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Brittle reactivation of ductile shear zones in NW Namibia

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Existing structural elements, such as shear zones, are regarded to have a significant influence on the orientation and extent of younger structures. Thus, shear zones are seen as a primary controlling factor on the development of rift zones (e.g. Piqué & Laville, 1996). Indeed, reactivation of such structures is observed in numerous areas. However, information on the amount of offset associated with a reactivation is often lacking. Reactivation of shear zones is also reported of in NW Namibia in relation to the South Atlantic Rifting (Marsh et al., 2001; Stanistreet & Charlesworth, 2001). Here, we present the results of a quantitative study on this reactivation.

NW Namibia is characterized by the ∼N-S trending Kaoko Belt which developed during the assemblage of Gondwana in the Neo-Proterozoic and incorporates a number of shear zones, e.g. the Purros Shear Zone and Three Palms Shear Zone, which run sub-parallel to the present-day continental margin. The shear zones are partly covered by the extrusives of the Paraná-Etendeka Large Igneous Province (∼133 Ma) which extruded shortly before or during the onset of the Atlantic rifting (e.g. Blaich et al., 2011).

Combining the analysis of satellite imagery and digital elevation models with extensive field work, we identified numerous faults tracing the old shear zones along which the Etendeka basalts were down-faulted. Listric faults developed along the shear zones and accumulated vertical offsets up to 900 m. The faults developed in areas where the foliation along the shear zones is steepest, indicating that a dip of >65° is necessary for normal reactivation. A basin developed along the section where the shear zone is supposedly widest.

Our results contribute to the view that the basement inheritance plays a significant role on rifting processes and that the reactivation of shear zones can accumulate significant amounts of displacement.

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