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Early stages of the Earth biosphere evolution

A. Rozanov and **M. Astafieva**

Paleontological Institute of Russian Academy of Sciences, Moscow, Russia (astafieva@paleo.ru / Fax: +7-495-3391266)

Abstract

The appearance of Bacteria, Eukaryotes, Metaphyta, Metazoa, etc., as well as the oxygenation of the atmosphere, took place much earlier than was formerly believed. The paleontological data clearly indicate that the difference in the surface temperature on the Earth from the Archaean to the present time was no more than 25-35° C.

Very important data concerning the origin and evolution of the biosphere and the surface conditions on the Earth can be obtained by investigation of the level of organization of fossil organisms of the Precambrian. Although it is a standard task for the study of organisms of the Phanerozoic, the definition of the level of organization for Precambrian organisms is a serious problem that could not always be solved by direct methods.

One of the most significant questions is the morphology, sizes, and biochemical traces of the first Eukaryotes. Analysis of the diverse data now available indicates that the appearance of Eukaryotic organisms is shifted to 3.0 Ga.

Current literature contains numerous contradictory suppositions about natural environments at the early stages of Earth evolution. Among them an idea of reducing conditions is the most stable. According to this idea, in the Archaean time only anaerobic organisms existed.

But the set of discovered Archaean organisms does not indicate anaerobic atmosphere as early as 3.5 Ga. The RNA-world must have existed at least at 3.9 Ga and, likely, close to

the beginning of degasification and appearance of water on the Earth surface. The earliest cellular organisms (membranes) also appeared before 4.0 Ga. So appearance of life on the Earth happened before 4.0 GA, or life has extraterrestrial origin.

Possibilities of evaluation of conditions on the Earth's surface are under the consideration of both geological-geochemical and possibly mainly paleontological data.

The important element in the analysis of the Earth conditions is the level of organisms organization presented in the paleontological record, because it is connected with the existence of peculiar abiogenic conditions, such as temperature, amount of oxygen, amount of water etc.

Studies of sedimentation that were documented by the earliest geological records lead many authors to conclude that both sedimentation processes and their set are not significantly different in the Archaean, Proterozoic and Phanerozoic. A large portion of sedimentary rocks in Archaean sections and absence of any rocks older than 3.9 Ga (beside zircon grains) are perplexing. Available isotopic data do not provide an ambiguous evidence for anaerobic situation in the Archaean either. Data on rounded uraninites and pyrites, which are commonly used for substantiation of Archaean anaerobic environments on the Earth, appeared to be less reliable than was supposed for a long time.

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