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Long-term landscape evolution of the Rwenzori Mts (Albertine Rift, Uganda) traced by thermal modelling

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The Rwenzori Mts, located SW of Lake Albert, form a striking feature within the Albertine Rift of the East African Rift System. They are located along the border of the Democratic Republic of the Congo (DRC) and Uganda, and extend for about 120 km NS and 50 km EW. The Rwenzoris are built up by a dissected Precambrian metamorphic basement block that has been uplifted to great heights of more than 5 km. Major questions related to the Rwenzori Mts are:
i) the timing of their formation; if their uplift has to be entirely ascribed to rift movements in Neogene times or if they represent an old basement block that formed a mountain high long before, and ii) the evolution of their formation; if they were uplifted as a single coherent block or if exhumation occurred at different times at different places.
The presented study seeks to determine the thermal, surface uplift and denudation history of the Rwenzori Mts using apatite fission-track (AFT) in combination with zircon (ZHe) and apatite (U-Th-Sm)/He (AHe) analysis for thermokinematic modelling. The resulting age data and track length distributions indicate a very complex cooling history that affected the Rwenzori Mts since at least the Mesozoic. Samples from the central and northern Rwenzori Mts reveal AFT ages between 195.0 $\pm$ 8.4 Ma and 85.3 $\pm$ 5.3 Ma, and AHe ages between 210.0 $\pm$ 6.0 Ma to 24.9 $\pm$ 0.5 Ma. Modelled tT-paths reflect a protracted cooling history for the Rwenzori Mts: Accelerated cooling in Permo-Triassic and Jurassic time, followed by a long period of constant and slow cooling, than succeeded by renewed accelerated cooling in Neogene times. Since Miocene differentiated erosion and rock uplift movements affected the Rwenzori Mts, with more pronounced surface uplift along the western flank. The final rock uplift of the central and northern Rwenzoris that partly led to the formation of the recent topography must have been fast and in the near past (Pliocene to Pleistocene). Erosion could not compensate for the latest rock uplift, resulting in Oligocene to Miocene AHe ages [1].
Samples from the southern Rwenzori Mts, however, reveal Carboniferous to Permian AFT ages, pointing to an earlier onset of cooling in this area and demonstrating once more the very complex cooling history of the Rwenzoris.
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