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Tectonomorphic evolution of the Kenya rift flanks: Implications for Late Cenozoic environmental changes in East Africa?

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The Kenya rift valley is the classic example of an active continental rift zone. Its flanks have been studied by apatite fission track analysis, revealing a complex denudation history involving several discrete cooling events (Foster and Gleadow, 1992 and 1996). About 1.2 to 2.0 km of denudation occurred during the Early Cretaceous, while a further 2.6 to 3.0 km of crust was removed during the Late Cretaceous-Paleocene. However, because of the limited amount of Late Cenozoic cooling, the most recent phase of extension associated with the formation of the present-day rift valley is not monitored by the AFT system (most sensitive between ∼110 to 60˚C). The apatite (U-Th)/He system with its lower temperature sensitivity (∼80 to 40˚C) records exhumation from shallower crustal levels and thus holds the potential to monitor the younger stages of rift valley evolution.

For this study we revisited profiles from the rift margins (0 to 2˚N) previously analysed using AFT thermochronology (Foster and Gleadow, 1992, 1996). The resulting cooling history, based on the combination of the previously existing apatite fission track data and new (U-Th)/He data, was interpreted in terms of the tectonomorphic evolution of the rift flanks and related to the environmental evolution of East Africa. The following can be concluded from our data:

(1) Samples from high elevations of the eastern rift flank yielded Late Cretaceous (U-Th)/He ages, corroborating the Late Cretaceous fast cooling event revealed previously by AFT dating. This cooling event was presumably of continent-wide significance and seems to reflect a change of the extensional stress regime in Africa. (2) Post-

Cretaceous cooling was slow with net cooling of less than 20˚C, corresponding to net denudation of 0.8 to 1 km, for the whole Cenozoic. We interpret this slow cooling in terms of absence of a significant relief. (3) Samples from the western rift flank and from low elevations of the eastern rift flank revealed a Late Neogene cooling event associated with net cooling of ∼38˚C and net denudation of 1.5 to 2 km. The western flank is slightly deeper eroded than the eastern flank. The Late Neogene cooling period is interpreted to reflect the uplift and relief formation of the graben shoulders. It largely coincides with the uplift of the Western Rift flanks in Uganda/Congo and with the change toward drier conditions and grassland-dominated vegetation in East Africa. We therefore suggest that the regional tectonomorphic evolution contributed to the Late Cenozoic environmental changes in East Africa.

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