

Chemistry breaks rocks and self-accelerate fluid flow in the lithosphere

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○ Hydrothermal flow-through experiments to simulate hydration&carbonation

○ Permeability evolution during the hydration experiments



periclase

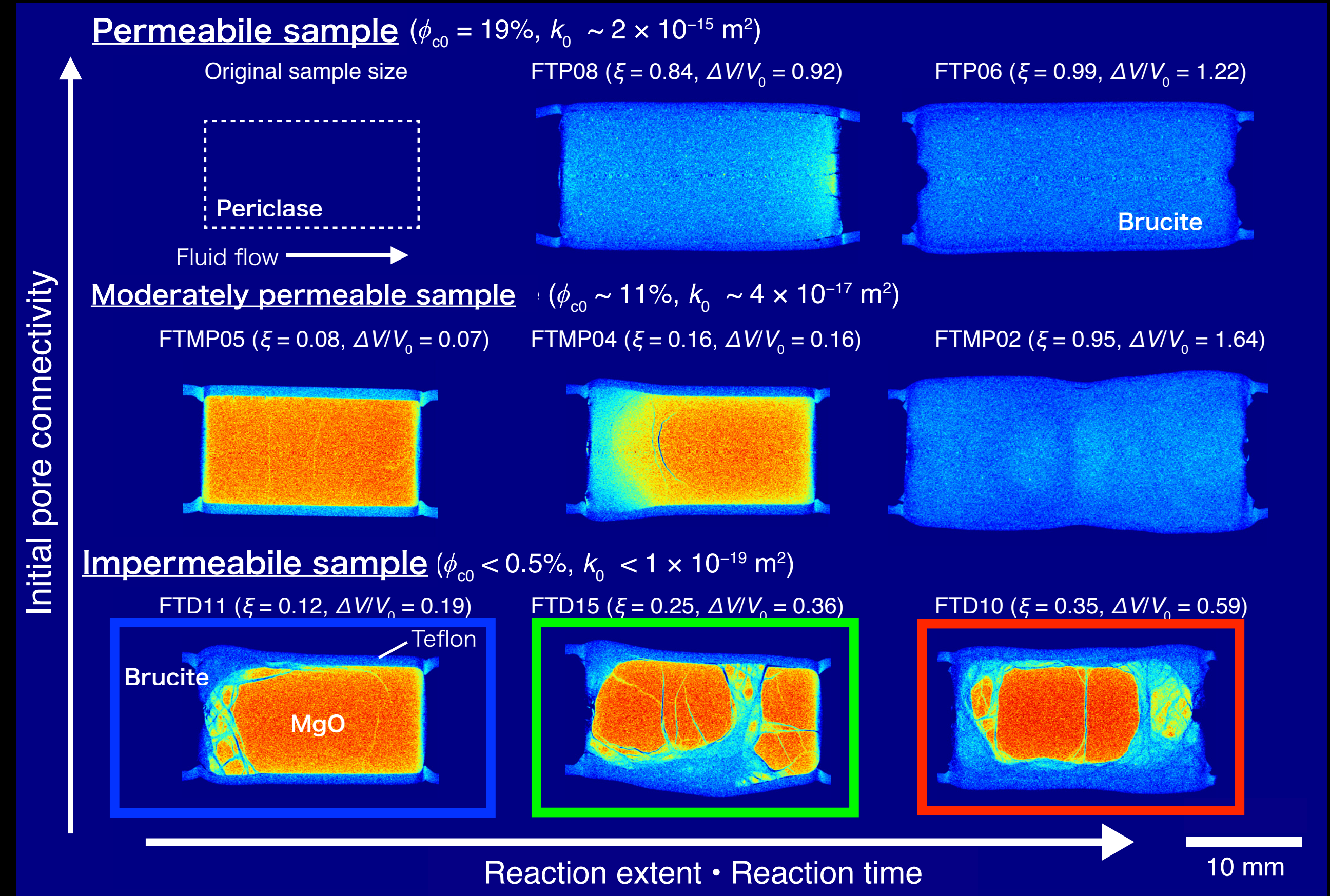
brucite

$$\Delta V_{\text{solid}} = +119\%$$

Exp. @ 200°C

