# Seismic Characterization of Old Excavation Damaged Zones at the Mont Terri Underground Rock Laboratory in Switzerland



**Author(s):**
Williams, Molly; Ziegler, Martin; Manukyan, Edgar; Loew, Simon

**Publication date:**
2018-04-13

**Permanent link:**
https://doi.org/10.3929/ethz-b-000276591



**Originally published in:**
Geophysical Research Abstracts 20

Geophysical Research Abstracts
Vol. 20, EGU2018-11756-2, 2018
EGU General Assembly 2018


# Seismic Characterization of Old Excavation Damaged Zones at the Mont Terri Underground Rock Laboratory in Switzerland

Molly Williams, Martin Ziegler, Edgar Manukyan, and Simon Loew
Department of Earth Sciences, ETH Zurich, Switzerland (molly.williams@erdw.ethz.ch)

The Opalinus Clay is the formation chosen as the potential host rock for Switzerland's high- and low-level nuclear waste. The assessment of the long-term properties and behavior of the Excavation Damaged Zones (EDZs) evolving around underground emplacement drifts is important for assessing the safety and potential risks associated with the Swiss nuclear repository concept. Due to the self-sealing nature of clay rocks, EDZs will reduce in hydraulic permeability over time through hydromechanical, chemical, and biological processes. The project "Self-sealing Processes" (SE-P) focuses on understanding these processes in previously well-studied EDZs on long (10-20 year) time scales. SE-P is funded by the Swiss Nuclear Safety Inspectorate (ENSI) and carried out together with the Federal Office of Topography in Switzerland (Swisstopo), the Federal Institute for Geosciences and Natural Resources in Germany (BGR), and the ETH Zurich Institute for Geophysics.

We have chosen two sites of interest in the Mont Terri Underground Rock Laboratory: galleries 98 and 08. These galleries were excavated approximately perpendicular to bedding strike by road header in 1998 and 2008, respectively. They contain previously characterized EDZs with large data sets that we can use to compare what rock and rock mass properties have changed over time. Depending on the site, prior data includes electrical resistivity, seismic refraction, seismic interval velocity measurements in boreholes, core logs, resin-injection studies, and hydraulic and pneumatic tests.

The first in-situ experiment of the SE-P project is a refraction seismic study carried out between November 2017 and January 2018. With these investigations the velocity structure of the near-gallery rock mass can be determined. At best, the velocity changes can be identified and interpreted (e.g., as sealing zones) once compared with older data sets. We recorded seven seismic refraction lines of 27–35 m length that were set up along the strike directions of the two galleries (six lines at gallery side walls and one line in the gallery crown). Initial tests were completed with one-component geophones placed into the shotcrete with a spacing of about 0.5 m. The source for these lines was a hammer impacting on the shotcrete surface. In order to understand the potential influence of the shotcrete support layer on the results, short boreholes were drilled to place geophones and sources directly into the Opalinus Clay Shale. The data will be processed using travel time inversion that takes into account bedding anisotropy. In addition, we sampled the shotcrete plugs from the boreholes to investigate the compressional and shear wave velocities in the lab.

We aim to present the results of this seismic characterization, including identification of possible sealed zones and the changes that have occurred in the seismic properties since initial testing. Based on these results we can then select EDZ locations for drilling, borehole experiments, and a comprehensive laboratory program on the cored rock material to investigate sealing processes.