

Elastic & hydro-mechanical properties of fractured sandstone reservoirs during & after CO₂ storage

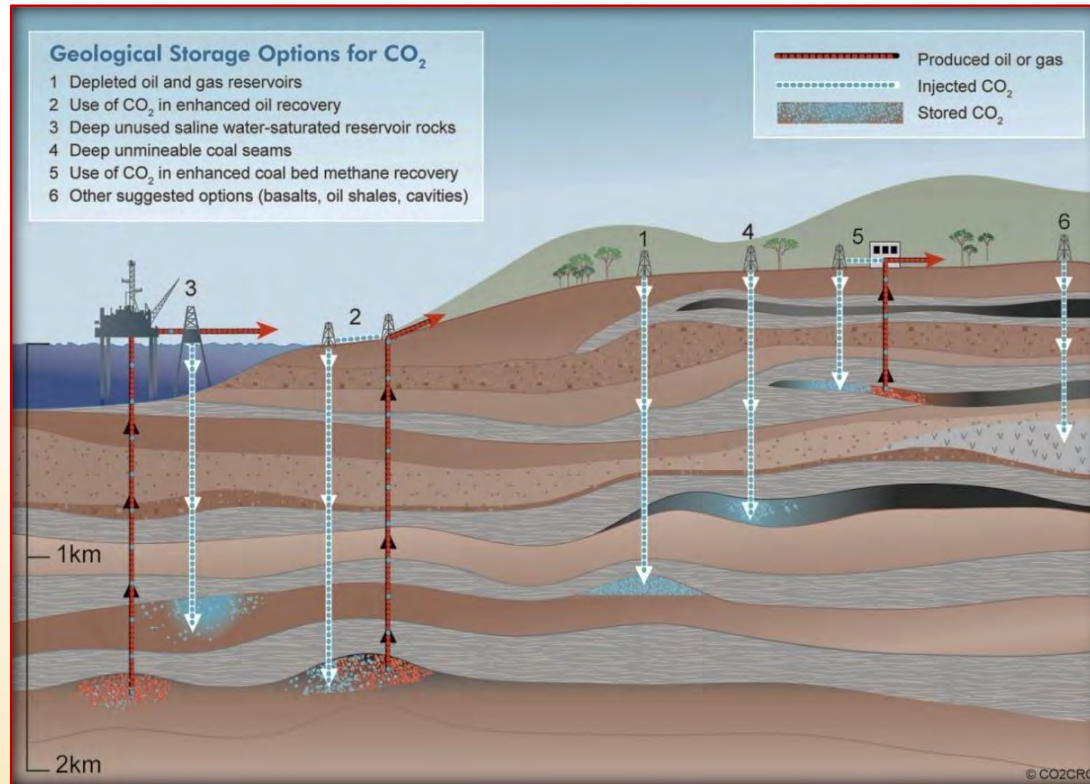
Publications from this work and contributors:

Muñoz-Ibáñez et al 2019 (JPSE) ; Falcon-Suarez et al, in review (GRL)

- University of A Coruna: Muñoz-Ibáñez, A.; Delgado-Martín, J.
- University of Edinburg: Papageorgiou, G.; Jin, Z.; Chapman, M.
- University of Southampton: Mackin, P.
- NOC: Marín-Moreno, H.; H.; Falcon-Suarez, I.H.



