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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

Contents

Tor Grenne, Bodil Østerås and Lars F. Stenvik

The Sandbekkdalen Quarry, Kvikne: A Window into Early Iron Age Soapstone Exploitation in Norway

The oldest known example of large-scale soapstone exploitation in Norway is found at Kvikne (south central Norway), where quarrying took place during the pre-Roman Iron Age (5th to 1st century BC). The quarry is located in a remote area at an altitude of nearly 1000 m ASL, and is untouched by Viking Age and medieval exploitation that was so extensive elsewhere in Norway. Excavations in the 1960s suggested a production of several thousand circular vessels. Later studies revealed a separate, large extraction area for angular and irregular blanks that were distinctly different but carved with similar adze-like tools. We speculate that the latter blanks were meant for forge-stones connected to the contemporary, large-scale exploitation and processing of bog iron. Radiocarbon dating results suggest that the circular and angular extractions represent early and late pre-Roman Iron Age phases of quarrying, respectively. The tool marks suggest that iron axes were used for soapstone extraction already from the earliest pre-Roman Iron Age. This nearly 500-year period of quarrying with a bladed tool technique is in marked contrast to the use of pointed tools in the Viking Age and later, in accordance with previous suggestions of a total break in soapstone vessel production during the Roman Iron Age and Migration Period. Similar production must have existed elsewhere in Norway in the pre-Roman Iron Age, but traces of the ancient quarrying were in most cases erased by the very extensive exploitation of soapstone in the Viking Age and later.

Background

In 1952, the Restoration Workshop of Nidaros Cathedral (NDR) started exploitation of soapstone at Sandbekkdalen (Figures 1 and 2) south of Kvikneskogen in the municipality of Tynset. Located 4 km west-southwest of the nearest settlement Bubakken at an altitude of 960 m ASL, well above the tree line in a desolate and barren mountain area, the quarry was worked during the summer season for various restoration purposes at the Cathedral (Storemyr 1997). In 1965, wooden spades found during removal of overburden were delivered to the Antiquarian Collection at the University of Oslo (UO – Universitetets Oldsaksamling). Several similar spades and fragments of soapstone vessels (Figure 3) were found during continued quarrying up until 1967 (Skjølsvold 1969:202–204). An early ^{14}C analysis gave a surprisingly high age of 2350±90 BP (Figure 4). The finds encouraged further investigations by Arne Skjølsvold in 1968–1969 followed by additional radiocarbon dating in 1969 that confirmed the pre-Roman Iron Age activity, including ^{14}C ages of wooden spades (2180±90 and 2310±70 BP), a worked trunk of birch (2440±70 BP), and a large piece of birch bark (2270±70 BP), the latter two items were apparently used to support waste heaps during quarrying (Skjølsvold

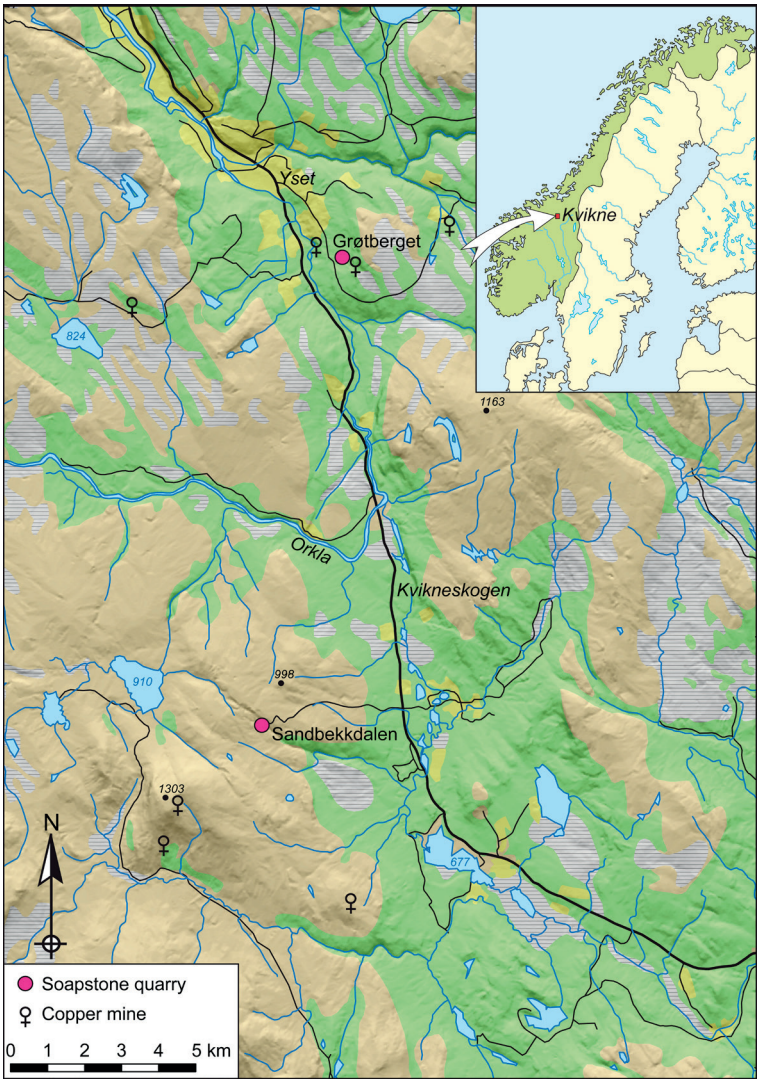

Figure 1. *Map of the Kvikne district with the location of the Sandbekkdalen soapstone quarry and other sites referred to in the text.*

