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Comparative anatomy of volcanic rifted margins in the South Atlantic, with emphasis on the high-velocity lower crust

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The onshore components of Volcanic Rifted Margins (VRM) in the South Atlantic region are flood basalts and felsic lavas with a wide range of intrusive rocks. The hidden components are offshore (seaward-dipping reflector sequences) and in the deep crust (high-velocity lower crustal bodies). This study focuses on the latter. The nature of high-velocity bodies at volcanic rifted margins, and their extent in time and space are very important for geodynamic studies. Not only do they count heavily in the total volume of magmatism produced in a VRM, but the size and spatial distribution of these bodies along the proto-rift can influence the location and style of breakup. After breakup, the high-velocity lower crust may affect the uplift and subsidence history the newly-formed continental margins, which is of relevance to basin modelling.

The high-velocity bodies are clearly an important part of the VRM story, yet their true nature is unknown, and magmatic intrusions related to breakup is not the only explanation. The best way to demonstrate a magmatic origin related to breakup is to test for variations in the size and physical properties of the bodies along a VRM where independent evidence indicates a major gradient in magmatic intensity. The South Atlantic is well suited for this kind of study. The northern segment hosts the Walvis Ridge-Rio Grande Rise hotspot track and the Paraná-Etendeka Large Igneous Province, whereas in the south, magmatic volumes are very small and petrologic data from exposed rocks indicate a southward decrease in the temperature of melting as well.

This contribution combines the data from 6 wide-angle onshore-offshore seismic profiles (2 from South America, 4 from Africa) with lithospheric-scale gravity models of the conjugate margins south of the Walvis Ridge. The gravity models provide the tool for interpolation between the wide-angle profiles. The goal is to define the size and bulk properties of the high-velocity crustal bodies and their variations in a continuous fashion along both conjugate margins and across the ocean basin. The preliminary results confirm a southward decrease in thickness and average p-wave velocity of the lower crustal bodies, supporting the magmatic interpretation. The final inventory of thickness and bulk property variations will provide input to petrophysical models that relate the production and composition of high-velocity crust to the dynamics of mantle melting.