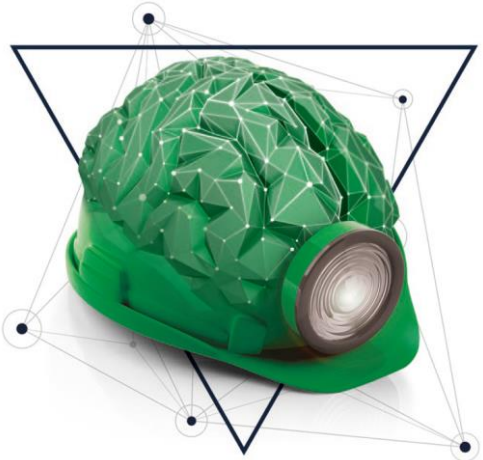
DIM ESEE-2 innovative workshop

Dubrovnik 20-22nd of Oct. 2021



Case studies: exploration of flooded underground spaces, the UNEXMIN-UNEXUP story

NORBERT ZAJZON
INSTITUTE OF MINERALOGY AND GEOLOGY
UNIVERSITY OF MISKOLC, HUNGARY

RICHARD Z. PAPP
UNEXMIN GEOROBOTICS LTD.

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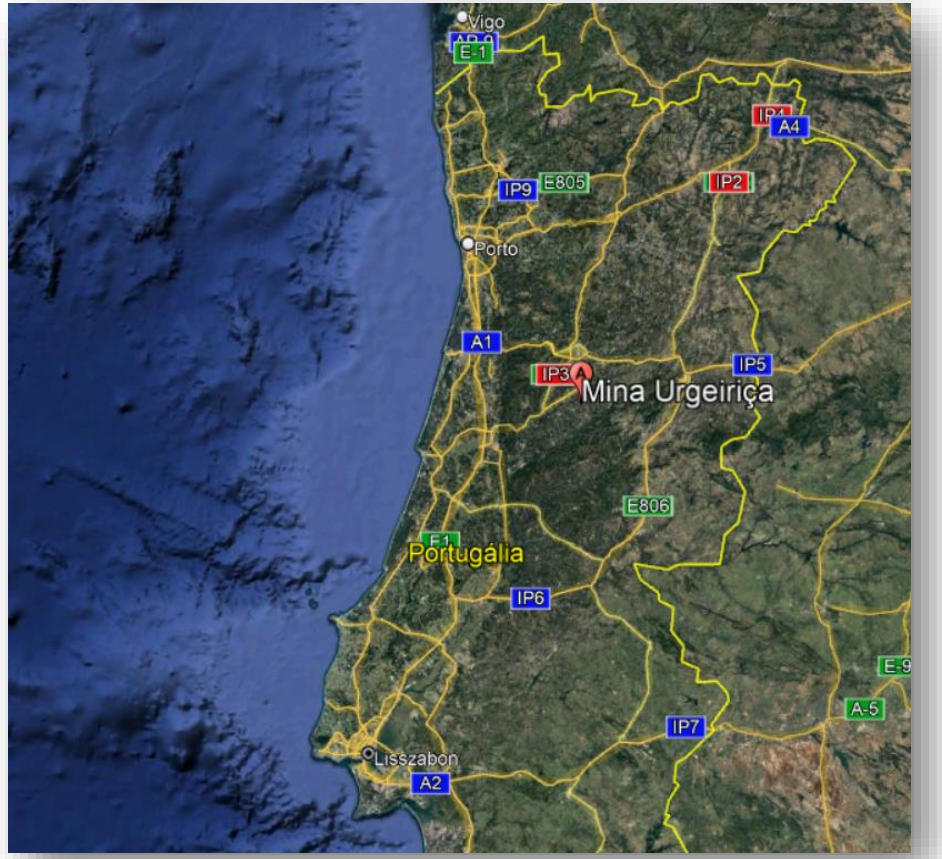
Case study 1: uranium mine, Urgeiriça, Portugal



6th of March to 7th of April 2019 (2021...)

Uranium mine in granite pegmatite

Flooded from ca. 7 m below the surface

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Urgeiriça mine map

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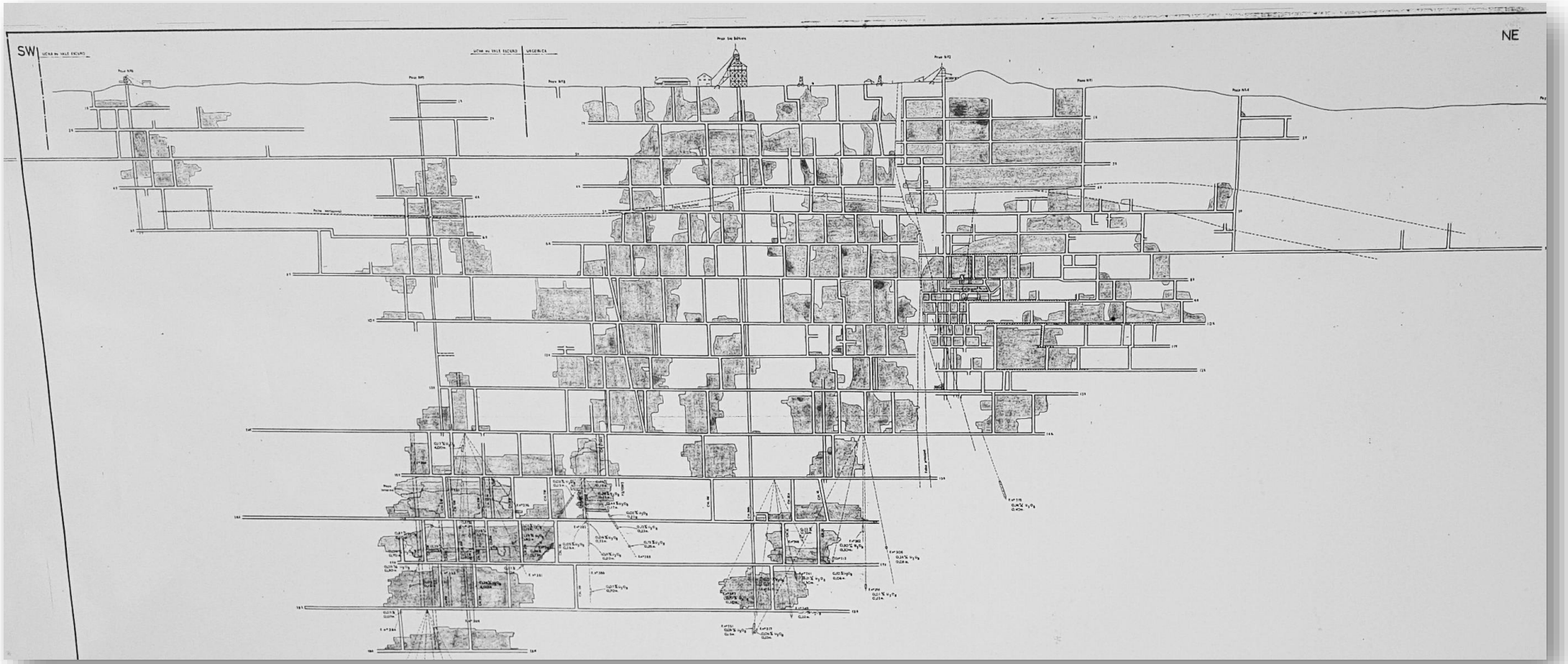
Urgeiriça mine map



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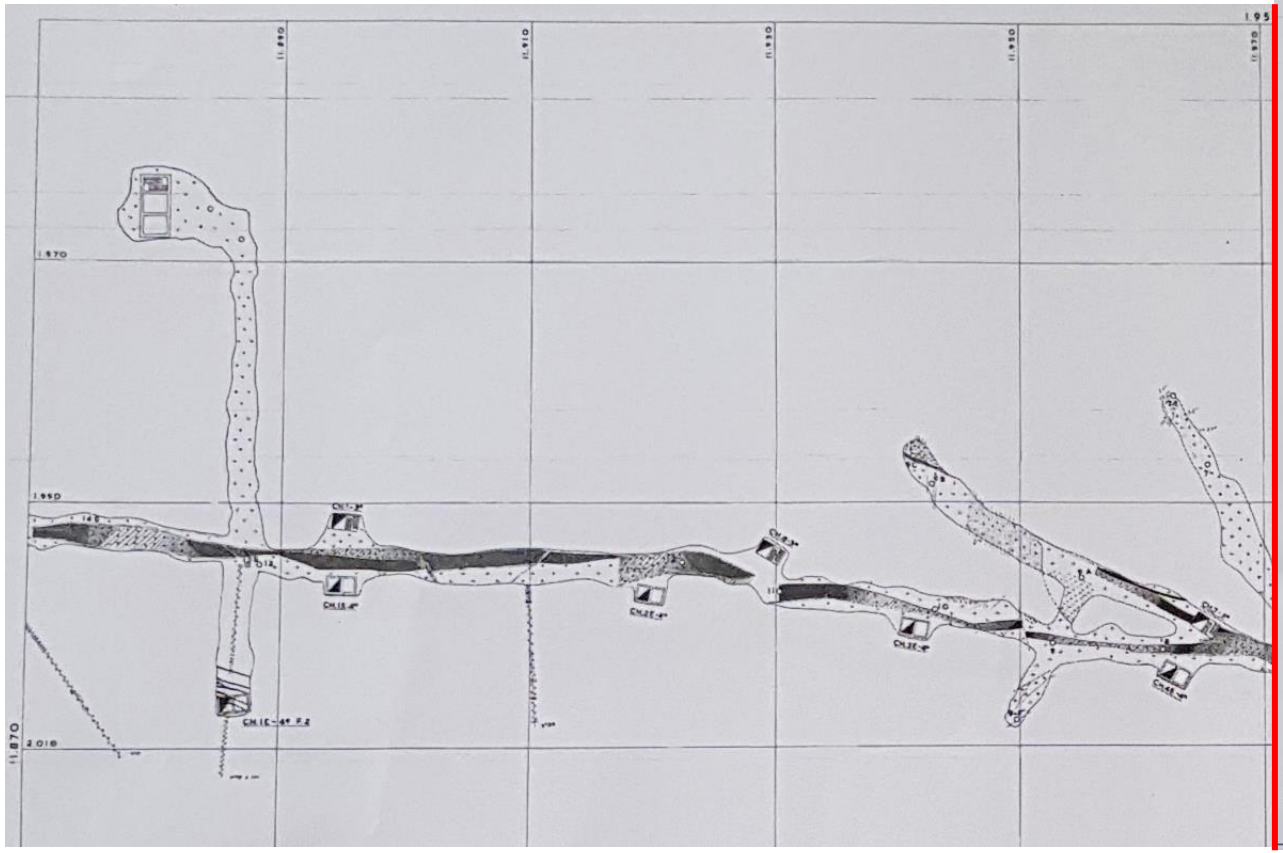
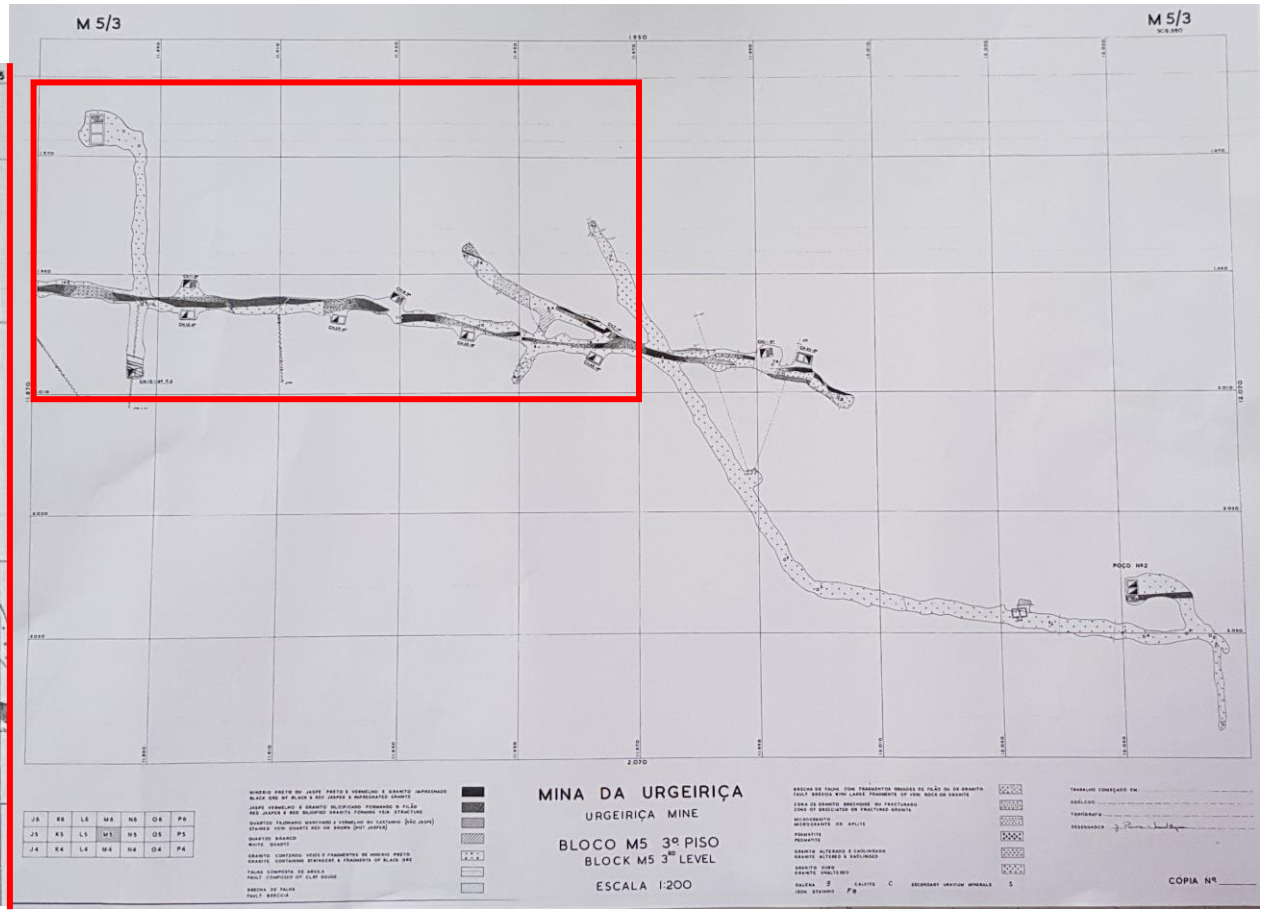
Urgeiriça, map of a level in the mine





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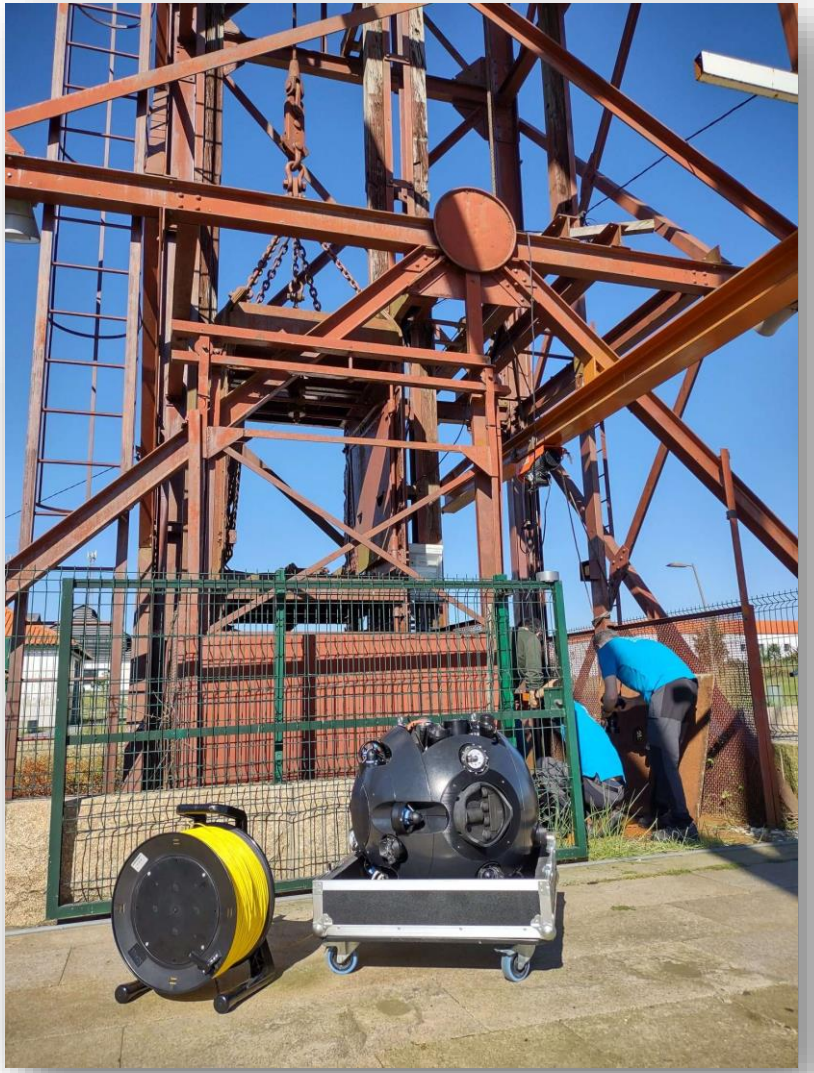
The control room and the shaft



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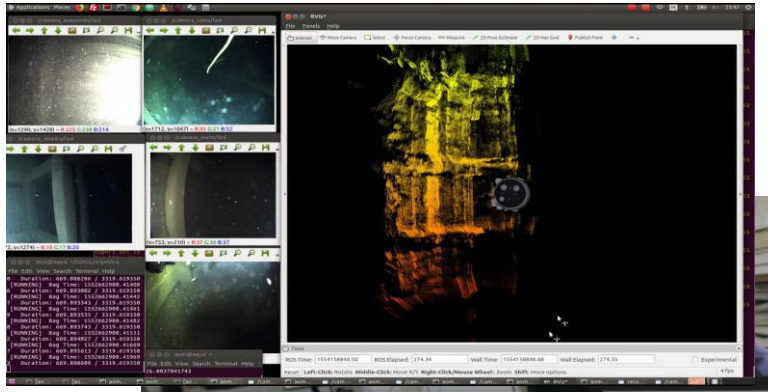
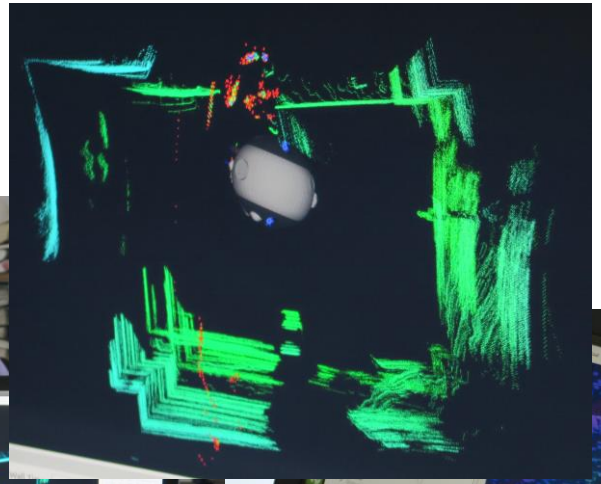
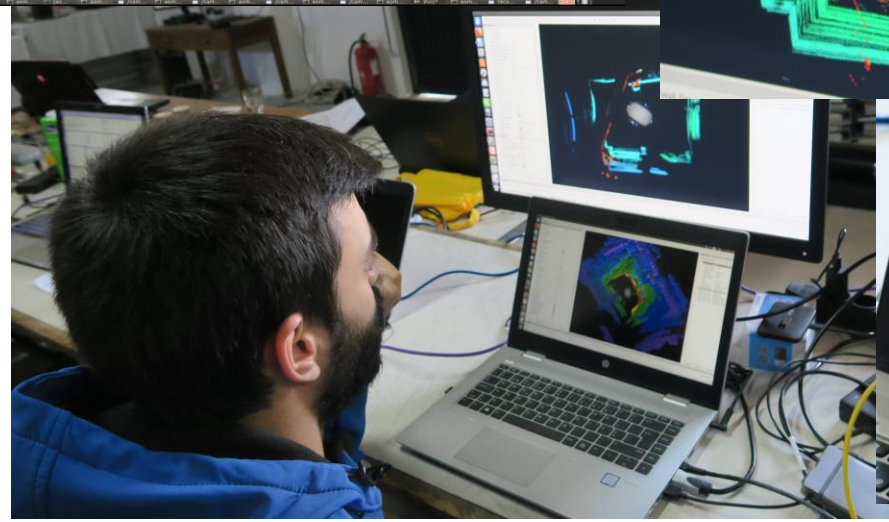
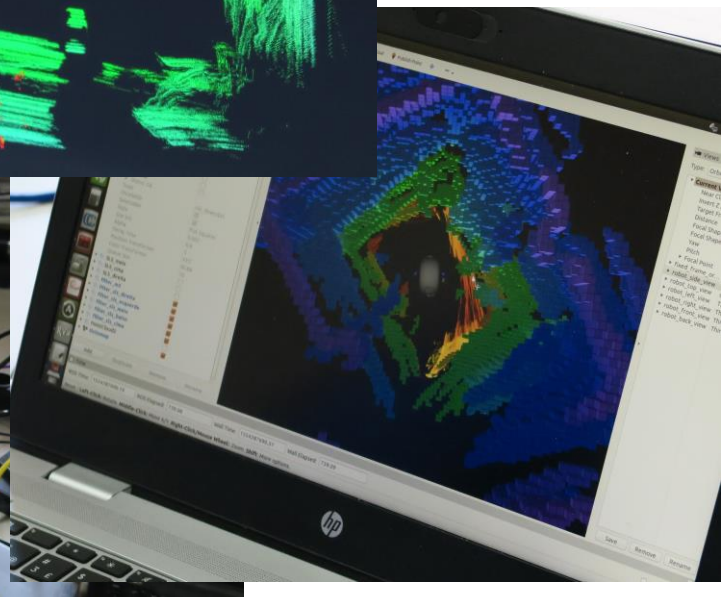
Mapping: from sonar + SLS (+DVL) to octomap









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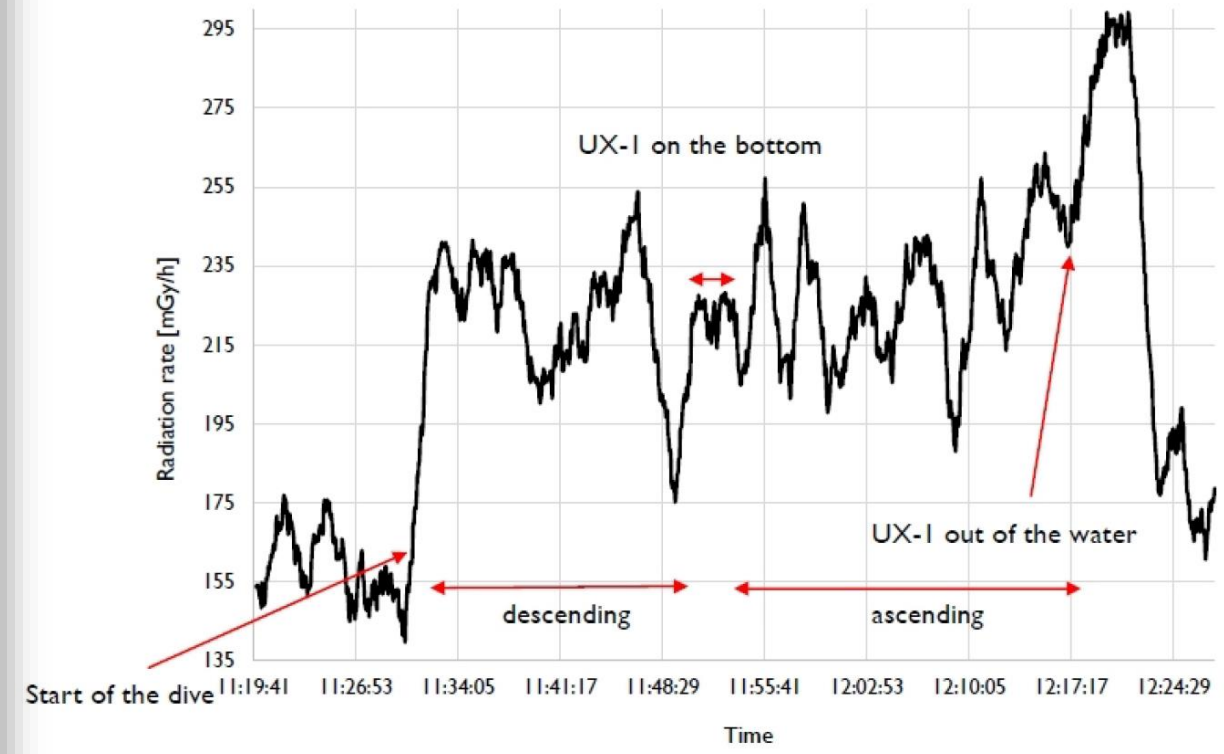

