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From Astrochemistry to Astrobiology? The importance of cosmic ices for astrochemical and prebiotic evolution

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1. Introduction

Ices made of simple molecules are ubiquitously detected in the infrared spectra of many astrophysical environments such as molecular clouds [1, 2] out of which stars and planetary systems do form, together with many icy debris (asteroids, comets, dust…). Ices may also undergo efficient energetic processing, including ultraviolet irradiation at the turbulent edges of protoplanetary disks [3]. Such icy materials can be straightforwardly simulated in laboratory non-directed experiments in which the photo and thermal evolution of the ices are performed using, in our case, vacuum ultraviolet irradiation, following the classical methods of "matrix isolation techniques" [4]. These laboratory ices may then be used as templates for the astrophysical ones, where an intricate radical chemistry develops, leading to the formation of a complex organic material, soluble (in water and classical organic solvents) and insoluble [5], similar to what is indeed observed in primitive carbonaceous chondritic meteorites and known as SOM for soluble) and IOM (for insoluble). More specific molecules such as amino acids [6], sugars [7, 8] and nucleobases [9] make these materials particularly attractive for the possible onset of a "true" prebiotic evolution at the surface of a telluric planet if adequate conditions are met (mostly liquid water, organic chemistry, free energy…). Global analytical methods using very high resolution mass spectrometry of the soluble organic residues [10,11] reveal the extreme complexity of these materials which parallels the one observed in the Murchison chondrite for example [12] or within the Paris meteorite, as far as specific "biological molecular bricks" are considered [13].

2. Scientific Content

I will replace the importance of extraterrestrial ices evolution toward the making-of the organic matter within the general framework of *Astrochemistry* i.e. the chemical evolution of the Galaxy [14] and show, under which conditions and conceptual considerations, the exogeneous delivery of volatiles and organic matter on telluric planets such as the Earth, as postulated a long time ago [15], should be considered as a serious possibility for the starting-up of a *Prebiotic Chemistry* on telluric planets and thus of importance for *Astrobiology*. A short presentation of an ongoing new non-directed experiment will also be given.

3. References

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Short Summary

From Astrochemistry to Astrobiology?

Extraterrestrial ices are abundant in diverse astrophysical environments, from molecular clouds to comets. Laboratory simulation of the photo and thermochemical evolution of ices leads to the formation of complex organic residues that may present some truly prebiotic potential if delivered on telluric planets.