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AEROMAGNETIC SURVEY

STAVERTON AREA
NORTH CENTRAL TASMANIA

for

GEOPHYSICS

THE MOUNT LYELL MINING AND RAILWAY
COMPANY LIMITED

by

AMEG PTY. LTD.

MICROFILMED

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SUMMARY

During March and April of 1966, Australasian Mining and Engineering Geophysics Pty. Ltd. (AMEG) conducted an airborne magnetometer survey over the Staverton Area in North Central Tasmania. The isomagnetic contours and the interpretation are shown on Plate 1.

In general the magnetic pattern of a large part of the area is complicated by numerous low to medium amplitude anomalies due to thick and widespread basalt flows.

The magnetic picture does not appear to bear any relation to the granites, sedimentary lithologies or structural orientations of the area. Areas of known mineralisation cannot be related to any recognisable magnetic feature.

It is possible to divide the magnetic pattern into six zones. The most significant are Zone B, which is dominated by a large plateau-like high of about 200 gammas; and Zone D, which contains several positive east-west striking trends. Detailed analysis of the features in these Zones indicates the sources to be basic rocks at a shallow depth. The magnetic expression of the plateau-like high indicates its source to be a tabular body with a gentle northerly dip. The positive trends of Zone D are most certainly due to vertical or steeply dipping dyke-like bodies.

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INTRODUCTION

In March of 1966, Australasian Mining and Engineering Geophysics Pty. Ltd. (AMEG) contracted with The Mount Lyell Mining and Railway Company Limited to perform an airborne magnetometer survey over the Staverton Area in north central Tasmania (Plate 2). The survey was flown during the months of March and April of 1966 in conjunction with a survey of the Sheffield Area for The Broken Hill Proprietary Coy. Ltd. The following pages and accompanying maps constitute the final report on the survey.

The purpose of the aeromagnetic survey was to aid in the interpretation of the geology of the area. More specifically, this included calculations of the depths to the anomaly sources, their strikes, dips, and susceptibilities; and the location of contacts, faults, intrusives and any other structural or lithologic information indicated by the magnetic data. The interpretation and the isomagnetic maps are presented at a scale of 1:31,680.

The survey was planned to be flown at 500 feet above the terrain along the east-west profiles spaced one quarter of a mile apart. The rugged topography of the area, combined with low altitude flying, made navigation difficult during the production phase of the survey. As a result some reflights were necessary. It was not possible to maintain 500 feet terrain clearance at all times and the altitude varied from 300 to 900 feet. This altitude variation was taken into account during the quantitative analysis of the anomalies.

All depth estimates referred to in this report are in feet sub-surface. Circled numbers on the map refer to anomalies mentioned or discussed in the report. Lettered numbers on the map refer to magnetic and structural features such as magnetic trends,

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BASS STRAIT

146°00'

41°00'

BURNIE

ULVERSTONE

DEVONPORT

RAILWAY

BLYTHE

LYELL

RIVER

LEVIN

RIVER

RIVER

Sheffield

RIVER

MOUNT

SURVEY AREA

Staverton

Moina

Lorinna

FORTH

MERSEY

Tullah

42°00'

LAKE ST. CLAIR

PLATE 2

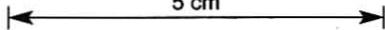
LOCALITY MAP
AEROMAGNETIC SURVEY
STAVERTON AREA - TASMANIA
MOUNT LYELL MINING
AND RAILWAY CO. LTD.

SCALE

MILES 5 4 3 2 1 0 5 10 15

146°00'

5 cm



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faults and other features of interest. The statistical data relevant to the survey are tabulated in Appendices A and B.

MAGNETIC PATTERN

It is possible to divide the magnetic pattern of the survey into six zones. These zones are discussed below.

Zone A This Zone is sharply contrasted with the others by its relative lack of anomalies although a few small low amplitude (40 gammas to 60 gammas) ones (Nos. 2, 3 and 4) do occur. The regional magnetic expression of this Zone is one of a gently decreasing gradient in a northeasterly direction. This decreasing gradient develops into a broad negative anomaly (No. 5) in the northern part of the area. Anomaly 5 is very clearly defined by the 2,400 gamma contour, and extends eastward into Zone B and south-eastwards out of the survey area. The partly recorded anomaly 1 is the only prominent feature in this Zone.

Zone B This Zone is occupied almost completely by a plateau-like high (Plate 3) upon which occur several features that are described below. This high is bounded by a rather steep gradient of about 200 gammas at the 2,500 gamma contour. The western outline of this high is very illdefined because of distortions produced by the medium-amplitude, highly complex anomalies superimposed on it.

Of the large number of anomalies present on the plateau-like high, two (anomalies 24 and 20) are the most conspicuous because of their large areal extent and greater amplitude. Anomaly 24 is an elongated northwest-southeast trending feature and has an intensity of approximately 1,400 gammas, which makes it the highest amplitude anomaly in the whole survey area. This anomaly seems to be connected at its southeasterly end to a less prominent anomaly (No. 23) of about 600 gammas. This latter anomaly takes the form of a narrow positive trend of about 200 gammas to just beyond traverse T-68.

Anomaly 20 is slightly smaller than anomaly 24 and has an

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amplitude of about 300 gammas. The main anomaly trend is east-west with a minor extension to the northwest.

The rest of the plateau-like high contains numerous anomalies ranging from 20 to 200 gammas. Most of the higher amplitude anomalies are concentrated in the western portion of the Zone. These anomalies do not appear to form a distinctive pattern. It should be noted that the negative anomalies are just as numerous as the positive ones.

A pronounced negative trend (TR1) cuts the plateau-like high. It strikes north northeast - south southwest in its southern part and northeast-southwest in its northern half. The northern half forms the southwest boundary of anomaly 24 and separates it from anomaly 20. The northern half seems also to be associated with the positive trend (TR4) which extends from Zone B to Zone D.

An unusual magnetic feature in this Zone is the 160 gamma negative trend TR14 which develops abruptly out of the rather persistent magnetic gradient which defines the plateau-like high. Only the western half of this trend falls within the survey area, and is recorded only on traverse T67E. The significance of this observation will be discussed later on under the section on Qualitative Analysis.

The southern portion of Zone B is occupied by the negative anomaly 5 which is the prolongation of the broad negative that extends eastward from Zone A as discussed above. The positive anomaly 7 is situated in the central part of this southeasterly striking negative. Two negative anomalies (Nos. 6 and 9) appear to be associated with anomaly 7. Another local negative anomaly (No. 8) separates anomaly 7 from the plateau-like high.

Zone C This Zone contains the same type of anomalies which are superimposed on the western portion of the large plateau-like high

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of Zone B. The anomalies of this Zone have been classed separately because their magnetic values are in general 200 to 300 gammas lower than their counterparts in Zone B.

A negative trend, (TR2) strikes roughly northeast-southwest along the boundary with Zone B. Trend TR2 contains several negative anomalies and its presence is not readily apparent because it is distorted by the adjoining, medium-amplitude, complex anomalies.

Zone D The most striking features of this zone are several high amplitude positive trends and their associated negatives. The general strike of these trends is east-west. Exceptions to this direction are the west-northwest and the northeast directions of trends TR4 and TR10 respectively.

Trend TR4 starts at the plateau-like high in Zone B. It has an amplitude of over 200 gammas and is bounded by the negative trend TR1 on its southwestern side and the negative anomaly 26 on its northwestern flank. It extends only a short distance to join the positive trend TR5. The latter trend is a well defined feature and has an amplitude greater than 200 gammas. The tendency of a corresponding negative to develop along its southern flank is exemplified by trend TR3 and anomaly 27.

The elongated anomaly 34 of 80 to 100 gammas is located just west of trend TR5 and is co-linear with it. The same negative trend which defines the southern limit of trend TR5 extends further west to bound the southern flank of anomaly 34. It appears that this anomaly is the western continuation of trend TR5 with a lower intensity.