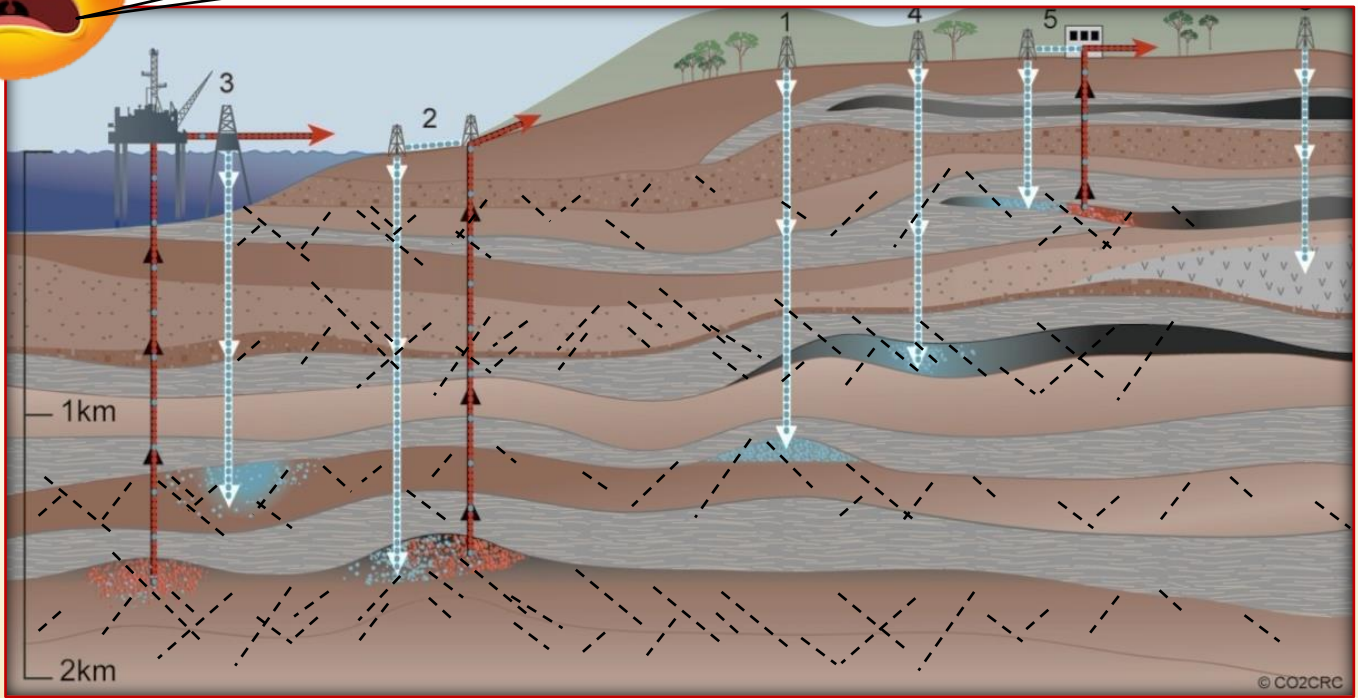
CO₂ Storage reservoirs



IPCC, 2005. IPCC Special Report on Carbon Dioxide Capture and Storage

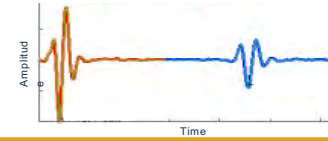
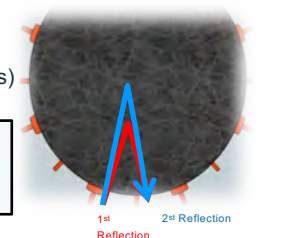
