500

Page 1 of 1

CORE RECOVERY				DESCRIPTION							CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Graphic Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
				0	36.0	Black shale, weakly pyritic. Strong foliation with quartz veining through it.				Tr. py, sp, cpy, gn				
							36.0		65					

142080

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

Logging - Ank Sept. '91

HOLE No. F9

PROJECT: Tullah

Graphic Scale 1: 500

Page 1 of 1

CORE RECOVERY				DESCRIPTION							CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
				0	7.0	highly deformed Black shale			60					
				7.0	9.7	Quartz-graphite Metasiltstone q/cb veining	7.0		8 25	Tr py				
				9.7	32.3	Highly deformed black shale	9.7 11.9							
						All core sampled 9.7 - 11.9 } Prob. mineralised zones.				Mineralised gn zones				
						12.0 - 13.1	18.8 20.4		q-cb	9.7-11.9				
						14.5 - 15.8				12.0-13.1				
						18.8 - 20.4			q-cb	14.5-15.8				
						Quartz - carb. veining with traces py	32.3 EOH			18.8-20.4				
						End of Hole								

142081

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

Logging: ANL Sept. '91

HOLE No. F 11

PROJECT: Tullah

Graphic Scale 1: 500

Page 1 of 1

CORE RECOVERY				DESCRIPTION							CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Graphic Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
				0		Core Missing								
				22.2	34.4	Quartz - graphite meta siltstone with minor bands of black shale	22.2							
							34.4		80					

0031

142082

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

HOLE No. F49

PROJECT: Tullah

Logging: ANL Sept. 1991

Graphic Scale 1: 500

Page 1 of 1

CORE RECOVERY				DESCRIPTION							CODES			
From m	Interval m	%	RQD	From m	Interval m	(Incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
				0	53.3	Core Missing								
				53.3	57.9	Black shale deformed, but bedding still visible. Qtz/carb veining throughout Goy× py assoc with much of this. Very broken at 57.9.	53.3 57.9 58.5 62.4			57.9-58.5 Massive galena				
				57.9	58.5	Near massive, crystalline galena amid veins × patches of crystalline carbonate								
				58.2	62.4	Very broken ground. Black shale with numerous qtz-carb veins. Rare carry pyrite								

014283

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

HOLE No. F50

Logging:- ANL, Sept. 1991

PROJECT: Tullah

Graphic Scale 1: 500

Page 1 of 1

CORE RECOVERY				DESCRIPTION							CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
				0	7.3	Core Missing								
				7.3	39.6	Strongly cleaved qtz-graphite Metasiltstone. Some bands of black shale. Bedding visible in places.	7.3		20					
									Slig. 70					
				39.6	54.2	As above, with abundant quartz veining and resultant brecciation of foliation.	39.6		30	q + seriate Tr. py in veins.				
				54.2	76.8	Quartz-graphite, Metasiltstone. 55.8-57.0, Brecciated, carbonate matrix. Strong foliation (some may be bedding), quartz carbonate veining throughout	54.2 55.8 57.0		35 38	q				
				76.8	77.4	Broken ground, semi-massive sphal + galena assoc. c̄ qtz-carb. veining.	76.8 77.4 79.9 82.3 E.O.C.		65	q-cb vein				
				77.4	79.9	Quartz veining with dissem sph + gh								
				79.9	82.3	Black Shale. Strong cleavage, weakly pyritic. End of Core								

142034

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

HOLE No. F 51

PROJECT: Tullah.

Logging:- A.N.L, Sept 1991.

Graphic Scale 1: 500

Page 1 of 1

CORE RECOVERY				DESCRIPTION							CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
				0	22.9	Quartz-graphite Metasiltstone with strong foliation			50					
						Quartz vein on contact.								
				22.9	27.4	Black Shale, deformed. Intense qtz veining Trace py.	22.86 / 27.40		50	Trace Py				
				27.4	31.4	Quartz graphite Metasiltstone Intense qtz veining. Strongly deformed	31.40		75					
				31.4	40.2	Less deformed Meta siltstone Angular folds in foliation	40.2		2	Py + barite in veins				
				40.2		Highly deformed Black Shale with small bands of Meta siltstone. Intense quartz veining. Py & barite assoc. c̄ veins	50.3 / 56.1	E.O.H.						
					56.1	Quartz-graphite Meta siltstone. End of Hole								

0084

142085

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

HOLE No. F53

PROJECT: Tullah

Logging: ANL, Sept. 191

Graphic Scale 1: 500

Page 1 of 1

CORE RECOVERY				DESCRIPTION							CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
				0	11.5	Core Missing								
				11.5	45.72	Quartz - graphite Meta siltstone Abundant qtz veins. Strong foliation.	11.5							
				45.72	71.9	Black shale with minor siltstone Quartz - carb veining with pyrite Strong foliation; folded in places End of Hole	45.72 71.9 E.O.H			Tr. py in veins.				

14203G

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

HOLE No. F54

Logging - ANL, Sept '91

PROJECT: Tullah

Graphic Scale 1: 500

Page 1 of 1

CORE RECOVERY				DESCRIPTION							CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
				0		Foliated Black shale.			30					
				32.3	34.1	Quartz-graphite Metasiltstone.	32.3		20					
				34.1	52.1	Foliated Black Shale	34.1		60					
				52.1	61.9	Quartz-graphite Metasiltstone.	52.1		35					
						End of Hole	61.9 E.OH							

0080

142087

142033

APPENDIX 3

List of Diamond Drill Holes with Collar Locations

142089

TULLAH DRILL HOLES ON A.M.G. GRID

Hole I.D.	Northing	Easting	R.L.	Depth(m)
STP 217	5374393	384190		249.1
MRP 219	5374104.18	384449.97	171.3	140.8
STP 220	5374200	384625	178	268.8
STP 221	5374399	384271	174	203.3
STP 234	5374400	384413	176	342.5
MRP 212	5375330.6	384424.4	170	293.5
STP 232A1	5374728.5	384395.8	170	198.2
MRP 226	5376288.4	384692.8	165.1	211.5
MRP 227	5376694	384778	158.5	155.6
MRP 233	5375400	384465	160	197.7
STP 231	5374266.8	384216.3	175.4	150.6
RED 86-1	5375604	384943	167	235.2
RED 87-2	5375420.5	384436.2	160.1	260.3
RED 87-3	5375401.4	384516.2	159.9	153.4
RED 87-4	5376995	384890	172	328
RED 87-5	5375350	384530	165.3	145.5
RED 87-6	5375300	384499.7	174.2	157
RED 87-7	5375550.9	384411.8	277	277
RED 87-8	5375551	384412.2	162.9	280
RED 87-10	5375740	384595		169.2
RED 87-11	5380330	386038		250.1
RED 88-1	5375551.1	384411.1	162.9	322
RED 88-2	5375249.5	384375.8	173.7	289.3
RED 88-3	5377450.2	385093.1	170.4	178.5
RED 88-4	5375352.1	384386	167.9	325
SV 1	5374044	384532		
SVD 87-2	5374243	384311		
MR1	5375175	384985		
MR2	5375225	384990		
DOM1N	5379785	386060	245	
DOM2N	5379860	386115	240	
DOM3N	5379915	386170	240	
DOM1N	5380085	386110	220	
DDH1S	5377795	385385	460	
DDH2S	5377800	385380	460	
DDH3S	5377805	385390	460	
DDH4S	5377855	385420	462	
DDH5S	5377975	385480	470	
DDH6S	5378055	385520	465	
DDH7S	5378085	385545	475	
DDH8S	5378095	385550	478	
DDH9S	5378115	385555	478	
DDH10S	5378195	385560	490	
DDH11S	5378275	385600	495	
DDH12S	5378350	385640	495	
DDH13S	5378440	385675	495	

STP, MRP – E.Z. drill holes
RED, SVD – Billiton drill holes
SV – Cominco drill hole
DOM – Department of Mines drill holes
DDH – Farrell Mines drill holes
MR – Getty Oil and Development Company drill holes

