



中国科学院武汉岩土力学研究所

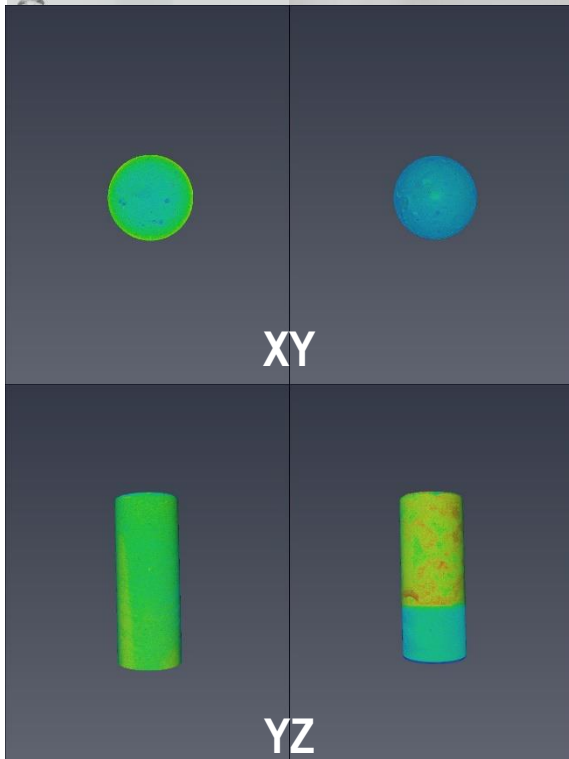
Institute of Rock and Soil Mechanics

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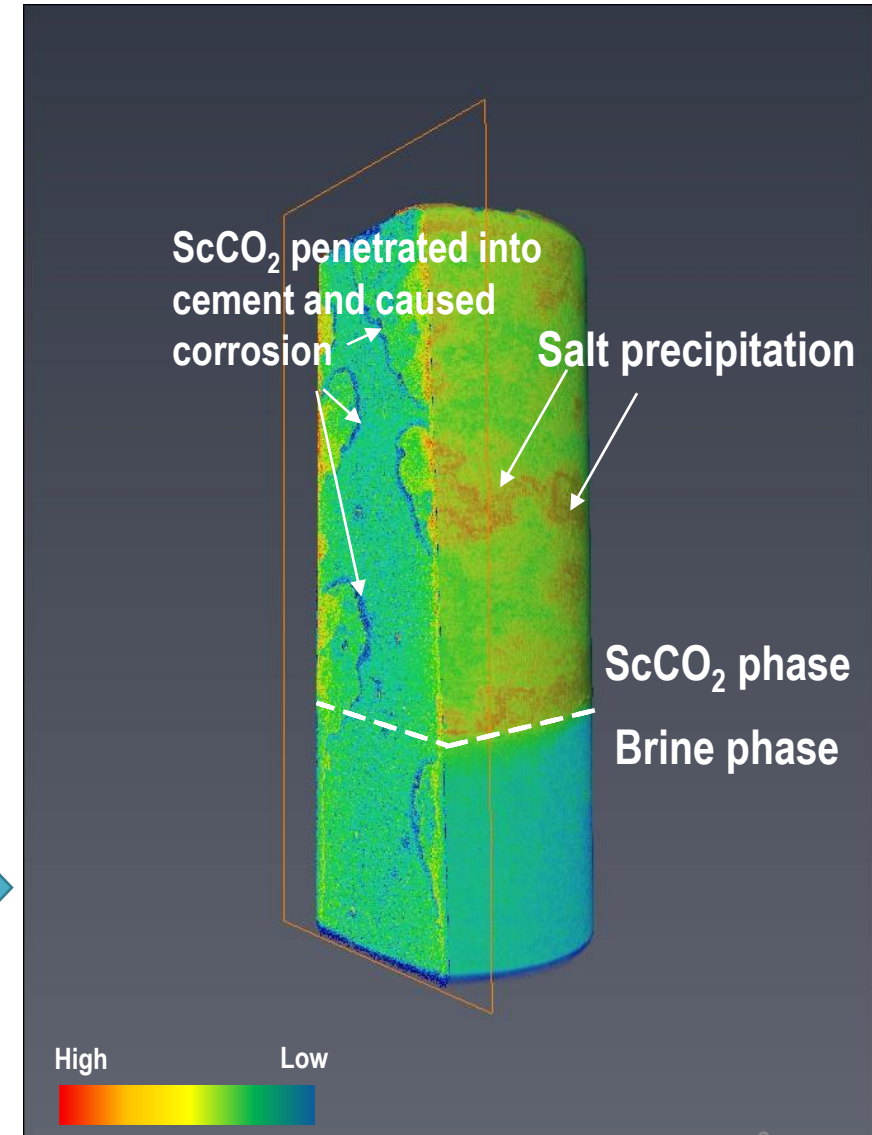