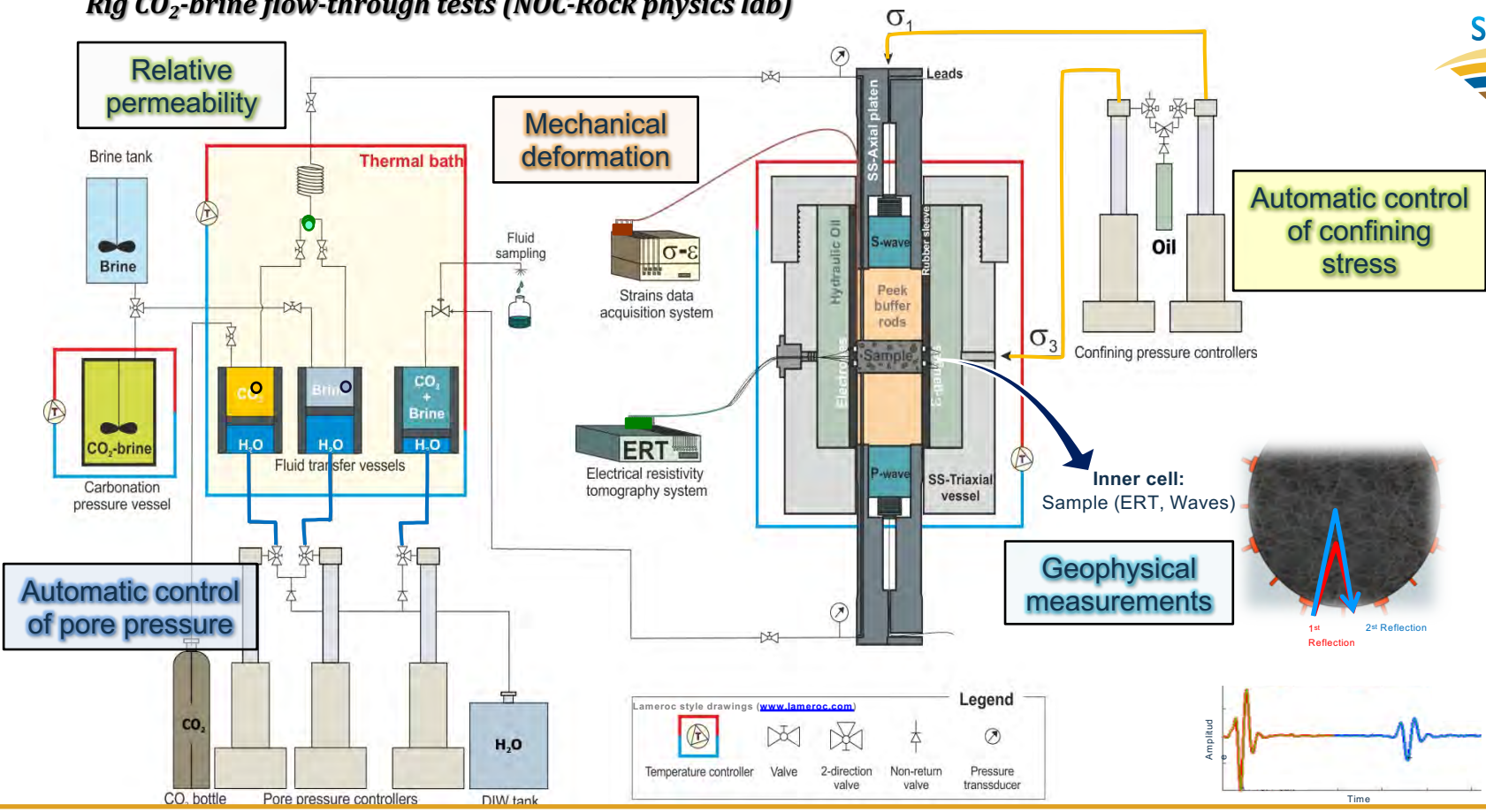


Fractures!!!



Adapted from IPCC, 2005

Rig CO₂-brine flow-through tests (NOC-Rock physics lab)



Lameroc style drawings (www.lameroc.com)