TULLAH DRILL HOLES ON FARRELL MINE GRID

Hole I.D.	Northing	Easting	R.L.	E.O.H.	Meters
F1	11411.5	10348	9862.5	120	36.576
F2	11472	10373	9862.5	114	34.7472
F3	11516	10389.5	9868.75	140	42.672
F4	11500	10506	9981.25	96	29.2608
F5	11531.5	10394	9862.5	154	46.9392
F6	10797	10261	9862.5	87	26.5176
F7	10798	10269.25	9862.5	188	57.3024
F8	11378.5	10347	9862.5	118	35.9664
F9	11300	10313	9862.5	115	35.052
F10	11257	10284.5	9862.5	98	29.8704
F11	11257	10284.5	9862.5	113	34.4424
F12	11525	10500	10181.25	125	38.1
F13	11497	10490	10181.25	80	24.384
F14	11522	10512	9981.25	100	30.48
F15	11522	10512	9981.25	129	39.3192
F16	11315	10512	9975	31	9.4488
F17	11384.5	10398.5	9975	86	26.2128
F18	11353	10374	9975	80	24.384
F19	11200	10360	9968.75	85	25.908
F20	11240	10556	9968.75	70	21.336
F21	11007	10340	9862.5	70	21.336
F22	11065	10337	9862.5	65	19.812
F23	10960	10332	9862.5	70	21.336
F24	10565	10282.5	9973.5	66	20.1168
F25	10565	10276	9973.5	80	24.384
F26	11335	10368	9876	172	52.4256
F27	11335	10368	9876	139	42.3672
F28	11107	10348	9863.5	148	45.1104
F29	11235	10345	9866	142	43.2816
F30	11474	10439	9871.5	180	54.864
F31	11688	10446.5	9875	73	22.2504
F32	10220	10170	9877	53	16.1544
F33	10245	10292	10087	61	18.5928
F34	10185	10291	10095	63	19.2024
F35	9993	10289	10094.5	57	17.3736
F36	11688	10446	9875	100	30.48
F37	11670.5	10446	9875	80	24.384
F38	11286.5	10148.5	9868.5	282	85.9536
F39	10537	10067	9892.5	252	76.8096
F40	10525	10066	9892.5	217	66.1416
F41	10634.8	10070.9	9894	221	67.3608
F43	no data				
F44	10099.7	9993	9889	308	93.8784
F45	10099.7	9993	9889	234	71.3232
F46	9950.5	9994	9888	171	52.1208
F47	9950.5	9994	9888	215	65.532
F48	10049.2	9993.5	9888.5	192	58.5216
F49	10049.2	9993.5	9888.5	207	63.0936
F50	9989	10000	9887	276	84.1248

F51	no data				
F52	10001	10000	9887	175	53.34
F53	9967	9998	9898	250	76.2
F54	11381	10156	9869	250	76.2
F55	11314	10258	9718	46	14.0208
F56	11312	10268	9718	64	19.5072
F57	10630	10070	9868	170	51.816
F58	10530	10069	9868	180	54.864
F59	11382	10165		225	68.58
ONE F	10871.7	9186.41	10562.1	1585	483.108
TWO F	8203.23	8661.94	10578.3	849	258.7752
THREE F	8203.23	8661.94	10578.3	2054	626.0592
TP133	11948	10702	surface	293	89.3064
TP134	12150	10705	surface	346	105.4608
TP135	14275	11283	surface	295	89.916
UDDH1	10955	10445	9954.2	252	76.8096
UDDH3	9670	10400	9954.2	70	21.336
UDDH4	9630	10425	9954.2	60	18.288
UDDH5	9480	10370	9954.2	30	9.144
UDDH6	9475	10380	9954.2	70	21.336
UDDH7	9433	10350	9954.2	252	76.8096
UDDH8	9410	10380	9954.2	60	18.288
UDDH9	9120	10330	9954.2	249	75.8952
UDDH11	11015	10505	9954.2	140	42.672
UDDH12	11042	10520	9954.2	50	15.24
UDDH13	11160	10412	9954.2	207	63.0936
UDDH14	11145	10540	9954.2	41	12.4968
UDDH15	11240	10490	9954.2	20	6.096
UDDH16	11240	10485	9954.2	52	15.8496
UDDH17	11280	10475	9954.2	30	9.144
UDDH18	11405	10500	9954.2	19	5.7912
UDDH19	11145	10530	9954.2	50	15.24

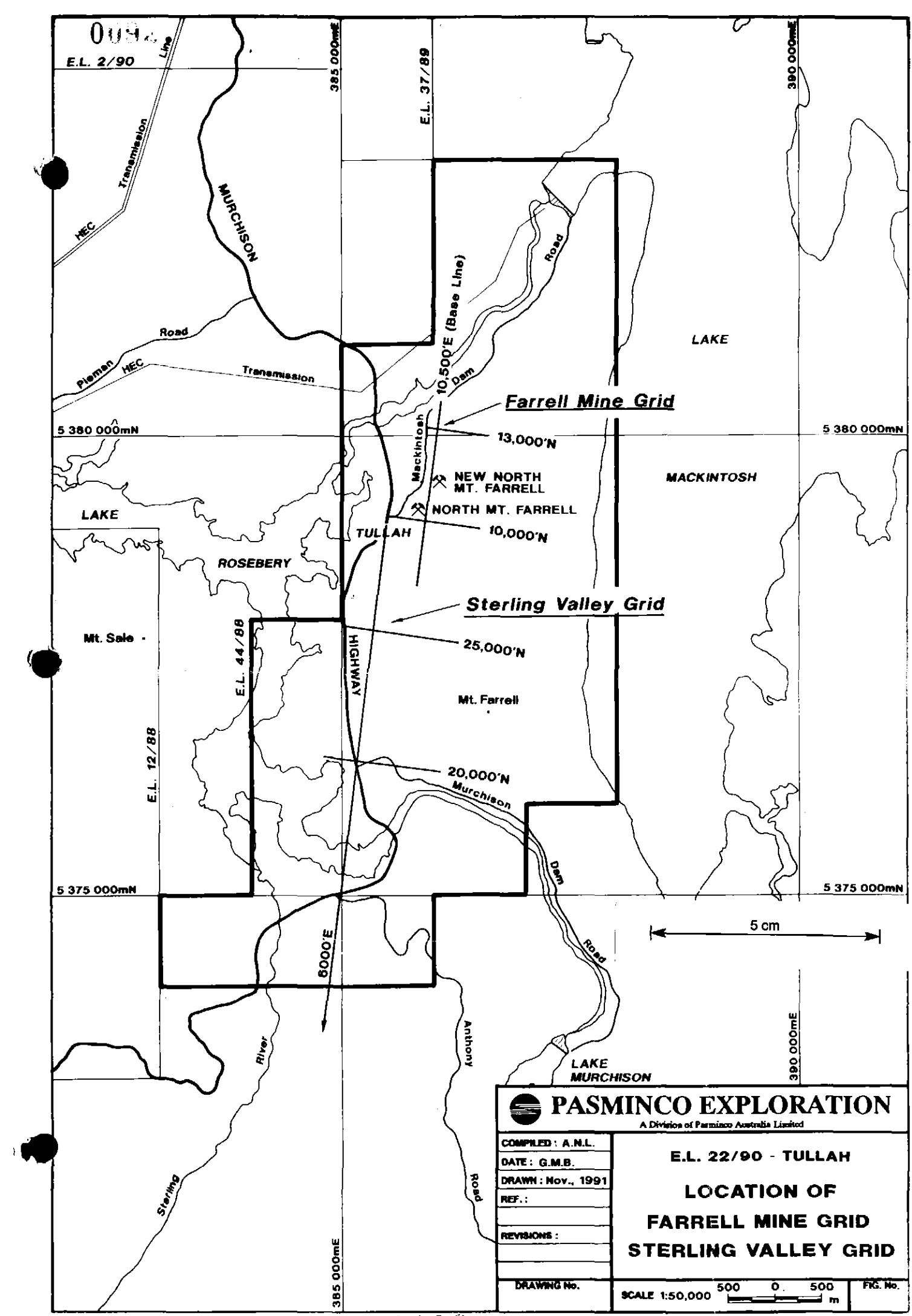
F - E.Z. underground holes
ONE F - E.Z. surface holes (mine leases)
TP - E.Z. surface holes (north of mine leases)
UDDH - underground holes drilled at New North Farrell Mine, probably by Rio Tinto.
Rio Tinto Australia

142092

HOLES ON TULLAH E.L., DRILLED ON THE STERLING VALLEY GRID

Hole I.D.	Northing	Easting	R.L.(ft)	Depth(ft)	Depth(m)
MP28	19942	7451	181	403	122.8344
MP29	19942	7450	180	373	113.6904
MP30	19847	7481	182	411	125.2728
MP32	20259	7884	293	361	110.0328
MP33	23887	6622	188	260	79.248
MP35	23888	6619	188	232	70.7136
MP37	23677	6466	131	284	86.5632
MP38	23478	6400	112	90	27.432
MP43	23282	6382	107	350	106.68
MP44	23874	6104	143	208	63.3984
MP70	23994	5863	133	546	166.4208
MP71	23546	5780	108	594	181.0512
MP86	33187	7878	488	331	100.8888
MP87	32392	8045	622	576	175.5648
MP88	23854	6039	128	659	200.8632
MP89	20571	5298	108	268	81.6864

MP – E.Z. drill holes



PASMINCO EXPLORATION
A Division of Pasminco Australia Limited

COMPILED : A.N.L.	E.L. 22/90 - TULLAH
DATE : G.M.B.	LOCATION OF
DRAWN : Nov., 1991	FARRELL MINE GRID
REF. :	STERLING VALLEY GRID
REVISIONS :	
DRAWING No.	SCALE 1:50,000 500 0 500 m — FIG. No.

