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Tracing the exhumation history of the Rwenzori Mountains, Albertine Rift, Uganda, using low-temperature thermochronology

Friederike U. Bauer (1), U.A. Glasmacher (1), M. Karl (1), U. Ring (2), A. Schumann (3), and B. Nagudi (3)

(1) University of Heidelberg, Institute of Geosciences, Heidelberg, Germany (friederike.bauer@geow.uni-heidelberg.de), (2) Geological Sciences, University of Canterbury, New Zealand, (3) Geology Department, Makerere University, Kampala, Uganda

South-west of Lake Albert, in the Western Rift of the East African Rift System (EARS) the Rwenzori Mountains emerge as a fairly narrow but extraordinary high mountain range. Representing a dissected Precambrian metamorphic basement block that has been uplifted to heights of more than 5.000 m a.s.l. they consequently raise the question about their evolution.

As low-temperature thermochronology provides well established tools to trace the cooling history of a crustal segment, the presented study seeks to confine the thermal, uplift and denudation history of the Rwenzoris using apatite fission-track (AFT) as well as apatite and zircon (U-Th)/He (AHe, ZHe) analyses. Thereof revealed data and associated protracted cooling paths of individual samples point to an exhumation history of the Rwenzoris that started with an accelerated cooling of the rocks in Jurassic times followed by a long period of constant and slow cooling. In Neogene times, the area again was affected by processes inducing an amplified exhumation of the Rwenzori block, with differentiated erosion and uplift movements during the last 10 Ma. Thermochronological data indicate that the final uplift of the Rwenzoris was in the near past, where erosion could not compensate for.

Uplift and erosion vary not only in time but also in space. In the central part of the Rwenzori Mts, for example, a northern and a southern block can be distinguished, with the latter giving AFT ages ranging from 326.2 (28.1) Ma to 389.6 (34.3) Ma, while most of the AFT ages of the northern block scatter at 130 (8.0) Ma. Although reaching from ca. 1.600 m a.s.l. to ca. 5.000 m a.s.l. AFT and ZHe ages in both blocks do not varying significantly with elevation. Obtained thermochronological data sets, therefore, give evidence for a complex exhumation history of the Rwenzori Mts, with zoned thermochronological age patterns across the range, indicating erosion and uplift of distinct blocks at different times.