MÁSTER PROPIO EN INGENIERÍA DE PETRÓLEO Y GAS
OIL & GAS ENGINEERING MASTER'S DEGREE

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SALINE AQUIFER – TRAP MECHANISM

ESCUELA TÉCNICA SUPERIOR DE INGENIEROS DE MINAS Y ENERGÍA

POLITÉCNICA

Problem Significance and Impact

- Determining the trap mechanism in the reservoir where CO2 is stored, it is a key factor in the gas injection process, to avoid possible leaks and contamination to the environment.

Research Contribution

- This e-Poster tries to inform the types of trap mechanism in which CO2 is trapping in a reservoir and how long it takes to finish its storage and the behavior it will have with other fluids in the subsurface. Teach that when the trap mechanism does not work the environmental damage is evident as it will be shown later

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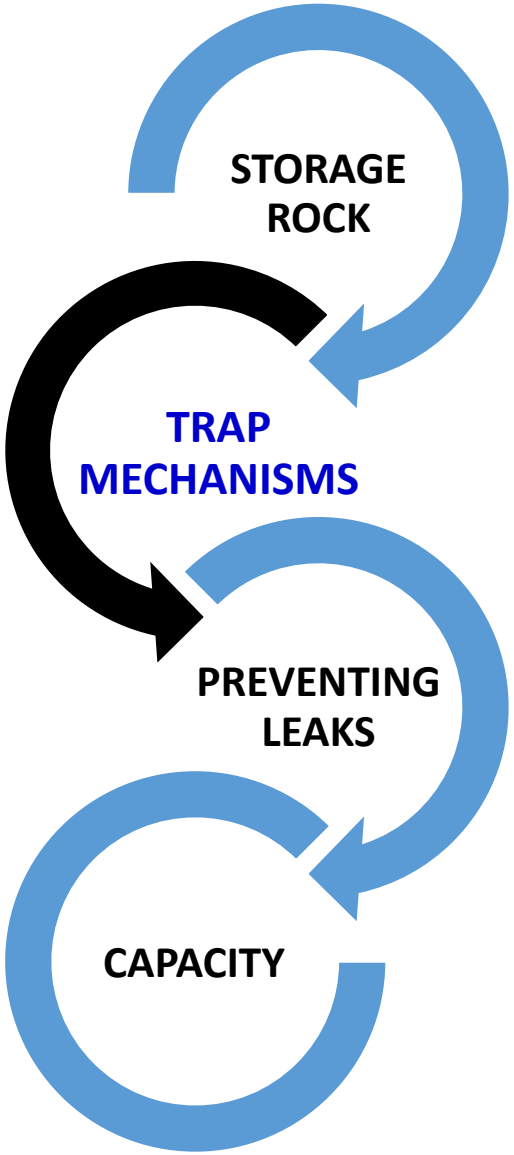
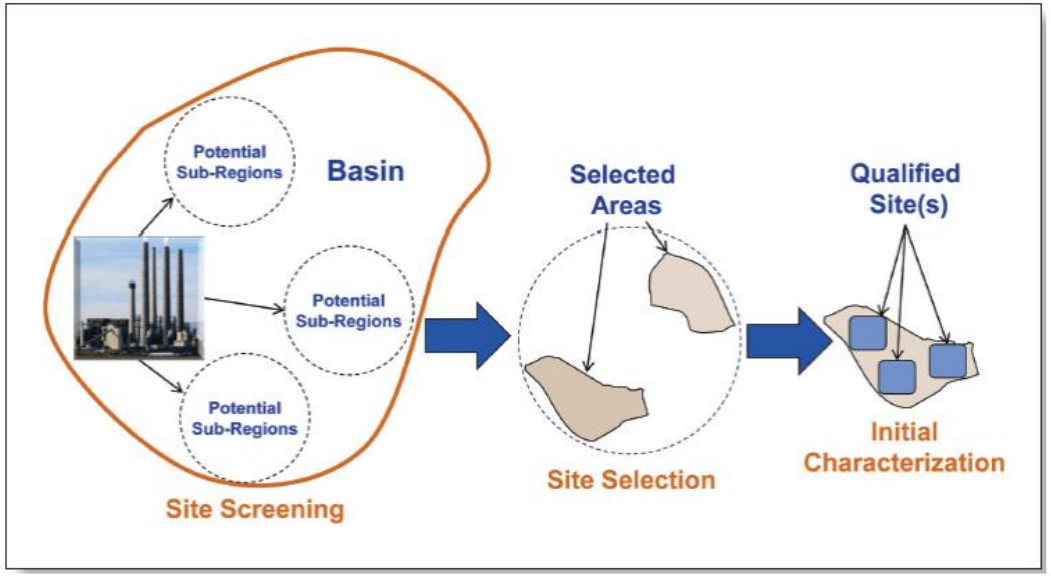
CO2 Storages

