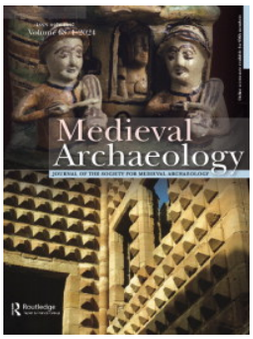

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Bakestones in Northern Norway: An Archaeological Witness to Medieval Foodways and Maritime Trade

By STEPHEN WICKLER[1]

BAKESTONES ARE A 11TH-CENTURY EARLY MEDIEVAL INNOVATION associated with flatbread production that reflect a distinctive Norwegian food culture spanning some 600 years. Large scale manufacture of chlorite schist bakestones at Ølve-Hatlestrand, western Norway, was linked to further distribution in Norway from the port of Bergen. Bakestones were an important item of maritime trade transported to northern Norway in exchange for stockfish (dried cod) and are most commonly found in coastal fishing villages and settlement mound sites. An attribute-based analysis of bakestones from northern Norway in the Arctic University Museum of Norway archaeological collection, the first comprehensive study outside of medieval towns, explores the role of bakestones for Norse/Norwegian maritime settlement and as a valued trade commodity, as demonstrated by reuse of bakestone fragments. In addition to documenting spatial and temporal bakestone distribution, geochemical (XRF) characterisation and a preliminary analysis of organic residues were also undertaken. Although bakestones are primarily associated with Norwegian settlement, their role in contexts with a combination of indigenous Sámi and Norse/Norwegian elements is also evaluated.

Bakestones are thin rock slabs shaped to a circular or oval form that were used to bake bread and potentially process other foodstuffs over an open fire, usually in a hearth. Bakestones range from c 250–550 mm in diameter and c 4–25 mm in thickness. The presence of incised grooves in a variety of patterns found on one or both surfaces is a distinguishing characteristic related to the production process but also had significant functional advantages. Although some bakestones were produced from soapstone, the majority are a rock type referred to as a chlorite-rich talc-amphibole schist, shortened to chlorite schist (Baug 2017). This rock type combines the heat-conducting properties of soapstone with a high degree of schistosity making it easier than soapstone to extract in thin slabs.

Quarry sites for chlorite-schist bakestones are limited to three locations in Norway: Øye near Trondheim in Trøndelag, central Norway, Ertenstein in Rennesøy, Rogaland, and Ølve-Hatlestrand in Kvinnherad municipality on the western side of Hardanger Fjord in western Norway. The extensive quarry landscape at Ølve-Hatlestrand, where bakestone extraction began in the early medieval period (c AD 1030–1100), was by far the largest and most important quarry location, characterised by large-scale, near

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industrial, production (Baug 2015a). The other two quarry areas, where building stones were also extracted, had significantly more limited production and distribution.

Bakestones are arguably an exclusively Norwegian medieval technological innovation in food processing, although there is speculation that their origin may be traced to soapstone implements produced in the Shetland Islands during the Viking period (Baug 2018, 65). Bakestones are linked to Norse culture and the origins of hard, unfermented flatbread, the most common bread type in medieval Norway (Baug 2015b, 37). Written records of bakestone production and use are limited, with Ølve first mentioned as a production centre for stones used to bake bread in 1535. The use of bakestones from the Hardanger region for flatbread baking is written about as late as 1753 (Weber 1984, 158). In 1613, the priest Peder Claussen Friis wrote of flatbread baked on thin rounded stone griddles produced in Hardanger (Baug 2015b, 37). Limited quantities of bakestones were distributed outside Norway to both Sweden and Denmark and spread to the North Atlantic islands by Norwegian settlers as an important household signifier of a common Norse ancestry (Baug 2018, 62). The distribution of bakestones in the North Atlantic region was a consequence of integration into a medieval trade network linked to Bergen from the twelfth century onward.

Although bakestones are found in both urban and rural medieval sites 'more or less all over Norway' (Baug 2018, 67), there has been a marked lack of research on this common household utensil outside of medieval towns such as Oslo, Bergen, Trondheim, and to a lesser extent Stavanger, where they occur in substantial numbers. Given its location closest to the Ølve-Hatlestrand bakestone production centre around 100 km to the south-east, and position as the most important medieval Norwegian town and port, Bergen became the main distribution centre for bakestones. This is supported by the large bakestone assemblage at Bryggen in Bergen studied by Tengesdal (2010), where approximately 1,600 excavated fragments from the Gullskoen residential area were analysed, dating to c AD 1120–1702. Bakestones made of soapstone account for 10% of the overall assemblage and although they are significant in the twelfth century at 45%, this figure drops to 3.5% following the early medieval period and they disappear from the archaeological record shortly after 1400 (Tengesdal 2010, 33–6). Bakestone assemblages from other medieval towns are substantially smaller and bakestone studies are limited in large part to general descriptions from the 1970s and 1980s. A study of 396 bakestones from the Folkebibliotekstomten site in Trondheim by Weber (1989) focused on bakestones as trade items by attempting to distinguish potential sources rather than an attribute-based characterisation of the assemblage. Most of the c 600 bakestone specimens registered from Oslo at this time came from extensive excavations in Gamlebyen during the 1970s at locations such as Mindets tomt and Søndre felt, where detailed bakestone descriptions are lacking. Although Weber (1989, 17–19) makes several assertions regarding the relative quantity of bakestones from Hardanger (Ølve-Hatlestrand) and those of soapstone in the assemblages from Trondheim and Oslo, source determination was based on a small number of thin sections rather than geochemical (XRF) characterisation of a representative sample. It is also claimed that the influx of Hardanger bakestones was lower in Trondheim than Oslo.

The most recent bakestone research has focused on documenting the quarry sites at Ølve-Hatlestrand for a PhD project on quarrying in western Norway by Irene Baug (Baug 2015a, 2015b, 2015c, 2017, 2018). This study provides a detailed assessment of bakestone quarrying in time and space where extraction is viewed as a process with

issues of control and organisation for a commissioned trade item. Apart from the Ølve-Hatlestrand quarry landscape complex, the only other known source of bakestones of any significance is a group of smaller quarry sites centred at Øye in Melhus, Trøndelag, where building stone and bakestones were extracted (Heldal and Storemyr 1997). A study by Nina Lundberg (2007) has dated quarrying of building stone here to c 1050–1200 but does not address bakestone extraction, which was apparently most active during the late medieval period.

A STUDY OF BAKESTONES IN NORTHERN NORWAY

The observation that bakestones from northern Norway are mainly found along the coast and rarely in the interior has been used to assert a close connection to places along the sailing route southwards to Bergen that played an important role in bakestone distribution (Øye 2011; Baug 2018). The association between bakestones and site locations in northern Norway involved in the medieval stockfish trade, particularly fishing villages and settlement mound sites with a maritime orientation, is widely recognised (Reiersen 1999).

The association between bakestones and the medieval stockfish trade was a motivating factor in the decision to initiate a study of all available bakestones from archaeological contexts in northern Norway within the jurisdiction of Tromsø University Museum located to the north of Saltfjellet. This study represents the first detailed analysis of bakestones from archaeological sites in Norway outside of the medieval towns. The study employed an explicitly holistic approach including a detailed characterisation of bakestone fragment attributes, documentation of the spatial and temporal distribution of this material, and geochemical (XRF) characterisation of a representative sample of specimens selected following a comprehensive examination of the entire bakestone assemblage. Preliminary results from ongoing analyses of organic residues from bakestones are also presented.

The goal of this comprehensive study is to provide a broad understanding of the role played by bakestones in northern Norway, both as an expression of Norse/Norwegian identity and as utilitarian objects representing a valued trade commodity introduced from western Norway. Access to bakestones was linked to the medieval stockfish trade. This is demonstrated by a distribution pattern that is principally restricted to the coast where maritime communities were engaged in the production and transport of stockfish to Bergen in exchange for essential food items such as flour and grain along with bakestones utilised to produce flatbread. The study also sought to better understand the significance of bakestones as an expression of a uniquely Norwegian food culture within Scandinavia that spanned a period of some 600 years. Although the production of flatbread using bakestones has been commonly associated with Norwegian settlement, the role of bakestones in contexts with a combination of indigenous Sámi and Norwegian cultural elements is also evaluated.

In order to understand the importance of settlement mound sites as the predominant archaeological context for bakestones in northern Norway, it is beneficial to provide a brief overview of this site type. The accumulation of domestic refuse, turf (peat) and other structural remains, dung from domestic livestock and other material associated with long-term use and occupation of specific locations has resulted in the formation of a distinctive northern Norwegian site type commonly referred to as a farm mound (Norwegian *gårdshaug*) in the archaeological literature. The main period of mound-site

formation extends from the eleventh century through to the early modern period. Early archaeological mound investigations focused on larger sites associated with farmsteads and agricultural activity. More recent archaeological studies have advocated use of the term 'settlement mound' rather than 'farm mound' since mounds reflect a variety of settlement types in addition to farms (Bertelsen 2011). The focus on associating mound formation with farming underplays the importance of maritime-based coastal and island settlement and masks the inherent variability between settlement mound sites. The commercialisation of cod fisheries in the early medieval period led to a dramatic increase in stockfish export and, indirectly, the formation of mound sites associated with fishing settlement (Norwegian *fiskeværhauger*) (Wickler and Narmo 2014; Nielssen 2016). These sites have been referred to as maritime settlement mounds (Wickler 2016, 173–6).

