LEAMAN GEOPHYSICS
Registered office:
3 MALUKA STREET, BELLERIVE, TAS. 7018
All correspondence to:
GPO BOX 320 D, HOBART, TAS. 7001
Telephone: (002) 44 1233
Fax: (002) 44 6674

EXPLORATION POTENTIAL OF CENTRAL TASMANIA
AN OUTLINE

for
Pasminco Exploration
by
Dr. D.E. Leaman

June 1994

CENTTAS

CONTENTS

FIGURES

SUMMARY

Southern and central Tasmania, although dominated by surface exposures of Permo-Triassic sedimentary rocks and massive sheets of Jurassic dolerite, is essentially identical to highly prospective western Tasmania, or parts of north east Tasmania.

Lower Palaeozoic rock suites, including thick limestones, mafic and intermediate volcanics, ultramafics, and a Precambrian dolomitic association, are present in the west, central and southern zones of central and midland Tasmania while rock suites equivalent to the Mathinna Beds and intruded granitoids occupy the eastern part of the midlands.

This distribution reflects conditions beneath the base Permian unconformity and all suites are structurally repeated; up to three times in the west central zone (west of the Derwent Valley). Distinctive gravity anomalies have been generated.

Very little drilling control is presently available to constrain these ideas but that does support the broad implications of the regional geophysical analyses based on magnetic and gravity data and fragments of seismic data. The present interpretation suggests how some ambiguous drilling results might be integrated.

Some major structures have been defined, NNW-SSE, NNE-SSW and sub E-W. The largest of these intersect near Poatina. There are suggestions that some structures have been sheared and gold may be associated with those.

The mix of structures and lithologies inferred suggests that east Tasmanian style gold and tin deposits, and west Tasmanian style gold, base metals, tin and platinoid deposits are present.

A cost effective methodology has been established for primary exploration of this concealed geology which may be patchily exposed or up to 1200 m below surface. It is possible, however, to estimate cover thickness and so target likely prospective suites or structures at depths of 200 to 300 m, or less, for initial evaluation.

Some attractive targets are already established - as at Cygnet, or indicated - as near Dover, Bagdad, Huntertson or Millers Bluff. Each of these sites might well repay further, localised and more detailed review and interpretation of existing data followed by licence application and commencement of a more formal exploration programme involving additional data acquisition and drilling.

INTRODUCTION

A cursory inspection of the geological map for central and southern Tasmania does not offer any great encouragement for mineral exploration when the post Carboniferous cover is contrasted with the exposed and mineralised Precambrian and Lower Palaeozoic rocks of western Tasmania.

This is an extremely misleading condition since there are many interesting, obscure and previously unexplained mineral occurrences within post Carboniferous rocks and there are small windows revealing older rocks.

Unfortunately most of the accessible areas rated as highly prospective by most current explorers in Tasmania are either under tenure or at risk from claims by the environment movement. Many of those same explorers upon failing to acquire prime tenements with outcropping target rocks in other parts of Australia are prepared to drill up to 500 m of cover in an experimental manner. Why not do it in Tasmania where the infrastructure is already developed?

The answer to this question depends on whether we have workable genetic and setting concepts for western Tasmania and whether these can be applied in practical exploration in covered areas.

Recent work in southern Tasmania has shown that the geological patterns of western Tasmania are repeated beneath the Permo-Triassic cover. The depth of the Lower Palaeozoic rocks is, in many areas, much less than depths now being explored in western Tasmania.

Any blind exploration of this type is clearly of higher risk than in western Tasmania, where the target conditions can be directly inferred even if concealed, unless some focus can be applied, or some recognisable indicators exist.

This report considers, in a very preliminary way, regional indications of rock distribution and structure and any anomalous related mineral occurrences. The methods and issues associated with detailed review, prior to any possible land claim or new data acquisition of any type, are also discussed.
This is a trail-blazing initiative, never previously attempted, which collates records of anomalous mineralisation and a primary structural evaluation through the cover.

The report is in two parts.
Part one outlines what was known prior to this review while part two presents some refinement in order to provide some primary understanding of the setting of known mineral occurrences and rank them.

PART ONE

STATUS OF PREVIOUS WORK

INTRODUCTION

This part of the report outlines existing data which may be relevant to appraisal and exploration in central Tasmania and describes any current interpretations either in the public domain, or in my own files.
A listing of confirmed, or possible, mineralised sites is also included. These have been reviewed in more detail in part two.

It should be recognised at the outset that the results, data and ideas presented below have been derived from no more than five boreholes which have penetrated the cover sequences, the geology of mapped windows in the cover, and the rather limited exploration undertaken by Conga Oil on its exploration tenements (EL 1/88 and predecessors).
No other organisation, whether private company or government, has attempted any serious evaluation of the "basement" geology.

Much of the information obtained by Conga Oil is now in the public domain as a result of duration of tenure, relinquishment and approved publication. Only one relatively detailed study, in the central Derwent Valley, remains confidential but most of central Tasmania was not evaluated. Compare the south Tasmania effort described by Leaman (1990). Most current information in the midlands is derived from my own research. Part II of this report attempts some small recovery of this situation.

It is Conga Oil's limited studies, and my own research and interest, which have established the current understanding.

MINERALISED SITES

Three mineralised sites within the general area covered by the post Carboniferous rocks of Tasmania are shown on the "Mineral Deposits and metallogenic map of Tasmania" released by the Mines Department in 1988.

These are:

Little Den	~ 508000, 5354500	Au	site 36
L. Oyster Cove	~ 519000, 5226000	Au	site 37
Cygnet	~ 507000, 5119000	Au	site 38

Some other sites are listed on the Mirloch data base:

Quamby copper	475000, 5393700	Cu, Ag, Au, Ni
Golden dawning	492000, 5325000	Au
Lawrenny	479000, 5293000	Au, Ag
Gunnings sugarloaf	533000, 5282000	Au?
Mt Wellington	522500, 5248500	Au, Ag, Co
Weld River	478160, 5234440	Au, PGM
Bagdad	~519000, 5283000	Au, Cu
Dover	~495000, 5203000	Au
Catamaran	~492000, 5182000	Au
Lune River	~493000, 5190000	Au

Most information is available about Little Den Goldfield (two worked occurrences) and the Cygnet Goldfield (two worked mines and some alluvials).

Virtually all the other sites are based on very old or incomplete records or reports. The emphasis on gold probably reflects the period of discovery or notice and the type of prospecting undertaken. The recorded presence of silver, or copper, at some sites suggests a more complex ore type may be involved. Every site is noted for unusual amounts of sulphide, notably pyrite but sometimes pyrrhotite.

The latest report, where the writer actually believed in his observations and results, is that of Twelvetrees (1902). He, and all subsequent recorders, have noted that the occurrences occur in either dolerite or Triassic sandstones. Since no one after about 1915 believed that either of these two lithologies could contain sulphides, and hence ore bodies, the reports have been first discounted, then disbelieved and then forgotten.

The Golden Dawning (Hunterston) site is important since it is reliably described and the material was analysed. The details have been preserved. This "extensive" pyrite deposit contained up to 10oz gold and 13 dwts silver. Incredibly, Twelvetrees described the occurrence as "common"! This material occurs in a dolerite contact.

Little is known of the Neika (Mt Wellington) and Campania (Gunnings Sugarloaf) occurrences since analyses seem to have been lost. The Neika material has been analysed but the exact location of the site is not recorded. Nye (1922) is rather dismissive of prospector's comments and he did not follow up. Similar comments apply at Bagdad where the sulphides were mined. The pits still exist but a prospector who has uncovered them is very tight-lipped about the site. I have deduced its location from his guarded descriptions. He has described the mixed sulphides. The Lawrenny site appears to be comparable. Each of these sites involves accumulations of sulphide in or near dolerite margins.

The Lawrenny site is reported to contain up to 14 dwt gold and 16 dwt silver.

The Weld River site has been explored in detail and confirmed as a mineralised site which includes ultramafics.

The sulphide-dolerite association is the common denominator at all these sites and may well be at the Dover and Catamaran sites although less is known about these. Figure 1 provides an extract from the Mines Department occurrences map and file. The same conjunction is true of Little Oyster Cove and Cygnet although all previous workers except Ramsay Ford have linked the gold at Cygnet directly to the Cretaceous syenites.

The Cygnet site is rather special in that significant amounts of copper and lead are known to be present (discussed in part II).

It has been argued that such sites or records are the result of wishful thinking by prospectors. Some clearly are not. A more profitable lesson may be learnt by asking, "could sulphides occurrences occur in dolerite margins and, if so, why and which?" A second question follows, "could these occurrences, which are trivial in themselves, flag something much more important and economic?"

Their relevance may be judged after some appraisal of basement structuring and abnormalities in the cover sequence.

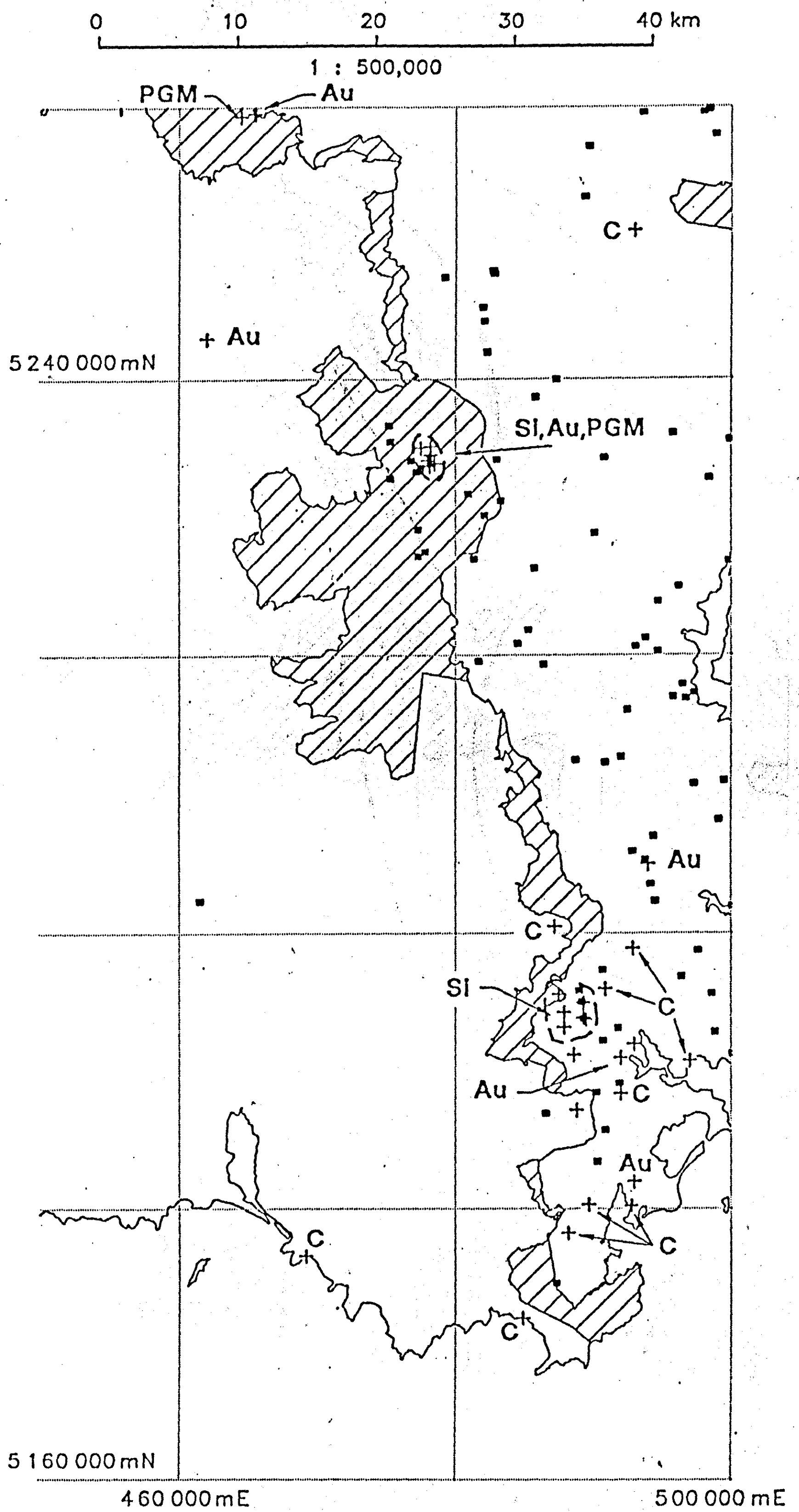
DATA AVAILABLE

High quality geological maps cover much of the midlands region and all of south east Tasmania. Much poorer maps are available for the central Plateau and Derwent Valley regions. See Figure 2 for an indication of map quality.

Gravity maps based on a nominal station spacing of 1 km or less also exist for most of the region (Figure 3). Some deficiencies in coverage occur in limited parts of the plateau. The gravity field expressed as a region based on the most recent mantle model is shown in Figure 4.

Three magnetic surveys are available for central and southern Tasmania. Each survey was acquired using different specifications and budget allocations.

MINERAL OCCURRENCES AND CONSTRUCTION MATERIAL WORKINGS SOUTHERN TASMANIA

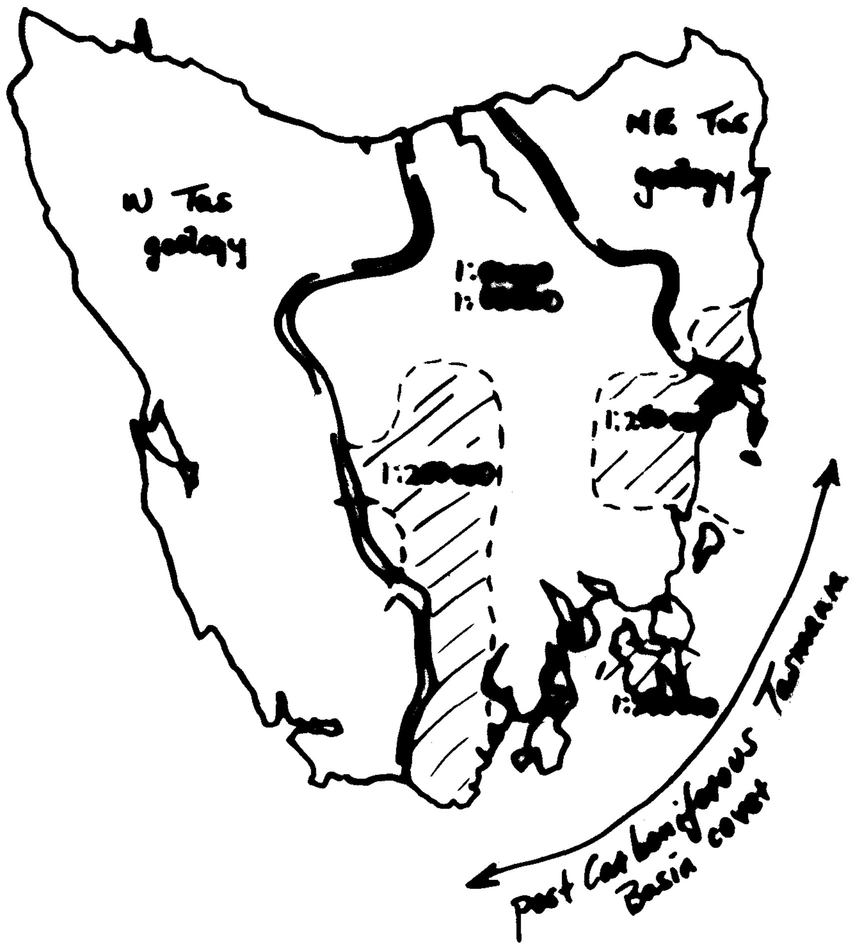


CROSSES (+) : METALLIC & INDUSTRIAL MINERALS

Au	:	*Gold (mostly placer)*	Fe	:	*Iron formations*
Bm	:	*Base Metals (Cu,Pb,Zn,Ba)*	L	:	*Limestone*
Sn	:	*Tin / Tungsten*	SI	:	*Silica*
PGM :		*Platinum-Group Minerals ± Cr,Au,Ni,Cu, Asbestos*	C	:	*Coal*

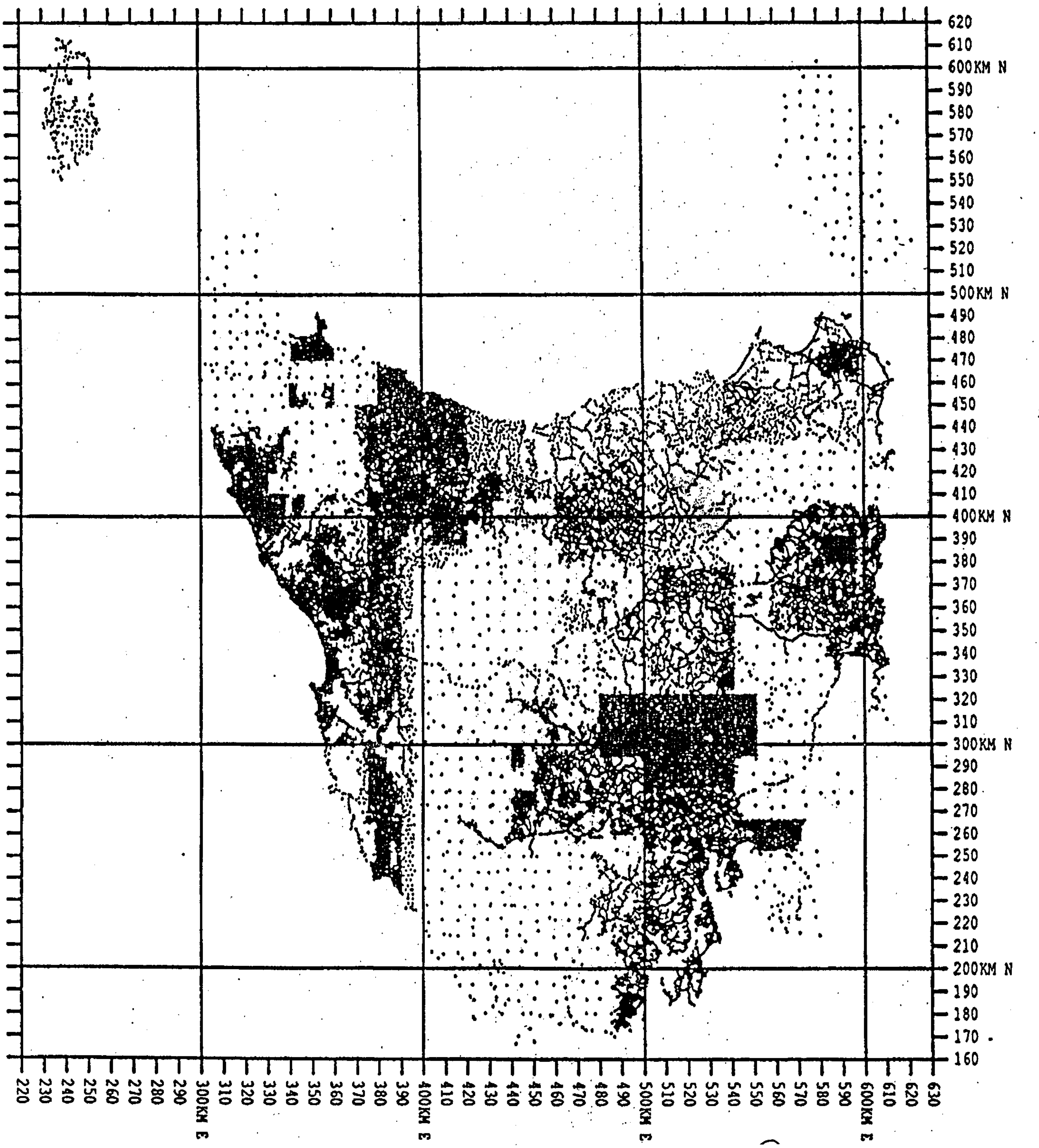
SQUARES (▪) : CONSTRUCTION MATERIALS

FIGURE 1



STATUS OF AVAILABLE MAPPING BY SCALE.
Note that the vintage of mapping may range from 1955 to 1991.

FIGURE 2



GRAVITY STATION COVERAGE IN TASMANIA
AS AT JUNE 1990
There has been no variation in central Tasmania since 1990.

FIGURE 3

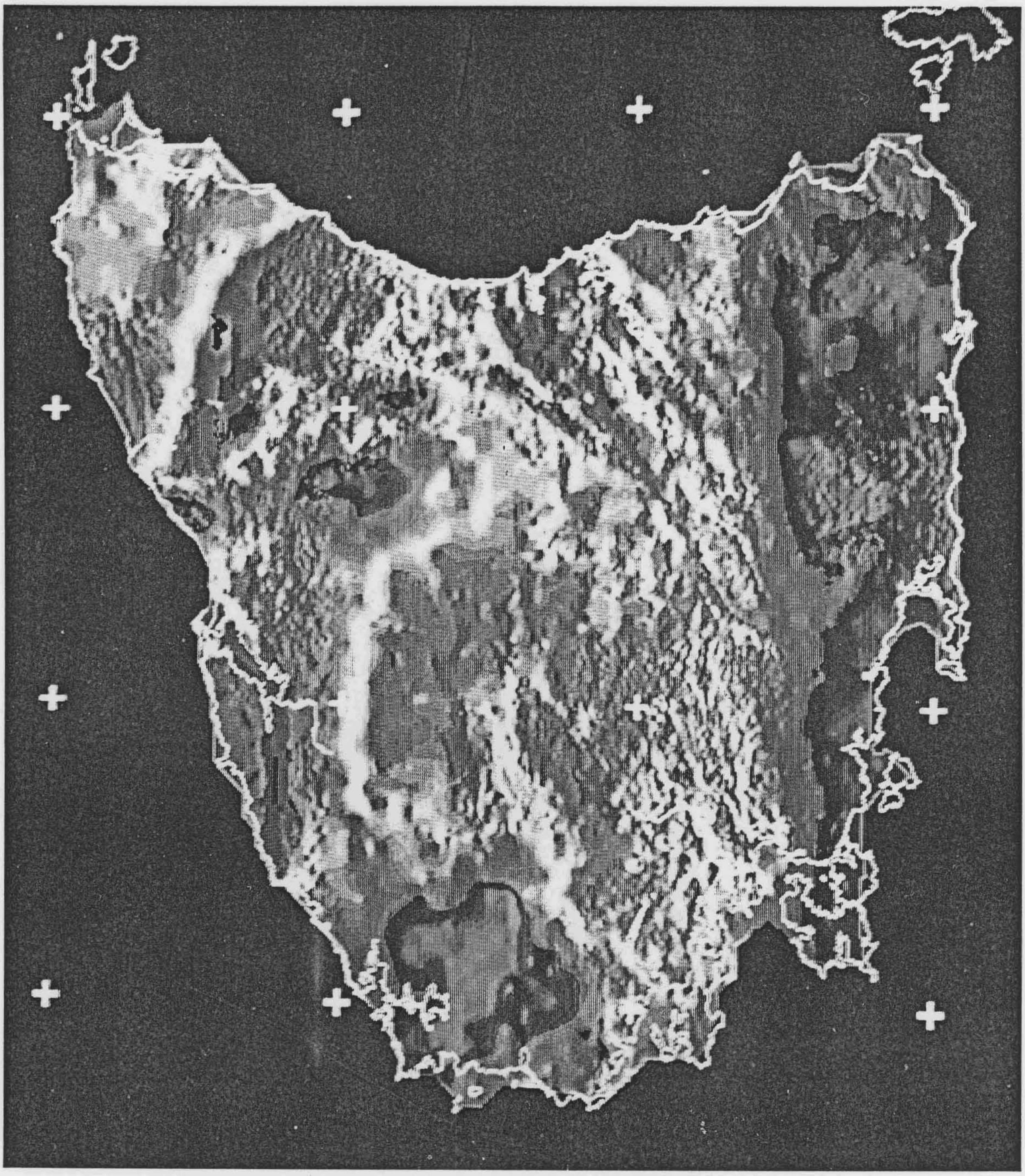


FIGURE 4

(D. E. LEAMAN — *Finding Cambrian keys)*

Residual Bouguer Anomaly map of Tasmania. Based on Mantle 91 model method (Leaman and Richardson, 1989*b*). Bouguer density 2.67 t/ m^3. (Image courtesy M. Roach, CODES).

A complete survey of the region undertaken at a declared terrain clearance of 150 m and 1500 m line spacing was completed by AGSO (then BMR) and the result was included in the map pocket for the Geology of Tasmania published in 1988. An extract from this survey is shown in Figure 5.
While the line specification was met the terrain clearance criterion was not. Indeed, some of the height information is not recoverable and the current presentations of this data are uneven and not the result of consistent correction.
It is not certain whether this data can ever be recovered.
Some trend character has been preserved but the data can not be converted into a trustworthy image or quantitatively analysed. A great pity.

A comprehensive survey of southern Tasmania was completed by Conga Oil using a line spacing of 2500 m at a barometric height of 1000 m ASL. This survey is shown in Figures 6 and 7.
These specifications were generally met with the exception of Adamsons Peak which was shrouded in cloud during the survey and near the Harz Mountains and Mt Wellington where are 150 m drape was flown.
The specification were designed to allow a reference level for analysis and a more distant response from the dolerite in the cover sequence in order to examine the basement (pre Permian) structures.
Some detail was lost as a result, but the objectives of the survey were successfully completed (see below).

A further survey was flown by Conga Oil across the midlands and plateau regions. This was flown with a line spacing of 5 km at a barometric height of 1600 m (see Figure 8).
These specifications followed the experience of the D'Entrecasteaux survey and were intended to allow clearance of all topographic features.
This data was acquired in 1988 but the results have never been comprehensively analysed or interpreted.

The cover rocks and their physical properties are well known. Many surveys have considered elements of the sequence and determined magnetic properties and densities. A typical magnetic contrast for dolerite is of the order of 0.003-0.005 cgs unless extreme differentiates are present. Basalt is much more variable but often of lower bulk contrast.

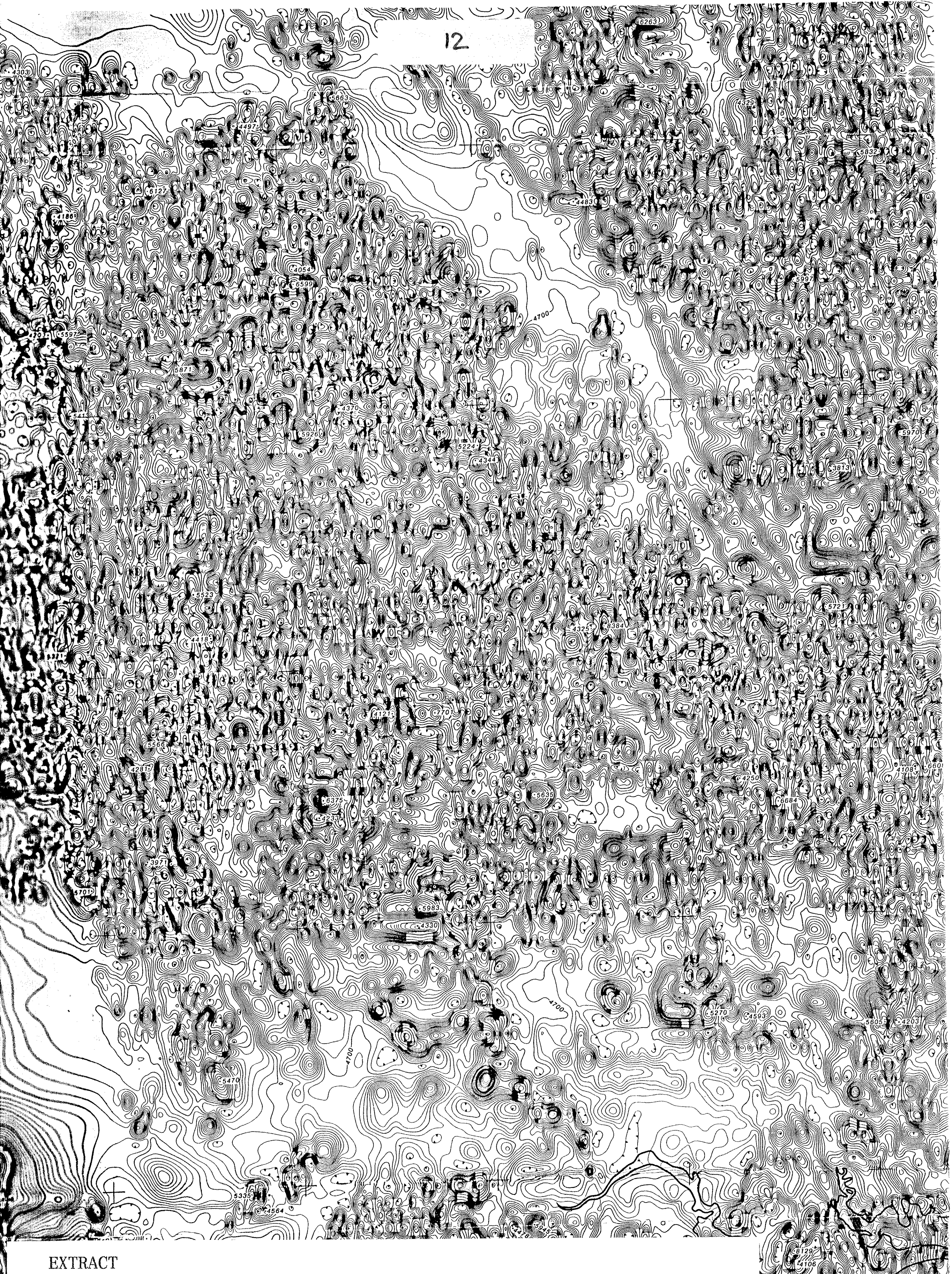
Only two lithologies are significantly magnetised; Jurassic dolerite and Tertiary basalts. In the case of the dolerite many determinations of remanence are also available. There is some scope for checking detailed variations but the general susceptibility is well known.
Tight limits may also be imposed on the bulk fresh densities of nearly every formation in the post Carboniferous sequence, including the Tertiary basin deposits. Sufficient data are available to provide formation-weighted averages for north and south Tasmania sections.

The following table summarises available density information for the covering sequences of the Tasmania Basin (from Leaman, 1972).

Table 1. BULK WET DENSITIES

Rock Unit	Density Range g/cm^3	Average Density g/cm^3	Weighted Average g/cm^3 (*b*)
Tertiary			
clay, sandy clay	1.82 - 2.00	1.92	
volcanics (solid basalt)	2.90 - 3.00		
Jurassic			
dolerite	2.75 - 2.95	2.90*c*	
Triassic			
lithic sequence			2.47
sandstone	2.36 - 2.48	2.43	
mudstone	2.49 - 2.52	2.51	
quartz sequence			2.45
sandstone	2.30*a*- 2.43	2.37	
mudstone	2.44 - 2.54	2.49	
Permian			2.57
Ferntree Group	2.37*a*- 2.58	2.50 - 2.52	
Malbina Formation	2.46 - 2.54		
Cascades Group			
weathered	2.10 - 2.14		
unweathered	2.49 - 2.54	2.53	
metamorphosed	2.64 - 2.68		
Faulkner Group, sandstone	2.37		
Bundella Mudstone			
mudstone	2.55 - 2.61	2.59	
limestone	2.63		
Lower Permian			
mudstone, siltstone	2.58 - 2.60		
tillite matrix	2.59		
tillite bulk	2.66		
Pre-Permian		2.67	

a weathered; *b* weighted average based on the proportions of rock types in the sequence; *c* average for sill, Jaeger, 1964



EXTRACT
BMR (AGSO) REGIONAL SURVEY
Note variation in character of anomalies due to differences in specification and recovery. Several large trends may be recognised.
FIGURE 5

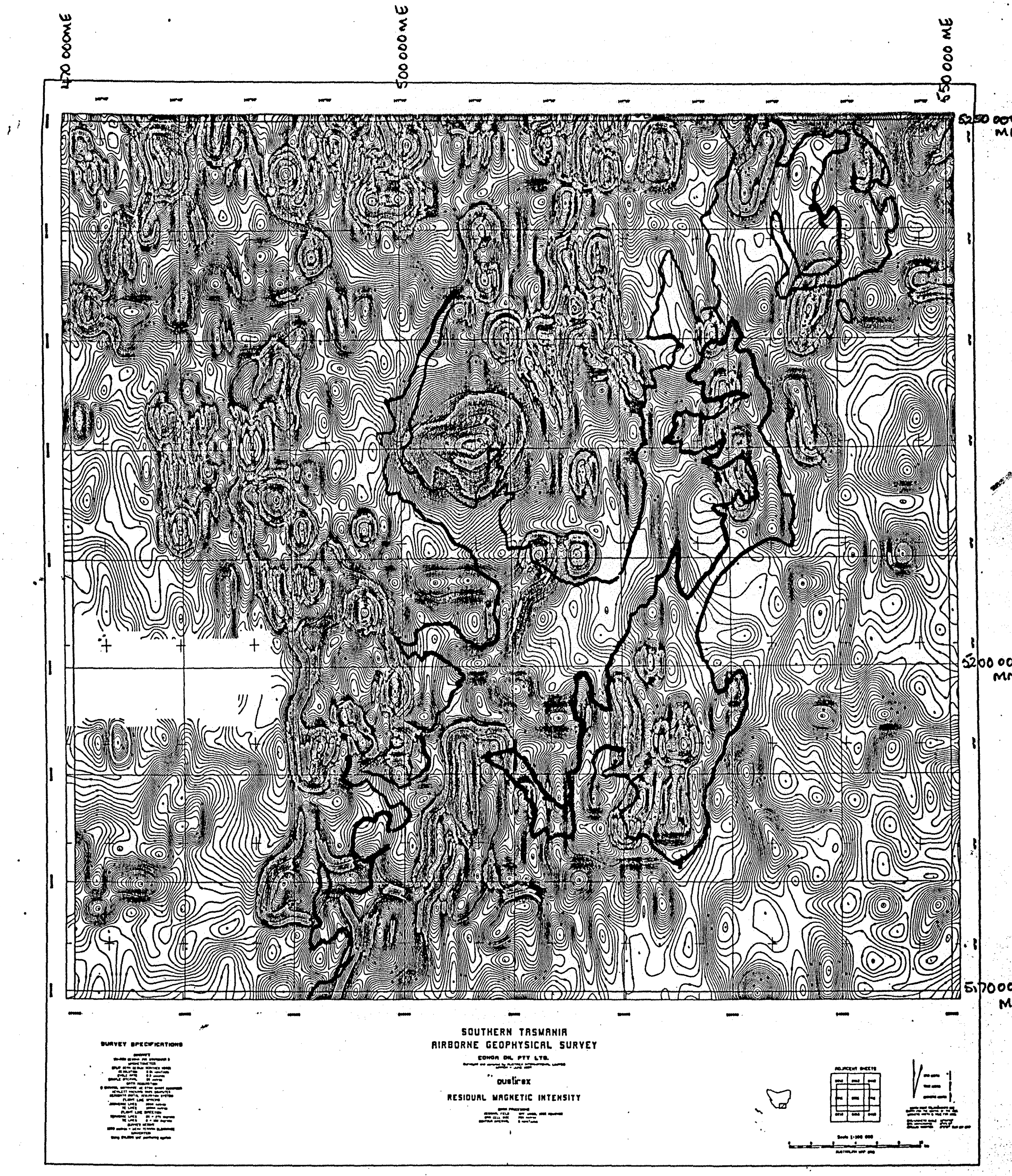


FIGURE 6

COMPILATION MAP: AEROMAGNETIC SURVEY AT 1000 M ASL

(Use transparent geographic overlay to locate positions)

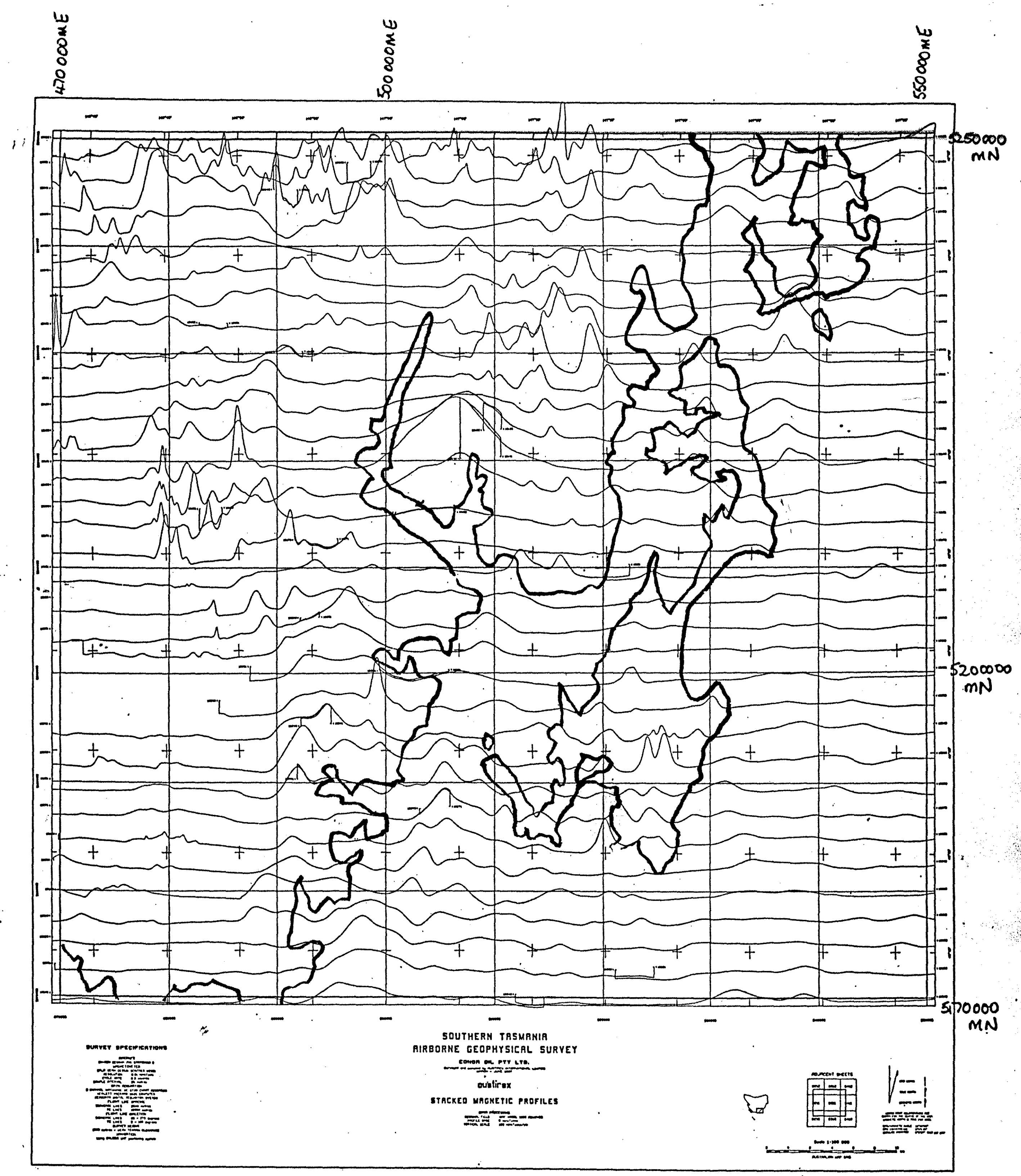
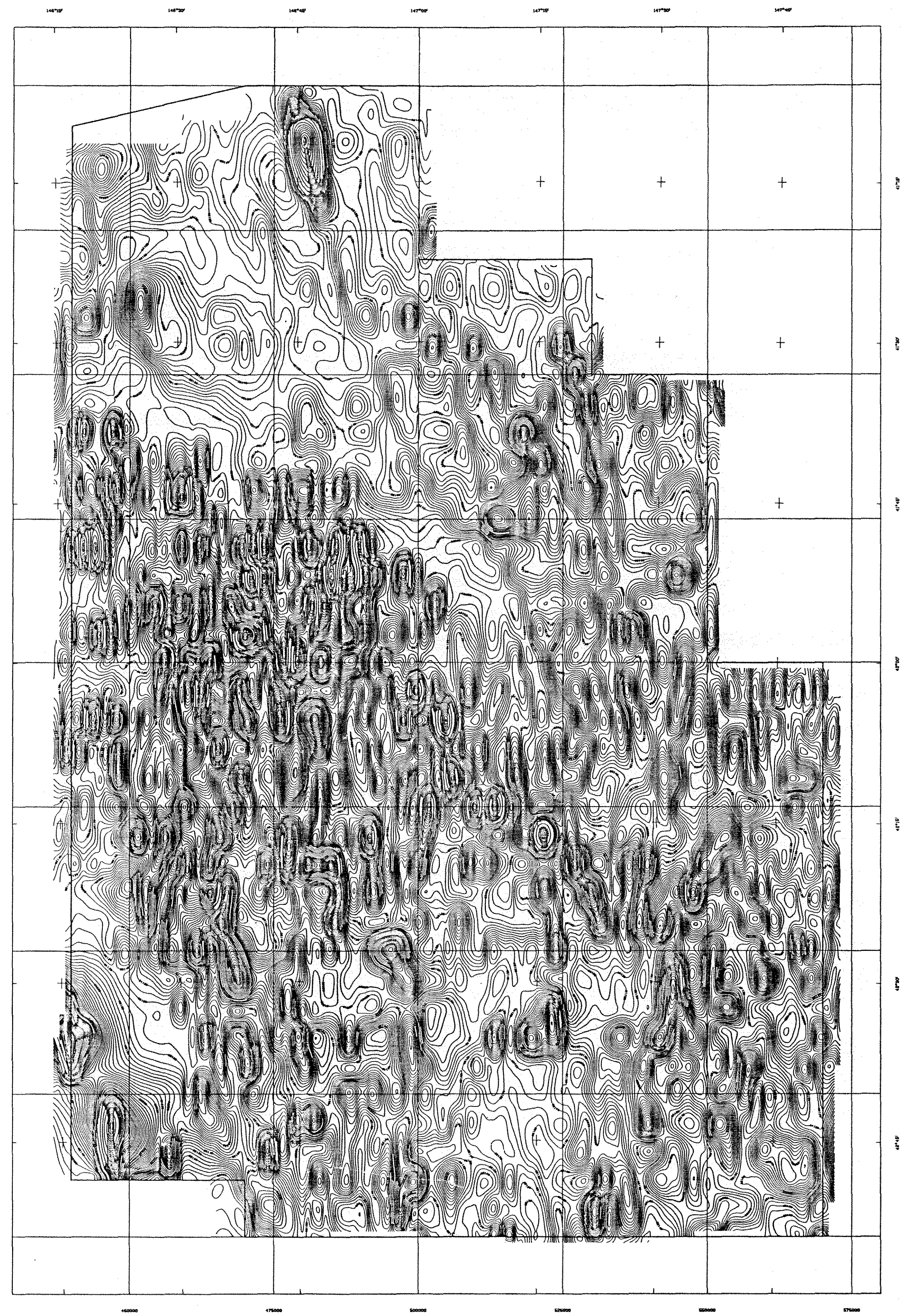


FIGURE 7

COMPILATION MAP: MAGNETIC PROFILES AT 1000 M ASL



AIRCRAFT
[illegible] ROCKWELL SHRIKE COMMANDER [illegible]
MAGNETOMETER
SPLIT BEAM CESIUM SCINTREX V201
RESOLUTION 0.01 nanoTeslas
CYCLE RATE 0.3 seconds
SAMPLE INTERVAL 20 metres
DATA ACQUISITION
8 CHANNEL WATANABE MC 6700 CHART RECORDER
HEWLETT PACKARD 9825 COMPUTER
AERODATA DIGITAL ACQUISITION SYSTEM
FLIGHT LINE SPACING
TRAVERSE LINES 5000 metres
TIE LINES 25000 metres
FLIGHT LINE DIRECTION
TRAVERSE LINES 090 - 270 degrees
TIE LINES 180 - 360 degrees
SURVEY HEIGHT
1600 metres - MEAN TERRAIN CLEARANCE
NAVIGATION
VISUAL FROM PLANNED FLIGHT STRIPS
FLIGHT PATH RECOVERY
ONTO R.M.G. CONTROLLED PHOTOGRAPHS

DATA PROCESSING
REGIONAL FIELD [illegible]
BASE VALUE ADDED 62200 nanoTeslas
GRID CELL SIZE 1000 metres
CONTOUR INTERVAL 10 nanoTeslas
PARALLAX CORRECTION [illegible]

NE TASMANIA
AIRBORNE GEOPHYSICAL SURVEY
TOTAL MAGNETIC INTENSITY

CONGA OIL PTY. LTD.
Surveyed and compiled by AUSTIREX INTERNATIONAL LIMITED
FEBRUARY - MARCH [illegible]
Job No. [illegible]
austirex

SHEET LAYOUT

Scale 1:250 000

AUSTRALIAN MAP GRID

Although general geological control in the region is good there are some significant gaps in understanding and information concerning the lower half of the Permian section. The sequence is well exposed near Cygnet in southern Tasmania and in northern Tasmania but there are no exposures of any formation lower than Faulkner-Liffey Group and correlates anywhere in central Tasmania. The precise nature of facies variations and formation thicknesses is not known; there are no mappable links between north and south of the island. There may well be some important variations in the thickness of lower units close to the presumed axis of the Tasmania Basin cover.
(Throughout this report I refer to the Tasmania Basin in two ways; as post Carboniferous cover - which is the usual meaning in the literature, and as something much larger which happens to include the cover. This reflects a view that Lower Palaeozoic post Cambrian shelf deposits underly this more recent cover and that the taken meaning of the basin simply represents a partial rejuvenation of an older basin)

There are few boreholes which can assist this position. These are located at Woodbridge (Precambrian deformed dolomite at 1000 m), Glenorchy west (Cambrian volcanics at 600 m), The Quoin (east Ross, Mathinna Beds at 200 m), Ross (possible Precambrian at <300 m), Tunbridge Tier (presumed Precambrian at 200 m). Four of these holes indicate a consistent Lower Permian section or thinned basal tillite.

