Triple oxygen and hydrogen isotopic variations of pore waters from the middle Bengal Fran (IODP Exp. 354)

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At the transect of the 7 drill sites of the IODP Expedition 354, at 8°N across the Bengal Fan, the interstitial water chemistry displays systematic changes found at every sites, and similar to pore water profiles in other deep sea fans. In the top 30 to 60m, large rise in alkalinity is associated with the complete reduction of sulphate. A consequence of high alkalinity values is some consumption of calcium (and magnesium) induced by the precipitation of carbonate.

Variations in the H2O isotopic compositions have been obtained by TDLAS using a modified Picarro L2140i. Pseudo bracketing with distilled waters have been used to correct for drift related to the progressive deposition of salt in the evaporation chamber, where an insert with Ni wool focussed the precipitation at the entrance of the chamber. With such protocol, no significant effect of salinity (up to 40‰) on the isotope analysis has been found and the external precisions were 0.6‰, 0.08‰ and 19 per meg on δD, δ18O and Δ17O, respectively, at 2σ level. The δ18O display a classical self-diffusion of the water-molecule profiles with a rise of up to 0.50‰ and maximum values reached between 20 to 30 m depth below sea floor (mbsf). This is associated with a rise in salinity by up to 4%, followed by a small decrease (1.6%) in the next 50 to 100m. Below 30 mbsf, the δ18O profiles are characterised by a monotonous decrease, reaching a minimum of -1.3‰ around 600 mbsf. Up to this depth, the δD profiles are mimicking the δ18O profiles. Despite some isotopic modification (evaporation) during the sampling and the preservation, the bottom parts of the 2 deepest holes suggest a slight (0.4‰) rise of the δ18O associated with a decrease in the δD of 1.3‰. Deep diagenetic hydration reactions could explain such diverging trend in δD and δ18O, but would only correspond to a loss of H2O to the sediment by no more than 1-2%. The diversity of biogeochemical processes along those profiles is not impacting the Δ17O since its average value of -1.4 ± 17 per meg (2σ, N=159) on the VSMOW-VSLAP scale is very close to the Δ17O of seawater and the variablility is smaller than the long term precision. In detail, however, they might be a slight increase (~7 per meg) in the Δ17O in the top 300 mbsf, followed by a decrease of ~15 per meg between 300 and 750mbsf and another decrease of 12 per meg in the bottom 300 mbsf.