High temperature carbon isotope fractionation in the COH-system

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Carbon isotope fractionation among CH_4, CO_2, CO (COH-fluids) and graphite has been calculated from theory[1,2] but lacks experimental determination at high temperatures. In a first set of synthesis experiments, on several organic compounds spanning a wide range of H:O ratios, at 800°C, 1-2 kbar, 0.5-172 h run time, we chemically equilibrated elemental carbon with a COH-fluid. Gas chromatography separated gaseous species and the solid carbon were analysed for their carbon isotope composition. In these experiments, the carbon precipitate was always the isotopically lightest phase, even compared to CH_4-dominated still ^{13}C-enriched COH-fluids. Unfortunately, H-diffusion through the capsule walls is relatively fast and the bulk C:O:H ratio of the system changes with experimental run time introducing some uncertainty whether these experiments include a kinetic component. At present experimental designs are adopted such that a closed system is achieved.

The isotope fractionation among the gaseous species is reproducible and within 1‰ of the theoretical calculations[1,2], indicating fast isotopic equilibration in the gas. We aim at the experimental determination of equilibrium isotope fractionation factors between CH_4, CO_2 and CO to test theoretical predictions[1,2] and extend the present lower-temperature experimental dataset[3]. The state of the carbon precipitate, which is not simply graphite, remains the largest obstacle for achieving isotopic equilibrium.

[1]Bottinga 1969, *GCA* **33**, 49-64. [2] Richet et al 1977, *Ann. Rev EPS* **5**, 65-110. [3] Horita 2001, *GCA* **65**, 1907-1919.