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Temperature effects on the metabolic pathway of acetoclastic methanogenesis

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Methane is an important greenhouse gas. Of all methane producing mechanisms, microbial methanogenesis accounts for a great proportion of methane budget. Thus, determining the dominant methanogenic pathway would be critical to assess the microbial potential for methane production and to delineate the interspecies regulation for organic mineralization in anoxic, subsurface environments. Of various methanogenic pathways, acetoclastic methanogenesis has been considered to account for 70% of methane inventory in terrestrial environments. Methane production, however, switches from acetoclastic pathway to acetate oxidizations coupled to hydrogenotrophic methanogenesis with the increasing temperatures in some environments, such as rice fields and petroleum reservoirs. In order to investigate the temperature effects on the potential of acetoclastic methanogenesis associated with hydrocarbon seeps, sediments collected from Kuan-Tzu-Ling in southwestern Taiwan were incubated with exogenous acetate at different temperatures (from 30˚C to 80˚C) in anaerobic conditions. Methane, carbon dioxide, and acetate concentrations, and carbon isotopic compositions of methane were monitored through time. Molecular approaches targeting on the detection of *mcrA* gene were also adopted to investigate the community assemblages of methanogenic populations in incubated sediments. Our results showed that methane was produced with the acetate consumption at different rates at different temperatures. The fastest methane production occurred at 60∼70˚C. The δ^{13}C values of methane increased through time at low temperatures. At high temperatures, the δ^{13}C values of methane decreased through time. These lines of evidence suggest that the dominant methanogenesis changed from acetatoclastic to hydrogentrophic pathways with the increase of temperature. Further analyses of methanogenic populations are undergoing.