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Geophysical Report 6

Interpretation of the North Tasmania Aeromagnetic Survey

by J. R. Bishop

TASMANIA DEPARTMENT OF RESOURCES & ENERGY
DIVISION OF MINES & MINERAL RESOURCES

030002

INTERPRETATION OF THE NORTH TASMANIA

AEROMAGNETIC SURVEY

for

The Tasmanian Department of Mines

by

Dr J.R. Bishop

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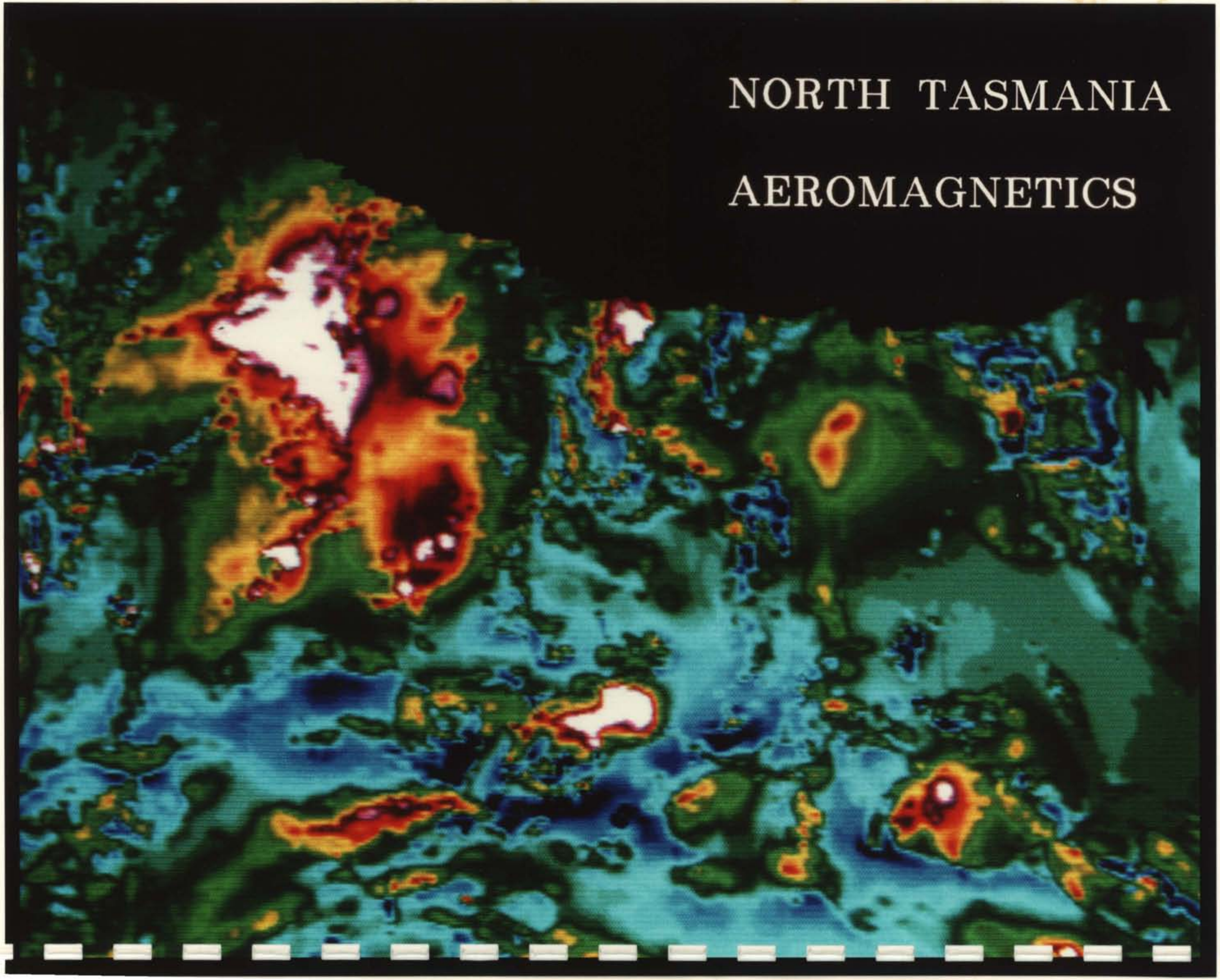
NORTH TASMANIA
AEROMAGNETICS

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SUMMARY

An aeromagnetic/radiometric survey has been flown over 'North' Tasmania; ie, the area between Wynyard and Badger Head east of Devonport, from the coast to the Western Tiers. The surveyed area contains a large number of old workings and prospects for a variety of minerals. Included amongst these are several skarns, which mostly have strong magnetic responses. Other mineralisation, including gold, is apparently structurally controlled and may have a magnetic signature. Tertiary basalt covers a large proportion of the area and the moderate to strong responses often obscure or at least modify those of the underlying rocks. Most of the buried sources have been interpreted as being due to Cambrian or Precambrian rocks, but the response from (an interpreted) Tertiary plug dominates the data in the north-west corner of the survey.

A number of trends have been identified in the data, the most obvious being caused by the arcuate belts of Cambrian volcanic rocks circumjacent to the Tyennan Nucleus. There is little correlation between the interpreted 'linears' and the published faults and structures. One such example is at a large circular feature discernible on some of the processed images. Radiometric data was also produced by the survey. These results have not been integrated with the magnetics in this report, but a brief examination indicates that areas of granite outcrop are well defined and the data may be useful for locating windows in the basalt.

INTRODUCTION

The central northern section of Tasmania, between, and south of, Burnie and Devonport, contains a large number of old mines, workings and prospects for a wide variety of minerals. Although many of the metallic deposits were vein or fissure-controlled and of limited size, there are a number of styles of mineralisation. The area's potential includes gold, tin and tungsten in skarns; volcanogenic and sediment-hosted poly-metallic massive sulphides and fault controlled and/or replacement gold. The area is geologically complex and Collins (1979) suggests that failure to understand and correctly interpret this, may at least partly explain why so few of the old mines achieved a significant production.

It is only in recent years that the area has received any systematic exploration and the aeromagnetic survey discussed in this report gives the first complete coverage of the area. The survey, carried out for the Tasmania Department of Mines as part of their Mt Read Volcanics Project, covers the area between Wynyard (396,000mE) and Badger Head (470,000mE) from the coast south to an irregular line through Western Bluff (approximately 5,392,000mN). Although geological maps at a scale of 1 inch to 1 mile cover the region, the mapping is often old and incomplete and in many areas there is still uncertainty about the structure and rock types underlying the Tertiary and Recent cover. The aim of the survey, which included radiometrics with the aeromagnetics, was to assist the lithological and structural mapping. A regional approach has been taken for this interpretation and although it has been considerably hampered by the Tertiary basalt which covers much of the surveyed area, it is hoped that some contribution has been made to the geological understanding of the area.

GEOLOGY AND EXPLORATION TARGETS

The surveyed area overlaps nine of the Mines Dept's detailed geological sheets (indicated below). All of these, except one (St Valentines), are at the old 1 inch to 1 mile scale. Explanatory notes giving details, for example, of the economic minerals, are available.

BURNIE*	DEVONPORT*	BEACONSFIELD*
ST VALENTINES	SHEFFIELD*	FRANKFORD*
MACKINTOSH*	MIDDLESEX*	QUAMBY*

* explanatory notes available

The dominant lithology is basalt, but the quadrangle contains samples of most of the rock-types found in Tasmania. These range from Precambrian sediments through Cambrian volcanics (including correlates of the highly prospective Mt Read Volcanics), granites and serpentinites plus a wide range of Palaeozoic sediments, to Quaternary glacial deposits and Recent alluvium. The relationships between these various rocks is, in places, complex and everywhere the geology is made more difficult to interpret by the ubiquitous basalt.

To enable a broad understanding of the geology and its relationship with the magnetics, a very simplistic diagram of the major rock types and structure is given in Figure 1. The Tertiary basalt cover and the much less widespread Jurassic dolerite have been 'lifted' from the map and only the dominant lithologies included with some of the major trends. At the southern end of the survey, lies the Tyennan Block of Precambrian sediments. Wrapped around this block, forming a well-defined arcuate shape is a wide (and thick) sequence of Palaeozoic rocks, from Cambrian volcanics to Devonian limestones (the former being a north-eastern extension of the Dundas Trough). In the south-east corner, these form the south-east trending Fossey Mountain Trough. In the north-west corner, a similar suite of rocks forms the north-east trending Dial Range Trough. What happens along the line of contact of these two orthogonal trends is apparently not well understood. Folded Precambrian sediments occur at the north-west (the Burnie Formation) and north-east (the Badger Head Group) corners of the survey, with hinge axes trending north-east and north-west respectively. Metamorphosed to a higher (amphibolite) grade are the Precambrian Forth Metamorphics which lie between the two. To the west of the Badger Head Group sediments, between Devonport and Port Sorell, lies a thick sequence of Tertiary sediments (Longman and Leaman, 1971). These were laid down, together with a number of basalt flows, in the north west trending Cressy Graben (unsuccessfully explored for oil many years ago). On the south west side of the Graben is a Permian basin containing the Mersey Coal Measures and oil shales at Latrobe. On the western side of the survey, there is a large exposure of Devonian granite. This body, the Housetop Granite, is considered to be the origin of the tungsten at the nearby Kara mine as well as being the source of alluvial tin in the area. The intrusion of the other granite shown in Figure 1, the Dolcoath Granite, "was responsible for the extensive mineralisation of the Round Mount and Moina districts" (Jennings, 1979). This mineralisation includes tin, tungsten, bismuth, molybdenum, lead, zinc, silver and gold. At Round Hill, high grade silver-lead deposits with good gold values occur in structurally controlled "soft beds" of the Ordovician Moina Sandstone. At Moina, tin, tungsten, bismuth and molybdenum occur in skarns. In the southern region generally, gold has been mined from skarns, quartz veins and lode deposits.

