



中国科学院武汉岩土力学研究所

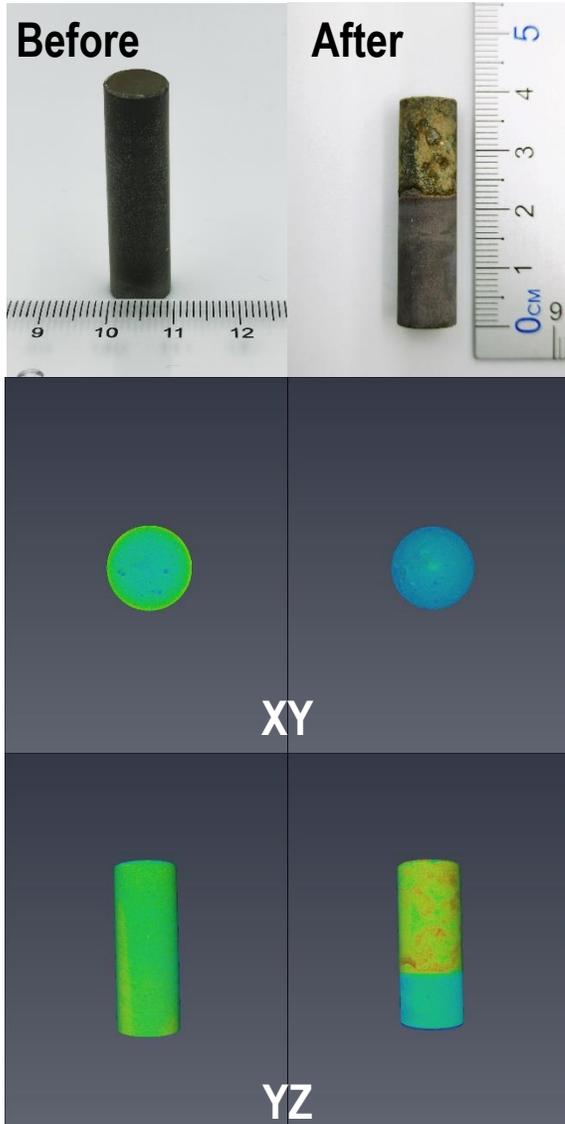
Institute of Rock and Soil Mechanics

Chinese Academy of Sciences

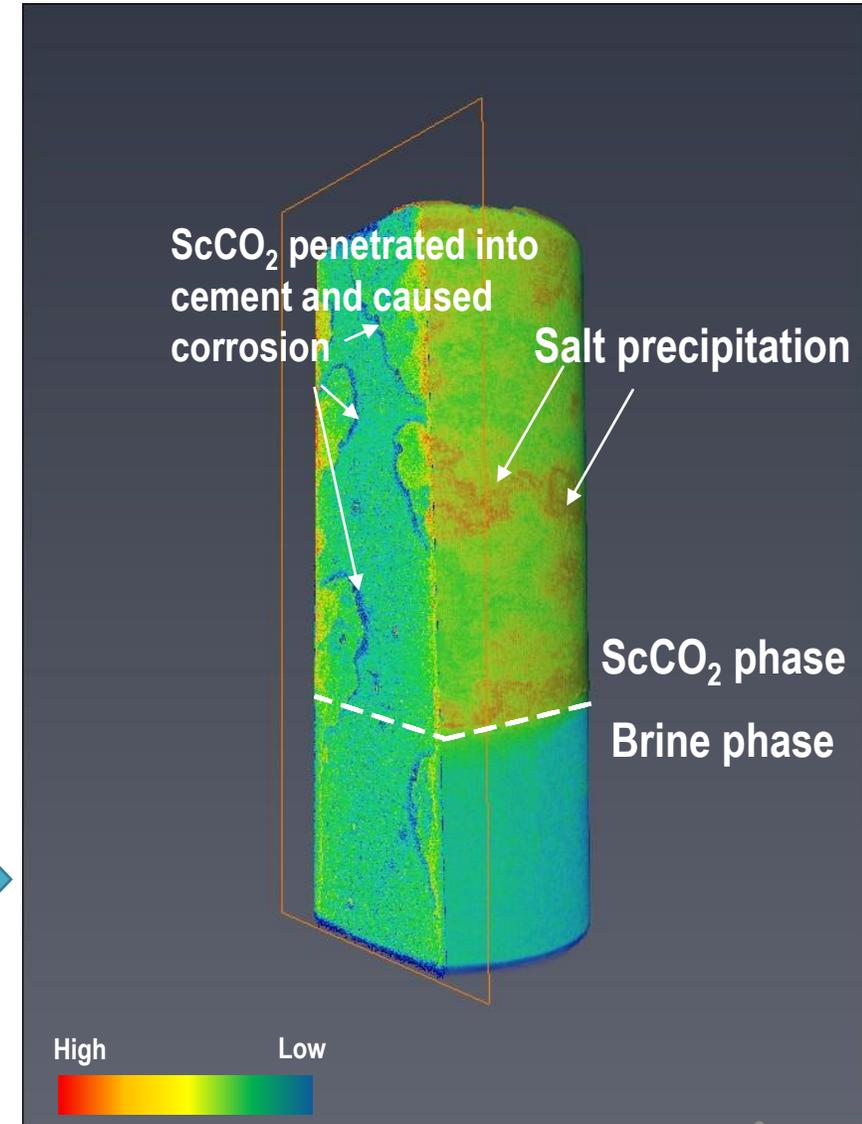
