Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

BPT23-11 会場:104 時間:5 月 25 日 11:45-12:00

地球史を通した海水塩濃度の経年変化
secular change of seawater salinity through Earth history

齋藤 拓也 [1*] ; 渋谷 岳造 [2] ; 澤木 佑介 [1] ; 小宮 剛 [3] ; 丸山 茂徳 [4]
SAITO, Takuya[1*] ; SHIBUYA, Takazo[2] ; SAWAKI, Yusuke[1] ; KOMIYA, Tsuyoshi[3] ; MARUYAMA, Shigenori[4]

[1] 東京工業大学大学院地球惑星科学専攻, [2] 海洋研究開発機構 プレカンブリアンエコシステムラボ, [3] 東京大学大学院総合文化研究科広域科学専攻, [4] 東京工業大学地球生命研究所
[1]Department of Earth & Planetary Sciences, Tokyo Institute of Technology, [2]Precambrian Ecosystem Laboratory, Japan Agency for Marine-Earth Science and Technology, [3]Department of Earth Science & Astronomy Graduate School of Arts and Sciences The University of Tokyo, [4]Earth-Life Science Institute, Tokyo Institute of Technology

The chemical evolutional history of the ocean must have been one of the most critical factors to unravel the origin and evolution of life on the Earth. Excluding cyanobacteria with hard cell wall and algae, life cannot survive in seawater over 2SU (SU=salinity unit: present day seawater salinity is defined as 1SU) because of osmotic pressure with the cell. If life body is in seawater over 2SU, intercellular fluid leaks into outside of the cell. However, this topic has not fully understood yet, because there are methodological problems to collect samples to be analyzed. Recently, some studies have tried to estimate seawater composition during Archean and Proterozoic using fluid inclusions trapped in hydrothermal quartz from pillowed basalt, which is expected to erupt at mid-oceanic ridge in open sea.. However, two problems are remained, one is that their estimations of salinity have highly varied from 1SU to 5SU. The other is that these previous studies leave probability of the fluid with no relation to seawater like as water in river and the salt lake.

Here, we tried to reveal secular change in seawater salinity by introducing the systematic analysis of fluid inclusions of hydrothermal quartz trapped as the relics of seawater, which originated from mid-oceanic ridges.

It is necessary to collect the quartz from MORB. Such rock samples can be obtained from accretionary complex preserved on land environment. Based on the huge accumulated information obtained from accretionary complexes by previous work of our group, we selected the best locality and collected hydrothermal quart samples for this study. The collected samples are quartz with growth zoning texture, filling the primary shaped drainage cavities and interstitial spaces of pillowed basalt without quartz vein crosscut pillow of lava, suggesting the quartz had precipitated soon after eruption of the basalt. To estimate sea water salinity using fluid inclusions in the collected quartz, microthermometric analysis is carried out after categorizing the fluid inclusions into three types, primary, secondary, and undistinguished, based on the detailed petrographic observation of slab and double polished thin section. We carried out the analysis using fluid inclusions in MORB at 3.2 Ga, 2.7 Ga, 600 Ma.

The results showed ca. 2.5-4.5 SU seawater at 3.2 Ga, also ca. 2.5-4.5 SU at 2.7 Ga, and 1.0-1.5 SU at 600 Ma. The mechanism to change seawater salinity dynamically over 1SU is to remove NaCl from ocean to fix as evaporitic halite subaerially as the area of landmass has increased through time. Considering to the NaCl removing mechanism and secular change of landmass, the best estimation of secular change of the seawater salinity is that the seawater salinity during Archean to Paleoproterozoic was 2.5-4.5 SU and sharply dropped down to 1.0-1.5 SU by 600 Ma, which is called three step model of secular change in seawater salinity. Through this drastic change through time, the Earth could become to secure the environment as a cradle for life by Neoproterozoic.

キーワード: 流体包有物, 海水, 塩濃度, 石英, 玄武岩
Keywords: fluid inclusion, seawater, salinity, quartz, basalt