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Soapstone in the North Quarries, Products and People 7000 BC – AD 1700

Gitte Hansen and Per Storemyr (eds)

UNIVERSITETET I BERGEN

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Preface

This book has been a long time in the making. It is an outcome of the five Norwegian University Museums' joint research programme Forskning i Felleskap (FIF, 2010–2015), supported by the Research Council of Norway. FIF kindly facilitated a number of workshops and meetings between archaeologists, geologists and craftspeople, all with a common interest in premodern soapstone quarrying and use. The result is the chapters of this book, which are based on studies carried out over the last two decades and, for the most part, are published scientifically for the first time. We very much thank the authors for participating in this venture. We also thank several colleagues – archaeologists, geoscientists and craftspeople – that assisted the editors in peer-reviewing the chapters: Irene Baug, Birgitta Berglund, Laura Bunse, Poul Baltzer Heide, Richard Jones, Tor Grenne, Torbjørn Løland, Therese Nesset, Astrid J. Nyland, Lars Pilø, Kevin Smith, Lars F. Stenvik, Frans Arne Stylegard and Stephen Wickler; we are very grateful for the job you have done. Not least, thanks go to Tromsø University Museum, NTNU University Museum (Trondheim) and the University Museum of Bergen for their economic support in publishing the book.

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Gitte Hansen
Per Storemyr

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Øystein J. Jansen and Tom Heldal

The Building Stones from the Vanished Medieval Church at Onarheim, Tysnes, Hordaland County in Western Norway: Provenancing Chlorite Schist and Soapstone

This study centres on the provenance of soapstone and chlorite schist building stones at Onarheim church, 50 km south of Bergen and also provides geochemical results that are of key interest in further studies of Norwegian chlorite schist bakestone. The present Onarheim church is made from wood but building stones from previous stone churches at the site (12th century and early 19th century) are found in foundation walls and the walls surrounding the churchyard. Geochemical analyses (main and trace elements, Sr-Nd isotope composition and rare earth profiles) from such stones were compared with results from similar analyses from a variety of quarries, including reference quarries in Rogaland and Trøndelag (chlorite schist). Unsurprisingly, the nearest soapstone quarry (Baldersheim) and the regional source of chlorite schist (Ølve-Hatlestrand) gave the best matches. However, the results also indicate two additional sources of soapstone, one of them is the distant Arnafjord quarry. This may represent an input of soapstone for post-medieval restoration and/or early 19th century construction works. A very important result of the study was that Sr-Nd isotope ratios distinguish between the known medieval chlorite schist quarries in Norway and different quarries at Ølve-Hatlestrand. Bakestone made from chlorite schist is found all over Norway and the opportunity to fingerprint their origin may aid in future interpretation of medieval trade patterns.

Introduction

The present wooden church at Onarheim in the Tysnes municipality, south of Bergen, was built in 1891/92 (Figure 1). However, building stones in the foundations of the church and in dry stone walls surrounding the church yard are believed to be re-used from older stone churches at the site: a medieval church dating from AD 1180–1200 and a larger stone church replacing the medieval one in 1819. The external measures of the former were, according to records from 1686 and 1721, 11.9 x 10 m, whilst the latter was significantly larger, measuring 32.6 x 13.1 m (Hoff & Liden 2000:267–268). Ashlars of chlorite schist (Figure 2a) and soapstone (Figure 2b) are seen in the foundations of the present church and occasionally found in the dry walls surrounding the grave yard. The majority of the reused stones are, however, undressed slabs and rubble of banded gneiss, augengneiss, quartzite, rhyolite and greenschist, probably supplied from local bedrock and erratics (Figures 2b and 2c). Remnants of lime mortar are found on the majority of the chlorite schist and soapstone ashlars and

Figure 1. *Onarheim church, built in wood 1891/92. (Photo: Ø. J. Jansen).*

also on many of the slabs of local rocks, supporting the idea that both the dressed stones and rubble blocks were reused stones from the older stone churches.

During archaeological excavations at the churchyard in 1990, dressed stones were collected from portals and window frames, supposedly from the medieval stone church (Hoff & Lidén 2000:268). The majority of the collection, stored at the University Museum of Bergen (inv. no. BRM 454), consists of chlorite schist but also include two blocks (Figure 3b) and a pillar base of soapstone. Based on the large amount of ashlars found, Anne-Marta Hoff and Hans Emil Lidén (2000:268) proposed that the previous generation(s) of church(es) at Onarheim were clad with ashlars of chlorite schist and soapstone, at least on the external walls. The find of a scalloped capital (Figure 3a) and a pillar base displaying a waterholding profile (Figure 3c), both made from chlorite schist, are particularly important for dating the ornamented building remnants to around 1180–1200. Thus, it is reasonable to assume that the masonry of chlorite schist and possibly soapstone, predominantly originated from the medieval church. For these two rock types, there are some likely sources close to Onarheim displaying strong visual and mineralogical similarities with the rocks found at the church site.

Numerous chlorite schist quarries are located in the Ølve-Hatlestad area, about 20 km from the church. Judging by the marks on the quarry faces and other evidence, these were quarried for several purposes: bakestones, roofing slate, slabs for grain drying and building stone (Weber 1984; Naterstad 1984; Jansen & Heldal 2009; Baug 2013, 2015, this vol.). Several of the quarries display marks from the extraction of ashlars of similar dimensions as those from the Onarheim Church. Commonly, such ashlar extraction overprints the typical circular depressions from baking slab production (Jansen &

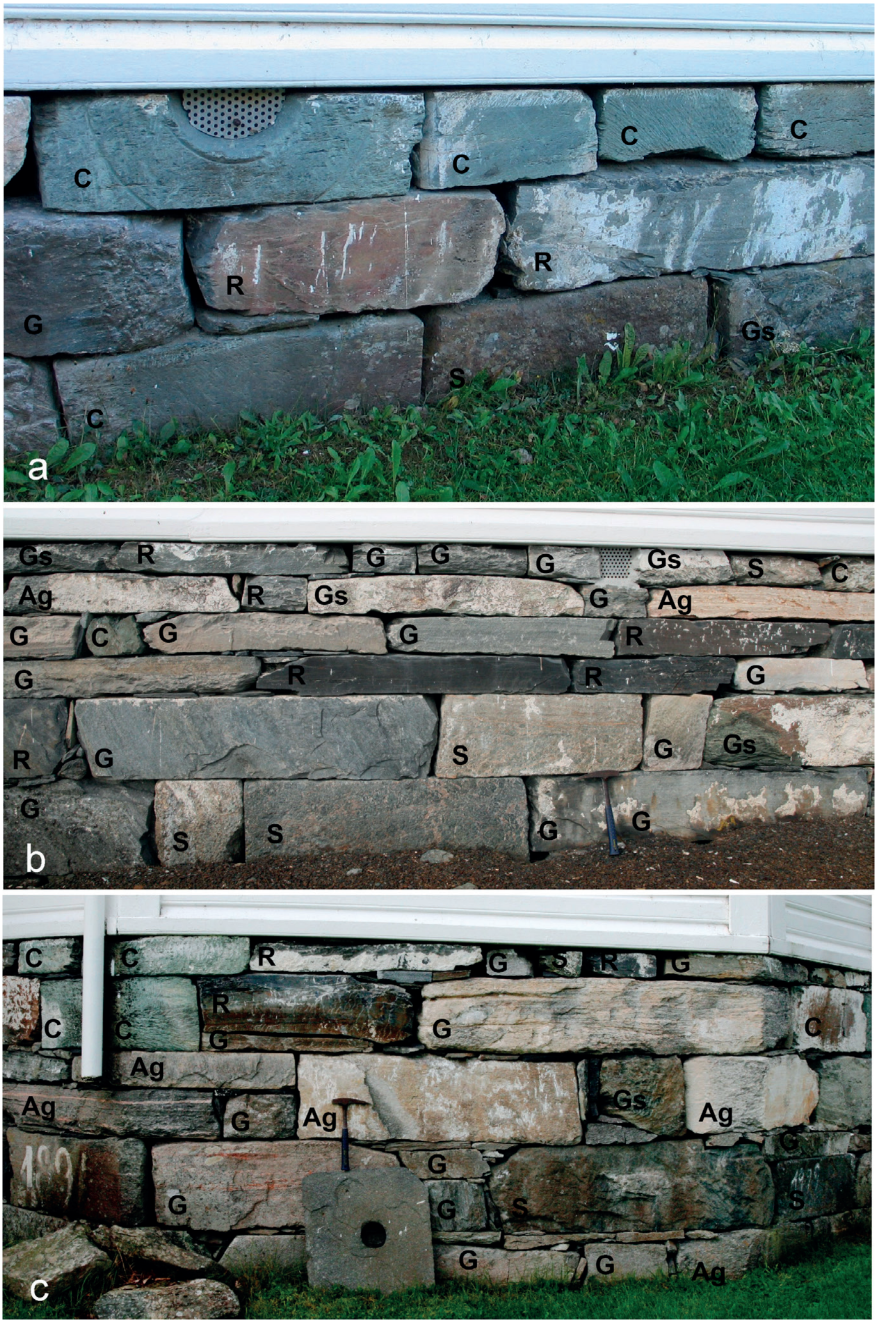


Figure 2. *(a) Ashlars from chlorite schist in the upper course of the western foundation wall. Note the reused Romanesque window frame. (b) Ashlars of soapstone set in a coursed dry stone wall of undressed slabs and rubble. (c) Coursed dry stone walling in the north eastern part of the foundations displaying large blocks of mainly gneiss, however in the upper left corner are a few ashlars of chlorite schist. Legend: C = chlorite schist, S = soapstone, Ag = augengneiss, G = gneiss, Gs = greenschist, R = rhyolite. (Photo: Ø. J. Jansen).*

Figure 3. *The University Museum of Bergen Collections: (a) Scalloped capital of chlorite schist; (b) Dressed block of soapstone; (c) Pillar base of chlorite schist. (Photo: Ø. J. Jansen).*

Heldal 2009; Baug 2013, 2015, this vol.). ^{14}C dating of charcoal in the spoil around quarries gave an age interval from AD 1025 until AD 1635 (Baug 2013:210, 2015), indicating the possibility that the 12th century production for Onarheim church could have taken place here.

A soapstone quarry with tool marks in accordance with the extraction of ashlars is located near the sea at Baldersheim, about 30 km NNE of Onarheim. There is no direct evidence of 12th century quarrying here but the similarities with other medieval soapstone quarries do provide indirect evidence of medieval production.

In the present study, our hypothesis is that these two quarry areas were the main providers of stone to the original medieval Onarheim church. We tested this hypothesis using various geochemical analyses on stone samples from the vanished church. As reference for the soapstone ashlars we have data sets from Baldersheim quarry and from 10 selected soapstone quarries in the Hordaland region (Baldersheim, Bergsholmen, Juadal, Klovsteinsjuvet, Kvernes, Russøy, Tyssøy, Vargahola, Vargavågen, Arnafjord, Lysekloster and Sævråsvåg). As reference for the chlorite schist ashlars we have data sets

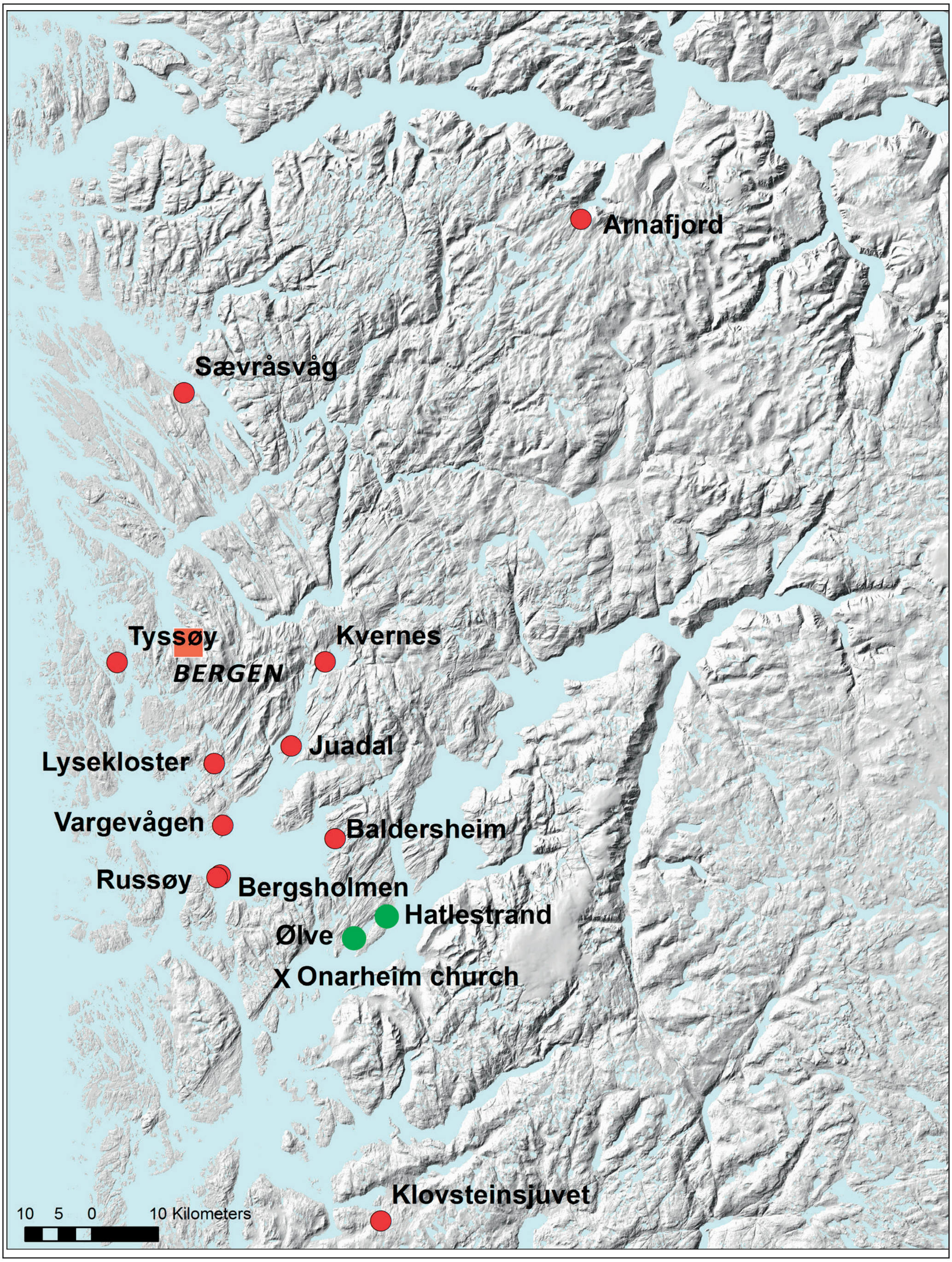


Figure 4. *The location of the chlorite schist quarries at Ølve and Hatlestrand (green dots). Baldersheim soapstone quarry and a selection of Medieval soapstone quarries in the area (red dots). The Onarheim church is marked as (x). (Map: T. Heldal).*

