

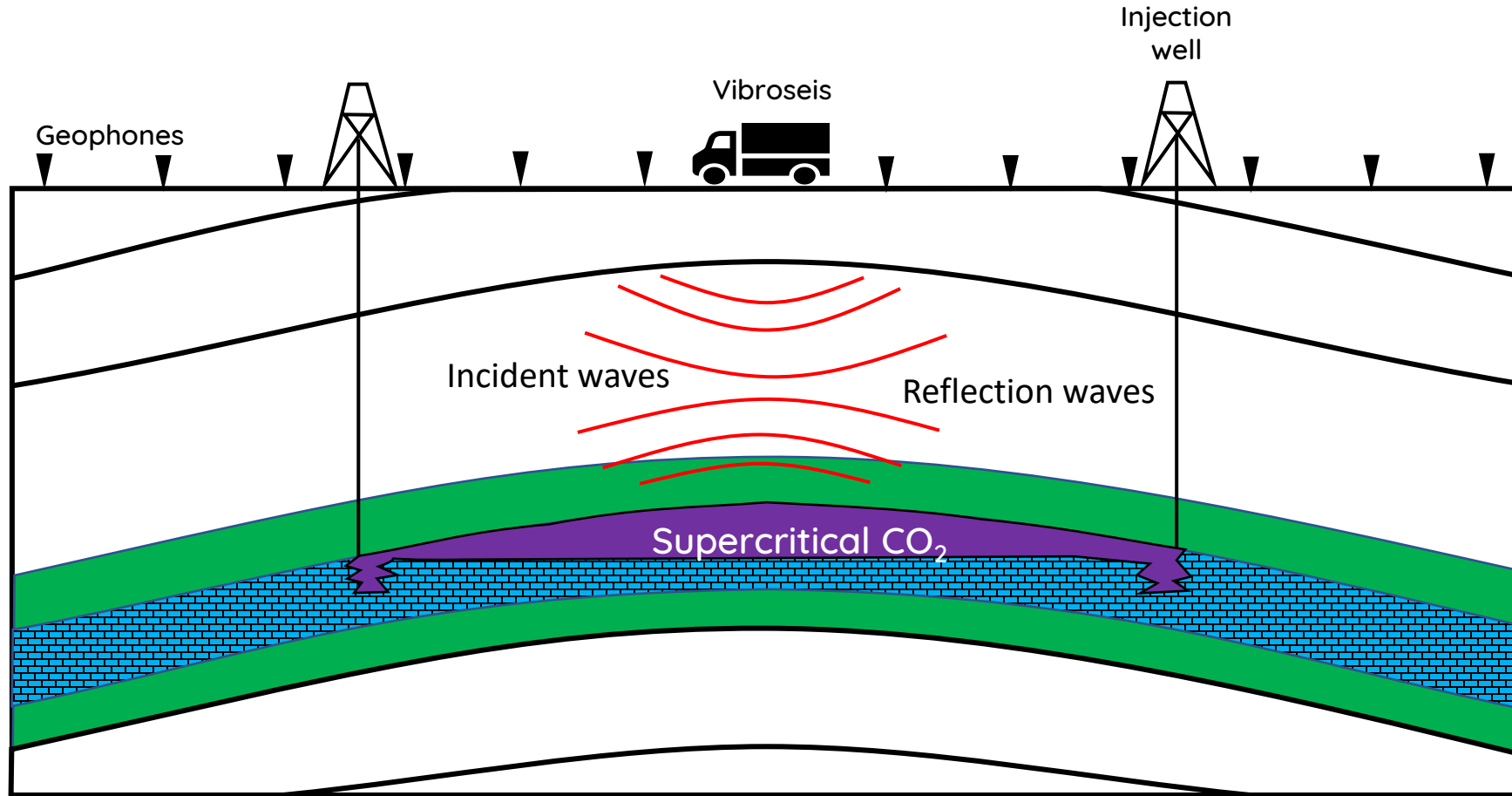
e-poster

Frequency-Dependent Velocity of Supercritical CO₂-saturated Carbonate Rock

Andika Perbawa
Thomas Finkbeiner
J. Carlos Santamarina

Motivation

Seismic Monitoring: CO₂ sequestration (illustration)