The dynamic behavior of the CO2 storages is influenced by the fluids present in the storage and the type of the storage rock, the same in the oil/gas reservoirs, but with a difference, the influence of the different trap mechanisms that help the CO2 sequestration in the long term.



Selection of the Area

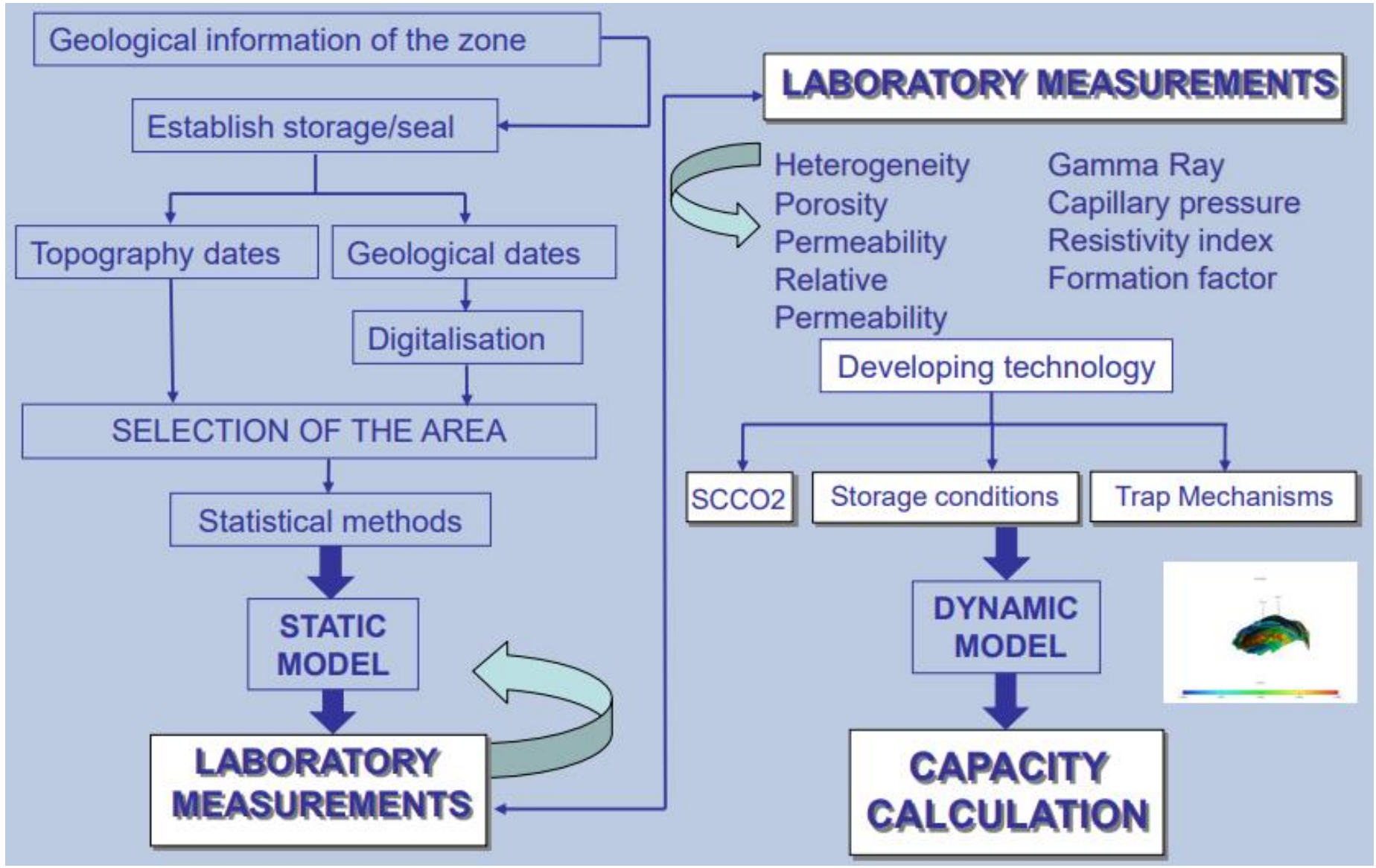


Graphical representation of "Project Site Maturation" through the Exploration Phase. Courtesy of NETL. The Energy Lab

