

June 12th 2008

CO202-08
" Modelling chemical reactivity during CO₂ geological storage "

PROGRAMME

| MONDAY October 13th 2008 – afternoon only | | |
|---|---|-------------------------------|
| 13.00-13.30 | WELCOME – INTRODUCTION OF PARTICIPANTS | Géraldine Picot |
| 13.30-14.00 | OVERVIEW OF CO₂ GEOLOGICAL STORAGE PROJECTS AT BRGM <ul style="list-style-type: none"> • Presentation of the European projects developed at BRGM, • Presentation of the French National projects developed at BRGM. INTRODUCTION TO THE COURSE <ul style="list-style-type: none"> • Description of the course items • Presentation of the 3D Reference Model | Isabelle Czernichowski |
| 14.00-17.15 | SPECIATION AND SOLUBILITY <ul style="list-style-type: none"> • Basic principles of thermodynamics • Aqueous solutions: speciation, CO₂ solubility, effect on pH • Practical exercises (PHREEQC) • PHREEQC limitations: contribution of the SCALE2000 code | Arnault Lassin Julie Lions |
| TUESDAY October 14th 2008 – full day | | |
| <i>* Synthesis by Arnault Lassin</i> | | |
| 8.45-12.30 | MINERAL REACTIVITY <ul style="list-style-type: none"> • Minerals: solubility, precipitation-dissolution • Reaction kinetics, reaction paths • Thermodynamic databases • Practical exercises (PHREEQC) | Arnault Lassin Julie Lions |
| 12.30-14.00 | <i>Lunch</i> | |
| 14.00-15.30 | MINERAL REACTIVITY (Next) | Arnault Lassin Julie Lions |
| <i>* Synthesis by Pascal Audigane</i> | | |
| 15.45-17.15 | INTRODUCTION TO SINGLE-PHASE REACTIVE TRANSPORT <ul style="list-style-type: none"> • Advection, dispersion, diffusion • Overview of some important numerical aspects • Practical exercises (PHREEQC and/or PHAST) | Christophe Kervevan |
| WEDNESDAY October 15th 2008 – full day | | |
| <i>* Synthesis by Christophe Kervevan</i> | | |
| 8.45-10.30 | INTRODUCTION TO SINGLE-PHASE REACTIVE TRANSPORT (Next) | Christophe Kervevan |

June 12th 2008

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| 10.45-12.30 | EXEMPLE OF APPLICATION TO A PRACTICAL CASE: <ul style="list-style-type: none"> • Design of a flow-through experimental set-up and interpretation of the measured data | Christophe Kervevan |
| 12.30-14.00 | <i>Lunch</i> | |
| 14.00-15.00 | EXEMPLE OF APPLICATION TO A PRACTICAL CASE: (Next) | Christophe Kervevan |
| <i>* Synthesis by Pascal Audigane</i> | | |
| 15.00-17.15 | INTRODUCTION TO MULTIPHASE REACTIVE FLOWS IN DEEP AQUIFERS <ul style="list-style-type: none"> • Multiphase reactive transport in the reservoir | Yann Le Gallo (IFP) |
| THURSDAY October 16th 2008 – full day | | |
| 8.45-12.30 | APPLICATION TO PRACTICAL CASES: COORES <ul style="list-style-type: none"> • Presentation of the COORES code • Practical exercises: multiphase flow in the depleted reservoir | Yann Le Gallo (IFP) |
| 12.30-14.00 | <i>Lunch</i> | |
| <i>* Synthesis by Pascal Audigane</i> | | |
| 14.00-17.15 | APPLICATION TO PRACTICAL CASES: TOUGHREACT <ul style="list-style-type: none"> • Presentation of the TOUGHREACT code • Practical exercises: multiphase reactive flow in the saline aquifer | Laurent André |
| FRIDAY October 17th 2008 – morning only | | |
| 8.45-10.00 | CURRENT LIMITATIONS AND RESEARCH TARGETS <ul style="list-style-type: none"> • Cement alteration, • Caprock Integrity • Near Well Zone • Pitzer Formalism • Impact of impurities <p><i>SYNTHESIS AND RECOMMANDATION FOR ASSESSING THE IMPACT OF CO₂ REACTIVITY ON STORAGE BEHAVIOUR</i></p> <ul style="list-style-type: none"> • <i>Description of a “Workflow Modeling” for building a reactive transport model</i> • <i>Questions</i> | Pascal Audigane |
| 10.15-12.30 | QUESTION AND DISCUSSION TIME: SPECIFIC CASES OF THE PARTICIPANTS CONCLUSION AND COURSE ASSESSMENT | Pascal Audigane Whole team |
| <i>End of the training course</i> | | |