Figure 5. *Onarheim church. Two soapstone ashlars (s) with a bluish tint displaying a brecciated structure, with veins of talc and carbonate. The upper half of the stone above the hammer demonstrates how the massive, lower part has been transformed to rock with well-developed foliation. (Photo: Ø. J. Jansen).*

Figure 6. *Soapstone ashlar with bluish tint in the dry walls surrounding the Onarheim churchyard. The ashlar was (re) worked parallel to the foliation, clearly displaying layers and lenses with chlorite, talc and carbonate. (Photo: Ø. J. Jansen).*

Figure 7. *Small soapstone ashlar in the western foundation wall of the Onarheim church displaying a medium-grained mosaic of talc, carbonate and chlorite. The small piece above, sampled for analysis, shows the difference between weathered and un-weathered surfaces. (Photo: Ø. J. Jansen).*

from the quarries at Ølve-Hatlastrand in Hordaland (Figure 4), as well as from the other known chlorite schist quarries in Norway: The Ertenstein quarry in Rogaland (some 25 km from Stavanger) and the Øye and Skaun quarries in Trøndelag (close to Trondheim). Moreover, we have visited the quarry sites to investigate whether they contain visible marks from the production of ashlars.

The soapstones

The majority of the soapstone ashlars present in the foundations of the church and in the surrounding drywalls are characterised by a more or less pronounced bluish tint, a colour which is not common among the Hordaland soapstone quarries. Thin section studies show that the bluish tint is probably caused by fine-grained magnetite and a minor content of serpentine. The stones occur as both massive and foliated. Massive varieties often show a characteristic, brecciated structure, with a network of talc and carbonate veins. Figure 5 shows both massive and foliated soapstone contained in one ashlar. The massive, veined lower part is transformed into soapstone with well-developed foliation in the upper half, which has a less pronounced bluish tint. Foliated soapstone are defined by layers and lenses of chlorite, talc and carbonate. This demonstrates that both foliated and massive, veined varieties occur in the same quarry, with the foliation being the result of shear zones developed during the formation of the soapstone. When ashlars are worked parallel to the foliation the foliated, lensoid structure is clearly displayed (Figure 6).

The other soapstone types have not yet been studied in detail but seem to be of a more common type, visually similar to soapstone from many quarries in the area – containing a medium-grained mosaic of talc, carbonate and chlorite (Figure 7). These soapstone blocks appear in markedly smaller size than the 'bluish' ones, which often appear in large ashlars, with a length of up to 1.10 m.

The Baldersheim quarry

The underground Baldersheim soapstone quarry (Askeladden ID no. 64089) is located at Sørtveit in the outskirts of Baldersheim village, about 200 m from the sea and about 55 m ASL. The entrance to the quarry has a triangular shape, about 10 m wide and 6 m high (Figure 8) but narrows to about 4 x 2.5 m at the NNE termination, about 30 m from the entrance. The accessible volume of the present quarry is calculated to be between 700 and 800 m^3. The quarry floor is covered with spoil and loose blocks of phyllite that have fallen from the ceiling; thus, the extracted volume is definitely larger than the accessible part but impossible to calculate. The ceiling and much of the upper quarry walls consist of the enveloping phyllite, with scattered grooves made by iron picks (Figure 9). Attempts, probably quite recent, to extract small tabular pieces, perhaps for fishing sinkers, are common. Soapstone appears mainly in the terminal northern quarry wall and in the lower part of the inclined side walls, especially in the western wall where tool marks made by iron picks are abundant. A few circular marks from vessel extraction appear at the upper terminal wall (Figure 10). At the base of the western wall abundant tool marks made by heavy iron picks indicate the extraction of large ashlars (Figure 11). At the base of the steep western wall a possible westerly extension may be concealed by large amounts of waste filling up to the ceiling. A ramp made from large blocks, 2–3 m above the quarry floor, is located near the entrance of the quarry: probably a base for a winch (Figure 12). A modern road passes 25 m from the quarry entrance and at the seaward side of the road a steep slope faces the sea. Spoil heaps are identified outside the quarry and a brief reconnaissance survey did not reveal quarry waste in the seaward slope; such waste is probably covered by rock masses from the construction of the road. No harbour/quay has been found.

Figure 8. *Baldersheim soapstone quarry with the triangular-shaped entrance to the underground operations. (Photo: Ø. J. Jansen).*

Figure 9. *Baldersheim soapstone quarry. Scattered grooves made by iron picks during extraction of soapstone attached to the enveloping phyllite. (Photo: Ø. J. Jansen).*

Figure 10. *Baldersheim soapstone quarry. Circular quarry marks from extraction of vessels at the upper terminal wall. (Photo: Ø. J. Jansen).*

In conclusion, the majority of the quarry marks and the ramp indicate that building blocks were the main output from the quarry. The circular depressions at the terminal wall (from extraction of cooking vessel blanks) and late extraction of tabular pieces may represent more, perhaps minor, stages in the history of the quarry.

As for the geology of the Baldersheim quarry, it is located in a lens-shaped body of soapstone embedded in phyllite. The phyllite is part of the Samnanger complex, consisting of micaschist, phyllite and greenschist and including bodies of ultramafic and mafic rocks. The rocks are mostly of ophiolitic origin and mainly of Ordovician age (Ragnhildstveit & Helliksen 1997). A range of serpentinite bodies of varying size occur NE of the quarry. These are interpreted as altered metadunites (Qvale 1978) and the quarried soapstone probably represents a further stage in the transformation of serpentinite to soapstone. The soapstone exposed in the quarry contains a high percentage of dark, greenish-blue chlorite-rich layers and abundant veins of carbonate, often appearing as lensoid aggregates (see Figure 11).

The latter rock is visually similar to the bluish, foliated ashlars at Onarheim church. The massive type of soapstone, however, does not appear in the quarry walls, nor in the waste. A possible explanation could be that the massive soapstone is covered by waste, or may have been quarried in the possible above-mentioned westerly extension, which seems to be concealed by large amounts of waste.

Ølve-Hatlestrand quarry area

In the Ølve-Hatlestrand area, 71 quarries were documented by Baug in connection with her doctoral work (2013:20, 2015, this vol.), all of them located in a zone of talc-actinolite-bearing chlorite schist (called chlorite schist in this paper) (Naterstad 1984; Jansen & Heldal 2009). Most of the quarries are situated in the Ølve area, surrounding Lake Kvitebergsvatnet

Figure 11. *Tool marks made by heavy iron picks at the base of the western quarry wall of Baldersheim soapstone quarry show extraction of large ashlars. The exposed soapstone has a banded appearance due to layers and lenses containing variable amounts of chlorite, talc and carbonate. (Photo: Ø. J. Jansen).*

Figure 12. *A ramp, probably a base for a winch, is seen in the foreground at the entrance to the Baldersheim soapstone quarry. (Photo: Ø. J. Jansen).*

but a major quarry area is also found by the sea at Netteland in the Hatlestrand area (see Figure 4). Our work is based on reconnaissance surveys between 2002 and 2010, the latest simultaneously with the archaeological excavations organised by Baug. The quarries included in the present study are (Baug's archaeological references in parentheses. For detailed location see Baug this vol.: Fig. 4): Bakkehidlaren (Fugleberg trenches 1 and 2), Båthidlaren (Netteland trench 1), Veslehidlaren (Fugleberg trench 3) and Hellebruddet (Fugleberg trench 4).

Ølve: Veslehidlaren, Hellebruddet and Bakkehidleren by Lake Kvitebergsvatnet

Veslehidlaren and Hellebruddet are small, underground quarries situated in the upper zone of quarries south of Lake Kvitebergsvatnet. At the entrance of Veslehidlaren, negative imprints of 'half-cylinders' occur on the walls, clearly related to the extraction of thin, circular bakestones, which were successively split loose from top to bottom after the outline was carved. Otherwise, the quarry marks reflect extraction of various products. Walls featuring oval to rectangular outlines, including rounded corners, probably represent extraction of bakestones with forms deviating from the common circular shape. Straight, vertical quarry walls seem, however, more likely the result of the production of ashlars for building stones or flagstones for different purposes, whilst extraction of sub-circular, thin slabs from the ceiling of the quarry may represent a late stage production of roofing slate (Baug 2013:179, 2013, 2015, this vol.). At Hellebruddet the quarry marks and spoil heap indicate that roofing slates were the main product but discarded bakestones also appear in the spoil.

Bakkehidlaren is located in the lower zone of quarries near Lake Kvitebergsvatnet. It is one of the biggest quarries with large underground works (Baug 2013:168–170). Most of the tool marks

Figure 13. *Bakkehidlaren chlorite schist quarry. The quarry marks and angular corners at the base of the quarry wall imply the production of slabs and ashlars, while the pick and chisel marks in the ceiling are related to extraction of square flagstone – probably for roofing purposes. (Photo: Ø. J. Jansen).*

indicate the extraction of rectangular blocks of various sizes, such as ashlars. In addition, there are marks reflecting extraction of rectangular schists – possibly for roofing – a few centimetres thick (Figure 13).

The quarries near Kvitebergsvatnet (9 m ASL) shared a common logistic in that stones had to be brought from the quarries (at 145–160 m ASL) down to the lake. They were then shipped on the lake to the south part of Ølve village, located only a few hundred meters from the sea.

Hatlestrand: Båthidlaren and Mannahidleren by Netteland

The Netteland quarry area is located by the fjord, in a bay offering excellent harbour facilities for all the quarries in the area. The small bakestone quarry, called Båthidlaren, is situated in this area and all samples for geochemical analyses representing the Netteland area are labeled Båthidlaren after this quarry. Close to the northern part of the Netteland bay, vertical quarry walls, up to 5 m tall, stretch laterally for about 100 m and display abundant marks from extraction of rectangular blocks. In front of the quarry wall facing the sea, a horizontal quarry floor is partly uncovered, exposing worked channels for extraction of square blocks measuring about 90 x 90 cm (Figure 14). Nearby, in the hillside about 100 m from the shore, a large underground quarry named Mannahidleren is located. The entrance is covered by scree and fallen blocks but inside the vertical quarry walls display tool marks typical of exploitation of rectangular blocks (Figure 15). Consequently, the area surrounding the bay of Netteland, was probably a quarry area producing large volumes of building blocks.

Figure 14. *A quarry floor at the Netteland chlorite schist quarry area exposing worked channels for extraction of square blocks. (Photo: Ø. J. Jansen).*

A proper investigation of other quarries in the Ølve-Hatlestrand area was not possible in our study. However, brief visits do indicate that building blocks may have been one of several products from several of the other quarries, as well.

Discussion

The traditional view of the Ølve-Hatlestrand quarry area is that it predominantly produced bakestone (Naterstad 1984;Weber 1984). As is understood, this view has now been considerably modified (Jansen & Heldal 2009; Baug 2013, 2015, this vol.). Building blocks were a major product during some periods, especially in the Middle Ages. Moreover, written sources mention a shipment of stone from Netteland to Kronborg Castle in Denmark in the early part of the 17th century (Buch 2011[1813]:14–15). The indications of roofing slate production can be explained by

Figure 15. *At Mannahidlaren chlorite schist quarry, a large underground quarry, the walls display tool marks made by heavy iron picks, typical of exploitation of rectangular ashlars. (Photo: Ø. J. Jansen).*

its local use in the area in the modern period; chlorite schist is found on several local roofs. A small production of grave monuments in the 19th century was also supplied by chlorite schist from the Ølve-Hatlestrand quarries.

