9. REGIONAL SECTIONS NORTH FLINDERS ISLAND

Three regional sections were proposed across the northern half of Flinders Island in order to suggest the origin of the various anomaly patterns and, in particular, to test if possible thrust slices containing ultramafics were responsible for the general rise in the magnetic field in the centre of the island. This can be seen in images, Figures 38 and 39.

The three sections selected are located at 5574 415, 5585 020 and 5595020 mN and termed 9FLINDA, 9FLINDB, 9FLINDC in the models below.

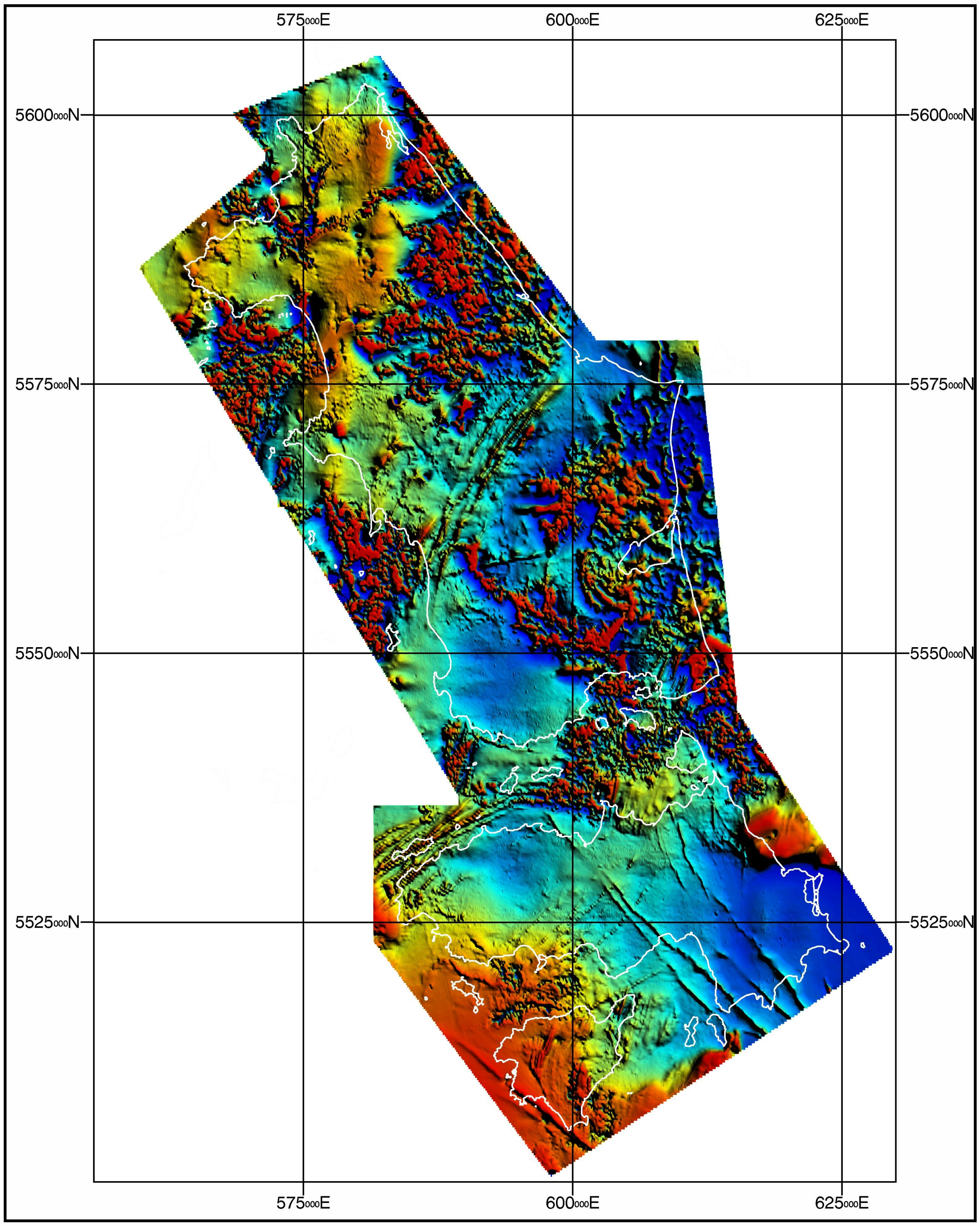


Figure 38. Image of Total Magnetic Field Intensity, Flinders Island.

