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Hydrogen isotopic composition of ca. 3.5 Ga seawater estimated from Archean MORB in South Afriva

Fumiya Tomiyasu[1*], Kaoru Mishima[1], Saitou, Takuya[1], Yuichiro Ueno[1], de, Wita, Maatin[2]

[1]Department of Earth and planetary Sciences,Tokyo Institute of Technology, [2]Nelson Mandela Metropolitan University

Origin of Earth's seawater and its subsequent evolution are still poorly understood. Hydrogen isotopic composition is a key to constrain secular change of seawater volume through hydrogen escape and degassing from mantle, and thus critical to estimate the original isotopic composition of the primitive ocean. A fragment of the Arhcean seafloor is well preserved in Barberton Greenstone Belt, South Africa. We have systematically analyzed hydrogen and oxygen isotopic compositions of sub-greenschistfacies pillow basalts in upper part of Hoogenoeg Complex. Petrographic observation together with XRD analysis showed that almost hydrous mineral in the sample is composed of chlorite with minor amounts of epidote and actinolite. Chlorite is useful to deduce seawater isotopic composition because of little temperature dependence both for hydrogen and oxygen isotope fractionations against H2O. Based on the relationship between isotopic composition and water contents, we have concluded that the 3.5 Ga seawater was depleted in deuterium by more than 20permil compared to modern seawater. These results indicate the seawater volume may have decreased by hydrogen escape into space through the Earth's history.

Keywords: South Afribca, basalt, chlorite, isotope fractionation, sea water, hydrogen isotope