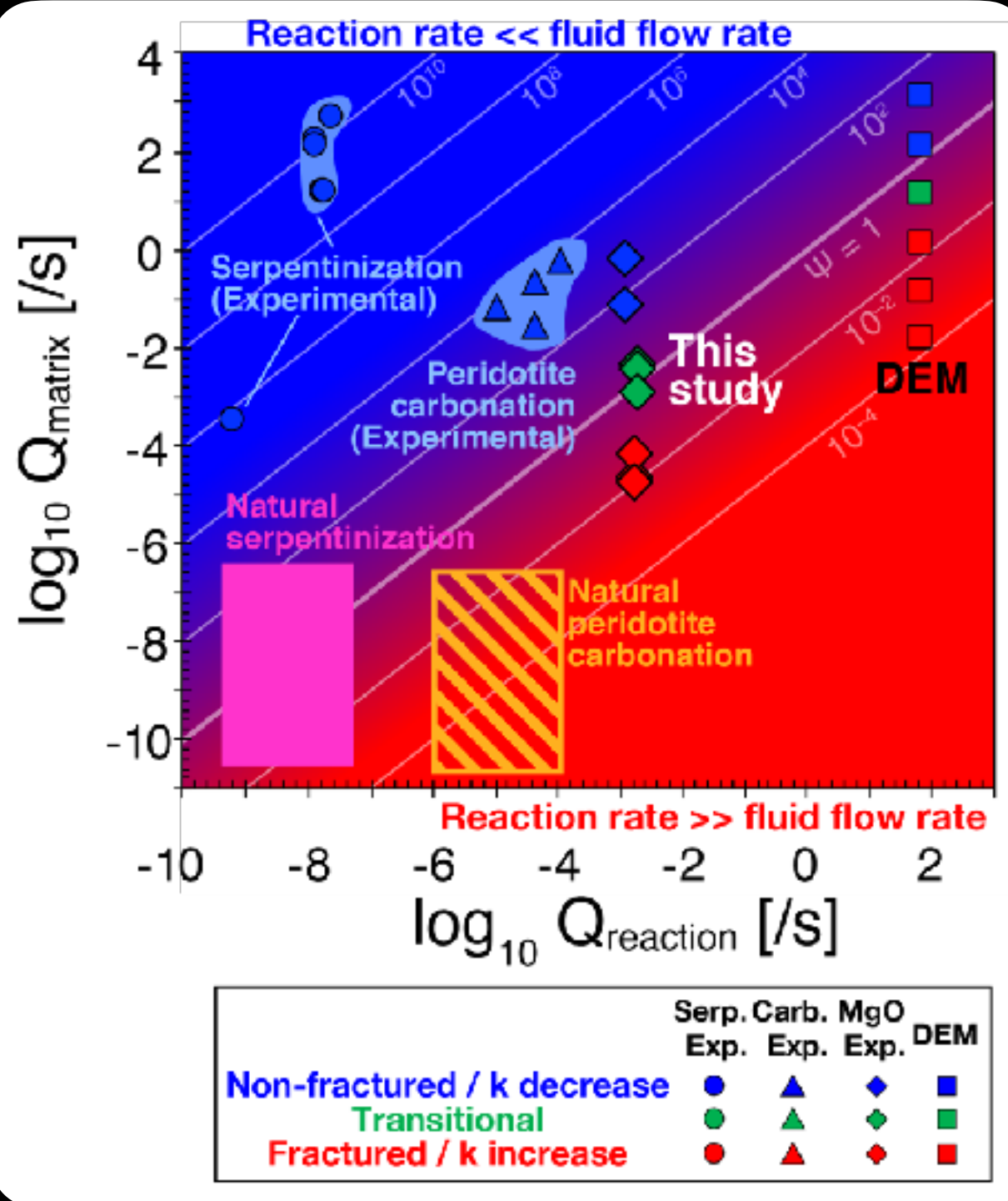
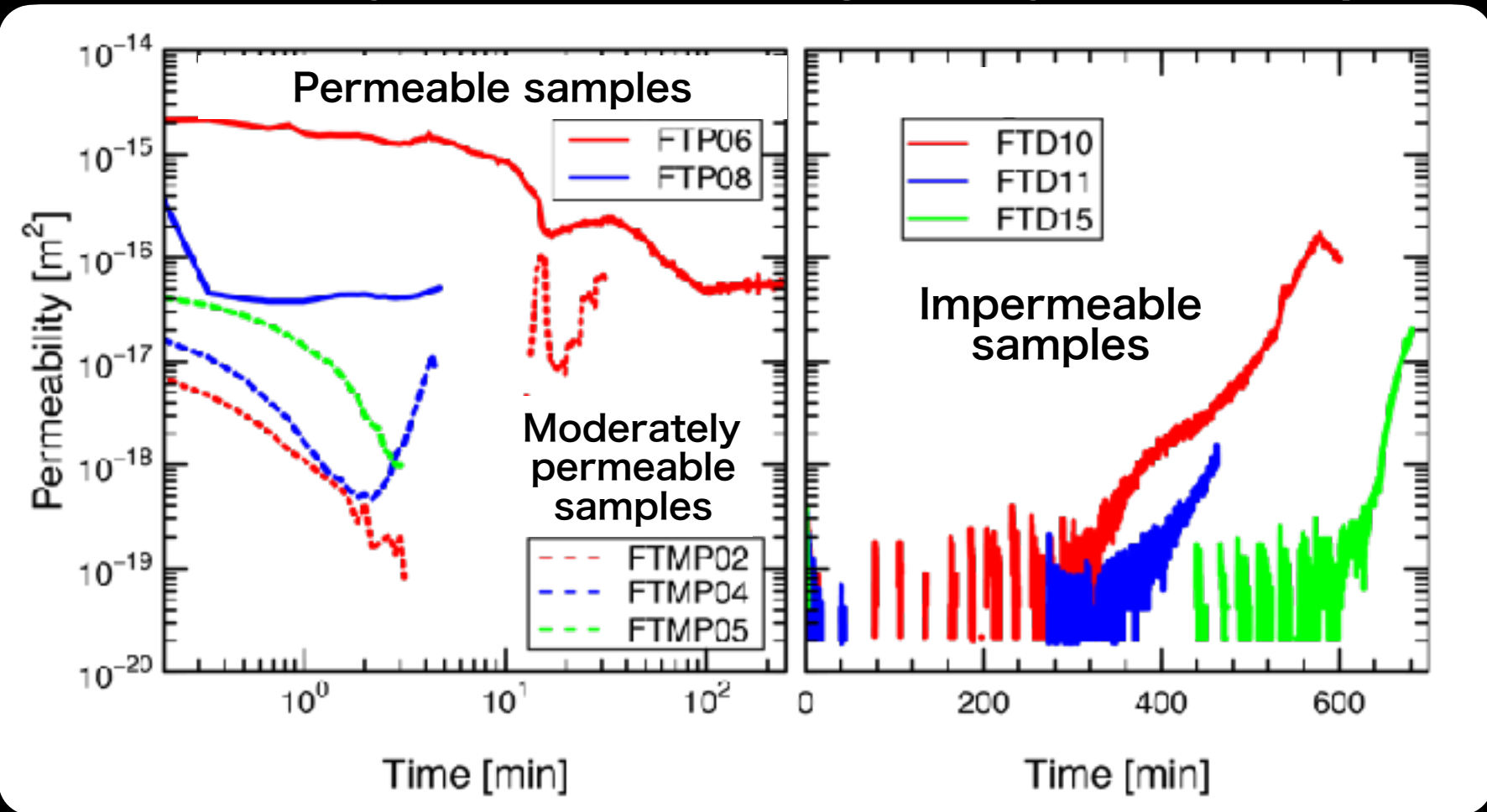
$P_c = 20 \text{ MPa}$

$P_f = 5 \text{ MPa}$,



Fist exp. report of permeability enhancement by volume-increasing chemical reactions

Pls. see Uno et al. (2022) PNAS for details



○ Controlling factor of mechanical-hydraulic behaviors

$$\Psi = \frac{\text{Fluid flow in the matrix [s]}}{\text{H}_2\text{O consumption by reaction [s]}}$$

Fluid flow in the matrix [s] $Q_{\text{matrix}} = \frac{q_{\text{pump}}}{AL}$

H₂O consumption by reaction [s] $Q_{\text{reac}} = \frac{Sv_{\text{reac}} V_{\text{H}_2\text{O}}}{AL V_{\text{per}}}$

Mechanical-hydraulic behaviors of

- This study
- Previous experiments
- DEM simulations
- Natural hydro/carbonation

can be systematically explained by the proposed non-dimensional parameter.