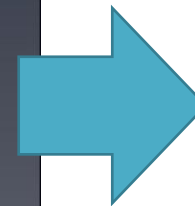
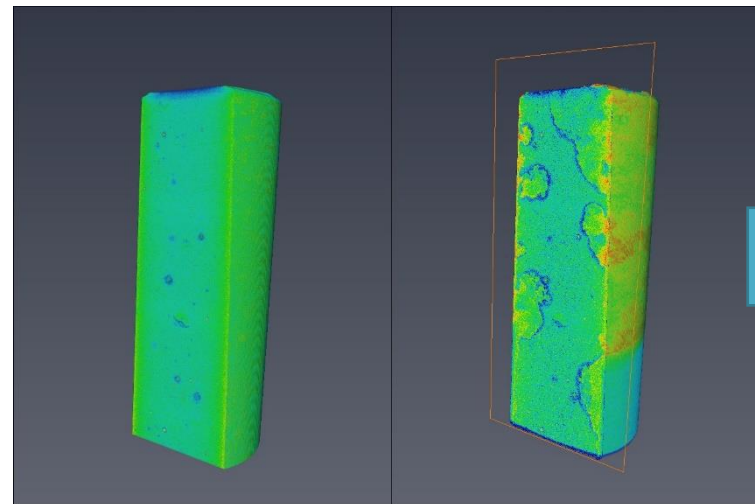
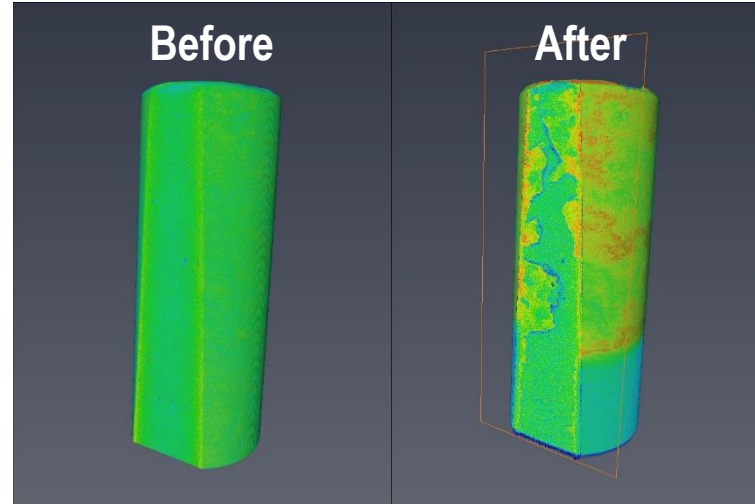
# A brief introduction — Salt deposition on cement — supercritical CO<sub>2</sub> interface