Cover structures have been the subject of detailed study.
Dolerite intrusion forms and relationships can be defined (e.g., Figure 9) and this major complication in the cover sequence can be treated with reasonable assurance provided sufficient data are available. Definition of the dolerite component within the cover essentially renders it transparent for all practical terms.

Some seismic data also exists. This is mainly concentrated south of Hobart but the total amount is very small. Too small to be significant. The data is of two principal vintages; 1977 and 1987-9. In each case it has resulted from feasibility testing and is very variable in quality. The 1977 tests (Leaman, 1978) were small focussed trials. Few were able to penetrate dolerite or the problems posed by it but some sites were transparent to the mantle. One such site was at Clifton Beach (Figure 10) and the strong layered character of the first three seconds suggests a thick sedimentary succession (much thicker than post Carboniferous cover) overlying basement. This test offers some encouragement about the viability of the method but it is expensive to use and the problems posed by the dolerite have not been generally resolved as yet.
Seismic data acquired by Conga Oil on North Bruny Island (Figure 11) illustrates some of the problems but also confirmed some of the deep structuring inferred from other analysis.
A portion of a marine survey in Storm Bay (AGSO/Conga Oil) (Figure 12) demonstrated that parts of the post Cretaceous section is structured and that deep extensions of the Clifton Beach character can be traced south westward. The presence of shallow dolerite degraded the quality of both these surveys.

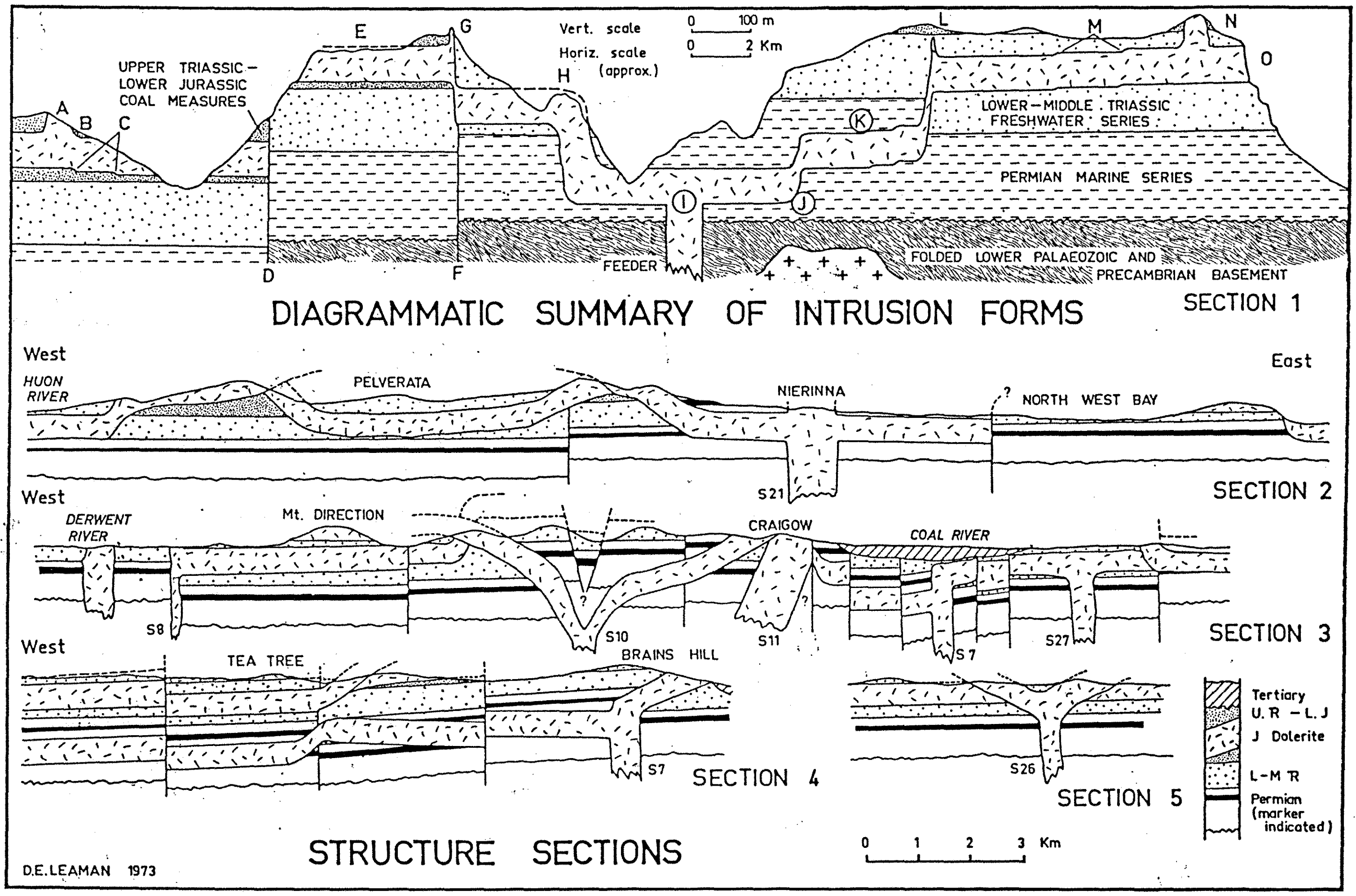
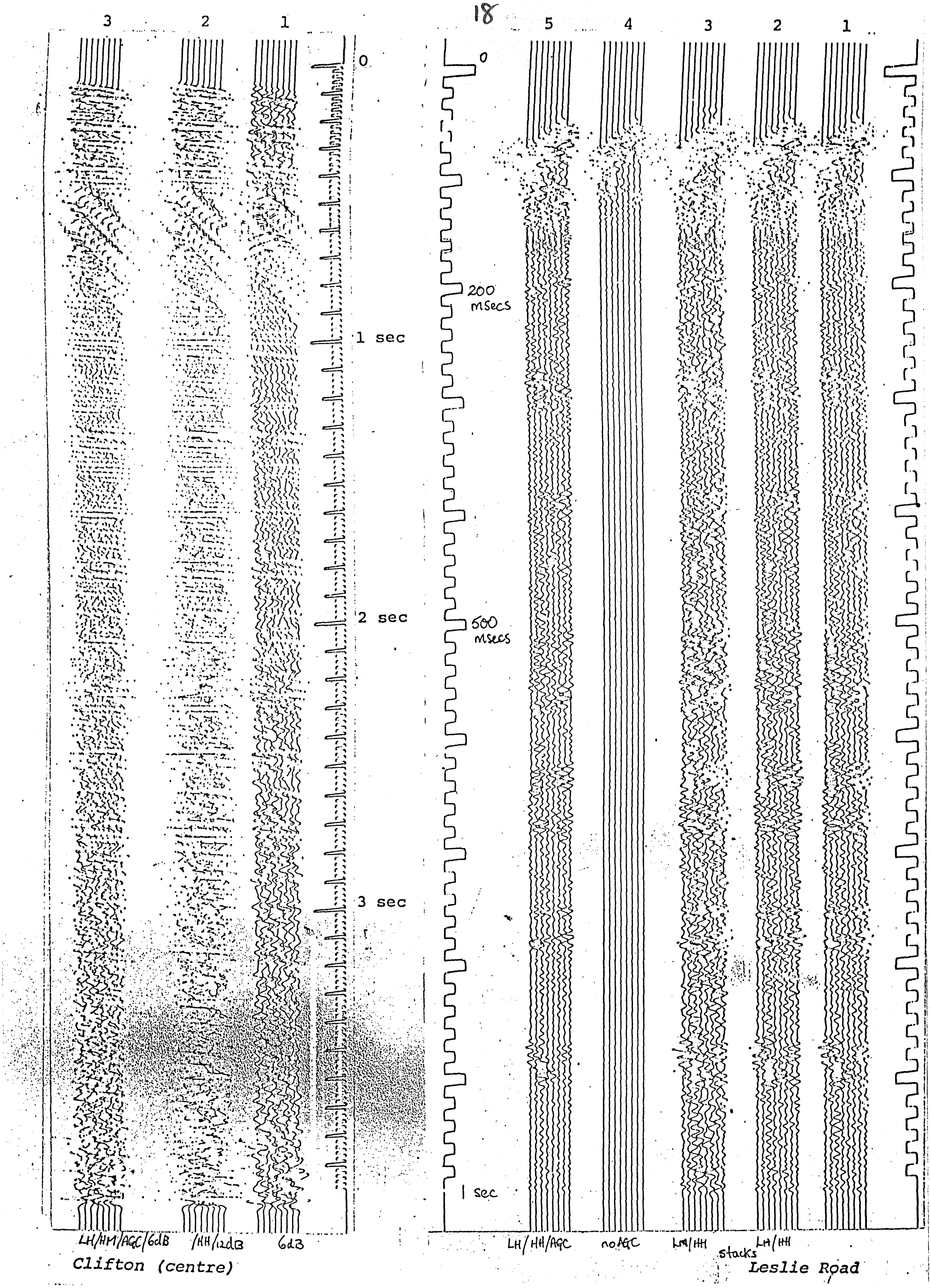


Fig. 2: Vertical sections of dolerite intrusion forms. 1: Diagrammatic summary of intrusion forms. Capital letters indicate features discussed in tex 2, 3, 4, and 5: East to west geological sections located by reference to Fig. 1 and Fig. 3. S7, S11, etc., refer dolerite sheets to the appropriate feeding sources in Fig. 3.

FIGURE 9

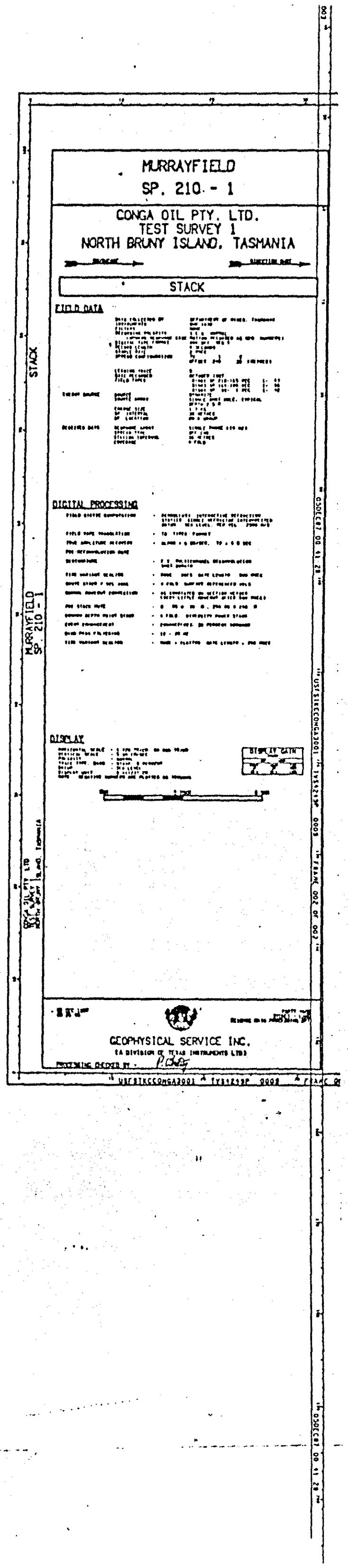
POST CARBONIFEROUS SECTION: SUMMARY OF RELATIONSHIPS
(after Leaman, 1975)

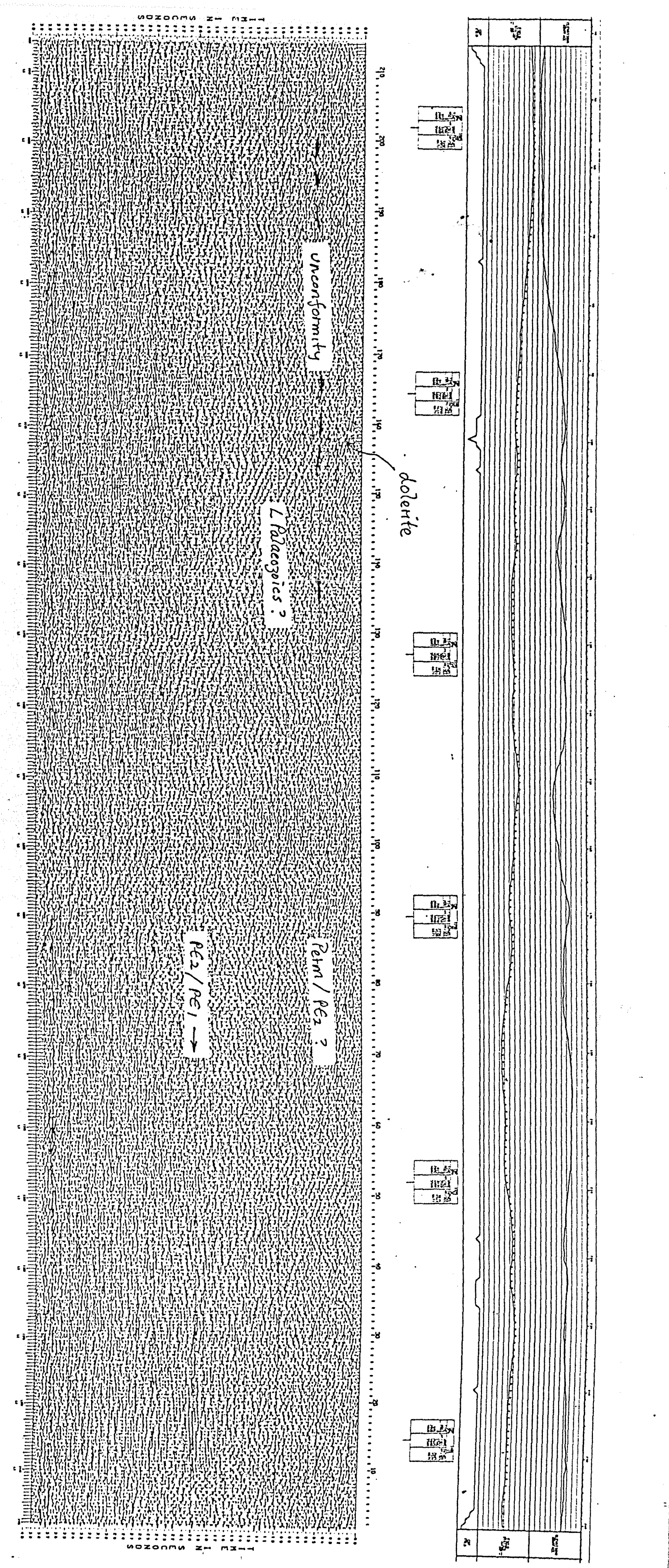


SEISMIC REFLECTION RESEARCH TRIALS : CLIFTON AND LESLIE RD

FIGURE 10

p. 19





MURRAYFIELD TRAVERSE
NORTH BRUNY ISLAND

FIGURE 11

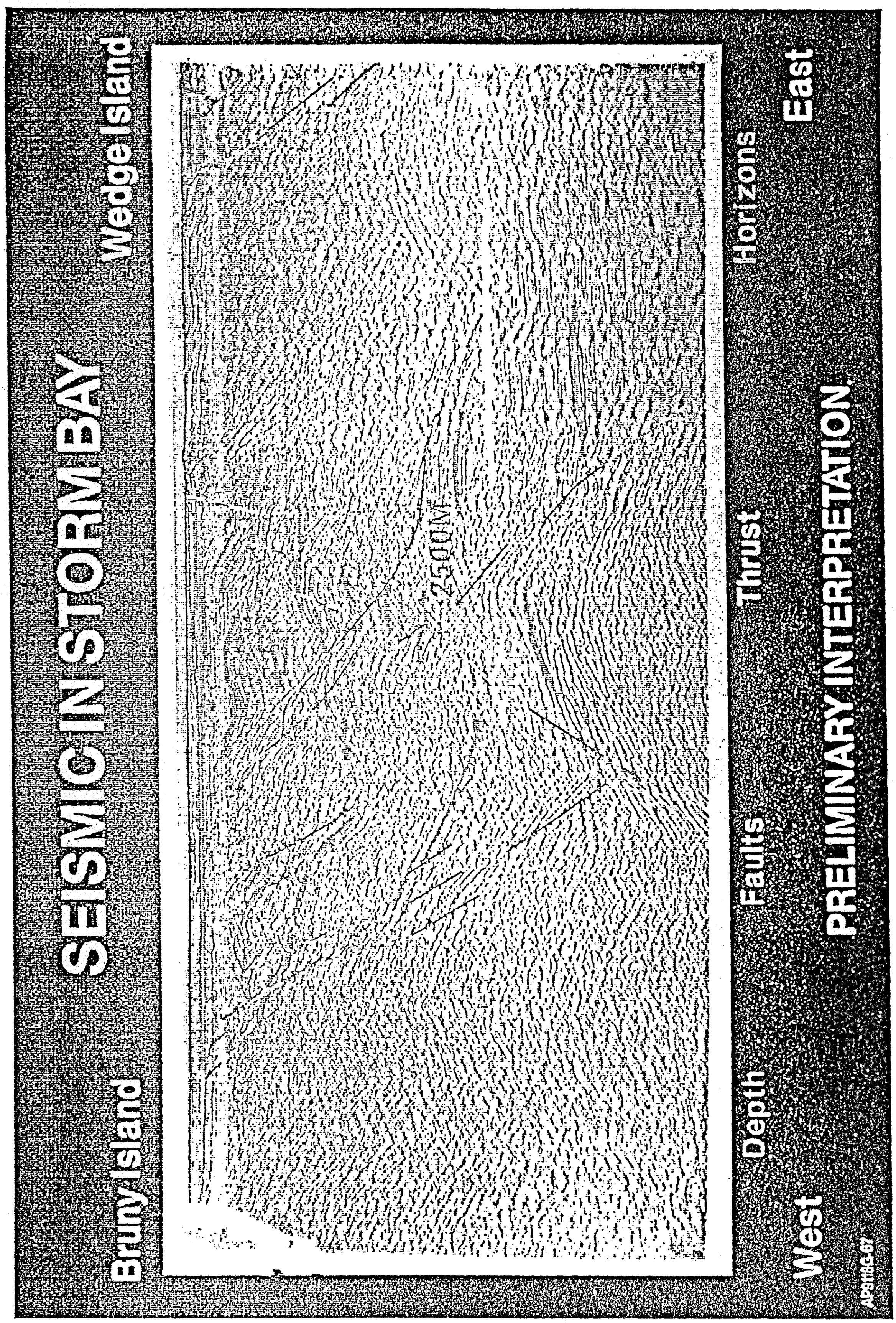

SEISMIC IN STORM BAY
Bruny Island
Wedge Island
2500M
Depth
Faults
Thrust
Horizons
West
East
PRELIMINARY INTERPRETATION

FIGURE 12

STRUCTURAL INTERPRETATION AND PROCEDURES

Detailed structural evaluations are available for the region south of Hobart, NW of Launceston and the central Derwent Valley based on the data listed in the previous section.

An integrated, regional view has been generated from a qualitative examination of the regional data sets described in the previous section. This has been supported by some limited regional modelling and high quality imaging.

Figures 13 and 14 present an overall view of boundaries and structures inferred. Several trends may be recognised. The orientations are not surprising in a whole Tasmanian context but the maps do suggest that the so-called Tamar Fracture Zone is a fiction; little more than modest and relatively recent developments are present. More information on this viewpoint was given by Leaman (1994).
Figures 13 and 14 also show the distribution of faults within the cover sequences. This is not a complete view since mapping is uneven in terms of coverage, quality and display policy. The diagram shown is now more than three years old and could also be updated.

Segments of this compilation are reviewed in Part II of this report with respect to particular sites.

The preliminary analysis has been supported by three blocks of more detailed study; two of which are in the public domain at the time of writing.

The most important of these covers most of **south-east Tasmania**. Complete details of this analysis are available in open file reports produced for Conga Oil in 1987 and 1988 and summaries appear in Leaman (1990, 1992).
An outline of results is shown in Figures 15 to 17.
These diagrams provide an indication of the types of information which can be extracted from regional data sets of fair quality; note the regional specification of both the gravity and aeromagnetic data used. The aim of the SE Tasmania interpretation was definition of Ordovician to Devonian sedimentary sequences and indication of any suggestions of zones which might be structured or abnormal. This information was then linked with observations on hydrocarbon seepages and reports in order to target relatively small areas which might justify seismic survey for drill targetting.

Figure 15 shows how the composition of basement (pre-Permian) rocks may be deduced. The study undertaken allows a regional assessment and many details have clearly been omitted or not recognised. Two of the predictions of this interpretation, which is consistent with the two deep drillholes and fragments ejected from volcanic centres, have already been confirmed.
Ultramafics inferred west of Geeveston, within a narrow belt bounding a major trough, have since been found along strike in the Weld River.

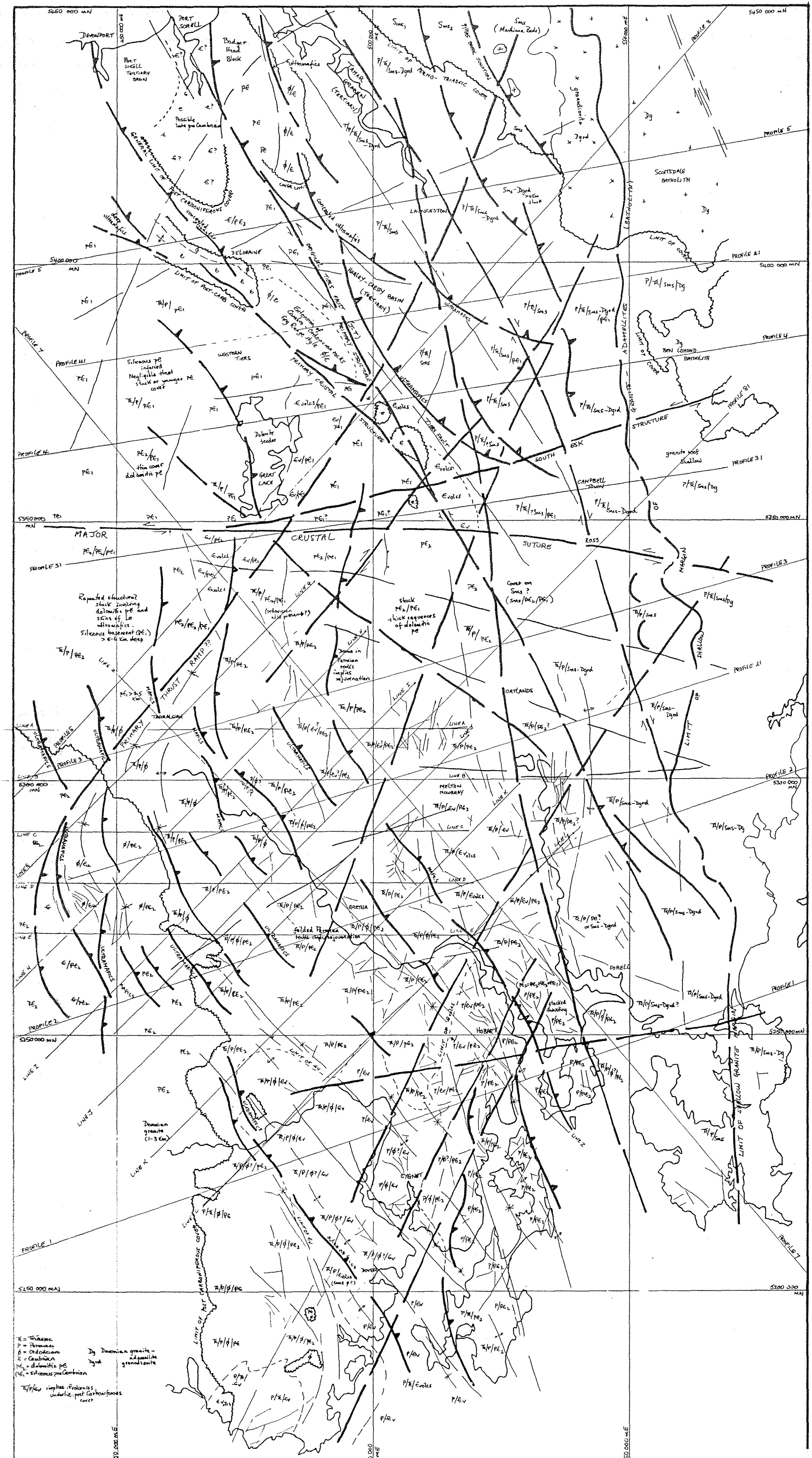
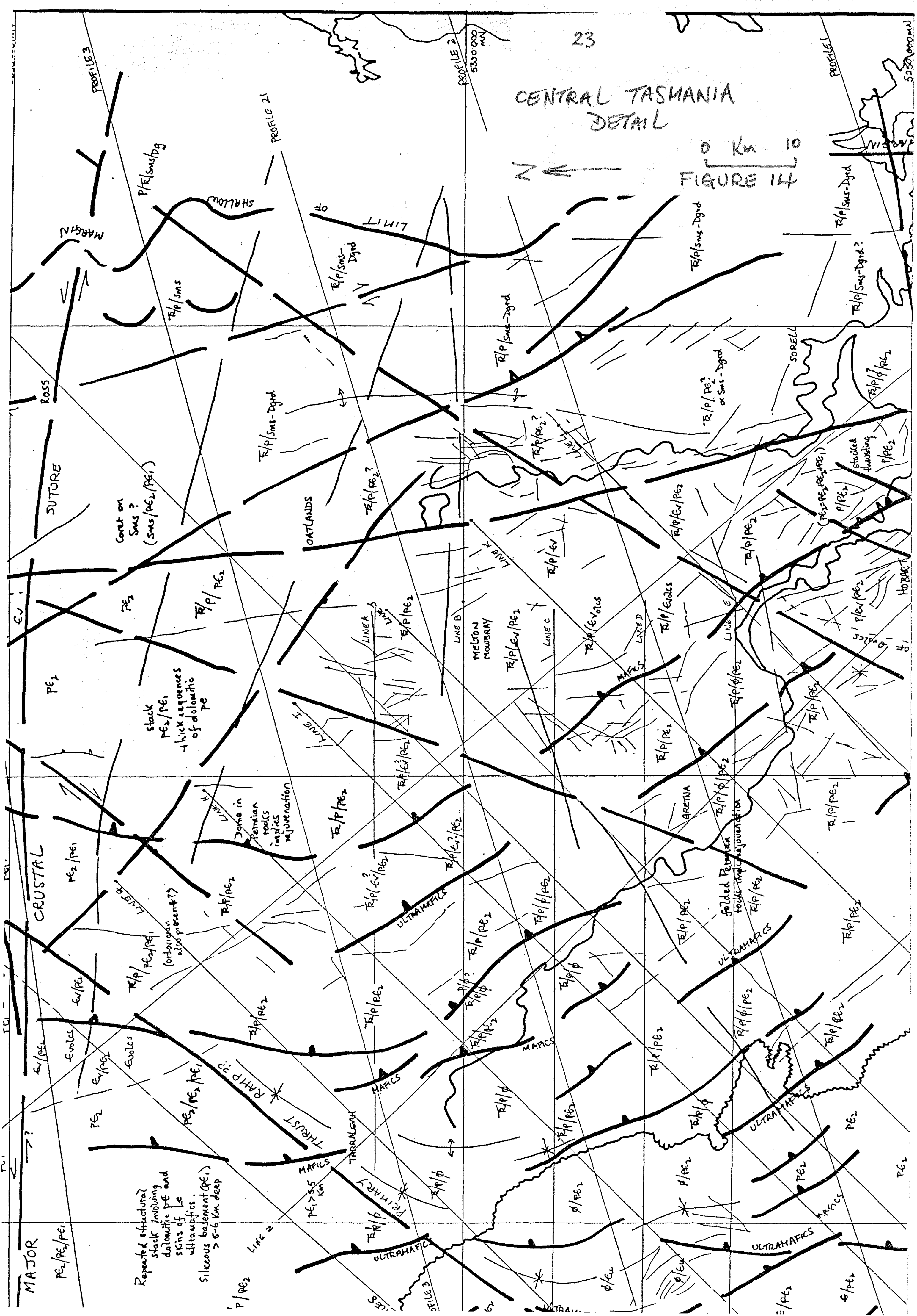
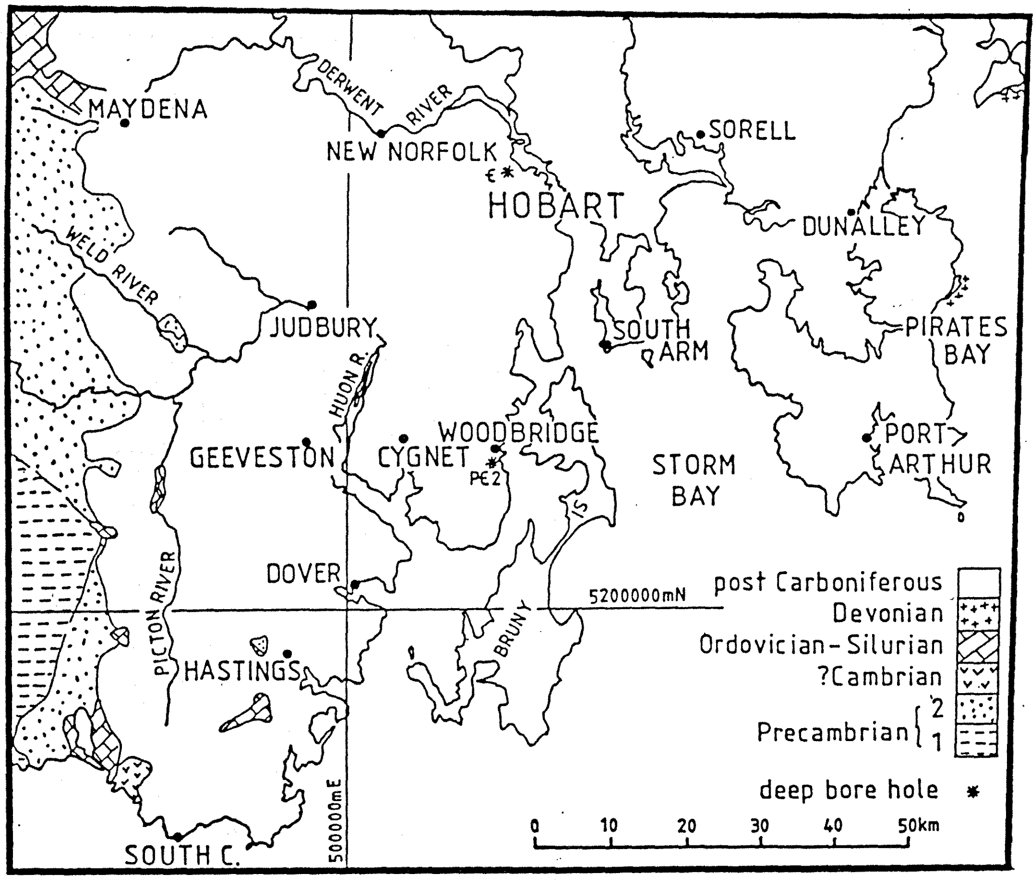


FIGURE 13

PRELIMINARY STRUCTURAL INTERPRETATION EASTERN TASMANIA


CENTRAL TASMANIA DETAIL
0 Km 10
FIGURE 14
PROFILE 3
PROFILE 2
PROFILE 1
PROFILE 2'
5330 000 mN
SHALLOW
MARGIN
LIMIT
OF
ROSS
SUTURE
OATLANDS
MELTON MOWBRAY
LINE A
LINE B
LINE C
LINE D
LINE E
LINE I
LINE 2
SORELL
HOBART
BRETHA
CRUSTAL
MAJOR
THRUST
RAMP ??
PRIMARY
TARRALEAH
MAFICS
ULTRAMAFICS
stacked thrusting
stack PЄ2/PЄ1 thick sequences of dolomitic pЄ
Dome in Permian rocks implies rejuvenation
Folded Permian rocks implies rejuvenation
Repeated structural stack involving dolomitic pЄ and skins of ultramafics. Siliceous basement (pЄ1) > 5-6 Km deep
Cover on Sms? (Sms/PЄ2/PЄ1)
(Ordovician also present?)

24



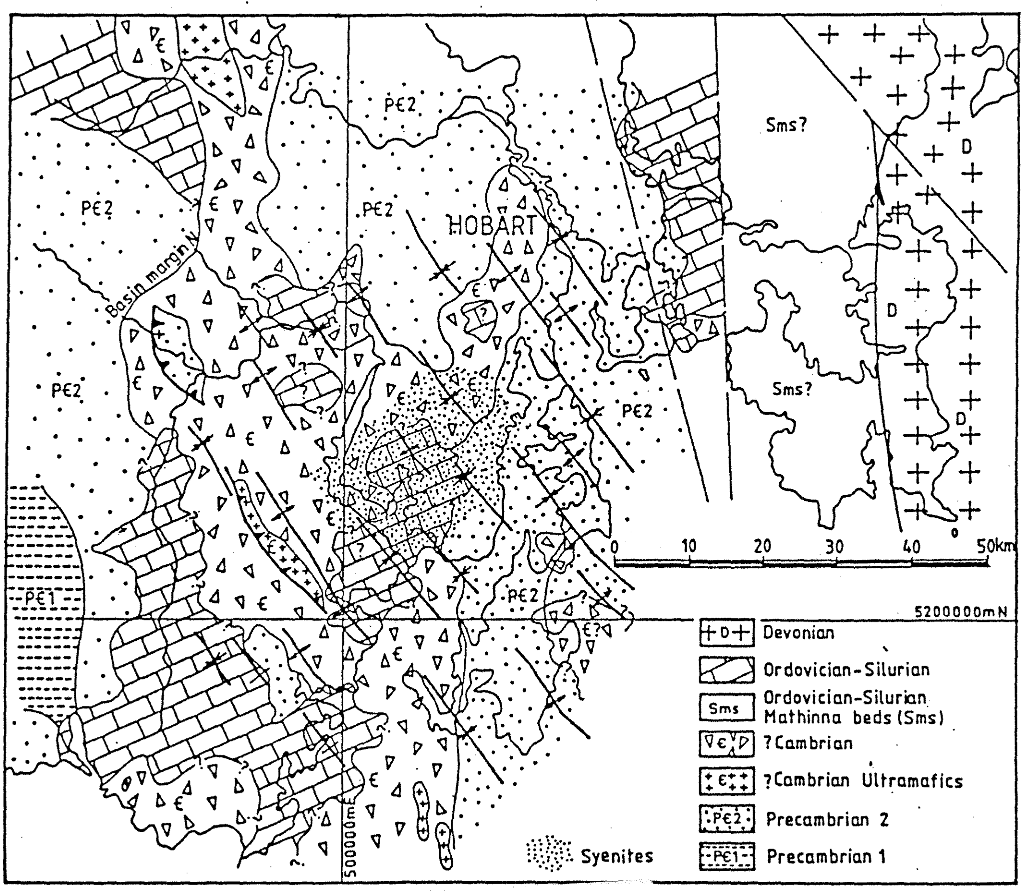


FIGURE 15

The upper map indicates the exposure and knowledge of the pre-Carboniferous cover in southern Tasmania. The lower map shows an interpretation of rocks at the unconformity. This is a typical west Tasmania terrane.

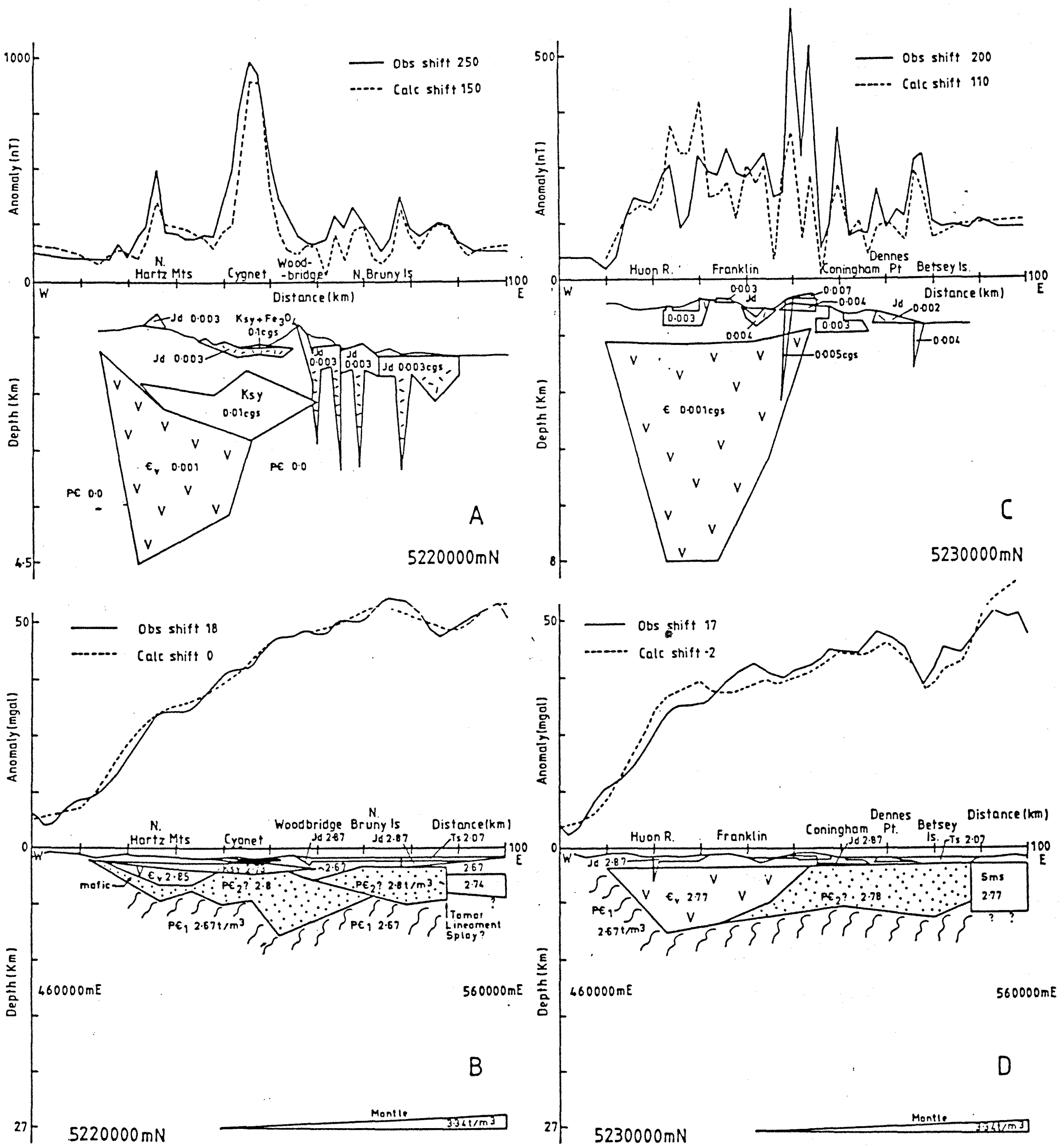


FIGURE 16

The models illustrate some of the basis for the interpretations offered, for the Cygnet or Huon region in particular. The style is identical to that inferred in central and northern Tasmania.

