# Secondary methanogenesis in dormant submarine mud volcano off Tanegashima Island, Japan

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Submarine mud volcanoes are an important source of methane to the hydrosphere and the atmosphere. Several tens of mud volcanoes have been found at off Tanegashima Island along the northern Ryukyu Trench. During the KH-15-2 cruise in 2015, we obtained two sediment cores from the summits of MV#1(30˚53´N, 131˚46´E; water depth: 1540 m; core length: 361 cm) and MV#14 (30˚11´N, 131˚23´E; water depth: 1700 m; core length: 311 cm). The vertical profiles of the chloride concentration show the strong upward advection of deep sourced fluid at the MV#1 and little advection at the MV#14. The nannofossils observation in the sediment sample suggests that the MV#14 is the dormant mud volcano in which the hemi-pelagic Quaternary sediments have covered on the Tertiary sediments conveyed from deep sedimentary realm by the mud eruption. At the active MV#1, generally low concentration ratios of methane to ethane ($C_1/C_2$: ~ 30) and the stable carbon and hydrogen isotopic compositions of methane ($\delta^{13}C$: ~ –45‰; $\delta D$: ~ –120‰) indicate that the hydrocarbon gases are derived from thermal decompositions of organic matter in deep sediments where the *in situ* temperature is >80˚C. At the inactive MV#14, the $C_1/C_2$ ratios were high as 700-4000, and $\delta^{13}C$ and $\delta D$ values of methane were –75‰ and –150‰, respectively. The data strongly indicate that most methane is microbially produced via hydrogenotrophic methanogenesis, suggesting the active methanogenesis in the dormant mud volcano MV#14.