1969:204, 235). Excavations revealed a large number of wooden spades (Figure 5), a low, bowl-shaped wooden vessel, a cup made of birch bark, two stone mauls, and fragments of relatively tall and narrow soapstone vessels with their greatest width well below the middle, the latter referred to as 'low-bellied' vessels (Skjølsvold 1969:206–210). The age estimates, ranging from late Bronze Age to pre-Roman Iron Age, made this the oldest documented example of large-scale soapstone exploitation in Norway.

By the late 1960s NDR quarrying had removed significant parts of the ancient quarry face in the southern and south-eastern parts of the soapstone body (Skjølsvold 1969:Fig. 8). Following the archaeological discoveries, UO demanded a halt to further production in 1969 based on the significance of the site as a unique monument of ancient stone extraction. Later, in the mid-seventies, the northern parts of the body – at that time unexposed and with no obvious sign of ancient quarrying

Figure 2. *Sandbekkdalen, view from the west. The southern quarry area excavated in 1969 is partly exposed on the lower right slope of the serpentinite knoll, while the northern quarry area studied in 2004 forms a flat at lower levels on the left. The irregular surface in the left part of the knoll is from modern block extraction by NDR.*

– were opened to new, limited production by NDR according to provisional permission from the UO. Subsequent discoveries of ancient quarrying also in this area again led to proscription of activity, and block extraction by NDR came to a complete halt in 1996. Limited geological and archaeological mapping was carried out in 2001–2004 (Grenne & Heldal 2002; Østerås 2004a), before most of the quarry faces were covered with soil for future conservation.

The soapstone deposit

Quarrying at Sandbekkdalen took place on a small lensoid body of ultramafic rocks, situated in a major geological unit commonly referred to as the *Gula Group* that otherwise comprises various schists and local amphibolites (Nilsen 1974). The ultramafic body, covering a surface of some 80 by 35 m, originally formed as a magmatic intrusion that crystallized to a relatively coarse grained mass of essentially olivine with some orthopyroxene and plagioclase feldspar. Later, the rocks were subject to deformation and metamorphism during the Caledonian orogeny, leaving the present zonal arrangement of fine-grained metamorphic assemblages (Figure 6).

The central part is a dark greenish serpentinite composed of flake-shaped to fibrous serpentine (antigorite) with minor amounts of intimately intergrown talc, chlorite, magnetite and carbonate

Figure 3. *Fragment of an excavated soapstone vessel. (After Skjølsvold 1969:Fig. 11).*

(Alnæs 1994:332, C7–3). Across a transitional zone of talc-rich serpentinite, this gives way to an outer zone of relatively dark grey soapstone composed essentially of Mg-carbonates (magnesite and subordinate dolomite), pale greenish chlorite, talc and trace amounts of opaque minerals (ilmenite and various sulphides), the talc forming a characteristic microcrystalline network of fibrous crystals. Except for local thin carbonate veins and a thin, peripheral zone of talc schist, the fine grained soapstone is massive, very homogenous and easily workable by fine carving, e.g. as required in ornamental stone for the NDR restoration works (Frigstad 1973:3, 6; Alnæs 1994:337; Storemyr 1997). The grey colour and fine grained texture makes the Sandbekkdalen soapstone rather unique in a Norwegian context (Frigstad 1973:6); most other ancient quarries are located in other geological units with soapstone that is either much lighter grey, coarser and more heterogeneous (e.g. North Gudbrandsdalen and Helgeland) or fine-grained but with a distinct green colour and abundant carbonate veins (e.g. Trondheim area and parts of western Norway) (Helland 1893; Karlsen & Nilsson 2000).

Figure 4. *^{14}C data for artefacts from Sandbekkdalen, Kvikne. Data for the piece of pelt were provided by the National Laboratory for ^{14}C- dating, Norwegian University of Science and Technology (project TUa-7315 DF4130) using the Uppsala accelerator laboratory; all other data are from Skjølsvold (1969). Calibrated ages and probabilities within 1σ and 2σ are calculated using OxCal (Bronk Ramsey 2009) version 4.2.3 with calibration curve from Reimer et al. (2013).*