The east-west striking trend TR7 is located north of anomaly 34 and is separated from it by the well defined negative trend TR6. Trend TR7 is very well defined and has an intensity of over 300 gammas. Anomaly 35 occurs within this trend and has an amplitude

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of 600 gammas.

The negative trend TR8 on the northern flank of trend TR7 separates it from the positive trend TR9 which joins trend TR7 as it changes strike from east-west at its western half to east-northeast at its eastern half. Trend TR9 has an amplitude of about 100 gammas and is less conspicuous than trend TR7. A minor and much less pronounced extension of trend TR7 is the north north-west trending 80 gamma anomaly 37, and the west-north-west striking 100 gamma anomaly 36.

To the north is the northeast-southwest striking positive trend TR10. This is a pronounced trend with a maximum amplitude of 660 gammas (anomaly 38). Trend TR10 joins the pronounced east-west striking positive trend TR12, whose southern flank only, falls within the survey area. It enters the survey area at the western boundary and extends eastward almost to the middle of the survey area. Its persistently higher amplitude of 500 gammas and greater length than the other trends makes it a very distinctive feature. The highest amplitude recorded within this trend is the 1,000 gamma anomaly 39. The southern flank of trend TR12 is distorted, and the contours are irregularly spaced. The negative trend TR11 separates trends TR10 and TR12.

The east-west elongation of anomaly 33 is comparable with the general direction of other trends in this Zone. It is similar in appearance to the rest of the trends, however it is shorter and comprises one small, high amplitude anomaly of over 600 gammas.

Zone E The magnetic pattern of this Zone is defined by gentle northeasterly decreasing gradient which contains three medium-sized positive anomalies (Nos. 29, 31, 32) which range between 100 and 180 gammas, and one large semi-circular negative anomaly 28 of 80 gammas. Attention is directed to the close parallelism of the northeasterly extension of the positive anomaly 32 with the edge

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of the negative anomaly 28. The probable significance of this association will be explained under the section on Qualitative Analysis.

Zone F This Zone is distinguished from those adjoining in that it contains numerous small anomalies, semi-circular to elongate in outline, ranging in amplitude from 80 to 200 gammas. These anomalies are very complex. The prominence of the negative features is similar to those in Zone C.

The anomalies of this Zone occur in groups and are separated by a featureless northerly decreasing gentle magnetic gradient.

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QUALITATIVE ANALYSIS

A preliminary inspection of the results indicated that the thick Tertiary basalts which cover large portions of the survey area greatly influence the magnetic pattern.

The outline of the basalt outcrops are indicated on the magnetic map. The 1 inch = 1 mile geological maps of Middlesex and Sheffield areas published by the Tasmanian Department of Mines, were used to correlate the basalts and the rest of the exposed geology and structure with the magnetic patterns. The numerous and complex anomalies of Zones B, C and F correlate well with the known basalt occurrences. Some basalt outcrops do not appear to affect the magnetic pattern. The elongate outcrops in Zone D over which the trends TR6 and TR7 are partly recorded fall in this category. Another example is the semi-circular outcrop located partly in Zones D and E. The basalt in the eastern half of Area B is less complex magnetically than that in the western half or in Zones C and F.

An east-west elongate outcrop is located on the south-central boundary of Zone B immediately west of the granite exposure along the Forth River. It is possible that the positive anomaly 13 and the negative anomaly north of it may be attributed to the presence of this outcrop.

The magnetic features of Zones C, F and portions of Zone B, represent the types of anomalies expected in areas covered by basalt. But in the examples just outlined the basalt outcrops lack this characteristic definition. This may be the effect of weathering, whereby the ferromagnetic minerals have lost their magnetic properties partly or completely.

In addition, other factors may have helped to complicate the

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magnetic patterns of the basalt. The first factor is the variation in the height of the helicopter above ground level. One excellent example is shown in Plate 4, diagram A, where the lower curve is the magnetic record of a segment of traverse T-67, (located partly outside the eastern boundary of the area), and the upper curve is the corresponding AFN-1 altimeter record of the same segment. It is very clear that in stretch (a) of the magnetic profile a drop of 250 gammas correlates with a change of height of the helicopter from 450 to 730 feet as shown on the altimeter profile.

In contrast, the magnetic expression of the lithologies with low susceptibilities are not influenced appreciably by variations in the height from which they are recorded. A clear example is shown in Plate 4, diagram B. Height variations of over 650 feet do not produce noticeable effects in the magnetic expression of the Precambrian Dove Group.

The second factor which has complicated the magnetic expression of the basalt is its variable thickness. The basalt filled the existing drainage systems and covered large portions of the landscape in Tertiary times. It is not possible to determine to what extent this factor has influenced the resulting magnetic pattern.

There are some borderline cases where it cannot be ascertained whether anomalies are due to basalt or to another shallow source under the basalt. Anomaly 7 may fall into this category. Its amplitude of about 250 gammas is close to other values obtained from basalts in the survey area. Depth estimates indicate a surface source, but its character is distinctively different from the rest of the anomalies attributed to basalts.

In general, the basalts in the survey area exhibit anomalies ranging from a few gammas up to 250 gammas. Negative anomalies

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are just as prominent as positive ones, which is most likely due to remanent magnetization. Adjacent to the southern part of the subject area, anomalies of 300 to 400 gammas have been correlated with thick basalts. On this account it is difficult to assign the 500 gamma anomaly 12 to a small, thin basalt outlier located partly within the outline of the anomaly. Depth estimates on this anomaly indicate a surface or near surface source. It is apparent that the anomaly could be due to a source beneath or near the basalt outlier.

It is evident from the foregoing that if the magnetic effects due to the basalt are removed from the magnetic map, the resulting picture is relatively simple. It consists of the gently decreasing gradient of Zone A, and possibly Zone C, the large plateau-like high of Zone B, the east-west trends of Zone D and the relatively featureless northeasterly decreasing gentle gradient of Zones E and F.

Little of the remaining magnetic pattern can be correlated with the local and regional geology. One interesting correlation is the negative anomaly 28 of Zone E and the exposed Dolcoath Granite. Granite exposures in the area are indicated on Plate 1.

Most of the sedimentary and metamorphic rocks within the survey area have no distinctive magnetic characteristics. This is clearly shown by the Precambrian rocks of Zone A, by the Cambrian and Ordovician rocks of Zone F and most of the rocks in Zone E. Anomaly 29 in the latter Zone seems to have a source other than the exposed sediments because it transgresses the contacts of these sediments without any visible effects. Anomalies 31 and 32 are mapped in an area of Ordovician Moina Sandstone, but it is not certain if their sources are within this formation. The close association of the northeasterly extension of Anomaly 32 with the edge of negative Anomaly 28 is possibly due to the metamorphosed Ordovician rocks surrounding the unexposed portions of the Dolcoath Granite.

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The magnetic patterns in Zones B and D are certainly not the expressions of the exposed rocks within these Zones because they do not correlate with surface lithology, formation boundaries or structural orientations.

This lack of correlation between magnetic and structural trends persists throughout the survey area. The regional structure consists of long east-west and northwest-southeast trending folds (Plate 1, from Jennings, 1963). Only the strong trend TR12 coincides with the east-west striking anticlinal structure in the northern part of the area.

It seems therefore that the plateau-like high of Zone B and the trends of Zone D are caused by rocks other than those exposed at the surface and which possess an appreciably higher susceptibility value than the neighbouring rocks. The local and possibly some of the regional structures do not extend deeply enough to affect the magnetic source which gives rise to the patterns of Zones B and D.

It is now possible to draw some conclusions concerning the mode of occurrence of the rocks causing the plateau-like high and other trends. The negative anomaly 5 is a very broad and conspicuous feature. Its position and outline suggest that it is related to the plateau-like high. If this is correct, the source of the plateau-like high is a tabular body with a gentle northerly dip. In Plate 5, diagram C, a theoretical curve is presented for a tabular body with a 10° north dip.