**Presenter: Kaiyuan Mei**

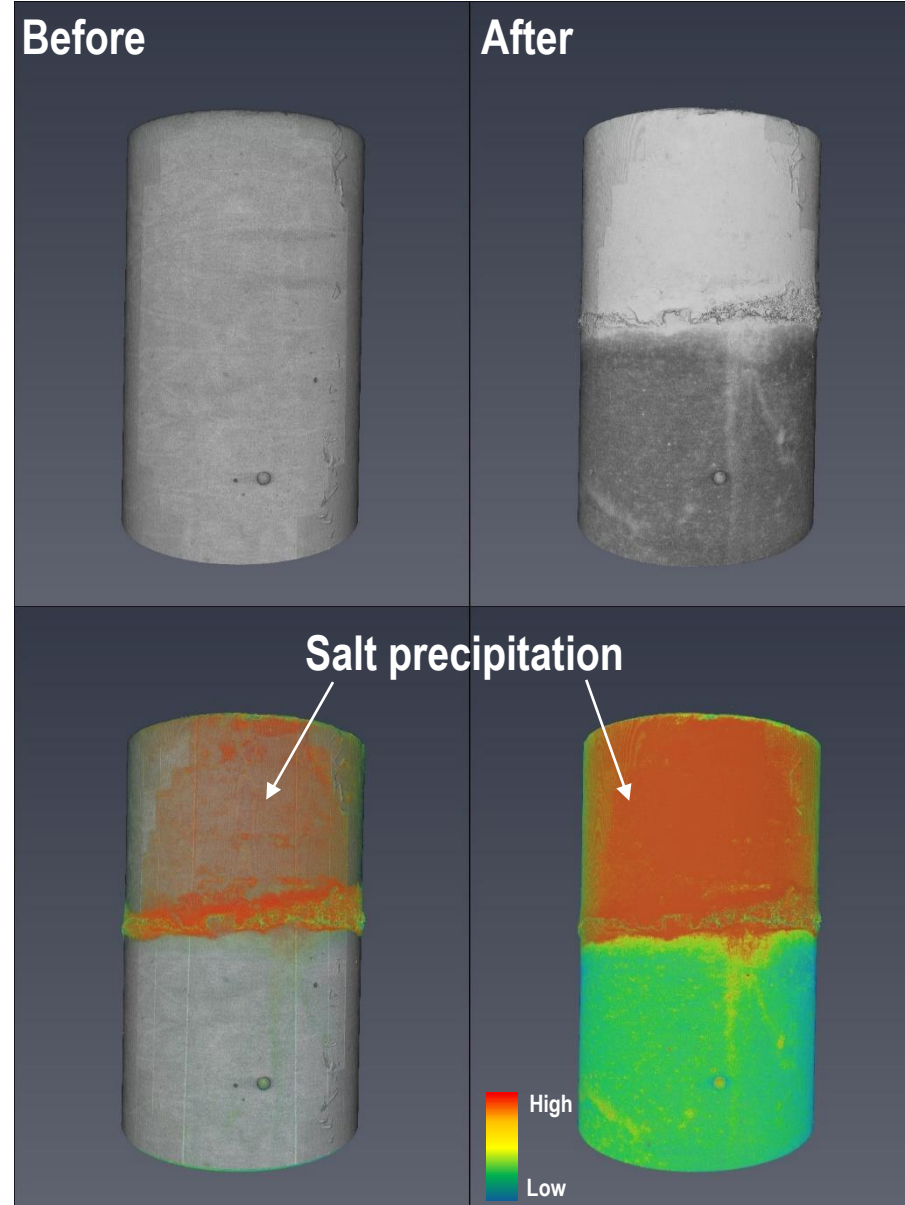