The quarries in the Ølve-Hatlestad area are situated in a thin, sub-horisontal/low dip zone (1.5–6 m thickness) of chlorite schist sandwiched between layers of harder greenschist (Naterstad 1984:164; Baug 2013). The rocks belong to the Varaldsøy Complex: a sequence of metamorphosed volcanic rocks of early Ordovician age (Ragnhildstveit & Helliksen 1997). The mineral content is actinolitic hornblende, talc and chlorite and J. Naterstad (1984:161) proposed that the original rock was a basic/ultrabasic layer of tuff or lava. The grain size varies; when fine-grained (mainly chlorite-talc) the schist appears with smooth, shiny surfaces and an excellent cleavage (type locality at Båthidlaren). However, usually larger and harder grains of actinolitic hornblende appear as 'knots', a few mm in size, giving the schist surfaces a more rugged appearance and a less pronounced cleavage.

The lateral extension of the quarried zone is estimated to measure about 5 km (Naterstad 1984:161). The quarried schist zone is enveloped in a harder and more resistant type of typical greenschist above and below, with nodules and lenses of light green epidote. The contrasting durability of the rocks results in natural 'overhang'-shelters, which have been dramatically enlarged by quarrying over the centuries.

Although there are some geological (and thus expected geochemical) variations across the Ølve-Hatlestrand quarry landscape, we know of no other rock unit in the region that bears strong similarities with these rocks. We have to move to other regions in Norway in order to find similar rock types containing a history of bakestone and building stone production in the Medieval period, for example in Rogaland (Ertenstein quarry) and Trøndelag (Øye chlorite schist quarry and similar quarries at Skaun) (Heldal & Storemyr 1997:9–12; Storemyr 2001:67, 2015:189–191; Lundberg 2007; Storemyr et al. 2010:189–192; Jansen 2013:78; Baug 2015, this vol.). Although we consider it entirely unrealistic that these rocks were applied for building the Onarheim church, we included them in the geochemical investigation for reference.

Geochemical analyses and methods

Soapstone samples from Onarheim church were analysed and compared with analyses of samples from Baldersheim quarry and from 10 other soapstone quarries in the Hordaland region. Chlorite schist samples from Onarheim church were analysed and compared with samples from chlorite schist quarries in the Ølve-Hatlestrand area (Figure 4). As reference materials one chlorite schist quarry in Rogaland and two in Trøndelag were also included for this rock type. The soapstone quarries were selected because they display rocks with similar visual appearances, as well as a documented or likely record of production in the Middle Ages. Three methods for geochemical provenance were applied:

- Main and trace element (MTE) analyses by conventional x-ray fluorescence spectrometry XRF, carried out at Geological Survey of Norway (NGU) and the Department of Earth Science, University of Bergen.
- Sr and Nd isotope compositions: measured at the University of Bergen on a Finnigan 262 thermal ionisation mass-spectrometer (TIMS). Analytical techniques are described in Pedersen & Furnes (2001).
- Rare Earth Element (REE) determination by inductively coupled plasma mass spectrometry solution (ICP-MS) analysis at the Department of Earth Science, University of Bergen.
- Numerical data from all analyses can be found in Appendix Tables 1–6.

Analyses of soapstone

Main and trace elements

Five different combinations of MTE were plotted (Figure 16). Collectively, the eight samples from Onarheim church define three groups with visible differences in geochemical composition (i.e., we consider it likely that they represent three different quarries). All samples in Group 1 were cut from

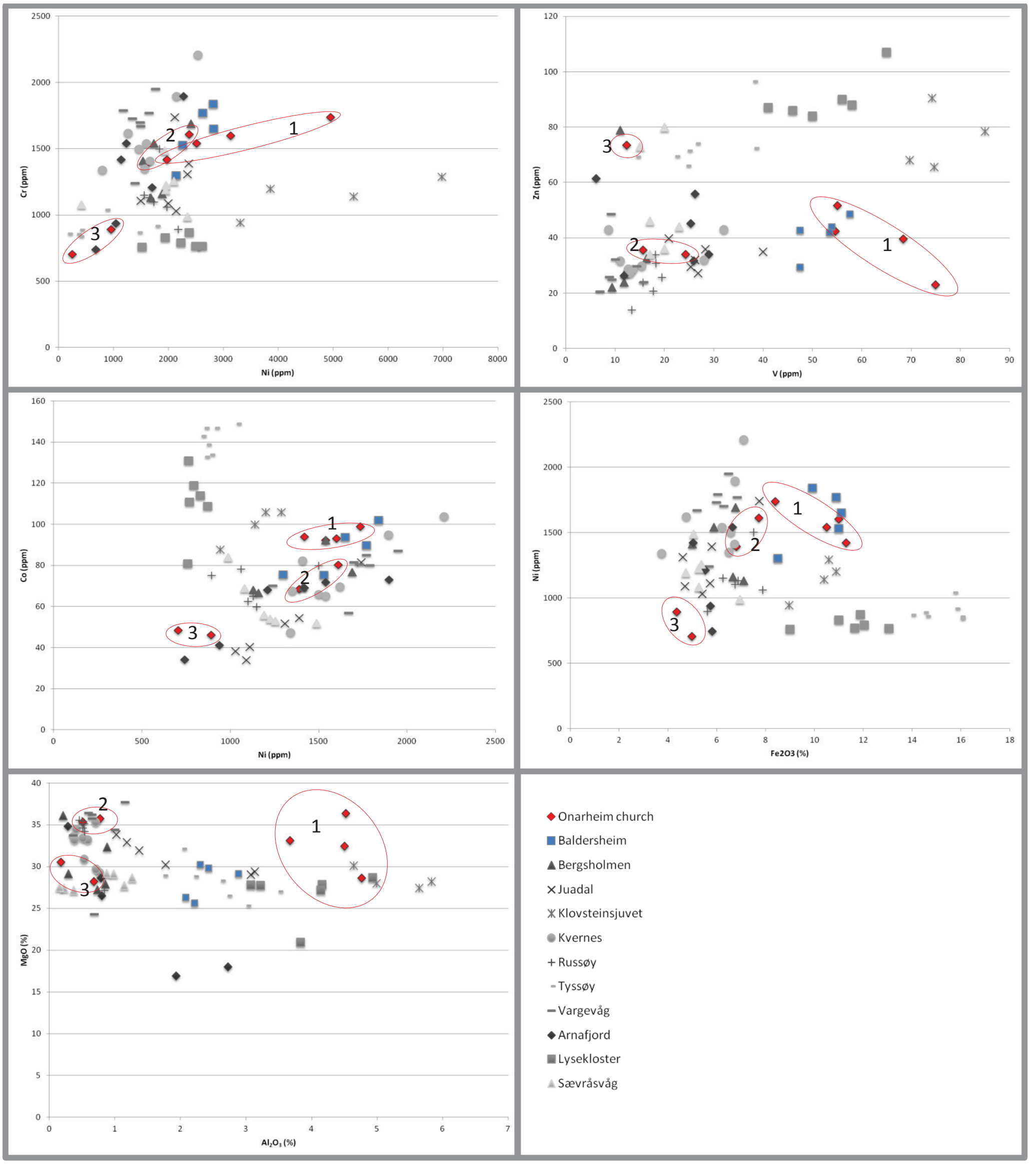


Figure 16. *MTE analyses of soapstone samples from the Onarheim church and different quarries. Group 1, 2 and 3 from the Onarheim church (described in the text) are marked.*

Figure 17. *Summary of MTE matches of soapstone quarries to the samples from the Onarheim church.* ***Bold*** *text implies a good match, normal text implies a weak match.*

Cr-Ni	Group 1	**Baldersheim**, Juadal
	Group 2	**Bergsholmen**, Baldersheim, Juadal, Kvernes
	Group 3	**Arnafjord**, Tyssøy
Zn-V	Group 1	**Baldersheim**
	Group 2	**Arnafjord, Kvernes**, Juadal, Sævråsvåg, Russøy, Bergsholmen
	Group 3	**Sævråsvåg, Tyssøy, Bergsholmen,** Arnafjord
Ni-Co	Group 1	**Baldersheim**, Bergsholmen
	Group 2	**Kvernes, Bergsholmen, Vargevågen**, Arnafjord, Baldersheim, Juadal
	Group 3	**Arnafjord**, Juadal
Co-V	Group 1	Baldersheim, Lysekloster, Klovsteinsjuvet
	Group 2	Russøy, Kvernes, Arnafjord, Sævråsvåg, Juadal, Bergsholmen
	Group 3	Arnafjord, Kvernes, Sævråsvåg
Al_2O3-MgO	Group 1	Klovsteinsjuvet, Lysekloster, Juadal, Tyssøy, Baldersheim
	Group 2	**Vargevåg, Kvernes**, Russøy, Arnafjord, Bergsholmen, Juadal
	Group 3	**Bergsholmen**, Arnafjord, Sævråsvåg, Kvernes
Fe_2O_3-Ni	Group 1	**Baldersheim**
	Group 2	**Juadal**, Russøy, Kvernes, Bergsholmen
	Group 3	Arnafjord, Russøy

the bluish, foliated type – a type which is not represented in the other groups.

The Baldersheim quarry is the only one that displays a good fit for Group 1 for Cr, Ni, V, Zn, Co, Fe2O3 and MgO. For Al2O3, the analyses from Baldersheim quarry display higher values than the church samples. However, as seen in the Al2O3-MgO plot, several quarries do display highly varying Al2O3 content. In particular, such variations only seem to occur when Al2O3 exceeds 1%. Thus, although Baldersheim and Onarheim church show two distinct clusters, we will not rule out Baldersheim as a possible source and none of the other quarries come anywhere close to a match.

Group 2 samples display best fit with the Bergsholmen quarry (which is one of the closest); however, neither Juadal nor Kvernes can be ruled out.

Only the Arnafjord quarry shows a rather good fit with Group 3. This was highly unexpected, since this particular quarry is the most distant to Onarheim of all selected for analyses (for location see Figure 4). Figure 17 summarises the results of the MTE analyses.

Sr and Nd isotopes

In Figure 18, Group 1 of Onarheim samples shows a close fit to the Baldersheim quarry. Also, the Lysekloster and Tyssøy quarries are found in the same cluster of analyses, but these have been ruled out by the MTE analyses.

Group 2 is more difficult to evaluate. The closest fits are Juadal (which could not be ruled out from the MTE analyses) and Arnafjord (which was ruled out). The Kvernes quarry fits one of the samples but not the other and the Bergsholmen quarry displays a weak fit to the latter.

Group 3 (only one sample gave valid isotope values) shows a good fit with the Klovsteinsjuvet

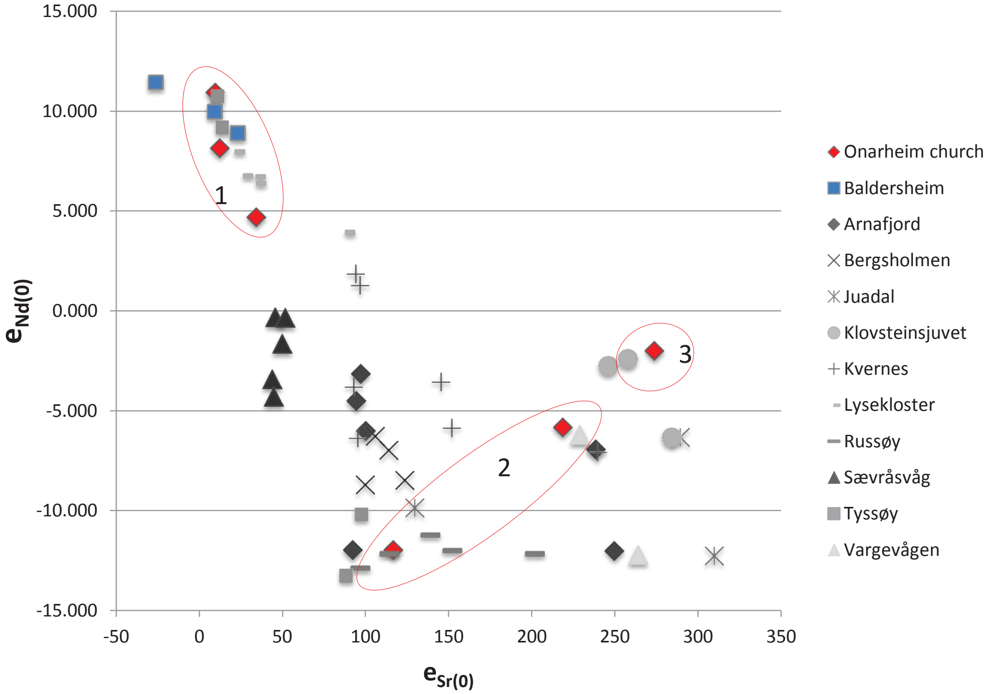


Figure 18. *Sr-Nd isotope plot of soapstone samples from the Onarheim church and different quarries. Group 1, 2 and 3 from the Onarheim church (described in the text) are marked.*

quarry but this match is completely ruled out by the MTE analyses. A weaker fit is found to the Arnafjord quarry but the spread in the Arnafjord isotope values shows that this method does not work for Arnafjord, which shares this problem with a lot of other quarries.

