Constraining fluid flow dynamics at the northeastern Pacific continental margin

H. STRAUSS[1], N. GUSSONE[2], C. MÄRZ[3] AND B. M. A. TEICHERT[1]

[1]Institut für Geologie und Paläontologie, University Münster, Germany, (barbara.teichert@uni-muenster.de)
[2]Institut für Mineralogie, University Münster, Germany
[3]Newcastle University, School of Civil Engineering and Geoscience, Newcastle upon Tyne, NE1 7RU, UK

During IODP Expedition 341 a cross-margin transect was drilled on the NE Pacific continental margin in southern Alaska. Sites U1417 and U1418 are a distal and a proximal record on the Surveyor Fan and provide a sedimentary record reaching back to the late Miocene and early Pleistocene, respectively. From distal to proximal, the sulfate penetration depth into the sediments shallows. At U1417 there is a gap between the deepest sulfate penetration and the methanogenic zone, while at U1418, a distinct sulfate-methane transition zone (SMTZ) is apparent at about 75 m depth below seafloor.

The upper section of Site U1417 indicates continuous sulfate reduction by organic matter degradation in the upper 200 m due to its typical convex-up curvature [1]. In the deeper section at about 650 m below seafloor, however, an SMTZ suggests that anaerobic oxidation of methane leads to the depletion of upward diffusing sulfate, likely derived from a deep aquifer that exists at the sediment-basalt contact. In contrast, the more linear sulfate profile at Site U1418 appears to reflect a more focused sulfate consumption driven by an upward methane flux from below at rates substantially higher than those for sulfate reduction of sedimentary organic matter.

Combined sulfate sulfur and oxygen isotope values, in part with extreme isotope enrichments, support the notion of progressive sulfate reduction.

Strontium (Sr) isotope geochemistry is directly linked to sulfate via barite dissolution. At Site U1417, the distinct increase in Sr concentration below the SMTZ indicates together with an increase in barium the dissolution of barite as pore water becomes undersatured with respect to sulfate. The same process can be observed below the much shallower SMTZ of Site U1418 where again the dissolution of barite leads to more seawater like Sr isotope values in the pore water.

[1] Borowski, *et al*. (1996) *Geology* **24**, 655-658.