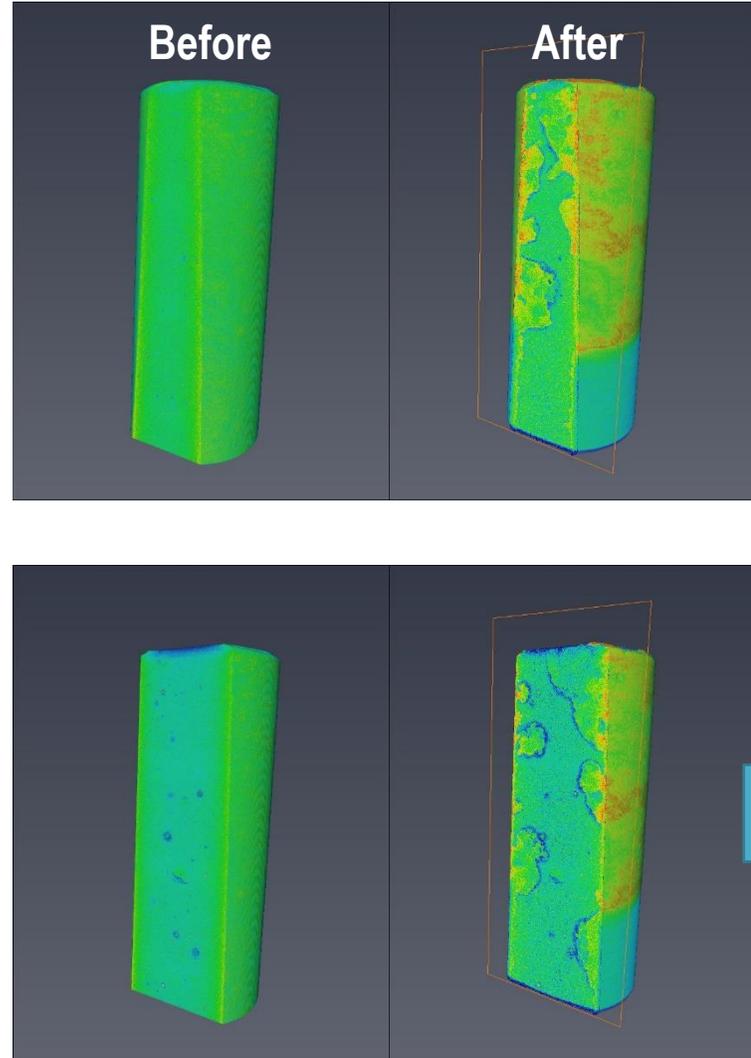
# A brief introduction — Salt deposition on cement — supercritical CO<sub>2</sub> interface

