

An early stage researcher (ESR) PhD position is available at the Université de Rennes 1 as part of the Marie Curie Innovative Training Network “PANORAMA”

Ph.D. Title : REE interactions with organo-mineral colloids as a control of the REE environmental dissemination

ORGANISATION/COMPANY		TYPE OF CONTRACT	<i>Temporary</i>
RESEARCH FIELD		JOB STATUS	<i>Full-time</i>
RESEARCHER PROFILE	<i>First Stage Researcher (R1)</i>	HOURS PER WEEK	35
APPLICATION DEADLINE	<i>15th June - Europe/Brussels or until position is filled.</i>	OFFER STARTING DATE	<i>As of 01/10/2020</i>
LOCATION		EU RESEARCH FRAMEWORK PROGRAMME	<i>H2020 / Marie Skłodowska-Curie Actions</i>

Host institution

University of Rennes 1 (UR1) is a multidisciplinary institution, famous for its excellence and dynamic research, consisting of 4 main scientific areas: Mathematics and ICT (Information and Communication Sciences & Technologies), Life and Health Sciences, Material Sciences, Humanities and Social Sciences. It welcomes about 23,300 students, all surrounded by 1,900 teachers & full-time researchers and about 1,100 administrative & technical staff. As part of UR1, **Géosciences Rennes** is a Joint Research unit supported by the French National Research Centre for Scientific Research (CNRS) and UR1. It is an internationally recognized multidisciplinary laboratory in Earth and Environmental Sciences, with research ranging from lithosphere dynamics, basin analysis, Earth surface processes up to physical hydrogeology/hydrology and biogeochemistry of emergent pollutants, coupling field, experimental and numerical modeling approaches. **Géosciences Rennes** has developed strong links with leading research institutions across Europe and partnerships with industrial, governmental and non-governmental bodies and publishes ~ 120 papers/year in high-quality refereed international journals. It received top marks during the 2016 national evaluation and is one of the outstanding research institutions in the Earth Science French academic landscape. Eleven Professors, 18 Associate Professors, 24 CNRS Researchers, about 30 technical and administrative staff, 43 PhD students and 18 post-doctoral fellows are currently working in Géosciences Rennes. It hosts ~10 foreign researchers/year.

Prof. Mélanie Davranche - Full-time UR1 Professor - Co-Coordinator of PANORAMA with Dr. Aline Dia, is a specialist of REE (bio)geochemistry (experimentation/modelling). She was awarded from the prestigious ‘Institut Universitaire de France’ and received the famous CNRS bronze medal (2013). **Dr Julien Gigault** - Full-time CNRS Researcher – is a young talented chemist expert in nanoparticle characterization and received the CNRS bronze medal in 2019.

Research objectives

Characterize and model REE interactions with organo-mineral colloids, which partially control REE dissemination in the environment.

Rare earth elements (REE) are crucial to a wide range of modern technologies such as catalytic additives, hybrid vehicles, wind turbines, oil refining and lighting technologies; all of them rely on the chemical, optical and electro-optic, and paramagnetic properties of REE. The industrial use of REE and all the strategies developed to increase the REE supply by either mining or recycling also increase the REE fluxes resulting in environmental and occupational exposures. Potential concerns about the environmental safety of their use is raised, since concentrations already 100 times above background in some areas have been reported. **Disruption of biogeochemical cycles by some REE is already apparent** notably in aquatic and terrestrial environments. However, many uncertainties in our current understanding and modelling are related to the lack of studies on the REE anthropogenic sources (e.g. mining and mining waste, recycling wastes, gasoil, oil sands, etc.) and transfer. Moreover, no studies were dedicated to the understanding of the mechanisms that control their transport in between soils, waters and sediments. A major reason is that REE are particle-reactive, having high affinity for colloids that subsequently control both their mobility and transport.

