

U020-P07

Room:Convention Hall

Time:May 24 10:30-13:00

Experimental study on hydrogen production through hydrothermal alteration of komatiite

Motoko Yoshizaki^{1*}, Takazo Shibuya², Katsuhiko Suzuki³, Kenji Shimizu³, Kentaro Nakamura², Soichi Omori¹, Ken Takai⁴, Shigenori Maruyama¹

¹Department of Earth & Planetary Sciences, ²JAMSTEC, Precambrian Ecosystem Lab., ³JAMSTEC, IFREE, ⁴JAMSTEC, SUGAR

Hydration of komatiite can be a source of significant amount of hydrogen in the Hadean and early Archean ocean floor. We report the direct evidence for this process based on the results of our hydrothermal alteration experiments on the synthetic komatiitic glass and spinifex komatiite at 300 degree C and 500 bars. Starting materials were synthesized by dehydration and remelting of weathered Al-depleted komatiite collected from the early Archean Komati Formation, the Barberton Greenstone Belt, South Africa. The komatiitic glass contained 10% aluminum and the spinifex komatiite contained 5% aluminum.

Since the composition of seawater in Hadean ocean have not been known, we use pure water and NaCl fluid for reaction water to examine the salt concentration dependence. In the experiment of komatiitic glass with pure water, accumulation of hydrogen (2.4 mmol/kg) over 2,600 hours is observed. This amount of hydrogen is truly significant and is comparable to those observed by hydration of peridotitic rocks. Another experiment was performed using komatiitic glass with NaCl fluid at 300 degree C and 500 bars. This experiment is conducted to compare H₂ generation process with alkalinity. The run is still continuing in our lab, and the concentration of H₂ was up to 2.8 mmol/kg after 1000 hours. The H₂ concentration and the trend of H₂ accumulation are comparable to experiment using pure water.

In contrast, 21 mmol/kg of hydrogen was produced in the experiment of spinifex texture with NaCl fluid at 300 degree C and 500 bars. The different of textures were reflected in the quantitative ratio of glass and olivine crystal in the starting materials. This result indicates that the amount of hydrogen production is not so much by controlled by the seawater composition but by the texture and the amount of aluminum.

Our results suggest that hydrothermal alteration of komatiite may have provided the H₂ in the vicinity of hydrothermal vents that fueled the early evolution of living ecosystems in the Hadean and early Archean.

Keywords: hydrothermal experiment, early Earth, komatiite, hydrothermal alteration, hydrogen