

The Andrew Whitham CASP Fieldwork Award - 2020-21 Winner

Applicant: Rosenqvist Marija

Project title: High-resolution reservoir model for CO₂ sequestration in volcanic margin basalt sequences

Scientific question and rationale: CO₂ sequestration in basalt sequences is a relatively new field of study, but important work is now being carried out (e.g. on Iceland with the CarbFix project) evaluating the possibility of storing CO₂ permanently in these rocks as carbonates through *in situ* secondary mineralization. The storage of CO₂ in solid form will minimize the risk of leakage, possibly removing one of the biggest concerns when it comes to CCS today. This study will focus on the basalt sequences located in the NE Atlantic, which may present a huge possible capacity for CO₂ storage. Basaltic sequences at the Faroe Islands will be studied as an analogue to possible subsurface reservoirs on the Norwegian continental shelf. The main questions in this study will be: 1) What basalt sequences in the NE Atlantic are favourable as reservoirs or as seals? 2) What is the heterogeneity within the sequences when it comes to reservoir properties? 3) How can this be put into the context of fluid migration through modelling of CO₂ injection?

Specific objectives and deliverables: The study will document the reservoir properties of the different basalt sequences at selected outcrops on the Faroe Islands. The reservoir properties of the different layers will be related to lithology, type of basalt flow and depositional history. Drone imaging will be used to make a 3D model of the outcrops. Local borehole logs and petrophysical experiments of field samples will give the quantitative data needed to make a detailed geo-model. The result will be a high-resolution reservoir model, created in Eclipse (Schlumberger Software) or a similar software, where the injection of CO₂ into different parts of the reservoir is simulated. The results will also be discussed in relation to CCS in basalt sequences on the Norwegian continental Shelf using previous mapping and seismic data from the volcanic margin.

Proposed work plan: The project will contain two trips of fieldwork (10 days in March and 10 in June 2020) on the Faroe Islands in the spring of 2020. The fieldwork will consist of observation logging, drone imaging and sample collection at selected outcrops. The different outcrops will be chosen upon arrival, with the aid from the Faroese Geological Survey. The Faroese Geological Survey may also provide the borehole data from the area containing FMI Fullbore Formation Imaging. The first few days of the first trip will be spent finding a suitable area and getting the necessary start-up data. The rest of the time will be spent doing the fieldwork. Observation logging and detailed descriptions of the layer lithology and deformation will be done. A drone will be used to take images of the outcrops which will later be processed and interpreted to make a 3D model. This 3D model can be linked to the borehole data to compliment the model and make the interpretations more accurate. Samples will also be taken in the field of layers that may seem like good reservoirs or seals when it comes to CCS. These will during autumn 2020 be analysed and tested for properties like porosity, permeability and possibly seismic velocities at the University of Aberdeen. The fieldwork is a part of a master thesis which will be handed in during May 2021. The thesis is an individual project, but it is under the same field of study as another UiO student Max Meakins who is also applying for this award. The applications are however separate.

Proposed expenditure, including details of any other sources of funding:

- Airplane tickets from Oslo, Norway to the Faroe Islands and return tickets (two trips): £550
- Housing on Faroe Islands (about 20 days weeks Airbnb): £1,000
- Car rental and gas (about 20 days): £1,200
- Meals (Breakfast, lunch and dinner for 21 days): £350
- **Total (minus additional funding of £430): £2,670**

Funding: I have gotten funding equal to £1,292 from the University of Oslo where £861 will go to laboratory work at the University of Aberdeen including travel and housing there. £430 will go to the fieldwork on the Faroe Islands.