Sample	^{14}C BP	Calibrated age	Probability	Calibrated age	Probability
		1σ		2σ	
Worked trunk	2440±70	747 BC – 685 BC	17.9	768 BC – 403 BC	95.4
		666 BC – 642 BC	6.9		
		587 BC – 583 BC	0.94		
		556 BC – 410 BC	42.5		
Wooden spade	2350±90	737 BC – 688 BC	9.0		
		663 BC – 647 BC	2.8		
		548 BC – 357 BC	50.9	766 BC – 346 BC	81.0
		282 BC – 257 BC	4.1	321 BC – 206 BC	14.4
		245 BC – 236 BC	1.3		
Wooden spade	2310±70	481 BC – 441 BC	8.2	745 BC – 687 BC	4.1
		434 BC – 351 BC	34.1	665 BC – 644 BC	1.3
		301 BC – 210 BC	25.9	552 BC – 183 BC	90.1
Birch bark	2270±70	401 BC – 350 BC	25.3	517 BC – 161 BC	94.9
		309 BC – 209 BC	42.9	131 BC – 118 BC	0.5
Wooden spade	2180±90	367 BC – 160 BC	64.5	402 BC – 20 BC	94.7
		132 BC – 117 BC	3.7	12 BC – 1 BC	0.7
Pelt	2045±30	95 BC – AD 2	68.2	165 BC – AD 24	95.4

Figure 5. *Wooden spades excavated in 1969. (After Skjølsvold 1969: Fig. 9).*

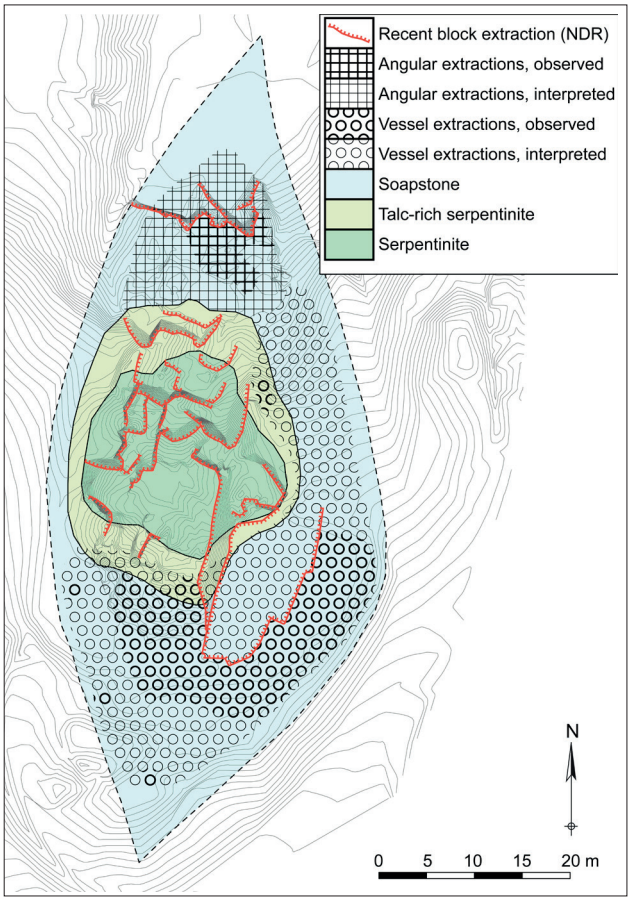

Figure 6. *Map of the Sandbekkdalen soapstone deposit and quarry. Contour line (light grey) intervals 20 cm.*

Figure 7. *View of the southern quarry area southeast of the knoll looking south-southeast. The water-filled pit is from modern quarrying by NDR. (Photo: A. Skjølsvold 1969).*

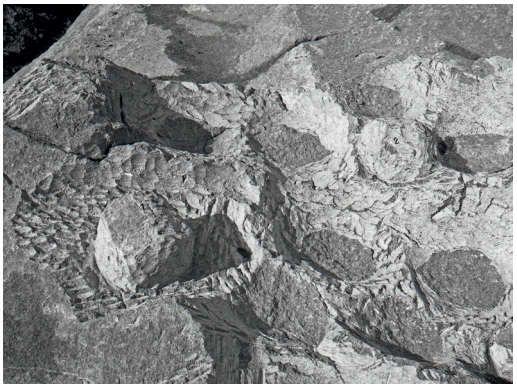

Figure 8. *Unfinished blanks and traces after extracted circular blanks for vessels in the southern quarry area. (Photo: A. Skjølsvold 1969).*

The central serpentinitic parts of the ultramafic body, covering some 30 by 25 m (Figure 6), is relatively hard and resistant compared to the surrounding soapstone, and forms a conspicuous, 5–6 m high knoll in the landscape (Figure 2). The serpentinitic rocks were exploited to some extent by NDR for block production, while they were apparently untouched by the ancient quarrying except for a few scattered extractions in the more talc-rich transitional zone.

Ancient quarrying at Sandbekkdalen

Southern quarry

Arne Skjøldsvold's excavations in 1969 focused on the area that was affected by recent block production for the NDR restoration works south and south-east of the serpentinite knoll (Figure 6). Traces of ancient extraction were seen covering an area of about 250 m^2, in addition to the 150 m^2 where ancient traces had already been removed by NDR (Figure 7). Moreover, limited trial excavations outside the uncovered area were interpreted to indicate that the total size was perhaps 600–800 m^2 (Skjølsvold 1969:204–205).

