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| **Project Number** | 10 |
| **Name/title of the PhD course** | Geotechnical Engineering and Geo-Sciences Doctoral Program, Technical University of Catalonia (UPC) |
| **Name/Title of the PhD project** | *Modelling of coupled THMC processes and assessment of long-term caprock integrity* |
| **Recruiting organisation and Department/Faculty of reference** | *Spanish National Research Council (CSIC)* is Spain's largest public research institution and ranks third among Europe's largest research organizations. CSIC has more than 10.000 employees, including nearly 4.000 staff researchers, and 120 Institutes. CSIC is a major player in the development of the European research area and therefore a significant contributor to the European integration process. The project will be carried out at the Mediterranean Institute for Advanced Studies (IMEDEA-CSIC-UIB) and in collaboration with Geoscience Barcelona (GEO3BCN-CSIC). The doctoral candidate will be integrated into an international and interdisciplinary research group currently composed by 6 postdocs, 9 PhD students and 1 MSc student. The group participates in several EU projects, including a Starting Grant from the European Research Council (CSIC) and two Doctoral Networks of the Marie Skłodowska-Curie Actions. CSIC counts with access to high-performance computing facilities to run numerical simulations related to the project. |
| **Scientific context and Objetives** | Assess the effect of coupled thermo-hydro-mechanical-chemical (THMC) processes on caprock sealing capacity |
| **Expected Results** | Development of a theoretical framework to solve coupled THMC processes for H2 storage; implementation of the theoretical framework into a numerical code; assessment of the caprock sealing capacity for multiple injection/production cycles |
| **Secondment opportunities** | UEDIN, K. Edlmann, M15, 6 months, purpose: incorporating chemo-mechanical effects into the mathematical and numerical framework; Seismik, M21, L. Eisner, 6 months, purpose: using microseismic data to identify potential damage to the caprock |
| **Brief CV of main supervisor** | Víctor Vilarrasa is a tenured scientist at the Spanish National Research Council (CSIC) and a full member of the Young Academy of Spain and the Global Young Academy. He leads an international research group at the Global Change Research Group of the Mediterranean Institute for Advanced Studies (IMEDEA-CSIC-UIB), currently composed by 6 postdocs, 9 PhD students and 1 MSc student. He performs interdisciplinary research in a collaborative environment, combining concepts of hydrogeology, geomechanics, geochemistry and seismology, which allows him to address complex challenges of geoenergies. His group is part of CSIC's Interdisciplinary Thematic Platform PTI-TRANSENER, which aims at contributing to the global challenge of the transition of the energy model. At the national level, he is ranked within the 100 Best Earth Science Scientists in Spain by Research.com and was included in the 101 Spanish innovative minds by Quo in 2015. At the international level, he has been appointed General Secretary of the Commission on Coupled Processes of the International Society of Rock Mechanics (ISRM). He has an extensive track record. In addition to 60 indexed journal papers (85% of which as 1$^{st}$, 2$^{nd}$ or last author), Vilarrasa has published 9 book chapters, 41 conference papers, 32 scientific-technical reports, 4 scientific advisory reports and 2 hydrogeological studies. He is also active in disseminating his results to the scientific community, with more than 200 contributions to congresses, including 4 keynote lectures, 13 invited presentations and 36 invited talks in seminars of national and international institutions. |
| **Publications** | 1-Vilarrasa, V., De Simone, S., Carrera, J. and Villaseñor, A., 2021. Unravelling the causes of the seismicity induced by underground gas storage at Castor, Spain. Geophysical Research Letters, 48, e2020GL092038<br>2-Vilarrasa, V. and Carrera, J. (2015). Geologic carbon storage is unlikely to trigger large earthquakes and reactivate faults through which $CO_2$ could leak. Proceedings of the National Academy of Sciences, 112(19): 5938-5943<br>3-Vilarrasa, V., Carrera, J. and Olivella, S. (2013). Hydromechanical characterization of $CO_2$ injection sites. International Journal of Greenhouse Gas Control, 19: 665-677. |
| **Projects participation** | Vilarrasa is Principal Investigator of nine active projects (>3.7 M€ in funding), including the prestigious Starting Grant of the ERC. His leadership is demonstrated by his coordination of a Doctoral Network of the Marie Skłodowska-Curie Actions. By leading these projects, he has supervised 2 PhD, 7 MSc students and 5 visiting scholars.<br>*1-GEoREST, ERC-2018-StG from the European Research Council under grant agreement no.: 801809* |