

BBG005-P05

Room: Convention Hall

Time: May 23 17:15-18:45

Methanogenic pathway in a depleted oil field

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The methanogenic pathway in a high-temperature petroleum reservoir was investigated by incubation of microcosms constructed with production water and crude oil from Yabase oil field (Japan), combined with tracer experiments and molecular biological analyses. Time profiles of the methane and acetate concentrations in the microcosms clearly indicated that methane was stoichiometrically produced from acetate under the in situ conditions. The activities of hydrogenotrophic methanogenesis in the incubated production waters were higher than those of acetotrophic methanogenesis, implying that methane was produced by syntrophic acetate oxidation coupled to hydrogenotrophic methanogenesis. This hypothesis was supported by results from the analyses of the microbial community structure. The 16S rRNA gene sequence analyses of the incubated production waters showed that bacterial communities were dominated by a thermophilic syntrophic acetate oxidizing bacterium, and archaeal communities were dominated by a thermophilic hydrogenotrophic methanogen. The cross-evaluation of biogeochemical and molecular biological data obtained from this simulation evidently indicates that syntrophic acetate oxidation coupled to hydrogenotrophic methanogenesis is the main methanogenic pathway in this high-temperature petroleum reservoir.

Keywords: Petroleum reservoir, Methanogenic pathway, Syntrophic acetate oxidation, Hydrogenotrophic methanogenesis