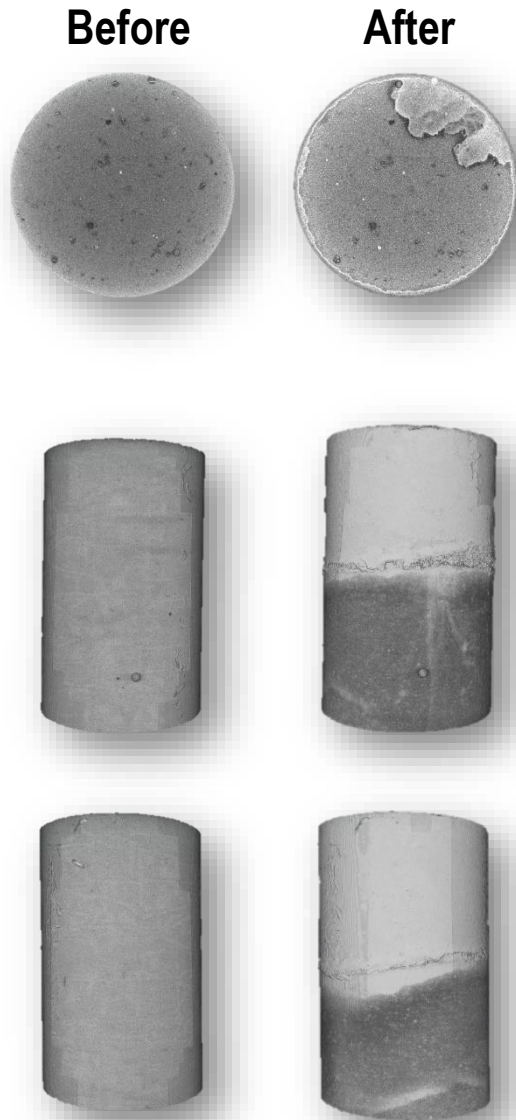
# Preliminary CT results