Granite with black veinlets (possibly pichblende)

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Case study 2: copper mine, Ecton, United Kingdom

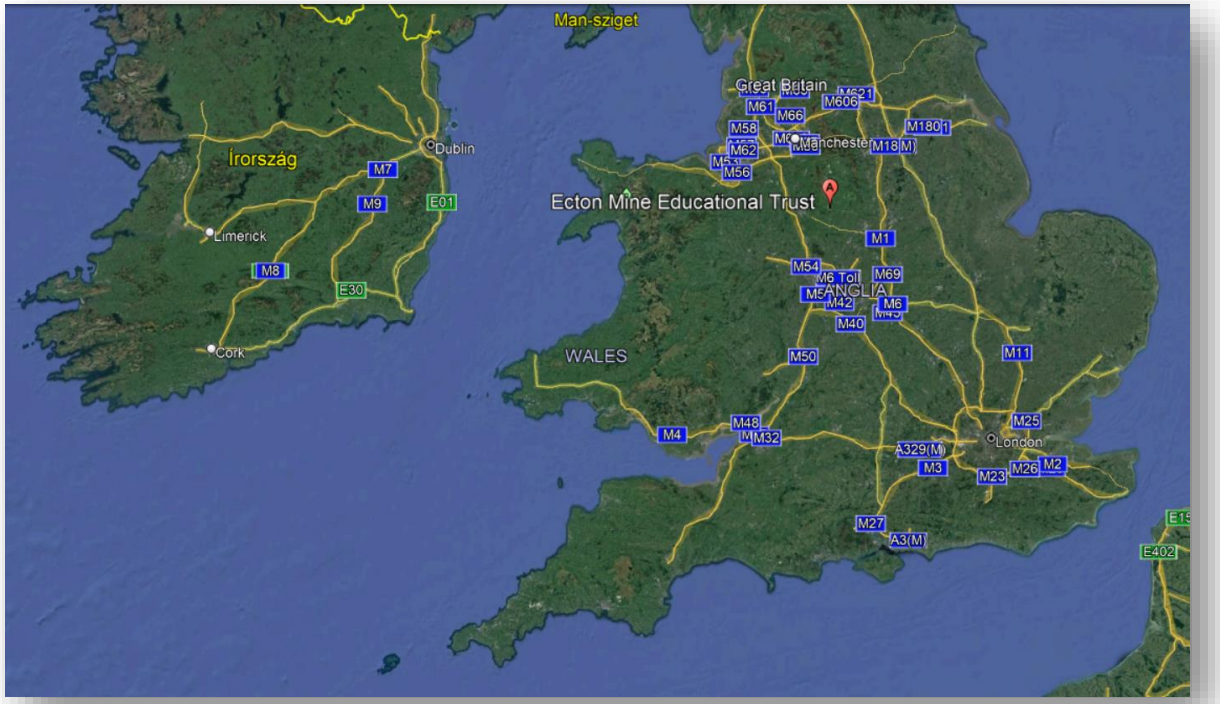
9-31st of May 2019

Cu – (Zn-Pb) mine

Mississippi-valley type mineralization

National monument site

Abandoned and flooded from 1850-55



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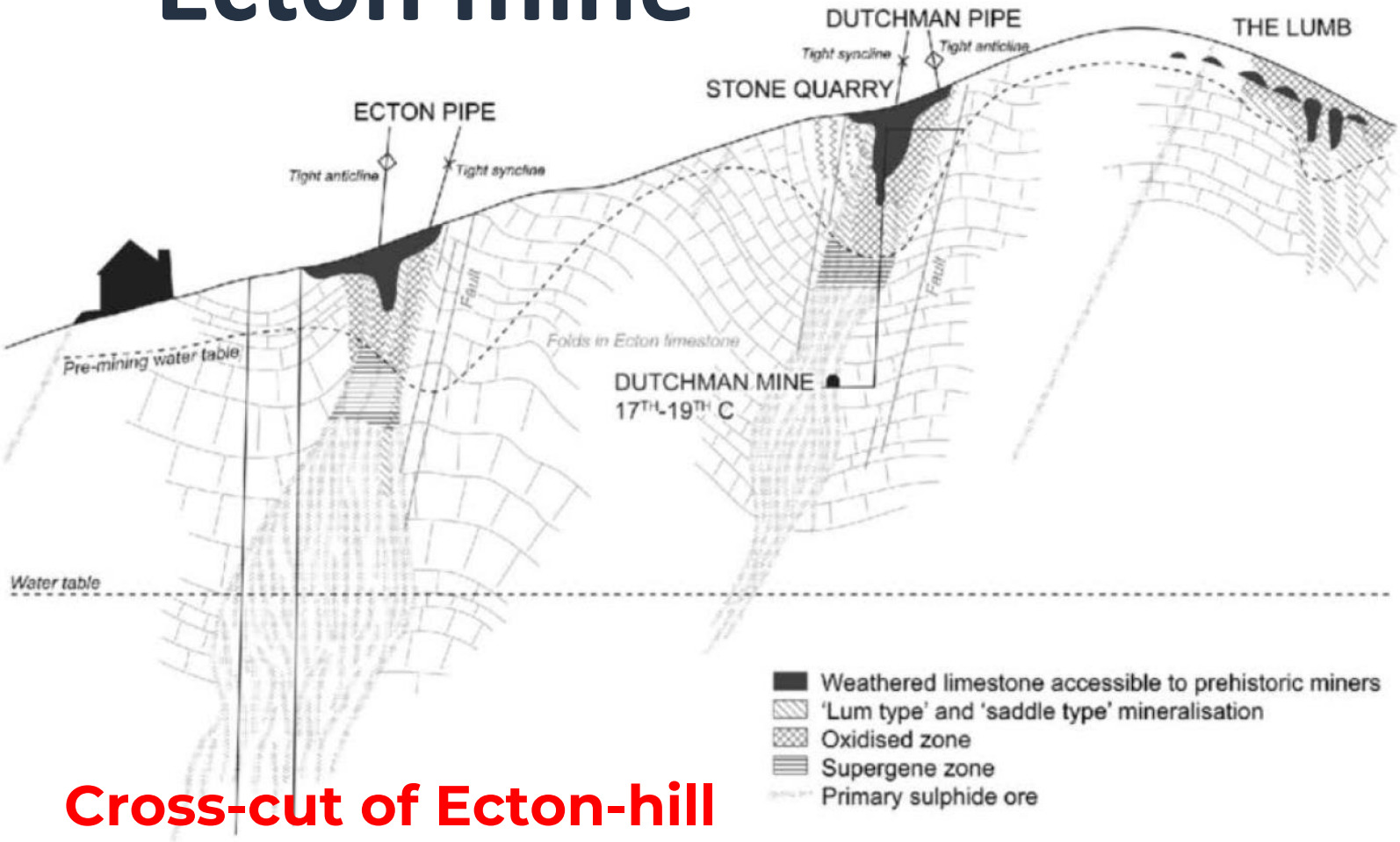
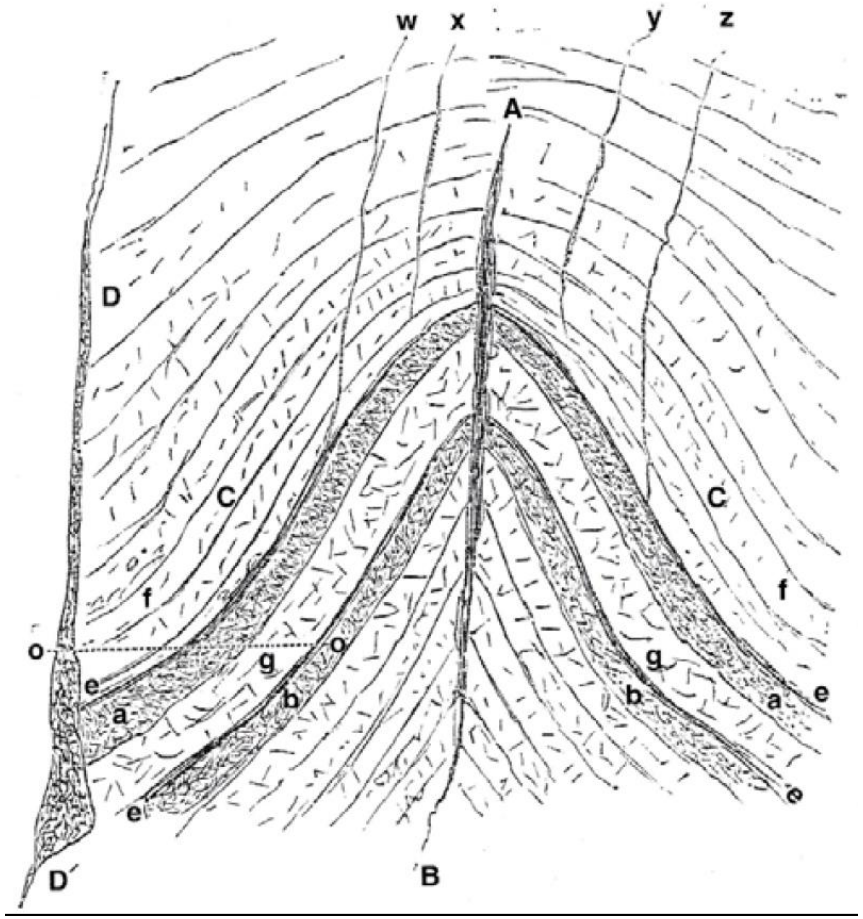
Ecton mine



Cross-cut of Ecton-hill



Mineralization process

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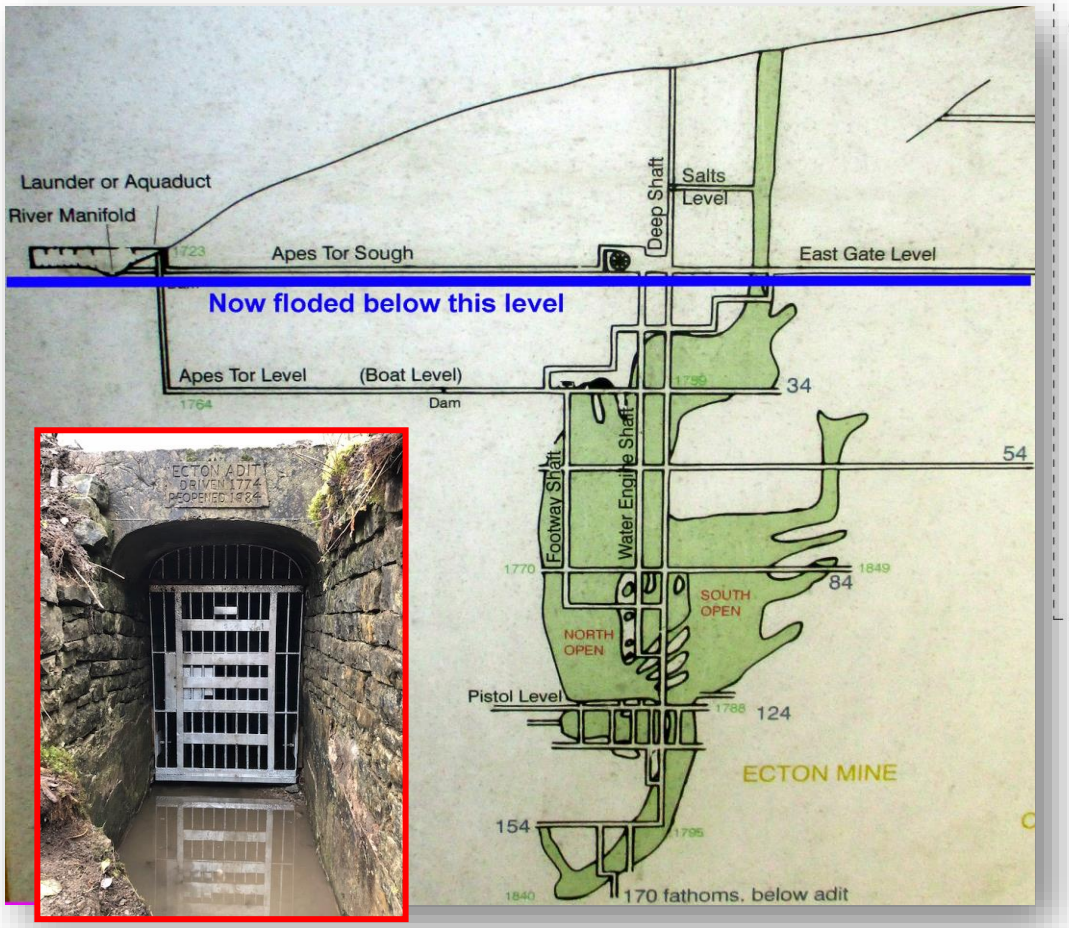
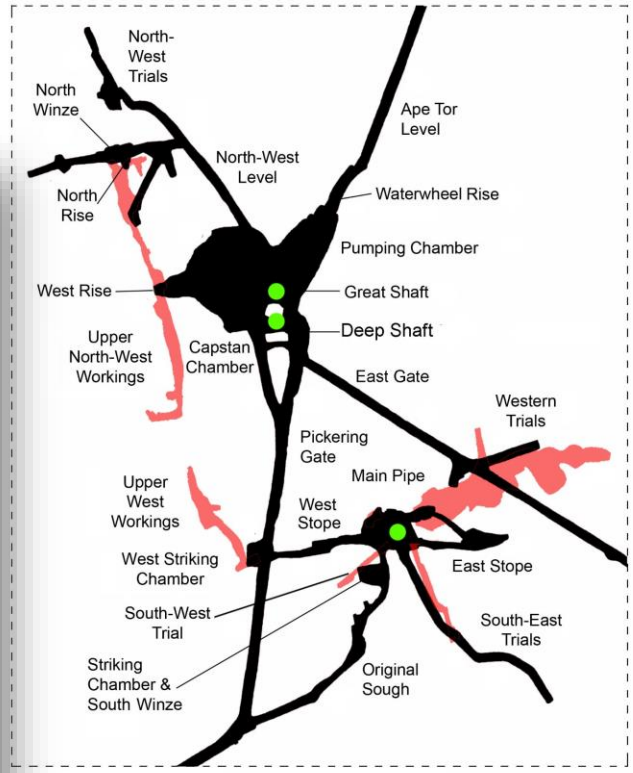
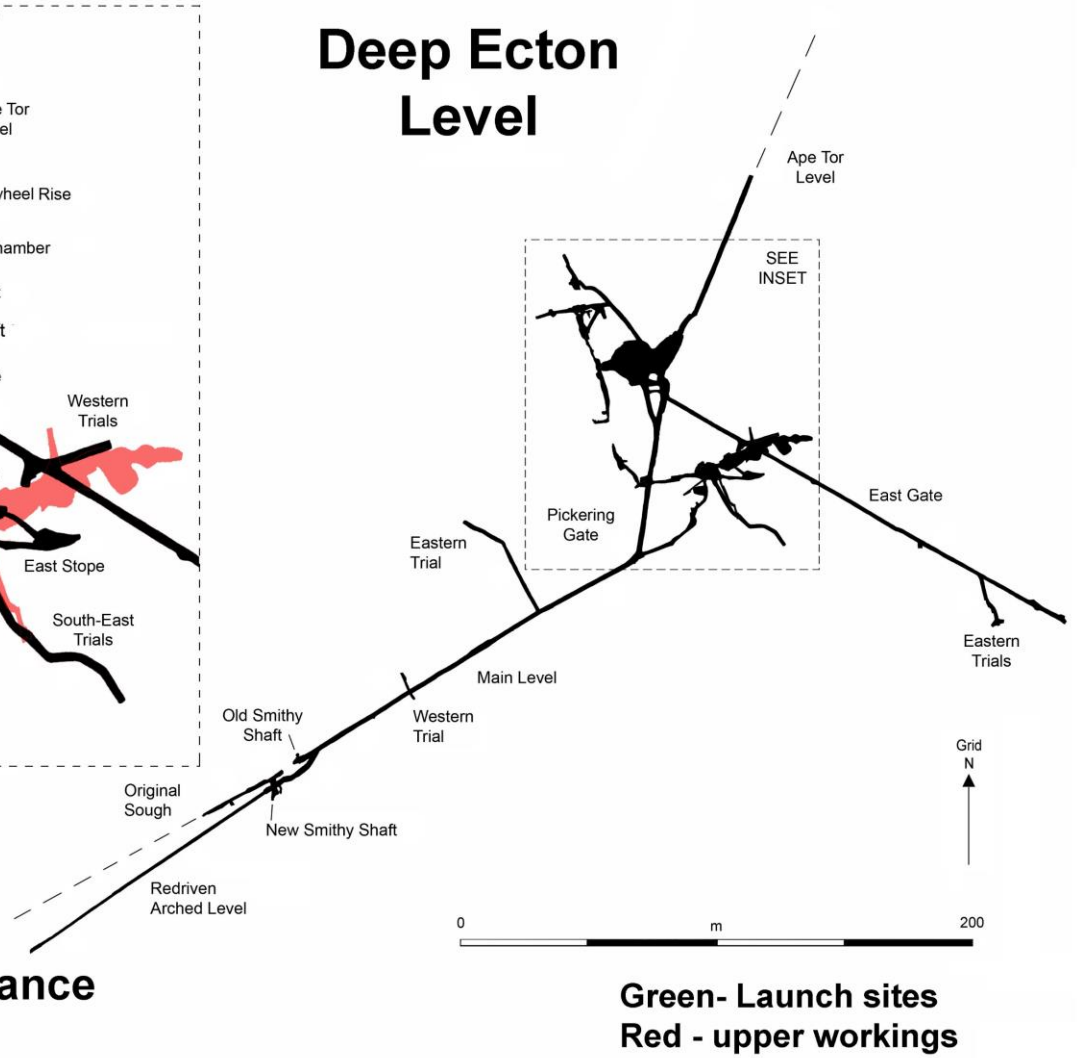
Ecton mine







Green- Launch sites
Red - upper workings

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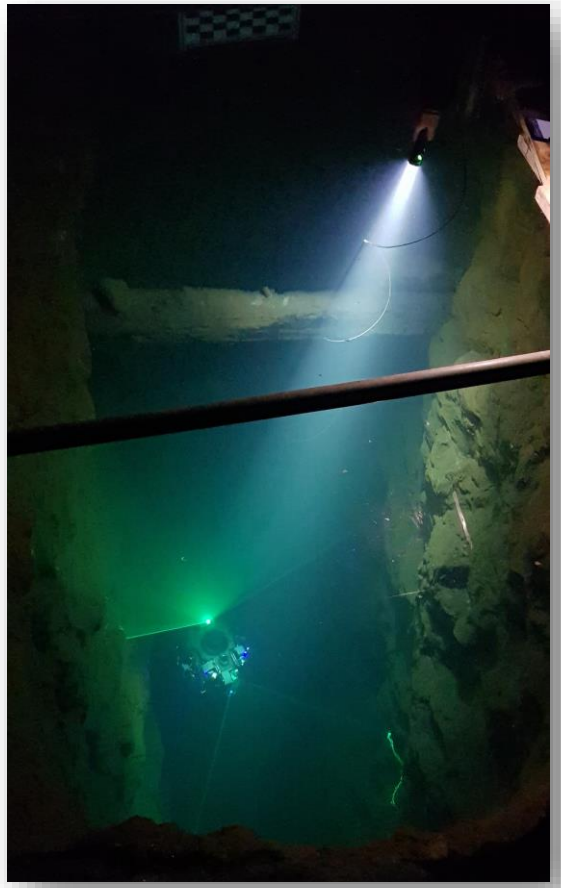
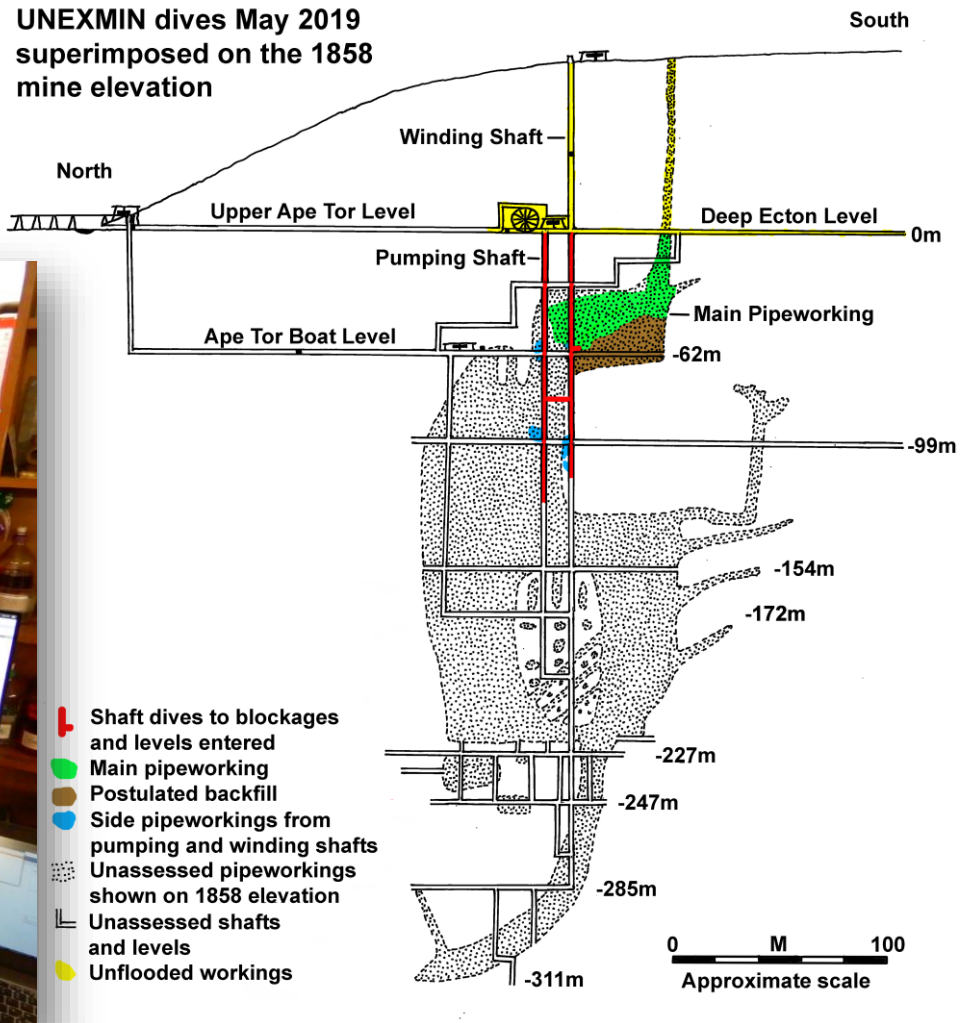
Ecton mine