The magnetic map of Flinders and surrounding islands displays many interesting features. It will be noted that the island is bisected in magnetic character by three “dykes” and that the magnetic field is generally of higher intensity to the north than the south. The northern character is not unlike the character east of Blue Tier or south of Bridport. The southern character is quite distinct. In other areas the underlying increase in field intensity has been found due to the presence of ultramafics at considerable depth and this possibility has been tested here for North Flinders Island. If the concept is supported by analysis then it would suggest that such materials are absent beneath South Flinders Island and that the small dyke group occupies a structurally important location. Previous modelling (as for Long Island) indicates that the dykes are probably not intensely magnetised and may be related to the lamprophyric set.

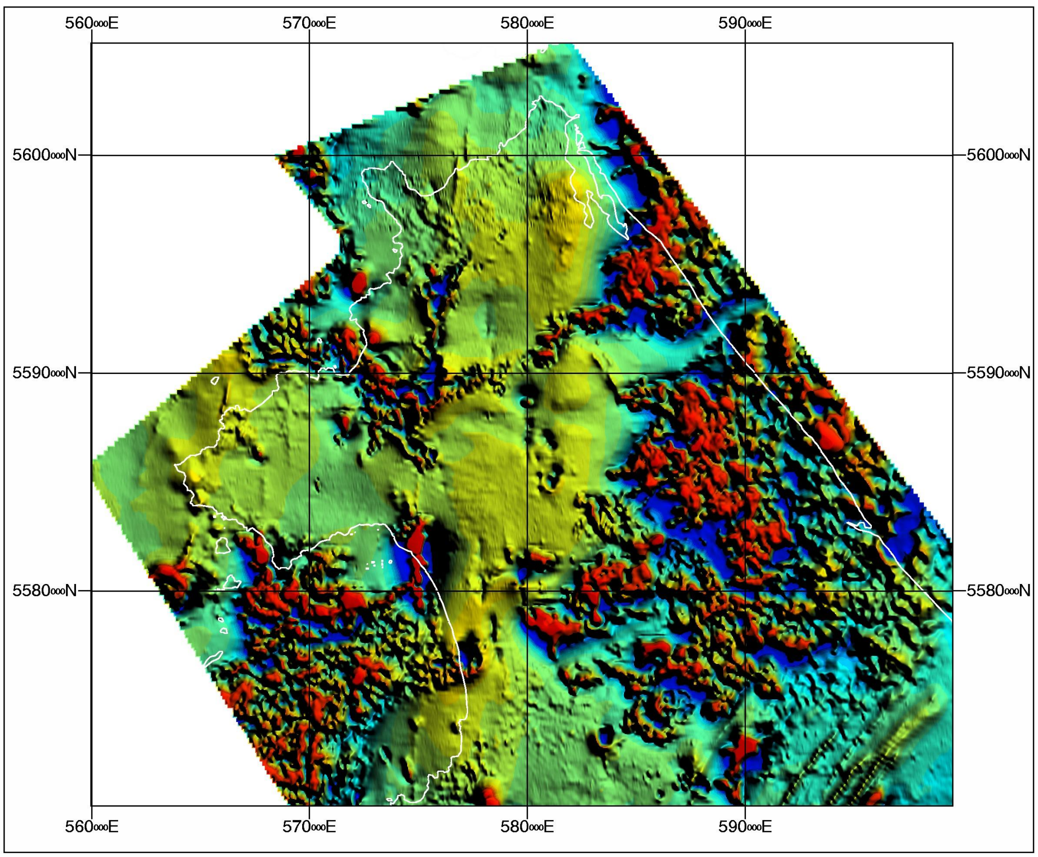


Figure 39. Image of Total Magnetic Field Intensity, Northern Flinders Island.

Much of the speckled character evident in the images can be directly correlated with the presence of Tertiary basalts, or inferences about their concealed extension. Some filled drainage systems are indicated.

Modelling has confirmed these suggestions, and the regional character of the field is consistent with the existence of ultramafic slices at considerable depth. At least two such slices are present but the field and the interpretation of them is largely unconstrained since no surface elements are known which can limit some lateral relationships.

Models for 9FLINDA, at 5574 415 mN, (line 103670, from 566 500 mE to 599 900 mE),include the effect of a deep mafic body but the predominant features are related to basalt at very shallow, but variable, depth. No attempt has been made to fully evaluate the contrasts or thickness of basalt but it is rarely more than 50 metres thick and must outcrop (or nearly outcrop) in many locations. The average contrast of the basalt exceeds 0.013 SI.

Modelling (see Figure 40) also suggests that a suite of more subtle features is located at the eastern end of the profile. These have dyke-like anomalies of low amplitude and are probably due to felsic material or alteration zones within underlying granites. These are deeply weathered (30 to 70 metres) and have contrasts in the range 0.0013 to 0.0039 SI – as noted for similar features at Long Island.