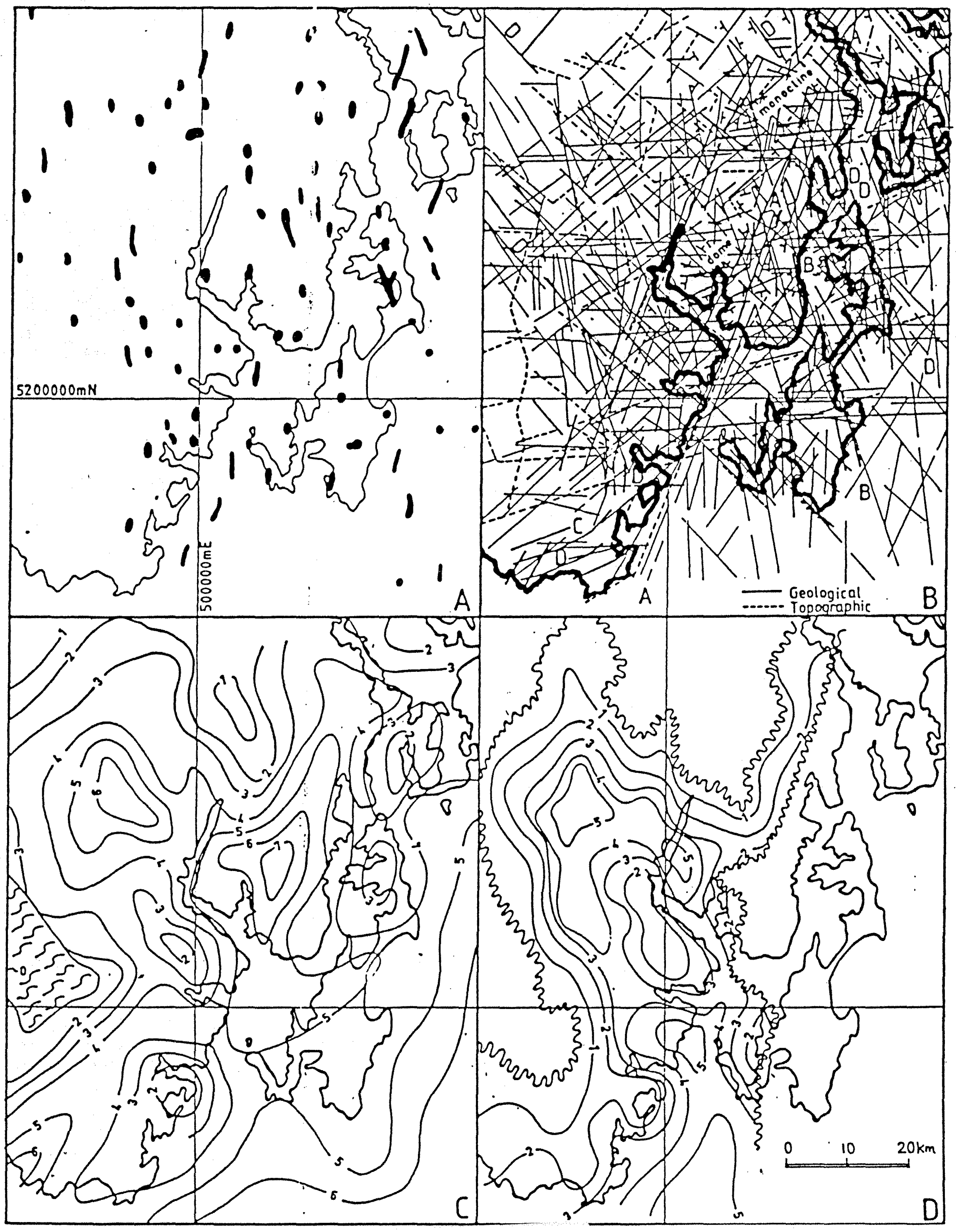


FIGURE 17

Summary of gravity and magnetic interpretation.

A. Jurassic dolerite feeders, location and shapes as defined by available data.
B. Compilation of all trend information (firm and broken lines represent post-Carboniferous or topographic features, fine lines represent features identified by geophysical data.
C. Combined method interpretation of depth to top of Tyennan region type Precambrian basement.
D. Interpretation of depth to base (?) Cambrian volcanic sequences (all contours in km below sea level).

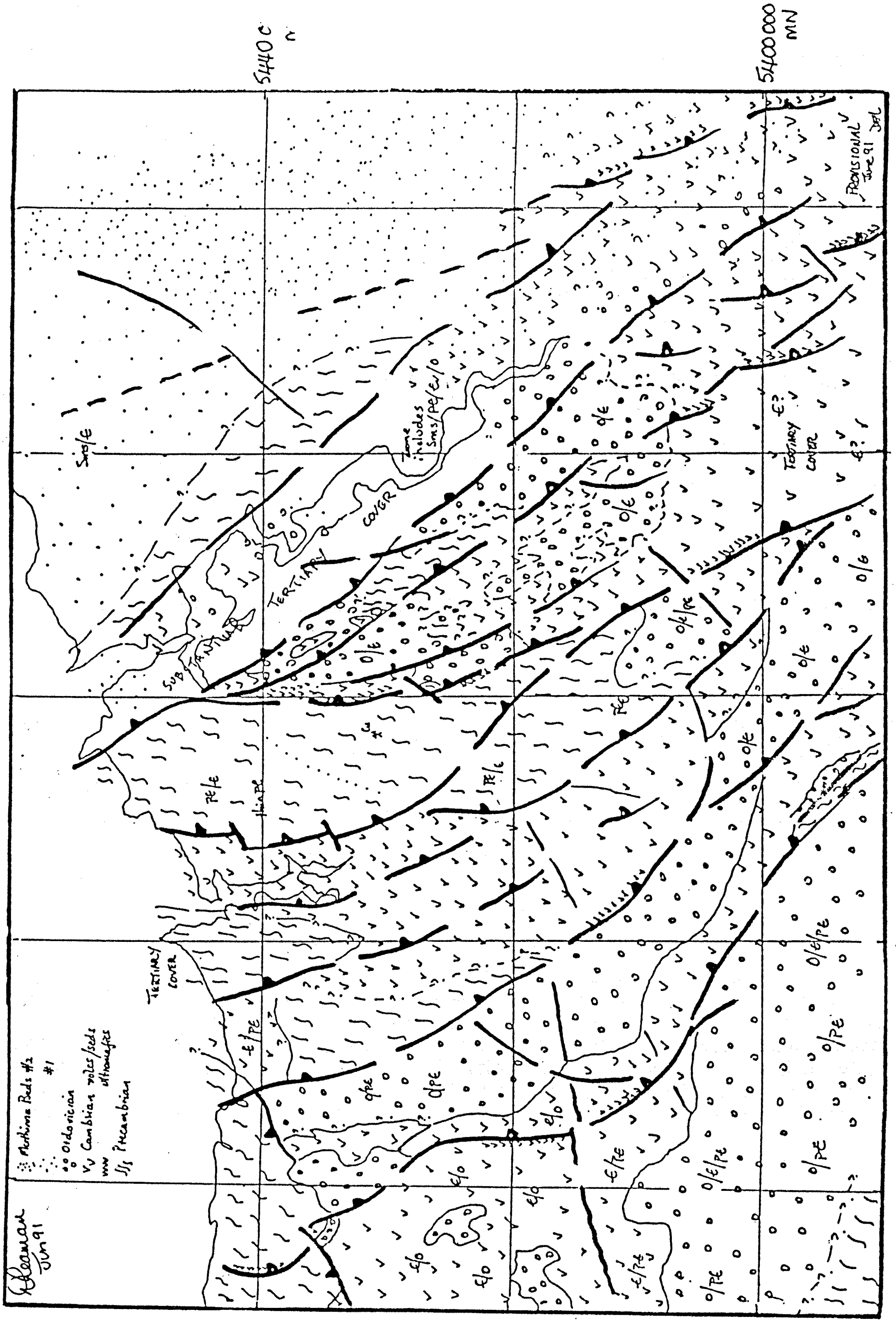
Major thrusts have also been implied. Two of these, one beneath North Bruny Island and another under Storm Bay, have been supported by the limited seismic data available at about the estimated depths of three to four kilometres.

Figure 16 provides some examples of the types of relationships involved and the dove-tailing of gravity, magnetic and surface geological data. The interpretation depends upon a comprehensive assessment of the dolerite component within the cover sequence. The diagram emphasizes the Cygnet region with its anomalous magnetic character and Cretaceous dyke swarm.
The interpretation presented represents an interim stage and more detailed analysis has been recommended and is warranted.

Figure 17 summarises several other aspects of the interpretation. It shows the distribution and orientation of dolerite feeders, within the limits allowed by the magnetic survey; trend patterns in all data and forms of deep basins and troughs. Diagram C represents the approximate shape of the deep fill which is believed to be equivalent to the Oonah and Burnie Formations capped with sequences comparable to those of the Jubilee and Jane River zones. A significant dolomitic content is implied. These materials were drilled at Woodbridge.
Diagram D defines the portion of the succession which includes strongly or significantly magnetic units. In a Tasmanian setting, and by direct correlation to rocks on the south coast, these represent correlates or equivalents of the Crimson Creek Formation and ultramafic/mafic slices or piles. Such responses thus define either Late Precambrian or Early Cambrian units and sequences. Subtler variations of these responses reflect elements such as the Dundas Group and, especially, volcanics comparable to the Mount Read Volcanics. These have been inferred along the eastern margin of the younger trough elements and it is this axis which was drilled at Glenorchy.

The implications of this interpretation are described in Part II.

Part of the **North Tasmania** interpretation is shown in Figures 18 and 19. These emphasize the complex overthrust nature of the zone immediately west of the Tamar River. It also implies that geological units of the west Tasmania type underlie the Mathinna Beds terrane of eastern Tasmania at medium depths. Virtually all thrust transport, and all Devonian-Carboniferous transport, has been from the east.
Figure 19 is particularly interesting west of the root thrust system where it is suggested that comparable thrusting of the Cambro-Ordovician units has also occurred. Relationships of this type must be considered in any exploration of central north west Tasmania but this is beyond the scope of this review.
The region covered by Figure 18 is not noted for any significant mineralisation (other than at Beaconsfield) or any suspected prospects. This may not be a fair view but the current interpretation is important in terms of its prediction of structure style and the ability to trace this style, or detect variations or termination of it, southward into the midlands.



The inferred pattern of major pre-Carboniferous units and structures in Northern Tasmania. The distribution is as would be seen if the cover were removed. (Courtesy Conga Oil Pty Ltd).

FIGURE 18

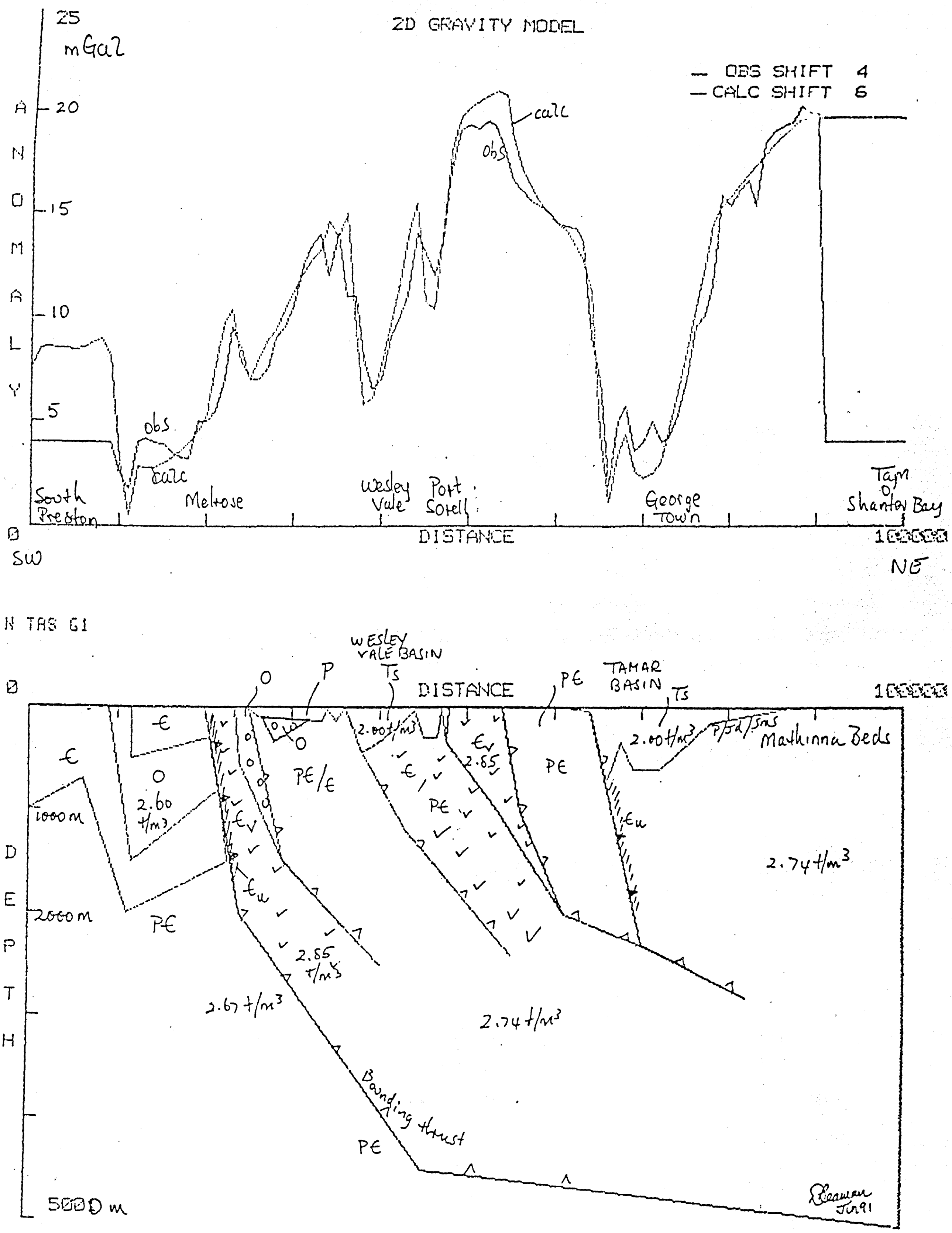


FIGURE 19

Section revealing inferred relationships in northern Tasmania. Note the dislocated and overthrust nature of Precambrian blocks — all from the east. Tertiary and Jurassic structures are associated with pull back of the larger detachments.

The structural style across the midlands is suggested in Figure 20. This view is directly derived from the implications of both the north and south Tasmania studies and the sampled profiles across the centre of the island. It is also consistent with the western study based on the Derwent Valley but the only details of this which can be discussed are shown in Figures 13 and 14 where the pattern extends westward to the structures of the Florentine Valley and Adamsfield. The west Derwent pattern appears comparable to the west Tamar pattern and the structural character can be traced across the region south of Huon River SE of Judbury. Some of the structures involved are compound and ancient since deep troughs are involved and overthrust. Ultramafics are involved in all major boundaries.

Samples of the crude and very preliminary interpretation which has been undertaken elsewhere in central Tasmania are shown in Figures 21 to 24. The models shown have been extracted from a basic research set selected to define mantle issues in general terms and to review gross elements in the gravity and magnetic fields. They clearly leave much to be desired and largely ignore near surface contributions. They do, however, indicate the nature and scale of the issues and basement structures.

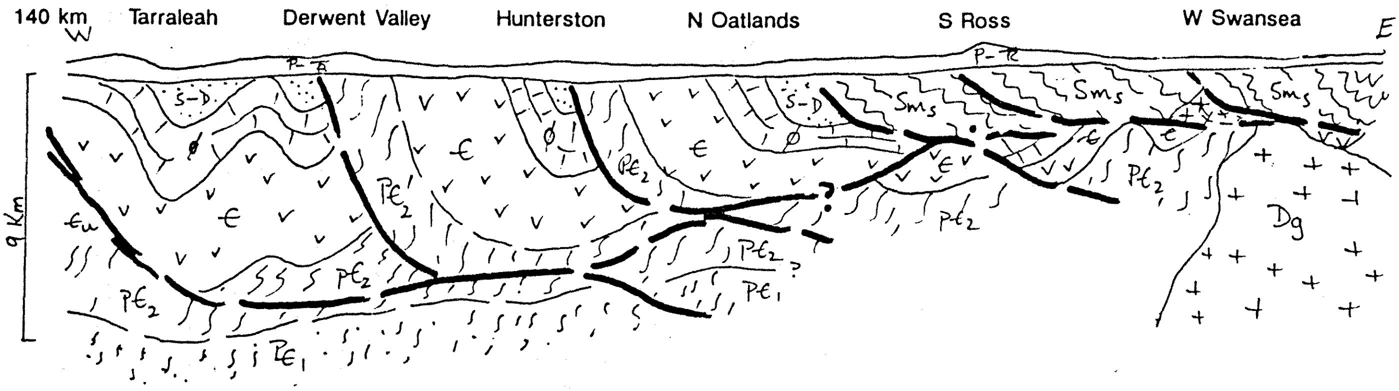
Line 2 (Figure 21) extends across the southern midlands from near Lake Pedder to Triabunna (see Figures 13, 14 for all line locations). This gravity model stresses the unusually spiked nature of the field and the need for high positive density contrasts of a width which cannot possibly be assigned to, or explained by the obvious very dense rock known to exist in the region, Jurassic dolerite. The explanation has to lie in the pre-Permian basement. Figure 22, the equivalent magnetic profile, shows that the source is not magnetic with the possible exception of part of the Levendale anomaly. Only the Late Precambrian dolomitic successions can explain these properties. Repetition is indicated.

The eastern part of the gravity profile is dominated by the influence of the underlying Devonian batholith and the position of the margin is easily assigned. Spikiness of the magnetic profile reflects the contribution from the complex forms of the dolerite sheets in the cover and the two largest single spikes almost certainly identify feeders. Note that each of these is located on the west side of the implied underlying major density contrast change and this association is consistent with a primary deep structural control. It should also be noted that the magnetic and gravity models presented have different depth scales and therefore distort the apparent relationships evident on limited inspection.

The general increase in magnetic anomaly, spikes included, in the Levendale region is of more interest since it is comparable to the broad Geeveston-Franklin anomaly (see Figure 16) which was directly traceable to major Cambrian successions. This broad effect can not be explained by any shallow influences although the imposed spikes are sourced within the cover.

Modelling of this line merely suggests that the patterns of southern Tasmania are repeated in this midlands region and that another deep trough fill is present. Only Cambrian rocks can be involved given the properties implied.

Along strike elements of the western sequence underlying the primary detachment have been incorporated within the thrust complex which includes the deep basin Mathinna facies. Figure 7 shows such pieces west of the Tamar River near Beaconsfield but similar variations occur east and south of Hobart.



SUGGESTED RELATIONSHIPS AND STRUCTURAL STYLE

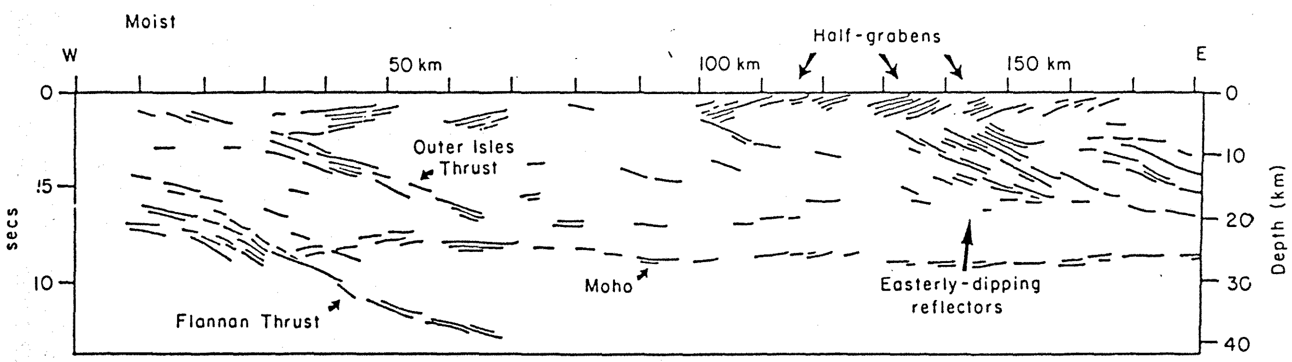
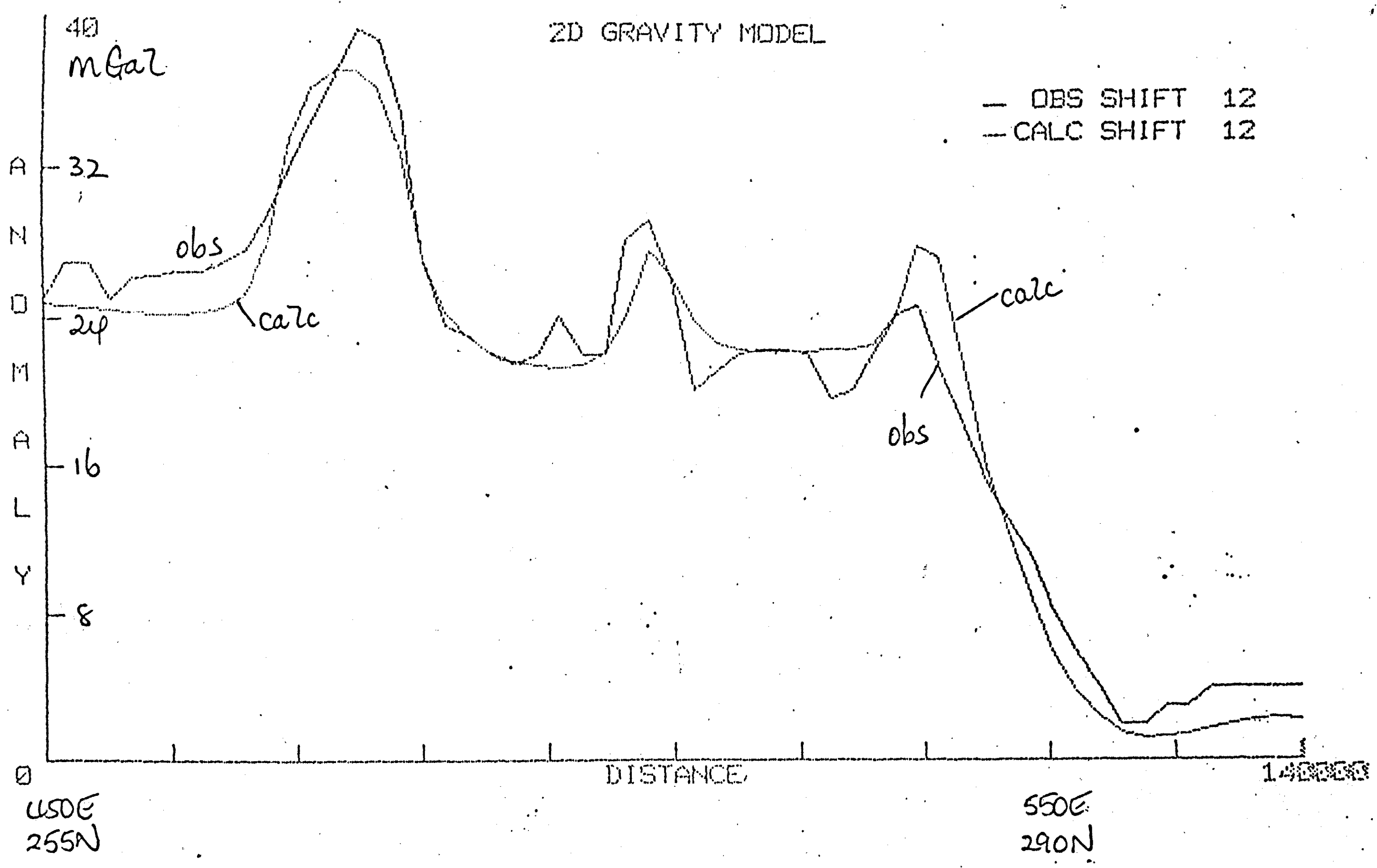


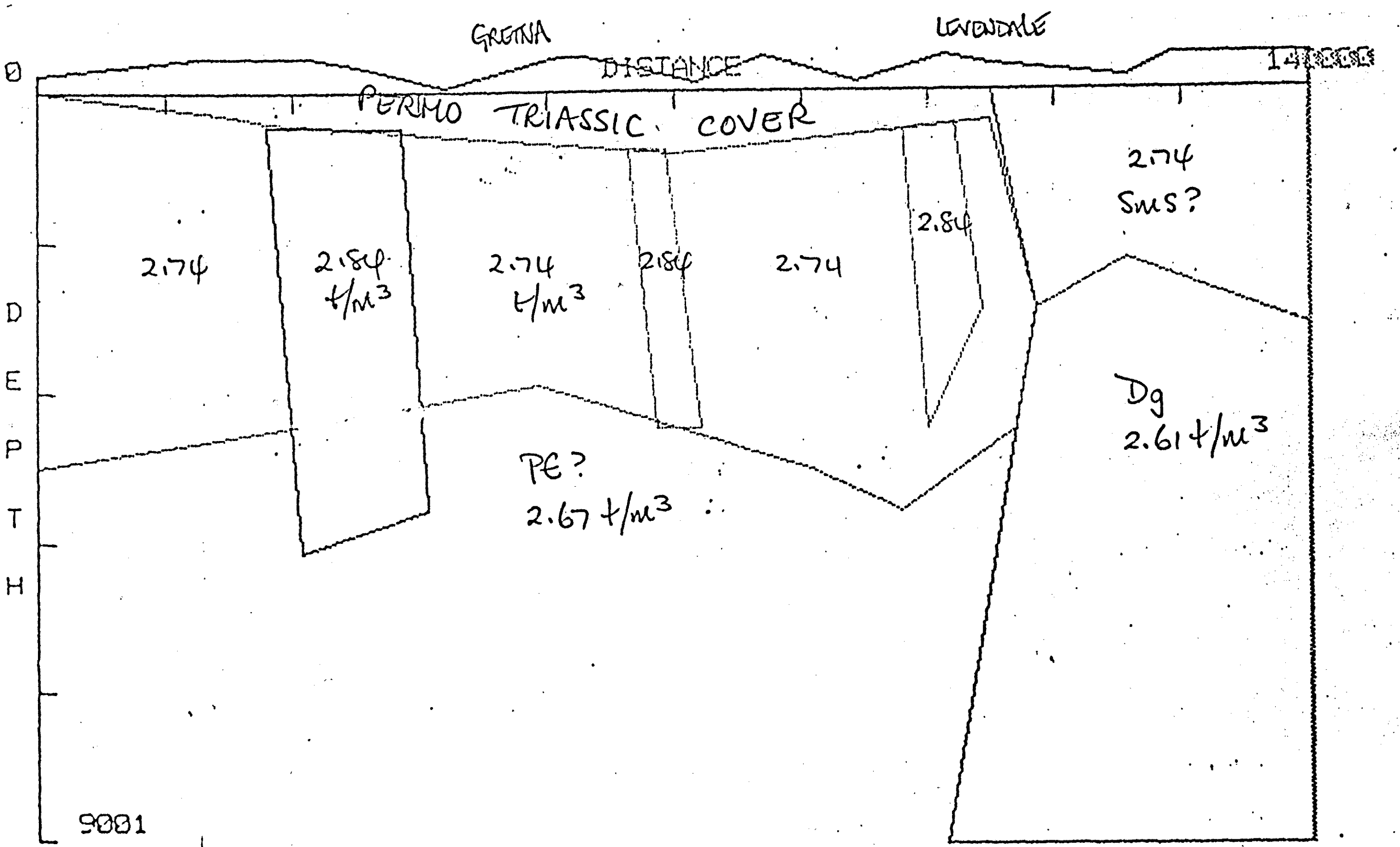
FIGURE 20

Regional conception of structures in eastern and central Tasmania, based on preliminary long line modelling of gravity and magnetic data. Note the continuance eastward of the western basement type and style. The major detachments incorporate slices of ultramafic rocks and can be mapped magnetically (see fig. 3). Pull back of these structures accounts for the Derwent, Cressy, Coal River and Tamar sub-basins of the post Triassic. The overall asymmetry of the section is related to the greater uplift to the east related to both the original basin axis and the batholith emplacement. The lower section shows similar relationships in northern Scotland (after Brewer, 1983), where North Sea-related tensions have pulled back the older detachments to create half grabens.

LINE PARAMETERS - ORIGIN,LIMIT,INCR : 0 140000 2500



TASRG2 LOWER MIDLANDS GRETNA-LEVENDALE



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

FIGURE 21

62000.0 -71.0 13.0 (33) 70.0

LINE PARAMETERS - ORIGIN,LIMIT,INCR : 0 140000 2500

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

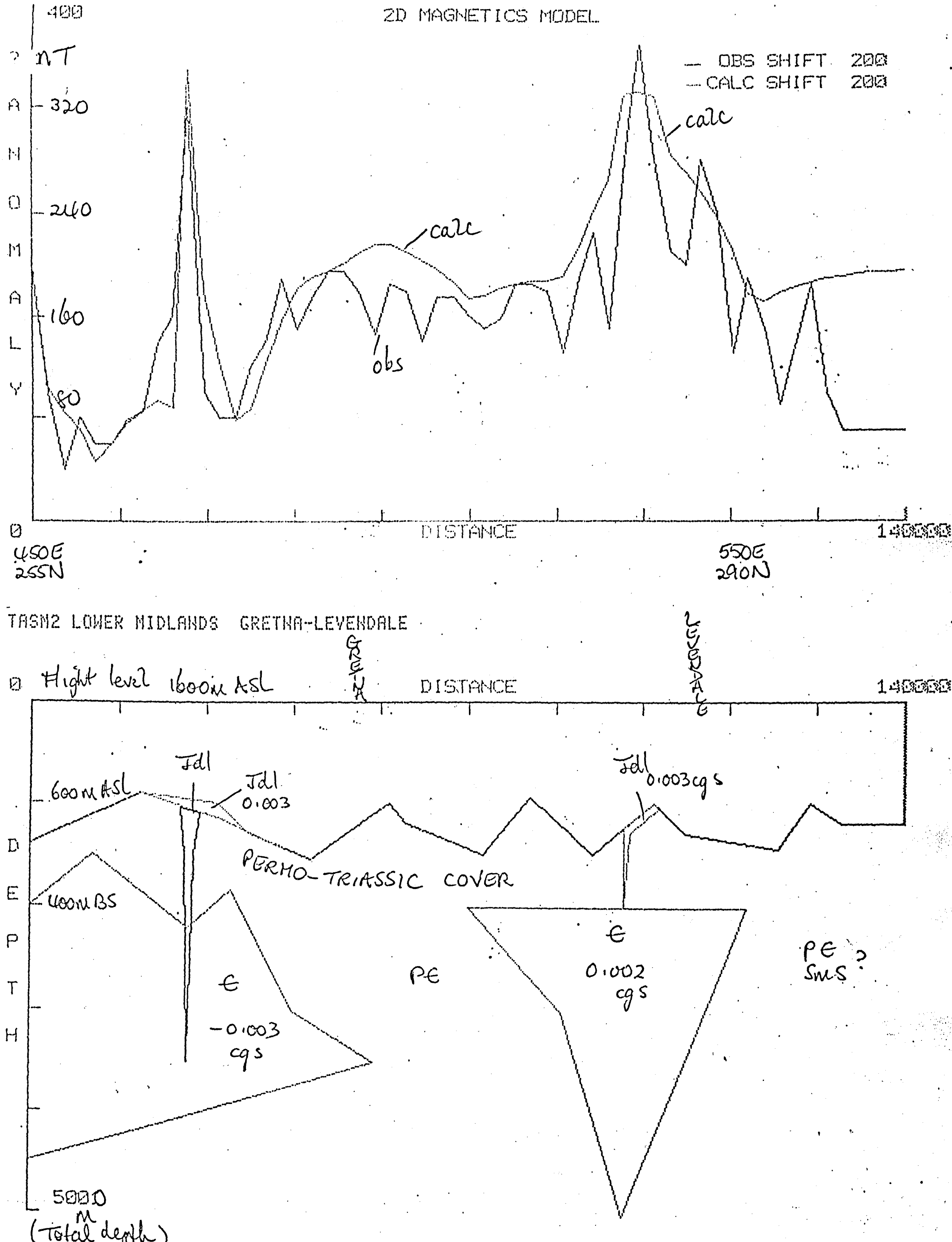


FIGURE 22

MAGNETIC MODEL LINE 2 (WITH DOLERITE EXAMPLES)

Similar conjuctions may be oberved in the Maydena region where the magnetic field is anomalous low. This can be achieved if similar Cambrian successions are present and either reversely magnetised or overturned. Significant magnetic contrasts are implied however the effect is explained and this limits the geological possibilities.
The structural section shown in Figure 20 suggests how these fragments of information may be combined and several elements are recognisable even though Figure 20 was based on modelling 40 km further north.

Figures 23 and 24 present gravity and magnetic models for a different portion of the southern midlands. Line L links Line 2 (above) to the western part of the D'Entrecasteaux study area.
The gravity field is dominated by the contributions from the dense Jubilee Group succession dolomitic rocks and the effect of the major pluton under SW Tasmania. Both response types can be traced to exposures and the general contrasts and relationships are not in question. The general gravity fitting is quite poor but all minor contributions, including Derwent Valley structures, have been ignored and the Brighton anomaly has not been reviewed.
The magnetic field, however, generally increases across the Brighton region which is the zone which includes the deep magnetic source shown in Figure 22. It is possible that part of the gravity response in this area represents a denser component in this magnetic sequence and, if this is the case, based on experience elsewhere, it may delimit types of Cambrian succession. The more local spikiness is almost certainly due to dolerite feeders.

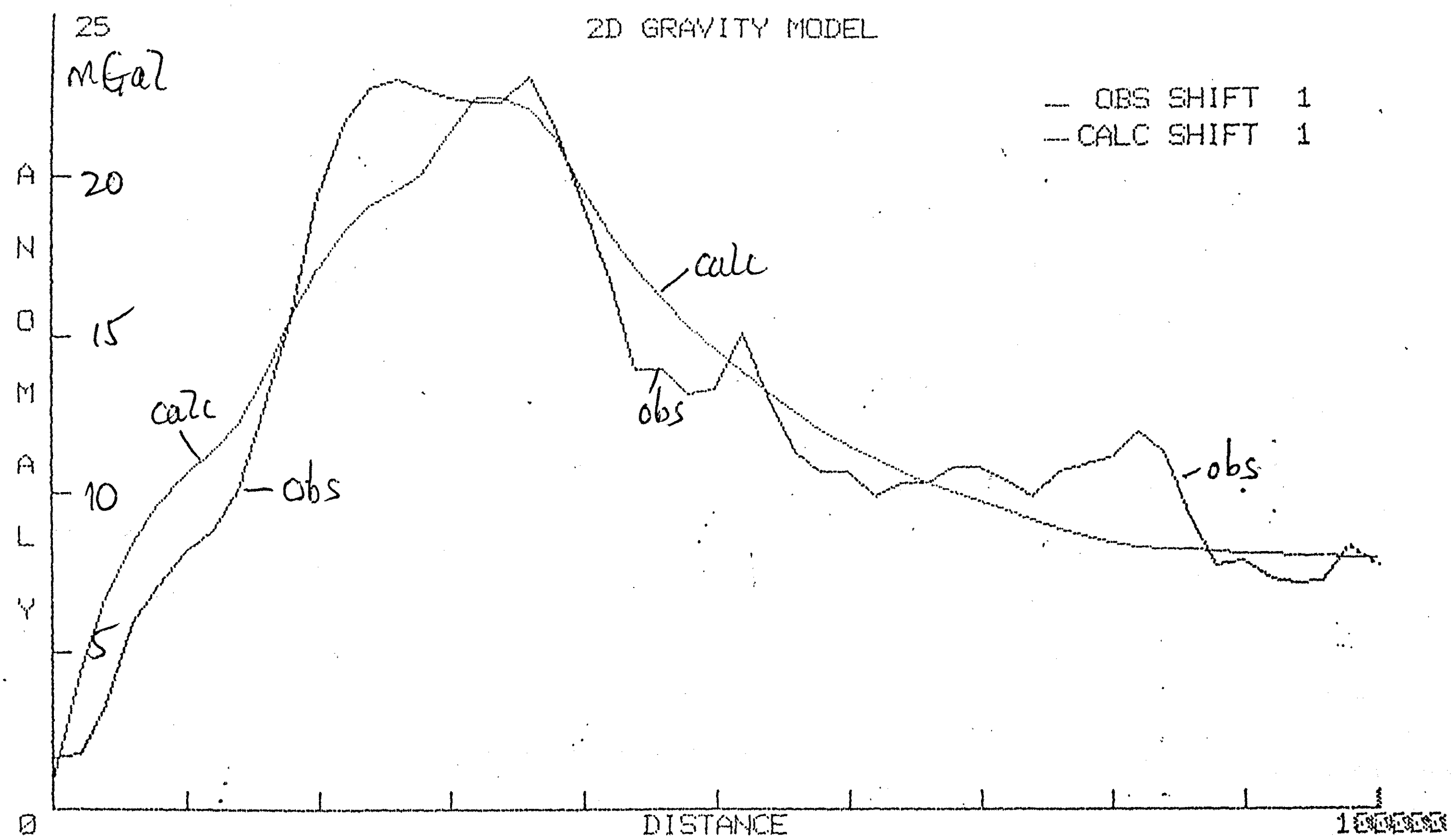
It should also be noted that the rough magnetic interpretations displayed in Figures 22 and 24 were based on coarse sampling of a very high level survey. The difference between flight level and terrain is indicated in the diagrams and this means that only penetrative elements of the dolerite sheet system (mainly the major dykes and feeders) will be represented obviously in the field observed.

The data available, e.g., Figures 4 and 8, will allow more detailed interpretation but there are some severe limitations. The gravity data, where coverage is adequate (generally the case), will allow a comprehensive analysis of both cover and basement structuring and relationships but the magnetic data will not. This data is generally too widely spaced to allow more than indicative evaluation of all components and a relatively poor assessment of cover components.
Both data sets should be used up to these limits since they can, with fair reliability, define all primary and crustal level structures. Any results, however, should be regarded with some caution until the local contributions from dolerite sheets have been fully checked by more detailed magnetic survey.

It is nevertheless clear that the regional data can define, with modest precision, target zones or sequence boundaries and assess the approximate thickness of cover within these constraints and so nominate small areas for detailed review and further acquisition.

