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The Evolution and Origin of the Biosphere

Jaswant

Assistant professor (Geography)

Ch. Balluram Godara government girls college, Sriganganagar (Rajasthan)

Abstract:

Modern natural science shows that the infancy of life on Earth experienced prebiotic evolution and included the emergence of primitive self-reproducing biologic forms and their systems. The subsequent coevolution of inorganic environment and biologic systems resulted in global propagation of life over the Earth and its enormous diversification. Diverse living organisms colonized the land, water, and atmosphere, as well as upper layers of the lithosphere, thereby forming the biosphere. The book covers notions by scientists of various branches on the evolutionary relationship between the biosphere and geosphere, evolution features at various levels of living matter organization, and problems of prebiotic evolution and life origin. The data were collected in the course of the RAS program "Biosphere origin and evolution" (subprogram II) in 2003-2006. The objectives of this subprogram were (1) generalization of data related to problems of biosphere origin and evolution accumulated by geneticists, molecular biologists, zoologists, botanists, paleontologists, microbiologists, geologists, chemists, and archaeologists; (2) search for new interdisciplinary approaches to biosphere origin and evolution; (3) development of a "lingua franca" understandable by experts in various fields

1. Introduction

We argue that the process of the origin and evolution of living organisms is indivisible from the process of the origin and evolution of biosphere, the global planetary system. The most general features of biosphere evolution as a directed process are formulated in the principle of “bio-actualism”. It is demonstrated, that this principle, stated for Phanerozoic eon, hold for early biosphere up to the period of biosphere coming into being. To support this thesis we considered an episode of pre-Cambrian history – Vendian phytoplanktonic crisis. Traditionally, the problem of the origin of life on Earth is the study of how biological life arose from inorganic matter and primary living organisms spread around the planet. Some philosophers and scientists such as Helmholtz and Arrhenius proposed the hypothesis of so-called “panspermia” and place the origin of life outside the Earth somewhere in cosmos. We suggest that such approaches are naive in view of modern progress of life sciences and astrophysics. It is clear that occasional appearance of some living forms (organisms) on any planet doesn’t mean they will survive, settle and evolve there. These conceptions ignore the problem of longtime existence and evolution of the earliest forms of life on the Earth. Moreover, they overlook the problem of the origin of the biosphere – unique milieu for early organisms survivorship and reproduction. Therefore we suppose that origin of earthly life and the origin of the biosphere are aspects of a whole indivisible process (Levchenko, 2010, 2011). Hence, we consider the appearance of such conditions on the early planet, which guaranteed the origin and survivorship of organic life. We suppose also that primary organisms should be incorporated in natural geological processes, accelerating them and transforming surroundings in directions favorable for the creation of higher forms of life.

2. Origin of the Biosphere

The origin of the biosphere is rooted in the origin of life. Scientific theories suggest that life began in the Earth's early oceans through chemical evolution. Key hypotheses include:

Abiogenesis: The idea that life arose naturally from non-living matter under prebiotic conditions.

Hydrothermal Vent Theory: Suggests life began near deep-sea vents where minerals and heat provided a suitable environment.

Panspermia: Proposes that life or its building blocks came from space via meteorites.

The earliest life forms were likely anaerobic microorganisms, capable of surviving in extreme environments.

3. Early Evolution of Life

The first known life forms appeared around 3.5 billion years ago. These were simple prokaryotic cells. Over time, photosynthetic organisms such as cyanobacteria evolved, releasing oxygen into the atmosphere in a process known as the Great Oxygenation Event (2.4 billion years ago). This was a turning point that enabled the evolution of aerobic organisms and eventually led to complex multicellular life.

4. Biosphere Development Through Geological Time

Life and Earth have co-evolved:

Precambrian Era: Dominated by microbial life. Stromatolites formed by cyanobacteria are the most significant fossil evidence.

Paleozoic Era: Marked the rise of complex life, colonization of land, and development of ecosystems.

Mesozoic Era: Known for the dominance of dinosaurs and the development of flowering plants.

Cenozoic Era: Mammals and birds diversified; human evolution began.

5. Human Impact on the Biosphere

Humans have become a major force shaping the biosphere. Activities such as deforestation, pollution, and greenhouse gas emissions are altering ecosystems at an unprecedented rate, leading to biodiversity loss and climate change.

6. Conclusion

Biosphere is a planetary, global expression of life activity and from the other side it is the only favorable milieu for durable existence of biota. Any living organism has relatively autonomous organization of metabolic processes and at the same time, all living creatures are fundamentally dependent on each other via trophic, behavioral, sexual relationships. Any organism is the element of many systems – group (family, flock, school, population, etc.), community, ecosystem and biosphere as a global planetary system. All organisms are included in local and global biogeochemical cycles. Systemic status of biosphere and mechanisms of its development (or evolution) are still debatable questions. But, it is clear, that biosphere have durable periods of gradual development and relatively short periods of uneven change. In some of these periods, often associated with so called global crises, structure of biosphere can radically change, as in the case of gradual increase of oxygen in atmosphere at the transition from the Archean to the Proterozoic, or in the period of Phanerozic explosion of biological diversity. We believe that biospheric crises are processes regulating texture and functioning of the biosphere. The crisis which took place on the border of Riphean and Vendian (630 Mya) has resulted in considerable changes of the early biosphere. Great Cambrian taxa radiation and the rise of role of predators in communities were important specific consequences of the crisis. Nevertheless, this Vendian phytoplanktonic crisis developed by the same way as that is known for more later Phanerozoic crises. We tried to discover the main traits of biospheric crises and present them in this chapter.

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7. References

Alexeev, A.S. (2009). Mass extinction in Phanerozoic (doctoral thesis in Russian), Moscow. Available from http://www.evolbiol.ru/alekseev.htm

Armand, A.D.; Lyuri, D.I. & Zherikhin, V.V. (1999). The anatomy of crises (monograph in Russian), Nauka, Moscow

Back, P. & Sneppen, K. (1993). Punctuated equilibrium and criticality in a simple model of evolution. Phys. Rev. Lett., Vol.71, No.24, pp. 4083–4086

Bailey, J. M. (1998) RNA-directed amino acid homochirality. FASEB J., Vol.12, pp. 503–507 Bangham, A.D. (1981). Liposomes: From Physical Studies to Therapeutic Applications, G. Knight, (ed.), Elsevier, Amsterdam. pp. 1–17