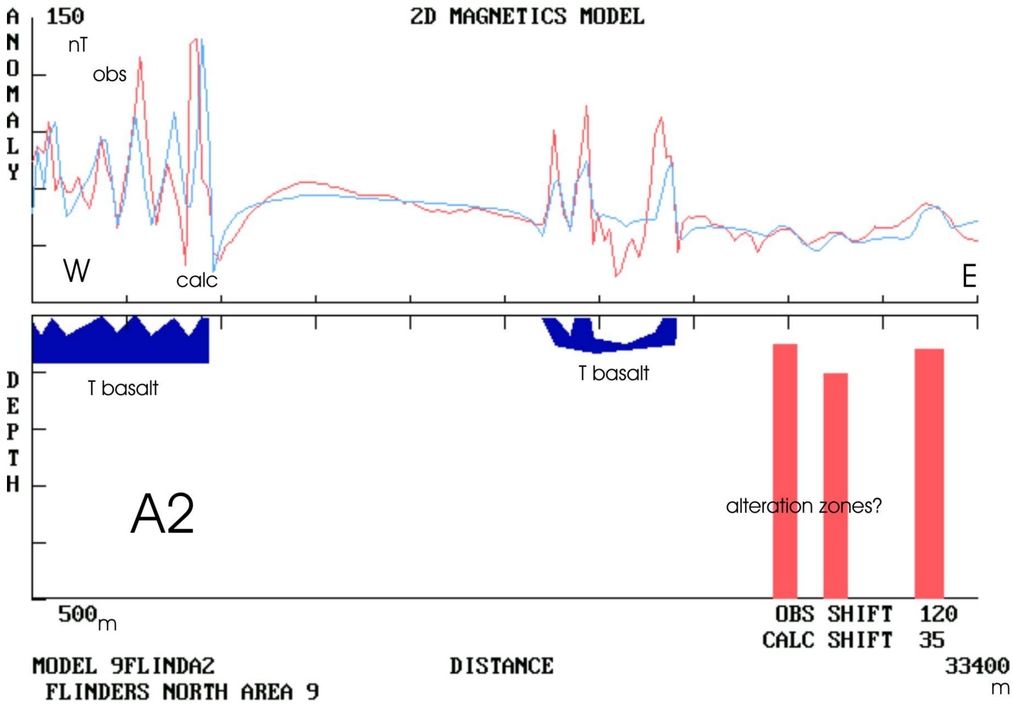
The overall form of the magnetic profile, however, is determined by the presence of thin slices of ultramafics which dip shallowly to the east. It is not possible to reliably estimate the depth of this body.

Models for line B (line 104200, 5585 020 mN from 560 000 to 597400 mE) show the entire set of magnetic relationships (Figure 41). Version B1 shows the effect of ultramafics in isolation while the detail from B2 shows the effect of all sources. Due to the minor nature of the shallow materials and their limited depth range, model B2 shows only the shallow features and a projection of the presence of the underlying ultramafics. The implied magnetic susceptibility or contrast of the ultramafics interpreted in all three lines is in the range 0.04 to 0.16 SI. The detailed fit of the volcanic-sourced section of the profile depends on the considerable variations in depth and contrast (including weathering) within the shallowly concealed flows.

The model includes an alteration(?) zone near Cape Frankland. This may be a thick felsic dyke, or a relatively non magnetic mafic dyke - given implications at Long Island.

Models for line C (line 104700, at 5595 020 mN from 570 000 to 590 000 mE) are a limited length variation of the longer southern lines, but quite consistent with them (Figure 40). No attempt has been made to account for all the variations in the magnetic field due to the range of properties or depth to Tertiary basalts.

The models demonstrate that most of the magnetic character in the northern half of Flinders Island is due to variations in the Tertiary basalt drainage fills, but that these effects are superimposed on, and swamp, the underlying effect of east-dipping slices of structurally controlled ultramafics. The mafic rocks at depth account for the modest bulge in the intensity of the magnetic field in the region.