In diagrams A and B of the same plate idealized curves of selected magnetic north-south cross-sections of Zone B have been drawn. These curves compare very closely with the theoretical curve in diagram C.

The positive trends of Zone D, almost certainly refer to vertical or steeply dipping dyke-like bodies. The amplitudes of these trends are comparable with the amplitude of the plateau-like high. This suggests that they are caused by the same or similar lithologies.

QUANTITATIVE ANALYSIS

An anomaly which is represented on the magnetic record by a curve, can be mathematically analysed to yield information on the depth, dip, dimensions and susceptibility of the causative body. A part of this process of analysis involves the comparison of the recorded anomaly with theoretical curves. This means that better results are obtained if anomalies to be analysed are free from effects of adjoining or superimposed minor anomalies. Unfortunately the analysis of some important anomalies in this survey is complicated by the presence of such superimposed anomalies.

The reliable analysis of anomalies is also dependent upon the angle at which the traverse intersects the anomaly axis. Best results are obtained if the traverse is at right angles, and this condition is not fulfilled for any of the trends of Zone D, and anomalies 20 and 24 of Zone B.

With these factors in mind several profiles were constructed and analysed in detail (See Plate 6). The profile of trends TR7 and TR4 shown in diagrams A and B, and anomaly 24 in diagram C are considered to be expressions of infinite dykes. The parameters obtained from the analysis are listed below:-

Trend 7

- Depth.. 700 to 800 feet subsurface
- Dip.. 51°N to 66°N
- Width.. 1,000 to 2,000 feet
- Susceptibility.. $5,000 \times 10^{-6}$ - $8,500 \times 10^{-6}$ c.g.s. units

Trend 4

- Depth.. 200 to 250 feet subsurface
- Dip.. 54°N to 64°N
- Width.. 550 to 600 feet
- Susceptibility.. $4,700 \times 10^{-6}$ - $5,500 \times 10^{-6}$ c.g.s. units

Anomaly 24

Depth..	200 to 500 feet subsurface
Dip..	86°S
Width..	500 to 1,200 feet
Susceptibility..	12,000 x 10 ⁻⁶ - 14,000 x 10 ⁻⁶ c.g.s. units.

Of all the data furnished by the detailed analysis, the most pertinent to us are the susceptibility values, for they help identify the lithologies responsible for the anomalous trends. It is clear that the range of susceptibility values of trends TR7 and TR4 indicate basic and ultrabasic lithologies. This is specially true of trend TR7.

Most certainly anomaly 24 cannot be considered to be the expression of magnetic iron ore such as the Savage River deposit. The weakest aeromagnetic anomaly associated with this deposit yields a susceptibility contrast of 127,000 x 10⁻⁶ c.g.s. units which indicates 37% magnetite by volume and 54% by weight. The susceptibility of anomaly 24 corresponds to 5% or 6% magnetite by volume and 10% by weight.

A small portion of anomaly 30 in Zone F (Plate 6, Diagram D) is covered by basalt and it is unlikely to be the expression of this rock. The southern flank of the anomaly crosses a very small serpentine outcrop, which could be regarded as the cause of the anomaly. But its comparatively low amplitude of 260 gammas (from maximum to minimum) makes one doubt if this is the actual case. Detailed analysis shows the susceptibility to be rather low for an ultrabasic rock. The parameters obtained from the analysis are listed below:

Anomaly 30

Depth..	300 to 400 feet subsurface
Width..	1,200 to 1,600 feet
Dip..	61°N
Susceptibility..	3,000 x 10 ⁻⁶ c.g.s. units.

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In addition to the detailed analysis discussed above, several depth estimates were obtained for various anomalies in the area. Table 1 lists the anomalies and the subsurface depth estimates of their sources. It is considered that the depth estimates are accurate to within 15% to 25%.

TABLE 1

<u>Traverse</u>	<u>Anomaly</u>	<u>Depth (in feet sub-surface)</u>
1 T-73E	Control points 111/2-112/1 (outside survey area)	200
2 T-73E	7	Exposed
3 T-69W	10	160
4 T-69W	14	Exposed
5 T-68W	11	250 to 300
6 T-68W	12	Exposed
7 T-68W	15	350
8 T-65W	16	Exposed
9 T-65W	17	Exposed
10 T-65W	18	200
11 T-65W	19	100
12 T-65W	22	350
13 T-65W	23 (southern extension)	300
14 T-29W	20	350
15 T-29W	21	550
16 T-63W	Control points 033/0-034/3 (outside survey area)	1,500 ?
17 T-62E	25	70
18 T-13W	31	50 - 100

With the exception of the depth estimate on anomaly 31 all fall into two main classes. In the first class, they range from surface to about 100 feet, and their source is the basalt. The rest of the depth estimates fall in the second class, and they are probably caused by the tabular basic body. The average depth estimate of anomalies 10, 11, and T-73E (111/2-112/1) is 210 feet, and of anomalies 21 and 22, 450 feet. This indicates that the depth to the tabular body is greater at its central part than at its southern edge.

The depth estimates of 300 feet for anomaly 23, and 350 feet for anomaly 20, agree well with the depth estimate of 200 feet to

500 feet obtained earlier by detailed analysis of anomaly 24.

It appears that these anomalies represent the shallower parts of the basic tabular mass at its central portion.

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RELATION OF MAGNETICS TO MINERALISATION

Mines and mineral workings in the survey area are indicated on the magnetic map. A brief examination of the map does not reveal any direct relationship between the mineralised localities and the recorded anomalies. This means that no individual anomaly can be investigated as a possible indicator of mineralisation.

Most of the known mineralisation in the survey area is restricted to two areas. The northern area is an east-west trending belt with the central part occupied by Dolcoath Granite. The southern area is the Five Mile Rise near Dove Granite. Published geological literature links the mineralisation of both these sections to the neighbouring granites. Jennings (1963) discusses this relationship as follows:

"The pattern of mineralisation in this district demonstrates clearly that the Dolcoath and Lone Pine Granites are related to the tin-tungsten mineralisation. It is particularly noticeable that no tin or tungsten deposits have been reported in association with the Dove Granite.

The silver-lead and gold deposits are much more widely distributed and correlation of these with any particular mass of granite is less certain. A wider area around the Dolcoath Granite must be examined to obtain a more realistic picture of this distribution. Elliston (1953) discussed the zonal distribution of ore bodies around the Dolcoath Granite, taking into account the mineral deposits at Moina and Round Hill in addition to those on the Middlesex Quadrangle. His account indicates a reasonable zonation of mineralisation around the Dolcoath Granite, with tin-tungsten-molybdenite in and near the granite surrounded by successive "haloes" of gold, silver-lead and copper deposits further out. This account does not mention the Dove Granite.

The structure of the orebodies on the Five Mile Rise suggests that they are controlled by structures formed during the emplacement of the Dove Granite. There is also a suggestion that these orebodies at depth pass into hematite lodes carrying small quantities of sulphides and gold. Such lodes were encountered in the lower

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workings of the Union mine. Hematite lodes of this kind seem to be restricted to the vicinity of the Dove Granite and related to it so that it must be conceded that there is as much evidence to indicate a relationship of the gold and silver-lead to the Dove Granite as there is to the Dolcoath Granite." (Pages 111-112)

The direct presence of Dolcoath Granite on the magnetic map is represented by the conspicuous negative anomaly 28. Distinctive negative anomalies similar to anomaly 28 are not recognised anywhere else in the survey area.

The Dove Granite has no characteristic magnetic pattern and its recognition beneath the sediments is uncertain.

The Shephard and Murphy Mine is located on the northern flank of the 600 gamma anomaly 33. The anomaly does not appear to be directly related to the mineralisation. According to Elliston (1953), mineralisation in Shephard and Murphy Mine is confined to six parallel, east-west aligned veins that cut the bedding of the enclosing sandstone and limestone at right angles. The veins dip from $30^{\circ}W$ to $50^{\circ}W$ (Jennings, 1965), and are up to 1,200 feet in length with an average width of between 13 and 18 inches. No magnetic minerals are present, either with the ore minerals or the gangue. The Campbell's Reward Mine is similarly located on the northern flank of anomaly 24. It is improbable that mineralisation in these mines is related to the sources of anomalies 33 and 24 because these anomalies are the expressions of basic lithologies whereas the mineralisation is related to granite.