142093

10196



LEGEND

1. General Form

Colour, grain size, overall texture, Rock Type, constituents & textutres, alteration, mineralisation.

Descriptors and Rock Types to be separated by comma or slash. Derwent series 19 colours (in brackets) are intended for the Cambrian sequences.

2. Rock Types

Lavas L

a	(9)	acid
i	(46)	intermediate
b	(49)	basaltic
r	(9)	rhyolitic
d	(11)	dacitic
n	(46)	andesitic

Intrusives I

a	(12)	acid
i	(46)	intermediate
b	(49)	basic
fel		felsic
p		porphyritic
g	(12)	granitic
peg		pegmatitic

Volcaniclastics V

pm	(7)	pumiceous mass flow
q	(32)	quartz phyric mass flow

Sediments S

sh	(35)	shale
t	(36)	slate incl. black slate
slt	(35)	siltstone
sst	(36)	sandstone
tb		turbidite
w	(36)	wacke
cong	(36)	conglomerate
Δ		breccia
cht	(34)	chert
lst	(65)	limestone
dol	(65)	dolomite
q	(39)	quartzite
Fe		iron formation
gl	(4)	glacial deposits
fgl	(4)	fluvioglacial deposits
alv	(4)	alluvial deposits

Metamorphic Rocks M
Colours should be hatched

sht	(36)	schist
sp	(35)	semi-pelite
ps	(39)	psammite
amph	(46)	amphibolite
gran		granulite
sk		skarn
mb	(65)	marble
m		mylonite

Unassigned ? Use alone or as a qualifier to other rock types where uncertain.

3. Descriptors

Colour:

ple	pale	bl	blue
dk	dark	wht	white
clr	clear	yel	yellow
or	orange	ol	olive
blk	black	grn	green
pk	pink	ppl	purple
rd	red	crm	cream
brn	brown		

Grainsize:

fg	fine grained
mg	medium grained
cg	coarse grained
vcg	very coarse grained

Overall Texture:

aug	augen
p	porphyritic
fol	foliated
clvd	cleaved
msv	massive
blk	blocky
bd	bedded
lam	laminated
xbd	cross bedded
xlam	cross laminated
br	brecciated
fb	flow banded
fΔ	flow brecciated

Constituents & Internal Textures:

f	feldspar
q	quartz
l	lithic
pm	pumice
styl	stylolites
wsp	wisps
ves	vesicles
sph	spherulites
lph	lithophysae

Alteration:

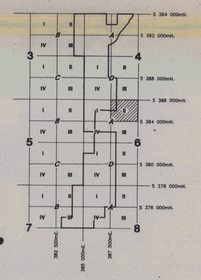
alb	albitised
co	carbonate alteration
chl	chloritised
ser	sericited
kaq	kaolinised
ep	epidotised
sil	silicified

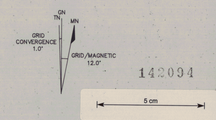
Mineralisation:

diss	disseminated
str	stringer
msv	massive
gos	gossan
bx	boxwork
py	pyrite
po	pyrrhotite
asp	arsenopyrite
gn	galena
sp	sphalerite
mag	magnetite
hm	haematite

4. Mapping Symbols

- Strike and Dip of Strata (25°)
- Strike and dip of inverted strata
- Strike and dip of cleavage or foliation (60°)
- Plunge of lineation (50°)
- Geological boundary position accurate
- Geological boundary position approximate
- Mine
- Abandoned prospect or mine
- Costean or trench
- Diamond drill hole, including projection
- Unconformity
- Fault
- Thrust Fault
- Plunging antiform
- Plunging synform





91-3297.

142094

PASMINCO EXPLORATION
A Division of Pasminco Australia Limited

COMPILED : A.N.L.	E.L. 37/89 - BULGOBAC HILL
DATE : Sept., 1991	
DRAWN :	**OUTCROP GEOLOGY**
REFERENCE :	
REVISIONS :	
DRAWING No.	SCALE 1:2500 (0 50 100 METRES) — FIG. No. 5

N.W. Coast Computer Aided Drafting Centre. Phone (004 354315) Fax. (004 354495)

10197

388 000mE. 388 500mE. 389 000mE. 389 500mE. 390 000mE.

5 383 500mN.

5 383 000mN.

E.L. 22/90 BOUNDARY

MACKINTOSH DAM

5 382 500mN.

5 382 000mN.

LEGEND

1. General Form

Colour, grain size, overall texture, Rock Type, constituents & textutres, alteration, mineralisation.

Descriptors and Rock Types to be separated by comma or slash. Derwent series 19 colours (in brackets) are intended for the Cambrian sequences.

2. Rock Types

Lavas L
- a (8) acid
- i (46) intermediate
- b (46) basaltic
- r (9) rhyolitic
- d (11) dacitic
- an (46) andesitic

Intrusives I
- a (12) acid
- i (46) intermediate
- b (49) basic
- fel felsic
- p porphyritic
- g (12) granitic
- peg pegmatitic

Volcaniclastics V
- pm (7) pumiceous mass flow
- q (32) quartz phyric mass flow

Sediments S
- sh (28) shale
- s (36) slate incl. black slate
- st (28) siltstone
- sst (28) sandstone
- ts turbidite
- w (6) wacke
- cgl (36) conglomerate
- b breccia
- cht (34) chert
- ls (45) limestone
- dol (46) dolomite
- q (28) quartzite
- fe iron formation
- gl (4) glacial deposits
- fgl (4) fluvioglacial deposits
- alv (4) alluvial deposits

Metamorphic Rocks M
Colours should be hatched
- sht (28) schist
- sp (28) semi-pelite
- ps (28) psammite
- amph (46) amphibolite
- gr gn granulite
- sk skarn
- mb (85) marble
- m mylonite

Unassigned ?
Use alone or as a qualifier to other rock types where uncertain.

3. Descriptors

Colour:

ple	pale	bl	blue
dk	dark	wht	white
clr	clear	yel	yellow
or	orange	ol	olive
blk	black	grn	green
pk	pink	ppl	purple
rd	red	crm	cream
brn	brown		

Grainsize:

fg	fine grained
mg	medium grained
cg	coarse grained
vcg	very coarse grained

Overall Texture:

aug	augen
p	porphyritic
fol	foliated
clvd	cleaved
mav	massive
blk	blocky
bd	bedded
lam	laminated
xbd	cross bedded
xlam	cross laminated
br	brecciated
fb	flow banded
fb	flow brecciated

Constituents & Internal Textures:

f	feldspar
q	quartz
l	lithic
pm	pumice
styl	stylolites
wsp	wisps
ves	vesicles
sph	spherulites
lph	lithophysae

Alteration:

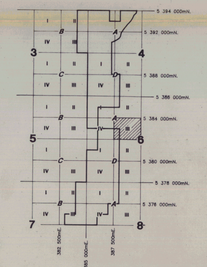
alb	albitised
ca	carbonate alteration
chl	chloritised
ser	sericited
kao	kaolinised
ep	epidotised
sil	silicified

Mineralisation:

diss	disseminated
str	stringer
mav	massive
gos	gossan
bx	boxwork
py	pyrite
po	pyrrhotite
asp	arsenopyrite
gn	galena
sp	sphalerite
mag	magnetite
hm	haematite

4. Mapping Symbols

- Strike and Dip of Strata (25°)
- Strike and dip of inverted strata
- Strike and dip of cleavage or foliation (60°)
- Plunge of lineation (50°)
- Geological boundary position accurate
- Geological boundary position approximate
- Mine
- Abandoned prospect or mine
- Costean or trench
- Diamond drill hole, including projection
- Unconformity
- Fault
- Thrust Fault
- Plunging antiform
- Plunging synform



GRID CONVERGENCE 1.0°

GRID/MAGNETIC 12.0°

142095

5 cm

91-3297.

PASMINCO EXPLORATION
A Division of Pasminco Australia Limited

COMPILED : A.N.L.	E.L. 22/90 - TULLAH
DATE : Sept., 1991	**OUTCROP GEOLOGY**
DRAWN :	
REFERENCE :	
REVISIONS :	
DRAWING No.	SCALE 1:2500 (0 50 100 METRES) — FIG. No. 6

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10198

385 500mE. 386 000mE. 386 500mE. 387 000mE. 387 500mE.

5 383 500mN.

5 383 000mN.

5 382 500mN.

5 382 000mN.

