

## PhD position is available at the [Amphos 21 Consulting](#) as part of the Marie Curie Innovative Training Network FluidNet

Ph.D. Research Project Title: [Mixing and precipitation patterns linked to groundwater evaporation](#).

<b>ORGANISATION/COMPANY</b>	Amphos 21 Consulting S.L. Hydrogeology/reactive	<b>TYPE OF CONTRACT</b>	<i>Temporary</i>
<b>RESEARCH FIELD</b>	transport modelling	<b>JOB STATUS</b>	<i>Full-time</i>
<b>RESEARCHER PROFILE</b>	<i>First Stage Researcher</i>	<b>HOURS PER WEEK</b>	40
<b>APPLICATION DEADLINE</b>	April 1 <sup>st</sup> , 2021	<b>OFFER DATE</b>	<i>Summer 2021</i>
<b>LOCATION</b>	Amphos 21 Consulting headquarters, Barcelona	<b>EU RESEARCH FRAMEWORK PROGRAMME</b>	<i>H2020 / Marie Skłodowska-Curie Actions</i>

### Research focus of H2020 FP Copermix

CoPerMix is a consortium of high-profile universities, research institutions and companies located in France, Spain, Germany, Switzerland, Belgium, Italy and the UK, and will train a total of 15 PhD students (Early Stage Researcher, ESR). The objective of the network is to develop a unified vision, numerical tools, and experimental techniques allowing the description and the quantification of mixing processes in complex flows, such as turbulent atmospheric or oceanic flows and those encountered in geological, granular and biological media.

### Research objectives of ESR 09 in CoperMix:

Objectives: Identify and characterize mineral precipitation patterns linked to groundwater evaporation in arid environments and their spatial and temporal evolution using reactive transport modelling techniques.

Evaporation in arid environments leads to the salinization of soils, which is one of the processes of soil degradation contributing to land desertification. Physically, the evaporated groundwater becomes denser and generates density-driven convective flow fields. Chemically, the evaporated water becomes saturated in carbonate minerals, gypsum and, eventually, halite. Precipitated calcium carbonate forms a hard, calcareous cement known as caliche, which changes the hydraulic properties of the soil. The precipitation patterns of these minerals can only be understood by the interplay between evaporation, convective flow, mixing and reactions. An experimental and numerical approach is proposed. First, numerical models to simulate groundwater flow and mixing in highly evaporative environments will be performed. The simulations will be used to design experiments in 2D tank experiments or Hele-Shaw cells to be performed in EAWAG (EAWAG-Zurich) and at ULB (Brussels). A reactive transport model will be developed to replicate the flow and reactivity patterns observed in the experiments. The temporal dynamics and spatial patterns of flow and reactivity will be investigated to predict the formation of mineral crusts, define desertification indicators and the critical time under which the process becomes irreversible and to design mitigation strategies.

### Host institution

AMPHOS21 Consulting S.L. is a SME that provides scientific and technical consultancy services addressing a range of environmental issues, mainly associated with the management and disposal of

hazardous wastes, contaminated groundwater and soils as well as environmental planning and management. The main output is the expert advice to national geological agencies and regulators, along with industrial innovation. Amphos21 counts on a team of more than 40 highly qualified professional specialized in scientific and technical disciplines related to geosciences. Amphos21 has been involved in more than 25 EC-funded projects from the 4th Framework Programme, playing both scientific and managing role.

This PhD. Project will be performed under the supervision of Dr. Elena Abarca, Project Director and Leader of the Group of Hydrogeological Modelling of coupled processes in Amphos 21 Consulting S.L.

### **PhD enrolment and secondments**

The PhD project will be based in the **Amphos21** offices in Barcelona; however, since Amphos21 is a non-degree awarding PhD institution, the ESR will be enrolled as a PhD student at the **Polytechnic University of Madrid**. The ESR will also follow a training program that will include mandatory secondments. at (1) **EAWAG, Zurich** and (2) **ULB, Brussels** to perform experiments on precipitation in evaporative systems and (3) **UPM, Madrid**, to explore the use of phase-field models to simulate the formation of caliche crusts. The PhD student will be also involved in scientific meetings and in research activities conducted in the framework of the CoperMix project.

### **Benefits**

- 3-years full-time employment contract.
- Attractive salary tuned to living standards of the hosting country.
- Based in a leading SME in I+R in Applied Geosciences in Europe, with expert staffs in modelling 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 a bachelor in geology, physics, mathematics, engineering, or related disciplines. Applicants must provide documentation of either a recently completed MSc degree or confirmation of completion of the MSc degree prior to starting the position.
- Knowledge and skills in quantitative research
- Experience with programming and scripting languages (e.g., Python, FORTRAN, C++) will be highly appreciated.
- Broad understanding of concepts and applications in hydrogeology.
- Ability to work independently and as part of a team.
- Ability to synthesize complex technical and scientific information.
- Fluent written/verbal communication in English.

### **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 April 1<sup>st</sup>, 2021 to [elena.abarca@amphos21.com](mailto:elena.abarca@amphos21.com)

**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)
- A copy of your grades list. If you have not graduated yet, please include Bachelor grades and available grades for your Master.
- **English language qualification certificates** (or equivalent)
- Contact information of two academic references
- A draft proposal related to the ESR position (ESR 9) (max. 3 pages including references).

### **Contacts:**

#### **ESR Supervisor:**

Elena Abarca, PhD, Project Director,  
Hydrogeological modelling of coupled processes Group.

#### **Human resources head:**

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