The exposed quarry floor displayed traces of the extraction of hundreds of vessels (Skjølsvold 1969:210–216). Some were left as circular unfinished blanks still attached to the rock surface (Figure 8) at various stages of completion. The average diameter ranges from 22 to 24 cm and heights are up to 28 cm. The majority have a tall and narrow profile, with a rim diameter less than the height. Skjølsvold (1969:212) also observed some blanks that possibly were designed for bowls with an open shape. Observations of exceptionally well preserved tool marks seemed to suggest carving with sharp adze-like tools that had a gently curved, 3.5–5.5 cm wide, transverse edge. The vessels were hewn with bottoms up on the quarry face, and they were loosened by carving a channel that made the blank narrower at the lower edge and future neck of the vessel ('low-bellied vessels'). No traces of wedging were observed. Based on the detailed topography in the quarry and documentation of 2–3 'extraction levels' in the vertical dimension, the number of vessels produced in the exposed parts of the quarry was estimated at 3000–4000, probably on the order of 6000 or more if the unexposed quarry faces were included (Skjølsvold 1969:212–213).

Much of the quarry was buried under three metres of rock waste, mostly fine debris from the ancient activity. Several pieces of birch trunks with one sharpened end were found in this debris together with large pieces of birch bark. Skjølsvold (1969:216) interpreted these finds as remnants of walls raised to protect the local working area at the quarry floor from the large masses of surrounding rock waste. The high number of excavated spades (n=60) also reflects a significant effort required to keep the rock surface clean and accessible for carving. An illustration of this is four wooden spades found together, carefully left in an upright position within a small pit in the soapstone surface before they were inadvertently covered by collapsing waste heaps (Skjølsvold 1969:217). Apparently quarrying was concentrated in a single, restricted area at a time, leaving large amounts of waste that had to be removed intermittently when new working areas were accessed.

Northern quarry

The ancient quarry faces discovered on the northern side of the serpentinite knoll after NDR had resumed block extraction in the mid-1970s were subject to limited excavation and archaeological mapping by Bodil Østerås (2004a). About 61 m^2 of the quarry surface was uncovered and revealed traces of 251 extractions. The average extraction density of 4.1 per m^2 is only slightly higher than that of 3.6 observed in the southern quarry area by Skjølsvold (1979:116). Earlier observations (Grenne & Heldal 2002) indicate that the total extent of the old quarry face was much larger than the excavated area, probably somewhere between 130 and 210 m^2 (Figure 6).

Surprisingly, this quarry area showed no evidence of extraction of the 'low-bellied' vessels with a tall and narrow profile that dominated the southern quarry area previously studied by Skjølsvold (1969:210–216). In contrast, nearly all the extractions (235 of 251) have angular forms, ranging from square and slightly rectangular through to various irregular outlines, commonly placed side by side like a chessboard pattern (Figure 9). Six per cent were classified as circular or oval during the field

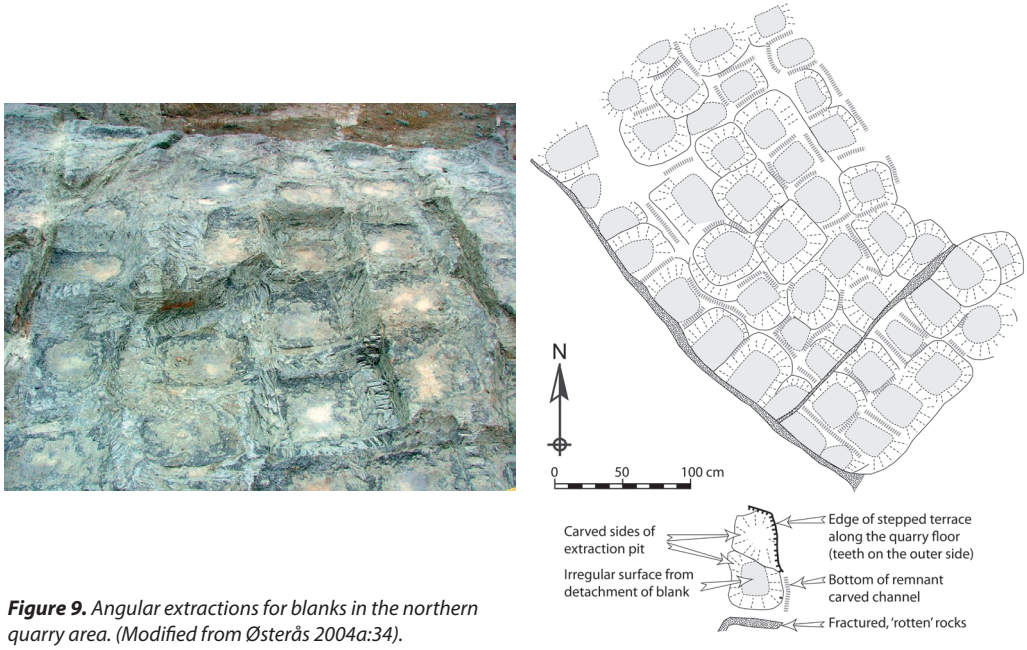

Figure 9. *Angular extractions for blanks in the northern quarry area. (Modified from Østerås 2004a:34).*

