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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.

Bergen/Hyllestad, Spring 2017
Gitte Hansen
Per Storemyr

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Amanda Forster and Richard Jones

From Homeland to Home; Using Soapstone to Map Migration and Settlement in the North Atlantic

One of the most characteristic features of Viking material culture is the use of soapstone (steatite) to make vessels, lamps and other artefacts. As soapstone was a readily available material in the Viking homelands, the inclusion of these characteristic objects with items transported by pioneer Norwegian migrants to the North Atlantic is likely. As settlements were established across the North Atlantic region during the Viking period other sources of this stone would have become available, for example in Shetland and Greenland. In this context a central question arises about the identification of those sources during the different phases of the Viking period. This paper presents some of the findings from two independent studies which have combined into a single project, Homeland to home, one concerning the morphology/typology of soapstone artefacts, the other applying analytical techniques to determine the origin of such artefacts. Based particularly on displaced artefacts found at Viking period sites in northern Britain (York to Orkney), Ireland, Faroe and Iceland, the main attributes of seven typological classes have been identified, allowing hypotheses to be proposed about the likely source and chronological floruit of each class. Some of these hypotheses have been tested by ICP-MS analysis (for rare earth elements) and to a lesser extent by portable XRF for semiquantitative analysis of major, minor and trace elements. Results are presented for a number of quarries on Shetland and south east Norway and artefacts from Shetland (Sandwick, Unst), York, Orkney (Quoygrew, Westray), Norway (Kaupang) and the Faroes. For several reasons including the still limited size of the quarry chemical database, positive assignments of origin to individual artefacts remain difficult to propose on the basis of chemical composition. On the other hand, more progress is made in a process of association: identifying groups of artefacts that are likely to have similar origin owing to their similarity of composition and then correlating those groups with their typological membership.

Introduction

Across the North Atlantic region (see Figure 1) archaeologists are acutely aware of the homelands of early Viking settlers who colonised the region from the ninth to the mid-eleventh century. The cultural blueprint of artefacts, building forms and economic base introduced by Viking period migration created a Scandinavian sphere of influence which is striking across the region – from Orkney to Greenland. This paper looks at one aspect of material culture, soapstone (also called steatite) vessels, in order to shed light on the movement of peoples – and their belongings – from the Norwegian homeland and into the North Atlantic. The premise is simple; Norwegian migrants to the North Atlantic region brought with them soapstone vessels, included with their belongings. These imported

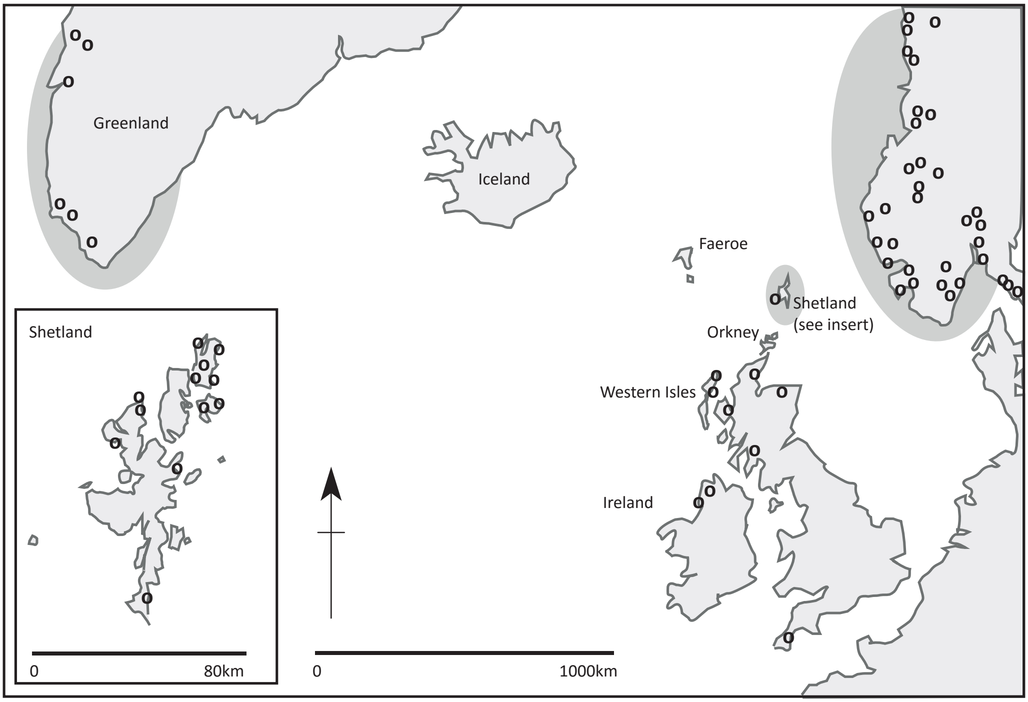


Figure 1. *The North Atlantic region, showing locations of known soapstone outcrops. Shaded areas are regions known to have been utilised during the Viking and Medieval periods; Norway, Shetland and Greenland.*

goods contain clues which have the potential to pinpoint the starting point of pioneer settlers using science-based provenance of the artefacts themselves. In addition, provenance studies can help shed light on the development of these island societies as pioneers settled and subsequently adapted to the opportunities and limitations apparent in their new homes.

The Homeland to home project brings together two independent studies, one on the morphology of North Atlantic soapstone artefacts (Forster 2004a) and the other on the science-based provenance determination of soapstone from Scotland (see Clelland et al. 2009). The breadth of understanding provided from both cultural and scientific study of the material has provided an excellent platform for more in-depth analysis. This paper presents preliminary results of targeted provenance studies of soapstone artefacts and samples from the North Atlantic region against a background of hypothetical origins based on typological classification.

Vikings in the North Atlantic region

During 9th and 10th centuries, the North Atlantic region was transformed from a barrier dividing remote and often uninhabited island groups, to an inland sea within a predominantly Norwegian sphere of interest (Larsen & Stummann Hansen 2001:115). The western expansions of the Norse linked Scandinavian homelands to a wider world, developing a medieval cultural identity across the maritime landscape. This common Norse ancestry diverged as settlers adapted to their new homes, separated by sea and variable access to resources. James Barrett (2012:6) describes the island settlements as insular societies, 'physically removed from centres of consumption yet potentially interconnected by the sea'. Rather than being isolated and marginal, these island societies were embedded within the wider political and economic landscape of northern and western Europe; 'The reality is that the 'chiefly' societies of the north – Orkney, Iceland, the Isle of Man and elsewhere – were interdigitated with contemporary chiefdoms, states and empires…' (Barrett 2012:7).

The nature of those migrations and the development of each island society in the North Atlantic is a study in itself – and not one to rehearse here (see Barrett 2008 for discussion). The provenance of soapstone has an important part to play in researching the nature of that society and how each of those insular societies developed and interacted. In the North Atlantic region, soapstone outcrops can be found in Norway, Shetland and Greenland (see Figure 1). Soapstone artefacts have a wide distribution during the Viking period which correlates with areas of Norse settlement across the region (see Forster 2005:55). Limited availability and wide distribution implies some movement of raw material and/or finished goods, and has often been taken to indicate presence of long-distance trade networks across the North Atlantic (e.g. Crawford 1987:152). However, morphological study of soapstone artefacts concluded that the distribution and nature of *displaced* artefacts (e.g. artefacts which have been transported, Needham 1993:162) suggested a more complex story of migration, adaptation, resource control and contact through the Viking and later Norse periods (Forster 2005; 2009). The authors believed that evidence provided by morphological analysis warranted further investigation, and that a more detailed investigation of provenance of artefacts could provide the level of detail needed to understand the complexities of this medieval commodity.

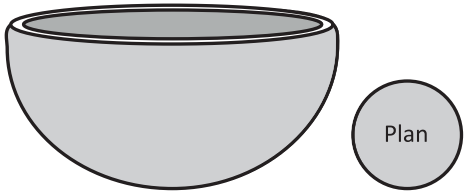
Typological reference series of soapstone vessels in the North Atlantic

By amalgamating regional type series developed through morphological study, Forster has developed a series of reference sheets for the assessment of displaced soapstone artefacts (Forster 2004a:Figs 5.1, 5.2). The original study (Forster 2004a) highlighted the chronological and regional sensitivity of particular types (not all), enabling some differentiation between the date and possible provenance of artefacts recovered from North Atlantic sites. The types identified remain relevant and, with some minor updates, are presented below (Figures 2, 3 and 4). The broad chronological and geographical sensitivity provides a useful mode of comparing assemblages from across the region. Within the remit of this paper, finds from sites in Greenland have been omitted. Whilst the Norse inhabitants of Greenland did utilise local sources (Arneborg 1984; Forster 2004a:197ff), morphological study highlights a number of distinctive traits which have not been recorded elsewhere. As such, there is no evidence to date of Greenland vessels being exported to other areas (see Forster 2004a for discussion of morphology) and, therefore, the material is not a core part of this phase of the Homeland to home project.

The main aim of the original morphological study was to evaluate displaced soapstone artefacts from the North Atlantic region. The study included finds from Ireland, York, the Western Isles, Caithness, Orkney, Faroe and Iceland (see Forster 2004a; 2004b; 2005; 2009). Research aimed to characterise soapstone assemblages, highlighting the role that source regions played in the manufacture and distribution of soapstone vessels through Viking and Medieval periods. Reference types illustrated here (Figures 2, 3 and 4) highlight vessel morphologies which feature most highly across the region, noting the main characteristics of those types and the assumed provenance region and date. These forms do not provide a comprehensive typological series for each source region, but should be seen as reference types for the North Atlantic. Primary analysis and discussion of typological series for each region can be found in Forster 2004a.

