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3D conductivity image of a young continental rift: Taupo Volcanic Zone, New Zealand

W. Heise (1,2), T.G. Caldwell (2), H.M. Bibby (2), and S.L. Bennie (2)

(1) Universidade de Lisboa, CGUL-IDL, Lisbon, Portugal (wwheise@fc.ul.pt), (2) GNS Science, Lower Hutt, New Zealand

The Taupo Volcanic Zone (TVZ), in the North Island, New Zealand is a continental back arc rift associated with the subduction of the Pacific Plate under the Australian Plate and is characterised by the eruption of large volumes of rhyolitic magma during the last 1.6 Ma and an exceptionally high present-day heat flow. Data from 220 magnetotelluric soundings covering the central (rhyolitic) part of the TVZ were analysed using 3D inverse resistivity modelling and phase tensor visualisation techniques. Modelling results compare well with the thickness of conductive volcaniclastic material in filling the rift basin and calderas and expected from observed gravity anomalies. Phase tensor ellipticity correlates well with the resistivity gradient in the 3D inversion model showing how the phase data control the inversion and allowing identification of which structures are, or are not, resolved by the data. The inverse modelling results show a zone of high conductivity in the lower crust and upper-mantle along the central rift-axis that correlates with a zone of high phase observed at long periods. An unusual feature of the MT data at periods of 3-30s is the large phase tensor skew angle values that coincide with the margins of a localized gravity high in the centre of the survey area. This feature appears to be caused by the interaction of a thick near surface layer of high conductive volcaniclastic material with conductive structures at greater depth.