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Biomarkers and carbon isotope composition of anaerobic oxidation of methane in sediments and carbonates of the northeastern part of South China Sea

Xiaoguo Yu (1), Xiqiu Han (1), Hongliang Li (1), Jianming Gong (2), Erwin Suess (3,4), Yongyang Huang (5), Nengyou Wu (5), and Xin Su (6)

(1) KLSG, Second Institue of Oceanography of the State Oceanic Administration, Hangzhou 310012, China (yuxiaoguo@sio.org.cn), (2) Qingdao Institue of Marine Geology of China Geology Survery, Qingdao 266071, China, (3) Leibniz-Institue for Marine Science, 24148 Kiel, Germany, (4) German Marine Resarch Consortium, 10117 Berlin, Germany, (5) Guangzhou Marine Geology Survery, guangzhou 510760, china, (6) China University of Geosciences, Beijing 10083, China

The study area locates in the northeastern part of South China Sea. Sampling was carried out during the Sino-German research cruise RV Sonne 177 in summer 2004. Sediment cores were taken in Haiyang IV area where water depth is around 3000m. Authigenic carbonates samples were retrieved by TV-guided grabs in the Jiulong Methane reef where water depth is shallow than 800m.

We here show the biomarkers and their isotopic composition in sediments and carbonates; bulk TOC, TN, 13Corg and 15N in sediment core GC16. These data suggest both the biomarker and isotope records have been changed when the surrounding environment occurring the methane fluid. All the anomalous data occurred in the sulfate-methane-interface (SMI).

Abundant AOM-related biomarkers (C20 Crocetane, C25 Pentamethylicosane, C30 Squalane) with highly depleted 13C (13C = -74.2 to -119.0 %■, vs, V-PDB) are present in sediment cores and authigenic carbonates. These data identify the authigenic carbonates as microbially-mediated methane-derived precipitates. Furthermore, the distribution of AOM-biomarkers in sediment core indicates that the modern AOM-process occurs around 400cm to 600cm below seafloor(bsf), coincident with the SMI. The upper boundary of the SMI is about 340cm(bsf) according to the sulfate, Chloride, methane concentration and total alkalinity of pore-water in GC16 site. Above the SMI, the content of AOM-related biomarkers is either very low or undetectable. This implies that abundant methane consuming microbes thrive just at the SMI and that methane becomes largely exhausted by methanotrophy before it reaches the seafloor. It is suggested that AOM-biomarkers serve as indicator of SMI. Besides, the 13Corg and 15N ratio show the anomalous in the SMI. Above the SMI, the ratio of 13Corg and 15N between –20.7 to -22.3 %■ and 3.6 to 4.5%■ (vs air), respectively, compared marine organism in sediment. Below the 340cm(bsf), the 13Corg values were in the range of –22.6 to –23.9 %■, obviously depleted 13C, and the 15N values were in the range of –2.6 to –3.6 %■, depleted 15N. We conclude that vigorous methane-rich fluid expulsion has occurred at the seafloor when the carbonates formed, while the fluid activity within the sediment is rather weak.