ATTRIBUTE-BASED BAKESTONE ANALYSIS

PROCEDURES AND OBJECTIVES

A comprehensive attribute-based analysis was undertaken utilising all available archaeological bakestone samples found in the Arctic University Museum of Norway (henceforth UM) collections. An important caveat regarding the empirical basis for this study is the explicit recognition that an undetermined number of bakestone fragments were excluded from the analysis. These include stray finds and some excavated bakestones found in local museums, private collections, and other locations outside of the UM collections, bakestones from excavated sites that remain uncatalogued, and catalogued bakestones that could not be located. Although this situation may influence sample representativity to some extent, the observed distributional pattern and range of site contexts for bakestones is unlikely to have been altered to a significant degree. Sampling issues do, however, remain a concern when attempting to provide a reliable picture of bakestone use. The relatively low percentage of excavated site contexts (c 38%) and those with adequate chronological control is also problematic.

The attribute analysis provided a broad characterisation of bakestone fragments by measuring thickness, size and weight as well as recording a range of discrete attributes including fragment type, texture, the presence and position of surface grooves, and evidence for secondary use such as drilled holes associated with rivets and iron bands (see Supplemental Online Excel Database). The recorded attributes provide insights into raw material parameters and geological variation, aspects of bakestone production, and both primary and secondary use. Attribute relationships were explored using cross-tabulation tables that included intra- and inter-site analysis based on function, chronology, and geographical distribution.

ANALYTICAL RESULTS

The attribute analysis included 650 bakestone fragments. An additional 48 catalogued fragments were either missing from the museum collections or too small for analysis. The greatest number of bakestones in northern Norway originates from the site of Vágar (Storvågan) in the Lofoten Islands, where 1,183 fragments were recovered. Although the number of fragments from Vágar may seem substantial, a majority are quite small, with a total weight of only 26.1 kg. Using a conservative average weight estimate of c 6 kg for a complete bakestone, this represents fewer than five bakestones. A

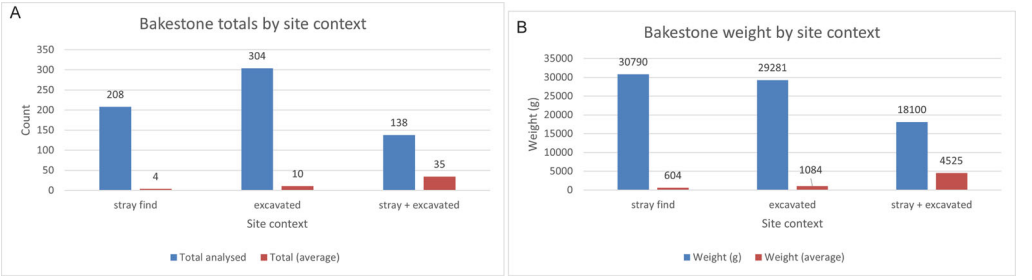

FIG 1.
Crosstabulation graphs of bakestone fragment distribution by site context. (A) By count. (B) By weight. *Illustrations by S Wickler.*

sample of 45 larger fragments from Vágar were selected for analysis, weighing in total 5.4 kg. Although Vágar is an extreme case in terms of the high number of small bakestone fragments, most excavated sites have a higher percentage of small fragments than those consisting entirely of stray finds (Fig 1A). The number of accessible bakestone fragments from all sites, including Vágar, was 1,789 fragments weighing 102.7 kg. This represents quite a low estimated average weight of 0.0574 kg per fragment. However, the analysed sample, weighing 82 kg, has a significantly higher average fragment weight of 0.1259 kg (Fig 1B).

The quantification of bakestone fragments by weight proved to be more reliable than count for estimating the total number of bakestones represented and reveals how few bakestones there appear to have been in northern Norway, especially in comparison to medieval urban contexts such as Bryggen in Bergen and Oslo. Unfortunately, existing studies of bakestones in medieval towns have not recorded fragments by weight and provide only rough estimates of total bakestones and their size. The overall evidence supports the conclusion that bakestones were relatively scarce and valuable imported objects in northern Norway. Evidence for the re-use of larger fragments from broken bakestones supports this assertion.

Although no complete bakestones were present in the material from northern Norway, both large and re-joined fragments enable estimates of bakestone size and thickness. These range from stones that are 6.2 mm thick and 320 mm in diameter with an estimated weight of c 1.2 kg to stones that are 22.5 mm thick and over 500 mm in diameter with an estimated weight of c 11.5 kg.

Thickness and texture

Bakestone fragments were classified as either edge pieces ($n = 283$; 43.9%) or non-edge pieces ($n = 362$; 56.1%). Thickness measurements were taken at the thickest point on each fragment. The analysed bakestone fragments have a thickness range of 1.5–29.2 mm with an average thickness of 8.5 mm. No pattern was observed in the thickness of edge versus non-edge bakestone fragments, although thicker bakestones tend to have thick edges and thinner stones have thin bevelled edges with thickness increasing towards the centre. Texture was recorded as either fine-grained ($n = 118$; 18.1%) or coarse-grained ($n = 533$; 81.9%). Distinguishing between coarse-grained and fine-grained bakestones was difficult in borderline cases and the general procedure was to classify

semi-fine specimens as coarse to clearly distinguish them from stones with a very fine texture.

The distinction between coarse- and fine-textured bakestones observed by geologist Erling Ravna (2017) as part of a geochemical characterisation of the material was confirmed through the attribute analysis. Grain size varies from medium to fine grained. The coarsest samples have a rough surface, whereas the finer-grained samples have a smooth surface. All the fragments show schistosity, defined as foliation that occurs in certain metamorphic rocks as a consequence of the parallel alignment of platy and lath-shaped mineral constituents. The degree of schistosity appears to be related to grain size with a general observation that the fine-grained varieties occur as thinner slabs with well-defined schistosity and shiny schistosity planes (Fig 2A). The coarser grained varieties generally occur as thicker slabs (Fig 2B).

Cross-tabulation of texture by thickness confirms the existence of the two general groups and reveals a correlation between thickness and texture. Fine-textured bakestones range from 2.4–16.8 mm with an average thickness of 7.2 mm and coarse-textured bakestones range from 1.5–29.2 mm with an average thickness of 8.8 mm. However, the overall thickness range is misleading as there are few bakestones thinner than 3 mm ($n = 5$) or thicker than 20 mm ($n = 8$). An examination of average thickness

FIG 2.
Bakestone texture and incised groove patterns. (A) Very fine-grained with parallel incisions (Ts. 5016). (B) Coarse-grained with short gash incisions (Ts. 2750). (C) Medium fine-grained with outer parallel and inner intersecting incisions (Ts. 11827). (D) Medium fine-grained with crosshatch and herringbone pattern incisions (Ts. 10943aa). *Photographs by M Karlstad. © Arctic University Museum of Norway.*

from locations with a large sample size supports the conclusion that fine-grained stones are thinner than coarse-grained stones. The analytical results suggest that two distinct types of bakestones were being used, those that are thick and coarse-grained with minimal thinning and those that are thin and fine-grained. Coarse-grained stones may have been a 'rough and ready' product that was less costly than extensively thinned fine-grained stones. There may also be a functional distinction between the two stone types in terms of how they were used and what type of foodstuffs were being processed.

There is no clear geographical pattern to the distribution of bakestones by texture. Fine-grained stones represent 17–26% of the sample at most sites with more than ten fragments. Nearly all sites with more than a few fragments have both fine and coarse stones. However, there is a significant degree of variation between specific sites. The highest percentage of fine-grained stones (31%) is documented at the multi-room house sites in Berlevåg on the coast of Finnmark in marked contrast to some areas in Nordland (Beiarn, Bodø, Gildeskål) with significantly lower frequencies (7.6–10.4%) and very low numbers at Alsvåg and Langenesvær in Vesterålen (1%). Given the fact that averages are heavily influenced by individual sites and regional site clusters with large sample sizes such as those from Vestvågøy and Vågan in Lofoten, interpreting observed variability must be done with caution. The figures do not suggest that sites with higher frequencies of fine-grained stones had preferential access to trade goods. A functional explanation appears more likely, such as the possibility that fine-grained stones were used for processing different types of bread compared with coarser stones.

Incised grooves

A distinguishing trait for bakestones is the presence of multiple incised grooves on one or both surfaces. Although the grooves or furrows were produced when slabs were thinned at the quarry site during the finishing stage of bakestone production (Baug 2017, 174), they also had a practical benefit for bakestone use by preventing bread from sticking to the stone surface (Baug 2015a, 96). Both the location and appearance of grooves were recorded as attributes in the study. Most bakestone fragments have grooves on both surfaces ($n = 420$; 65.5%). However, a substantial number of bakestones ($n = 192$; 30%) with grooves on one surface have surfaces that are flaked off or worn down on the opposite side. Bakestones with two intact surfaces where grooves are limited to one side are uncommon ($n = 29$; 4.5%). Groove patterns were recorded by distinguishing between bakestones with grooves in a single direction ($n = 265$; 42.1%) and those with multiple directions ($n = 365$; 57.9%). Distinguishing between grooves in single and multiple directions proved to be difficult and unreliable for small fragments. A general observation was that grooves near the edge were oriented parallel to the margin but those further inward occur in multiple or intersecting directions, often forming a herringbone pattern (Fig 2C–D).

