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EXPLORATION LICENCE 22/83

MOOREY MOUNTAIN, TASMANIA

FINAL REPORT

**OPEN FILE**

**MICROFILMED**

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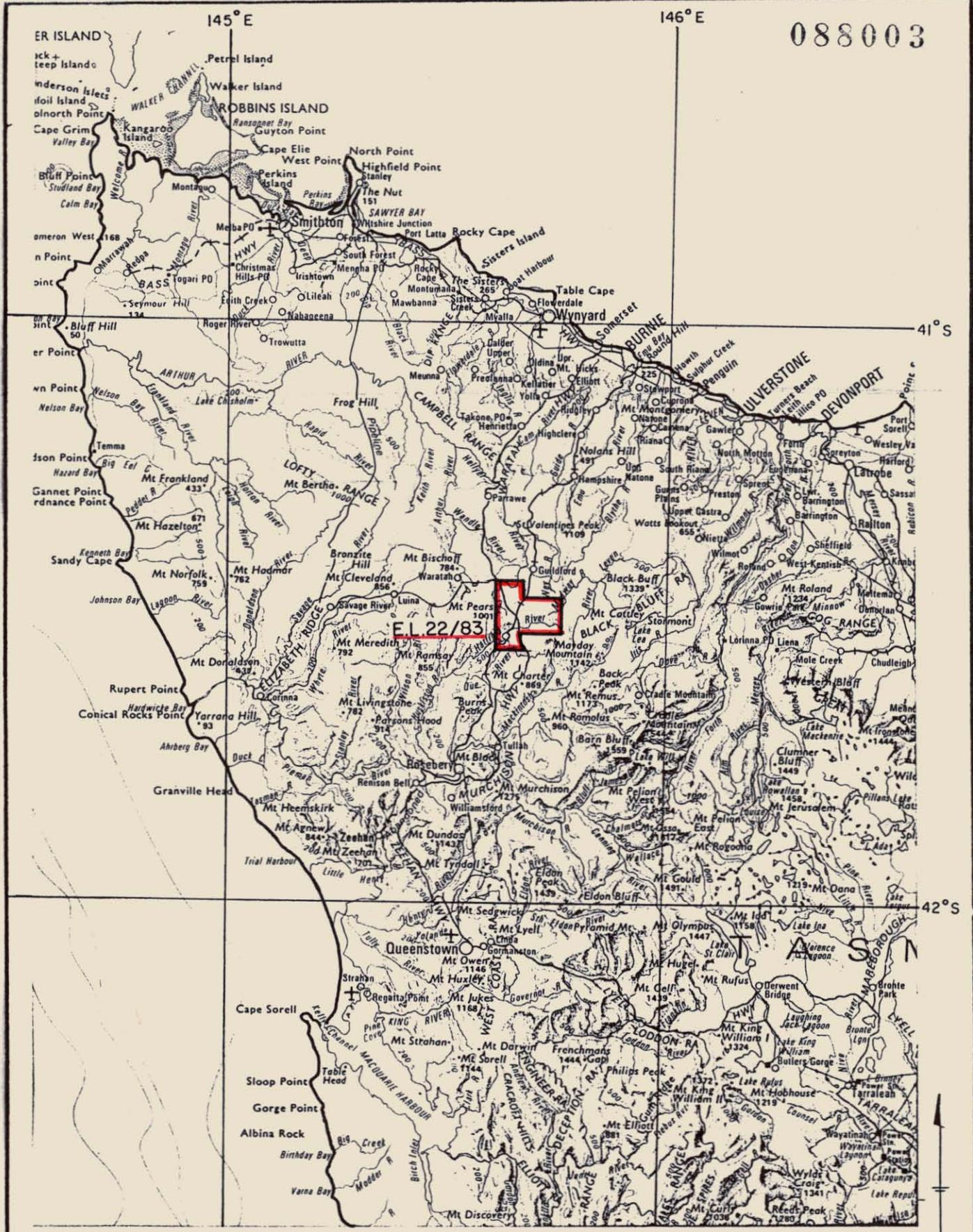
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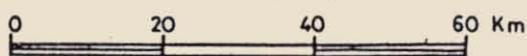
- Appendix 1 EM37 Survey Data - Anomalies S and T.

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5 cm

Scale 1:1,000,000



Centre  
Melbourne

Date:  
26-1-84

THE BROKEN HILL PROPRIETARY CO. LTD.  
E.L. 22/83, MOOREY MOUNTAIN, N.W. TASMANIA.

LOCATION MAP

Project N<sup>o</sup>:  
T69

Drawing N<sup>o</sup>:  
A4-2443

1. GENERAL

Exploration Licence 22/83 of 110 square kilometres was granted to the Broken Hill Proprietary Company Limited on 1st October, 1983. It was located contiguous with and on the eastern side of our pre-existing Waratah licence area (E.L. 33/79).

Exploration during the period of tenure was restricted to the testing of two aeromagnetic anomalies by ground EM geophysical surveys. Results were negative.

Following a reappraisal of our overall regional effort we submitted notification of our intention to relinquish title on 26th June, 1985.

Because it was anticipated that relinquishment was imminent, no annual report was completed for the year ending 1st October, 1984. This Final Report covers all exploration work carried out by BHP.

2. RATIONALE

Regionally the principal target was a massive sulphide carbonate-hosted tin deposit of the Renison type. Suitable host rocks are presumed to extend beneath the blanket of Tertiary basalt which covers most of the licence area.

Our exploration was largely dependent upon the generation of drill targets by interpretation of geophysical anomalies.

An extension of the Mt. Read volcanic belt is projected within the licence area under basalt cover. However, volcanogenic base metal mineralisation did not constitute a definite target during our period of tenure.

### 3. REGIONAL GEOLOGY

No new geological information was obtained during the course of the current exploration programme; the brief comments that follow are based on those of previous investigators and on Geological Survey work on the Mackintosh and St. Valentines sheets.

Most of the licence area ( 90%) is covered by a variable thickness of Tertiary basalt, probably averaging around 200 metres. Outcrops of Ordovician conglomerate and sandstone protrude above the basalt plain at Mt. Pearse and Moorey Mountain, defining the nose of a major syncline. Small isolated outcrops have also been reported in the upper reaches of the Hellyer River.

The Cambrian sequence to the south of the EL includes a mudstone-greywacke sequence in the Hatfield River valley, partially tuffaceous with quartzite and minor conglomerate units. Undifferentiated lavas, pyroclastics and sediments are adjacent to the east, with subordinate quartz-feldspar porphyries. Shales of the Que River Beds, associated with undifferentiated volcanics, can be projected on a north easterly trend towards the southeast corner of the licence area.

This southern Cambrian sequence can be broadly correlated with a mixed sequence of dominantly extrusive felsic to intermediate volcanic and sedimentary rocks in the Companion Hill-St. Valentines Peak area to the northeast. In the intervening basalt-covered terrain the extent of overlying Ordovician to Devonian sediments is unknown, but probably considerable.

The Cambrian volcanics and sediments are overlain unconformably by an apparently conformable Ordovician to Siluro-Devonian sequence comprising correlates of the Denison and Gordon Sub-Groups and the Eldon Group.