U.S. DEPARTMENT OF ENERGY

How to Characterize the Storage

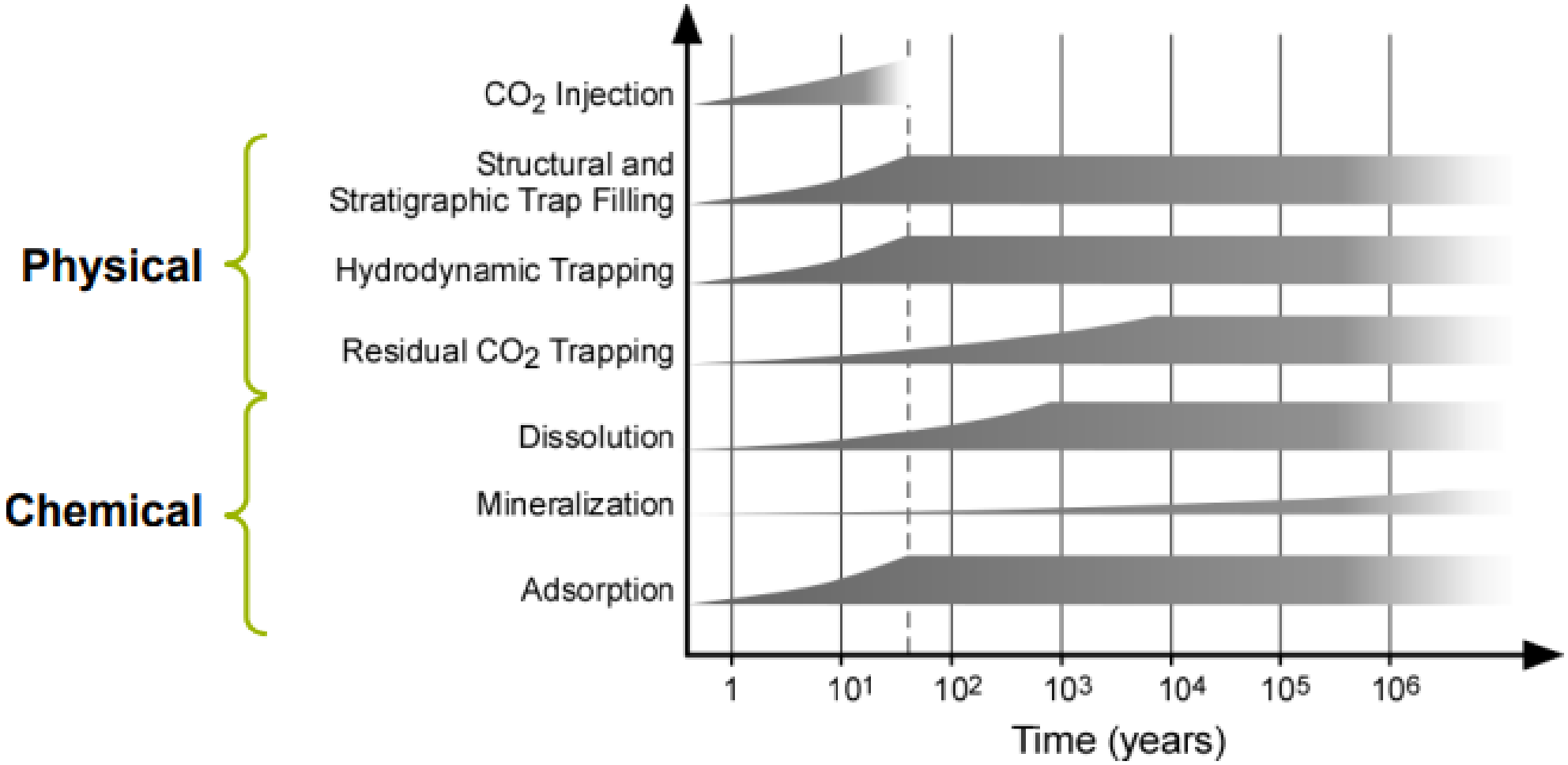
Storage/Cap Rock Characterization



Behavior of the fluids

Trap Mechanisms

Capacity = Geometric Volume (Φ) * Trap Mechanisms * Efficiency

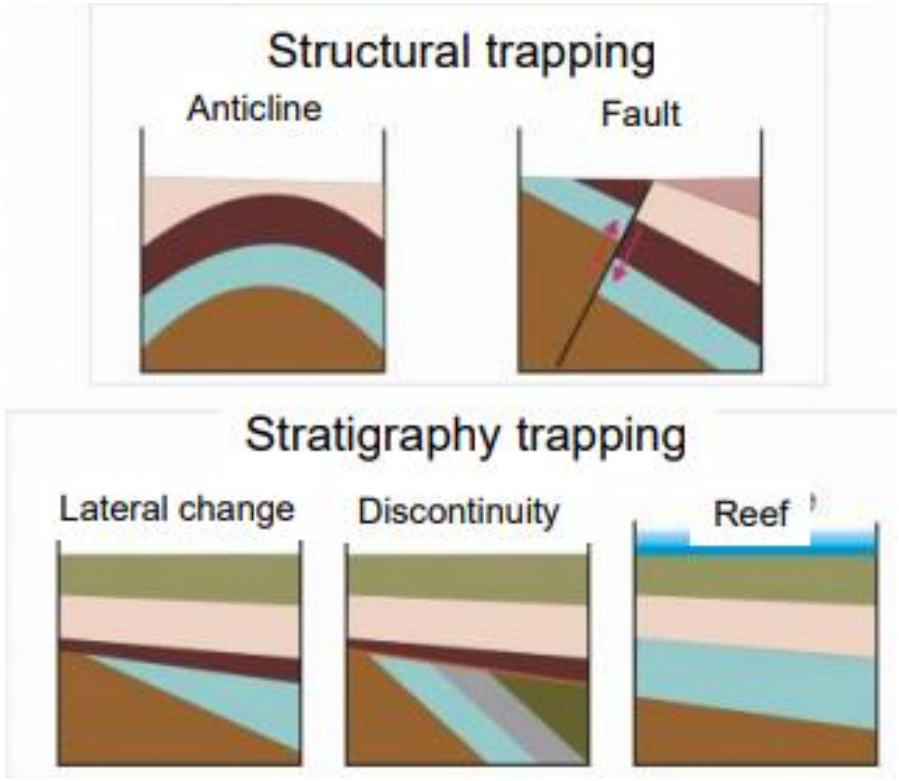