No bakestones with intact surfaces that lacked grooves were recorded. This observation fits the production sequence model documented at the Ølve-Hatlestrand bakestone quarries (Fig 3) where a hammer with a fine pointed end was used to thin the bakestone blanks following extraction (Baug 2015a). It also implies that bakestones with intact surfaces should have some traces of thinning grooves or furrows. The few bakestones recorded as lacking grooves at Bryggen in Bergen (Tengesdal 2010) potentially may have had at least one eroded surface where grooves were originally present.

FIG 3.
Underground quarry site at Ølve with concave semi-circular traces from horizontal extraction of bakestone blanks. The quarry is 1.6–2.5 m high, 9 m wide and 10 m deep. *Photograph by S Wickler.*

Short gash-like grooves running parallel to the edge on one surface but lacking or limited in number on the opposite surface were observed on coarse-grained bakestones (Fig 2B). This suggests that coarse-grained bakestones may have been quarried from bedrock along fracture planes that provided a flat, even surface where additional thinning was unnecessary, thus explaining why grooves were restricted to a single surface.

RE-USE OF BAKESTONE FRAGMENTS

Evidence for secondary use or re-use of bakestone fragments consisting of drilled holes found either in isolation or associated with rivets and iron bands was recorded on 23 bakestone fragments. These modifications include single holes or hole fragments ($n = 10$; 43.5%), double or paired holes ($n = 4$; 17.4%) and single or multiple holes associated with traces of iron oxide (rust) and/or remnants of narrow iron bands ($n = 5$; 21.7%). A few bakestone fragments had single partially drilled holes ($n = 4$; 17.4%), but it is uncertain whether these represent unfinished perforations on fragments intended for re-use in a similar fashion as the other modified bakestones. The characteristics of the modifications, their sporadic distribution, and the lack of similar features recorded for historically documented bakestone-use all point to secondary rather than original use.

The evidence for re-use of bakestone fragments, although restricted to a relatively small fraction of the assemblage, was still unexpectedly high (3.5% of the total analysed assemblage) and widespread when compared to evidence for such modifications reported in previous bakestone analyses. The highest percentages occur in Finnmark with seven fragments from four site localities, including single holes, paired holes, and holes with traces of rust/iron at Kongshavn (Fig 4A–B). In Troms, evidence is restricted to single fragments with single holes at three sites in Harstad municipality (Erikstad, Flatøy and Trondenes vicarage). Nordland has the highest number of modified bakestones with ten fragments from nine site localities. In Lofoten, there are three modified fragments from two sites on Røst and single fragments from Borge, Mærvoll and Pettvik on Vestvågøy. The sites of Alsvåg and Langenesvær in Øksnes have single modified fragments as do the sites of Forstranda in Gildeskål and Steigen vicarage. Three of the four fragments with partially drilled holes are from Nordland. A bakestone fragment from Flatøy in Harstad represents a unique example of modification and re-use. A single drilled hole with evidence of wear was placed in the centre of the fragment and the margins were ground smooth. The shape and size suggest potential secondary use as a fishing net sinker.

Drilled holes occur almost exclusively on bakestone edge fragments ($n = 20$; 87%), representing 7% of all edge fragments. Most of the drilled holes have a diameter of

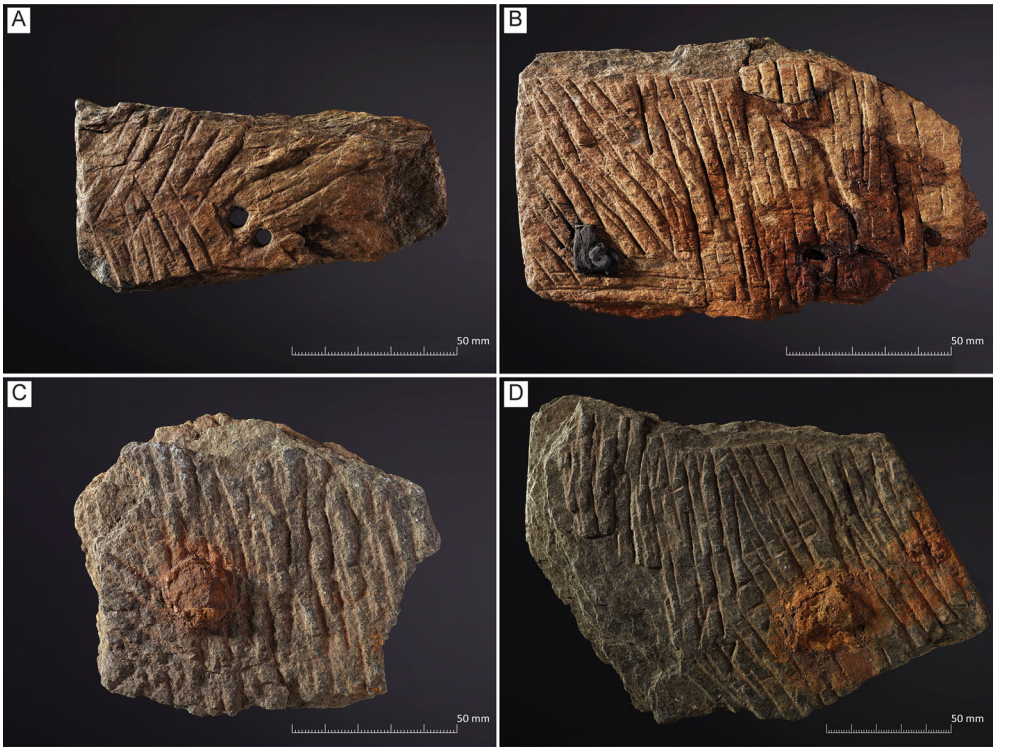

FIG 4.
Evidence for secondary bakestone use. (A) Paired holes (Ts. 11382.48). (B) Series of holes with remnants of a metal band fastened with a rivet (Ts. 11382.224). (C) Iron rivet (Ts. 10943ab). (D) Rivet with rust staining from an iron band (Ts. 10535e). *Photographs by M Karlstad. © Arctic University Museum of Norway.*

5 mm with a few larger (c 6 mm) examples. Some paired holes have a slightly oval shape with some evidence of wear. However, there is little evidence of abrasion or wear around most hole margins, indicating that they were used for attaching bakestone fragments to a stationary surface rather than repair or suspension. Unlike soapstone vessels, bakestones made from chlorite schist would be extremely difficult to repair once broken due to their thinness and fracture patterns. Drilled holes are restricted to relatively thin bakestones with an average thickness ranging from 7.8 to 8.9 mm, making them more manageable and easier to re-use than thick, bulky stones. Drilled holes occur in isolation, as pairs, and in rows of single or paired holes. Four bakestone fragments have holes with the remains of iron rivets and/or rust staining from iron strips or bands that were fastened to one side of the bakestone with rivets (Fig 4C–D). One bakestone from Røst has a single hole with an *in situ* copper-tube shaped to form a head at one end.

The collective evidence strongly suggests that edge fragments from relatively thin bakestones were fastened to larger objects with riveted iron bands for secondary use. The lack of wear along the margins of the drilled holes in bakestone fragments supports a pattern of re-use in which they were attached to a larger stationary object. The mounted bakestone fragments may have functioned as a heat reflector placed behind an oven or hearth to retain and spread warmth by utilising the highly valued properties of chlorite schist for heat absorption and retention enhanced by the presence of talc.

This type of re-use highlights the increased value of bakestones as an imported trade commodity for communities situated far from their source. In contrast, only 13 bakestone fragments with single drilled holes c 5 mm in diameter suggestive of re-use were found at Bryggen in Bergen where bakestones were common and easily obtained (Tengesdal 2010, 31). Although bakestone fragments with drilled holes, as well as much scarcer rivets and iron bands, that may reflect similar re-use patterns have been documented from excavations in medieval towns such as Trondheim and Oslo, their occurrence has not been systematically quantified in existing studies. A wide range of theories regarding the purpose of drilled holes in bakestone fragments have been offered, including repairs, facilitating bakestone transport or suspension, and re-use of fragments as loom weights and fishing net sinkers.

SITE DISTRIBUTION

Bakestone fragments have been recorded at 95 site locations to the north of Saltfjellet in northern Norway, including those restricted to stray finds, and 89 of these sites have geo-referenced map locations in the national archaeological site register (Fig 5A). Most site locations have very few bakestones, with single fragments from 31 sites. Only 16 of 86 geographically distinct find locations have more than ten fragments. Bakestones from over half of the site locations ($n = 59$; 62%) are limited to stray finds. Only 36 sites have bakestones from excavated contexts, including four locations with both excavated and stray finds (Fig 5B). A total of 650 bakestone fragments was included in the analysis, representing 87 site localities with 53 in Nordland, 25 in Troms and nine in Finnmark. Finnmark has the lowest number of sites but highest frequency of excavated sites ($n = 7$, 78%) while Troms ($n = 8$, 32%) and Nordland ($n = 18$, 34%) have similar, although substantially lower, percentages of excavated sites. The number of analysed bakestone fragments by county reflects a general decline from south to north with 420 from Nordland, 132 from Troms and 98 from Finnmark.