REE profiles

Five samples from Onarheim church were analysed (Figure 19). These indicate three different sources. Two samples, both with bluish tint, have a smooth REE profile, gradually ascending from left to right, showing best fit with the Baldersheim quarry.

Two samples display weakly ascending to fluctuating curves. None of the three quarries, as indicated from the MTE and isotope analyses (Baldersheim/Bergsholmen, Juadal and Kvernes), display a perfect match, yet considering the bluish tint of the samples and a reasonable match with one of the Baldersheim quarry REE profile lines, Baldersheim is regarded as the best match.

One sample describes a smooth REE curve, interrupted by a distinct negative europium (Eu) anomaly. One sample from the Arnafjord quarry shows a similar trend. The Group 3 sample was cut from an ashlar in the foundation of Onarheim church (Figure 7), which displays a good visual match with the soapstone quarried at Arnafjord. In addition, the two blocks of Onarheim soapstone stored in the University Museum of Bergen (Figure 3) also display the same visual similarity with the soapstone quarried at Arnafjord. Thus the proposed Arnafjord provenance seems to have both visual and geochemical support.

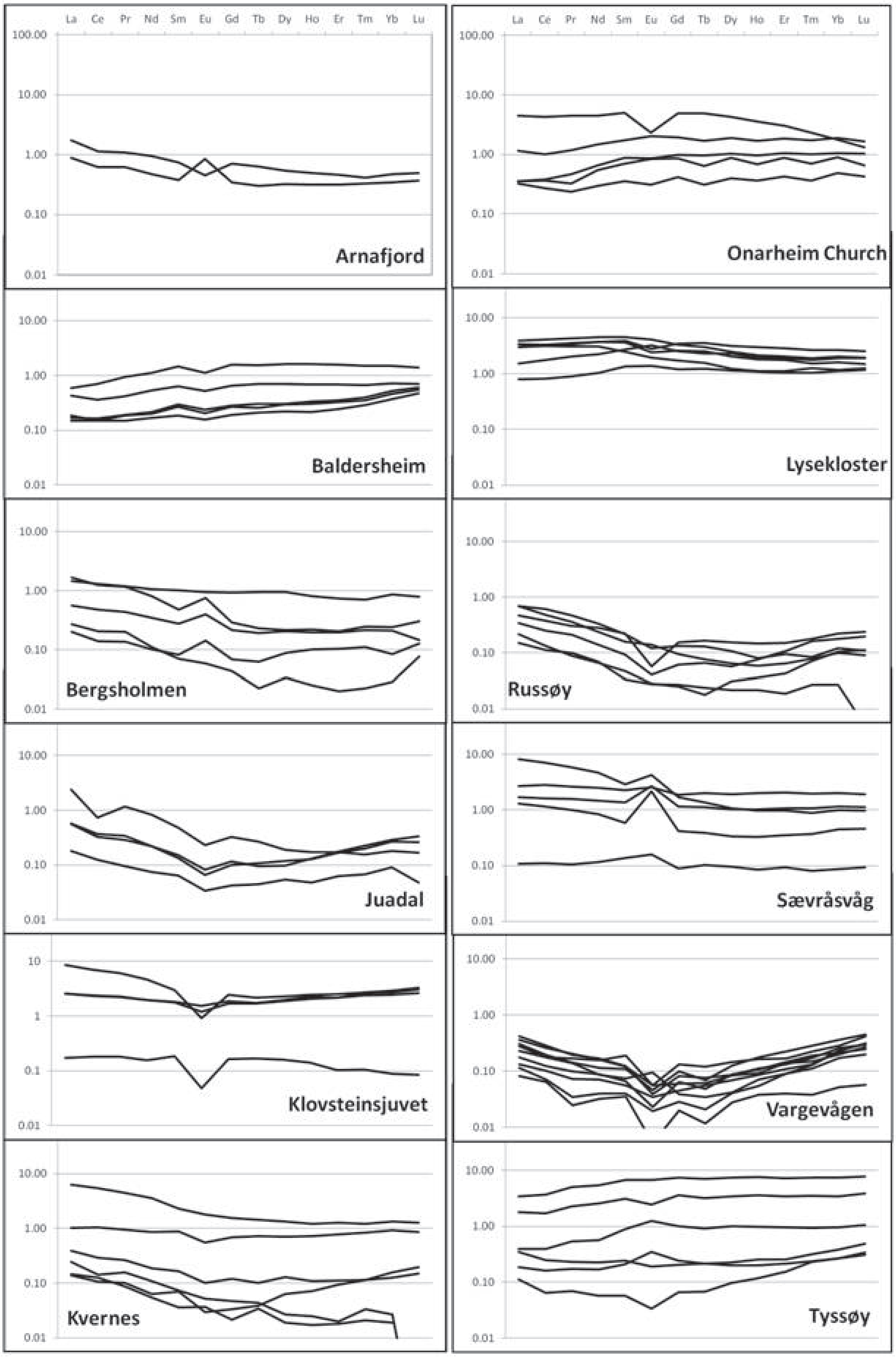


Figure 19. *REE profiles of soapstone samples from the Onarheim church and different quarries. Note logarithmic vertical scale.*

Discussion

The analyses of soapstone do seem to provide fairly good evidence that the Baldersheim quarry delivered stone to Onarheim church, most likely to the medieval version. It was, however, surprising that the analyses indicate two additional sources. One of them may have been another nearby quarry – Bergsholmen, Juadal or Kvernes. The analyses are yet too inconclusive for more specific provenance.

Even more surprising was the possible match with the Arnafjord quarry, which was very distant to Onarheim (about 240 km by boat). This may be related to restoration or rebuilding of the church; the Arnafjord quarry may have been one of few active quarries during the construction of the second stone church at Onarheim in the early 19th century.

Analyses of chlorite schist

Main and trace elements

Figure 20 shows plots of the main elements Al2O3-MgO and trace elements Ni-Cr for Onarheim church and most of the surveyed quarries in the Ølve-Hatlestrand quarry landscape, as well as the reference quarries in Rogaland (Ertenstein) and Trøndelag (Øye and Skaun). The main elements do not show significant variations between the quarries and, with the exception of the Vetlehidlaren quarry, they all roughly match the analyses from Onarheim church.

The Ni-Cr diagram is not much better for discrimination. We can vaguely see linear trends defined by the points, which is to be expected for these elements in such rocks. The Onarheim church samples together with the Ølve-Hatlestrand quarries define a weak trend between the Rogaland quarry and the Trøndelag quarries. This indicates that the Onarheim samples and the Ølve-Hatlestrand quarries are from the same geological formation. However, since we know that the Veslehidlaren quarry belongs to the same formation as the other two in this quarry area, there must be some overlap between the Ølve-Hatlestrand quarries and the ones from Sør-Trøndelag. Moreover, the two points clustering in the bottom left corner (Onarheim church and the Øye quarry) may easily lead to a conclusion of a geochemical match between the church and this quarry. This is misleading as the clustering of analyses in this diagram is along the lines and not defined by the proximity of points.

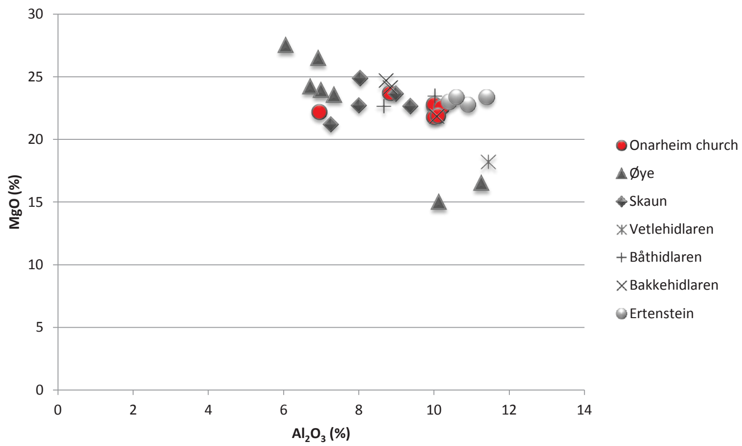
In conclusion, the MTE analyses on the chlorite schist samples did not provide reliable results; only a vague, inconclusive link between the church and the Ølve-Hatlestrand area is indicated.

Sr-Nd isotopes

The diagram in Figure 21 shows Sr-Nd isotope plot of the Onarheim church chlorite schist samples and samples from the four quarries in the Ølve-Hatlestrand area, the Trøndelag chlorite schist quarries (Øye) and the Rogaland quarry(Ertenstein). The samples from Onarheim church plot within the field of the Ølve-Hatlestrand quarry area. In more detail, they plot close to the Båthidlaren and Veslehidlaren quarries and clearly away from the Bakkehidlaren quarry.

REE profiles

The REE profiles in Figure 22 point in the same direction as the isotopes in that the four samples from the church have REE trends displaying a best match with the Veslehidlaren and the Båthidlaren quarries and a clearly lesser match with the Bakkehidlaren quarry.



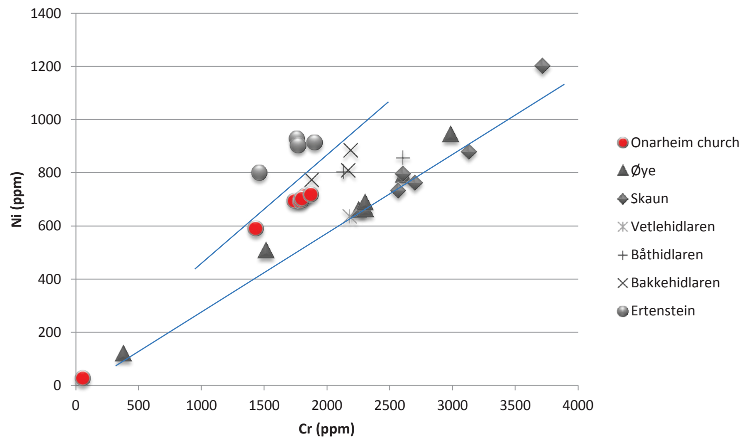


Figure 20. *MTE plots for chlorite schist samples from the Onarheim church compared with the Ølve-Hatlestrand quarries and other known chlorite schist quarries in Norway.*

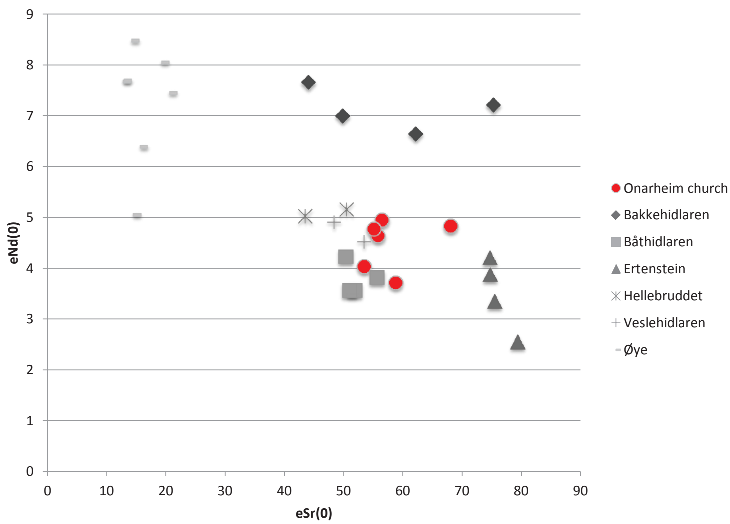


Figure 21. *Sr-Nd isotope plot of chlorite schist samples from the Onarheim church and quarries.*

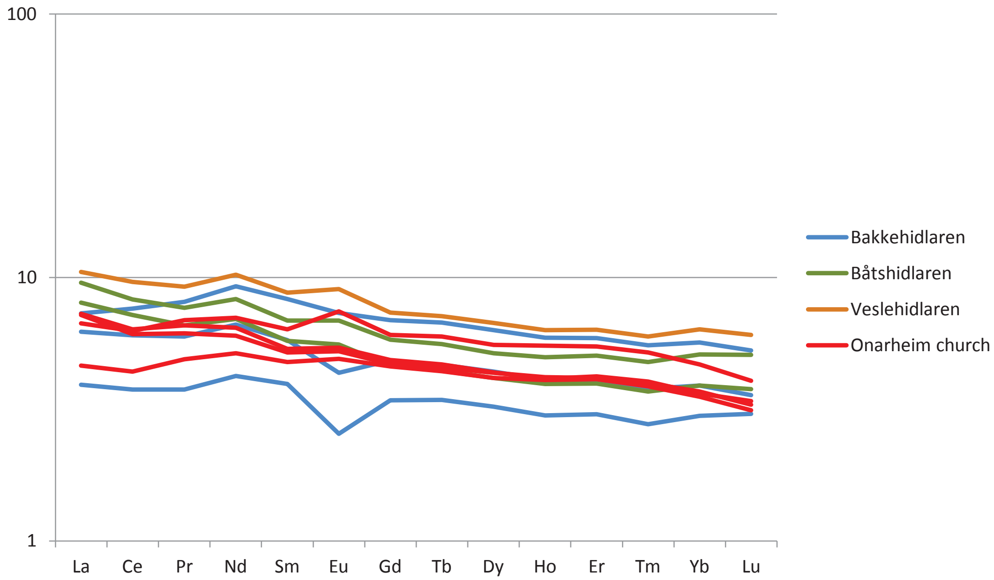


Figure 22. *REE profiles of samples from the Onarheim church and quarries in the Ølve-Hatlestrand area. Note logarithmic vertical scale.*

Discussion

The geochemical analyses (with the exception of MTE analyses) clearly indicate that the chlorite schist used at Onarheim church came from at least one quarry within the Ølve-Hatlestrand area. There are close geochemical fits for both the Veslehidlaren quarry (Ølve area, above Kvitebergsvatnet) and the Båthidlaren quarry (by the Netteland fjord in the Hatlestrand area). Since we do not have data for all 71 quarries in the Ølve-Hatlestrand area, it is difficult to provide evidence for a more specific provenance.

