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Microbial methane consumption at cold seeps of the Hikurangi Margin (South-West Pacific, New Zealand)

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Ocean margin research of the last decade has provided evidence for a variety of fascinating ecosystems associated with fluid, gas and mud escape structures. Over the last decade, several indications for gas seepage were found in the South-West Pacific along the convergent margin of New Zealand (Hikurangi Margin). In 2007, we surveyed this region for seep ecosystems and microbial methane turnover during the 2^{nd} and 3^{rd} leg of cruise SO-191 with R/V Sonne. Among the investigated sites were Bear's Paw, Kaka, L.M.9, Rock Garden and Wairarapa. Several sediment samples were recovered using a video guided multiple corer (MUC) and gravity corer from habitats adjacent to active methane escape or carbonate outcrops, from blackish, reduced sediments devoid of megafauna as well as from those populated by ampharetid polychaetes ("raindrop" site). The microbial consumption of methane and sulphate were measured with radiotracer assays. Highest rates of anaerobic oxidation of methane (AOM) and sulphate reduction (SR) of up to 4.5 mol m^{-2} yr^{-1} were detected at the "raindrop" sites. These rates are comparable to other highly active seeps (e.g. Hydrate Ridge and Haakon Mosby Mud Volcano) where maximum rates were found in a narrow horizon of a few centimetres just below the sea floor in reduced sediments covered by bacterial mats. In contrast, at the "raindrop" sites, maximum rates were comparably low ($<$300 nmol cm^{-3} d^{-1}), but the AOM horizon was stretched over a sediment interval of about

10 cm. The polychaete worms probably irrigate this sediment horizon with sulphate. Accordingly, reduced sediments devoid of megafauna at the Hikurangi Margin were characterised by a substantially lower microbial activity ($\sim$1 mol m^{-2} yr^{-1}). These results highlight the importance of bioirrigation and bioturbation, replenishing sulphate to the electron acceptor depleted sediments, and hence increasing the efficiency of the microbial filter against methane.