**Presenter: Kaiyuan Mei**

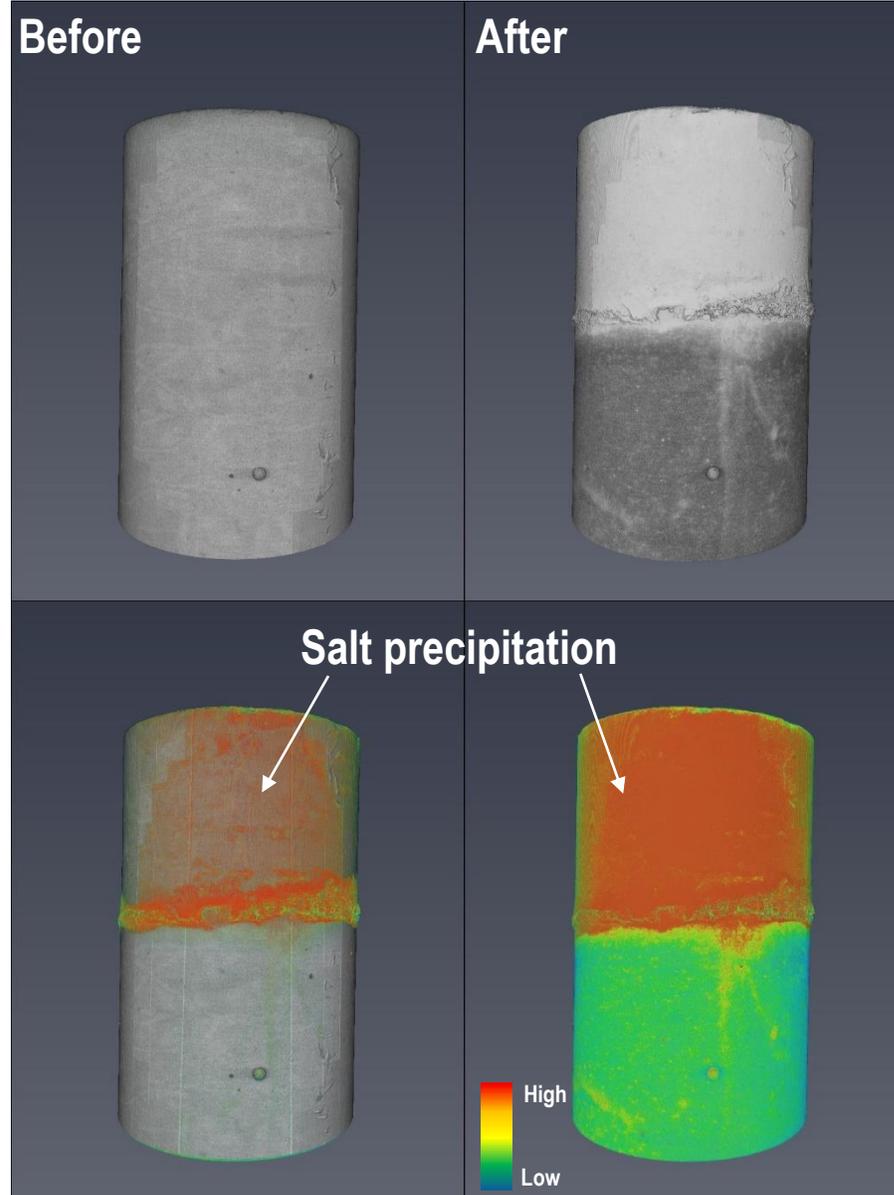