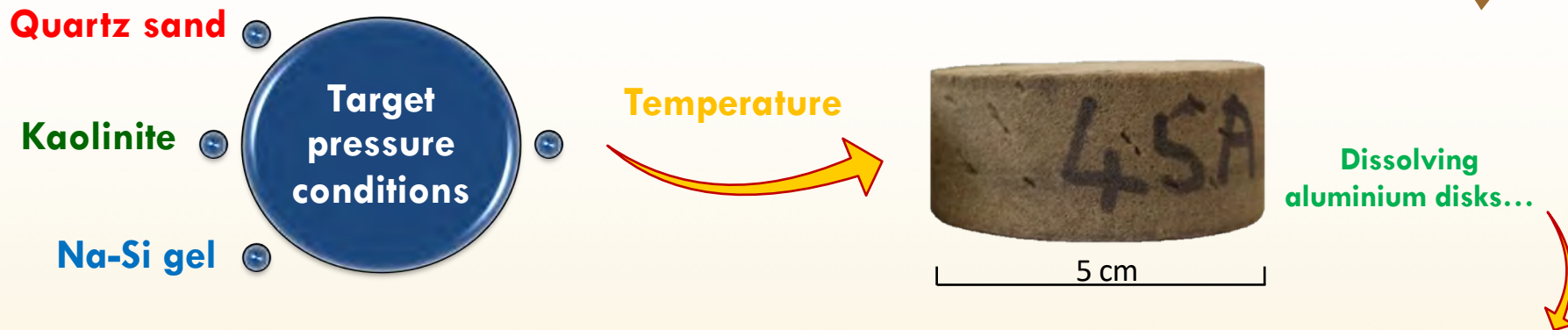
Legend				
Temperature controller	Valve	2-direction valve	Non-return valve	Pressure transducer



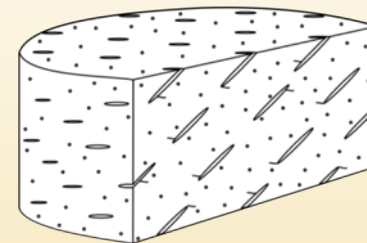
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 654462



How do we make our reservoir?



L (mm)	D (mm)	ϕ_0	k_0 (mD)	Fracture orientation	Fracture density	Fracture aspect ratio
19.85	49.54	0.273	5.48	45°	~0.0298	~0.088



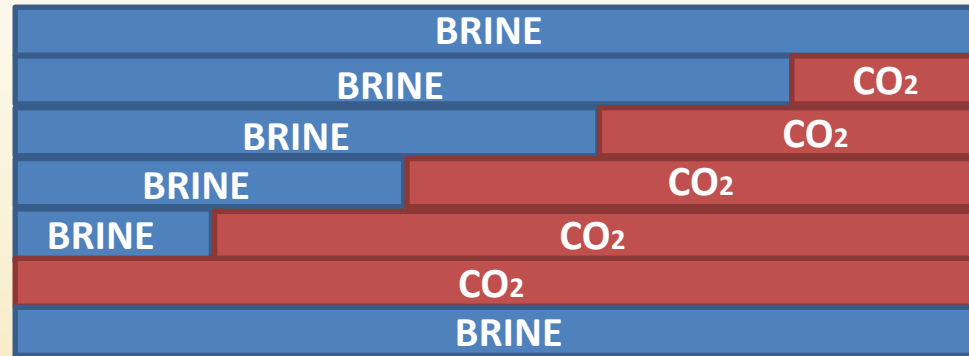
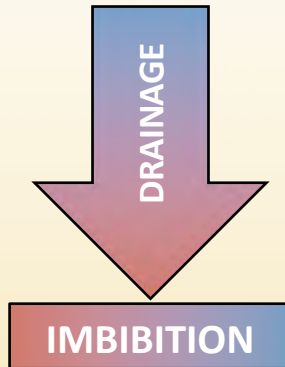
CO₂-brine flow-through test