## Stochastic slices



# Preliminary CT results



The same salt precipitation phenomena was found on the other sample.

This sample was added with some Ca-montmorillonite.

# Mechanism of salt deposition and corrosion



## Experiment parameters:

**Sample:** G class oilwell

cement with  $w/c=0.44$ ;

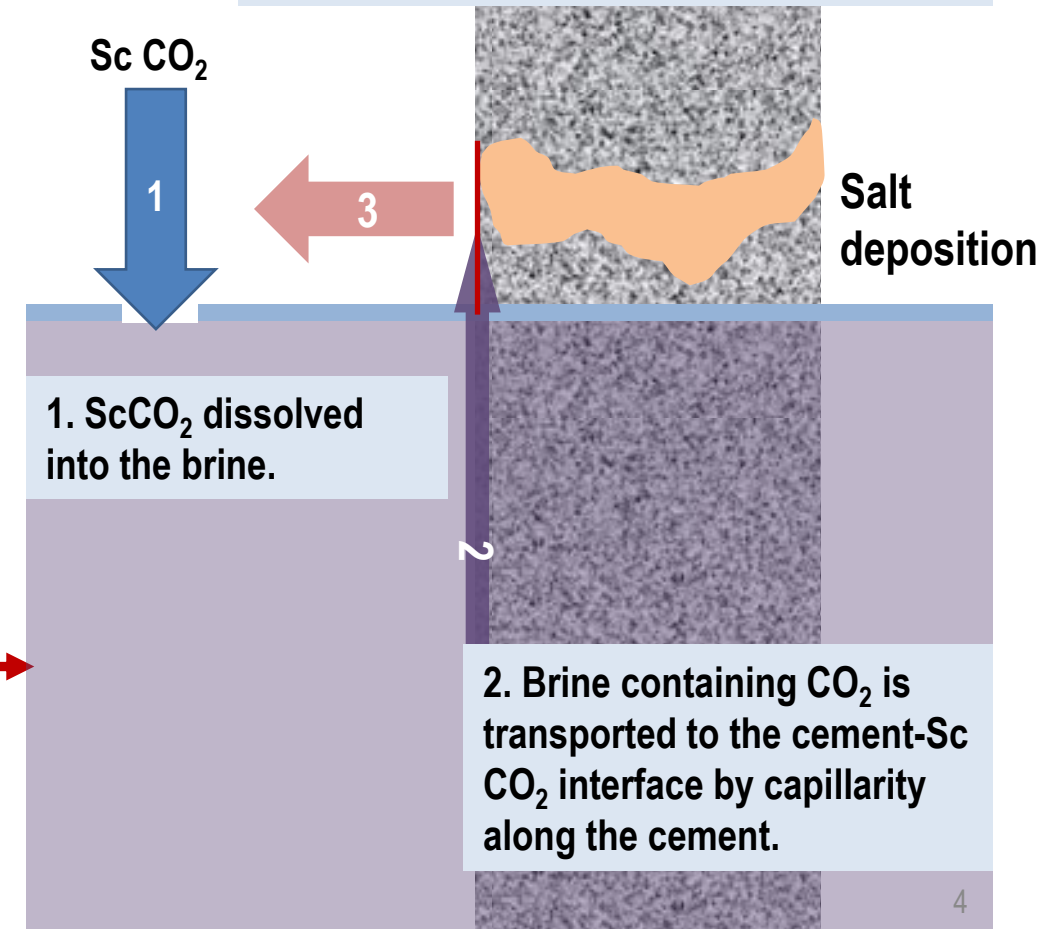
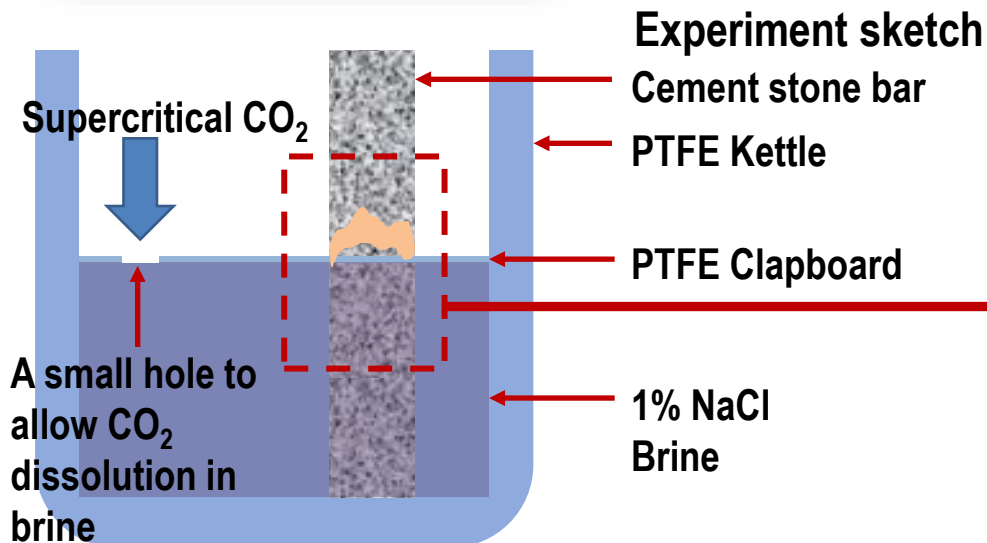
**Temperature:** 62 °C;

