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INTERPRETATION OF  
AIRBORNE MAGNETIC SURVEY  
STAVERTON AREA  
NORTH CENTRAL TASMANIA

**OPEN FILE**

for

THE MOUNT LYELL MINING AND RAILWAY  
COMPANY LIMITED

by

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**MICROFILMED**

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AMG REFERENCE POINTS ADDED

AIRBORNE MAGNETIC SURVEY - STAVERTON AREAINTRODUCTION

The Staverton area in North Central Tasmania was covered by an airborne magnetometer survey by Ameg using a helicopter-borne proton magnetometer, flown at ¼ mile flight line intervals. The results of this survey were produced as an isomagnetic contour map and were interpreted by Mr. P.A. Zarzavatjian. The survey was flown during April-May 1966 on behalf of Mt. Lyell Mining & Railway Co. Ltd. In July 1967 the author was requested by Mt. Lyell Mining & Railway Co. Ltd. to undertake a second interpretation. The original magnetometer recorder charts, positioning films, etc., were made available in Adelaide during August, 1967. These were inspected in detail by the author who came to the conclusion that owing to the paucity of points plotted from the positioning film and large variations in the ground speed of the aircraft the original isomagnetic contour map was not sufficiently accurate for any interpretive work except in very general terms.

Authorisation was obtained for the re-reduction of the original data. During this process it was discovered that charts for four flights were not available (flight lines 50, 65, 72 and 75) subsequently, the magnetometer chart for flight 65 was obtained, however, the remaining charts could not be located and the reduction was completed without them. The loss of these charts has not affected seriously the contour plan.

GENERAL COMMENTS ON DIFFERENCES IN THE APPROACH TO THE INTERPRETATION.

By comparison with Mr. Zarzavatjian's zoning of anomalous areas the author's interpretation recognizes only two groups of anomalies. Those due to basalt cover and the remainder. All anomaly or residual trends (however short) were considered by the second interpretation. Continuities and discontinuities in those trends were then considered. Considerable amount of correlation between this interpretation and the known structural information resulted.

Unlike Mr. Zaravatjian the author did not attempt any quantitative interpretation for the following reasons:-

The magnetic picture of the area is quite complex and the resulting anomalies are affected by the adjoining anomalies; i.e. no simple anomalies are available for comparison with theoretical curves, or any other mathematical treatment of field data. The large variations in height of the aircraft over the rugged terrain further complicate the overall picture. In addition most of the anomalies are intersected obliquely by the flight pattern. Construction of profiles from the magnetic contour map is not satisfactory as the contours are an interpolation between flight lines and as such include considerable amount of "human factor". The susceptibility calculations are equally meaningless as the result of the factors mentioned above, in addition to which remanent magnetization can vary widely, and the assuming of normal polarization may lead to misleading results.

Further to quote Smellie (1957) "The deduction of magnetite content from magnetic polarization is very uncertain since the remanent magnetization can vary widely. Even if it were possible to calculate magnetic susceptibility from polarization, the spread in susceptibility values for a given percentage magnetite is too great to allow confident conclusions to be drawn".\*

#### DISCUSSION OF RESULTS

The first stage of the interpretive work consisted of delineating and plotting of trends evident within each individual anomaly. Both high and low trends were plotted and these are shown on the Sheet No. 3. These should not be confused with the more regional features also indicated by the magnetic pattern within the area.

Examination of the anomaly trends led to the following observations:-

1. Trends within the basalt covered areas are predominantly in the North-Southerly direction. The difference in this picture from that in areas without basalt cover is very pronounced. The limits of these trends agree well with the known geological boundaries.
  2. Anomaly trends in the remainder of the area i.e. without basalt cover in the main have an E-W direction except in the area to the South of the Dolcoath granite, where the direction is approx. WNW-ESE.
- \* DW Smellie 1957 Quantitative Interpretation of Aeromagnetic Data Nov. 1957. Report in author's possession of unknown source.

3. A number of discontinuities in the anomaly trends exist throughout the area. These are also shown on the overlay. The discontinuities fall easily into two distinct families intersecting one another. The first group of sub-parallel discontinuities runs in the NW-SE direction and is considered to reflect major structural features within the area.

