Geochemically coupled 2D models reproduce the formation of transition zones within potash seams

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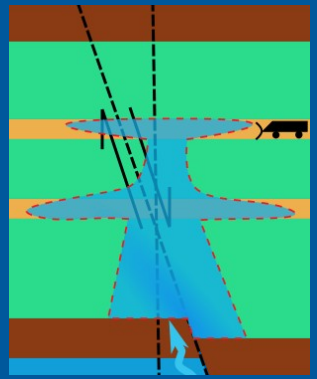

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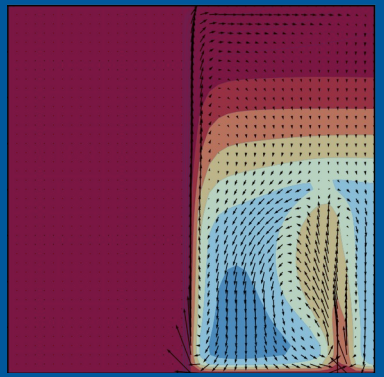

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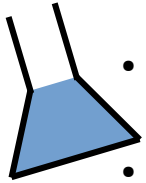
Geochemical reaction models facilitate an early detection of caverns in salt rock

Geogenic caverns = risk factor

- When does the expansion along the potash seam stop?
- Can the transition zone help to detect them earlier?

1D geochemical reaction model



- Kieserite/sylvite ratio controls the reaction path.
- Rock and brine composition change along the transition zone.
- Validated by >1000 of field data points.

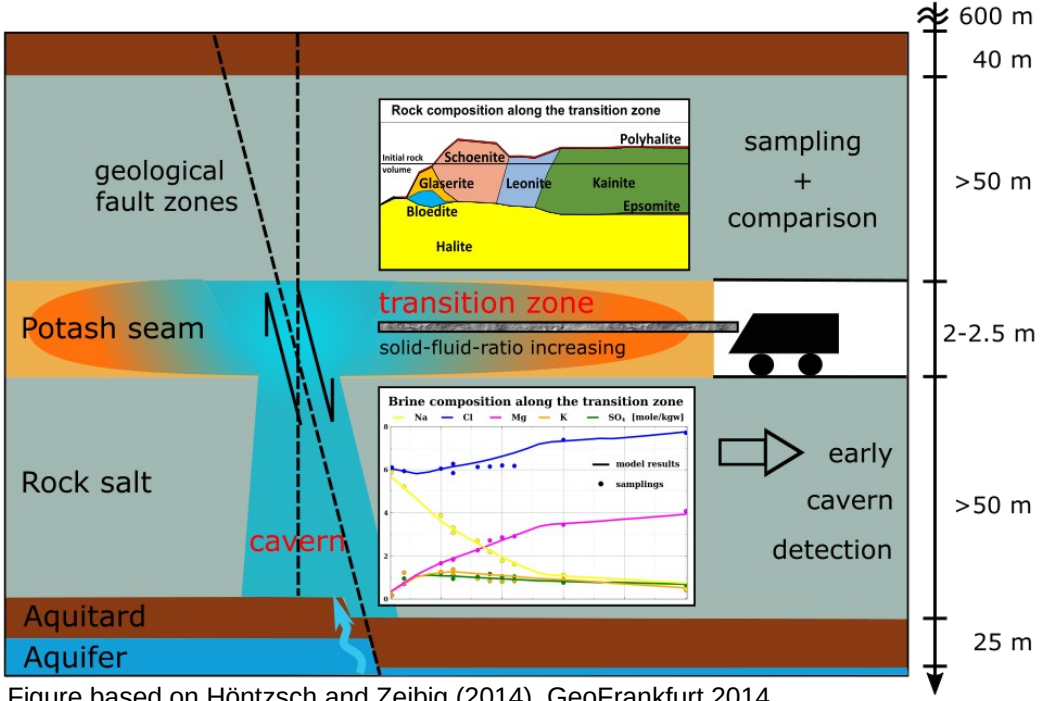
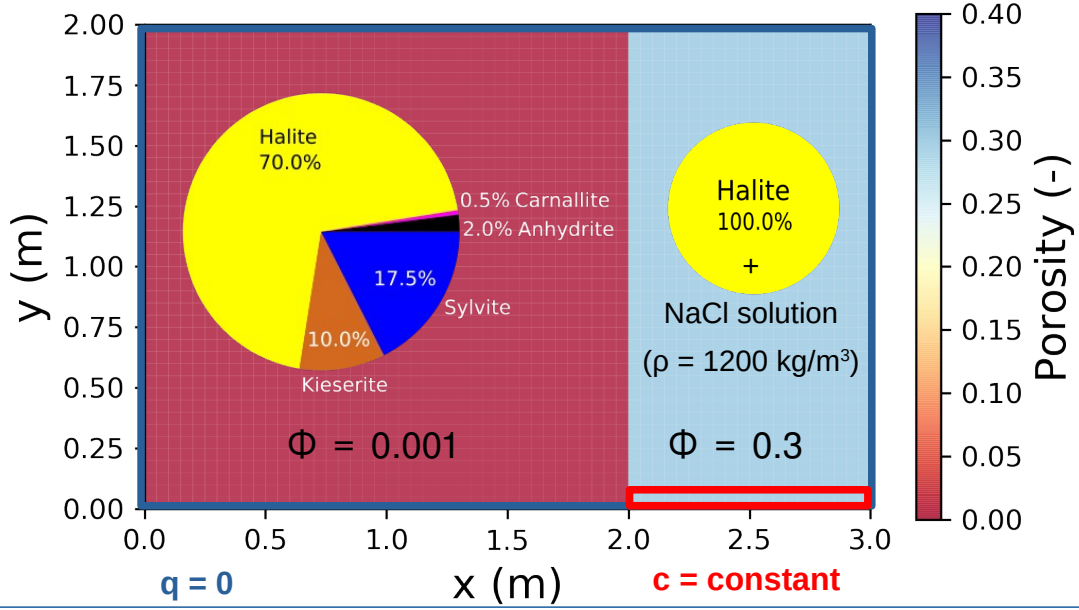


