5. CONSIDERATION OF POSSIBLE VOLCANIC PLUGS

A number of point anomalies can be observed in all presentations of the magnetic field in northeast Tasmania (see for example Figures 4 and 11). These are more evident in some areas, depending on the background field and other local influences. Figure 27 presents an extreme example of an area where many such features are present.

Examination of available geological mapping reveals that some features are associated with alteration boundaries, and some focus upon them, whilst others can be associated with small exposures of Jurassic dolerite (rare) and Tertiary basalt. Most, however, cannot be correlated with any other known information and some confirmatory field work is required in these cases. Figure 27 provides an indication of these associations; one feature can be linked to Mathinna Beds alteration, and another to a mapped plug near Halfway Hill.

Some questions have been posed. Are all these effects due to volcanic plugs? What composition and properties might be involved – and hence what age? How large are the features? Are they likely to be exposed, and therefore able to be sampled?
Several features have been examined in order to offer possible answers to these questions.

Inspection of available mapping reveals that very few of the magnetic anomalies can be associated with a geological unit – but usually Tertiary basalt. This may reflect weathering, the limited traversing involved in the preparation of the maps, and perhaps the very small dimensions of the sources.

Detailed review of the actual anomalies shows that about half of the sources appear to be normally magnetised with negligible remanence, but several sources are very strongly magnetised with signatures which reflect both ancient and modern pole positions. A small subset of each category was isolated with the intention of modelling using three dimensional methods in order to extract as much information as possible and to indicate whether further examination of other sites would prove valuable.

A selection of features has been examined initially using two dimensional methods. 2D methods are faster and simpler but are clearly of dubious reliability in terms of absolute geometry and contrast when dealing with nominally cylindrical sources. Comparisons have been made to assess the degree of difference so that many evaluations can be made quickly and then either used to control a 3D interpretation, where warranted, or to suggest the scale of correction factors.

Figure 28 provides some models and profiles for features titled 5A and 5C.
These anomalies are located at 599 000 mE, 5432 400 mN and 589 600 mE, 5421 250 mN approximately. The first of these, 5A, is quite unusual in its intensity and sign and the location should be inspected. The models indicate a narrow plug extending to considerable depth – but the feature is highly magnetic at 0.26 SI and may be due to human structures. If the feature is geological and real then the lithology is most unusual and almost ultramafic, and may not be exposed since modelling indicates a

depth below surface to the magnetic contrast is of the order of 30 metres. The feature may dip steeply to the northeast. The maximum dimensions of the source are 70 m east-west and 140 m north-south with top located at 598 820 mE.

