

Life Origination Hydrate hypothesis (LOH-hypothesis): CH₄-hydrate matrix as a necessary condition for life origin

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Abstract

The Life Origination Hydrate hypothesis (LOH-hypothesis) presents a mechanism of living matter origination from simple mineral substances within natural underground or underseabed methane-hydrate matrixes with no external energy. The mechanism is well-founded chemically, thermodynamically, and logically and is applicable to any celestial body where the corresponding temperature and mineralogical conditions are maintained at a constant level for a rather long time.

1. Introduction

The Life Origination Hydrate hypothesis (the LOH-hypothesis) [1–12] is the original one and has no common features with any other hypothesis that considers mysterious origination of this phenomenon. This hypothesis has been developed by us for about twelve years. At different steps of its development, it was presented at about 20 International physical, chemical, thermodynamic, biological, geological, and specialized conferences in the form of lectures or oral presentations [13]. The LOH-hypothesis proposes the life origination mechanism realizable at any celestial body where appropriate conditions exist.

We use the following terminology. The phenomenon of life is a combination of the natural chemical processes that lead to extended self-reproduction of DNA molecules from generation to generation and to translation of all or almost all significant features from a maternal DNA to the daughter one. Living matter is a mass of the substance of a cell or of a cellular conglomerate, each mass containing, at least, one DNA molecule and a set of the source substances capable of synthesizing new DNA molecules and being located in an environment capable of supplying it with necessary “nutrient” and of absorbing the side products of the synthesis.

2. The LOH-hypothesis essence

Living matter results from thermodynamically conditioned, natural, and inevitable chemical reactions governed by universal physical and chemical laws; such an approach underlies the LOH-hypothesis (and the Mitosis and Replication Hydrate hypothesis, the MRH-hypothesis [6, 14]); Nature went step by step by its way from minerals to living matter and decreased gradually the Gibbs free energy at each step. The similarity of the principal chemical and structural features inherent in DNA molecules of different species is considered by us as an evidence for the similarity of the conditions of origination of different DNAs and for the long-term constancy of the corresponding natural parameters (such as the temperature, pressure, medium composition, gravitation, and so on) characterizing these conditions. On the other hand, the wide multiplicity of the DNA structural and chemical peculiarities is considered by us as a result of some dissimilarity in the medium parameters occurring in different regions where the primary DNA molecules had originated. Meanwhile, according to our notions, DNA-like molecules with different sequences of nucleotide links and with different included nontrivial N-bases (e.g., xanthine) could be formed within one localization.

Origination of nucleic acids (DNA and RNA) had preceded cellular life, while origination of the living matter simplest elements (LMSEs) (N-bases, desoxy-D-riboses, and D-riboses, nucleosides, and nucleotides) had preceded nucleic acids. In our terminology, the formation of the first proto-cells and development of the mechanism of extended self-reproduction of DNA molecules inaugurated the living matter origination, DNA and RNA molecules being the simplest forms (objects) of the pre-cellular living matter rather than the living matter as such and the LMSEs being the living matter constituents. Substantially the same phenomenon of formation–destruction of the underground or underseabed gas-hydrate matrix structures, but in its different visualizations, is applied by Nature to solve these two

sub-problems; synthesizing of the LMSEs, assembling them together, and joining in certain sequences went in the same localization. A great number of such localizations existed. The LMSEs and DNA and RNA molecules were produced within the large (N-bases) and small (riboses) cavities of the methane-hydrate structure as a result of diffusion into it of nitrate-ions of niters and phosphate-ions of phosphates (large and small cavity's sizes of the hydrate structure are as if created as the moulds for N-bases and for riboses and phosphates, respectively), and living matter as such originated in the semi-liquid soup that arose after melting of the hydrate structure as a result of an increase in the temperature (it is shown that gas-hydrate structures exist in highly-concentrated semi-liquid aqueous systems). The mineral gas-hydrate matrix structure determines not only the sizes but also the strictly determined sequence of the groups in the DNA and RNA structures. The thermodynamic grounds and the reaction mechanisms that lie in the ground of the LOH-hypothesis will be presented and discussed.

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