

Magnetotelluric measurements across the southern Barberton greenstone belt: Data analysis

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ABSTRACT

The Kaapvaal Craton of South Africa is one of the oldest well-preserved continental fragments on our planet and thus is a key area for studies of geodynamic processes of the early Earth. One major controversy concerns the importance of plate tectonic processes in Archean times and the time when this may have been first initiated. Several potential ancient suture zones have been identified at the surface within the Barberton greenstone Belt, and these provide an ideal natural laboratory to test for possible subsurface remnants of mid-Archean plate tectonic processes on lithospheric scale.

Within the framework of the German-South African geo-scientific research initiative Inkaba yeAfrica, a high resolution magnetotelluric (MT) field experiment, ELIBABA, was carried out in April/May 2009 in the Barberton/Badplaas area, eastern Mpumalanga, RSA. A 120 km long profile and two complimentary shorter 60 km long profiles with nearly 100 MT sites provide a good areal coverage of the Barberton suture and its complex geology.

Strong cultural electromagnetic noise, possibly originating from nearby mines and the DC railway system, is present in the entire area of investigation. As this man-made noise is much larger than the natural electromagnetic signal, which we use to calculate the magnetotelluric transfer functions, advanced data processing schemes have to be used to obtain the cleanest possible sounding curves. This is of major importance for all later analysis steps as we have to make sure that our impedance tensor represents the conductivity structure of the subsurface and does not mirror the electromagnetic noise. We present first results of a standard data analysis in comparison with the remote reference technique and give an outlook on other approaches aiming to improve the data quality.

Key words: Magnetotellurics, Barberton Greenstone Belt, Kaapvaal Craton, data analysis, remote reference techniques