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Outcrop lithologies are dominated by quartz-sandstone and conglomerate.

Major open Devonian folding along NNE and northerly trends is the main structural influence on the area, with some important east trending cross folds. In addition to the northeasterly trend parallel to bedding there are several northwest trending lineaments apparent on the aeromagnetic data; their significance and relation to the sub-basalt geology is unclear.

#### 4. PREVIOUS WORK

North Prospecting Pty. Ltd. held EL 1/75 and put down three diamond drill holes in the area immediately north of EL 22/83. All failed to penetrate the basalt cover, the deepest hole reaching 152 metres.

Comalco held EL 1/76, with Shell farming in to the area in 1980. The southern portion of this licence was relinquished in 1983, and then granted to BHP as EL 22/83. Prior to 1980 Comalco carried out a regional stream geochemical survey; several anomalies were investigated but none proved to be of major interest. Some detailed work was carried out in the St. Valentines Peak-Blythe Road area but no significant exploration was done in that area covered by this report.

Exploration carried out by The Shell Company of Australia Ltd. was directed towards locating Bischoff-style pyrrhotite (pyrite)-cassiterite deposits or Moina/Kara style magnetite-cassiterite-scheelite deposits. A helicopter magnetic and radiometric survey was flown by Geometrics in March 1980 with a flight line spacing of 250 metres. Enhancement methods were attempted to highlight deeper sources; these included upward continuation and spectral analysis. Interpretation problems are caused by the very variable magnetic properties of the basalt, which is known to have a wide range of magnetic remanent magnitudes and directions.

Various methods of estimating basalt thickness were also tried, including resistivity, TEM and AMT soundings. The different geophysical sounding methods applied appear to give generally consistent results, strongly suggesting that the Tertiary basalt exceeds 200 metres in thickness over most of the EL. One percussion/diamond hole was drilled on the Hellyer River West anomaly, some 7km northeast of Mt. Pearse. This was stopped at 197.6 metres in basalt and a basalt-filled valley was accepted as being the cause of the magnetic anomalism.

#### 5. GEOPHYSICS

A regional aeromagnetic survey was flown by Geometrics in January 1982, to cover BHP's Waratah (EL 33/79) and Wynyard (EL 23/79) licence areas. A 250 metre line spacing was used with a mean sensor terrain clearance of 90 metres. An overlap to the east gave coverage of a belt some 3-4 kilometres wide on the western side of the subsequent Moorey Mountain EL 22/83. Data from the Tasmanian Mines Department West Coast aeromagnetic survey also became available in mid 1982 (500 metre line spacing).

Initially, prospective magnetic anomalies were identified from the airborne survey by displaying the gridded data on an image processor and using standard enhancement techniques to emphasise "deep-seated" magnetic sources. Spectral analysis was then applied to the measured magnetic profiles across these anomalies to determine an approximate depth to source and the thickness of the overlying basalt.

During the 1982-83 summer field season 8 boreholes were drilled in the Waratah/Wynyard licences, mainly to test aeromagnetic anomalies but also to give stratigraphic information on the range and distribution of basement lithologies. It became clear after this phase of work that the basalt cover does exceed 200 metres in thickness over large parts of the region.

Prior to the commencement of the 1983-84 fieldwork further interpretation of the detailed aeromagnetic data was carried out and promising anomalies with probable basement sources were identified. Two anomalies within EL 22/83 were selected for further testing; These were designated as Anomaly S, located 3km SE of Mt. Pearse, and Anomaly T, 3km NNE of Mt./ Pearse.

It was decided to apply a filtering technique to our exploration work, by doing preliminary EM37 geophysical surveys on cut lines in an attempt to define conductors that could be drill tested. Surveys conducted by Geoterrex Pty. Ltd. using this transient EM system were carried out over anomalies S and T. In the event, no indication of any sub-basalt conductors was obtained so no further work was considered warranted. Soundings in each anomalous area gave an interpretative estimate of basalt thickness.

Details of the EM37 surveys are presented in Appendix 1.

## 6. CONCLUSIONS

No drilling was carried out on EL 22/83, but testing of targets in adjacent licence areas and a regional assessment strongly suggest that the basalt cover commonly exceed 200 metres in thickness over large areas. Given the interpretation problems it is clear that testing geophysical anomalies at these depths constitutes very high risk and costly exploration.

In addition to the technical problems the latter years of licence tenure also coincided with a general decline in exploration interest directed towards tin as a commodity target. As our identified priority anomalies had either been drill tested or proven non-conductive it was felt that further exploration expenditure in the region could not be justified.

