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II Coloquio Hispano-Francés sobre Almacenamiento Geológico de CO_2

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26 : Monográfico Hontomín

Injection of CO_2-equilibrated brine into a vuggy limestone from Hontomín. Chemical, mechanical and hydrodynamic characterization.

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INTRODUCTION

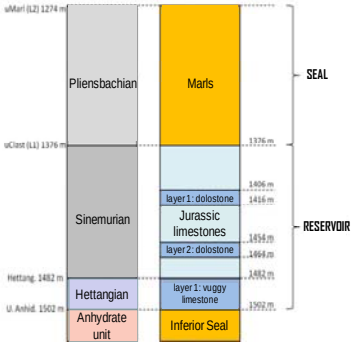

Fig 1. *Simplified stratigraphic column from Hontomin.*

The main reservoir rock at the Hontomín 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 CO_2-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).

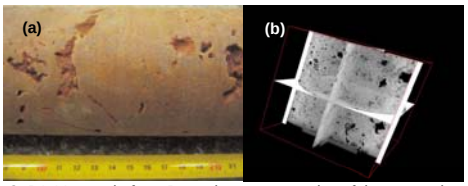

Fig 2. *B1.11 sample from Bercedo, representative of the reservoir rock at Hontomin (vuggy limestone). Images show (a) photograph of the core (4-12 % porosity) and (b) X-Ray microtomography of the sample.*

EXPERIMENTAL METHODOLOGY

Pre-Injection

Core Samples

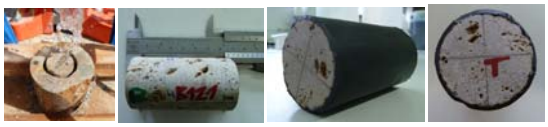

Fig 3. *Core preparation: drilling, cutting and wrapping.*

Input Solution

Synthetic version of the Hontomín brine

Na	Mg	Ca	Cl^-	SO_4^{2-}	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

P_{axial} = 10 Mpa
$P_{confining}$ = 10 MPa
P_{pore} (in) = 4 Mpa
P_{pore} (out) = 3.5 MPa
T = 40 °C

Experimental setup

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

Injection

1. N_2 injection to measure gas permeability.
2. H_2O injection to saturate the core sample.
3. Injection of synthetic brine.
4. Injection of synthetic brine equilibrated with CO_2.

EXPERIMENTAL RESULTS

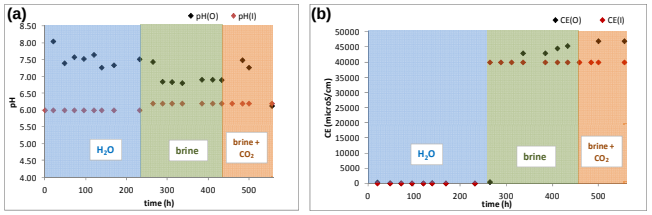

Fig 4. *Variation of (a) pH versus time; (b) Electrical Conductivity versus time.*

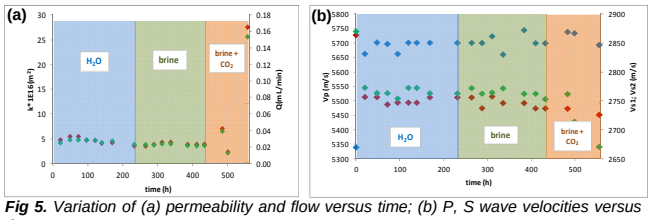

Fig 5. *Variation of (a) permeability and flow versus time; (b) P, S wave velocities versus time.*

SUMMARY

A successful experimental methodology has been developed to characterize the chemical, mechanical and hydrodynamic processes affecting the reservoir rock at Hontomín during injection of CO_2.

Preliminary tests under subcritical CO_2 conditions (40 bar, 40 °C) show that injection of CO_2-brine causes (1) an increase in permeability (from $4.0x10^{-16}$ to $2.7x10^{-15}$ m^2), (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 CO_2 conditions coupled with X-Ray microtomogaphy will be performed to confirm these results.

ACKNOWLEDGMENTS

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