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Microstructural parameters controlling the mechanical properties of granite aggregates

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The microstructure is of great importance in understanding a rock's mechanical properties.

The term microstructure includes the complete spatial and geometrical configuration of all those components that make up a rock. It covers concepts such as grain size, grain shape, and the orientation of grains and fractures, all of which are products of the rock's origin and tectonic history. The main issues studied are the influence of microstructure on granites resistance to fragmentation when it is used as an aggregate.

Traditionally, most microstructural investigations are based on qualitative visual estimations. This presentation gives an overview of which microstructural parameters are crucial for the mechanical properties and also some methods which shows how it is possible to quantitatively describe these parameters. The texture, here defined as the mineral size, shape and spatial dispersion were quantified by measuring the perimeter of each mineral phase from SEM/BSE images. The degree of foliation was numerically described using a foliation index (FIX) based on linear-traverse measurements on thin sections using optical microscopy. The results of the perimeter measurements of the granites showed that high values corresponded to fine-grained granite where the minerals occur as individual grains rather than monomineralic aggregates. High perimeter values corresponded to rock aggregates with high resistance to fragmentation. However, foliated samples do not show this relationship because the foliation creates mechanical weak discontinuities, which is not taken into account in the perimeter measurements. But by using the foliation index the intensity of variation in foliation

can be numerically described.

Microcracks are another very important parameter controlling quality of the aggregate. Microcracks occur naturally in almost all granites, but can also be formed from blasting and the manufacturing process of the aggregate. It is the type and size of microcrack rather than the amount that are crucial for the mechanical properties. Studies have shown that intragranular and transgranular microcracks are most important compared to grain-boundary cracks. Combined fluorescent and polarised optical microscopy is a very suitable tool to numerically describe and make a differentiation of the microcracks.