Tracing sedimentary processes in rapidly eroding settings with paired cosmogenic in-situ ^{14}C and ^{10}Be

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Cosmogenic nuclides, such as ^{10}Be, measured in detrital river sediments are widely used to derive denudation rates and sediment fluxes at the scale of entire catchments. Pairing ^{10}Be with another short-lived nuclide such as in-situ ^{14}C (5700 years half-life) allows tracing erosion and sediment processes occuring on Holocene time-scales to be traced at the Earth's surface [1].

In this contribution we use paired ^{10}Be - in-situ ^{14}C measurments in detrital sediments produced by the rapidly eroding Himalayan range to better quantify how sediments are produced and transferred from source to sink. ^{10}Be and in-situ ^{14}C data from trans-Himalayan rivers show that the concentration of in-situ ^{14}C relative to ^{10}Be is lower than what would be expected if sediments were produced by steady-state superficial erosion of the landscape. Such apparent offset between ^{10}Be and ^{14}C concentrations may be explained by the erosion and mobilisation of sediments from large, deep-seated landslides. In that case, we show that it is possible to use paired ^{10}Be and in-situ ^{14}C measurements in detrital sediments to evaluate the average landslide depth and recurrence time averaged over the scale of entire catchments.

Once the sediments are exported to the lowlands, the paired ^{10}Be - in-situ ^{14}C concentrations measured in sediments are mainly sensitive to sediment transfer processes in the floodplain. Sediment storage in alluvial settings leads to the partial shielding of sediments from cosmic rays and results in the rapid decay of ^{14}C in comparison to ^{10}Be. Our preliminary data obtained from the sediments sampled at the mouth of the Ganges in Bangladesh has ^{10}Be-^{14}C signatures close to those measured in the trans-Himalayan rivers mentioned above, suggesting a rapid sediment transfer of sediments through the floodplain separating the Himalayan range from the Bay of Bengal.

[1] Hippe, 2017 – Quaternary Science Reviews, vol. 173, p. 1-19.