The second family, also considered to be the reflection of structure consists of a group of sub-parallel discontinuities with predominantly east-westerly direction (generally speaking) it is slightly south of west).

Good correlation of a number of the discontinuities with the known structure suggests that by extending from "the known into the unknown" these will be useful in the general interpretation of the geology of the area.

4. Dolcoath granite is well shown by the anomaly low. These are considered to be due to a higher magnetite content in the rocks near the granite contact.

The Dove granite is also shown by lows or low gradients in the total intensity.

#### Discussion of the Residual Results

The second stage consisted of the construction of residuals. These were obtained from the map of Total Magnetic Intensity by means of a template giving the difference between the value at a point and the average of values around a circle of one half mile radius.

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Residuals are an averaging process and this process tends to remove the larger or regional features and emphasise the localised features. Highs and lows are still evident in the residuals however their areal size depends upon the radius of the template used for obtaining the residuals. In addition areas of higher or lower intensity which appear as noses or a change of spacing of the contours rather than a discrete anomaly are brought out as highs and lows.

The residual map tends to emphasise many of the features which were picked out of the total intensity map by the process of marking all trends. This is the purpose of residual mapping. The following points are evident and in general similar to the points brought out of the discussion of the total intensity results.

1. The basalt covered areas show a general N-S pattern.
2. The trends in the remainder of the area again exhibit a general E-W trend and the area to the south of the Dolcoath granite exhibits the WNW-ESE trends.
3. Because of the averaging process used in the residual calculations the continuity of trends mentioned under section 3 of the discussion of total magnetic intensity are not as apparent. They do however exist. A NW-SE trend is evident in the residuals particularly below the Dolcoath granite where the trend runs to the N-W and joins into the E-W trend present in the vicinity of the Stormont anticline.

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4. The Dolcoath granite is shown on the residual map as an area of widely spaced contours and therefore is very similar to the result shown on the total intensity map. This is to be expected. An area of low magnetic change must be reflected as an area of very small residuals. The areas of Dove granite are shown as areas of little residual change but are not as well outlined as the Dolcoath granite.
5. The zero line of residual marks, in general, a place where a gradient exists in the total magnetic intensity. Therefore the line of zero residual can be considered the centre line of the magnetic change (or gradient) and generally useful in interpretation. Although not one continuous zero line, the Dolcoath granite is bounded by zero's in close proximity to the shown outcrop. It would appear that the Dolcoath granite cannot be considered to extend very far under cover in any direction with possible exception of a small extension to the south. The Dove granite outline is better obtained from the total intensity change.
6. The large anomaly to the east central part of the area and almost immediately to the south of Dolcoath granite has a very large residual as would be expected and is by far the largest residual feature of the area.

General Discussions of Results with reference to structure

The discontinuity lines shown on the plan of total magnetic intensity are lines where magnetic pattern changes. This can be either parallel to a fairly steep gradient or where the trend lines are interrupted or as in many cases shown a combination of these.

1. The long fault running NW-SE through the area and finishing near Lorinna runs approximately parallel to a discontinuity line and it is possible that some displacement of this fault could exist as it intersected several approximately EW lines of discontinuity. One of these E-W lines runs slightly to the north of Lorinna showing a possibility that this fault is cut off at least a little south of the most southerly point shown on the geological map. At this point the discontinuity lines are accompanied by a very sharp swing from NW-SE to approximately E-W in the contours of total magnetic intensity so that a large discontinuity exists at this point.

Where the NW-SE fault passes under quartzite and basalt near its northern end is also a point where two lines of E-W discontinuity cut the fault line and there is a possibility of a break or shift in the fault line at this point. Although the fault is outlined by the lines of discontinuity in the magnetic pattern there is no overall change in the pattern at this point, that is, the magnetic intensity cannot be said to be higher on one side of the fault than on the other.

This is to be expected, as no marker bed has been discovered, which would be expected to show a great disparity in the magnetic pattern due to faulting.