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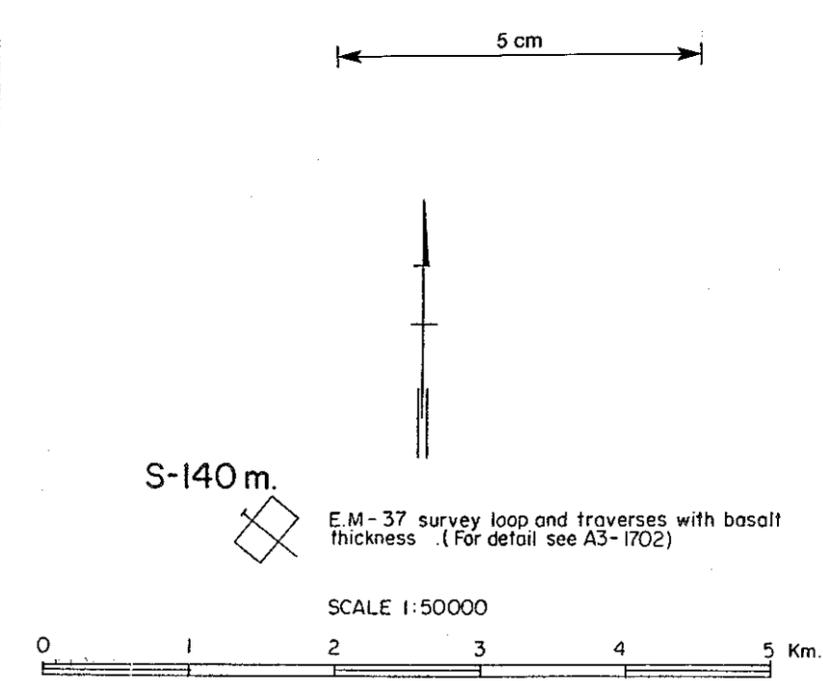
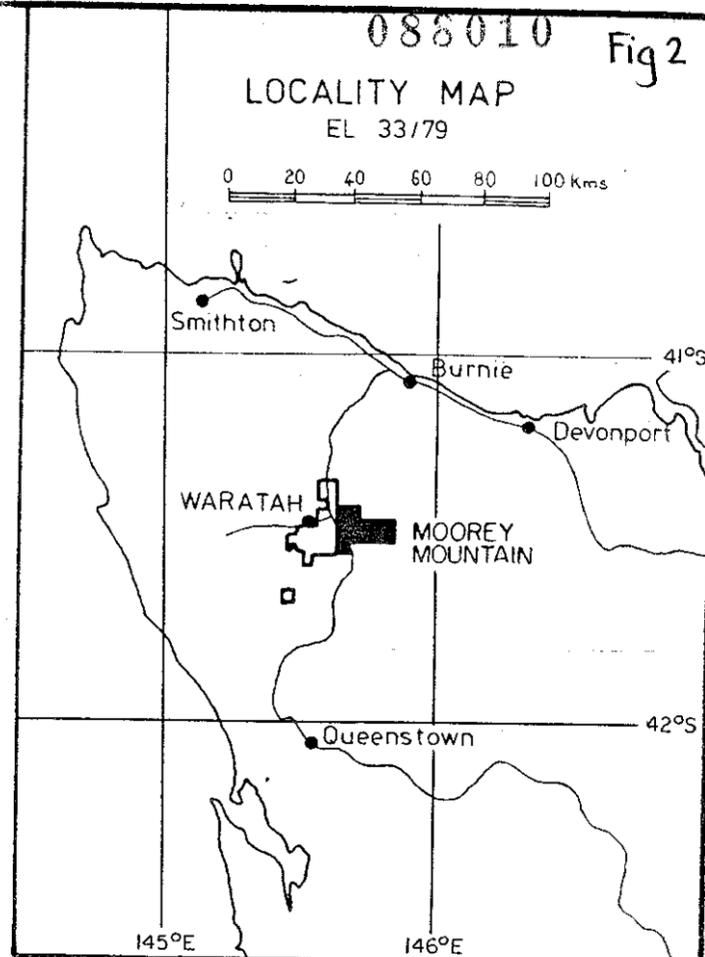
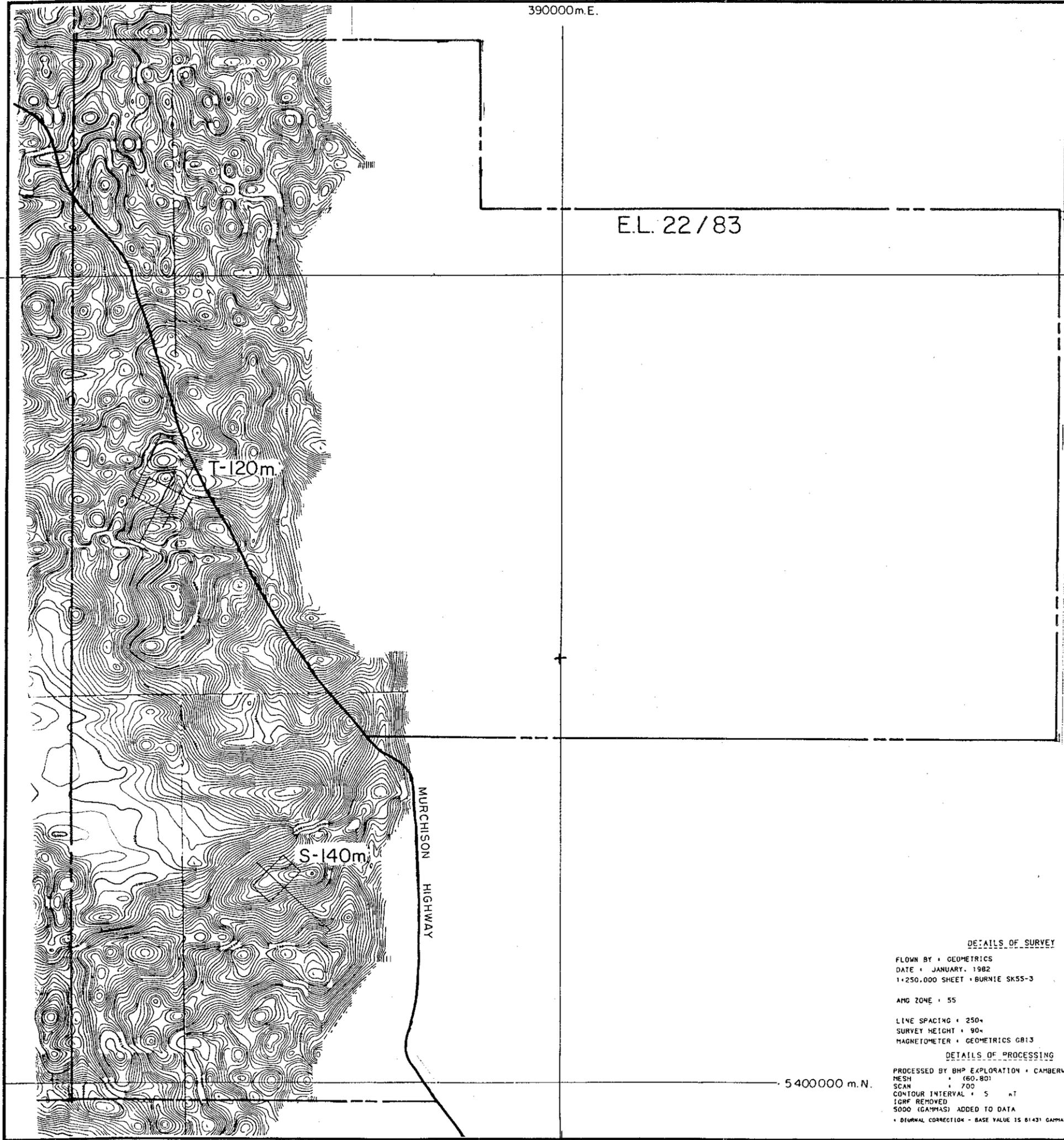
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7. EXPENDITURE

Total Expenditure to the end of July, 1985 was:

Wages and Salaries	2,174
Field Support	721
Vehicles	1,249
Geophysics	7,049
Surveys	2,953
Tenement Fees	1,581
Drafting	190
Other	315
Administrative Charges	1,623
	<hr/>
	17,855

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**DETAILS OF SURVEY**

FLOWN BY • GEOMETRICS  
 DATE • JANUARY, 1982  
 1:250,000 SHEET • BURNIE SK55-3

ANG ZONE • 55

LINE SPACING • 250+  
 SURVEY HEIGHT • 90+  
 MAGNETOMETER • GEOMETRICS G813

**DETAILS OF PROCESSING**

PROCESSED BY BHP EXPLORATION • CAMBERWELL  
 MESH • (60,80)  
 SCAN • 700  
 CONTOUR INTERVAL • 5 mT  
 10RF REMOVED  
 5000 (GAMMAS) ADDED TO DATA  
 • DIURNAL CORRECTION - BASE VALUE IS 61431 GAMMAS