Five vessels types are highlighted as regionally sensitive and two could be manufactured in either source region. *Type 1* (hemispherical circular vessel) is the most common type within Scandinavia

Type 1

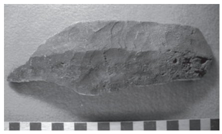


Hemispherical vessel

- Circular in plan with curved profile
- Can be carinated
- Consistent wall thickness and finish
- Attributes can include patterned tooling, decorative grooves below rim (usually one or two in parallel), single or opposing lugs and iron handles
- Common Norwegian vessel type
- Viking Age, though can extend to later medieval
- Assumed Norwegian origin

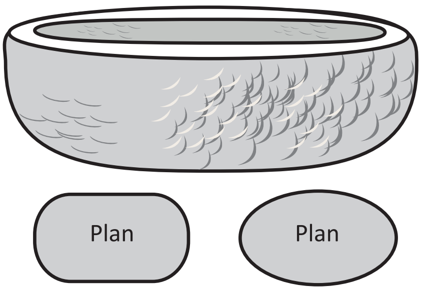
Beginish Island, Ireland
BEG-C1959:748

York, Coppergate
COP7565/7723/7792



Old Scatness Broch
OSB368

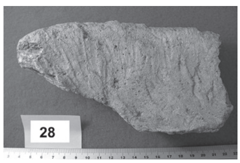
Type 2



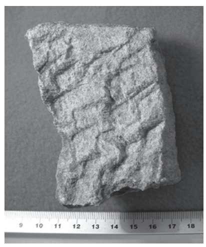
Thick walled curved vessel

- Curved vessel, oval to subrectangular to oval in plan
- Inconsistent wall thickness and rough finish
- Tooling often present
- Norwegian or Shetland origin

Old Scatness Broch
OSB11114



Norwick
NORW028



Norwick
NORW015

Figure 2. *Reference sheet for soapstone vessels of the North Atlantic region; Types 1 and 2 © Forster.*

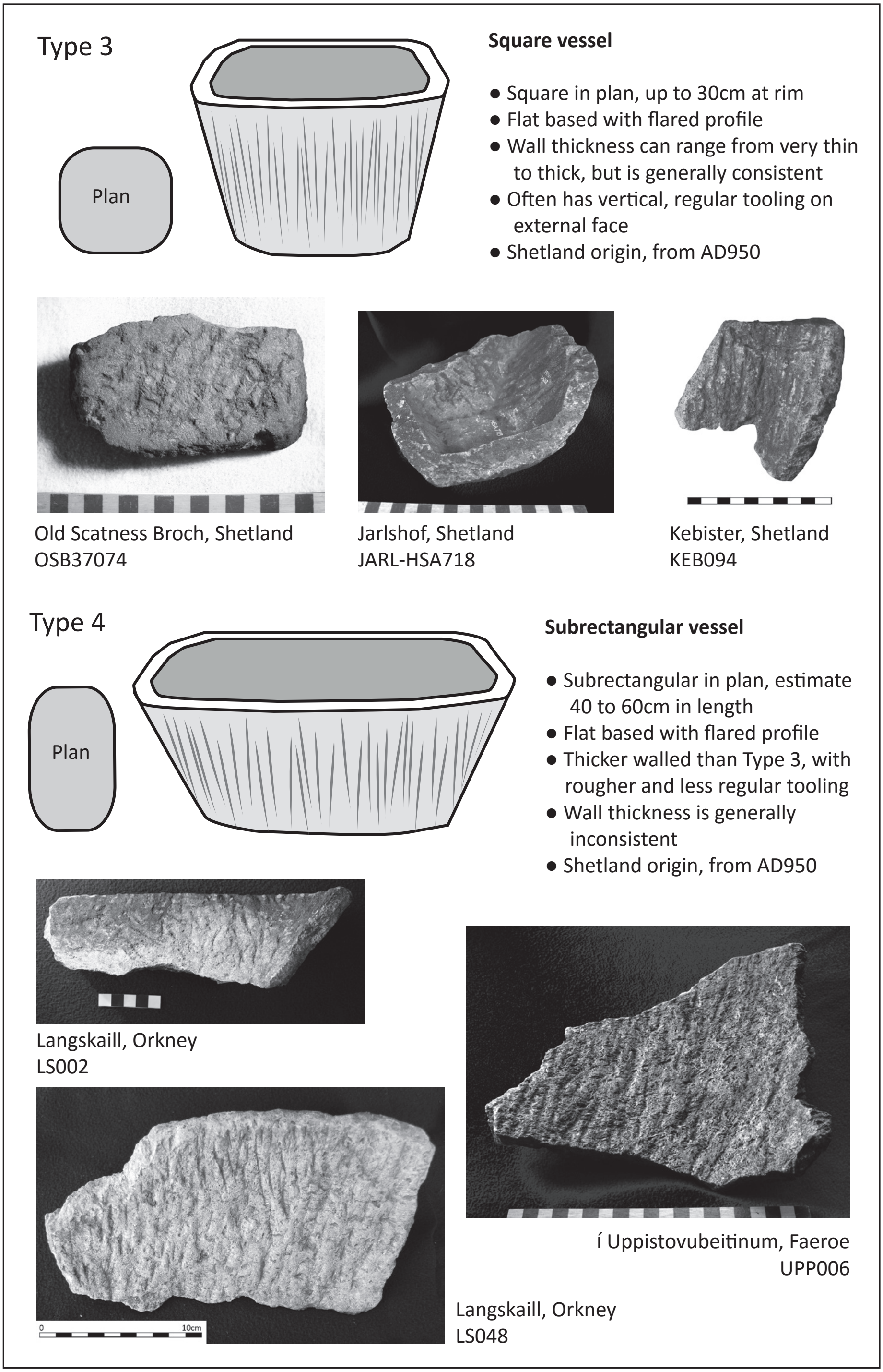
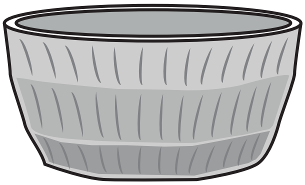
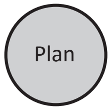


Figure 3. *Reference sheet for soapstone vessels of the North Atlantic region; Types 3 and 4 © Forster.*

Type 5



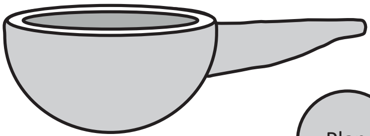


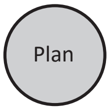
Viðey, Iceland
Við52313-5

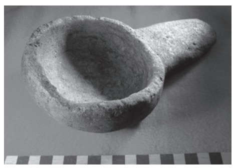
Circular flat-based vessel

- Circular in plan with straight, flared profile
- Can be banded, often with vertical tooling but can be plain
- Well made, with thin wall thickness rim (usually one or two in parallel)
- Norwegian vessel type, especially West coast. Assumed Norwegian source.

Type 6







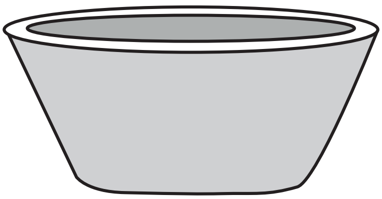
Old Scatness Broch
OSB14950

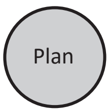
Norwick
NORW002

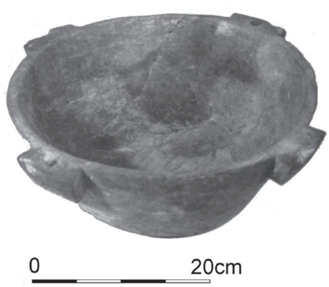
Handled ladle

- Circular bowl with extended handle
- Predominantly Viking contexts
- Norwegian or Shetland

Type 7







Jarlshof, Shetland
(Hamilton 1956)

Large circular flared vessel

- Circular in plan, with flared and straight walled profile
- Flat based
- Uncommon find, assumed Norwegian source

Figure 4. *Reference sheet for soapstone vessels of the North Atlantic region; Types 5, 6 and 7 © Forster.*

and provides a standard morphology to which a number of attributes can be added. Within the North Atlantic region, Type 1 vessels have been recorded at sites in every area (for examples see Old Scatness, Shetland, Forster 2010:258; Pool, Orkney, Smith and Forster 2007:412). The common factor is quality; a consistent wall thickness, reasonably symmetric shape and curved profile. *Type 2* is a less accomplished curved vessel, with thicker walls, a flatter base and rougher finish. This vessel is not strongly recognisable as either Norwegian or Shetland in origin, although in Shetland it may be a stepping stone towards a more developed morphological type (see Forster 2009:67).

The large assemblage recovered from the Viking age settlement at Norwick (Shetland) provides an insight into early Viking period use of Shetland soapstone, where a number of Type 2 vessels are recorded (Forster 2006). Rather than being the aim of the maker, Type 2 vessels could represent early attempts to recreate Norwegian Type 1 vessels which failed when using Shetland stone. This may result from a lack of experience; skilled artisans familiar with producing soapstone vessels may not have been among those who settled in that area, or perhaps local inhabitants emulating exotic Norse imported vessels were simply not skilled in working soapstone in this way. It is interesting to note that early prehistoric vessels from Shetland are also subrectangular in form and are striking in their similarity to those which developed centuries later in the Viking period (see Forster and Sharman 2009). There is no obvious explanation for this, although it seems unlikely to be the result of a coincidence. The relict quarry faces and spoil tips of Shetland's prehistoric workings would have been visible to those producing vessels in the Viking and Norse periods – and perhaps those then ancient workings simply provided inspiration. Another possibility is that soapstone sources differ in their working qualities according to the geological environment at each source, and that those in Shetland may more easily be worked into square and rectangular vessel forms, e.g. *Types 3* and *4*. Perhaps some experimental production of soapstone vessels could shed some light on the puzzle.

