Injection of CO₂-equilibrated brine into a vuggy limestone from Hontomin. Chemical, mechanical and hydrodynamic characterization.

María García a, Jacobo Canal b, Jordi Delgado b, Jordi Camac c and Josep M. Soler c

a Fundación Ciudad de la Energía, II Avenida de Compostilla 2, Ponferrada 24400.
ETSI Ingenieros de Caminos, Canales y Puertos. Campus de Elviña s/n. Universidade da Coruña, Coruña 15192.
c Departament de Geociències, Institut de Diagnosi Ambiental i Estudis de l’Aigua (IDAEA), CSIC, Barcelona 08034.

INTRODUCTION
The main reservoir rock at the Hontomin test site is a vuggy limestone made up of calcite (~97%) and dolomite (~1%). An experimental methodology has been developed to characterize the chemical, mechanical and hydrodynamic behavior upon injection of CO₂-equilibrated brine.

The core plugs (samples B1.11 & B1.2) used in the test belong to the Puerto de la Palombera Formation. The rock is highly heterogeneous and shows secondary porosity (Fig. 2a, b).

EXPERIMENTAL METHODOLOGY

Pre-injection

Core Samples

Fig 2. Core preparation: drilling, cutting and wrapping.

Input Solution

| Synthetic version of the Hontomin brine |
| Na | Mg | Ca | CO₃²⁻ | SO₄²⁻ | K |
| mol/L | mol/L | mol/L | mol/L | mol/L | mol/L |
| 0.384 | 0.032 | 0.042 | 0.494 | 0.019 | 0.011 |

Experimental Conditions

| Ppore (in) = 4 Mpa |
| Pconfining = 10 Mpa |
| Ppore (out) = 3.5 Mpa |
| T = 40 °C |

Experimental setup

Control parameters
T, P, pH, Electrical Conductivity, P-S Wave Velocity & Deformation

INFLUENCES

Injection

1. N₂ injection to measure gas permeability.
2. H₂O injection to saturate the core sample.
3. Injection of synthetic brine.
4. Injection of synthetic brine equilibrated with CO₂.

EXPERIMENTAL RESULTS

Fig 4. Variation of (a) pH versus time; (b) Electrical Conductivity versus time.

Fig 5. Variation of (a) permeability and flow versus time; (b) P-S wave velocities versus time.

SUMMARY
A successful experimental methodology has been developed to characterize the chemical, mechanical and hydrodynamic processes affecting the reservoir rock at Hontomin during injection of CO₂.

Preliminary tests under subcritical CO₂ conditions (40 bar, 40 °C) show that injection of CO₂-brine causes (1) an increase in permeability (from 4.0x10⁻¹⁷ to 2.7x10⁻¹⁵ m²), (2) an increase in electrical conductivity and (3) changes in S wave velocities. These results suggest formation of preferential flow channels as a consequence of calcite dissolution.

Future experiments under supercritical CO₂ conditions coupled with X-Ray microtomography will be performed to confirm these results.

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