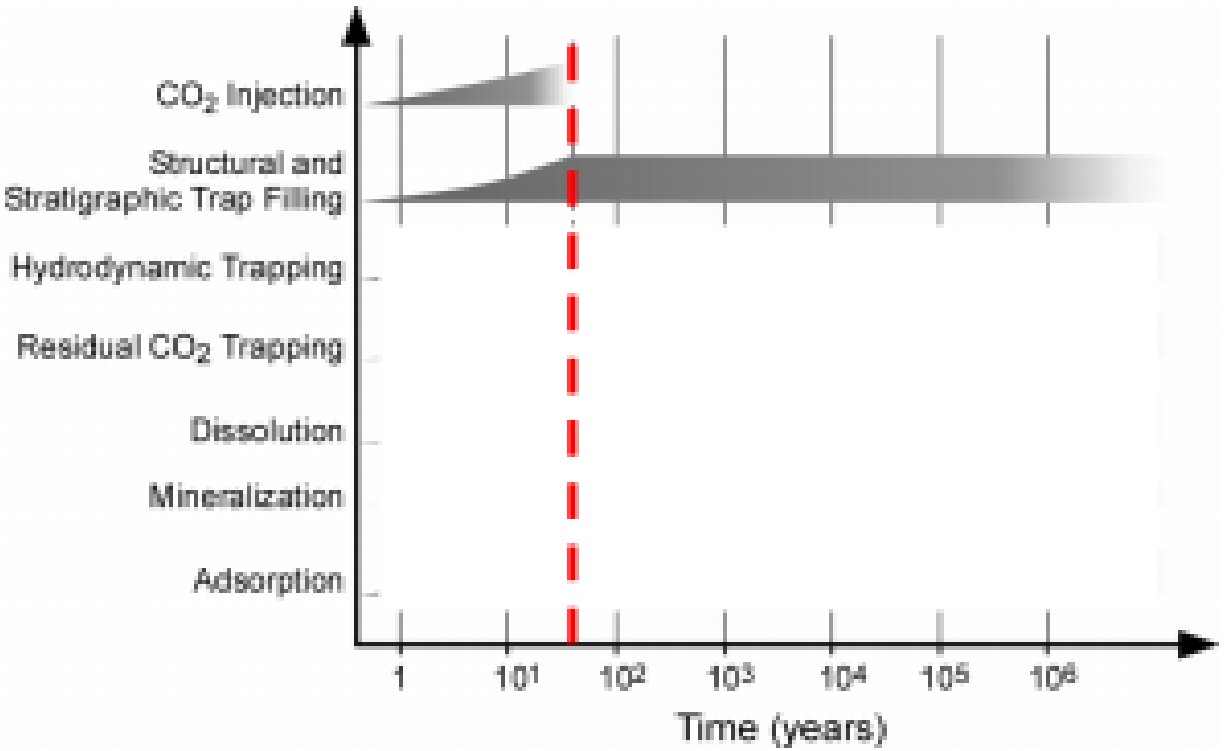
Physical Trap Mechanisms – Storage Rock

Structural and Stratigraphy Trapping

Structural: It is caused by the deformation of sedimentary layers after deposition.

Stratigraphy: it is associated with overlap, overlying and lateral change of facies between