Dense Timber

E.L. 22/90 BOUNDARY

Clark Sill/Lf

Clark Sill/Lf

Clark Sill/Lf

10199

385 500mE. 386 000mE. 386 500mE. 387 000mE. 387 500mE.

5 381 500mN. 5 381 000mN. 5 380 500mN. 5 380 000mN.

E.L. 22/90 BOUNDARY

MURCHISON HIGHWAY

LAKE ROSEBERY

Mackintosh Bridge

MACKINTOSH DAM ROAD

Locked Gate

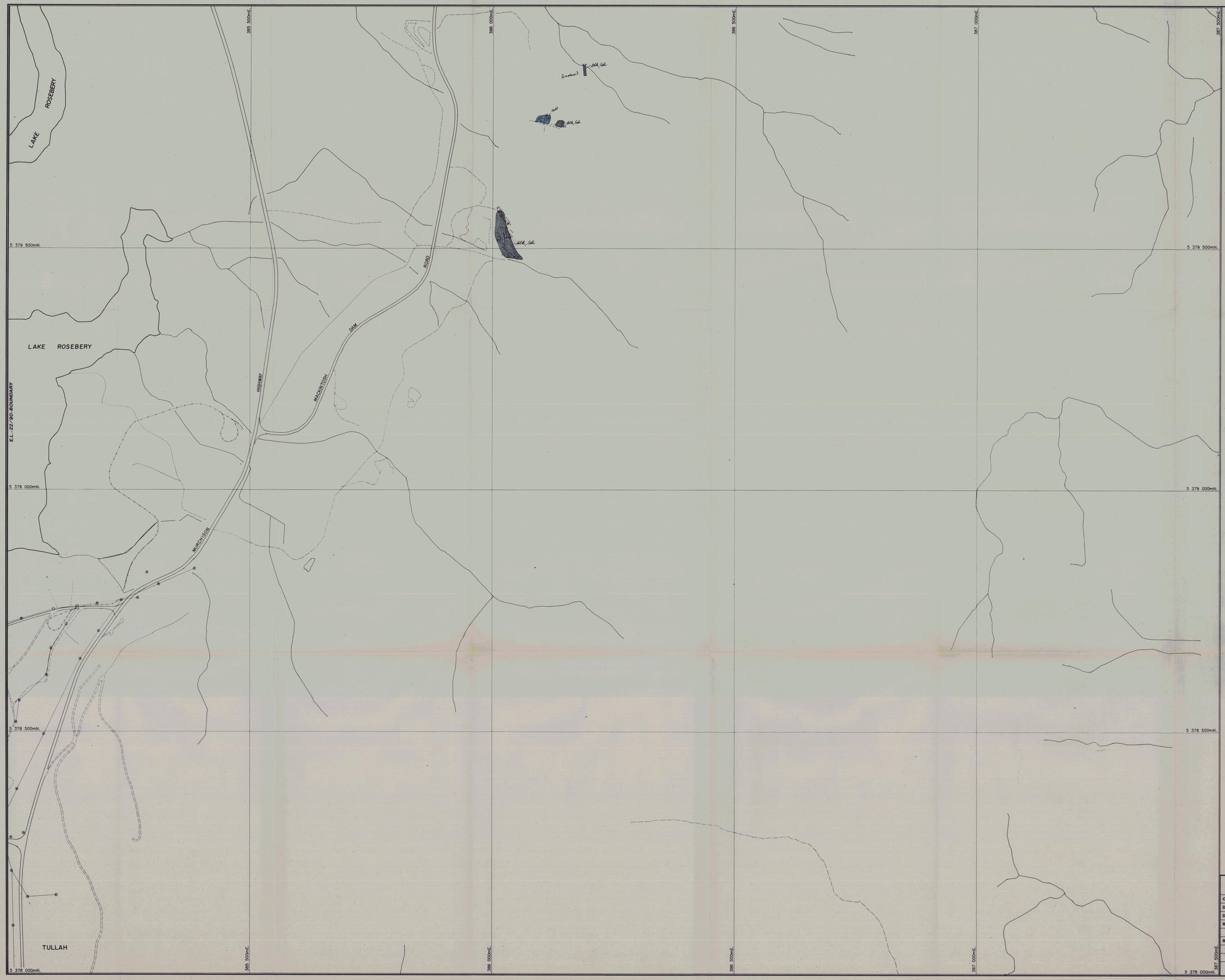
Locked Gate

Qld, Sds

Qld, Sds

Qld, Sds

10200



LEGEND

1. General Form

Colour, grain size, overall texture, Rock Type, constituents & textutres, alteration, mineralisation.

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Lavas L

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b	(48)	basaltic
r	(9)	rhyolitic
d	(11)	dacitic
n	(46)	andesitic

Intrusives I

a	(12)	acid
i	(46)	intermediate
b	(48)	basic
fel		felsic
p		porphyritic
g	(12)	granitic
peg		pegmatitic

Volcaniclastics V

pm	(7)	pumiceous mass flow
q	(32)	quartz phyric mass flow

Sediments S

sh	(35)	shale
s	(36)	slate incl. black slate
slt	(35)	siltstone
sst	(36)	sandstone
tb		turbidite.
w	(36)	wacke
cong	(36)	conglomerate
Δ		breccia
cht	(34)	chert
lst	(65)	limestone
dol	(65)	dolomite
q	(36)	quartzite
Fe		iron formation
gl	(4)	glacial deposits
fgl	(4)	fluvioglacial deposits
alv	(4)	alluvial deposits

Metamorphic Rocks M
Colours should be hatched

sht	(36)	schist
sp	(35)	semi-pelite
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amph	(48)	amphibolite
gran		granulite
sk		skarn
mb	(65)	marble
m		mylonite

Unassigned ? Use alone or as a qualifier to other rock types where uncertain.

3. Descriptors

Colour:

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clr	clear	yel	yellow
or	orange	al	alive
blk	black	grn	green
pk	pink	ppl	purple
rd	red	crm	cream
brn	brown		

Grainsize:

fg	fine grained
mg	medium grained
cg	coarse grained
vcg	very coarse grained

Overall Texture:

aug	augen
p	porphyritic
fol	foliated
clvd	cleaved
msv	massive
blk	blocky
bd	bedded
lam	laminated
xbd	cross bedded
xlam	cross laminated
br	brecciated
fb	flow banded
fΔ	flow brecciated

Constituents & Internal Textures:

f	feldspar
q	quartz
l	lithic
pm	pumice
styl	stylolites
wsp	wisps
ves	vesicles
sph	spherulites
lph	lithophysae

Alteration:

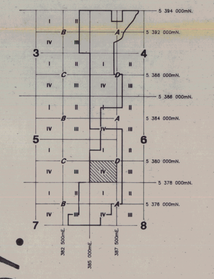
alb	albitised
co	carbonate alteration
chl	chloritised
ser	sericited
kao	kaolinised
ep	epidotised
sil	silicified

Mineralisation:

diss	disseminated
str	stringer
msv	massive
gos	gossan
bx	boxwork
py	pyrite
po	pyrrhotite
asp	arsenopyrite
gn	galena
sp	sphalerite
mag	magnetite
hm	haematite

4. Mapping Symbols

- 25° Strike and Dip of Strata
- Strike and dip of inverted strata
- 60° Strike and dip of cleavage or foliation
- 50° Plunge of lineation
- Geological boundary position accurate
- Geological boundary position approximate
- Mine
- Abandoned prospect or mine
- Costean or trench
- Diamond drill hole, including projection
- Unconformity
- Fault
- Thrust Fault
- Plunging antiform
- Plunging synform





91-3297.