**Pressure:** 17 MPa  $\text{CO}_2$ ;

**Time:** 14 days;

Salt deposition and  
severe corrosion

3. With water evaporation into  $\text{ScCO}_2$  phase, salt deposited on cement surface. During water evaporation, dissolved  $\text{CO}_2$  concentration in residual water becomes high and causes severe corrosion.



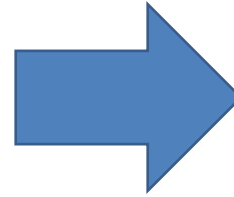
## Four comparing groups:

G1 -- Brine dissolved with  $\text{ScCO}_2$  **Aging for 28d**

**G2** -- Brine isolated from  $\text{ScCO}_2$

**G3** -- UP water dissolved with  $\text{ScCO}_2$

**G4** -- Sanding the cement surface (P400)



## Four key factors:

G1 -- Aging time

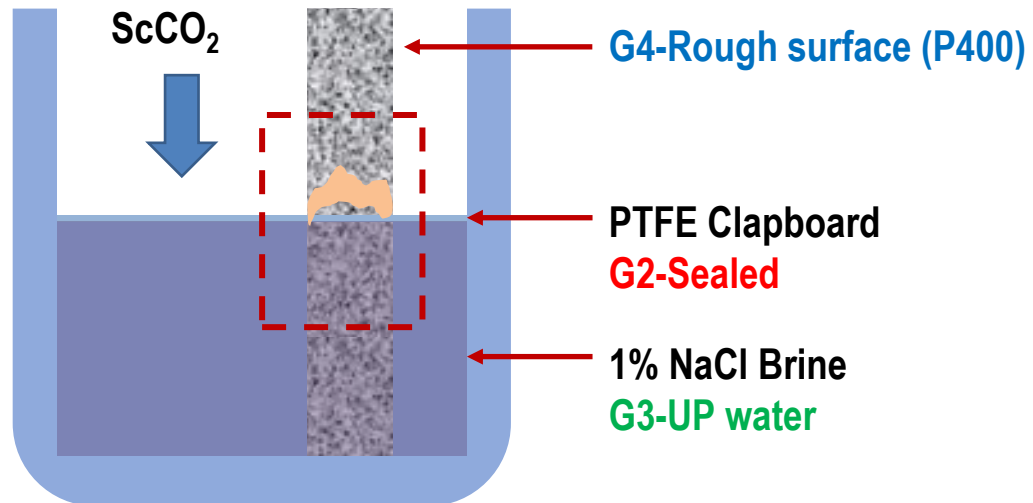
**G2** -- Dissolved  $\text{CO}_2$  concentration

**G3** -- Salt concentration

**G4** -- Roughness



**Sealed by heat-shrinking tube to allow water permeation**

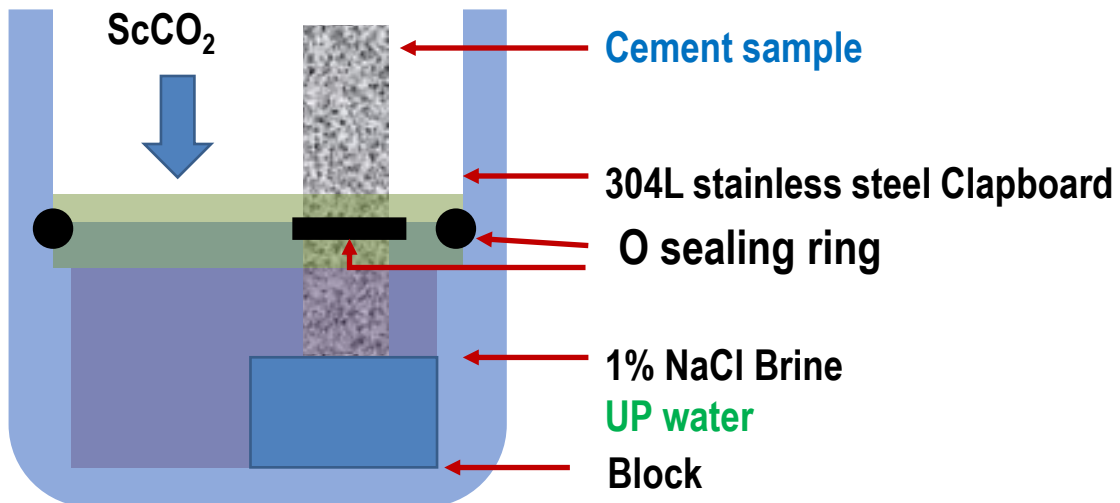






## Redesigned kettle:

- 1) Isolating the  $\text{ScCO}_2$  dissolving into the water below clapboard.
- 2) Isolating the water or brine vaporing into the  $\text{ScCO}_2$ .
- 3) This kettle will provide a pressure imbalance condition when simulating the sealing conditions.