DISCUSSION OF RESULTS

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A reasonably clear picture of the geologic structure can be obtained from the previous discussion. It must be pointed out that this discussion is of a general nature, and illustrates in broad outline only, the major structure of the survey area. All the references to geology have been taken from publications listed in the bibliography.

To understand the magnetic patterns on the map it is best to review them against the background of the regional tectonics.

During Precambrian times a north-south trending structural high, the Tyennan Geanticline, occupied the central part of Tasmania. The rocks of the Geanticline were composed of metamorphosed sediments. In late Precambrian time a miogeosynclinal trough developed around the outer edge of the Geanticline. This structural pattern persisted throughout the Cambrian period. The source of the sediments filling the trough during this time was largely from within the trough itself. These Cambrian sediments are correlated with the Dundas Group. Also during the Cambrian, a sheet-like body of basic or ultrabasic material intruded into the base of the Dundas Group and its correlates, or alternatively, was extruded prior to its deposition. The probable existence of such a sheet-like body in the survey area is assumed on the basis of its occurrence in the Waratah-Zeehan area, and also on the basis of small serpentinite exposures within and north of the survey area.

The Jukesian Orogeny in Upper Cambrian time resulted in the general folding of the sediments, including the basic intruded or extruded sheet. The direction of the folding was parallel to the periphery of the Tyennan Geanticline. Thereafter, the Ordovician, Silurian, and early Devonian sediments were deposited in a tectonically uneventful environment until the commencement of the

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Tabberabberan Orogeny when granite intrusions, uplifts, faults and folding took place. All the previously folded Cambrian rocks as well as the later undeformed ones were folded along northwest-southeast axes.

With the aid of the geological map and a knowledge of the tectonic history, we may examine the magnetic map again. The featureless Zone A corresponds to the Tyennan Geanticline in the southern half of the Middlesex area. It extends further north beyond Zone A to include Zones B and C. The northern edge of the Geanticline coincides roughly with the northern boundaries of Zones B and C. The Geosynclinal Zone begins north of this line and includes the northern half of the survey area.

The key to this correlation between the structure and the magnetics is the probable presence of the basic Cambrian sheet-like body.

The Jukesian and the later Tabberabberan Orogeny folded this sheet-like body within the geosynclinal belt producing the positive trends of Zone D and probably anomaly 30 of Zone F. That part of the sheet-like body which was located over the Geanticline, was spared from the intense deformational forces of the geosyncline and is represented by the plateau-like high of Zone B. This latter feature however, seems likely to have been uplifted due to granite intrusion from beneath. It is possible that Dove Granite, exposed in the channels of Dove, Forth and Mersey Rivers, represents the higher portions of this intruded granite. Jennings (1963) makes the following statement:-

"From the relationship of the granite outcrops to the topography it appears that only the top of the granite is exposed and that many of the exposures represent marginal cases." (Page 78).

It is significant that the positions of the granite exposures are

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coincident with the southern edge of the plateau-like high.

This may explain the gentle northward dip of the source (the tabular body) which causes the plateau-like high, and the

shallower depth estimates at its southern end. The east-west course of Dove River just south of the Plateau-like high should also be noted.

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RECOMMENDATIONS

It is rather difficult to recommend any followup work in an area where the anomalies do not seem to be related to the observed mineralisation.

The value of ground magnetometer work is questionable because no magnetic minerals have been found in the vein deposits. It is possible that magnetic minerals are present at depth however, and such local mineralisation would not have been detected by the airborne survey.

A very good example is the Renison Bell Tin Field. The ground magnetometer survey (Davidson, et. al., 1957) indicated sharp, very high amplitude anomalies due to pyrrhotite and magnetite associated with the ore bodies. An aeromagnetic survey which included the area covered by the ground survey revealed a relatively broad, medium amplitude anomaly. The reason for this discrepancy is that the airborne survey has recorded the sub-regional picture only in terms of major anomalies and anomalous trends. The altitude of the airborne survey (500 feet M.T.C.) and possibly the traverse spacing ($\frac{1}{2}$ mile) did not aid in the registration of minor sharp anomalies as revealed by the ground survey.

Additional field work in the area should include collection of samples for susceptibility measurements. This will enable some sections of the interpretation to be reviewed.



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October, 1966.

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027

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028

APPENDIX ASTATISTICS

Client:	The Mount Lyell Mining & Railway Company Limited.
Contractor:	Australasian Mining and Engineering Geophysics Pty. Ltd. (AMEG)
Commencement of Flying:	March 25th, 1966) Flown in con-
Termination of Flying:	May, 18th, 1966) junction with Sheffield survey for B.H.P.
Aircraft:	Bell G3B-1
Aircraft Base:	Mole Creek, Westbury, Beaconsfield, Devonport.
Magnetometer:	Barringer Research (Aust.) Pty. Ltd. AM-102 proton magnetometer.
Magnetometer Installation:	Detector head located in a bird towed below and behind the helicopter on 60 feet of cable.
Recorder:	Hagan Optimac
Tape Speed:	3 inches per minute
Full Scale Deflections:	400 gammas and 4,000 gammas
Fiducial Interval:	5 seconds
Camera:	Modified Bolex 16 mm movie camera, fitted with a Fairey extreme wide angle "fish eye" lens.
Terrain Clearance:	500 feet M.T.C. (pre-planned) 300-900 feet (actually flown)
Terrain Clearance Control:	APN-1 Radioaltimeter
Diurnal Control:	Barringer Research Ltd. (Toronto) portable proton magnetometer type GM102
Flight Direction:	East-west
Area:	120 square miles (approximate)
Milage:	400 miles (approximate)
Line spacing:	$\frac{1}{2}$ mile
Compilation Scale:	1:31,680
Final Map Scale:	1:31,680
Inclination of the earth's magnetic field:	72°

029

Appendix A (Cont'd.)

Declination:	12°E
Total Magnetic Field:	62,500 gammas
Regional (not removed):	5.8 gammas per mile (southwesterly direction)
Crew:	Pilot - J. Reilly Magnetometer Operator - J. Dawson Data Technician - K. Miller

030

030

APPENDIX BINDEX TO PROFILESAltitude - 500 feet M.T.C.Sensitivity - 400 gammas and 4,000 gammasJob No. - A175

Traverse No.	Start	Finish	Flight	Date Flown
1E	0418	0428	BD5	4.5.66
3W	210	218	BD2	2.5.66
5E	0201	209	BD2	2.5.66
7W	105	117	WY36	25.4.66
9E	055	103	WY36	25.4.66
11W	042	053	WY36	25.4.66
13W	0139	0153	WY34	24.4.66
15E	0129	0137	WY34	24.4.66
17W	0114	0127	WY34	24.4.66
19E	0105	0113	WY34	24.4.66
21W	111	120	BD1	2.5.66
23E	100	109	BD1	2.5.66
25W	050	059	BD1	2.5.66
27E	045	055	WY31	20.4.66
29W	548	558	WY47	30.4.66
31E	0609	0616	MK26	14.4.66
33E	539	546	WY47	30.4.66
35E	0543	0551	MK26	14.4.66
37W	0532	0542	MK26	14.4.66
39W	0512	0522	MK26	14.4.66
41E	514	522	WY47	30.4.66
43W	0447	0459	MK26	14.4.66
45E	0437	0446	MK26	14.4.66
50E (west part)	109	119	WY42	28.4.66
51W (part line)	120	130	WY42	28.4.66
52E	612	645	WY38	25.4.66
53	601	611	WY38	25.4.66
54E (part line)	119	145	WY36	25.4.66
55W	002	012	WY36	25.4.66
56E	017	034	WY36	25.4.66
57E	0432	0503	WY35	24.4.66
58W	418	429	WY35	24.4.66
59E	0154	0225	WY34	24.4.66
60	053	104	WY34	24.4.66

031

Appendix B (Cont'd.)