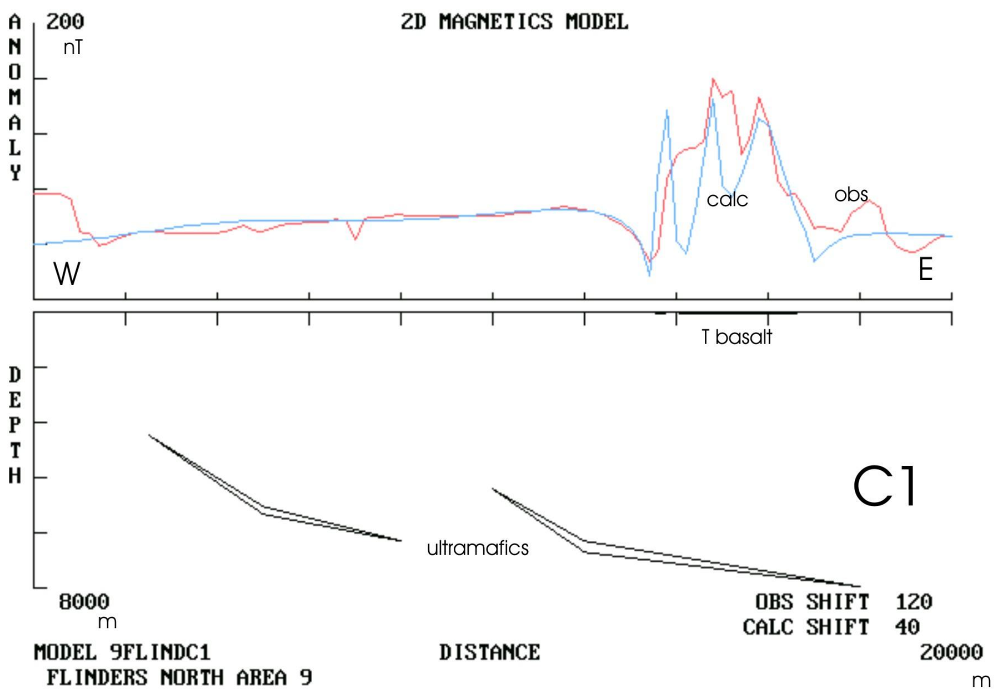


Figure 40. Models for North Flinders Island data lines 9FLINDA and C.
The models indicate the magnetic dominance of shallow Tertiary lavas but the underlying anomaly is regionally significant and requires thin slices of intensely magnetised material at depths of the order of 5 km or more.

