A meta-biological thought on a source for life: split of water

Takeshi Naganuma[1]

[1] School of Biosphere Sci., Hiroshima Univ.

http://home.hiroshima-u.ac.jp/hubol/members/naganuma.html

Life on a global biosphere basis is substantiated as organics and organisms, and defined as the intermediate forms (briefly expressed as CH2O) hovering between the reduced (CH4, methane) and (CO2, carbon dioxide) ends, different from the classical definition of life as complex organization maintaining ordered structure and information. Both definitions consider sustenance of life meant to be protection of life against chaos by input of external energy. The CH2O-life is maintained as long as the supply of H and O lasts, which is in turn provided by the spilt of the water molecule H2O. Water is split by electricity as well-known in school experiments and by solar radiation and geothermal heat on a global scale. In other words, the Sun's radiation and the Earth's heat split water to supply H and O for continued existence of life on the Earth. These photochemical and geothermal processes have influences on the evolution and current composition of the Earth's atmosphere, compared with those of Venus and Mars, and influences on the planetary climatology. This view of life may be applicable to search for life in space, or astrobiological explorations.

Since the life on the Earth is based on carbon, the reduced and oxidized ends of carbon, CH4 and CO2, respectively, are mainly discussed. Organics and organisms are expressed as CH2O. I view life as transitory intermediates on the balance of hydrogen and oxygen supplies, considering the Global biosphere as a whole life. In this sense, organisms are ephemeral and hovering between life and death. Methane is the end-product of anaerobic (anoxic) degradation of organic compounds, while carbon dioxide is the end-product of aerobic degradation and respiration. Methane is also produced by the Sabatier reaction (CO2+H2 to CH4+H2O)inorganically, or by methanogenic organisms mediating the same process in deep-sea hydrothermal vents and deep subsurface.

Organic compounds and organisms, generally expressed as CH2O, are intermediates of CH4 and CO2, and various forms of are found, in nature. Methane has the maximum number of hydrogen, 4, per carbon, and thus manifests the greatest potential energy (890 kJ mol-1) among carbon compounds when oxidized by oxygen. Methanotrophic organisms (methane-oxidizing bacteria) take up methane to generate energy for metabolisms and assimilate carbon for growth and reproduction in deep-sea hydrothermal vents and deep subsurface, for example. That is, life vortex as realized as methanotrophic bacteria is manifested on the slope from CH4 to CO2.

All the organics and organisms are partially oxidized forms of CH4, and are to be further oxidized to CO2. Oil (petroleum) is the mixture of relatively less oxidized hydrocarbon chains (with more hydrogen per carbon on average), while formaldehyde (truly CH2O) and acetaldehyde (CH3CHO) are more oxidized forms and close to the CO2-end. Life vortices may vary in numbers, sizes, features, etc., according to the amounts of manifested chemical potential energy.

Life of the Earth is carbon-based, and is substantiated as intermediate forms (expressed as CH2O) hovering between the reduced end (CH4) and the oxidized end (CO2). The intermediate forms, organics and organisms, are ephemeral and eventually subject to full reduction or oxidation when the supplies of O or H cease, respectively. In other words, life is maintained only with the continuous supplies of H and O, which are in turn provided by the split of water. Solar radiation and geothermal heat split water, and therefore the life on the Earth is maintained by the Sun and/or the Earth, depending on the ecosystems where relevant lives dwell. The photochemical (photosynthetic) and geothermal processes of water split have influences on the composition of global atmosphere. This viewpoint of life would be applicable to the search for life in space, namely, astrobiology or exobiology.