DERWENT GRAVITY REL 1000M LINE L 35

LINE PARAMETERS - ORIGIN,LIMIT,INCR : 0 100000 2000



SW NE

DERWENT GRAVITY REL 1000M LINE L

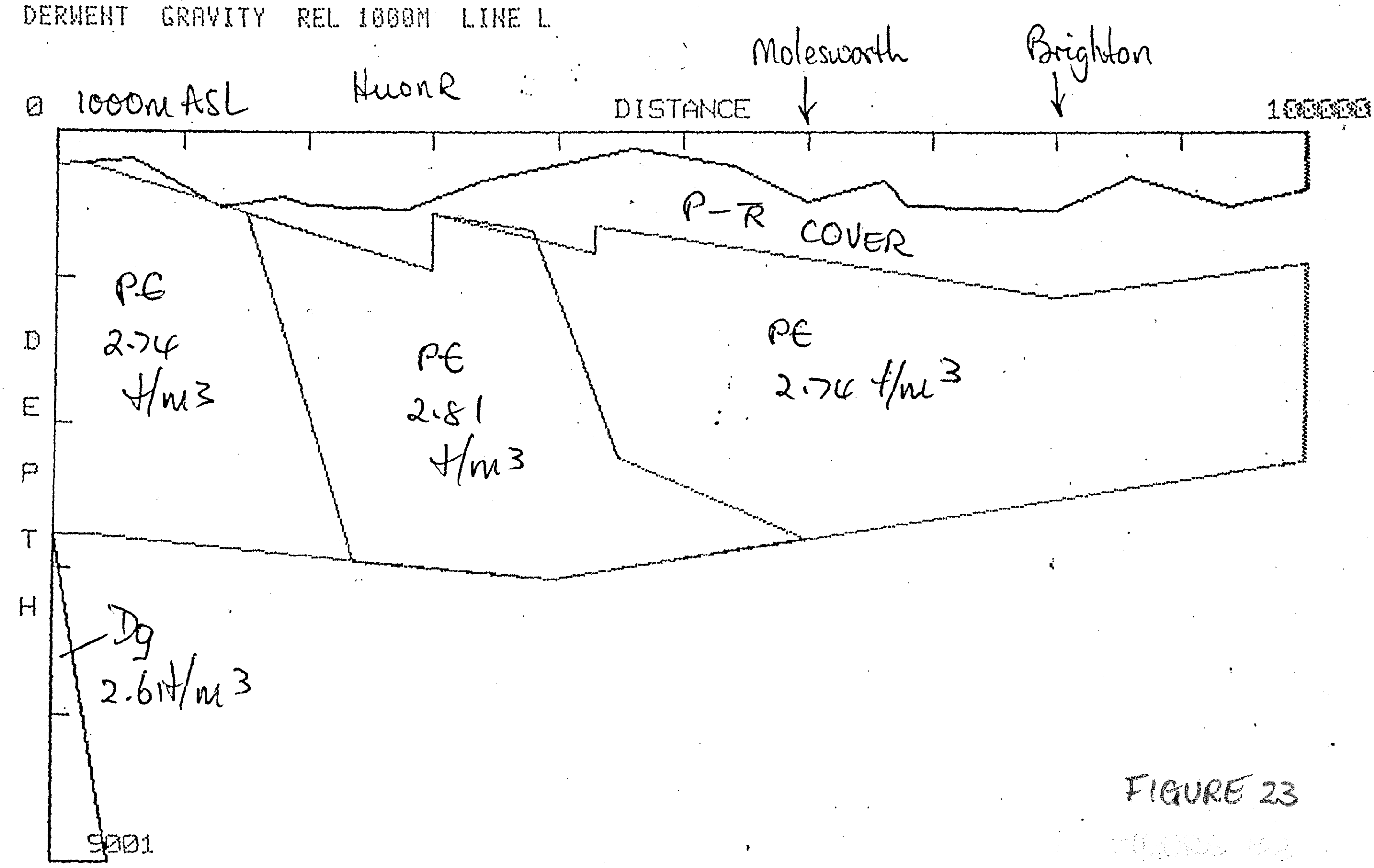
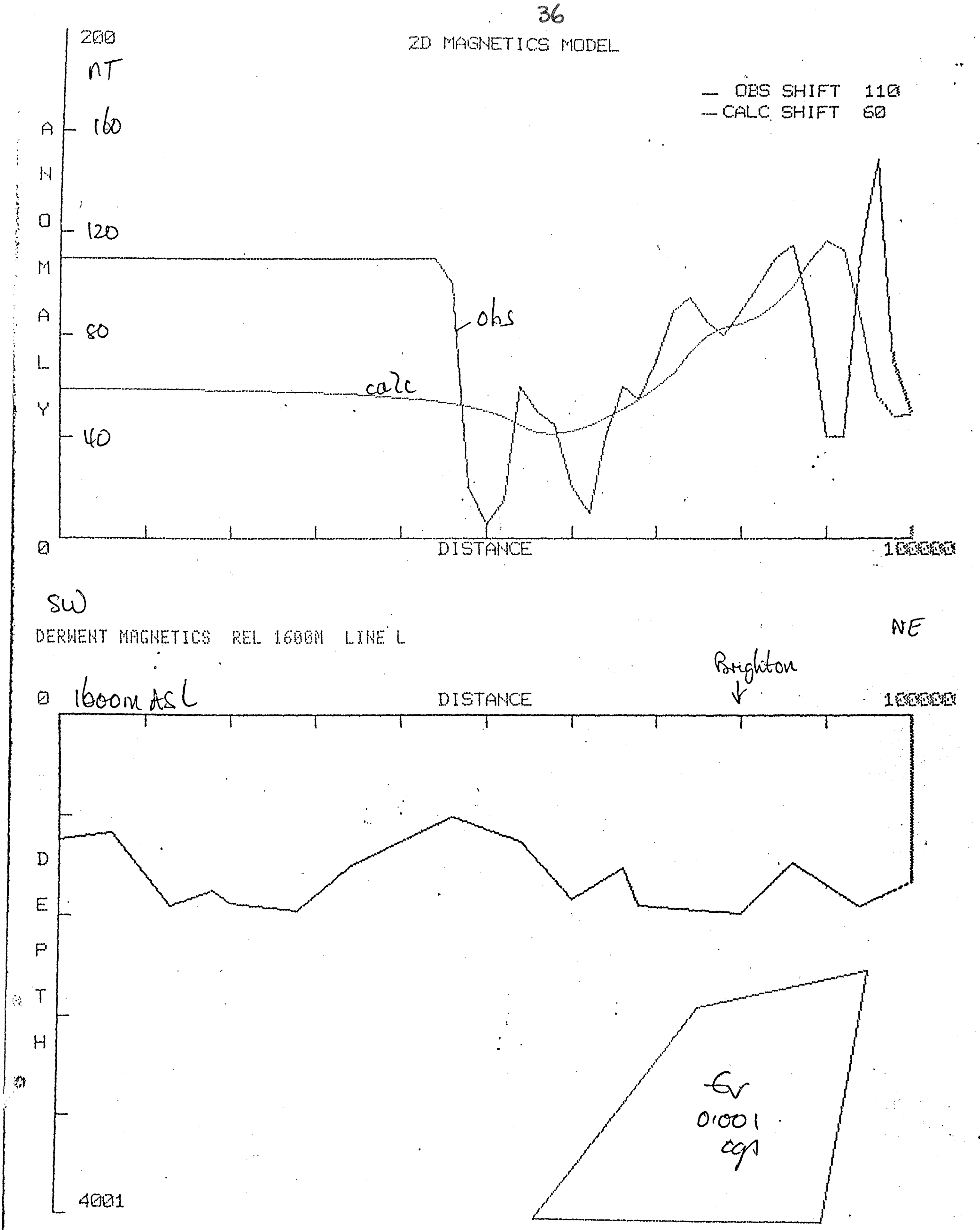


FIGURE 23



200
2D MAGNETICS MODEL
nT
OBS SHIFT 110
CALC SHIFT 60
ANOMALY
160
120
80
40
0
obs
calc
DISTANCE
100000
SW
NE
DERWENT MAGNETICS REL 1600M LINE L
Brighton
0
1600m ASL
DISTANCE
100000
DEPTH
4001
Gr
0.001
cgs

FIGURE 24

INTERMEZZO

An intermezzo is a short section or interlude separating major parts of a symphonic work.
That is how I see this report.

Before considering what is known of the detailed setting of the reported mineralised sites in central and southern Tasmania it may be useful to reflect on what is known of the mineralised sites of western Tasmania.

A recent review reported to Pasminco Exploration suggested that the major, known mineralised sites of western Tasmania were associated with the deformed margin of an ancient trough. It was proposed that this margin had been persistently wrenched while the entire region was in gross extension. This coupling of forces has led to an erratic series of local compressions and development of deep cross margin rifts. Much of the activity was focussed during the Cambrian period and the Mount Read Volcanics and associated mineralisation can be linked to a second phase of structural development within the marginal zone. Volcanism has been concentrated toward the eastern side of the widening deformation.
A much quieter history with reduced intensity punctuations followed the Early Ordovician until many of the older crustal structures were rejuvenated and occupied during the Devonian deformation and granitoid intrusion sequence.

Key elements of the known mineralised sites include
1. Relative closeness to the primary concealed older trough margin.
2. Association with deposits formed during the active phase of basin formation when half grabens are actively rotated. This is also the period of initial primary melting focussed adjacent to the most active penetrative structures.
3. Local structural controls may show intra-sequence inversion.
4. A local break in section is implied. This may be related to local uplift, or inversion due to underlying wrenching dispersed in complex flower structures.
5. The fluid system is held open by cross shearing either at the site of old transforms or the intersections with shear couples related to, or generated by, the main wrench. No major ore body can be formed unless large volumes can be transmitted in relatively short periods and this implies activity and continual breaking of seals.
6. The most active sites will also display anomalous facies and depositional variations as well as foci for feeder and volcanic centres.

Given that some of these elements are more readily observed where the target rocks are actually exposed it should also be noted that most of them require major crustal components which are recognisable in regional data. Cover need not be an issue. Cover may, however, only transmit suggestions of underlying structure and younger structures - whether in directly associated rocks, or in much younger cover - must be seen in this manner; as guides and clues.

PART TWO

REVIEW OF MINERALISED SITES

INTRODUCTION

This part of the report examines the mineralised sites which have been reported and which were tabulated in Part I.

Each site is considered in terms of data available prior to this review. In most cases this is supplemented by inspection and comment based on evolving ideas since most of the interpretive basis reported in Part I is older than mid 1991; negligible work or analysis having been done since 1990. Most of the detailed interpretations which form the basis for Figures 13 to 17 were prepared prior to 1988.

An attempt has then been made to rank each reported site and to infer the possible location of other sites. These are difficult assignments given the present level of data and analysis and much work is required before a complete list of possibilities could be assembled. The final segment of the report represents a start along this path and some new and more detailed solutions have been offered for parts of the midlands.

SITE DESCRIPTIONS

CYGNET

The Cygnet area of southern Tasmania has long been known for its gold occurrences. There has even been moderate production (a total of 3000 ozs prior to 1902). Most gold was won from alluvial deposits but some lode mining was included.

The occurrence of gold in the Cygnet area is anomalous. Most of the regional geology consists of a Permo-Triassic sequence of marine and freshwater siltstones, mudstones, sandstones, and calcareous mudstones. These rocks do not normally carry any useful grades of any mineralisation. The anomalous geological components of the area involve a large domal structure centred on Cygnet and a dyke swarm with some minor sills of Cretaceous alkaline syenitic rocks.

It has always been assumed that the gold is genetically related to the syenites. These notes consider this assumption, previous exploration and the implications of new structural understanding of the dome, the syenites and the underlying rocks.

The most recent exploration effort, by Cyprus-Poseidon, was encouraging but led to enigmatic results and not much understanding of the origin and association of the gold. The relinquishment report concluded with the following comments:
"..(the area) is considered to have significant potential for hosting a replacement style (Carlin type) disseminated gold deposit

associated with intrusion of gold-anomalous alkaline porphyries into limey/calcareous mudstones and tills etc.......detailed programmes conducted by Cyprus/Poseidon have failed to identify economic mineralisation and it is now felt that new blood is needed to generate new ideas ....."

This is a most eloquent admission that the area is both attractive and difficult to understand.
Review of the work done shows that many key elements of the structure were not understood, nor included in the concepts for the origin of the mineralisation. (New ideas on the area were first published by Leaman, 1990, 1992)).

About previous mining..

Most production from the area was alluvial and derived from the valley systems draining the Lymington area and the Huon river south and east of Mt Windsor. It is likely that there is further potential for this type of production in Copper Alley, Wheatleys and Petcheys Bays.

Underground mining began in 1898 and was continued for about thirty years. It was restricted principally to the Mt Mary area south of Cygnet and Tobys Hill to the north east. Production was patchy and limited. Grades were extremely variable. Alkali rocks contained up to 6 g/t gold while adjacent altered sediments contained up to 22 g/t.

Findings of previous exploration...

No record of any coherent exploration is known prior to late 1964. The Mines Department sent a prospector to the Lymington area in the summer of 1964-5 and his work confirmed the presence of rich pockets of alluvial gold within recent silts.

Pechiney, in 1971, established that gold was not the only anomalous material. Geochemical surveys in the Mt Windsor and Mt Mary areas defined copper anomalies of 275 and 115 ppm resp. BHP undertook a feasibility study of the area prior to taking up a licence and this showed that the gold was associated with significant concentrations of Ag, As, Cu, Pb, Zn and Ba. Little was done until about 1980 when a small local company was established to re-open the Mt Mary mine. This amateur operation cleaned up the site but achieved little else other than to draw attention to the area. This led Amoco Minerals, subsequently Cyprus Minerals and Cyprus Gold, to apply for an exploration licence of 100 sq km centred on Mt Mary (EL 36/82). The Cyprus programme included review of past work, much as summarised here, followed by a regional rock chip sampling programme, some local gridding of defined anomalies, costeans, further sampling and some drilling. The regional programme concentrated interest in the Toby's Hill, Mt Mary-Kings Hill and Black Jack Ridge (503E, 2175N) areas.

Most work was limited to the Mt Mary area. All lcoations are shown in Figure 25. The element association was Au-As-Pb-Zn with up to 0.42% Zn at Mt Mary and 0.86% Pb at Kings Hill. These were extreme values

M = extreme metamorphism

FIGURE 25

NTOUI

in this area. The main lode yielded an average of 1 g/t but the recorded grades of 23 g/t were encountered occasionally. The "western reef", however, averaged only 0.1 g/t with a peak value of 10.6 g/t. A shear zone, encountered during drilling, yielded up to 24 g/t. Costeans and drilling in the Mt Mary area demonstrated that much of the gold was concentrated in the sedimentary rocks or shear zones rather than the syenites.
No consistent reef system was found at Mt Mary but gold was locally concentrated in the host shales. One of the best intersections of this type was 11m averaging 0.23 g/t. All mineralisation was associated with carbonate/epidote/ haematite alteration.
Syenites were also occasionally significant yielding average grades of 0.7 g/t peaking to 3 g/t - in association with silver grades of 9.5 g/t.

No system was established in any of these intersections.

Arsenic anomalies were also noted in Bundella Mudstone on Black Jack Ridge.

All of this work has been reported in annual reports for 1985-88 and summarised by Cyprus Report 614 for 1987-88 (Jones, 1988).

Other information...

Much information described by Leaman & Naqvi (1968) and Farmer (1985) was available to most explorers. Some of it has been misunderstood. Jones (1988), for example, states that the doming preceded intrusion of the Jurassic dolerite when much evidence can be advanced to show that doming followed intrusion. This type of structural information and its implications for appraisal of reported shear zones and nature of emplacement and distribution of the the alkaline rocks - and presumably the gold as well - has been ignored.

All previous workers have also noted the presence of free galena and chalcopyrite - especially in the Lymington area. The name of the Copper Alley Bay is indicative. None of these sites appears to have been reviewed during the Cyprus programme and yet grades in this area must exceed any values noted during the exploration programme.
The key question, however, is why and how are lead, silver and copper levels anomalous? None of these elements is significant within the syenites. Also, how is the gold transferred to the host rocks when the alteration associated with most alkaline intrusives is minimal? And all of this ignores the huge volume of coarse grained pyrite and pyrrhotite to be found between the eastern side of Port Cygnet and the foothills of Mt Windsor. Mt Mary lies within this pyrite rich zone. None of these matters have been considered.

The new regional work undertaken for Conga Oil may help answer some of these questions.

Recent regional setting analysis...

Understanding of the regional setting of the Cygnet area has been greatly improved as a result of gravity and magnetic surveys undertaken and interpreted on behalf of Conga Oil. The primary brief of the work, reported by Leaman (1990) and various Conga Oil documents in the public domain, was to establish the presence or absence of Ordovician rocks within the sequence beneath the base Permian unconformity. Achievement of this goal meant comprehensive evaluation of all parts of the upper crust and interpretations considered intrusion forms, lineaments, and structures to a depth of about 7 km.

Magnetic data are most expressive.
Figure 26 shows the 1965 compilation from Leaman & Naqvi (1968). This limited survey reveals a central anomaly located east of Mt Mary with three radiating prongs. These do not correlate with exposed structures or faults but the NE-SW terminating trend across Port Cygnet reflects the regional extension of the syenites toward Woodbridge. Tobys Hill is adjacent to the N-S trend while the anomalous values in the Kings Hill region are associated with the E-W axis. The mineralised part of the Lymington and Black Jack Ridge zones lie on the terminating trend. The exposed sulphides of Copper Alley lie on this trend.
These relationships cannot be accidents.
The magnetic field within Port Cygnet was clarified by Leaman (1977) - Figure 27. The pyrrhotite-rich zone on the eastern side of the bay is clearly defined.

None of these associations or data were recognised or used by the Cyprus programme!

It has always been assumed that the peak anomaly near Regatta Point is associated with thermal alteration of dolerite by the syenite. But why should this be so localised when dolerite is massively intruded elsewhere and only a dyke swarm is exposed?
Note also that most of the rocks affected magnetically are basal tillites.

Leaman & Naqvi (1968) and previous authors reviewing the petrology of the dolerite and the syenite have always considered that some form of hybridisation, or extreme thermal metamorphism, to have taken place in the Regatta Point area. Farmer (1985) misunderstood what was meant by this term and in doing so completely overlooked the general high grade of metamorphism of the tillite in the Mt Mary - Regatta Point region. The effect covers all of the northern part of Port Cygnet and extends west to the foothills of Mt Windsor. An area with a 5 km diameter is involved and all high relief magnetic anomalies fall within it - in so far as current surveys have defined them. There is scope for some detailing here.
The general volume of metamorphosed rock is too great and too extreme and out of character to be associated simply with the dyke swarm. It is also not consistent with a dolerite feeder system. All gold values of any consequence have been derived from this same zone.

I argued in Leaman & Naqvi (1968) that the dome was high level and related to a laccolith of alkaline rocks. The root of the laccolith

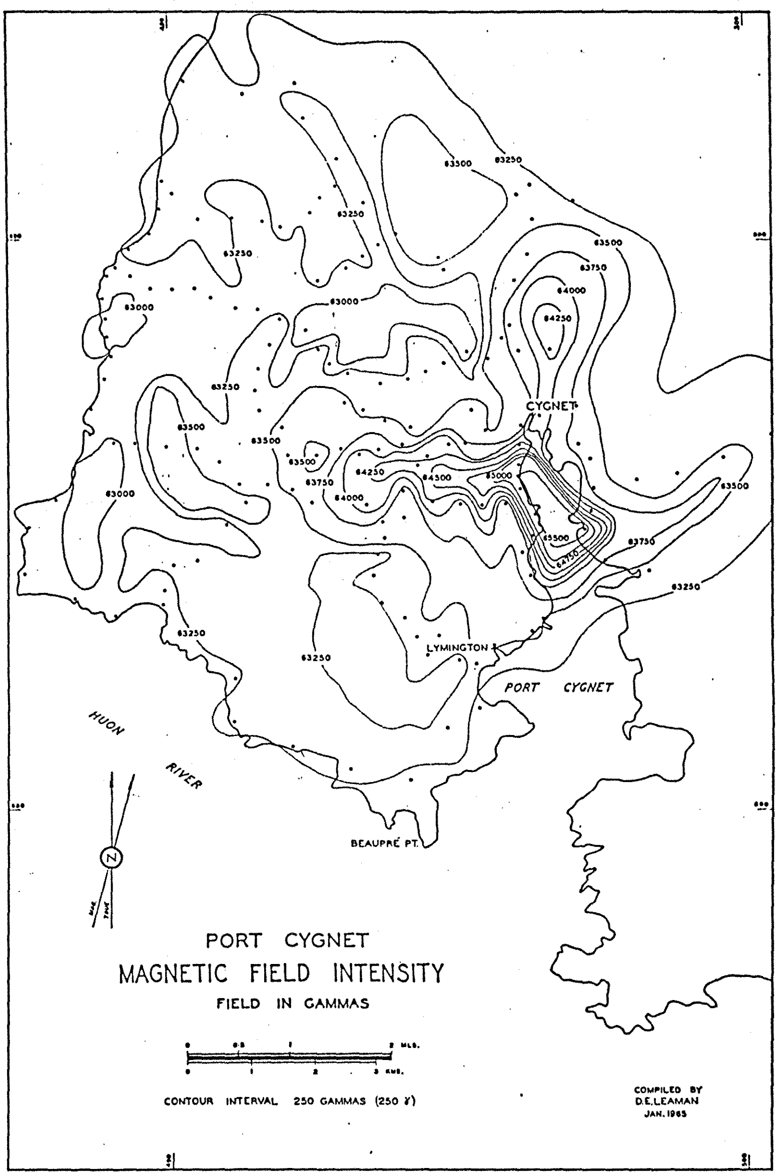
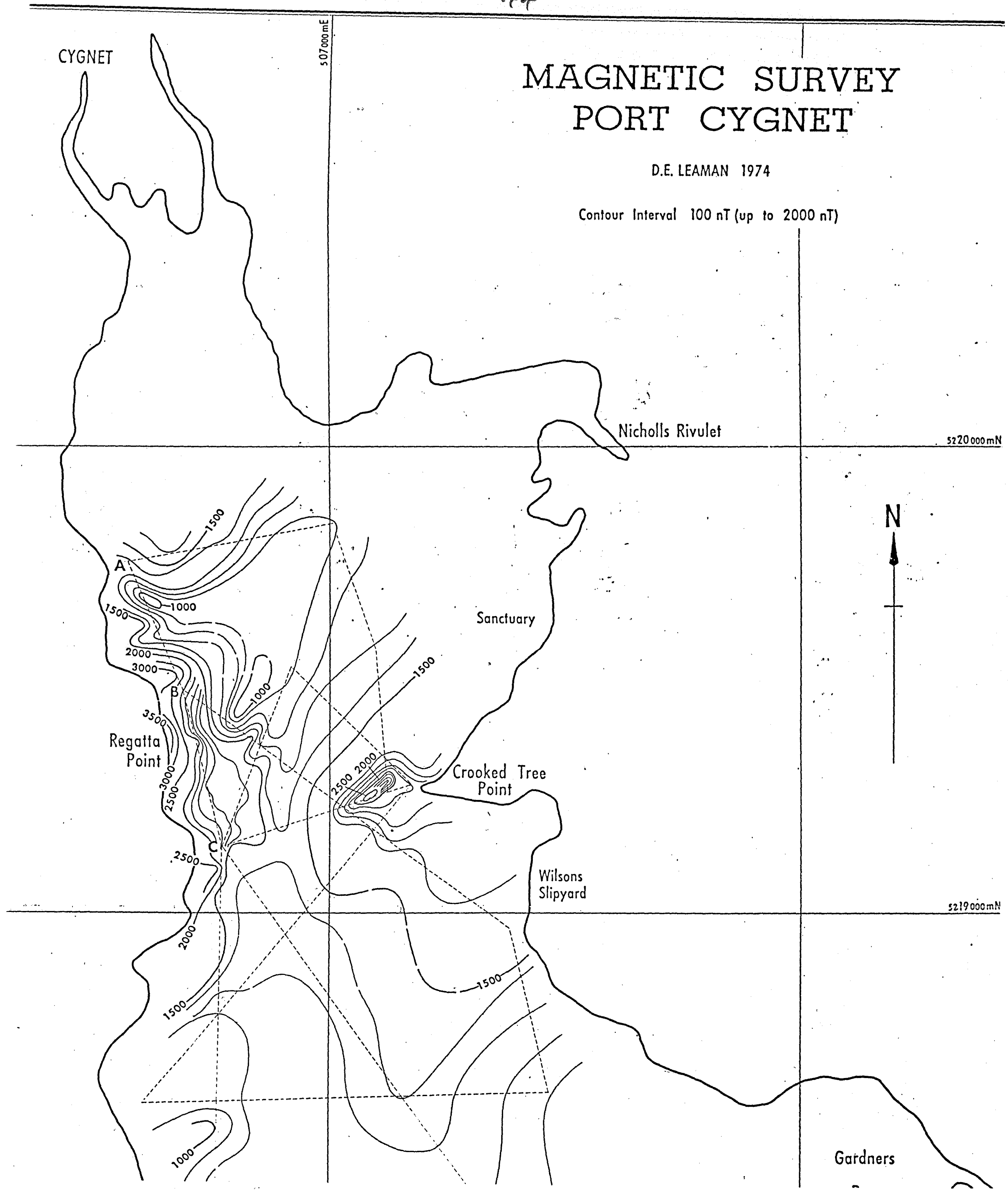


FIGURE 15.

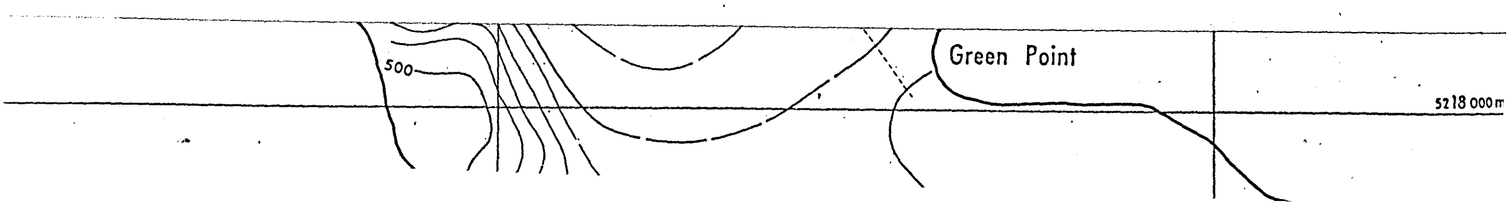
SURFACE MAGNETIC DATA IN CYGNET REGION - from Leaman & Naqvi (1968)

FIGURE 26



MAGNETIC FIELD ACROSS PORT CYGNET - MARINE SURVEY
from Leaman (197[illegible])

FIGURE 27



was thought to be adjacent to a dolerite feeder - both located near Regatta Point in order to explain the metamorphism. Farmer (1985) dismissed this view since he considered most of the syenites to be small bodies. This is probably the case and recognising this fact leaves the enigma of the alteration.

The high level magnetic survey by Conga (Figures 6, 7) illustrates the magnitude of the magnetic anomaly at Cygnet and contains suggestions of the three trends. Continuation of the surface data to the flight level yielded a comparable curve. Note that neither data set presently has the resolution or coverage to properly define or locate the sources; they are simply generally consistent.

Interpretation, however, transforms this position.
Figure 16 summarises the regional interpretation of gravity and magnetic data in this area. The Cygnet area is critically located. It lies above the eastern margin of a major structure which includes a thick pile of volcanic rocks, presumed Cambrian in age by nature of properties and linking to coastal exposures, and established Precambrian rocks (drilled at Woodbridge). The Precambrian rocks are of the upper dolomitic suites and are about 3 km thick. The volcanic pile is at least 4 km thick in this area.
The crucial element of the interpretation relates, however, to the syenite. The anomalies of the region can only be explained by a thick lens-shaped mass of this material at shallow depth. The shape and extent of the mass is wholly consistent with the shape and extent of the observed doming. Furthermore the thickest section is located beneath the Mt Mary-Regatta Point area and may protrude into it.

These models explain the location and extent of metamorphism, the siting of the intrusive suites (and the local dolerite feeders as well) and possibly the mineralisation which may be derived from the main mass or remobilisation of the shallowly buried Cambrian rocks. Structure margin volcanism during the Cambrian could well have emplaced massive ore bodies. Note that the location of this site bears marked similarities with those of western Tasmania in simple crustal/structure terms.

It is perhaps time to consider the composition of the alkaline rocks; it is, I am advised, not consistent with the sulphides observed. Prof. Carey many years ago observed the peculiar composition of these rocks and suggested digestion of some carbonates prior to final injection as a swarm. The rocks are highly differentiated and variable - and calcium enriched. The interpretation in Figure 16 allows this possibility. There is space in the models for an onlapped wedge of Ordovician rocks beneath the tillite. Part of this wedge has been intruded by the main syenite intrusion which does have the form of a laccolith. The dolomitic Precambrian rocks may also have contributed.

I conclude from all this that the gold and other sulphide mineralisation is associated with the alkaline rocks - but only by accident. It is probably remobilised. This means that somewhere beneath Port Cygnet there is probably a Cambrian massive sulphide deposit. All these relationships have been suggested in Figure 28.

The transferred mineralisation has not been properly assessed. The present magnetic data suggest distinct zones which should be carefully defined and sampled. The occasional high grades found by Cyprus in shear zones (orientations and extent not reviewed) implies concentrating mechanisms probably definable magnetically. A much better magnetic survey is advised. I also suspect that the peak anomaly defines the x-y coordinates for the ultimate sulphide source.

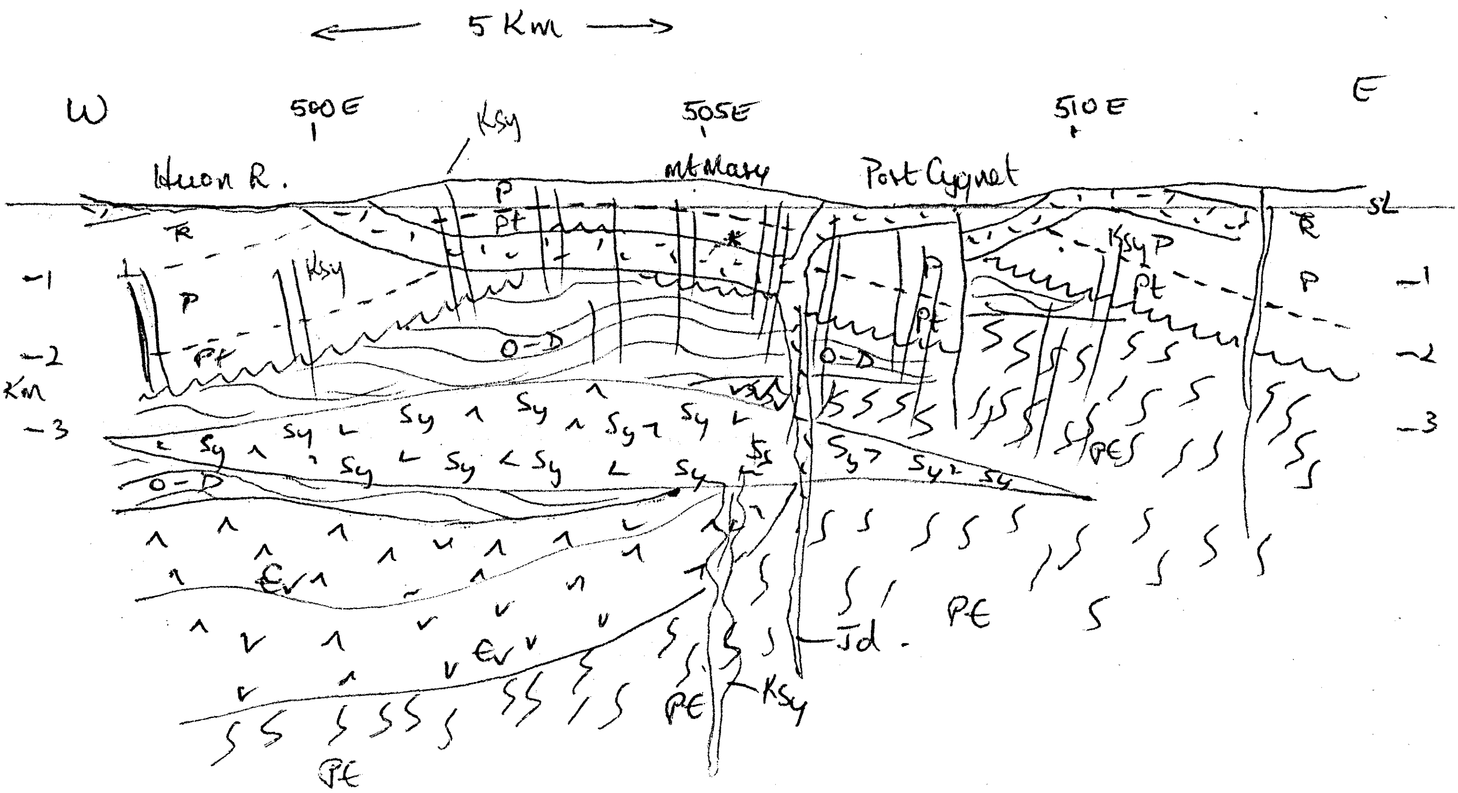
There is some evidence for this view based on some special traverses acquired to test the ideas. One of these is shown in Figure 29.
The profile was observed along the highway and is a reasonably direct traverse (see Figure 25). It transects one of the main arms of the Cygnet anomaly. The character of the profile is distinctive and has a reasonably definitive style of solution which clearly separates two primary sources; one of which comes up to surface! There is obviously scope for much more work, and more profiles, but this simple model demonstrates that there is much left to learn and that the target zones might well be defined very tightly. This one certainly is. Three dimensional analysis of the deep source would also constrain the depth range but only a few hundred metres of space is available.

No reliable indication of the thickness of tillite in this area is available. It is possible that a target exists within mining range.
The risk in this concept is associated with the scale and position of the syenite lens beneath Port Cygnet. Has it fully dilated or absorbed the target? Or, is the target beneath the syenite? The local dolerite sheet and feeder offers some clues about this by implying that the unconformity could lie above the syenite and there is a fair chance that some of the transmission has been by dolerite. This is the picture at many other sites. If this is the case it is likely that the target lies as flotation splitting depth which lies very close to the unconformity. It is most unlikely that the target lies at great depth along the margin; it just may lie beneath the syenite, or it may not.

The Conga interpretation also provided information on gross trend patterns in the region and their relationship to large structures and dolerite feeders (Figure 17). The trends expressed by the Huon River reflect these deeper fundamental and clearly rejuvenated or impressed fracture systems. The fault patterns around Cygnet are consistent with them but the arms of the magnetic anomaly pattern are unique. This abnormality is worth further review, especially since it correlates -with established Au-Cu-Pb mineralisation.
Figure 17 also shows that the Port Cygnet region lies along the west side of an old trough and the east side of a younger one - which has clear Cambrian affinity. Definite and large marginal structures are implied in each case suggesting a primary crustal feature with a long history. Even more important, however, is the indicated dislocation of this feature in terms of its Cambrian character. Two trends intersect at the head of Port Cygnet and disrupt this primary margin. These trend ESE and ENE.

CYGNET

5220 000 mN



V/H = 1

* = approx location of deepest extant drilling (still in tillite north of dolerite) ~ 150m bsl.

Section approximate. Scope for considerable revision geophysical analysis.
Style only.
Thickness of poss. O-D section not established.
Ksy, Єv estimates fair.
Dyke swarm above main syenite body

D Leaman
Nov 90.

(D)

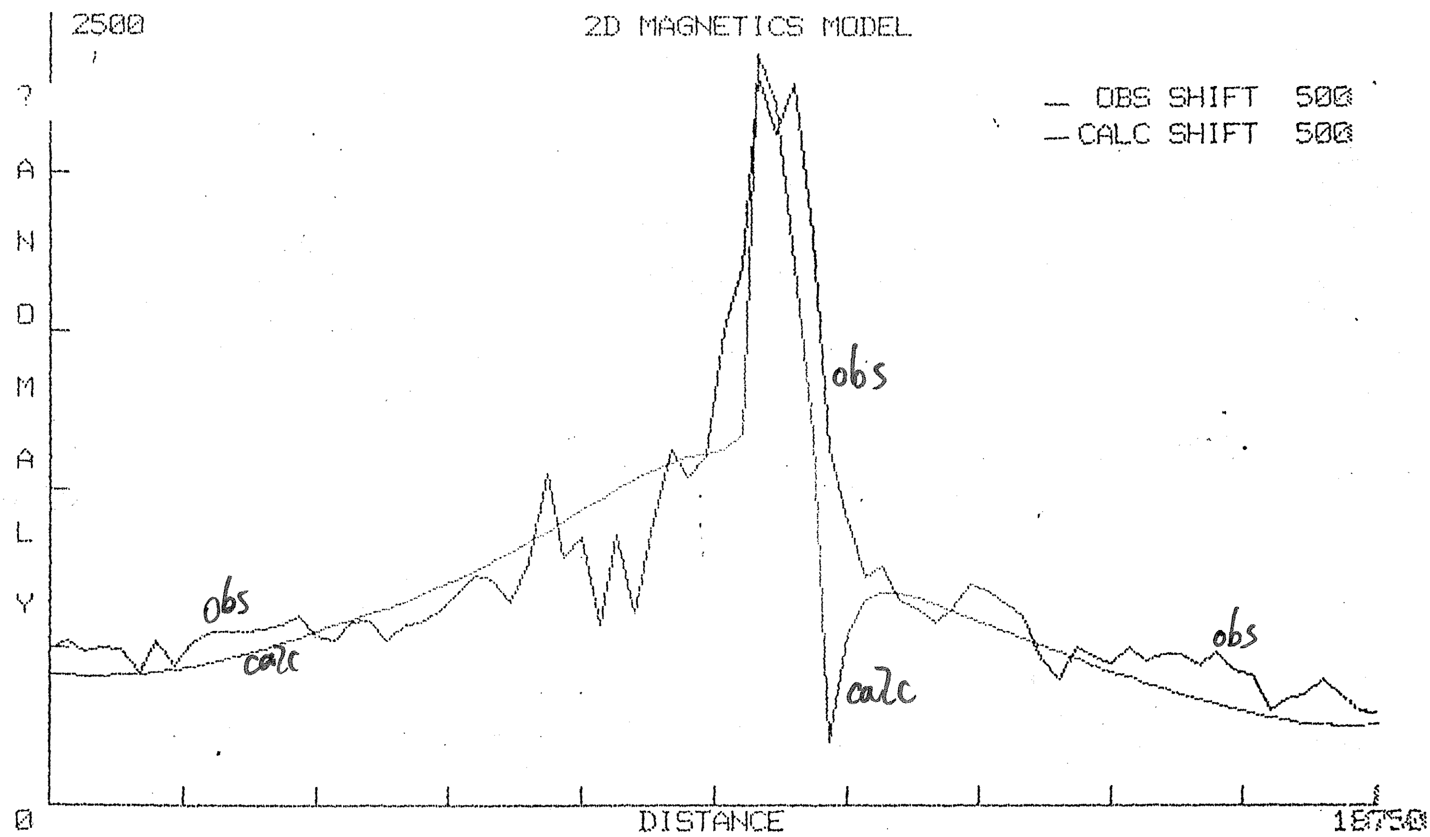
FIGURE 28

CYGNET CHANNEL HWY CRADOC-GARDEN IS CK

FIELD DATA

INTENSITY	INCLINATION	DECLINATION	OBS LEVEL	LINE DIRECTION
62700.0	-72.0	13.0	0.0	150.0

LINE PARAMETERS - ORIGIN,LIMIT,INCR : 0 18750 250



CYGNET CHANNEL HWY CRADOC-GARDEN IS CK

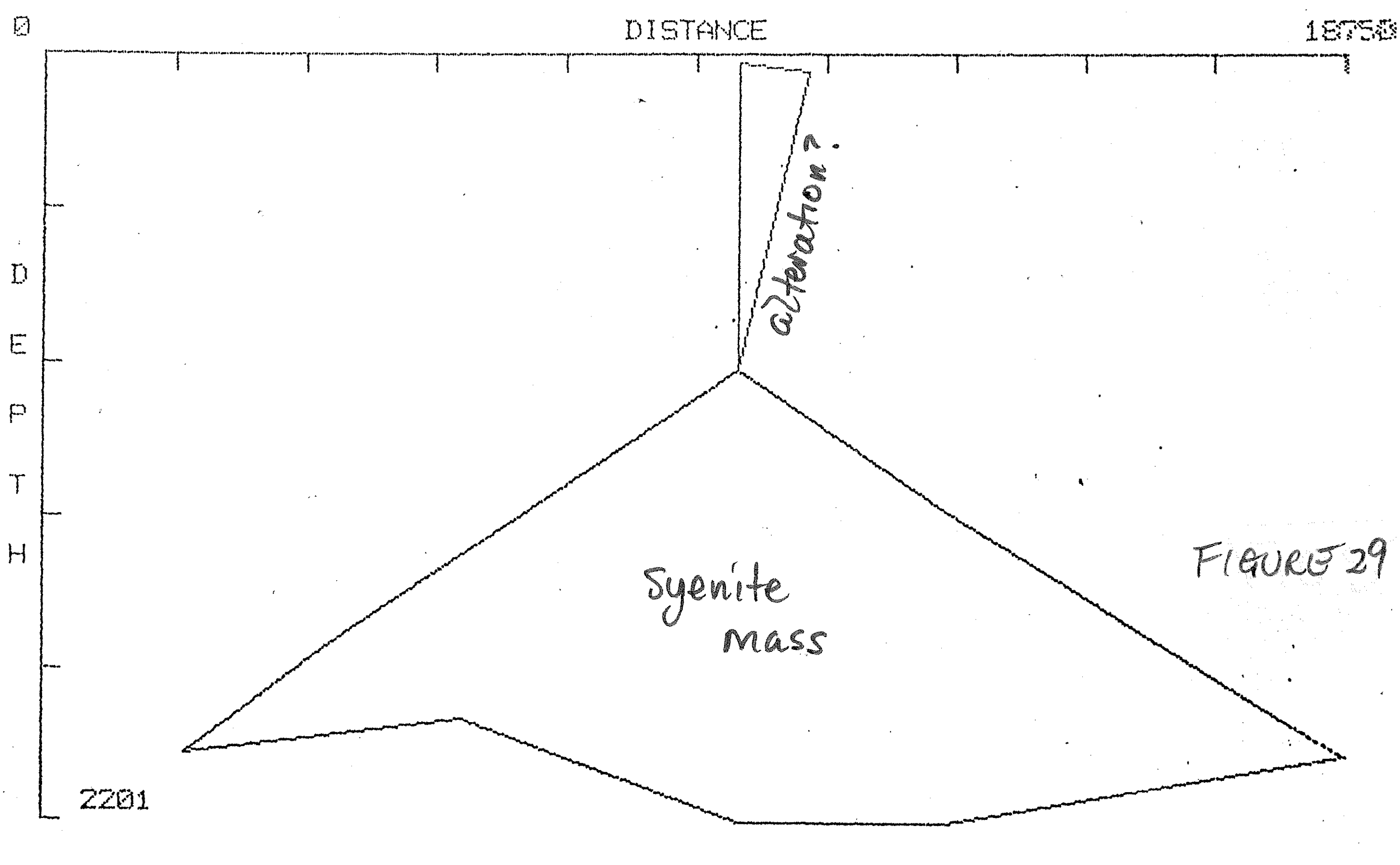


FIGURE 29

This is the very conjunction of trends which is common to the economic sites of western Tasmania. And the association was active during the Cambrian. It has been active since; a dolerite feeder and the syenite intrusives are centred on it.

Cygnet has been described as a gold producing area but this does not necessarily make it a gold province. The element association indicates a base metal province.

It is also clear how the area should be explored. A high quality low level or ground magnetic survey of the entire area is long overdue. The gravity coverage, already good, should be infilled and the two surveys analysed using 3D methods to define all structures and depths to critical boundaries. This is feasible and relatively low cost. The nominal target zone is already very small - about 2 sq km between Robleys Point and Copper Alley Bay on current indications.
Isotopic analyses may also prove very interesting and could well confirm the viability of the concept.