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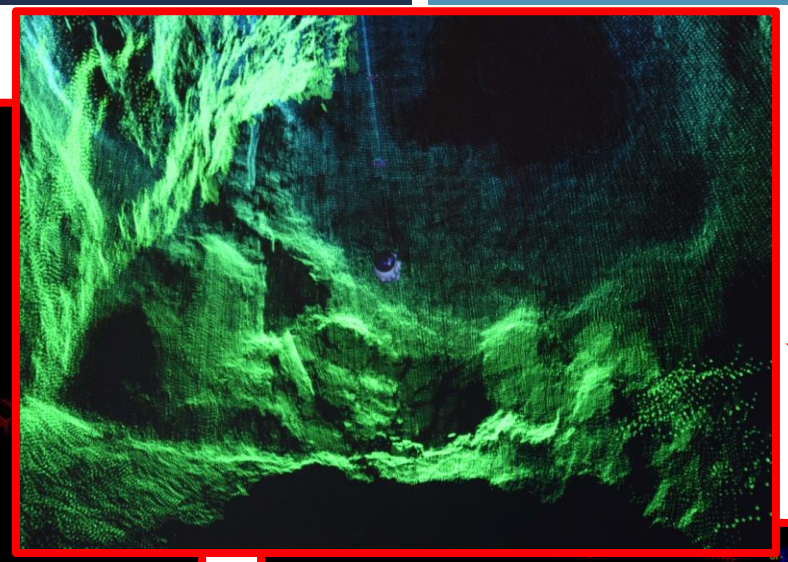
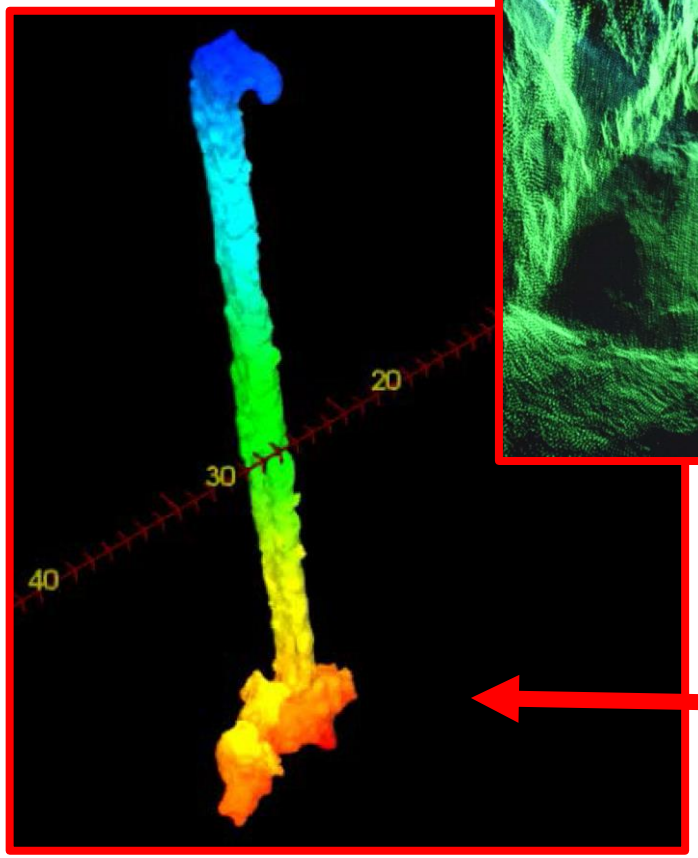
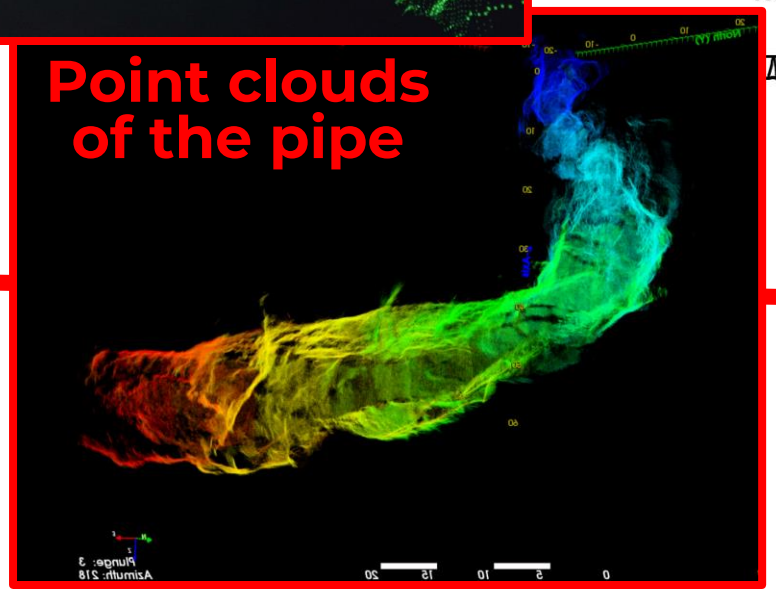
Ecton mine, morphology

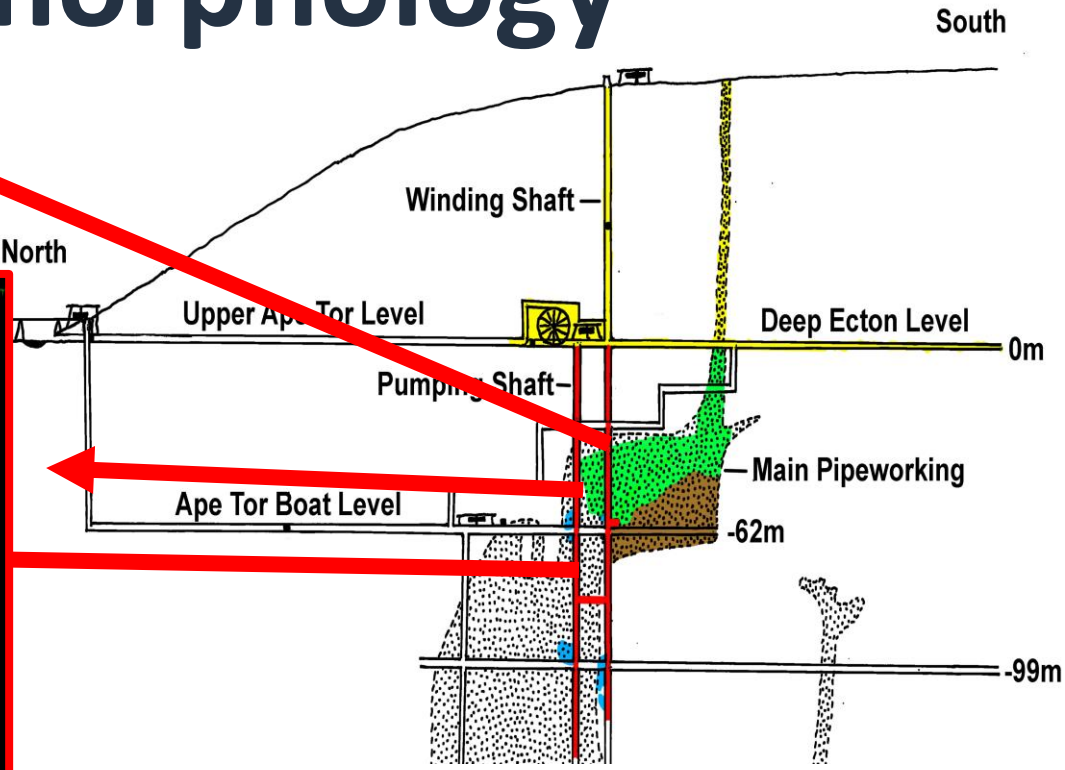




Point cloud of the great shaft to -125 m



Point clouds of the pipe



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Mining artefacts underwater

Built dam in the pumping shaft (-64 m)

Metal drum in the winding shaft (-57 m)

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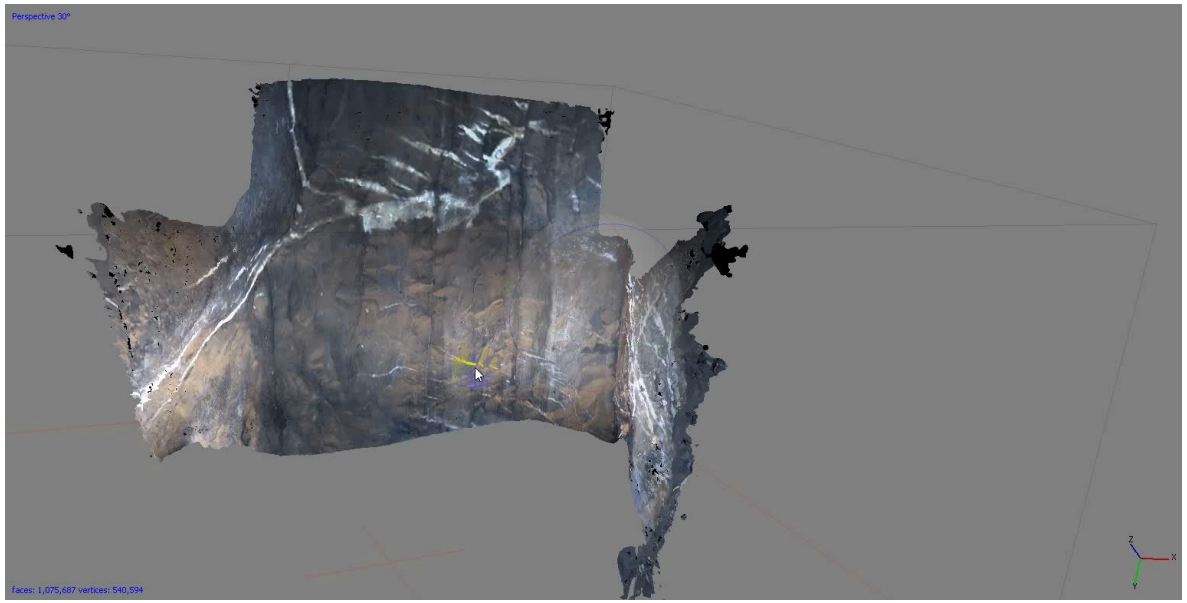
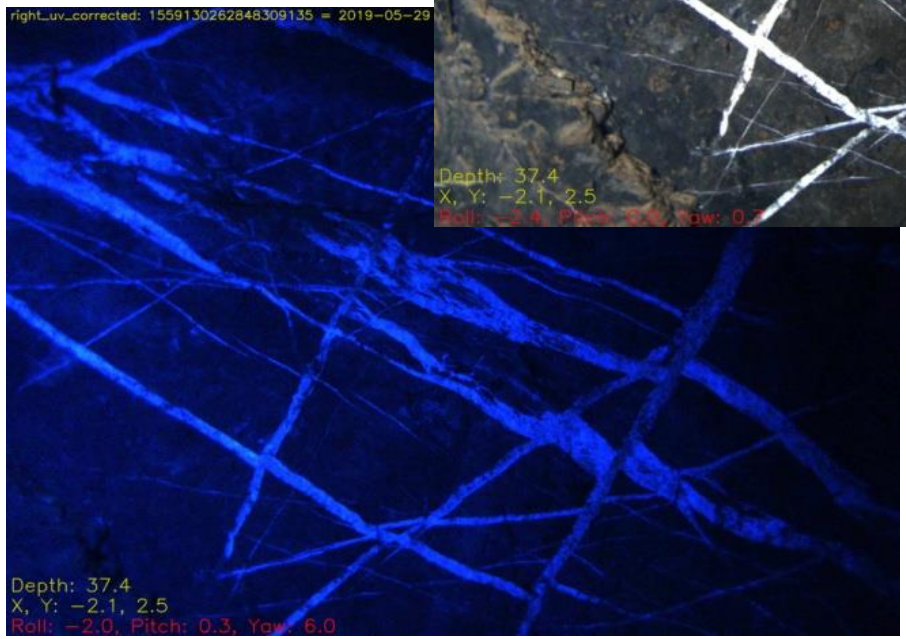
Ecton mine, calcite veins in the winding shaft (-37.4m)





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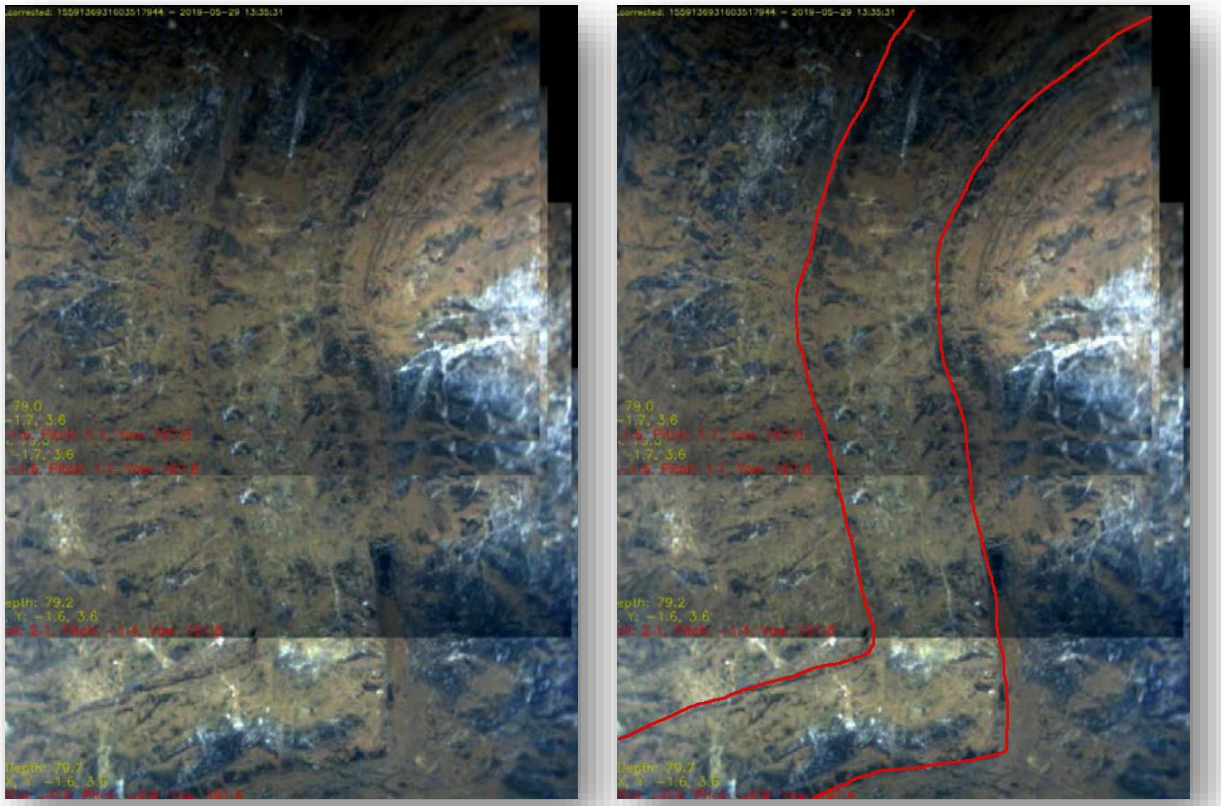
Structural geology observations in Ecton



Folding, winding shaft (-79 m)

Syncline with calcitized tension cracks, winding shaft (-46-48 m)

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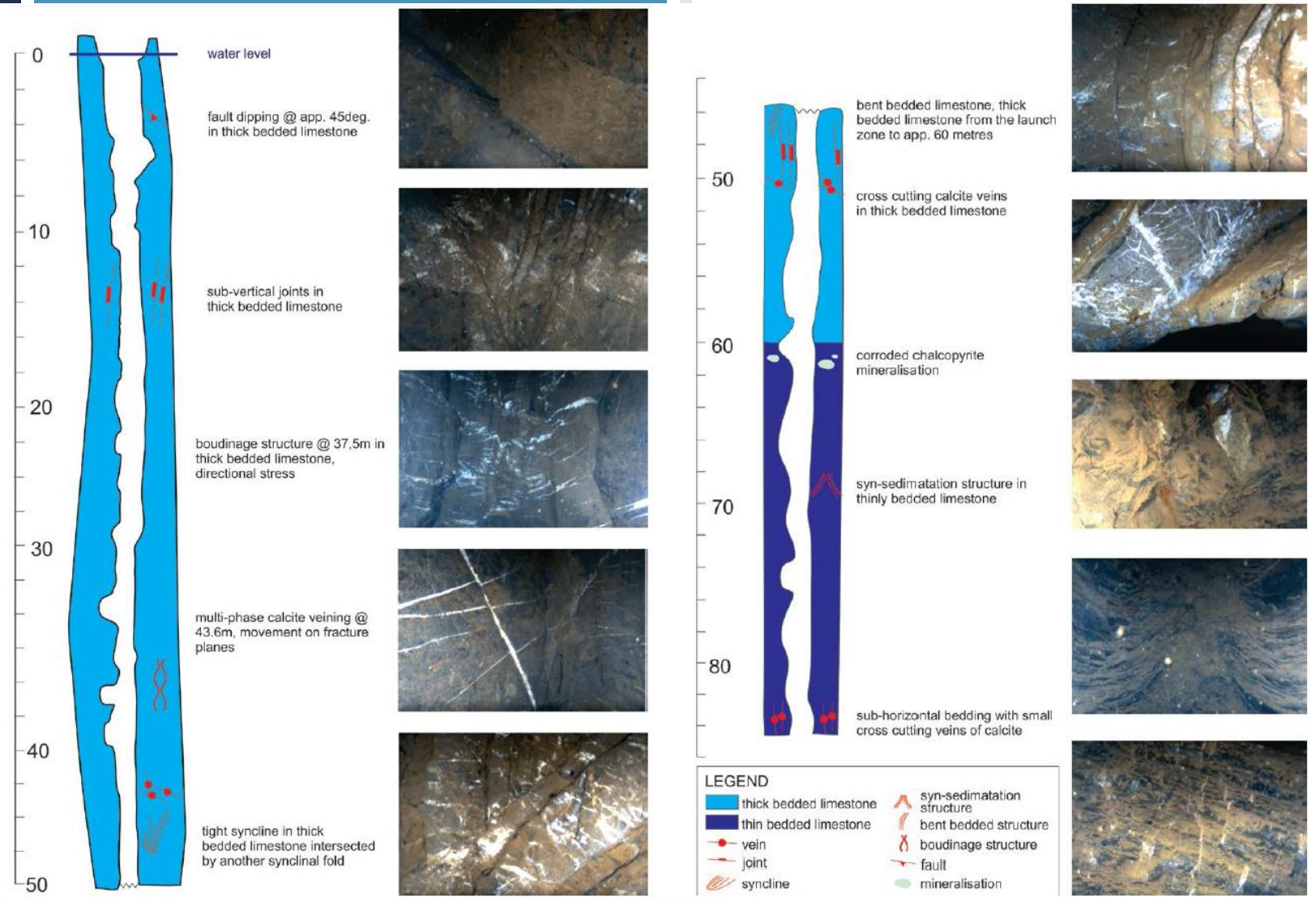
Ecton mine, geology of the winding shaft 0 m to -85 m



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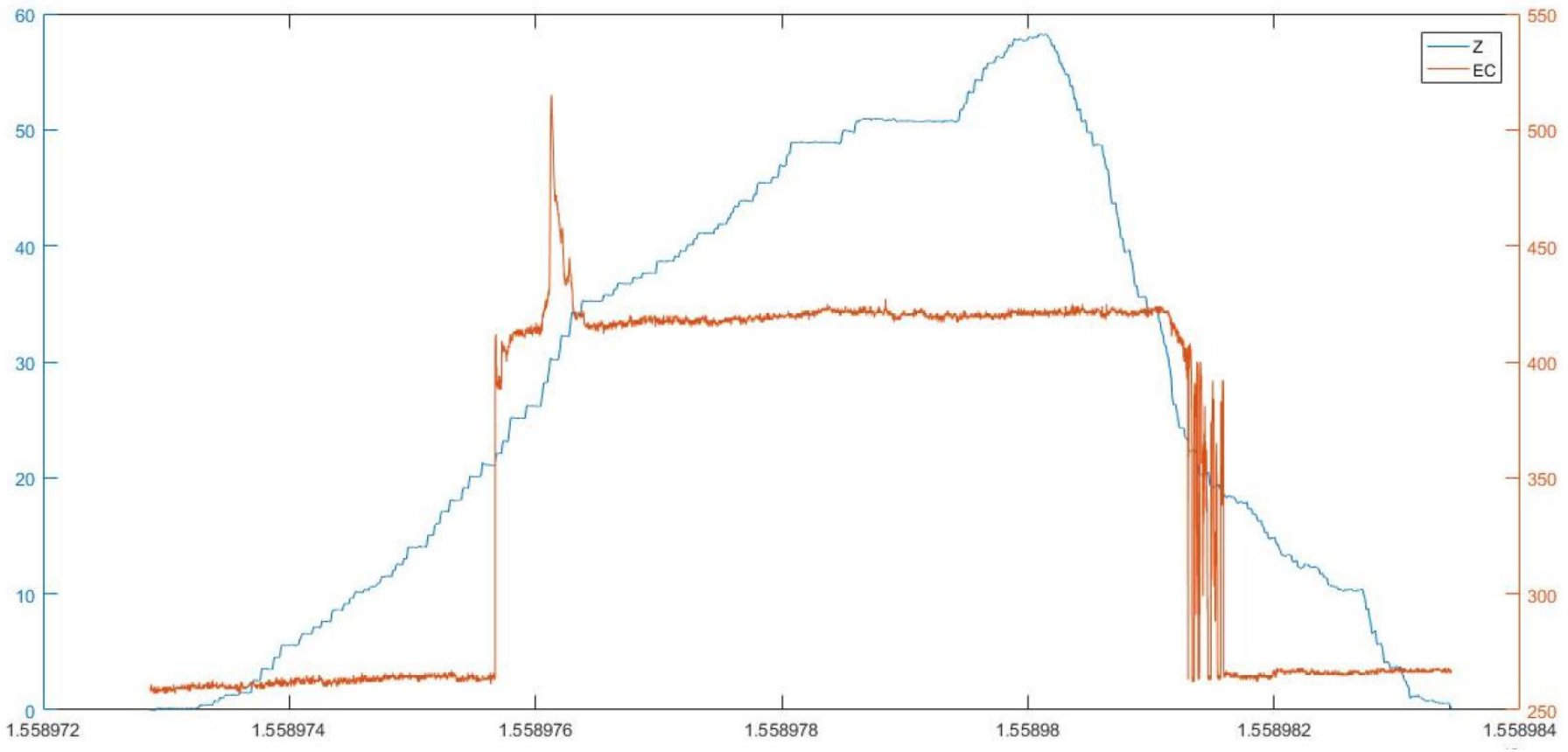
EC measurement in the „Pipe”



