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Metamorphic micro-textural variations and their bearing on rock technical properties. A case study of the transition from greenschist- to high-pressure granulite-facies in the Eastern Segment, Sveconorwegian orogen

Cindy Urueña[1], Charlotte Möller[1], Jenny Andersson[2], Mattias Göransson[2], Jan Erik Lindqvist[3], and Urban Åkeson[4]

[1]Lund University, Geology, Lund, Sweden (cinur.geol@gmail.com)
[2]Geological Survey of Sweden, Uppsala, Sweden
[3]RISE, Lund, Sweden
[4]Swedish Transport Administration, Gothenburg, Sweden.

The Precambrian shield in southern Sweden exposes a granitic bedrock segment that represents a part of an ancient eroded mountain belt and expose a gradual change in metamorphic grade from cold (<300°C), little affected by recrystallization, to hot (>800°C) and partially molten sections at the west coast (Möller and Andersson, 2018). This area – the Eastern Segment – offers a large scale study of the interdependence of metamorphism, deformation, partial melting, and functional properties of crushed rock aggregates.

In the petrological community, it is well-known that the evolution of a metamorphic unit (e.g. a high-pressure unit) with respect to pressure, temperature, time, and deformation holds key information on its tectonic history. It has rarely been emphasized, however, that the same factors determine the physical properties of the rock and thus, its technical properties. Basic research in metamorphic petrology thus contributes with a fundament to applied and technical science, e.g. by providing data that lead to quarrying of proper materials.

This study assesses the variations of technical properties with the metamorphic state, primarily metamorphic temperature and partial melting during metamorphism. Our first results show the correlation between the petrological characteristics and technical properties of felsic orthogneiss within a migmatized eclogite-bearing terrane and its high-pressure granulite-bearing footwall.

Measurements include the Los Angeles and Micro-Deval value tests. The Los Angeles value is a measure of the resistance to fragmentation (EN 1097-2, 2010). The Micro-Deval test measures the resistance to wear.

High values of the Los Angeles and Micro-Deval analyses for felsic orthogneiss in the eclogite-bearing domain reflect poor technical properties and are largely linked to that the rocks underwent partial melting. Orthogneisses in the footwall, which recrystallized under high-

temperature, dry conditions, and without partial melting, tend to have lower values. This group includes high-quality rocks for the production of aggregates suitable for asphalt base courses and unbound road layers.

Micro-textures in the orthogneisses are linked with these metamorphic conditions. The clinopyroxene-bearing orthogneisses have complex grain boundaries and micro-perthitic feldspars, finer average grain size, lower biotite content, and absence of migmatitic segregation or penetrative veining. These textures in the footwall orthogneisses contrast with those in the migmatitic orthogneisses from the eclogite-bearing domain, which have a coarser average grain size, even-grained and granoblastic texture, and lack of perthitic texture in feldspars. Thus, these petrographic parameters govern the technical differences.

Our ongoing research addresses the relations between macro-fabric, micro-texture and technical properties of felsic orthogneiss and metagabbro, respectively, along 120 km profile across the metamorphic field gradient from greenschist- to high-pressure granulite-facies in the Eastern Segment.