Types 5, 6 and *7* are less common, but are distinctive and have been included as types for that reason. *Type 5* is the most regionally sensitive. Various styles of flat-based circular vessel are widely found in Norway, but it is the banded form which is most apparent in the North Atlantic region. This type has been recorded at a small number of sites in Iceland (Viðey and Storaborg, Forster 2004b) which date to the later Medieval period and appear to demonstrate a strong link with west Norway and possibly Bergen. *Type 6* has a wider distribution and appears to be a feature of Viking period assemblages. The type has been recorded in Orkney, Shetland, Faroe and Iceland, but has not been strongly linked to a specific source region. Finally, *Type 7* is a larger vessel type which is circular in plan and has straight, flared walls. This is not a common type and is represented by only a handful of single examples in Orkney (Quoygrew 61989, Batey et al.:215) and Shetland (Jarlshof, Hamilton 1956; and possibly The Biggings 1503a; Smith 1999:133) from Medieval period sites. It is assumed to be a Norwegian vessel type, mainly due to its rarity within Shetland assemblages.

Mapping morphologies; interpreting distribution maps

Using the reference types outlined above, assemblages recovered from sites across the region can be compared as a group. This has allowed more informed interpretation of the distribution of soapstone vessels, and consideration of the mechanisms behind those distribution maps. In addition, comparison has highlighted the main questions which can be addressed with targeted science-based analysis.

AD 800–950: Landnám phase, original imports

The displaced soapstone artefacts of the North Atlantic region from the Landnám phase can be interpreted largely as original imports, based on their types (Stummann Hansen 1991:51). Stummann

Hansen used the term original imports to refer to materials introduced by the pioneering Norwegian settlers to Faroe, rather than being goods imported as items of trade. Large numbers of well-preserved Type 1 vessels were recorded at Toftanes (Faroe), Pool (Orkney), Old Scatness (Shetland), Jarlshof (Shetland) and, to a lesser extent, Reykjavík (Suðurgata 3–5, Iceland). Vessel fragments tended to be of medium to large size (e.g. at Old Scatness the average weight of 112 vessel fragments was 190 g), with a reasonable level of conservation and repair where vessels had broken. Re-working of larger fragments for the manufacture of small portable objects such as whorls and weights is common. The discard of numerous large fragments (e.g. over 100 g in weight) is taken to be an indication that artefacts were relatively common and could be replaced when broken beyond reasonable repair.

Vessels are mostly of Type 1, believed to be of Norwegian origin, although morphologies are diverse within individual sites, contrasting with the uniform assemblages recorded at contemporary proto-urban Scandinavian sites such as Kaupang (Baug 2011:313) and Hedeby (Resi 1979). This diversity has been interpreted as indicating domestic-level manufacture (e.g. uniformity of vessel form indicating more organised production), the variation resulting from occasional production by individuals when needed. The existence of both forms of production in Norway has previously been suggested by Skjølsvold (1961:155)

A different type of assemblage is found at York and Dublin; soapstone objects have been interpreted as possessions but representing individuals rather than groups. Vessels are exclusively Type 1, believed to be of Norwegian origin. Scandinavians resident in York and Dublin are likely to have been traders and craftsmen, and the few soapstone vessels and moulds recovered probably represent the personal possessions of individuals. Richards (2000:67) questioned the number of Scandinavians actually resident at York, and the level of migration and intensity of Scandinavians settling was certainly greater in Scotland than in England (Barrett 2003:82). Although this paper is concerned with vessels, it is worth mentioning one find from York, a four-sided bar mould, which is undoubtedly part of a toolkit. Such a find indicates craft specialisation consistent with the proto-urban nature of Viking York, an interpretation reiterated by presence of a similar find at Hedeby (Resi 1979:58), and a possible example from Kaupang (Baug 2011:329). Only one mould of this type has been recovered from the Northern Isles, and it seems no coincidence that this example was recovered from Brough of Birsay (Curle 1982:SF577, Ill 28:45), a site considered to be a high status settlement (see Crawford 2005 for discussion of Birsay's relationship with the Orkney Earldom).

The origin of soapstone goods across the North Atlantic region during this phase is almost exclusively believed to be Norwegian, although utilisation of local sources appears within the Norwick assemblage (see Type 2 above). The distribution of soapstone finds recovered from the landnám phase strongly reflects areas of Norwegian settlement during the 9th century AD. The dominance of Type 1 vessel forms suggest that, despite use of sources within Shetland, the majority of finds across the North Atlantic region are imported from Norway, probably transported by settlers. A key question that is considered in the next section is whether science-based techniques of analysis can identify the sources of those assumed Norwegian artefacts found abroad. The premise that these imports derive from the belongings of settlers (rather than from a trade in goods) implies that the identification of their sources could pinpoint the regions within Norway or neighbouring regions from which pioneer settlers started their journey. This pivots on the assumption that Type 1 vessels are indeed a Norwegian import.

A broad-based approach to the analysis of samples has been taken, targeting Type 1 examples from across the region and including material from York. In addition, the analysis of material from sites such as Norwick, where Type 2 vessels have been identified as early Shetland examples, will provide some understanding of the development of the Shetland vessel types. Source material from

Shetland quarries and early prehistoric sites in the Northern Isles will provide further refinement of the identification of Shetland quarries, building on previous analytical work (see below). The examination of both archaeological and geological samples from Norway is necessary to provide comparison to material from Shetland.

AD 950–1200: Utilising local resources and developing an industry

This phase of soapstone use is characterised by the adaptation of Norse communities throughout the North Atlantic region to the local environment. Use of soapstone throughout the region is variable and determined by local access to materials. Soapstone goods are no longer assumed to be transported from Norway in large numbers as original imports, and in areas devoid of local sources vessels are few and preservation is very poor due to the degree of secondary working. In extreme cases, extensive re-working results in the preservation of only very small flakes, such as at Sveigakot, Iceland (Forster 2004b) and í Søltuvík, Faroe (see Forster 2004a). Low numbers of fragmented soapstone are an indication that access to replacement vessels was limited. Although reworking of material is recorded in all areas, regions where soapstone is accessible consistently discard larger and more numerous vessel fragments.

The proximity of Orkney to Shetland meant that vessels continued to be accessible despite no local source being present on the Orkney Islands. High numbers of Type 3 and 4 vessels are clearly seen at Pool from the mid-10th century onwards, suggesting Shetland goods were attainable and provided an accessible replacement for diminishing original imports (Smith & Forster 2007:412). Examples of Shetland vessels are noted at Brough of Birsay (see SF5000, 5001 and 5027, Hunter 1986) and Quoygrew (Batey et al. 2012:214), where material was used to a similar extent as in Shetland. The uniformity and wide distribution of Shetland types suggest some level of resource control and perhaps provides the first suggestion of an organised Shetland soapstone industry. Evidence from Faroe and the Western Isles suggests that a limited number of soapstone Type 4 vessels were imported from Shetland (Forster 2009:67).

Within Shetland and Orkney, imported soapstone vessels believed to be of Norwegian origin are present in low numbers, certainly by comparison with vessels thought to be produced in Shetland (see Forster 2005). Such low numbers could indicate that Norwegian vessels were not transported in great numbers to the North Atlantic islands, resulting in occasional examples such as the Type 7 vessels recorded at Jarlshof and Quoygrew. In Iceland, the numbers of soapstone artefacts remain extremely low (with the exception of Viðey) and are exclusively assumed to be Norwegian. Finds from Viðey are comparatively numerous and well preserved, and include both Type 1 and Type 6 vessels. The objects are of high quality, adorned with copper alloy accoutrements, decorative tooling or of exceptional size. The number and quality of the soapstone goods must reflect the high status of this monastic site (Hallgrímsdóttir 1989).

Science-based analysis for this phase aims to shed light on the development of the Shetland industry, with analysis of well-dated archaeological samples from Orkney. Analysis of archaeological samples from Shetland from recently excavated sites aims to identify the source quarry for a possible organised industry by including archaeological and geological samples from quarry sites. In addition, a key question for this phase is the export of Shetland goods beyond the Northern Isles. Archaeological examples from Faroe and the Western Isles will be analysed, and samples thought to be from Shetland will be targeted alongside assumed Norwegian examples.

Science-based analysis of North Atlantic soapstone vessels

The previous section has explained the desirability of acquiring objective information on the sources of Viking soapstone artefacts and has set out the broad sampling strategy of the Homeland to home project. This information derived from science-based analysis is now accumulating for those regions of the Viking world where soapstone occurs naturally (Bray et al. 2009:Fig. 2.1), for example Norway (several papers in this volume), northern Britain and Greenland (Appelt et al. 2005). In the case of Norway Storemyr and Heldal (2002) have outlined the geological basis of the main soapstone outcrops on the one hand in the Trondheim and Gudbrandsdalen areas and between Bergen and Stavanger, all of which belong to Caledonian formations, and on the other in the Precambrian deposits lying east and south east of Oslo (Storemyr & Heldal 2002:Fig. 1); notable is the variety of geological settings of all these deposits (Storemyr & Heldal 2002:Fig. 2). Of the Viking Age quarries, Storemyr and Heldal (2002:365–6) describe the serpentinite and soapstone deposit at Slipsteinberget.

Regarding the sources in northern Britain, those in Shetland have received the most attention (Forster & Turner 2009). The outcrops of soapstone and talc have been well documented geologically, initially by Wilson and Phemister (1946), and in a broader context by Mykura (1976). Bray et al. (2009) have provided a convenient overview of this topic as well as valuable field descriptions of 23 sources on the Islands. Some of the archaeologically relevant sources (which are illustrated in several contributing chapters in Forster and Turner (2009) have been characterised in terms of elemental, mineralogical, magnetic and isotopic composition, as reported by Clelland et al. (2009). These authors implicitly emphasise that the complex nature of soapstone demands a multi-technique approach for provenance determination, a view that features strongly in Ritchie's (1984:77–82) review of early characterisation work on material from Norway and Shetland. While endorsing the desirability of applying such an approach, the present report is based on the *elemental* characterisation, more specifically the determination of soapstone's rare earth element (REE) composition by ICP-MS, coupled in a more limited, exploratory manner of the major (Fe, Mg), minor (K, Ti, Ca) and trace (Cr, Mn, Sc, V) element contents with portable XRF (X-ray fluorescence spectrometry, abbreviated here pXRF). This is the same technique that Smith et al. (2013) used to establish that a jasper fire-starter found at L'Anse aux Meadows was neither Icelandic nor Greenlandic; that it was tentatively linked to Newfoundland's Notre Dame Bay area is interesting for the fact that another jasper fire-starter from the same site analysed by INAA was linked to a source on Greenland (Smith 2000). Analysis by pXRF of the major, minor and trace elements, which proved useful in Magee et al.'s (2005) study of Arabian softstone, has the additional benefit of providing a rapid assessment of the relative heterogeneity of the archaeological/geological soapstone's composition.