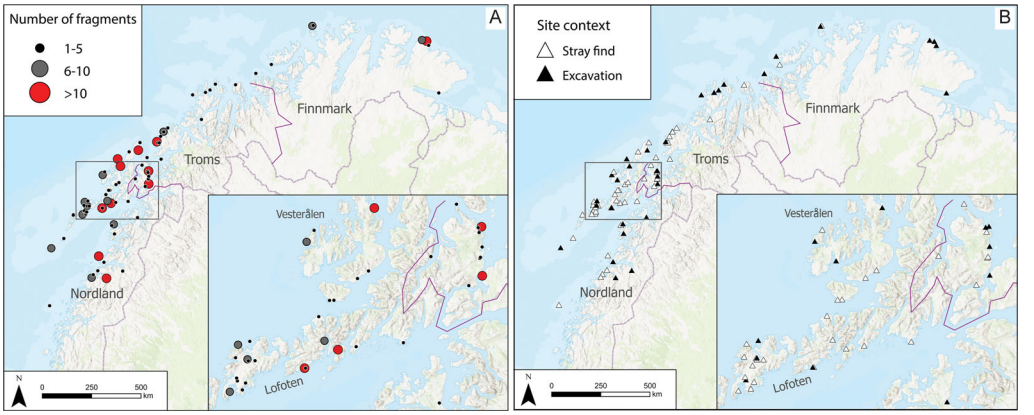

FIG 5.
Map of Northern Norway showing the site distribution of bakestone fragments. (A) Number of fragments grouped by intervals. (B) Number of sites by site context. *Illustration by J G Blom. © Arctic University Museum of Norway.*

NORDLAND

Lofoten and Vesterålen archipelagos

Most sites with bakestones from Nordland are settlement mounds in Lofoten and Vesterålen. The densest concentration of sites occurs in Lofoten with 27 find locations and five excavated sites. The main cluster of sites ($n = 16$) lies on Vestvågøy with stray finds from at least six settlement mounds and three residential house sites, including Eggum on the outer coast with 20 bakestone fragments. Most of the Vestvågøy bakestones are from Pettvika in Buksnesfjord ($n = 76$), including stray finds from a disturbed settlement mound and 25 fragments from a nearby residential site with two occupation phases from AD 1200 to 1350 (Svestad 2002).

A low number of bakestone fragments occur in several contexts at Borg on Vestvågøy where extensive excavations of multiple Iron-Age longhouse structures have been undertaken (Munch et al 2003), including two disturbed and undated house structures and upper fill in a cooking pit from a Viking-period boathouse (Wickler and Nilsen 2012, 113). Bakestones were also recovered from a maritime settlement mound excavation on the small offshore island of Borgvær near Borg (Wickler and Narmo 2014).

The site of Vágar at Storvågan on Austvågøy has the highest number of bakestones with 1,183 of the 1,789 fragments (66%) from northern Norway. As mentioned, this figure is misleading as most of the fragments are quite small. A representative sample of 45 fragments was included in the bakestone attribute analysis. The site was excavated as a research project with test excavations in the 1980s and extensive areal excavation during the 1990s (Bertelsen and Urbańczyk 1988; Bertelsen 2008, 2009). Vágar is the only medieval site in northern Norway with potential urban traits and expanded from limited activity in the 1100s to a main 'town-like' phase from 1200–1400 before reverting to an average-sized fishing village after 1400. Other sites with bakestones in Lofoten are limited to stray finds from settlement mounds in Flakstad and the islands of Værøy and Røst. Simonsen (2002b,

13) recorded 21 bakestone fragments at Skau settlement mound on Røst from a late medieval context.

The Vesterålen region has the second highest concentration of sites with bakestones in Nordland including nine find locations and at least five settlement mounds. Moving from south to north, there are five sites in Hadsel, three sites from Bø, a single site from Sortland, and three settlement mounds on Andøya. A substantial number of bakestones were recovered from two large settlement mound sites in Øksnes. The Alsvåg settlement mound is 70 × 80 m and excavations of 28.5 sq m extended to a depth of two metres. The 55 bakestone fragments recovered, at a density of 0.96 fragments per cu m, are dated to c 1280–1405 (Helberg 2002). The second Øksnes site is a cluster of four contiguous settlement mounds at Langenesvær, with excavations undertaken at two of them (Simpson et al 2000, Bertelsen 2011). Bakestone fragments ($n = 16$) are associated with the main occupation phase from 1300–1500.

Salten district

Sites with bakestones from the northern part of the traditional district of Salten in Nordland are concentrated in Steigen and include two excavated sites on the island of Engeløya. Only a few bakestone fragments, most likely post-dating 1300, were recovered from the 200 × 60 m settlement mound at Steigen Øvre excavated by H E Lund in 1956 and 1958, which remains unpublished. Bakestone fragments ($n = 12$) from a nearby house site at Gjerdet, Laskestad excavated by Lund in 1953 were apparently restricted to the final occupation phase in the late medieval period. The Hunstad site near Bodø was a wealthy Iron-Age and medieval farming settlement. Bakestones were recovered from a 12th-century house along with stray finds from the plough zone (Chruickshank 2002).

TROMS

Sites with bakestones in northern Troms are found exclusively on islands that are located outermost along the coast, referred to here and subsequently as the outer coast. Site contexts include two settlement mounds with a maritime orientation excavated by the Helgøy project (Helgøy and Vannareidet), where only three fragments were recovered from the most extensive mound excavation (25 sq m). The scarcity of bakestones from the Helgøy project, a multi-disciplinary research programme from 1975–80 representing the most extensive settlement mound excavations undertaken to date in northern Norway (Holm-Olsen 1981), is surprising given ample evidence for other imported trade goods such as ceramics in the mound deposits. Other sites in northern Troms include late medieval house structures at Melvik and Værneset on the small island of Sandøya and an inner fjord site complex with c 35 house structures at Fagerfjord, both excavated by Simonsen (1980). Eight site locations with bakestones are spread along the outer coast of Senja Island. Most, if not all, represent maritime settlement mounds. The only excavated site from Senja with bakestones is a large settlement mound at Grunnfarnes with occupation spanning the entire medieval period (Munch 1966), including both excavated and stray bakestone fragments ($n = 51$).

The southernmost sites in Troms include nine locations in the Harstad region. Three are excavated settlement mound sites situated within or near the town of

Harstad. Most of the analysed bakestones ($n = 24$) are from Trondenes vicarage, a disturbed and truncated mound site with two-metre thick cultural deposits where a 2,000 sq m excavation was undertaken from 1962 to 1964. Results remain unpublished with a poorly understood site chronology that may extend from the 12th to eighteenth century. Saurbekken is a settlement mound excavated in 1970 and 1972 with bakestones in deposits dating from 1100–1350 (Bertelsen 2002). The settlement mound at Stauran in Tjeldsund has three occupation phases extending from c 900 to site abandonment around 1300 (Urbańczyk 2002). Most of the bakestone fragments ($n = 14$) appear to be from the final phase.

FINNMARK

The few sites with bakestones in Finnmark are grouped into two general clusters with five sites located on islands along the outer coast of western Finnmark and four sites along the outer coast of the Varanger Peninsula in eastern Finnmark. The western sites are Norwegian fishing villages or fishing stations (Norwegian *fiskevær*). The four sites in Varanger are multi-room house structures with mixed ethnic signatures.

SITE TYPES AND CHRONOLOGY

Of the 95 recorded site locations with bakestones, it was possible to classify 75 into functional categories or types. Nearly three quarters of the sites with assigned type designations are classified as definite or probable settlement mounds ($n = 56$). The second most common category, residential sites, includes probable house sites and other structural remains (Norwegian *tufter*) assumed to represent residential units ($n = 11$; 14.7%). Nearly all the recorded sites are located along the outer coast or on islands with a maritime orientation where subsistence is dependent on marine resources. The remaining two functional categories include multi-room house sites in eastern Finnmark and two boathouse sites. The boathouses represent atypical contexts that include an excavated structure at Borg and three stray bakestone fragments from a site on Sanna, Træna described as a boathouse by the finder. The sites classified by function include stray finds ($n = 39$) and excavated ($n = 36$) contexts. The distribution of sites from each county by context and function is presented in Fig 6A. Although it is likely that most sites of unknown function with stray finds represent settlement mounds, this must still be confirmed by field investigations.

Of the 95 site locations with bakestones, only 32 have reliable age estimates. Most of the radiocarbon site chronologies are based on very few dates and age ranges from early excavations with large standard deviations that are of limited value. Medieval Norway is traditionally divided into the early medieval (1050–1150), high medieval (1150–1350) and late medieval (1350–1550) periods. To provide a more detailed chronological framework, sites were grouped into the following four categories: twelfth century, thirteenth century, fourteenth century, and 15th to sixteenth century (Fig 6B). The assignation of sites to a specific century is based on the earliest documented phase of occupation in which bakestones are found, although site use often extended beyond a single century within the medieval period. This means, for example, that sites assigned to the twelfth century may also represent occupation continuing throughout the

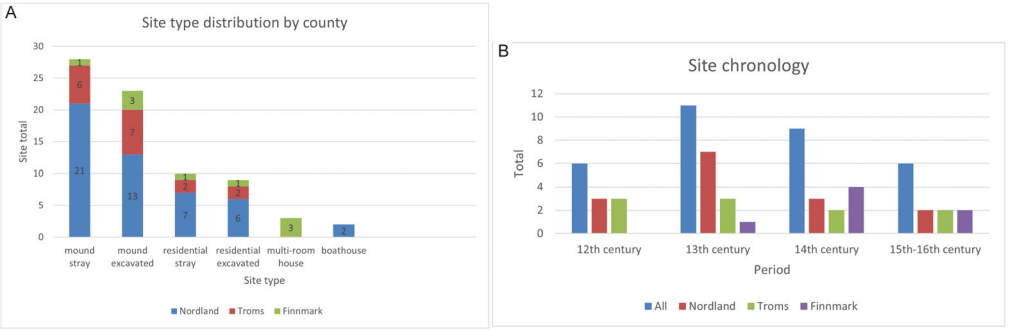

FIG 6.
Cross-tabulation graphs. (A) Site type. (B) Site chronology by county. *Illustrations by S Wickler.*

medieval period. There are also a few excavated sites with age estimates where bakestones are restricted to stray finds or disturbed contexts.