The Dial Range is another mineralised area which has seen a number of mines; these include iron, copper and silver-lead. All(?) prospect locations with their mineral occurrences are shown in Figure 4. Much of the recent exploration has been for volcanogenic base metal deposits within the Cambrian volcanics which are correlates of the Dundas Group and/or Mt Read Volcanics. There are a number of sites of minor sulphide mineralisation within the volcanics plus other signs of interest such as occurrences of baryte. Other exploration has been directed towards sediment-hosted precious- and base-metal mineralisation and for Renison-style carbonate replacement tin deposits.

There are a number of non-metallic minerals of economic interest within the surveyed area. These include the worked-out coal measures and the less exploited oil shales in the Devonport area. Other minerals include high purity silica, heavy sands and zeolites, as well as the usual construction materials.

SURVEY DETAILS

The aeromagnetic/radiometric survey of North Tasmania was carried out for the Tasmania Department of Mines by Geometrics in November, 1985, using proton precession magnetometers with a stated sensitivity of 0.2nt. Three magnetometers were used; one in the tail 'stinger' and the other two at the wing tips*. The lines were flown north-south and visual positioning was assisted with a doppler navigation system. The nominal line spacing was 500m with tie lines every 20kms#. The nominal terrain clearance was 150m with a sampling interval of 30m. Thus the survey has very similar specifications to the adjacent survey of North-West Tasmania flown by the BMR in 1984 (see Bishop, 1986). Radiometric data was also obtained. A 16.8 litre detector was used and the usual four channels (total count (TC), potassium (K), uranium (U), and thorium (Th)), were recorded.

The data has been processed by Engineering Computer Services (ECS). The magnetics has had the international geomagnetic reference field (1980) subtracted and 2000nt added. To produce a contour map, the data was gridded using a 100m x 100m cell and a filter applied. Examination of the contour map shows a number of 'bad' flight lines; eg, in the north-east and south-west corners. The topography of the area generally is not rugged, but there are a number of steep ranges and valleys as well as some isolated mountains. The altitude records have not been studied, but are expected to show a considerable variation over the survey area. The sections of bad data can be ignored for the regional interpretation, but this is not good enough for detailed work. A better final product should be achievable. The radiometric data was corrected for height, background subtracted and energy stripped for the K, U & Th channels. The survey data has been produced by ECS for the Mines Department in the following form at 1:50,000:-

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* The wing tip magnetometers are used to give a horizontal transverse gradient, which in turn can be used to provide a more accurate contour map. This technique is most applicable for surveys with widely spaced lines. On this relatively detailed survey, there is little difference between the residual magnetic contours and the 'gradient enhanced' magnetics.

Not 10kms as is stated on the maps.

* flight path lines
* total magnetic intensity profiles
* residual magnetic contours
* gradient enhanced magnetic contours
* total count contours

Magnetics and total count contours will also be available at 1:100,000 scale: the former is included as Figure 2 of this report. Located data tapes for all five parameters (magnetics, TC, K, U, Th) are available from the Mines Department which will carry out further data processing if requested.

INTERPRETATION

An interpretation map (Figure 3) has been produced to overlay the 1:100,000 scale magnetic contours. This map outlines the more magnetic areas, some isolated highs, magnetic lineaments and interpreted faults. At the same scale, a second plan (Figure 4) compares the published structures (faults and fold axes) with the interpreted magnetic trends. The strongest anomalies (seen as white or red on the Frontispiece) have been outlined and labelled. The locations of the numerous old mines and prospects are also shown on this plan. This data has then been reduced to 1:250,000 to act as an overlay to the 1:250,000 published geology (Figure 5). The areas of Tertiary basalt and Jurassic dolerite shown on these maps have also been drafted onto Figure 5. The interpretation has been carried out using processed images for trend recognition (some of the images have been reproduced here; all are retained as photographic slides at the Mines Dept and are listed in Table 1) and by overlying the magnetic contours onto the 1:250,000 scale geology. Those sections of the survey covered by Billiton's detailed survey (coverage shown on Figure 4) were examined at 1:63,360 scale. Use has also been made of the available open file reports for exploration licences within the surveyed area. Profiles of four flight lines have been reproduced and interpreted geological cross sections presented with some responses modelled (Figure 10). These profiles have been produced at 1:100,000 scale and although the models are drawn to scale, the depths and thicknesses are generally not quantitative. Only broad lithologies have been identified on the profiles; eg, sedimentary sequences have not been identified within the Cambrian volcanics. The main aim of the profiles has been to illustrate the types of magnetic responses over the different rock types and the variation in response over apparently similar rock types. Some simple modelling has been carried out to suggest possible sizes and, in some cases, attitudes of the sources.

The dominant feature on the magnetic contour plan is the large area of highly variable magnetic response; the typical 'basalt' response. These regions have been outlined from the 1:100,000 scale contours (shown on Figure 3) and reduced down to 1:250,000 for Figure 5. A comparison of the outlines of the magnetic areas with the extent of the basalts and dolerites shows a generally good agreement. Although most of the boundaries are unambiguous, some are not and for many of these the scale used will determine the position of the boundary. That is, in some regions the greater detail evident in the smaller scale (the 1:50,000 maps), separates the apparently uniform variable response at 1:250,000 scale into two or more types. Some discrepancies occur over the Cambrian volcanics and others in the regions of the Devonian granites. These, and some other differences, are further discussed below.

As previously stated, the 'basalt' areas dominate the contour map (Figure 2) and little other detail is evident. Considerably more can be seen in a coloured image such as the one at the front of this report. Specifically, an (?)unexpected large area of elevated values can be seen in the north west corner*. This presentation also shows the structure of the arcuate belt of volcanics in the southern half of the survey. In the north eastern corner, the area of variable response correlates well with the Tertiary basin. The Permian basin immediately to the west and south, corresponds to the 'quiet' (green) area with a deep seated magnetic source beneath the northern section of the basin. The large area of light blue colour along the eastern side of the southern boundary of the survey reflects the non-magnetic nature of the Ordovician sediments. The highs forming the arcuate pattern in the southern half of the survey are mostly due to mafic Cambrian volcanics. These features are discussed in more detail below. In many cases the suggested cause for a particular anomaly could probably be verified by a field visit; unfortunately this has not been done for this interpretation.

LITHOLOGIES

The following magnetic rock types have been recognised within the surveyed area:-

* Tertiary basalt
* Jurassic dolerite
* Devonian skarns
* Cambrian mafic volcanics
* Precambrian metamorphics

Other magnetic rocks include the Cambrian Dove Granite and sections

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* On the Frontispiece, the lowest values are dark blue through blue, green, yellow and red, to white representing the highest values.

of the Devonian Housetop Granite. These responses are further discussed below, together with descriptions of isolated anomalies such as occur over the iron deposits in the Natone area. Effectively non-magnetic lithologies include Permian sandstones and mudstones (and coal measures); Ordovician and Devonian sediments; most of the Devonian granites; some (?most) Cambrian sediments and acid volcanics; and Precambrian metasediments.

TERTIARY BASALT

Tertiary basalt covers much of the surveyed area. It has occurred mostly as a series of flows which filled the existing drainage systems in the then apparently steep topography. In places, eg the Cressy Graben, sediments intercalate with the basalt flows. The magnetic properties (especially the remanence) may be quite different between the different flows. For example, flows with dominant reversed remanence occur at several locations. (These can be seen as blue coloured 'troughs' in the Frontispiece; eg, across the Housetop Granite in the north-west and as a 'T' shaped flow in the south-west.)

Although much of the basalt is thin, giving rise to moderate responses (see profiles in Figure 10), some of the largest anomalies are associated with Tertiary volcanics. The large area of 'white' in the north west corner of the Frontispiece is interpreted as being mostly due to a large Tertiary plug (labelled Camena on Figure 4). Other highs, eg. Castra and (?)Ulverstone may be due to small plugs or thick valley fills. There has been little work done on the magnetic properties of the basalts, but they are mostly of high susceptibility. Oakes (1983) has made some measurements (see Table 2) and states that the strong remanence in the basalts is either parallel or anti-parallel to the earth's present magnetic field and thus a "pseudo-susceptibility may be used in modelling". The 'Camena' plug has been modelled (profile AA') assuming a single source which indicates a large, buried body. (More detailed modelling would allow for a 'feeder' reaching to the surface.)