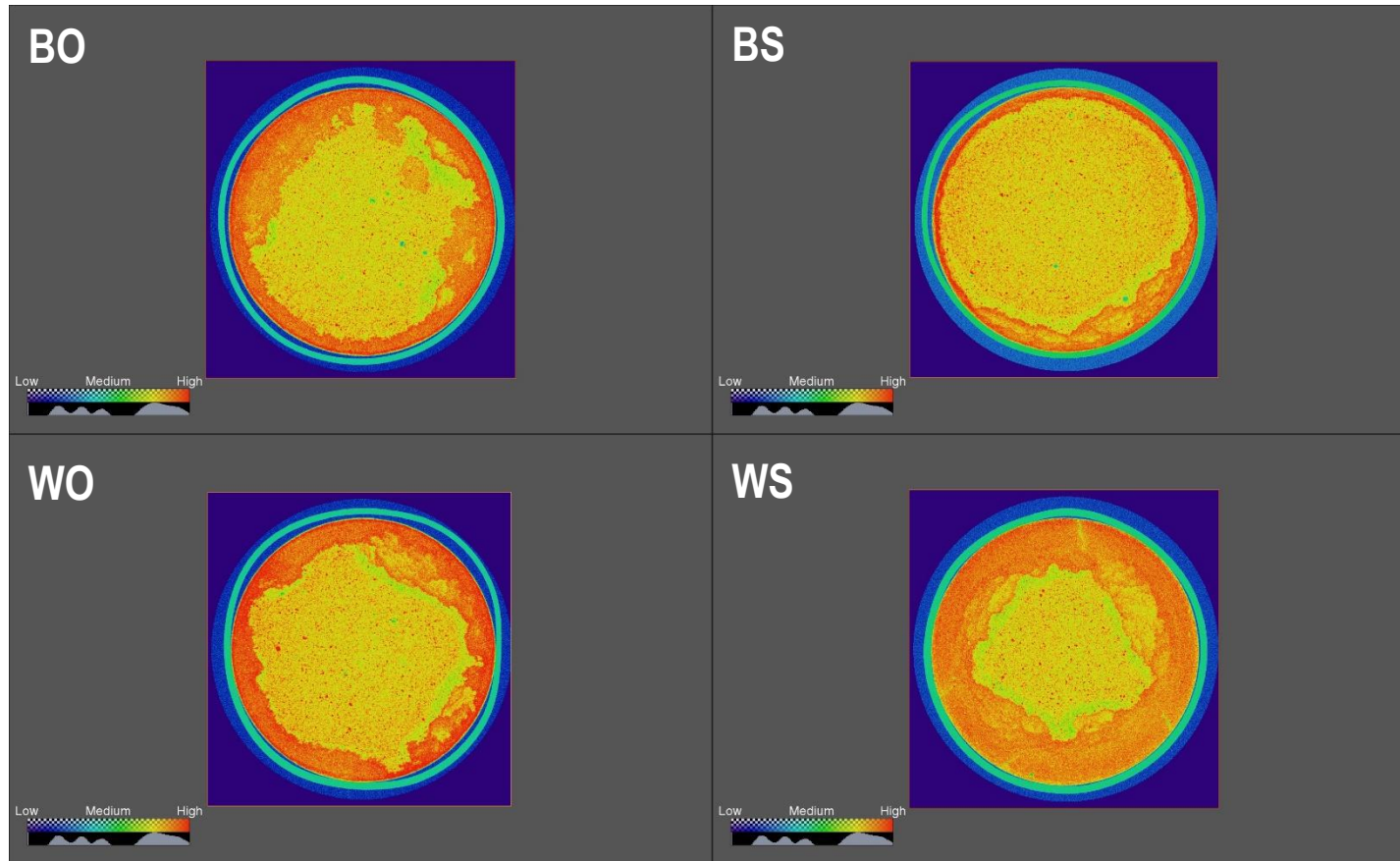
## Four comparing groups:

BO -- Brine dissolved with  $\text{ScCO}_2$

BS -- Brine isolated from  $\text{ScCO}_2$

WO -- UP water dissolved with  $\text{ScCO}_2$

WS -- UP water isolated from  $\text{ScCO}_2$



**Experiment parameters:**

**Sample:** G class oilwell

cement with  $w/c=0.44$ ;

