Origin of hydrocarbons in continental serpentinite–hosted Hakuba Happo hot spring

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Serpentinite–hosted hydrothermal systems have been considered to be important sites for abiotic synthesis of organic compounds, which may have been a crucial stage in the origin of life on Earth. The presence of hydrocarbons, particularly carbon number 1 to 4, has been reported in serpentinite–hosted systems, regardless of continental or seafloor setting [e.g., 1,2]. However, production mechanisms of hydrocarbons in serpentinite–hosted systems so far has not been satisfactorily understood. We report systematic isotopic study of hydrocarbons for a continental serpentinite–hosted system: Hakuba Happo hot spring in the Shiroumadake area, Japan. The water at Hakuba Happo is pumped up from two drilling wells more than 500 m deep. It is one of the most alkaline (pH >10.5) hot springs in Japan and rich in abiotic H_2 and CH_4 [3]. We collected gas and water samples from two wells in November 2013 and January 2014. The water chemistries (temperature, pH, dessolved oxygen level, salinity) were almost exactly the same as that at prevous investigations conducted in July 2010 and June 2011 [3]. In this work, the hydrocarbon constituents of 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. The concentration of ethane, propane and butane was two, three and four orders magnitude less than the methane, respectively. We have conducted the isotopic analyses of hydrocarbons and discuss the process of hydrocarbons generation in serpentinite–hosted systems. Particularly intramolecular carbon isotopic distribution could provide important information for the origin of these hydrocarbons.

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