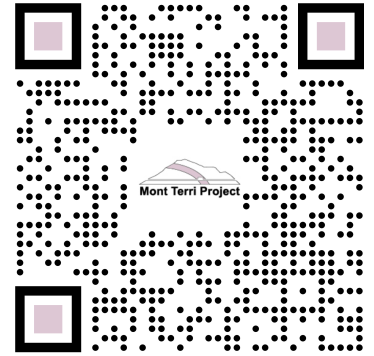


# Mont Terri Project Underground Rock Laboratory

Report period: November 27 – December 3, 2023

Assembled and edited by swisstopo, St-Ursanne



**Spotlight of the week:** HT experiment: Hydrogen gas is expected to be generated by anoxic corrosion of the steel present in a deep geological repository for nuclear waste. The Hydrogen Transfer (HT) experiment started in 2009, the objective is to determine the fate of  $H_2$  in the Opalinus Clay: can  $H_2$  consumption be detected in situ? Do micro-organisms play a role? The experimental concept is based on gas circulation and water sampling in a borehole in which pure  $H_2$  started to be injected in 2011, then pure  $D_2$  since 2021. The figure shows (from left to right) the water sampling module, the gas circulation module and the Raman spectrometer used for gas composition monitoring.

## **CD-A (Influence of Humidity on Cyclic and Long-Term Deformations) experiment**

- On Tuesday, November 28, S. Schefer (swisstopo) removed the ERT data acquisition system from CD-A and moved it to the CL test boreholes. The tiltmeters had to be stopped too because they use the same UPS. The acquisition system will be back to CD-A on Friday afternoon.
- On Friday, December 1, J. Windisch and S. Schefer (swisstopo) measured the geodetic position of the NMR measuring surfaces in Niche Closed Twin.

## **CI-D (Diffusion Across 10-Year-Old Concrete/Claystone Interface) experiment**

- On Monday, November 27, A. Eul and J. Eul (Eul GmbH) drilled 3 stabilisation boreholes, two of 2.1 m length (outer stabilisation with GFK tubes) and one with 1.9 m length (inner stabilisation with GFK threaded rods). U. Mäder (RWC) did the resin injection for the two holes with tubes - the one with a threaded rod will be done tomorrow after lifting the drilling template a bit for a better view with the borehole camera.
- On Tuesday, November 28, A. Eul and J. Eul (Eul GmbH) drilled the remaining 3 stabilisation boreholes. We decided to drill also the central position for stabilisation and position a 2 m-long M16 threaded steel rod there. This might be the easiest option to lift the core after drilling. U. Mäder (RWC) measured only background activity on the small cores despite that some are positioned quite close to the circulation interval. U. Mäder impregnated a section of BCI-D4-OC1 with Denepox resin in its PVC liner. Some samples were measured for weight-loss and drying at 105 degC to determine water content .
- On Wednesday, November 29, was a happy day! A CI-D core was born at 5 pm. Measures 2.15 m, and weighs in at a healthy 520 kg. The core is very healthy and was named BCI-D1-OC. The three daddies are very proud, although a bit tired. Borehole BCI-D1-OC extends from 5.38 m depth (inside the steel liner of BCI-D1) and was drilled with a diameter of 350 mm to 7.53 m absolute depth (2.15 m of retrieved core) (**Figure 1**).
- On Friday, December 1, U. Mäder (RWC) and A. Jenni (RWI) with the help of S. Schefer (swisstopo) used the big saw for cutting discs from the core of BCI-D1-OC. These discs contain the circulation interval. Radio protection measures were in place and all the readings showed background values, in some places close to the interval up to 1 cps (**Figure 2**).

## **CL (CO<sub>2</sub>LPIE-CO<sub>2</sub> Long-Term Pulse Injection) experiment**

- On Monday, November 27, A. Grignaschi (swisstopo) together with A. Rinaldi (ETHZ) tested the fibre optic cables that have been installed in BCL-3 and BCL-4 and attached them to the interrogator of CS-E (**Figure 3**).
- On Monday, November 27, M. Ziegler, D. Jaeggi, J. Windisch and A. Grignaschi (swisstopo) together with S. Czerner and T. Fritsche (ZHAW) and A. Eul (Eul GmbH) installed modular multi-sensor monitoring systems (MMMS) that hold in place fiber optic sensor cables, electrodes, as well as acoustic and temperature sensors, inside the CL pre-test boreholes BCL-3 and BCL-4 (**Figure 4**).
- On Tuesday, November 28, J. Windisch and L. Borgeaud (swisstopo) adjusted all the lines and sensor cables while A. Grignaschi and S. Schefer (swisstopo) attached the fiber optics and performed the first baseline measurement.
- On Tuesday, November 28, S. Schefer (swisstopo) moved the ERT measuring system to boreholes BCL-3 and BCL-4 and M. Furche (BGR) remotely measured the first ERT profiles in both boreholes.
- On Wednesday, November 29, M. Ziegler, D. Jäggi and J. Windisch (swisstopo) filled the annulus space of BCL-4 with resin. Borehole temperature, strain, and electrical resistivity were monitored. Active ambient air flushing inside the borehole was used to control resin polymerisation temperature for the next 48 hours (**Figure 5**).

## **DR-E (Long-Term Diffusion Experiment in the Main Fault-Zone) experiment**

- On Tuesday, November 28, A. Ammon (Solexperts) replaced the injection pumps in both cabinets and performed a leakage test on tracer vials.

## **FE-M (Long-Term Monitoring of the Full-Scale Emplacement Experiment) experiment**

- On Thursday, November 30, S. Schefer (swisstopo) measured water content (PR2 inside BFE-B49) and thermal conductivity (KD2) inside the FE-tunnel.