Traverse No.	Start	Finish	Flight	Date Flown
61W	024	033	BD1	2.5.66
62E	035	046	BD1	2.5.66
63W	034	044	WY31	20.4.66
64W	516	522	WY29	16.4.66
65E	0410	0437	WY29	16.4.66
66W	356	407	WY29	16.4.66
67E	0135	0202	WY28	16.4.66
68	123	132	WY28	16.4.66
69	007	016	WY28	16.4.66
70E	0023/4	0051/11	WY28	16.4.66
73E (part line)	0102	0117	MK19	1.4.66



? Source of 29

Basalt lens complex magnetically than in west of Area B or in Zones C & F.

Depth of 21, 22 is 450

depth of these 210

due to source under basalt?
500m to 1000m level

208033

- LEGEND**
- (15) ANOMALY NUMBER
 - TR.2 ANOMALOUS TREND
 - ZONE B ANOMALOUS ZONE BOUNDARIES
 - ZONE A ANOMALOUS ZONE BOUNDARIES
 - BASALT OUTCROP
 - - - GRANITE OUTCROP
 - SURFACE STRUCTURAL FEATURES
 - FAULTS
 - FOLDS
 - ⊗ MINES AND MINERALS WORKINGS

- LEGEND**
- MAGNETIC CONTOURS
 - MAGNETIC LOW
 - MINIMUM CONTOUR INTERVAL - 20 GAMMA
 - TRAVERSE INTERVAL - 1/4 MILE
 - FLIGHT ALTITUDE - 500 FEET M.T.C.
 - MAGNETIC DATUM - 60,000 GAMMA

INTERPRETATION
STAVERTON AREA - TASMANIA
 TOTAL MAGNETIC INTENSITY
 MEASURED BY AIRBORNE PROTON MAGNETOMETER
 FOR
 MT. LYELL RAILWAY & MINING CO.

SCALE 1:31,680

MILES 1/2 0 1 2

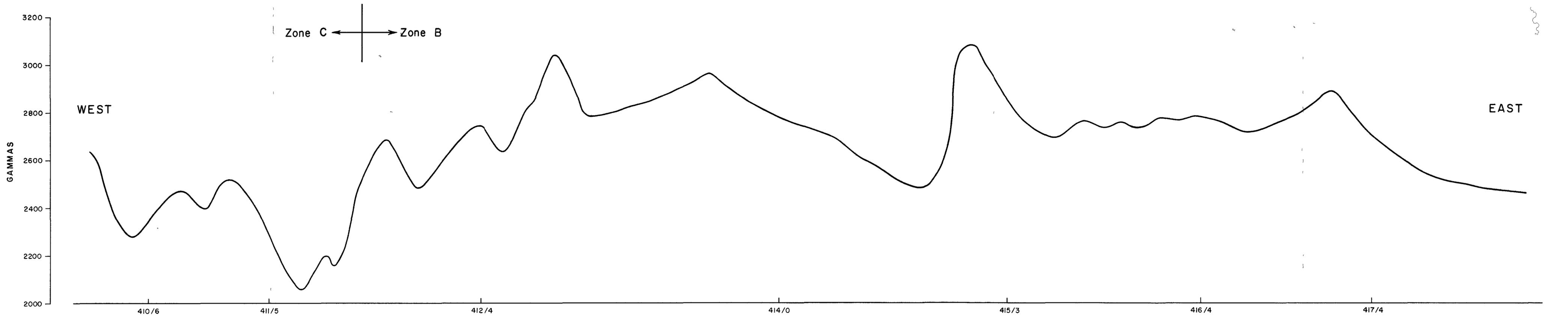
FLOWN BY AMEG

5 cm

PLATE I

INTERPRETATION BY PAKEN A. ZARZAVATJIAN

COMPILED BY AMEG & BKLENON & ASSOC. PTY. LTD.



208034

PLATE 3

EAST - WEST MAGNETIC PROFILE
ACROSS ZONE B AND PART OF ZONE C
TRAVERSE T-65E

STAVERTON AREA - TASMANIA

AMEG Pty Ltd
To accompany interpretation by P A Zarzavatjian
October 1966

Vertical Scale 1 in = 200 gammas
Horizontal Scale Variable
Numbers along horizontal axis refer
to flight path control points



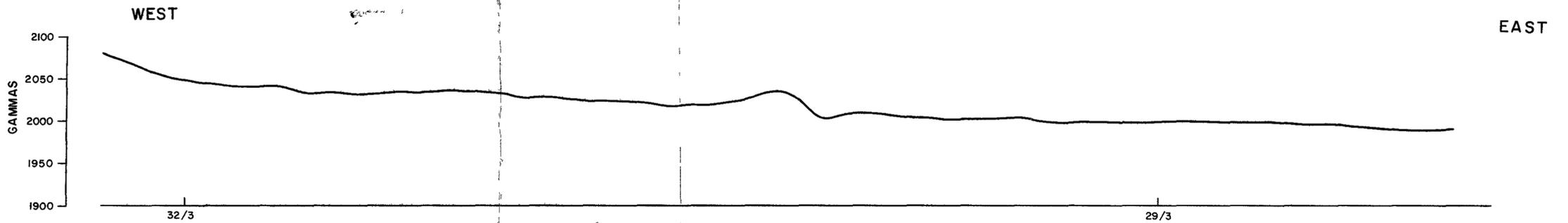
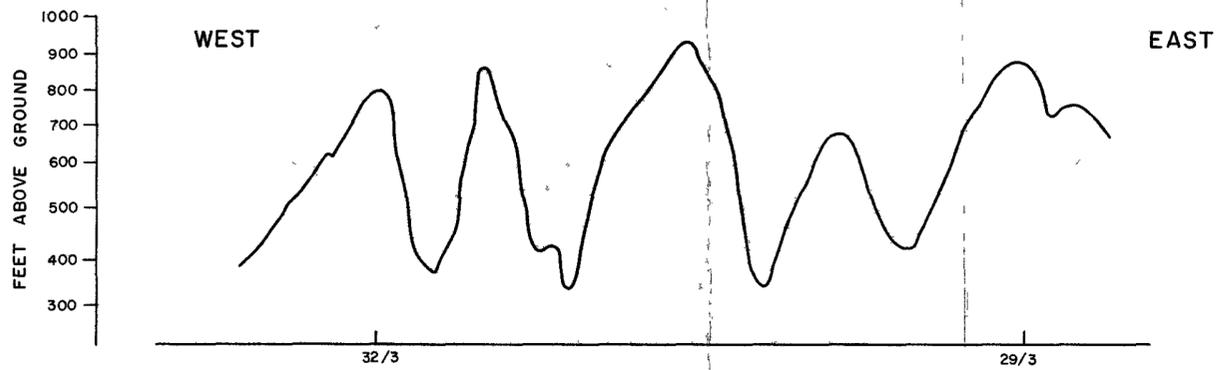


