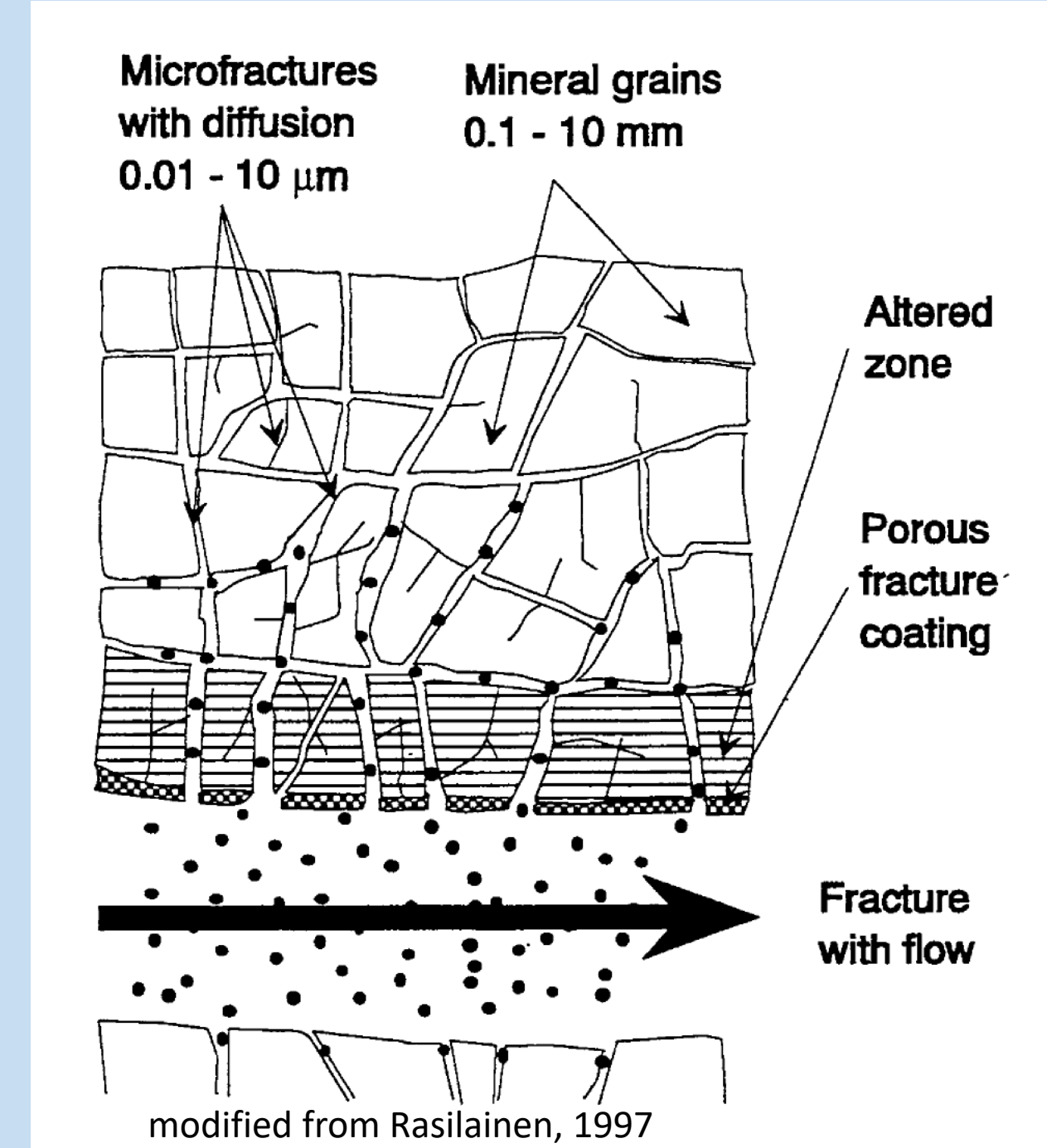


Isotopes as tool for the evaluation of aquitard – aquifer interactions

F. Eichinger

Objectives

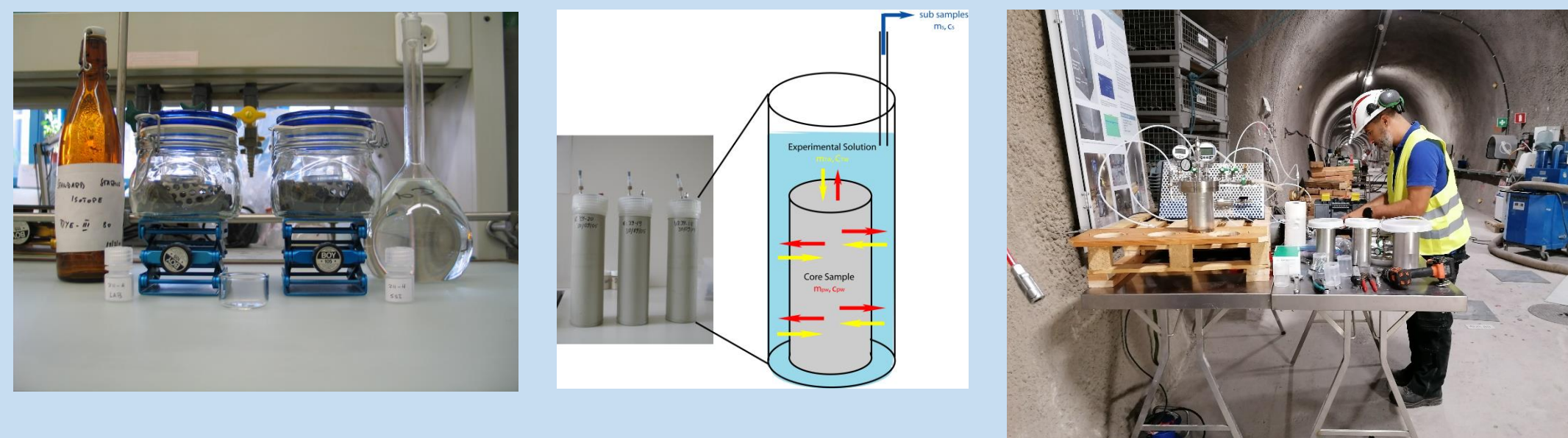
The assessment of geological sites as potential hosts for radioactive waste repositories requires a fundamental understanding of the hydrogeological and hydrogeochemical conditions. In geological environments, water occurs as advective flowing groundwater and as porewater in the inter- and intragranular pore space of the rock matrix. Both compartments interact with each other, mainly by diffusion. Due to the slow interaction, porewater is a valuable climatic and palaeohydrological archive, which delivers valuable information from the past, which can be extrapolated to future forecasts. Thereby isotopes play a significant role. Stable water isotopes can be used to evaluate the influence of meteoric water from different climatic epochs. Noble gas isotopes dissolved in porewater serve as an indirect dating method of porewater and chloride stable isotopes keep information about the origin of saline components in there. In low transmissive layered or fractured groundwater aquifers, the diffusion from and in the rock matrix plays a major role for the isotopic and chemical conditions of such groundwaters, leading to challenges in dating. Nevertheless, for a thorough evaluation of hydrogeological conditions and the palaeohydrological history of a potential investigation site, integrative porewater - groundwater studies are essential.



Methods

Porewater, that resides in the inter- and intragranular pore space of low-permeable bedrock has to be extracted by indirect methods, such as

- Isotope diffusive exchange
- Out diffusion
- Out-gassing
- Advective Displacement
- Squeezing
- etc

