Hydrogen Isotopic Composition of Archean Seafloor Basalts & Gabbros

*Tomokazu Murai(Ueno)[1], Yuichiro Ueno[1], Julien Foriel

1. Tokyo Institute of Technology

The oceans are the main water reservoir in Earth’ s surface. The evolution of the hydrogen isotopes composition of seawater reflects the hydrogen budget in Earth's ocean and atmosphere through time. We have analyzed hydrogen and oxygen isotopic composition of Archean seafloor basalts and gabbros in 3.2 Ga Pilbara Cleaverville Formation, Western Australia. The Cleaverville Formation has undergone regional sub-greenschist to amphibolite facies metamorphism and was interpreted by Shibuya et al., 2007 as an metamorphized ophiolite. So it is possible that hydrated Cleaverville Formation basalts and gabbros preserved δD reflecting the seawater value at 3.2 Ga.
Our results show a clear correlation between metamorphic facies in hydrated ocean-floor minerals and H and O isotopic compositions. The measured δD values are positively correlated with δ^{18}O values and H_2O content in response to metamorphic grade. By analogy with moden seafloor basalts, the correlation beween δD and H_2O content implies seafloot basalt hydrothermal alteration and dehydration with metamorphism. From this hypothesis, we estimate that seawater at 3.2 Ga was depleted in deuterium by about 20‰ compared to modern seawater.

Keywords: Hydrogen isotpe, Archean, Earth's History

