Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.35791

Hydrogen-Deuterium Isotope Fractionation under Core-Forming Conditions

SHUHEI MITA[1], NAOYA SAKAMOTO[2], KEI HIROSE[1,3], NAOKI KURITA[1], SHIRO MIWA[2] AND HISAYOSHI YURIMOTO[2]

[1]The University of Tokyo
[2]Hokkaido University
[3]Institute of Science Tokyo

Core may be the largest reservoir of hydrogen on rocky planets such as Earth and Mars, and therefore the D/H ratios of the bulk planets could be largely different from that of ocean or mantle. We performed melting experiments on a metal Fe + D_2O doped hydrous MORB glass sample in order to determine the metal-silicate D/H isotope fractionation under high pressure and temperature conditions using a laser-heated diamond-anvil cell (DAC). The sample was recovered from the DAC and examined by secondary-ion mass spectroscopy (SIMS) with a high-resolution imaging system for the D/H ratios in quenched liquid metal and coexisting molten silicate. Because hydrogen escapes from iron at ambient conditions, sample recovery and SIMS measurement were conducted under cryogenic temperatures. The results demonstrated lower D/H ratios in liquid metal than in silicate melt. With fractionation factors obtained in these experiments, we can calculate the the bulk Earth D/H ratio, implying that nebular hydrogen was incorporated during planetary formation. In addition, the low D/H ratios observed in deep-rooted plume magmas at Baffin island and others may be reconciled with hydrogen from the core.