Proxy of past and present methane migration in the active accreted continental margin sediments offshore Southwestern Taiwan

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Methane migration and associated venting processes were invested in sediments from the accreted continental margin offshore Southwestern Taiwan. A set of core samples were taken and analyzed for pore water sulfate, chloride, methane, sulfide and sediment pyrite, AVS, organic carbon and carbonate contents.

Distinct spatial variations of methane concentration and depth of sulfate-methane interface were found. Rapid sulfate reduction, high concentrations of methane, dissolved sulfide and pyrite were found in active margin sediments with shallow SMI at the accretionary wedge deformation front. Methane migration control sulfate reduction, pyrite formation and authigenic carbonate in the study area. Deeper SMI and concentrations of methane and dissolved sulfide decreased rapidly away from the accretionary front from west to east with the exceptions of some venting areas. In addition, high pyrite concentrations, C13 depleted authigenic carbonate and dead vent tubes were found in sediments with little sulfate reduction in the middle and rear part of the accretionary wedge, reflecting past methane venting and associated processes. The occurrences of past venting features away from the deformation front and the active methane vent near the front indicate that tectonic activity associated with accretionary wedge formation is controlling methane migration and venting in the study region.

Stable carbon isotope probing of intact polar lipids from benthic archaea in marine subsurface sediment

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Benthic archaea contribute significantly to the biomass in the marine deep biosphere [1] but their metabolic activity and role in subsurface microbial communities remain poorly understood. The lack of distinctive natural isotopic signatures in archaeal cells or lipids [2] makes it difficult to associate the isotopic values with a particular carbon source or an assimilation pathway. The hypothesis of heterotrophic benthic archaea [2] therefore awaits further confirmation. In this study, we adopted a stable carbon isotope probing approach with diglycosyl-glycerol dibiphytanyl glycerol tetraethers (2Gly-GDGTs) as the target compounds. Focusing on biphytanes cleaved from intact polar GDGTs after preparative HPLC circumvents isotope dilution caused by apolar GDGTs from unspecified fossil sources. A sediment sample from Hydrate Ridge (ODP Leg 204, Site 1245, 8 mbsf) was slurried and tested with the following ^{13}C-labeled substrates: [^{13}C]*Spirulina platensis* (lyophilized cyanobacteria cells), [2-^{13}C]acetate, $NaH^{13}CO_3$, and $^{13}CH_4$.

After 176 days of incubation, the isotopic compositions of biphytanes in amended samples were not significantly different from the time-zero control. The only exception was the cyanobacteria-amended sample, in which 1-1.5‰ ^{13}C-enrichment was found in bicyclic and tricyclic biphytanes, with at least the latter derived from crenarchaeol. This initial result indicates heterotrophic assimilation of carbon by benthic crenachaeota under extremely slow growth rates. The initial pattern of ^{13}C uptake in archaeal biomarkers will be examined by prolonged incubation of up to 18 months, in which the assimilation of additional low-molecular-weight organic substrates is evaluated. Phylogenetic analysis will be performed on the initial and incubated sediments to clarify the composition of archaeal community.

[1] Lipp *et al.* (2008) *Nature* **454**, 991-994. [2] Biddle *et al.* (2006) *Proc. Natl. Acad. Sci. USA* **103,** 3846-3851.