142098

5 cm

PASMINCO EXPLORATION
A Division of Pasminco Australia Limited

COMPILED : A.N.L.	E.L. 22/90 - TULLAH
DATE : Sept., 1991	**OUTCROP GEOLOGY**
DRAWN :	
REFERENCE :	
REVISIONS :	
DRAWING No.	SCALE 1:2500 (0 50 100 METRES) — FIG. No. 9

N.W. Coast Computer Aided Drafting Centre. Phone (004 354315) Fax. (004 354495)

6093

142099

APPENDIX 1
FIGURES

10202

381000.mE 382000.mE 383000.mE 384000.mE 385000.mE 386000.mE 387000.mE 388000.mE

145 ° 34' 00" E 145 ° 36' 00" E 145 ° 38' 00" E

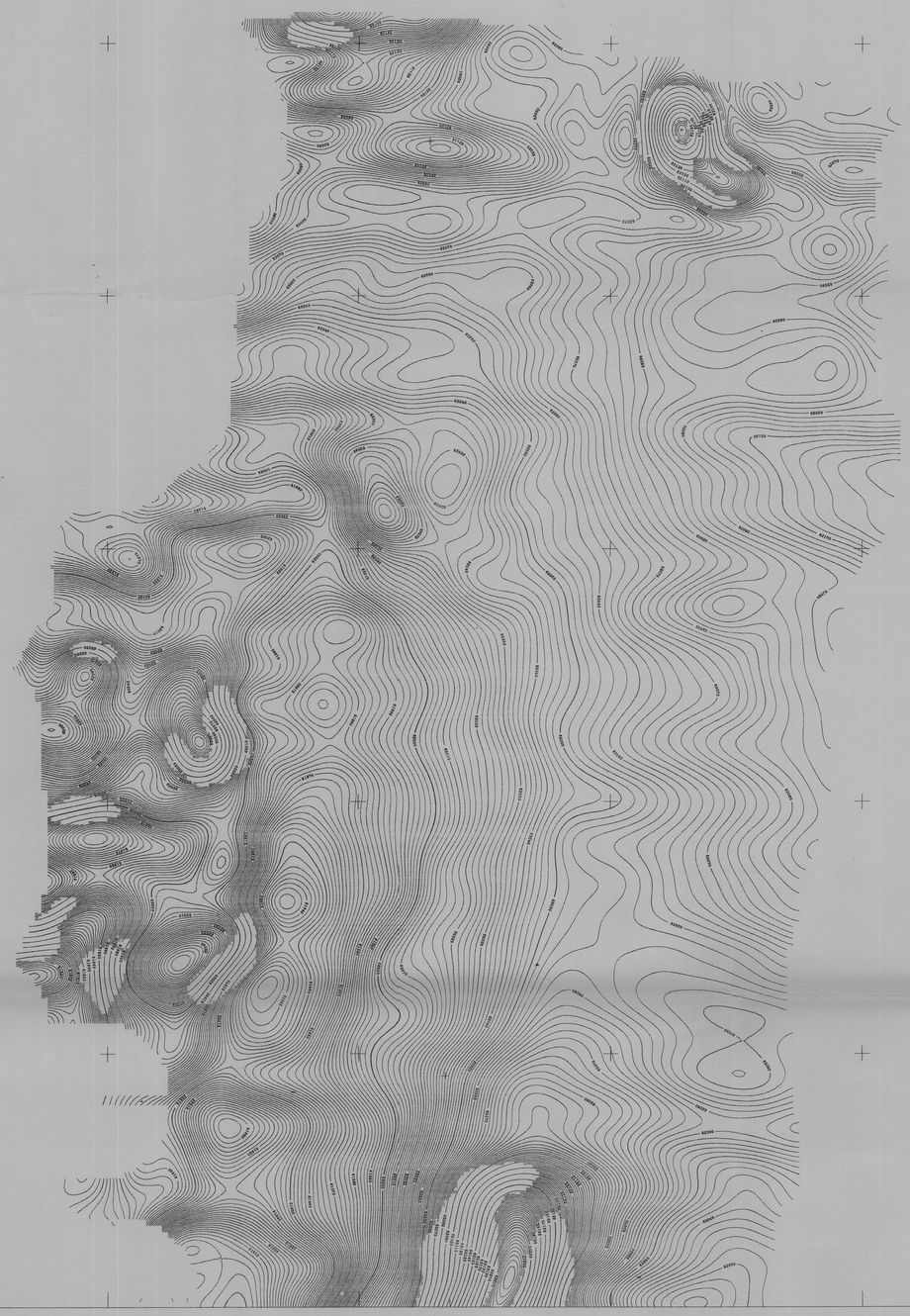
5383000.mN 41 ° 42' 00" S

5382000.mN

5381000.mN

5380000.mN

5379000.mN 41 ° 44' 00" S



145 ° 34' 00" E 145 ° 36' 00" E 145 ° 38' 00" E

381000.mE 382000.mE 383000.mE 384000.mE 385000.mE 386000.mE 387000.mE 388000.mE

142100

AIRBORNE SURVEY EQUIPMENT

Aircraft	Aerospatiale Ecureuil "Squirrel" VH-HRR
Magnetometer	Geometrics G833 Helium Vapour
Magnetometer Resolution	0.01 nT
Magnetometer Sample Interval	0.2 seconds (approx 7 metres)
Data Acquisition	GeoInstruments Model 2000
Data Recording	1.2Mb floppy disk
Spectrometer	Geometrics GR800
Crystal Size	16.4 Litres in downward array
Spectrometer Sample Interval	1.0 Seconds (approx 35 metres)
Flight Path Record	VHS Colour Video System
Flight Path Recovery	Visually onto aerial photographs

AIRBORNE SURVEY SPECIFICATIONS

Flight Line Direction	090 – 270.00 degrees
Flight Line Separation	100 metres
Tie Line Direction	0 – 180 degrees
Tie Line Separation	2000 metres
Terrain Clearance	80 metres (MTC)

Flown by GEOINSTRUMENTS PTY. LTD.

GeoInstruments job number	9101
Survey flown	February 1991
Processed by	Kevron Geophysics

RESIDUAL MAGNETIC CONTOURS

Diurnal variations removed
IGRF(1985) updated to 1991.3 removed
Average survey base station value and a constant of 62000 nT added to datum

Grid mesh 25 x 25 metres

Contour Interval 2, 10, 50, 250 nT

Sheet Index

2
1

N

Grid North

SCALE 1:10,000

0.25 0 0.25 0.5 0.75 1

Kilometres
AUSTRALIAN MAP GRID ZONE 55

PASMINCO EXPLORATION

A Division of Pasminco Australia Limited

EL22/90 – Tullah

Magnetic Intensity Contours

DATE : Jun 1991	REPORT :
DRAWN : Kevron Geophysics	PLAN NO.
SCALE 1: 10000	91-3297.