JURASSIC DOLERITE

Jurassic dolerite occurs extensively on the far eastern side of the survey (on the Launceston 1:250,000 sheet). The magnetic responses are generally more subdued than those over the basalt, but similar in character. (Profiles CC' & DD' in Figure 10 cross some dolerite.) Burns (1964) notes that the dolerite occurs as sills intruding into Permian rocks in the Devonport quadrangle. Leaman (1979) writes that within the Sheffield sheet it "is in the form of small dykes or plugs": some probably fault controlled. The smaller amplitude anomalies over the dolerite may be due to smaller volumes of rock, or more probably, to a lower susceptibility (see Table 2).

DEVONIAN SKARNS

Three separate Devonian granites have been recognised in the survey area. These are the Housetop, the Dolcoath and the Beulah Microgranite. The first covers a large area south of Burnie centred near Upper Natone. It is partially covered by basalt and there are several separate outcrops. A number of skarns have developed within calcareous sequences around the margins of the granite; amongst them, the Kara tungsten mine. The association of the skarns in the Moina area with the Dolcoath Granite is less obvious, but drilling has located the granite at depth in at least some of the deposits. The Beulah Microgranite, intruding Cambrian volcanics, has (?)no associated skarns. Several of the Housetop and Dolcoath skarns are strongly magnetic and can be clearly recognised, when located, as spot highs on the Frontispiece. On Figure 4, some of these responses, plus others, have been identified and labelled. Much of the exploration of these areas has been carried out by Billiton who have found the skarns to have high susceptibilities (some in excess of 0.1cgs; see Table 2). Magnetite is the dominant source of most of the skarn anomalies but some contain significant (magnetic) pyrrhotite. Remanence is usually significant and variable and not in the direction of the earth's present field (Oakes, 1983).

CAMBRIAN VOLCANICS

There are several areas of magnetic responses overlying Cambrian sequences. Some of these, at least superficially, are very similar in character to the typical basalt pattern (eg, Native Track Tier; Profile AA'). Other anomalies are more regular and indicate a deeper source. Several anomalies over Ordovician sediments are most likely caused by underlying Cambrian rocks.

The Dial Range in the north-west of the survey area, which has potential for volcanogenic base metal sulphides and for Renison style replacement deposits, has been flown with a detailed aeromagnetic survey (Large and Sumpton, 1983). Follow up of most anomalies revealed Tertiary basalt as the source, but some anomalies are considered to be due to local equivalents of the Cambrian Dundas Group volcanics; ie, to Motton Spilite and Lobster Creek Volcanics (Herrmann, 1985). The boundaries of this survey and the locations of four 'Venture' anomalies over volcanics are indicated on Figure 4. Investigation of the aeromagnetic anomaly near the old Penguin Ag-Pb mine at the northern end of the Dial Trough also indicated a source within Cambrian volcanics (Ruxton, 1984).

Most, if not all, of the spatially large anomalies in the southern half of the survey are ascribed to Cambrian rocks. In many cases these also have the highest amplitudes; eg, the Wilmot and Lobster Falls anomalies. Source rocks for the Cambrian responses have been recognised as "rhyolitic lavas with magnetite in fractures" (Lake Gairdner: Smyth, 1982), andesites (Lorinna North: Smyth, 1981), tuffs, etc.. Certainly the Cambrian volcanics have a highly variable magnetic response*. Some large amplitude responses; eg, Loyetea and Lorinna North, are in close proximity to Devonian granites and it is probable that the higher magnetite content in these rocks is related to the granite emplacements.

PRECAMBRIAN METAMORPHICS

Precambrian rocks in the Forth-Ulverstone area have been metamorphosed to garnet schists, with some small areas to amphibolite grade. The high amplitude anomalies at Ulverstone and Abbotsham (Figure 4) partially overlie the Tertiary basalt, but are interpreted as being mostly due to the underlying Precambrian, with the Abbotsham anomaly at the foot of a north plunging syncline. The remaining areas of Precambrian -the Burnie Quartzite in the north-west, the Badger Head Group in the north-east and the Tyennan Block to the south -are non-magnetic.

Precambrian metamorphics are the most likely source of the 'Spreyton' and 'Sassafras' anomalies underlying the Permian basin (Figure 4). Several coal bores indicate "quartzite" or "schist" at the bottom of the holes (Burns, 1964) and the Sassafras anomaly is adjacent to unassigned Precambrian (and non-magnetic) quartzites and schists along the Mersey River. The Spreyton response has been modelled in profile DD' (Figure 10), using the intermediate susceptibility of 2000 x 10^{-6}cgs.

OTHER MAGNETIC ROCKS

The Cambrian Dove Granite occurs at three separate sites in the south of the surveyed area. It seems likely that these intrusives join at depth and although the elevated values in the southern central part of the survey, are undoubtedly largely due to the Tertiary basalt, there may be some contribution from the Dove Granite. Investigations over the granite near Liena (Smyth, 1981) have found magnetic sections (to 8000 x 10^{-6}cgs) in a generally non-magnetic background#. The granite has been suggested as the cause of the 'regional' high on profile BB', although other sources such as Cambrian volcanics are also possible. A small area of Cambrian serpentinite has been mapped near the Ulverstone magnetic anomaly. There does not appear to be a coincident magnetic response

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* Vivian (1984) noted that the Gog Range Greywacke had a low susceptibility; the Beulah Formation a high susceptibility and the Minnow Keratophyre volcanics, intermediate values.

The magnetic properties of Tasmania's Cambrian granites are apparently variable; from the strongly magnetic Murchison granite to the weakly magnetic Elliott Bay granite.

over the outcrop, but it can be assumed to have a high susceptibility and may of course be more extensive at depth. There are a number of old iron deposits in the north-west quadrant of the survey. Deposits such as Highclere, Natone and Cuprona have been mapped as hematitic bodies in (?)Cambrian sediments. Other deposits occur within Precambrian sediments. With the possible exception of Cuprona, none of these appear to be strongly magnetic. The Cuprona response is shown on profile AA' where it has been modelled as a vertical dyke-like body. However investigations by Billiton (Banwell, 1981) have found little magnetite in the ironstones and large magnetic responses over Tertiary basalt.

Some of the elevated magnetic values in the north-west corner of the survey occur over a part of the Devonian Housetop Granite. The interpretation shown in profile DD' (Figure 10) suggests a magnetic source (labelled as Cambrian volcanics, but possibly Precambrian metamorphics) beneath a relatively thin section of granite. This interpretation is supported by Sheehan (1969) who interpreted a mushroom shaped intrusion from the gravity data. However magnetically, a thick granitic stock is acceptable with a portion of it magnetic. Investigations by Billiton (Ruxton, 1983) have found that sections of the outcropping granite are magnetic (eg, the 'Housetop' anomaly in Figure 4).

STRUCTURE

The faults and fold axes published on the 1 inch to 1 mile sheets are shown on Figure 4. These show a predominantly north-west trending grain to the area. The magnetic trends interpreted from the aeromagnetic contour plan and processed images have also been drafted onto this Figure. With the exception of the arcuate trends circumjacent to the Precambrian Tyennan Nucleus in the southern section of the survey, very few of these magnetic lineaments were well defined. Some of those within the Tertiary basalt or along an edge of it may reflect features of the Tertiary topography; eg, old river systems or cliffs.

There is little coincidence between the published faults and fold axes and the interpreted linears, however the latter reflect the above-mentioned north-west trend, together with an equally strong north-east trending series of linears. A number of linears in the region of, and subparallelling, the important Bismuth Creek Fault have been interpreted as faults, but most of the others are unspecified. Exceptions are the previously mentioned arcs reflecting the change in strike of magnetic Cambrian sequences. An extension of the Henty Fault, an important structure on the west coast, was sought but not found.

Perhaps the most remarkable structure shown on Figure 4 is the circular feature to the south of the Camena anomaly. This is prominently seen in Figure 8. The feature is over basalt which probably overlies the Housetop Granite. If it is real and not an artifact of the processing, the feature may reflect Tertiary drainage patterns, or more likely some structure within the granite. One could also speculate on a meteorite crater or volcano as the source.

CONCLUSIONS

This report has attempted to relate the magnetic responses to the known geology and, by interpreting the subsurface anomalies, to extend the lithological and structural knowledge of the surveyed area. The interpretation was considerably hampered by the widespread and dominating responses from the Tertiary basalt. Some of these effects were minimised by the various techniques used to produce the processed images (including simple filtering). Billiton have had some success with upward continuation of sections of their data (Hungerford, pers. comm.), allowing them to produce an interpretive sub-basalt geological map. Time did not permit such processing of this data, but it is recommended for any susequent interpretation. Most sub-basaltic sources have been interpreted as being due to Cambrian volcanics, with some contributions from Precambrian metamorphics and Cambrian granite. Magnetic skarns have developed in Ordovician sediments around the Devonian granites, with often increased magnetite content at the margins where Cambrian rocks have been intruded.