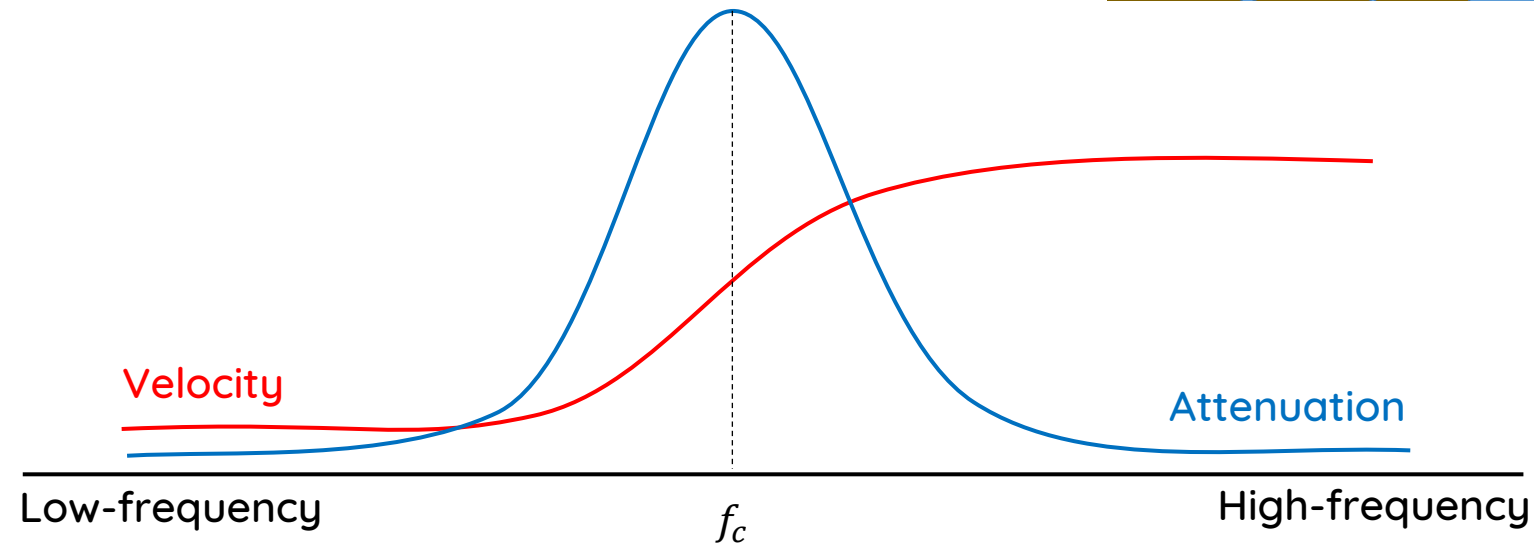
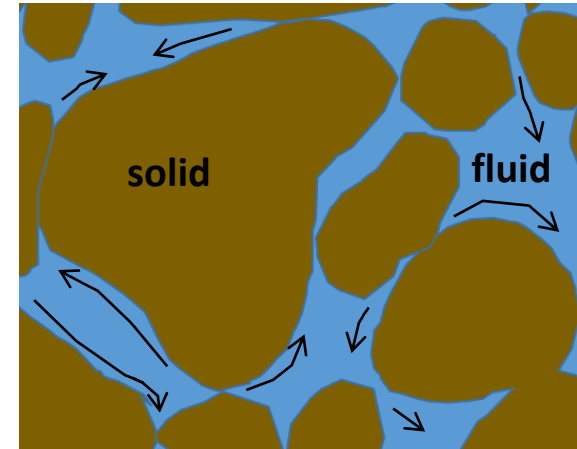
Provide field-scale rock properties using lab measurement techniques for field data calibration and simulation

Challenges

Seismic methods require lab calibration, but:

- $\lambda_{\text{seismic}} \gg L_{\text{specimen}}$
- $f_{\text{seismic}} \ll f_{\text{laboratory}}$
- Velocity is frequency-dependent