The Ph.D. project aims at providing both speciation datasets and innovative analytical and modelling tools required to fully understand the intimate bonds linking REE to heterogeneous colloids. Such knowledge is crucial to understand, quantify and predict the REE mobility, bioavailability and toxicity in the environment. Investigate the REE speciation onto heterogeneous surfaces is still unexplored and requires advanced spectrometry and spectroscopic techniques (XAS, WAXS, SAXS, GC-MS, etc.) but also the development of innovative analytical and colloids-characterization methodologies adapted to field studies (e.g. REE selective electrodes, field DLS). Indeed, the “nano-speciation” of REE is still unexplored. By developing multi-dimensional analytical approach, such as field flow fractionation coupled to high resolved mass spectrometry, a one-step further approach will be achieved on the REE distribution to colloidal phase. New development using MSⁿ will allow to characterize trace REE and related mechanisms to colloids and other nanoscale materials. The use of multi angle light scattering associated to these methods will bring new data on the implication of the colloid aggregation mechanisms on the REE distribution.

The ESR will benefit from advanced expertise on REE-surface modelling from UR1, spectroscopy from SOLEIL and huge technical expertise of Cordouan Technology. More precisely, the PhD project will consist on a coupling between experimental laboratory work, field campaign and modelling calculations to investigate the distribution of REE on heterogeneous nanoparticles in order to evaluate the ability of such nanoparticles to control the REE bioavailability and dissemination in the environment. For this, nanoparticles will not only be synthesized in the laboratory but also collected in contrasted REE contaminated sites. The targeted field sites (Portugal, Spain, France) were selected according to both their low (wetlands) and high REE contamination (mine) level.

Presentation of the research project (cooperative aspect)

This PhD position is within the framework of a European ITN project named PANORAMAM: EuroPean trAining NetwOrk on Rare eArth elements environMental trAnsfer: from rock to human involving 15 PhD positions.

Under the supervision of Mélanie Davranche and Julien Gigault, the PhD student will investigate the binding between REE and heterogeneous synthetic and natural nanoparticles under various physico-chemical parameters. The nanoparticles were characterized following advanced characterization techniques (DLS, Zeta potential, SAXS, WAXS, SANS, A4F-UV-SLS-ICPMS, XAS spectroscopy, CryoMET, etc....) as well as the REE-nanoparticles physico-chemical interactions (A4F-UV-ICPMS, XAS spectroscopy, etc). All the produced dataset, will secondly be modelled to test various binding scenarios and determine the most relevant REE-nanoparticles complexation mechanisms in order to estimate REE bioavailability and potential dissemination in the environment.

The project involves a strong collaboration with several institutions and private companies, including required research stays (secondment) with **SOLEIL** (2 months) on REE-colloids interaction characterization by spectroscopy, **CORDOUAN technology** (3 months) colloids characterization, characterization tools development, **EDM** for field sampling and superior **Institut of Technology of Lisboa** (1 month) for support to field

The PhD student will be also involved in scientific/soft-skills meetings and in research activities conducted in other laboratories/companies from Europe and associated countries.

An important component of the training will be the participation to 3 main major **training events**:

WS1-(December 2020) REE as emerging contaminants: Properties, uses and dissemination –Germany-fundamental REE biogeochemistry and currently known anthropogenic REE inputs into the environment

SS1 (May 2021) - AMD and REE contamination mitigation - Portugal-Management and remediation solutions of AMD in old mining areas and Management of WEEE, recycling areas

WS2 - Colloids and nanoparticles as REE vectors -France- Structural characterization of colloids and nanoparticles by innovative and fine spectroscopic and scattering techniques: X-Ray absorption fluorescence and scattering, light scattering. REE interactions with bearing phases.