24-10-82

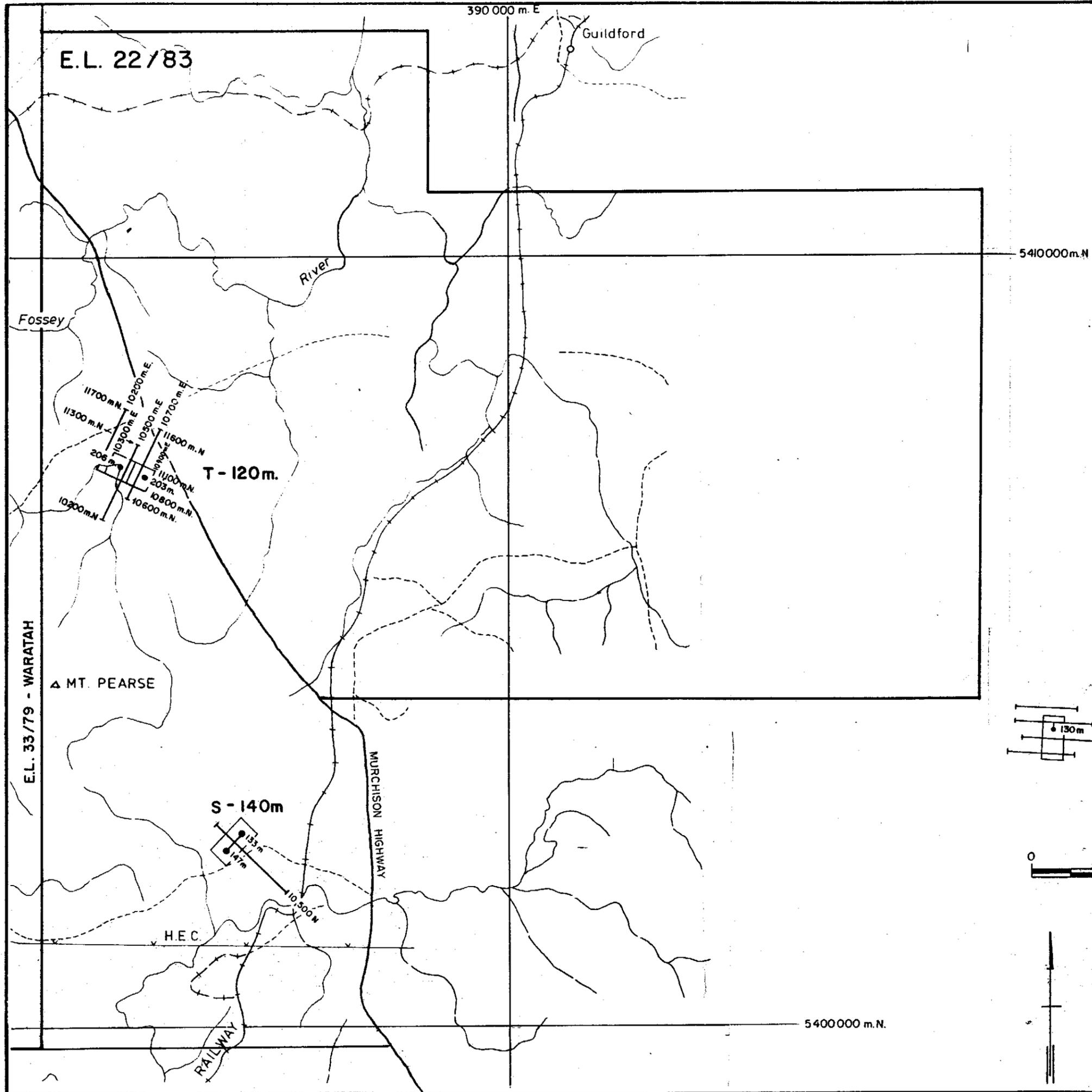
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EXPLORATION DEPARTMENT

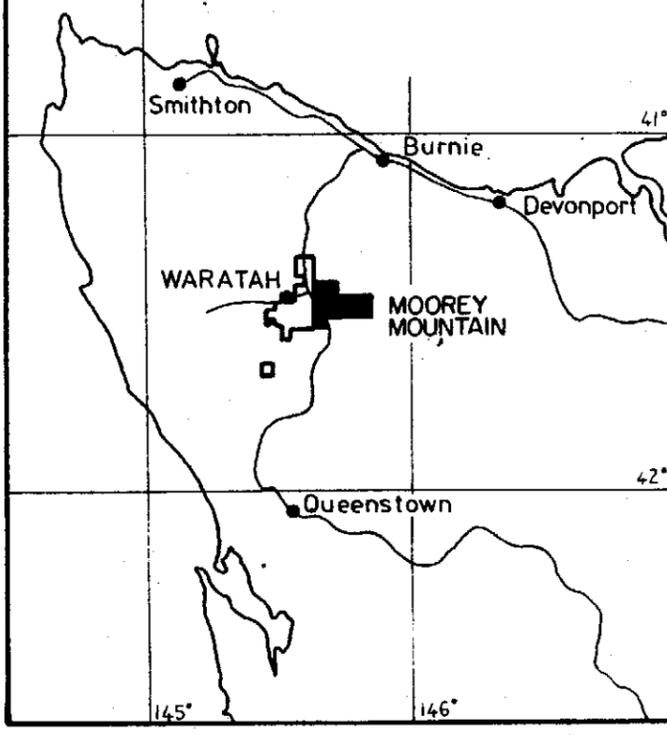
E.L. 22/83-MOOREY MOUNTAIN, TAS.  
**TOTAL MAGNETIC INTENSITY  
CONTOURS (WESTERN AREA)**

Revisions:	Prepared by: A. Clarke	Centre: Melbourne
	Date: Aug. 85	Project No: T69
	Drawn: C. Osborne	Drawing No: A3-1701

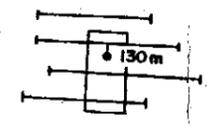
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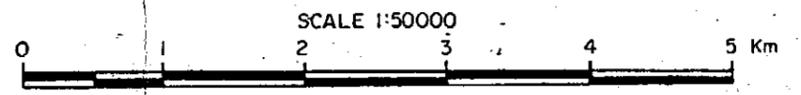
088011 Fig.3  
 LOCALITY MAP  
 EL 33/79  
 0 20 40 60 80 100 Kms