This interpretation has not clarified the structure to the south of the Ulverstone Nucleus where the Dundas Trough bifurcates; producing the Dial Range Trough to the north and the Fossey Mountain Trough to the south-east. However it has defined a number of trends in the mineralised areas around the Dolcoath Granite which, at a smaller scale, may have significance for mineralisation. The influence of this granite extends some distance beyond its surface outcrop and skarns and other mineralisation may be sought over a considerable area (as evidenced by the spatial extent of the prospects shown in Figure 4). A detailed interpretation of the magnetics, beyond the scope of this work, should prove most worthwhile in this area.

Not examined here in any detail, but relevant to the geological and structural interpretation, are the radiometric and gravimetric data. A brief examination was made of both sets of data. A 1:100,000 scale map of the total count contours suggests that the areas of granite can be easily recognised and, at a more detailed scale, could perhaps be used to identify windows in the basalt. The gravity data, collected and interpreted by Sheehan (1969) could most usefully be integrated with the aeromagnetic data. In particular, constraints could be placed on the thicknesses of the sections shown in the profiles.

ACKNOWLEDGEMENTS

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J.R. Bishop
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Table 1

LIST OF PROCESSED IMAGES

North Tasmania aeromagnetic survey

Data held as photographic slides at the Department of Mines.

DEVMAG	1.	Raw data (Figure 6 of this report).
DEVMAG	2.	Raw data with pseudocolour added (Frontispiece of this report).
DEVMAG	3.	Shaded relief: azimuth = 0^{o}.
DEVMAG	4.	Shaded relief: azimuth = 45^{o} (Figure 8 of this report).
DEVMAG	5.	Shaded relief: azimuth = 90^{o}.
DEVMAG	6.	Shaded relief: azimuth = 135^{o} (Figure 9 of this report).
DEVMAG	7.	East-west gradient (Figure 7 of this report).
DEVMAG	8.	North-south gradient.

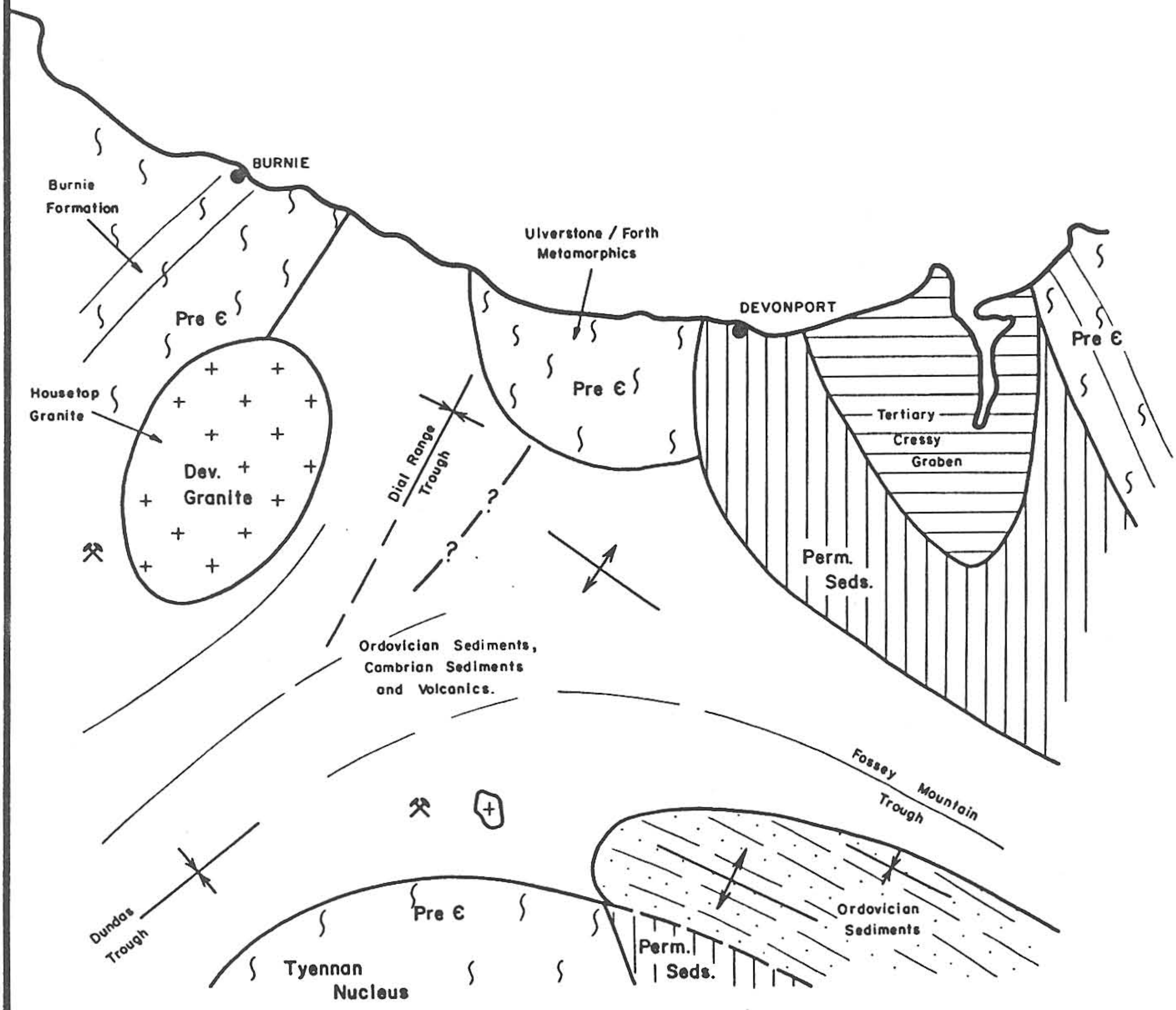
Table 2

MAGNETIC PROPERTIES

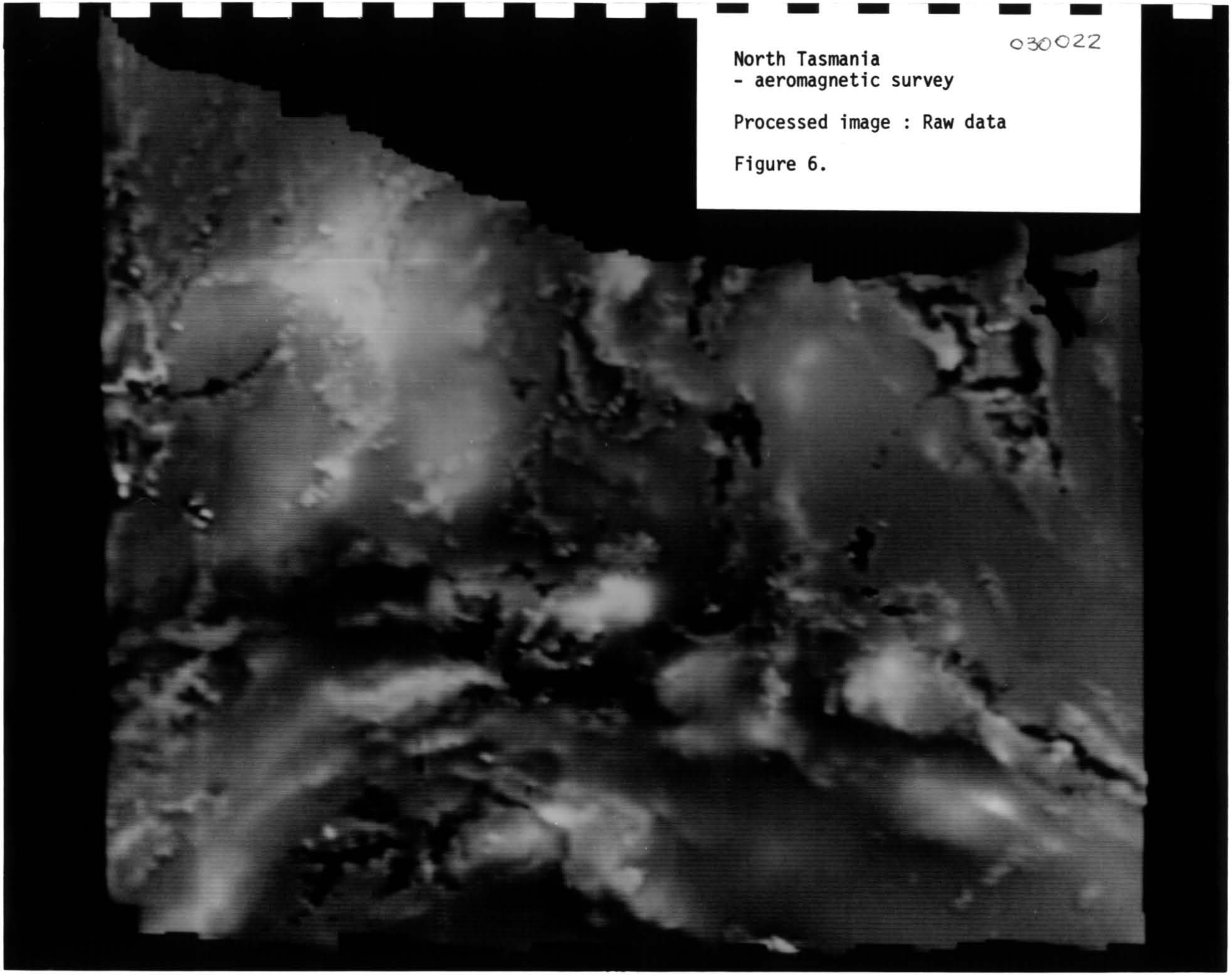
No specific measurements were made for this report, but the following values have been obtained from open file reports, etc. Estimates used for modelling have been given where no other values have been found. The magnetic properties of most of the major rock types in western Tasmania will be given in Hudspeth (1987).

