SALTGIANT ETN – Early Stage Researcher in Numerical Modelling of Overpressure in Salt Basins – ESR 12

Title	**Overpressure development in rapidly deposited salt basins. Application to the Salt Giant on the Mediterranean Basin**
Duration	36 months
Expected start date	October 2018
Host Institution	National Oceanography Centre, Southampton (UK) - www.noc.ac.uk (doctoral degree to be awarded by the University of Southampton).
Primary Supervisor(s)	Hector Marin Moreno (NOC), Lisa McNeill (University of Southampton), Jon Bull (University of Southampton), and Jean Vaunat (UPC BarcelonaTECH)
Objectives	Excess pore pressure (pore pressure above the hydrostatic or overpressure) likely played an important role on the evolution of the Mediterranean basin (Messinian to present) and needs to be quantified to ensure the safety of likely future drilling operations in the area. However, the amount and distribution of overpressure below and within the Salt Giant on the Mediterranean basin is poorly understood. The combination of the large thickness and the impermeable character of the salt layer prevents the upward migration of pore fluids, developing overpressure. The objective of this project is to numerically model the generation of overpressure at different Mediterranean geological environments from the Messinian to the present. The ultimate aim is to better understand the role of overpressure in the evolution of basins containing rapidly deposited salt layers. ESR 12 will employ state-of-the-art numerical models to estimate the amount and distribution of overpressure generated by disequilibrium compaction of pre-Messinian sediments, lateral movement of the salt, catagenesis of organic matter, and mineral diagenesis. First, ESR 12 will constrain the petrophysical parameters of the salt, sub-salt and supra-salt formations using available seismic and borehole data from the Mediterranean Salt Giant and other analogous salt basins in close collaboration with ESR 10. Then, using available geochronological information will adopt and modify an in-house 1D numerical inverse model to estimate the overpressure that satisfies the seismic velocities and densities from the available data. Based on the results from the 1D models, 2D/3D models will then be developed using Code-Bright, a code that couples mechanical, hydraulic and thermal problems in multiphase geological media. Different conceptual models have been proposed in the literature to explain the deposition of the salts in the Mediterranean, and these will be tested. The use of adequate input parameters and the multistage modelling approach will result in reliable models that allow assessing the role of overpressure in the Mediterranean basin, and other rapidly deposited salt basins.
Expected results	Models of overpressure distribution below, within and above the salt and associated salt deformations and fractures at different Mediterranean sub-basins. Seismic evidence for the overpressure predicted by the models and the evidence for fluid migration pathways across the salt.
Specific requirements	Completed MSc or Diploma degree in Geophysics, Physics, Civil Engineering, Geological Engineering, Geology, Earth Sciences, or related fields; Knowledge in fluid flow in porous media and stress-strain response of materials;

	Basic knowledge in numerical methods and modelling in Earth Sciences; Skills in scientific programing would be helpful.
Planned secondments Provided by SALTGIANT partners to ESRs; duration 1-3 month each	(1) OGS, Trieste, Italy (A. Camerlenghi, for training in seismic processing techniques and borehole analysis to understand how some of the input petrophysical parameters used on the modelling of overpressure development in sedimentary basins are estimated); (2) MARUM, Bremen, Germany (Katrin Huhn, for training in numerical modelling of Mediterranean salt deformation with geometric, geological and sub-salt fluid pressure constraints utilizing Discrete Element Simulations); (3) VBPR, Oslo, Norway (S. Planke, for training on seismic imaging and interpretation to extract geometries of salt bodies from the Barents Sea and the Northeast Greenland Shelf as analogous to the Mediterranean Salt Giant).
Keywords	overpressure, petrophysical and seismic data analysis, numerical modelling.
Application	Send application via: www.ipgp.fr/saltgiant
For further information	Contact primary supervisor: hector.marin.moreno@noc.ac.uk