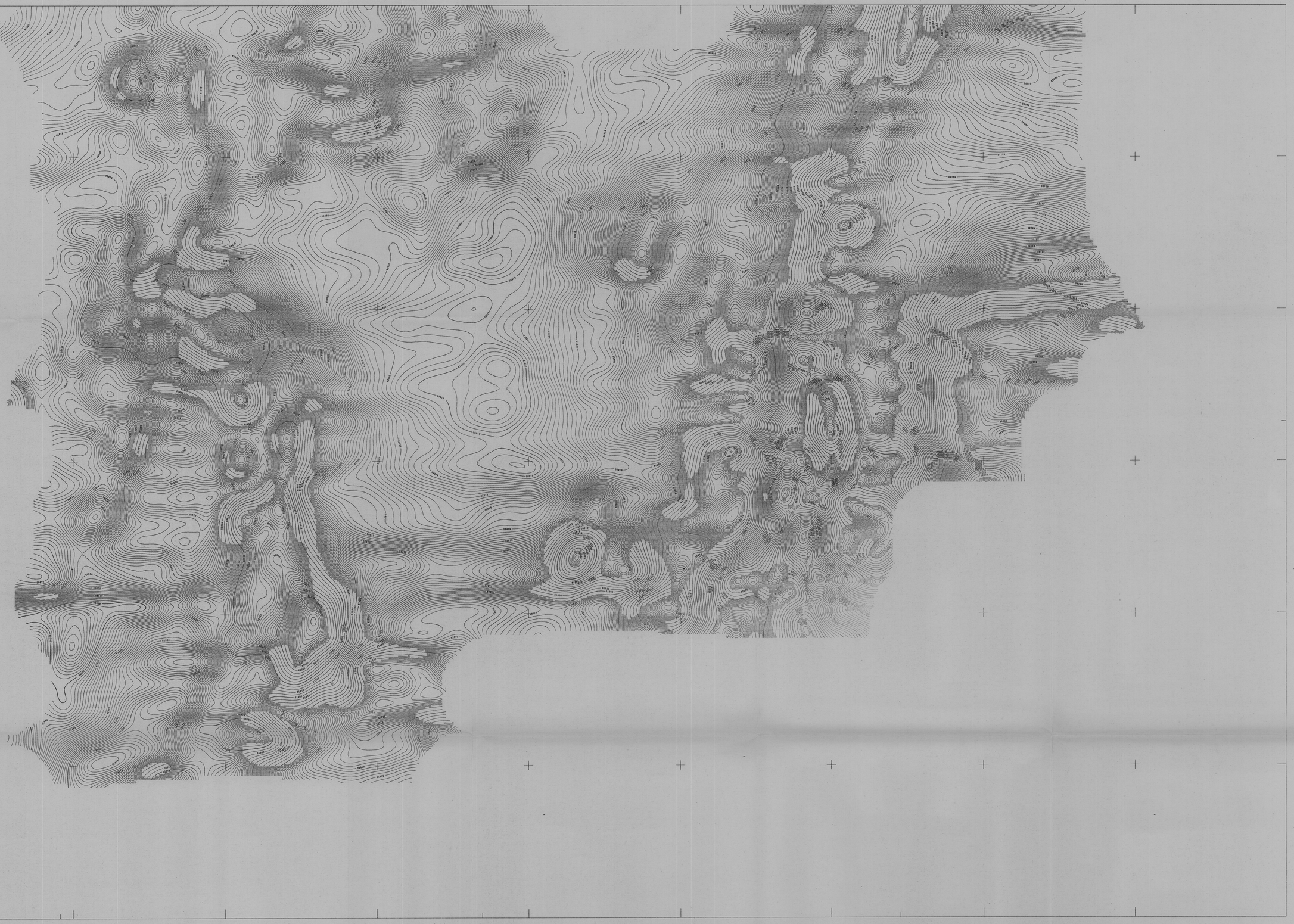
5 cm

16201

381000.mE 382000.mE 383000.mE 384000.mE 385000.mE 386000.mE 387000.mE 388000.mE

145 ° 34' 00" E 145 ° 36' 00" E 145 ° 38' 00" E

5377000.mN 5376000.mN 41 ° 46' 00" S 5375000.mN 5374000.mN 5373000.mN



145 ° 34' 00" E 145 ° 36' 00" E 145 ° 38' 00" E

381000.mE 382000.mE 383000.mE 384000.mE 385000.mE 386000.mE 387000.mE 388000.mE

142101

AIRBORNE SURVEY EQUIPMENT

Aircraft	Aerospatiale Ecureuil "Squirrel" VH-HRR
Magnetometer	Geometrics G833 Helium Vapour
Magnetometer Resolution	0.01 nT
Magnetometer Sample Interval	0.2 seconds (approx 7 metres)
Data Acquisition	GeoInstruments Model 2000
Data Recording	1.2Mb floppy disk
Spectrometer	Geometrics GR800
Crystal Size	16.4 Litres in downward array
Spectrometer Sample Interval	1.0 Seconds (approx 35 metres)
Flight Path Record	VHS Colour Video System
Flight Path Recovery	Visually onto aerial photographs

AIRBORNE SURVEY SPECIFICATIONS

Flight Line Direction	090 – 270.00 degrees
Flight Line Separation	100 metres
Tie Line Direction	0 – 180 degrees
Tie Line Separation	2000 metres
Terrain Clearance	80 metres (MTC)

Flown by GEOINSTRUMENTS PTY. LTD.

GeoInstruments job number	9101
Survey flown	February 1991
Processed by	Kevron Geophysics

RESIDUAL MAGNETIC CONTOURS

Diurnal variations removed
IGRF(1985) updated to 1991.3 removed
Average survey base station value and a constant of 62000 nT added to datum

Grid mesh 25 x 25 metres

Contour Interval 2, 10, 50, 250 nT

Sheet Index

2
1

N

Grid North

SCALE 1:10,000

0.25 0 0.25 0.5 0.75 1

Kilometres

AUSTRALIAN MAP GRID ZONE 55

91-3297.

PASMINCO EXPLORATION

A Division of Pasminco Australia Limited

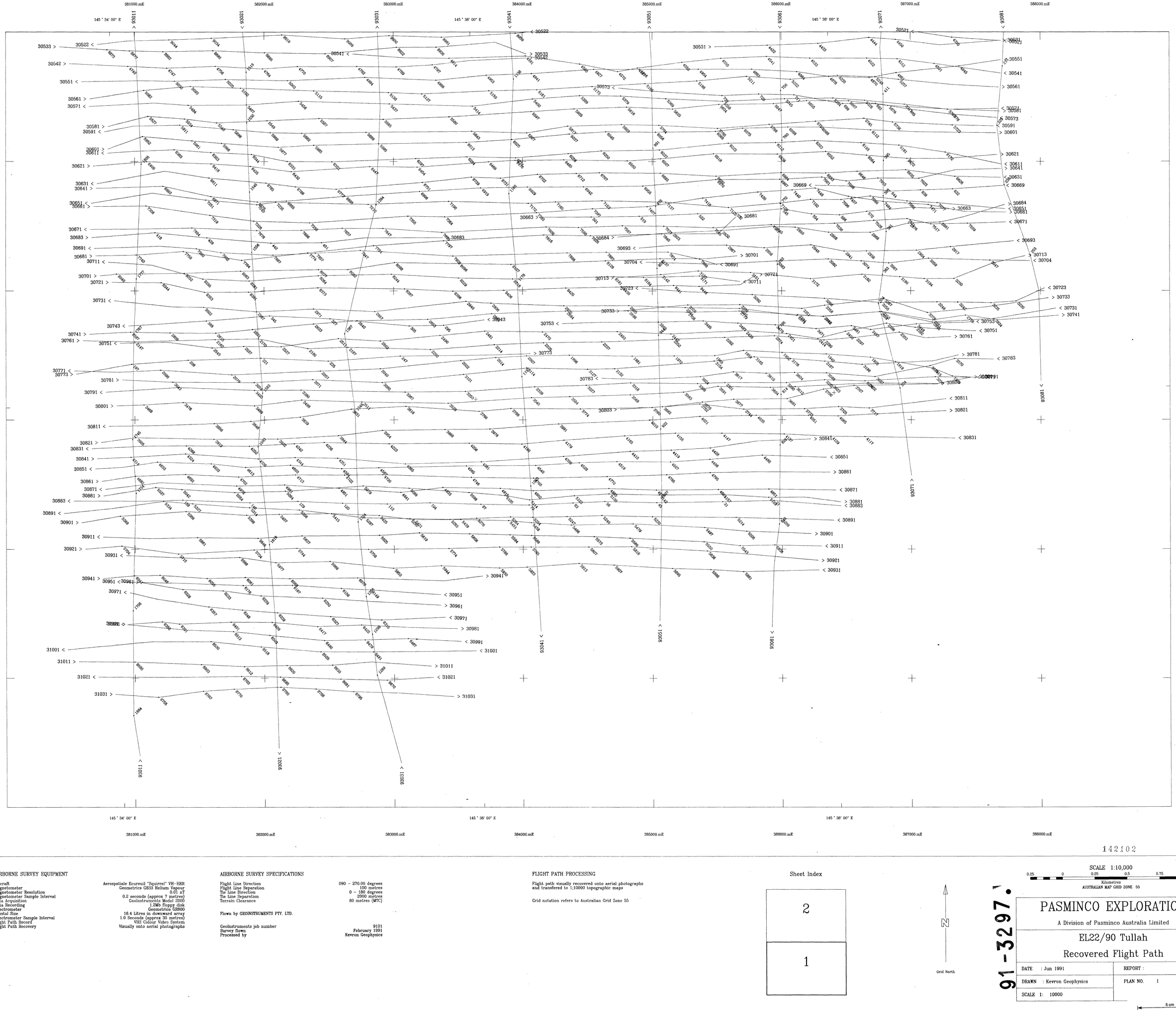
EL22/90 – Tullah

Magnetic Intensity Contours

DATE : Jun 1991	REPORT :
DRAWN : Kevron Geophysics	PLAN NO.
SCALE 1: 10000	

5 cm

142102



AIRBORNE SURVEY EQUIPMENT

Aircraft	Aerospatiale Ecureuil "Squirrel" VH-HRR
Magnetometer	Geometrics G833 Helium Vapour
Magnetometer Resolution	0.01 nT
Magnetometer Sample Interval	0.2 seconds (approx 7 metres)
Data Acquisition	GeoInstruments Model 2000
Data Recording	1.2Mb floppy disk
Spectrometer	Geometrics GR800
Crystal Size	16.4 Litres in downward array
Spectrometer Sample Interval	1.0 Seconds (approx 35 metres)
Flight Path Record	VHS Colour Video System
Flight Path Recovery	Visually onto aerial photographs

AIRBORNE SURVEY SPECIFICATIONS

Flight Line Direction	090 – 270.00 degrees
Flight Line Separation	100 metres
Tie Line Direction	0 – 180 degrees
Tie Line Separation	2000 metres
Terrain Clearance	80 metres (MTC)

Flown by GEOINSTRUMENTS PTY. LTD.