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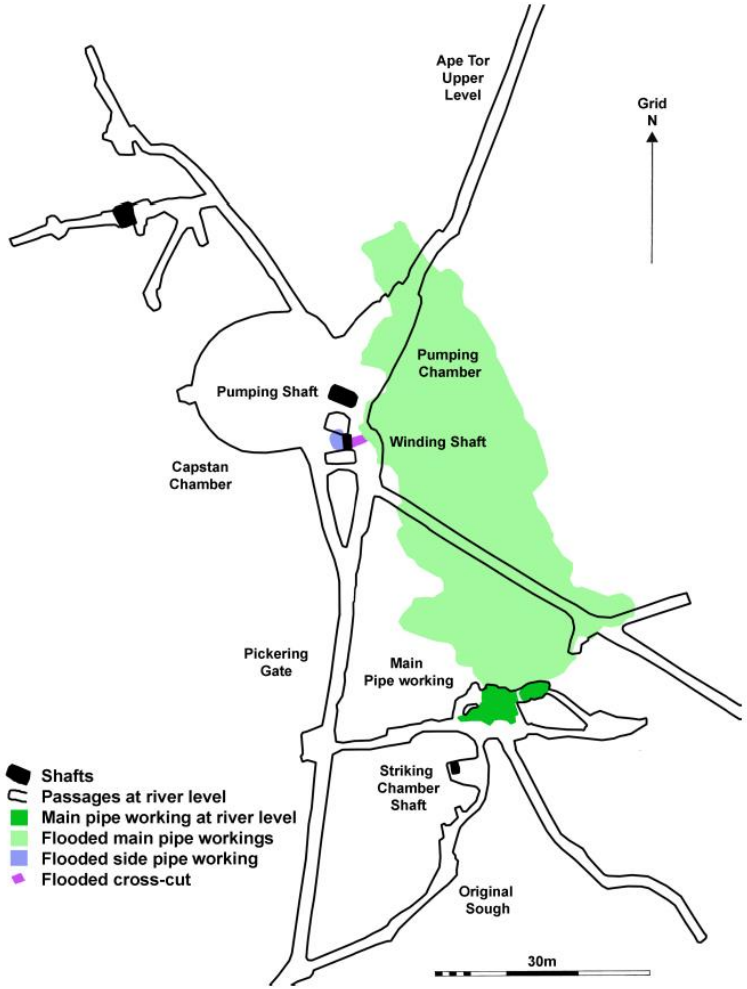

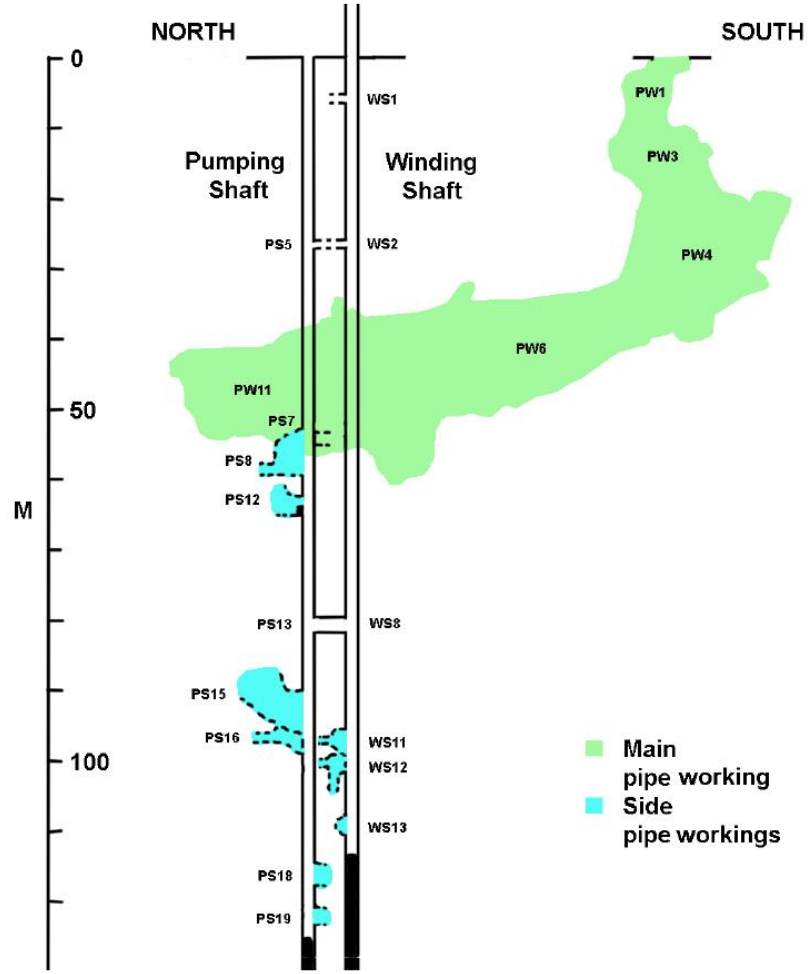

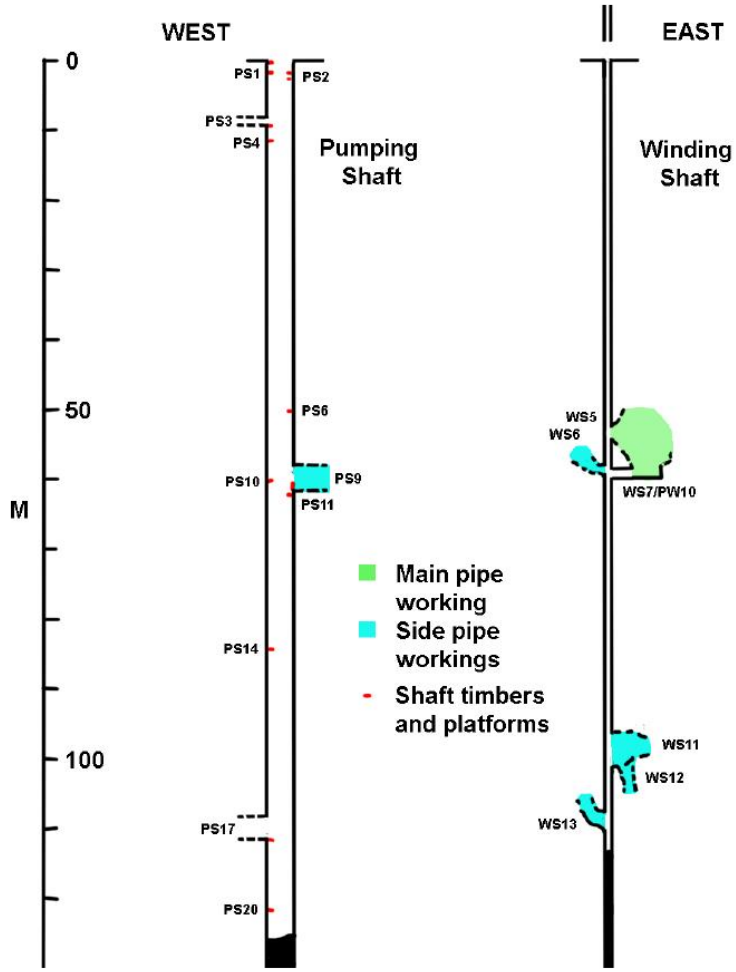

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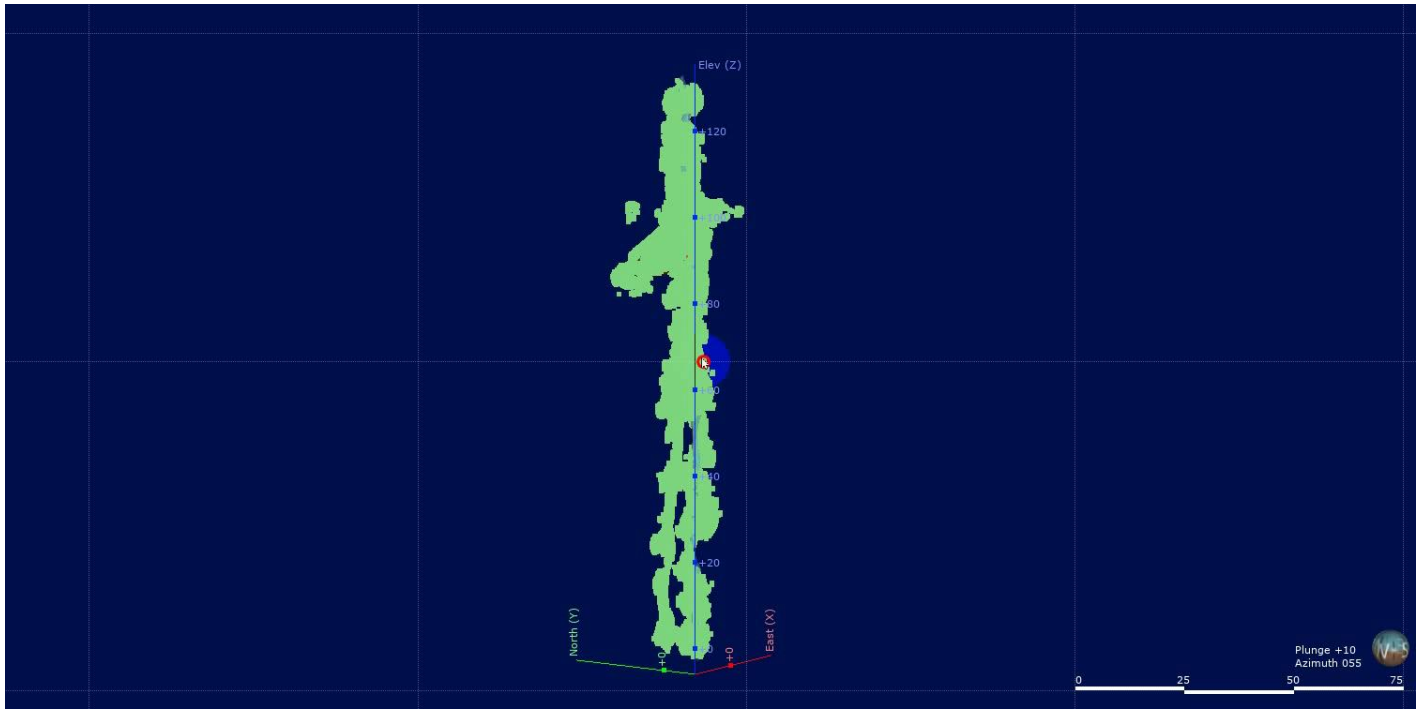

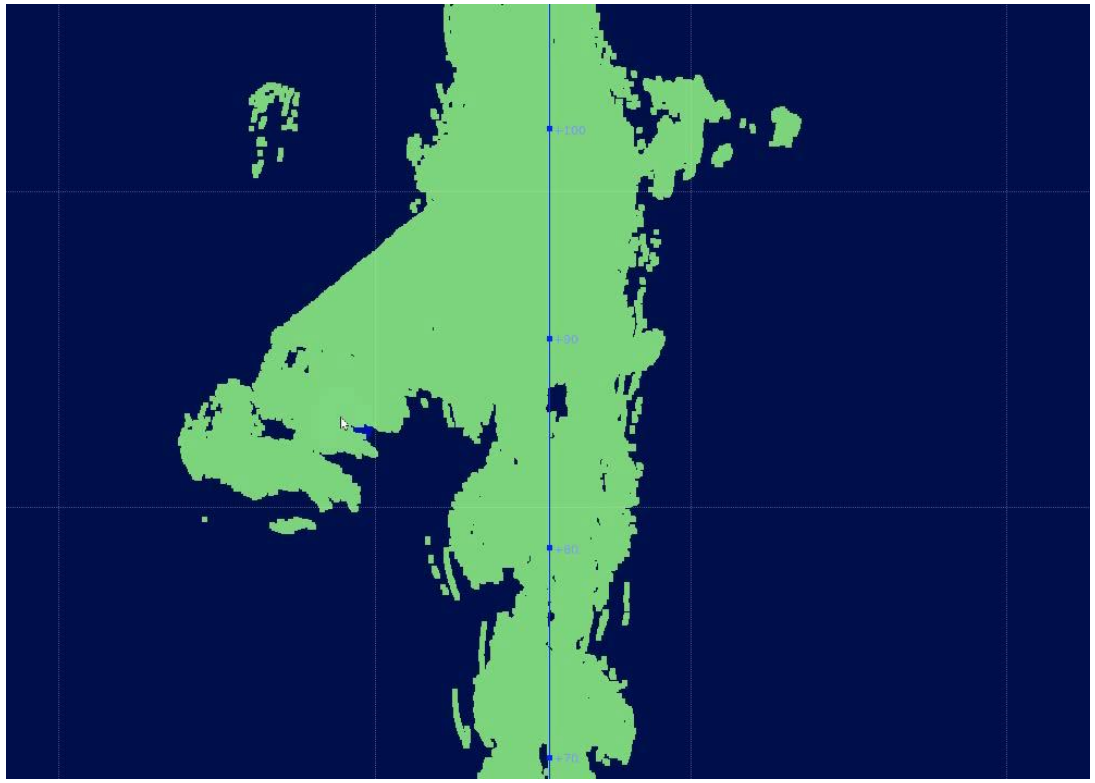

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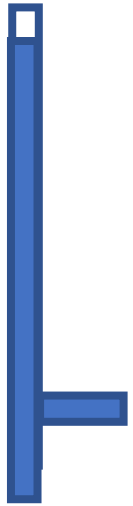
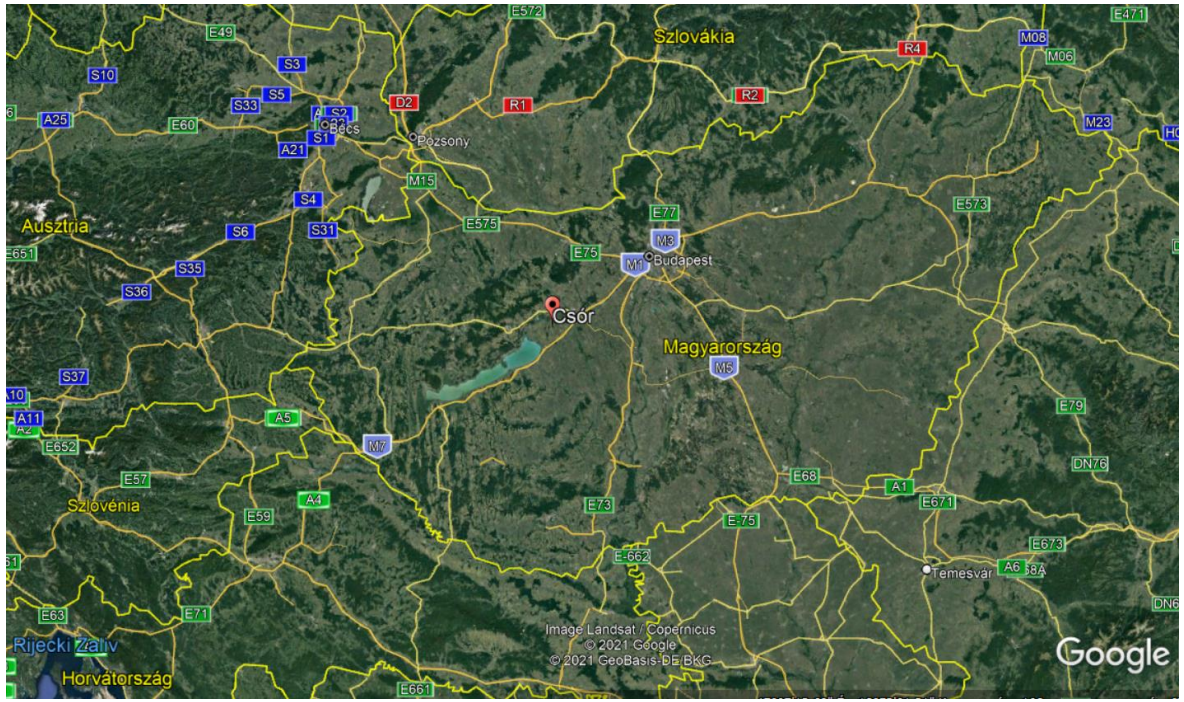
Case study 3: water-well, Csór, Hungary





75 m deep well, ca. 4 m diameter

Water level is ca. 5–6 m

At 60 m there is one ca. 10m long horizontal tunnel

Task: measure the 3D geometry of the well in few cm accuracy (most important is the diameter) during operation.

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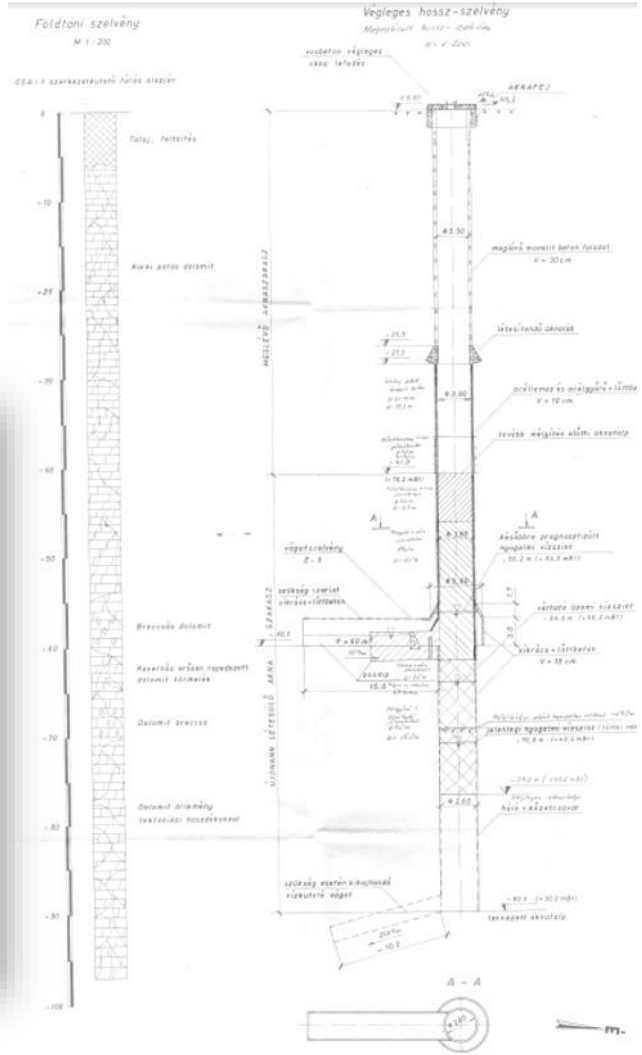
They want to lower down to the bottom a quite big size thing.

„during operation” is the extra which saves a lot to the company.

Everything which goes into the well must be cleaned and sterilized

Horizontal tunnel from the shaft

Horizontal tunnel to the shaft



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The well-house and well-head

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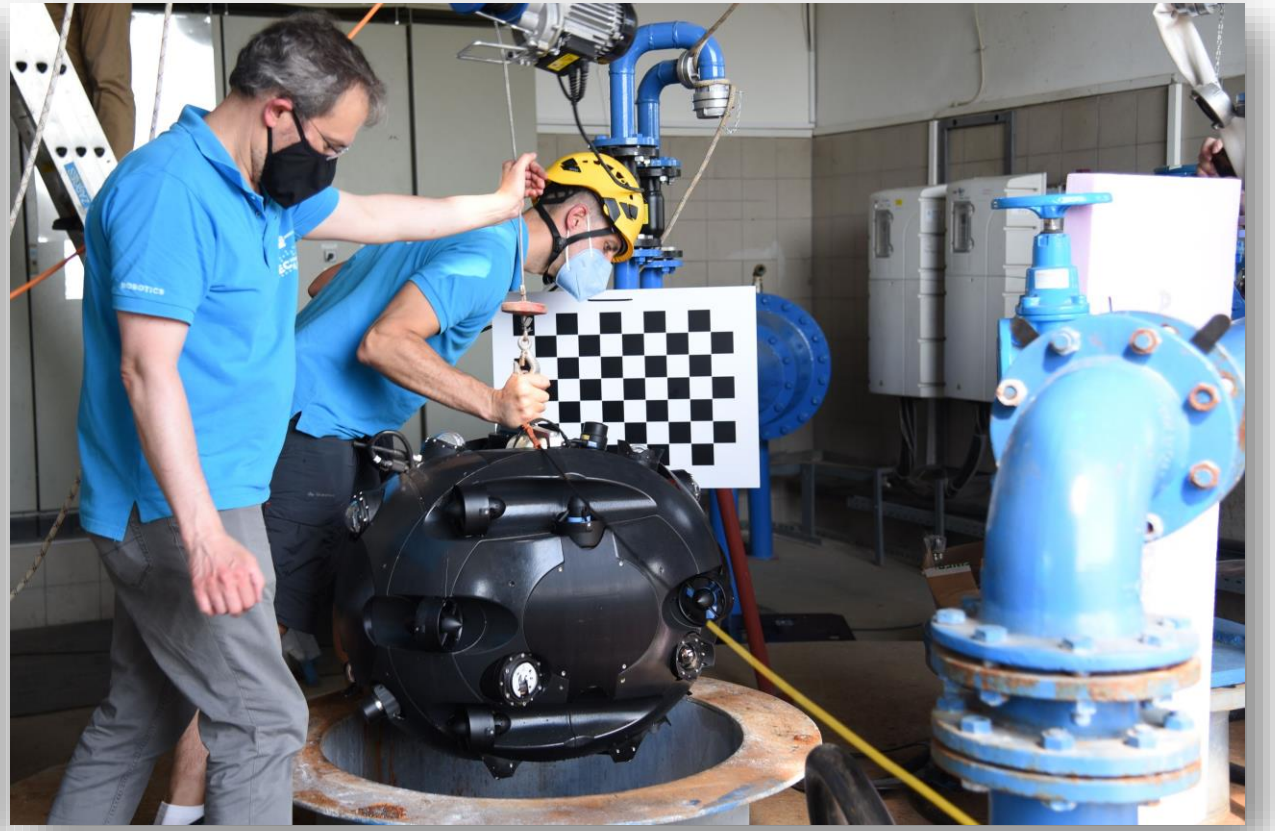
Sterilization and referencing of UX-1Neo



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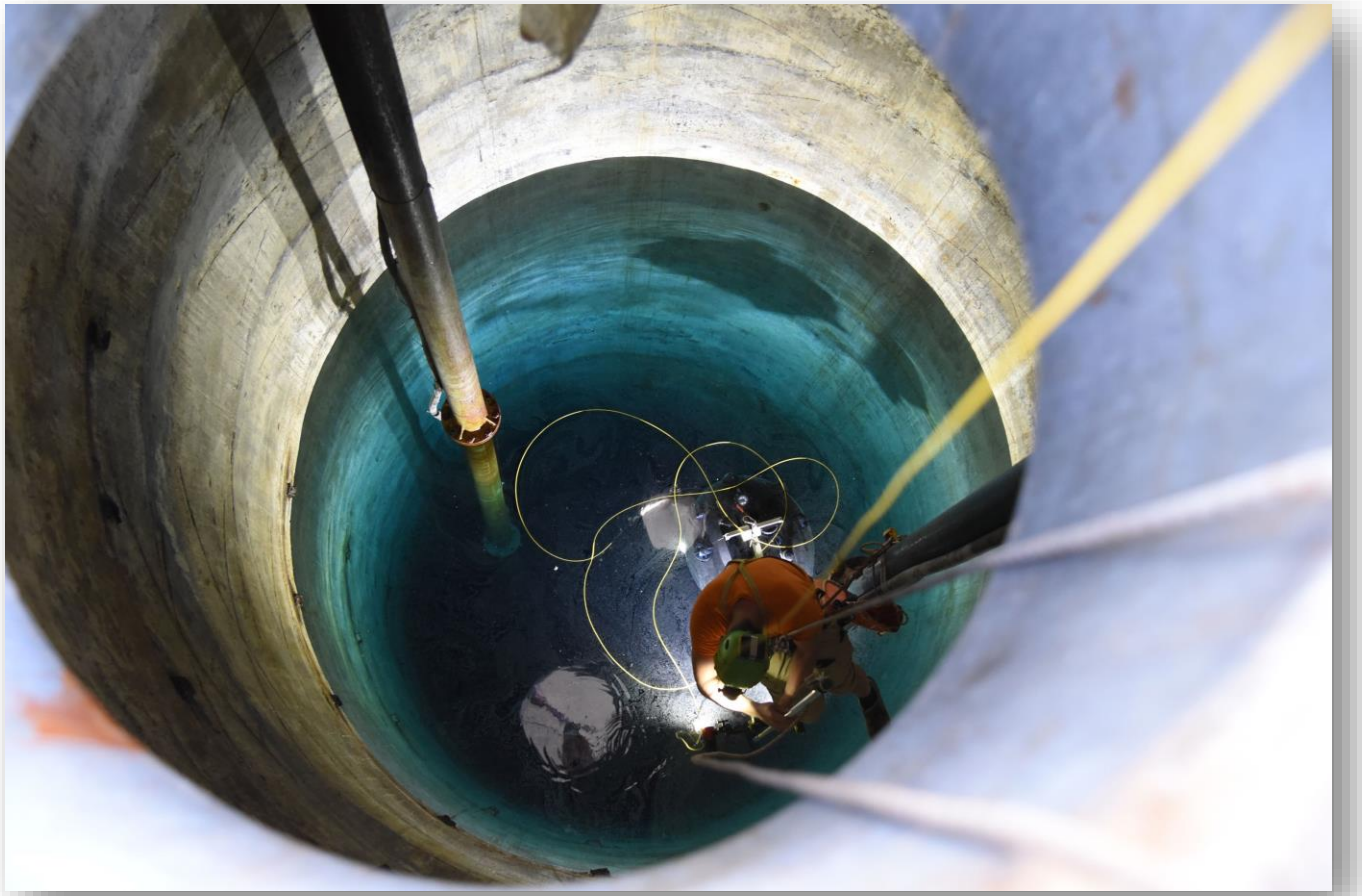
Release and recovery of the robot



