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3D Geophysical modelling of the Karoo Basin, South Africa, to investigate basin evolution

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The Karoo Basin in South Africa has recently been identified as a possible source for shale gas. The basin which was deposited in the Late Carboniferous (300 Ma) to Middle Jurassic (180 Ma) presently covers an area of 600 000 km2. However, no clear tectonic model exists for the Karoo Basin, though several have been proposed including a retroarc foreland basin and subsidence of basement blocks combined with mantle flow. This study attempts to constrain a model using isostasy and flexure studies.

In this study we present the first broad-scale 3D model of the Karoo basin based on teleseismic, reflection and refraction seismic, MT, borehole and potential field data, including satellite gravity data. The basin is shallowest in the northeast where it is underlain by the strong Archean Kaapvaal craton, and deepens over the weaker Proterozoic Namaqua-Natal mobile belt which surrounds the craton to the south and west. The basin is deepest just north of the Cape fold belt which stretches along the southern and southwestern coast of South Africa.

We also present preliminary backstripping results from proximal and distal regions of the basin which reveal the extent of tectonic subsidence. The importance of including Cape syn- and post-rift sediments ($\sim$ 483 to 330 Ma) in the south in the analysis is highlighted. This allows for a complete understanding of the crustal strength at the time of Karoo deposition. Investigation of flexure profiles across the basin, from on to off-craton, show the effect of varying crustal strength during cycles of Cape orogenic loading (between 292 and 215 Ma).