I have included, by way of appendix, more detailed notes on the sampling by Cyprus.
About 300 samples were collected and the anomalous sites, as defined by Cyprus, are shown in Figure 30. The coverage was generally good but a bit thin in the Mt Mary area south of Cygnet and in the the Mt Windsor area. The coverage north of Cygnet was quite good and the absence of gold values north of Golden Valley is clearly significant. They followed the regional effort up by more detailed work, rock chips this time, in the areas noted in Figure 31. Many of the areas yielded little data (Copper Alley and Forsters and their sampling in this area seems to have avoided sites I know to be mineralised) while others yielded very low levels of tested elements (Erics Rd, Coads Hill Rd, Silver Hill Rd, Golden Valley Rd, Gourlays Rd, Olbrichts Rd, Langdons and SW Langdons.
The anomalous areas were

Zone	Cu	Pb	Zn	Ag	As	Au
Kings Hill	5-975	-0.86%	-0.21%	-186	-85	-0.23
Mt Mary	10-260	-0.31%	10-0.42%	-151	-270	-0.23
NW Langdons	5-160	-1550	10-185	-6	-28	-0.11
Black Jack	-300	-85	5-240	-1	-900	-1.3
Tobys Hill	5-195	5-1500	20-570	-2	-680	-0.62

Values are ppm unless otherwise noted. There is quite a range but all these sites are fairly tightly restricted spatially to the Mt Mary E-W axis, the Tobys Hill N-S axis (magnetics features noted in my report) and the NE-SW fault zone which extends from Mt Mary to Black Jack Ridge.

Cyprus followed this work up by gridding three areas and extensively trenching them. The results were variable but some sections of these trenches (no patterns evident) returned intervals of 0.1 g/t Au. Mainly in sediments and mainly in tillite. Some gold was in syenite but there was no pattern to this either. The best intersections appeared to be in structural disturbances, shears or faults.
They sampled up to 40 times per trench to get this picture.

GOLD VALUES CONSIDERED ANOMALOUS after REGIONAL SAMPLING (ppm) (CYPRUS)

305 samples total survey (stream sed/ panned concentrate).

0.065

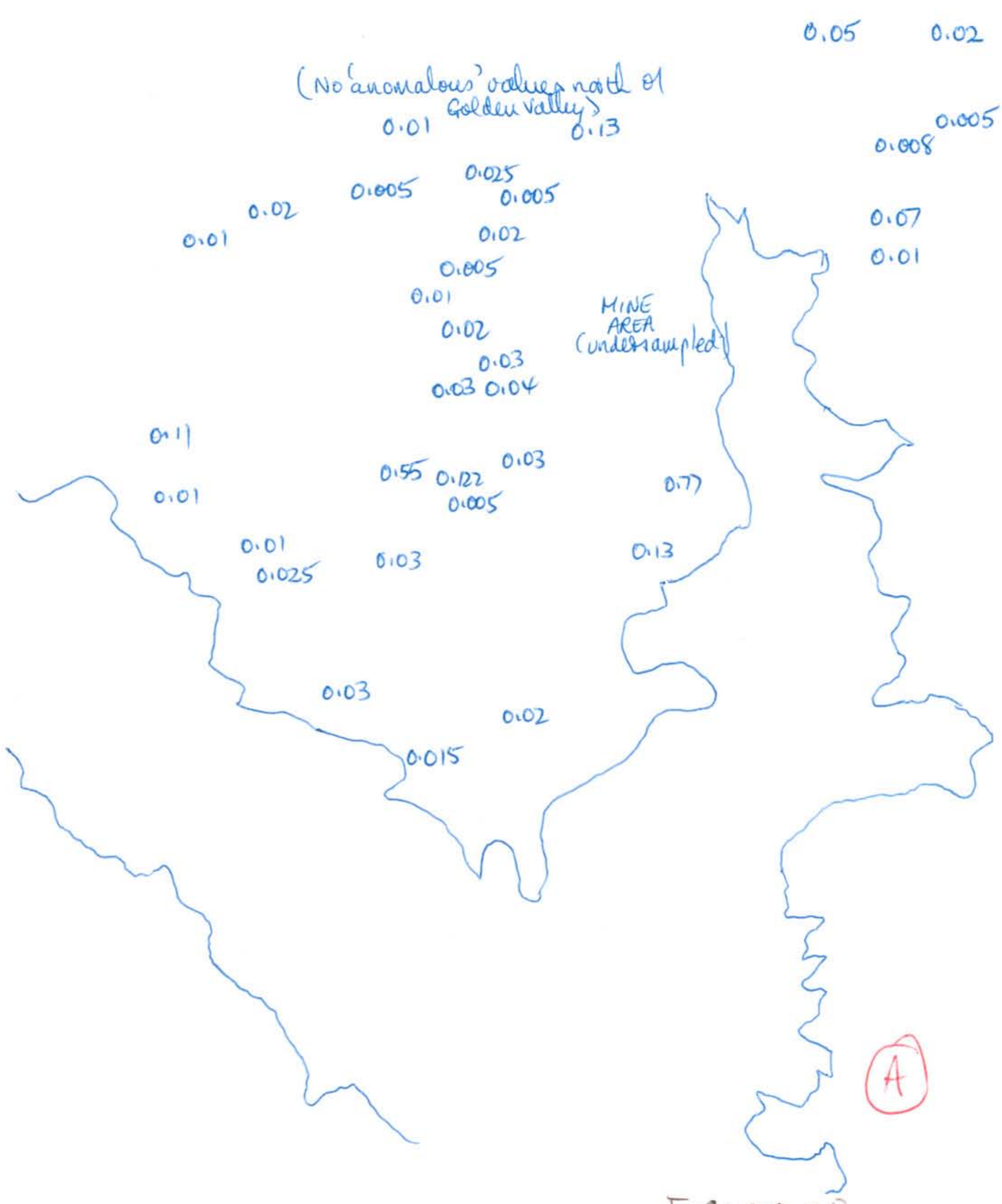


FIGURE 30

LOCATION OF GRIDS AND DETAILED ROCK CHIP SAMPLING (CYPRUS)

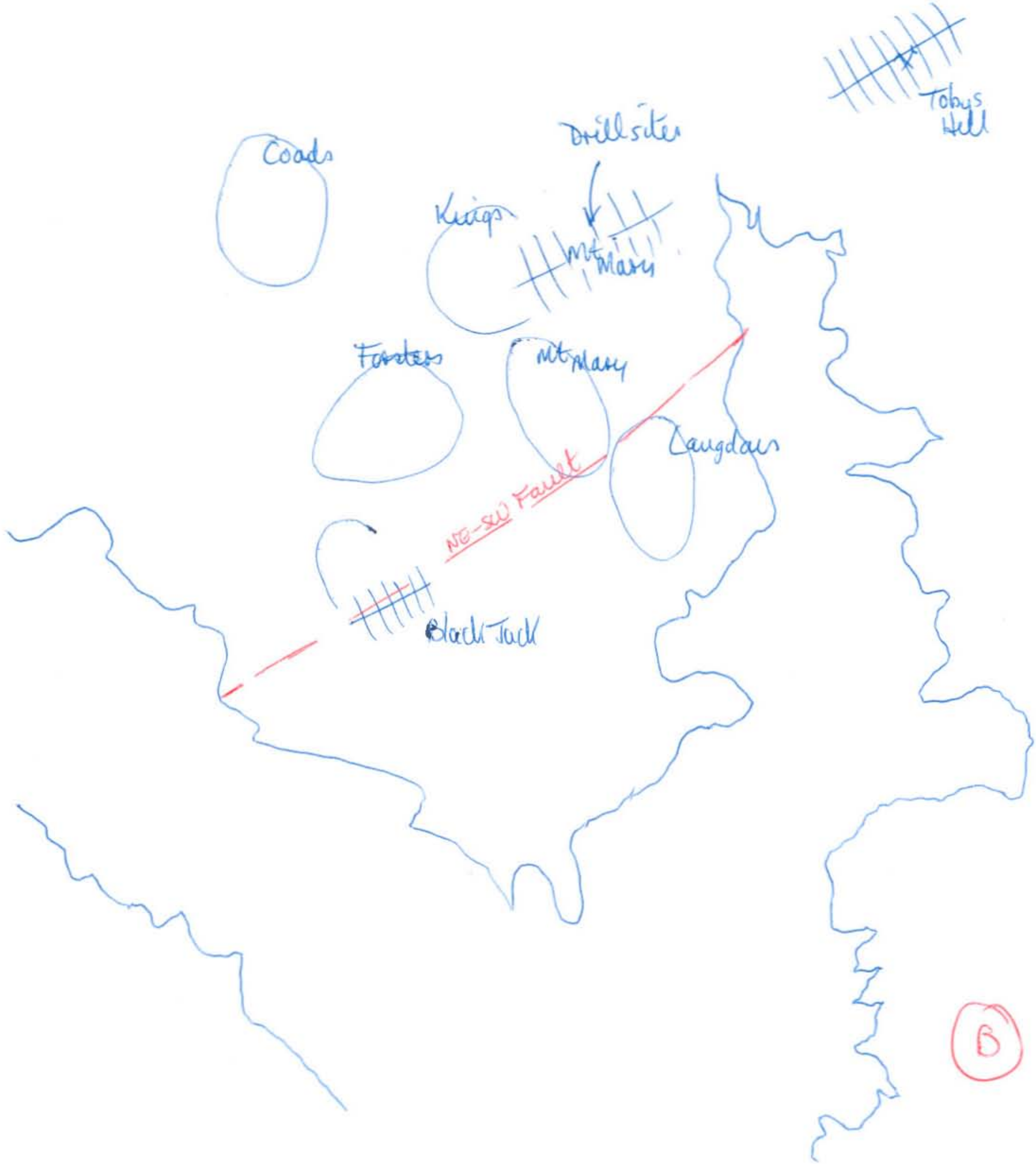
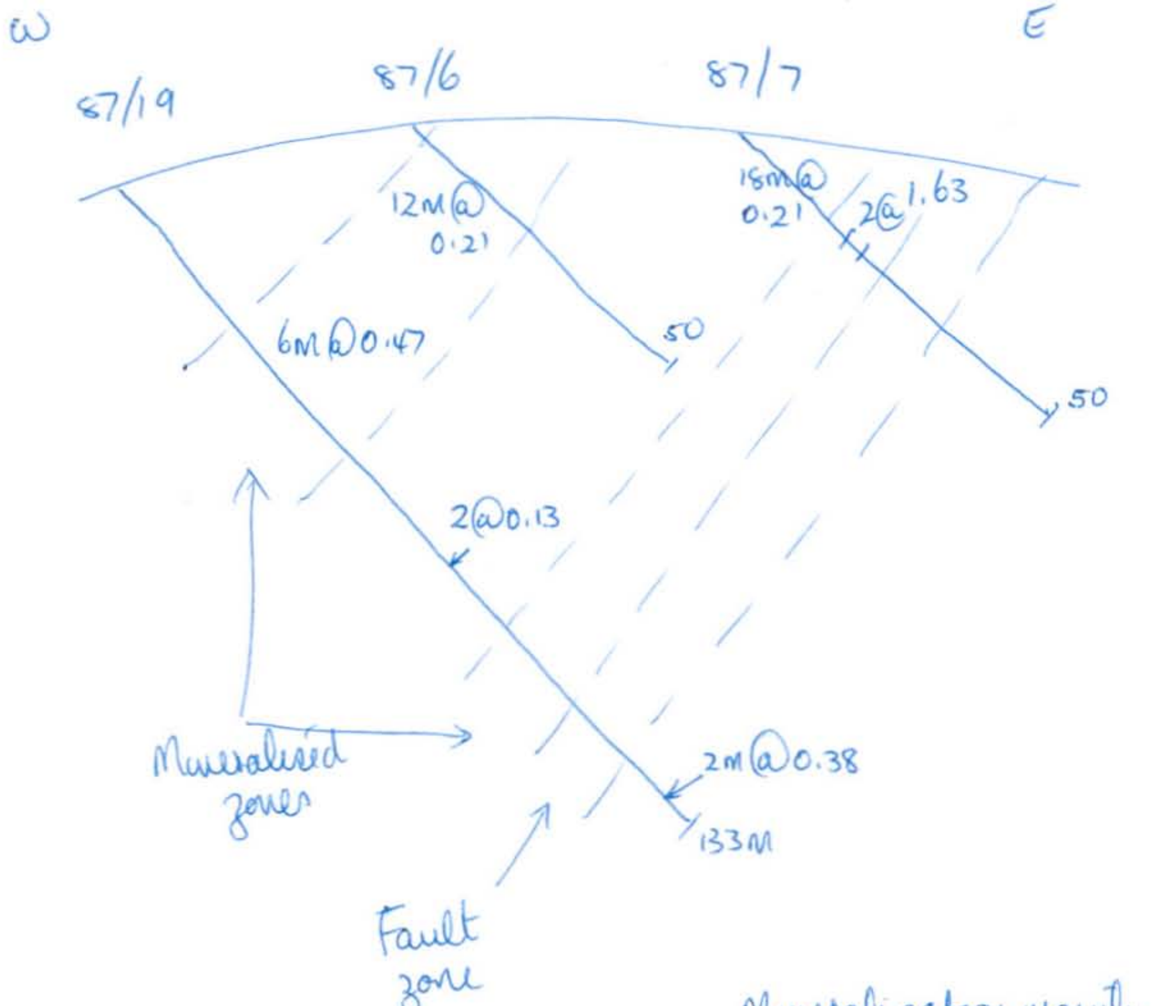


FIGURE 31

DRILLING MT MARY



Mineralisation mainly in Truro Tillite.

FIGURE 32

Drilling was concentrated in the Mt Mary area in order to gain some understanding of what was worked and whether some systematic relationships were apparent. They were also looking for a large volume of low grade mineralisation at shallow depth. I have reduced and summarised Cyprus' final section for Mt Mary in Figure 32. This shows that they identified up to three mineralised zones but that these were quite narrow, were independent of lithology and that one of them was shear zone related. Grades were generally low but limited in distribution except near the surface in the shear zone (fault?). The zones are not related to dips within the Permian section or obviously related to the dyke/sill swarm. The mineralisation appears to be imposed.
This type of resource gave them encouragement but in the end they just did not know where to look next, or why. This is where a bigger picture would have helped.

LITTLE OYSTER COVE

Gold mineralisation has been reported in the Little Oyster Cove area but few details are available. It has been presumed to be related to syenites, as at Cygnet, but there is no proof that this is the case. Figure 33 groups the Cygnet and Little Oyster Cove occurrences and the ENE extension is consistent with the distortion and extension of the dyke swarm as mapped. It is also consistent with the orientation of the inferred underlying shear described above.

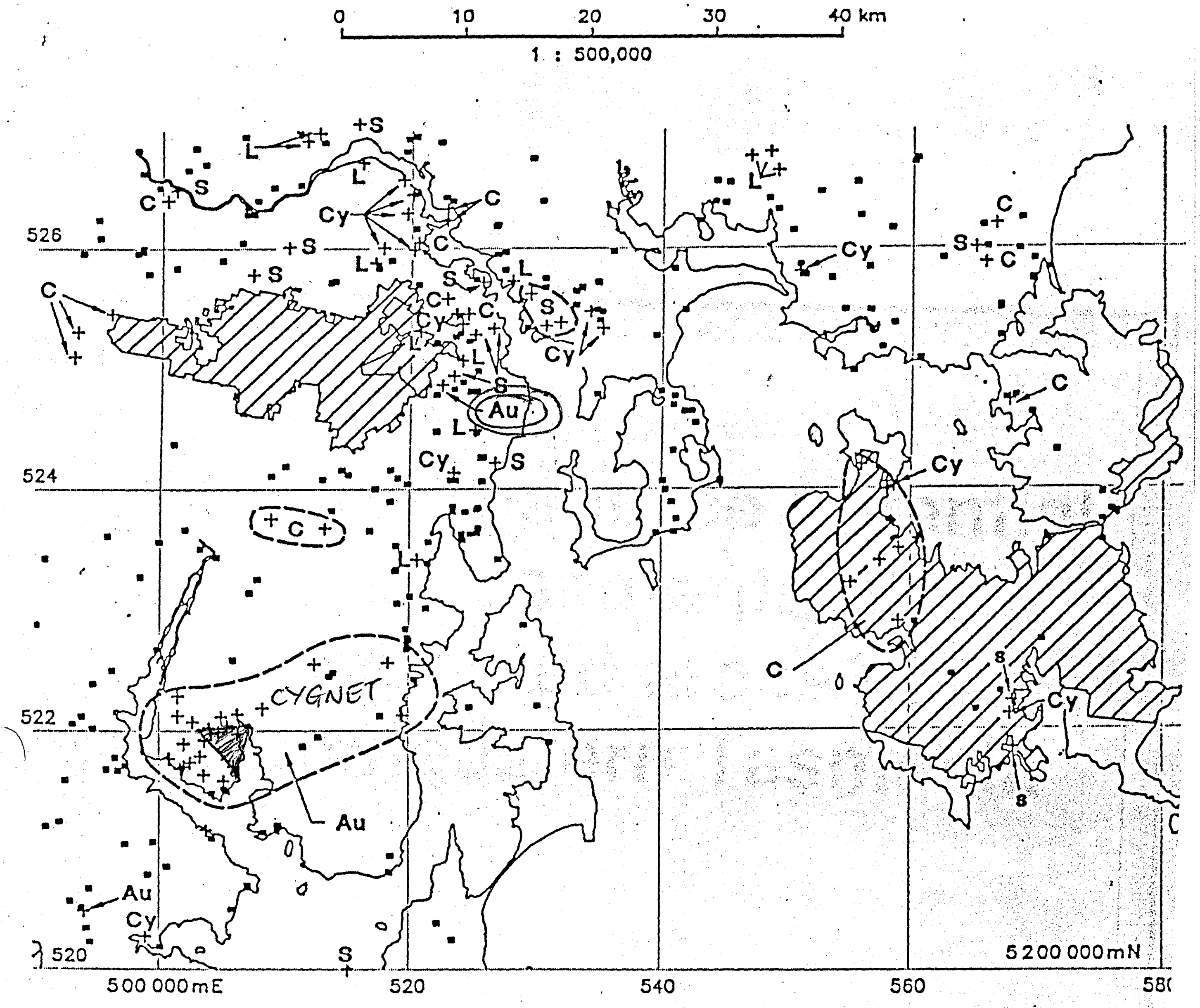
Thus mineralisation might have been transferred laterally along this system from a primary site near Cygnet.
Or, it may be related to the same structure and a different conjunction.
The Little Oyster Cove site lies on a dolerite feeder axis. The Red Hill-Hickmans Hill dyke intersects the ENE feature at about the described site. Is this a quite separate target? Some local geochemical sampling might not go amiss.
There is, however, no convincing evidence as yet for a significant underlying Cambrian section but more work to separate all the confusing interference from the granophyric dolerites of this zone might clarify this view.

DOVER/CATAMARAN AREA

Contrary to popular opinion, and my own ignorance until recently, gold has been recovered at several other sites in the region south and west of the Huon River.

Figure 34 presents a Mines Department mineral report summary map with an overlay of the residual gravity field. This new innovation draws attention to a number of features but the principal concern here is the association of gold with a major regional gradient and structural boundary east of the exposed Precambrian basement. Unfortunately this boundary slips in and out of wilderness reserves and is almost

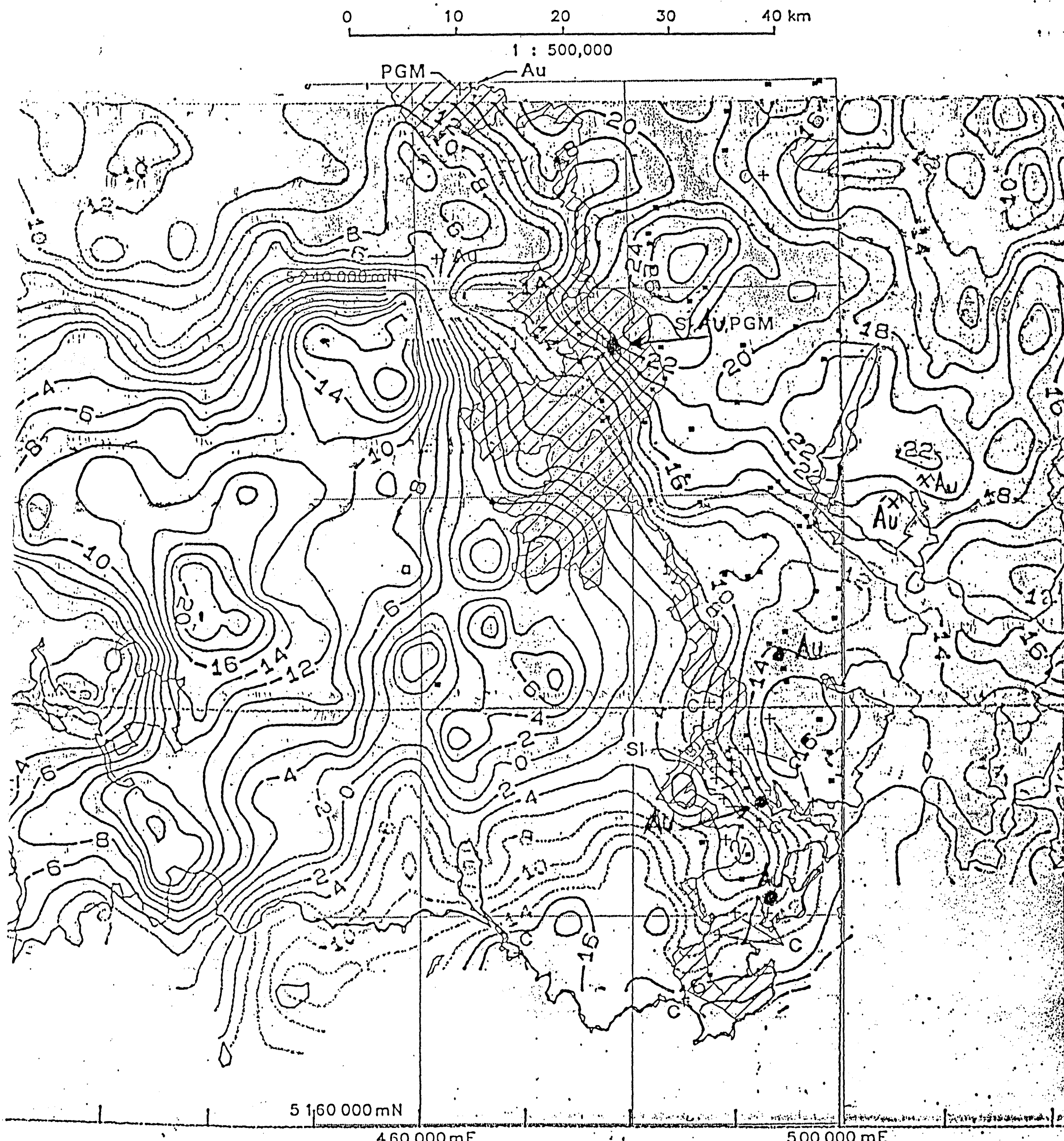
MINERAL OCCURRENCES AND CONSTRUCTION MATERIAL WORKINGS SOUTHEASTERN TASMANIA



CROSSES (+) : METALLIC & INDUSTRIAL MINERALS					
Au	:	*Gold (mostly placer)*	Fe	:	*Iron formations*
Bm	:	*Base Metals (Cu,Pb,Zn,Ba)*	L	:	*Limestone*
Sn	:	*Tin / Tungsten*	SI	:	*Silica*
PGM	:	*Platinum-Group Minerals ± Cr,Au,Ni,Cu, Asbestos*	C	:	*Coal*
Cy	:	*Clay*	S	:	*Sandstone*
SQUARES (▪) : CONSTRUCTION MATERIALS					

FIGURE 33

RESIDUAL BOUGUER ANOMALY and MINERAL OCCURRENCES AND CONSTRUCTION MATERIAL WORKINGS SOUTHERN TASMANIA



CROSSES (+) : METALLIC & INDUSTRIAL MINERALS

Au	:	*Gold (mostly placer)*	Fe	:	*Iron-formations*
Bm	:	*Base Metals (Cu,Pb,Zn,Ba)*	L	:	*Limestone*
Sn	:	*Tin / Tungsten*	SI	:	*Silica*
PGM	:	*Platinum-Group Minerals ± Cr,Au,Ni,Cu, Asbestos*	C	:	*Coal*

SQUARES (▪) : CONSTRUCTION MATERIALS

FIGURE 32

entirely covered by a veneer of Permian and Ordovician rocks. The Southport occurrences and structure should be reviewed and explained. I am of the opinion that the gold, and possibly other metals, have been locally raised by a dolerite feeder from host rocks beneath and then released by weathering and exposure. If this can be established then some useful targets may have been defined by such accidents of intrusion. These sites and the local geology must be reviewed. The Lune River and Catamaran sites are peripheral to older structures (see Figure 17C, D). Dolerite feeders have been inferred close to the Lune River and Dover sites (Figure 17A). This may also be the case at Catamaran but there is insufficient magnetic coverage.
Note that a splinter structure of the type indicated by the main gradient, and marked by a subdued gradient, passes along the southern arm of the Huon River to the Weld River occurrences. The river, and perhaps the Cygnet target, are associated with this structure. The character of this gradient suggests that the source structure is deeper near Cygnet than in the Southport area.

Most of the sites indicated in this area occur in areas where Upper Permian or Triassic rocks are exposed. This means that any concealed target must lie at depths in excess of about 500 or 600 m in those areas which are free of heritage/wilderness risk; a situation which can be contrasted with the Cygnet/Oyster Cover area which involve basal units.

NEIKA

The Neika site is marked in Figure 33 and appears to be a mistake, as indeed do many of these occurrences.
Skeletal information is available and suggests that the material was a sulphide mass embedded in dolerite.
An early view of the setting of the Neika site was presented by Leaman (1992). A major shear was inferred to cross the region using indications based on the location of feeders, vents, monocline offsets, dykes and other abnormal trend and structure changes. The inferred structure trends ENE. Some minor(?) structures with this orientation have been mapped within the cover but none is continuous. The width of the inferred zone could be 1500 m and it is clearly complex.

A critical problem with this, and many other sites, is the accuracy of the location. The site has been referred to as Neika, or Mt Wellington, or Pipeline Track. The descriptions are consistent and possible. The coordinates quoted on the Mineral Resources Data Base fall at Ferntree. It is interesting to relate that the Ferntree and Neika locations lie on the same axis and both lie adjacent to large feeders..

Further consideration of this site (considered as either the Ferntree or Neika locations) focusses attention on the forgotten or omitted aspects of previous work.

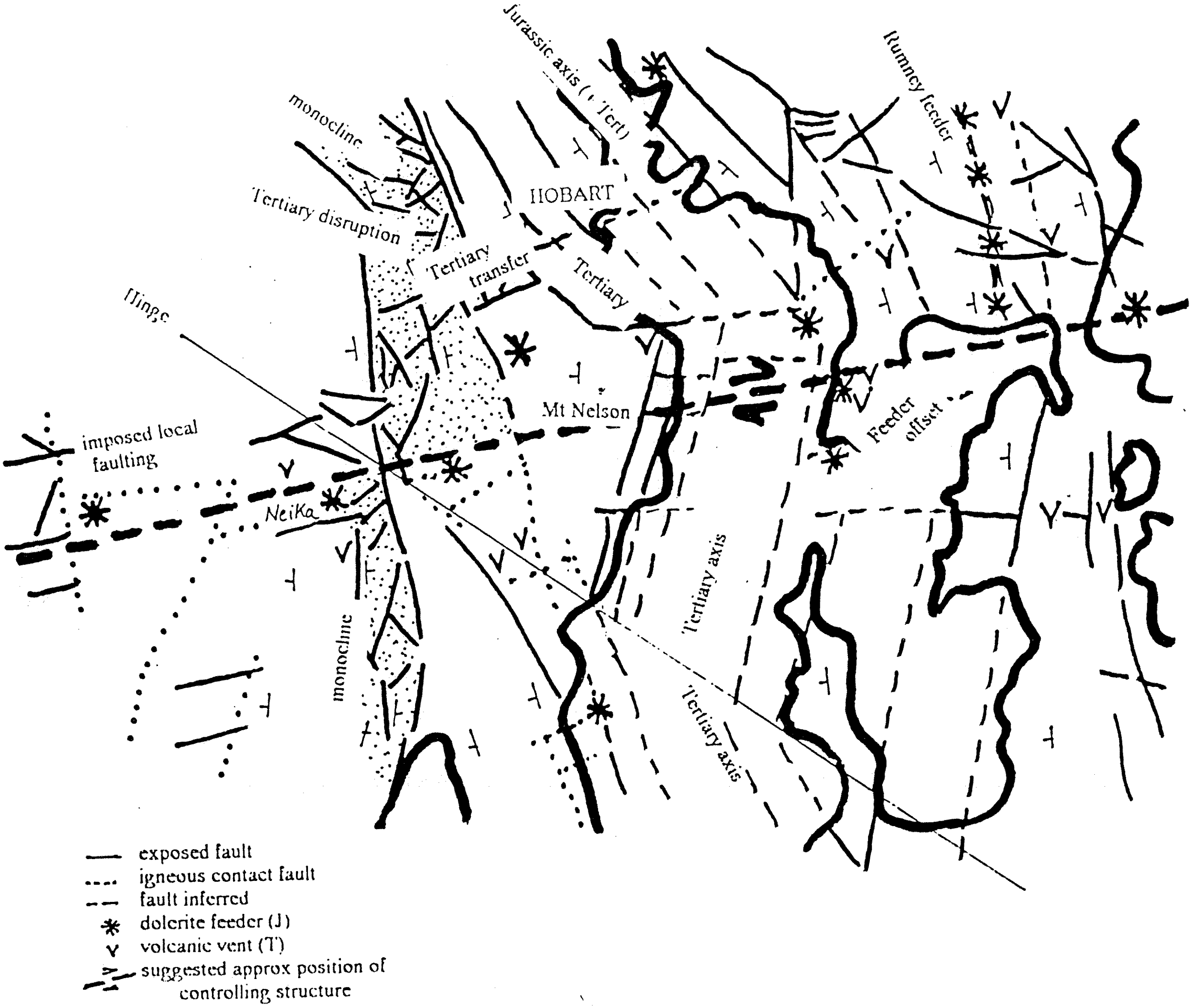


FIGURE 35

Possible relationships between structures observed in post-Carboniferous rocks of the Hobart area and major concealed structures. Diagram suggests one feature only. Note the trend changes, vent locations and sub-parallel sympathetic faults associated. Offset defined by monocline and eastern feeder axis (heavy dots mark matched locations). It is possible to infer both dextral and sinistral motions on different parts of the structure shown depending upon features selected. A complex history is almost certain.

Figure 36 presents a fragment of the original residual Bouguer anomaly map of the Hobart area (from Leaman, 1972). This detailed residual treatment need reworking in light of subsequent developments and the nature of filtering applied which has distorted display of deeper elements. The original interpretation and use was directed to dolerite structuring and these were not serious limitations.
The Mt Wellington site is marked (Ferntree and Neika optional sites).

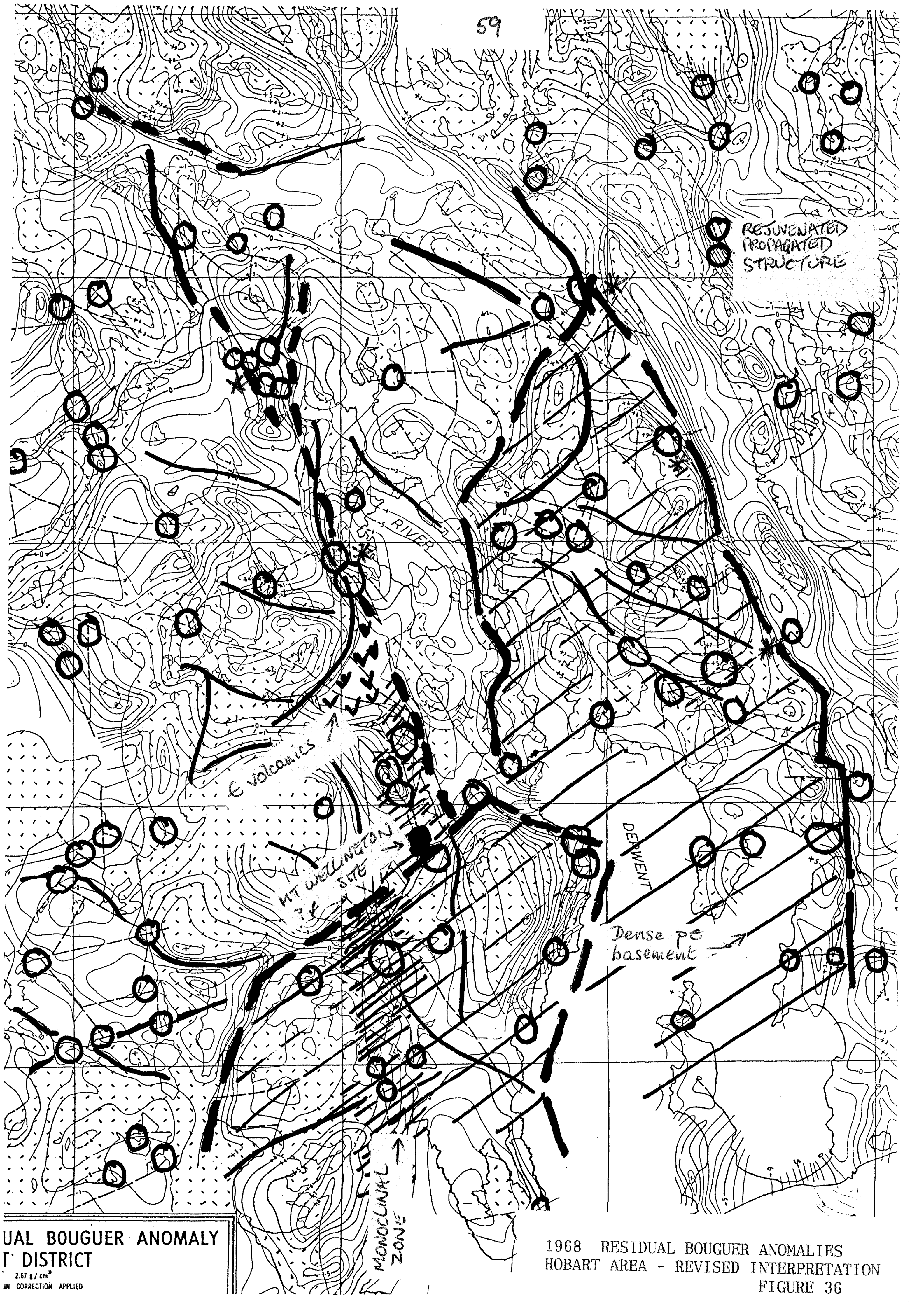
Appraisal of this map has necessitated review of original Bouguer data and the filter used. It was found that some elements of the major gradients extending from the D'Entrecasteaux Channel region toward Tea Tree had been modified and diffused. The heavy lines shown in the Figure mark the approximate location of the largest changes in the gravity field which must reflect significant changes in the basement. All basement effects were ignored in the original interpretation; there was simply no way to rationally infer them from the limited gravity coverages and the lack of drilling control which existed in 1968.

The importance of this data to the Mt Wellington site is evident; there is a direct correlation between underlying boundaries and the possible locations. Large dolerite feeders lie along the structural arm which extends NE from Longley to Hobart city.
Basalt centres and other feeders lie along the margins of this basement change - especially along the eastern Cambridge face of the structure. Several volcanoes within this large basement block have transmitted blocks of altered Precambrian rocks comparable with portions of the Oonah Formation. Similar materials were recovered in the Woodbridge borehole.

The other major structure (Cascades Fault System) in the region extends slightly west of north from North West Bay to Granton. It is also associated with feeders and a monoclinal zone, where dips are abnormal and to the east, and a major transfer zone near the Mt Wellington sites. This transfer is, undoubtedly, related to the older structural change. The Cambrian volcanics drilled at Glenorchy lie immediately west of the Cascades Fault System.

This new view of the area appears to conflict with that of Figure 35.

Figure 36, however, combines several types of information.
Major structures identified from gravity changes or major intrusion forms are shown. Two large curled dolerite margins are shown; near Glenorchy and Grass Tree Hill, and each structure curls in the same way. The curl may extend either to the general N-S features and to either the one NE trend or two ENE trends.
The diagram is not the result of exhaustive examination, and ideas are still evolving.
All circled sites define an anomalous conjunction of cover structures; kinks, compound joins, intrusion triple points and similar elements. Some other features may be identified with further thought. Each structure of this type is symptomatic of transferred stress into the cover sequence and thus suggests the approximate location of a node on an underlying structure.



1968 RESIDUAL BOUGUER ANOMALIES
HOBART AREA - REVISED INTERPRETATION
FIGURE 36

There is some scatter to these node sites, which might be expected, but there are several possible ways of linking them. Some groups have a NNW linkage, others could be organised NE, some are NNE. Most can be grouped into near ENE bands. One of these was inferred in the older view shown in Figure 35. There is no doubt that major elements join, or are offset, where these intersect the general ENE fractures.

If the Mt Wellington site has significance then it may be considered an indicator for other sites in the Hobart area. Several possibilities may be suggested; Glenlusk, western Duck Hole Rivulet, Middle Tea Tree, Granton, Cambridge. Each is marked by an *. All sites are significant in that the cover sequence is unlikely to exceed 700 m and in several select variations of these sites it may be less than 500 m. The Glenlusk and Granton regions may lie within 200 m of basement.

GUNNINGS SUGARLOAF - BAGDAD

Sites within the southern midlands may be reviewed in terms of the only adequate geophysical data set; gravity. A residual version of the data is supplied in Figures 37 and 38. Figure 37 places the anomalous positive zone east of Hobart in regional perspective. The largest anomalies in southern Tasmania are related to the east Tasmania batholiths, east of Sorell, and complex basement variations south of Westerway. Several other subsidiary structures are indicated.

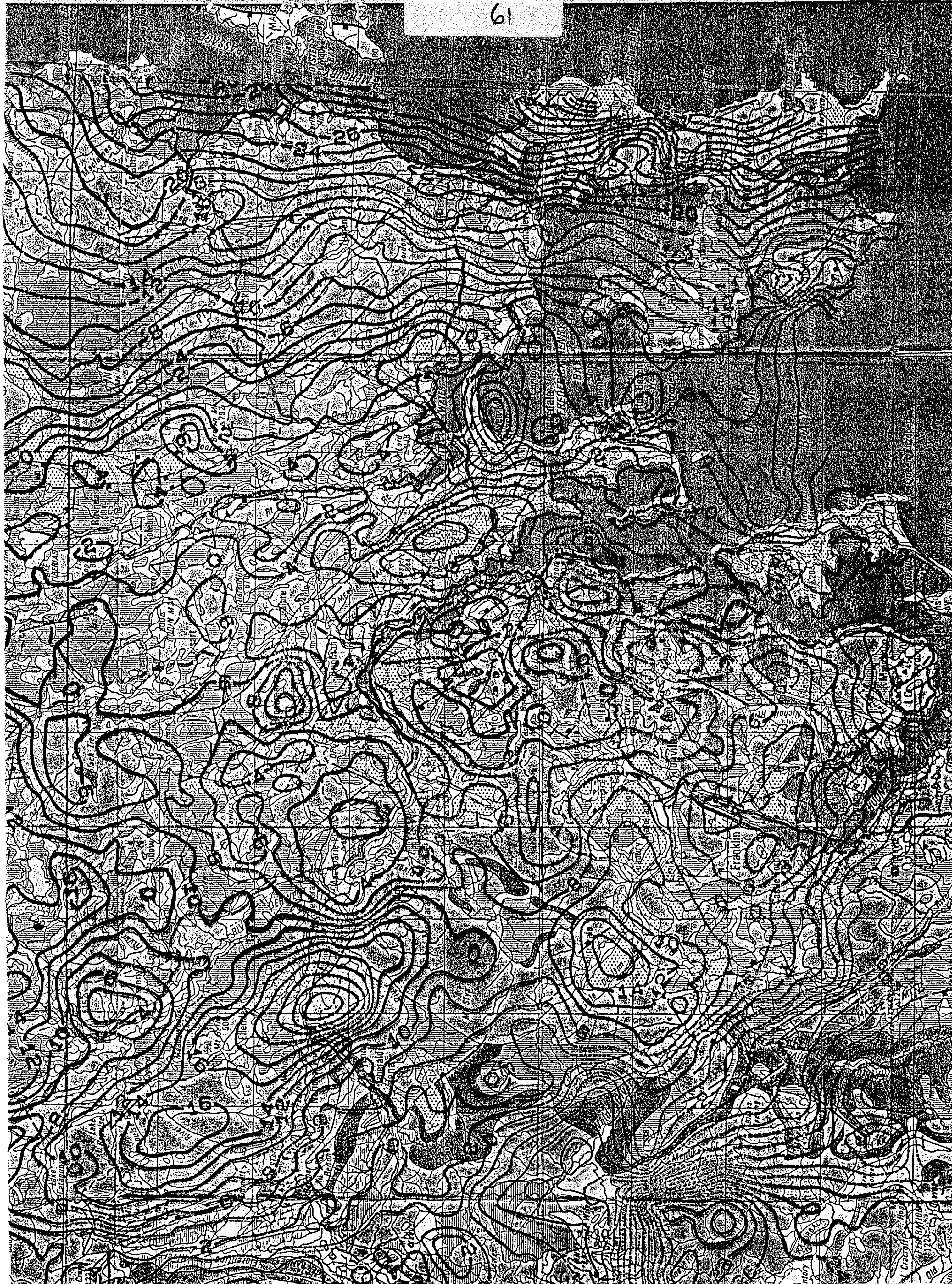
Figure 39 presents the gravity field, some of the more obvious regional elements, and the mineralised(?) sites south of Oatlands.

Several common factors emerge. The gravity field defines a number of ESE, ENE, NE and N-S features while the magnetic field describes several sub N-S features. This combination is indicated and the sites may be linked. The open circles represent transferred, complex structural conjunctions in the cover sequences. These tend to support the implied dominance of the ENE structures.