**Temperature:** 62 °C;

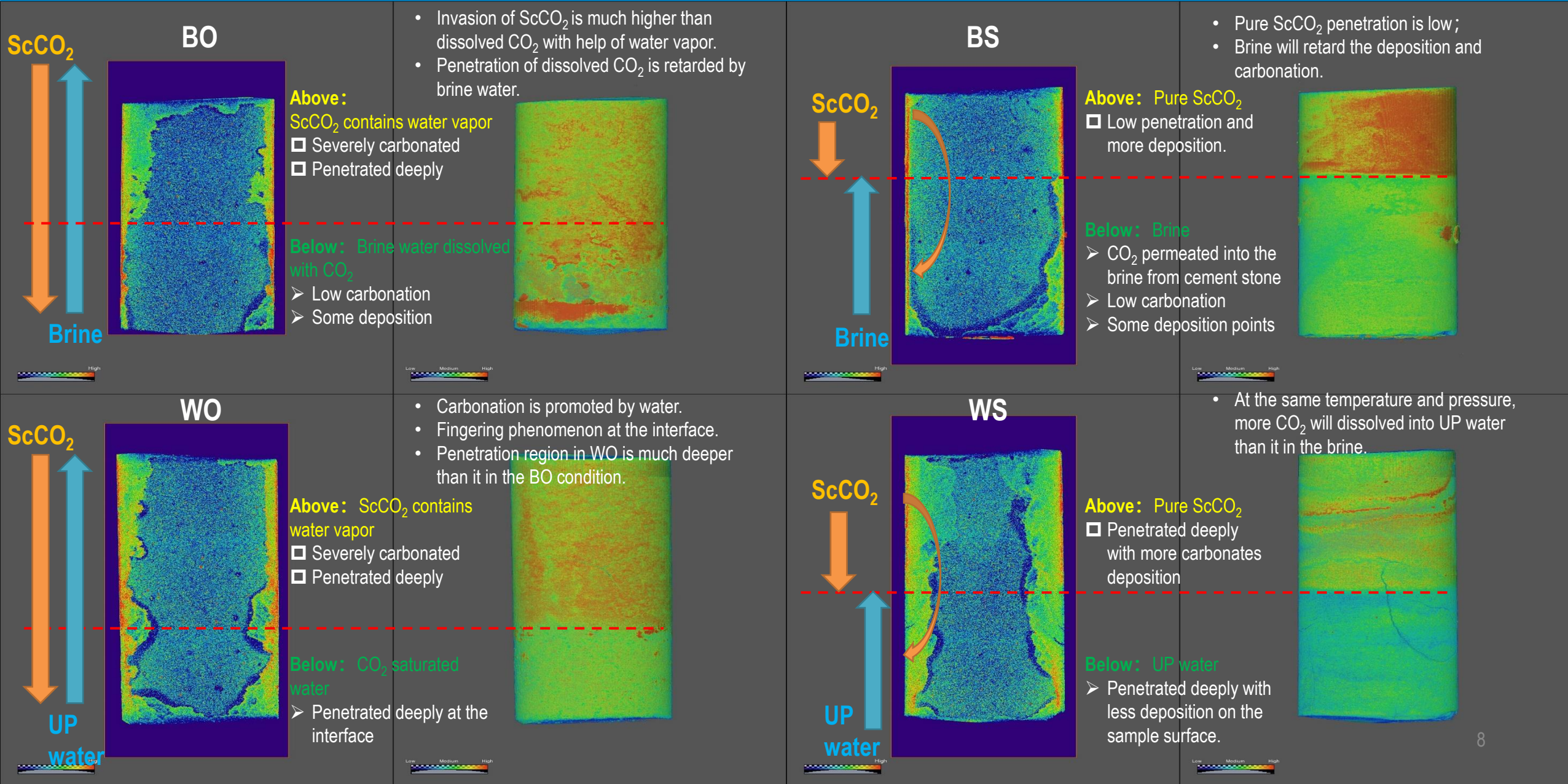
**Pressure:** 17 MPa CO<sub>2</sub>;

**Time:** 14 days;

**Overview slice from four samples**



# Longitudinal slice from experimental samples







### Some points need further discussion:

- How to clarify the salt deposition and its effects in the penetration of  $\text{ScCO}_2$  or dissolved  $\text{CO}_2$ .
- Deposition on the surface should be carbonates, salts or mixture of two in the different conditions.
- The interface region between  $\text{ScCO}_2$  and brine/ UP water should involve the contact angle and the wetting properties of two phases.
- At the imbalance condition, how to figure out the capillarity effects of cement stone.



**Thank you for your attention !**