EXPERIMENTAL CONDITIONS

P _c (MPa)	P _p (MPa)	T (°C)	Salinity (% of NaCl)
40	10	19	3.5

INJECTION STEPS



$$X_{\text{CO}_2} = \frac{V_{\text{CO}_2}}{V_{\text{CO}_2} + V_{\text{W}}}$$

0

0.2

0.4

0.6

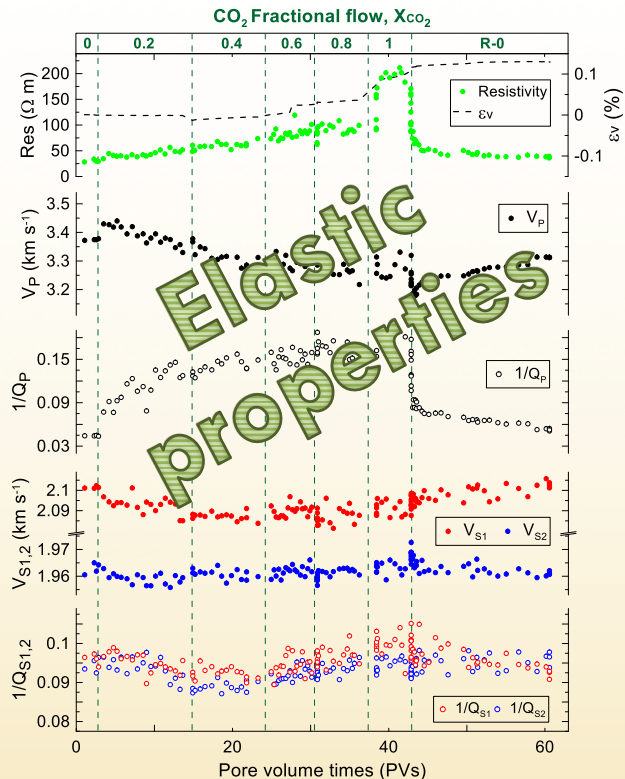
0.8

1

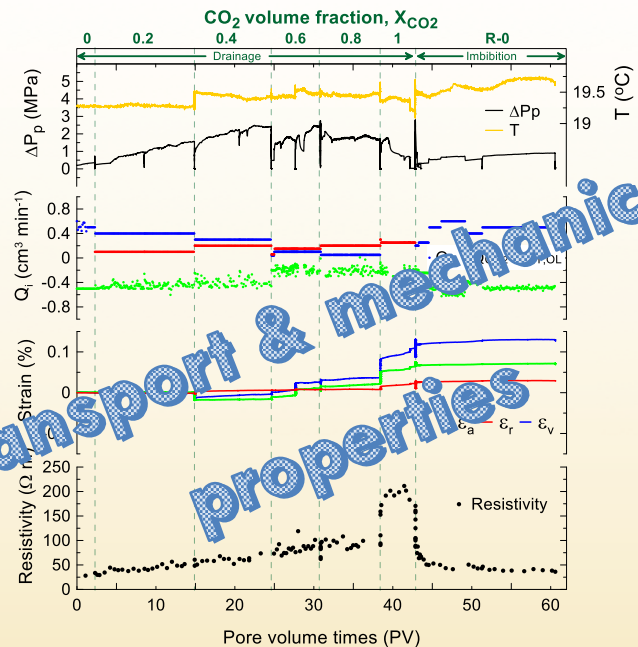
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Geophysical & hydro-mechanical properties



Falcon-Suarez et al, in review (GRL)