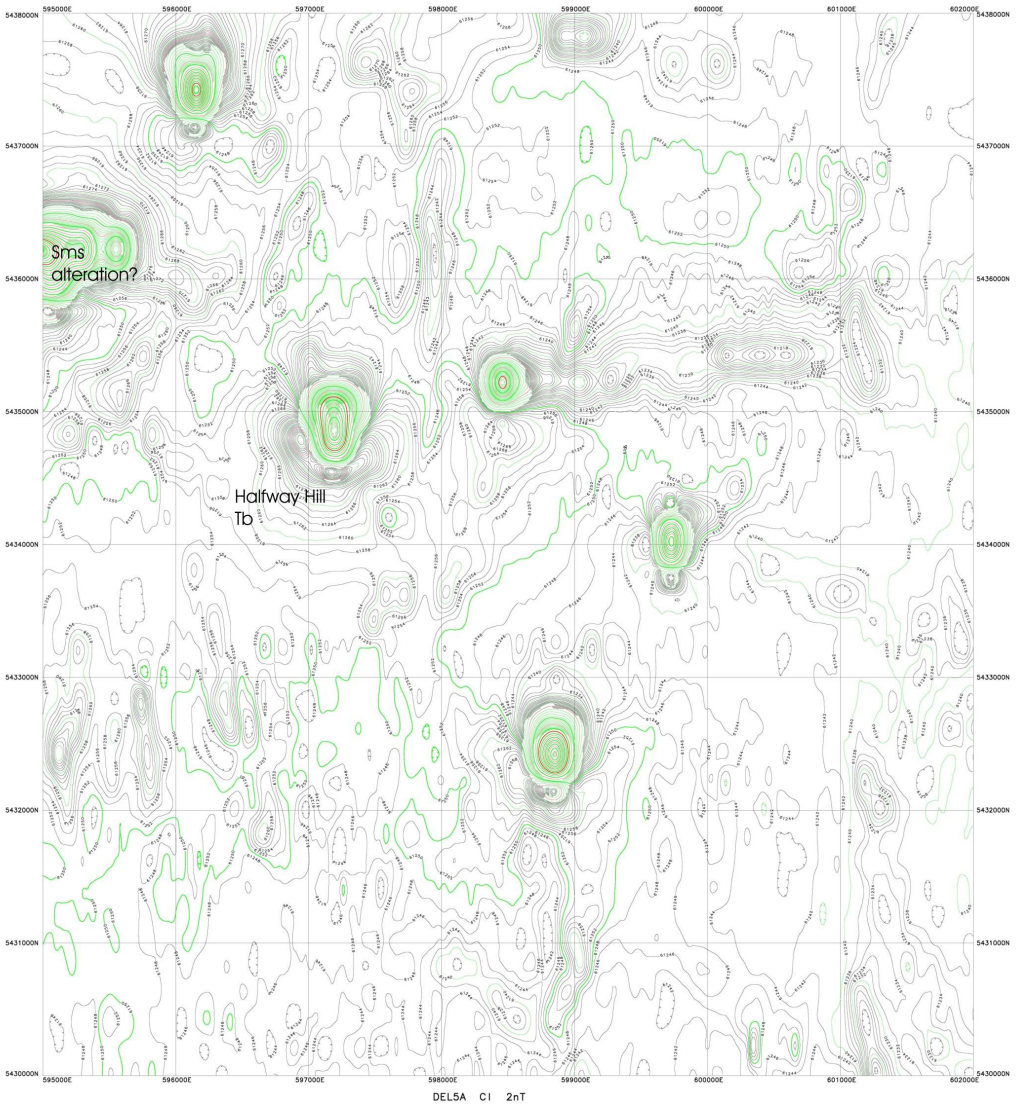

Figure 27. Point anomalies in magnetic field north of Blue Tier. The origin of most of these effects is unknown at the time of writing and ground checking is required.