DIAGRAM B
TRAVERSE T-71

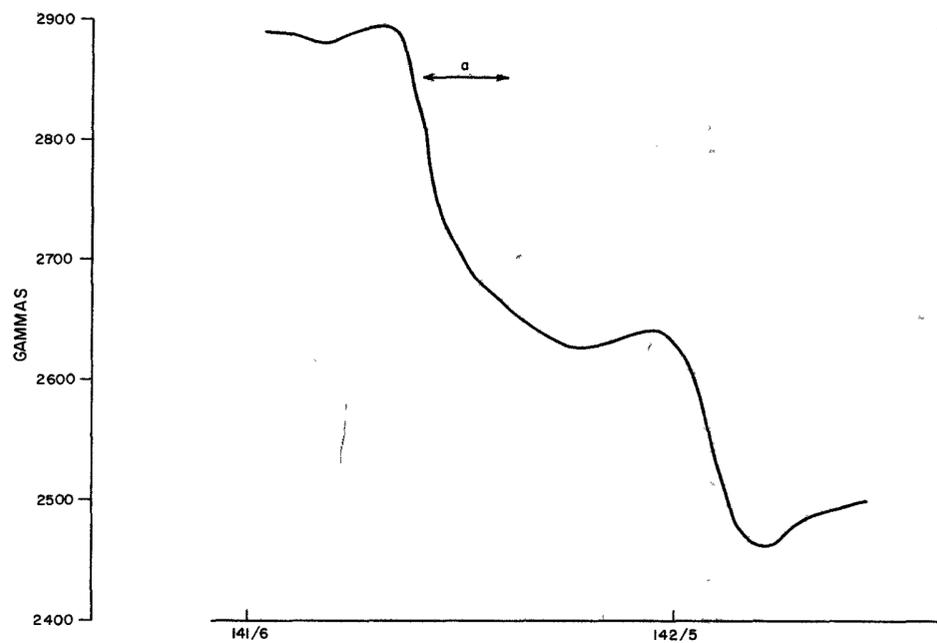
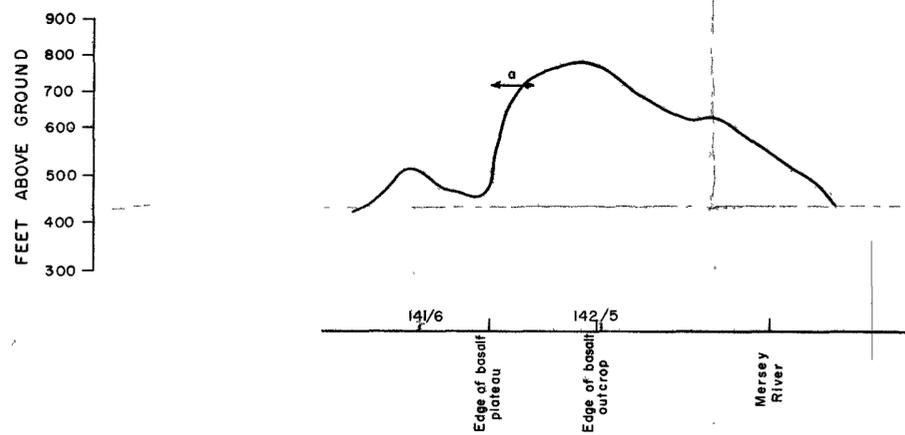


DIAGRAM A
TRAVERSE T-67

208035

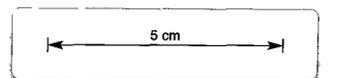


PLATE 4

MAGNETIC PROFILES AND
CORRESPONDING ALTIMETER RECORDS
STAVERTON AREA - TASMANIA

Numbers shown along horizontal axes
are flight path control points

Horizontal Scale variable
Vertical Scale
altimeter profile variable (feet above ground)
magnetic profile in 100 gammas

AMEG Pty Ltd
To accompany interpretation by P.A. Zarzavatjan
October 1966

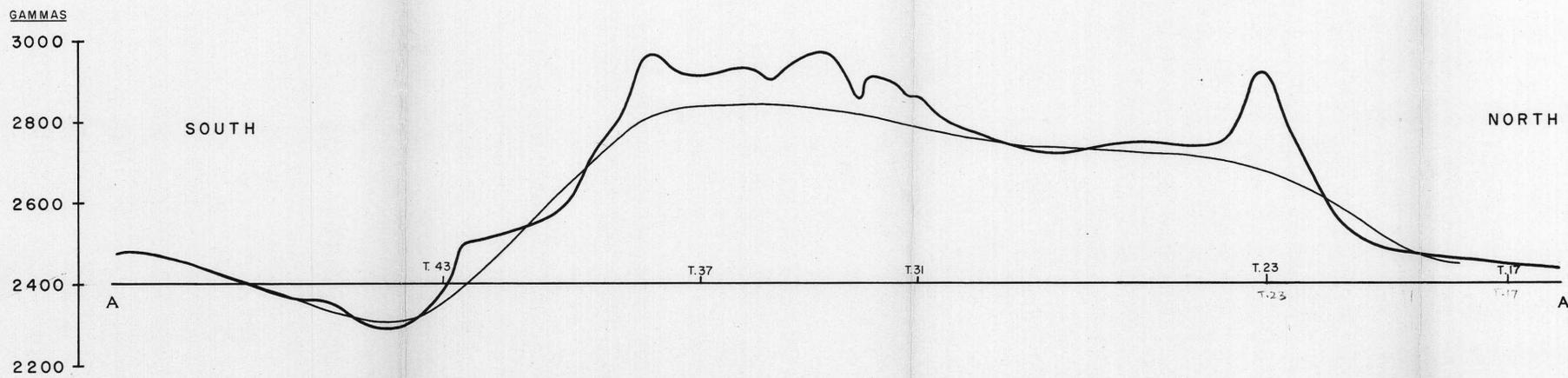


DIAGRAM A

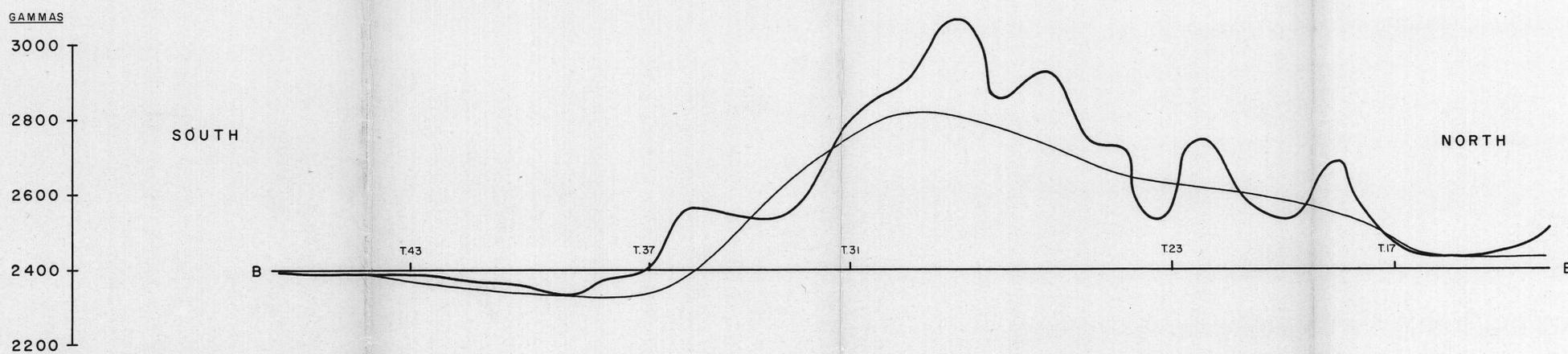


DIAGRAM B

Recorded profile 
 Idealized profile 
 Vertical scale 1" = 200 gammas
 Horizontal scale 1in = 1/2 mile