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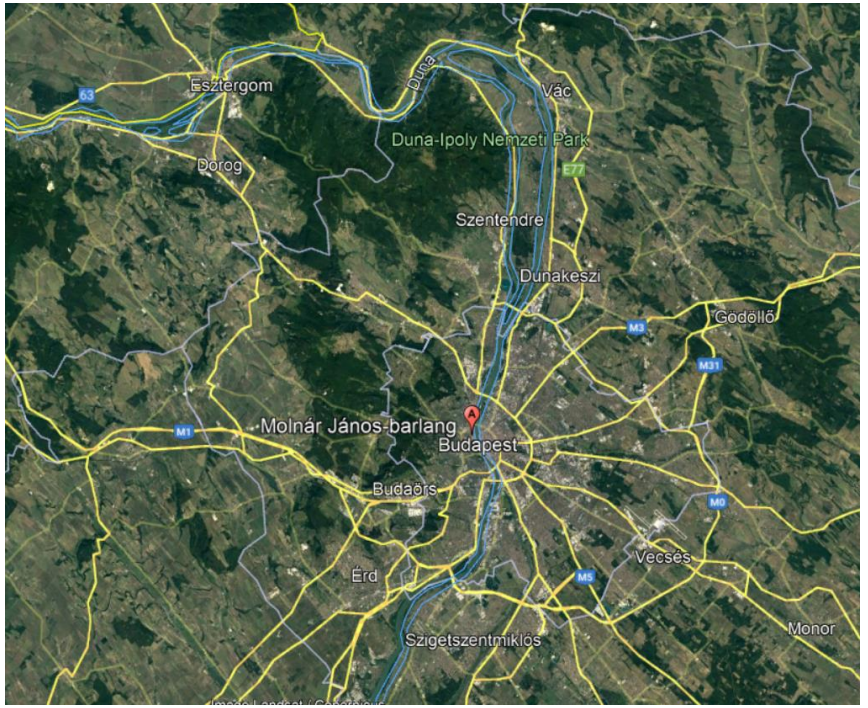
Case study 4: Molnár János cave, Budapest, Hungary

24th of June to 5th of July 2019 (2021…)

Ca. 7 km corridor (-90 m depth) are mapped

20 – 28 °C water reservoir for a thermal bath



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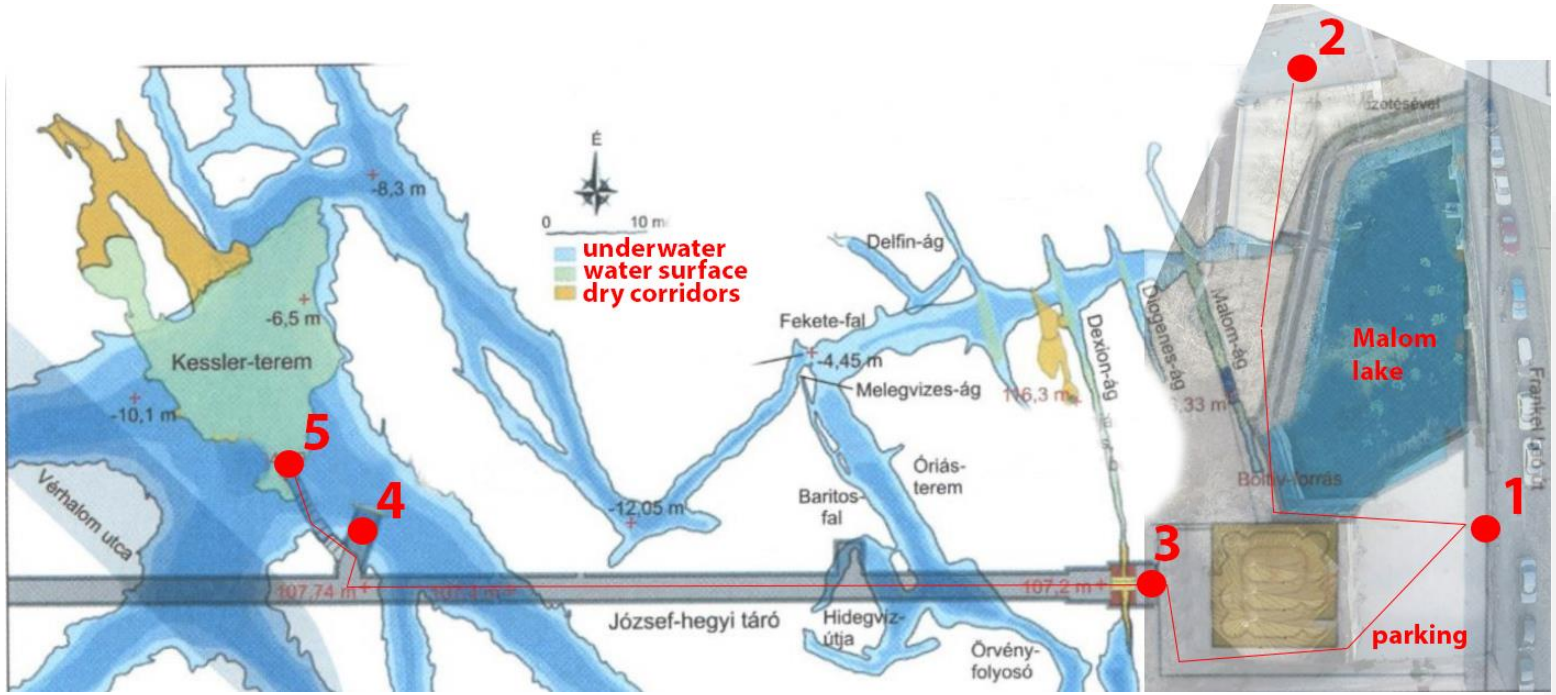
Molnár János cave, site map



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Molnár János cave, control room and launch site

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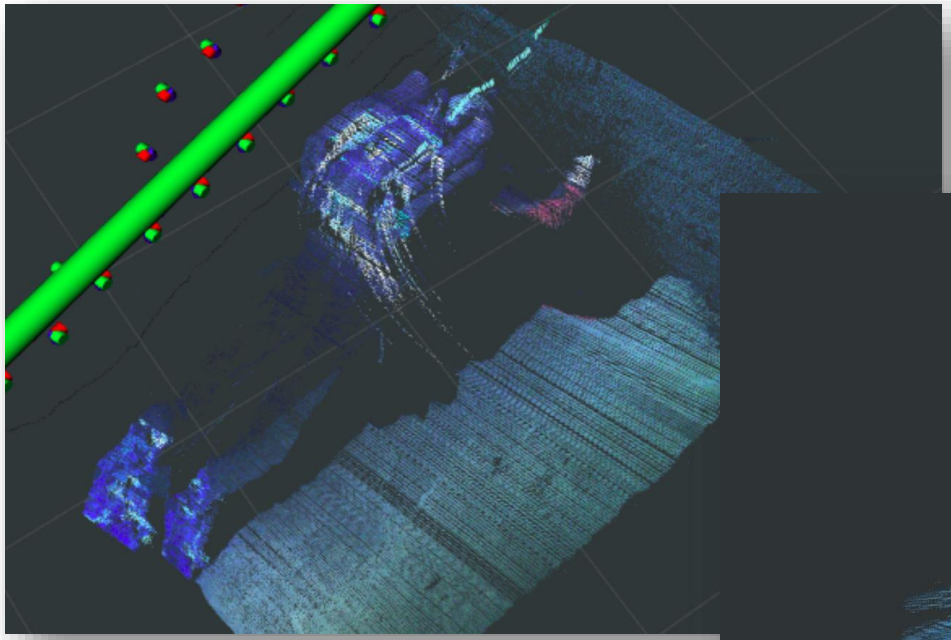
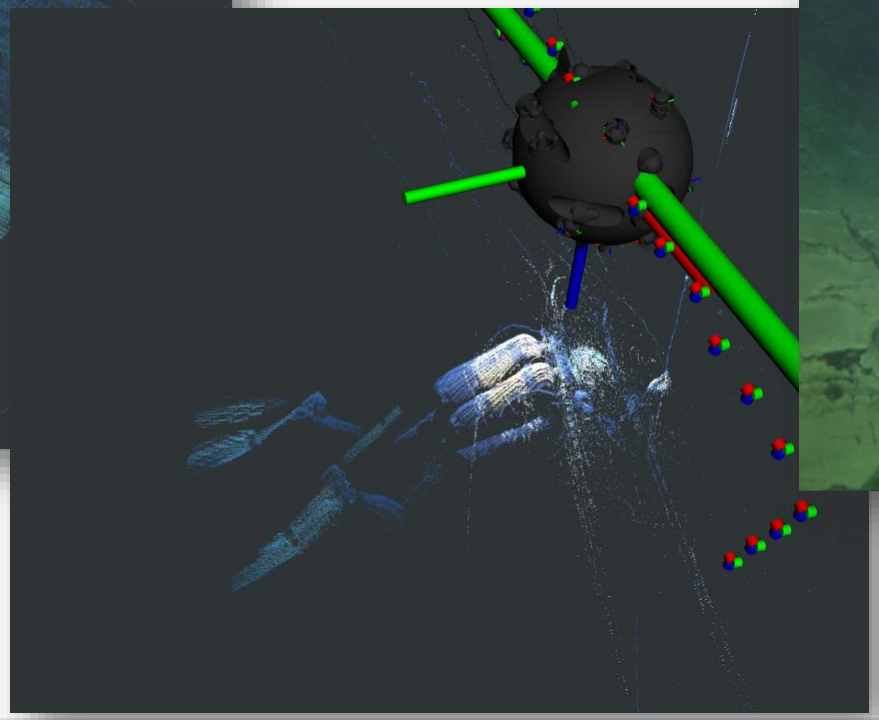
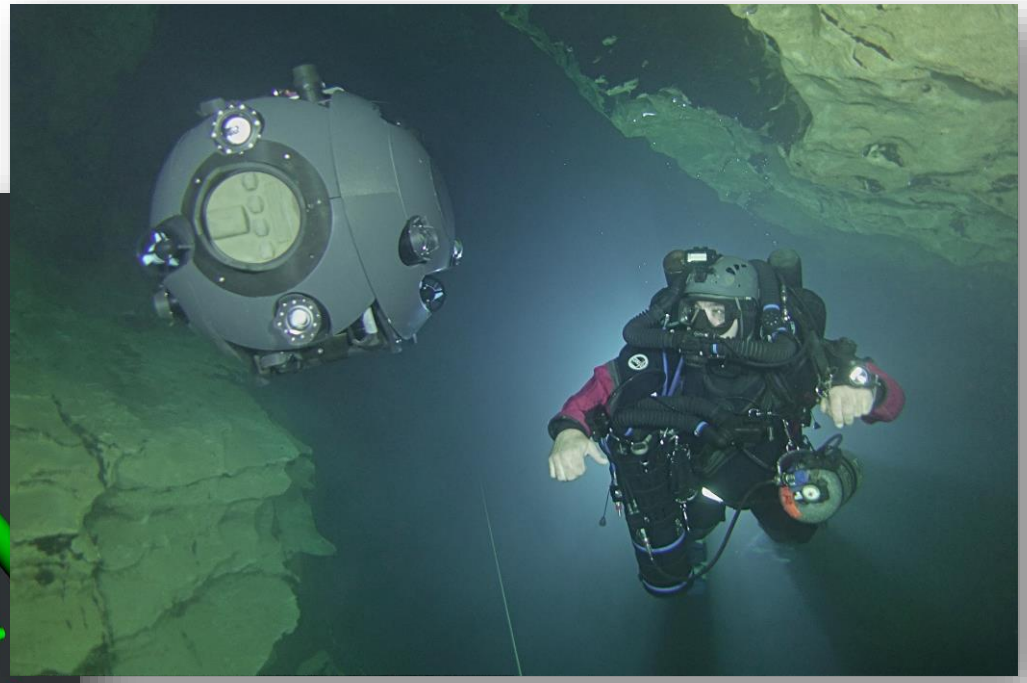
Molnár János cave, UX-1Neo and scubadivers







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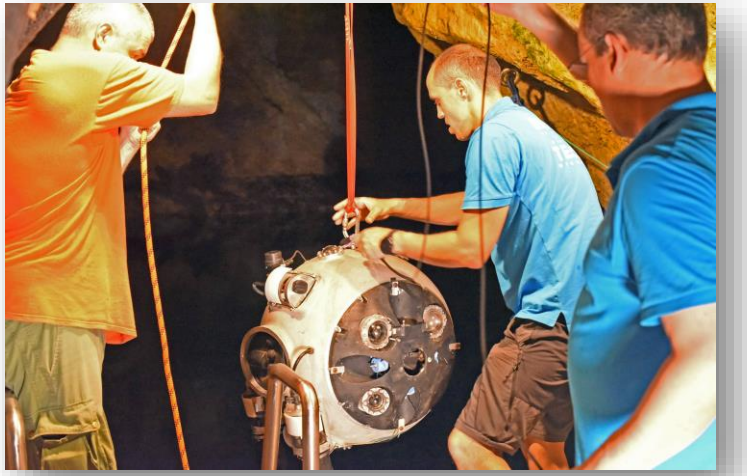
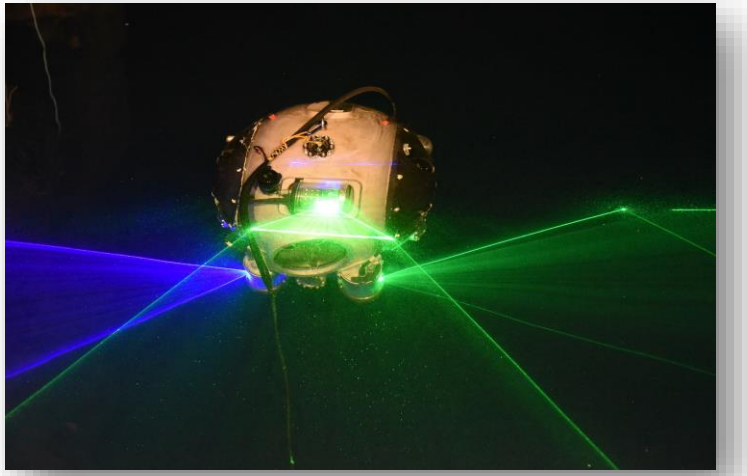
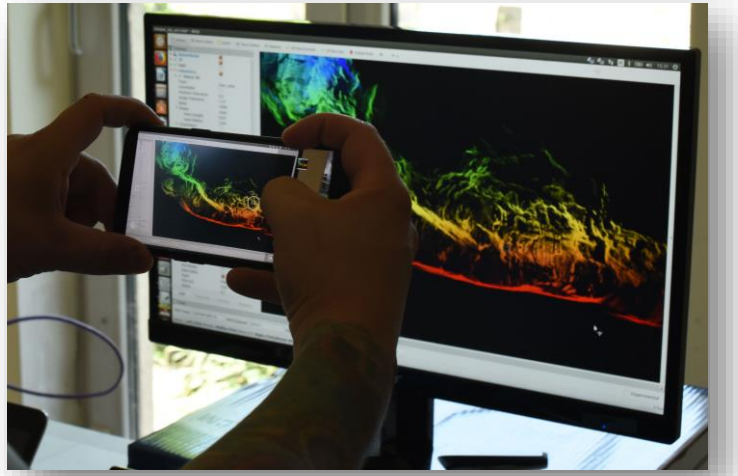
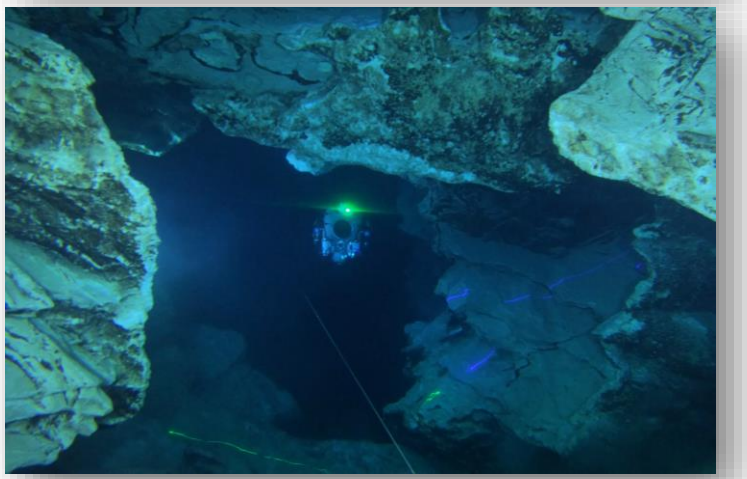
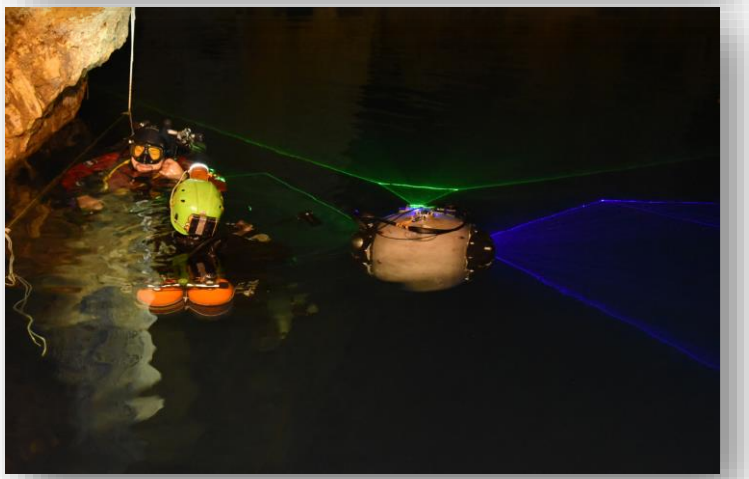
Molnár János cave











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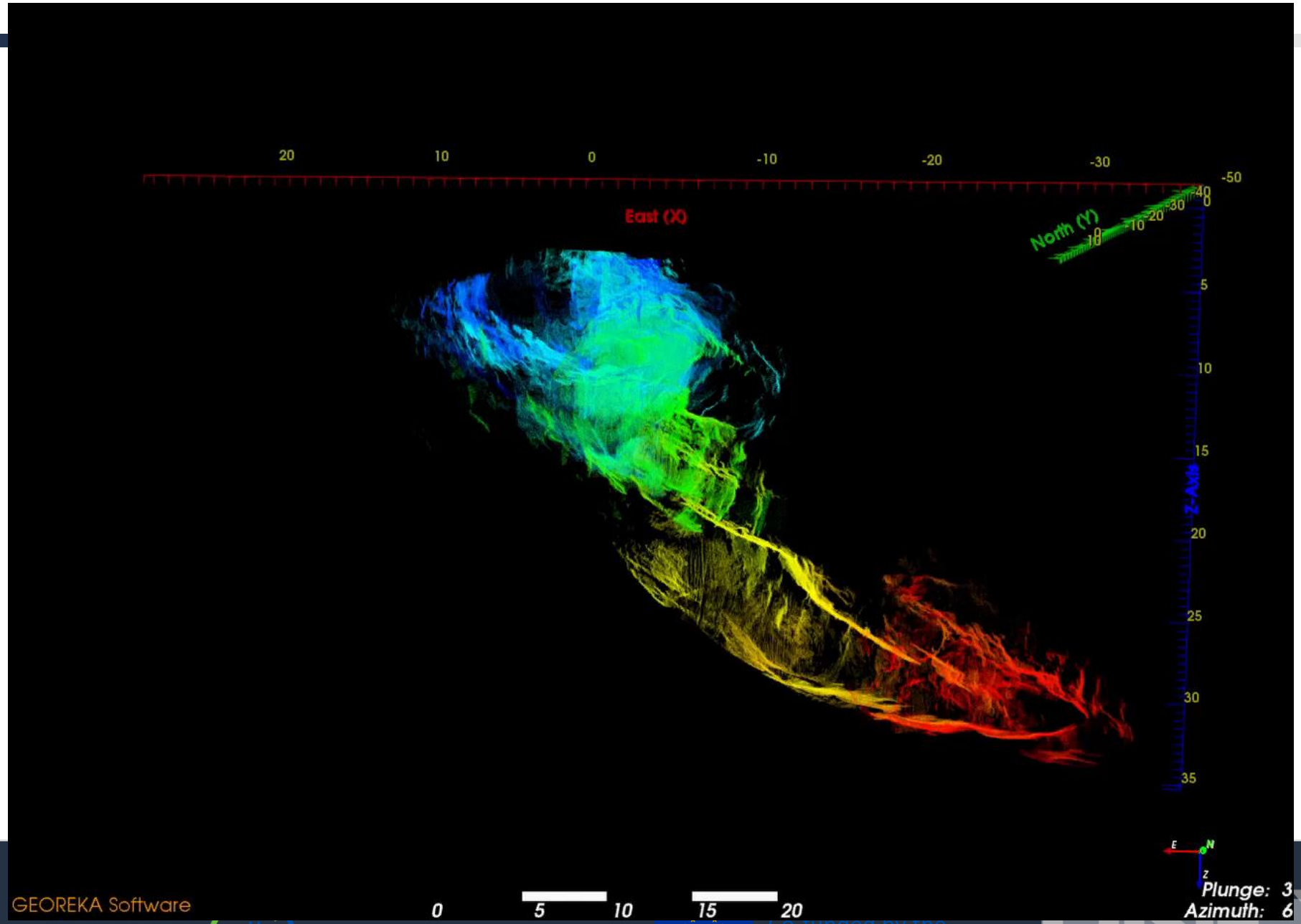