The purpose of this section is to consider some of the results of analysis of soapstone carried out over the last ten years and more recently as part of the on-going Homeland to home project. This enables us to assess the extent to which these results can indeed shed light on the archaeological questions that were posed in the previous section. An essential methodological element of the project has been to consider *concurrently* geological soapstone, worked soapstone found at sources as well as soapstone artefacts. Furthermore, as indicated in Figure 5, the project's sampling strategy has deliberately been broad-based geographically. On the one hand, there are assemblages comprising more than ten samples at individual archaeological sites, such as Bayanne, Sandwick and Fetlar on Shetland, and with relevant quarry material, for example at Kaupang. On the other, more recent selection has been more targeted to include, on the basis of morphology and/or fabric appearance, likely imports from Shetland as well as Norway; examples here are York, Quoygrew and Faroe. Raw data that has not previously been published appears in Appendix, Tables 1 and 2. The pXRF data set is as yet incomplete as analyses are still in progress.

Methods

The REE analyses were carried out by inductively-coupled plasma-mass spectrometry (ICP-MS) at the Scottish Universities Environmental Research Centre, East Kilbride, using Varian VG PQ II quadrupole and more recently Agilent 7500ce instruments. Jones et al. (2007) describe the sampling of geological material, the analytical procedure and the method of acid dissolution in HF and aqua regia. For artefacts, sampling usually involved drilling into the wall of the artefacts with an electric drill with a 2.5 mm diameter head; up to 1 g of powder was collected from four holes drilled into the cross-sectional wall of artefacts, having discarded any surface residue or weathering. In the case of large artefacts it was often possible to drill in well separated locations to provide a larger, more representative sample, and in a few cases two separate samples were taken, one by drilling, the other by crushing a small cleaned fragment to powder in an agate mortar. The latter method was used more frequently on geological soapstone: fragments were crushed in a mortar to *c*. 50µm, yielding

Figure 5. *Soapstone analysed by ICP-MS (and pXRF).*

Reference material	Number of samples	Publication
Shetland: Cunningsburgh/Catpund Shetland: Catpund	12 10	Jones et al. 2007 This volume
Shetland: Clibberswick	8	Jones et al. 2007
Shetland: Fethaland (Cleberswick)	10	Jones et al. 2007
Shetland: Dammins, Clemmil Geo (Houbie) on Fetlar	10	Unpublished; Bray 1994
Norway, Oslofjord region: Solerudberget and Fluetjern (Østfold), Piggåsen and Folvelseter (Akershus)	5 from each quarry	Baug 2011:330 (see also http://www.ngu.no/en-gb/hm/Resources/prospecting/)
Norway: numerous locations including Slipsteinsberget (Nord-Trøndelag)	1 from each quarry	Baug 2011:330; Batey et al. 2012:209–10. For Slipsteinsberget see Storemyr & Heldal 2002:365–366
Archaeological material found on Shetland		
Bayanne, Yell	18 early prehistoric artefacts (all vessel fragments) and three unworked pieces	See text; Forster & Sharman 2009; Forster & Jones 2014
Sandwick, Unst	15 prehistoric artefacts and miscellaneous material	See text; Jones 2009
Houbie and Giant's Grave, Fetlar, (http://www.fetlar.com/time_team_index.htm)	13 Viking period artefacts	Jones internal report 2007a
Archaeological material found elsewhere		
Quoygrew, Orkney	31 Viking and Norse period artefacts	See text; Batey et al. 2012
York, Coppergate	7 Viking period artefacts	See text; Jones 2007b
Faroe Islands: Inni á Tvørgarði, Toftanes, Uppistovubeitið	6 Viking period artefacts	See text
Kaupang, Norway	24 Viking period artefacts	See text; Baug 2011:329–31; Jones et al. 2006

up to 2 g and 10 g artefact and geological samples respectively) of homogenised powder. Having obtained the concentrations (in ppm) of fourteen REE, their *pattern* and *concentration range* of the data in chondrite-normalised form offer the best means of visual examination. This may sometimes be followed with bivariate plots of elements (chondrite-corrected, normalised to La) and multivariate treatment with principal components and discriminant analyses (Batey et al. 2012:Figs. 12.2–12.4).

For analysis of the major, minor and trace elements by non-destructive pXRF, a portable Thermo-Scientific Niton XL3t energy-dispersive instrument with a 50 kV silver X-ray tube and a Geometrically Optimized Large Drift Detector pXRF analysis was employed. The nature of the surface selected for analysis required attention. Experiments on geological soapstone showed significant variation in certain element contents according to the nature of the surface: naturally flat, sawn, and sawn and polished. But because the preparation of a fresh surface on *artefacts* with a cutting saw was not normally permissible it was decided to analyse surfaces of both geological and artefactual soapstone that were naturally as flat as possible: we exploited the often smooth laminated surface in the former and the interior surface or flat rim top of vessels. Weathered or carbonised material was removed, where necessary, prior to analysis. The artefact or fragment was placed on a stand allowing reasonably constant distance and geometry between the X-ray beam and the selected location on the fragment. At least three locations on each artefact or fragment were analysed, the count time of each analysis being 75 seconds and the analysis area *c.* 10 mm^2. The instrument's calibration algorithms TestallGeo and Mining were employed. No great claims of accuracy can be made: most element determinations of USGS BCR, DNC, AGV and GSP (powdered) standards were found to be up to 20% lower than the certified compositions, and for chromium at low concentration (<200 ppm) the discrepancy was much larger. Since the analysis was of a surface rather than a bulk sample, the element determinations should be regarded as *semi-quantitative*. Of the approximately twenty detectable elements, the concentrations of nine – Fe, Mg, Ca, K, Mn, Ti, Ni, Cr and V – were retained for processing and presented as element to Mg ratios.

Results

Quarries

The geological environment and hand specimen description of the soapstone at the main quarry sources on *Shetland* are set out in Figure 6. The inter-quarry distinctions can be made from the respective elemental, magnetic, isotopic and mineralogical compositions appear to be limited and yet they reflect the contrasting tectonic environments given in Figure 6 (Clelland et al. 2009:113). Thus, as discussed further below, the REE compositions at Cunningsburgh (including the Viking quarry at Catpund located at the southern end of the Cunningsburgh outcrop (Turner et al. 2009), can be differentiated from those at Fethaland (previously called Cleberswick), but only with difficulty from those at Clibberswick. In terms of mass specific magnetic susceptibility there are two distinct groups separating Fethaland and Clibberswick from Houbie and Cunningsburgh. The strontium isotope ratios – $^{87}Sr/^{86}Sr$ – are lower in samples from the Ophiolite zone than in those from the Dalradian zone; Shetland Basement samples have the highest values (Jones et al. 2007:Tab. 6). While talc and magnesite are the dominant minerals in soapstone from Cunningsburgh and Clibberswick, talc and Mg-hornblende are present in soapstone from Fethaland. But encouraging though this picture may appear at a general level, there are two observations which, confirming previous views, have marked implications for provenance determination purposes: no single technique can decisively discriminate between these sources, a situation that would worsen as further sources on Shetland are introduced, and intra-source variation in composition is significant at several quarries.

Both these observations are relevant to the present purpose of reviewing the currently available REE patterns at four quarries – Catpund-Cunningsburgh, Fethaland, Dammins and a neighbouring quarry on Fetlar, and Clibberswick (Unst) – expressed in Figure 7a as indicative ranges. Fethaland stands well apart in terms of shape; the Clibberswick ranges are narrow but are encompassed by those on Fetlar and are very close to those at Catpund. The corresponding pXRF-derived data, albeit incomplete but including new samples of worked soapstone from excavations at Catpund (Turner et al. 2009), reveals that the ranges in several elements overlap at the three quarries considered, however it is encouraging to find relatively narrow ranges in most elements at Catpund. Here the Fe, Ni and Mn ranges are higher than at Clibberswick. At Fethaland, the Ca range is notably higher than elsewhere but the Cr range is wide (Figure 7b).

Turning to the corresponding situation in *Scandinavia*, the chemical and other characterisations of soapstone quarries are still in progress (see papers in this volume) and for present purposes a comparison is made of ICP-MS and pXRF compositions of soapstone sources/quarries in Norway of Viking age relevance: Slipsteinsberget (Nord-Trøndelag) in central Norway and four quarries in the south east of the country which Baug (2011:330–31; Fig. 12.20) has argued were probably known to the settlement at Kaupang; they are Pigåssen and Folvelseter in Akerhus County and Solerudberget and Fluetjern in Østfold County (Figure 5). Inspection of Figure 8a, b indicates that, although there are wide *intra*-quarry ranges of Ca and K, Folvelseter stands apart from the others with respect to those two elements; Solerudberget seems to differ in Mn and Slipsteinsberget perhaps in Ti. In terms of REE composition (Figure 8c), the quarries of SE Norway are rather similar to each other and at the same time offer resemblance with the range found among the vessels found at Kaupang which this author proposed formed a single composition group (Baug 2011:Tab. 12.11, Group 1). Other artefacts at Kaupang such as spindle whorls, loomweights and sinkers were found to have patterns different from that of the vessels; for example, a tuyere at Kaupang – F1025599 – shows a measure of similarity with Slipsteinsberget (Figure 8d). This finding is unexpected since Baug (2011:334) has proposed that such artefacts – classed as secondary products – were probably derived from vessels, representing primary production, which had broken.