Even if we would have managed to carry out an extensive geochemical program involving all 71 quarries, our present data suggest that a significant overlap between quarries should be expected and thus the cost-benefit for further analyses would probably be limited. For logistical reasons, we consider it more likely that the quarries at Hatlestrand were employed for the construction of the church, rather than the ones much farther away from harbour facilities. Moreover, this is the area that carries most visible remains of building stone quarrying.

Concluding remarks

Our hypothesis, that the nearest quarries were the main sources of ashlar and decoration for the medieval construction of Onarheim church, has largely been confirmed. Both the Ølve-Hatlestrand chlorite schist quarries and the Baldersheim soapstone quarry bear direct or indirect evidence of medieval production of building-stone and we have established a convincing geochemical match between the church and these quarry areas.

Somewhat surprising was the geochemical data, which indicated that at least two additional soapstone quarries supplied Onarheim with stone. This either implies that several soapstone quarries were employed simultaneously for building the medieval church, or that new quarries further away, including the distant Arnafjord quarry, were used in later rebuilding and restoration works. Stone from Arnafjord quarry is unknown in medieval buildings in Hordaland.

We suggest that the quarries at the fjord by Hatlestrand are the most likely sources of chlorite schist. In addition to logistics, there are other aspects supporting this. Baug (2013, 2015, this vol.) established a timeline for the production of bakestone in the whole Ølve-Hatlestrand quarry landscape. According to Baug, production peaked between the 13th and 15th centuries. Thus, since the construction of Onarheim church and possibly other buildings took place earlier (starting in the 12th century), it may be that only a few quarries were employed for bakestone production by then. The fact that the seaward quarries at Hatlestrand mostly contain evidence from building stone quarrying could perhaps imply that they were depleted when the main phase of bakestone production started.

The geochemical analyses indicate that Sr-Nd isotopes separate the main known chlorite schist quarries in Norway and even different quarries within the Ølve-Hatlestrand area. Thus isotope analyses may provide a good tool for further studies of chlorite schist building stone and bakestone. We know that bakestones are found in households all over Norway in the Middle Ages and the opportunity to fingerprint the stones' origin may surely aid future interpretation of medieval trade networks.

Provenancing soapstone geochemically is, however, not straightforward. This study shows that there is a need to combine several methods and even then it is difficult to obtain results with high confidence. This challenge is confirmed by other studies (i.e., Forster & Jones this vol. and Hansen et al. this vol.).

Acknowledgements

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Appendix

Tabel 1. *Main and trace element (MTE) compositions of soapstone.*

Sample	Locality	SiO[2]	Al[2] O[3]	Fe[2] O[3]	TiO[2]	MgO	CaO	Na[2] O	K[2]O	MnO	P[2] O[5]	LOI	Total	Pb	Cr	V	Ga	Zn	Cu	Ni	Yb	Co
ONARH.-1	Onarheim kirke	32.8	0.772	7.72	0.014	35.7	0.113	-0.1	-0.01	0.097	-0.01	22.8	100	25.5	2380	24.3	3	34	-2	1610	39.3	80.3
ONARH.-2	Onarheim kirke	36.8	4.5	11	0.316	32.4	1	-0.1	-0.01	0.128	-0.01	13.5	99.7	21.3	3140	68.4	7.3	39.5	40.8	1600	41.6	93.2
Onarh2b	Onarheim kirke		4.52	8.4		36.35									4955	75		23		1737		99
ONARH.-3	Onarheim kirke	34.6	3.67	10.5	0.063	33.1	1.21	-0.1	-0.01	0.184	-0.01	16.5	99.8	22.3	2520	55.1	6.4	51.6	34.2	1540	40.3	92.4
ONARH.-3B	Onarheim kirke	40.4	4.76	11.3	0.11	28.6	3.11	-0.1	-0.01	0.082	-0.01	10.9	99.3	22	1980	54.6	7	42.4	33	1420	35.6	93.9
ONARH.-4	Onarheim kirke	31.1	0.51	6.8	-0.01	35.3	0.316	-0.1	-0.01	0.157	-0.01	25	99.2	22.9	1610	15.6	2.7	35.5	9.1	1390	33.9	68.5
ONARH.-5	Onarheim kirke	16.9	0.175	4.99	-0.01	30.5	11.5	-0.1	-0.01	0.237	-0.01	35.8	100	67.1	249	-5	2.3	595	59.5	705	20.6	48.4
ONARH.-6	Onarheim kirke	24.9	0.677	4.36	-0.01	28.2	12.5	-0.1	-0.01	0.195	-0.01	29.3	100	27.7	959	12.3	2.7	73.4	-2	891	20.9	46.2
BALDER-1	Baldersheim	39.3	2.3	9.92	0.086	30.2	1.09	-0.1	-0.01	0.115	-0.01	15.2	98.2	21.1	2820	47.5	5.1	42.7	38.6	1840	41.7	102
BALDER-2	Baldersheim	33.7	2.21	8.51	0.075	25.6	10	-0.1	-0.01	0.144	-0.01	19	99.2	21.3	2140	47.5	4.8	29.3	15	1300	26.1	75.6
BALDER-3	Baldersheim	35.8	2.43	11.1	0.089	29.8	1.87	-0.1	-0.01	0.164	-0.01	17.2	98.5	20	2830	57.6	5.3	48.6	10.4	1650	38.2	93.7
BALDER-4	Baldersheim	42.6	2.08	11	0.076	26.3	5.2	-0.1	-0.01	0.089	-0.01	11.8	99.1	22.2	2260	53.9	5.4	43.9	16.1	1530	32.7	75.4
BALDER-5	Baldersheim	41.3	2.88	10.9	0.139	29.1	1.15	-0.1	-0.01	0.106	-0.01	12.5	98.1	21.1	2630	53.5	5.7	41.8	20	1770	34	89.9
BERGSH.-2	Bergsholmen	55	0.733	5.88	-0.01	27.2	1.91	-0.1	-0.01	0.062	-0.01	7.08	98	21.5	1740	11	3.3	78.8	10	1540	32	92.4
BERGSH.-3	Bergsholmen	54.9	0.854	5	-0.01	27.9	1.9	-0.1	-0.01	0.039	-0.01	7.19	97.8	22.6	1540	16.3	3.6	32.5	-2	1410	33.4	69.6
BERGSH.-4	Bergsholmen	27.3	0.209	6.77	-0.01	36.1	0.211	-0.1	-0.01	0.115	-0.01	28.4	99.1	21.6	2410	11.8	2.3	24	9.3	1690	34.2	76.8
BERGSH.-6	Bergsholmen	37.8	0.877	6.67	-0.01	32.3	1.06	-0.1	-0.01	0.05	-0.01	20.3	99	19.4	1890	9.4	3.1	22.1	-2	1160	23.9	66.6
BERGSH.-7	Bergsholmen	27.2	0.286	7.1	-0.01	29.1	7.97	-0.1	-0.01	0.246	-0.01	26.2	98.1	20.9	1680	12	2.8	27.2	31.4	1130	23.5	68.2
JUADAL-1	Juadal	34.5	1.02	7.74	-0.01	33.8	0.137	-0.1	-0.01	0.054	-0.01	22.4	99.8	20.7	2120	26.8	3.3	27.2	4.5	1740	41.4	81.5
JUADAL-10	Juadal	42.8	1.18	5.8	-0.01	32.9	0.231	-0.1	-0.01	0.058	-0.01	16.5	99.4	21.3	2370	26.2	5.4	32	-2	1390	32.5	54.5
JUADAL-11	Juadal	53.5	3.13	5.41	-0.01	29.4	0.531	-0.1	0.011	0.02	-0.01	6.79	98.7	22.5	2140	40	8.6	34.9	46.1	1030	24.5	38.3
JUADAL-12	Juadal	47.8	3.07	4.7	0.028	29	2.7	-0.1	0.114	0.053	0.029	11.3	98.8	22.3	2000	28.3	7.4	35.8	-2	1090	27.3	33.9
JUADAL-13	Juadal	48.3	1.37	5.72	-0.01	31.9	0.067	-0.1	-0.01	0.034	-0.01	12.6	100	21.5	1500	20.9	5.3	39.7	-2	1110	23.5	40.4
JUADAL-2	Juadal	57.2	1.77	4.62	-0.01	30.2	-0.01	-0.1	-0.01	-0.01	-0.01	5.72	99.5	21.2	2350	25.3	5.9	29.5	35.7	1310	33.2	51.7
KLOVSTEINSJ.-3	Klovsteinsjuvet	40.5	5.83	10.6	0.105	28.2	1.84	-0.1	-0.01	0.099	0.011	9.92	97.1	23.3	6980	85	8.5	78.4	113	1290	30.4	106
KLOVSTEINSJ.-5	Klovsteinsjuvet	40.7	5.64	8.96	0.084	27.4	3.73	-0.1	-0.01	0.142	-0.01	11.3	98	23.4	3310	74.7	7.2	65.6	124	943	21.2	87.8
KLOVSTEINSJ.-6	Klovsteinsjuvet	39.2	4.99	10.4	0.094	28	2.66	-0.1	0.011	0.141	0.012	12.2	97.8	23.4	5380	74.3	7.5	90.4	124	1140	25.6	100
KLOVSTEINSJ.-8	Klovsteinsjuvet	42.3	4.64	10.9	0.059	30.1	0.844	-0.1	-0.01	0.09	-0.01	9.04	98	23.1	3860	69.7	6.9	68.1	147	1200	21.9	106
KVERNES-10	Kvernes	60	0.761	4.75	-0.01	29.3	0.01	-0.1	-0.01	0.022	-0.01	4.67	99.5	21.7	1270	11	2.9	31.6	-2	1620	37.3	69.8
KVERNES-11	Kvernes	60.2	0.713	3.74	-0.01	29.7	-0.01	-0.1	-0.01	-0.01	-0.01	4.77	99.1	21	800	8.7	2.9	43	-2	1340	31.9	47.5
KVERNES-20	Kvernes	37.8	0.368	6.58	-0.01	33.6	0.128	-0.1	-0.01	0.069	-0.01	20.3	98.8	20.7	1470	13.6	2.7	28.5	4.3	1500	34.2	66
KVERNES-21	Kvernes	34.4	0.378	6.5	-0.01	33.2	1.83	-0.1	-0.01	0.111	-0.01	22.8	99.2	21.5	1570	12.7	2.9	28.8	9.7	1350	29.1	67.7
KVERNES-22	Kvernes	35.6	0.405	6.22	-0.01	34.5	0.121	-0.1	-0.01	0.055	-0.01	22.2	99.2	19.4	1600	13	2.3	27.2	2.7	1540	37.8	65.2
KVERNES-23	Kvernes	44.5	0.527	6.73	-0.01	30.9	1.91	-0.1	-0.01	0.135	-0.01	14.9	99.7	21.5	1670	15.4	3.2	29.8	34.4	1410	31.2	82.4
KVERNES 1	Kvernes	39.99	0.58	7.89	0.02	33.19	2.29	n.d	n.d	0.11	0.01	17.09	100.83									
KVERNES 2	Kvernes	40.8	0.7	7.11	0.01	35.32	0.83	n.d	n.d	0.08	0.01	15.67	100.21		2544	32		43	18	2211		104
KVERNES 3	Kvernes	42.67	0.51	6.75	0.01	33.43	1.62	n.d	n.d	0.12	n.d	16.49	101.34		2154	28		32	19	1895		95
ROSSØY-12	Russøy	31.8	0.454	6.87	-0.01	35.5	0.391	-0.1	-0.01	0.174	-0.01	24.4	99.6	20.3	1660	18.3	2.7	30.8	4.8	1130	28.2	65
RUSSØY-1	Russøy	34.4	0.507	6.75	-0.01	34.6	0.961	-0.1	-0.01	0.111	-0.01	21.2	98.5	20.8	1740	17.7	2.6	20.7	2.8	1100	25.8	62.6
RUSSØY-10	Russøy	33	0.494	7.88	-0.01	35.4	0.1	-0.1	-0.01	0.11	-0.01	21.2	98.3	21	1980	19.5	3	25.6	3.4	1060	21.9	78.3
RUSSØY-13	Russøy	35	0.534	6.26	-0.01	34.2	0.099	-0.1	-0.01	0.123	-0.01	22.4	98.6	20.9	1560	15.6	2.8	23.7	-2	1150	23.4	59.8