5 cm

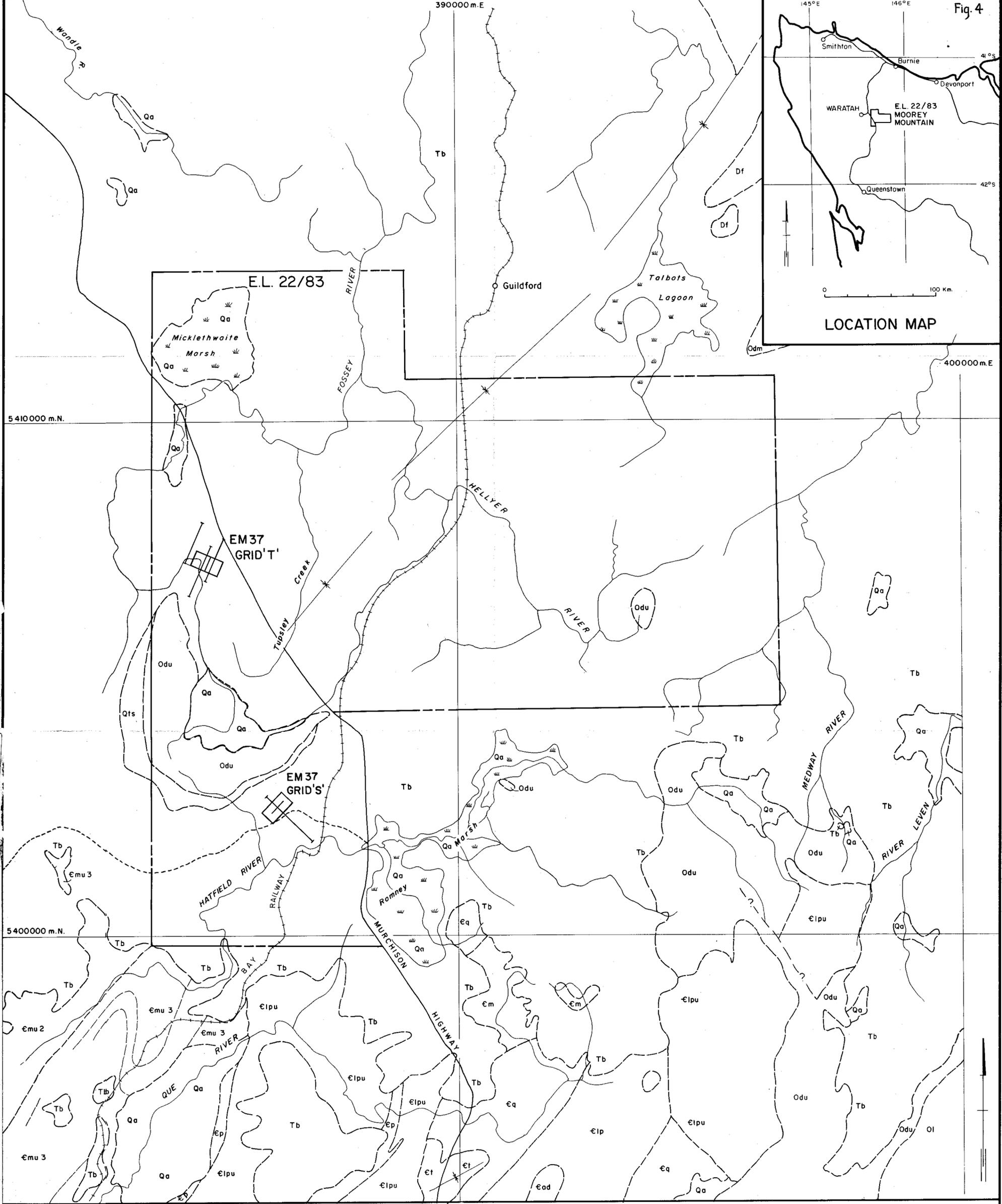
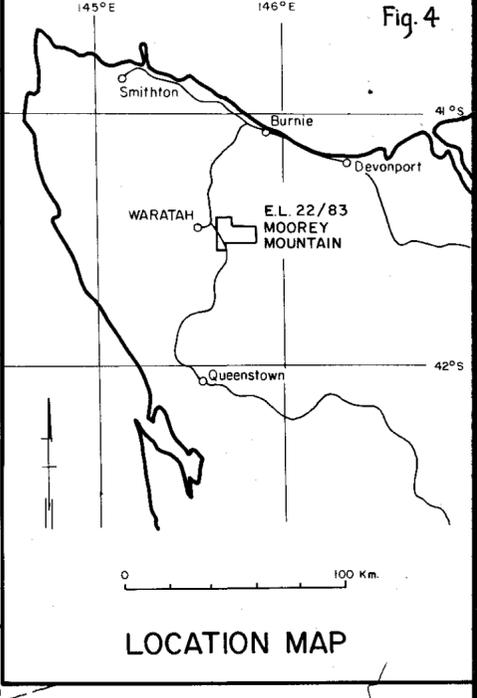


E.M.-37 survey loop and traverses and  
 E.M.-37 sounding site with basalt thickness (interp.)

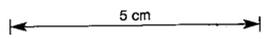


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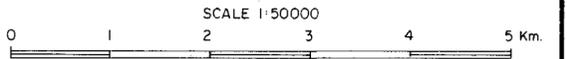
THE BROKEN HILL PROPRIETARY CO. LTD. EXPLORATION DEPARTMENT		
E.L. 22/83-MOOREY MOUNTAIN, TAS. LOCATION OF EM-37 LOOPS		
Prepared by: A. Clarke	Centre: Melbourne	
Date: Aug. 85	Project No:	Drawing No:
Drawn: C. Osborne	T69	A3-1702



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Note: Geology on this map derived in part from Dept. of Mines Unpubl. Rep. - 1982/46 (A.V. Brown) Dept. of Mines Mackintosh sheet (1:63360)



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EXPLORATION DEPARTMENT

E.L. 22/83 - MOOREY MOUNTAIN, TAS.  
**REGIONAL GEOLOGY**

Drawn: A. Clarke	Date: 9 9 85	Centre: Melbourne
Traced: C. Osborne	Project No: T69	Drawing No: A2-1546
Checked:		

QUATERNARY	Qfs	Sand, gravel, basalt talus	
	Qa	Younger alluvium, swamp and marsh deposits	
TERTIARY	Tb Ts	Basalt (Tb) with deposits (Ts) of sand and gravel, some leaf bearing.	
	Tb	IGNEOUS ROCKS - Olivine basalt (Correlate of Moire sandstone) (Odm)	
SILURIAN	Eldon group Correlate	Df	Quartz sandstone with minor siltstone (Correlate of Florence Quartzite)
	Gordon Sub-Group Correlate	Oj	Fossiliferous limestone and impure limestone, variable texture. Magnetite skarn indicated. Bioturbated sandstone and minor conglomerate
ORDOVICIAN	Denison Sub-Group Correlate	Odu	Dominantly siliceous conglomerate (Odc)
		Ods	Dominantly quartz sandstone with minor siliceous conglomerate (Ods)

Mount Read Volcanics Correlate	€m	Mixed sequence of dominantly extrusive felsic to intermediate volcanic and sedimentary rocks
	€mu 2	Greywacke-mudstone sequence of Hatfield River.
	€mu 3	Mudstone-quartzite-greywacke and tuffaceous greywacke-mudstone sequence of the Bulgobac-Pinnacles area with conglomerate horizons indicated.
	€t	Tuff and minor agglomerate.
	€q	Que River Beds, with basal (?) agglomerate indicated. Shale horizons in volcanic sequences
IGNEOUS ROCKS		
	€lp	Feldspar-phyric and minor quartz-phyric lavas and pyroclastic rocks with dominant pyroclastic sequence indicated
	€lpu	Undifferentiated lavas, pyroclastic rocks and sediments
	€p	Quartz-feldspar porphyry
	€ad	Andesite-dacite

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APPENDIX 1

EM 37 SURVEY DATA - ANOMALIES S AND T

GEONICS LIMITEDEM37 Ground Transient Electromagnetic System  
Technical SpecificationsTransmitter