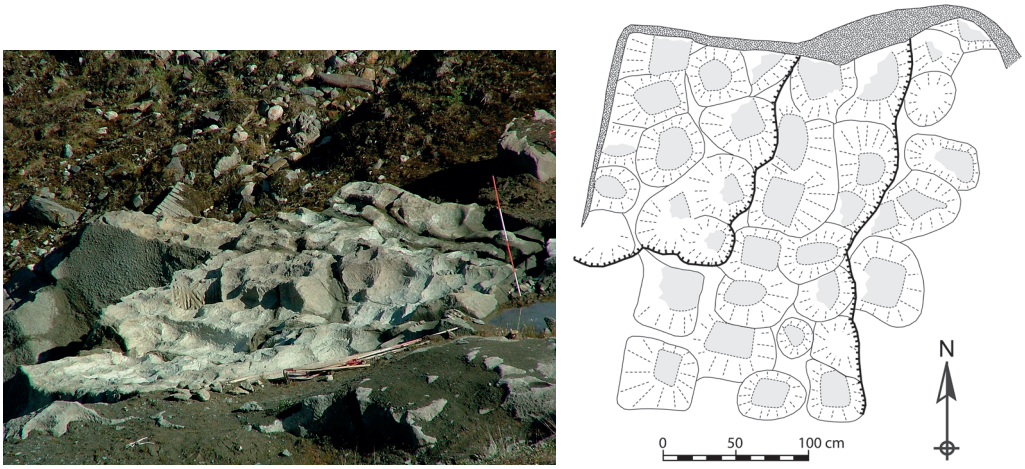

Figure 10. *Part of the northern quarry area showing layer-wise extraction of blanks on terraces that are stepped along the quarry floor. (Modified from Østerås 2004a:31). See Figure 9 for legend.*

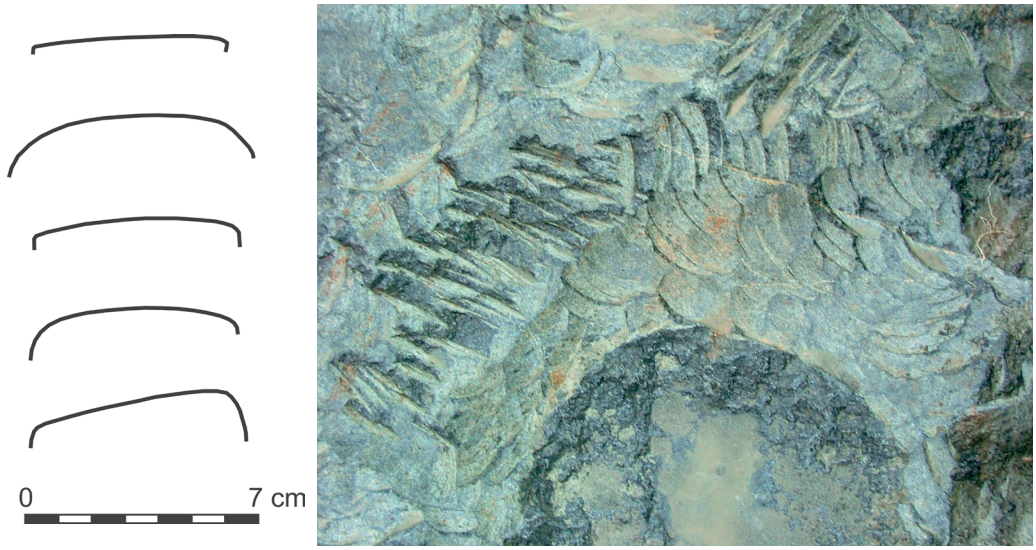

Figure 11. *Close-up photo of angular extraction pit with tool marks in the northern quarry area, Sandbekkdalen. The darker area at the bottom of the photo is the irregular surface where the blank was broken off from the quarry surface. Left: sketch of cutting edge marks from inferred adze-like carving tools.*

investigations, but the classification of these as a different product is questionable in view of the large variation in angular shapes. The extracted blanks are small, with a majority 18–26 cm in length. All of the blanks had been extracted horizontally along 'layers' at different levels, leaving a series of relatively wide stepped terraces along the quarry floor (Figure 10).

Well preserved tool marks denote that carving was done mostly with sharp adze-like tools that had a variably curved transverse edge with rounded sides. The tool marks are comparable to those of the southern quarry area with respect to general shape, but the edge of the tool appears to have been

somewhat wider, i.e. 4.8–7.3 cm vs. 3.5–5.5 cm (Figure 11). Wedge holes are absent, and the blanks were apparently released from the bedrock simply by the inward-directed force of the edged tool at the bottom of the surrounding channel, similar to the southern quarry.