GeoInstruments job number	9101
Survey flown	February 1991
Processed by	Kevron Geophysics

FLIGHT PATH PROCESSING

Flight path visually recovered onto aerial photographs and transfered to 1;10000 topographic maps

Grid notation refers to Australian Grid Zone 55

Sheet Index

SCALE 1:10,000

0.25 0 0.25 0.5 0.75 1

Kilometres
AUSTRALIAN MAP GRID ZONE 55

91-3297.1

PASMINCO EXPLORATION

A Division of Pasminco Australia Limited

EL22/90 Tullah

Recovered Flight Path

DATE : Jun 1991	REPORT :
DRAWN : Kevron Geophysics	PLAN NO. 1
SCALE 1: 10000	

5 cm

10204

381000.mE 382000.mE 383000.mE 384000.mE 385000.mE 386000.mE 387000.mE 388000.mE

145° 34' 00" E 145° 36' 00" E 145° 38' 00" E

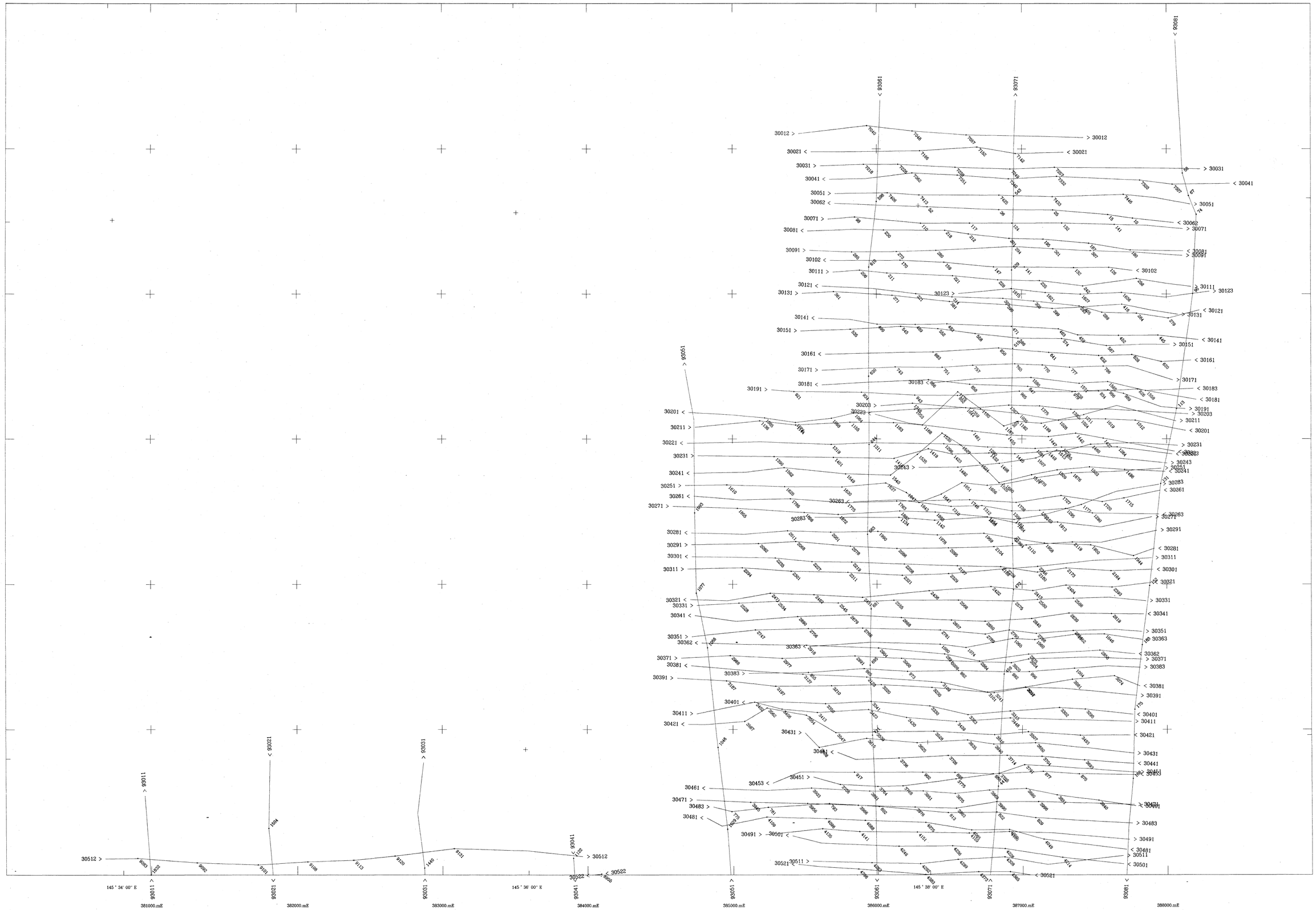
5383000.mN 41° 42' 00" S

5382000.mN

5381000.mN

5380000.mN

5379000.mN 41° 44' 00" S



142103

AIRBORNE SURVEY EQUIPMENT

Aircraft	Aerospatiale Ecureuil "Squirrel" VH-HRR
Magnetometer	Geometrics G833 Helium Vapour
Magnetometer Resolution	0.01 nT
Magnetometer Sample Interval	0.2 seconds (approx 7 metres)
Data Acquisition	GeoInstruments Model 2000
Data Recording	1.2Mb floppy disk
Spectrometer	Geometrics GR500
Crystal Size	16.4 Litres in downward array
Spectrometer Sample Interval	1.0 Seconds (approx 35 metres)
Flight Path Record	VHS Colour Video System
Flight Path Recovery	Visually onto aerial photographs

AIRBORNE SURVEY SPECIFICATIONS

Flight Line Direction	090 – 270.00 degrees
Flight Line Separation	100 metres
Tie Line Direction	0 – 180 degrees
Tie Line Separation	2000 metres
Terrain Clearance	80 metres (MTC)

Flown by GEOINSTRUMENTS PTY. LTD.

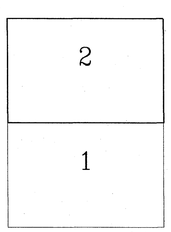
GeoInstruments job number	9101
Survey flown	February 1991
Processed by	Kevron Geophysics

FLIGHT PATH PROCESSING

Flight path visually recovered onto aerial photographs and transfered to 1;10000 topographic maps

Grid notation refers to Australian Grid Zone 55

Sheet Index



SCALE 1:10,000

0.25 0 0.25 0.5 0.75 1

Kilometres
AUSTRALIAN MAP GRID ZONE 55

91-3297

PASMINCO EXPLORATION

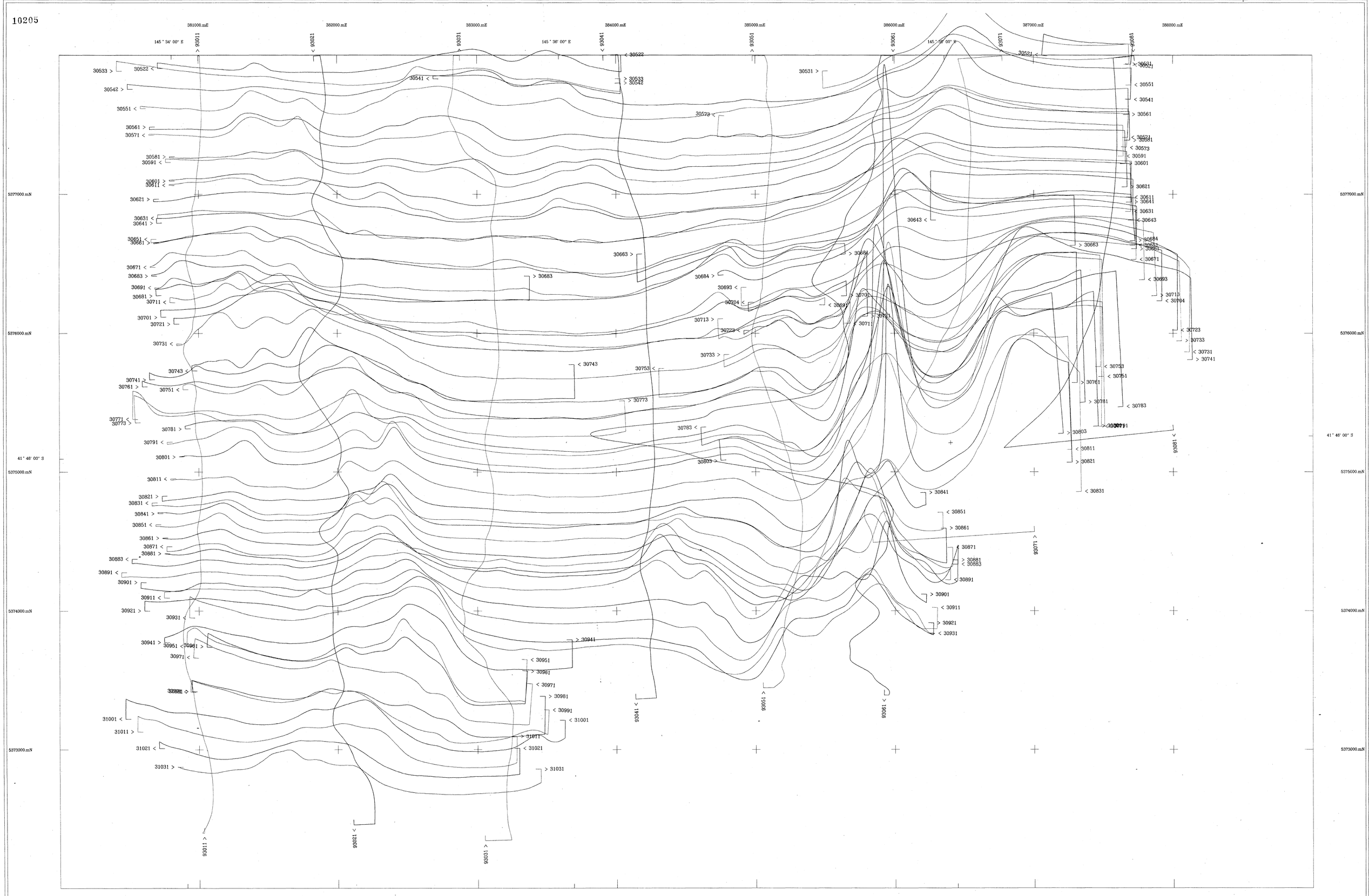
A Division of Pasminco Australia Limited