- Current Waveform - See Fig. 1
- Repetition rate - 3Hz or 30Hz in countries using 60Hz power line frequency; 2.5Hz or 25Hz in countries using 50Hz power line frequency; all four base frequencies are switch selectable.
- Turn-off time ( $\Delta t$ ) - fast linear turn-off of maximum 300  $\mu$ sec. at 20 amps into 300x600m loop. Decreases proportionally with current and (loop area)<sup>1/2</sup> to minimum of 20  $\mu$ sec. Actual value of  $\Delta t$  read on front panel meter.
- Transmitter loop - any dimensions from 40x40m to 300x600m maximum at 20 amps. Larger dimensions at reduced current. Transmitter output voltage switch adjustable for smaller loops. Value of loop resistance read from front panel meter; resistance must be greater than 1 ohm on lowest voltage setting to prevent overload.
- Transmitter protection - circuit breaker protection against input over-voltage; instantaneous solid state protection against output short circuit; automatically resets on removal of short circuit. Input voltage, output voltage and current indicated on front panel meter.
- Transmitter output voltage - 150 volts (zero to peak) maximum;  
20 volts (zero to peak) minimum
- Transmitter output power - 2.8 kw maximum.
- Transmitter wire supplied - 1800m. #10 copper wire PVC insulated with nylon jacket; transmitter wire contained on 6 reels (supplied); 2 reel winders supplied.
- Transmitter motor generator - 5 HP Honda gasoline engine coupled to 120 volt, 3 phase, 400Hz alternator. Approximately 8 hours continuous operation from full (built-in) fuel tank

## Receiver

- 014
- Measured quantity - time rate of decay of magnetic flux along 3 axes.
  - Sensor - air-cored coil of bandwidth 40 kHz; 100cm dia. by 7x5cm cross-section. Coil holder supplied to facilitate measurement along 3 axes.
  - Time channels - 20 time channels with locations and widths as shown in Fig. 2. Successive operation at 30Hz, then 3Hz, effectively gives 30 channels covering range from 80  $\mu$ sec. to 80 msec.
  - Output display - 4 digit plus sign LED display; display also shows channel number and gain.
  - Integration time -  $2^n$  cycles at 30Hz; n=4,6,8,10,12,14 (switch selectable); similar integration times at other base frequencies.
  - Receiver output noise referred to input - typically  $1.5 \times 10^{-10}$  volt/m<sup>2</sup> at last gate at 30Hz with integration time of 34 seconds. Noise will be higher during intense local spherics activity.
  - Output connector - all 20 channels in analogue format and house-keeping functions in digital format available from output connector.
  - Synchronization to Tx - any of the following (switch selectable)
    - (1) reference cable
    - (2) primary pulse
    - (3) 27 MHz radio link (40 channels)
    - (4) high stability (oven controlled) quartz crystals.
  - Noise rejection circuitry - Selective clipping of atmospheric noise pulses at all times. Audio output of Rx coil (transmitter pulse blanked out) is available on built-in loud speaker for ready identification of interference.
  - Receiver batteries - 12 volt rechargeable Gel-cell; 9 hours continuous operating time at 17°C. Two batteries and a battery charger supplied to permit charging of ground battery from transmitter motor-generator during survey.

Component Dimensions

Transmitter console	25x42x56 cm
GPU	35x74x48 cm
Wirewinder	42x38x35 cm each (2 off)
Wire reels (20 amp)	33x31 (dia.) cm each (6 off)
Receiver console	38x37x27 cm
Receiver coil	100 cm dia. 7x5 cm cross-section

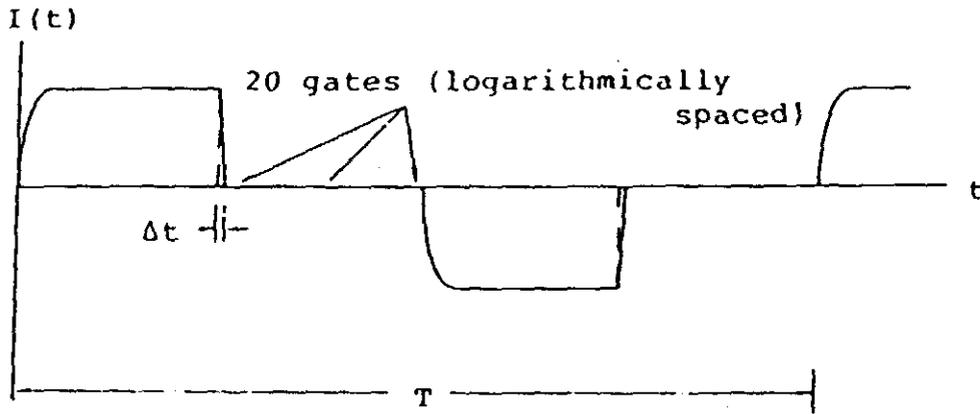
Component Weights

Transmitter console	20 kg
GPU	60 kg
Wirewinders and loaded reels (20 amp)	120 kg (total)
Receiver console (incl. 20 amp-hour battery)	21.8 kg
Receiver coil	8.0 kg

Shipping Information

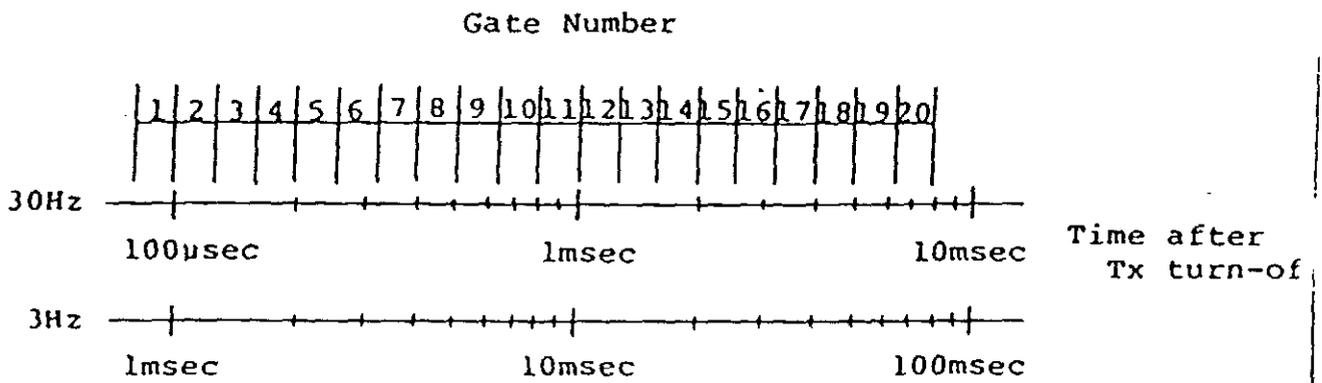
Shipment consists of 5 boxes

Two wire boxes	116x62x48 cm @ 186 kg (total)
GPU box	96x61x73 cm @ 90 kg
Receiver/transmitter box	96x75x73 cm @ 86 kg
Receiver coil/coil-holder box	110x110x20 cm @ 34 kg
Total shipping volume	1.90 cubic metres
Total shipping weight	390 kg



Transmitter Current Waveform

FIG. 1



Gate Location and Widths (30 and 3Hz)

FIG. 2

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EM-37 PLOTTING AND  
INTERPRETATION CONVENTIONS

The Geotrex fixed-loop time-domain convention system has been designed with consistency in mind. Given the great diversity of grid and loop orientations, it is most important that anomalies are of a predictable shape.

To fully understand the convention, four basic rules must be laid down:

- 1) The vertical primary field (Z component) is positive within any loop. To be consistent with a Cartesian co-ordinate system, the  $Z^+$  direction is defined as 'up', i.e. the field vectors point up within the loop and down when outside the loop.
- 2) The X component is defined as that which points along the grid lines. Depending upon which direction the lines run, W or S is defined as  $X^+$ .
- 3) Using a right hand orientation where  $X^+$  is direction of the middle finger, and  $Z^+$  is the direction of the thumb, then  $Y^+$  is the direction defined by the index finger.
- 4) North or East is always plotted to the right on the page.