Biot's theory: solid and fluid interaction

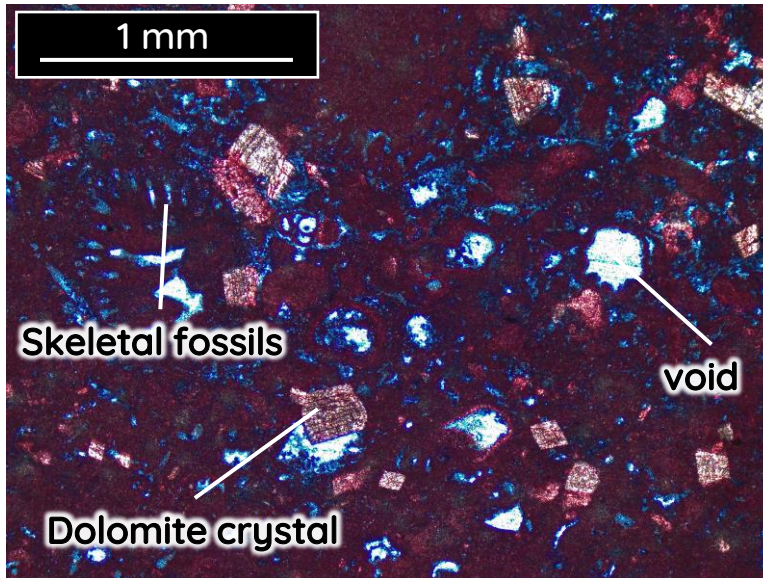


Specimen

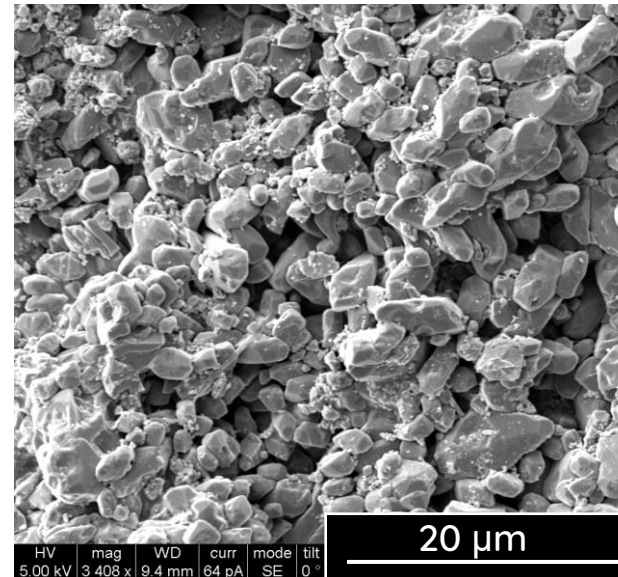
