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IODP Expedition 354 to the Bengal Fan: a Neogene record of Himalayan erosion. Implications on the carbon cycle

Christian France-Lanord (1), Volkard Spiess (2), Albert Galy (1), Valier Galy (3), Pascale Huyghe (4), Adam Klaus (5), and Iodp Expedition 354 Scientists ()

(1) CRPG CNRS/U. Lorraine, Vandoeuvre-les-Nancy, France, (2) University of Bremen, Germany, (3) WHOI, Woods Hole, MA, USA, (4) ISTER, CNRS-UJF, Grenoble, France, (5) IODP, TAMU, College Station, TX, USA

Bengal Fan Expedition 354 drilled an E-W transect in the middle fan at 8°N to investigate interactions between the growth of the Himalaya, the development of the Indian monsoon, and processes affecting the carbon cycle. A comprehensive record of turbiditic deposition between the Late Oligocene and Holocene was drilled over a seven sites E-W transect at 8°N. Shipboard results reveal that the chemical and mineralogical compositions of turbiditic sediments cored across the transect are relatively stable throughout the Neogene. By comparison to modern river sediment compositions (Lupker et al. ref), they reveal a weak intensity of chemical weathering without marked variation through time. Clay assemblages are dominated by illite and chlorite with minor proportions of newly formed clays. This differs from the distal fan record (Leg 116) where the Late Miocene and Pliocene turbidites show high weathering signatures and smectite rich clay assemblage. This difference im plies that the distal fan record does not reflect to an evolution of the source erosion. Rather it is controlled by a change in sediment transport within the fan. Shipboard estimates of organic carbon loading and behaviour resemble observations made in the modern Ganga-Brahmaputra river sediments, suggesting efficient terrestrial organic carbon burial in the Bengal Fan [1]. Preliminary observations support the idea that Himalayan erosion has consumed atmospheric CO_2 through the burial of organic carbon, more than by silicate weathering.

The main evolution observed in Expedition 354 record is the content of detrital carbonate that is persistent through the Neogene but appears to show a consistent decreasing trend from 8–10% during the Miocene to 3–6% during the Pleistocene and Pliocene. Also, a prominent feature of Miocene silt and sand beds is the higher abundance of plant fragments compared to younger sediments. Together these observations reveal changes in the sediment sources and erosion conditions of the hinterland during the Miocene and Pliocene. Amongst hypotheses, the Miocene Himalaya may have exposed more Tethyan limestone rich formations than during Pliocene to modern time. Alternatively, carbonate preservation during erosion may reflect lower water/sediment ratio, which would imply weaker weathering condition during Miocene.

Expedition 354 cores will allow to estimate the overall impact of Himalayan erosion on the carbon cycle by coupling growth rate of the fan, erosion rate and chemical composition of the sediment. Preliminary observations support the idea that Himalayan erosion has consumed atmospheric CO_2 through the burial of organic carbon, more than by silicate weathering.

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