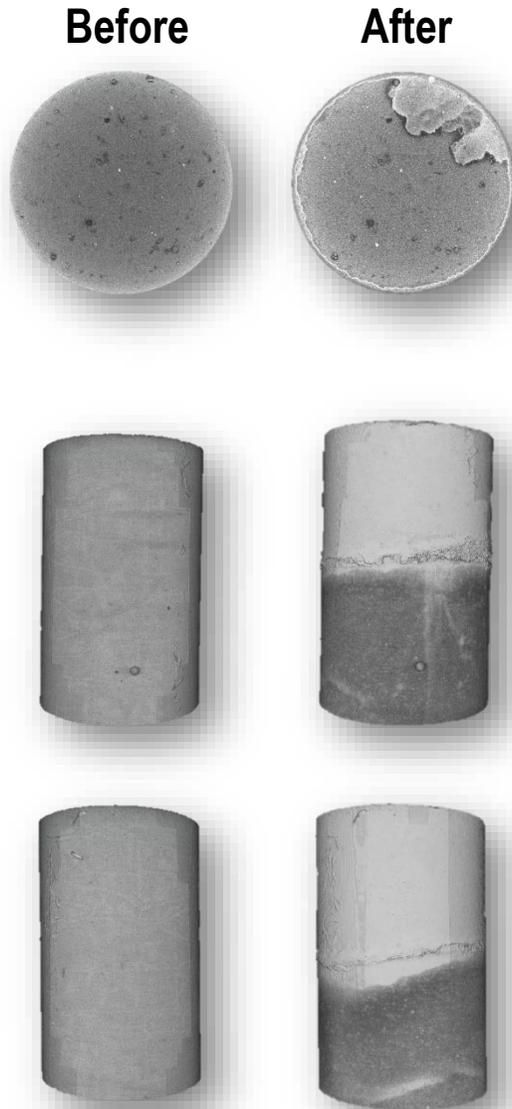
# Preliminary CT results