2. The thrust faults in the N-E corner of the area are not well outlined by the magnetic pattern, but they are approximately parallel to discontinuity and trend lines in the immediate area. Again it cannot be said that the magnetic pattern outlines the thrust fault, but inversely, it can be said that they are in very approximate agreement with the magnetic pattern. The most southerly of the group of thrust faults does follow very closely a zero residual line and also the general contour lines of the total intensity map, although a reliable diagnostic relationship however can not be postulated.
3. The approximately NW-SE fault in the NW corner or Stormont area in the Moine sandstone is again parallel to the lines of NW-SE discontinuity, but is some distance from the nearest of these discontinuities. It is also approximately at right angles to the trend of the residual contours. Again, all that can be said is that the fault is in agreement with magnetic discontinuities trends, but cannot be definitely located or said to be reflected in the magnetic pattern.
4. The E-W syncline and anticlines in the Stormont Creek Area are in good directional agreement with the trends, or more correctly, the discontinuity patterns in the total intensity magnetics and also the

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NW-SE faults in this immediate vicinity, are in agreement with another trend and discontinuity pattern. Again these features cannot be said to be outlined by the pattern but rather to agree with it. The E-W synclines and anticlines are expressed directionally in the residual pattern but cannot be said to be indicated by this pattern. However the eastern extremity of the synclines and anticlines coincide approximately with a change of direction of the residual pattern and likewise terminate approximately on a NW-SE trending discontinuity line. This may be indicative of structural control but more likely is merely brought about by the fact that the magnetic pattern from the overlying basalt is more dominant than the general E-W structural pattern.

5. The other syncline or anticline and fault lines shown on the geological plan are generally in the NW-SE direction and again are in good agreement with this particular trend in the magnetics and to a lesser extent in the residuals. But summarizing the whole of these effects, it can be only reiterated that the structural features are in agreement with the magnetic trends and discontinuity patterns rather than the magnetic patterns, indicate any of these individual features in the geological structural pattern.

Discussion of Individual Anomalies

In addition to the structural features and their reflection in the magnetic pattern, there are several anomalies worthy of individual attention.

1. Anomaly A

This is a large complex anomaly to the north and east of Lorinna and it is undoubtedly the combined result of several sources. The peak value exceeds 4160 gammas and it is the highest magnetic value in the area of the survey and it is associated with a low of 2400 and to the South.

The anomaly lies at the junction of an WNW-ESE trend with a N-S trend and a minor NE-SE trend and therefore has a good structural position for mineralisation. The anomaly is further emphasised on the residual map (Sheet 2). Campbell's Reward Mine lies at the NW end of the anomaly. It is not possible to give any indication of depth as the anomaly is complex.

This anomaly was discussed at length with Messrs. Elm and Reid during a visit to Queenstown (February 1968) and a test ground magnetic survey was recommended to cover "Anomalies A & B". Any further recommendations should await the results of this survey.

2. Anomaly B

This is a small anomaly to the SE of Anomaly A and has a peak value of 3100. It appears to have an E-W strike but the residuals emphasise the N-S direction of this anomaly coupled with another to the north. The anomaly lies along a line of E-W discontinuity and at the junction of EW and NS trend lines. Copper has been reported near anomaly B (See mineralization map). The survey already set out for A has also been planned to cover anomaly B.

3. Anomaly C

This is a small anomaly of intensity 3010 and lies on the eastern side of an outcrop of Dove Granite. The anomaly is not large enough to express in the residual map as a high but it does appear to be an offset continuation of the N-S trend.

Caution is again expressed on depth estimates but it would appear that the anomaly would be under very shallow cover. It lies near the Powerful Mine.

Ground magnetometer lines are recommended (See Sheet 4).

4. Anomaly D

This is an anomalous area in the S-W corner of the area and lies under cambrian cover of the Dove Group. The peak value is 3630 gammas.

This anomaly is of interest as its magnetic pattern is entirely different from the rest of the magnetics over Dove Group which is magnetically undisturbed.

The main anomaly has a WNW-ESE strike but the overall group has an approximately E-W strike. Again it is possible that the pattern will alter drastically at lower level and ground traverses are recommended. (See Sheet 4).