EL22/90 Tullah

Recovered Flight Path

DATE : Jun 1991	REPORT :
DRAWN : Kevron Geophysics	PLAN NO. 2
SCALE 1: 10000	5 cm

10205



142104

AIRBORNE SURVEY EQUIPMENT

Aircraft	Aerospatiale Ecureuil "Squirrel" VH-HRR
Magnetometer	Geometrics G833 Helium Vapour
Magnetometer Resolution	0.01 nT
Magnetometer Sample Interval	0.2 seconds (approx 7 metres)
Data Acquisition	GeoInstruments Model 2000
Data Recording	1.2Mb floppy disk
Spectrometer	Geometrics GR800
Crystal Size	16.4 Litres in downward array
Spectrometer Sample Interval	1.0 Seconds (approx 35 metres)
Flight Path Record	VHS Colour Video System
Flight Path Recovery	Visually onto aerial photographs

AIRBORNE SURVEY SPECIFICATIONS

Flight Line Direction	090 - 270.00 degrees
Flight Line Separation	100 metres
Tie Line Direction	0 - 180 degrees
Tie Line Separation	2000 metres
Terrain Clearance	80 metres (MTC)

Flown by GEOINSTRUMENTS PTY. LTD.

GeoInstruments job number	9101
Survey flown	February 1991
Processed by	Kevron Geophysics

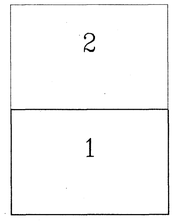
STACKED MAGNETIC PROFILES

Diurnal variations removed
IGRF(1985) updated to 1991.3 removed
Average survey base station value and a constant of 62080 nT added to datum

Base Value 62000 nT

Vertical Scale 50 nT/cm

Sheet Index





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Kilometres
AUSTRALIAN MAP GRID ZONE 55

91-3297

PASMINCO EXPLORATION

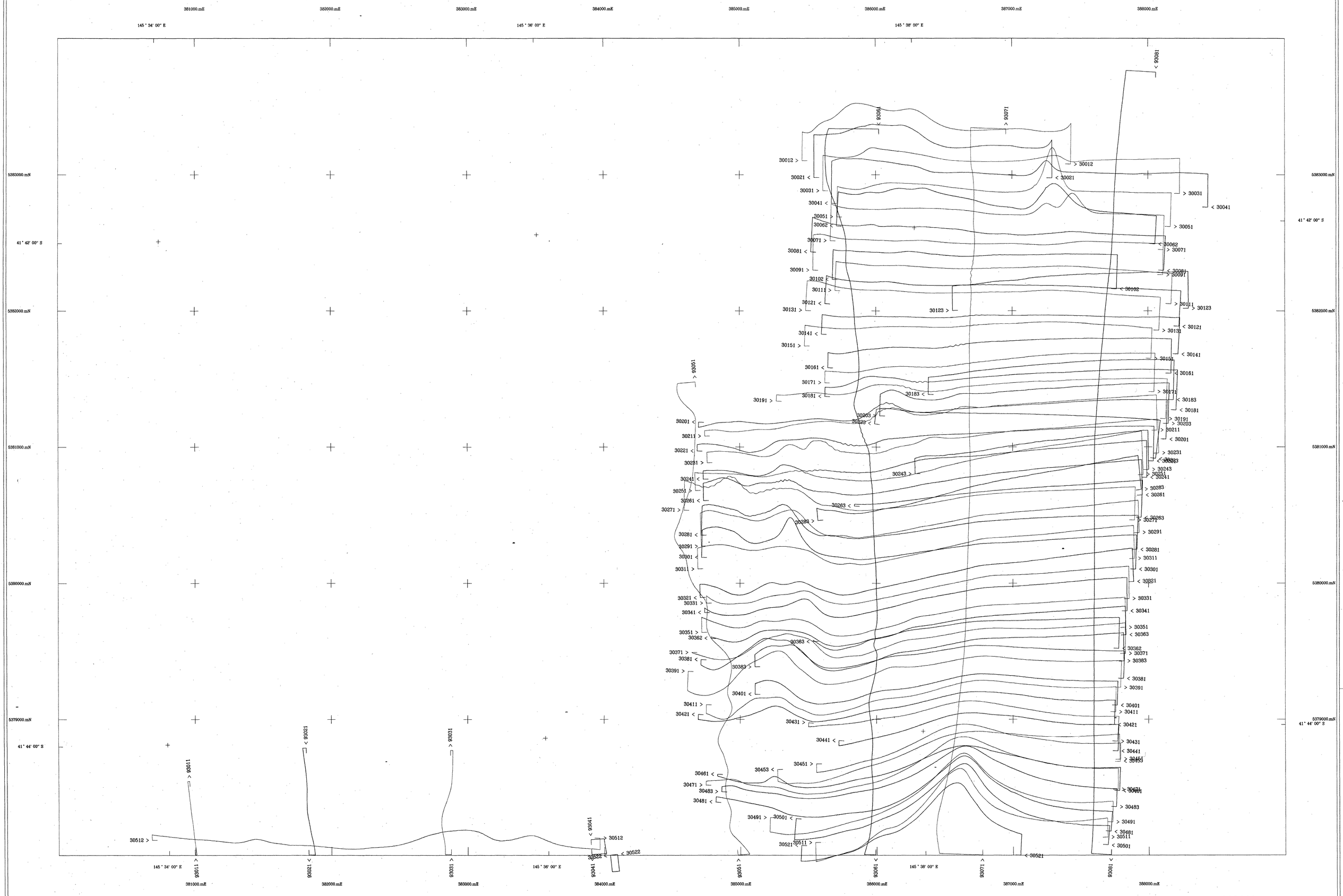
A Division of Pasminco Australia Limited

EL22/90 - Tullah

Magnetic Intensity Stacked Profiles

DATE : Jun 1991	REPORT :
DRAWN : Kevron Geophysics	PLAN NO. 1
SCALE 1: 10000	5 cm

10206



142105

AIRBORNE SURVEY EQUIPMENT

Aircraft	Aerospatiale Ecureuil "Squirrel" VH-HRR
Magnetometer	Geometrics GR33 Helium Vapour
Magnetometer Resolution	0.01 nT
Magnetometer Sample Interval	0.2 seconds (approx 7 metres)
Data Acquisition	Geoinstruments Model 2000
Data Recording	1.2Mb floppy disk
Spectrometer	Geometrics GR800
Crystal Size	16.4 Litres in downward array
Spectrometer Sample Interval	1.0 Seconds (approx 35 metres)
Flight Path Record	VHS Colour Video System
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AIRBORNE SURVEY SPECIFICATIONS

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Flown by GEOINSTRUMENTS PTY. LTD.

Geoinstruments job number	9101
Survey flown	February 1991
Processed by	Kevron Geophysics

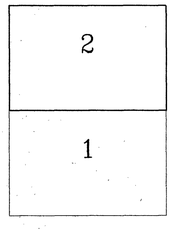
STACKED MAGNETIC PROFILES

Diurnal variations removed
IGRF(1985) updated to 1991.3 removed
Average survey base station value and a constant of 62000 nT added to datum

Base Value 62000 nT

Vertical Scale 50 nT/cm

Sheet Index





SCALE 1:10,000

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Kilometres
AUSTRALIAN MAP GRID ZONE 55

91-3297

PASMINCO EXPLORATION

A Division of Pasminco Australia Limited

EL22/90 – Tullah

Magnetic Intensity Stacked Profiles

DATE : Jun 1991	REPORT :
DRAWN : Kevron Geophysics	PLAN NO. 2
SCALE 1: 10000	

5 cm