Particulate organic carbon transport during Himalayan erosion

VALIER GALY[1] AND CHRISTIAN FRANCE-LANORD[1]

[1] Centre de Recherches Pétrographiques et Géochimiques, BP 20, 54501 Vandœuvre-lès-Nancy, France ; vgaly@crpg.cnrs-nancy.fr

Himalayan erosion generates the world largest sediment flux to the oceans. Each year, between 1 and 2 billion tons of sediments are transported from the Himalayan basin to the Bengal fan through the Ganga-Brahmaputra fluvial system. The associated Organic carbon (OC) flux, although poorly constrained, likely represents a significant part of the global terrestrial organic carbon flux and therefore should have a great impact on the global OC cycle.

Suspended and bed sediments were sampled in the G-B fluvial system from the Himalaya to the delta during several monsoons. Suspended sediments were collected at different water depth in order to integrate sediment heterogeneities. Total OC concentration (TOC), stable carbon isotopic composition ($\delta^{13}C$) and sediment characteristics were determined. This allows: (1) to study the OC fate during the transport from the Himalaya to the delta and (2) to re-estimate the organic carbon flux generated by the Himalayan erosion.

From the Himalayan range to the delta, all sediments define a clear positive correlation between TOC and Al_2O_3/SiO_2 ratio. Throughout all the system, the organic carbon content is therefore determined by the proportion of fine and clayey minerals. In the Himalayan rivers, sediments have stable low $\delta^{13}C$ around –24 ‰, indicating a dominant C3 plants contribution. In the plain, Ganga and Brahmaputra suspended sediments present contrasted $\delta^{13}C$, as high as –20.6 ‰ for Ganga and around –23.5 ‰ for Brahmaputra. In the Ganga basin, the $\delta^{13}C$ evolution from the Himalaya to the delta indicates a significant recycling of the organic carbon pool during the deposition-erosion cycles in the plain. This process does not appear in the Brahmaputra basin, indicating contrasted OC fate in the G-B system likely due to different river type: meandering for the Ganga, braided for the Brahmaputra.

Previous studies, based on surface suspended sediments, propose a mean organic carbon content in the suspended sediments of the system ranging between 0.6 % and 1.0 %. Our sampling strategy allows to take into account the sediment heterogeneity and thus to re-estimate a weighted mean TOC, integrating the flow velocity, the sediment concentration and the TOC variability. The mean TOC of fluvial sediments delivered to the Bengal fan appears lower than previously estimated and ranges between the integrated concentration for suspended sediments (0.4 %) and bed sediments TOC (around 0.1 %).