Detecting and Analyzing Sound of Fracturing in Rocks

Rocks cry when they are under pressure! If damage or any irreversible changes happen in a rock, they release elastic energy in the form of acoustic signals. Just like a baby, a rock cries if the applied stress hurts it! The phenomenon that is known as “acoustic emission (AE)” is based on detecting seismic signals radiated from micro deformations in the rock. The number/rate of the AE signals is related to the number/rate of cracks, and the energy of the AE signal is related to the energy or magnitude of the cracking. AE conducts realtime and continuous detection of micro damages at their early stage of initiation, long before the crack is ever visible to the human eye. As a result, it can be used in health monitoring and damage detection of civil infrastructures, mines, tunnels, rock slopes, nuclear waste repositories etc.

In this thesis, by attaching sensors and listening to the rock fracturing under tensile and compression loads, the AE signals associated with actively growing cracks in the rock are detected and analyzed. Rock specimens from sandy and shaly facies of Opalinus clay as a host rock for nuclear waste disposal have been cored for laboratory testing in this thesis. The student has the chance to visit Mont-Terri underground laboratory where large-scale experiments are being conducted and rock specimens have been obtained.

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[Images of sensors and diagrams related to acoustic emission signals and a tunnel with a rock specimen.] (https://www.mont-terri.ch)