

**Digital volume correlation for the characterization
of crystallisation-induced damage in natural rocks
(Ezponda & Newpores project)**

NewPores research project presentation

NewPores is an international hub dedicated to the mechanics and physics of porous materials, which intends to answer to new Energy and Environment challenges. This is a joint effort of the group on Geomechanics and Porous Materials (G2MP) of the Laboratoire des Fluides Complexes et leurs Réservoirs at E2S UPPA (France), the Centre for Sustainable Engineering of Geological and Infrastructure Materials (SEGIM) at Northwestern University (USA), the University of Vigo (Spain), the Technical University of Madrid (Spain) and University of Liège (Belgium).

Ezponda research project presentation

The Ezponda project intends to answer to E2S-Energy and Environment challenges by predicting the evolution of the impact and the velocity of coastal erosion under current climate changes and forthcoming sea level rises. In particular, the Ezponda project aims at studying and hierarchizing the different key parameters (haloclasty, rain, storms), which drives coastal erosion and coastal protection building damage.

Haloclasty is a natural rock failure process driven by salt crystallization and salt weathering. It is particularly at sight on coastal areas because it is a key parameter for their natural erosion, which is a crucial social-economic challenge for local authorities in charge of coast management.

When saline fluids are present in the pore space of the material, salt crystals might precipitate upon changes in temperature or humidity conditions, leading to salt precipitation on the surface, efflorescence, or to salt crystals precipitating in the pores, subflorescence. The confined crystal growth within the pores might lead to a buildup of crystallization-induced stresses, which can eventually induce fractures in the porous medium.

It has been shown recently that neutron imaging and X-ray tomography are well-suited techniques for saline transport/precipitation visualization in rock sample and crystallization-induced fracturing analysis respectively. Three experimental campaign have been performed (UGA61/UGA90/UGA115) on D50/Next beamline at the Institut Laue-Langevin (ILL) on homogeneous and heterogeneous samples and X-ray and neutron 3D tomographic data sets have been collected for further analysis and model validation.

Partners

- E2S Newpores project (an international hub for the mechanics and physics of porous materials)
- Ezponda project, the European Regional Development Fund (FEDER) and the French Basque Country authorities

Master candidate objectives

Within the Ezponda project, the master candidate will be in charge of post processing the experimental data sets already acquired at ILL in term of Digital Volume Correlation (DVC) in order to characterize deformation strain and damage induced by salt crystallization and prepare documented case-study for further computational model validation. Note that an application has been filled for ILL beam time in 2021 and the master candidate may be integrated to the experimental team if beam time is granted. The next ILL experiment will focus on the influence of natural cracks in the damage induced by salt weathering.

Laboratory and internship location

- G2MP research team, LFCR lab (UMR5150 UPPA CNRS Total), Anglet, France.
- 3SR laboratory and Institut Laue-Langevin, Grenoble, France

Grant 560 € / month.

Duration From March to August 2021 (6 months).

Supervision David Grégoire – www.davidgregoire.fr, Alessandro Tengattini – <https://next-grenoble.fr/>