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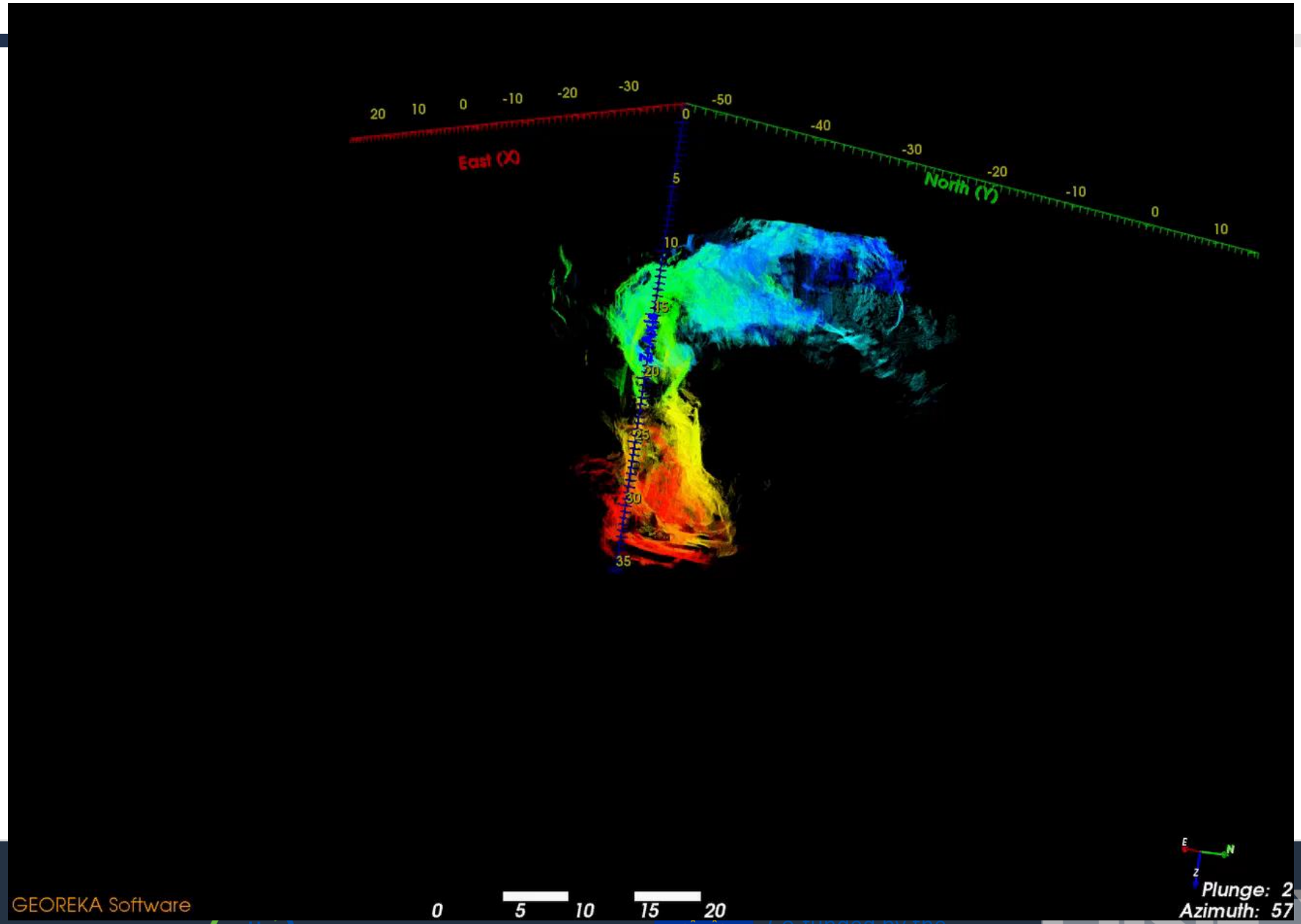
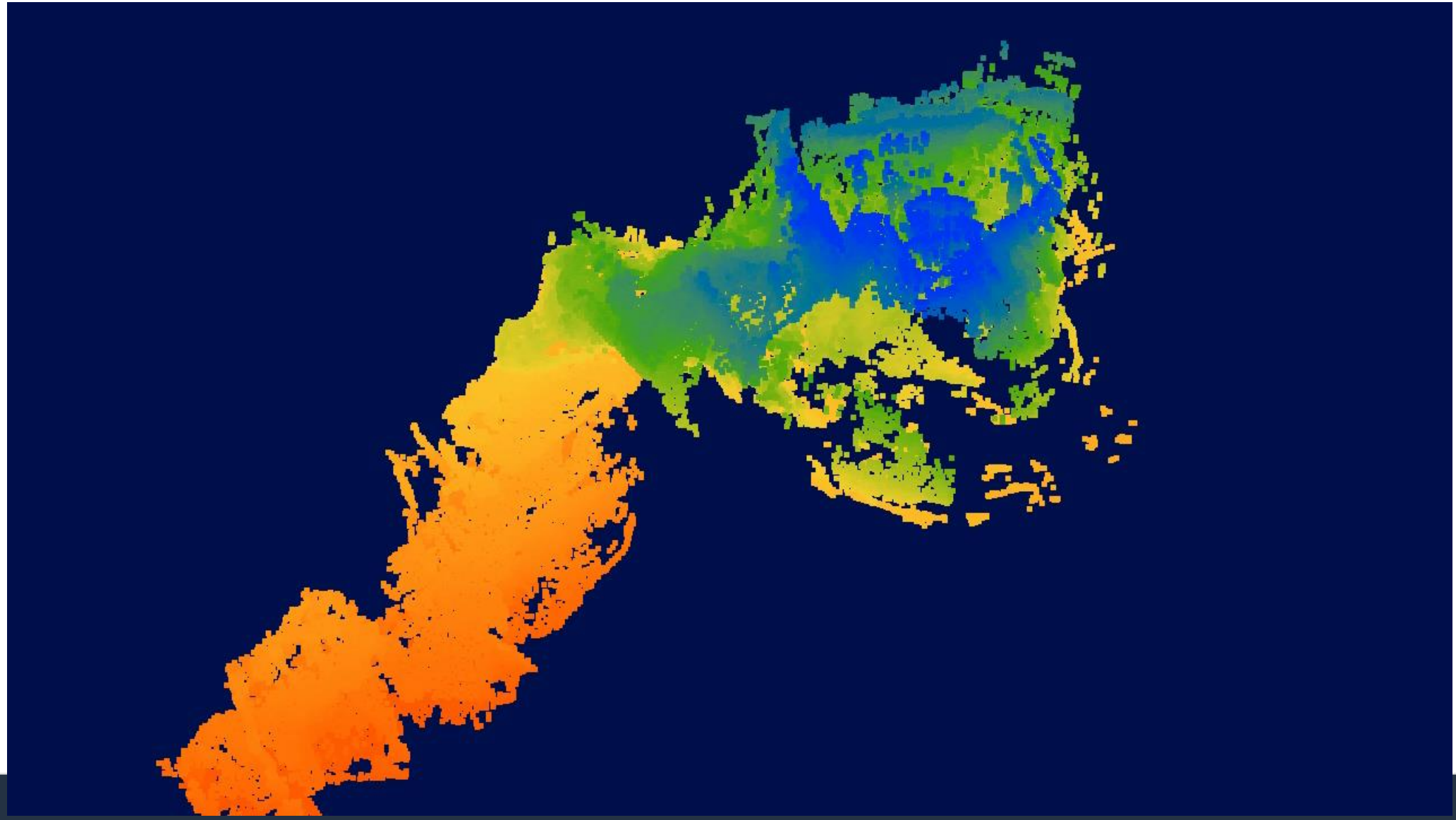

East (X)
North (Y)
GEOREKA Software
0 5 10 15 20
Plunge: 2
Azimuth: 57

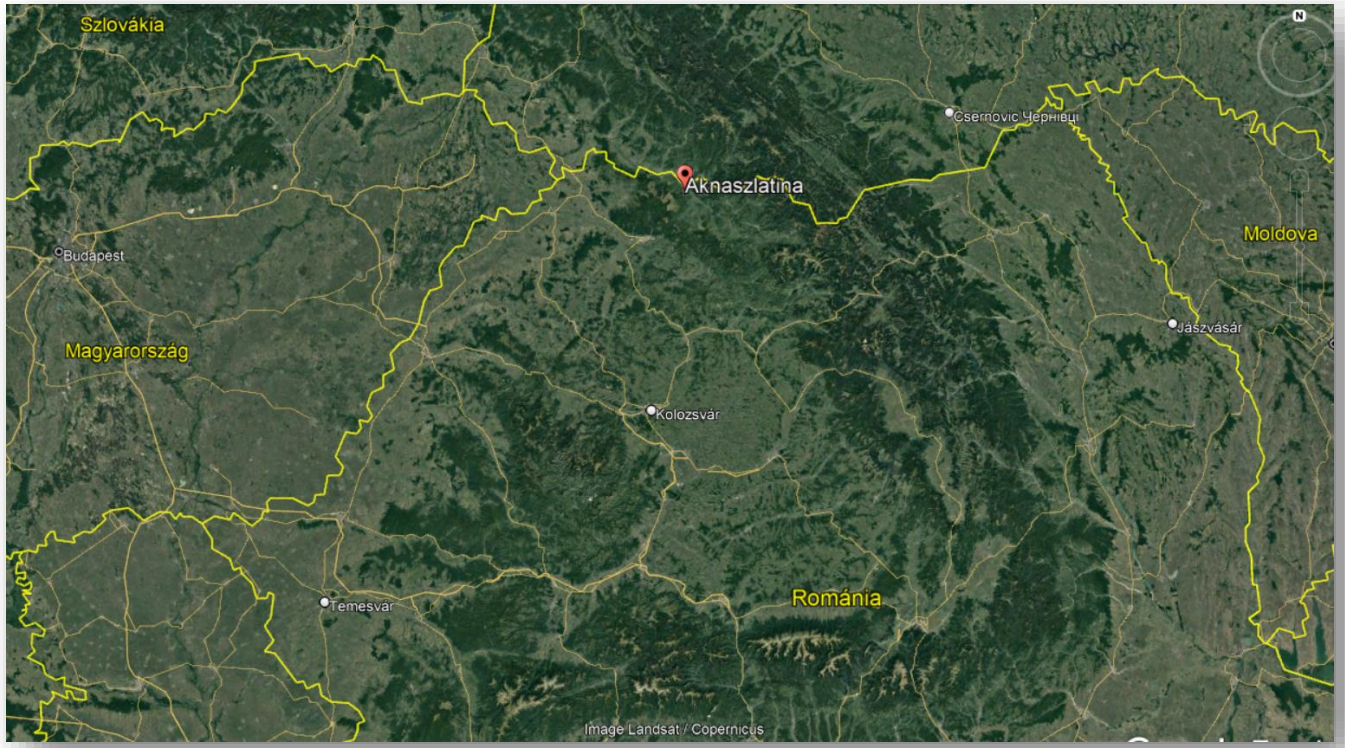


Case study 5: salt mine, Solotvyno, Ukraine

Collapsing abandoned salt-mine with environmental hazard

14–25th of June 2021
15-19th of November 2021

Mapping of the mine corridors
Visual inspection and water-properties



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Solotvyno salt mine aerial view

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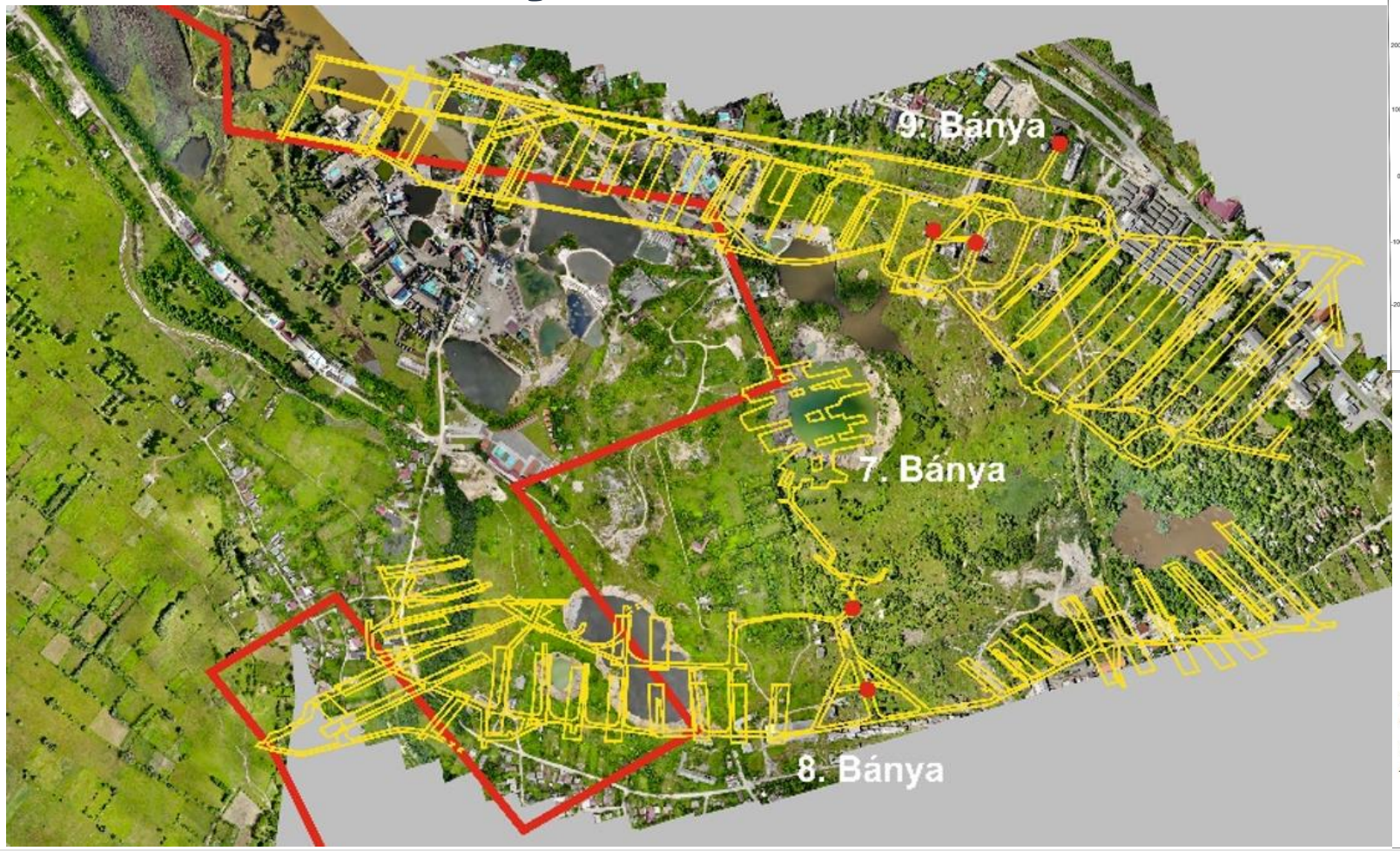
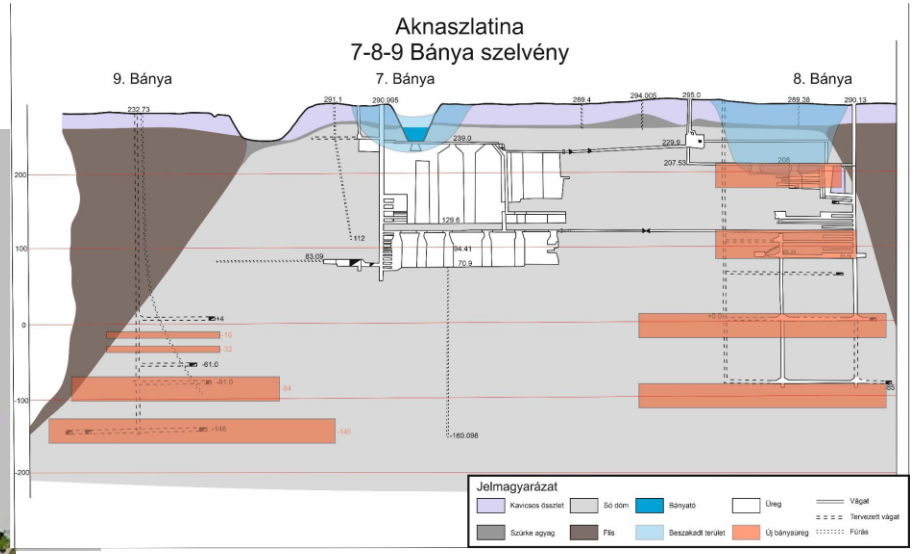
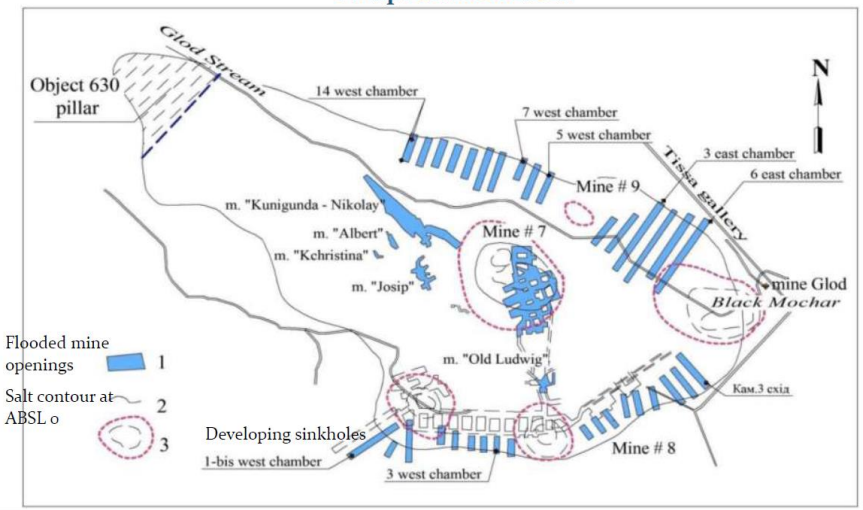
Solotvyno salt mine





Complex assessment



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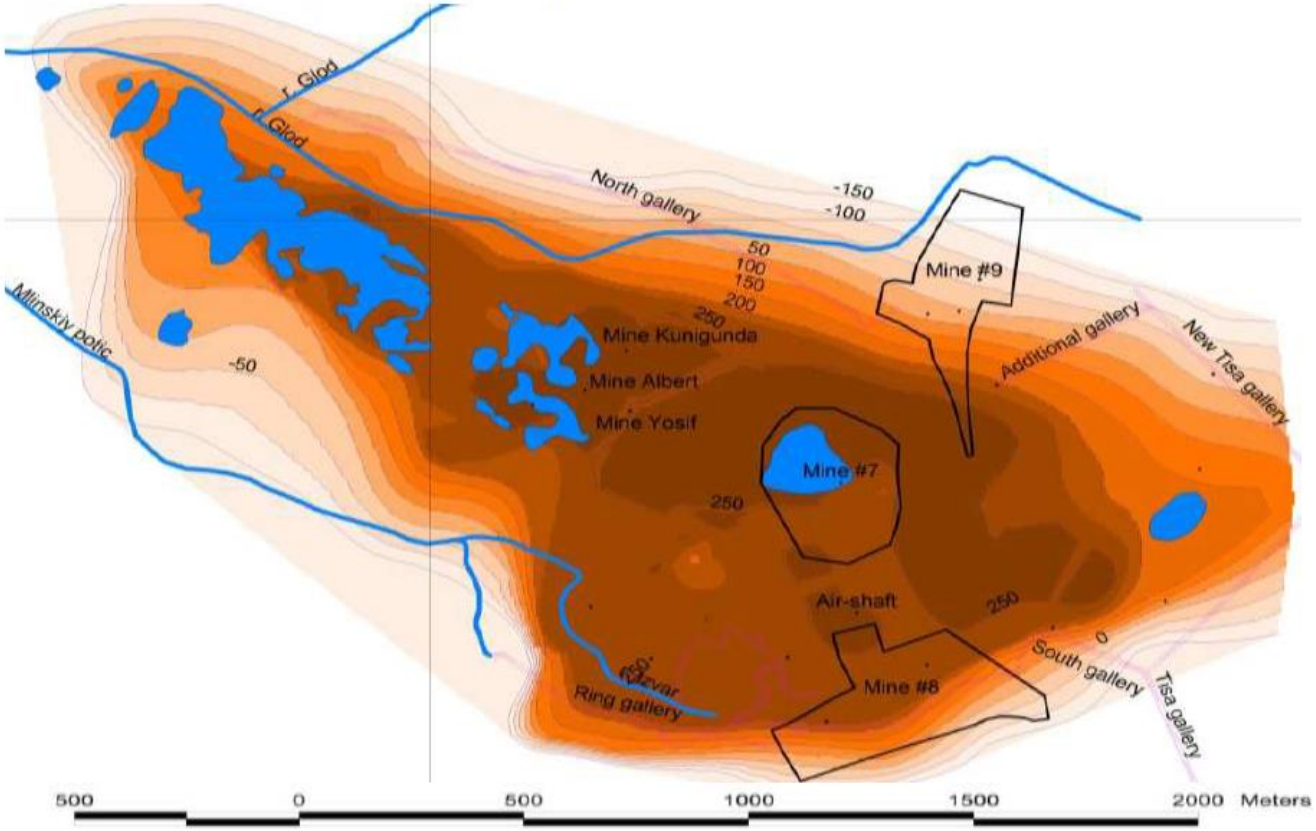
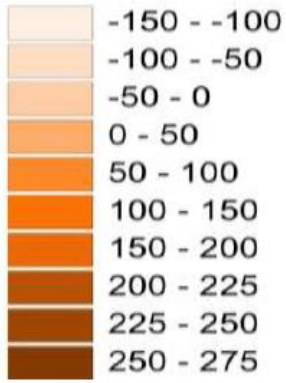
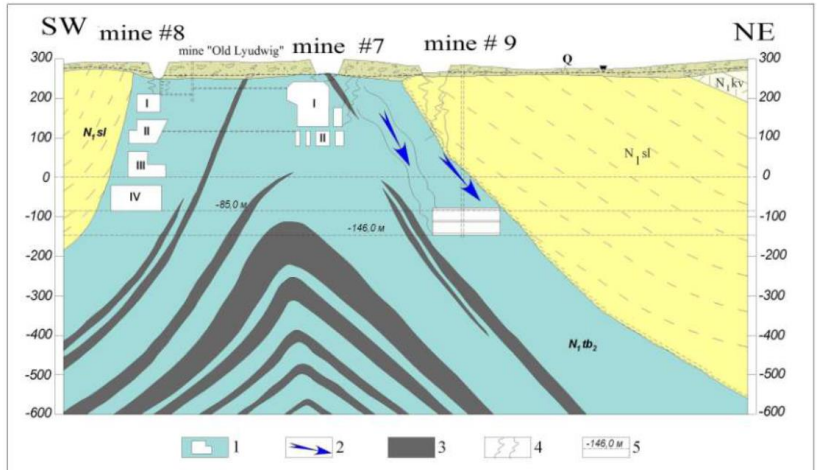
Morphology of the salt dome



