Serpentinites as a capsule of deep biosphere and proposal of Serpentine biosphere

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Ultramafic rocks form the Earths upper mantle and change into serpentinites during the alteration processes. These serpentinites expose on the seafloor and onshore metamorphic terrenes owing to tectonic processes. Ultramafic rocks expose on the seafloor at mid-oceanic ridges, fracture zones, forearc seamounts and backarc rifts. As serpentinites include a large amounts of water density of serpentinites is low compared to the peridotites. Therefore serpentinites uplift to the seafloor owing to their negative buoyancy. Such serpentinites will capture deep biosphere during the way up to the surface. We can call these biologic community as serpentine biosphere. The serpentinites will serve as a capsule of deep biosphere.

Ultramafic rocks consisting of olivine, orthopyroxene, clinopyroxene, and spinel or garnet form the Earths upper mantle and change into serpentinites (utramafic rocks including serpentine minerals such as serpentine, chrysotile, antigorite and lizardite) during the hydrothermal and low temperature alteration and weathering processes under deep and shallow parts of the Earths crust and upper mantle. These serpentinites often expose on the seafloor and onshore metamorphic terrenes owing to tectonic processes. Ultramafic rocks expose on the seafloor at mid-oceanic ridges, fracture zones, forearc seamounts of immature island arc and backarc rifts. During the process of alteration of peridotite hydrogen and methane gases, if enough of organic materials existed, will be produced. Metabolism of microbes will be proceeded by these gases under anoxic condition. As serpentinites include a large amounts of water (up to several tens of percentage) density of serpentinites is considerably low compared to the unaltered upper mantle peridotites. Therefore serpentinites uplift to the seafloor owing to their negative buoyancy compared surrounding dense rocks, Such serpentinites will capture deep biosphere during the way up to the surface and if so we can call these biologic community as serpentine biosphere. The serpentinites will serve as a capsule of deep biosphere from the upper mantle to the surface.

The thermal gradient of oceanic lithosphere and forearc of island arc-trench system is low compared with spreading center and continental lithosphere. The limit of temperature and pressure of living cells and genes are unknown however some bacteria are still alive under 113 deg. hotspring and it may estimate 300 deg. and 9kb in some cases. This condition may reflect upper mantle condition in the subduction zone. If serpentinite capture deep biosphere it is possible to estimate the temperature and pressure condition by the use of coexisting mineral assemblage, fluid inclusion and so on. Serpentines offer the depth limit of the deep biosphere.

Presently two serpentinite bodies with biosphere on the seafloor were recognized; one is the Rainbow hydrothermal field in the Mid-Atlantic Ridge and another is the Chamorro Seamount in the Mariana Trench forearc seamount. The former is a high temperature (max. 374 deg.) blacksmoker vents with Rimicaris, Corocaris and Galathea and the latter is a cold seep with bivalves. Ultramafic rocks are also exposed on land in the ophiolite and metamorphic belts and sometimes are accompanied by hot springs, diagnostic soils, minerals and flora which may produce a special biosphere including a living fossil-microbe. We propose a serpentine biosphere to have elucidated study on the serpentinite bodies both seafloor and onshore by geologic, geophysical, geochemical, biological and microbiological point of view. Serpentine biosphere if exist we can tuckle on the deep biosphere and origin of life without waiting for super deep drilling cores. This will be the first attempt to estimate the lower limit of the deep biosphere and the nature of the microbes if could get them from serpentinites on the seafloor and onshore tectonic belt.