ROCK TYPE	MAGNETIC SUSCEPTIBILITY X 10^{-6}cgs	KOENIGSBERGER RATIO	REFERENCE
Tertiary basalt	15000- 20000	71	Lawton, 1982.
	200- 300		Oakes, 1981.
	110- 4300	1 - 71 (often reversed)	Clark, 1985.
	200- 800	>1	Oakes, 1983.
	200- 400		Banwell, 1981.
	330- 4760	6 - 27	Ruxton, 1984.
Devonian granite	<100		Oakes, 1981.
	7	<.01	Clark, 1985.
	200- 1500		Oakes, 1983.
	10000		Ruxton, 1984.
Devonian skarns	18000-100000		Oakes, 1981.
	27000-303000	0.4-14	Clark, 1985.
	40000- >100000	4.7-5.9	Oakes, 1983.
Cambrian volcanics	2000- 4000		Oakes, 1983.
	2000- 15000		Banwell, 1981.
	200- 3000 (background)		" "
Cambrian granite	3000- 8000		Smyth, 1981.
	200- 400 (background)		" "
Precambrian metamorphics	0- 2000		values used for modelling only; no measurements made.
Ironstones	50- 45000		Banwell, 1981.
	50- 100		" "

030021



TASMANIA DEPARTMENT OF MINES	
NORTH TASMANIA AEROMAGNETIC SURVEY	DRAWN BY : J.B.
	DRAFTSMAN : T.G.D.S.
	DATE : Feb. '87
OUTLINE OF GEOLOGY	REVISIONS :
	FILE NO.
Ref. MD/MG87/02	FIG. 1

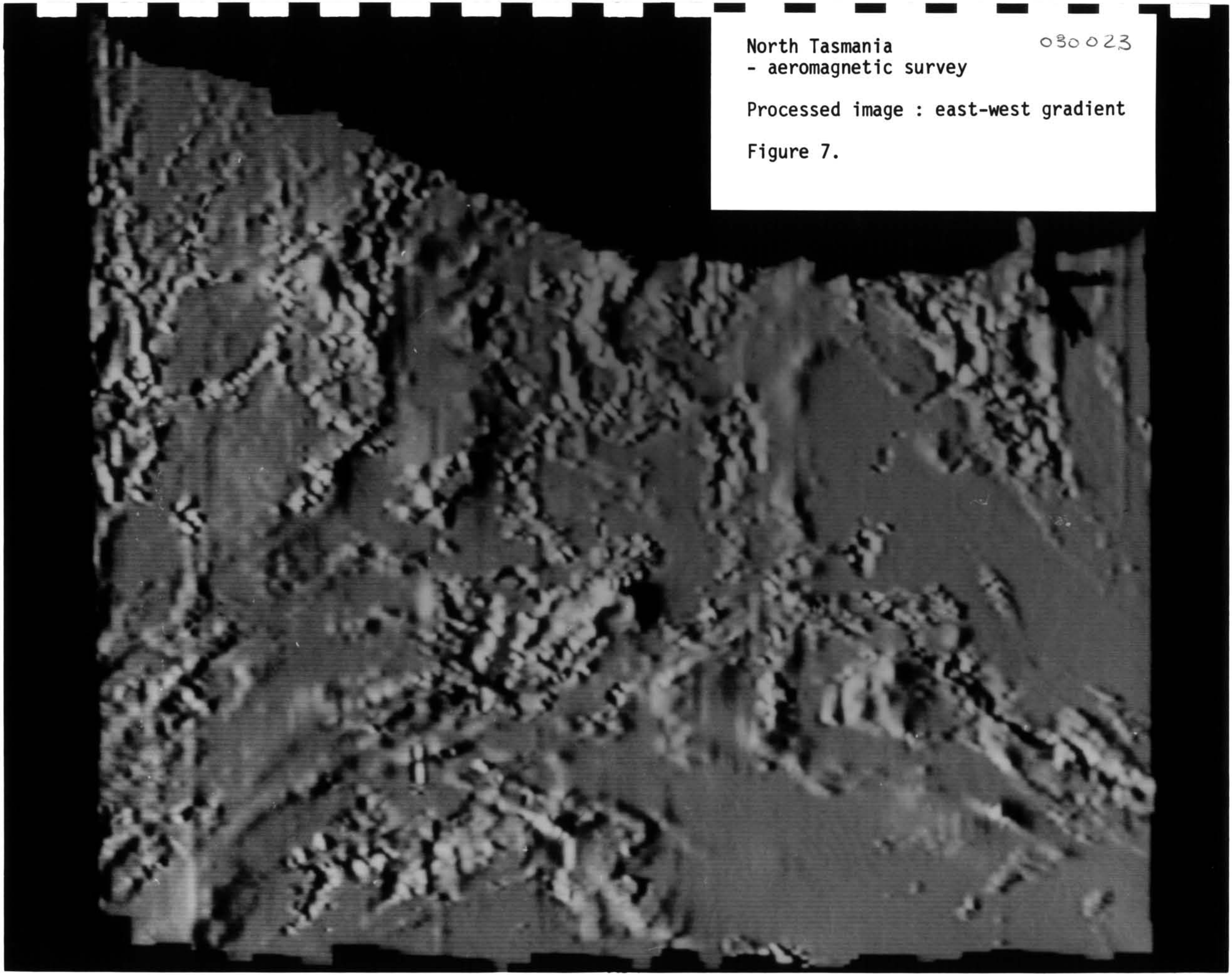


030022

North Tasmania
- aeromagnetic survey

Processed image : Raw data

Figure 6.