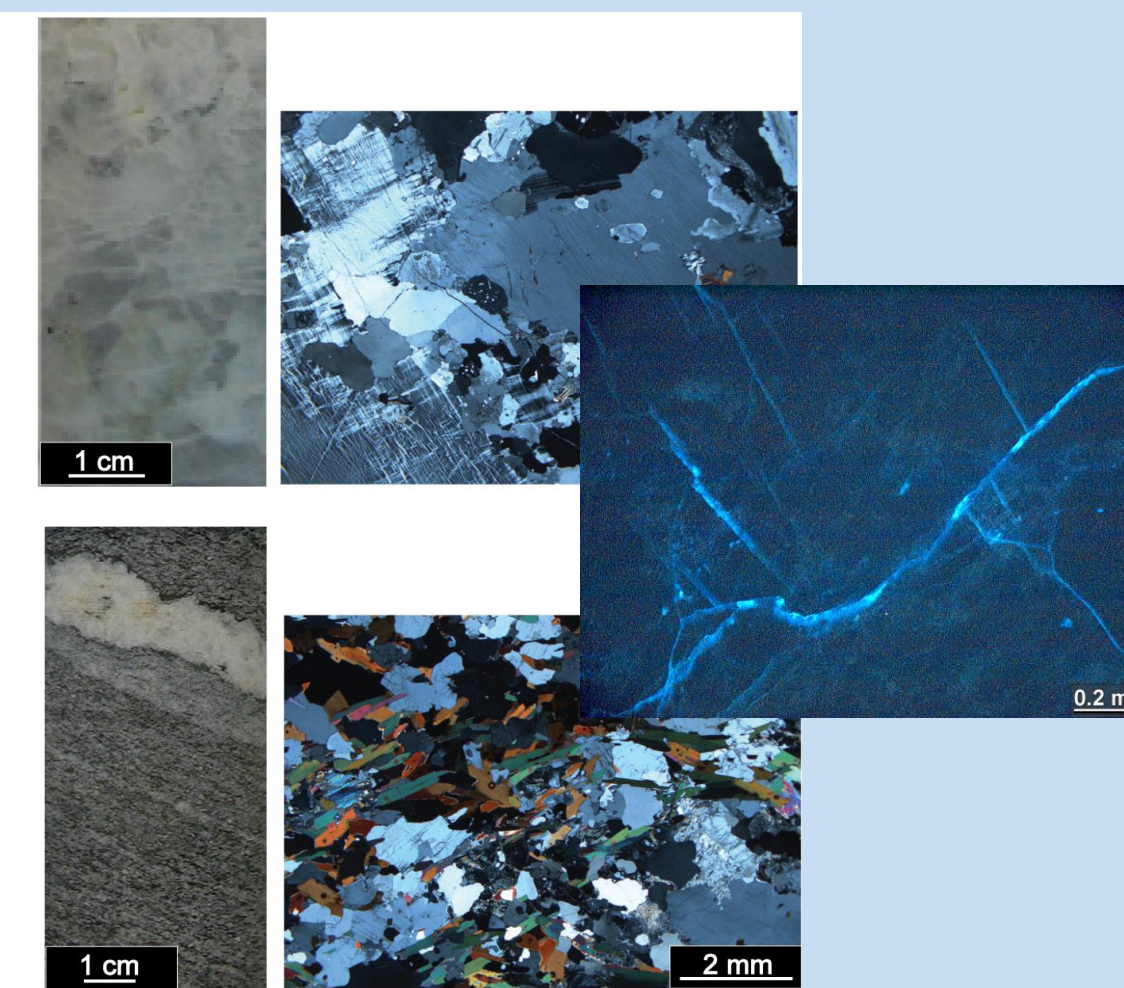


Only crystalline rocks
Only argillaceous rocks

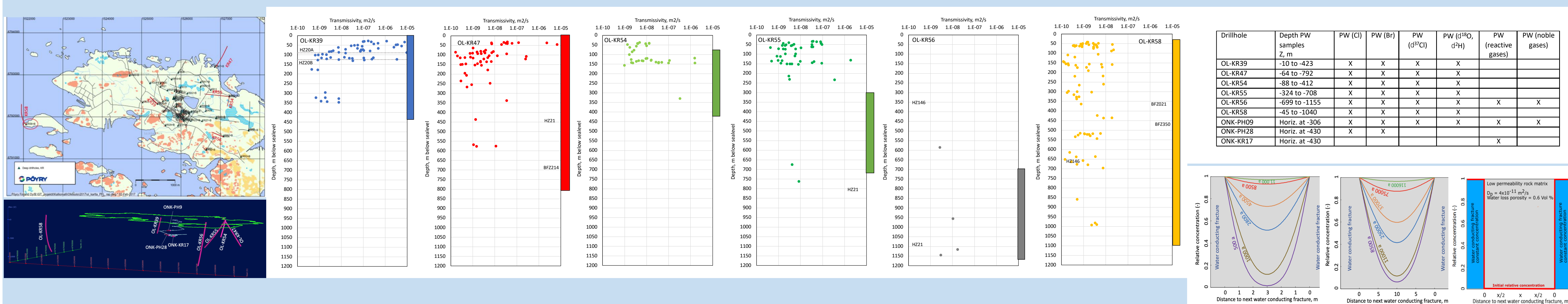
Materials

Crystalline Rocks
WL-Poro. 0.3 – 1.5 Vol.%

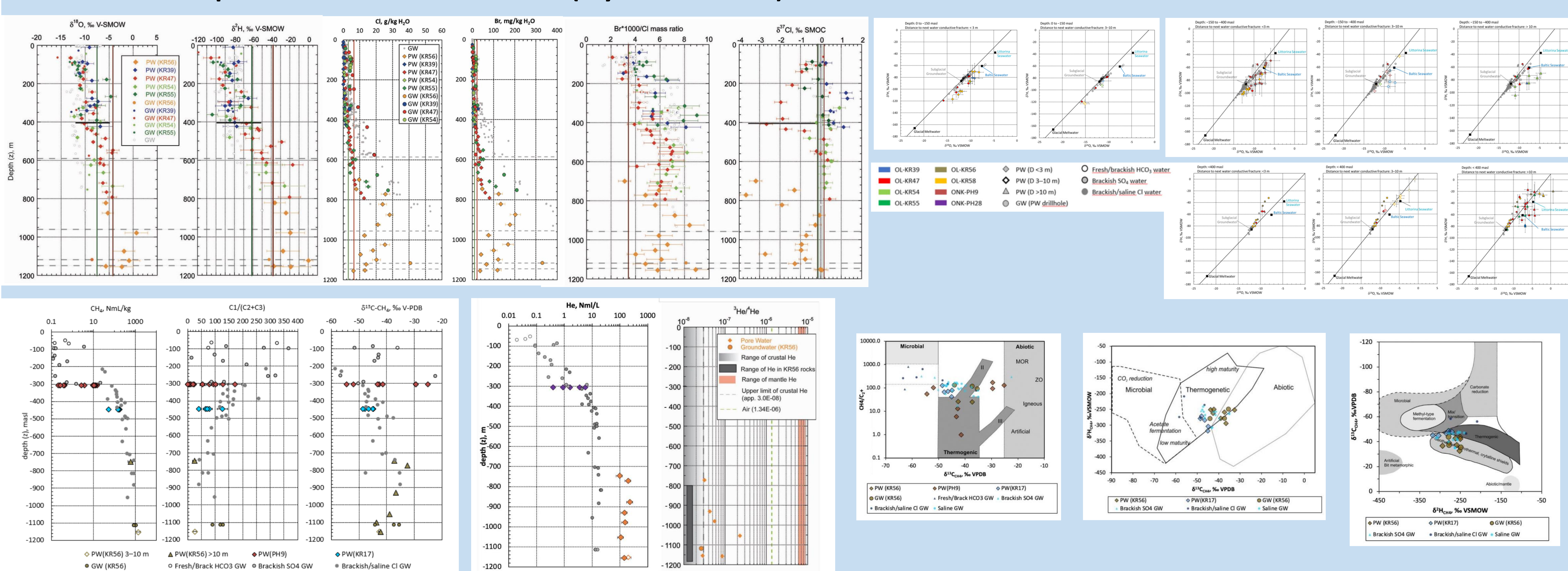
Argillaceous Rocks
WL-Poro 3 – 15 Vol.%



Palaeohydrological site investigations (Example Olkiluoto, Finland)



Porewater tracer profiles in Olkiluoto bedrock (crystalline rocks)



Posiva, 2022: Palaeohydrogeochemical Data, Concepts and Interpretation for the Olkiluoto Site. Posiva Report 2021-13, Posiva Oy, Olkiluoto, Finland
Eichinger, F., 2021: Matrix Porewater in Olkiluoto Bedrock from Drilling OL-KR58. Posiva Working Report 2021-03, Posiva Oy, Olkiluoto, Finland
(All reports can be downloaded from www.posiva.fi)

