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# $^4$He/U-Th dating of pore waters from Quaternary sediments of the Swiss Midland

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Dating based on the $^4$He/U-Th method can be used to estimate the residence time of pore waters in very low-permeable rocks and consolidated sediments. The residence time is inferred from the time necessary to accumulate radiogenic $^4$He measured in the pore water being produced by the decay of U and Th in the sediment matrix [1].

In the Jurassic Opalinus Clay, the pore water still contains the signature of the original marine formation water that was entrapped during sediment deposition. The pore water composition was altered only by diffusive processes [2]. The fact that even ~100-Ma-old water signatures can be preserved in their original pore space suggests that such preservation might also be possible in younger dense glacial deposits. Evidence from lacustrine sediments [3], suggest that, if the solute transport in the pore space is sufficiently attenuated, even unconsolidated sediments can “store” and host “old” pore waters.

Here we investigate if the $^4$He/U-Th dating of pore waters can be used as a novel tool to complement other dating tools (e.g., optically-stimulated luminescence) of unconsolidated Quaternary sediments. We applied the $^4$He/U-Th method to date pore waters in the time range of 10 to 100 thousands of years which covers the age range of the sediments targeted by the Quaternary drillings (QBO) conducted by the National Cooperative for the Disposal of Radioactive Waste in Switzerland. We focus on fine-grained lacustrine sediment layers that might provide low-permeability conditions suitable for the preservation of radiogenic $^4$He concentrations.

We report the results of the $^4$He/U-Th dating based on the measurements conducted in sediment samples from the QBO Hochfelden-Strassberg, highlighting potential and challenges of the method with respect to the studied sediments of the Swiss Midland.

[1] GCA 49, 1211–1218. [2] WRR 43(4). [3] QSR 104, 117–126.