5. Anomaly E

This anomaly is within the general E-W striking belt and lies directly over the Shepherd and Murphy Mines. It has a peak value of 3600 with a E-W strike.

Testing with ground traverses is recommended.

6. Anomaly F

Is similar to Anomaly E with a peak value of 3550 and on E-W strike. It lies over a reported copper showing on the mineralisation map. Testing is recommended but after testing of D (See Sheet 4).

CONCLUSION & RECOMMENDATION

1. The overall conclusion that can be drawn from the extensive examination of the magnetics is that all the known structural features in the area agree in direction and in a few cases can be positionally tied to the magnetic pattern. It is difficult to give forward interpretation from magnetics to geology.

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2. The magnetic pattern of the basalt is a strong feature and where basalt is present its magnetic trends, which are approximately N-S, take over from the general E-W trend evident in the non-basalt areas.
  3. A number of separate anomalies have been mentioned for further testing in the form of ground surveys. No further recommendations should be made until these results are available.



John E. Webb.

APPENDIX 1

Note on

Tasmania Aeromagnetic Survey 1966by Finney & ShalleyB.M.R. Record No. 1967/19.

This survey was flown at an altitude of 10,000 feet above sea level and therefore measures only the large magnetic features representing changes of magnetic basement.

Line 8 crosses the Staverton area about two miles to the north of Lorinna. This shows a wide anomaly of approximately 150 gammas over the area of the present survey so that the area is undoubtedly underlain by magnetic rocks, most likely ultrabasics. The depth is at least 2000 feet below ground level and possibly much deeper.

While this anomaly could have an effect over the area of the present survey it is too wide and deep to be reflected in the results of the survey.

A study should be made of the results of the Bureau's survey in the light of known geology to determine the advisability of examining areas in the vicinity of other large anomalies.

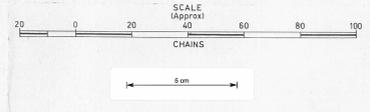
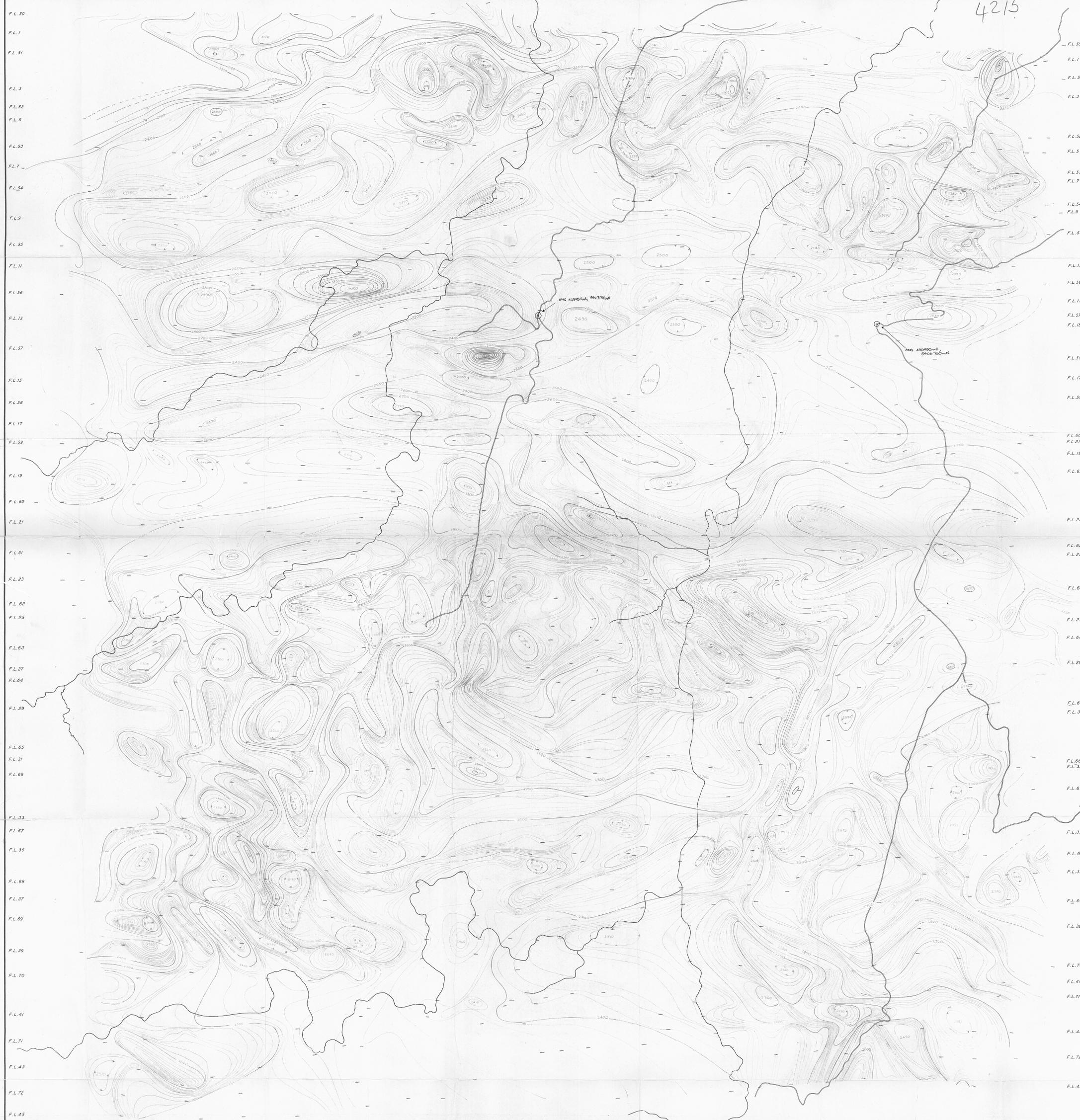
Accompanying Plans