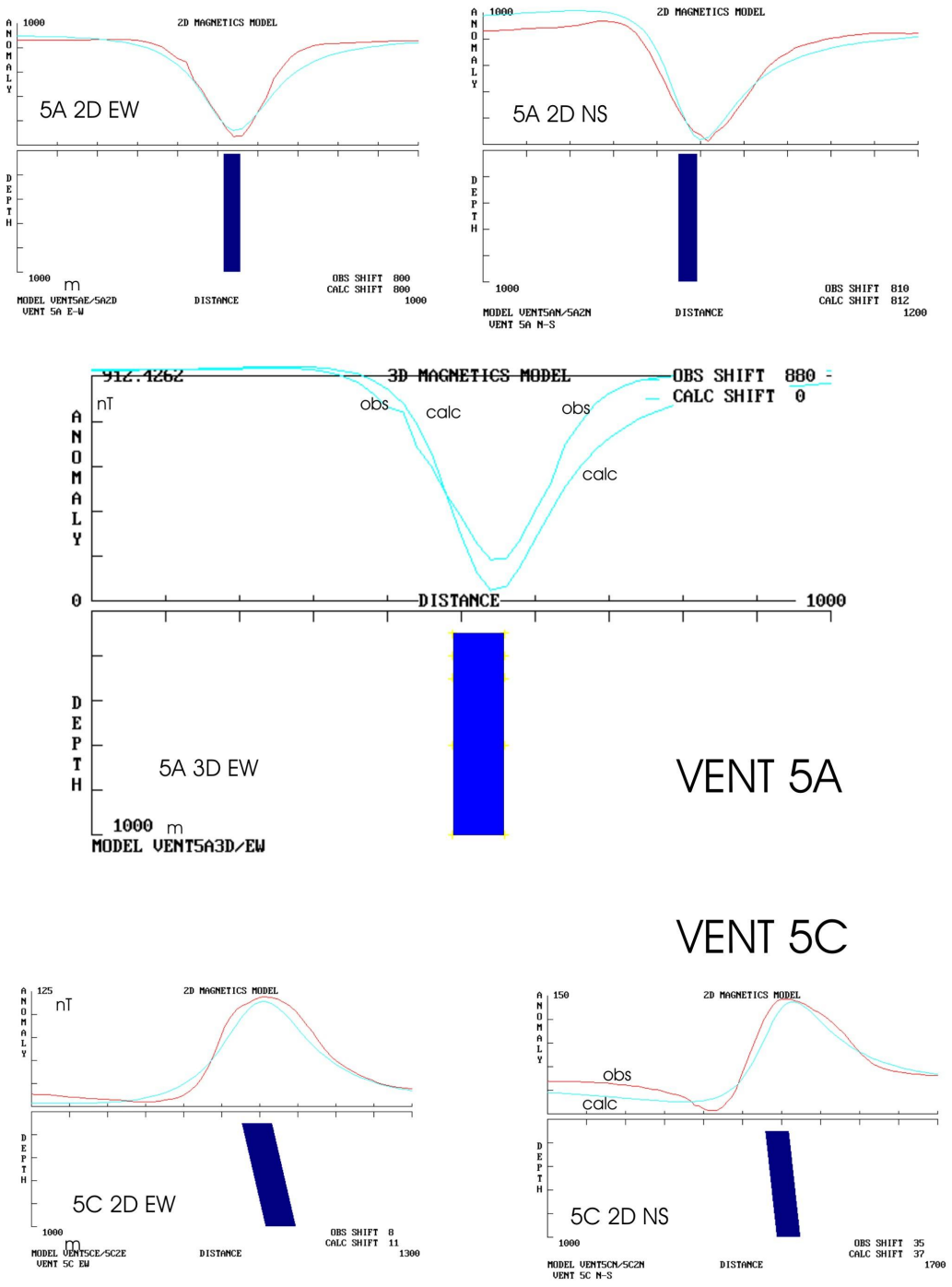

Figure 28. Comparative 2D and 3D interpretations of features 5A and 5C.

Feature 5C is much more normal and appears to dip steeply eastward and, depending on method of analysis, possesses clearly basaltic properties (0.026 to 0.05 SI). This plug may have a maximum diameter of about 50 to 75 m and is located near 589 530 mE, 5421 270 mN. As was the case with 5A, models indicate that the top of this body is concealed and may be at a depth of 50 m.

All models presented above were based on the assumption that the sources are basaltic and in plug or dyke form. It has been noted that various aspects of the anomalies are not well fitted with these presumptions – even when tested three dimensionally and with some allowance for remanent magnetisation with an orientation which might distort the effect in the manner observed for many anomalies.

Anomaly 5D (at 585 150 mE; 5461 200 mN) has been calculated with some alternative assumptions and the results are shown in Figure 29.

The models have been calculated for east-west and north-south aspects. All profiles sample the crest of the anomaly.
E1 represents an E-W profile and offers an apparently reasonable solution. The body is about 150 metres in diameter with a contrast of 0.035 SI.
D1 is a N-S profile with comparable contrast and diameter. There are serious misfits which a simple shape cannot generate.
D2 is the N-S profile in which the source has pronounced dip and is not regular in shape. This generates a better fit and might be accepted as a solution. The contrast is the same but the general width is variable.