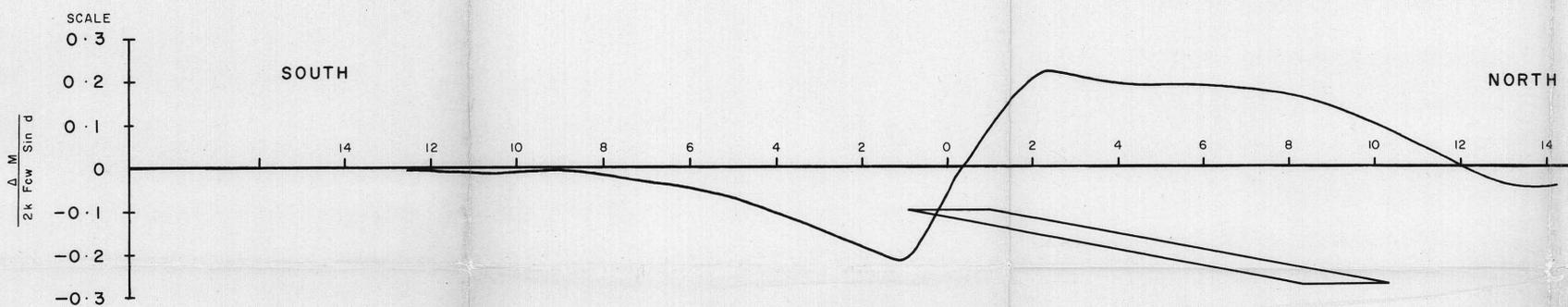


DIAGRAM C

**THEORETICAL MAGNETIC PROFILE OF A
 FINITE DYKE DIPPING 10° N**

Horizontal Distance is in units of h
 h = Distance from the plane of observation
 to the source of the anomaly

PLATE 5

**NORTH-SOUTH IDEALISED AND
 THEORETICAL PROFILES ACROSS ZONE B
 STAVERTON AREA-TASMANIA**

A.M.E.G. Pty. Ltd.
 To accompany interpretation by P.A. Zarzavatjian.
 October 1966

208036

66-432

4222

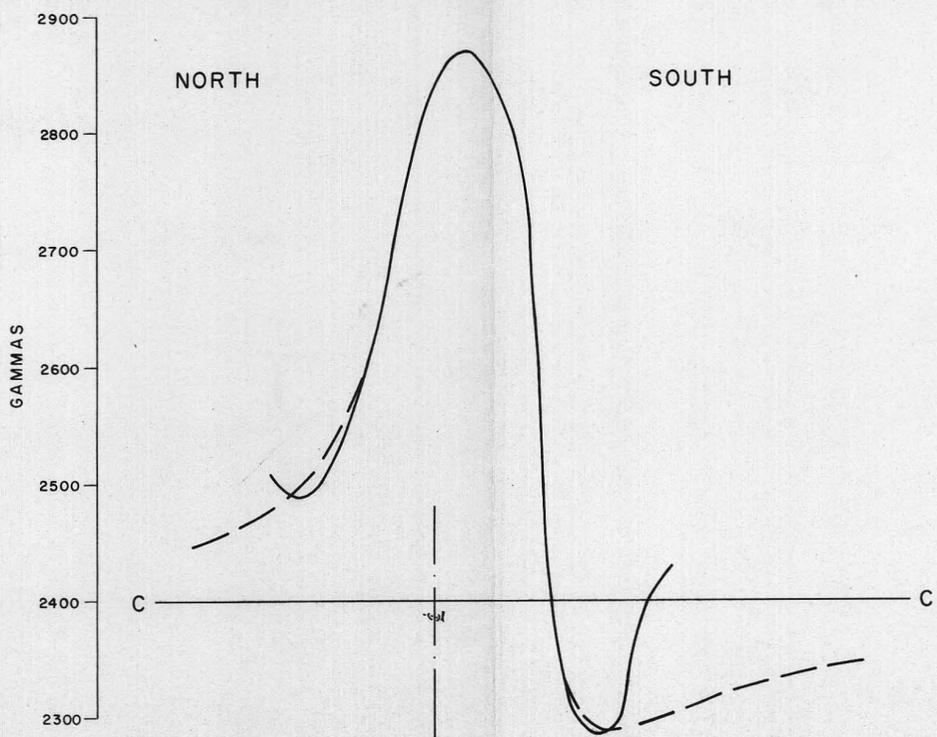


DIAGRAM A
TREND TR7

Depth..... 700 - 800 feet subsurface
Dip..... 51° N - 66° N
Width..... 1000 - 2000 feet.
Susceptibility value... 5000×10^{-6} - 8500×10^{-6} e.g.s. units.

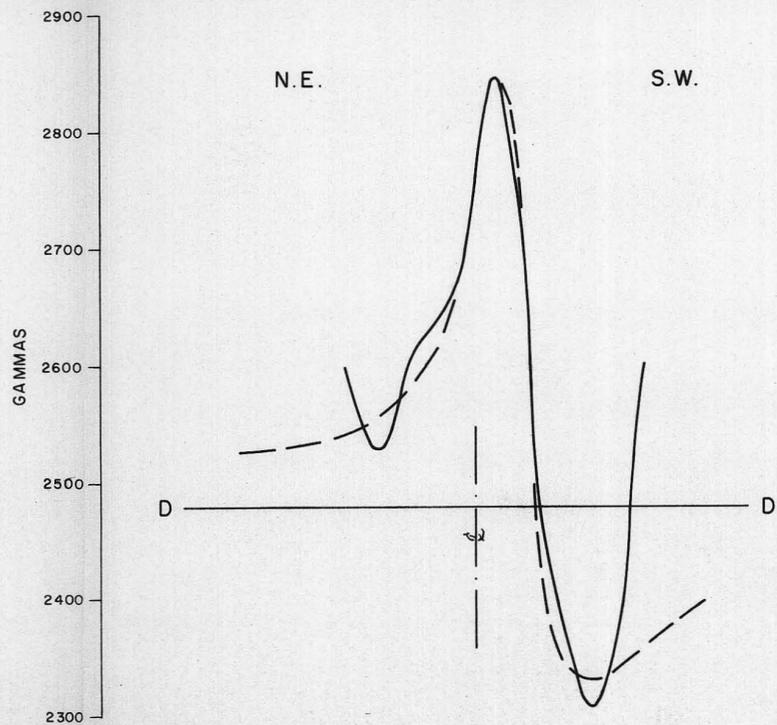


DIAGRAM B
TREND TR4

Depth..... 200 - 250 feet subsurface
Dip..... 54° N - 64° N
Width..... 550 - 600 feet
Susceptibility value... 4700×10^{-6} - 5500×10^{-6} e.g.s. units.

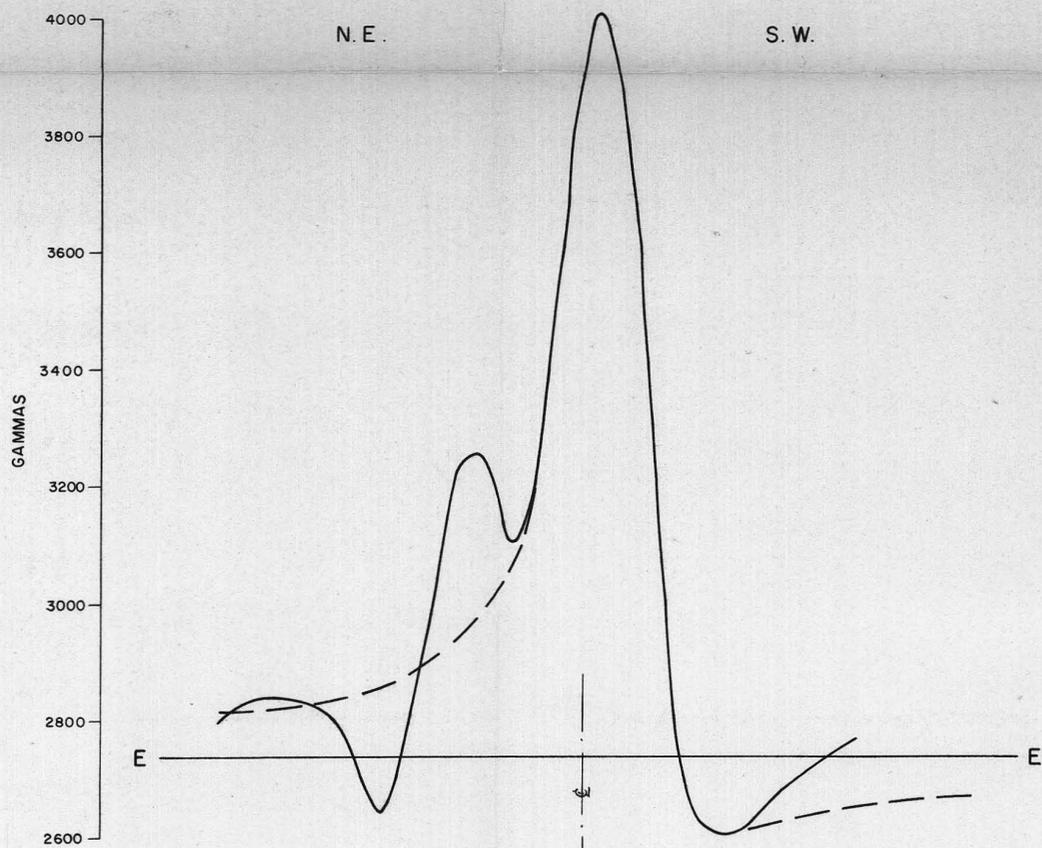


DIAGRAM C
ANOMALY 24

Depth..... 200 - 500 feet subsurface
Dip..... 86° S
Width..... 500 - 1200 feet
Susceptibility value... $12,000 \times 10^{-6}$ - $14,000 \times 10^{-6}$ e.g.s. units.

