Hydrogen isotopic ratio of Archean mantle based on ion microprobe analysis of gabbro

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Water is one of the most important content for origin of life and biological activity. Hydrogen isotopic evolution of mantle may tell us water-cycling through the Earth history, though dD values of ancient mantle and its evolution is still largely unknown. Kyser and O’ Neil (1984) evaluated that δD value of present mantle is -80‰ by MORB glasses. However, the MORB glasses rarely exist in sea floor basalt. In this study, hydrogen isotopic composition of Ti-rich amphibole in Archaean gabbro in 3.2 Ga Pilbara Formation, Western Australia was analyzed by ion microprobe in order to estimate the δD value of the 3.2 Ga mantle. The Cleaverville Formation is one of the best preserved records of ocean-floor metamorphism based on petrological and geochemical analysis (Shibuya et al., 2007; Shibuya et al., 2012). The high Ti content is characteristic of igneous amphibole, thus may reflecting δD value of the Archean source mantle. Based on the relationship between the structure and isotopic ratio analyzed by ion microprobe, small but a number of amphiboles occurred as exsolution lamellae in diopside are responsible for the low dD value, that may represent the dD value of 3.2 Ga mantle (− 119 ±20 ‰). The results of this study demonstrated that mantle were depleted in deuterium at 3.2 Ga in comparison to modern mantle (dD = −80‰).

Keywords: Mantle, Gabbro, Amphibole, Hydrogen isotope, Archaean, Secondary Ion Mass Spectrometry