Photograph



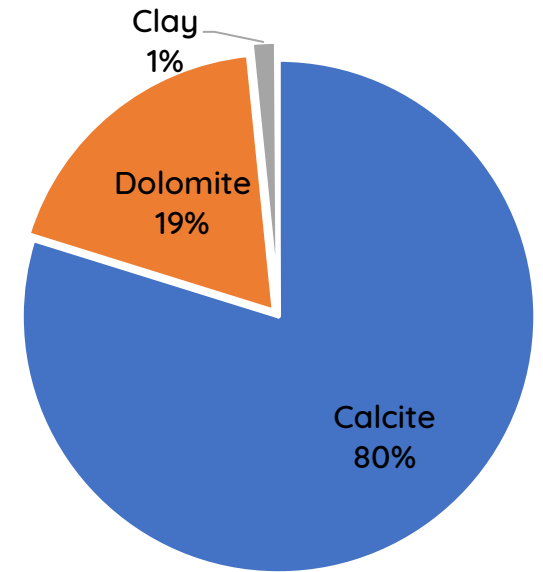
Thin Section



SEM Image



Mineral Compositions



Lithology: Carbonate

Age: Jurassic

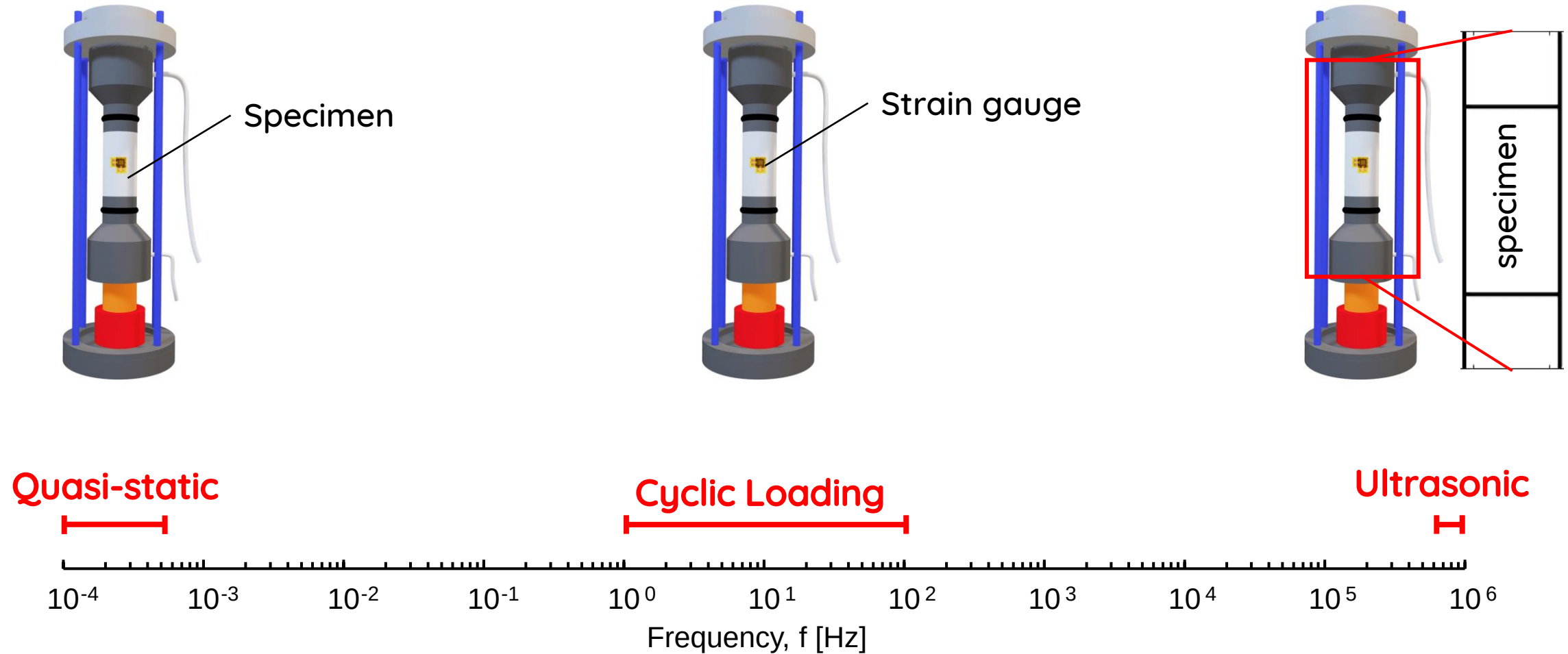
Porosity: 20.48 %

Permeability: 1.38 mD

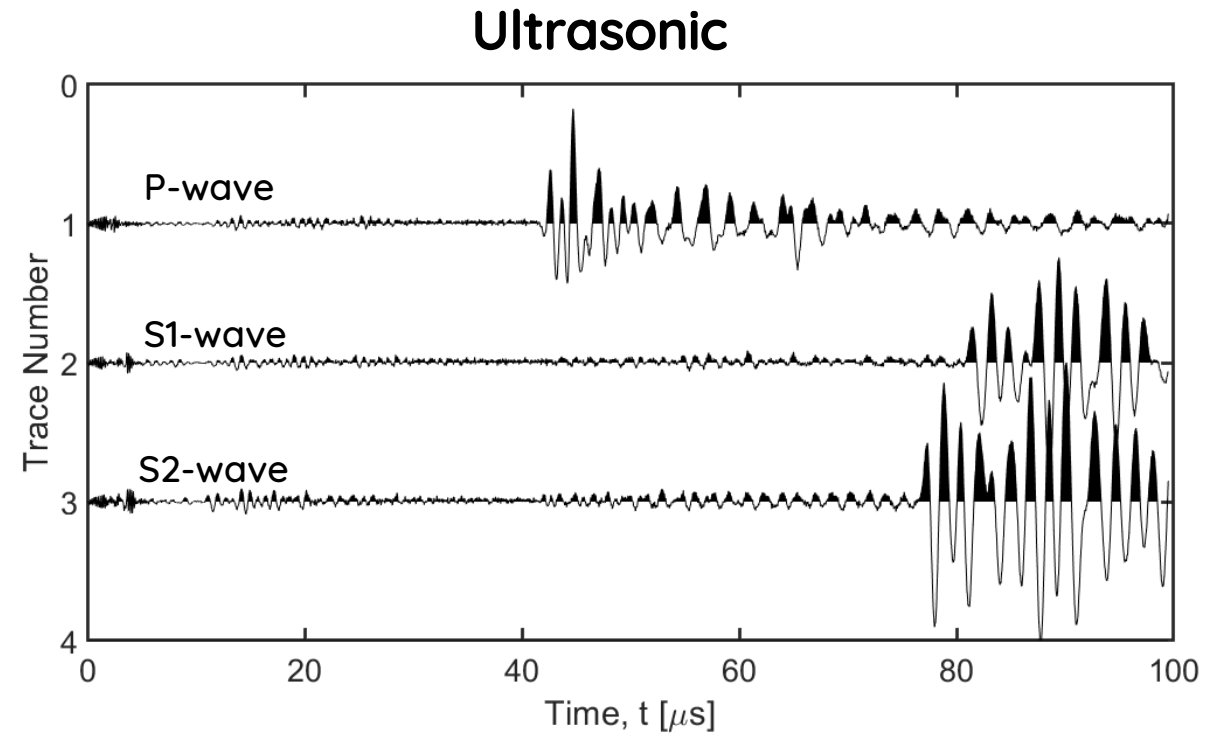
