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Contrasting long-term denudation in Sri Lanka

F. Lisker (1), B. Emmel (2), and T. Hewawasam (3)

(1) University of Bremen, FB 5 - Earth Sciences, Geodynamics of Polar Regions, Bremen, Germany (flisker@uni-bremen.de), (2) Dept. Earth Sci., University of Bergen, Allégaten 41, NO - 5007 Bergen, Norway, (3) Faculty Appl. Sci., Sabaragamuwa University, 70140 Belihuloya, Sri Lanka

The landscape of the Sri Lanka is characterized by a unique relief that can be divided into three distinctive physiographic provinces: lowlands, uplands and highlands. This geomorphological pattern largely coincides with the distribution of three NNE-SSW striking tectonic provinces called Wanni, Highland and Vijayan Complexes. Of these, the central Highland Complex represents the backbone of the Precambrian rocks of Sri Lanka. Only the southern escarpment of the highlands is not associated with any major basement structure.

Early geomorphological studies link the island's topography with repeated tectonic and erosional episodes. In contrast, most recent workers interpret the high relief in Sri Lanka as the remnant of a stable geomorphic block that was uplifted during rifting at 130 Ma or even earlier, and that was reduced subsequently by rapid escarpment retreat. Published cosmogenic nuclide data indicate extremely low weathering and short-term erosion rates for the steep, humid, tropical central highlands of Sri Lanka.

A current research project combines fission track analysis, remote sensing and structural research to quantify and interpret the regional Phanerozoic geological history and long-term landscape evolution. Apatite fission track ages of 40 samples from southern and western Sri Lanka range between ca. 70 and 350 Ma, hence being substantially younger than the Pan African regional thermal overprint. All fission track ages >250 Ma are confined to Jurassic sediments of the coastal lowlands whereas basement ages increase from lowlands towards highlands.

Thermal history modelling of the fission track ages, associated track length data and composition proxies indicates that cooling of the now exposed rocks below temperatures of $\sim$110°C commenced in the late Paleozoic/ early Mesozoic. Both thermochronological and sedimentological data refer to a distinctive denudation pulse likely triggered by rifting due to Gondwana breakup during Jurassic times. Younger cooling of minor magnitude is mainly related to escarpment retreat while long-term erosion rates of the highland plateaus are very low.

The coincidence of the course of western escarpment with the boundary between Wanni and Highland Complex suggests some lithological control of escarpment formation. However, lithological contrasts are widely absent across the steeper, and more distinctive southern escarpment. Instead, the correlation of new brittle structural data with the fission track pattern indicates that at least the formation of the southern escarpment is tectonically determined. Moreover, the significant increase of precipitation towards SW Sri Lanka suggests that regional denudation may be superimposed by climatic effects.