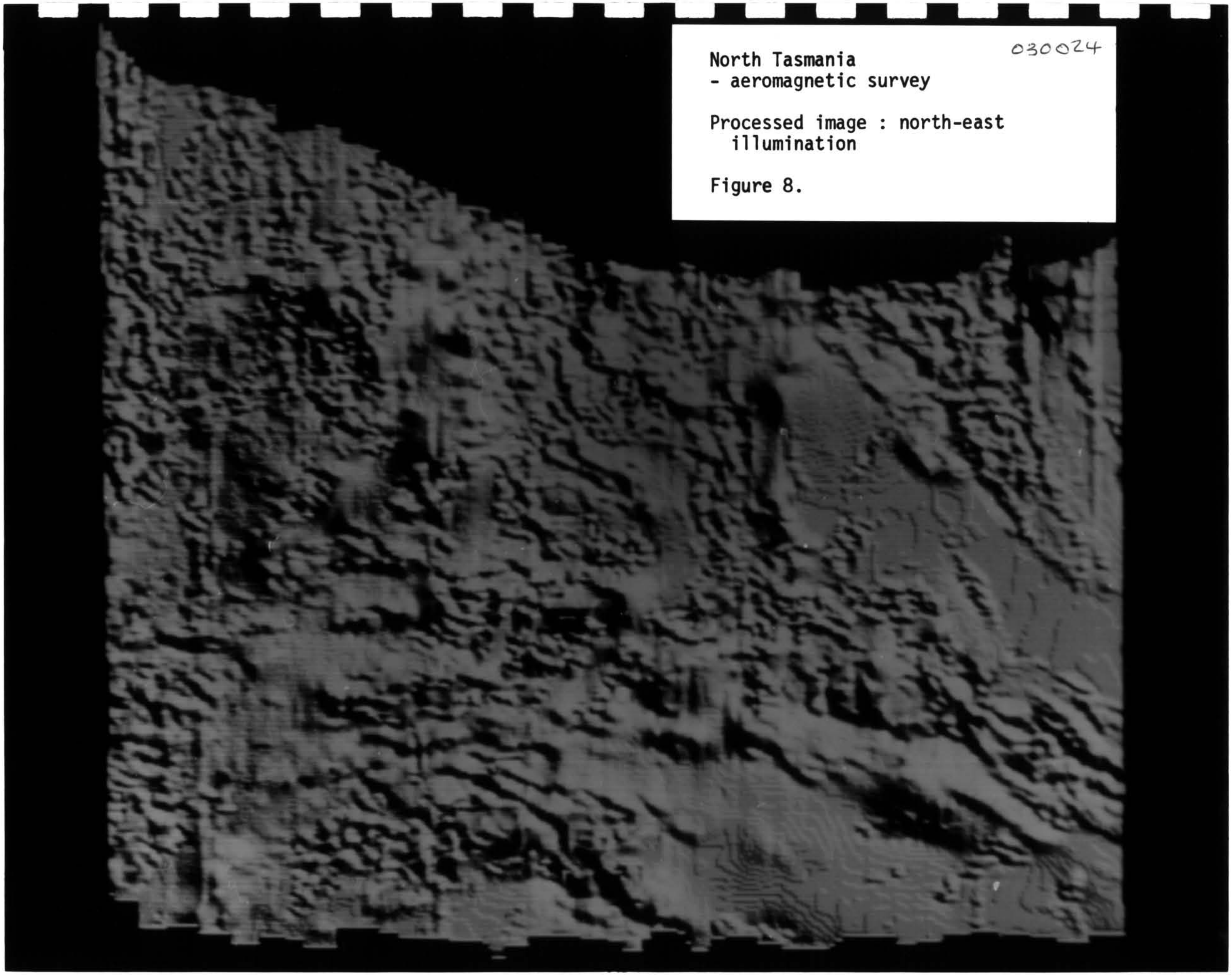


North Tasmania
- aeromagnetic survey

030023

Processed image : east-west gradient

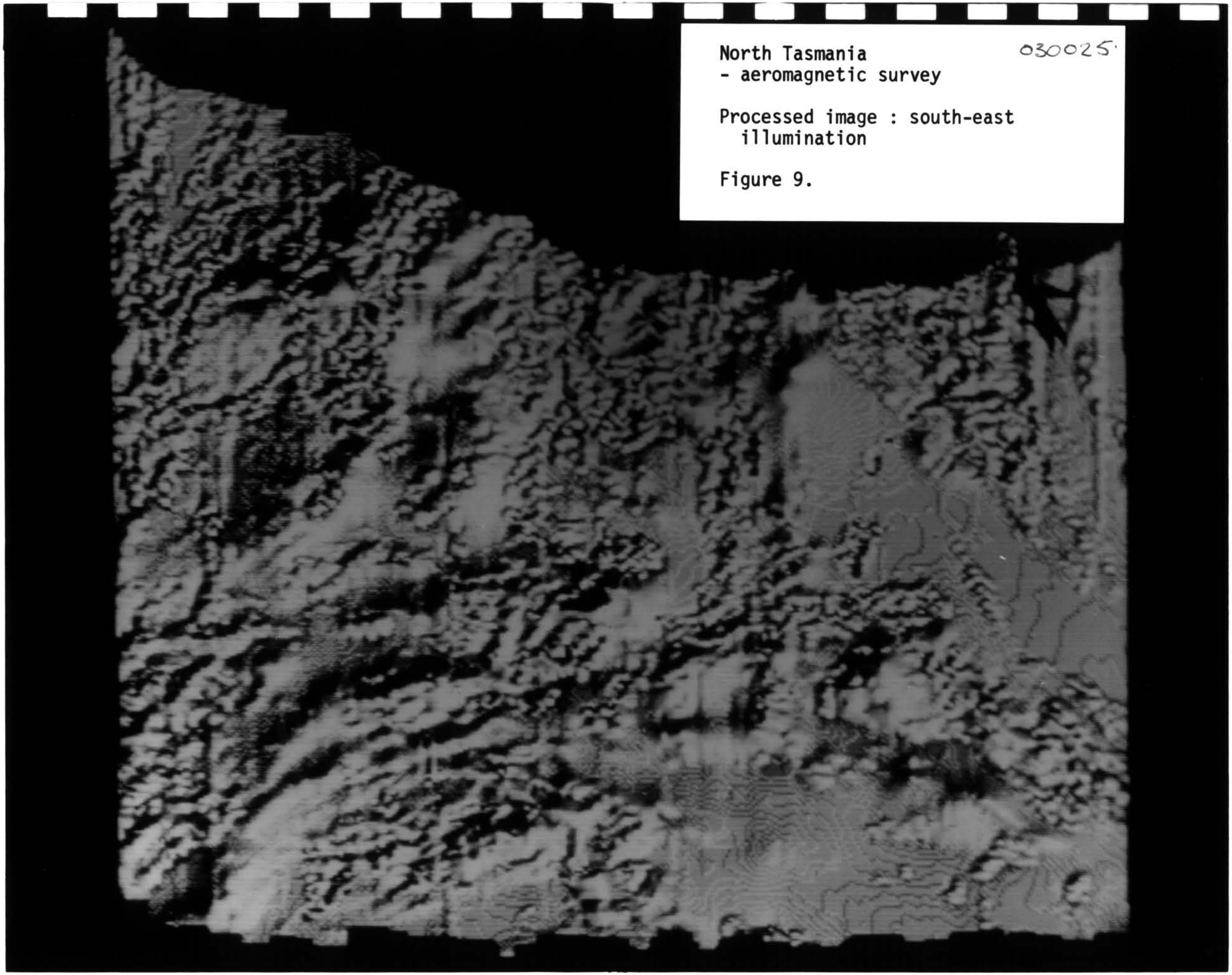
Figure 7.



North Tasmania
- aeromagnetic survey

Processed image : north-east illumination

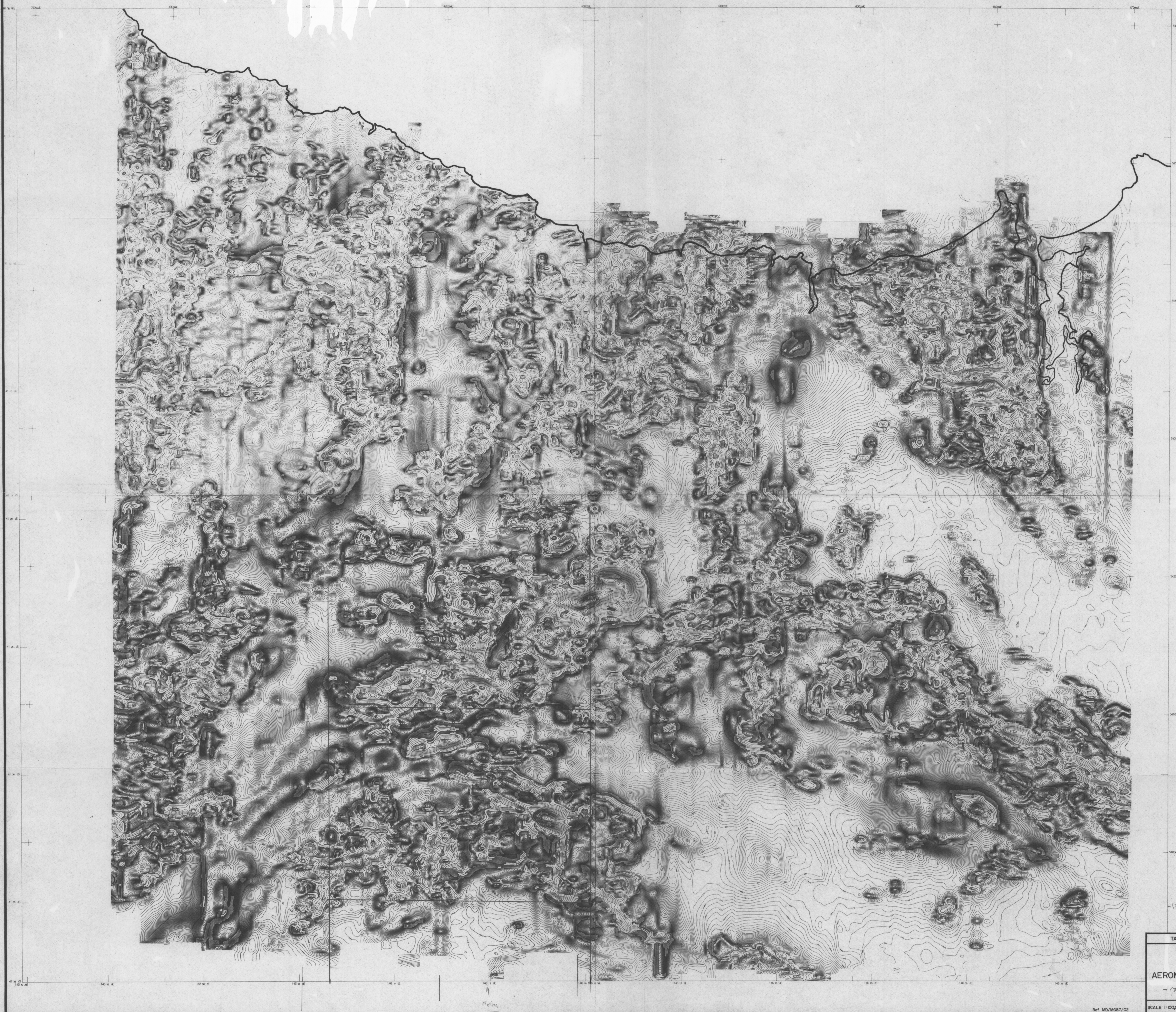
Figure 8.



North Tasmania 030025
- aeromagnetic survey

Processed image : south-east illumination

Figure 9.