## 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



Salt deposition and severe corrosion

## Experiment parameters:

Sample: G class oilwell

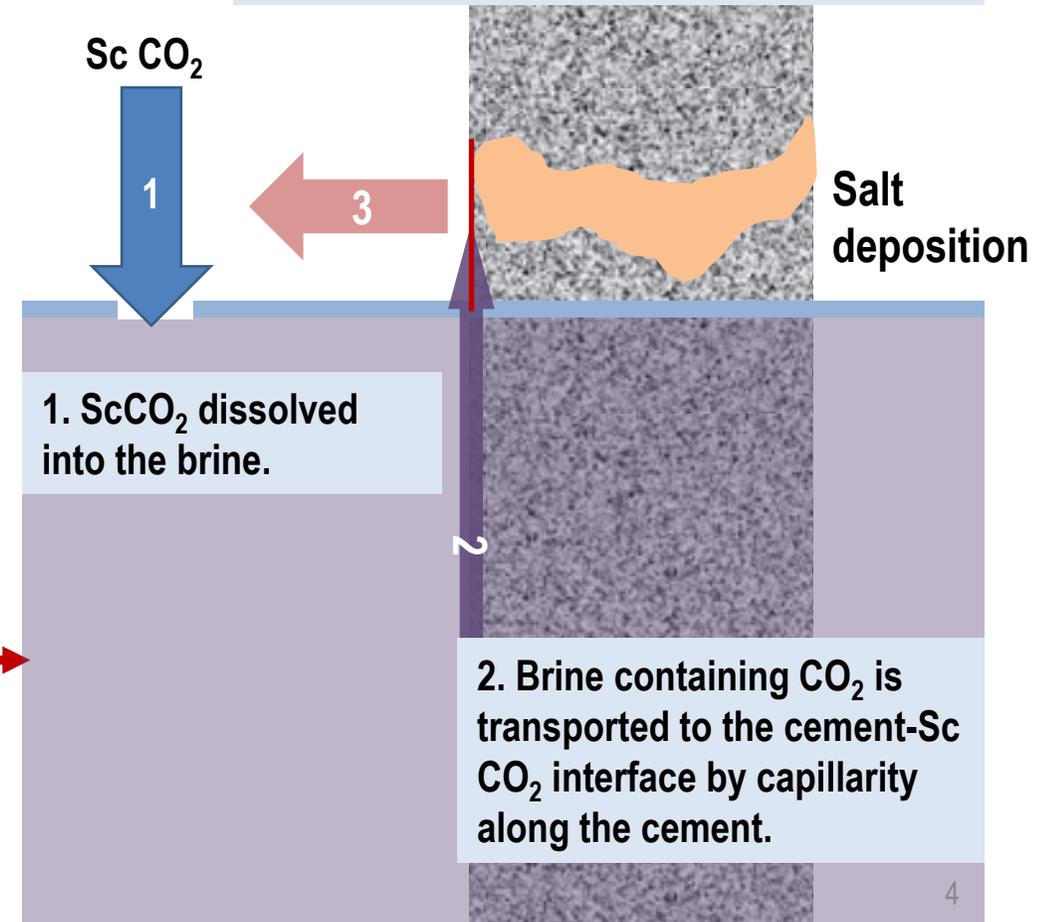
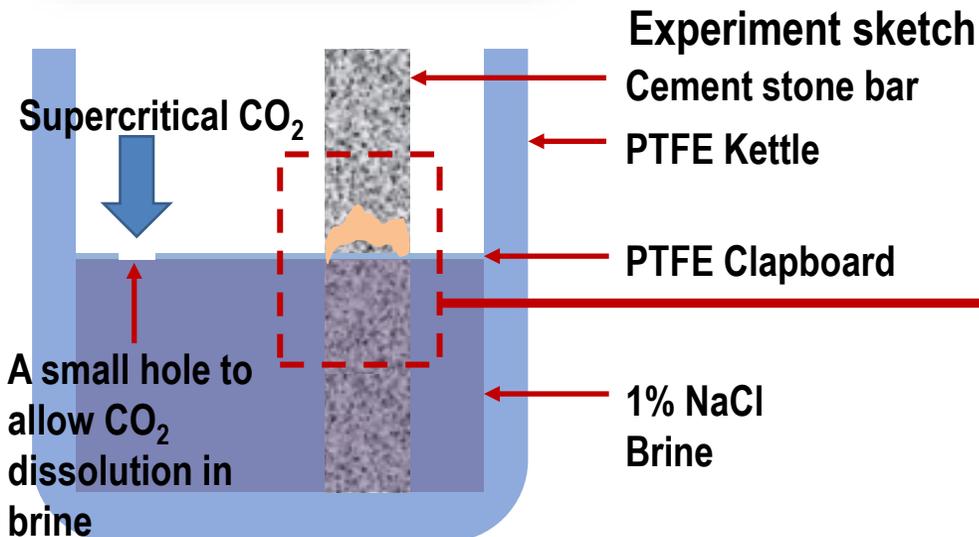
cement with  $w/c=0.44$ ;

Temperature:  $62\text{ }^{\circ}\text{C}$ ;

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

Time: 14 days;

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.



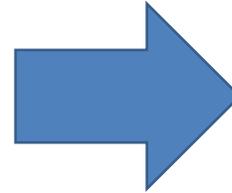
## Four comparing groups:

G1 -- Brine dissolved with ScCO<sub>2</sub> **Aging for 28d**

**G2** -- Brine isolated from ScCO<sub>2</sub>

**G3** -- UP water dissolved with ScCO<sub>2</sub>

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



## Four key factors:

G1 -- Aging time

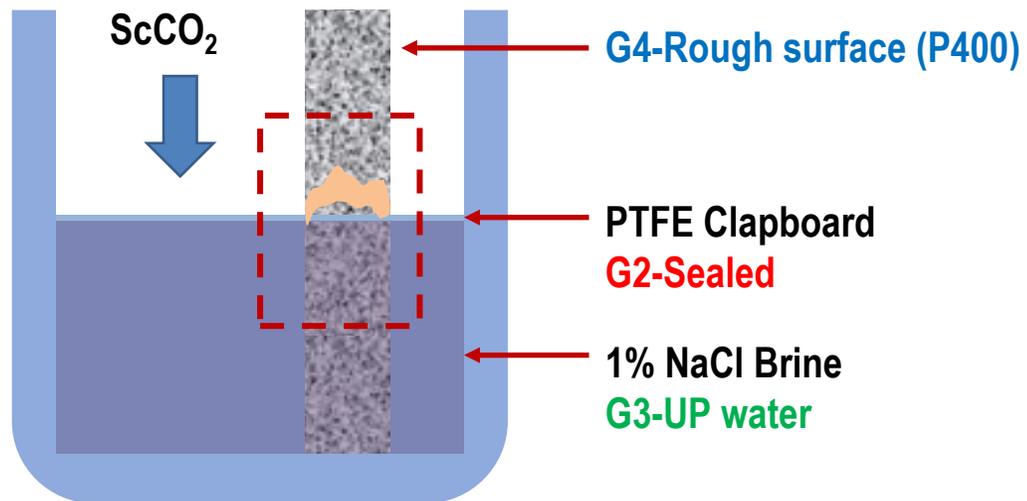
**G2** -- Dissolved CO<sub>2</sub> concentration

**G3** -- Salt concentration

**G4** -- Roughness



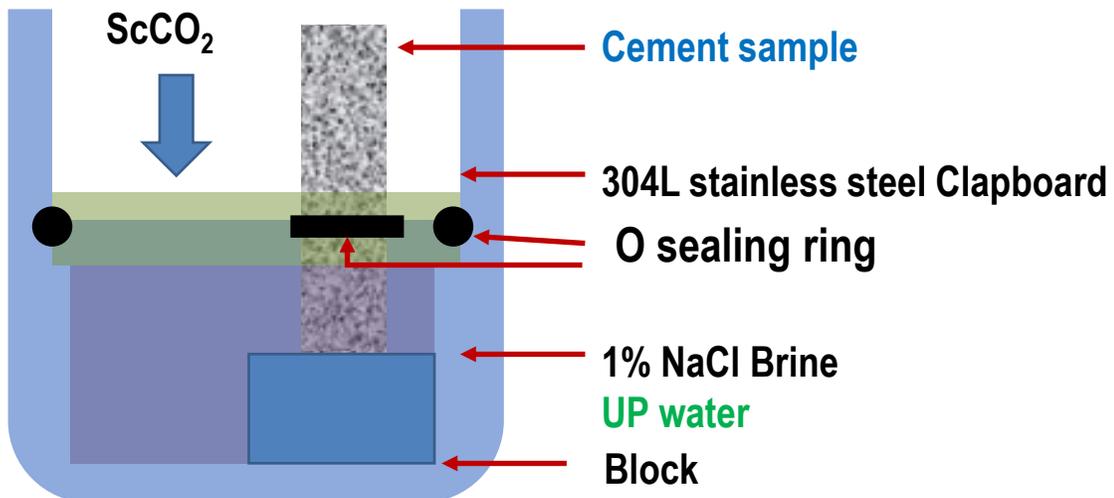
**Sealed by heat-shrinking tube to allow water permeation**





## Redesigned kettle:

- 1) Isolating the  $\text{ScCO}_2$  dissolving into the water below claspboard.
- 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.



