Paper Number: 1091

Carbon Dioxide Migration in Sediments on the Chatham Rise, New Zealand

Coffin, R. B.[1], Rose, P.S.[1], Pecher, I.[2], and Davy, B.[3]

[1]Texas A&M University – Corpus Christi, Corpus Christi, Texas, USA
[2]University of Auckland, Auckland, New Zealand
[3]Geologic Nuclear Survey, Wellington, New Zealand

Seismic studies have identified an extensive field (>20,000 km^2) of seafloor depressions and pockmarks across the southwestern flank of Chatham Rise, New Zealand. The pockmarks were initially interpreted to result from past hydrate dissociation and high gas advection through the sediments into the overlying water column and atmosphere. Sediment piston coring across the Chatham Rise targeted areas thought to have a high present-day vertical CH_4 flux in the sediments. Pore water SO_4^{2-} and sediment CH_4 were measured at these sites to characterize the current-day CH_4 flux in this study region, assuming steady-state consumption of SO_4^{2-} and CH_4 by anaerobic oxidation of methane (AOM): $CH_4 + SO_4^{2-} \rightarrow HCO_3^- + HS^- + H_2O$. This reaction is one of the primary controls on CH_4 distributions in sediments. Results from >40 cores in three different regions showed there was no evidence of vertical migration of CH_4.

Solid phase sediment organic and inorganic radiocarbon natural abundance offers an alternate explanation. The inorganic and organic radiocarbon signatures in eight cores at distinct locations ranged 9,200 yBP to 50,000 yBP and 8,400 yBP to 38,000 yBP, respectively. Comparing the radiocarbon age profiles with published sedimentation rates for this area (20 to 400 m/ma), all radiocarbon signatures are older than a conservative aging line. These data suggest that there is a current, active migration of deep sediment CO_2 to the shallow sediment. Recent studies have shown depleted radiocarbon DIC values in the water column overlying the Mariana Arc Volcano that are thought to result from hydrothermal fluid advection. As well strong decarbonation of carbonate rich sediments have been shown to produce CO_2-rich fluids and liquid CO_2 with subduction in the western Pacific. Seismic and geochemical data from Chatham Rise will be presented to as evidence for current CO_2 vertical fluxes at three different locations.