

REE composition of circa 3.4 Ga seawater deduced from that of Precambrian carbonate intercalated in pillows

K. YAMAMOTO¹, N. ITOH¹, T. MATSUMOTO²
T. TANAKA¹ AND M. ADACHI³

¹Dept. of Earth & Planet. Sci., Nagoya University
(yamamoto@eps.nagoya-u.ac.jp)

²Dept. of Earth & Space Sci., Osaka University

³The Nagoya University Museum

The REE composition of the early Archean seawater has been estimated through analyses of dolomite intercalated in pillow basalts from the Pilbara Block, Australia. We have critically evaluated the possible disturbances, such as domonitization and metamorphism, that might have affected the chemical composition of these carbonate through geologic time. The dolomites show a chondrite-normalized LREE-enriched pattern with profound downward convex tetrad effects, suggesting that these REE signatures are related to ancient seawater from which the dolomite precipitated. Contribution of a hydrothermal component to the seawater component is negligible because of the very small Eu anomalies observed in dolomites. Therefore, the dolomite samples from the Pilbara Block appear to preserve REEs intrinsic to the ancient seawater. This suggests that the REE composition of seawater could be estimated by using appropriate carbonate-seawater partition coefficients of REEs. We used REE partition coefficients based on the analyses for a dolomite reference sample (JDo-1 from the Geological Survey of Japan), and show that REE concentrations of ~3.4 Ga seawater could have been one or two orders of magnitude higher than in the present seawater. Moreover, it appears that the 3.4 Ga seawater was significantly enriched in HREE and had less pronounced W-type tetrad effects relative to that of the present seawater. This may reflect paleoenvironmental conditions in Archean, in particular a high salinity and $[\text{CO}_3^{2-}]$, that are preserved in the ancient seawater.

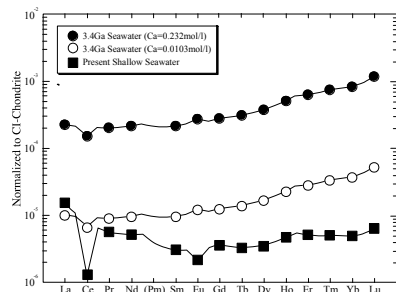


Figure 1.
Comparison of
estimated REE
patterns of 3.4Ga
seawater with those
of the present
seawater.

Reference

Yamamoto et al. (2004) Precam. Res., 135, 331-344