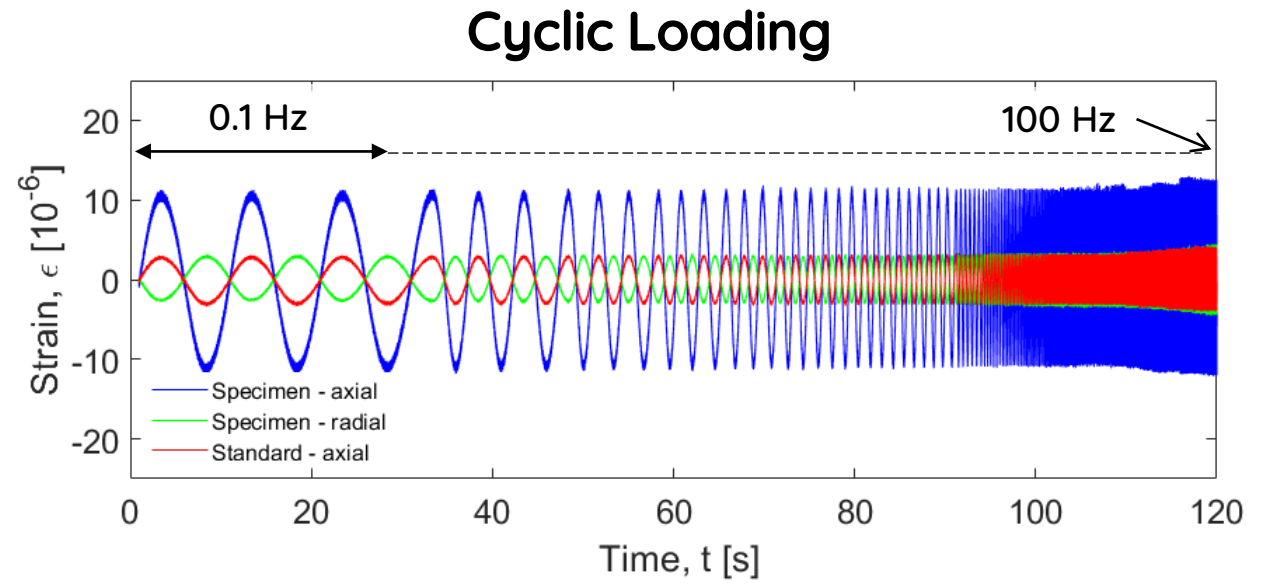
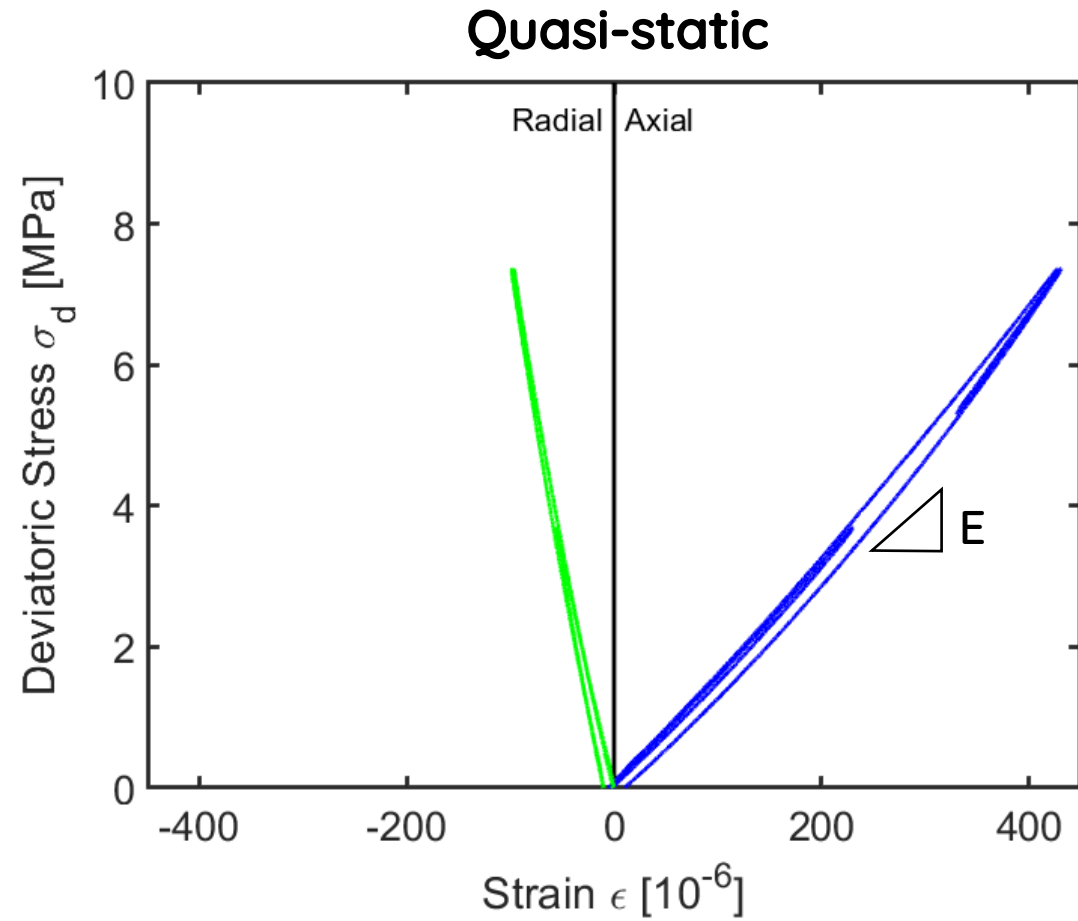
Experimental Setup – Triaxial Frame



