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Diverse Microbial Communities Mediate Anaerobic Oxidation of Methane at Mud Volcanoes in the Gulf of Cadiz

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The Gulf of Cadiz is an area characterized by numerous mud volcanoes, diapirs and pockmarks. During the SONNE-175 GAP Cruise (Dec 2003), several mud volcanoes (MV) and mud diapirs were investigated for active gas seepage and the presence of hydrocarbon degrading microorganisms. Pore water analyses of sediment cores recovered from the summits of several mud volcanoes reveal that uprising thermogenic methane is consumed via the anaerobic oxidation with sulphate in sub-surface sediments (Duarte et al. EGU 2005, SSP11/TS1). Concentrations of 13C-depleted, archaeal and bacterial lipid biomarker are increased in a narrow horizon at the sulphate methane transition zone (SMT). This shows, that methane is consumed anaerobically in a distinct subsurface horizon by consortia of methanotrophic archaea and sulphate reducing bacteria (SRB). A combination of DNA analyses and biomarker fingerprints provide evidence that AOM is mediated by archaea of the ANME2 and SRB of the Seep SRB1 cluster at Captain Arutyunov MV but by a mixed community comprising both, ANME1 and ANME2 associated to Seep SRB1 at Bonjardim MV. In the northern part of the Gulf of Cadiz, previous expeditions revealed mud diapiric ridges that were littered with carbonate crusts and fragments of chimneys. The lipid imprint in carbonate crusts recovered from two of these structures, Hesperides and Faro, shows the presence of ANME1 and a mixed ANME1/ANME2 community, respectively. Their biomarker signatures in the carbonate indicate that carbonate precipita-

tion was associated with conditions favouring anaerobic methane oxidizers. At the investigated mud volcanoes, methane flux was controlled by AOM communities in subsurface sediments >25 cm. Moreover, video observations could not reveal signs of recent fluid or gas escape from mud volcanoes and diapirs in the Gulf of Cadiz.

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