The interplay of tectonics, erosion and topography across the Drakensberg Escarpment, South Africa; A fission track study

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South Africa's eastern margin hosts one of the most spectacular geomorphological features in southern Africa: The Drakensberg Escarpment. It has the greatest relief of any passive margin and thus became the historic type locality for many studies of passive margin evolution or landscape evolution in general (e.g. [1]). Applying thermochronology and numerical surface process models (e.g. [2]) has greatly contributed to a far more detailed understanding of the evolution of this area. These studies have estimated a minimum of 4.5 km of denudation for the coastal zone, with amounts decreasing inland to approx. 2 km, since formation of the margin some 130 Myr ago. Here we discuss three deep boreholes from the coastal platform (Springfontein) and the elevated continental interior (Vrede and Weltevrede).

While Vrede and Weltevrede provide evidence of Early Jurassic magmatic overprinting (Karoo), Springfontein shows the denudational history of a structurally separated inlier during rifting in the Early Cretaceous.

The most striking difference in the thermal histories of these three boreholes is, beyond the varying denudational pattern for Vrede and Weltevrede, that the borehole closest to the continental edge (Springfontein) has very little memory of the most recent Mid Cretaceous event. This is is in contrast to the interior boreholes Vrede and Weltevrede and the Swartberg borehole, which is just seaward of the escarpment, and outcrop samples published by Brown et al. (2002). We interpret the Springfontein data as evidence for differential movement of a crustal inlier along a complex sequence of faults during the Mid Cretaceous, where this crustal block was down thrown and thus little affected by denudation during the Mid Cretaceous event. This structural interpretation is supported by the occurrence of several major E-W oriented rift basins within the vicinity of Springfontein which are all bounded to the north by normal faults and down thrown blocks to the south.

References

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