AIRBORNE SURVEY SPECIFICATIONS

MAGNETOMETER : 3 G-813 proton precession magnetometers in tail stinger and wing tips. Sensitivity : 0.2 nT
RECORDING INTERVAL : 30m sampling

SPECTROMETER : GR - 800 gamma ray spectrometer Volume : 16.8 litres
TOTAL COUNT WINDOW : 0.8 - 3.00 MeV
POTASSIUM WINDOW : 1.36 - 1.56 MeV
URANIUM WINDOW : 1.66 - 1.86 MeV
THORIUM WINDOW : 2.42 - 2.82 MeV
RECORDING INTERVAL : 60m sampling

DATA RECORDING : Geometrics 714 acquisition system. Digital to magnetic tape.
NOMINAL TERRAIN CLEARANCE : All detectors in aircraft at 150m.
NOMINAL LINE SPACING : Traverse lines 500 metres. Tie lines 10 km.
FLIGHT PATH RECORD : continuous tracking colour video.
FLIGHT LINE RECOVERY : Visually to 1:100,000 mosaics with Doppler interpolation between recovered points

RESIDUAL MAGNETIC CONTOURS
Grid notation refers to Australian Map Grid Zone 55
Digitised from mosaics at 1:100000

Magnetics : Tie Line Levelled.
IGRF (1980) : Updated to November 1985
IGRF (1980) : Removed. Datum 2000 nT added
Grid mesh size : 100 x 100 metres
Grid filter : Polynomial, radius 150 metres
Contour Interval 5,10,50,100 and 200 nT

Survey by : Geometrics
Date : November 1985

030026

5 cm

TASMANIA DEPARTMENT OF MINES

NORTH TASMANIA

AEROMAGNETIC SURVEY

DRAWN BY	: J.B.
DRAFTSMAN	: T.G.D.S.
DATE	: Feb. '87
REVISIONS	:
FILE NO.	
FIG.	2

SCALE 1:100,000 — KILOMETRES

TASMANIA DEPARTMENT OF MINES

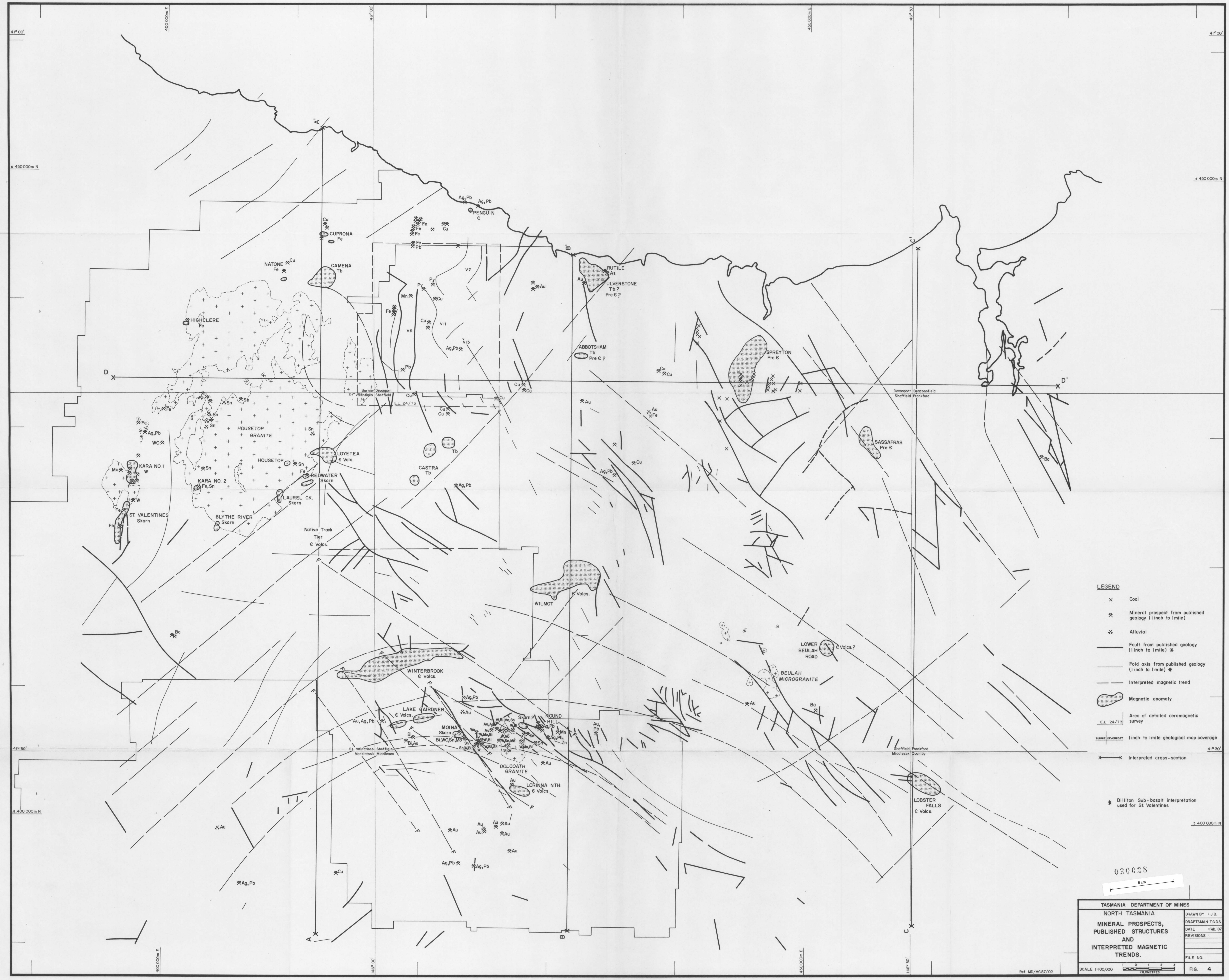
NORTH TASMANIA

INTERPRETATION OF THE AEROMAGNETIC SURVEY

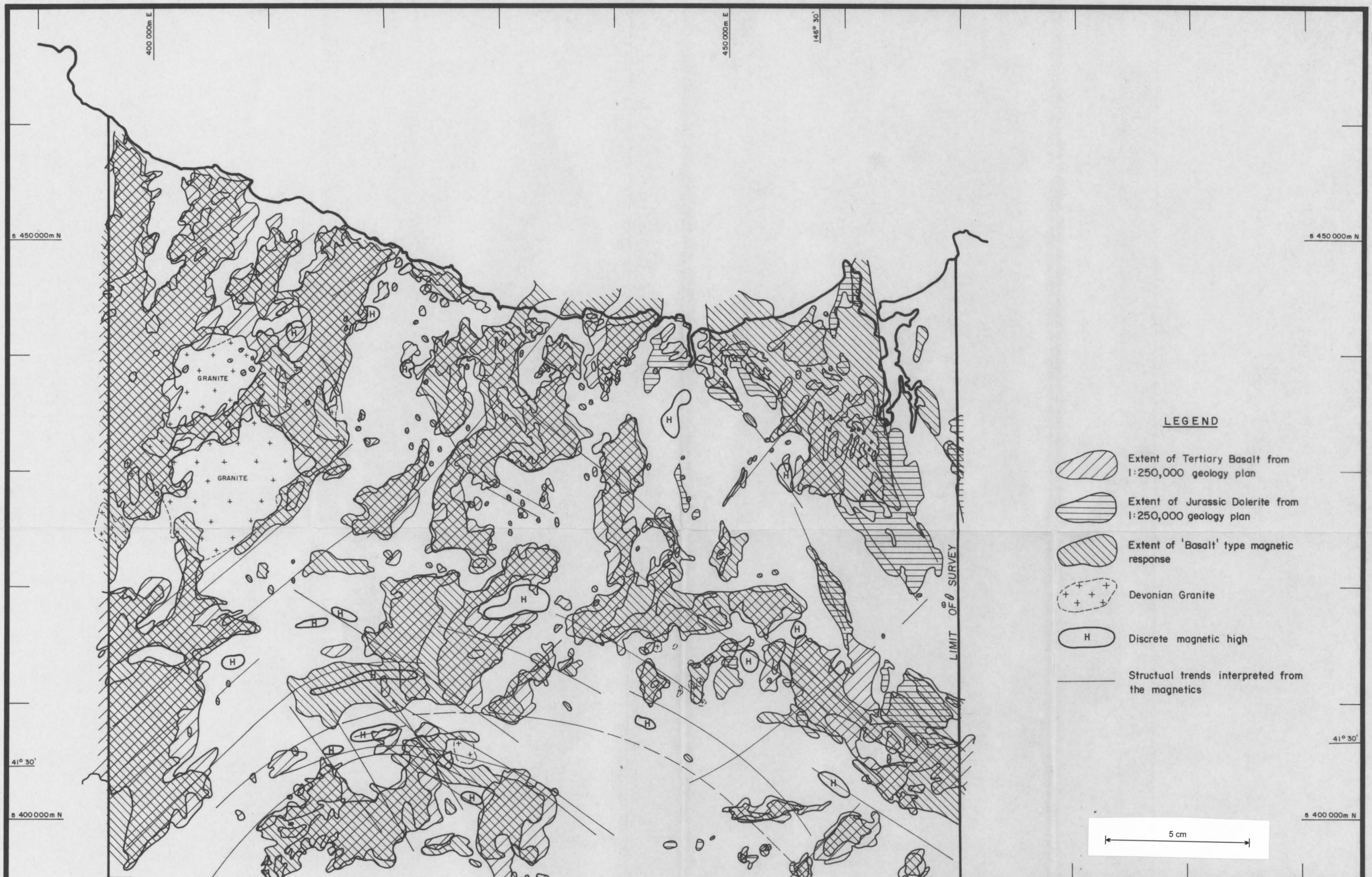
DRAWN BY : J.B.
DRAFTSMAN: T.G.D.S.
DATE : Feb. '87
REVISIONS :
FILE NO.