Sites where settlement with probable bakestone use was initiated by the twelfth century include farmsteads at Hunstad and Eiterjord, settlement mounds at Grunnfarnes, Saurbekken and Stauran, and the trading centre/fishing village of Vágar with occupation beginning in the twelfth century but few bakestones prior to 1200. The only radiocarbon dates for Grunnfarnes were obtained from organic residues on two bakestones, the earliest dating to the 12th to thirteenth century (Reiersen 1999). The age determination for Eiterjord is based on artefact typology (Munch 1967).

The number of sites with probable initial use during the thirteenth century represents a substantial increase from the previous century to a total of eleven localities. The only potential site from this century in Finnmark is the multi-room house site at Kongshavn, although bakestones may not appear here before the fourteenth century. Sites in Troms are limited to settlement mounds at Kila and Bergsodden near Harstad and the Skansen fortification site in Tromsø. Most 13th-century sites occur in Nordland, including settlement mounds at Kvalnes, Skutvik, Vik, Alsvåg and Borgvær, and house sites at Laskestad in Steigen and Pettvika in Lofoten.

Although fewer sites with bakestones were initially occupied during the late medieval period in Nordland and Troms, the earliest secure evidence for bakestone use in Finnmark dates to the fourteenth century. Sites from this period in eastern Finnmark include the multi-room house site at Skonsvika, and potentially Kongshavn as well. The other sites are maritime settlement mounds on islands along the outer coast of western Finnmark at Finnes on Ingøy, Sørvær on Sørøya and Yttervær on Loppa reflecting Norwegian fishery-related settlement in locations previously inhabited by the coastal Sámi. The only sites from this period in Troms are settlement mounds on Helgøya and at Vannareidet on Vannøya along the northern outer coast where an expansion in Norwegian fishing settlement occurred. Three settlement mounds in Nordland date to the fourteenth century; Steigen, Drag and Langenesvær in Vesterålen. Post-1400 sites in Finnmark are limited to a single multi-room house at Løkvika and a maritime settlement mound at Inga on Ingøy. Sites in Troms are limited to settlement mounds at Fagerfjord and Melvik on islands along the northern outer coast in similar contexts to those from the fourteenth century. Both sites in Nordland are settlement mounds located at Myklebostad in Steigen and Skau on Røst in Lofoten.

BAKESTONES AND NORWEGIAN SETTLEMENT IN MULTI-ETHNIC CONTEXTS

Most sites with bakestones in northern Norway are situated along the outer coast in locations associated with Norse/Norwegian settlement. However, there are also sites in Finnmark where indigenous Sámi settlement is predominant as well as a few inner fjord and inland locations in Nordland with a mixture of Sámi and Norwegian settlement.

FINNMARK

The majority of bakestones in Finnmark come from coastal multi-room house sites in Berlevåg, eastern Finnmark investigated as part of an international research project (Olsen et al 2011). The sites include the two largest excavated multi-room house structures at Kongshavn with 71 bakestone fragments, and the nearby Skonsvika site with eight bakestone fragments. These residential structures are interpreted as medieval multi-ethnic coastal nodes for exchange and trade with Norse/Norwegian, Karelian and Sámi involvement. Site chronologies extend from the 13th to 15th centuries with a main occupation phase in the fourteenth century. Artefact assemblages include objects associated with each of the three ethnic groups.

Henriksen (2018) has argued that both bakestones and soapstone artefacts represent a Norse identity marker that is most visible at Kongshavn where the Norwegian royalty had an important role, and where their investment was an underlying factor. Skonsvika reflects a more eastern Karelian/Novgorod influence and may have served as a Russian trade outpost (*pogost*) with only a few bakestone fragments and no soapstone artefacts.

At the Kongshavn site, fragments of an *in situ* bakestone were found next to a stove in one room and a large fragment in the fireplace of another room, although bakestones were also documented in a variety of other contexts (Henriksen et al 2011, 187). Bakestones appear at Skonsvika during the most extensive settlement phase that reached its peak in the fourteenth century. A single bakestone fragment was found in a late multi-room house structure at Løkvika to the east of Skonsvika dated to 1500–1650. This site is more closely linked to the expansion of Norwegian fishing settlements along the coast of Finnmark than the earlier complexes at Kongshavn and Skonsvika.

There are a few maritime settlement mound sites with low numbers of bakestone fragments in western Finnmark associated with the expansion of Norwegian fishing settlements beginning in the fourteenth century (Andreassen and Bratrein 2011). Bakestones from the Finnes site on Ingøy are interpreted as associated with a permanent Norwegian fishing settlement at the site in the fourteenth century following periodic Sámi occupation related to marine resource exploitation in the early medieval period (Wickler 2016, 190).

NORDLAND

Vesterålen has been a region with a mixture of Norse and Sámi settlement and interaction since the Iron Age. Although several maritime settlement mound sites with bakestones have Sámi elements, the bakestones appear to be exclusively associated with Norwegian occupation. The Alsvåg site in Øksnes is interpreted by Helberg (2002) as a

central farmstead and an example of ethnic dualism, or at least a context with close Norwegian and Sámi relations. Supporting evidence includes the use of reindeer antler, two antler spoons and a single *komag* shoe commonly used by the Sámi. However, none of these items are exclusively Sámi and Alsvåg is a predominantly Norwegian mixed-economy settlement. The Kvalnes/Finnvika site on Andøya produced a significant number of bakestones associated with a Norwegian fishing settlement extending back to the early medieval period, although there is also evidence of Sámi settlement potentially dating to the 1700s.

A single bakestone fragment was recovered from a cultural layer dated to cal AD 1300–1430 (Beta-276474) in a settlement mound at Drag in Tysfjord, an inner fjord location with predominantly Sámi settlement (Andersen 2019). Nielssen (1990) interprets the site as a Norse farm until 1350 when it was taken over by Sámi following a hiatus in occupation. Andersen (2019, 112) asserts that medieval farm sites in the area represent Sámi settlement but acknowledges the presence of finds typical of Norwegian occupation such as the bakestone at Drag.

In the South Salten region, there are two inland farmsteads located c 16 km from one another at Eiterjord and Vestvatn. The sites are typologically dated to the early medieval period and occupied during the 11th and 12th centuries according to Gerd Stamsø Munch (1967, 118), who excavated both sites in the 1960s. Both farms relied on hunting and fishing in addition to animal husbandry, with evidence of limited cultivation at Eiterjord. Munch interprets the sites as Norwegian farms with Sámi influence or 'infiltration'. There are several strikingly similar artefact types at both sites reflecting Norwegian, Sámi and mixed or hybridised ethnic signatures. Eiterjord, where 12 bakestone fragments were recovered, is the only inland location in northern Norway with bakestone evidence. Simonsen (2002c) refers to Vestvatn as a site with a predominantly Sámi cultural character while Eiterjord, dated to c 1000–1250, has mixed Norwegian and Sámi elements. The bakestones at Eiterjord strongly suggest a Norwegian presence within a traditional Sámi area.

GEOCHEMICAL BAKESTONE CHARACTERISATION

Bakestones made from soapstone are present in medieval Norwegian towns and Tengesdal (2010) has traced their declining importance relative to chlorite-schist bakestones at Bryggen in Bergen from the early 12th to early 15th centuries when they drop out of the record. This contrasts significantly with the available bakestone material from northern Norway where no soapstone bakestones have been identified. The inaccurate recording of a substantial number of bakestone fragments in the Arctic University Museum of Norway artefact catalogue as soapstone rather than schist due to a lack of geological expertise has caused considerable confusion (Wickler et al 2017, 46). Uncritical acceptance of bakestones classified as soapstone by archaeologists such as Reiersen (1999, 47) has perpetuated this misconception (Baug 2017, 178). The lack of bakestones made of soapstone fits a distribution model linked to the stockfish trade and the central role of Bergen. It has been shown that the quantity of bakestones in northern Norway increased significantly in the thirteenth century and coincided with increased production of chlorite-schist bakestones at Ølve-Hatlestrand for which Bergen was the main distribution centre (Baug 2017, 177). Due to lower quality, bulkiness and limited

production, soapstone bakestones were probably unable to compete with the more desirable Hardanger stones as a trade item transported to the north.

A systematic geochemical examination using standard X-ray fluorescence (XRF) methods was undertaken on a sample of the bakestones available from northern Norway by geologist Erling Ravna (2017). The geochemical analysis was based on a representative sample reflecting artefact attributes such as thickness, texture, geological composition, and variability as well as spatial, temporal, and functional aspects of site locations with bakestones. The following section summarises results from the geochemical investigation report (Ravna 2017).

