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Long-term and present-day erosion of the Eastern Himalaya as detected by detrital thermochronology.

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River networks regulate mass fluxes and modulate the topography produced by tectonic forces, transporting critical information downstream in the foreland basin. River sediments contain an inventory of the characteristics of the source rocks eroded in the hinterland of a drainage basin. Thus, detrital thermochronology can be used as a tool to infer spatial variability of exhumation and erosion rates in an actively evolving landscape. In the eastern Himalaya, the Namche Barwa syntaxis is exhuming and eroding anomalously rapidly compared to the rest of the Himalaya (Zeitler et al., 2001; 2014). This relatively small area provides a significant proportion of the material flux drained by the major modern fluvial system, the Yarlung-Siang-Brahmaputra River. This is reflected in the detrital signal by a characteristic young peak (<3 Ma for ZFT and < 5 Ma for muscovite Ar-Ar).

We present here new detrital zircon fission-track and muscovite 40Ar/39Ar data from modern sediments in rivers draining the Eastern Himalaya. The cooling ages reflect three major pulses of exhumation spanning from Miocene to Quaternary with a characteristic signature related to the young exhumation (<5 Ma) of the Namche Barwa syntaxis for both thermochronometers. The young ages can be traced in river sediments hundreds of kilometers downstream from their source in the Brahmaputra foreland. However, the signal is heterogeneous for the applied systems, which record a substantial mismatch in the density of the youngest ages.

In order to quantify present-day erosion rates in the catchments and the amount of the mixing of different sources in the river, we applied a linear inversion to the binned age distributions. The results from the modelling highlight the downstream evolution of the detrital signal in the Eastern Himalaya. The inversion predicts higher erosion rates in basins adjacent to the Siang River, where young cooling ages from the Namche Barwa are drained into the system, forming a characteristic peak. Lower exhumation rates are predicted from sediments in rivers draining Tibet and the Lohit plutonic suite of the Mishmi hills, where Early-Miocene ages form the major peak in the age distributions. Our data define consistent trends in regional mica and zircon cooling ages in the source rocks and can be used to assess sediment provenance and drainage-basin averaged bedrock exhumation in different sectors of the Eastern Himalaya.