

PhD in the HydrASA team of « Institut de Chimie des Milieux et Matériaux de Poitiers (IC2MP) » (France)

Title: Diffusion and adsorption of nutrients in clayey matrices

In order to better understand and predict transfer of organic and inorganic contaminants in surface environments, as soils, reactive transport models can be used. These models allow to couple numerically (i) transport processes as advection and diffusion to (ii) chemical reactions as adsorption/desorption occurring in/onto reactive constituents of soils, as clay minerals. However, it remains difficult with previous and published diffusion models to clearly quantify the dynamic of contaminants in the different types of porosity located in the clayey matrices of soils (interparticle *versus* micro/nanopores porosities). In this context, this project will contribute to prioritize intrinsic properties of clay particles (size, morphology, adsorption capacity, intrinsic porosity) and organizational properties of clayey matrices which control the diffusion of water and solutes in clayey porous media, representatives of clayey matrices of soils.

In a first step, the work of the candidate will consist to study the dynamic of water tracer and nutrients/contaminants (sulfate, calcium, strontium...) in clayey porous media reconstituted in laboratory, built with clayey particles having a known morphology and characterized by fixed distribution between the different types of porosities (interparticle *versus* interlayer/nanopore). This work will ask to have a strong interest for experimental studies, and the applicant will use an experimental set-up already validated for water tracers to perform his/her experiments. In a second step, isotopic fractionation which could be appeared during diffusion in these clay porous media will be assessed. Then, results obtained with different model systems will be compared with those which could be obtained with natural soil samples, in order to validate the properties of clayey particles and organization of the media which control the macroscopic diffusion of water and nutrients/contaminants in the clay matrices of soils.

Duration of the project: 3 years from 1 October 2018.

Financial support: allocation from Ministry or Nouvelle-Aquitaine region already obtained (\approx 1420 € net/month).

Candidate profile: the candidate should have a Master degree (or equivalent) and knowledge in material sciences and/or soil sciences and/or transport in porous media. Knowledge in clay materials and/or properties of finely divided solids will be appreciated. Candidate will work in team and should have a good knowledge of English.

Procedure for applying: please send a curriculum vitae and a covering letter to Emmanuel Tertre (emmanuel.tertre@univ-poitiers.fr) - Tel.: +33 5 49 45 36 57.

Deadline to apply: **26 April 2018.**

Publications in connection with the project:

- Tertre E., Savoye S., Hubert F., Prêt D., Dabat T. & Ferrage E. (2018) Diffusion of water through the dual porosity swelling clay mineral vermiculite. *Environmental Science & Technology*, 52 (4), 1899-1907.
- Ferrage E., Hubert F., Tertre E., Delville A., Michot L.J., Levitz P. (2015) Modeling the arrangement of particles in natural swelling-clay porous media using three-dimensional packing of elliptic disks. *Physical Review E* 91, 062210.
- Tertre E., Delville A., Prêt D., Hubert F., Ferrage E. (2015) Cation diffusion in the interlayer space of swelling clay minerals – A combined macroscopic and microscopic study. *Geochimica et Cosmochimica Acta* 149, 251–267.
- Hubert F., Bihannic I., Prêt D., Tertre E., Nauleau B., Pelletier M., Demé B., Ferrage E. (2013) Investigating the anisotropic features of particle orientation in synthetic swelling clay porous media. *Clays and Clay Minerals* 61, 397-415.