other formations with different permeability.



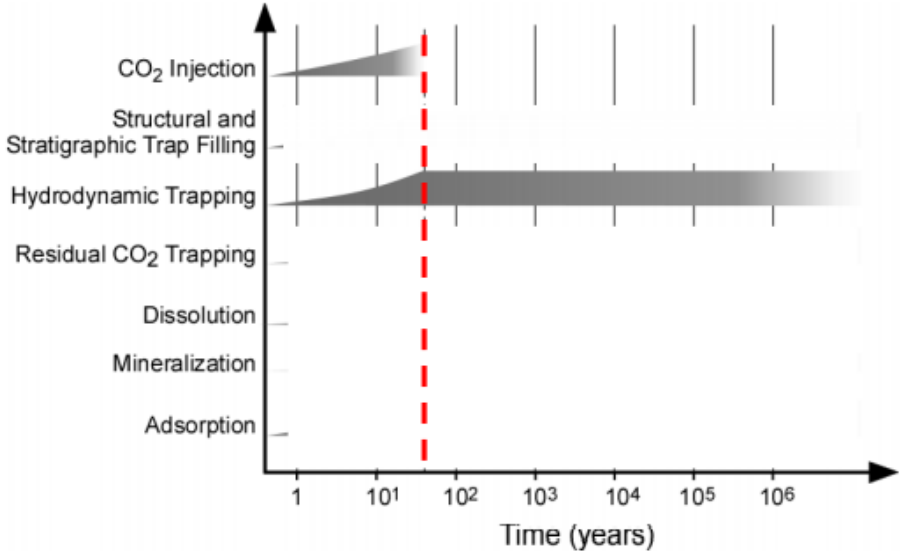


Physical Trap Mechanisms – Storage Rock

Hydrodynamic Trapping

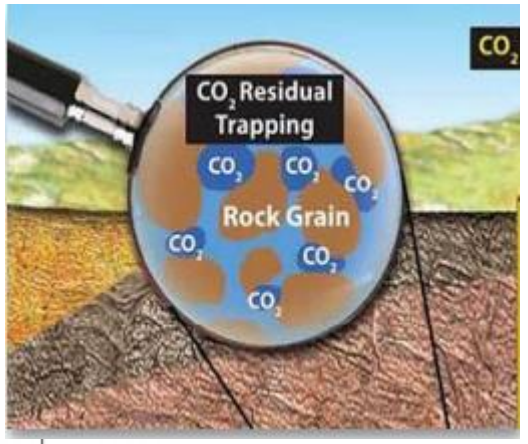
The ”immobilization” of CO2 is reached through the pressure applied by the formation water:

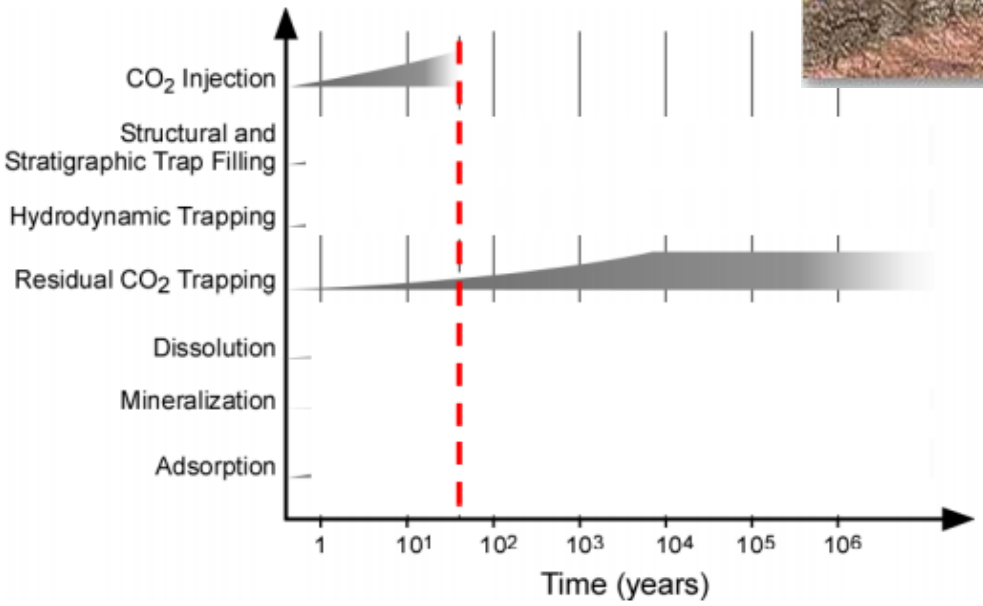
- Hydrostatic pressure of the water column located above the storage and
- By the flows of formation water that improve or not the confinement.



Residual CO2 Trapping

While the CO2 migrates through the formation, part of it is retained in the inter-granular space, due to capillary forces.