It is encouraging to find that the SE Norwegian quarries offer an indication of differentiation from Clibberswick and Fethaland in terms of both REE pattern and higher concentration ranges

Figure 6. *Geological environment of the main steatite quarries on Shetland, including hand specimen description (Bray et al. 2009).*

Quarry	Geological environment	Hand specimen description
Catpund-Cunningsburgh	Dalradian (*metamorphosed marine sediments of late Precambrian age*)	Much variation, but coarse grained >2 mm, weathering brownish yellow and containing large cream-coloured carbonates
Fethaland	Shetland basement (*acid banded orthogneiss with accessory hornblende/ banded schistose hornblende gneiss*)	Dark grey and fine grained, made up of talc with few grains of carbonate
Fetlar (Dammins)	Ophiolite (*peridotite, dunite, pyroxenite, gabbro, sheeted dyke complex, basic metavolcanics*)	Coarse, platy, grey green talc surrounded by pale brown carbonates in patches and clusters
Clibberswick, Unst	Ophiolite	Cream to pale greenish grey, fairly homogeneous; equigranular; 0.5 mm grains of carbonate surrounded by finer talc with small opaques.

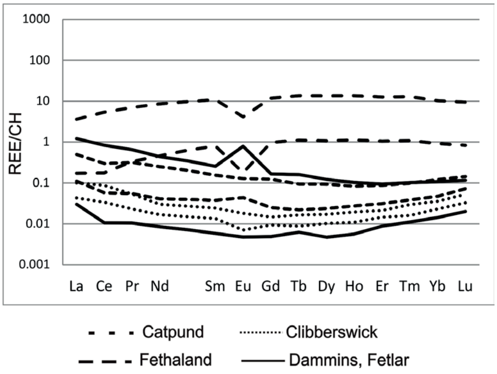


Figure 7a. *Ranges of REE patterns at Shetland quarries; Catpund (Jones et al. 2007 samples), Clibberswick , Fethaland and Dammins Fetlar.*

than on Shetland; Catpund and Fetlar also have lower concentration ranges but their REE patterns seem to be less significantly different. However, this picture, presently based on limited results, may become more complex as the database expands. Anticipating the findings obtained below on artefacts, it looks likely that positive assignments of origin will remain very difficult to make, although it should be possible to exclude sources. Working with associations rather than assignments of origin is a sensible way forward, thus artefacts having similar compositions may be regarded as having a similar origin. On the methodological front, current evidence suggests that intra-source and, for large artefacts, even intra-artefact variation in composition is significantly more marked than variation introduced through vessel use or burial conditions.

Artefacts

The soapstone artefacts found within prehistoric deposits at Bayanne and Sandwick, and Viking period phases at Fetlar on Shetland were analysed on the premise that the majority of artefacts at each site would represent exploitation of local source(s). Analysis confirmed this; in all three cases, although the concentration ranges were

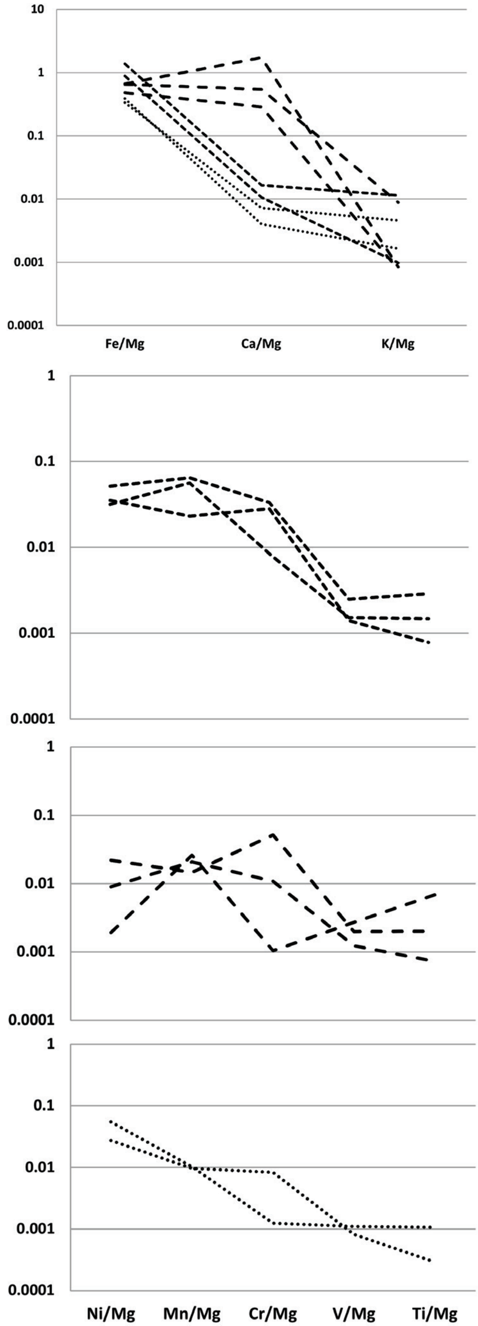


Fig. 7b. *Indicative ranges of element patterns at Shetland quarries: (top) Fe/Mg, Ca/Mg, K/Mg ratios and (bottom) trace element/Mg ratios at Catpund (new samples), Clibberswick and, Fethaland. Same site symbol style as in Figure 7a; pXRF data.*

wide, the REE patterns with few exceptions conformed to those represented at Clibberswick, Fetlar and even Cunningsburgh as demonstrated for Sandwick (Figure 9; cf. Figure 7a). The exceptions were interesting as they often combined a marked Eu anomaly (which need have no significance in terms of origin) with an atypical appearance in hand specimen. For example at Sandwick 2322, notwithstanding its Eu anomaly, may be regarded as different from the rest owing to the combination of its REE pattern (Figure 9) and atypical macroscopic appearance.

For the seven vessel fragments from Coppergate site at York there are the results of macroscopic examination (by G.D. Gaunt in Mainman & Rogers 2000:2541, 2547*)* which pointed to a strong connection with the Dalradian Supergroup in Shetland for all but 7256 (Type 1) and 15699 (Type 1) (see Figures 2–4). But the REE analyses (Figure 10) seem to indicate otherwise: 9682 (Type 1) stands well outside the Shetland concentration ranges. The pattern of 15699 (Type 1) is notable for its higher concentrations of the heavy REEs, a feature which is found, but to a significantly lesser extent, at Fetlar on Shetland. That leaves 7256 (Type 1), 9689 (Type 2), 9672 (Type 2), 9692 (Type 1) and 9677 (Type 1) which all share a similar pattern; on the grounds of both pattern and concentration ranges they show more resemblance with the vessels found at Kaupang (Figure 8d) than any of the Shetland quarries. The two separate samples taken from 9672 have gratifyingly similar compositions, but less so in the case of 9677.

In the writer's classification (in Batey et al. 2012) of the data for 31 subrectangular, hemispherical and uncertain vessel forms at Quoygrew, a large group of artefacts was found to have compositions that were an order of magnitude lower in concentration than those of a group of four vessels. In

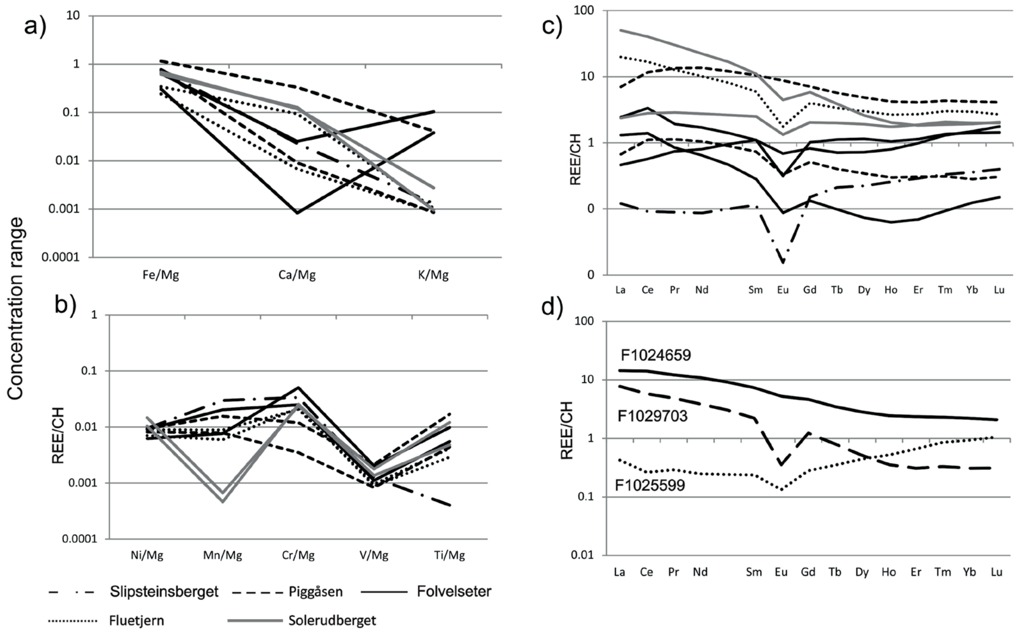


Figure 8. *(a) Fe/Mg, Ca/Mg and K /Mg ratios and (b) trace element/Mg ratios at quarries in SE Norway (Piggåsen, Folvelseter, Fluetjern and Solerudberget) and at Slipsteinsberget (Nord-Trøndelag); pXRF data. (c) The corresponding REE patterns and (d) the range of REE patterns among soapstone vessels at Kaupang represented by F1024659 and F1029703 (Baug 2011:Tab. 12.11, Group 1), and the REE pattern of tuyere F1025599 at Kaupang.*

