Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.30333

Carbon isotopic analysis of organic acids synthesized under hydrothermal conditions

HARUNA WAKABAYASHI[1], KOUDAI TAGUCHI[2], TAKAZO SHIBUYA[2] AND YUICHIRO UENO[1,2,3]

[1]Institute of Science Tokyo
[2]JAMSTEC
[3]Earth-Life Science Institute

During serpentinization, hydrocarbons may be formed by Fischer-Tropsch type (FTT) reactions catalyzed by metals or minerals (e.g., Holm et al., 2001; Proskurowski et al., 2008; McCollom and Seewald, 2007). Furthermore, organic acids (formates and acetates) have been identified in some serpentinite hydrothermal systems (e.g., Nothaft et al., 2021; Suda et al., 2017), however, the formation mechanisms of these organic acids their fate are still largely unknown. Here, we report hydrothermal experiments conducted to understand organic acid formation from Awaruiite-catlyzed reaction and its carbon isotopic systematics. In our experiment, formate (HCOONa) was used as a starting carbon source, which has been found in serpentinite hydrothermal systems. The formate was mixted with f Fe-Ni alloy and NaCl water and reacted at 300°C and 50 MPa up to 1824h. Contamination issues were evaluated by comparing with a control run using isotopically labeled $H^{13}COONa$. As a result, CH_4 and other hydrocarbons like the typical products of Fischer-Tropsch type synthesis were produced from the formate. Carbon isotope ratio measurements of the reaction products from the experiment showed that the product $CH_4$was 40‰ ^{13}C-depleted than the initial formate, while CO_2 showed about 10‰ ^{13}C-enrichment. Furthermore, acetate was detected in this experiment as well. The carbon isotope ratio of the bulk acetate was about 10‰ depleted than the initial formate. In our talk, Position-Specific-Isotope-Analysis(PSIA) of the acetate will be presented and discussed. Our experiment confirm that formate could be a source to synthesize hydrocarbons and acetic acid at the surface of native Fe-Ni metals during serpentinization.