

## Two sites of life system on the Earth

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### Abstract

Life is a phenomenon occurring only in the space of water-rock interactions driven by magma underneath or surface material circulation driven on the top by Sun.

### Nutrient supply

Life cannot be synthesized and sustained by only water and CO (CO<sub>2</sub>). Moreover, nutrients are necessary such as P, Fe, Ca, K and others, in addition to N. Most nutrients are concentrated into the final residue of fractionated magma ocean, hence nearly absent in mantle peridotite or chondritic meteorites.

Furthermore, the life is a metasomatic phenomenon possible only in the space of water-rock interaction where both material (nutrients and water) and energy are supplied constant. If they are stopped, life stops to die immediately.

It is noteworthy to point out that the size of nutrient supply on the surface system is more than 10<sup>6</sup> times bigger than the mid-oceanic hydrothermal system.

### Subground ecosystem

Recently the idea of subground ecosystem has been proposed as an independent third life system. Subground hydrothermal system is right such as mid-oceanic ridge and as hotspot, because of the steady-state supply of magma underneath, but not in general because of absence of material circulation of nutrients and thermal and chemical energy.

### History

Under the extreme environment right after the birth of consolidation of magma ocean, UV could have been eight times higher than today. First life was not possibly synthesized near the surface, but in the deep-sea hydrothermal system, presumably in the Hadean time. Emergence of huge landmass was 800-500Ma, by the return-flow of seawater into mantle as documented by the appearance of high-P/T regional metamorphic belts along the subduction zone. This was the timing of extensive enlargement of life system using the driving force of Sun, and the golden time of life on this planet. After the establishment of the surface ecosystem, metazoan and evolved bacteria invaded the deep-sea hydrothermal system.