

EGU2020-4138

<https://doi.org/10.5194/egusphere-egu2020-4138>

EGU General Assembly 2020

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## Time-dependent behaviour and water influence on the mechanical response of gypsum rock in underground quarry frameworks

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The mechanical response of natural gypsum rock is relevant in a wide range of engineering applications (e.g. tunnel excavation, stability assessment of underground quarries, oil and gas accumulation). In particular, in underground quarry environments, static loading conditions insisting on the gypsum pillars during and after the exploitation activities (i.e. several decades) require a specific attention to the sub-critical time-dependent deformation of the rock. The short-term stability (referred to the possibility of a failure in consequence to the sudden application of the axial load) does not preclude the possibility of deformation or even failure in the long-term.

In addition, the underground drifts of gypsum quarries are often located below the static level of the groundwater table, requiring a continuous water pumping to allow for the accessibility of the drifts themselves. The end of the quarry activity, coinciding with the interruption of the dewatering operations and the re-assessment of the original level of water table, brings to the new water saturation of the gypsum body. The water fills the connected porosity of the rock, influencing the general stability of the underground voids.

For these reasons, the present work aims to investigate the mechanical response of gypsum rock in time-dependent regime, also considering the influence of water saturation. The study proposes an experimental investigation of the influence of water on the rheology of a natural gypsum facies (i.e. branching selenite gypsum), distinguishing between the mechanical effects of a saturating fluid (in relation to the internal pore pressure), that should also be observed with a non-reactive fluid such as oil, and the water-gypsum chemical interactions. This influence of water is investigated in uniaxial compression, under uniaxial creep conditions and conventional triaxial compression. The new mechanical data are accompanied by microstructural observations of the effects induced in the rock by the mechanical compression, aiming to propose a description of the mechanisms involved in the gypsum deformation process.