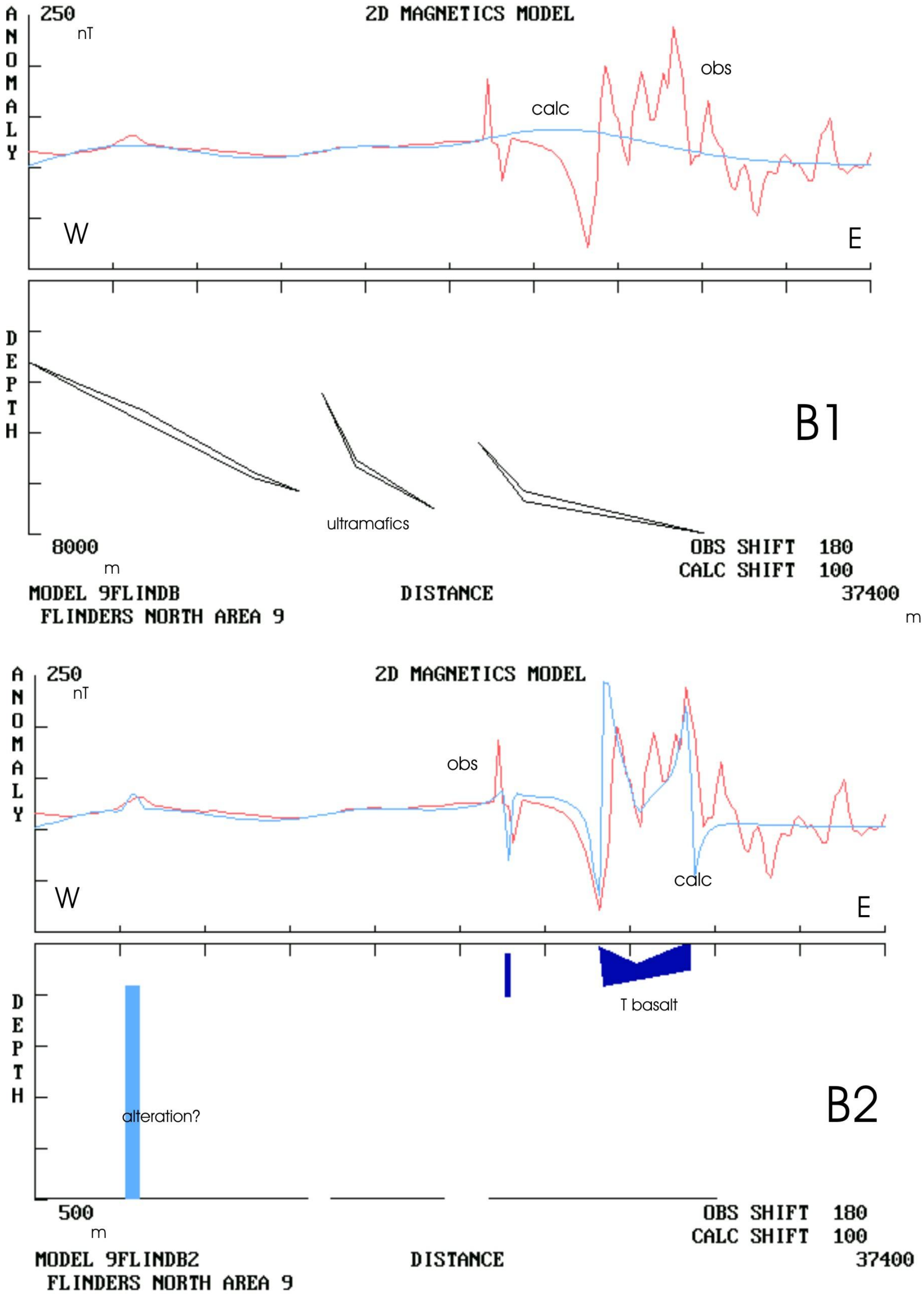


Figure 41. Models for North Flinders Island data lines 9FLINDB.
The models (shown in a regional full scale context – upper; detail of near surface portion – lower) indicate the magnetic dominance of shallow Tertiary lavas, modestly magnetised mafic dykes or altered zones near surface (lower diagram) but the underlying anomaly is regionally significant and requires thin slices of intensely magnetised material at depths of the order of 5 km or more (as shown in the upper diagram).

10. ALTERATION/DYKE? TEXTURE NORTH OF LADY BARRON

Pronounced trends have been observed in the magnetic field north and east of Lady Barron. Modelling of similar features in northeast Tasmania and on Long Island, off Cape Barren Island, has suggested that some of these may be dolerite dykes, whilst others may be felsic dykes or alteration zones. The group of structures shown in Figure 42 is relatively isolated but does present NNE trend patterns comparable to those found elsewhere.

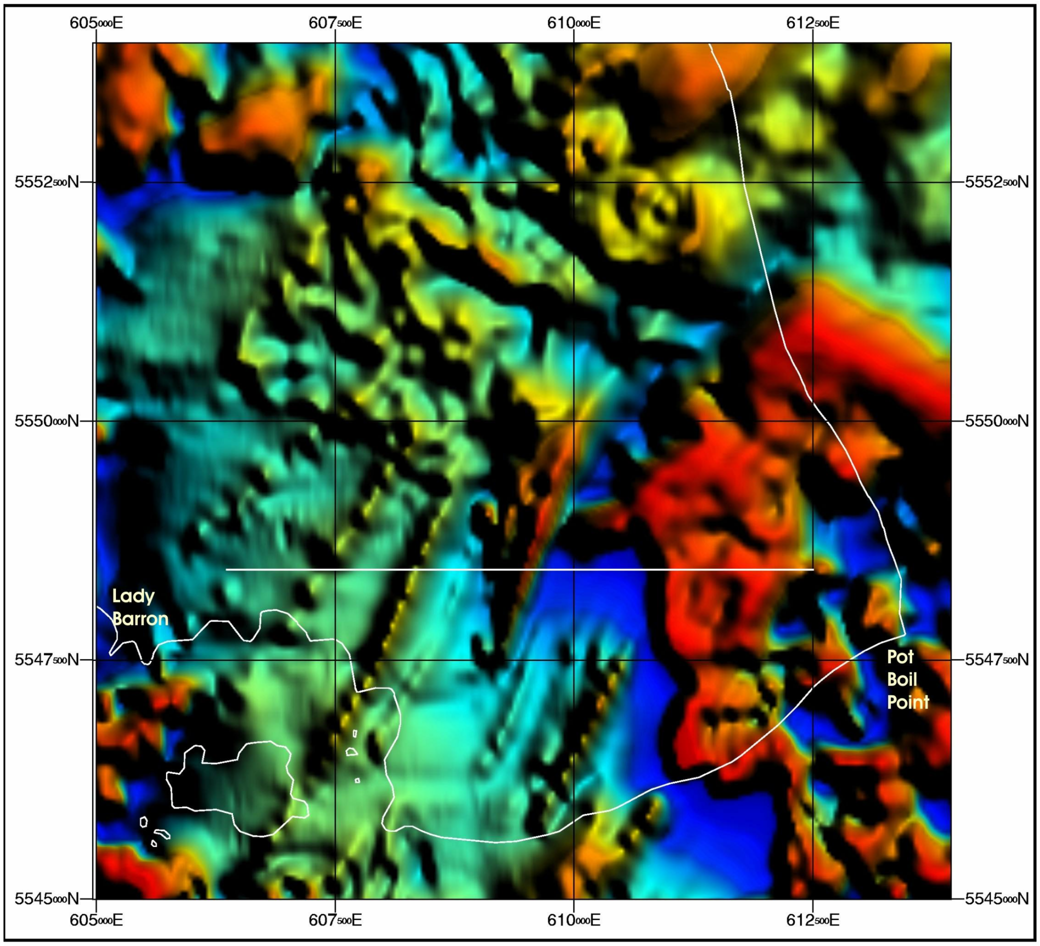


Figure 42. Image of Total Magnetic Field Intensity, northeast Lady Barron.