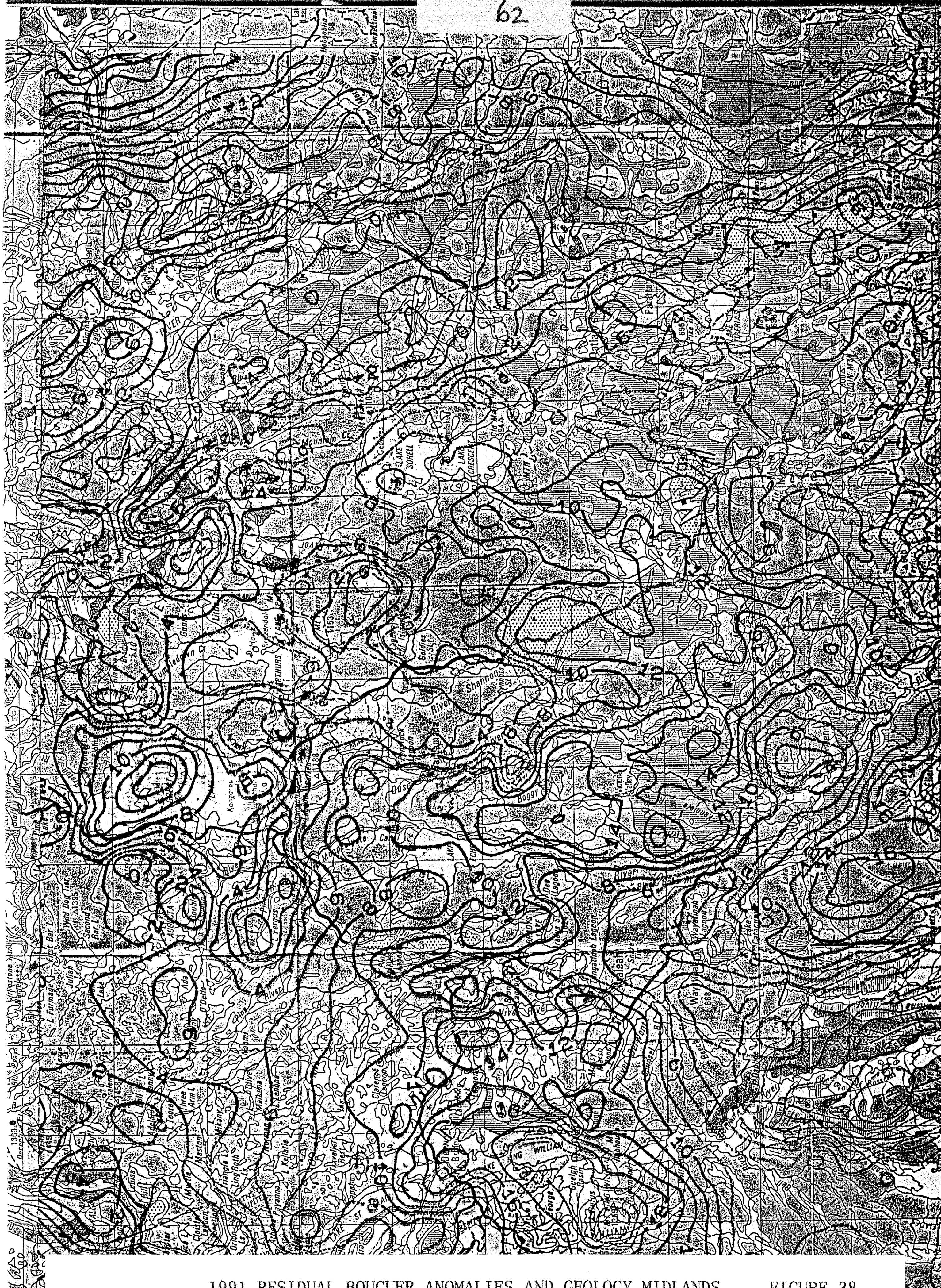
Figure 40 presents a more detailed view of the geologically anomalous structures and the location of large scale basement variations based on the gravity and magnetic data. These features appear relatively random but some ENE bands can be correlated with fragments of other structures of similar orientation and the large scale distortion of primary gravity gradients. One of these sites occurs just east of Bothwell and another is near Tunnack.

The Bagdad and Gunnings Sugarloaf sites bear no comparable relationships but both lie close to a probable ENE corridor.

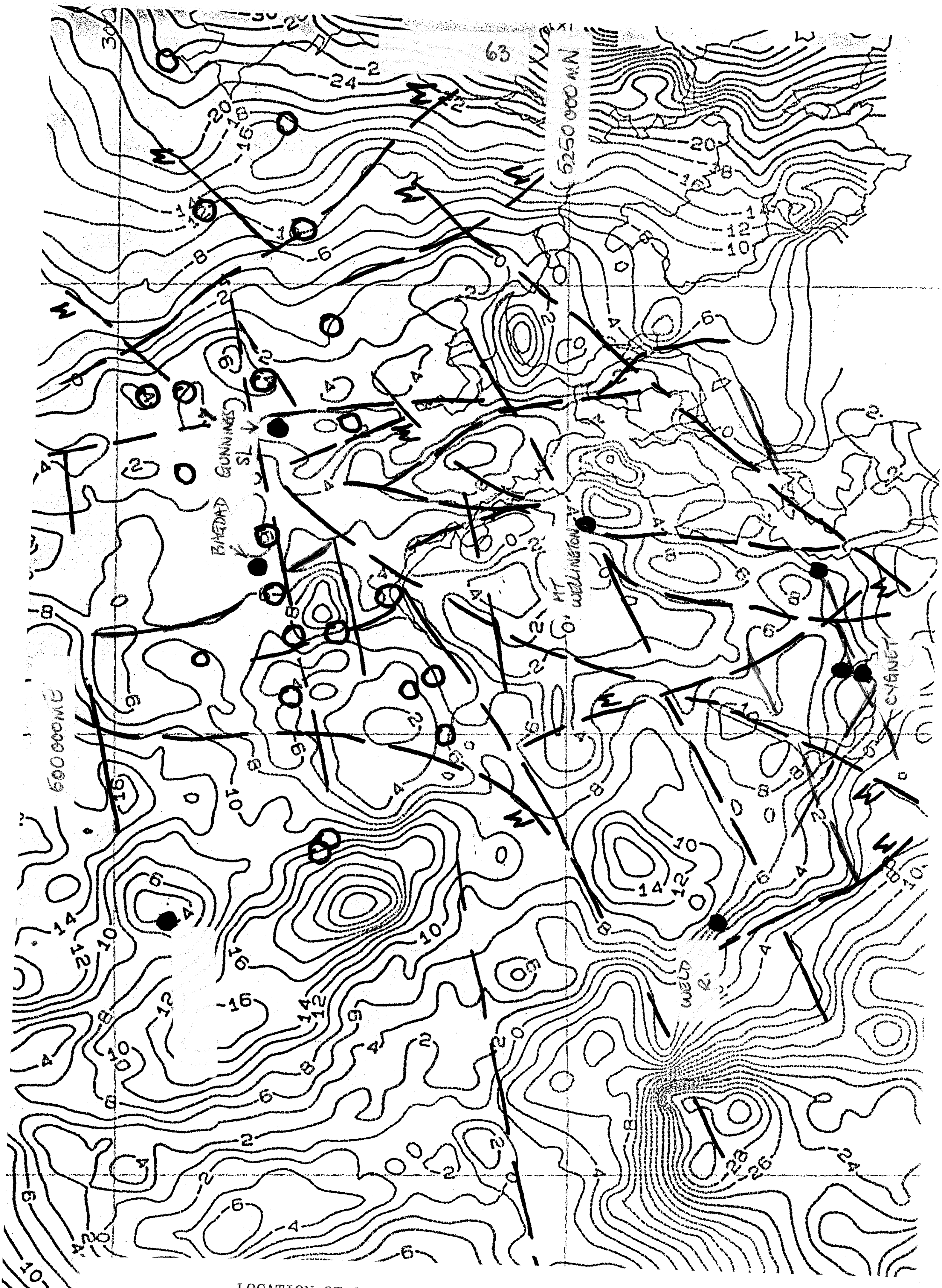
Little is known of the Bagdad site and the location is inferred from discussion with a tight-lipped prospector who has re-opened an old working and recovered sulphide samples from a dolerite contact. It may lie near the intersection of a NNW structure and the local ENE



1991 RESIDUAL BOUGUER ANOMALIES AND GEOLOGY S TASMANIA FIGURE 37



1991 RESIDUAL BOUGUER ANOMALIES AND GEOLOGY MIDLANDS FIGURE 38



LOCATION OF SITES AND TRENDS IN LOWER MIDLANDS

FIGURE 39

ANOMALOUS GEOLOGICAL AND GEOPHYSICAL SITES IN LOWER MIDLANDS

FIGURE 40

corridor.
The Gunnings Sugarloaf site has been described by Nye (1922) who thought it was due to pyritic deposition in weathered dolerite. The site is located in a large feeder dyke situated adjacent to the major NNW structure in the region and which can be traced southward to Storm Bay (Figures 37, 39).

The common denominators for these sites include an adjacent feeder, major underlying structuring and an association of NNW and ENE features.
Preliminary modelling of the geophysical data undertaken in the period 1988-1990 for the revised mantle separation model for creation of residual data (shown in Figures 37 to 39) based on model MANTLE91. Samples are shown in Figures 21 to 24. These models are sketchy and most previous analysis of the alignments were directed at crustal form. Magnetic units, inferred to be Cambrian volcanics, are suggested within the Bagdad region and the distribution is suggested in Figure 40.

All information presently available suggests that the observations of, and about, these sites (or the approximate locations) are valid. Unfortunately both sites occur in an area where the cover sequences are unlikely to be significantly less than 1000 m thick.

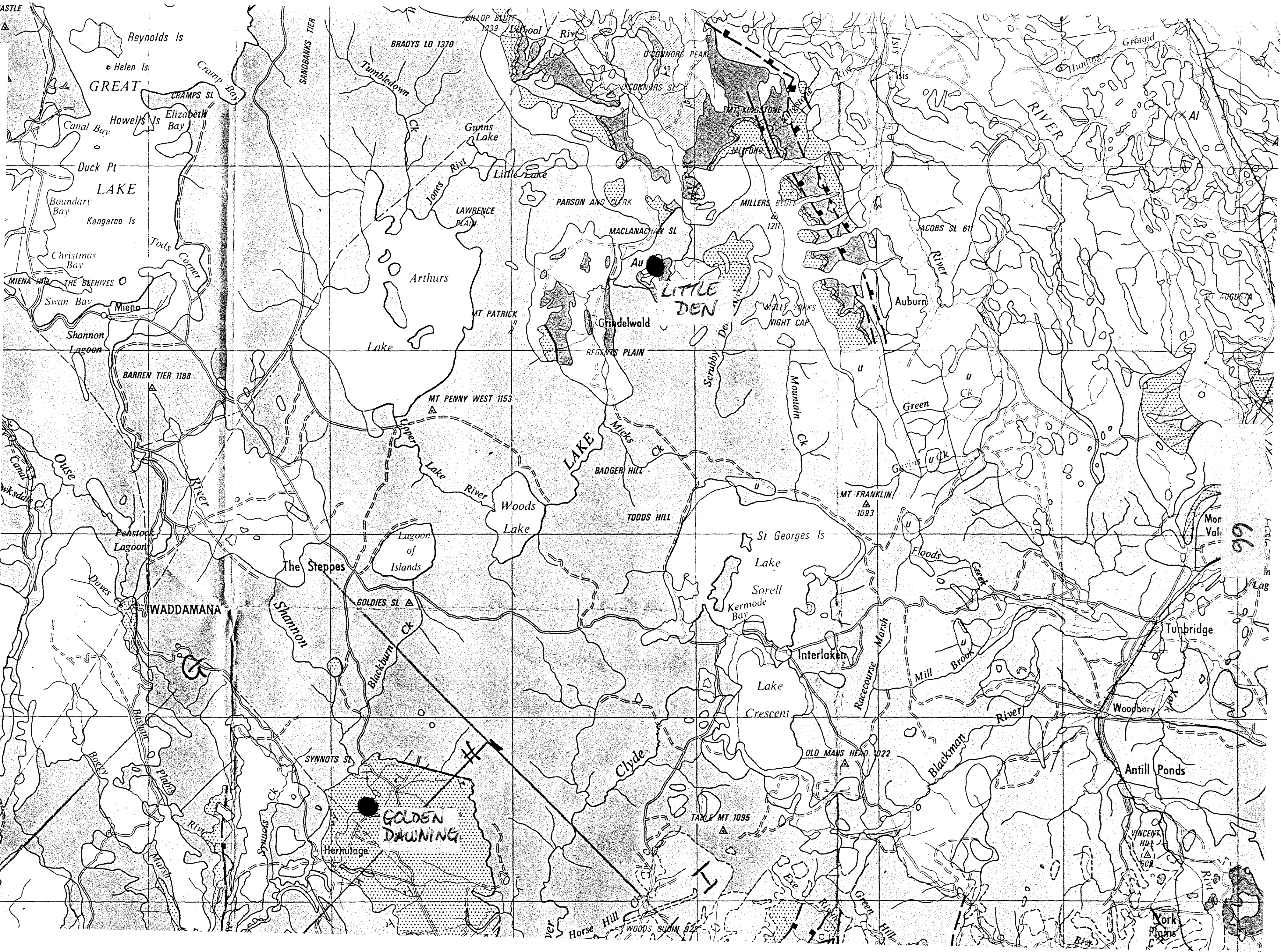
Other sites, such as near Tunnack and Apsley, could be associated with much thinner (<500 m) cover.

GOLDEN DAWNING

As is the case with many other sites the exact location is unknown. The mineral data base defines the site shown in Figures 39, 40 and 41. The location is put within the Permian outcrop near the Hermitage and Hunterston on the southern part of the central plateau.
Twelvetrees (1902) described this site as being associated with much pyrite within the Permian rocks adjacent to the dolerite contact and that such contact phenomena were common. A company was floated to mine the material which was assayed with initial encouragement.

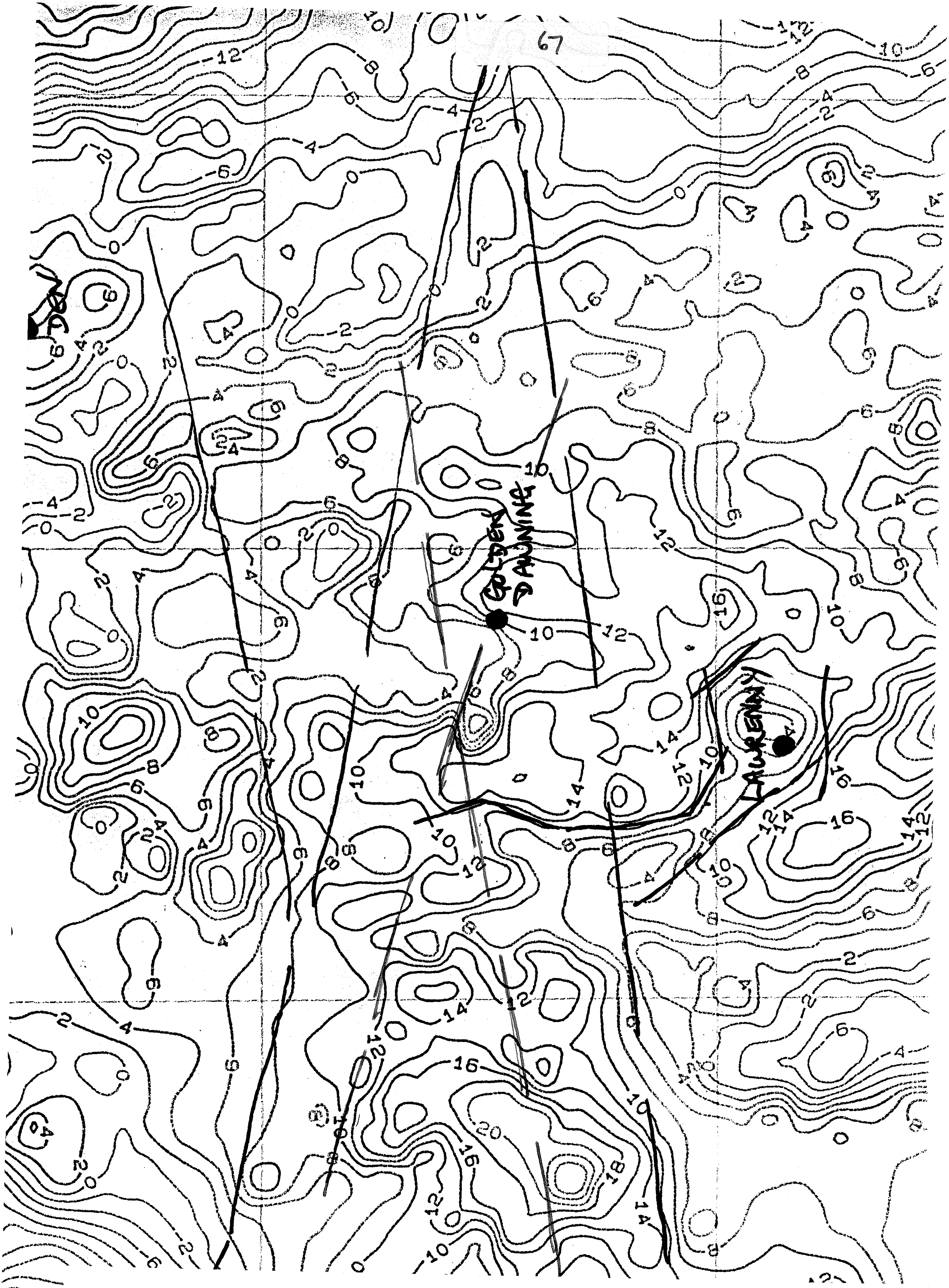
The geological map shows that the nominated site appears to lie south of an anomalous intrusive boundary and it may be that the coordinates are in error. Some further investigation is required to properly locate this site.
The gravity field is most informative about this site. It lies, as currently specified (or with a slight northern shift), on a substantial gradient. This gradient is unrelated to any aspect of the exposed geology. If the conjunction were with the Hermitage contact intersection then the presence of ESE, ENE and N-S elements would make the site consistent with all others.

Insufficient regional analysis, or magnetic data, are available to resolve any further details.



LOCATION OF SITES AND GEOLOGY CENTRAL PLATEAU

FIGURE 41



1991 RESIDUAL BOUGUER ANOMALIES AND SITES CENTRAL PLATEAU

FIGURE 42

LAWRENNY

The Lawrenny site was referred to by Nye (1922). Very little has been reported and the site must be re-located.
The site lies in an anomalous location (Figure 42). The Tertiary developments in this region were clearly controlled by a triple point involving N-S, NNW, and E-W structuring.
The site is clearly complex but may not warrant detailed exploration due to the thickness of cover in the region.

THE LITTLE DEN

Previous discussions in this report consider sites where the mineralisation occurs in cover rocks. The Little Den Goldfield defines little known gold occurrences and previously unsuspected belts of concealed Cambrian volcanics.

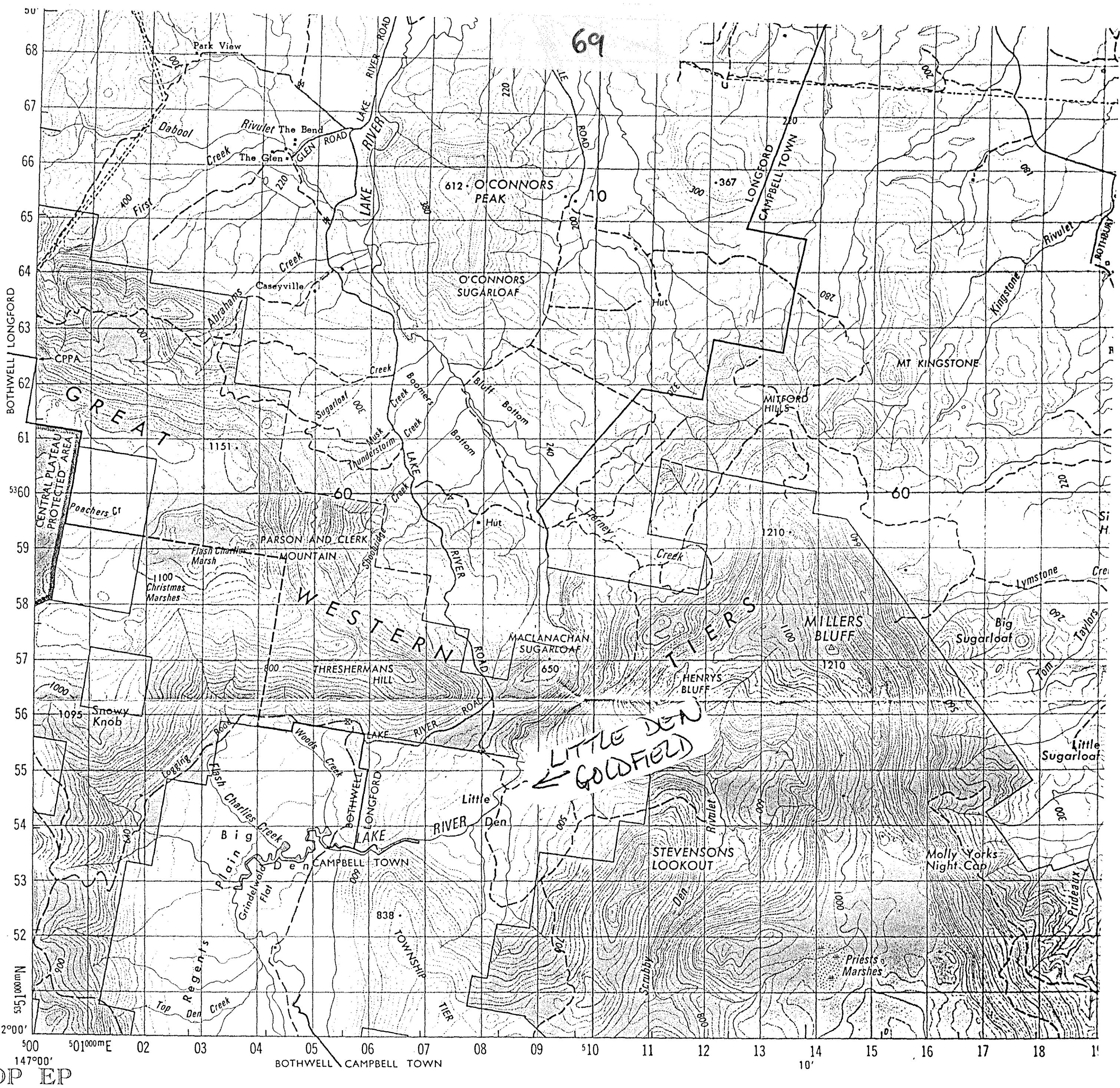
Since the volcanics, and many major structures, are buried by a variable and, as yet, unassessed thickness of Permo-Triassic formations and dolerite intrusions those sites in which volcanics or major structures are exposed, or virtually exposed, are worthy of more immediate attention.

Such a site occurs near the Lake River at the Little Den. The Cambrian (?) rocks are exposed in a window at the foot of the Great Western Tiers near Millers Bluff (Figure 43). This particular site is of interest because it is also known to be gold-bearing.

These notes consider the Little Den site and current data status.

PREVIOUS KNOWLEDGE AND EXPLORATION

A literature search has uncovered some relatively recent comments (Threader, 1963). These have been reproduced in full as Figure 44 since they provide a useful summary.
Key elements of the description relate to the observation of veining and the coarseness of the gold. Exploration and production from this area had been very limited up to the time of Threader's visit and have been negligible since. This reflects limited interest in gold for much of the post 1962 period and private ownership of the land under old title. The latter requires sensitive treaties which recognise a free carried right to minerals. This type of negotiation seems to have been beyond Shell Minerals, one of the few companies to have applied for the Connorville-Millers Bluff area.
The geology of the area is reasonably well known (Matthews, 1974). Mapping has revealed a small exposure of about 1 square kilometre of presumed Cambrian volcanics overlain by basal Permian tillite. The area is massively intruded by Jurassic dolerite and dolerite, or its debris, occurs from the Little Den area at about 400 m above sea level to the cap of the Great Western Tiers or outposts of the tiers, such as Millers Bluff.
No petrographic or magnetic information is available to confirm the proportion of actual dolerite outcrop or scree/talus, or the



PRODUCED by the Mapping Division, Lands Department, Hobart, 1982.
NOMENCLATURE: Topographic names on this map have been approved by the Nomenclature Board of Tasmania.
MAP ACCURACY: The average accuracy of this map is ± 25 metres in the horizontal position of well defined detail and ± 5 metres in elevation.
MAP RELIABILITY: Topographic information shown on this map is correct to May 1982.
PUBLIC RIGHT OF WAY: Roads or tracks on this map do not necessarily indicate a public right of way.
CORRECTIONS: To assist in correcting future editions of this map, users noting errors and omissions are invited to write to the Director of Mapping, GPO Box 44A, Hobart, Tasmania, 7001.

UNIVERSAL GRID REFERENCE
BEFORE GIVING A GRID REFERENCE, CIVILIAN USERS SHOULD STATE THE NUMBER AND NAME OF THIS MAP:
8314: SOUTH ESK

GRID ZONE DESIGNATION: 55G	TO GIVE A STANDARD REFERENCE ON THIS SHEET TO NEAREST 100 METRES		
100 000 METRE SQUARE IDENTIFICATION	SAMPLE POINT: 1210 △ MILLERS BLUFF		
DQ EQ 5400 / DP EP / 500	1 Read letters identifying 100 000 metre square in which the point lies:	EP	
	2 Locate first VERTICAL grid line to LEFT of point and read LARGE figures labelling the line in either the top or bottom margin, or on the line itself:	14	
	3 Estimate tenths from grid line to point:	3	
	4 Locate first HORIZONTAL grid line BELOW point and read LARGE figures labelling the line in either the left or right margin, or on the line itself:		57
IGNORE the SMALLER figures of any grid number; these are for finding the full co-ordinates. Use ONLY the LARGER figures of the grid number; example:	5 Estimate tenths from grid line to point:		2
	SAMPLE REFERENCE:	EP143572	

Kilometres 2 1 0 2

Built-up area; National route marker
Roads maintained for continuous public use — sealed / unsealed
Primary road; Route number — A6
Secondary road; Route number — B61
Minor road; Route number — C412
Roads of restricted use or access
Other roads; Bridge
Vehicular track; Gate
Walking track
Railway; Tunnel; Station; Bridge
Light railway or tramway
Power transmission line
Levee or bank; Landmark area
Landmark object; Quarry; Mine — Tower
Building/s; Church; Ruin; Drive-in theatre — Ruin
Trig station; Spot elevation — • 515

BLACK NUMBERED GRID LIN
GRID VALUES ARE
VERTICAL DATUM FOI
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Lake perennial; Str
Lake intermittent; S
Swamp perennial; i
Land subject to inu
Bore or well; Sprin
Breakwater; Pier; V
Wreck, exposed; Li
Rock, bare or awas

LOCATION OF LITTLE DEN GOLDFIELD

FIGURE 43

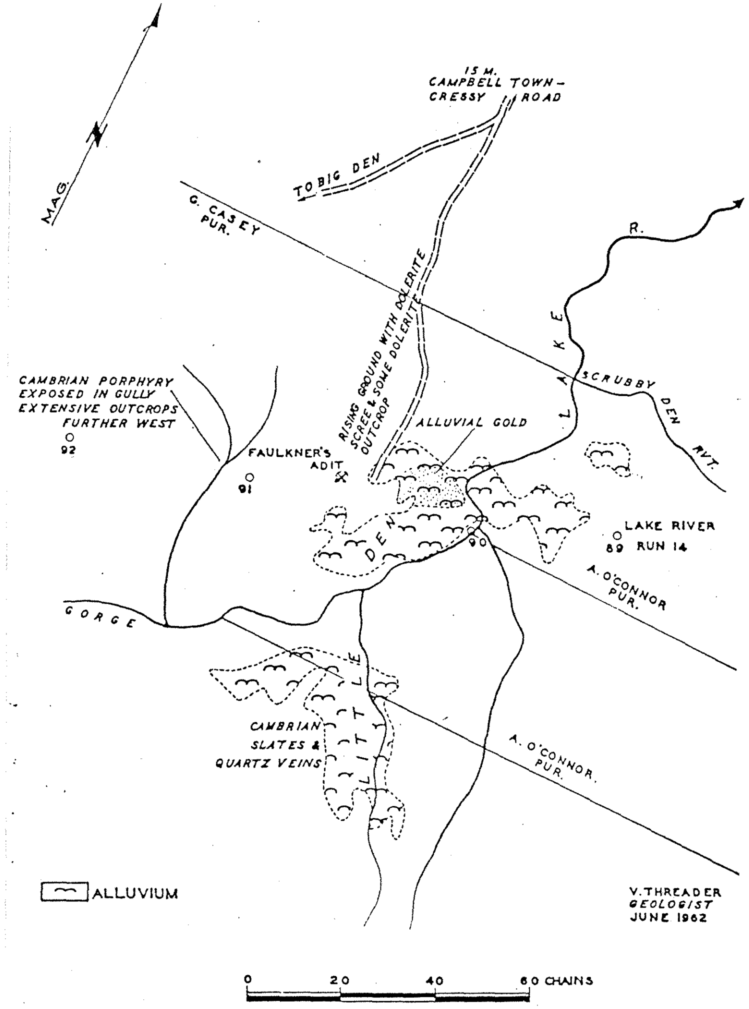

FIGURE 44

6. LITTLE DEN GOLDFIELD

by V. M. Threader

The Little Den Goldfield was visited on 5th-6th of June 1962 in company of L. Faulkner of Launceston who had previously written to the Department for geological advice.

The Little Den is an alluvial flat on the Lake River; it takes its name from an old homestead in the area.

A good motor road (to Parknook) leads south from the Campbell Town-Cressy road as far as Dabool Rivulet, a distance of some nine miles, then follows about six miles of rough road to Little Den. There is a slightly more direct route through the Connorville Estate by a private road which joins the public road two miles south of Dabool Rivulet.

Gold was reported to have been discovered in this area in 1932 but local residents stated that the discovery had been made 50 years earlier. The land is all privately owned and has been worked for gold intermittently since its discovery. The last permit to enter expired in October 1961. Departmental reports were prepared by Scott (1932; 1935) and Nye and Blake (1933). Voisey (1949) included this area in a report prepared for the Hydro-Electric Commission.

Scott considered that alluvial gold was being won from an old course, now abandoned, of Lake River. At the time of his first visit, Cambrian slate on the east side of the river was being prospected, there being some weakly auriferous quartz veins in it.

Nye and Blake made a thorough investigation and produced a geological map of the area. They described a basic igneous rock as a gabbro porphyrite of Devonian age. As outcrops were found bounding the Little Den, it was assumed to underlie the alluvium of the Den and to be the source rock of the alluvial gold. The report concluded that the field had very limited potential. Scott (1935) recommended a pitting or boring programme to delimit the payable area of alluvial gold and to determine its depth.

Voisey (1949) grouped the porphyries with the Cambrian slate and pyroclastic rocks which occur in the area. If this interpretation is correct, they are host rocks and not source rocks of the gold.

During the present investigation it was observed that these Cambrian rocks were more abundant than is shown on Nye and Blake's map, several additional large outcrops and stream exposures having been seen. On the western edge of the Den alluvial flat there are Jurassic dolerite outcrops and on the slopes there is a mantle of dolerite scree. It was thought that Cambrian rocks underlie much of the scree, but the transgressive nature of the dolerite contact and the presence of scree make it difficult to determine any limits. It is fairly certain though that it dips under the Den alluvium as Nye and Blake concluded. Mr. Faulkner demonstrated the local distribution of the alluvial gold by washing several dishes of the ground. It appears that the gold is coarse, some pieces being the size of grains of wheat, and nuggets over 1 ounce have been reported. Mr. Faulkner stated that he has not found gold deeper than a few inches, the best places being on the surface beneath eucalypt trees where the ground has been slightly raised by root growth. Whether such is the case or not, the gold is of local distribution, shallow depth, coarse grain and irregular shape. These indications all point to a nearby origin. Faulkner and others have prospected on the edge of the alluvial flat and have sunk a small shaft to 10 feet and driven an adit of 10 feet exposing two parallel quartz veins containing visible sulphide mineralization. These appeared to be strong bodies of quartz and samples were taken for assay. It was not possible to determine the nature of the country rock as the workings are still in decomposed ground. Mr. Faulkner was advised to follow these veins along the strike and to attempt to obtain fresher rock by deepening the shaft on the veins. It is possible that these veins or others running parallel to them were the source of the alluvial gold and it was suggested that continuing the adit into the hill could be undertaken when these two veins have been thoroughly prospected.

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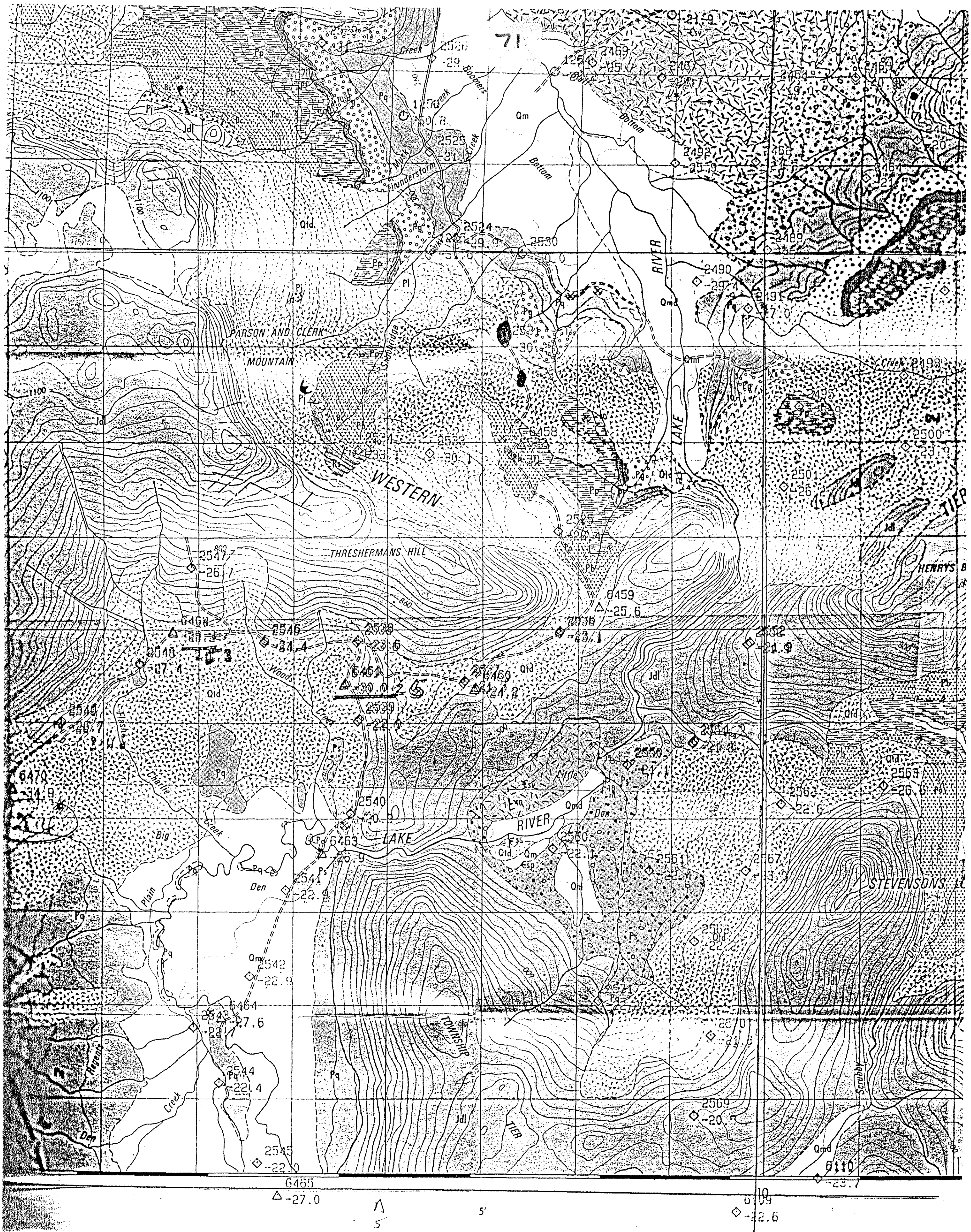
SCOTT, J. B., 1932.—Recent gold discovery. *Rep. Dep. Min. Tas. (unpublished)*.

SCOTT, J. B., 1935.—Lake River goldfield. *Rep. Dep. Min. Tas. (unpublished)*.

VOISEY, A. H., 1949.—The geology of the country between Arthur's Lakes and the Lake River, Tasmania. *Proc. Roy. Soc. Tas. for* 1948, pp. 105-110.



GEOLOGY AND LOCATION OF GRAVITY STATIONS - LITTLE DEN

FIGURE 45

INDEX T

Vehicular Track

Foot or Pack Track

Railway

QUAMBY

relationship between sheet base/tops or feeders. It is possible that a feeder occurs in the Little Den area. I predict its position at 506 500 mE, 5354 500 mN extending to 509 000, 5357 000 on the basis of mapped relationships although the actual rock should be inspected for textural and compositional indicators. (Note that a coordinate printing error is present in the SW corner of the Lake River sheet, Matthews, 1974).

Other information, discussed below, suggests that this is a primary structural and crustal axis and presence of feeding dykes is thus highly likely. Any demonstrated feeder dyke would, by inverse corrollary, define the location of the primary structure.

There is little in any published geological mapping or geophysical interpretations to account for the gold mineralisation in the Little Den or its disposition.

GEOPHYSICAL DATA

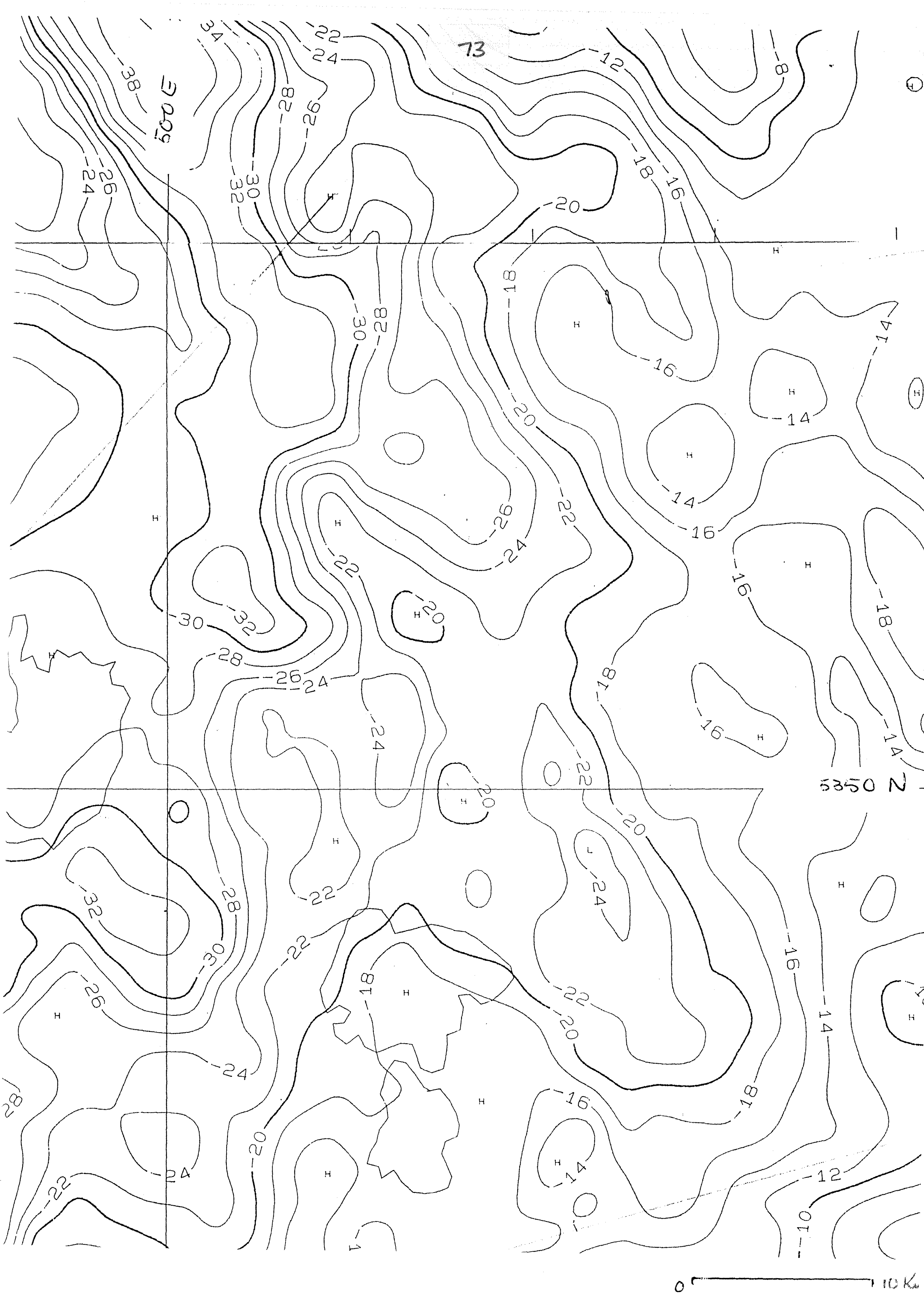
All geophysical data in the Little Den area has been collected since 1962. The first traverses, now included in the gravity data base, were acquired in 1967 but were not included in any early interpretations of the Tiers-Poatina-Cressy areas. Virtually all data discussed below have been acquired since early 1988.

GRAVITY coverage in the Little Den area is patchy and restricted to main tracks. The nominal station spacing is 1 km but very large gaps (> 3 km) occur, especially north and south of the Den. Data local to the mineralisation does not greatly assist evaluation due to lack of detail (Figure 45). More regional compilations are, however, most suggestive. Figure 46 presents the raw Bouguer anomalies and Figures 47 and 48 the residual anomalies after separation using the MANTLE88 process of Leaman and Richardson (1989).(The newer processed version is indicated in Figure 42) The larger scale of Figure 48 - although now updated as shown in Figure 47 - reveals a NE-SW trending feature which extends across the region near the Lake River at the Den and continues far beyond this area. The nominal position is shown in Figure 49.