Map of salt dome ABSL with lakes, mines and shafts





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Collapsing lake at mine 7

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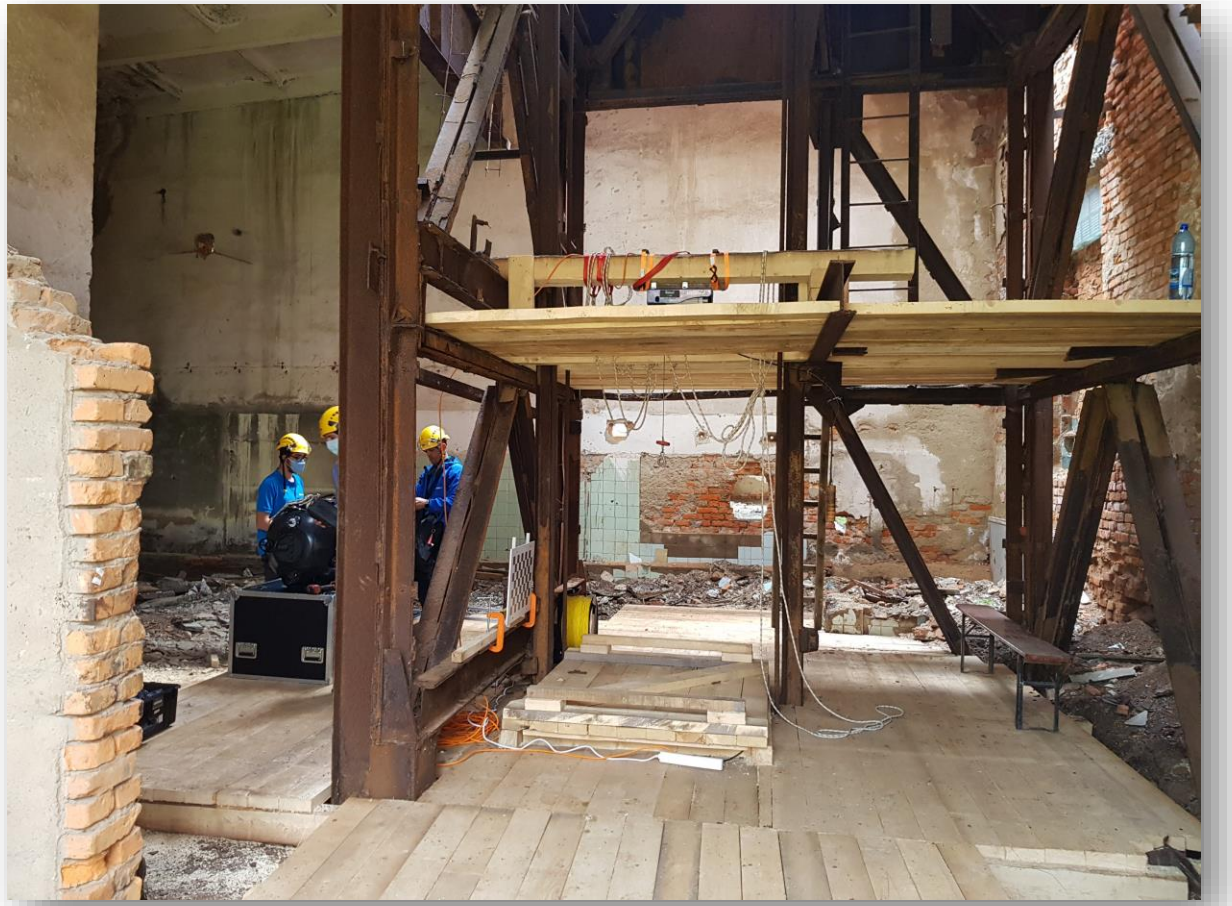
Entrance of shaft 9 before and after building the dive platform



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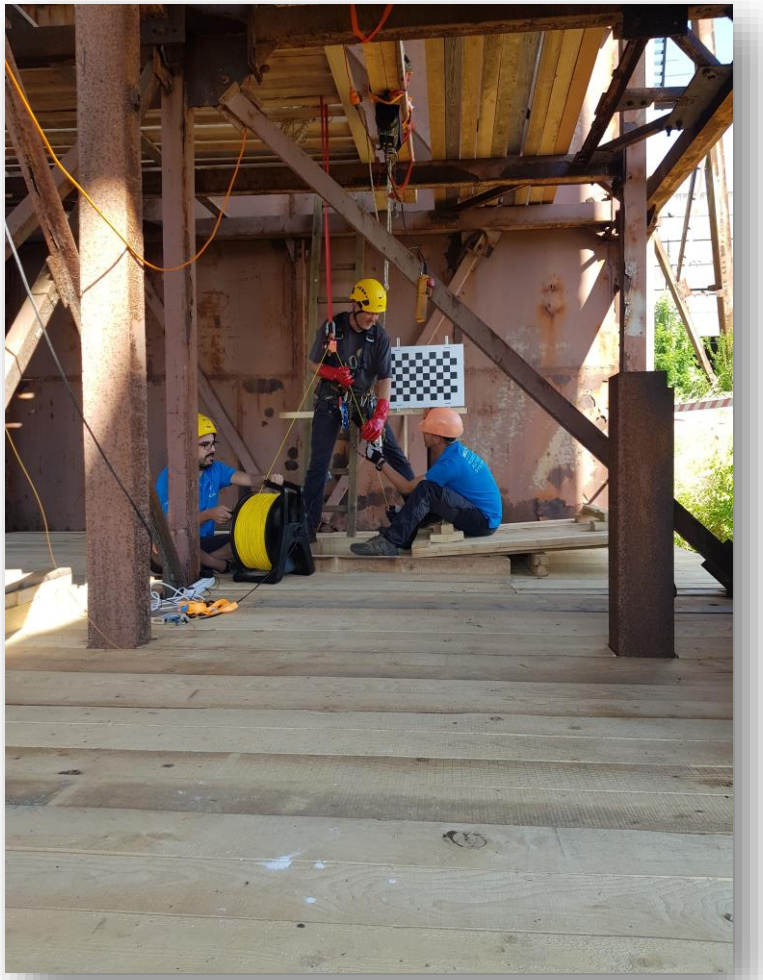
Entrance of shaft 10 before and after building the dive platform



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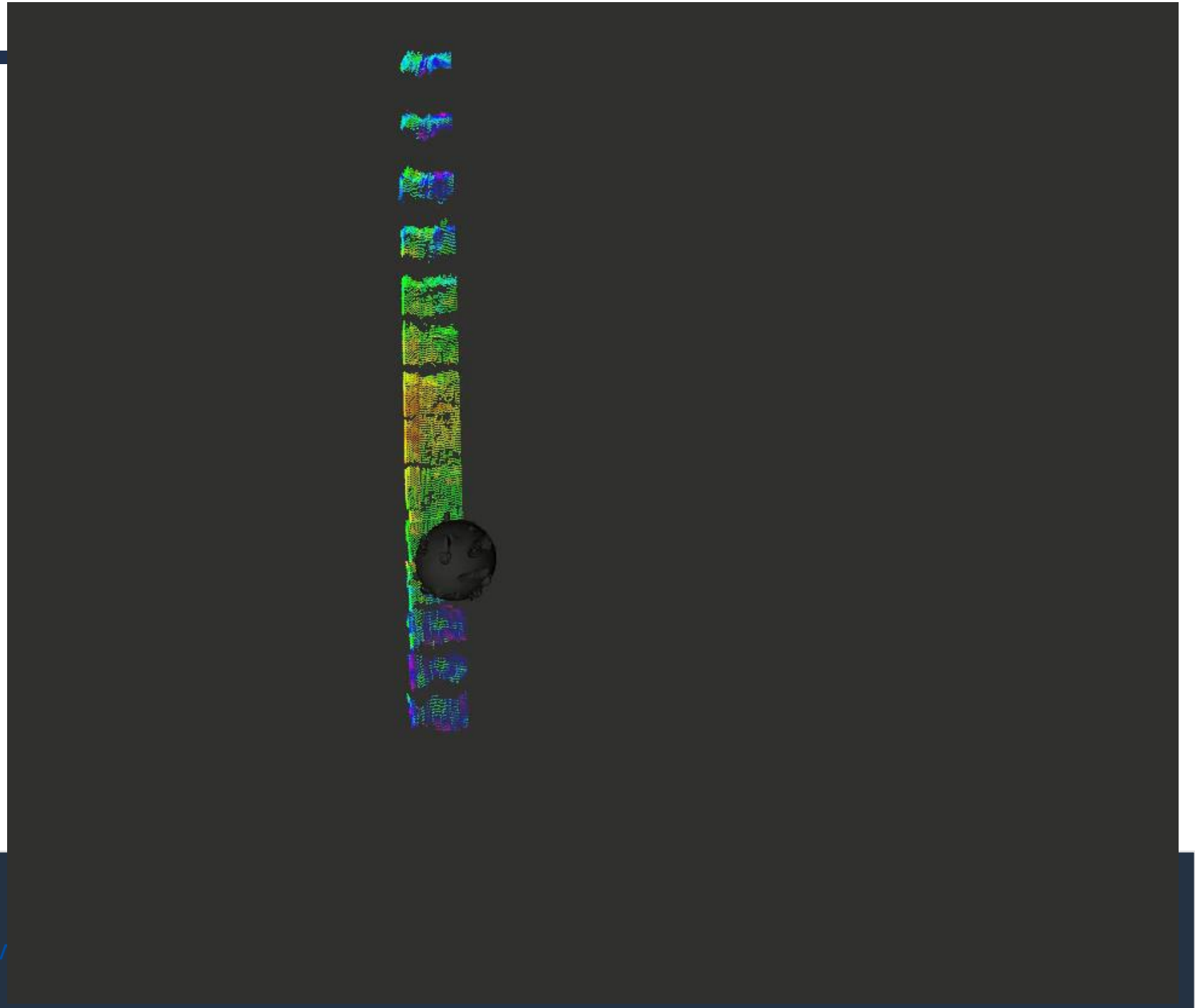
Building point cloud in the Shaft 10



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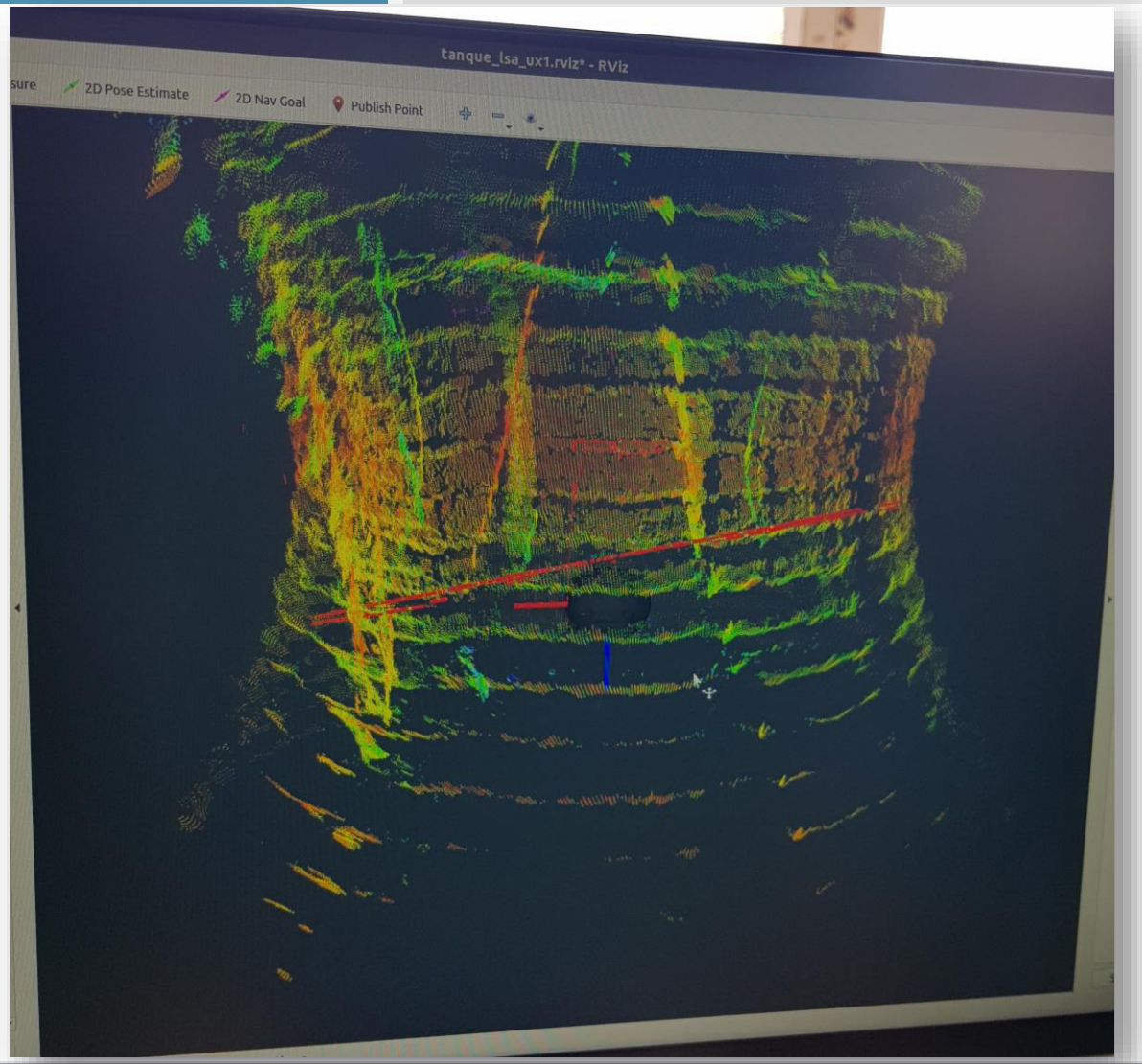
The salt saturated water



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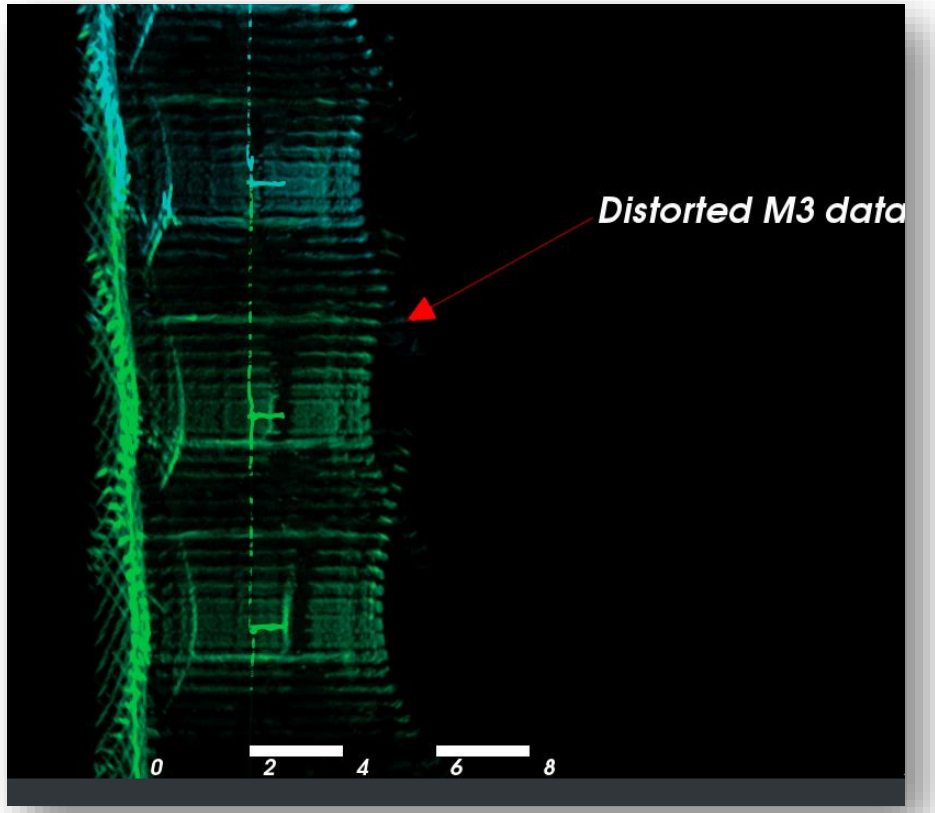
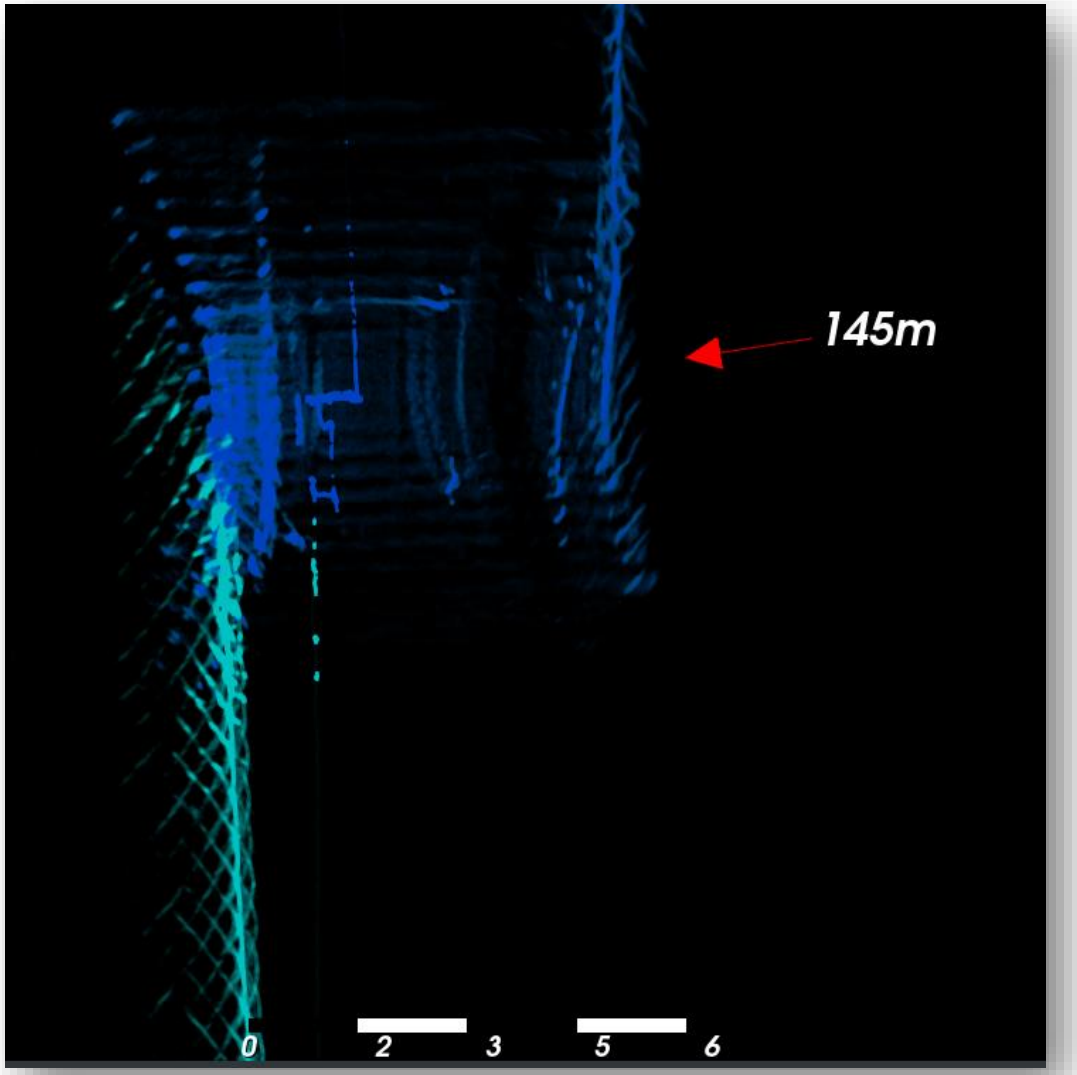
The salt saturated water





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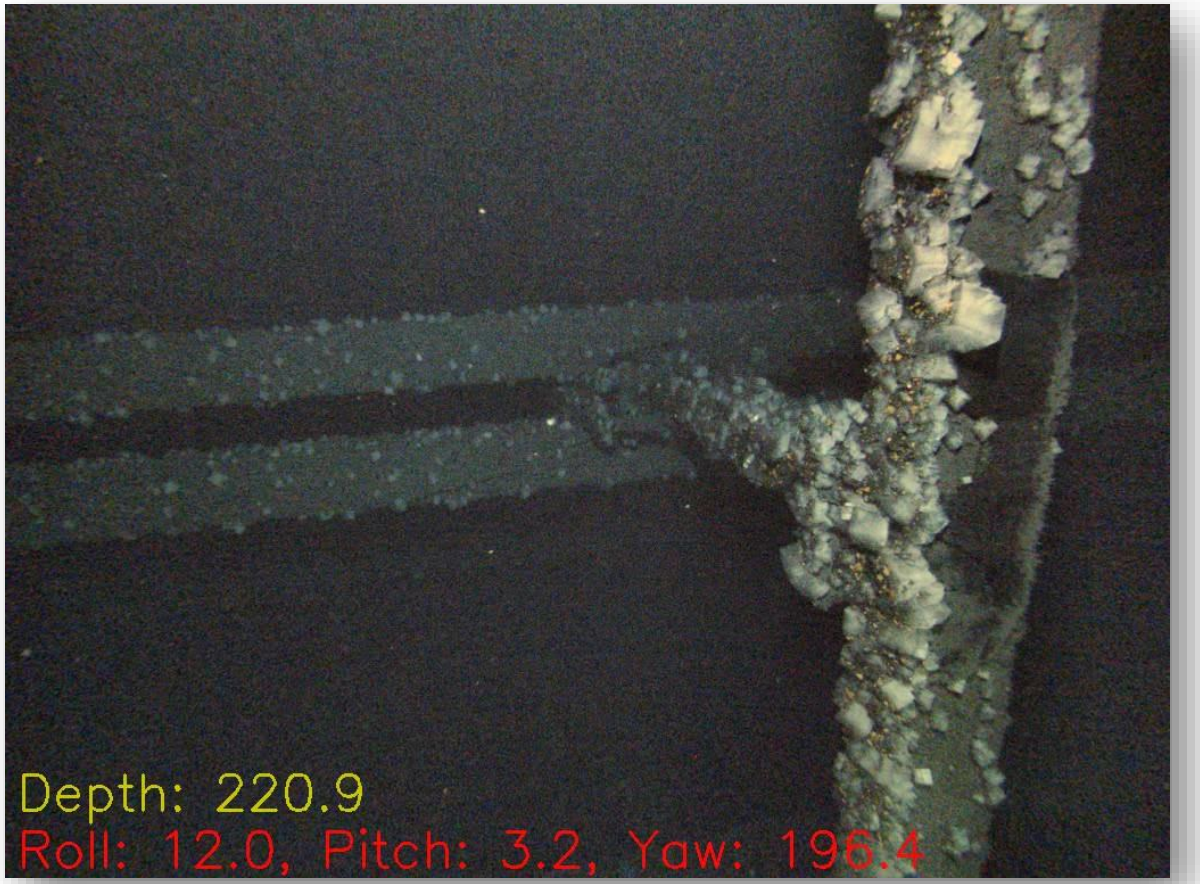
The salt saturated water



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The closed adit at -307 m (shaft 10)