The dyke or alteration character has limited continuity and is lost within the disturbed magnetic field of the Tertiary volcanics in the north of the sampled area. The elevated magnetic field intensity close to Pot Boil Point is distinctive. There is evidence of the basaltic signature of the Tertiary volcanics but this is overprinted on a more regional effect. The western boundary of the change in magnetic character is marked by an elevated response consistent with boundary alteration. It is unlikely to be due to a filled channel deposit, including lavas, given the presence of volcanic patterns and a regional effect bounded by the change. The contoured version of the data (Figure 43) emphasizes the distinct character change in a manner that the image cannot.
Both types of magnetic feature have been assessed in the indicated profile.

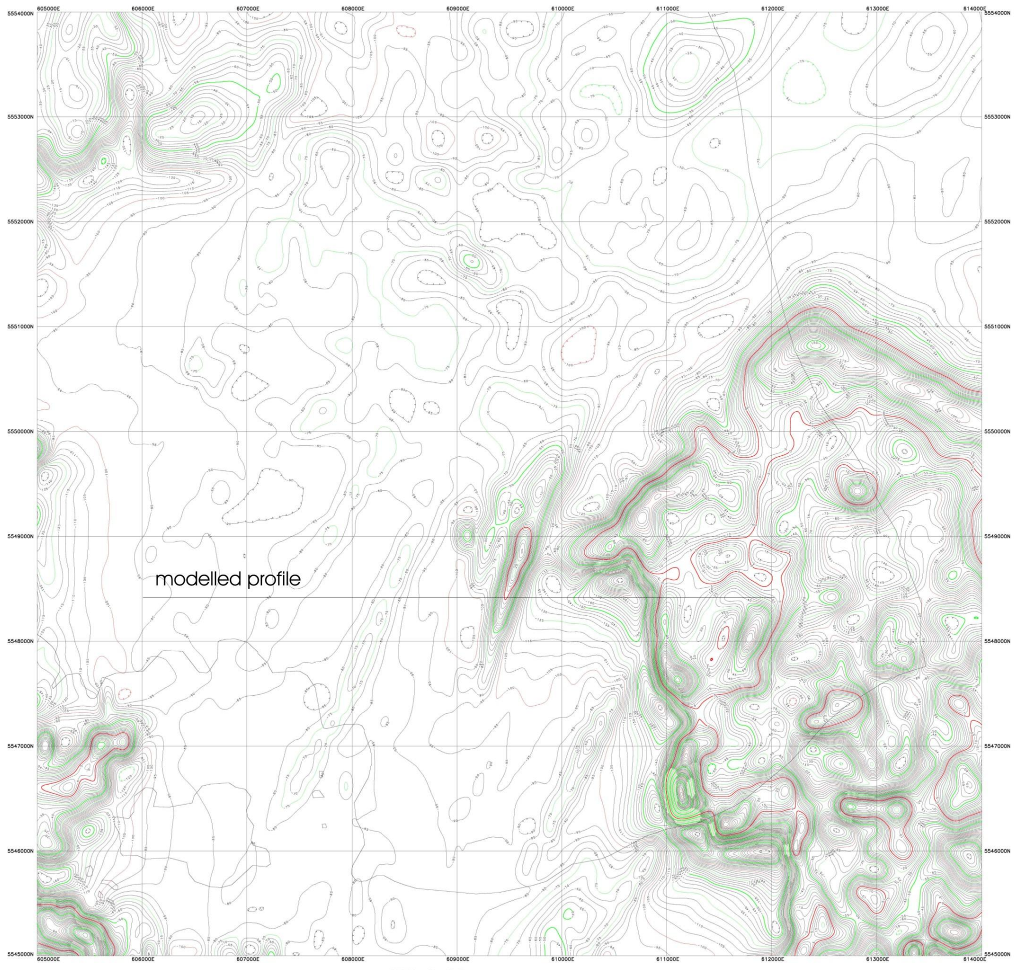


Figure 43. Contour presentation of Total Magnetic Field Intensity east of Lady Barron. The major anomaly near Pot Boil Point is evident, as is the strong gradient and anomaly ridge which forms the margin of the anomaly. This presentation places in context the character due to Tertiary volcanics, dykes, and another major regional source.