Definition of the location of this structure can be improved by close inspection of the raw data values, limited as they are, and correlation with particular elements of the geological mapping. The mapping reveals that a series of faults, intrusion concomitant fault junctions and the Millers Bluff offset from the Tiers lie on this alignment.

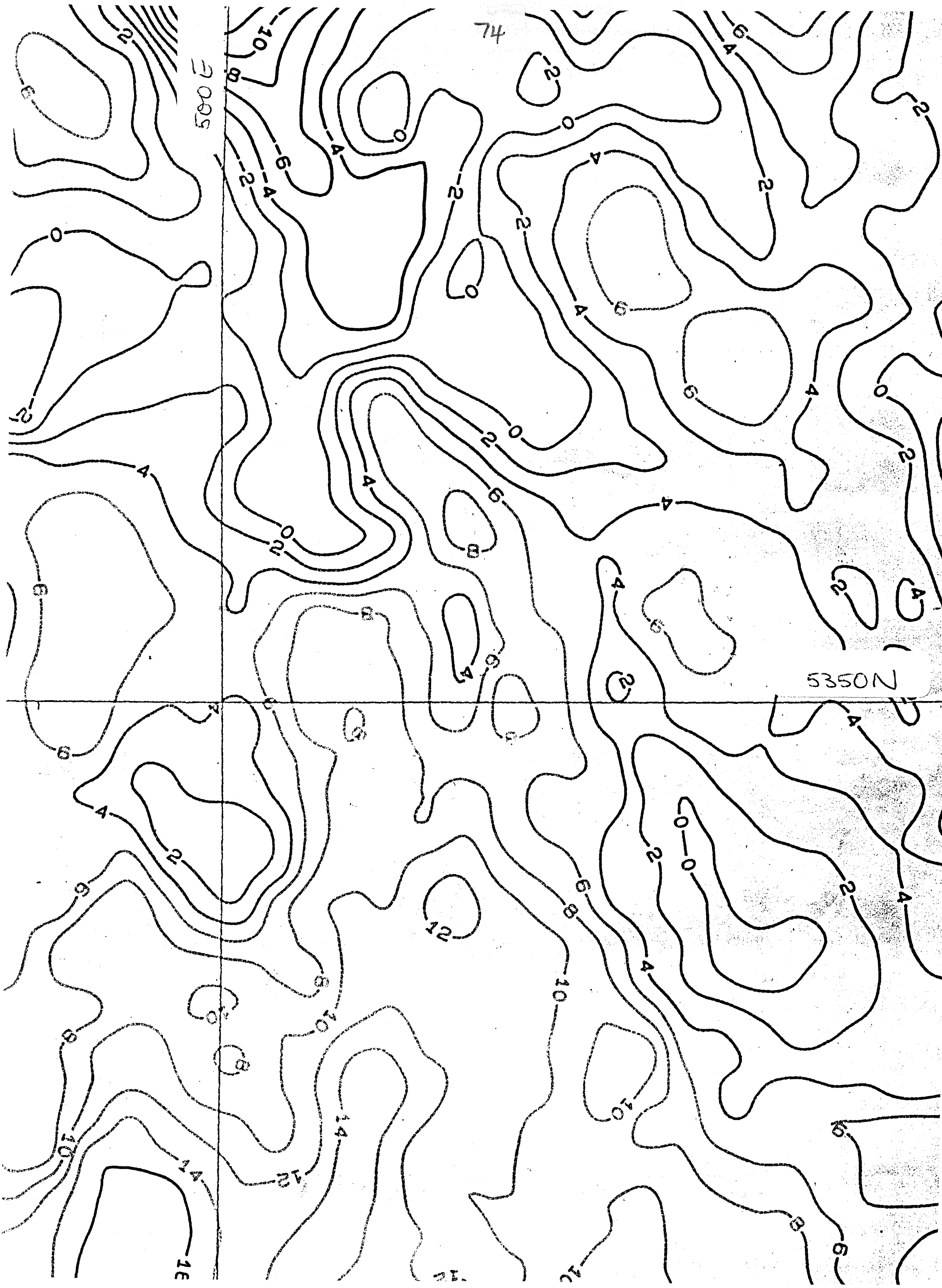
The Little Den Goldfield is clearly not far removed from a major crustal feature which has certainly influenced post Permian deposition, intrusion and tectonics, albeit in relatively minor forms. Close inspection of the raw Bouguer values confirms the effect and major gradient offsets associated with the fringe of the Tiers and the Cambrian rocks. A dextral offset of perhaps 10 km is involved. Extant mapping, given application of the indicators noted above, shows that the structure is pre or syn- Tabberabberan. It is not post Devonian in origin although it has influenced subsequent events.

It is tempting to accept the topographic forms as direct indicators of the location of the structure but these will only reflect the imposed subtle fracture systems which have encouraged differential



BOUGUER ANOMALY 1:250000 COMPILATION

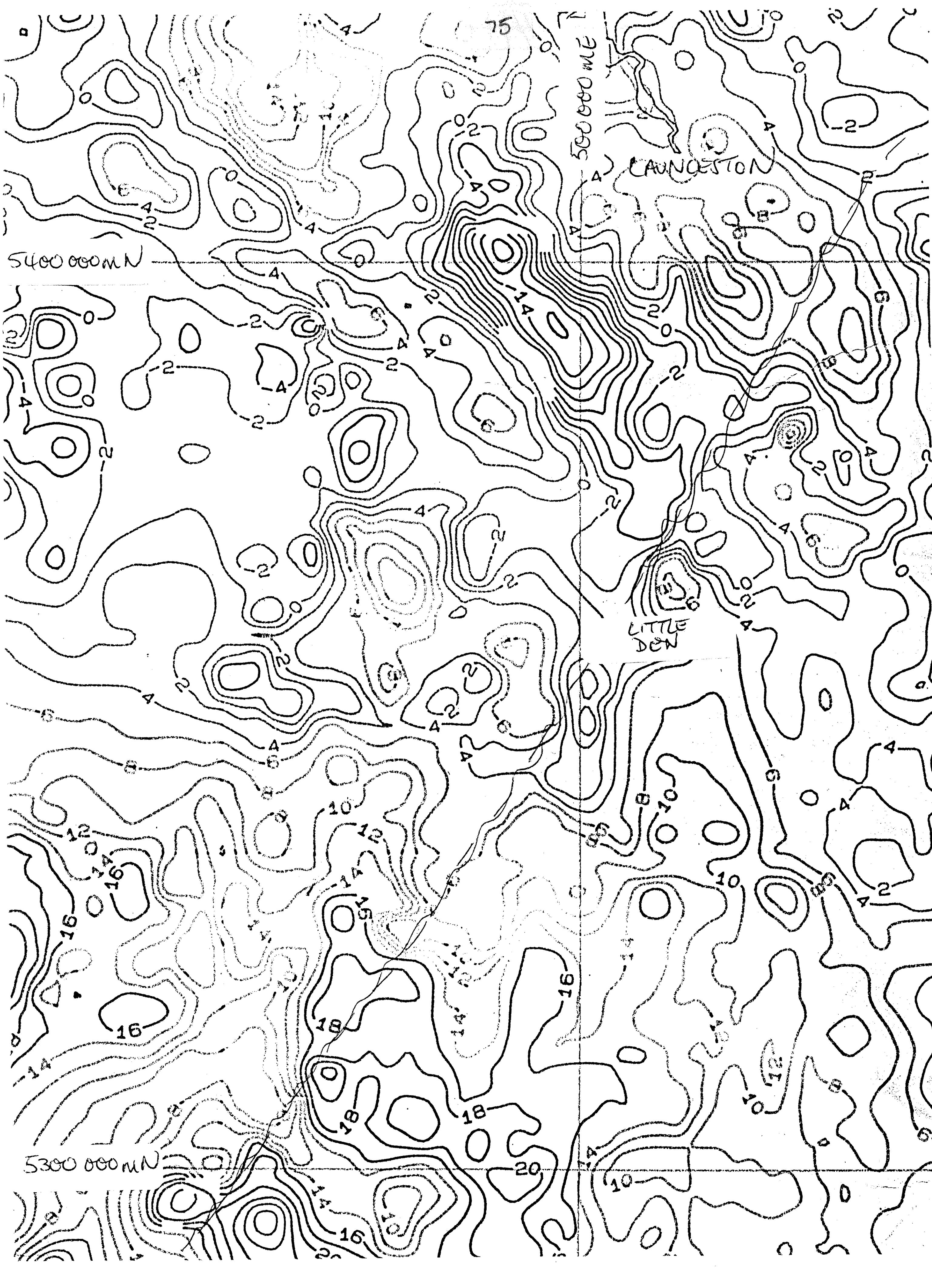
FIGURE 46



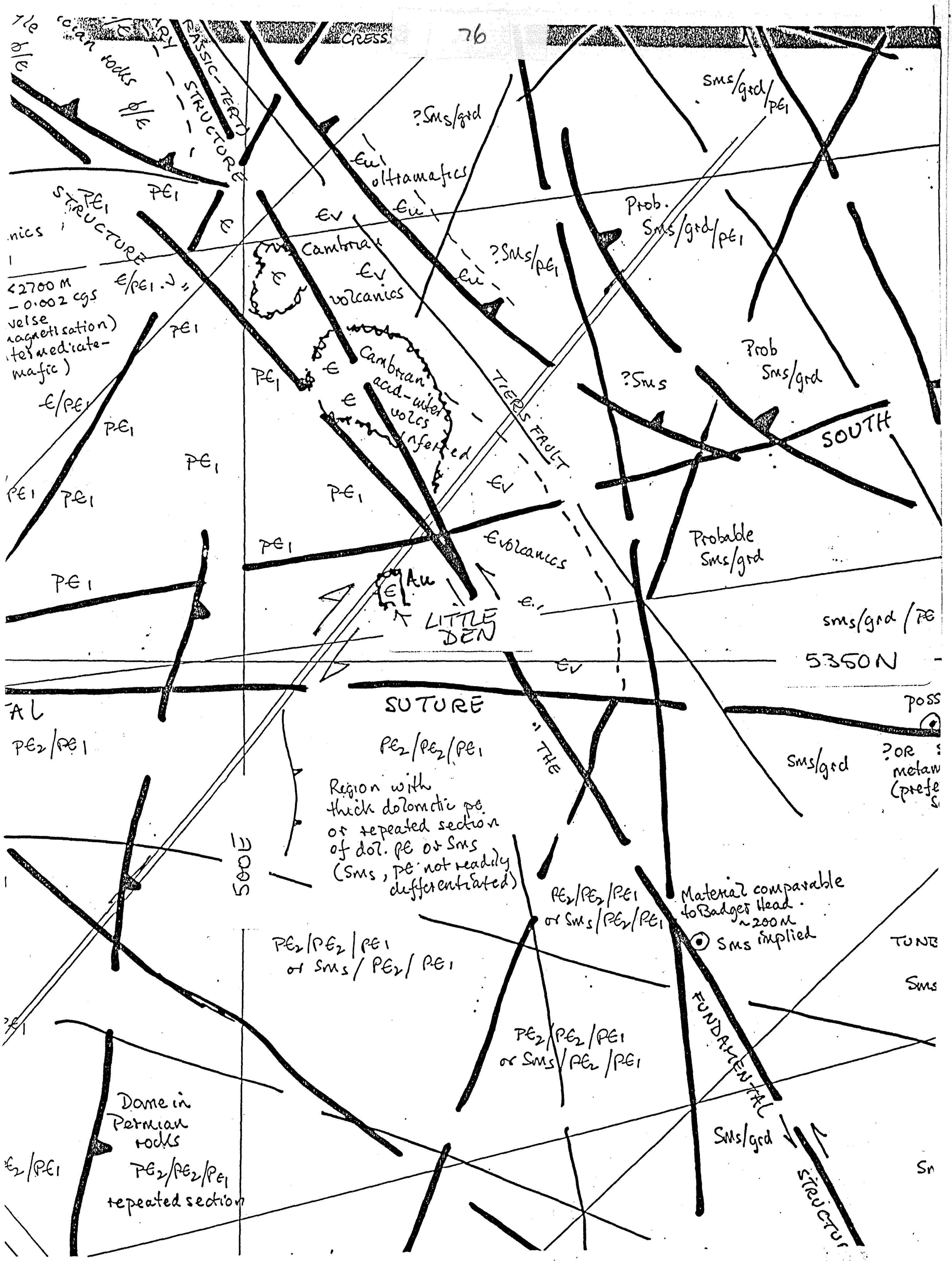
1988 RESIDUAL BOUGUER ANOMALY 1:250000 COMPILATION

FIGURE 47

10 Km



RESIDUAL BOUGUER ANOMALY 1:500000 COMPILATION FIGURE 48

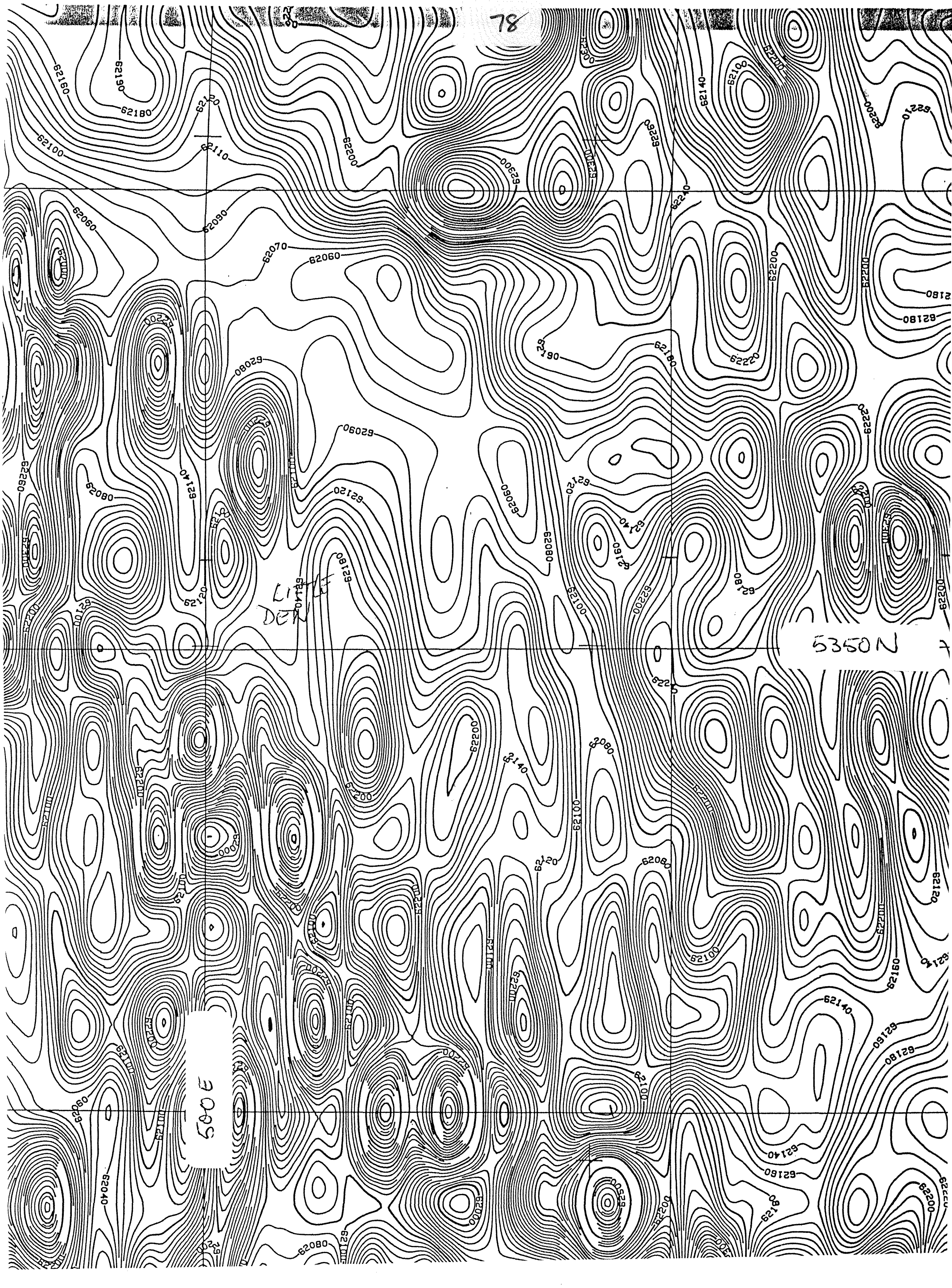


PREVIOUS STRUCTURAL SYNTHESIS (LEAMAN, 1990) AND LITTLE DEN SHEAR INFERRED

FIGURE 49

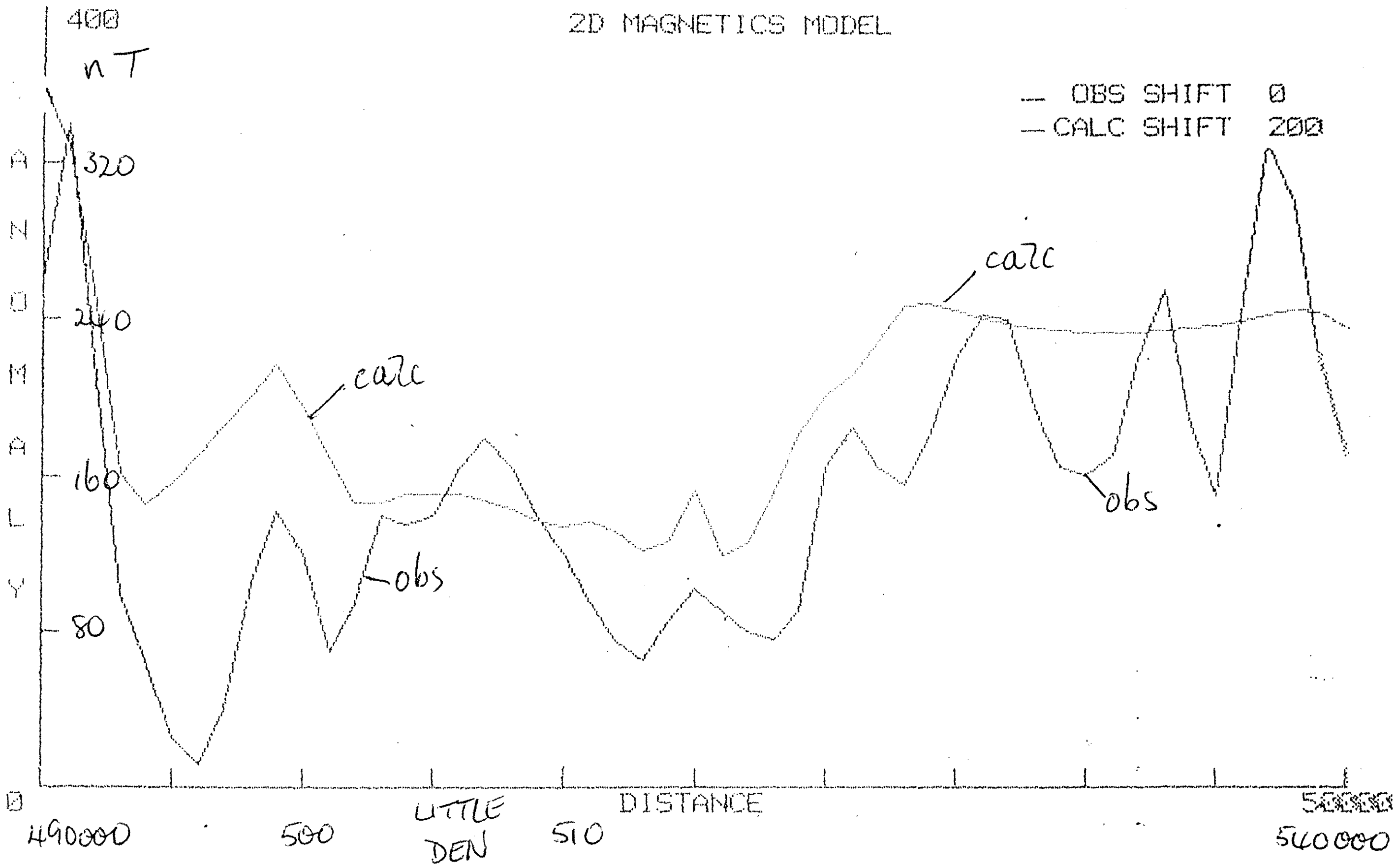
erosion and these may be offset some distance from the actual source structure. Pre-dolerite faulting and dolerite intrusion boundaries near 514 000 mE, 5365 000 mN show orientation changes and terminations consistent with a dextral motion and stress field. The obtuse intrusion corner at the nominated coordinates probably defines an ACTUAL point on the control shear. The structure then extends SW to 505 000, 5354 000 - or about 1 km NW of the gold workings at the Little Den. Near the Den it is concealed by dolerite and may include a feeder as described above. Confirmation of such a feature would establish the position of the structure. A large crustal shear could readily account for the mineralisation and mean that the most prospective volumes have not been sampled. All would lie at shallow depth or be exposed. Some might be concealed by dolerite or talus.
MAGNETIC data are of poorer quality and not capable of such informative coupling with the geological data base. The public domain BMR surveys are useless due to unrecoverable flight positions (R. G. Richardson, Mines Dept., pers. comm.). A fragment of the more rigorous survey by Conga Oil is presented in Figure 50 but this has a 5 km line spacing only and was flown at 1600 m ASL.
Coverage density is the primary limitation since the reference level allows all aspects of the field to be three dimensionally compensated. Numerous gradients are indicated but are not definitively located in terms of the complex terrain and geology about Millers Bluff and the Little Den. This data has not been generally available until recently and only fragments have been released in publicity material by Conga Oil. Very little work has been done with it. Many features observed may reflect topographic variations and dolerite relationships or exposure patterns with respect to the topographic geometry. Others clearly do not.

In order to assess coverage needs and application and significance of each data set a test line was established at 5355 000 mN and analysed.
This line is acute to the proposed shear system and cannot be expected to provide much reliable information about it due to 3D lateral effects. The line does, however, honour the extant data distribution and enable some assessment of those features which contribute to the gravity and magnetic fields and how these can be best defined.
The treatment is not exhaustive since 3D aspects and much more data should be included.
Figure 51 suggests that two types of volcanics are present and that these dominate the magnetic field. Dolerite features produce generally minor responses. Imperfections in the model shown imply greater thickness of volcanics to the west (not a wedge as shown) and persistence of reversed magnetisation/overturned rocks to the east *beneath* the eastern normal block. This profile may present the illusion of a thrust in the style of Leaman (1990) or simply be affected by the acute 3D effects across a sub vertical shear.
Whatever the origin, magnetic data can certainly be used to locate the major basement boundaries in the area as well as resolve many aspects of the dolerite. This test line shows that the main structure lies near Millers Bluff but cannot precisely locate it due to profile and data alignment.

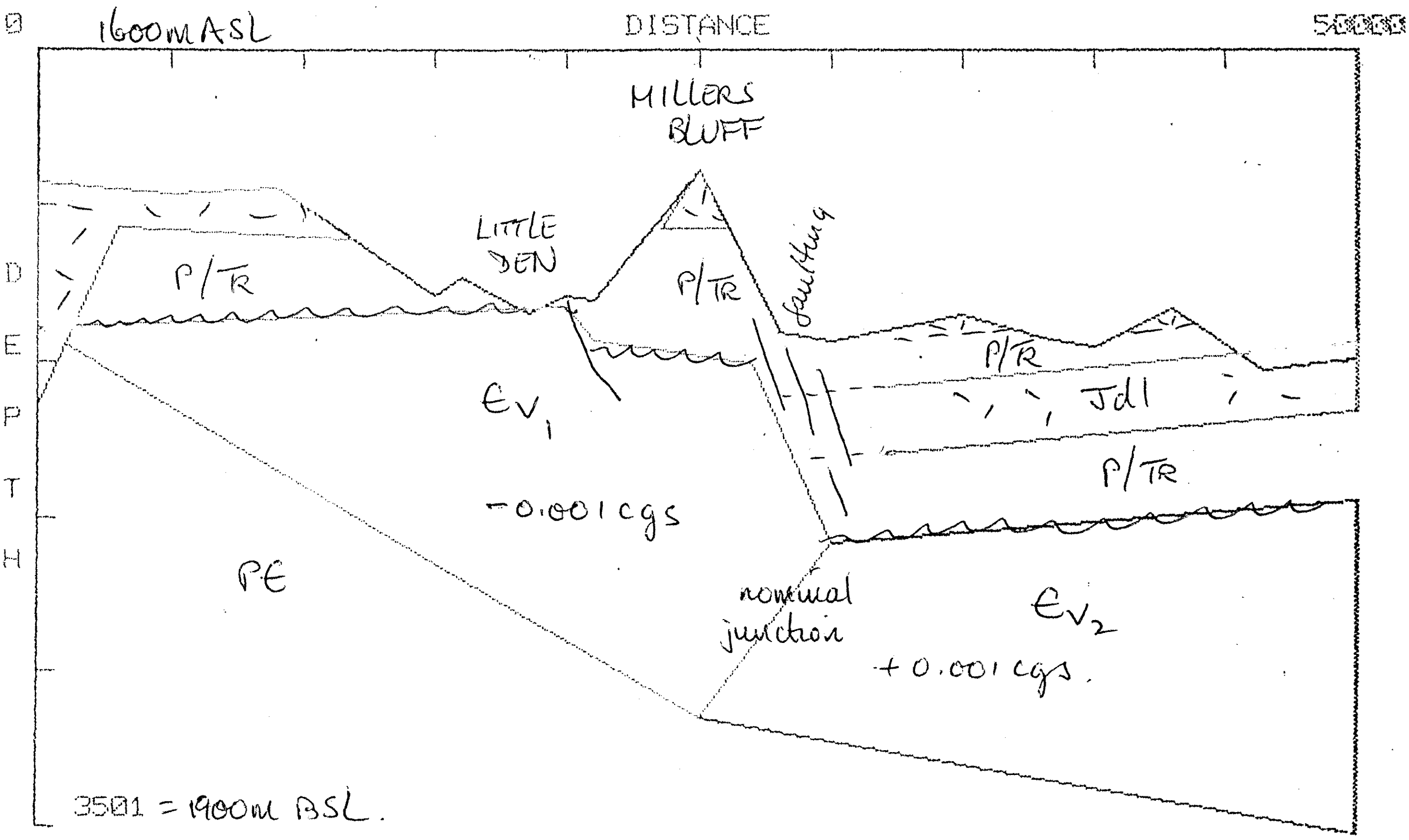


PART OF AEROMAGNETIC SURVEY BY CONGA OIL, CENTRAL TASMANIA

FIGURE 50



DEN GOLDFIELD MAGNETICS 1600 5355N 490-540E



MAGNETIC MODEL 5355 000 MN LITTLE DEN

FIGURE 51

The major Tiers offset and faulting (Jurassic) lies east of Millers Bluff. Figure 52 examines the near surface contribution to the gravity anomalies. This includes the effect of Permo-Triassic rocks and dolerite within the irregular terrain. The calculation shows that it is not generally significant and there is much cancellation. Such materials can be compensated or "stripped" from the residual field and the resultant analysis can be focussed on the older rocks. Figure 53 shows the scale of the underlying mass of volcanics. These rocks are of the order of 3 km thick, an estimate consistent with the magnetic models. The correlation of the two methods enables removal of the Upper Precambrian dolomitic sequence option for the models since there are few materials with the required density properties and even fewer with the required magnetic properties. This crude model shows that the volcanic mass is not wedged to the west.
This model does not allow for the near surface effects estimated in Figure 52. Inclusion of these will reduce some of the cyclic character noted in the observed profile. The maximum values define the scale of the anomalous mass.
The minima are associated with steep slopes or alluvial plains and may indicate problems with terrain corrections or local inadequacies with the Bouguer density. The general peak values which correspond to elevated areas or areas free of mapped talus suggests that the terrain corrections are generally acceptable but that some pockets of talus are very thick and of much lower density than the Bouguer assumption. This conclusion has ramifications for any further surveys and specifications for new work must allow for this.

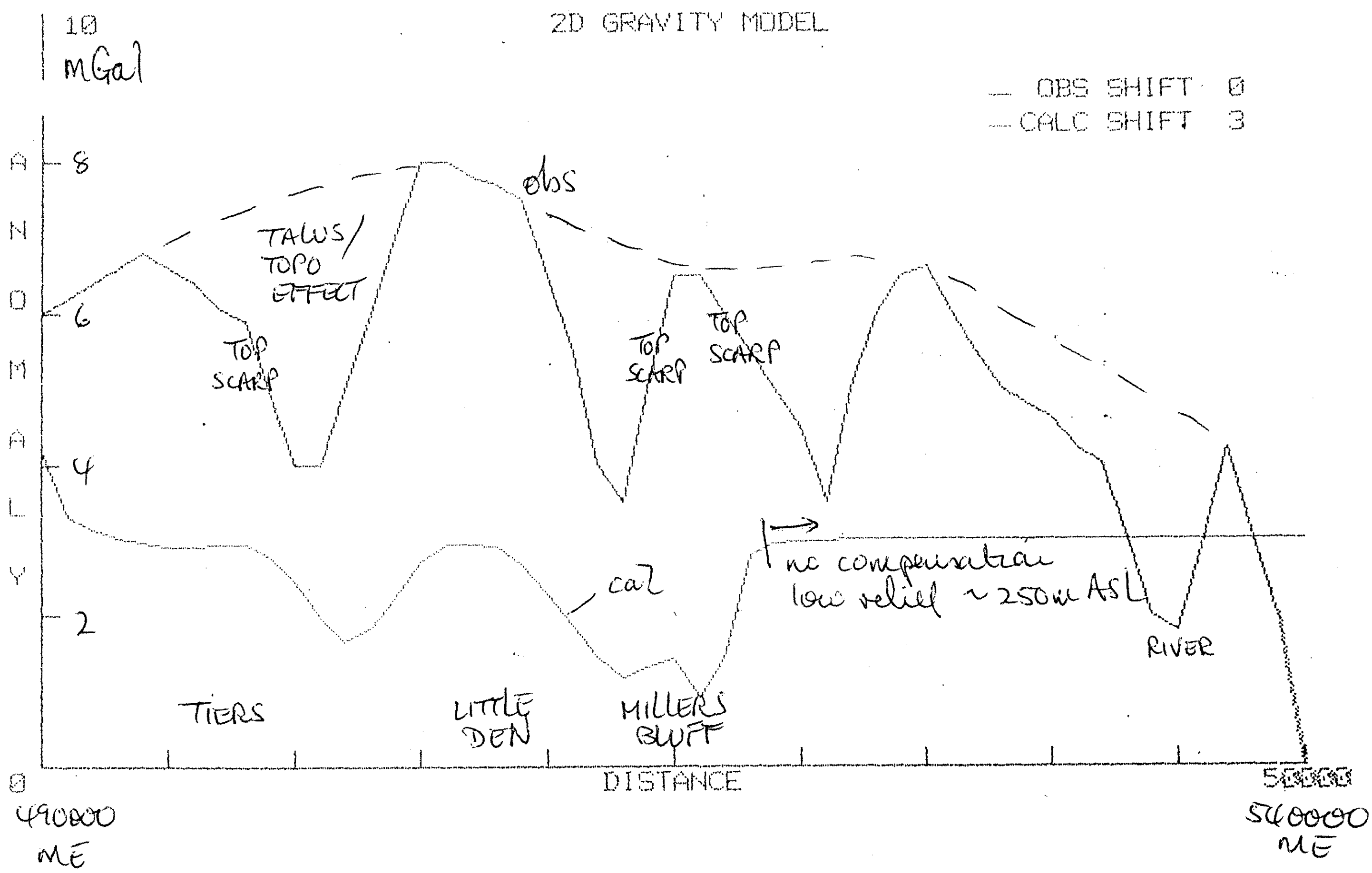
The preliminary analysis suggests that useful magnetic data requires a line spacing of no more than 500 m but may be, and should be, flown at relatively high altitude in order to ease interpretation problems and source compensations. The magnetic method may yield useful information about dolerite and pre-Permian structures.

Gravity data must be widely and evenly distributed with a nominal spacing of 500 m within 4 km of the Little Den and perhaps 250 m within 1.5 km. This is necessary for two reasons.
a)to define dolerite structure and confirm magnetic indications of feeder location. This is essential if any exploration programme is to avoid evaluation or drilling of a feeder given that one may lie immediately NW of the Little Den Goldfield.
b)to define and assess any effects due to talus and to provide true solid geology response patterns.
Some more regional infill may help locate extensions of the main shear structure inferred.

QUAMBY COPPER

This site was listed on page 4 as one of the few sites to lie within the covered region of Tasmania. This is misleading since, like the Little Den, it occurs in an area south of Deloraine where Lower Palaeozoic rocks are exposed. It will not be considered further in this report.
A substantial discussion was offered for the Den since it occurs in an area in which cover rocks are predominant and conceal much.

LINE PARAMETERS - ORIGIN,LIMIT,INCR : 0 50000 1000



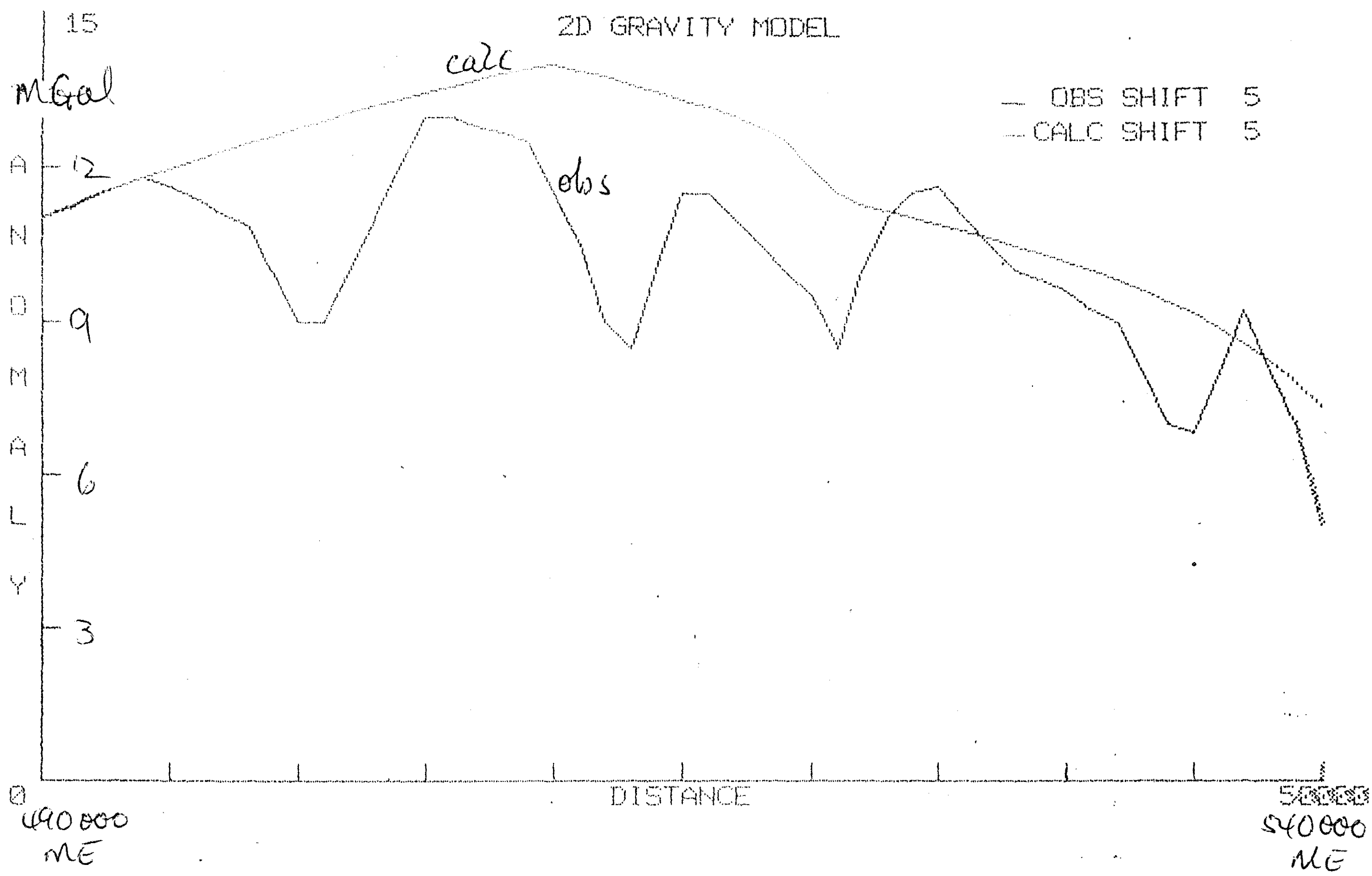
DEN GOLDFIELD GRAVITY 5355N 490-540E

Jdl + P/TR compensated
as in Fig 10.

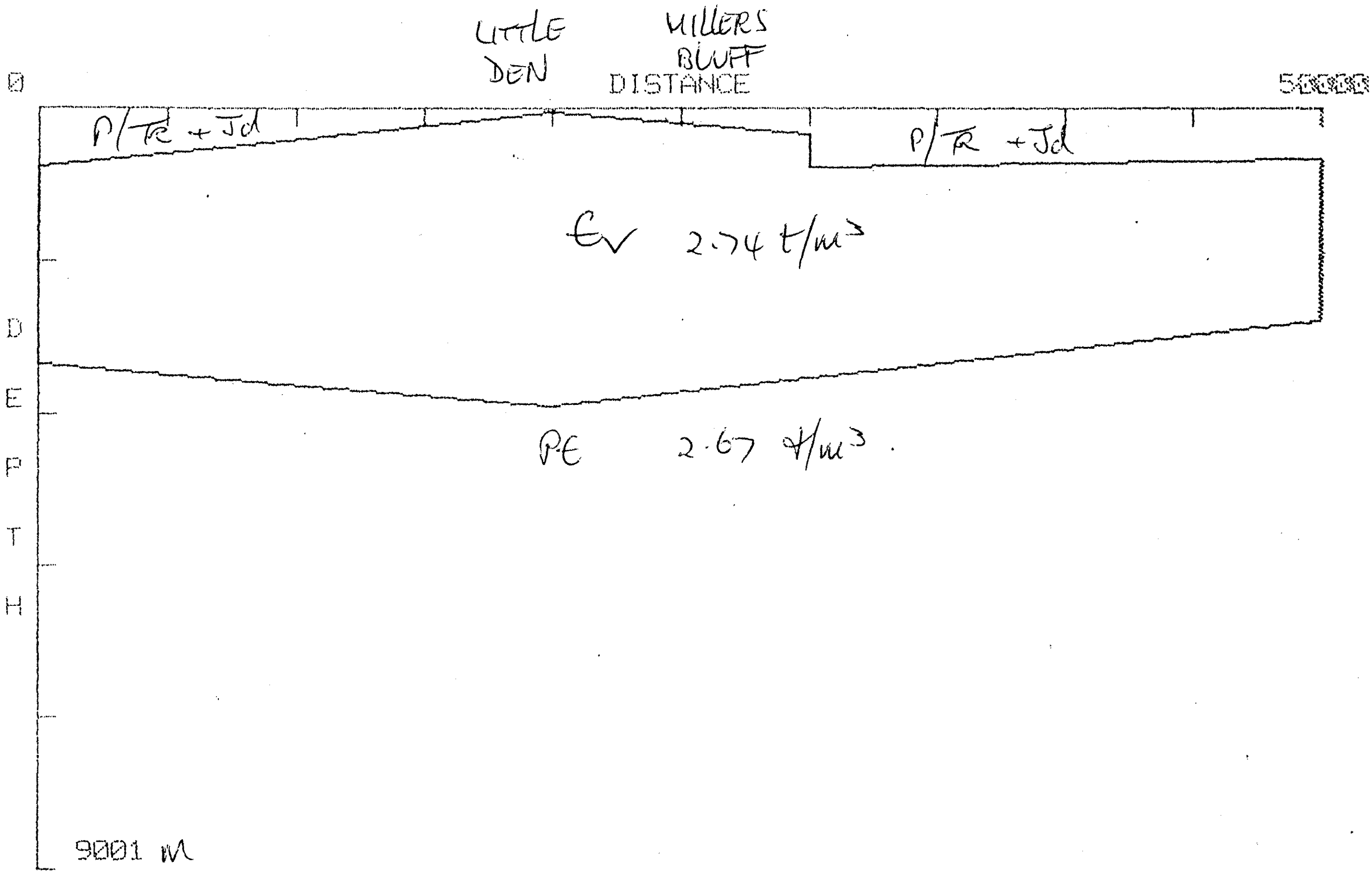
NEAR SURFACE GRAVITY EFFECTS 5355 000 MN LITTLE DEN FIGURE 52

4.00 0.07
50001 600 55000 600 55000 3[illegible] 82 [illegible]3001 2500

LINE PARAMETERS - ORIGIN,LIMIT,INCR : 0 50000 1000



DEN GOLDFIELD GRAVITY 5355N 490-540E



REGIONAL MASS MODEL 5355 000 MN LITTLE DEN

FIGURE 53

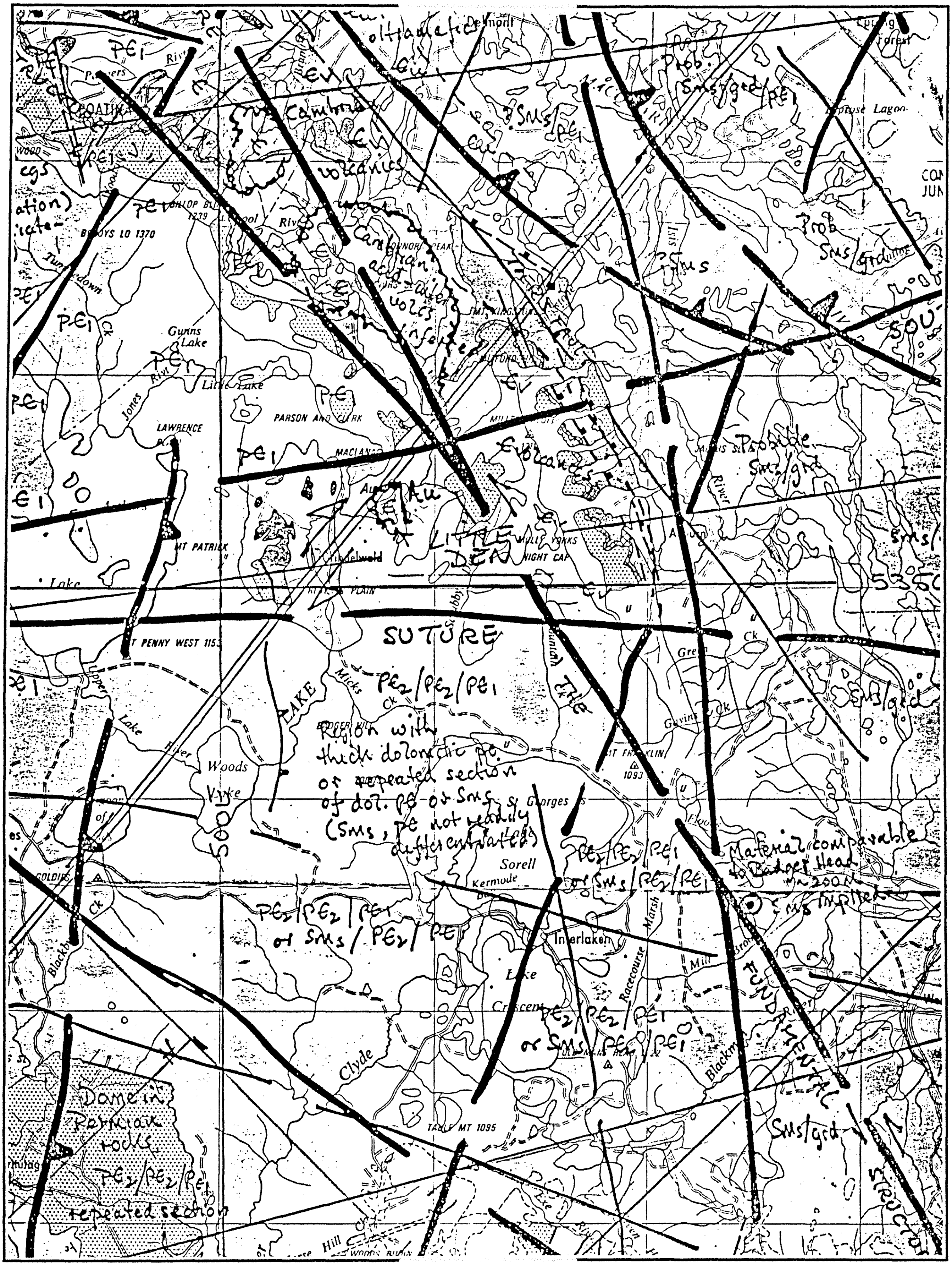


FIGURE 54

Little Den Goldfield area showing an elemental pre-Permian interpretation. Note the intimate relationships between these older features and both the mineralisation — and orientation of veins, and the pull apart structures toward Cressy. Note the detachment beneath the Hermitage dome in the southwest of the map and the orientation of the dolerite contacts everywhere. Young features mirror old.

