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Early Miocene river capture in the Eastern Himalaya: a multi-technique provenance study of the paleo-Brahmaputra deposits (Bengal Basin, Bangladesh)

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Fluvial drainages impact on, and are impacted by, surface uplift, exhumation and strain, and thus an investigation of their evolution provides a key to understanding crustal deformation processes and erosion-tectonic-climate interactions. The peculiar fluvial drainage configuration of the eastern syntaxial region in the Himalaya has been interpreted either as distorted drainage resulting from crustal shortening (due to India-Asia convergence) and lateral extrusion of crustal material, or as the result of river capture (of the Yarlung Tsangpo by the Brahmaputra river) tectonically-induced by surface uplift. It has also been suggested that the rapid fluvial incision by the Yarlung Tsangpo in the Namche Barwa massif area potentially resulted in such dramatic erosion by focused weakening of the crust, that deep seated ductile rocks were induced to flow upwards and be rapidly exhumed (erosion-tectonic coupling). An investigation of the evolution of the Yarlungo Tsangpo-Brahmaputra fluvial drainage during Neogene times therefore provides a key to understanding crustal deformation processes and erosion-tectonic interactions in the Himalayan orogen. Yet, robust constraints on the occurrence of the proposed river capture and an independent time-frame for such an event have not been provided.

The geology, tectonostratigraphic affinity as well as the geochronology and thermochronology of the Yarlung Tsangpo and Brahmaputra river catchments prior to the capture event would have been very different. The Yarlung Tsangpo follows the line of the India-Asia suture zone, draining the Jurassic-Paleogene Trans-Himalayan arc of the Asian plate to the north of the suture and the northern part of the Tethyan Himalaya of the Indian plate to the south of the suture, while the Brahmaputra prior to capture would have drained the southern Himalayan slopes composed only of Precambrian-Palaeozoic Indian crust, much of which metamorphosed to high grade during the Oligo-Miocene. Hence, the first arrival of detritus carried by the Yarlung Tsangpo in the Neogene deposits of the palaeo-Brahmputra river in Bangladesh (Bengal Basin) is key to date the river capture.

To address this open issue we have applied a multi-disciplinary approach (that ranges from basin analysis and petrography to detrital single grain chronology) to the paleo-Brahmaputra sedimentary record. Using our recent refined approach to U-Pb dating of rutile by LA-MC-ICP-MS we have combined U-Pb data of detrital rutile and zircon from the same sample (Bracciali et al., this meeting, and [1]). These two minerals are stable and widely distributed in igneous, metamorphic and sedimentary rocks and together retain source crystallisation and cooling information over the temperature range down to $\sim$500ºC and thus are ideal proxies for potential source areas with complex tectono-metamorphic histories such as those of the Himalayan region. Our results show that the river capture is as old as Early Miocene, and does not appear to be as young as the literature consensus suggests (< 8 Ma).

[1] Bracciali L., Parrish R.R., Condon D., Horstwood M.S.A., Najman,Y., U-Pb LA-(MC)-ICP-MS dating of rutile: new reference materials and applications to sedimentary provenance, under review in Chemical Geology.