Geophysical Research Abstracts,
Vol. 10, EGU2008-A-02972, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-02972
EGU General Assembly 2008

Geophysical signatures associated with the Auckland volcanic field, New Zealand: implications for structural control and emplacement styles

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The Auckland volcanic field (AVF), which comprises 49 Quaternary basaltic volcanoes, coincides with an area of crustal complexity resulting from a Mesozoic terrane suture. This suture is marked by the Junction Magnetic Anomaly (JMA) which is caused by highly magnetised basement rocks. In the Auckland region a significant discontinuity in the JMA (marked by multiple lineaments) occurs, which correlates with a major Bouguer gravity anomaly. The AVF is coincident with the southern boundaries of both this discontinuity and the gravity anomaly. Furthermore, the extent of the AVF correlates closely with the width of these anomalies, suggesting that basement structures may exert significant control on both the location and geometry of the field. However, there is no clear correlation between individual volcanic vents and the magnetic lineament fabric. The residual aeromagnetic map of the AVF shows that anomalies associated with the volcanoes range from about 10 - 1000 nT. Volcanoes with scoria cones are associated with significant magnetic anomalies whilst maars exhibit a wide range of magnetic expressions. The most significant sources of the observed anomalies are basalt bodies which occur below the cones and some maars, and are interpreted as sub-volcanic intrusions or crater-filling lava lakes. Lava flows are also marked by discernable anomalies, including those buried by later deposits. The residual magnetic data therefore are particularly effective in delineating the subsurface components of the volcanic field and detailed 3D modelling of these magnetic data, together with gravity data, allows for improved estimates of magma volumes. Within the AVF, apart from the mapped volcanoes, there is no evidence in the magnetic data

for other near-surface intrusions, including dykes.