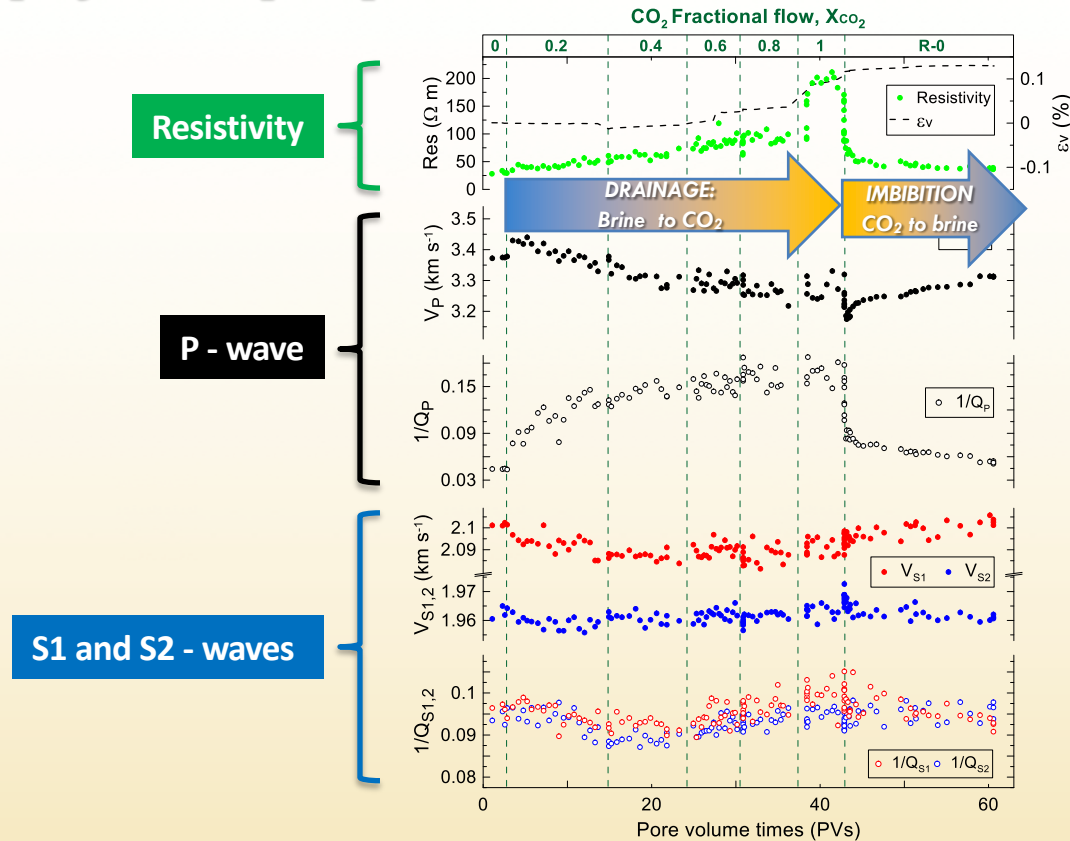
Muñoz-Ibáñez et al 2019 (JPSE)



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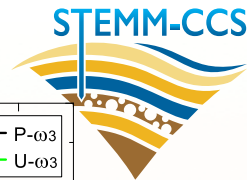
Geophysical properties



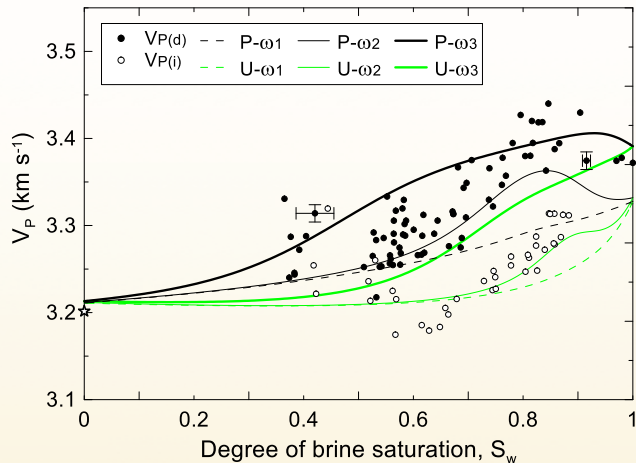
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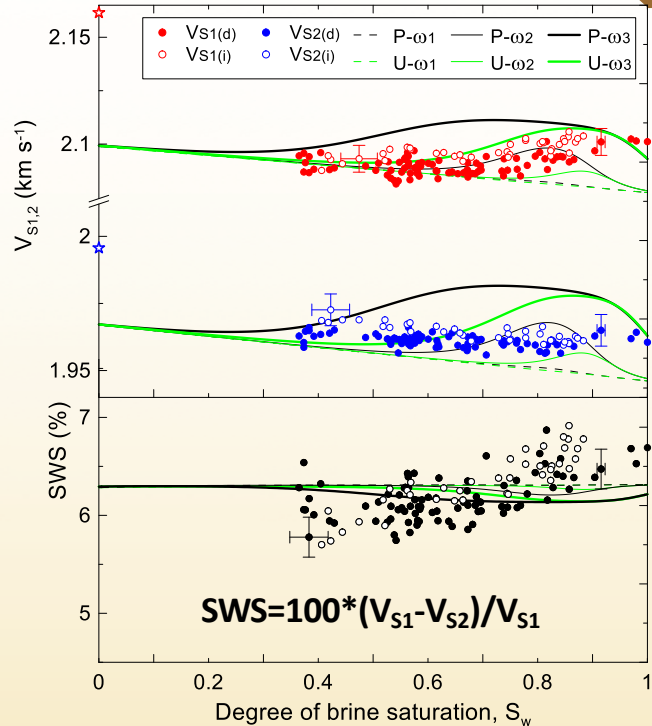
Elastic assessment: fractured CCS reservoirs