Tabel 1 *(continued).*

Sample	Locality	SiO[2]	Al[2] O[3]	Fe[2] O[3]	TiO[2]	MgO	CaO	Na[2] O	K[2]O	MnO	P[2] O[5]	LOI	Total	Pb	Cr	V	Ga	Zn	Cu	Ni	Yb	Co
RUSSØY-2	Russøy	34	0.526	7.51	-0.01	35.1	0.318	-0.1	-0.01	0.122	-0.01	21.2	98.8	21	1840	18.2	3.2	33.9	12.9	1500	36.3	79.9
RUSSØY-4	Russøy	42.2	0.835	5.63	-0.01	27.1	7.83	-0.1	-0.01	0.114	-0.01	15.9	99.7	24.7	2180	13.4	4.5	13.9	-2	894	23.3	75.2
TYSSØY-1	Tyssøy	37.9	2.72	14	0.034	26.5	4.59	-0.1	-0.01	0.152	-0.01	13.1	99	18.3	1450	24.8	5.6	71.5	143	870	14.9	139
TYSSØY-10	Tyssøy	29	2.62	16	0.042	28.3	4.35	-0.1	0.015	0.258	-0.01	20	101	19.9	386	24.5	5.2	66	99.7	841	12.8	143
TYSSØY-2	Tyssøy	45.9	3.5	14.6	0.059	27	0.559	-0.1	-0.01	0.022	-0.01	7.04	98.7	19.3	179	26.5	5.5	74	8.5	861	13.9	133
TYSSØY-3	Tyssøy	35.1	1.74	14.5	0.024	28.9	3.54	-0.1	-0.01	0.19	-0.01	15.6	99.6	19.1	403	14.3	4.2	69.3	34.6	890	15.3	134
TYSSØY-6	Tyssøy	30.8	3.01	16	0.04	25.3	6.95	-0.1	-0.01	0.171	-0.01	17.6	99.9	18.2	351	22.3	5.6	69.4	72.8	857	16.5	147
TYSSØY-8	Tyssøy	38.4	2.03	15.7	0.101	32.1	0.603	-0.1	-0.01	0.165	-0.01	10.1	99.2	19.2	862	38.1	4.7	96.5	86.1	1040	20	149
TYSSØY-9	Tyssøy	28.5	2.21	15.8	0.059	28.8	4.65	-0.1	-0.01	0.299	-0.01	19.5	99.9	19.5	1780	38.3	5.4	72.3	128	917	12.4	147
VARGAH.-1	Vargahola	28.7	0.683	5.19	-0.01	24.3	15.5	-0.1	0.013	0.25	-0.01	25.8	101	25.9	1500	9.2	3.2	48.6	135	1670	36.6	56.9
VARG.-1	Vargevågen	32.7	0.65	6.3	-0.01	36.2	0.08	-0.1	-0.01	0.077	-0.01	24.2	100	20.4	1490	9.4	2.6	24.9	-2	1700	39	81.5
VARG.-2	Vargevågen	26.9	1.15	5.69	-0.01	37.7	0.104	-0.1	-0.01	0.134	-0.01	28.5	100	19.1	1400	8.8	3	25.8	-2	1240	31.3	70.1
VARG.-3	Vargevågen	35.9	0.995	6	-0.01	34.4	0.064	-0.1	-0.01	0.046	-0.01	21	98.6	19.4	1350	10.1	2.8	32.1	-2	1730	37.9	80.6
VARG.-4	Vargevågen	32.9	0.649	6.85	-0.01	35.7	0.071	-0.1	-0.01	0.075	-0.01	23.8	100	20	1650	15.8	2.5	24	2.8	1770	36.5	85
VARG.-5	Vargevågen	32.7	0.594	6.49	-0.01	36.4	0.063	-0.1	-0.01	0.093	-0.01	22.2	98.6	18.5	1770	14.4	2.6	29.7	-2	1950	46.2	87.1
VARG.-6	Vargevågen	38	0.361	6.04	-0.01	33.7	0.636	-0.1	-0.01	0.152	-0.01	20.6	99.4	19.7	1180	6.9	2.8	20.6	2.4	1790	39.6	80.2
Arnafjord 1	Arnafjord														2276	29		34	71	1898		73
ARNAFJORD-12	Arnafjord	47.2	2.72	5.74	0.017	18	9.86	0.23	0.047	0.168	-0.01	16.4	100	26.3	1050	26.2	6.5	55.8	-2	938	20.7	41.2
ARNAFJORD-16	Arnafjord	45.8	1.93	5.82	0.028	16.9	11	-0.1	0.098	0.231	-0.01	18.2	99.9	26.4	680	25.3	5	45.1	-2	742	14.6	34.2
ARNAFJORD-2	Arnafjord	45.5	0.798	5.53	-0.01	26.5	6.08	-0.1	-0.01	0.078	-0.01	12.7	97	23.5	1710	25.9	4.3	31.7	47.7	1210	31.9	68.2
ARNAFJORD-3	Arnafjord	32.9	0.282	6.65	-0.01	34.8	0.153	-0.1	-0.01	0.111	-0.01	24.3	99.3	20.4	1240	11.8	2.8	26.3	4	1540	35.2	71.8
ARNAFJORD-9	Arnafjord	59.2	0.783	5.03	-0.01	28.6	-0.01	-0.1	-0.01	0.031	-0.01	4.57	98.2	20.6	1140	6.1	3.6	61.4	-2	1420	34.9	69.2
LYS 01	Lysekloster	41.18	4.93	13.06	0.25	28.67	1.47	n.d	n.d	0.18	0.04	11.53	101.1		2502	56		90	13	765		131
LYS 010	Lysekloster	37.39	3.07	11	0.26	27.77	4.93	n.d	n.d	0.2	0.03	16.17	100.59		1943	41		87	10	831		114
LYS 011	Lysekloster	38.06	3.22	11.89	0.19	27.73	4.69	n.d	n.d	0.16	0.03	14.69	100.35		2380	46		86	24	871		109
LYS 012	Lysekloster	47.43	4.16	11.66	0.46	27.84	1.96	n.d	n.d	0.14	0.03	8.02	101.39		2619	58		88	9	768		111
LYS 013	Lysekloster	40.87	4.14	12.05	0.24	27.16	3.04	n.d	n.d	0.17	0.04	11.95	99.536		2233	50		84	n.d	793		119
LYS 014	Lysekloster	38.97	3.83	9.01	0.19	20.93	12.8	n.d	0.01	0.21	0.02	14.41	100.12		1521	65		107	27	760		81
SÆV 010	Sævråsvåg	42.37	1.14	5.26	0.02	27.73	8.41	n.d	n.d	0.13	n.d	16.05	100.78		1962	23		44	23	1225		54
SÆV 11	Sævråsvåg	59.32	0.98	6.95	0.01	29.14	0.16	n.d	n.d	0.03	0.01	4.7	100.99		2348	20		80	n.d	988		84
SÆV 12	Sævråsvåg	46.47	1.26	4.74	0.02	28.64	6.65	n.d	n.d	0.09	n.d	14.21	101.83		1950	20		36	n.d	1190		56
SÆV 14	Sævråsvåg	43.59	0.22	5.38	0.01	27.43	8.15	n.d	n.d	0.12	0.01	15.85	100.71		2106	17		46	7	1256		53
SÆVRÅS 2	Sævråsvåg	39.73	0.37	5.06	0.01	27.16	10.36	n.d	n.d	0.13	n.d	18.8	101.3		1935	17		34	13	1488		52
SÆVRÅS 3	Sævråsvåg	60.73	0.15	5.27	0.01	27.55	3.25	n.d	n.d	0.08	0.01	3.94	100.7		422	15		73	n.d	1081		69
SÆVRÅSVÅG	Sævråsvåg	42.64	0.87	5.23	0.02	29.19	6.39	n.d	0.01	0.13	0.01	16.77	101.17									

Tabel 2. *Sr and Nd isotope compositions of soapstone.*

Lab#	Sample	Location	$\varepsilon_{Nd(0)}$	$\varepsilon_{Sr(0)}$
øj 3989	Arnafjord 1	Arnafjord	-3.141	96.93
øj 4720	Arnafjord 12	Arnafjord	-11.938	92.2
øj 4721	Arnafjord 16	Arnafjord	-5.989	100.03
øj 4695	Arnafjord 2	Arnafjord	-4.467	94.32
øj 4696	Arnafjord 3	Arnafjord	-11.997	249.60
øj 4719	Arnafjord 9	Arnafjord	-6.925	238.31
øj 4339	BALD 1	Baldersheim	11.470	-26.29
øj 4340	BALD 2	Baldersheim	10.007	9.04
øj 4722	Balder 3	Baldersheim	8.915	23.15
øj 3957	Bergholmen 1	Bergsholmen	-6.262	105.75
øj 4409	BERGSH. 5	Bergsholmen	-8.466	123.71
øj 4400	BERGSH. 6	Bergsholmen	-8.681	99.77
øj 4401	BERGSH. 7	Bergsholmen	-6.964	114
øj 4381	JUADAL 10	Juadal	-9.851	129.64
øj 4382	JUADAL 11	Juadal	-12.25	309.79
øj 3951	Juadalen 2	Juadal	-6.301	289.35
øj 3914	Klauvsteinsjuv l	Klovsteinsjuvet	-2.731	245.66
øj 3915	Klauvsteinsjuv ll	Klovsteinsjuvet	-2.380	257.62
øj 3950	Klauvsteisjuvet 4	Klovsteinsjuvet	-6.301	283.94
øj 3923	Kvernes	Kvernes	-3.804	92.74
øj 4383	KVERNES 10	Kvernes	-7.062	239.54
øj 3955	Kvernes 2	Kvernes	1.287	96.66
øj 4495	Kvernes 21	Kvernes	-3.531	145.31
øj 4741	Kvernes 22	Kvernes	-5.838	151.75
øj 4742	Kvernes 23	Kvernes	-6.359	95.14
øj 3956	Kvernes 3	Kvernes	1.873	93.93
øj 4057	Lys 011	Lysekloster	7.978	21.39
øj 4058	Lys 012	Lysekloster	6.730	33.85
øj 4059	Lys 013	Lysekloster	6.398	34.10
øj 4060	Lys 014	Lysekloster	3.940	87.78
øj 4014	Lysekloster 1	Lysekloster	6.788	26.39
øj 4727	Russøy 14	Russøy	-11.197	138.67
øj 4728	Russøy 15	Russøy	-11.997	151.98
øj 4729	Russøy 16	Russøy	-12.153	201.87
øj 3958	Russøy 2	Russøy	-12.875	96.71
øj 3918	Russøy l	Russøy	-12.153	114.15

Tabel 2 *(continued).*

Lab#	Sample	Location	$\varepsilon_{Nd(0)}$	$\varepsilon_{Sr(0)}$
øj 4061	Sæv 010	Sævråsvåg	-0.293	45.58
øj 4062	Sæv 014	Sævråsvåg	-1.639	49.78
øj 3922	Sævråsvåg	Sævråsvåg	-3.394	43.78
øj 3959	Sævråsvåg 2	Sævråsvåg	-4.272	44.78
øj 3960	Sævråsvåg 3	Sævråsvåg	-0.332	51.71
øj 4335	TØ 1	Tyssøy	10.768	10.70
øj 4411	TØ 3	Tyssøy	9.196	13.8
øj 4749	TØ 6	Tyssøy	-13.226	88.32
øj 4750	TØ 7	Tyssøy	-10.163	97.39
øj 4336	VARG 4	Vargevågen	-12.192	263.88
øj 4337	VARG 5	Vargevågen	-6.184	228.73
øj 4733	On 1	Onarheim church	-11.938	116.51
øj 4734	On 2	Onarheim church	4.721	34.17
øj 4807	On 2B	Onarheim church	8.173	12.31
øj 4341	ON 3	Onarheim church	10.963	9.40
øj 4342	ON 4	Onarheim church	-5.794	218.52
øj 4735	On 5	Onarheim church	-1.970	273.67