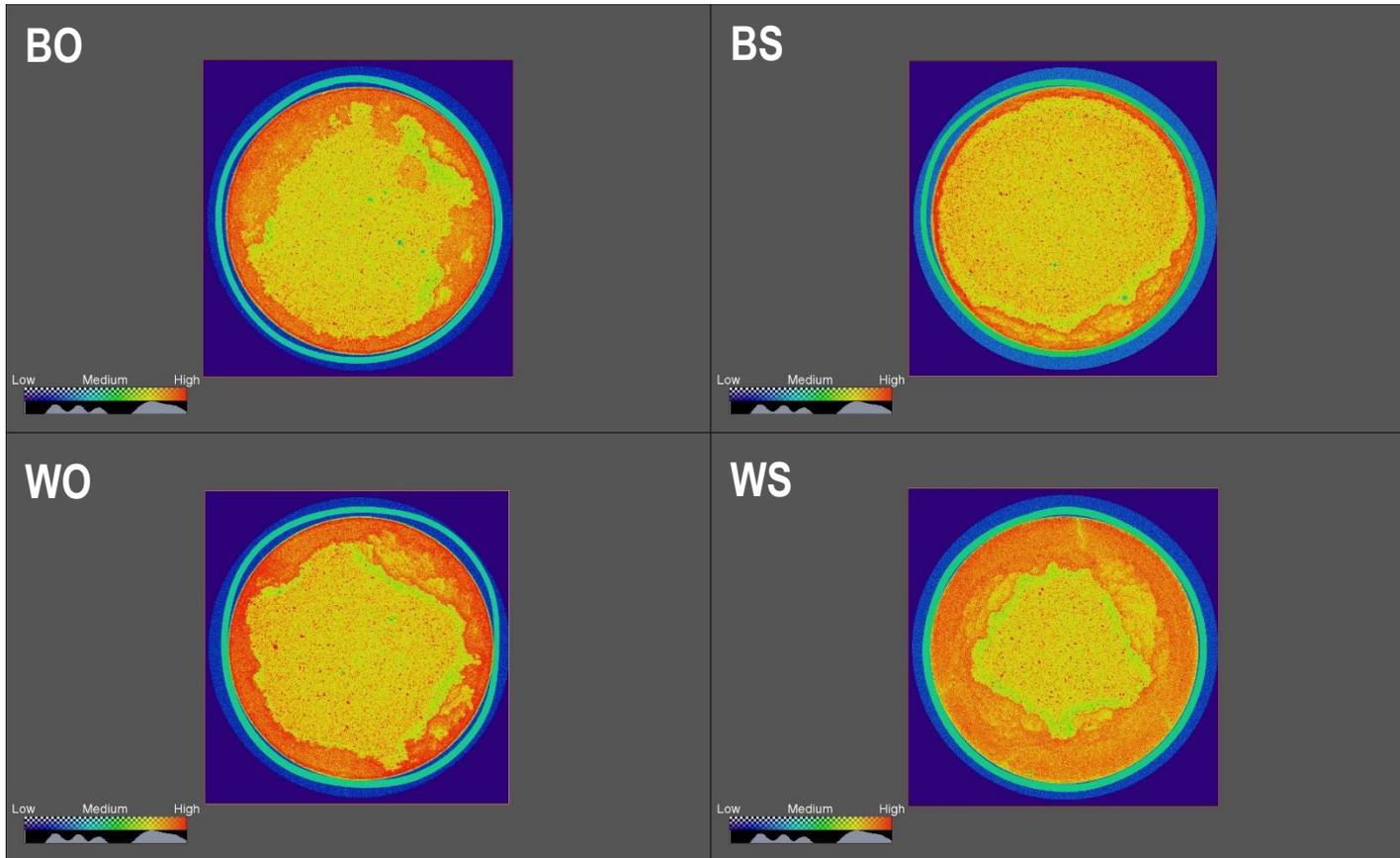
## Four comparing groups:

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  $w/c=0.44$ ;