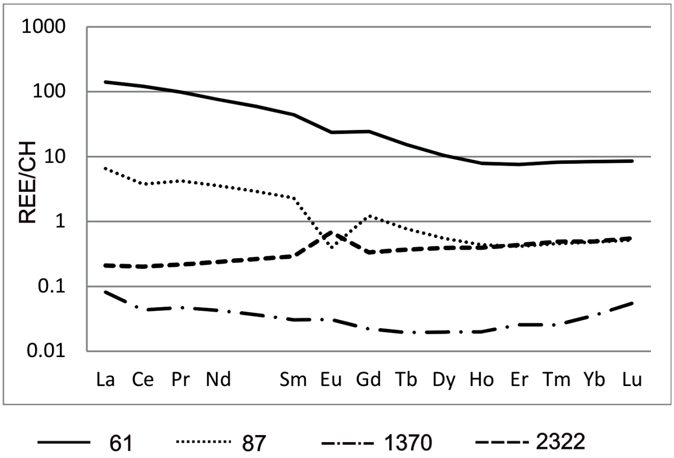


Figure 9. *REE patterns of vessel fragments 61, 87, 1370 and 2322 at Sandwick, Unst.*

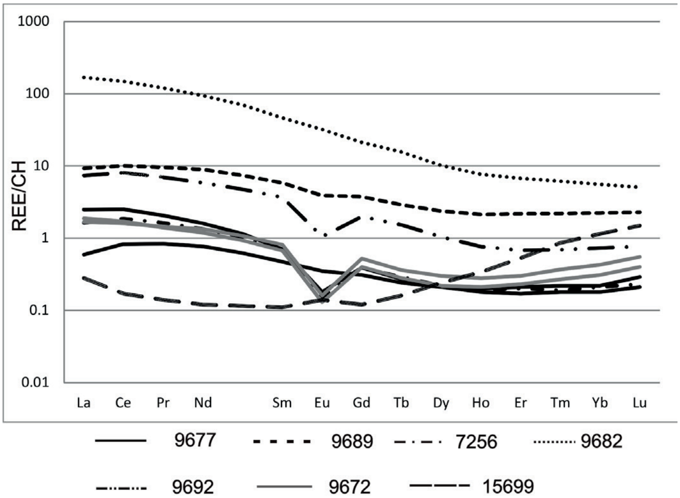


Figure 10. *REE patterns of vessel fragments at Coppergate, York. They are identified by their catalogue number (Mainman & Rogers 2000: 2627) except for small find 15699. The two samples of 9672 are indicated in grey.*

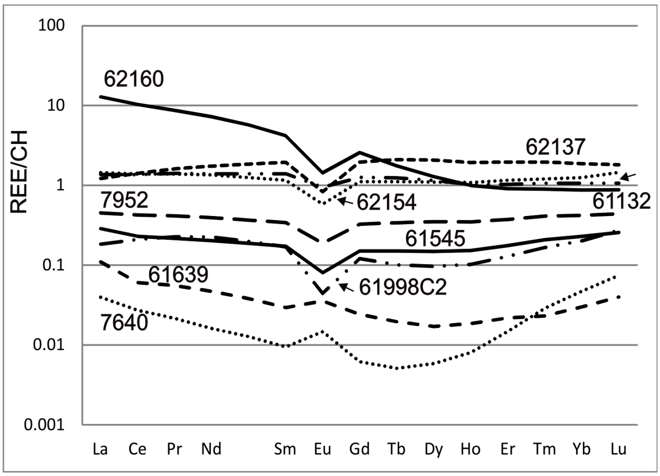


Figure 11. *REE patterns of vessel fragments at Quoygrew. 62160, 62154, 61545 and 61998 are hemispherical; 62137, 61639, 7640 and 7952 are of uncertain shape.*

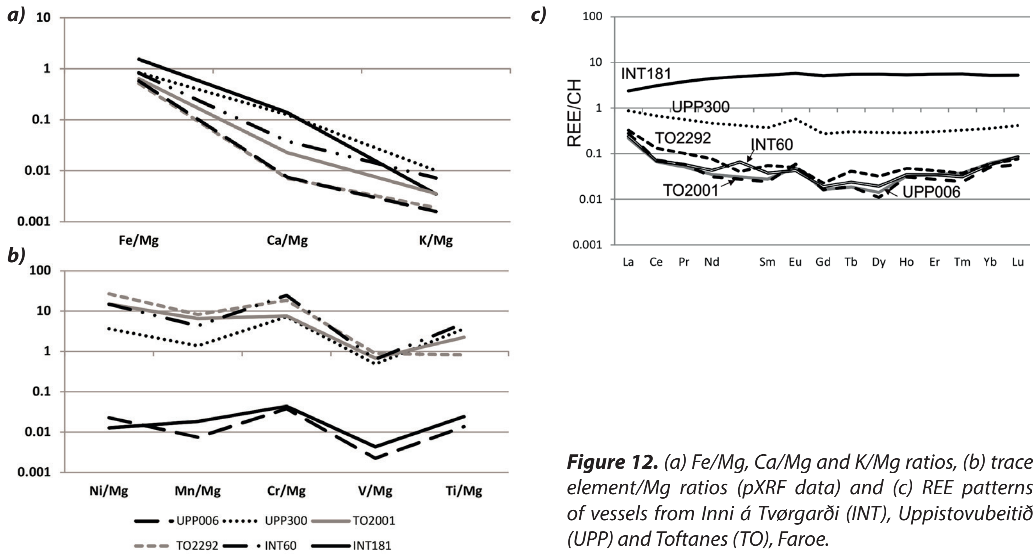


Figure 12. *(a) Fe/Mg, Ca/Mg and K/Mg ratios, (b) trace element/Mg ratios (pXRF data) and (c) REE patterns of vessels from Inni á Tvørgarði (INT), Uppistovubeitið (UPP) and Toftanes (TO), Faroe.*

the multivariate data treatment, discriminant analysis assigned, albeit with varying confidence, the members of the main group to either Catpund or Clibberswick with just one sample to Fethaland. However, examination of the corresponding REE patterns of examples of this Shetland group (Figure 11) indicates considerable variability, for instance the contrast between on the one hand 61545 (Type 1), 7952 (unknown), 61998C2 (Type 1) and on the other 61639 and 7640 (both unknown forms). Regarding the group of four, the least that can be said is that 62160 (Type 1 hemispherical), 62137 (uncertain), 62154 (Type 1 hemispherical) and 61132 (uncertain) (Figure 11) are not from Shetland but rather from probably more than one source in Norway.

Finally, of the six vessels from Faroe analysed so far, INT181 (Type 1 carinated circular vessel with lipped rim from Inni á Tvørgarði) has a hard dark grey fabric, UPP300 (Type 2 large oval dish from Uppistovubeitið) with a soft almost white fabric, contrasting with TO2292 (Type 1 hemispherical bowl from Toftanes) with a notably fibrous looking fabric and the remaining three – INT60 (Type 4) large subrectangular vessel, TO2001 (Type 2) large hemispherical vessel, and UPP006 (Type 4) large 4-sided vessel – which have a greyish more crystalline fabric. The pXRF data (Figure 12a, b) shows that INT181 and UP006 have much lower trace element contents than the rest but only the former stands somewhat apart in terms of pattern. As regards REE pattern (Figure 12c), INT60, TO2001, UPP006 together with TO2292 lie within the Shetland ranges, albeit with lower concentrations than at Catpund. Sharing a similar pattern is UPP300 which may therefore also belong to Shetland; its concentration ranges lie at the upper limit of the Fetlar group. That leaves INT181 which is unlikely to be from Shetland.

Discussion

The second part of this paper has explored the extent to which hypotheses based on traditional criteria can be usefully tested by elemental analysis. The outcome has been reasonably positive: similarity of REE signature may be used to associate artefacts, whether or not from the same findspots, to a common origin, but defining that origin is much more likely to be in the form of a negative than

Figure 13. *Comparison between origin assignments of individual artefacts found at Sandwick, York, Quoygrew and Faroe based on morphology and chemical analysis.*

Site	Period	ID	Mor-phology	Chemical analysis	Comment
Sandwick		2322	Un-known	Atypical Shetland	
York	Viking	7256	Type 1	More likely Norway (possibly Kaupang area?) than Shetland	Ok
York	Viking	9672	Un-known	More likely Norway (possibly Kaupang area?) than Shetland	
York	Viking	9677	Type 1	More likely Norway (possibly Kaupang area?) than Shetland	Ok
York	Viking	9682	Type 1	Not Shetland	Ok
York	Viking	9689	Un-known	More likely Norway (possibly Kaupang area?) than Shetland	
York	Viking	9692	Type 1	More likely Norway (possibly Kaupang area?) than Shetland	Ok
York	Viking	15699	Type 1	More likely Norway (possibly Kaupang area?) than Shetland	Ok
Quoygrew	Norse	61545	Type 1	Shetland	Disagreement
Quoygrew	Norse	62154	Type 1	Not Shetland	Ok
Quoygrew	Norse	62160	Type 1	Not Shetland	Ok
Quoygrew	Norse	61998C2	Type 1	Shetland, same source as 61545	Disagreement
Inni á Tvørgarði	Norse	IAT060	Type 4	Catpund; Clibberswick	Agreement
Uppistovubeitið	Norse	UPP060	Type 4	Uncertain Shetland	Agreement
Inni á Tvørgarði	Norse	IAT181	Type 1	Not Shetland	Agreement
Toftanes	Viking	TO2001	Type 1	Catpund; Clibberswick	Disagreement; morphologically this sample is consistent with a Norwegian provenance
Toftanes	Viking	TO2292	Type 1	Catpund; Clibberswick	Disagreement; morphologically this sample is consistent with a Norwegian provenance

a positive statement. Although much remains to be done to expand the reference data for quarries throughout the North Atlantic region as well as to integrate the corresponding data from other techniques of analysis, it is already apparent that the combination of relatively small inter-source composition differences and sometimes significant variations within a quarry and even within a (large) artefact will always limit the quality of assignment of origin to individual soapstone artefacts. For the moment at least, the way forward is to formulate modest aims for the science-based effort. On the basis of the semi-quantitative pXRF data accumulated so far, it certainly provides a valuable, broad characterisation, but the REE composition probably remains the more informative.

