

Relation between chemical composition of seawater and weathering of basalt under the low oxygen condition in early stage of Proterozoic era

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To date, various investigations have gradually revealed the environment of the early Proterozoic era. The pH of rainwater and P_{CO_2} in atmosphere of the Proterozoic was probably somewhat lower and higher than the present, respectively [1]. On the other hand, basaltic rocks were distributed widely on the earth's surface in the Proterozoic [2]. Consequently, in order to predict the effect of weathering on the chemistry of seawater and ore formation in submarine, artificial chemical weathering of polished plates of basalt was conducted using HCl, HNO₃ and H₂SO₄ solutions at pH 4, and CO₂ saturated water, and distilled water as artificial rainwater under the low oxygen condition in an open system. The basaltic fifty plates weighing about 40 g were reacted with each the rainwater in an improved Soxhlet extraction apparatus at 50 °C for a different period of time up to 600 days. The each solution was dripped on the plates in each apparatus a roller pump with 150mL/day. The weathered basalt surface was studied by SEM, EPMA, XRD and microscopic techniques. The leached solutions were analyzed for 32 elements using ICP-MS.

The dissolution of olivine by the H₂SO₄, HNO₃ and HCl solutions is remarkable. (Mg+Fe) / Si (apfu) ratio for the olivine surface, and (Na+Ca+K) / (Al+Si) (apfu) ratio for plagioclase surface, decreased with increasing duration by 5 kinds of rainwater. In leached solutions, molar ratios of each element in the leached solutions to those in the unaltered basalt varied depending on the experimental period. The ratios of Fe, Mg, Ni, Zn and Co near 70 pm in ionic radius, which reflect the dissolution from the octahedral site of olivine, were relatively high. The ratios of Ca, Na, Ce, La and Sr, which reflect the dissolution from the cavity of plagioclase, were relatively high. The relation between these soluble ions from basalt and chemical composition in seawater showed positive correlation.

[1] Shikazono, N. (2007) *Japan. Mag. Min. Petrol. Sci.*, **37**, 69-77. [2] Ernst, R.E. (2014) *Large Igneous Provinces*, 653p. Cambridge.