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Crustal structure of Africa's southern margin from geophysical experiments

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A number of geophysical on-shore and off-shore experiments were carried out in a profile across the southern margin of the African continent in the framework of the Inkaba yeAfrica project. Refraction seismic experiments have shown that the crustal thickness decreases rapidly from over 40 to around 30 km well inland of the present coast, before gently thinning out towards the Agulhas Falkland Fracture Zone, which marks the transition zone between continental and oceanic crust. This is consistent with a non-volcanic mode of breakup due to shear along the Agulhas-Falkland Transform Fault. In region of the abruptly decreasing Moho depth inland from the coast, lower crustal P-wave velocities up to 7.4 km/s are observed. We interpret these to represent metabasic lithologies of the Mesoproterozoic Namaqua-Natal Metamorphic Complex, or intrusions of gabbroic material added to the base of the crust by younger magmatism. This magmatism could be the result of the mid-Jurassic Karoo-Ferrar-Chon Aike event. The velocity model for the upper crust has excellent resolution, and is consistent with the known geological record. A comparison of the velocity model with electrical conductivity models shows that a zone of high seismic velocities north of the centre of the Beattie Magnetic Anomaly, one of the largest magnetic anomalies, correlates well with a resistive zone. Contrary to existing interpretation, the Beattie Magnetic Anomaly does not origin from an area which is electrically conductive but seems to correlate with a source region which is resistive and has high seismic velocities.