P - wave



S1 and S2 - waves



Different models for injection (drainage) and post-injection (imbibition) stages

SWS is not robust indicator of pore fluid distribution

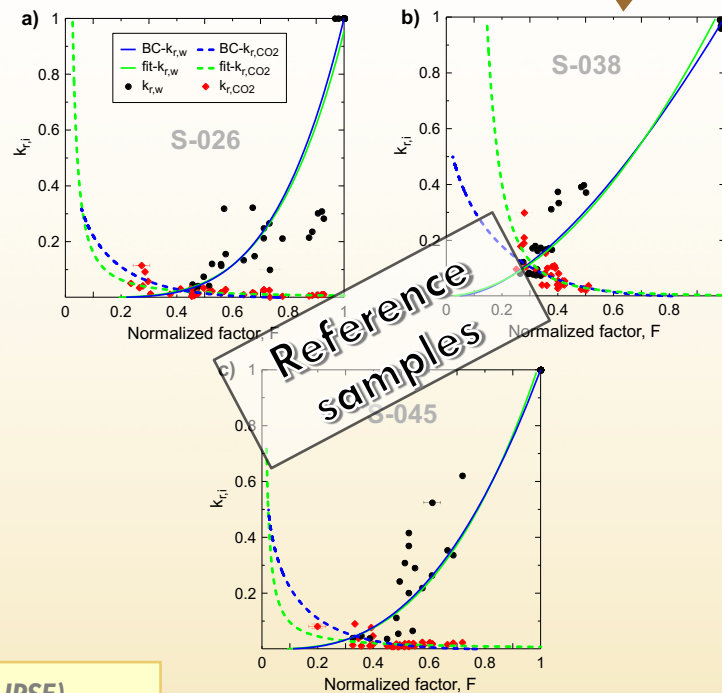
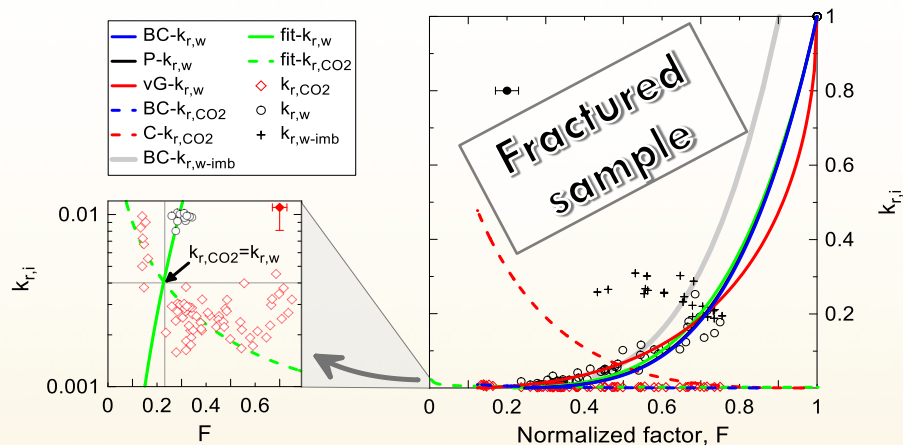
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Transport properties: fractured CCS reservoirs



Poorly connected fracture network may:
 hamper the CO_2 mobility through the rock;
 while increasing the CO_2 isolation (good CO_2 trapping)

