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The morphotectonic history of the Atlantic continental margin of South Africa: insights from combined (U-Th)/He and fission track thermochronometry

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The morphotectonic evolution of the South African continental margins and the interior plateau remains unresolved, with the crux of the debate being whether the present day topography represents an eroded remnant of a Cretaceous elevated interior or if the topography is much younger, developed as a result of Miocene epeirogenic-style uplift. In recent years, advances in the understanding of mantle dynamics have led to an appreciation of its importance as a major controlling factor on the evolution of the South African plateau since the break-up of Gondwana. However, constraints on the timing and amount of uplift derived from geodynamical models are still controversial due to a lack of tight constraints on mantle viscosity and density structure and because of differences in the way the plate motions at the surface are incorporated into the different models. It is therefore essential to obtain more directly relevant empirical observations that can be used to test these models.

Low temperature thermochronology (LTT) is a powerful tool well able to address this question by providing constraints on the time-temperature history of rocks, denudation, landscape evolution and tectonic history. Over the past two decades, the main focus of LTT analysis in South Africa has been on Apatite Fission Track Analysis (AFTA) which generally supports a dominant Cretaceous (c. 90Ma) uplift event with km-scale erosion, but spatially as well as temporally variable, in the interior of the plateau. However, AFTA data is unable to provide robust constraints on the Tertiary cooling history due to the temperature range covered by the fission track system (e.g. 60-110°C). The (U-Th)/He method with a lower temperature range (c. 40-75°C) will therefore be more sensitive to more recent and smaller amounts of erosion offers a new opportunity to evaluate the magnitude of Cenozoic denudation in southern Africa.

Here we present the first (U-Th)/He ages from SW South Africa, obtained from a transect along the Orange River, alongside existing fission track ages and track length distributions. We also present a detailed summary map which will draw together all the current AFT data available from southern Africa and highlight the focus of on-going research in Africa being undertaken at the University of Glasgow.