Modelling chemical reactivity during CO₂ geological storage

★ New training course ★

BRGM - CO₂GeoNet* Partnership

* European Network of Excellence on CO₂ geological storage

» Aims

- Raise awareness concerning the impacts of geochemical processes on CO₂ storage behaviour from the short-term through to 10,000 years
- Acquire basic knowledge on geochemical modelling and become familiar with certain standard modelling codes
- Learn which methodology to adopt when modelling real CO₂ storage test cases
- Grasp modelling limitations and uncertainties, as well as current R&D challenges

» Participants (limited to 12)

Engineers, researchers.

» Training code

CO₂02-08

» Required knowledge

Good understanding of chemistry, geochemistry, and thermodynamics.
Some experience in numerical modelling.
A good level of English.

» Length

4 days

» Teaching aids

Technical presentations, backed up by examples and case study documents.
Computer-based modelling exercises.
Training manuals will be distributed to participants.

» Dates

13 (p.m.) - 17 (a.m.)
October 2008

» Language

French or English (depending on the group)

» Location

BRGM Orléans

» Cost

1550€ excl. tax
Lunch included

Programme

Introduction

- Conceptual system of CO₂ storage
- Basic physical-chemical processes
- Potential impact, whether positive or negative, of CO₂ reactivity on storage behaviour in the short and long term

General principles of the physical-chemistry of aqueous solutions and solid-fluid interactions

- Basic principles of thermodynamics
- Aqueous solutions: speciation, CO₂ solubility, effect on pH
- Minerals: solubility, precipitation-dissolution, surface complexation, ion exchange, adsorption-desorption
- Reaction kinetics, reaction paths

Numerical modelling of CO₂-water-mineral interactions

- Approaches for closed and open systems
- Geochemical modelling: the main computing codes used and their specific features, thermodynamic databases
- Coupled chemistry-transport modelling: the main computing codes used and their specific features
- Current limitations and research targets

Application to practical cases

- CO₂ injectivity in carbonate reservoirs
- Quantification of geochemical trapping in the reservoir in the short and long term
- Reactivity of an argillaceous caprock in the long term
- Reactivity of well cement in the long term

Best practice guidelines for assessing the impact of CO₂ reactivity on storage behaviour

- Initial detailed site characterization
- Evaluation using an iterative combined approach between modelling and observations (laboratory or field)

Questions, discussion, conclusion, course assessment

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Registration

BRGM Orléans
3 avenue Claude Guillemin
BP 36009
45060 Orléans cedex 2
Tel: +33(0)2 38 64 37 91 – Fax: +33(0)2 38 64 47 00

Cost: 1550€ excl. tax (lunch included)

Dates: 13 (p.m.)-17 (a.m.) October 2008

| Institution/Company details | | |
|---|------------------|----------|
| Corporate name: | Registration no: | |
| Address: | | |
| Postcode: | City: | |
| Country: | | |
| Tel.: | Fax: | |
| Person in charge of training: email: | | |
| Billing address: | | |
| Postcode: | City: | |
| Country: | | |
| Participant(s) details | | |
| Ms – Mr | First name: | Surname: |
| Position: | Tel.: | email: |
| Ms – Mr | First name: | Surname: |
| Position: | Tel.: | email: |

Signature

Date

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| | | |
|-----------------------|-------|-----------|
| Ms - Mr. First name : | | Surname : |
| Position: | Tel.: | email: |
| Institution/Company : | | |
| Address: | | |
| Postcode: | City: | Country: |

Expectations of this course

Background knowledge

Level of Chemistry / Geochemistry / Thermodynamics

Experience in numerical modelling / Applications / Numerical tools

Level of English / French

Please send this additional information to BRGM Formation.
It will help us in planning and preparing the course.