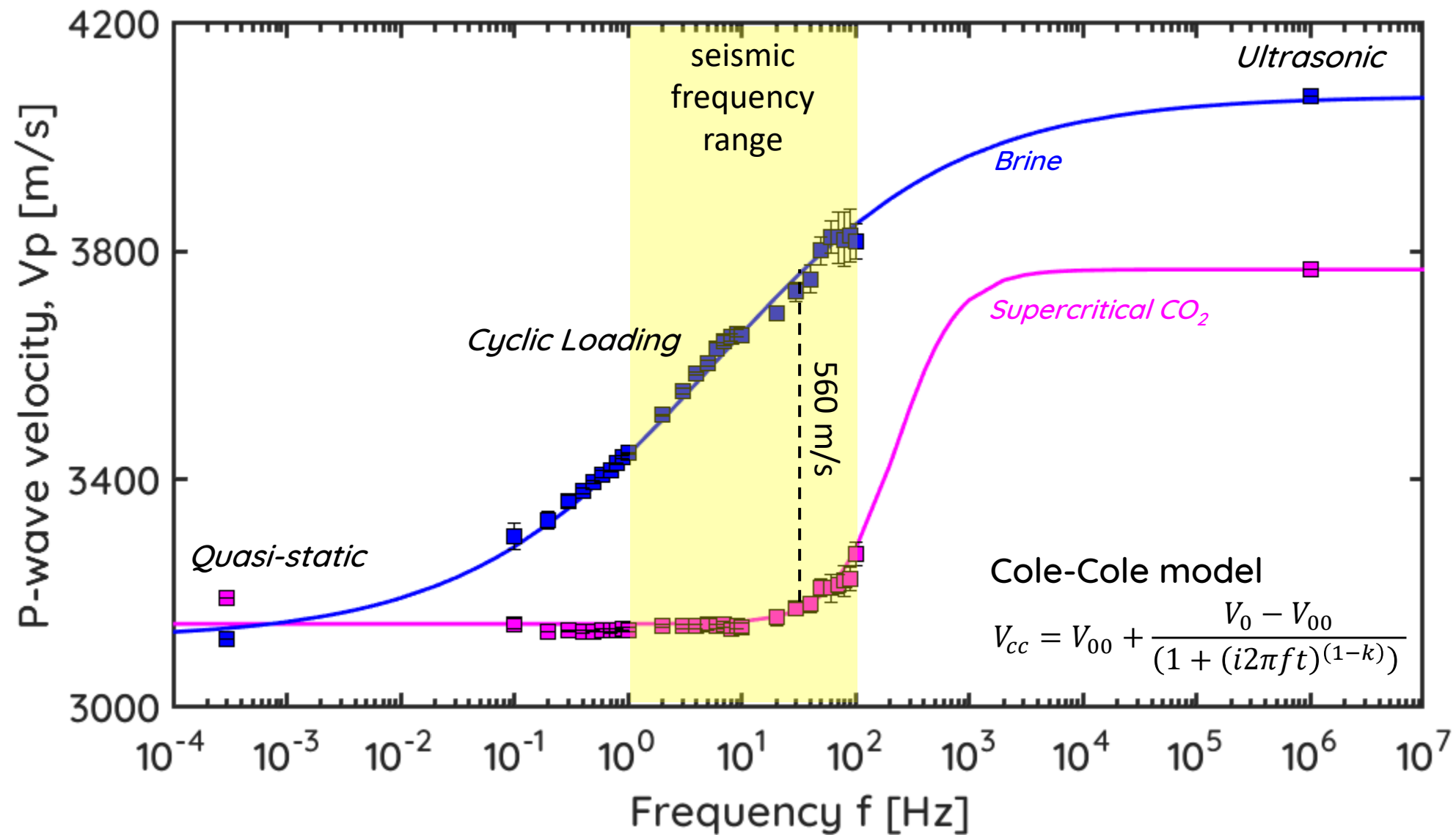
Experimental Setup - Specimen Stack



Results



Analysis



Conclusions

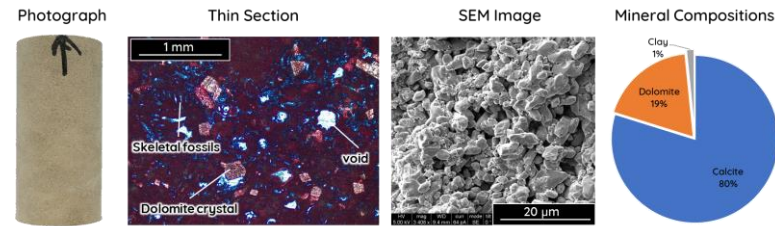
- Broadband studies → field data calibration, simulation, verification & feasibility study
- Complex apparatus, measurements (quasi-static, cyclic loading, ultrasonic) and signal processing
- Laboratory measurements
 - field-scale conditions (frequency, stress, fluid/rock properties)
 - V_p at 30 Hz (seismic): brine vs supercritical CO_2 = 560 m/s
 - Total V_p dispersion: Brine = 950 m/s, supercritical CO_2 = 620 m/s
- Fluid-solid interaction → frequency-dependent velocity → dispersion
- Fluid type → affects dispersion magnitude & sensitivity (density, stiffness, viscosity)