Sheet 1 Total Magnetic Intensity Contour Map.

Sheet 2 Residual Magnetic Intensity Contour Map.

- Sheet 3 Interpretation of Total Magnetic Intensity Contour Map.
- Sheet 4 Total Magnetic Intensity Contour Map, showing Anomalies and  
Recommended Ground Traverse Lines.

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**STAVERTON AREA - TASMANIA**

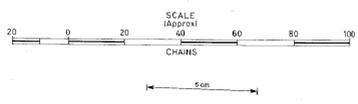
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 TOTAL MAGNETIC INTENSITY  
 CONTOUR MAP  
 COMPILED BY AUSTRAL EXPLORATION SERVICES  
 FROM ORIGINAL AIRBORNE PROTON  
 MAGNETOMETER SURVEY FLOWN BY A.M.E.G.

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SHEET 1

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AMG REFERENCE POINTS ADDED

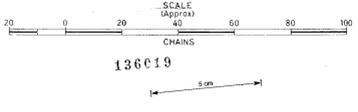


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**STAVERTON AREA - TASMANIA**  
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**RESIDUAL MAGNETIC INTENSITY  
 CONTOUR MAP**

COMPILED BY AUSTRAL EXPLORATION SERVICES  
 FROM ORIGINAL AIRBORNE PROTON  
 MAGNETOMETER SURVEY FLOWN BY A.M.E.G.

