Riverine particulate organic matter sourcing varies across the Himalaya

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Rivers are the main agents tranporting particulate organic matter (POM) from mountain ranges into long-term geological sinks with contrasting implications for the long-term carbon cylcle depending on the type of POM eroded. Globally, river transport of petrogenic and biospheric organic carbon is related to sediment yield[1], but significant scatter remains in these relationships. Ties with sediment yield and causes of scatter can be explored in mountain catchments with strong gradients in precipitation, rock type and vegetation. Bulk stable and radiogenic isotope ratios of C and N are often applied to unmix different sources of POM exported by rivers but uncertainties such as the variability in the isotopic composition of sources and composite river load are rarely accounted for. Novel Bayesian mixing models taking into account these uncertainties have recently been combined into the MixSIAR framework[2].

We have used MixSIAR to decipher the contributions of different POM sources along the Trans-Himalayan Kali Gandaki River, based on bulk ^{15}N, ^{13}C and ^{14}C ratios. Our isotopic data allowed us to separate POM sources in the Tibetan headwaters, characterized by petrogenic carbon bearing shales as well as aged and modern soils, from those in the High Himalayas, consisting of high-grade metamorphic rocks, ample standing biomass and thin modern soils. We found that POM sourcing in the upper catchment was dominated by petrogenic carbon with a minor input of soil carbon, and that POM exported from this compartment continued to be an important component of the total riverine POM throughout the High Himalayan river section. While petrogenic carbon from the High Himalayas could be detected in local tributaries it did not significantly influence the POM isotopic signature of the main river. This suggests that the POM source composition is an important control on POM export. In the Kali Gandaki River, this results in a high petrogenic carbon export from a part of the catchment with low relief and erosion rates, contrasting with a lower petrogenic carbon export from the fast eroding High Himalaya.

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