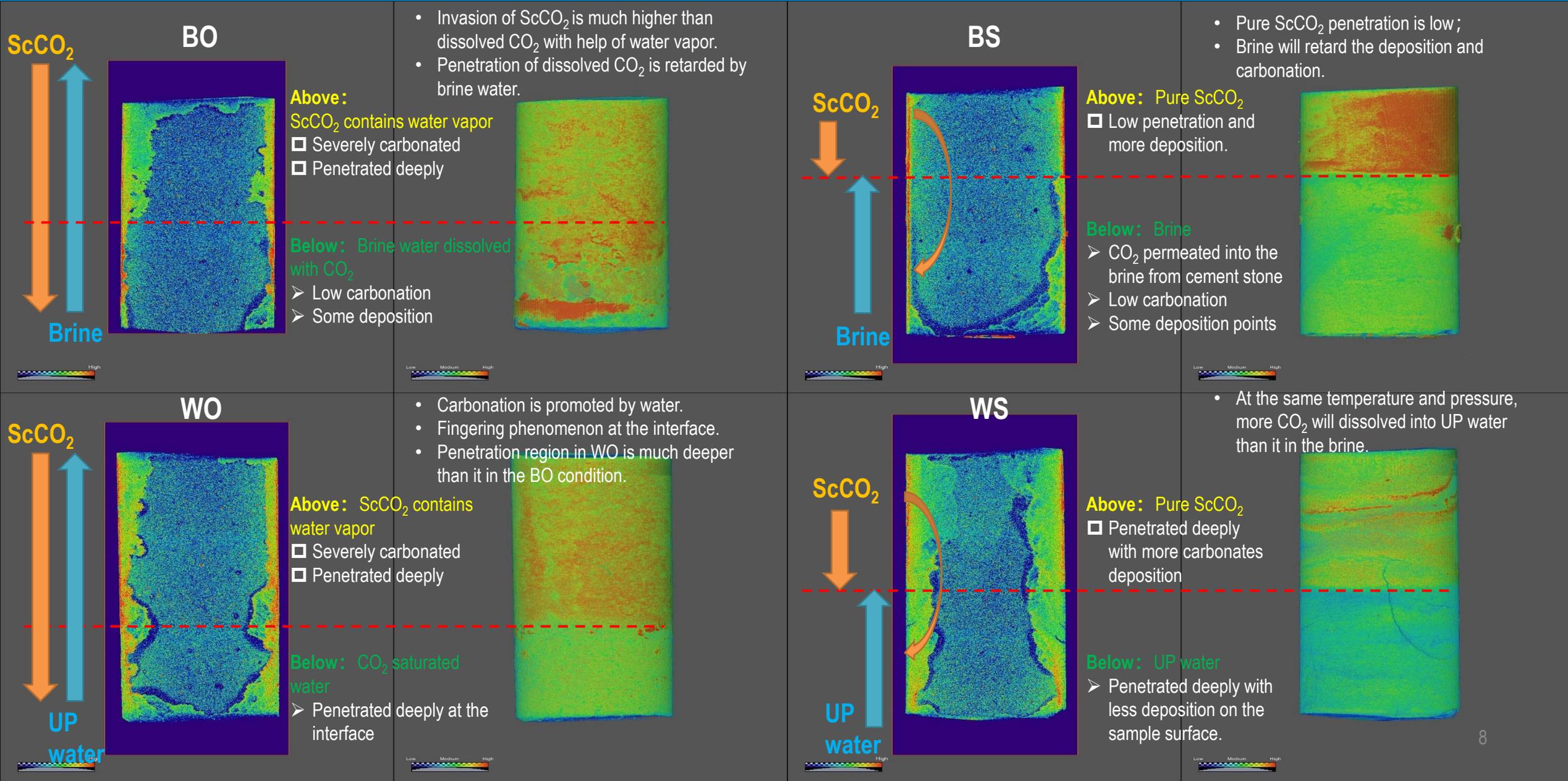
**Temperature:** 62 °C;

**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 ScCO<sub>2</sub> or dissolved CO<sub>2</sub>.
- Deposition on the surface should be carbonates, salts or mixture of two in the different conditions.
- The interface region between ScCO<sub>2</sub> 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 !**