Tabel 3. *REE compositions of soapstone.*

LabNo	ICP-296	icp1832	ICP-198	ICP-199	ICP-200	icp -910	icp-911	ICP-201	ICP-202	icp 503		
Sample	Arnafj 1	Arnafj 2	Balder 3	Balder 2	Balder 1	Balder 4	Balder 5	Bergsh 2	Bergsh 3	Bergsh 5	Bergsh 6	Bergsh 7
Location	Arnafjord	Arnafjord	Baldersheim	Baldersheim	Baldersheim	Baldersheim	Baldersheim	Bergsholmen	Bergsholmen	Bergsholmen	Bergsholmen	Bergsholmen
La	0.88199677	1.75070968	0.16817419	0.58794194	0.14784194	0.42294194	0.18385484	1.4770129	0.5565	0.20225806	0.26944194	1.65595484
Ce	0.61719012	1.13275	0.16493688	0.70047153	0.14774505	0.36068688	0.14995173	1.29160025	0.4770099	0.14087531	0.20355926	1.23747901
Pr	0.62664167	1.07890164	0.19188525	0.93246721	0.18408197	0.41190984	0.14955738	1.19128689	0.4342623	0.1359	0.19953333	1.16869167
Nd	0.47743	0.954885	0.21317167	1.12657333	0.20046333	0.533325	0.16967167	1.06162	0.35077333	0.10042333	0.11079167	0.804905
Sm	0.37694	0.74980513	0.29295897	1.47299487	0.27076923	0.6308	0.18637949	1.01982051	0.27933333	0.08258	0.06953	0.482605
Eu	0.84931429	0.45721088	0.23759184	1.10111565	0.20466667	0.51846259	0.15462585	0.94915646	0.40229932	0.14278571	0.05804286	0.75855714
Gd	0.34703846	0.70884556	0.28068726	1.57423166	0.26917375	0.64599614	0.1903861	0.93242857	0.21462548	0.06875769	0.04326923	0.29171923
Tb	0.30324	0.63185654	0.30295359	1.52432489	0.25331224	0.69149789	0.20883966	0.95483122	0.19151899	0.0627	0.02222	0.2325
Dy	0.3264625	0.53788509	0.30370186	1.62992547	0.29514286	0.69795652	0.22142236	0.95315528	0.20535093	0.08767188	0.03383438	0.21417188
Ho	0.31454286	0.49426184	0.33097493	1.60519499	0.30370474	0.67824513	0.21561281	0.80643454	0.19399721	0.10178571	0.02517143	0.22121429
Er	0.31405238	0.45865714	0.35032857	1.5821619	0.3292381	0.68618571	0.24054762	0.73310476	0.19431429	0.10307619	0.0202619	0.20433333
Tm	0.333	0.41385802	0.39222222	1.49604938	0.34996914	0.66385802	0.29070988	0.70845679	0.21583333	0.11093333	0.02253333	0.24576667
Yb	0.34368571	0.47435885	0.51488995	1.4937799	0.46292344	0.72061722	0.37234928	0.85788995	0.20990909	0.0851619	0.02895238	0.23948571
Lu	0.36556667	0.4931677	0.605	1.39745342	0.54177019	0.70257764	0.46881988	0.78804348	0.14434783	0.12626667	0.0766	0.30316667
LabNo	ICP-192	ICP-193	ICP 181	ICP 182	ICP321	ICP322	ICP323	ICP324	ICP 184	ICP 189	ICP-194	ICP-196
Sample	Juadal 11	Juadal 10	Juadal 2	Juadal 1	Klauvj 1	Klauvj 2	Klauvj 3	Klauvj 4	Kvernes 1	Kvernes 3	Kvernes 10	Kvernes 11
Location	Juadal	Juadal	Juadal	Juadal	Klovsteinsjuvet	Klovsteinsjuvet	Klovsteinsjuvet	Klovsteinsjuvet	Kvernes	Kvernes	Kvernes	Kvernes
La	2.37912903	0.57777097	0.56668065	0.17932903	2.55870645	2.56412258	0.17484516	8.69994516	6.34905484	1.01181613	0.24446452	0.14650645
Ce	0.73531683	0.37304208	0.32734653	0.12410149	2.38770741	2.3587679	0.18132099	7.00433704	5.4142599	1.05210644	0.14239356	0.12521658
Pr	1.17027049	0.34786066	0.28889344	0.09594262	2.26345833	2.20778333	0.18215	6.05688333	4.49360656	0.95837705	0.15638525	0.08767213
Nd	0.8425	0.22039	0.21823	0.07410667	1.97816833	1.97152	0.15719167	4.6347	3.57320667	0.866005	0.11041667	0.05483333
Sm	0.48083077	0.1533641	0.13661026	0.06412308	1.767625	1.820475	0.186995	3.007395	2.30655385	0.89270769	0.07342564	0.03624103

Tabel 3** (continued)**.

Eu	0.23423129	0.08284354	0.06680272	0.03370068	1.20731429	1.5544	0.04787143	0.92462857	1.80395918	0.55948299	0.0527619	0.0367483
Gd	0.32512355	0.11697297	0.09994208	0.04304633	1.69431923	1.88583077	0.16575	2.46995769	1.546	0.69763707	0.04696139	0.02142085
Tb	0.26812236	0.09603376	0.10700422	0.04493671	1.69422	1.75222	0.1698	2.19016	1.42607595	0.72027426	0.04394515	0.03400844
Dy	0.18986646	0.09841925	0.1189441	0.05424534	1.87425938	1.98747813	0.16043125	2.2985875	1.32379193	0.70623292	0.02695963	0.01892236
Ho	0.1744429	0.13279944	0.13013928	0.04809192	2.0978	2.26095714	0.1424	2.45978571	1.20392758	0.72952646	0.02487465	0.01714485
Er	0.17254286	0.17496667	0.1687619	0.0634	2.18955238	2.17215238	0.10248095	2.54140952	1.26624762	0.77288571	0.0199	0.0181619
Tm	0.15595679	0.22475309	0.20095679	0.06731481	2.4165	2.66786667	0.10696667	2.73326667	1.21743827	0.84358025	0.03324074	0.02083333
Yb	0.18075598	0.28976077	0.26637321	0.0916555	2.48535238	2.74972857	0.0895	2.90490952	1.33739713	0.92964593	0.02703349	0.01907177
Lu	0.16686335	0.33189441	0.25950311	0.0486646	2.67103333	3.08696667	0.08436667	3.27103333	1.26326087	0.85009317	9.3168E-05	-0.00521739
LabNo	ICP524	ICP525	icp 62	icp 63	icp 64	icp 65	icp 66	icp 67	ICP 176	ICP 177	ICP 187	ICP-195
Sample	Kvernes 20	Kvernes 21	Lyse 1	Lyse 10	Lyse 11	Lyse 12	Lyse 13	Lyse 14	Russøy II	Russøy 2	Russøy I	Russøy 13
Location	Kvernes	Kvernes	Lysekloster	Lysekloster	Lysekloster	Lysekloster	Lysekloster	Lysekloster	Russøy	Russøy	Russøy	Russøy
La	0.14049032	0.39433871	3.40505161	3.89152581	1.50376774	3.38612903	0.79475161	2.99436774	0.68885806	0.21429355	0.68750323	0.34584839
Ce	0.10678395	0.29358148	3.13760644	4.04946782	1.76354703	3.25813366	0.80566955	3.1397005	0.48577847	0.13476485	0.60713366	0.24922153
Pr	0.10228333	0.26585	3.06306557	4.28287705	2.00737705	3.49987705	0.89305738	3.40160656	0.36107377	0.08836885	0.46854098	0.21163934
Nd	0.06282167	0.18564833	3.03496167	4.521595	2.24865667	3.67050167	1.04275167	3.676835	0.24037167	0.06552333	0.335155	0.138415
Sm	0.070675	0.165175	2.46029231	4.54945641	2.70171282	3.62738974	1.35876923	3.85567692	0.15693846	0.04761026	0.21637436	0.09262051
Eu	0.02941429	0.10252857	1.91285714	4.11051701	3.20564626	2.37887075	1.37542857	2.7952517	0.13926531	0.0282585	0.12038095	0.04111565
Gd	0.03350769	0.12132692	1.70166409	3.31759073	2.52537838	2.61374903	1.18871815	3.48236293	0.09504633	0.02482625	0.13426641	0.06195367
Tb	0.03868	0.10256	1.56685654	2.97147679	2.30879747	2.49312236	1.21189873	3.50763713	0.07723629	0.01797468	0.12991561	0.0664135
Dy	0.06309063	0.13040625	1.22895342	2.46531988	2.27640683	2.04468944	1.13618012	3.11	0.06375466	0.03158696	0.10691615	0.05688199
Ho	0.07261429	0.10784286	1.11689415	2.10852368	1.95456825	1.81038997	1.07899721	2.96115599	0.05905292	0.03626741	0.07935933	0.07603064
Er	0.09466667	0.11118571	1.11620952	2.01578095	1.90667143	1.7435	1.02926667	2.85999524	0.06505238	0.04302857	0.0951	0.10670476
Tm	0.11526667	0.11423333	1.24765432	1.86753086	1.77506173	1.52839506	1.02734568	2.63098765	0.07901235	0.07141975	0.08354938	0.16098765
Yb	0.1256381	0.15893333	1.17717225	2.01278469	1.88227273	1.598689	1.10054067	2.65013397	0.09955024	0.10592344	0.12139713	0.18014833
Lu	0.15033333	0.19653333	1.23906832	1.93729814	1.88565217	1.50021739	1.17295031	2.52537267	0.0907764	0.11223602	0.11031056	0.19689441

***Tabel 3** (continued).*

LabNo	ICP-197	ICP -909					ICP-205	ICP312	ICP313	ICP314	ICP315	ICP316
Sample	Russøy 11	Russøy10	SÆV 010	SÆV 011	SÆV 012	SÆV 014	Sævråsvåg	Tø1	Tø2	Tø3	Tø4	Tø5
Location	Russøy	Russøy	Sævråsvåg	Sævråsvåg	Sævråsvåg	Sævråsvåg	Sævråsvåg	Tyssøy	Tyssøy	Tyssøy	Tyssøy	Tyssøy
La	0.15207097	0.47139355	1.68383548	0.10779677	2.67399032	1.29318387	8.2461	0.39551935	0.11302903	0.18680968	1.81062581	3.47931613
Ce	0.11295173	0.38053342	1.62687005	0.11011386	2.78861386	1.14137376	7.0065198	0.38996173	0.06478148	0.16184691	1.70892716	3.67625679
Pr	0.09890984	0.30436066	1.5822459	0.10561475	2.65109836	0.99631967	5.84422131	0.53608333	0.068825	0.17556667	2.2959	5.080925
Nd	0.069395	0.28211667	1.48550333	0.11561167	2.52206167	0.84020667	4.657985	0.56680333	0.05674167	0.17051667	2.59673667	5.50537333
Sm	0.03389231	0.22118974	1.36232308	0.13664103	2.25362564	0.58004615	2.88511282	0.90205	0.057735	0.211635	3.13686	6.777685
Eu	0.02782313	0.05738776	2.69397279	0.15791837	2.53748299	2.1624898	4.25665306	1.25257143	0.034	0.35258571	2.43774286	6.74244286
Gd	0.02723166	0.15417761	1.14111197	0.08911583	1.87425483	0.41927027	1.69637838	1.00543077	0.06658462	0.24074231	3.58061923	7.48328462
Tb	0.02405063	0.1657173	1.13670886	0.10331224	1.98985232	0.38679325	1.35177215	0.92524	0.06768	0.21306	3.23628	7.05762
Dy	0.02191925	0.15256832	1.03346894	0.09645031	1.91257143	0.33240994	1.06326708	1.01279688	0.0974625	0.22795	3.4647125	7.50751563
Ho	0.02160167	0.14696379	1.01552925	0.08367688	1.99625348	0.32733983	0.98247911	0.97961429	0.11681429	0.25751429	3.60457143	7.5475
Er	0.01879048	0.15195238	1.0799381	0.09209048	2.06714762	0.35199048	0.97400476	0.94953333	0.15291905	0.25602857	3.47281429	7.1898619
Tm	0.02722222	0.1787037	1.08342593	0.08080247	1.94614198	0.37166667	0.89169753	0.9357	0.22993333	0.3156	3.54473333	7.53966667
Yb	0.02679426	0.22303349	1.14717225	0.087	1.99505263	0.4452488	1.00572249	0.95662381	0.26817619	0.38094762	3.4117619	7.44747619
Lu	0.00496894	0.2381677	1.13521739	0.09322981	1.90139752	0.45717391	0.97201863	1.0584	0.34106667	0.49086667	3.872	7.85676667
LabNo	ICP907	varg 1	varg 2	varg 4	varg5	varg 6	varg7	varg 8	varg 9	varg 10		
Sample	Tø6	ICP-299	ICP-300	ICP-301	ICP-302	ICP-303	ICP-304	ICP-305	ICP-306	ICP-307		
Location	Tyssøy	Vargevågen	Vargevågen	Vargevågen	Vargevågen	Vargevågen	Vargevågen	Vargevågen	Vargevågen	Vargevågen		
La	0.35219355	0.1768	0.30465806	0.4154	0.23226452	0.11502258	0.08253226	0.36681935	0.13071613	0.27956129		
Ce	0.24704332	0.12209877	0.19535185	0.28304815	0.17638272	0.0714679	0.06494568	0.26117778	0.10158889	0.17839506		
Pr	0.23230328	0.09909167	0.14190833	0.19534167	0.166675	0.034625	0.02471667	0.20588333	0.07269167	0.13865833		
Nd	0.22644333	0.08869833	0.11372667	0.17011833	0.15754	0.03935667	0.03172333	0.15996667	0.07074333	0.08642667		
Sm	0.24182564	0.0663	0.10866	0.122255	0.187565	0.03972	0.034905	0.118885	0.055795	0.074815		
Eu	0.18915646	0.02297143	0.04578571	0.03898571	0.05504286	0.0192	0.00515714	0.05528571	0.03434286	0.09432857		
Gd	0.20288803	0.06382308	0.09827308	0.08131154	0.13191538	0.02872692	0.01971923	0.06013846	0.04506923	0.03872692		