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Frequency-Dependent Velocity of Supercritical CO₂-saturated Carbonate Rock

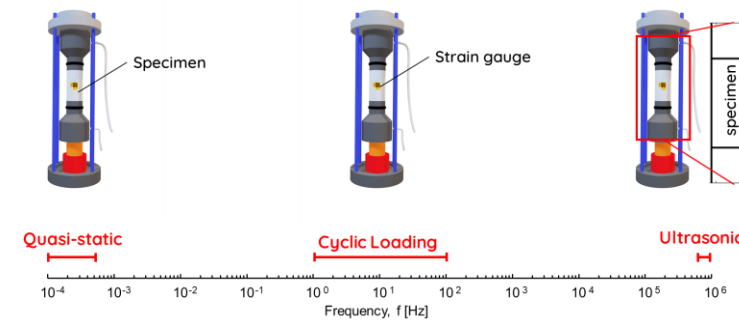
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Specimen

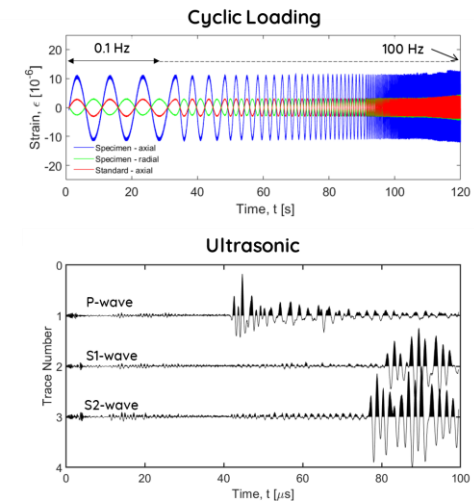
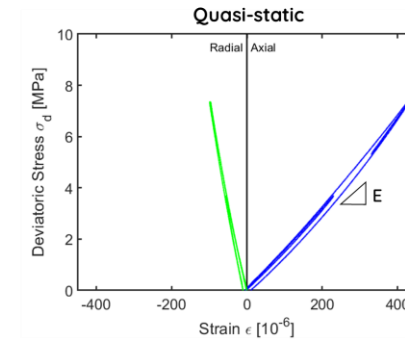


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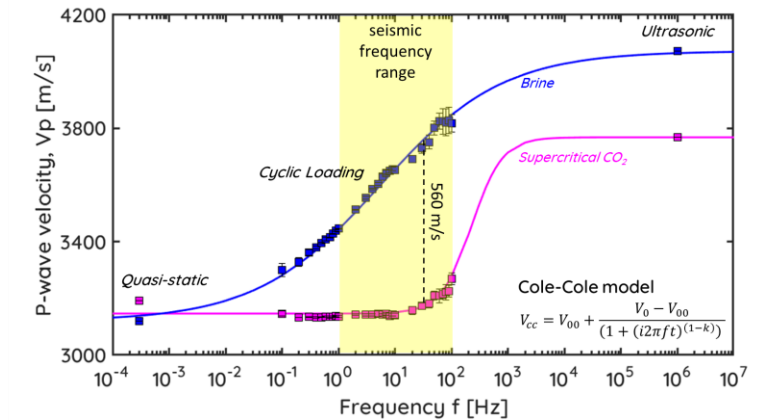
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Analysis

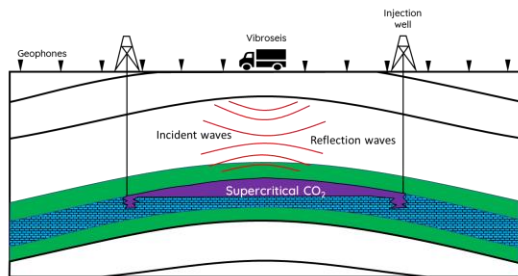


Conclusions

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