

## **Uniting geology and craftsmanship to find the optimal soapstone for restoration of the Nidaros soapstone Cathedral in Norway**

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The Nidaros Cathedral situated in Trondheim, Norway is a restored cathedral resting on the remnants of an original medieval church sanctified St Olav. The cathedral became one of the most important sanctuary for pilgrimage during the Middle Ages and still is today. In a European context the cathedral, along with a certain group of other churches and monasteries in Norway, is unique by being build from soapstone (steatite). This talc and chlorite dominated metamorphic rock is relatively soft, heat resistant and dense making the material ideal for cooking pots, stoves and all kinds of utensils. Soapstone has therefore been appreciated, used and quarried since the Stone Age in Norway. At the onset of Christianity the choice of soapstone from harder rock types was not difficult for the building owners combining the vision of stone churches in Norway with the skills of wood carving traditions of local handicraftsmen. The best example is the Nidaros Cathedral built in the 11th to 14th century. In 1869, the Nidaros Cathedral Restoration Workshop (NDR) was founded with the purpose of restoring the cathedral using original craftsman's techniques and authentic materials.

The restoration was originally completed in 1969, but is still ongoing due to weathering of certain used soapstone types. A major challenge remains to find soapstone resources of the right quality. Core issues relate to avoid rocks with cracks and cleavage, a demand for homogeneity, maintaining esthetic authenticity, resistance to weathering (disintegration) and last but not least the ultimatum of workability. Thus locating new soapstone resources depends strongly on geological understanding, quarry experience and stone carver's knowledge.

The present work is based on close cooperation between stone carvers and geologists in a common goal of uniting knowledge and experience in defining qualities of soapstone for various purposes of restoration. Cooperate observations of geology and carving properties in the very same spots has been performed during fieldwork, through studies of drill cores and during carving in the workshop of NDR. Through careful geological translation of terms and experience from the stone carvers, a series of stone properties have been outlined. Supplementary studies of alteration and damages to stone has added significantly to the present bank of knowledge. The internal qualities of a soapstone has subsequently been described in terms of the geological processes forming it and the cycles of deformation altering it. The most important conclusion from this work is, that most deposits holds contradictions between workability and durability. The workability calls for soft minerals while the durability is dependent on weathering resistant and hard minerals. Only a narrow window exists in which the softness is united with resistance to alteration.