With these four rules, the shapes of the half space responses for late times for all three components are uniquely defined as shown in Figures 1, 2, 3a and 3b.

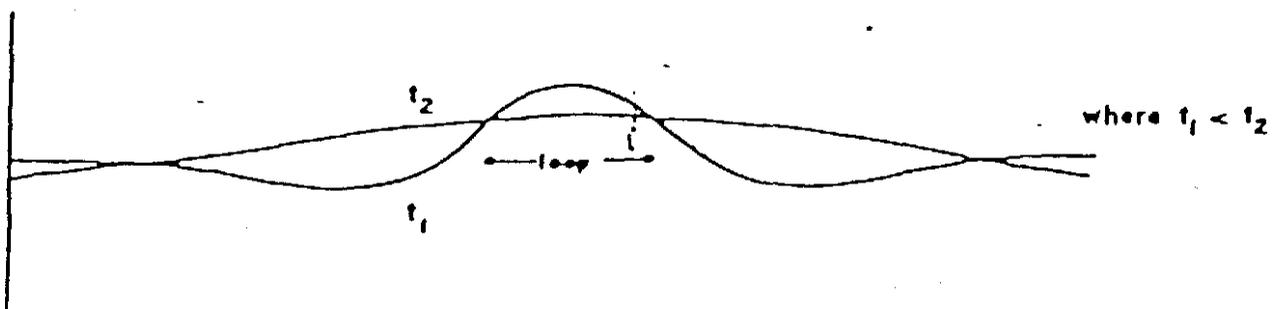


Fig. 1 Half-space response : Z component

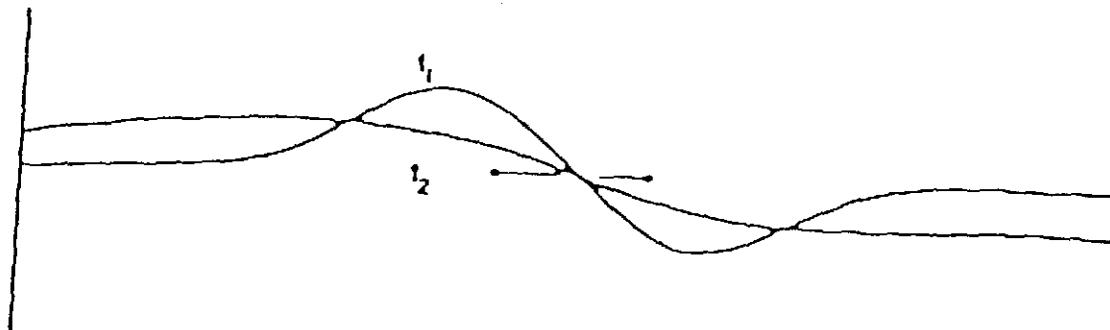


Fig. 2 Half-space response : X Component

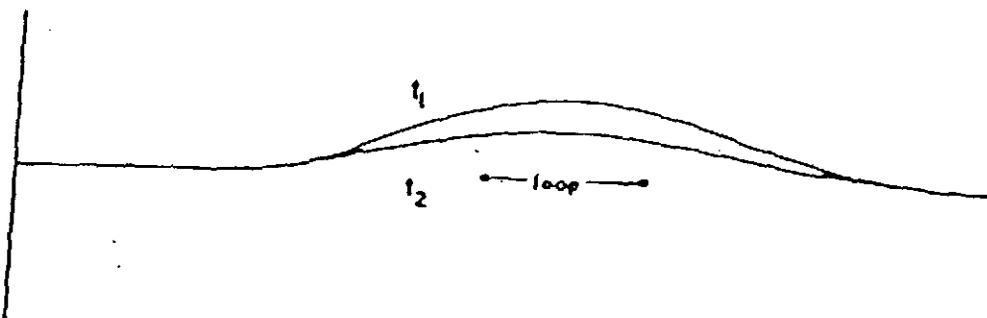


Fig. 3(a) Half-space response : Y component (Positive half of loop)

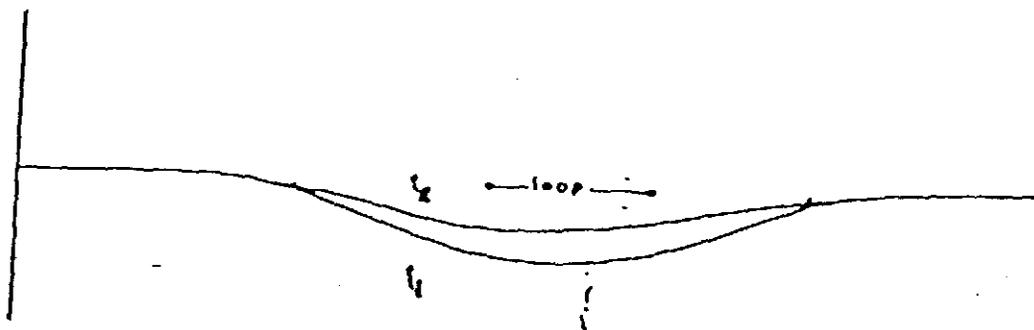
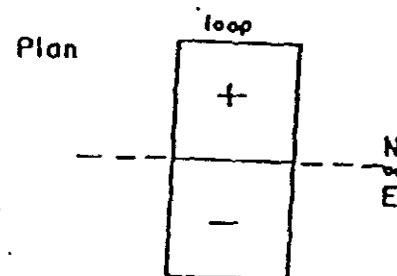


Fig. 3(b) Half-space response : Y component (Negative half of loop)

Note: Unlike the Z component, there is only one maxima or minima for the Y component for a homogeneous half-space.

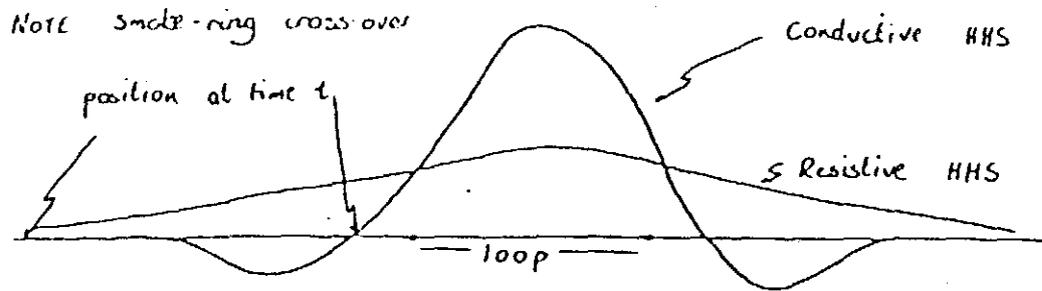


Fig 4. Comparison of conductive and resistive homogeneous half-space responses for Z-component.

A conductive homogeneous half-space is characterised by an early channel high amplitude response with a slow migration of the smoke-ring crossover from the loop.

By comparison, a resistive HHS will exhibit a lower early channel amplitude response and a rapid migration of the smoke-ring.