From a surficial view, the bakestones are of the same type of rock. Their general colour is various shades of green, ranging from dark brownish-green to light grey-green. A few fragments show a greenish colour typical for the mineral chlorite. Under the binocular magnifier, it is possible to observe rosettes of light-green amphibole, apparently the mineral species tremolite. The rocks are relatively soft due to a high proportion of the mineral talc. The grain size varies from middle- to fine-grained. The coarsest-grained samples have a rougher surface, whereas the finer-grained samples are smooth. All the bakestone fragments show schistosity, but the degree of schistosity is related to grain size. A general observation is that the fine-grained varieties occur as thinner (<10 mm) bakestones with well-defined schistosity and shiny schistosity planes. The coarser-grained varieties generally occur as thicker (10–25 mm) bakestones. These distinctions in lithic morphology, including thin versus thick and course versus fine-texture material, were documented in the bakestone attribute-based analysis.

SAMPLE SELECTION AND ANALYTICAL PROCEDURES

An initial batch of 28 specimens was selected from the Vágar site in Lofoten as this context has the largest assemblage of bakestones in northern Norway and represents an important centre for the stockfish trade. The results were then used as a reference base for an additional 58 specimens from a representative selection of site contexts elsewhere in northern Norway for a total of 86 analysed bakestones. Sample distribution includes nine bakestones from six site locations in Finnmark, 18 bakestones from 15 site locations in Troms and 59 bakestones from 27 site locations in Nordland.

In addition to archaeological criteria, sample selection sought to include as many site locations as possible as well as the full range of colour varieties and grain sizes, along with a few atypical specimens. Samples from 3 to 6 g were deemed sufficient considering the homogenous nature of the material. The material from each sample was milled to a fine-grained powder in an agate mill, and a small portion (0.8 g) of this powder was weighed up for further treatment. A 5.6 g mixture of lithium borate flux designed for melting rock powder was mixed with the rock powder. This mixture was melted and homogenised at 1,125 °C in platinum and gold crucibles in an electrical furnace. After c 15 min, the melt was poured into Pt-Au moulds and cooled. This resulted in clean and homogeneous glass discs with a diameter of 32 mm.

Analysis was performed with a Bruker S8 Tiger XRF instrument at the Department of Geosciences, UiT—The Arctic University of Norway. The instrument was calibrated using well-documented international reference rock samples covering the range of composition of the analysed material. The elements analysed and the lower

limit of detection (in ppm) are as follows: Na (100), Mg (120), Al (200), Si (0), K (10), Ca (80), Ti (13), Cr (20), Mn (8), Fe (0) and Ni (9).

GENERAL PETROGRAPHY AND PROPERTIES OF THE ROCK MATERIAL

The rock type used for bakestones consists of minerals that are stable at relatively high temperatures and have a low thermal expansion coefficient. Ultramafic metamorphosed igneous rocks with extremely low silica composition are, in this respect, well suited for this purpose. All these minerals are green-coloured due to a certain amount of iron. Common rock types are talc schist, chlorite schist, soapstone, and serpentinite. As most of the minerals of metamorphosed ultramafic rocks have a flaky shape (talc, chlorite, serpentine) or are needle shaped (amphibole hydrous minerals), the rocks tend to develop a certain schistosity. Together with their softness, making them easy to work, and thermal properties of their constituents, they appear to be ideal for production of bakestones.

A triangular plot shows the relationship among the chemical components Al_2O_3, $FeO + MgO$ and $CaO + Na_2O$ in bakestones from Vágar (Storvågan) and other locations in northern Norway designated as Kysten ('coast' in Norwegian) compared with rock types from bakestone quarries in Øye, Trøndelag (ten specimens) and Ølve-Hatlestrand in Kvinnherad municipality, labelled as Hardanger (six specimens) collected and made available by the Norwegian Geological Survey (NGU) (Fig 7). Most of the analysed samples group close to a straight line connecting the (Fe, Mg) O corner (representing olivine and orthopyroxene) and the projected mid-point between $CaO + Na_2O$ and Al_2O_3, representing the mineral plagioclase.

Several trends in bakestone distribution are evident in the plot. All the analysed samples, including those from quarries in Trøndelag and Hardanger, cluster together. There seems to be no way to discriminate between any groups. There is a gradual transition in composition within all groups, from true ultramafic to coarse-grained igneous rocks similar to gabbro, and most fall within the field of olivine-plagioclase-clinopyroxene. Eleven samples fall within the field of olivine-plagioclase-spinel, the most extreme ones being represented by chlorite schist. This indicates that they essentially consist of the mineral chlorite (Chl).

BINARY PLOTS OF MAJOR ELEMENTS

As a first attempt to use immobile elements to distinguish between various rock suites, the major elements chromium (Cr) and nickel (Ni), assumed to be immobile during hydration and metamorphism, were chosen (Fig 8A). In this plot, the bakestone assemblage from northern Norway is clearly separated into two distinct groups, called Kysten1 and Kysten2. Kysten1 has a total of 76 specimens from 45 site locations while Kysten2 has only ten specimens from seven site locations (Fig 9). Two sites, Vágar (Storvågan) and Grunnfarnes, have bakestones from both groups represented. Both groups show a positive correlation between the two elements, but the level of Ni is substantially higher in the Kysten2 group. The samples from Øye in Trøndelag lie on a well-defined trend, with lower Ni content than the average of the Kysten1 samples. The samples from quarries in Hardanger fall essentially within the Kysten1 cluster of samples.

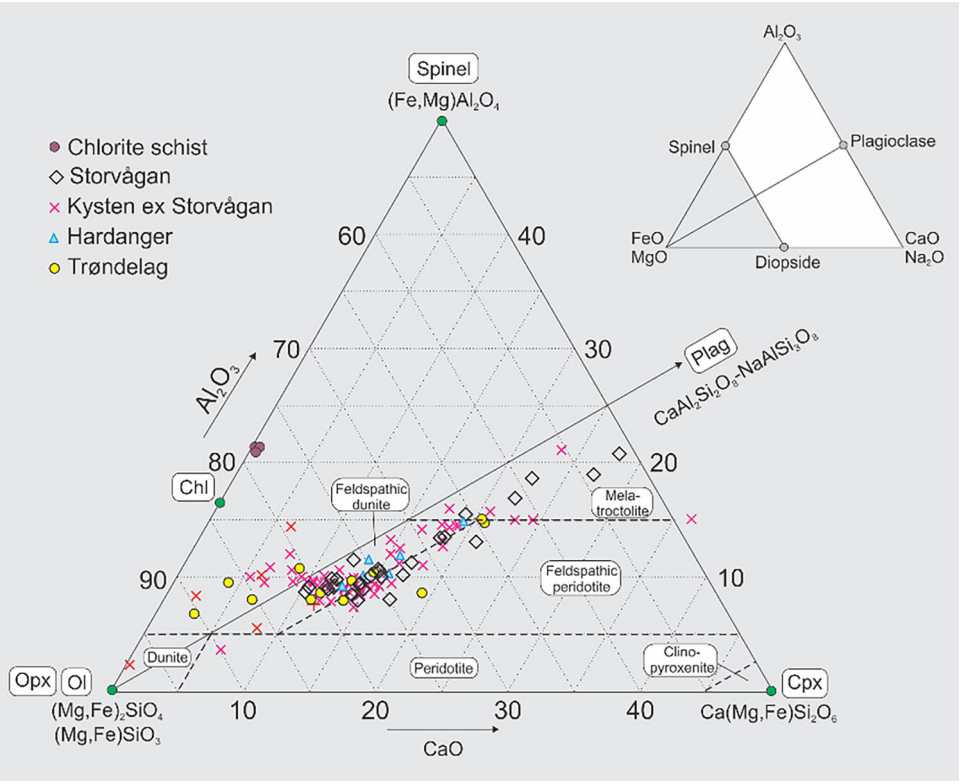

FIG 7.
Triangular XRF plot showing relations between $CaO + Na_2O$, $FeO + MgO$ and Al_2O_3 in bakestone fragments from storvågan and other sites in Northern Norway (labeled kysten ex storvågan). Also shown are rock samples from bakestone quarries in Ølve-Hatlestrand (labeled hardanger) and quarries in øye (labeled trøndelag). *Illustration by E ravna. © UiT—arctic University of Norway.*

The major components, silicon dioxide (SiO_2) and iron oxide (Fe_2O_3), also seem to discriminate well between Kysten1 and Kysten2, as well as between Kysten1 and Trøndelag. Again, samples from Hardanger appear well within the Kysten1 cluster (Fig 8B). Attempts to plot other chemical components against each other were unsuccessful in providing any further clues to the provenience of the archaeological material analysed in this geochemical study.

A total of 86 bakestones from archaeological sites in northern Norway were analysed for major and minor elements by XRF. The results have been compared to geochemical data for waste material from bakestone quarries in Trøndelag and Hardanger provided by the NGU in selected binary plots of chemical components. The general picture from these plots clearly favours the quarries at Ølve-Hatlestrand in Hardanger as the most probable source area for the majority of these bakestones (Kysten1). However, some of the analysed artefacts (Kysten2) have an anomalous composition, as shown in the binary plots.

