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STUDYING THE EVOLUTION OF NUCLEOBASES IN MARS-LIKE CONDITIONS: IMPACTS OF PERCHLORATES ON URACIL AND CYTOSINE UNDER ULTRA-VIOLET IRRADIATION.

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Searching for organic molecules is a main goal for current and future Martian space missions. Indeed, many sources of organic molecules could be possible at the surface of this planet: exogenous sources such as the interplanetary medium and/or endogenous sources like hydrothermalism... or even a potential biological activity. However, only few organics have been detected so far [1, 2] and are not related to any endogenous sources nor to the compounds that are brought to the surface by interplanetary bodies [3, 4, 5].

One explanation is that organic molecules are not well preserved in the Martian environment. This environment is characterized by different parameters *i.e* strong oxidants (perchlorates, iron oxides...), energetic radiation (UV, X-rays...) that can degrade organic matter.

The detection of perchlorates in the Martian regolith, (0,4-0,6% by weight) [6, 7], leads to think that these strong oxidants (containing ClO₄⁻ ion) could react with the organic molecules [8] especially when they are activated by energetic sources such as X-rays and UV light. This could explain why it is so hard to detect organics on the surface and near-surface of Mars.

Understanding the effect of perchlorates on organic matter in the Martian environment is a high priority for current and future space missions aiming to look for organic molecules on Mars especially as Life tracer.

The MOMIE (Mars Organic Matter Irradiation and Evolution) experiment (Figure 1) is meant to study the evolution of organic molecules in a simulated Martian environment especially in terms of temperature, pressure and UV radiation. In the context of prebiotic chemistry, nucleobases are organic molecules of interest. Some of them were proven to be UV resistant in Mars-like conditions [9]. Furthermore, some nucleobases were detected in meteorites [10] and were therefore brought to the surface of Mars at some point. To investigate the effect of perchlorates on prebiotic organic molecules, we selected those nucleobases to study with the MOMIE experiment.

This study is focused on the evolution of different nucleobases (uracil, cytosine...) in the presence of a calcium perchlorate solid phase.

On one hand, first results showed that perchlorates accelerate the degradation of uracil. On the other hand, a new compound is formed when cytosine is in contact with perchlorates even when the sample is not exposed to any UV radiation.

Keywords:

Organics on Mars – Nucleobases – Perchlorates – Ultra-Violet radiation – experimental simulations

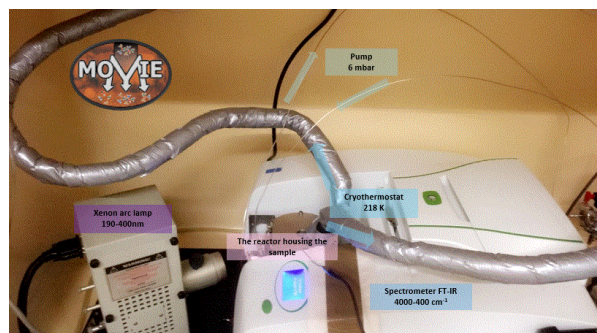


Figure 1: Mars Organic Matter Irradiation and Evolution

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