

A Rock Tour of Scandinavia

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A Churchill Fellowship in 2009 took the author to study traditional building craft, skills and materials in Scandinavia. It was primarily a learning exercise for future training at the National Stone Centre, but it provided a great opportunity to see some of the geology and stone quarries in the Nordic countries.

The geology of Scandinavia can be summarised as a Precambrian shield beneath most of Finland and much of eastern Sweden, with Norway dominated by the Caledonides. The Baltic islands of Öland and Gotland are almost undisturbed Silurian and Ordovician sediments, whereas Skåne in southern Sweden has Mesozoic rocks. The Oslo Graben is largely filled with Permian igneous sequences. The small Danish island of Bornholm remarkably combines almost all of these elements. Timber is the predominant building material and always has been, but Norway, Sweden and Finland each have about fifty key quarries for building stone. Lime is produced on Gotland and in Denmark.

Norway has two main clusters of activity – in the Fjordlands between Trondheim and Bergen, and around Oslo Fjord. Larvikite (on the south coast) dominates national production, followed by flagstone (quartzite at Oppdal and Alta), black phyllites (at Otta), and granites (notably at Iddefjord). A wide variety of other rocks that are also worked include soapstone, marble and slate. In Trondheim, the Nidaros Cathedral is remarkable for the sixty sources of its ornamental stonework. Soapstone is dominant, but others include sandstone, dolomite, marble, greenschist, granite, syenite and gneiss. Not far south of Trondheim, the old copper mines at Løkken and Røros are heritage sites (the latter has World Heritage status), and Oppdal has quarries in cleaved quartzite.

In southern Norway, large quarries near Larvik each produce different varieties of larvikite. Almost all the building and decorative stone is exported, with about 80% of it going to China and then as finished products to the USA and Europe. Of the larvikite that doesn't reach the quality for making worktops or cladding stone for shop fronts, blocks weighing 20-60 tonnes are loaded directly onto barges for despatch to coastal defence sites, including many in Britain. On the southern border near Fredriksborg is one of the few remaining, traditional, monumental workshops, and one of the nearby islands has a community-run granite museum.

Denmark has historically been dependent for stone on her former Baltic territories such as Gotland. Hard rock is confined to the island of Bornholm in the southern Baltic, but production is now almost nil. What was a granite industry at Mosseløkken now mainly delivers education in heritage skills.

Sweden has most of its stone industry based in the southern quarter of the country, especially around Kristianstad, on the Baltic islands and along the west coast. Most stone, including that from an active diorite



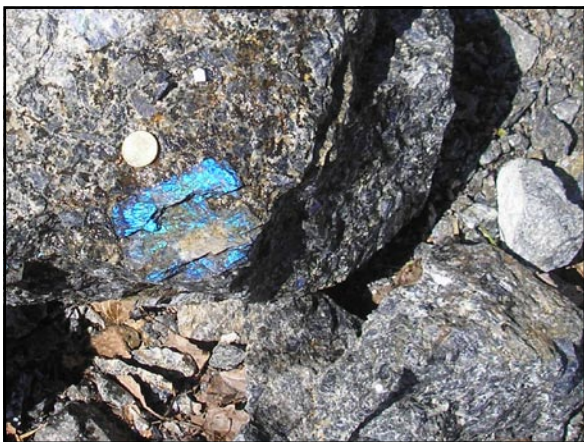
A coastal quarry producing larvikite in southern Norway.

quarry near Boalt, is used domestically or within Scandinavia. The Baltic islands of Öland and Gotland have more than their share of the stone industry, with shallow extraction of sandstone on both and an important lime industry on the latter. On Gotland, Visby is a centre of the modern lime industry and was once noted for its building stone; it has many very large and mainly derelict churches built of limestone. A local industry in green marble is just surviving, though most of its former quarries now host tigers in a safari park.

Finland has most of its stone industry in the southern half of the country, and this has grown significantly over the last twenty years. Granite is worked mainly in the southwest, notably at the massive quarries of Balmoral Red granite. Further northeast, at Lappeenranta, extensive quarries extract rapakivi granite and supply processing works nearby. In contrast, very small quarries, some only metres from the Russian border near Ylämaa, produce spectrolite, an iridescent variety of labradorite feldspar prized as a semi-precious gemstone. It occurs in rafts of anorthosite within a small batholith, and is largely produced from very selective, one-man

quarry operations. A soapstone industry in central Finland works deposits of talc-magnesite-greenstone. The forts of Suomenlinna, at Helsinki, are a national treasure maintained by prisoners training as masons.

Choices of natural stone are dictated by price, aesthetics and the ability to deliver, but some decisions have been controversial. In Helsinki, there is flexing and potential failure, under the sub-Arctic conditions, of the panels of Carrara marble used on the Finlandia Concert Hall. Now there is controversy over the potential use of Carrara marble for cladding and roofing the Norwegian National Opera House. The main types of stones used originally in Sweden's Royal Palace in Stockholm were Roslagen Sandstone from the north of the city (now either exhausted or built over) and Gotland Sandstone (which some claim poses technical issues); the Palace is in need of restoration, but national pride may not accept the use of German or British sandstone. By contrast, the Danes lost their original building stones when Gotland was ceded to Sweden in the seventeenth century, and they have had few qualms about restoring the Amalienborg Palace using imported stone.



The iridescence of spectrolite shows in a loose block on a quarry floor near Ylämaa in eastern Finland.

A small quarry exposes the spectrolite.

