

地球生命の起源と誕生した場所 Origin and birth place of life on the Earth

丸山 茂徳^{1*}
MARUYAMA, Shigenori^{1*}

¹ 東京工業大学
¹Tokyo Institute of Technology

Birth of life

In spite of those new trends, and against reluctant astronomers, I point out the idea against it. First of all, the life cannot be formed only by water and CO₂. Phosphorous is a key critical element to run metabolism in life as an example. The related major and trace elements are all derived from the rock, not from ocean and atmosphere. The water-rock interaction driven by steady-state supply of heat by magma at mid-oceanic ridge was the birth place of life on the Earth, and another survival place of life is the surface of the Earth where continent (source of nutrients) interacts with ocean-atmosphere, resultant constant supply of nutrients to the ocean. Engine to drive the system is Sun, whereas the deep-sea hydrothermal system is plate tectonic supply of MORB magma. Phosphorous is nearly absent at MOR and absent in underlying mantle which are critically important if we discuss the origin of life in the Hadean time.

To form life, we it is critical to supply phosphorous and related other nutrients continuously to the birth place through the water-rock interaction which has never been considered seriously. Moreover, the chemical composition of primordial ocean could be pH=1-2 and enriched heavy metals in oxidized material of water.

Primordial continent, anorthosite with KREEP on the Hadean Earth

To overcome such hard conditions to bear life, hydrogen-producing environment under peridotite-water hydrothermal system with P-bearing ore as well as nutrients could be only available on the deep-lake on primordial continents with KREEP basalts. The latter could be erupted basalts, gabbro (dike or sill) and lower mafic crust. If primary ocean was thin, the primordial continents (20km upper crust of anorthosite + 20-25km lower mafic crust) could be above sea-level, to transport nutrients into lakes which were clean to bear life by evaporation through ocean.

How to synthesize life on the Hadean Earth: A new model

First life was synthesized by the successive FT reactions from inorganic compounds under the excess amounts of P-bearing and other nutrients (ore body) in the deeply fractured lake with constant magma supply underneath. The birth place was under anoxic conditions (H₂) local in an oxidized material of water. The most difficult process is the process from RNA world to DNA world, which may have taken over several hundreds of million years.

After the birth of life in such a localized area, the mother primordial continents have all gone into deep mantle remaining life on the deep-sea hydrothermal system. Plate tectonics has operated to clean-up ocean chemistry by the formation of ores at mid-oceanic ridges to transport them into mantle. Salinity was 3-5 times more in the Precambrian time, and plate tectonics was not effective to omit halogens from ocean into mantle. Continent-collision orogeny was critical to dilute salinity after the drop-down of sea-level at 800-600Ma.