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Origin-of-life's scenario: the role of cosmic and planetary physicochemical contributes

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Abstract

A new approach, aimed at revealing the ability of meteorites and some terrestrial rocks to perform catalytic reactions operative in present-day life was previously reported [1].
With the aim to examines potential source of energy available to protocells on early Earth and/or elsewhere and mechanisms by which the energy could be used to drive polymer synthesis, experiments, on a possible role of sunlight, liquid water and ferrous ions containing mineral, were carried out. Results of recent and ongoing studies will be presented and discussed.

1. Introduction

How, when and where Life begins, remains a fundamental unsolved mystery and likely, the origin of Earth's life represents only one pathway among many others, along which life can emerge.
We know that life is driven by the universal laws of chemistry and physics and by applying these laws over the past few decades, enormous advances have been made in our understanding of the molecular mechanisms that underlie the living state [2].
Studies and recent findings, that challenge the paradigms of modern biology, have forced scientists to re-think some intriguing questions like "what is life?" and "what are the limits of life?"; what were the conditions on those planets which provided these life seeds with the necessary ingredients to kick-start life? and "how did these conditions make life possible?". In all theories on the origin of Life, since it is thermodynamically an open system, the energy sources gain first importance as well as "evolution". Previous research papers on life's origins have for the most part focused on the chemistry and energy source required to produce the small molecules of life, amino acids, nucleobase and amphiphiles, and to a lesser extent on condensation reaction by which monomers can be linked into biological relevant polymers. In this context it is reasonable to expect "proto enzymes" much more simpler in composition and structure than modern day enzymes that likely have been act in the early stage of developing life to increase the complexity .of a primeval soup.
Therefore, instead of screening for compound formed in abiogenic syntheses I developed screening tests for reactions and catalysts.

2. Figures

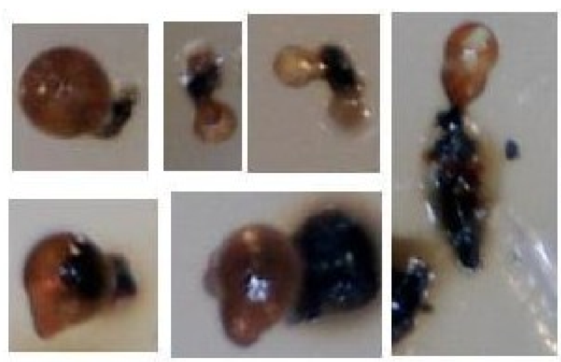

Figure 1: Examples of magnetic metallorganic structures obtained from terrestrial olivine and magnetite.

3. Summary and Conclusions

In numerous theories on prebiotic chemistry the mineral-water interface plays a major role. Following the bottom-up approach, laboratory experiments are currently targeted on metallorganic materials organized as micro-nano hollow pigmented structures, rich in iron with a complex structural organization (fig.1) combining fluorescent and brightfield light microscopy in order to localize catalytic activities with regards to the morphology and chemical composition in relationship to some of the kinds of energy often considered as energy source on the prebiotic Earth the photochemical energy (as visible and ultraviolet) and geological electrochemical energy.

Just as it is today most of the energy flux on the early Earth was in the form of light energy from our sun and in fact photochemistry drives virtually all life today. Even if this is an obvious possibility, yet there is a major conceptual problem because in modern life, capturing visible light requires a pigment system and mechanisms for trasducting the energy content of photons into chemical energy to be used in metabolism, and there is as yet no plausible way to do this in a prebiotic scenario. Indeed, I found until now that olivine and magnetite if properly fragmented in suitable environment, excluding liquid water, are capable to produce metallorganic structure which look like to those produced before from meteorites [1] and show also surprising ability to absorb light with absorbtion band similar to carotenoids.

To conclude, the hypothesis is that these non-enzymatic, photochemical or self-sustaining reaction might be a primitive form of reaction network supporting abiogenic development of life on Earth or elsewhere in the Universe and probably responsible for the emergence of a large pre-biotic pool of molecules.

These reactions appear sufficient enough to provide the variety and abundance of biologically favorable molecules from which Darwinian selection operating at molecular level may have seeded proto-metabolic reaction in the pre-biotic contexts**.**

This is in addition to the hypothesis that microbial or early forms of life were already present in our solar system at the time of Earth's formation [3].

As a result, when considered within the new emerging paradigm of biological cosmology (or cosmic biology), panspermia and abiogenesis are not rival theories but are two complementary disciplines. In other words such dichotomy is just a consequence of our Earth-centered and anthropocentric way of thinking .

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