## **SW-A (Large-Scale Sandwich Seal in Opalinus Clay) experiment**

- On Wednesday, November 29, T. Theurillat and D. Jaeggi (swisstopo) refilled the HPT of shaft 1 and the LPT of shaft 2.

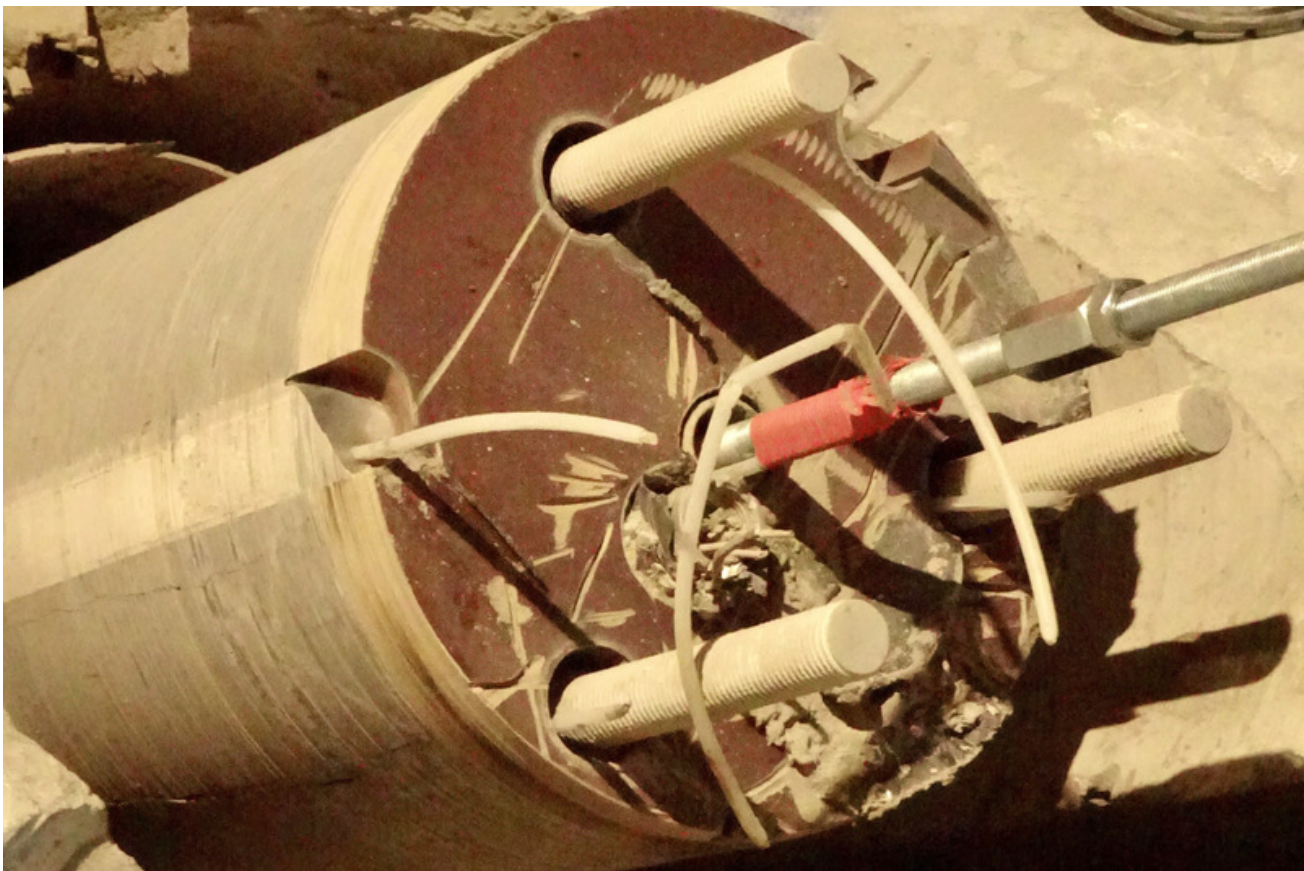
## **Varia**

- On Monday, November 27, a power outage in Niche FE-A on Friday late afternoon due to FI problems on a consumer led to a loss of a connecting fiber and therefore put several computers offline for the weekend. Some of the computers were shut down after the eventual loss of the backup power. Unfortunately, the incident wasn't realised until Monday morning.

## Visits

Day	Date	Group Name	Group Size	Visitors Guide
Tue	28.11.2023	Hochschule Luzern HSLU	10	C. Nussbaum (swisstopo) R. Nicol (swisstopo)
Thu	30.11.2023	Sinitude	27	C. Nussbaum (swisstopo)
Fri	1.12.2023	RCJU Section Des Bâtiments Et Des Domaines	22	C. Boner (freelance) R. Nicol (swisstopo)
Sat	2.12.2023	Feuerwehrverein Bärschwil	12	H. Hauser (freelance)

## Figures



**Figure 1: CI-D:** BCI-D1-OC after retrieval from the approach borehole. The RN circulation interval is contained in this OPC section. One of the cut fiberglass stabilization tubes is seen along the top edge. At the top (red-brown) is a section of the Hgw base plate of the approach borehole (U. Mäder (RWC)).



**Figure 2: CI-D:** The core is in place, ready for sawing. It weighs around 500 kg (S. Schefer, swisstopo).



**Figure 3: CL:** Pulling a fiber through the lab is like working out... (S. Schefer, swisstopo).



**Figure 4: CL:** Many sensor cables and tubes had to be neatly placed for the installation (S. Schefer, swisstopo).



**Figure 5: CL:** Resin injection in BCL-4 (A. Grignaschi, swisstopo).