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D. Rufer, H.N. Waber, T. Gimmi

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# Identifying temporally and spatially changing boundary conditions at an aquifer – aquitard interface using helium in porewater

D. Rufer <sup>a,\*</sup>, H.N. Waber <sup>a</sup> and T. Gimmi <sup>a, b</sup>

<sup>a</sup> RWI, Institute of Geological Sciences, University of Bern, CH-3012 Bern, Switzerland

<sup>b</sup> Paul Scherrer Institut, CH-5232 Villigen, Switzerland

\* Corresponding author: Daniel Rufer, Institute of Geological Sciences, Baltzerstrasse 1+3, CH-3012 Bern, Switzerland; email: [daniel.rufer@geo.unibe.ch](mailto:daniel.rufer@geo.unibe.ch)

## Abstract

Helium concentrations and  $^3\text{He}/^4\text{He}$  isotope ratios of porewater, groundwater and rock were measured on samples collected from a Jurassic sediment sequence at the Mont Terri underground rock laboratory (Northern Switzerland). Porewater He data of rock samples collected from borehole BDB-1 at high spatial resolution across a karstic limestone unit (Passwang Formation) into the underlying claystone sequence (Opalinus Clay, Staffelegg Formation) describe a continuous profile from the water-conducting zone in the limestone into the clay-rich rocks of low permeability. Concentrations of  $^4\text{He}$ ,  $^3\text{He}$  and their parent nuclides in the rock allow calculating in-situ production and accumulation terms. Since the time of sedimentation, 90% - 97% of the in-situ produced  $^4\text{He}$  has been released to the porewater. Today only 2.5% of the maximum possible accumulated  $^4\text{He}$  is still retained in the porewater while the major part of in-situ produced  $^4\text{He}$  was removed from the system presumably by porewater–groundwater exchange. The porewater  $^4\text{He}$  concentrations show a diffusion profile from the aquitard towards the aquifer, reflecting a) a transient state

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