From the perspective of assigning origin to reference Types presented in the first section of this paper, we are far from drawing firm conclusions but results are reasonably encouraging (Figure 13). Types 1 and 2 samples of Viking period artefacts from York could be Norwegian, and are a poor match to Shetland samples. From the later Norse site of Quoygrew, Type 1 vessels are also consistent with possible Norwegian sources, despite the slight prevalence of Shetland vessel Types 3 and 4 at the site. Artefacts from Faroe demonstrate that Type 1 samples are unlikely to be from Shetland, and that Type 2 and Type 4 examples are within Shetland ranges. Where regions are more confidently assigned, the provenance assignments suggested by analysis and by morphology (e.g. Type 1, Norwegian, Type 2, Norwegian or Shetland and Types 3 and 4, Shetland) are in broad agreement. While links to individual quarry sites may well be beyond the capability of currently used techniques as a result of intra-source (and even intra-artefact) variation in composition, associations between artefacts from across the region can provide tangible results. These results will have implications for the original distribution of soapstone vessels throughout the region in the Viking period and for the potential control of the resource in the later Norse period. By increasing the number of analyses and concentrating on targeted samples (with regards to sites studied and types of vessel fragments sampled), the nature of the manufacture and distribution of soapstone vessels should be better understood. To this end, the next phase of the Homeland to home project includes analysis of further material from the Faroe Islands, Shetland (Norwick, Scatness) and Orkney (Pool, Snusgar), as well as a greater emphasis on integrating fabric description (as in Figure 6 for the main Shetland quarries) with vessel morphology and chemistry (ICP-MS and pXRF).

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Appendix

Table 1. *pXRF compositions expressed as % element (Mg, Fe, Ca, K) or ppm element (Mn, Ti, Ni, Cr and V) of soapstone quarry samples in Shetland and Norway and artefacts from Faroe.*

	Mg	Fe	Ca	K	Mn	Ti	Ni	Cr	V
Shetland									
Catpund	1,9	3,4	0,08	0,03	5572	158	891	804	90
	5,1	4,5	0,05	lod	1176	40	1805	1431	71
	4,2	4,3	0,04	0,01	1213	53	1277	1096	77
	3,1	3,6	0,05	lod	1110	38	1203	1214	64
	3,9	5,6	0,06	0,02	2038	94	1605	1285	102
	3,8	5,2	0,06	0,04	2450	110	1962	1264	95
	3,7	2,2	0,06	0,01	2089	55	1178	314	57
	4,7	3,6	0,06	0,05	1294	106	1757	1383	74
	5,1	4,0	0,05	0,05	1106	108	2187	879	75
Fethaland	5,1	3,3	2,8	0,04	741	102	1114	2619	101
	6,5	3,1	1,9	lod	633	84	414	1984	115
	7,2	3,9	2,3	lod	811	46	677	2250	137
	7,2	4,1	4,9	lod	1311	71	718	3693	152
	6,0	4,0	10,3	lod	1302	753	539	101	155
	6,3	3,0	7,8	lod	1314	46	568	683	78
	4,3	3,3	7,2	lod	1123	295	83	45	117
	7,6	4,1	5,9	lod	967	108	198	4807	163
Clibberswick	8,4	3,3	0,03	0,01	811	24	2294	698	69
	9,3	3,4	0,05	0,04	824	59	2319	1061	77
	6,2	2,1	0,04	0,03	639	66	3392	77	68
Norway									
Piggåsen	11,1	7,4	0,6	lod	1173	501	1012	687	95
	11,4	8,7	2,0	lod	1758	554	957	1357	140
	11,7	8,5	0,1	lod	940	582	1068	1139	98
	10,2	6,5	0,2	0,02	797	446	949	738	84
	9,1	10,4	3,0	0,40	1417	1538	741	318	195
Folvelseter	9,6	6,2	0,2	1,00	1960	944	872	4846	196
	13,8	7,3	0,0	0,02	1057	762	860	3443	153
	12,4	5,8	0,1	1,20	1722	917	1016	4020	172
	11,5	4,7	0,0	1,40	1203	778	889	3187	158
	12,1	3,7	0,0	0,50	1150	531	761	3629	95
Fluetjern	11,5	6,2	0,3	lod	940	387	921	3635	141
	11,5	2,8	0,1	lod	680	333	810	2494	101
	10,8	4,5	0,6	lod	798	572	680	1884	101
	12,3	3,5	0,9	lod	826	515	1282	1839	83
	9,6	3,3	0,9	lod	852	397	863	1986	92
Faroes									
INT181	6,5	9,9	0,9	0,020	1197	1589	829	2029	283
TO2001	4,7	3,0	0,1	0,020	663	227	1499	1042	69
UPP300	3,8	3,2	0,5	0,040	389	1029	1029	502	137
TO2292	5,3	2,7	0,04	lod	569	57	1842	1142	62
INT60	4,0	3,3	0,2	0,030	595	689	2040	2331	87
UPP006	6,3	3,6	0,1	lod	470	864	1426	2380	141

Table 2. *Rare earth element concentrations (expressed in ppm) of soapstone artefacts and quarry samples.*

Sandwick, Shetland	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
61	43,6407	97,8784	12,0463	45,0961	8,5775	1,7403	6,3275	0,7226	3,3372	0,5663	1,5878	0,2648	1,7485	0,2742
61a	0,1908	0,6790	0,1331	0,7734	0,3138	0,0614	0,3633	0,0750	0,4784	0,0891	0,2342	0,0326	0,1722	0,0208
87	2,0132	3,0305	0,5142	2,1230	0,4463	0,0289	0,3150	0,0365	0,1773	0,0314	0,0868	0,0147	0,1004	0,0167
600	24,8807	53,5314	6,7825	28,6778	6,5386	1,9666	6,6586	1,0539	6,4044	1,2661	3,6835	0,5624	3,4040	0,5179
629	0,0577	0,0835	0,0119	0,0442	0,0085	0,0024	0,0085	0,0014	0,0082	0,0018	0,0066	0,0012	0,0092	0,0016
630	24,4596	57,2641	6,7712	24,3059	5,3544	1,2881	5,4724	0,9680	6,2172	1,2432	3,4884	0,5435	3,2347	0,4689
665	0,0353	0,0749	0,0087	0,0342	0,0078	0,0028	0,0083	0,0015	0,0084	0,0017	0,0052	0,0008	0,0054	0,0008
715	0,0398	0,0764	0,0090	0,0352	0,0067	0,0019	0,0069	0,0011	0,0061	0,0013	0,0042	0,0007	0,0061	0,0009
907	0,0918	0,2576	0,0554	0,3561	0,1627	0,0193	0,2132	0,0421	0,2770	0,0577	0,1691	0,0252	0,1497	0,0193
907a	0,0887	0,2104	0,0497	0,3142	0,1411	0,0157	0,1797	0,0362	0,2430	0,0502	0,1436	0,0219	0,1296	0,0171
1370	0,0252	0,0349	0,0057	0,0255	0,0060	0,0023	0,0057	0,0009	0,0064	0,0014	0,0054	0,0008	0,0074	0,0018
1473	16,6035	36,1597	4,4615	17,7157	3,4334	0,6748	2,2758	0,2735	1,4435	0,2848	0,8528	0,1532	1,0132	0,1691
1505	0,1263	0,2536	0,0373	0,1670	0,0507	0,0036	0,0630	0,0112	0,0732	0,0156	0,0471	0,0074	0,0486	0,0079
2233	27,1124	66,6625	7,3446	26,6013	5,6085	1,2696	4,7652	0,6742	3,7281	0,7060	2,0827	0,3422	2,1724	0,3350
2322	0,0650	0,1628	0,0265	0,1430	0,0566	0,0502	0,0863	0,0174	0,1260	0,0284	0,0913	0,0158	0,1030	0,0177
2338	0,0859	0,1676	0,0211	0,0881	0,0202	0,0071	0,0221	0,0038	0,0223	0,0048	0,0145	0,0023	0,0149	0,0021
Tuyere	0,1291	0,2321	0,0284	0,1129	0,0215	0,0069	0,0208	0,0030	0,0166	0,0032	0,0093	0,0016	0,0114	0,0019
Faroe	**La**	**Ce**	**Pr**	**Nd**	**Sm**	**Eu**	**Gd**	**Tb**	**Dy**	**Ho**	**Er**	**Tm**	**Yb**	**Lu**
INT60	0,075	0,056	0,0071	0,026	0,007	0,0031	0,0049	0,0011	0,0062	0,0025	0,0073	0,0010	0,0120	0,0028
INT181	0,740	2,483	0,4595	2,676	1,034	0,4248	1,3277	0,2612	1,7945	0,3872	1,1695	0,1809	1,0938	0,1690
UPP006	0,067	0,054	0,0062	0,021	0,005	0,0036	0,0043	0,0009	0,0046	0,0023	0,0073	0,0012	0,0130	0,0028
UPP300	0,269	0,544	0,0691	0,278	0,072	0,0423	0,0706	0,0144	0,0934	0,0205	0,0636	0,0106	0,0747	0,0132
TO2001	0,086	0,059	0,0071	0,019	0,005	0,0044	0,0042	0,0009	0,0035	0,0022	0,0058	0,0008	0,0105	0,0019
TO2292	0,101	0,107	0,0124	0,046	0,011	0,0037	0,0059	0,0020	0,0103	0,0034	0,0089	0,0012	0,0126	0,0025
York	**La**	**Ce**	**Pr**	**Nd**	**Sm**	**Eu**	**Gd**	**Tb**	**Dy**	**Ho**	**Er**	**Tm**	**Yb**	**Lu**
9677	0,7701	2,0388	0,2516	0,9625	0,1357	0,0136	0,1012	0,0127	0,0670	0,0129	0,0367	0,0059	0,0384	0,0066
9677	0,1832	0,6681	0,1029	0,4606	0,0921	0,0258	0,0805	0,0116	0,0682	0,0147	0,0435	0,0071	0,0468	0,0095
9689	2,8733	8,0824	1,1668	5,3581	1,1327	0,2849	0,9701	0,1371	0,7636	0,1529	0,4558	0,0709	0,4656	0,0737
7256	0,5050	1,5037	0,1994	0,8040	0,1329	0,0113	0,0999	0,0137	0,0718	0,0137	0,0410	0,0063	0,0430	0,0074
9682	52,1895	119,9332	14,6132	56,3462	8,9910	2,3413	5,9948	0,7367	3,2647	0,5485	1,4150	0,1989	1,1571	0,1633
9672	0,5199	1,3015	0,1763	0,8067	0,1577	0,0116	0,1335	0,0168	0,0963	0,0200	0,0638	0,0120	0,0907	0,0176
9672	0,5829	1,3805	0,1711	0,7155	0,1302	0,0095	0,1035	0,0133	0,0709	0,0147	0,0487	0,0088	0,0652	0,0129
15699	0,0881	0,1387	0,0168	0,0712	0,0211	0,0100	0,0304	0,0074	0,0783	0,0245	0,1113	0,0277	0,2395	0,0480
9692	2,2867	6,5158	0,8493	3,4858	0,7139	0,0773	0,5150	0,0719	0,3350	0,0548	0,1432	0,0224	0,1518	0,0247

