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New constraints on the morphological evolution of the Namibian passive margin

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The morphological evolution of passive margins and processes that maintain high topography after the continental breakup remain debated. A steep escarpment, an arid climate and the very slow erosion of a granitic landscape characterize the Northern Namibian passive margin. In addition, in this region between the coast and the escarpment, numerous inselbergs dominate the landscape. However, both the persistence of high topographic relief along the Namibia margin some 130 Myr after rifting and the formation of inselbergs, such as the Brandberg Massif, remain poorly understood. Quantifying the denudation rates and landscape evolution is essential to understand the processes that shaped the Namibian margin since rifting. We provide apatite (U-Th)/He ages and 10Be erosion rates along a vertical profile in the Brandberg igneous complex and 10Be erosion rates along a $\sim$220 km-long E-W profile across the escarpment that includes the Brandberg. The 10Be erosion rates increase with distance to the coast from 2.1 m/Myr up to 8.0 m/Myr close to the present day escarpment. Apatite (U-Th)/He ages range from 131.6 $\pm$ 9.6 to 46.5 $\pm$ 3.3 Ma. The time-Temperature paths obtained by inverse modeling of the new apatite (U-Th)/He ages combined with published apatite fission track ages (Raab et al., 2005) suggest an early denudation/cooling phase at $\sim$100-80 Ma and a more recent denudation phase. Finally, we have coupled 10Be erosion rates, thermochronological ages (apatite fission track and (U-Th)/He) and landscape evolution modeling to perform a joint inversion of the present day topography, using a numerical landscape evolution model (FastScape, Braun and Willett, 2013). This approach provides new independent constraints on the thermal evolution of the Namibian margin, the velocity of the escarpment retreat/migration, the topographic evolution across the margin and associated processes. Our inversion also yields values for the parameters controlling the physical erosion and weathering of the Brandberg Complex and the rocks it intruded.