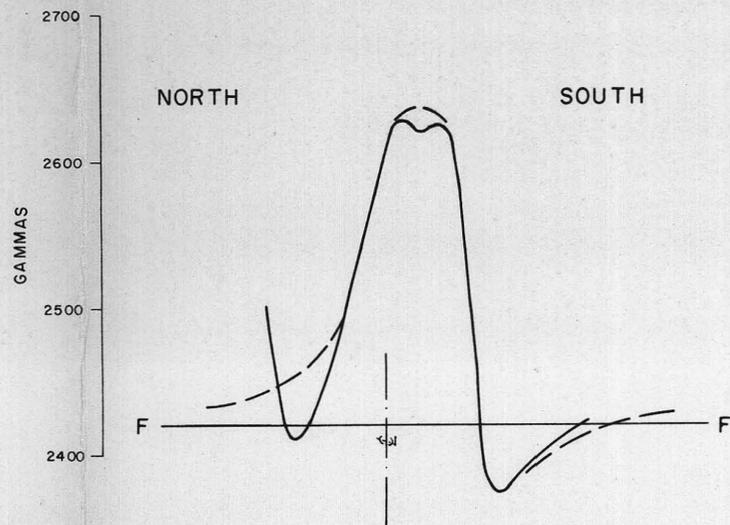


DIAGRAM D
ANOMALY 30

Depth..... 300 - 400 feet subsurface
Dip..... 61° N
Width..... 1200 - 1600 feet
Susceptibility value... 3000×10^{-6} e.g.s. units.

208037

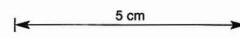
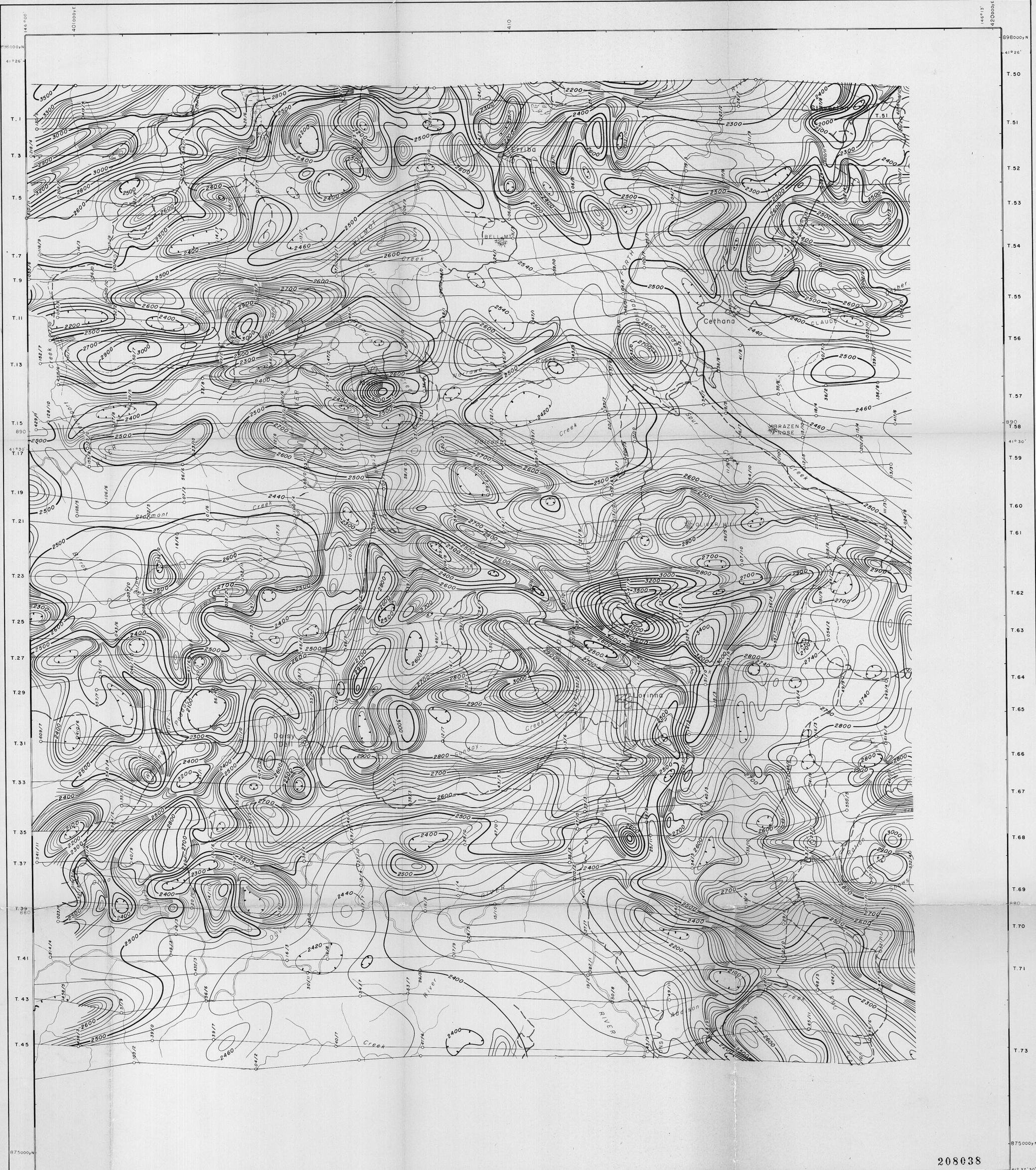


PLATE 6

DETAILED ANALYSIS OF
MAGNETIC PROFILES
CONSTRUCTED FROM THE
AEROMAGNETIC MAP
STAVERTON AREA - TASMANIA

Horizontal Scale... 1 in. = 2640 ft.
Vertical Scale... in gammas as indicated.

A.M.E.G. Pty. Ltd.
To accompany interpretation by P.A. Zarzavatjian.
October 1966



208038

LEGEND

- MAGNETIC CONTOURS 
- MAGNETIC LOW 
- MINIMUM CONTOUR INTERVAL - 20 GAMMA
- TRAVERSE INTERVAL - 1/4 MILE
- FLIGHT ALTITUDE - 500 FEET MTC.
- MAGNETIC DATUM - 60,000 GAMMA.

COMPILED BY AMEG & B.KLENON & ASSOC. PTY. LTD.

INTERPRETATION
STAVERTON AREA - TASMANIA
 TOTAL MAGNETIC INTENSITY
 MEASURED BY AIRBORNE PROTON MAGNETOMETER
 FOR
MT. LYELL RAILWAY & MINING CO.

SCALE 1:31,680
 MILES 1/2 0 1 2

FLOWN BY AMEG

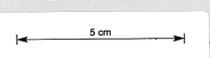


PLATE 7

DEPT OF MINES - TAS.

4224

37/21