# The influence of atmospheric conditions on the weathering process and physical properties of rocks

## Purpose of research

The main scientific objective of the project is to investigate the impact of atmospheric conditions (rainfall, high temperature) on the weathering process and physical properties of selected types of rocks. The tests will be carried out on freshly collected samples from four quarries and then on selected objects built from the same rock from the same quarry. The questions that will be asked during the research will concern the differences between selected types of rocks, whether they occur, how strong they are and which measured parameters of the physical properties of rocks most define the weathering process.

## Research plan

Four granite, basalt, dolomite, and sandstone quarries located in southern Poland will be selected for the study. A sculpture/object made of the same natural raw material will be selected for each type of rock. Laboratory tests will be preceded by taking samples from four different quarries and cutting them to 20 cm x 20 cm x 30 cm. The minimum sample size depends on the transducer frequency and sampling rate used. The study will measure the longitudinal and transverse wave velocities and, additionally, the hardness of the rock.

After the study, the data will be developed, interpreted, and visualized. The results obtained will allow for the correlation of results and finding common relationships. Additionally, additional machine learning tools will be introduced to model the geological medium and the object being studied.

### Motivation

From a geological point of view, the rock mass is a very complex anisotropic medium divided by cracks of various shapes and sizes. Hence, an important feature of the massif that influences its elastic properties is its fissure nature. Recognition of this phenomenon and the impact of cracks on the strength of the massif is necessary due to the use of the obtained results in constructing tunnels, landfills, or testing the stability of a geological medium in engineering research. The rock material is also used as a finishing material and decorative stone. Therefore, it is important to know the influence of atmospheric factors and conditions on the weathering process and to know what parameters describing the physical properties of rocks influence the rate of the weathering process and the durability of selected rocks. In order to determine physical parameters and assess the weathering process, elastic wave velocity measurements are performed, among others. Since some methodologies are invasive and destroy or affect the structure, non-destructive testing (NDT) is the best technique. An example is the ultrasonic tomography method, that will be the main method used in this project.

The scientific design aspect presented is important because integration between laboratory-scale measurements of rock physical properties, relief measurements, and modeling is critical to better understanding the evolution and dynamics of the Earth's crust. It is also an effective approach to predicting the destruction of rock materials by taking into account their heterogeneity, which is important for safety and stability and the preservation of cultural values.

## Expected results

The obtained results will provide knowledge on the influence of cracks on the strength of the massif and the influence of atmospheric conditions on the rate of weathering of rocks. Research on the above-mentioned topics is not the first research on a global scale, but it will certainly contribute to improving the methodology of performing ultrasonic tests. In addition, the idea of comparing the influence of atmospheric conditions on freshly collected samples from the quarry and on selected objects, together with modeling, which allows for verifying the interpretation of the obtained results, is very rarely used. Additionally, examining this phenomenon in southern Poland in the described way will most likely be the first study of this type in Poland.