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Production mechanism for hydrocarbons in serpentinite-hosted hydrothermal systems: Hakuba Happo hot spring

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Serpentinite-hosted hydrothermal systems have been considered to be important environment for birth or evolution of earlier life. Serpentinite is a rock that results from the geological processes of hydration and metamorphic transformation of ultramafic rock from the Earth's mantle. Although ultramafic rocks are rarely exposed at the surface of the Earth today, they were likely to be an abundant component of the early crust owing to the higher potential temperatures compared to the present-day mantle [Komiya et al., 2004]. The presence of hydrocarbons has been reported in serpentinite-hosted systems at not only seafloor but also continental settings [e.g., Charlou et al., 2002; Proskurowski et al., 2008; Etiope et al., 2011; Szponar et al., 2013]. However, production mechanisms of the hydrocarbons in serpentinite-hosted hydrothermal systems so far has not been satisfactorily understood. In this study, we conducted chemical and isotopic analyses of hydrocarbons from a continental serpentinite-hosted hydrothermal system; Hakuba Happo hot spring in central Japan. Hakuba Happo hot spring is situated in the ultramafic rock body and is a site where serpentinization processes are likely to be ongoing at low-temperature of 50-60 [Suda et al., 2014]. The water at Hakuba Happo is strong alkaline (pH $>$10.5) and rich in H_2 and CH_4. Gas and water samples were obtained directly from two drilling wells in November 2013. Water temperature, pH, dissolved oxygen level (DO), oxidation-reduction potential (ORP) and salinity were measured at the sampling points using portable sensors. The water temperatures and chemistries were almost exactly the same as that at previous investigations conducted in 2010 and 2011. The hydrocarbon constituents of CH_4, C_2H_6, C_3H_8, iso-C_4H_{10} and normal-C_4H_{10} were detected from gas samples of Hakuba Happo hot spring. We report the isotopic analyses of hydrocarbons and discuss the process of hydrocarbons generation in serpentinite-hosted hydrothermal systems.

Keywords: serpentinite-hosted hydrothermal system, hydrocarbon, isotopic analyses, abiotic synthesis