Geophysical Research Abstracts
Vol. 16, EGU2014-16468, 2014
EGU General Assembly 2014

New Insights from Seismic Imaging over the Youanmi Terrane, Western Australia

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The Youanmi terrane is located in the central parts of the Yilgarn craton, Western Australia, an Archean granite-greenstone unit containing numerous mineral deposits such as gold, base metals, nickel, uranium and gemstones. The terrane is surrounded by the Kalgoorlie and Narryer terranes to the east and west, respectively. To the southwest it is bounded by the South West terrane. In order to study the transitions between the Youanmi terrane and the surrounding terranes, as well as identifying potential mineral rich areas, the Geological Survey of Western Australia acquired three deep crustal 2D seismic profiles with a total length of about 700 km in 2010. Correlated record lengths of 20 seconds allow the deep structure of the crust to be investigated with the data, down to Moho depths and greater. Initial processing using a conventional 2D flow show a highly reflective crust with several interesting features. We have now reprocessed the data following mainly the previous processing flow, but with a focus on the shallower crust, less than 10 seconds (about 27 km). Due to the complex geology in the region, 3D aspects of the structures need to be considered in the data processing. Therefore, we investigated the effect of cross-dip corrections to the data. The cross-dip correction has two advantages; (i) reflections are more coherent and enhanced after the correction and (ii) the orientation and dip angle of the geological structures of the corresponding reflections can be identified in the cross-line direction. Where the profiles intersect each other sparse 3D processing can be performed. First arrival travel-time tomography was also tested on parts of the dataset. Travel-time inversion may provide better velocity models at shallow depths than standard reflection seismic processing provides. Preliminary results show that the travel-time tomography has a depth of investigation of about 1 km, a depth that is of interest for mining purposes. Therefore, the tomography results in combination with the 3D processing of the Youanmi data set may be relevant to the mining industry active in the Youanmi terrane of Western Australia.