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Crustal structures and processes along the sheared South African continental margin

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The southern margin of South Africa, which developed during the Cretaceous break-up of Gondwana, offers an unrivalled possibility to enhance our understanding of the structure and processes involved in the formation of sheared continental margins. During the RV Sonne cruise SO-182 in 2005, the AWI acquired marine seismic reflection and refraction/wide-angle reflection data along two sub-parallel profiles across the continental margin. These are part of the onshore-offshore Agulhas-Karoo Geoscience Transect within the German - South African “Inkaba ye Africa” project. Velocity depth-models along these profiles show a crustal thickness of 28 - 30 km on the inner continental shelf and 6 - 8 km in the Agulhas Passage. The eastern profile exhibits a distinct increase in crustal thickness farther south beneath the Agulhas Plateau. Both profiles place the continent-ocean transition at the Agulhas-Falkland Fracture Zone, where it extends over a width of 52 km. Seismic reflection measurements suggest a re-activation of parts of this zone. On the western profile a layer of sediments with P-wave velocities between 1.7 and 3.0 km/s can be observed from the continental shelf to the Agulhas Passage, where it becomes thinner and disappears. In the Agulhas Passage, almost no stratified sediment cover can be observed due to erosional processes driven by strong ocean currents. A layer with velocities between 3.5 and 5.0 km/s can be found along the entire profile. Our seismic reflection data in the Agulhas Passage suggest that this layer may consist of alternating layers of volcanic flows and sediments. Beneath the Southern Outeniqua Basin and the Diaz Marginal Ridge, a 3 km thick zone with relatively low velocities was found in the upper crust. This structure is interpreted as an old foreland basin filled with pre-break-up metasediments which were altered by magmatic and tectonic processes. Our model suggests that the evolution of the Diaz Marginal Ridge may be connected with the history of

this basin. The top of the crystalline basement is marked by a sharp P-wave velocity increase. In the upper crust velocities from 5.7 to 6.6 km/s were modelled. Average velocities between 6.4 and 6.9 km/s are found in the middle to lower crust. Uppermost mantle velocities of 7.8 to 8.0 km/s are observed from clear Pn phases.