

DFG Schwerpunktprogramm 1375 "South Atlantic Margin Processes and Links with Onshore Evolution (SAMPLE)": Structural-kinematic history of crustal-scale lineaments along the South Atlantic continental margins

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Summary

The aim of the project is to reconstruct the mode of opening of the South Atlantic. Using the Mesozoic structures as a reference frame it will be tested whether the break-up of southwestern Gondwana followed pre-existing older lithospheric structures or not. Several different tectonic scenarios appear possible: (i) the South Atlantic opened along Pan-African suture zones that had formed between the southern African continental cratonic blocks and the South American Rio de la Plata Craton during the assembly of Gondwana, i.e. within a former subduction and continental collision zone, (ii) break-up may have commenced along a former back-arc along the western margin of the Kalahari palaeocontinent along a thermally and rheologically softened crustal domain or, (iii) it may turn out that inherited lithospheric anisotropies did not play any significant role for the initiation and location of Mesozoic continental rifting.

In order to achieve the set goal, the kinematic evolution of the Mesozoic structures associated with the South Atlantic opening need to be determined first. This will serve as a reference frame for comparison with the structural-kinematic history of pre-rift structures, which needs to be inferred from field observations. Integral to the proposed study is to infer the orientations (and their change) of the palaeostress fields that produced the Mesozoic and pre-Mesozoic structures. This will be done with an algorithm developed by the T. Will that uses robust regression techniques, which are capable of detecting outliers, to calculate geologically meaningful palaeostress orientations (i.e. the reduced stress tensor) from field data. This structural-kinematic study will be augmented by petrological and geochemical investigations on selected samples. In addition, the proposed study should demonstrate whether pre-Mesozoic structures influenced rift-related magma emplacement. Furthermore, an effort will be made to directly date the age of movement along the major fault and shear zones using the Rb-Sr and Ar-Ar isotope systems.

Publications

Frimmel, H.E., Basei, M.S., Gaucher, C. (2010): Neoproterozoic geodynamic evolution of SW-Gondwana: a southern African perspective. - *International Journal of Earth Sciences*, in press.

Will, T.M., Miller, R.M.G., Frimmel, H.E. (2009): Orogenic tectono-thermal evolution of the Kaoko Belt. - In: Gaucher, C., Sial, A.N., Halverson, G.P., Frimmel, H.E. (eds.), *Neoproterozoic-Cambrian tectonics, global change and evolution. A focus on southwestern Gondwana. Developments in Precambrian Geology*, Elsevier, Amsterdam, 16, 205-218.

Miller, R.M.G., Frimmel, H.E., Will, T.M. (2009): Geodynamic synthesis of the Damara orogen sensu lato. - In: Gaucher, C., Sial, A.N., Halverson, G.P., Frimmel, H.E. (eds.), *Neoproterozoic-Cambrian*

tectonics, global change and evolution. A focus on southwestern Gondwana. *Developments in Precambrian Geology*, Elsevier, Amsterdam, 16, 231-235.