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Magnetotelluric measurements across the Magnetic Beattie Anomaly and the Southern Cape Conductive Belt in South Africa

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South Africa hosts two of the world's largest known geophysical anomalies, the Beattie Magnetic Anomaly (BMA) and the Southern Cape Conductive Belt (SCCB), that extend in South Africa for almost 1000 km in east-west direction and possibly also continue into Antarctica and southern South America. In South Africa the surface expressions of these anomalies appear to coincide approximately with the mapped boundary of the Cape Fold Belt and the Namaqua-Natal Mobile Belt, but the nature of both anomalies remains enigmatic. However, they have been interpreted as a slice of paleao-oceanic lithosphere or alternatively as thrust zones, but the existence of a common source, their extent and internal structures are all unknown.

We report on the results of a high resolution magnetotelluric (MT) study conducted in March, 2004 along a profile between Prince Albert and Fraserburg crossing the BMA and the SCCB. Within the framework of the multi-disciplinary integrated German-South African project "Inkaba ye Africa", MT data were collected at 82 sites in the frequency range from 1000 Hz to 0.001 Hz with an average site spacing of 2 km. With these new data we are able to resolve conductivity structures associated with both geophysical anomalies, and an initial 2D inversion model resolves the conductivity distribution of the entire crust. A zone of very high electrical conductivity ($\sim$1 Ωm), at a depth of approximately 5-10 km, seems to be associated with the BMA. Another

conductivity anomaly is located beneath the northern boundary of the SCCB, extending from the shallow crust down to approx. 15 km depth. Both conductors are inclined towards the south, which coincides with a general southward dipping trend of mapped faults of the Cape Fold Belt. We therefore interpret these high conductivity anomalies as images of tectonic structures which may have evolved during the formation of the Karoo basin. The conductivity image furthermore reveals several sub-horizontal regions of high conductivity (2 Ωm) in the upper 5 km of the crust that may reflect sedimentary sequences of the Namaqua-Natal Mobile Belt.