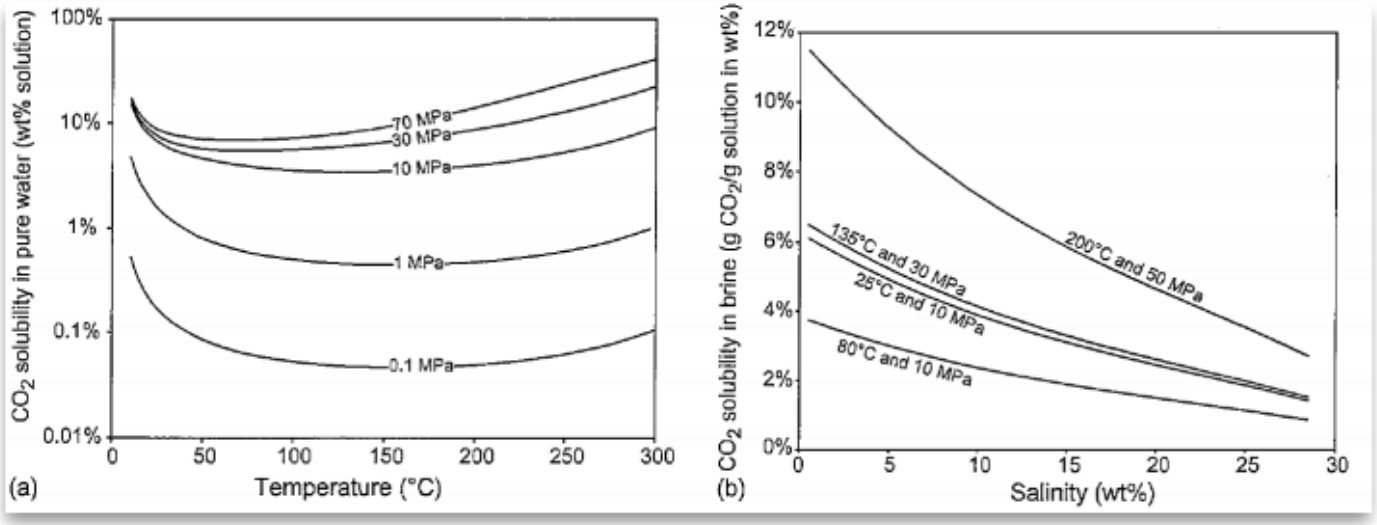


Chemical Trap Mechanisms – Storage Rock

DISSOLUTION TRAPPING: CO2 MOVEMENT INTO THE AQUIFER

Dependency of the dissolution with temperature, pressure and salinity

(Pressure and Temperature ranges of sedimentary basins)



Span R, Wagner A

T: The solubility of CO2 decreases with the increase of T, at low T, until it reaches a minimum. After that, it increases.

P: The minimum solubility is reached at very low T with an increase of P.

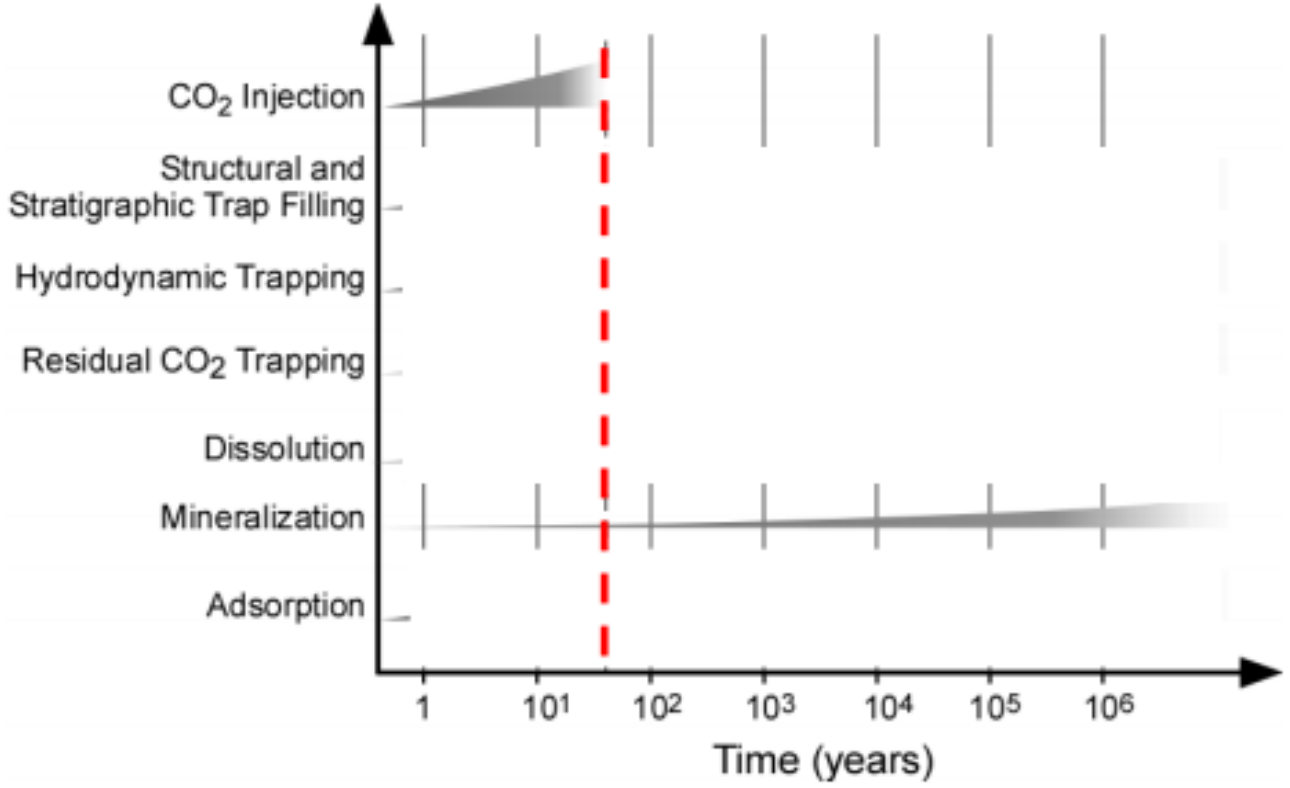
The solubility of CO2 decreases 5 times with the increase of the salinity from 0% to 30%.

