Isotope provenance of Eastern Himalayan rivers draining to the south into India, Nepal and Bhutan

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The Himalayas represent a unique natural laboratory where the interactions between tectonics, erosion, climate and drainage evolution can be investigated. The purpose of this work is to understand, in collaboration with other PhD students and researchers collaborating in the iTECC Marie Curie Initial Training Network, the importance of processes involving the complex links and feedbacks between climate, tectonics and erosion.

The two syntaxes of the Himalaya (eastern and western) show anomalously fast recent exhumation compared to the rest of the Himalaya, as typified by mineral ages <10 Ma (Zeitler et al., in press). Various hypotheses and models have been proposed to explain this anomaly, for example those include coupling between tectonics and erosion, such as the Tectonic Aneurism model (Zeitler et al., 2001; Zeitler et al., in press), which calls on ductile upwelling of weak lower crust (Beaumont et al., 2001).

Understanding the timing of onset of this rapid exhumation is critical to informing these models. Bedrock studies suggest rapid exhumation since 4 Ma (Seward and Burg, 2008) or maybe 10 Ma. However, detrital studies (Ar-Ar micas, ZFT), using the record of material eroded from the syntaxis and preserved in the foreland basin, show no evidence of anomalously young grains and thus rapid exhumation throughout the duration of the sedimentary succession studied (Bracciali et al., 2012; Chirouze et al., 2013). However, both these detrital studies were conducted in regions distal to the syntaxes, and it is possible that downstream dilution may have affected the signal.

The purpose of this research is to investigate the potential effect of dilution on the detrital signal by 1) looking at how the detrital signal evolves downstream i.e. the degree to which the "young" grain signal is diluted at increasing distance from the source and 2) a comparison of ZFT and Ar-Ar mica ages from the same samples, to investigate whether there is any distinction in the dilution effect depending on mineral type.

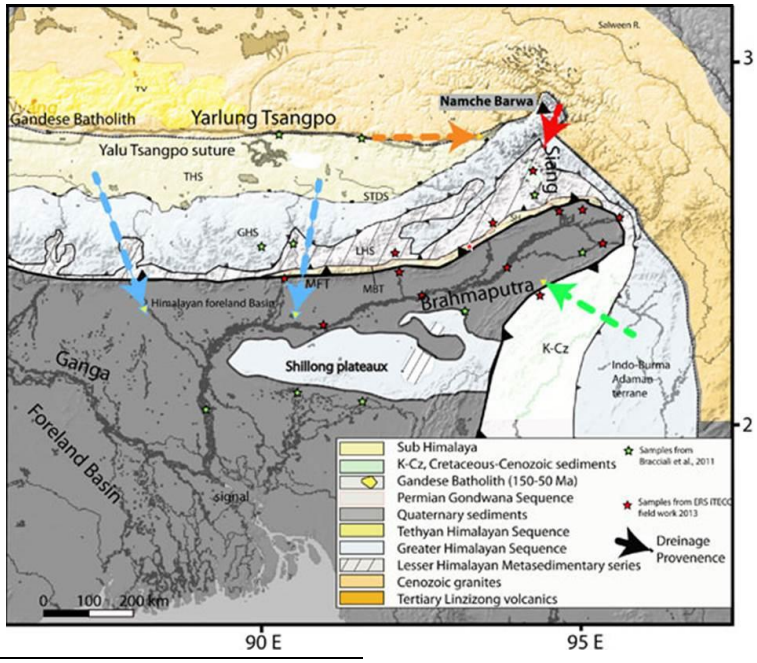

Figure 1. Regional tectonic map showing sampled geology and location of major rivers. The red stars indicates the location of the samples collected during the fieldwork. The arrows indicates the main provenance sediments into the Yarlung Tsangpo-Bramaputra River system. (modified after Chirouze et al., 2012).

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Building on the existing database, eleven samples from the Yarlung-Brahmaputra River system and from tributaries draining the Himalaya, the Arakan belt and the Shillong plateau have been collected in the Arunachal Pradesh and Assam regions of the North-east India (Fig. 1). We will analyse this potentially important aspect in detail, using high-resolution dating of micas of different grain sizes. To analyse smaller and younger grains, newly developed high-sensitivity multi-collection noble-gas mass spectrometry will be used. In this way, we will determine the extent to which dilution should be taken in to account when interpreting detrital signals, and also contribute further to our knowledge of exhumation ages in the source regions.

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