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Transition from Non-Living to Living Matter: filling the gap with a laboratory-based approach according to a Land-based birthplace and Iron catalysis hypotheses at the origin of life on the early Earth and beyond.

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Abstract

The story of life's origins is one of the deep, intriguing, and unsolved mysteries of our Science. With several hypotheses in play, the challenge is to replicate the conditions that allowed life to emerge.
I developed a new approach to stimulate the energetic processes that may have led to the emergence of proto-metabolic pathway on Earth or earth-like planet. Current status of my laboratory experiments in hydrogel environments, utilizing the self-organizing M4 material obtained from meteorites and terrestrial rocks and minerals as model for the emergence and early evolution of life on Earth, will be presented and discussed.
My findings give support to MuGeRo hypothesis that I have already proposed are in line with recent paper showing that mineral containing Iron and Nickel that would have been common on the early Earth and those reported by other authors on a land-based birthplace supporting the theory that life could have emerged on Earth from inanimate matter via mineral/rocks-organic interfacial processes.

1. Introduction

A new approach, aimed at revealing the ability of some terrestrial rocks and meteorites both containing iron to perform catalytic reactions operative in present-day life, was firstly reported and patented in 2003 [1].
In this research topic, results presented here give more support for the theory that life could have emerged on Earth from inanimate matter via mineral/rocks-organic interfacial process [2]. The aim of the work is to present and discuss the results of past [3], [4], recent [5], [6], and further ongoing (molecular and catalytic) mineral-organic interfacial experiments supporting the Multiple Root Genesis hypothesis (MuRoGe) already proposed [7] to approach the questions surrounding the origin of life on Earth and on Earth-like planets.
Current status of my laboratory experiments in hydrogel environments utilizing the self-organizing M4 material obtained from meteorites (Fig.1a-b), and terrestrial rocks and minerals (Fig.1c-d), as model for the emergence and early evolution of life on Earth, will be presented and discussed.
My findings are in line with some recent paper showing that mineral containing iron and nickel that would have been common on the early Earth [8] and those reported by other author [9], [10] and give support to MuGeRo hypothesis previously proposed [11].
Moreover the results so far obtained could point a way towards understanding how Earth kick-started metabolism emerged on landmass that arose from Archean oceans rather than in the depths near a deep sea hydrothermal vent.

2. Figures

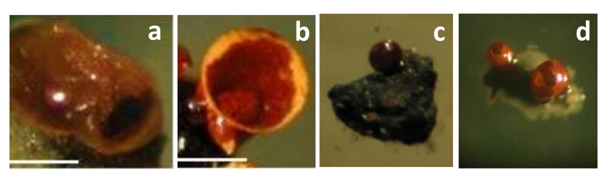

Figure 1: Examples of Micro-nano Magnetic Metallorganic Material (M4) self-organizing obtained as described from iperstenic chondrite (a) siderites (b) olivine (c) and magnetite (d)

3. Summary and Conclusions

In conclusion, in quest of a framework for the emergence and evolution of early Earth, designing plausible geochemical scenarios in which abiotic, photo- geochemical reactions could become photobiological reactions, the results so far obtained do not prove or exclude the possibility that the self-organizing M4 materials, having a complex chemistry, might be examples of proto-metabolic reactions occurred in a pre-biotic hydrogel context as recently proposed [12]. Moreover, they are certainly the result of several coordinated activities and only some of them can be attributed to the meteorite or terrestrial rock components.

I propose that abiotic, photo-geochemical reactions could have given rise to a variety of independent biogenic events getting to a plurality of Initial Darwinian Ancestor (IDA) form of life [13] and the origin of life on Earth represents only one pathway among many, along which life emerged.

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