A small piece of cut pelt with seam holes, probably from a shoe or clothing that had been reused and wrapped around a tool (Berg-Hansen 2011) was found at the bottom of one of the extraction pits (Østerås 2004a:19). The pelt was from an unidentified species of deer (Cervidae). Radiocarbon dating produced an age of 2045±30 BP (Figure 4). Occurring in undisturbed soapstone debris directly on a surface with exceptionally well preserved tool marks, the pelt must have been buried in the rock waste shortly after carving, before the soapstone was affected by weathering that occurs very rapidly in this particular rock type (Storemyr 1997). The pelt was stained with rust in the otherwise light grey soapstone debris, indicating that it had been in contact with an iron tool (Berg-Hansen 2011).

Discussion

The two quarry areas at Sandbekkdalen were both worked by similar carving and extraction techniques and with comparable adze-like tools, yet they show significant differences with respect to products. Relatively small, narrow and tall vessels were by far the dominant product in the southern quarry. The great majority of blanks, as well as the few vessels apparently carved at the site, fit the typology for pre-Roman Iron Age soapstone vessels (Skjølsvold 1969:221; Pilø 1989). The only possible exceptions are a few low blanks that may have been designed for bowls with an open shape (more akin to late Bronze Age typology; Pilø 1989); however, Skjølsvold (1969:212) stated that this interpretation was ambiguous since the blanks may have been only partly processed. The typical pre-Roman Iron Age soapstone vessels, commonly used as grave urns, were distinctly different from the vast production of soapstone for cooking pots and similar domestic utensils in the Viking Age and Middle Ages (e.g. Pilø 1989:87; Storemyr & Heldal 2002). Lars Pilø (1989:96) notes that vessels of this type are absent in Bronze Age to pre-Roman Iron Age contexts in south-east Norway and that the Sandbekkdalen quarry at Kvikne instead may have served to supply the population of Trøndelag.

In marked contrast, the northern quarry seems to have been worked almost exclusively for the extraction of variably-shaped angular blanks. The practical application of these blanks is unknown, since finished products have not been identified in the quarry. Rectangular soapstone vessels were used in the Viking Age and later (Shetelig 1912:66), but such forms are unknown in older contexts. Extraction of rectangular blocks for building stone are seen in numerous soapstone quarries in Norway, but these blocks were much larger and practically all quarrying was related to the erection of ecclesiastical buildings in medieval times; soapstone is not found as construction or ornamental material in pre-Roman Iron Age buildings.

A preliminary interpretation by Østerås (2004a) suggested the production of rectangular blanks for bronze casting moulds. The size of many blanks, about 25 x 30 cm, is more than sufficient to form a two-piece mould for the casting of, for example, a bronze celt, by splitting the blank in two similar halves that were subsequently carved to form the hollow space inside. Such moulds were particularly common in the Bronze Age, as in Denmark where their great abundance has been taken to reflect large-scale trade with either Norway or Sweden (e.g. Skjølsvold 1961:107). Although scarce, similar moulds are also found in pre-Roman Iron Age contexts in northern Norway (e.g. Wickler et al. this vol.). According to Preben Rønne (1996:17) the Danish moulds were imported as roughly shaped blanks and finished when received by the customer. However, the interpretation is problematic in view of the presumably limited use of bronze casting moulds in this time period (late pre-Roman Iron Age, see below).

Another possible interpretation is that the angular and variably-shaped blanks were intended for the manufacture of heat-resistant products related to the production or processing of iron. This is interesting particularly in view of the extensive utilization of bog iron documented in areas close to the Sandbekkdalen quarry: Central Norway seems to be the most important area for iron production in Norway and perhaps in the whole of Scandinavia from around 500 BC through to the Roman Iron Age (Stenvik 2005), a production apparently organized by persons at a chieftain level in a stratified society (Grønnesby 1999, Sauvage & Mokkelbost 2013). Contemporary smithies have also been identified in the region (Øien 2009). Possible soapstone products in this context are cylindrical forge-stones (*tuyères*) through which air was blown into a furnace, or shield-shaped forge-stones with a hole used to protect bellows from the heat. Both are known from prehistoric iron smelting and smithies elsewhere (Tylecote 1987:118). We do not know contemporary examples that have been identified in Norway; however, in view of the existing, large-scale exploitation and processing of bog iron (Stenvik 2005) and the suitability of soapstone as a heat-resistant and easily carved material, we consider it very likely that both cylindrical and shield-shaped forge-stones were widely used in the region.

The systematic organization of soapstone extraction at Sandbekkdalen suggests that experienced artisans were operating the quarry: The extractions have a comparable size and seem to be standardized both with respect to shape and carving technique. Moreover, the extractions were strategically positioned in order to maximize utilization of the best stone quality and at the same time take advantage of natural fractures to minimize the need for laborious carving.

The question of who these quarry artisans were, however, is still an open issue. Available data for total output and production period (see below), albeit uncertain, suggest a production rate on the order of 5000 to 10,000 vessels over perhaps 200–400 years, i.e. not more than c. 10–50 vessels per year. Similar estimates are valid for the production of angular blanks (see below). Hence, although production was relatively extensive over time, it seems most likely that the quarry was worked only periodically by people who were otherwise occupied elsewhere, e.g. in farming or hunting. The production rates may also suggest that products were traded locally or within the region rather than for a wider export.

