

SEDIMENTARY CHARACTERISTICS, BRITTLE STRUCTURES AND
PROSPECTING METHODS OF THE FLAMMET QUARTZITE
a feldspathic metasandstone in industrial use from the Offerdal Nappe, Swedish Caledonides

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ABSTRACT

This thesis deals with the sedimentary characteristics, brittle structures, and prospecting methods of the Flammé Quartzite (loc. Offerdalskiffer), a dimension stone quarried in the Swedish Caledonides. The two main areas of emphasis are firstly the exploration in an area of no bedrock exposure, and secondly the assessment of the deposit.

The Flammé Quartzite is quarried within the Offerdal Nappe at the Landögssjön area, in the county of Jämtland, Sweden. The Offerdal Nappe belongs to the lower part of the Middle Allochthon of the central Scandinavian Caledonian thrust belt, and contains three tectonostratigraphic units separated by thrust displacement. The Offerdal Nappe is correlated with the riftogenic Risbäck paleobasin. The Risbäck basin is characterised by coarse clastic sediments dominated by fluvial deposits passing laterally into lacustrine and various marine facies. The extracted rock material is derived from subunit D of the local stratigraphy of the Finnsäter region, which belongs to the lower part of The Upper Tectonostratigraphic Unit (UTU) of the Offerdal Nappe. Subunit D is composed of feldspathic metasandstone with a sharply defined compositional layering differentiated into cleavage domains and microlithons. The cleavage domains are characterised by oriented phengitic muscovite and microcrystalline quartz, and the microlithons are made up mainly of recrystallised quartz and feldspar. The cleavage has an average frequency of 4 cleavage planes/10 mm. The thickness of the cleavage domains varies between 0.5 to 1.5 mm with crenulation amplitudes of up to 0.5 mm. The persistency of parallel series of cleavage planes can be traced for several meters (> 5 m).

Fracture studies within the Nya Finnsäter quarry have defined 3 main fracture sets. Mean direction of orientations are 277/85, 149/89 and 208/86 with an estimate of mean fracture trace length of 4.4 m, 3.4 m and 8.0 m respectively. Fractures oriented along 208° and 149° occur in fracture zones that are generally traceable along the full length and width of the Nya Finnsäter quarry (more than 150 m). Based on the presence of larger continuous fracture zones, it is possible to predict fracture frequencies in non-accessible areas (i.e. areas covered by drift material). By extrapolating fracture traces from a small mapping window a rough picture of the geometry of the local fracture system can be obtained. For example, in a trench 30 – 50 m long and 1 m wide excavated down to bedrock, a valid fracture prognosis can be made extending 14 m to either side of the trench.

The fracture prognosis also takes into consideration natural and induced fractures. Two types of fracture occurrences related to blasting have been defined; type A coalescing fractures with at least one end terminating in a drill hole, and type B coalescing fractures with one end terminating in a type A fracture. Fractures of type A increase the fracture frequency to 23 %, type A and B together increase the fracture frequency to 36%. In this investigation, approximately 17 % of the rock volume shows increased fracturing from the blasting operation.

Keywords: Cleavage, cleavage domains, microlithons, induced fracturing, natural fracture system, dimension stone quarry, Flammé Quartzite, Offerdalskiffer, Offerdal Nappe.