One observed profile has been modelled across these structures and the result is presented in Figure 44.

Analysis suggests that two subtly magnetised alteration zones (0.0013, 0.0025 SI) occur west of Lady Barron and that something much more magnetic (0.016 SI) occurs mid section (~609 500 mE). All features are shown in this model as the thick, low contrast solution and proportional changes similar to those defined at Long Island may be made to the interpretation. The anomaly, mid section, clearly represents a more magnetic version of the material, or has greater depth range. None of these alternatives can be separated with existing geological control but the contrasts implied, however the features are assessed, indicates a mafic composition but are likely to be lamprophyric rather than basaltic or doleritic.

East of Lady Barron there is a clear change in granite composition and a relatively magnetic granodiorite is indicated (0.006 SI). There is a marked contact zone anomaly which is in at least two parts, one very narrow and strongly magnetised (0.039 SI) and the other wider but reversely and lightly magnetised (0.004 SI). Tests of the contact suggest it dips steeply east.
The profile, coupled with the view offered by the contour presentation, shows that the eastern anomaly is not like the Tertiary channel anomalies, including basalts, seen in other models and other areas.

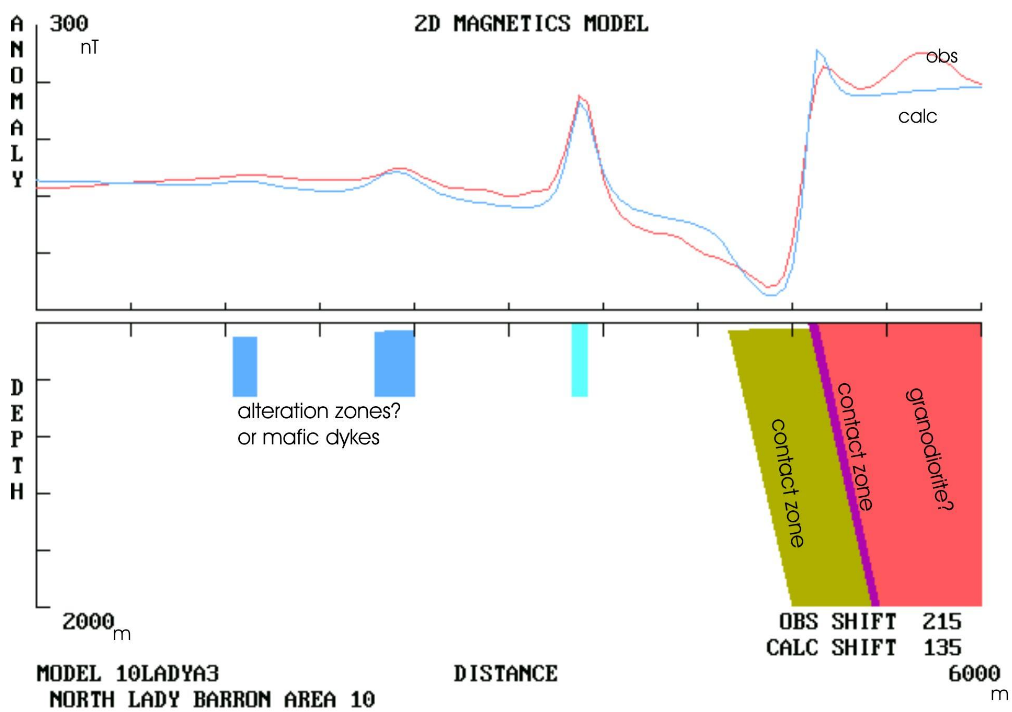


Figure 44. Models for the Lady Barron north zone of dyke-like features and the change in character of the magnetic field near Pot Boil Point..

SUMMARY

Ten regions or aspects of northeast Tasmania were selected for quantitative assessment in order to guide both the appreciation of, and further evaluation of, the 2007 Magnetic and Radiometric Survey of Northeast Tasmania.

The relative subtlety of effects and anomalies reduced many of these reviews to a few themes; such as the origin of the dyke-like features which cross the region (including Flinders Island), the possible presence of ultramafics at great depth to account for low amplitude-long wavelength features, the effect of metamorphism on the Mathinna Beds and the patchy presence of magnetic character within these units, and some isolated but distinctive features such as observed south of Ben Lomond or west of Lady Barron.

Webster (pers. comm., 2008) has considered the largest regional anomaly, located south and west of Bridport and concluded, consistent with previous interpretations, that it is due to **large slices of ultramafics**.
Other, smaller, anomalies of the same type are located near Blue Tier and on Flinders Island and have been reviewed in this report. All can only be explained by thin slices of intensely magnetised material at depths of three to six kilometres, approximately.