The presence of bakestones from both groups at two sites in Nordland and Troms suggests some degree of shared accessibility. The ten bakestone fragments in Kysten2 may well have come from the extensive quarry landscape at Ølve-Hatlestrand in Hardanger. The six rock samples provided by the NGU represent a small fraction of the

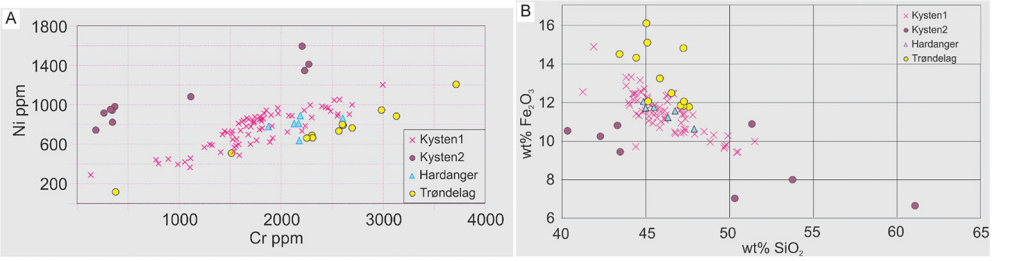

FIG 8.
(A) Binary plot of concentrations of chromium (Cr) and nickel (Ni) in bakestone fragments from Northern Norway (Kysten1 and Kysten2) along with rock samples from quarries in Hardanger and Trøndelag. (B) Binary plot of the major elements SiO_2 and Fe_2O_3 for bakestones from Northern Norway and quarry locations. *Illustrations by E Ravna. © UiT – Arctic University of Norway.*

71 documented extraction sites in the Ølve-Hatlestrand quarry complex and the chemical characterisation of additional quarry sites might reveal a match for the Kysten2 group. There is no evidence to suggest that Kysten2 represents a source in northern Norway.

ORGANIC RESIDUE ANALYSES

Analyses of organic residues from artefacts, primarily those associated with food remains, have a long history within archaeological science but remain limited in Norway, and northern Norway in particular. An initial study of organic residues from bakestones was conducted for an MA thesis on food in the Iron Age and medieval periods in northern Norway by Reiersen (1999). This was limited to an analysis of lipid molecules in residues found on two bakestone fragments from the excavated settlement mound at Grunnfarnes on Senja Island in Troms conducted by the Archaeological Research Laboratory at Stockholm University (Isaksson et al 1999). Radiocarbon dates were also obtained from the residues on both specimens (Reiersen 1999, 74–5), and remain the only directly dated bakestones to date. The age ranges span the 12th to 14th centuries AD and fit the relative site chronology of the settlement mound (Munch 1966).

Gas chromatography-mass spectrometry (GC-MS) and Fourier-transform infrared spectroscopy (FTIR) analyses of the Grunnfarnes specimens revealed a mixture of lipids with a high frequency of n-alkanes indicative of vegetable lipids and fatty acids that are common in cattle-based dairy products such as cream and butter. This combination is comparable to prehistoric bread containing oil-rich vegetable products with similarities to analysed bread remains from late Iron-Age sites in Sweden, including Vendel, Birka and Grobin (Isaksson et al 1999, 2). Although one of the bakestone fragments (catalog no. Ts. 6100 dl) had traces of lipids that may originate from peas or beans mixed with milk fat, there is no conclusive evidence regarding what type of foodstuff this might represent. These results have been subsequently cited as evidence that northern Norwegian bakestones do not match the traditional interpretation of use for baking flatbread and that a wider range of ingredients, such as beans and rye, should be considered (Baug 2018, 38). Considering the limited data available from a single specimen and lack of conclusive results, it is difficult to reach definite conclusions regarding bakestone use.

Documenting potential spatial-temporal variation in what was baked or fried on bakestones is critical to understanding their importance as a central component of a

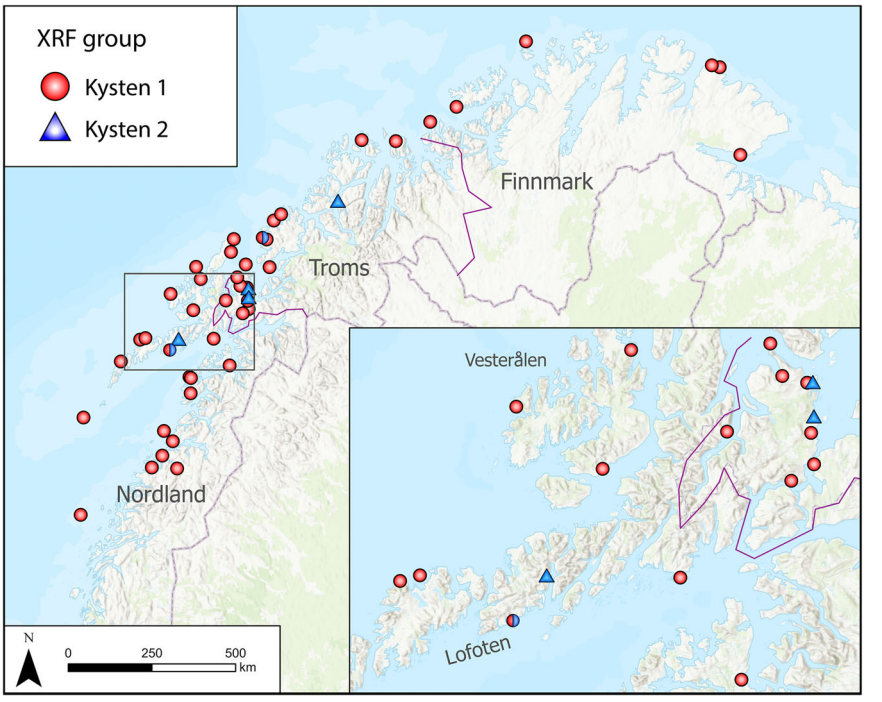

FIG 9.
Map of Northern Norway showing the distribution of bakestone fragments with geochemical characterisation separated into XRF groups. *Illustration by J G blom. © Arctic University Museum of Norway.*

distinctive food culture existing within a specific socio-cultural framework. Apart from flatbread, what other types of bread and foodstuffs may have been processed? To answer these questions, it is necessary to expand both the sample size and range of bakestone residue studies. As a step towards achieving this goal, a preliminary examination of bakestone residues on 25 specimens from Finnmark ($n = 8$), Troms ($n = 6$) and Nordland ($n = 11$) was undertaken by residue specialist Carol Lentfer (2017). An initial assessment of residue preservation and types of macro-residues was followed up by examination of micro-residues (eg starch granules, fats, and organic particulates) with transmitted light microscopy fitted with a polarising filter. Initial results confirm the presence of numerous phytoliths, including burnt vegetable matter and cereal grass inflorescences. Most phytoliths are likely to originate from cereal grains, although there is a lack of discrimination to species level from this source. Starch granules were present in at least eight samples. The limited evidence of starch originating from cereal flour is not surprising as this is usually destroyed by the application of heat necessary for bread production.

In order to expand the currently limited results from lipid analyses of bakestone residues, a pilot study was undertaken by Sven Isaksson at the Archaeological Research Laboratory, Stockholm University in collaboration with the author. Isaksson was also involved in the analysis of bakestones for Reiersen (1999), although analytical techniques and interpretational frameworks have developed to a considerable extent since that time. An initial sample of 20 specimens from securely dated site contexts in Finnmark ($n = 3$), Troms ($n = 2$) and Nordland ($n = 15$) was analysed. All bakestone fragments were

initially inspected under a low magnifying microscope and organic surface residues found on four of them. These were analysed using FTIR and a variety of material observed, including carbohydrate residues, fats/resins, and bone. Ground 100–200 mg samples were collected from the surface of four bakestones with no visible residues.

All specimens with observed organic surface residues as well as the ground samples were subjected to solvent extraction and molecular analysis of the extractives by GC-MS. There were poor yields from all but one of the surface residues found on a bakestone from the Trondenes vicarage excavations (Ts. 6315b). This sample had a fatty acid distribution with short-chain dicarboxylic acids and isoprenoid alkanoic acid typical of aquatic animal residues. In three of the other samples there were traces of fatty acids. These include bakestones from settlement mound excavations at Alsvåg (Ts. 8962cs), Kvalnes (Ts. 11088e) and Helgøy (Ts. 6012wl). Residues were extracted using an acid catalysed extraction and derivatisation technique developed for the analysis of very small and very old samples (Papakosta et al 2015). This extraction resulted in the recovery of fatty acid methyl esters from two samples (Ts. 11088e and Ts. 6315b). These two samples were explored further by compound-specific stable-carbon isotope analysis using gas-chromatography combustion isotope-ratio mass-spectrometry (GC-C-IRMS). Lipids from Ts. 6315b are clearly marine and the second sample probably has a marine component, since the d13C-values are higher than −25 per mil. But the delta D (dD) values can indicate a mixture, potentially with terrestrial ruminant since it is lower than −1.1 (Isaksson 2022). The low amount of lipids recovered from the bakestone specimens may suggest that the chlorite schist is too dense to adsorb lipids in substantial quantities. Despite the limited data obtained from the pilot study, the presence of lipids from marine fauna suggests a broader use-range for bakestones as do those potentially associated with domesticated livestock.