D3, however, tests whether the assumption of plugs, or simple vents, might be invalid.

The anomaly, if due to a remnant of a flow, cannot be generated with a uniform contrast: one would not be expected in any case due to weathering and variations in flows. The solution offered, in which the bulk of the effect is produced by a massive basaltic core surrounded by an altered skin, readily accounts for the distribution and shape of the anomaly as observed, as well as its profile character.
The model does, however, indicate that the source might be as much as 100 m thick locally – at the contrasts used. The modelled contrasts are 0.055 for the flow core and 0.013 for the outer skin.

The inferred thicknesses might be reduced if it could be shown that the actual contrasts are significantly higher. Although the figure presents the solution in a slightly exaggerated version vertically the geometry and distribution of the source might allow a remnant of this vertical dimension.
This is a site which should be located, exposures inspected for evidence of vent character (ejecta, inclusions etc) and any samples found tested for magnetic properties.

The analysis of site 5D raises the entire question of the nature of the sources. The properties inferred, whether for plugs or flows, are clearly consistent with basalt and many of these sites have not been found during regional mapping. It is, however, possible that several of the magnetic features observed in this new survey represent small remnants of basalt flows.
It should not be assumed without other evidence, which will require either ground location and characterisation of contents of material or some geochemistry, that all "spot" anomalies represent plugs. Most may do, but many may not.

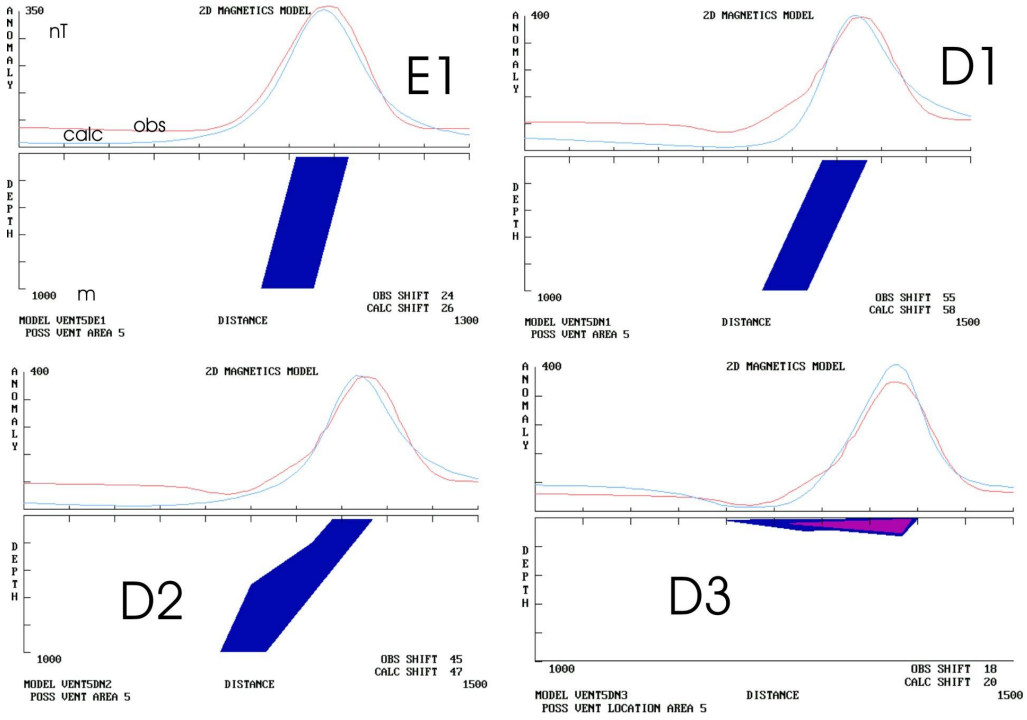

Figure 29. Tests of some variants for site 5D. These tests indicate the effect of dip or changes in thickness – if the source is plug-like – and contrasts these with the effect of a shallow remnant.