Intitulé du Sujet de Thèse : Analytical chemistry and physical chemistry in the context of the evolution of organic matter on the primitive Earth

Laboratoire : Physique des Interactions Ioniques et Moléculaires

Equipe : ASTRO

Directeur de thèse HDR (% 100) : Grégoire Danger

Codirecteur HDR (50%) :

Co-encadrant HDR ou non HDR (0%) : Vassilissa Vinogradoff

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Descriptif du projet

A PhD scholarship opportunity is open at the ASTRO' team of the PIIM laboratory at Aix-Marseille University, Institut Origines, Marseille, France. The successful candidate will work on simulating the aqueous environments of the early Earth in order to better understand the physical and chemical evolution of extraterrestrial organic matter. Specifically, he or she will develop experiments to investigate how molecular diversity observed in some meteorites might evolve once delivered to the surface of the early Earth. The experiments will simulate the so-called 'primordial soup' in aqueous environments that allow organic interactions with minerals and UV photons. The goal is to test the hypothesis of an exogenous supply of organic matter via interplanetary bodies to terrestrial planets, and its potential role in the emergence of prebiotic chemical systems.

The candidate will manage the synthesis of organic analogs of exogenous organic matter, using specific experiments at low temperature and pressure developed at PIIM lab. The resultant organic matter will be the organic substrate used in simulated early Earth environments. The evolution of these analogs will be carried out using microfluidic systems that will be developed in collaboration with Samuel Marre from ICMCB, Bordeaux, France. The candidate will be also responsible for sample analysis using various analytical techniques, such as high resolution mass spectrometry coupled to gas or liquid chromatography.

The PhD position will be supervised by Pr G. Danger in co-supervision with Dr V. Vinodradoff from PIIM, Marseille. The candidate will work in the interdisciplinary environment of the Institut Origines, which will provide opportunities for expanding their knowledge

Références Bibliographiques

1. Comprehensive Insights into Organic Matter from Astrophysical Ice Analogues by Multimodal Ionisation High-Resolution Mass Spectrometry, L. Honold, J. Hertzog, A. Ruf, F. Aubriet, V. Carré, P. Schmitt-Kopplin, A. Domaracka, **G. Danger***, Monthly Notices of the Royal Astronomical Society, 2026, accepted
2. Relationship between ices and gas phase organic compounds in simulated extraterrestrial environments, T. Javelle, F. Duvernay, A. Ruf, C. Granjon, L. Selliez, G. Danger*, Communications Chemistry, 2025, 8, 306
3. Unexpected mineral impact on organic evolution during simulated aqueous alteration in asteroids, C. Serra, V. Vinogradoff*, G. Danger, MV Coulet, F. Duvernay, Icarus, 2024, 423, 116273
4. Molecular diversity and amino acid evolution in simulated carbonaceous chondrite parent bodies, A. Garcia, Y. Yan, C. Meinert, P. Schmitt-Kopplin, V. Vinogradoff, J-C Viennet, L. Remusat, S. Bernard, M. Righezza, L. Le Sergeant d'Hendecourt, G. Danger*, ACS Space and Earth Chemistry, 2024, 8, 606-315