



Factors controlling the type of consortia in cold seep environments: a molecular and isotopic investigation on authigenic carbonates from the South China Sea

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The patterns, distributions and stable carbon isotopic compositions of lipid biomarkers in cold seep carbonates from the South China Sea continental slope were investigated. Distinct suites of ^{13}C -depleted membrane lipids attributing to archaea and bacteria that mediate anaerobic oxidization of methane (AOM) were recognized. The strong ^{13}C -depletion (as low as $-138.7\text{\textperthousand}$ of biomarkers, such as C20–C30 isoprenoid hydrocarbons, isoprenoid fatty acids are typically associated with archaea. Bacterial lipids, on the other hand, are mainly composed of terminally-branched fatty acids, n-alkanes, n-fatty acid and hopanoids. The lipids with largely variable $\delta^{13}\text{C}$ values suggest that they derived from different bacterial communities co-occurring with methanotrophic archaea. In addition, biomarkers point to terrestrial and planktonic organisms were detected. As revealed by a diagnostic suite of ^{13}C -depleted biomarkers preserved in the carbonates, methane was predominantly oxidized by heterogeneous AOM-related microbial consortia. The varying predominant microbial consortia in different samples are interpreted as the differences in carbonate formation conditions, such as water depth, degree of anoxia, alkalinity, supply of methane and sulfate.