SOME FURTHER INTERPRETATION

Some examples of early interpretations in the Midlands region were described in Part I of this report. See Figures 21 to 24. This work was very gross and the sections presented are fragments of an analysis designed to review the Tasmanian crust between the Southern Ocean and the Tasman Sea. Data sampling was coarse and no fine detail was incorporated. The curve fits are simply indicative; the information sought about the mantle was separated.

The D'Entrecasteaux interpretation published by Leaman (1990) (see also open file reports for Conga Oil for the period 1987-1989) was much more comprehensive and included a primary appraisal of cover contents to the limit allowed by the magnetic data available. The gravity data would have permitted further analysis (and still will). Similarly the north Tasmania interpretation, extracts of which were included in Leaman (1992)(Figures 18, 19), was comparable. Both represent nearly two orders of difference in terms of quality of interpretation with respect to the issues discussed in this report.

An interpretation of structures in the Derwent Valley, which remains confidential, was of much lower standard.
No previous interpretation, including that of Leaman (1972), has used the available gravity data to its potential. Problems do exist with all magnetic data sets and detailed appraisals of the cover will ultimately depend on some upgrading of this data type.

A limited attempt has been made, as part of this appraisal, to refine some of the existing profiles across the midlands in order to test, or confirm, earlier implications and to suggest the nature and quality of structural information which might be obtained.
Three lines have been selected for these tests; two of which were illustrated in part I. Each uses essentially the same data as the original interpretation but more detail and consistency has been demanded.
Each data profile has been compensated and referred to the same level above sea level and is able to properly consider sources within the terrain which has a relief of about 1000 m along each profile. The sampling, however, remains coarse and a comparable quantum leap in interpretation quality would follow sampling at the actual spacing of the data available. This was not done for this illustration because the necessary information was not to hand. The gravity profiles are based on the Mantle88 separation (no detailed maps of the Mantle91 separation being available to me) but this will not lead to large errors in this part of Tasmania. The magnetic data depends on coarse inter-profile sampling and should only be considered indicative. The models, themselves, do not include complete details of the terrain shape, or dolerite cover, since the data sampling used does not justify this.

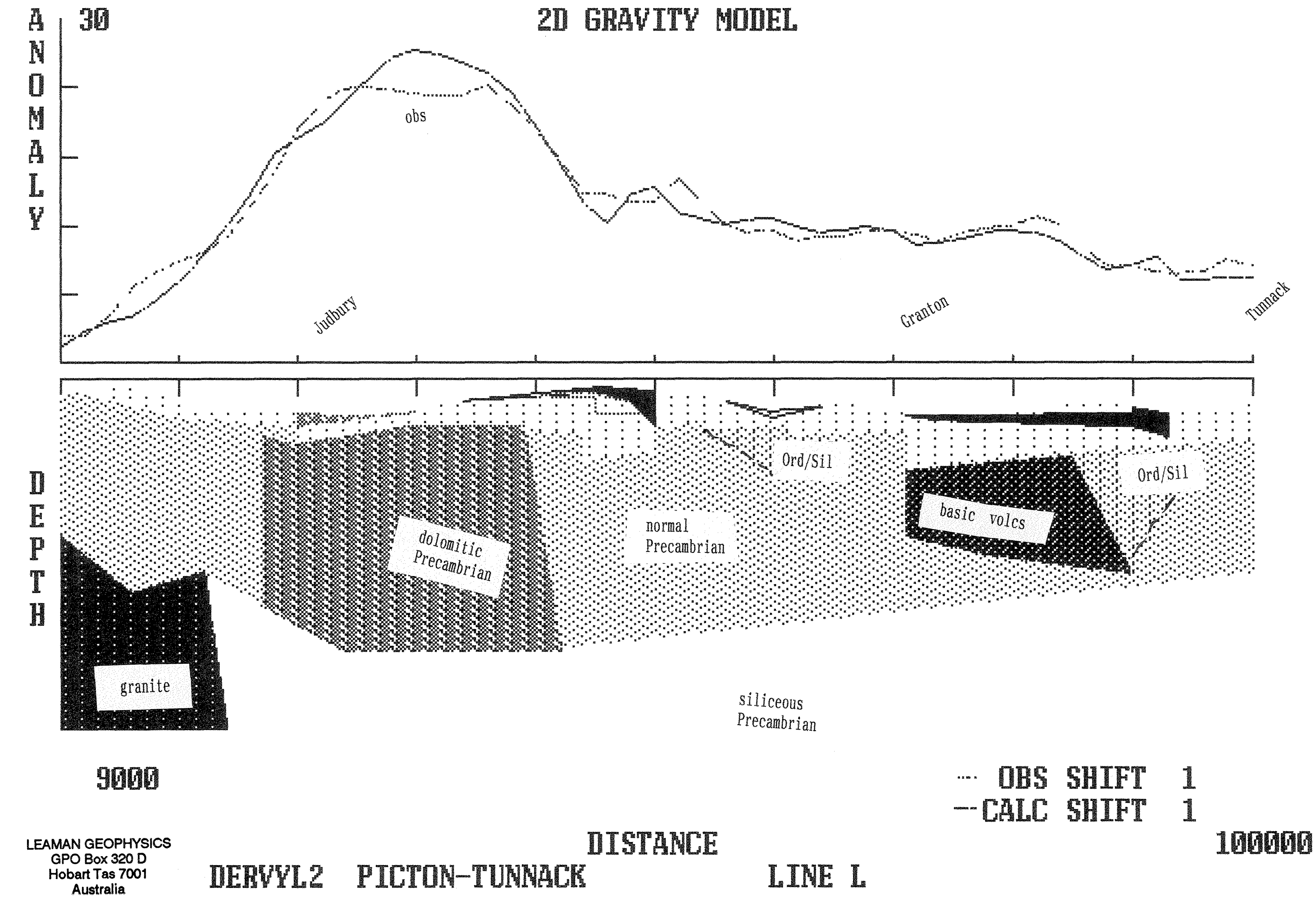
These caveats might suggest that any treatment might be worthless but they, in fact, highlight what can be achieved when adequate data is properly integrated with the known surface geology.

Consider **Line L** (Figures 55, 56) from the region of Mt Picton toward Tunnack. The location of all lines is shown in Figures 13 and 14.

The gravity profile is dominated by a large negative anomaly SW of Mt Picton and a large positive anomaly near the Huon River. The profile to the NE of the crest of the Wellington Range is fairly uniform.
The negative anomaly is related to the Port Davey Granite and the positive anomaly is due to a basement variation (see also Figure 17C). The field to the east is largely controlled by variations within the basement sequence and some of this is slightly denser than background. It should be noted that the basement complex is essentially of two types as defined by the D'Entrecasteaux interpretation and the limited seismic data available; a denser style like the Jubilee and Oonah Formations and a lighter siliceous variety such as the Tyennan Precambrian blocks. The gravity data demonstrate beyond all doubt that the denser sequence must be of the order of 4 km thick in order to balance the field. This estimate is based on a typical density of 2.74 gm/cc and is tied to the realistic contrasts which must be used to explain the enormous positive aberrations from this background. A density of 2.81 gm/cc has been used for this, usually non magnetic, material; a value which is consistent with a dolomitic sequence. No significantly higher values for non magnetic rocks can be justified. Both density types are feasible for Tasmanian geology.
The magnetic data force some variations upon this scheme in the east of the area. A portion of the section is magnetic, some parts strongly so. The contrasts implied are consistent with equivalents of both the Mt Read Volcanics and the Crimson Creek Formation. No anomalies on this profile can be linked to ultramafics but this would not have been true if data had been available in the region of Mt Picton.
The principal variation in units occurs across the Wellington Range and Cascades Sytem faulting. This is wholly consistent with the implications of Figures 36 and 40 but does suggest that the acid volcanics might be more widespread than previously thought.

Line 2 (Figures 57, 58) extends from west of Maydena to the east coast north of Triabunna.

The gravity profile possesses many of the characteristics of Line L. A benched anomaly profile is marked by several positive elements and a large negative feature. The granite in this case is part of the eastern batholith complex. The positive anomalies represent dense variations within the basement complex. Two of these are not magnetic and are almost certainly dolomitic sequences. Variations in the cover produce very fine details compared to these elements of the structure and the data sampling does not allow them to be reproduced.
The magnetic profile is much more instructive since it ties many of these elements to a structural pattern. There are some large variations in field intensity and the negative components are of long wavelength - which shows that they are not sourced by dolerite in the cover. One of these can be directly linked to the Adamsfield ultramafics and traced 70 km east into the section. Some other features have comparable origin and these slices of ultramafics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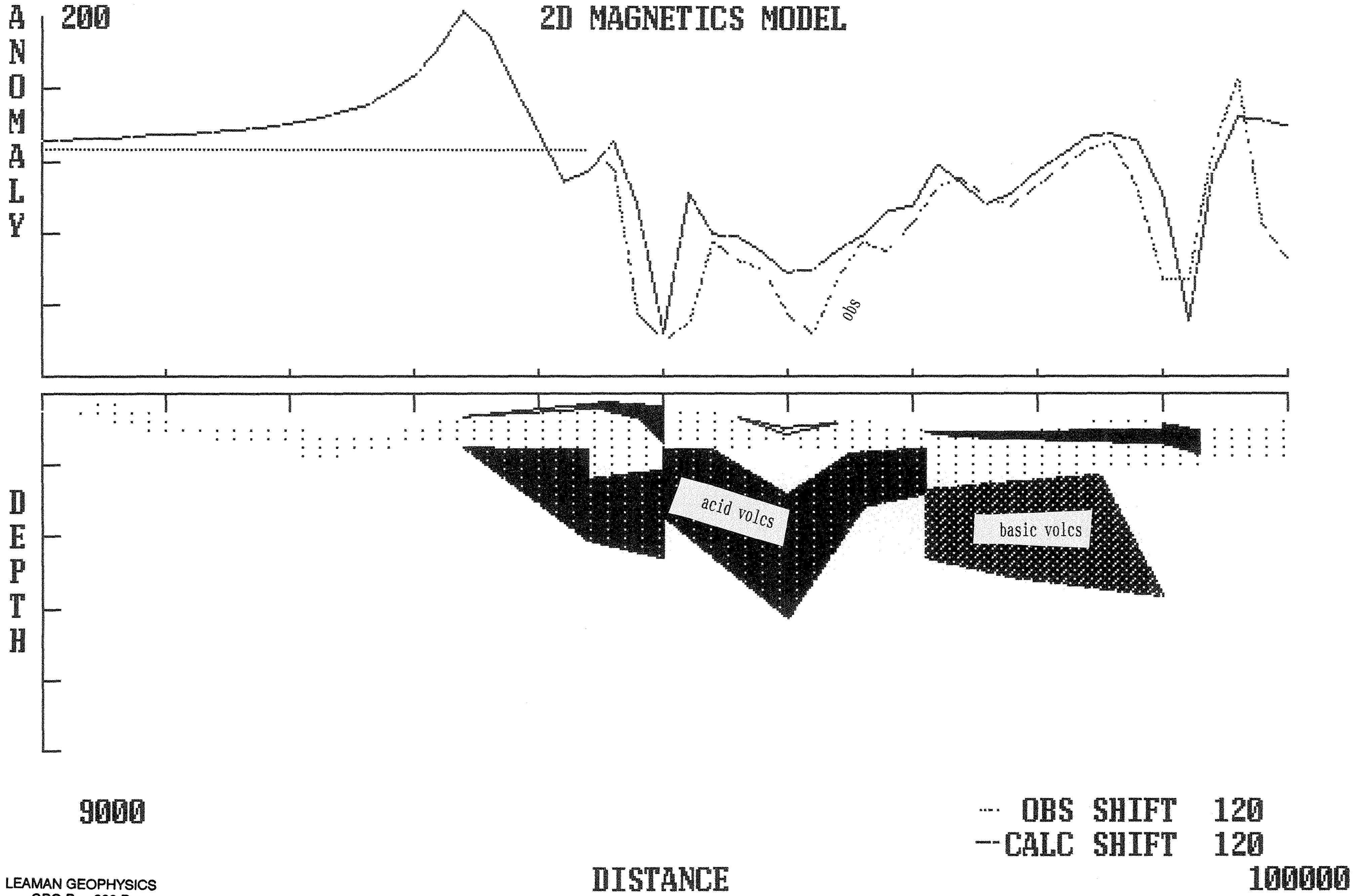
Granton
Tunnack
DEPTH
Ord/Sil
Ord/Sil
basic volcs
dolomitic Precambrian
normal Precambrian
granite
siliceous Precambrian
9000
OBS SHIFT 1
CALC SHIFT 1
DISTANCE
100000
LEAMAN GEOPHYSICS
GPO Box 320 D
Hobart Tas 7001
Australia
DERVYL2 PICTON-TUNNACK LINE L

FIGURE 55



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GPO Box 320 D
Hobart Tas 7001
Australia

DERVYL2 PICTON-TUNNACK LINE L

FIGURE 56

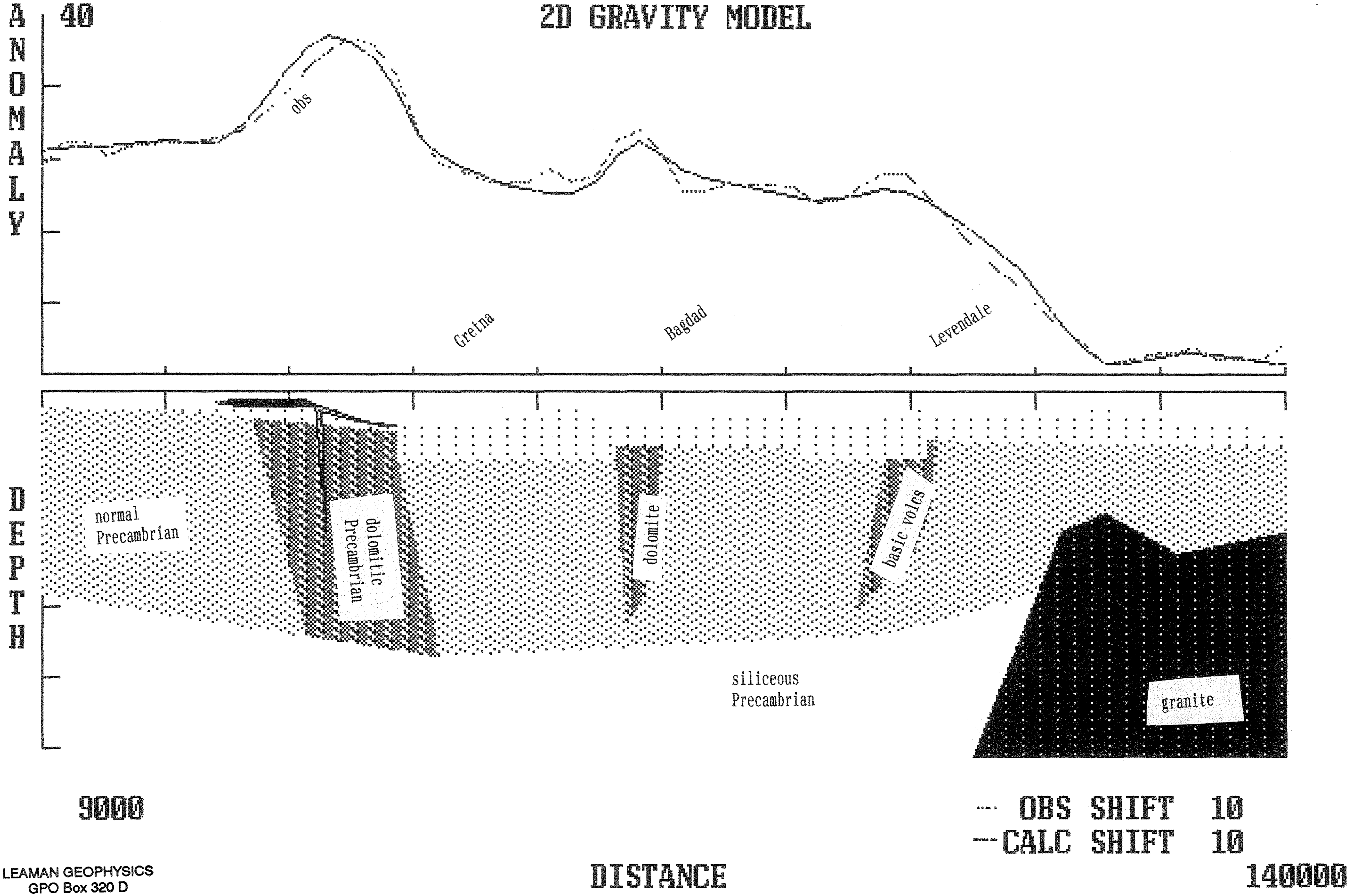
define several elements of the mass variations suggesting a root thrust and stack repetitions of a style now considered normal in northern and western Tasmania.
The most anomalous aspect of the magnetic field occurs above the eastern batholith. The negative response near the coast cannot be explained by materials which could be inferred - Mathinna Beds or granitoids, or cover. The model suggests an alteration halo about the granitoid but two thin mafic slices in the granite roof could also achieve the effect. Acceptance of the second concept depends on examination of more data and other suggestions of a thin Mathinna cover on the west Tasmania style basement.
Only one block can be considered magnetic and the properties are consistent with those of the Crimson Creek Formation.

Line 3 (Figures 59, 60) across the southern part of the central Plateau from near Wayatinah and the northern Florentine valley to the central eastern highlands is much more asymmetrical

The general characteristics of the gravity profile are similar to those of line 2 but the gross basement sequence of denser units thins to the northeast. The section incorporates the Florentine Valley synclinorium and ends at the major change in basement geology west of it. The model suggests that the structures to the east of the synclinorium, beneath cover, are overturned or reversed. Neither gravity, nor magnetic, profiles can be fitted unless this surface dips east. The very dense basement unit overlies the Lower Palaeozoic rocks; it is not magnetic. But it is overlain by a magnetic unit with density contrasts comparable to the general background. These properties are consistent with Mt Read Volcanic type materials.

The asymmetry displayed by the magnetic profile is more important. The model fit appears imperfect but the shapes are affected by the height of survey, data sampling and terrain shape. The forms observed can only be explained by deep, very magnetic sources. One of these can be traced to the area north of Adamsfield. Several others can be linked to edges of the mass changes. Ultramafics are implied in each case. Some additional features of this type are probably involved in the Florentine synclinorium but have not been modelled. Note the intense spikes at the western end of the traverse where only non magnetic sedimentary rocks are exposed.
The asymmetry modelled is characteristic of thin slices which dip shallowly to the east. The negative components of these anomalies cannot be explained in any other way and no other Tasmanian material possesses the very high contrast implied. Due to these characteristics the calculated profile is very sensitive to small changes in geometry and these cannot be properly evaluated with the current profiles and data sampling. The general style of the model and its implication is not in doubt.

The improved modelling of long lines across the midlands has confirmed the existence of volcanic elements within the basement. All of them occur at, and have been truncated by, the base Permian unconformity. This work can be further refined using existing data bases.



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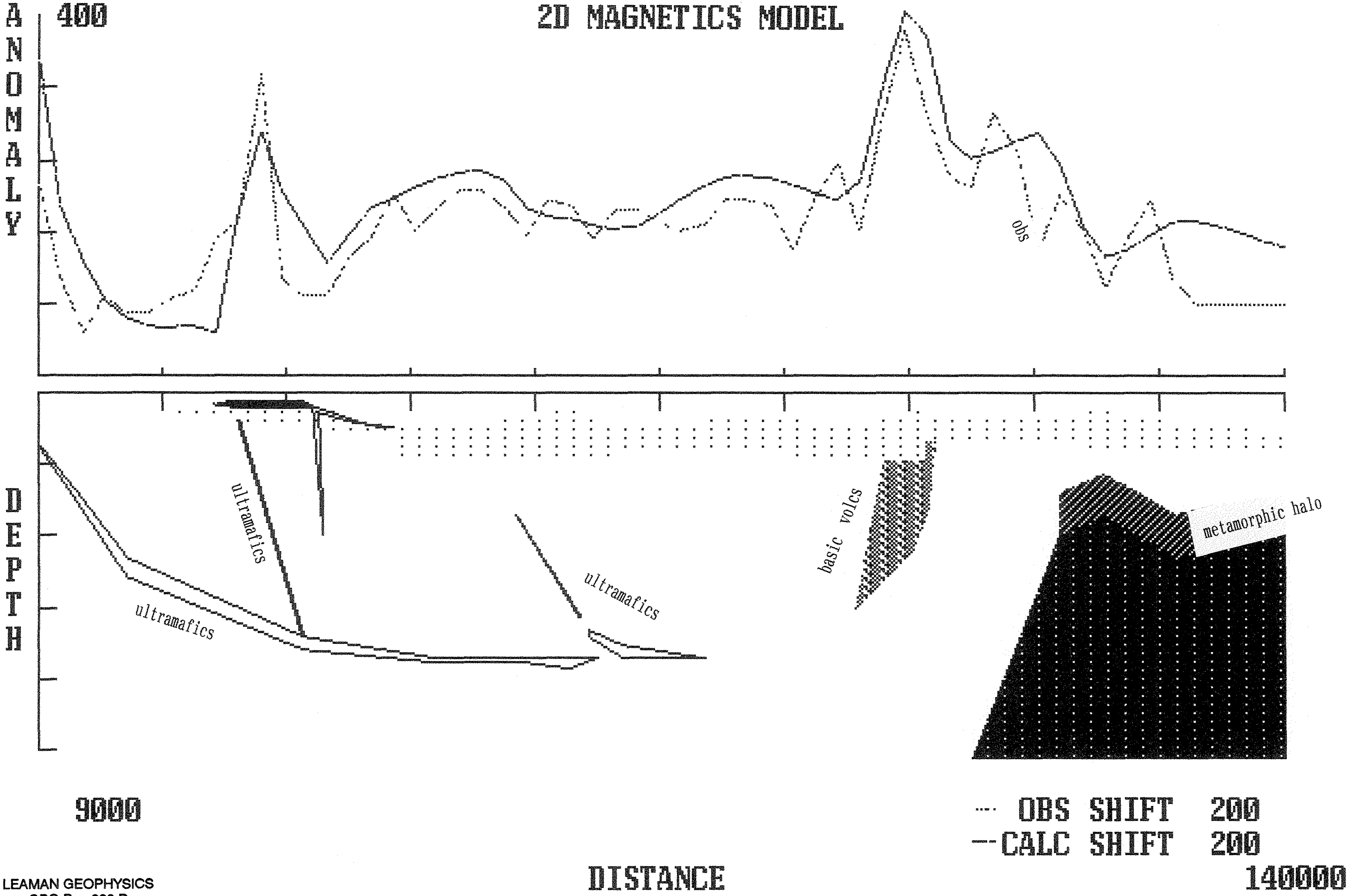
Australia

TAS2C PEDDER-TRIABUNNA LINE 2

FIGURE 57



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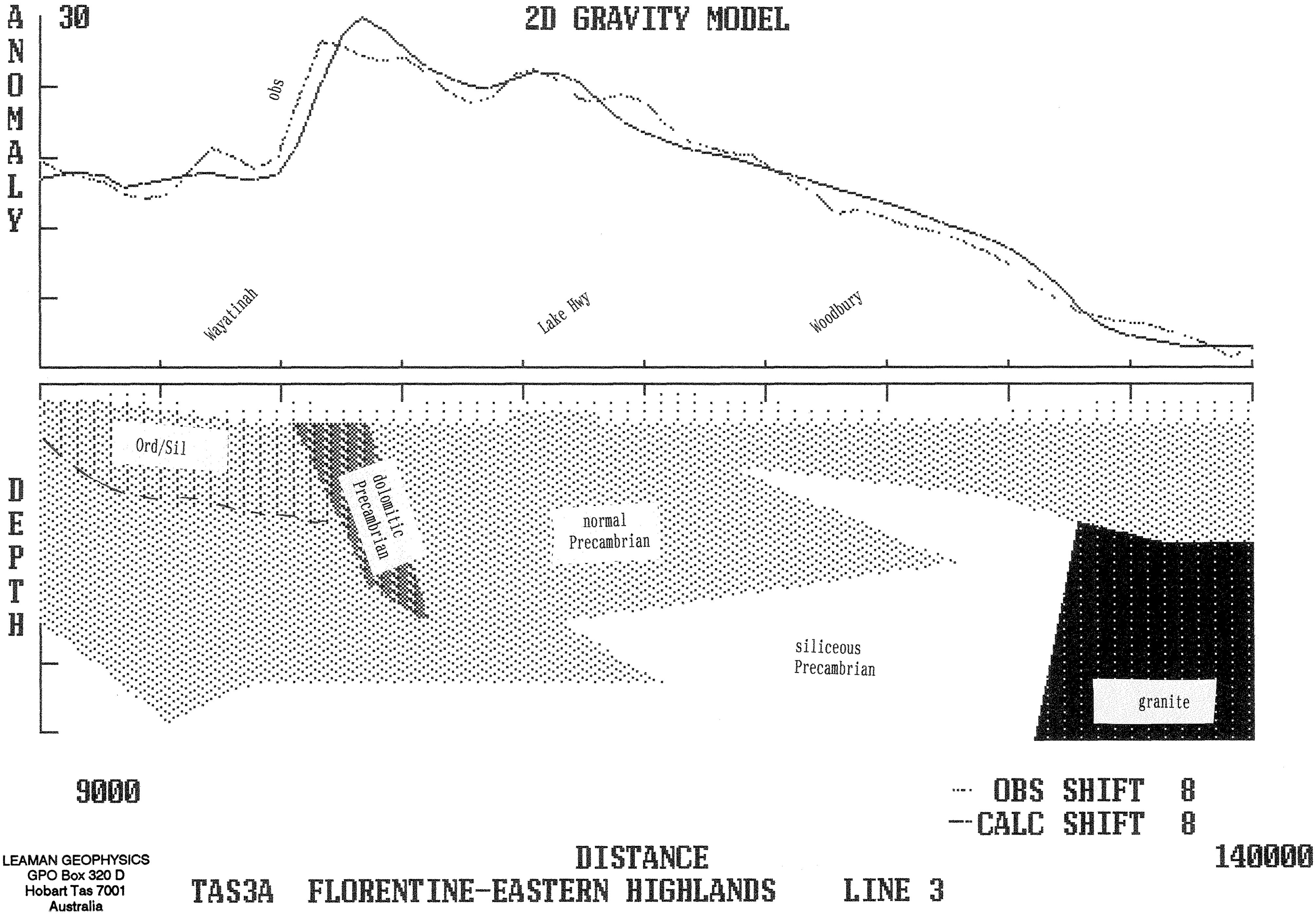
Australia

TAS2C PEDDER-TRIABUNNA LINE 2

FIGURE 58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Lake Hwy
Woodbury
DEPTH
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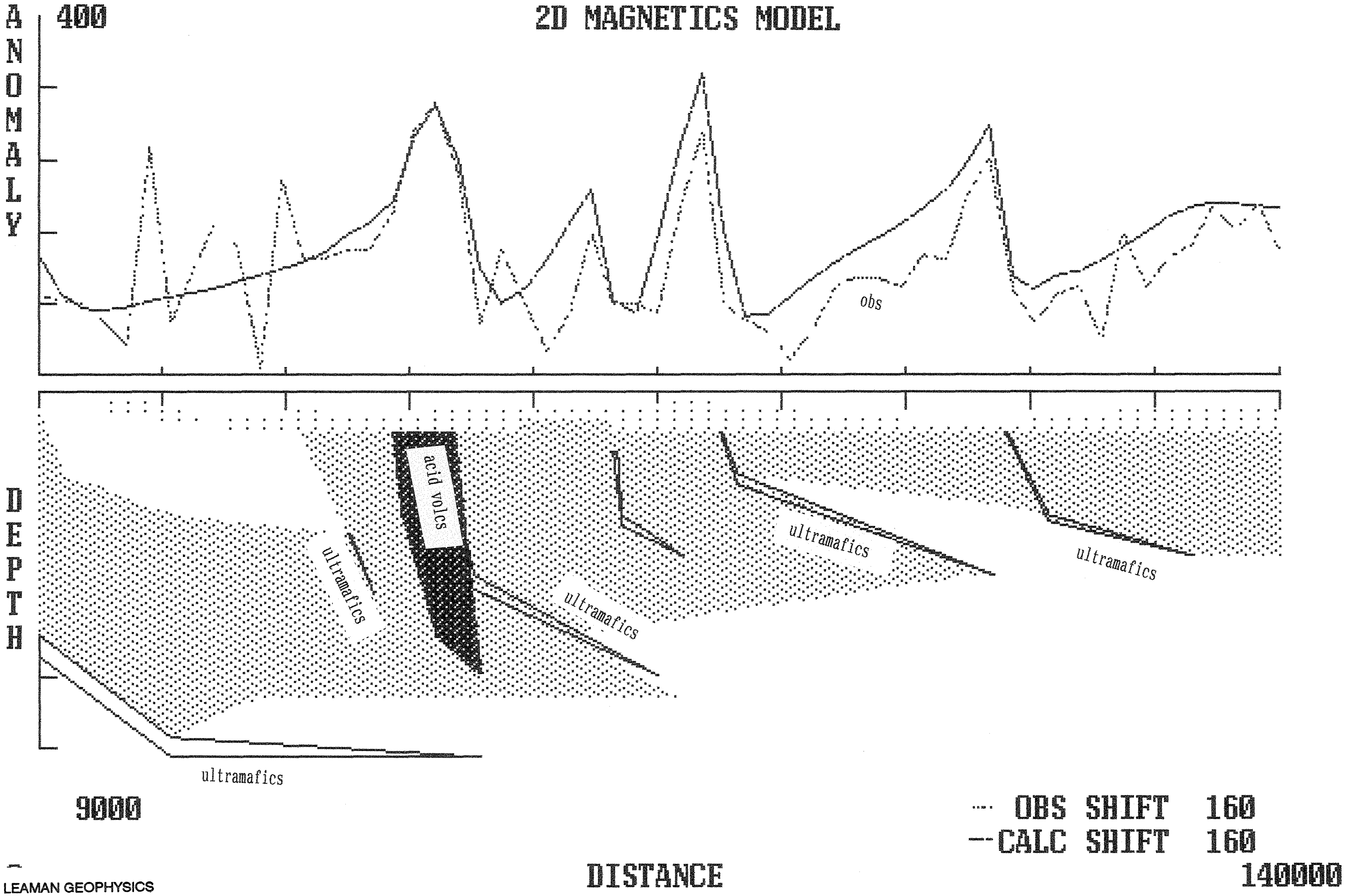
normal Precambrian
siliceous Precambrian
granite
9000
OBS SHIFT 8
CALC SHIFT 8
DISTANCE
140000
TAS3A FLORENTINE-EASTERN HIGHLANDS LINE 3
LEAMAN GEOPHYSICS
GPO Box 320 D
Hobart Tas 7001
Australia

FIGURE 59



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TAS3A FLORENTINE-EASTERN HIGHLANDS LINE 3

FIGURE 60

RANKING OF SITES

Each of the sites "reported" to date may be ranked in terms of its reality, thickness of cover, and supporting evidence of an underlying or controlling structure.

Preliminary discussions in this report suggest that each of the sites listed on page 4 represent real observations of interesting sulphides even though there may now be some doubt as to the exact position.

It is also clear that every site would benefit from further appraisal although sites such as Cygnet and the Little Den are free from basic argument having been significant past producers.

The ranking which follows also allows a greater weighting to those sites which have been reported than those which have been inferred. It must be admitted that some inferred sites may have greater economic potential than many known sites due to cover factors.

Inferred sites have been defined in terms of regional gradients, major kink points, fault transfer zones, stratigraphic variations and the location of feeders and dykes or intrusive triple points. Some of this information is lacking across most of the midlands due to limited mapping and even more limited evaluation of the dolerite.

Other sites, or orders, may be suggested by further work.

1. CYGNET

This site must be ranked first. The anomalous geochemistry of the site and its approximate focus in basal Permian rocks means that the cover may be minimal. The cover thickness coupled with the complex Cretaceous and Jurassic intrusions create the risk at this site. These risks can be minimised by detailed examination and targetting to avoid such elements. The unknown at this site is the thickness of tillite, a notoriously variable unit. The exposed rocks at Port Cygnet lie up to 500 m into the tillite.
The site can be justified in terms of regional structural control and direct inferences about the composition of basement rocks.

2. LITTLE DEN

This credible site lies within the target rocks and may well prove to be most interesting after evaluation of the local cover rocks in order to avoid/define the dolerite feeders. The cover is relatively thin in the neighbourhood of this site and basal rocks are thin.

3. LITTLE OYSTER COVE

This site is a variant of the Cygnet area and may have similar potential. It can be justified in terms of its location in basal Permian rocks, the structural conjunction and its on-strike location with respect to the proven target rocks of the Hobart area.

4. MT WELLINGTON

Although there is some dispute as to the referred site - and there may be two - the zone is clearly of structural interest and overlies a major basement boundary which has involved acid volcanics. The cover thickness is unlikely to be less than 500 m anywhere along the structural axis. This is the risk in this zone but further detailing of the location may clarify the problems.

5. GOLDEN DAWNING

The Hermitage-Hunterston site attracted Twelvetrees and it has to be taken seriously and checked. There may be an important structural conjunction near the site which, based on likely location, overlies a major gravity gradient and is in many respects comparable to Cygnet. The significant problem at this site is the thickness of cover which may exceed 500 m. The stratigraphic position must be reviewed even though modelling (eg. line 3) confirms an upfaulted block.

6. GRANTON

This inferred site has all the characteristics of the above sites and is along strike from the Glenorchy volcanics. Modelling along line 2 stresses this site which overlies a major fault zone which may have a history from the Precambrian and which has 'flower' characteristics with acid volcanics developed on the western side of the fault. Fortunately this zone is low in the Permian and the cover may be significantly less than 500 m.

7. APSLEY

This site is comparable to the Granton site in every way but the stratigraphy must be checked.

8. SANDFORD

This site is similar to 6 and 7 but the cover thickness may be slightly greater. At least one dolerite sheet will be drilled in the northern part of South Arm.

9. TUNBRIDGE WEST

Drilling in this region has shown that it is possible to enter basement at depths of 200 to 300 m. No volanics have been encountered but this may be due to drilling on the eastern side of the Tiers structure. The primary analysis of the Little Den, which lies along strike to the north of the Tiers zone, suggests that comparable materials may exist at the foot of the Tiers. Cover thickness may be variable but is likely to be about 300 to 400 m.

Sites 1 to 9 define locations within the Permian cover rocks. The following sites involve dolerite or Triassic rocks and it is unlikely that the cover will be less than 900 to 1100 m.

10. GUNNINGS WEST (NATIVE CORNER)

This site is located on the western side of the Gunnings Sugarloaf intrusion and is marginal to all structures in the region. Granophyres produced by absorption are evident nearby which emphasizes the rarity of this location and its feeder system. The rocks exposed are close to the Permo-Triassic boundary.
This site should be distinguished from the principal Gunnings site which is further east (below).

11. DOVER

This site warrants further examination but the cover is likely to be about 1000 m.

12. BAGDAD

This site must be re-located and reviewed but any target will lie at depths in excess of 900-1000 m.

13. LUNE RIVER and CATAMARAN

These sites are little known but may be located in regions where cover exceeds 800 m and may be as much as 1500 m.
It is unlikely that the Catamaran site can be re-ranked even if rich mineral traces are found. The Lune River site may be changed if it occurs on the western side of the Lune River Fault but there is then a risk of entering the heritage area.

14. TEA TREE

This site has been inferred from the Hobart study and carries all structural indicators. The cover thickness, however, may exceed 1000 m.

15. GUNNINGS SUGARLOAF and LAWRENNY

Both sites, with clear potential, lie in areas where the thickness of cover may exceed 1200 m. They have been discounted as a result.

It is stressed that the present rankings are based on presumptions about the locations, interpretations, and other information. All must be reviewed, with the exception of numbers 1 to 3. All sites require further analysis prior to further exploration or drilling.

RECOMMENDATIONS

Considerable effort will be required to translate these ideas into solid prospects.
The following projects and data acquisition are considered an essential part of such effort.

1. An archive search. Can more details be found about the lesser known sites. Are there other sites (note Twelvetrees' comments)? Request information from the public.

2. Analyse the available gravity data across the entire midlands. Formalise a predictive view of both cover contents and basement materials. This work should be regional initially and then focussed into small areas of about 100 sq km suggested by the regional study. A comprehensive definition of dolerite will be essential at this scale for prospect and target evaluation and ranking within the reduced areas. This type of work is already justified at the Cygnet, Hobart, Hermitage and Den sites. Some extra data may be required.
   The gravity interpretation should use the latest version of the residual data base (unlike this report) and develop a wholly new model array.

3. Link the gravity interpretation with the implications of the available regional magnetic data sets. Test critical components of the gravity models.
   All sites selected for detailed analysis will require a high resolution magnetic survey.

4. Review current mapping.
   The gravity interpretation will assist location of feeder systems and each should be confirmed by differentiation indicators.
   Some areas will require improved mapping but this may be delayed until the region enters the detailed category. Some areas may need partial review during interpretation.
   Consideration of possible fault and flower transfer zones.

5. Isotopic and geochemical analyses of all sulphides found within the region are required. This may confirm the actual age and origin of the lead found. This recommendation includes analysis of sulphides found in inclusions or joints in Permian rocks.

Recommendations 1, 2 and 5 may be undertaken immediately and are low cost options which will provide substantial background for further review or advance. No targetting should be considered in any area until work of types 2, 3 and 5 has been completed (and 4 if necessary).

CONCLUSIONS

The work and information compiled in this report suggests that eastern Tasmania has considerable mineral potential. There are sufficient reportings to indicate a rich province given the total area involved.
Existing geophysical work has confirmed that the basement is structured, that those structures can be defined and described, and that significant volumes of volcanics occur directly beneath the base Permian unconformity in several regions.
It may be expected that further work will clarify this understanding and certainly enlarge the possibilities and potential.

Considerable work and analysis of existing data, as well as some additional acquisition, will be required to realise this potential.

Most risk attaches to the thickness of post Carboniferous cover which may exceed 1000 m for more than half of the area. Basic analysis will delimit those areas in which target criteria can be coupled with cover thicknesses of 500 m or less. Sites may exist where the cover is less than 200 m. This can not be specified with current knowledge and very limited existing interpretations.
Fortunately, given the public domain gravity data base and basic magnetic coverage, initial refinements will be low cost.

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Report prepared by D.E. Leaman B.Sc., Ph.D.,

Leaman Geophysics F.Aus.I.M.M., M.I.C.A.

June 1994