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Interpretation of multiple archaeal lipid biomarkers in deep sediments bearing gas hydrate in the East Sea

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We investigate the distributions and stable carbon isotope values of arhaeal lipid biomarkers at seismically chimney and non-chimney sites (UBGH 2-3, UBGH 2-1_1) of gas hydrate bearing deep core sediments during the second Ulleung Basin Gas Hydrate Drilling Expedition (UBGH 2). The objective of this study was to identify and compare the metabolic pathway of methane-related archaea between both sites. The increased concentration and δ^{13}C-depleted archaeol and *sn*-2-hydroxyarcheol at the Sulphate-Methane transition Zone (SMTZ) of UBGH 2-1_1 could be predominantly methanotrophic activity indicating methane consumption by Anaerobic Oxidation of Methane (AOM). The concentration of methane-related specific biomarkers (PMI, crocetane, archaeol, *sn*-2-hydroxyarcheol) within deep core sediment bearing gas hydrate of both sites is relatively higher than in other sediment sections, showing lower Cl^- concentration. The carbon stable isotopic data (–47.5 ‰ –75.2‰ to –52.4‰) for archaeol, *sn*-2-hydroxyarcheol in the sediment sections (20mbsf, 93 - 100mbsf) at UBGH 2-1_1 reflect methane production via microbial carbon dioxide reduction in deep core sediment. Archaeal lipid biomarker concentrations are slightly different depending on upward methane diffusion or advection with the seismic characteristics of both sites. Based on the archaeal lipid biomarker ratio (*sn*-2-hydroxyarchaeol/archaeol) as a tool to demonstrate the different ANME communities, our result suggest that the predominant occurrence of ANMEs is mediated by upward migration of microbial methane. Consequently, geochemical signature of archaeal lipid biomarkers in the East Sea of the western North Paci?c may be a potential indicator reflected by upward transported-methane in methane cycle of deep core sediment. In addition, the distribution of glycerol dialkyl glycerol tetraethers (GDGTs) is discussed with archaeal lipid biomarkers in the gas hydrate bearing deep sediment.