

## Microscale variation in stable isotope composition of fracture minerals – a key to subsurface processes

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The Olkiluoto site, an island located on the western coast of Finland, is the planned site for the geological disposal of nuclear waste in Finland. Stable isotope of fracture filling minerals have been used to interpret hydrogeochemical conditions of paleogroundwaters at Olkiluoto. Especially, microscale variations in stable isotope compositions of mineral phases, obtained using secondary ion mass spectrometry (SIMS), have proven to be a useful tool in interpreting hydrogeochemical conditions.

In situ analyses of sulfur isotope composition of fracture pyrite showed the influence bacterial sulfate reduction (BSR) in bedrock fractures and the complex sulfur evolution in the fractures (Sahlstedt et al., 2013). New, microscale data on carbon isotope variations, analysed in situ by SIMS, have added information on the carbon sources in the fractures. In the upper parts of the bedrock, dissolved inorganic carbon pool was supplemented by mineralisation of organic material. The organic material likely provided substrates for BSR. At the upper parts (34 m) of the bedrock, localized methanotrophic activity was detected in anomalously low  $\delta^{13}\text{C}$  values, down to -53.8 ‰. At the depths >50 m, high positive  $\delta^{13}\text{C}$  values indicate methanogenetic activity. Comparing conventional bulk isotope analyses to in situ data showed that microscale analyses were able to provide information on processes which were masked in data obtained by bulk analytical methods.

### References:

Sahlstedt, E., Karhu, J.A., Pitkänen, P. and Whitehouse, M., 2013. Implications of sulfur isotope fractionation in fracture-filling sulfides in crystalline bedrock, Olkiluoto, Finland. *Applied Geochemistry* 32, 52-69.