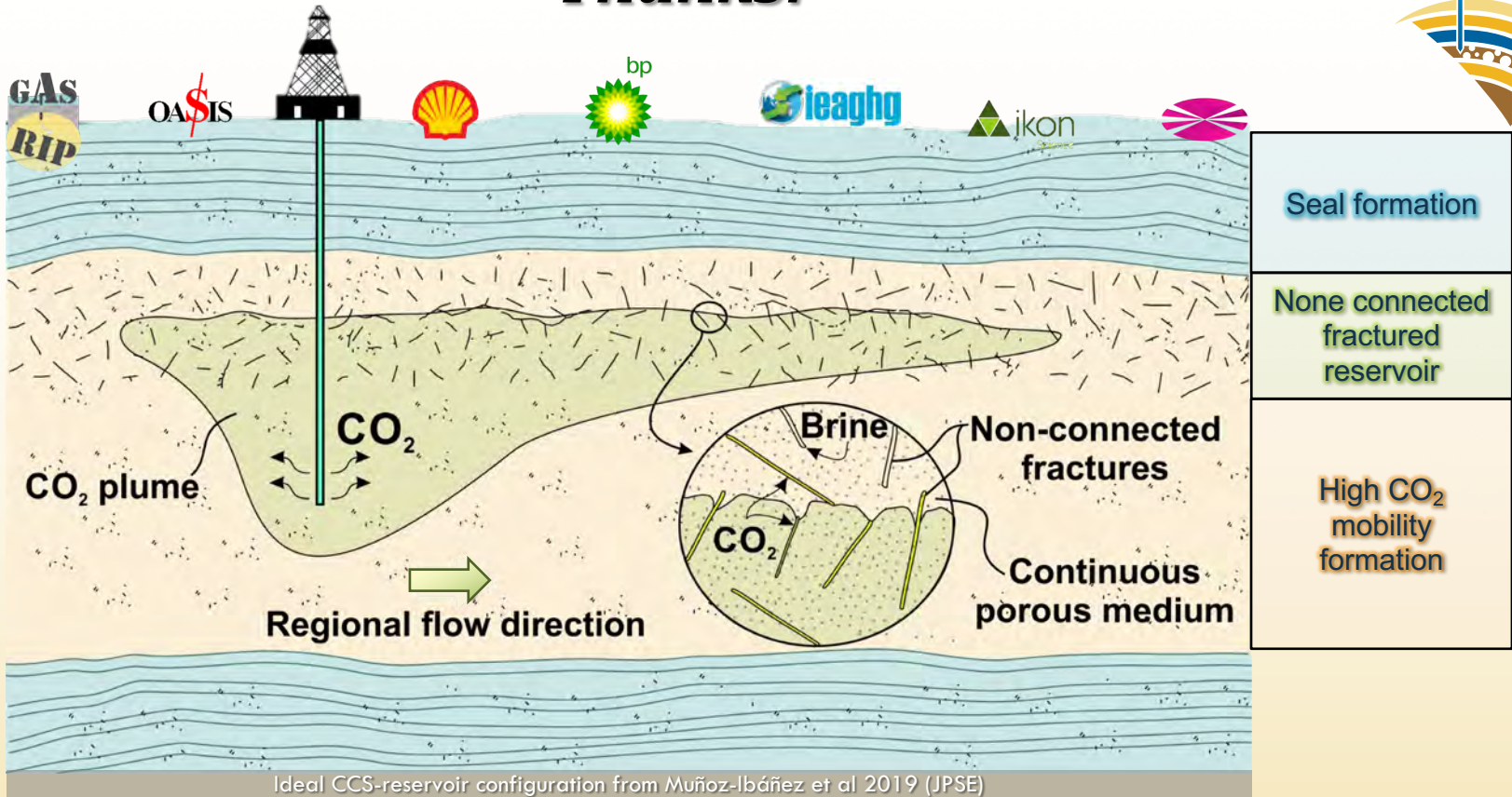
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Thanks!



Ideal CCS-reservoir configuration from Muñoz-Ibáñez et al 2019 (JPSE)



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