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Initial rifting and long-term landscape evolution of the Albertine Rift in East Africa

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In East Africa, the feedback between tectonic uplift, erosional denudation and associated possible climate changes is being studied by a multidisciplinary research group, 'RiftLink'. The group's focus is the Albertine Rift of the East African Rift System (EARS), and therein rising Rwenzori Mountains that stretch along the border of the D.R. Congo (DRC) and Uganda. Major questions relate to temporal and spatial evolution of the Rwenzori Mountains and surrounding Albertine Rift: is the surface uplift of the Rwenzoris (>5 km) directly linked to rift movements in Neogene times, or was there a topographic high long before [1].

To understand the morphological evolution of an area or landscape, knowledge about phases of (dis-)equilibrium between rock exhumation and rock uplift governed by climatic and tectonic processes is essential. Low-temperature thermochronology, like fission-track and (U-Th-Sm)/He dating on apatite and zircon (AFT, AHe, ZHe) are well established tools to trace rock displacements through the upper crust. And, therefore, provide fundamental information helping to decipher the long-term landscape evolution of an area.

Thermokinematic modelling, applied to samples from different parts of the working area allow to better constrain the cooling history and landscape evolution of the Rwenzori Mts as well as surrounding Albertine Rift which will be discussed in the frame of this presentation.

Samples taken along and across the Albertine Rift, cover the area around the Rwenzori Mts and the mountain range itself. From thermochronological analyses (AFT, AHe & ZHe) and subsequent thermal modelling a protracted cooling history since Palaeozoic times can be revealed. This allows tracing back the thermal evolution of this area, long before initiation of the EARS, with the latter showing only minor effects on the cooling of the samples. Striking is the distinct cooling pattern within the Rwenzori Mts, where different blocks can be distinguished revealing differentiated cooling histories. Samples from the southern to south-central part reveal Carboniferous to Permian AFT ages, whereas samples further to the north show Jurassic to Carboniferous AFT cooling ages. Youngest AHe cooling ages of $\sim$25 (0.5) Ma, obtained from this area point to a near surface position of these rocks since Miocene/Oligocene times and very recent (Plio-/Pleistocene) final surface uplift, where erosion could not compensate for.

Thermokinematic modelling, applied to samples from different parts of the working area allow to better constrain the cooling history of the Rwenzori Mts and surrounding Albertine Rift and will be discussed in the frame of this presentation.

References

[1] Bauer F.U. et al. (2010): Thermal and exhumation history of the central Rwenzori Mountains, Western Rift of the East African Rift System, Uganda. IJES, DOI: 10.1007/s00531-010-0549-7