SCALE 1:100,000 (1 0 1 2 3 KILOMETRES)

FIG. 3



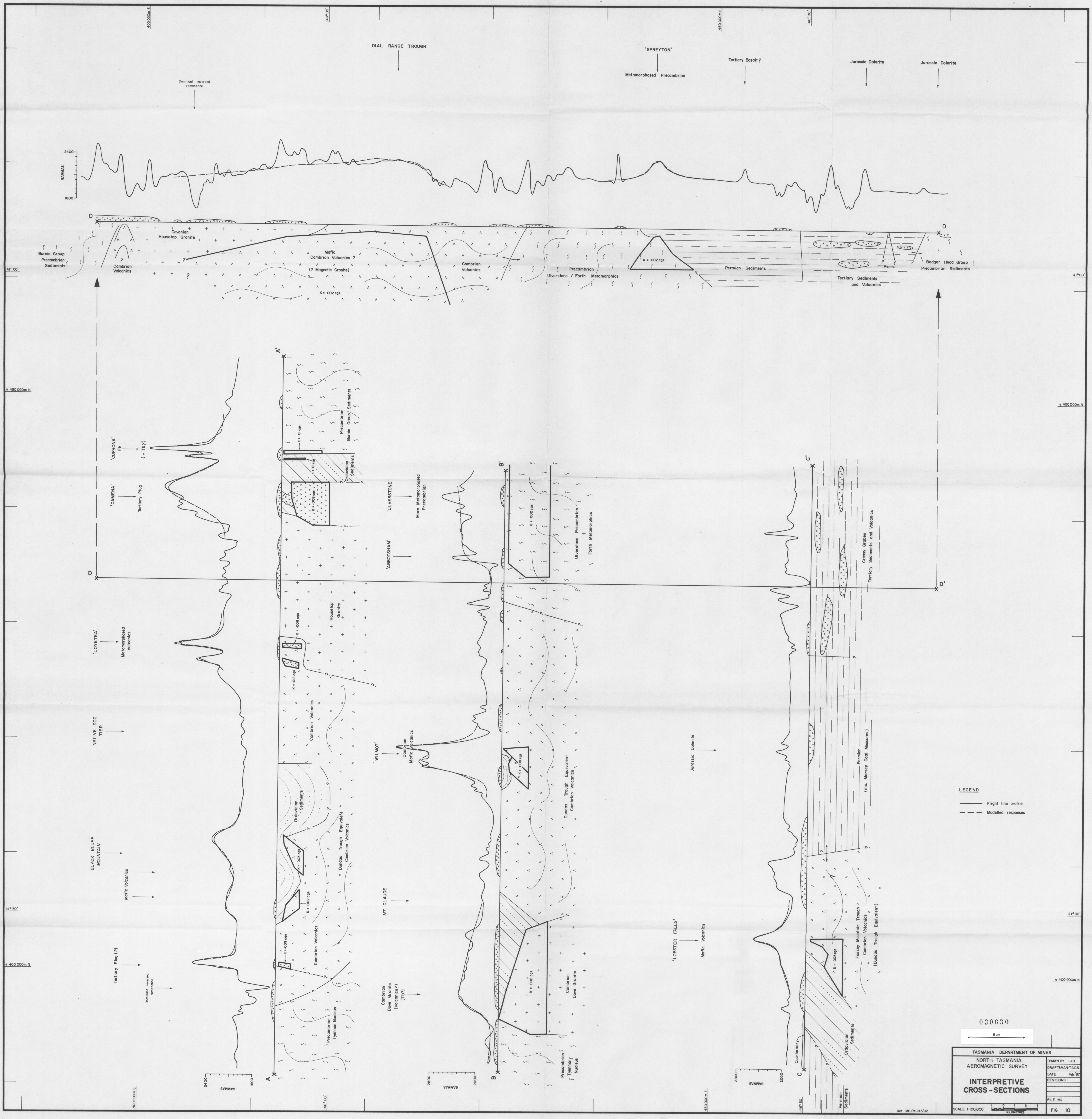
CUPRONA Fe
NATONE Fe
CAMENA Tb
PENGUIN €
HIGHCLERE Fe
HOUSETOP GRANITE
HOUSETOP
LOYETEA € Volc.
REDWATER Skarn
KARA NO. 1 W
KARA NO. 2 Fe, Sn
LAUREL CK. Skarn
ST. VALENTINES Skarn
BLYTHE RIVER Skarn
Native Track Tier € Volcs.
CASTRA Tb
RUTILE As
ULVERSTONE Tb ? Pre € ?
ABBOTSHAM Tb Pre € ?
SPREYTON Pre €
SASSAFRAS Pre €
WILMOT € Volcs.
LOWER BEULAH ROAD € Volcs.?
BEULAH MICROGRANITE
WINTERBROOK € Volcs.
LAKE GAIRDNER € Volcs.
MOINA Skarn
ROUND HILL
DOLCOATH GRANITE
LORINNA NTH. € Volcs.
LOBSTER FALLS € Volcs.
E.L. 24/73
Burnie Devonport
St. Valentines Sheffield
Devonport Beaconsfield
Sheffield Frankford
St. Valentines Sheffield
Mackintosh Middlesex
Sheffield Frankford
Middlesex Quamby
A A' B B' C C' D D'
41°00'
41°30'
146°00'
146°30'
400 000m E
450 000m E
5 450 000m N
5 400 000m N
LEGEND
Coal
Mineral prospect from published geology (1 inch to 1mile)
Alluvial
Fault from published geology (1 inch to 1mile) *
Fold axis from published geology (1 inch to 1mile) *
Interpreted magnetic trend
Magnetic anomaly
Area of detailed aeromagnetic survey
E.L. 24/73
BURNIE DEVONPORT
1 inch to 1mile geological map coverage
Interpreted cross-section
* Billiton Sub-basalt interpretation used for St. Valentines
030028
5 cm
TASMANIA DEPARTMENT OF MINES
NORTH TASMANIA
MINERAL PROSPECTS, PUBLISHED STRUCTURES AND INTERPRETED MAGNETIC TRENDS.
DRAWN BY : J.B.
DRAFTSMAN : T.G.D.S.
DATE : Feb. '87
REVISIONS :
FILE NO.
SCALE 1:100,000
1 0 1 2 3
KILOMETRES
FIG. 4
Ref. MD/MG 87/02



TASMANIA DEPARTMENT OF MINES	
REDUCED INTERPRETATION PLAN OF THE NORTH TASMANIA AEROMAGNETIC SURVEY	DRAWN BY : J.B. DRAFTSMAN: T.G.D.S. DATE : Feb. '87 REVISIONS : FILE NO.
SCALE 1:250,000 — 2 0 2 4 6 8 KILOMETRES	FIG. 5

Ref. MD/MG87/02

030029


DIAL RANGE TROUGH
'SPREYTON'
Metamorphosed Precambrian
Tertiary Basalt ?
Jurassic Dolerite
Jurassic Dolerite
Dominant reversed remanence
2400
1600
GAMMAS
Burnie Group Precambrian Sediments
Cambrian Volcanics
Devonian Housetop Granite
Mafic Cambrian Volcanics ?
(? Magnetic Granite)
K = ·002 cgs
Cambrian Volcanics
Precambrian Ulverstone / Forth Metamorphics
Permian Sediments
Tertiary Sediments and Volcanics
Perm.
Badger Head Group Precambrian Sediments
'CUPRONA' Fe (+ Tb ?)
'CAMENA' Tertiary Plug
'ULVERSTONE' More Metamorphosed Precambrian
'ABBOTSHAM'
'LOYETEA' Metamorphosed Volcanics
NATIVE DOG TIER
BLACK BLUFF MOUNTAIN
Mafic Volcanics
Tertiary Plug (?)
Dominant reversed remanence
Precambrian Burnie Group Sediments
Ordovician Sediments
Housetop Granite
Cambrian Volcanics
Ordovician Sediments
Dundas Trough Equivalent Cambrian Volcanics
Precambrian Tyennan Nucleus
'WILMOT' Cambrian Mafic Volcanics
MT. CLAUDE
Cambrian Dove Granite (Volcanics ?) (Tb ?)
Ulverstone Precambrian + Forth Metamorphics
Dundas Trough Equivalent Cambrian Volcanics
Cambrian Dove Granite
Precambrian Tyennan Nucleus
Jurassic Dolerite
'LOBSTER FALLS' Mafic Volcanics
Cressy Graben Tertiary Sediments and Volcanics
Permian (inc. Mersey Coal Measures)
Fossey Mountain Trough Cambrian Volcanics (Dundas Trough Equivalent)
Ordovician Sediments
Quaternary
Permian Sediments
LEGEND
Flight line profile
Modelled responses
030030
5 cm
TASMANIA DEPARTMENT OF MINES
NORTH TASMANIA AEROMAGNETIC SURVEY
INTERPRETIVE CROSS-SECTIONS
DRAWN BY: J.B.
DATE: Feb. '87
REVISIONS:
FILE NO.
SCALE 1:100,000
FIG. 10
Ref. MD/MG87/02