Figure based on Höntzsch and Zeibig (2014), GeoFrankfurt 2014

Steding, Zirkler and Kühn (2019), Chemical Geology (https://doi.org/10.1016/j.chemgeo.2019.119349)

Coupling geochemistry and transport enables temporal and spatial scaling of the model

2D model of the potash seam:

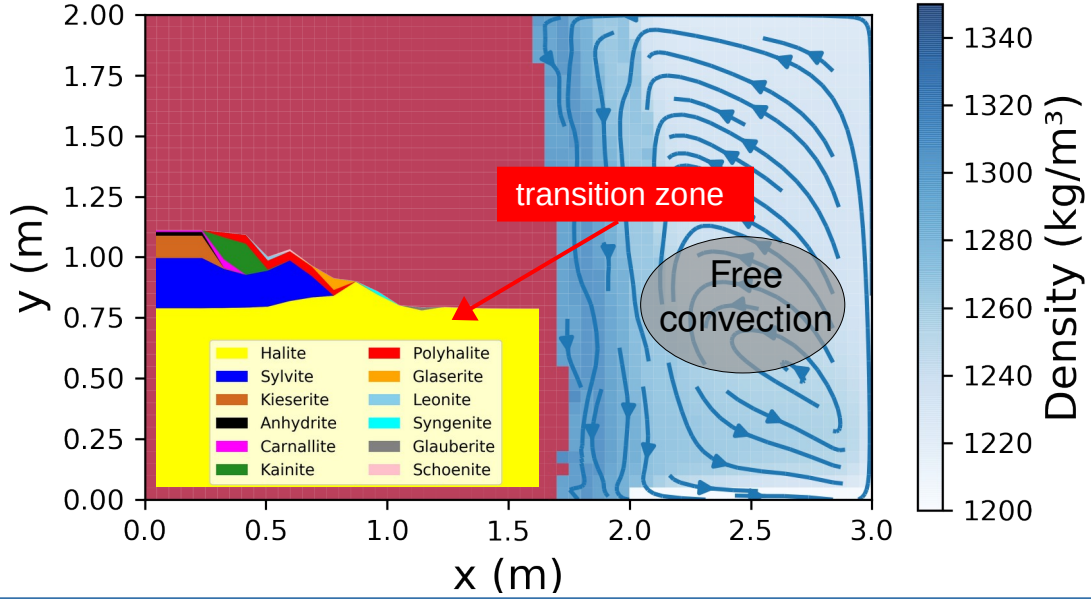


Motivation: Reproducing spatial and temporal composition of transition zones within potash seams.

Methods: Coupling PHREEQC with a density driven transport model taking into account porosity and permeability changes.

Coupling geochemistry and transport ensures temporal and spatial scaling of the model

Density distribution after 1 year:



Motivation: Reproducing spatial and temporal composition of transition zones within potash seams.

Methods: Coupling PHREEQC with a density driven transport model taking into account porosity and permeability changes.

Results: Transition zone evolves due to free convection which drives typical mineral alteration. Over time, it penetrates more deeply into the rock.