At any rate, the quarry workers must have been based in the same district. The nearest settlement with significant farmland is Yset (Figure 1), situated c. 15 km to the north at an altitude of some 550 m ASL. It is noteworthy that another significant soapstone quarry, Grøtberget, is located close to this settlement (Figure 1), on the rim of a protruding knoll of harder ultramafic rock like at Sandbekkdalen and in a similar geological context (Nilsen 1974). Here, exposed traces from the extraction of relatively large pots and trough-shaped vessels are typologically consistent with activity in Viking Age or later periods (Østerås 2004b); however, recent mapping indicates that the larger part of the quarry is presently covered by waste heaps that could be related to earlier activity. Although this remains somewhat speculative in the absence of archaeological studies and radiocarbon dating, it opens the possibility that at least two soapstone quarries were operated near Yset in the early Iron Age. Indeed, it is highly unlikely that the Grøtberget soapstone – standing out as a well exposed and easily accessible resource of good quality near the settlement – was not known and exploited at the same time as the much more remote Sandbekkdalen quarry.

Stone mauls of the type that was found in the quarry often appear in old copper mines on the Continent and in the British Isles, where they seem to be standard equipment for workers in mines and quarries (Stenvik 1988). Anne Lene Melheim (2012:290) pointed to the copper mines of the Kvikne district as a possible connection between mining and soapstone quarrying, although presently visible traces of copper mining evidently relate to modern activity (mid-17th century and later). So far we have no solid proof of copper mining as early as the Bronze Age or pre-Roman Iron Age in

Norway, but it is a possibility that has been raised (Stenvik 1988; Prescott 2006; Melheim 2012). A combination of copper mining and soapstone quarrying would have been an interesting coexistence since there are obvious relations between activities, tools and craftsmanship. It is noteworthy in this regard that the Kvikne district is well known for its many copper mines (Nilsen & Mukherjee 1972). Two of these, Kaltberget and Olkar, are found as close as 100 metres and 1.2 km, respectively, from the Grøtberget soapstone quarry near Yset, while others are about 3 km from the Sandbekkdalen quarry (Figure 1).

Our recalibration of Skjøldsvold's (1969:204, 235) ^{14}C data from the southern quarry area (Figure 12 and Figure 4) indicates that a birch trunk used for support of the waste heaps is most likely from the time interval c. 750–410 BC (at 68% confidence), with the highest probability at c. 560–410 BC. Similarly, the three spades have an age range of c. 740–120 BC, with the highest probability at c. 550–360 BC, 430–350 BC and 370–160 BC, respectively. The piece of birch bark falls within these ranges with a likely age of c. 400–210 BC at 68% confidence. Hence, while it is possible that the birch trunk and one of the spades are from the Bronze Age (i.e. older than 500 BC) as suggested by Joakim Goldhahn (2007:132–133), their similar contexts makes it more likely that all these five artefacts comprise a group that overlap in age within the 4th and 5th century BC. In contrast to these, the piece of pelt found within one of the angular extraction sites in the northern quarry area shows that quarrying at that site most likely took place sometime within the first century BC (Figure 4 and Figure 12).

Coupled with the volume of production, which indicates that quarrying had a relatively long history, the data suggest that the southern part of the Sandbekkdalen quarry was operating at least in the 4th and 5th century BC. Limited ^{14}C data from the northern quarry gives a significantly younger age, suggesting that that there was still activity here in the 1st century BC. Two scenarios seem viable for this development in time and space, from the early production of circular vessels to the south followed by angular blanks to the north: 1) it may reflect a gradual shift from exploitation of the southern to the northern quarry area over time and a concomitant change in products, or 2)

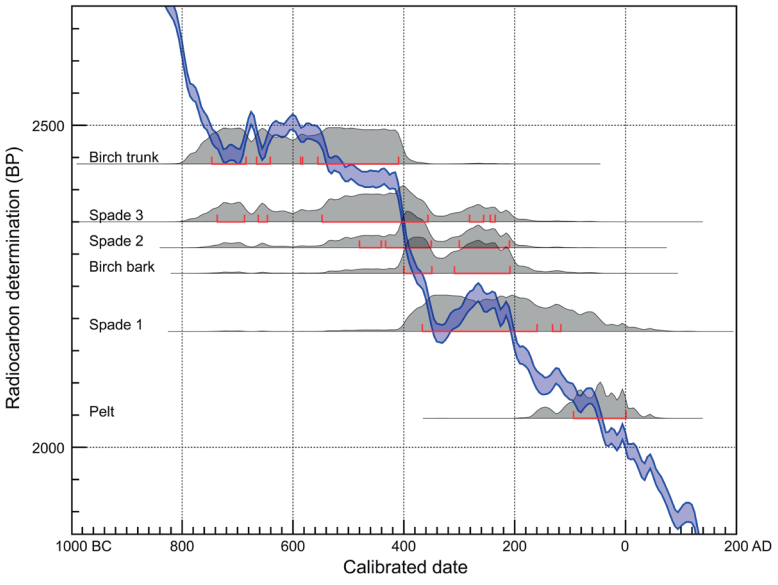

Figure 12. *^{14}C ages, Sandbekkdalen quarry. Probability distributions (grey) and probability intervals at 68.2% confidence (red) calculated by OxCal (Bronk Ramsey 2009) version 4.2.3, with calibration curve (blue) from Reimer et al. (2013).*

quarrying of the two different commodities was temporally discontinuous and only the northern part of the quarry was worked for angular blanks.

