Is primordial atmosphere a key to organic matter delivery to early Earth?

Gaia Micca Longo*[1] and Savino Longo[1]

[1]University of Bari – Italy

Abstract

Earth's chemical evolution and the origin of life represent one of the most important issues in astrobiology and astrochemistry.
A critical stage of any scenario evaluating the perspective of the origin of life on Earth is the so-called delivery, i.e. the actual transport of molecules from space to Earth. Life-related molecules, which are particularly thermolabile, should reach the Earth's surface associated to solid particles; in this way, the mineral composition of these grains could provide the necessary thermal protection against the high temperatures reached during the first stages of the atmospheric entry process.

A theoretical model of the atmospheric entry of sub-mm grains is employed to evaluate the effect of the chemical composition of the primordial Earth's atmosphere on the grain heating, in the context of organic matter delivery.

We demonstrate that: the total gas budget of the atmosphere is not highly relevant as far as the determination of the heating associated with slowing to subsonic speed is concerned; accordingly, light components, which are expected to be present in a primordial atmosphere and more abundant in the upper one, may be considered the primary ones in the evaluation of momentum and heat transfer in such scenarios. Moreover, light components, like hydrogen and methane, have a strong mitigating effect on grain heating, an crucial perspective to be accounted in the formulation of panspermia theories.

Calculations are performed with spherical, uniform micrograins of forsterite/fayalite composition as well with the recently proposed white soft mineral (WSM) micrometeorites.

*Speaker