



UNIVERSITÀ DI PAVIA

Corso di Dottorato in Scienze della Terra e dell'Ambiente

FORM PER PROGETTI BANDO DOTTORATO

1. Project title

GEOCHEMISTRY AND CCS: FROM EXPERIMENTAL DATA TO REACTIVE TRANSPORT MODELS

2. Proposer

Surname	Toscani
Name	Giovanni

3. Research Unit

Surname	Name	Institution
Geloni	Claudio	ENI

4. Key words

(Max. 5 – at least 2)

Carbon Capture Storage; Reactive transport; numerical models.

5. Abstract

(Max. 1.500 characters with spaces)

This project is aimed at understanding the geochemical reactions in geological CO₂ storage reservoir and seal developing models to detect and predict the behaviour of the storage complex affected by the presence of CO₂ rich fluids ensuring the integrity of reservoir and seal when they come in contact with CO₂ bearing fluids. Depending on the lithology of reservoir and seal (siliciclastic or carbonate), and their chemical reactivity the response is highly different.

The project is focused on all the (bio-)geochemical processes driven by CO₂ injection in the subsurface. Preliminary work was carried out to estimate and validate the thermodynamic parameters of the site-specific minerals, which were then entered into the thermodynamic databases used by the modelling software. 0D-batch geochemical models and 1D-reactive transport models (RTM) of seal and reservoir characterised by the mineralogical content of a siliclastic storage site have been carried out.

The objectives and the main activities of the PhD project are:

- 1) Calibration of RTM with aging experiments in Eni S.p.A. labs
- 2) Calibration of the geochemical and reactive transport model in relation to diffusive processes for calibration of transport parameters
- 3) Development of thermodynamic-geochemical and reactive transport models for the simulation of cement alteration due to interaction with acidic CO₂-rich fluids
- 4) Investigate the reactive process at small scales (core scale) by improving the integration with experimental analyses (increase integration with tomograph)



UNIVERSITÀ DI PAVIA

**Corso di Dottorato in Scienze della Terra
e dell'Ambiente**

5) Adding thermal effects and salts precipitation induced by anhydrous CO₂ injection in the (very) short terms.

The ultimate goal of the project is to develop and provide a complete 3D model capable of describing all characteristics from reactivity to fluid dynamics, taking into account variations in petrophysical properties at the reservoir scale of the specific storage complex.