Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

BBG21-03 Room:102B Time:May 22 11:30-11:45

Carbon cycle at Iheya hydrothermal field, mid-Okinawa Trough, Japan

Akira Ijiri[1], Uta Konno[1*], Shinsuke Kawagucci[1], Fumio Inagaki[1], Ken Takai[1]

[1]JAMSTEC

The hydrothermal chemistry in the Iheya hydrothermal field, mid-Okinawa Trough, is characterized by high methane concentration. For the origin of high concentration methane, Kawagucci et al. (2011) hypothesized the microbially produced methane at lower temperature basin-filling sediments surrounding the Iheya hydrothermal field is recharged together with the source fluid into the deep hydrothermal reaction zone.

We investigated carbon cycle mediated by hydrothermal circulation and microbial activity at the Iheya hydrothermal field based on stable isotope chemistry of methane, acetate, dissolved inorganic carbon (DIC) and dissolved organic carbon (DOC) in the core samples obtained by D/V Chikyu during IODP Exp. 331 in 2010.

At Site C0014 located 450 m east off the main hydrothermal vent, the carbon isotopic compositions and hydrogen isotopic compositions of methane are ca. -55 permil and ca. -125 permil, respectively. These values corresponded to those in the reported value from hydrothermal vent. While, in the depth around 8.5 m bellow sea floor (mbsf) at Site C0014B, The values of d13C?methane and dD?methane increased to -55 permil and +199 permil, respectively, with decrease of methane concentration to 8 micro-M. It suggests that the isotopic fractionation by anaerobic methane oxidation (AOM) in which 12C and H in methane are selectively oxidized. The ratio of isotopic change between hydrogen and carbon with decrease of methane concentration was ca. 10. It corresponds to the reported ratio of hydrogen versus carbon discrimination (8?10) (Feisthauer et al., 2011). The acetate concentrations ranged from 6 to 170 micro-M. The concentrations were relatively high compared to those in the ordinary marine sediments (less than 15 micro-M). The carbon isotopic compositions of acetate ranged from -47 to -17 permil. The lower d13C-acetate values than those in typical organic matter from -27 to -20 permil indicate that the some contribution of homo-acetogenesis to total acetate production, because homo-acetogenesis results in 13C depletion of the acetate produced. However, the low d13C-acetate values less than -27 permil were also observed at higher temperature zone (more than 120?C) where microbes cannot survive. It suggests that some portion of acetate in the high temperature zone was not produced in-situ but produced by a microbial activity at lower temperature area and recharged with source fluid in a similar way of the recharged microbially produced methane hypothesized by as Kawagucci et al. (2011).

Keywords: hydrothermal fluid, carbon cycle, methane, acetate, stable isotope