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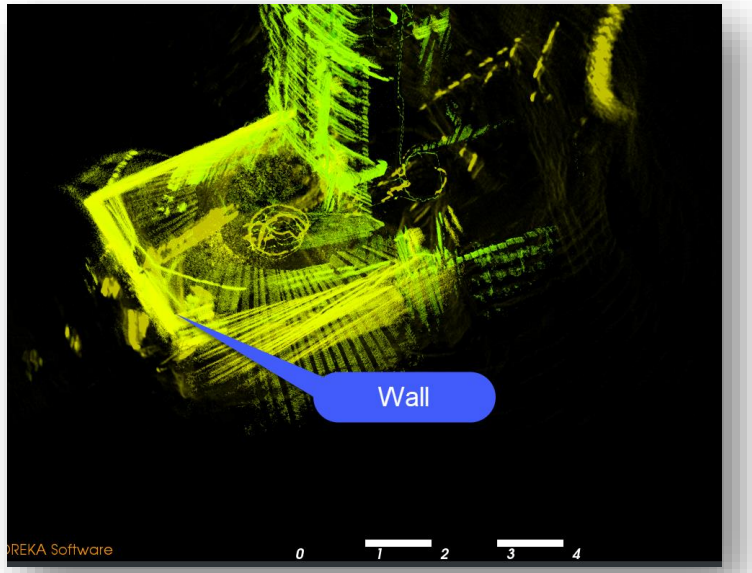
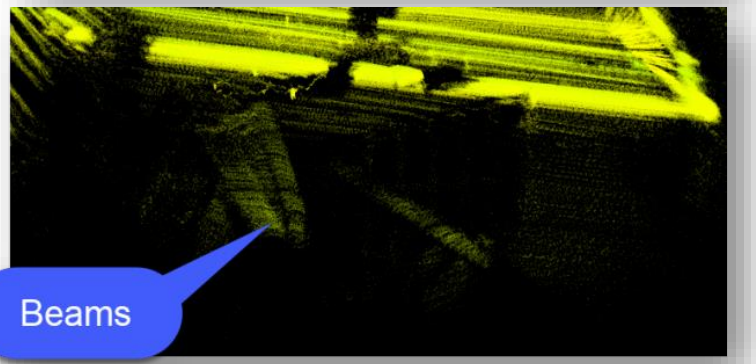
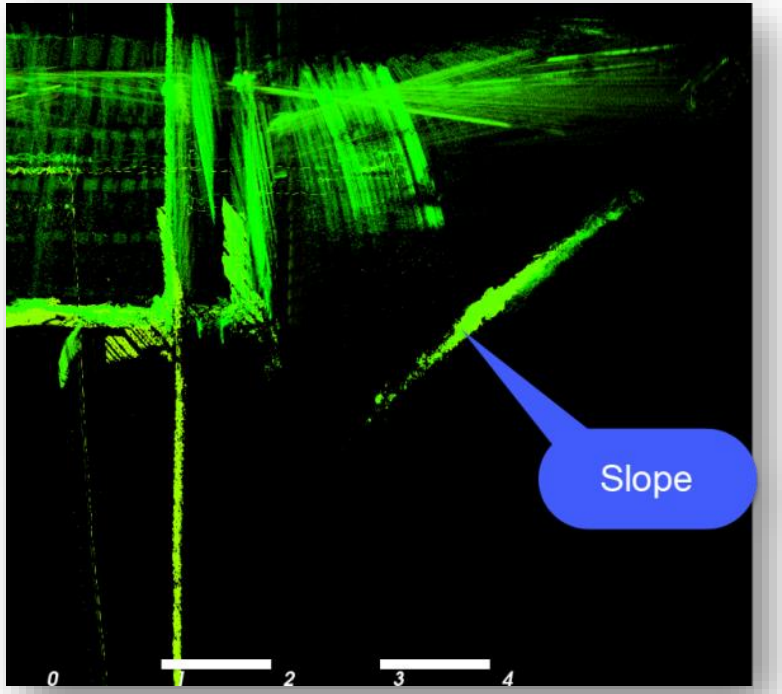
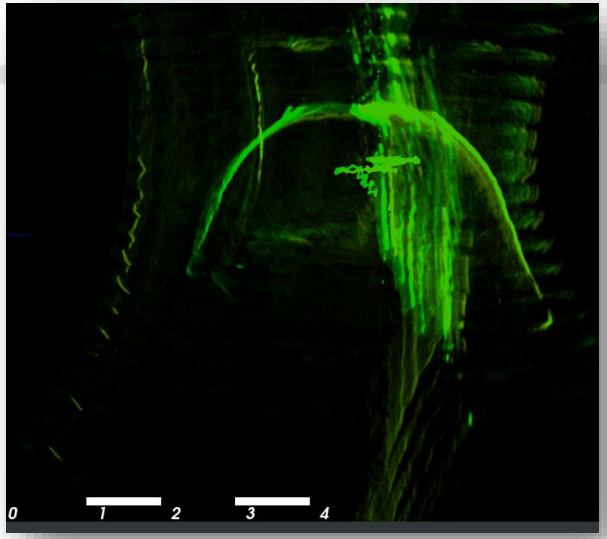
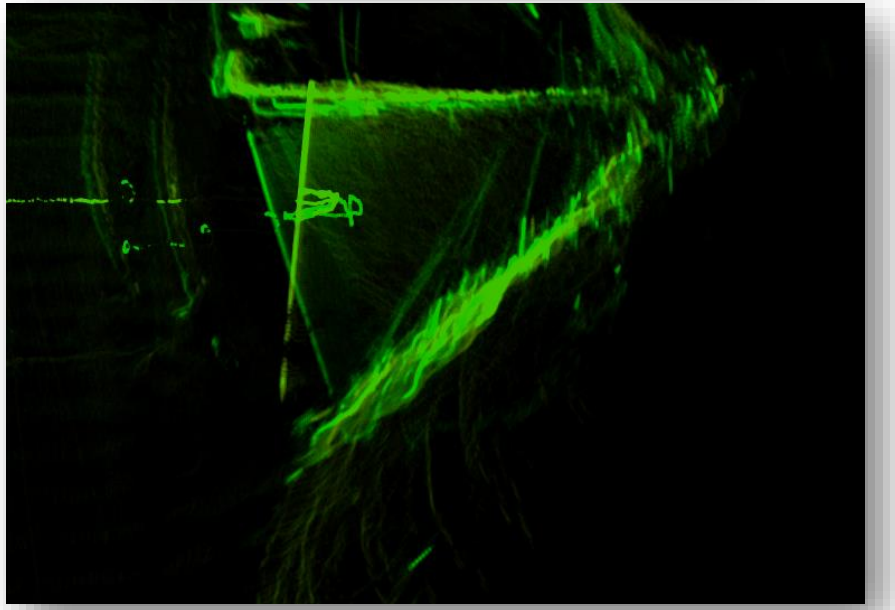
The closed adit











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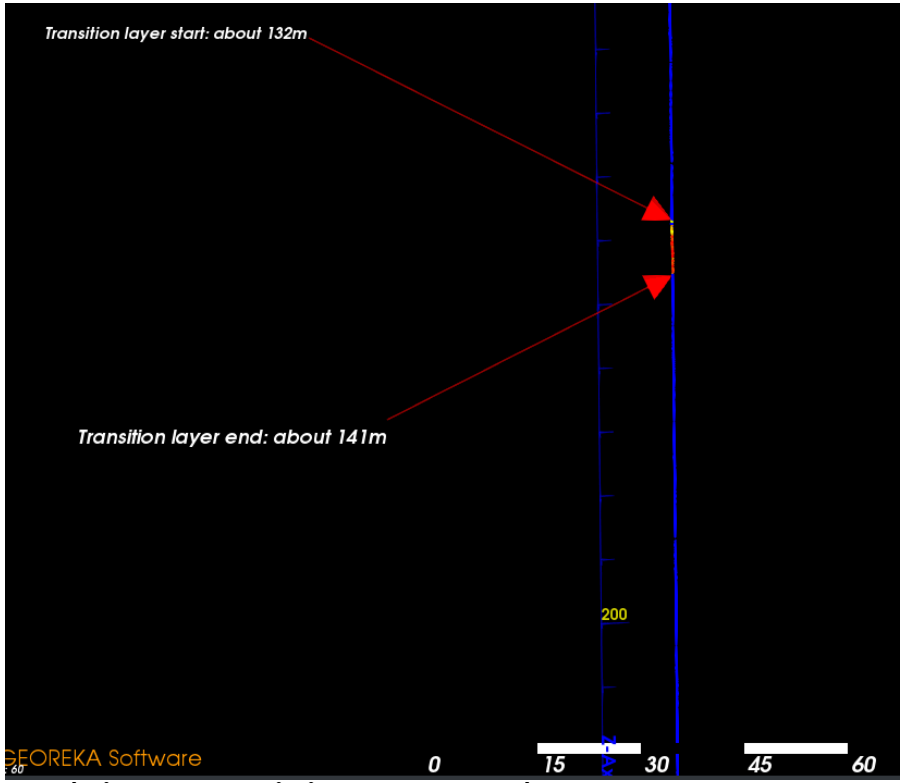
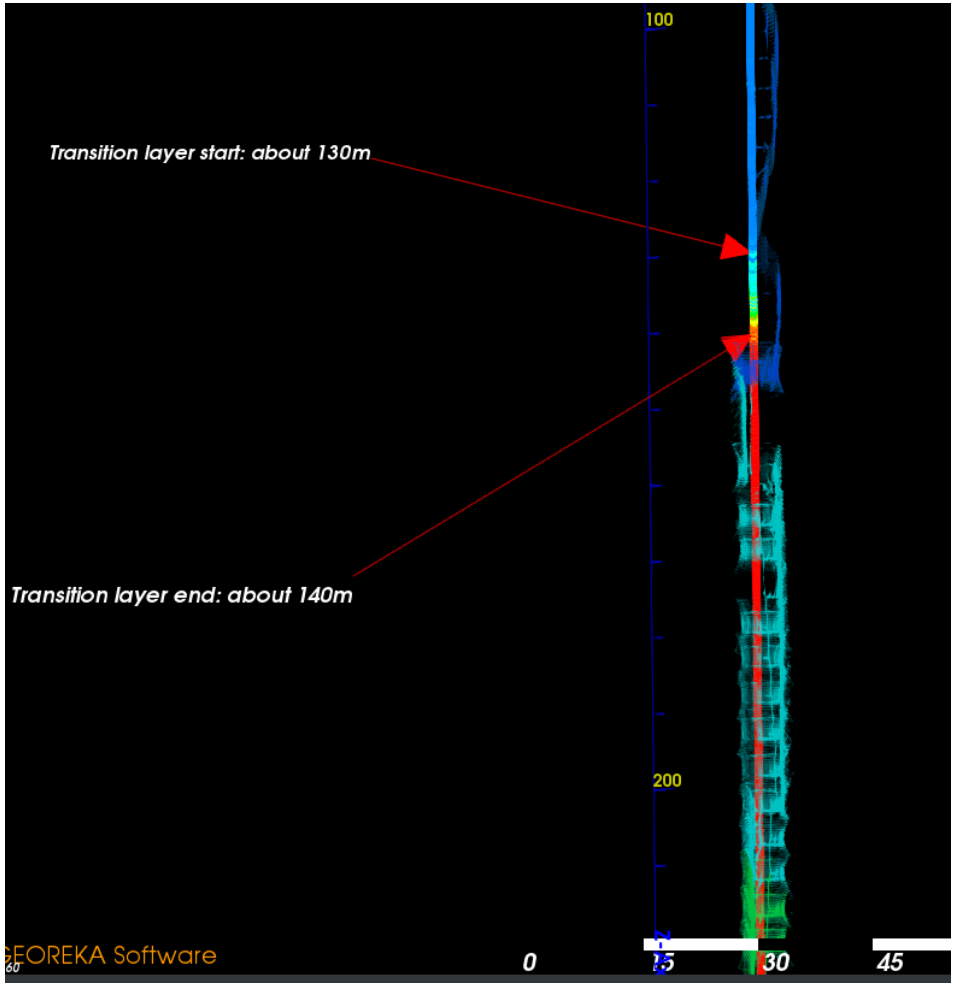
Water parameter measurements



This transition zone between 132m and 141m (oxygen fugacity)



This transition zone between 132m and 141m (EC)

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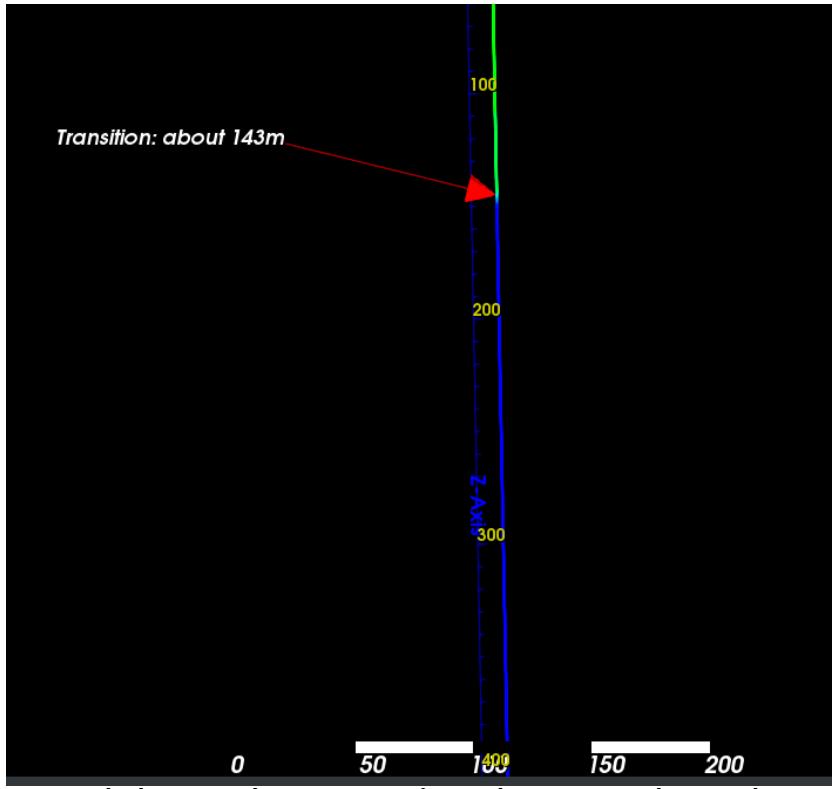
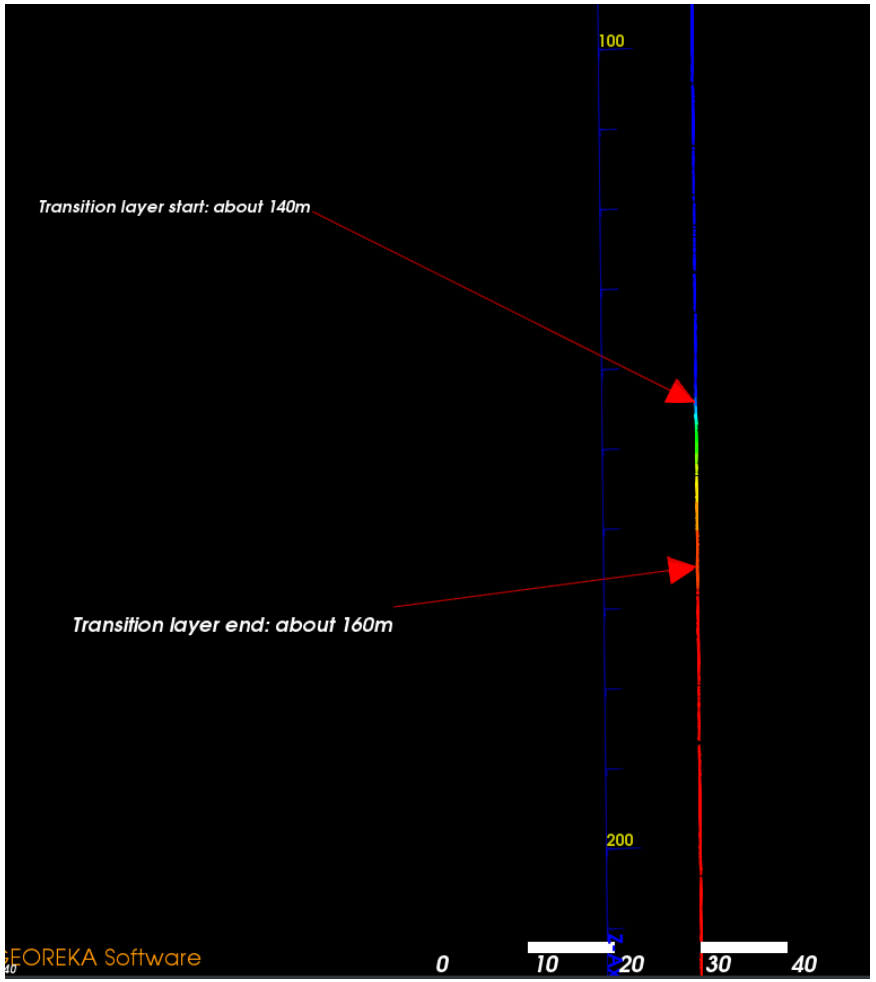
Water parameter measurements



Sudden change in the pH level at 143m



This transition zone between 140m and 160m (temperature)

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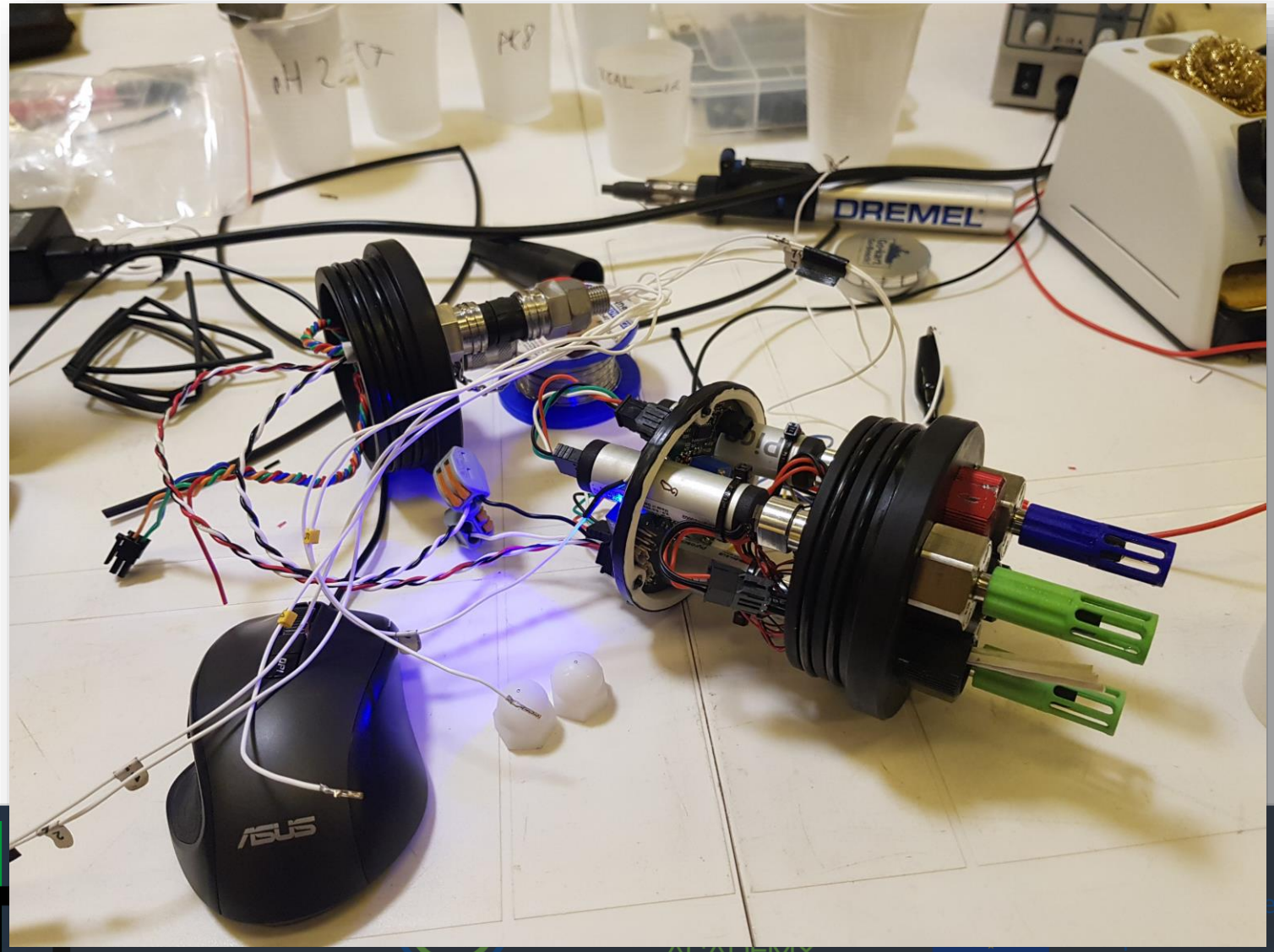
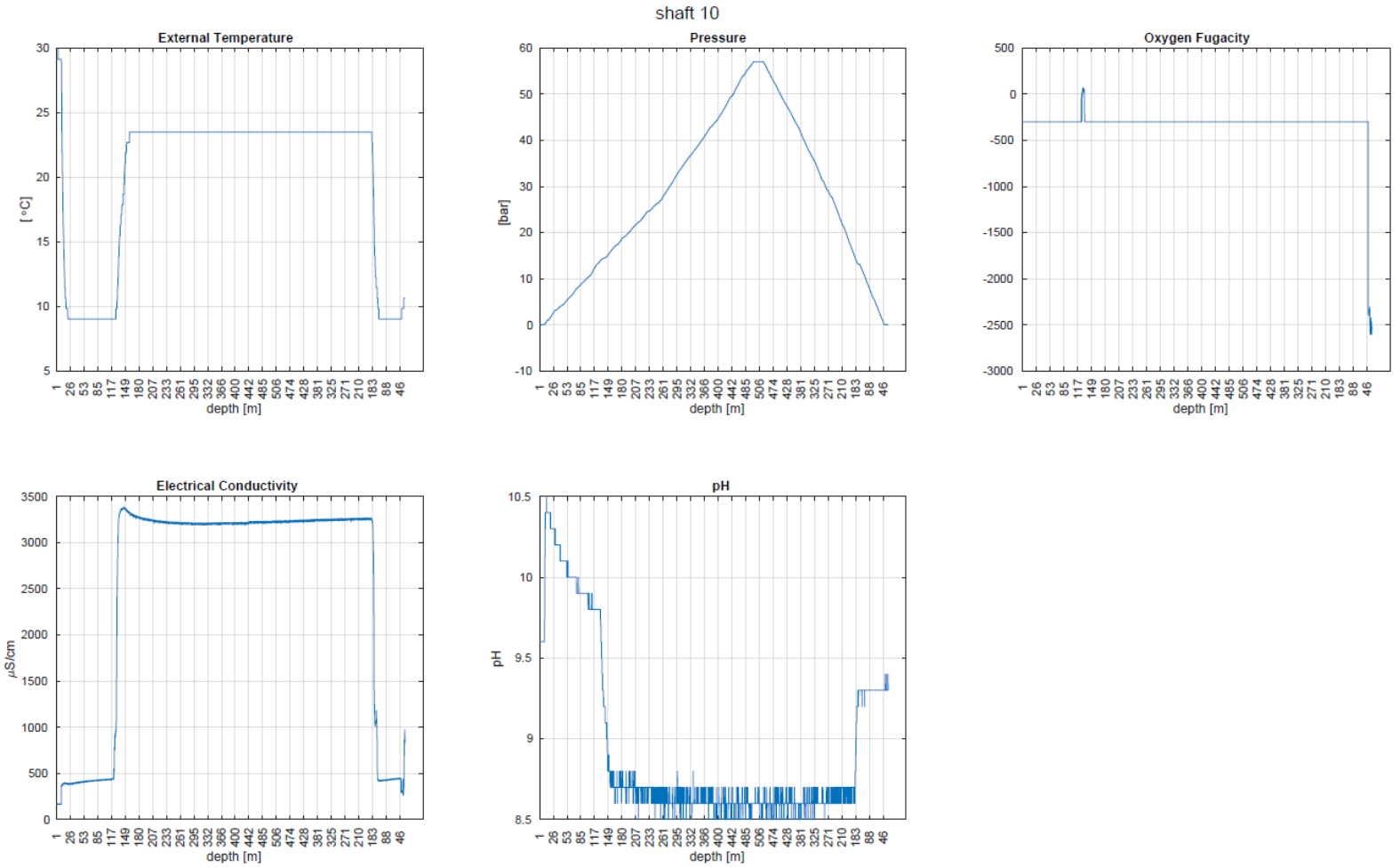
Standalone water parameter measurements



Standalone water parameter measurements



Thank you!

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