Preliminary results of interstitial water geochemistry from IODP Expedition 362: Subduction inputs to the Sumatra subduction zone

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The Mw 9.2 Sumatra earthquake in 2004 resulted in unexpectedly shallow megathrust slip, which amplified the earthquake magnitude and caused a devastating tsunami. At two sites (Sites U1480 and U1481) International Ocean Discovery Program (IODP) Expedition 362 cored the input sediment with R/V JOIDES Resolution ~250 km seaward of the Sumatra subduction zone to groundtruth the material properties that contributed to the unexpectedly shallow seismogenic slip and a distinctive forearc prism structure of the North Sumatra subduction zone. The recovered sediment comprise a Late Cretaceous to Miocene abyssal-plain environment facies consisting of mixed tuffaceous and pelagic sediments and a series of intercalated pelagic and igneous materials, which is overlain by a thick sequence of siliciclastic sediments (mostly siliciclastic mud, siliciclastic sand and calcareous mud) of the Nicobar fan. Here we present preliminary results from shipboard geochemical analyses of interstitial waters.
The sulfate-methane transition zone (SMTZ) exists at 120 mbsf. Concentrations of ammonium and phosphate have positive peaks above the SMTZ, which reflect the remineralization of organic matter. Low alkalinity and calcium concentration below the SMTZ indicate carbonate precipitation. Release of silica and cations (K^+, Ca^{2+}, Na^+, Al^{3+}) to the interstitial water are indicative of volcaniclastic ash alteration in the upper 20 mbsf. A subsequent depletion of potassium below 400 mbsf to values as low as 1 mM suggest zeolite formation, consistent with observations in the recovered sediment. The high sulfate concentration of 15 mM in pelagic sediment at 1403 mbsf may reflect a presence of sulfate-rich fluid in the basement aquifer. Ongoing post-expedition analyses of interstitial water geochemistry will provide additional insights into fluid-rock interactions and fluid flow processes which will shed light on the evolving properties of the sediment incoming to the North Sumatra subduction zone.

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