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## Analytical chemistry engineer

### Job offer from the institut de physique du globe de Paris | CNRS UMR 7154

Category	A
BAP	B
Rank	Ingénieur d'étude
Job – type REFERENCE	B2A41
Duration	18 months
Affectation	IPGP ACE team
Salary	2055.63 euros net per month with allowance
Date of publication	21/09/2023
Starting date	January 2024
Location	1 rue jussieu 75005 Paris

### The institut de physique du globe de Paris

A world-renowned geosciences organisation, the IPGP is associated with the CNRS and an integrated institute of the Université Paris Cité. Bringing together more than 500 people, the IPGP studies the Earth and the planets from the core to the most superficial fluid envelopes, through observation, experimentation and modelling.

The research areas are structured through 4 main unifying themes: Interiors of the Earth and Planets, Natural Hazards, Earth System and Origins.

The IPGP is in charge of labelled observation services in volcanology, seismology, magnetism, gravimetry and erosion. And the IPGP's permanent observatories monitor the four active French overseas volcanoes in Guadeloupe, Martinique, Réunion Island and Mayotte.

The IPGP hosts powerful computing resources and state-of-the-art experimental and analytical facilities and benefits from first-class technical support. The IPGP provides its students with geosciences training that combine observation, quantitative analysis and modelling, and that reflects the quality, richness and thematic diversity of the research conducted by the IPGP teams.

### Team Department

The research activity of the team focuses on the biogeochemical cycles of metallic elements in the critical zone and more specifically on their evolution during the Anthropocene. These elements, naturally present in the lithosphere, see their fate being highly dependent on chemical or physical alteration processes. Their cycles are controlled by regional and global hydroclimatic variations, but also largely by anthropogenic activities which participate in global changes by altering the relationship between atmosphere and the earth surface.

The research questions addressed are:

Which speciation for these elements (ions, complexes, colloids);

What are the transport and transfer processes of metallic elements (ME) in natural compartments (soil, sediment, water, air);

What change in the mobility and availability of metallic elements under the action of anthropogenic forcing;



What behaviour and what fate for emerging contaminants that are manufactured or accidental nanoparticles in the environment;

What are the processes allowing the valorisation of Technological Critical Elements (TCE) in the context of the circular economy and urban metabolism, and whose biogeochemical cycles in the critical zone will be modified by their massive use for new technological applications.

While climatic and geological processes were for a long time the main drivers of terrestrial surfaces transformation, our team is studying how humans, at the time of the Anthropocene, are at the origin of most of the transformations that affect the critical zone.

## Missions

> Presentation of the missions within the context : The position is open within the context of an ANR project called : Post-FIRE pollutants mobilisation into surface water resources (Post-Fire). Wildfires have become a pressing concern due to their increasing frequency, size and severity, which can lead to the release of emerging contaminants in addition to established contaminants. These wildfires have significant impacts on water resources through the transfer of contaminants and nutrients during rainfall events. Pyrogenic organic matter (PYROM) and **nanoparticles (NPs)** derived from burned ash, charred soil organic matter and aerosols enter surface waters, fundamentally altering water quality and impacting ecosystems and drinking water safety.

The hypothesis of this study is that PYROM induce the formation of new disinfection by-products when chlorine is used in drinking water treatment plants, which requires a thorough characterisation of soluble PYROM and their reactivity during disinfection. In addition, the research highlights the need to characterise these soluble compounds, particularly persistent mobile organic compounds. Furthermore, the study explores how wildfires generate uncharacterised nanophases and induce changes in metal speciation that affect the quality of aquatic ecosystems, with a focus on metal ion speciation, whether as NPs or complexed with organic matter.

Within this context we are looking for an engineer that will be in charge of field and some experimental work and detection of nanoparticles in various type of soils and solutions. The main goal is to detect and quantify new nanoparticles released during fires and post fire conditions. The main task will be the characterization of nanoparticles issued from burnt material. The number and the composition of each family of NPs will be determined. In addition to NPs detection, bulk elementary analysis (major and trace elements), DOC on filtered (two steps filtration first  $<1\mu\text{m}$  and  $<0.02\mu\text{m}$ ) extinguishing solution will be performed to acquired metal ion distribution in solutions.

The number and the composition of each family of NPs will be determined by single particle ICP-MS (sp-ICP-MS) coupled with machine learning algorithm (hierarchical agglomerative clustering – HAC). The project uses Time of Flight ICP-MS used in single particle mode (sp-TOF-ICP-MS), allowing high frequency acquisition of individual NPs chemical composition (from Na to U) when combined to HAC.

Molecular characterization of the nanoparticles will be carried out by laser desorption ionization (LDI) FTICR MS. In order to target more polar molecules adsorbed in the particles, extraction with solvent such as methanol will be used followed by ESI-FTICR analysis.

> Number of agents : 1 position

## Activities

> Laboratory Work:

- Conducting laboratory experiments and tests on collected samples.
- Analyzing the composition and concentration of metallic contaminants thanks to ICP-OES, ICP-MS and spICP(-ToF)-MS
- Check and adjust equipment periodically
- Diagnose and treat common equipment malfunctions
- Apply and enforce the safety and hygiene rules

> Report and Documentation:

- Preparing detailed reports summarizing field observations, data analysis, and findings.
- Documenting methodologies, equipment used, and results.

> Logistics Planning:

- Coordinating field missions, including equipment and personnel logistics.
- Procuring necessary field equipment, safety gear, and materials.

> Field Mission Execution:

- Collecting samples of soil, water, and other environmental parameters.
- Deploying monitoring instruments in relevant locations.
- Ensuring safety protocols during fieldwork.
- Gathering data on water quality, contaminants, DOC/DON, nutrients, and pyrogenic organic matter (PYROM).
- Monitoring water flow rates, soil conditions, and weather patterns.
- Managing and organizing collected data for further analysis.



- > Collaboration and Communication:
  - Collaborating with interdisciplinary teams of scientists, researchers, and environmental experts.
- > Continuous Learning and Adaptation:
  - Staying updated on the latest research and technology related to wildfire impacts.
  - Adapting strategies and approaches based on new information and emerging challenges.

### Expected Skills

- > Chemical analysis techniques (ICP-OES, ICP-MS and splCP(-ToF)-MS)
- > Water chemistry
- > Mathematical and computer tools required to process results
- > Quality concepts applied to chemical analysis techniques
- > Chemical species (basic concept)
- > Sample preparation techniques
- > Health and safety regulations
- > Occupational risks (chemical, electrical, radiation, microbiological, etc.)
- > English language: B1 to B2 (Common European Framework of Reference for Languages)

### Obligations and risks

- > Work schedules : standard day
- > Professional trips : field mission

### Training and experience required

- > Maximum of 3 years experience
- > Education level or diploma : Master 2 or engineer degree

### How to apply

- > CV and cover letter
- > Deadlines for applications : 1/02/2024
- > Contacts (2 contacts are required for the interview): Professor M. F. Benedetti ([benedetti@ipgp.fr](mailto:benedetti@ipgp.fr)) & Dr.M. Tharaud ([tharaud@ipgp.fr](mailto:tharaud@ipgp.fr))