CONTOUR INTERVAL 25 GAMMA  
 IN THE RANGE -100 TO +100 GAMMA  
 THEN 100 GAMMA



**STAVERTON AREA - TASMANIA**

INTERPRETATION OF  
TOTAL MAGNETIC INTENSITY  
CONTOUR MAP

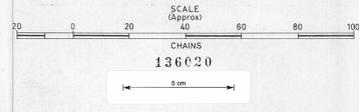
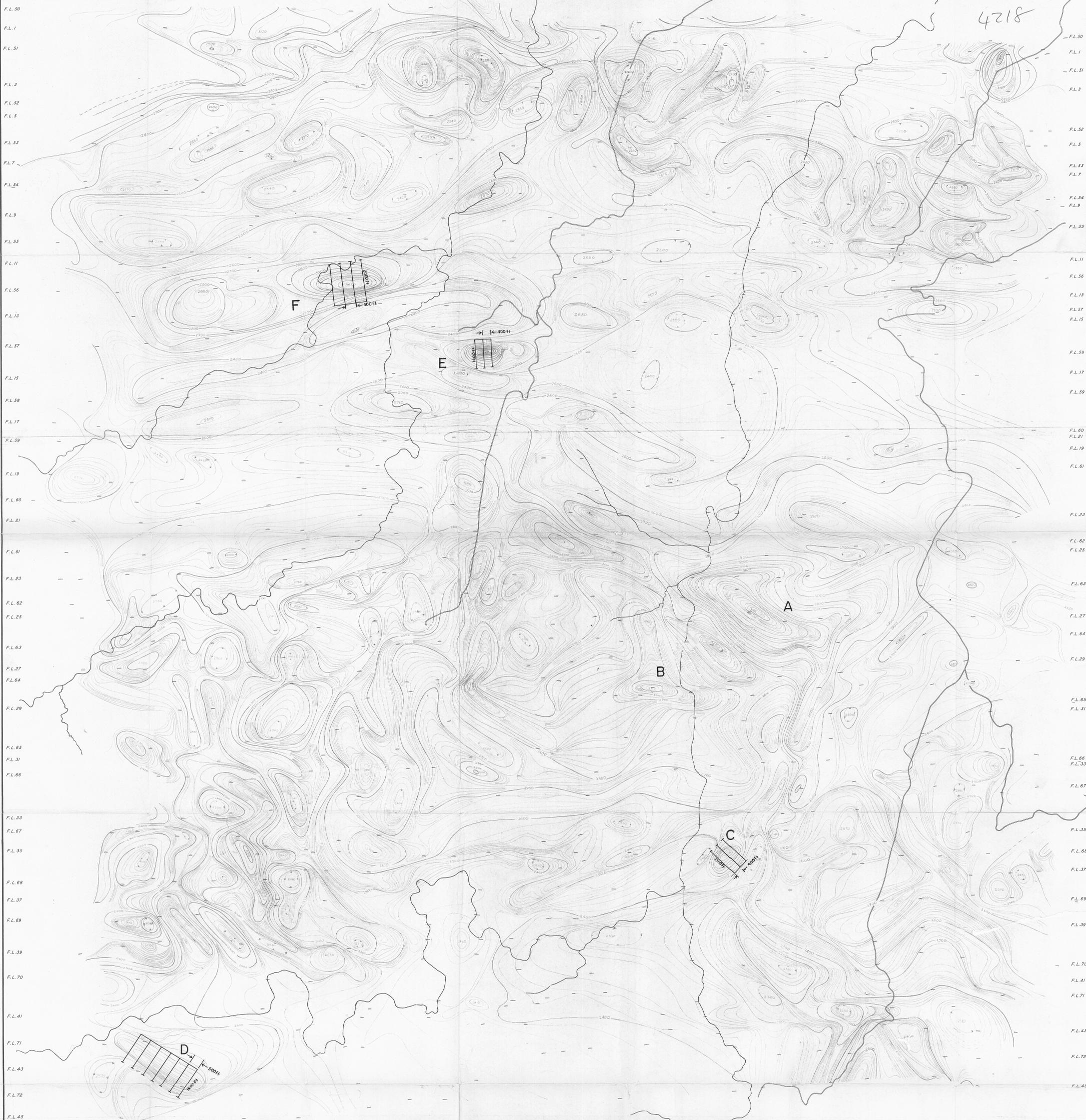
COMPILED BY AUSTRAL EXPLORATION SERVICES  
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MAGNETOMETER SURVEY FLOWN BY A.M.E.G.

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SHEET 3

POSITIVE TREND.....  
NEGATIVE TREND.....  
DISCONTINUITIES.....

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**STAVERTON AREA - TASMANIA**

TOTAL MAGNETIC INTENSITY  
CONTOUR MAP  
(SHOWING ANOMALIES AND RECOMMENDED GROUND TRAVERSE LINES)  
COMPILED BY AUSTRAL EXPLORATION SERVICES  
FROM ORIGINAL AIRBORNE PROTON  
MAGNETOMETER SURVEY FLOWN BY A.M.E.G.

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SHEET 4

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