DISCUSSION AND CONCLUSIONS

Bakestones are a relatively scarce domestic item with widespread distribution along the coast of northern Norway during the medieval period. Geochemical characterisation of chlorite-schist bakestones from a representative sample of northern Norwegian site contexts was compared with waste material from known bakestone quarry sites in central and western Norway. Results reveal that most, and potentially all, of the analysed bakestones can be sourced to the Ølve-Hatlestrand quarry complex in western Norway, and that none of the bakestones were produced in northern Norway. Large-scale production at Ølve-Hatlestrand dominated the market by the thirteenth century and bakestones were widely distributed within Norway from the port of Bergen. Nearly all sites with bakestones in northern Norway are associated with maritime communities located along the outer coast with access to the main sailing routes. The number of sites with bakestones increases substantially from the 12th to 13th centuries, paralleling increased production from the Ølve-Hatlestrand quarries. In contrast, the percentage of bakestones made from soapstone in Bergen dropped dramatically following the twelfth century, most likely due in part to competition from Ølve-Hatlestrand, and they have not been recorded in northern Norway.

Analytical results have confirmed that bakestones are closely associated with residential sites, particularly settlement mounds with a maritime orientation, in addition to farmsteads with a mixed economy combining fishing and farming. Bakestones are also a product

directly linked to the stockfish trade as supported by their common presence in settlement mounds where communities were involved in the trade. The marked south to north decline in the quantity and geographical extent of sites with bakestones between Nordland and Finnmark also reflects a reduced degree of involvement in stockfish production.

Despite the assumed accessibility of bakestones through maritime trade with Bergen, they appear to be relatively uncommon in northern Norwegian site contexts when compared to quantities in medieval towns where they are far more concentrated. Both the attractiveness and scarcity of bakestones in northern Norway is illustrated by relatively substantial and widespread evidence for re-use of bakestone fragments in the form of drilled holes associated with rivets and iron bands found predominantly on relatively thin edge fragments. The collective evidence suggests that bakestone fragments were fastened to a stationary object for potential use as a heat reflector placed behind an oven or hearth to retain and spread warmth.

The uneven distribution of bakestones from some settlement mounds in the same region and period representing maritime communities engaged in similar activities is noteworthy. A case in point is the lack of bakestones in the most extensive settlement mound excavations undertaken to date associated with the Helgøy project in northern Troms. These sites are linked to Norwegian fishing settlement expansion into coastal Sámi areas beginning around 1350 encouraged by the growth of commercial cod fisheries in the 14th and 15th centuries. The almost complete absence of bakestones here is puzzling when considering the ample evidence for other imported goods linked to the stockfish trade. Another example of variable bakestone distribution exists between individual medieval site locations at Borg in Lofoten and is potentially related to site function and chronology.

It is argued that the presence of bakestones reflects Norwegian settlement and previous studies have demonstrated a close association between bakestones and the Norwegian cultural sphere and foodways (Reiersen 1999; Øye 2011; Baug 2018). However, limited numbers of bakestones have been documented at a few inner fjord and inland locations in Nordland with a mixture of indigenous Sámi and Norwegian settlement. In these cases, bakestones are interpreted as representing a Norwegian element. Along the coast of Finnmark, where Sámi settlement is predominant, bakestones appear to reflect the Norwegian component of multi-ethnic occupation in multi-room house structures. Other sites with bakestones in Finnmark are associated with Norwegian fishing communities that colonised coastal Finnmark in the fourteenth century (Olsen 2011).

An attribute-based analysis by the author sought to provide a broad characterisation of bakestone fragments by measuring thickness, size and weight, as well as recording a range of discrete attributes including fragment type, texture, the presence and position of surface grooves, and evidence for secondary use in the form of drilled holes associated with rivets and iron bands. The distinction between coarse and fine bakestones observed by geologist Erling Ravna (2017) as part of this study was confirmed through attribute analysis. Grain size varies from medium- to fine-grained and a functional explanation appears most likely, such as the possibility that fine-grained stones were used for processing different types of bread or other foodstuffs than coarser stones.

One of the critical questions to be addressed by the bakestone analysis was how these domestic products were being used. Although historical sources confirm that bakestones were used to bake or fry flatbread, there is increasing evidence that they were also used for preparing a variety of other foodstuffs. Analyses of organic residues,

primarily food remains, on bakestone surfaces remains minimal. The only previous study is an analysis of lipid molecules in residues found on two bakestone fragments from a settlement mound at Grunnfarnes in Troms (Isaksson et al 1999). Results from these samples suggested a wider range of ingredients than those traditionally associated with flatbread. Although a recent pilot study of residues on a sample of 20 bakestone fragments from northern Norway was only able to recover lipids from a few samples, it has provided evidence for lipids from marine fauna and potentially domesticated livestock, suggestive of food preparation unrelated to flatbread production.

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Résumé

Pierres de cuisson du nord de la Norvège : un témoin archéologique des habitudes alimentaires médiévales et du commerce maritime *par* Stephen Wickler

Au début du 11e siècle, les pierres de cuisson sont une innovation associée à la production de pain plat (galettes), reflétant une culture alimentaire norvégienne caractéristique qui s'étend sur environ 600 ans. La fabrication à grande échelle de pierres de cuisson en schiste à chlorite, à Ølve-Hatlestrand, dans l'ouest de la Norvège, était liée à leur distribution dans tout le pays depuis le port de Bergen. Articles importants pour le commerce maritime, les pierres de cuisson étaient transportées vers le nord de la Norvège en échange de morue (cabillaud séché) et sont retrouvées le plus souvent dans les villages de pêcheurs du littoral et les sites de peuplement à monticules. Une analyse fondée sur les attributs des pierres de cuisson du nord de la Norvège, provenant de la collection du musée de l'Université arctique de Norvège – la première étude complète ayant été réalisée en dehors des villes médiévales – explore le rôle des pierres de cuisson pour les peuplements du littoral nordique/norvégien et leur grande valeur en tant que produit commercial, comme le montrent les fragments de pierres de cuisson

réutilisés. Outre la répartition spatiale et temporelle des pierres de cuisson, la caractérisation géochimique (XRF) et l'analyse préliminaire des résidus organiques ont également été réalisées. Bien que les pierres de cuisson soient associées principalement aux peuplements en Norvège, leur rôle dans des contextes combinant des éléments indigènes sámi et nordiques/norvégiens est également évalué.

Zussamenfassung

Backsteine in Nordnorwegen: Ein archäologisches Zeugnis der mittelalterlichen Ernährungsgewohnheiten und des Seehandels *von* Stephen Wickler

Backsteine sind eine frühmittelalterliche Innovation aus dem 11. Jahrhundert, die mit der Herstellung von Fladenbrot in Verbindung gebracht wird und eine unverwechselbare norwegische Esskultur widerspiegelt, die sich über einen Zeitraum von etwa 600 Jahren erstreckt. Die groß angelegte Herstellung von Backsteinen aus Chloritschiefer in Ølve-Hatlestrand, Westnorwegen, war mit dem weiteren Vertrieb in Norwegen vom Hafen Bergen aus verbunden. Backsteine waren ein wichtiges Seehandelsgut, das nach Nordnorwegen transportiert und gegen Stockfisch (getrockneten Kabeljau) getauscht wurde. Man findet sie am häufigsten in Fischerdörfern und Siedlungshügeln an der Küste. Eine attributbasierte Analyse von Backsteinen aus Nordnorwegen in der archäologischen Sammlung des Arktischen Universitätsmuseums von Norwegen, die erste umfassende Studie außerhalb mittelalterlicher Städte, untersucht die Rolle von Backsteinen für die nordische/norwegische maritime Besiedlung und als geschätztes Handelsgut, wie die Wiederverwendung von Backsteinfragmenten zeigt. Neben der Dokumentation der räumlichen und zeitlichen Verteilung der Backsteine wurden auch eine geochemische Charakterisierung mittels RFA und eine vorläufige Analyse der organischen Rückstände durchgeführt. Backsteine werden zwar in erster Linie mit der norwegischen Besiedlung in Verbindung gebracht, wir untersuchen jedoch auch ihre Rolle in Kontexten, in denen indigene samische und nordische/norwegische Elemente in Kombination auftreten.

Riassunto

Pietre per cottura nella Norvegia settentrionale: testimoni archeologici di abitudini alimentari e di commerci marittimi medievali *di* Stephen Wickler

Le pietre per cottura sono un'innovazione altomedievale dell'XI secolo associata alla produzione di focacce che rispecchia una cultura alimentare norvegese particolare la cui diffusione copre un arco di circa 600 anni. La manifattura su larga scala di pietre per cottura in cloritoscisto a Ølve-Hatlestrand nella Norvegia occidentale era collegata a un'ulteriore distribuzione in Norvegia dal porto di Bergen. Le pietre per cottura furono un elemento importante nel commercio marittimo, trasportate nella Norvegia settentrionale per essere scambiate con stoccafissi e si rinvengono assai comunemente nei villaggi costieri di pescatori e nei siti con tumuli formatisi dall'accumulo di rifiuti degli stanziamenti. Un'analisi degli attributi delle pietre per cottura provenienti dalla Norvegia settentrionale che fanno parte della collezione archeologica del Museo dell'Università di Tromso, il primo studio esauriente all'infuori delle città medievali, esamina il ruolo delle pietre per cottura sia per lo stanziamento marittimo norreno/norvegese che per il notevole valore come prodotto commerciale, come dimostrato dal riutilizzo di frammenti delle pietre per cottura. Oltre a documentare la distribuzione spaziale e temporale delle pietre per cottura, si sono intraprese sia la caratterizzazione geochimica (spettrofotometria XRF) che l'analisi preliminare dei residui organici. Benché le pietre per cottura siano principalmente associate allo stanziamento norvegese, si è valutato il loro ruolo anche in contesti con presenza di elementi indigeni sami e norreno/norvegesi.