



The Whitehill Formation - a high conductivity marker horizon in the Karoo Basin

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Within the Inkaba yeAfrica project magnetotelluric data were acquired along two profiles across the Karoo basin in South Africa. One of the most consistent and prominent features in the electrical conductivity images is a shallow, regionally continuous sub-horizontal band of high conductivity, that seems to correlate with the so called Whitehill Formation. In the Karoo basin a number of boreholes up to 5.5 km in depth which were drilled during exploration for coal, oil and uranium, intersected this formation. The Whitehill Formation is regionally very persistent in thickness and composition, and can be traced throughout the entire Karoo Basin and its equivalents in South America, where it is known as the Irati Formation. In the region of our experiments, the Whitehill Formation varies in thickness between 50 to 70 m and consists of black pyritic shales with up to 14 wt% carbonaceous matter which seem to be the cause of the observed high conductivity. To study the maturity of the carbon present in the Whitehill Formation impedance spectroscopy and vitrinite reflectance were applied to core samples from the SA 1/66 borehole taken from a depth range between 2750 and 2800 m. Vitrinite reflectance analysis of the pseudo-coal and oil shale rocks indicates that most of the carbon is in the meta-anthracite maturity field, approaching in one sample the “graphite window”. Impedance Spectroscopy reveals that the highest electrical conductivities are associated with the Pyrite rich portions of the samples, showing conductivities well above 1 S/m. Recordings on pyrite-poor samples are less conclusive, with observed conductivities varying in the range of a few tenths to mS/m.