Immiscible Hydrocarbon Fluids in the Mantle

Isabelle Daniel*†[1], Fang Huang‡[2], Dimitri Sverjensky[2], Gilles Montagnac[1], and Hervé Cardon[1]

[1]Laboratoire de Géologie de Lyon - Terre, Planètes, Environnement [Lyon] (LGL-TPE) – École Normale Supérieure - Lyon, Université Claude Bernard Lyon 1, Institut national des sciences de lÚnivers, Centre National de la Recherche Scientifique : UMR5276 – 69364 Lyon cedex 07, France
[2]Johns Hopkins University (JHU) – Baltimore, USA, United States

Abstract

The cycling of carbon between Earth's surface and interior governs the long-term habitability of the planet. But how carbon migrates in the deep Earth is not well understood. In particular, the potential role of hydrocarbon fluids in the deep carbon cycle has long been controversial. Here we show that immiscible isobutane formed *in situ* from partial transformation of aqueous sodium acetate at 300 °C and 2.4 - 3.5 GPa. These observations complement recent experimental evidence for immiscible methane-rich fluids at 600 – 700 ∘C and 1.5 – 2.5 GPa and the discovery of methane-rich fluid inclusions in diamonds and metasomatized ophicarbonates at peak metamorphic conditions. Theoretical predictions indicate that high pressure strongly opposes decomposition of isobutane and that it can coexist in equilibrium with silicate mineral assemblages. Decomposition at lower pressures could provide a source of abiogenic methane in the deep crust. Consequently, a variety of highly mobile, immiscible hydrocarbon fluids might be facilitating major carbon transfer in the deep Earth carbon cycle. doi: 10.1038/ncomms15798

*Speaker
†Corresponding author: isabelle.daniel@univ-lyon1.fr
‡Corresponding author: fanghuang007@gmail.com