Post doc position (24 months)

Understanding processes and time scales in ancient terrestrial and extraterrestrial (phosphate) materials through nanoscale investigations.

Key words:
Atom Probe Tomography (APT); phosphates; correlative microscopy with TEM; geochronology; processes; cosmochemistry

Context:

This post doc is part of a wider project *COSMO-SAT* (P.I. A.-M. Seydoux-Guillaume, Co-P.I. F. Vurpillot and M. Roskosz) from the PEPR Origins (https://pepr-origins.fr/en/). The objective of *COSMO-SAT* is to develop a new generation of tomographic atom probe dedicated to the analysis of terrestrial and extraterrestrial geological samples in order to significantly improve their quantitative and isotopic measurements at the nanometric scale. Measuring quantitatively the elemental and isotopic composition of samples, down to the atomic scale, allows to trace and quantify the irradiation processes and the gas-grain interactions in the protoplanetary disk, to determine the origin of pre-solar grains and their associated nucleosynthesis, as well as the origin of primitive complex objects. The project has several ambitious instrumental improvement objectives (https://pepr-origins.fr/en/projet/cosmo-sat/) to tackle various questions. One concerns extraterrestrial nano-geochronology and the understanding of complex samples from the Archean to the Hadean through isotopic analysis of very small volumes of chronometric minerals (zircons, baddeleyites, phosphates, etc.), and the study of processes at the nanoscale. This will be at the centre of the present Post doc.

Objectives:

The recent use of APT in the field of nano-geochronology, especially on phosphate minerals monazite and xenotime (e.g. *Fougerouse et al. 2020 and 2021; Joseph et al., 2021; Seydoux-Guillaume et al., 2019; Turuani et al., 2022, 2023 and 2024*), has shown the potential but also its limitations and the technological hurdles to be overcome. It is, in particular, essential to improve isotopic quantification at such small spatial scales, which suffers from technical limitations at the level of detection and mass spectra. Recent advances by Tom Veret (*doctoral thesis, 2025; Veret et al., 2026*) on simplified synthetic phosphate samples have opened new prospects for improving isotopic quantification using APT. These have been considered in the construction of the COSMO-SAT prototype located at the GPM in Rouen. The postdoctoral researcher will therefore benefit from these developments and work on COSMO-SAT, a unique instrument in the world (*Vurpillot et al., 2026*).

The objective of the present post doc will be to implement the developments made on the prototype (COSMO-SAT) on a selection of well-characterized samples of ancient terrestrial (Archean to Hadean) and extraterrestrial samples (Martian meteorites) down to the micro-scale. The post doc will focus essentially on phosphate minerals (e.g. apatite, merrillite, tuite) from ancient rocks (e.g. Western Dharwar craton, India), and extraterrestrial samples (e.g. “Black Beauty” Martian meteorites). These phosphate samples have the capability of recording various events that their host-rock experienced from magmatic crystallization to thermal events (metamorphic) and fluid circulation, therefore providing access to the history of these samples. Such events could be retrieved from the study of various proxies (e.g., U-Th-Pb isotope system, Rare Earth element concentrations, halogen contents). Previous studies based on internal textures (cathodoluminescence images) and geochemical data confirmed that the targeted samples recorded multiple events, notably fluid circulation which is a critical issue related to the hydrous history of Mars but also for the global evolution of Archean cratons (*Shang et al., 2022; Clavé et al., 2024; Mallens PhD thesis, 2026*).

At the same time, transmission electron microscopy (TEM) will be performed at LGL-TPE in order to develop cross-correlative analyses of atom probe specimen prepared by FIB and observed by TEM, thus combining isotopic analyses with structural analyses at the nanometric scale.

Profile:

The targeted candidate should hold a PhD in Earth and planetary Sciences, and be highly motivated by analytical work and material characterization. Moreover, advanced knowledge in geochronology, early Earth, and small-scale analytical techniques are pre-requisites for the successful completion of this project. Prior experience on FIB preparation, APT or TEM would be an advantage.

Application:

Interested candidates should send a short CV **before July 15th, 2026** (including the list of articles/communications) + a letter of motivation + at least one letter of recommendation, by email to anne.magali.seydoux@univ-st-etienne.fr

Starting date: **November 2026 (flexible over a few months)**. Participation in the atom probe school in Rouen (early November 2026) is mandatory.

Gross salary: 3,000 – 4,000 € per month depending on experience. Salaries include Health and Retirement benefits.

Working places:

The present postdoctoral project will be mostly based at LGL-TPE in Saint-Etienne (https://lgltpe.fr/) in a completely new building on the manufacture campus of the University Jean Monnet (https://lgltpe.fr/inauguration-du-batiment-sciences-manufacture-de-lujm/) with Anne-Magali Seydoux-Guillaume (FIB/TEM developments). Significant time will be spent at Groupe de Physique des Matériaux (GPM) in Rouen (https://gpm.univ-rouen.fr/) where the COSMO-SAT APT is hosted. Regular visits to Laboratoire Magmas et Volcans in Clermont-Ferrand (https://lmv.uca.fr/) are also planned, mainly for scientific meetings with partner researchers specialized in primitive earth and Mars geochemistry and geochronology (Martin Guitreau and Maud Boyet).

Some references:

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