Note that the rate of decay of the channel amplitude responses for both conductive and resistive HHS is the same, and is proportional to  $t \cdot \exp(-5/2)$ .

The migration of the smoke-ring determines the detection of a conductor with respect to time and space. For example, a conductor located beyond the smoke-ring in a relatively conductive environment will not be energised by intermediate times but may be evident at late times if the smoke-ring has passed beyond it. In short, only conductors within the limits of the smoke-ring at a given time can possibly be detected.

Confined Conductor Responses

The response due to a confined conductor is closely related to the aforementioned half-space responses and to the conductor's position with relation to the loop. Figures 5, 6, 7a and 7b show the responses for a vertical plate.

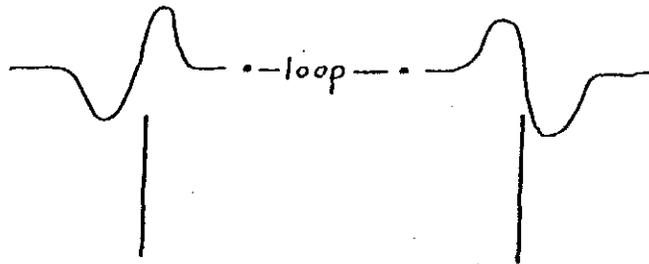


Fig. 5 Vertical conductor: Z component

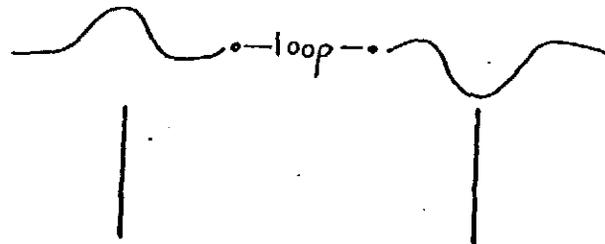
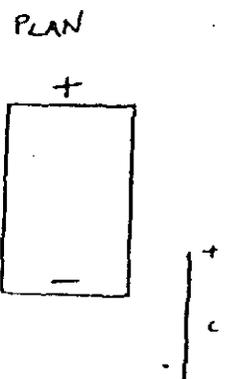
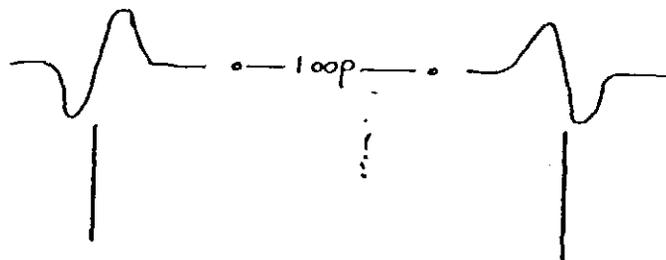


Fig. 6. Vertical conductor: X Component



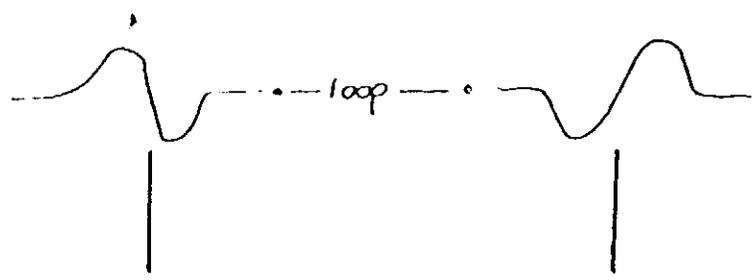


Fig. 7b Vertical conductor : Y component  
(Negative side of conductor)

When the dip of the conductor is allowed to vary, the responses become more complicated. Figures 8 through to 12 show how the dip effects the vertical and horizontal components.

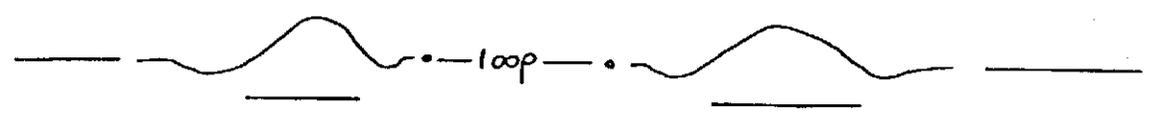


Fig. 8 Horizontal conductor : Z component

NOTE: Late-time response identical both inside and outside loop the same.

NOTE: difference of amplitude

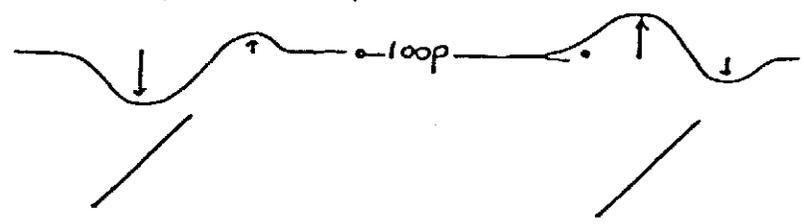


Fig. 9. Dipping conductor : Z component

NOTE: That the positive shoulders in Fig 9. are on the loop side of the anomaly.

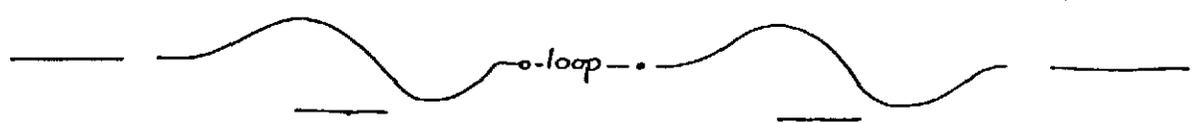
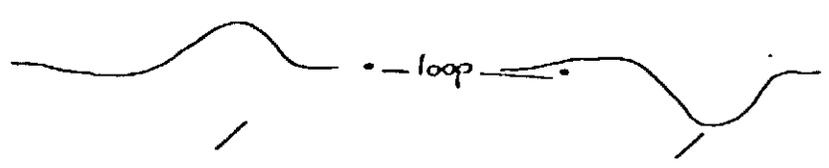


Fig. 10. Horizontal conductor : X component



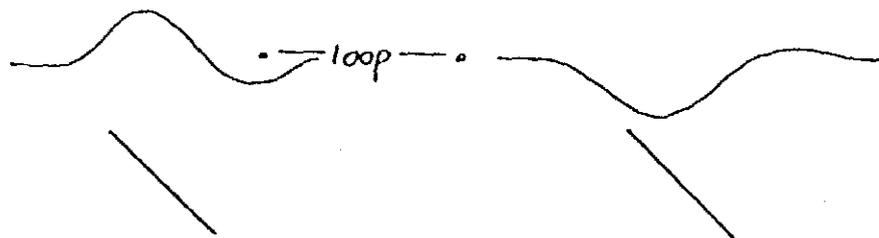


Fig. 12 Dipping conductor : X component

By remembering the shapes of the responses for these few simple geometrics, the identification of false anomalies can be avoided.

In conclusion, by identifying features which appear to have stable (non-diffusing) responses with respect to an appreciable length of time one can isolate confined targets from the half-space. After these interesting features have been identified, the geometry of the situation can be ascertained.