Probabilistic modelling of broadband MT for basement topography mapping, East Albany Fraser Orogen, WA

H. Seillé[1], G. Visser[2] M. Lowe[2] and K. McKenna[2]
[1]CSIRO, Mineral Resources, Perth, Australia, hoel.seille@csiro.au
[2]BHP Exploration, Perth, Australia

SUMMARY

Many Australian metallogenic provinces are buried under thick post-mineralization cover. Precise and reliable detection of the depth to prospective basement and other intra-sediments geological boundaries is essential to understand the distribution of mineral and groundwater resources. In this work we present an application of the modelling of magnetotelluric (MT) data using a probabilistic workflow to map the structure of a sedimentary basin in the East Albany Fraser Orogen, in Western Australia. The MT survey consists in 550 MT sites distributed along 12 profiles oriented EW across the area of interest. The workflow consists in modelling magnetotelluric (MT) data using a 1D Bayesian inversion that takes into account 2D and 3D effects present in the data. The results of these inversions consist in ensembles of resistivity models for each MT site. These are then analyzed to extract probability distributions on the location of various geophysical transitions associated to geological interfaces using a newly developed ensemble clustering method. Four to five sedimentary layers were identified in the basin, consistently across all the profiles. A good match between these results, drill hole data and airborne geophysics (regional gravity) is observed. Finally, we derive probabilistic maps of the depth to basement over the complete area using two different interpolation approaches: 1) a Bayesian Estimate fusion and 2) a neural network interpolation constrained by a regional gravity dataset.

Keywords: Magnetotellurics, Bayesian inversion, Mineral Exploration