

PhD position: “ERC – Investigating the effects of accretionary heating and partial differentiation on the N content and isotopic composition of small planetesimals”

Host institute: Centre de Recherches Pétrographiques et Géochimiques (CRPG, Nancy, FR) (<https://crpg.univ-lorraine.fr>)
Supervisors: Evelyn Füre and Sune Nielsen
Collaborators: Laurette Piani and Laurent Zimmermann
Contract duration: 36 months
Expected start date: 1 October 2024
Funding: ERC-CoG-2022 "IRONIS" (<https://cordis.europa.eu/project/id/101087562>)

Project description

Volatile elements (H, C, N) were essential for the emergence of life on Earth, yet their origin(s) on the terrestrial planets remain debated. Whereas isotopic evidence indicates that Earth’s primary feedstocks may have included both chondritic materials and differentiated planetesimals that formed in the inner Solar System, the effects of accretionary heating and (partial) differentiation on the volatile cargos of the terrestrial building blocks need to be better investigated. Therefore, for this thesis project, we seek to better understand how the nitrogen abundance and isotopic composition of small planetesimals evolved during thermal metamorphism and partial differentiation. To this end, enstatite chondrites/achondrites and various Fe-Ni-alloy-rich (primitive) achondrites will be targeted for coupled nitrogen-noble gas analyses by static mass spectrometry at the noble gas facility of the Centre de Recherches Pétrographiques et Géochimiques (CRPG, Nancy, FR). Noble gases will permit to quantify any solar wind-derived and cosmogenic components, and to identify the isotopic composition of primordial nitrogen in each sample. Ultimately, the results will provide key insights on the extent of nitrogen loss and isotopic fractionation during planetesimal heating, melting, and partial differentiation, and they will improve our understanding of the origin of life-forming elements on Earth.

Working context

This work will be conducted within the framework of the ERC-CoG-2022 project "IRONIS" (PI: Evelyn Füre, 2023-2028; see <https://cordis.europa.eu/project/id/101087562>). Project IRONIS aims to answer the fundamental questions of (i) how the distributions of H, C, and N (and their carrier phases) evolved in space and time within the earliest stages of the protoplanetary disk, and (ii) how H, C, and N were distributed between metals and silicates during planetesimal accretion, differentiation, and subsequent evolution. The available funding will cover the 36-months salary, all analytical costs, participation at several national and international conferences or workshops, and any open-access publication fees.

The thesis project will be jointly supervised by Evelyn Füre and Sune Nielsen, in close collaboration with Laurette Piani and Laurent Zimmermann. The PhD student will join the “Cosmochemistry and Planetology” research team at CRPG, and they will be registered at the doctoral school SIRENA (<http://doctorat.univ-lorraine.fr/en/doctoral-schools/sirena>).

Coupled nitrogen-noble gas analyses of various meteorites (enstatite chondrites/achondrites and Fe-Ni-alloy-rich (primitive) achondrites), which are already available at CRPG, will be carried out by static mass spectrometry at CRPG’s noble gas facility. Any additional analyses of the samples (by microscopy, SEM, EPMA) will also be carried out at CRPG.

Additional information

A master's degree (or the equivalent) in Earth Sciences is required. The candidate should have a solid background in geochemistry and/or planetology as well as experience in analytical work. Strong organisational and writing skills are essential, and good speaking and writing skills in both English and French are advantageous.

Additional details about the project and application procedure can be found here: https://adum.fr/as/ed/voirproposition.pl?site=adumR&matricule_prop=55896.
The deadline for application is set for **May 13th 2024**.

For any questions, please contact Evelyn Furi (evelyn.furi@univ-lorraine.fr).