Tabel 2 *(continued).*

Norway /Piggåsen	**La**	**Ce**	**Pr**	**Nd**	**Sm**	**Eu**	**Gd**	**Tb**	**Dy**	**Ho**	**Er**	**Tm**	**Yb**	**Lu**
P1	1,6136	5,2403	0,7808	3,6300	0,9049	0,1650	0,8426	0,1287	0,7869	0,1604	0,4780	0,0756	0,4776	0,0726
P2	1,1445	3,6975	0,5749	2,7351	0,7374	0,1300	0,6924	0,1070	0,6584	0,1340	0,3953	0,0628	0,3889	0,0586
P3	0,2075	0,8946	0,1373	0,6290	0,1427	0,0243	0,1325	0,0190	0,1107	0,0214	0,0642	0,0101	0,0588	0,0098
P4	0,4192	1,3528	0,1987	0,9244	0,2411	0,0318	0,2259	0,0347	0,2054	0,0408	0,1286	0,0191	0,1209	0,0212
P5	2,1701	9,4051	1,6289	8,1351	2,0456	0,6413	1,8257	0,2688	1,5581	0,3013	0,8576	0,1398	0,8793	0,1320
Folvelseter														
FO1	0,7529	2,6982	0,2336	1,0196	0,2139	0,0505	0,2119	0,0336	0,2316	0,0573	0,2068	0,0420	0,3115	0,0567
FO2	0,4046	1,1215	0,1027	0,3864	0,0551	0,0064	0,0343	0,0047	0,0236	0,0045	0,0145	0,0030	0,0258	0,0048
FO3	0,5027	1,5187	0,2343	1,1941	0,3145	0,0305	0,2865	0,0406	0,2342	0,0455	0,1392	0,0254	0,1817	0,0303
FO4	0,3393	0,9256	0,1283	0,5674	0,1094	0,0223	0,0900	0,0125	0,0727	0,0162	0,0552	0,0104	0,0875	0,0163
FO5	0,3125	0,7166	0,0944	0,4497	0,0987	0,0158	0,0918	0,0124	0,0709	0,0139	0,0443	0,0075	0,0531	0,0101
Fluetjern														
FL1	1,0248	2,3615	0,2882	1,1733	0,2775	0,0268	0,2718	0,0440	0,2944	0,0646	0,2117	0,0398	0,2829	0,0485
FL2	1,6539	5,4156	0,6041	2,4853	0,5870	0,0597	0,5899	0,0932	0,5816	0,1219	0,3832	0,0627	0,4026	0,0652
FL3	0,1432	0,4594	0,0904	0,4809	0,2147	0,0232	0,2631	0,0530	0,3685	0,0755	0,2391	0,0438	0,2948	0,0461
FL4	0,3684	1,4723	0,2806	1,5231	0,5575	0,0645	0,5836	0,0940	0,5865	0,1170	0,3550	0,0580	0,3691	0,0586
FL5	6,1272	13,5261	1,5485	6,0655	1,1578	0,1291	1,0337	0,1586	0,9639	0,1897	0,5669	0,0973	0,6140	0,0859
Solerudberget														
S1	2,8295	7,4966	1,1120	5,3633	1,5315	0,2491	1,4881	0,2395	1,3838	0,2505	0,6681	0,1061	0,6437	0,0907
S2	3,2179	8,8798	1,3208	6,0896	1,5144	0,3097	1,2679	0,1838	1,0112	0,1819	0,5015	0,0829	0,5297	0,0813
S3	15,4674	32,4223	3,6565	13,3308	2,1583	0,3256	1,5003	0,1833	0,8332	0,1450	0,3842	0,0611	0,4033	0,0662
S4	10,7449	22,9671	2,6687	10,0607	1,7947	0,2061	1,3109	0,1624	0,7388	0,1221	0,3113	0,0463	0,2869	0,0457
S5	0,7319	2,2507	0,3501	1,6520	0,4865	0,0972	0,5269	0,0945	0,6161	0,1252	0,3935	0,0671	0,4173	0,0641
Slipsteinsberget	0,0373	0,0738	0,0109	0,0520	0,0222	0,0011	0,0390	0,0100	0,0715	0,0184	0,0609	0,0107	0,0750	0,0128
Kaupang	**La**	**Ce**	**Pr**	**Nd**	**Sm**	**Eu**	**Gd**	**Tb**	**Dy**	**Ho**	**Er**	**Tm**	**Yb**	**Lu**
F66871	1,4187	3,3249	0,4584	1,9627	0,5083	0,1270	0,5443	0,0887	0,5435	0,1057	0,3034	0,0467	0,2966	0,0474
F1028137	1,9592	4,8140	0,5201	2,1003	0,5016	0,1162	0,5027	0,0858	0,5180	0,0968	0,2706	0,0417	0,2335	0,0343
F1024659	4,4728	11,3822	1,4854	6,5273	1,4306	0,3856	1,2041	0,1652	0,9096	0,1763	0,4959	0,0749	0,4606	0,0673
F1031790	0,7975	1,4019	0,2143	0,9290	0,2020	0,0216	0,1864	0,0284	0,1477	0,0265	0,0735	0,0112	0,0723	0,0121
F1031628	0,7681	0,7186	0,1919	0,9216	0,1965	0,0449	0,2169	0,0316	0,2014	0,0469	0,1561	0,0279	0,1956	0,0353
F10229961	0,2857	0,5542	0,0732	0,2924	0,0643	0,0340	0,0596	0,0097	0,0488	0,0118	0,0356	0,0061	0,0396	0,0065
F1024436	0,4293	0,9546	0,1116	0,4706	0,1159	0,0398	0,1335	0,0234	0,1586	0,0362	0,1194	0,0213	0,1497	0,0262
F1029703	2,3921	4,6813	0,5936	2,3171	0,4298	0,0260	0,3190	0,0379	0,1645	0,0256	0,0647	0,0107	0,0647	0,0100
F1031227/A	0,7211	1,9636	0,2425	0,9609	0,1765	0,0345	0,1456	0,0208	0,1216	0,0253	0,0770	0,0142	0,0998	0,0174
F1031227/B	1,7598	2,7028	0,3730	1,3853	0,2605	0,0904	0,2321	0,0352	0,1999	0,0410	0,1219	0,0192	0,1306	0,0222
F1027483	1,0974	2,2129	0,2796	1,1433	0,1941	0,0132	0,1390	0,0168	0,0740	0,0120	0,0324	0,0051	0,0309	0,0047
F1033599	0,5070	1,1155	0,1073	0,4323	0,0779	0,0227	0,0688	0,0098	0,0544	0,0104	0,0333	0,0063	0,0427	0,0071
F1025599	0,1318	0,2123	0,0354	0,1482	0,0462	0,0098	0,0727	0,0165	0,1432	0,0374	0,1394	0,0278	0,1949	0,0341
F1024559/A	0,1079	0,1690	0,0224	0,0932	0,0233	0,0170	0,0237	0,0046	0,0310	0,0064	0,0200	0,0034	0,0217	0,0030
F1024559/B	0,2935	0,5981	0,0832	0,3727	0,0925	0,0251	0,1126	0,0192	0,1330	0,0279	0,0951	0,0158	0,1139	0,0197
F1024559/C	0,1776	0,4199	0,0566	0,2522	0,0706	0,0235	0,0866	0,0157	0,1072	0,0247	0,0752	0,0130	0,0862	0,0148
F1026902	1,3008	3,0728	0,3690	1,3905	0,2224	0,0325	0,1893	0,0258	0,1395	0,0298	0,0923	0,0162	0,1119	0,0189
F1024899	1,9480	5,6334	0,8583	3,8831	0,8677	0,1889	0,7444	0,1140	0,6974	0,1397	0,4252	0,0664	0,4317	0,0640
F1001958	0,8745	2,0970	0,2786	1,2014	0,2913	0,0934	0,3032	0,0491	0,3021	0,0639	0,1929	0,0307	0,2028	0,0319
F1002641	1,2035	2,0827	0,3128	1,1579	0,2539	0,0778	0,2309	0,0383	0,1992	0,0387	0,1136	0,0176	0,1185	0,0188
F1004043	0,8059	1,2340	0,1706	0,6236	0,1084	0,0212	0,1091	0,0186	0,1398	0,0362	0,1375	0,0307	0,2433	0,0452
F1022980	0,6269	1,8593	0,2502	1,0721	0,2486	0,0227	0,2351	0,0349	0,1959	0,0349	0,1008	0,0165	0,1018	0,0178
F1016134	0,8077	1,3423	0,1938	1,0580	0,4263	0,0422	0,5939	0,1163	0,7583	0,1552	0,5119	0,0978	0,7448	0,1262
F1007403	0,2737	0,3695	0,0400	0,1287	0,0224	0,0056	0,0213	0,0034	0,0184	0,0034	0,0107	0,0018	0,0130	0,0021

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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