SS2 - (Eco)toxicology of REE –Germany- Eco)toxicological concepts and approaches, Physico-chemical properties of REE for bioavailability, ecotoxicity and environmental risk

In addition to these major milestones of the program, the PhD students will 1) continuously develop their **core research skills via their own research project** locally and within the network while at secondments and conferences, 2) receive a mandatory amount of **hard and soft-skills training** specific to their own doctoral school, along with mentoring by joint supervising bodies, 3) use **conferences both as dissemination events for ESRs results and network events for progress reports and evaluations**, and 4) **collaborate into practical activities aimed at network-structuring legacy deliverables**.

PANORAMA's research objective is to elucidate the man-induced environmental dissemination of REE and the associated effects on the environmental health. For that purpose, interdisciplinary approaches are required combining geochemistry, ecotoxicology, hydrology, chemical analysis and coupling field monitoring, original in and ex situ experimental set-up and modelling from the element speciation to the environmental impact. PANORAMA's key aim is to **set-up an optimal scientific and non-scientific training to the understanding and forecasting of the environmental impacts of new emerging pollutants such as REE**.

Benefits

With indicative financial conditions of the research project (in local currency)

- 3-years full-time employment contract
- Attractive salary tuned to living standards of the hosting country. Brut salary, and excluding family and mobility allowance will be around 2900 euro
- Conditional family allowance of 500€ per month (potentially subject to taxes)
- Mobility allowance of 600€ per month (potentially subject to taxes)
- Based in 3 leading institutions in Environmental Sciences in Europe and 2 private companies, Geosciences-Rennes (30 months), Soleil (2 months), IST/EDM (1 month) and Cordouan Technology (3 month), with excellent staffs in Geosciences-Rennes and friendly working conditions.
- Possibility to collaborate with a large network of international research groups engaged in the ITN

Requirements

- The candidate should be in the first four years of their research career. They should not have a doctoral degree and fulfil the eligibility criteria and mobility rule (see below)

- The candidate should hold or be about to obtain a Master's degree in Earth Science, Geochemistry or (Environnemental) chemistry.
- Excellent technical skills including experience in geochemistry, mineralogy, analytical chemistry and thermodynamic modelling
- Ability on numerical modelling. Experience with geochemical modeling codes (PHREEQC, MODEL VII, NICA-DONNAN, ORCHESTRA...) will be appreciated
- Broad understanding of concepts and applications in environmental geochemistry
- The ability to work both as part of a team, and independently, coupled with excellent communication, organizational and problem-solving skills
- Availability to travel for training events and research secondments.

ELIGIBILITY CRITERIA

Recruiting is in accordance with the European rules for Marie Curie Initial Training Networks. Early-stage researchers (ESR) can be of any nationality. They must be, at the time of recruitment by the host organization, in the first four years (full-time equivalent) of their research careers and have not yet been awarded a doctoral degree. The research career starts after the degree that enables a student to proceed with a PhD (usually, the Master degree).

MOBILITY RULE

At the time of the recruitment by the first host institution, the ESRs must not have resided or carried out their main activity (work, studies, etc.) in the country of their first host institution for more than 12 months in the 3 years immediately before the recruitment date. Short stays such as holidays and/or compulsory national service are not taken into account.

How to apply

Send your complete application before June 15th to both contacts below (application will remain open until position is filled).

A **single pdf file** needs to be submitted including:

- a cover letter, stating your research motivation and interests; including relevant background and career plan (max 1 A4 page)
- a Curriculum Vitae, including academic background, previous research and/or industrial experience (max 2 A4 pages)
- Degree transcripts (with marks)
- English language qualification certificates (or equivalent)

Reference letters:

- at least 2 confidential reference letters from academics (including name, position and email address of the referee) (max 1 A4 page, with substantiated assessment of the applicant's technical skills, creativity, innovation ability, working capacity, efficiency and level of independence) must be sent directly to the contacts below.

Contacts:

ESR Supervisor: mélanie.davranche@univ-rennes1.fr, Julien.gigault@univ-rennes1.fr and aline.dia@univ-rennes1.fr

Recruitment committee: [to be completed after the kick-off meeting](#)

Project website: [Created by Cordis when grant agreement will be signed](#)