Tomographic Imaging of the Excavation Damage Zone for an Underground Disposal Facility

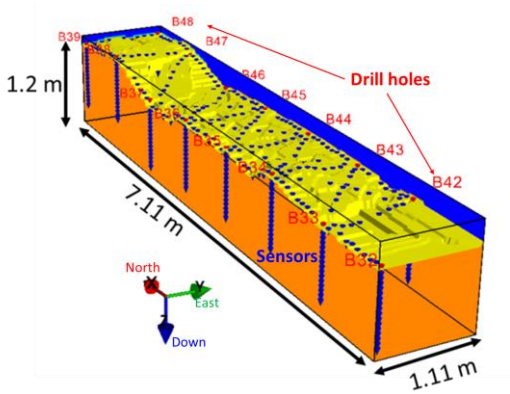
Areas: Geological Storage, Civil
Client: Posiva Oy
Location **Olkiluoto, Finland**.

Ultrasonic tomography is an active imaging technique that utilises the ultrasound to image the velocity variation beneath the excavation surface. This can provide a map of damaging through the structure based on the spatial variation of velocity images.

The combination of tomography with other geophysical measurements was used to quantify and evaluate the rock integrity in the floor area of an underground niche excavated at ~400 m depth to host medium to high level radioactive waste. The combined imaging technologies provided a thorough evaluation of the long-term safety and integrity of the rock mass.

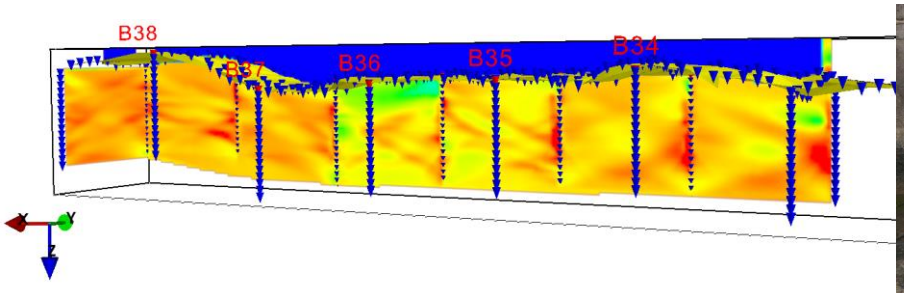
ASC's ROLE

ASC carried out the design and data processing for imaging the Excavation Damage Zone (EDZ) of the ONK-TKU-3620 niche at Posiva's Onkalo Underground Disposal Facility, excavated through drill and blast, to obtain a P-wave tomographic image of the top 0.8 m of the tunnel floor. The P-wave tomography covered a three-dimensional volume of the EDZ field sampled by multiple two-dimensional planes defined by drill-holes, providing 30 2-D sections along the North-South, East-West, North West-South East and North East-South West directions.



PROJECT RESULTS

The results showed that the P-wave velocity varies between 4,800 m·s^{-1} and 6,500 m·s^{-1}, with higher velocities at the northern end of the EDZ field. A general trend of increasing velocities with depth was observed, with lower velocities confined to the top 0.5 m associated with a higher degree of fracturing or damage. The modest variation of velocity with direction also indicates weak anisotropy. The higher velocities in the NE-SW direction may suggest oriented fracturing developed in its normal direction NW-SE. Some low velocity anomalies near a number of drill-holes can also be observed in the tomographic image and may be associated with local damage around the drill-holes. The combination of tomography surveys with other geophysical measurements can characterise the rock deformation in the EDZ and provides better evaluation of the long-term safety and integrity of the rock mass around engineered openings in the nuclear disposal facility.



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