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Geophysical characterization of the southwestern Karoo Basin using gravity, density and borehole data, South Africa

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A geological investigation was conducted in June 2015, to image the sub-surface structure of the southwestern Karoo Basin, as well as to estimate thicknesses of various geological groups using geophysical techniques. The raw gravity, density, and borehole data were used to construct 2½ D sub-surface gravity models that image the complex structure of the main Karoo Basin to a depth of 50 km along seven selected profiles. Approximated thickness maps of various geological groups including the Dwyka, Ecca, and Beaufort Group were produced using data extracted from sub-surface gravity models. The models revealed that the Ecca Group shale units, the main target for shale gas exploration in the Karoo occur with the depth range of 0-4 km across the study area with an approximate thickness of 3681 m. While the Dwyka and the Beaufort Group occurs within the depth range of 0- 5000 and 0- 2500 m with an average thickness of 4180 and 4456 m, respectively. Seen on the models the Jurassic dolerite intrusions of the Karoo Supergroup prove to form a complex network of interconnected dykes and sills below the surface. The deepest part of the basin occurs at the centre, in this locality there is a high concentration of dolerite intrusions as compared to elsewhere in the basin. It is believed that all the information presented here will add a piece in a puzzle of accumulating scientific knowledge about the main Karoo Basin as much as possible.