Tabel 3 *(continued)***.**

Tb	0.21529536	0.04798	0.06988	0.07564	0.12038	0.02098	0.01178	0.06144	0.0554	0.03476		
Dy	0.20131988	0.08811563	0.12645938	0.08556875	0.14484063	0.04121563	0.02804375	0.08285938	0.06961875	0.04191563		
Ho	0.19869081	0.10597143	0.17792857	0.11171429	0.1656	0.05447143	0.03827143	0.09284286	0.0858	0.07012857		
Er	0.2144	0.14453333	0.22591429	0.13203333	0.1691	0.09008095	0.0397619	0.13785714	0.1102	0.08999048		
Tm	0.23888889	0.1894	0.2885	0.173	0.2238	0.1294	0.03833333	0.14793333	0.13333333	0.11103333		
Yb	0.26837321	0.21298095	0.36179524	0.2575381	0.28348571	0.23144286	0.05173333	0.20088095	0.23668571	0.17301429		
Lu	0.30838509	0.24746667	0.4522	0.29783333	0.4234	0.31433333	0.05656667	0.2718	0.30996667	0.20096667		
LabNo	ON 2	ON 5	ON 15/2	ON 15/3	ON 15/4							
Sample	Onarheim church	Onarheim church	Onarheim church	Onarheim church	Onarheim church							
Location	0.35422343	4.44141689	0.32697548	1.14441417	0.35422343							
Ce	0.37617555	4.24242424	0.27168234	1.0031348	0.36572623							
Pr	0.45985401	4.49635036	0.23357664	1.16788321	0.32116788							
Nd	0.64697609	4.48663854	0.29535865	1.47679325	0.54852321							
Sm	0.87012987	4.96969697	0.35497835	1.72294372	0.70562771							
Eu	0.86206897	2.34482759	0.31034483	2.04597701	0.83908046							
Gd	0.99019608	4.88888889	0.41503268	1.94117647	0.8496732							
Tb	0.96551724	4.9137931	0.31034483	1.70689655	0.63793103							
Dy	1.02624672	4.2335958	0.39370079	1.87401575	0.88451444							
Ho	0.96470588	3.55294118	0.36470588	1.69411765	0.68235294							
Er	1.04417671	3.03614458	0.42570281	1.83935743	0.87148594							
Tm	1	2.33333333	0.36111111	1.72222222	0.69444444							
Yb	1.05645161	1.77419355	0.48790323	1.88104839	0.89112903							
Lu	1.02631579	1.31578947	0.42105263	1.65789474	0.65789474							

Table 4. *Main and trace element (MTE) compositions of chlorite schist.*

Region	Sample	Quarry/site	SiO2 %	TiO2 %	Al2O3 %	Fe2O3 %	MnO %	MgO %	CaO %	Na2O %	K2O %	P2O5 %	Total %	Cr ppm	Ni ppm
Hardanger	26 Veste1	Veslehelleren	44.76	0.45	11.44	9.87	0.15	18.22	7.21	1.26	0.1	0.05	54.61	2179	637
Hardanger	16 Båts_1	Båthidlaren	44.39	0.3	8.66	10.94	0.16	22.66	7.31	0.47	0.06	0.06	56.56	2132	805
Hardanger	15 Båt_b1	Båthidlaren	41.88	0.36	10.01	11.18	0.16	23.48	6.34	ND	0	0.05	58.53	2606	857
Hardanger	25 Bakke3	Bakkehidlaren	41.7	0.51	10.07	10.79	0.16	21.87	7.25	0.23	0.1	0.05	57.43	1877	775
Hardanger	9 Bakke1	Bakkehidlaren	42.26	0.4	8.72	10.84	0.16	24.72	5.81	ND	0	0.03	58.16	2189	885
Hardanger	8 Bakke2	Bakkehidlaren	43.58	0.39	8.83	10.5	0.16	24.14	6.5	ND	ND	0.03	57.12	2171	810
Trøndelag	TG-04-44A	Skaun (Eidsli)	44.96	0.63	7.25	11.09	0.2	21.24	8.54	0.42	0.04	0.05	99.78	2602	798
Trøndelag	TG-04-44B	Skaun (Eidsli)	42.4	0.72	8.98	12.23	0.19	23.68	3.82	0.27	0.01	0.09	99.31	2567	734
Trøndelag	TG-04-44C	Skaun (Eidsli)	41.56	0.79	8.03	14.85	0.16	24.92	1.63	0.23	-0.01	0.07	98.95	3715	1203
Trøndelag	TG-04-34	Skaun (Skausetra)	44.17	0.55	8	11.24	0.15	22.74	6.01	0.31	0.02	0.04	99.05	3130	881
Trøndelag	TG-04-35	Skaun (Skausetra)	42.14	0.68	9.37	11.23	0.17	22.69	6.5	0.37	0.02	0.05	99.5	2699	764
Trøndelag	Ø1	Øye	43.62	0.82	11.26	10.93	0.18	16.54	6.74	2.04	0.05	0.08	99.48	1514	507
Trøndelag	Ø8	Øye	42.36	0.44	6.92	14.16	0.16	26.49	2.99	0.26	0.02	0.04	99.12	377	119
Trøndelag	Ø3	Øye	40.08	0.59	7.34	12.9	0.18	23.58	4.99	0.39	0.04	0.03	99.79	2253	661
Trøndelag	Ø4	Øye	43.4	0.41	6.99	11.59	0.21	23.95	6.19	0.31	0.03	0.04	99.7	2985	946
Trøndelag	Ø5	Øye	44.27	0.48	6.06	13.86	0.1	27.53	1.06	0.26	0.01	0.01	99.22	2309	663
Trøndelag	Ø6	Øye	38.22	0.51	6.7	12.75	0.21	24.24	4.94	0.32	0.02	0.02	99.23	2607	793
Trøndelag	Ø7	Øye	39.37	0.75	10.13	9.9	0.16	15.03	6.15	1.88	0.04	0.08	99.21	2303	689
Hardanger	Onarh.10	Onarheim church	41.4	0.393	10	10.8	0.161	22.7	6.61	<0.1	0.032	0.048	99.1	1740	695
Hardanger	Onarh.12	Onarheim church	43.7	0.387	8.83	10.4	0.155	23.7	6.79	<0.1	0.028	0.052	98.7	54	28
Hardanger	Onarh.13	Onarheim church	42	0.373	10	10.8	0.167	21.8	7.04	0.2	0.074	0.052	98.9	1790	695
Hardanger	Onarh.14	Onarheim church	46.1	0.231	6.95	9.61	0.157	22.2	8.34	<0.1	0.028	0.031	98.9	1430	590
Hardanger	Onarh.15	Onarheim church	41.8	0.348	10	10.9	0.162	22.8	6.62	0.11	0.041	0.044	99.5	1830	714
Hardanger	Onarh.16	Onarheim church	41.2	0.442	10.2	11	0.172	22.6	6.46	<0.1	0.037	0.068	98.9	1800	703
Hardanger	Onarh.17	Onarheim church	41.7	0.498	10.1	11	0.166	21.9	7.23	0.17	0.078	0.065	99.4	1870	719
Rogaland	1	Ertenstein	43.4	0.308	10.4	10.3	0.2	23	6.84	0.48	0.079	-0.01	100	1900	916
Rogaland	2	Ertenstein	40	0.328	10.9	9.8	0.177	22.8	7.66	0.47	0.077	0.016	99.8	1460	801
Rogaland	3	Ertenstein	40.4	0.313	10.6	9.52	0.174	23.4	7.71	0.33	0.077	0.021	99.3	1760	930
Rogaland	4	Ertenstein	42.2	0.367	11.4	10.6	0.188	23.4	6.60	0.51	0.075	-0.01	100	1770	904

Table 5. *REE compositions of chlorite schist.*

Sample	bakke1	bakke2	bakke3	båts1	båtb1	vesle1	ONARH2	ONARH3	ONARH5	ONARH6
Location	Bakkehidlaren	Bakkehidlaren	Bakkehidlaren	Båthidlaren	Båthidlaren	Veslehidlaren	Onarheim church	Onarheim church	Onarheim church	Onarheim church
La	6.22074839	3.91883226	7.29493871	8.03484516	9.5633129	10.4951677	4.63215259	7.19346049	6.70299728	7.27520436
Ce	6.02868812	3.74815594	7.62718564	7.2094245	8.25808045	9.6045198	4.39916405	6.09195402	6.26959248	6.36363636
Pr	5.97617213	3.7585	8.07313115	6.57103279	7.67017213	9.2375	4.89781022	6.1459854	6.87591241	6.58394161
Nd	6.63069167	4.22524333	9.26101167	6.94857667	8.28438167	10.231995	5.16174402	6.00562588	7.0323488	6.4416315
Sm	5.77935385	3.94064103	8.27641538	5.74653333	6.87050769	8.74524103	4.77489177	5.18614719	6.34632035	5.35064935
Eu	4.35219048	2.5467483	7.31742857	5.56820408	6.85953741	9.03651701	4.90804598	5.24137931	7.42528736	5.4137931
Gd	4.83746718	3.41922008	6.88829344	4.62118147	5.79983012	7.36192664	4.59150327	4.69934641	6.05555556	4.8627451
Tb	4.65187764	3.42512658	6.73822785	4.41934599	5.59253165	7.12894515	4.4137931	4.55172414	5.96551724	4.67241379
Dy	4.39220186	3.22956832	6.31016149	4.14931988	5.15829193	6.72145031	4.15485564	4.33858268	5.5511811	4.35433071
Ho	4.08473538	2.9983844	5.90584958	3.93630919	4.98662953	6.30735376	4.08235294	4.17647059	5.50588235	4.12941176
Er	4.01536667	3.02024762	5.88501429	3.9622	5.05534762	6.33512857	4.1124498	4.16064257	5.46586345	4.20883534
Tm	3.77901235	2.77253086	5.52395062	3.68916667	4.77987654	5.97558642	3.86111111	3.97222222	5.19444444	4.02777778
Yb	3.88588995	2.98790909	5.66510526	3.88123923	5.10119139	6.34859809	3.52419355	3.69354839	4.68145161	3.62903226
Lu	3.57658385	3.04074534	5.28950311	3.77201863	5.07782609	6.04335404	3.13157895	3.28947368	4.05263158	3.39473684

Table 6. *Sr and Nd isotope compositions of chlorite schist.*

Lab#	Sample	Location	eSr(0)	eNd(0)
øj 5417	Bakke 4	Bakkehidlaren	49.8221681	7.00299236
	Bakke 2	Bakkehidlaren	44.0367179	7.66622841
	Bakke 3	Bakkehidlaren	75.2689716	7.21756873
	Bakke 1	Bakkehidlaren	62.1164846	6.6518674
øj 5412	Båtb. 2	Båthidleren	55.5845374	3.82336073
øj 5414	Båtb. 4	Båthidleren	51.8370564	3.56977048
	Båtb. 1	Båthidleren	50.2968719	4.23300653
	Båts 1	Båthidleren	50.9598138	3.56977048
øj 5408	Erten 1	Ertenstein	74.69	4.21349958
øj 5409	Erten 2	Ertenstein	75.5	3.35519411
øj 5410	Erten 3	Ertenstein	74.72	3.88188156
øj 5411	Erten 4	Ertenstein	79.36	2.55540947
øj 5391	TH 001A	Gravdal	62.7533306	2.84801361
øj 5392	TH 001B	Gravdal	33.8235295	2.65294418
øj 5395	Gravdal 2	Gravdal	42.4395791	2.71146501
øj 5396	Gravdal 3	Gravdal	34.8025918	2.6139303
øj 5399	Helle 1	Hellebruddet	43.4618971	5.03279117
øj 5407	Helle 2	Hellebruddet	50.4749471	5.16933977
øj 5403	Onar 3	Onarheim	53.4125042	4.0379371
øj 5404	Onar 5	Onarheim	56.4644515	4.9547634
øj 5405	Onar 6	Onarheim	58.7782534	3.72582602
øj 5406	Onar 8	Onarheim	55.7405012	4.64265232
	Onø 1	Onarheim	68.050947	4.83772175
	Onø 2	Onarheim	55.083148	4.77920092
øj 5400	Vesle 2	Veslehidlaren	53.4552079	4.52561066
	Vesle 1	Veslehidlaren	48.3410313	4.91574952
th 4954	Ø1	Øye	15.6816384	6.39827715
th 4955	Ø3	Øye	14.2324278	8.48552
th 4956	Ø4	Øye	14.5346189	5.05229811
th 4957	Ø5	Øye	19.2669289	8.05636726
th 4958	Ø6	Øye	12.807198	7.68573535
th 4959	Ø7	Øye	12.9533972	7.7052423
th 4960	Ø8	Øye	20.6196258	7.45165204

Soapstone in the North. Quarries, Products and People. 7000 BC – AD 1700

Soapstone is a remarkable rock. While it is soft and very workable, it is also durable and heat-resistant, and with a high heat-storage capacity. These properties have been recognised and valued around the world since prehistoric times, and soapstone has been used for a multitude of purposes, ranging from everyday household utensils to prestigious monuments and buildings. This book addresses soapstone use in Norway and the North Atlantic region, including Greenland. Although the majority of the papers deal with the Iron Age and Middle Ages, the book spans the Mesolithic to the early modern era. It deals with themes related to quarries, products and associated people and institutions in a broad context. Recent years have seen a revival of basic archaeological and geological research into the procurement and use of stone resources. With its authors drawn from the fields of archaeology, geosciences and traditional crafts, the anthology reflects cross-disciplinary work born of this revival.

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