Chemical Trap Mechanisms – Storage Rock

Mineralization The reactions between CO2, formation brine and storage rock make the CO2 fixation.

The total quantity of fixed CO2 and the reaction time depend on:

- The chemical composition of water
- The mineralogy of the rock
- The composition of the CO2 plume (impurities)



The set of geochemistry interactions could increase the storage capacity and the effectiveness

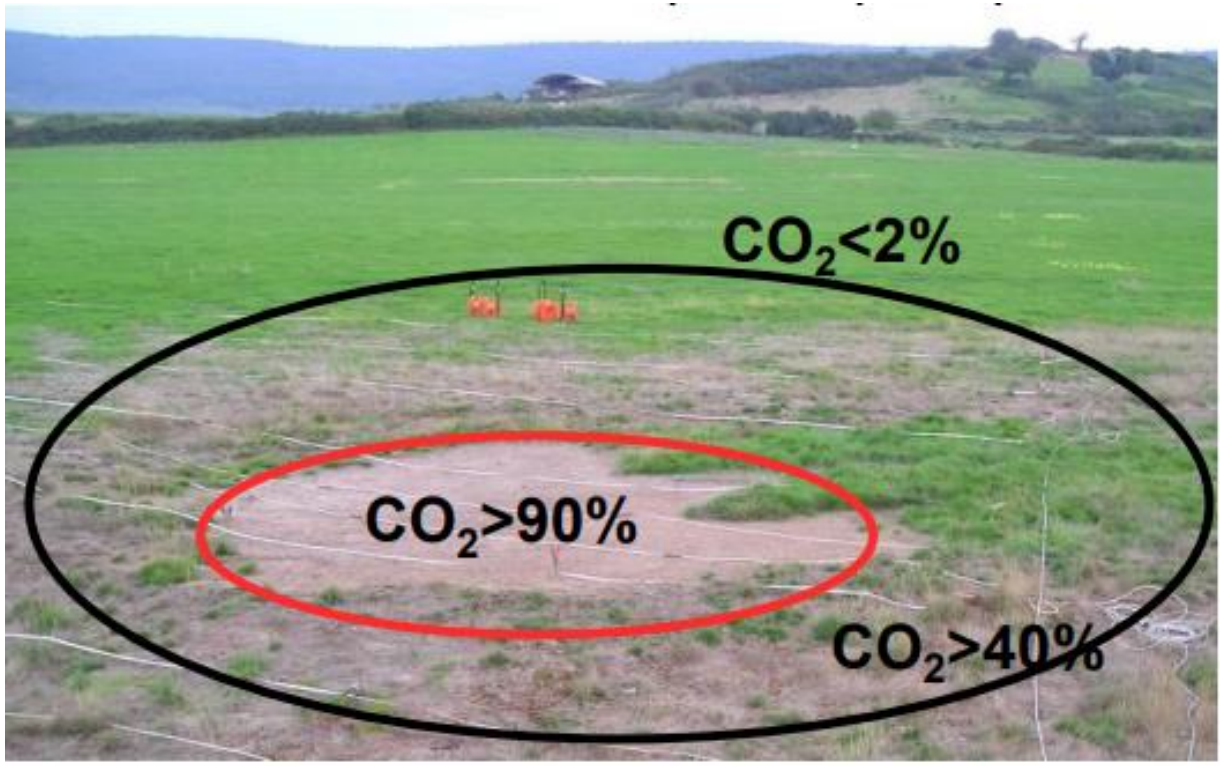
Impact of a CO2 leakage

In the Vegetation

- Depends on the concentration and the extension

In the animals and human beings

- Lethal only in large concentrations
- Dangerous in closed spaces or in Deep valleys depressions



CO2GeoNet

Natural Carbon dioxide scape in Latera (Italy)

The impact of CO2 in the vegetation is restricted to a certain area

Message Awareness

1. Sites need to demonstrate that the storage activity is under best available standards and will still be in the long term.
2. Operators need to know what happens in the subsurface to maximize the efficiency
3. Authorities need to ensure that everything is other program and safe