The large, isolated anomaly south of Ben Lomond and east of Rossarden can, similarly, accounted by a slice of comparable material, although other solutions are possible in this case which may prove both more realistic and important stratigraphically if any more detailed ground work or interpretation can be undertaken.

The slices of ultramafics which have more regional extent and which are not of ambiguous presentation, appear to splinter from a soling thrust, dip eastward near Ben Lomond and on Flinders Island, but westward near Scamander and Blue Tier. This interpretation of them confirms the inferences outlined by Keele *et al* (1994) in a conceptual structural model.

The **dyke-swarm character** evident in image presentations of the data has been reviewed carefully. In the Scamander-Blue Tier-Eddystone sub region it is clear that many of these anomalies are due to narrow dykes of dolerite, or equivalent material. Some anomalies correlate directly with known dykes, others represent continuations of limited exposures, while others may be inferred to be due to similar structures. Such dykes are typically 10 to 30 metres wide, steeply dipping and with modest magnetic properties consistent with mafic rocks. The same region, however, contains mapped dykes with no magnetic expression and it is possible that dykes are of different ages and structural origins and location. This response pattern is consistent with the observations of Cocker (1982) and more recent sampling by Dr. M. McClenaghan (pers. comm. 2008).

In other areas, such as around Flinders Island (Long Island and Lady Barron north) and in the region of Mt Paris, there are dyke-like anomalies which are not necessarily associated with strongly magetised mafic rocks. Either none are known in these areas, or the inferred properties and dimensions are not consistent with a solution such as

dolerite dykes.

In the case of Mt Paris the anomalies may be due to larger felsic dykes or alteration zones within the granitic rocks. These features, typically, exceed 100 metres in thickness and may represent greisens. Greisens have been mapped but their scale and chemical content – and its effect on magnetic properties – has never been assessed. Some research on these associations may be of economic value given the association of mineralisation with some of the greisens.

In the Bass Strait and Furneaux Group region the dyke anomalies appear to be due to modestly magnetised mafic rocks, probably lamprophyres, which may be Cretaceous in age. This appears to be the explanation at Long Island, central Flinders Island and near Lady Barron.

All dyke-type features display some variation in properties but, more critically, considerable variation in approach to surface. Their full magnetic contrast is rarely applied at depths less than 25 to 50 metres indicating the presence of substantial weathering or covering materials, effects which may well have constrained the mapping of them. Appraisal of these features leads to estimations of thickness, depth to upper surface, depth range and magnetic contrast. Regardless of assumptions there are distinct groups of materials, some definitely basaltic, others much more subtly magnetised. Complete evaluation of these features, now that many of them can be accurately located, will depend on ground observations (geological and magnetic) in order to constrain either some element of their geometry, or magnetic properties.

The region contains a large number of **isolated point anomalies** and many of these can be associated with mapped patches of Tertiary basalt. Others present no such correlation, perhaps due to the realities of regional mapping or limited exposure. While it has been suggested that these features mark the sites of volcanic vents detailed two and three dimensional review indicates that some may be vents and others may be remnants of basaltic flows. Most possess intense magnetisation with at least some component of remanence, and the magnetisation is generally variable across the location.
There is need to locate and review many of these features and note composition and properties. Dr M. McClenaghan (pers. comm.) has already, as a result of preliminary inspection of the data of this survey, found several sites and their character and content is often consistent with vents.

Parts of the Mathinna Beds also present marked magnetic character. Such sites tend to be very isolated and not predictable, but are not consistently associated with contact zones or any other obvious feature. Most appear to represent a distinctive part of the succession which is dominated by pelites and considerable lithological variability.

A zone east of Gladstone has been examined previously and there was some explanation of the variations in properties.
A more intensive effect has been observed in the present survey west of Mathinna and the rocks are far removed from granitoids- as far as can be judged with extant contact indicators and gravity data, and the implied magnetic depth ranges. Interpretation suggests, however, that a bracket of rocks may be repeated within thrust slices since the effects appear depth limited – at both top and bottom. This solution is consistent

with structural styles within the detachments known or inferred within the Mathinna Beds succession. The relatively magnetic rocks may thus represent a particular part of the succession and their presence could prove important to unravelling relationships and timing of deposition.
Dating of this unusual part of the succession, if fossils can be found, would be both interesting and important to understanding of the region.
More detailed magnetic analysis would be justified of each of the zones where the Mathinna Beds have magnetic character. It may be noted that one of the bounding blocks may lie north of the South Esk River and its eastern boundary may lie along Dan Rivulet. There is scope for much more work and it is recommended.

The full value of this survey will only be realised once a range of features and their sources have been sought on the ground and the geometric and magnetic characters observed introduced to yield a revised interpretation.

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Feb 21, 2008