Overlap of the two products in time would potentially leave traces of both types on the same quarry surface or, at least, in the same part of the quarry; however, this may not necessarily be the case in a long-lived quarry, where older traces will inevitably be removed as quarrying goes deeper and observed extraction traces on the quarry floor only represent the latest activity at that particular site. The absence of angular extractions to the south, where observed traces obviously represent a late phase of work in that part of the quarry, strongly suggests that this area was abandoned while circular vessels was still the only or predominant product. The northern quarry area is more problematic, since it is impossible to tell if circular vessels had been extracted at a shallower, presently removed, level before the carving of angular blanks as seen on the quarry floor. The sporadic presence of more circular traces may reflect a continued, subordinate, vessel production, but this is highly uncertain in view of the variable shapes of extractions as discussed above. While we know that the Sandbekkdalen quarry had a lifespan of at least four centuries, the ^{14}C data are not conclusive as to whether there was continuous activity during this period. At the 68% confidence level, the data allow for a break in the 2nd century BC, but this is speculative in view of the limited number of dated artefacts.

At any rate, it is unlikely that only the southern part of the knoll was exploited for circular vessels in the early period, especially since glacial drift is very thin in the area and has left protruding knolls more or less uncovered. This implies that the later production of angular blanks in the northern quarry area was most likely established in a soapstone exposure that was previously known and exploited for vessel production. Moreover, it suggests that earlier vessel production may have been significantly more extensive than previous estimates, possibly covering a quarry area of nearly 1000 m^2 (Figure 6). Following Skjølsvold's (1969:212–213) estimate of extraction density and the number of extraction levels, the total output may have been on the order of 10,000 vessels. A similar calculation for the later phase in the north would suggest a total production of angular blanks on the order of 2000. It must be emphasized, however, that the figures are uncertain because we do not know the shape of the original quarry surface and hence how deep the quarries were.

Whether or not extraction of the two different products was continuous and overlapping, the similarity in extraction technique and tool marks points at a unbroken stone craft tradition through the entire lifespan of the ancient quarry, characterized by carving with adze-like tools that had a curved, transverse edge. This was significantly different from that of the mass production of soapstone bowls and other vessels in the late Iron Age and medieval times, when carving with sharp edge tools was replaced by picking with pointed tools (e.g. Østerås 2001). The difference in stone craft traditions lends further support to previous suggestions that soapstone vessel production ceased after the pre-Roman Iron Age, about AD 0, when soapstone vessels were replaced by ceramics, and resumed only after the Migration Period (Pilø 1989).

Tool marks in the quarry demonstrate the use of adzes or axes with a sharp and hard metal edge. The kind of metal is not revealed by direct findings; however, two observations serve as indirect evidence for the use of iron or steel in these tools. Firstly, rust was observed on a piece of pelt that was apparently wrapped around an iron object. The context of this object, lying directly on unweathered extractions, demonstrates that it was related to the quarrying. We do not know whether the metal was removed (and reused?) and just left rust on the pelt prior to disposal, or if the metal rusted away and the pelt was preserved while buried in the rock waste (which is quite possible in view of the exceptional preservation of spades and other organic matter in the quarry debris); at any rate this leaves no doubt that iron or steel was used during quarrying at Sandbekkdalen. Secondly, in spite of fairly extensive excavations with very abundant finds of tools (e.g. 60 wooden spades) lost in the

debris, there are no finds of bronze tools, even though the likelihood for preservation of bronze – or at least of copper staining from such tools – is far higher than that of iron. Recent ^{14}C data from iron production sites in neighbouring communities north of Kvikne (Midtre Gauldal, Holtålen and Rennebu) demonstrate that extensive iron production took place at about 300 BC (Stenvik 2005), and a huge site with remains of smithies and forges at Forsetmoen in Midtre Gauldal, about 60 km north of Sandbekkdalen, corroborates iron working as early as 500 BC (Øien 2009). Hence it was obviously possible to produce tools with steel edges at that time (Stenvik 2005).

The documented pre-Roman Iron Age quarrying at Sandbekkdalen is seemingly unique in a Norwegian context in terms of age and products. None of the innumerable soapstone quarries elsewhere in Norway have so far revealed evidence of activity older than the Viking Age. This is an apparent paradox since many soapstone quarries have been worked with resources that are much bigger and logistically far more favourable with respect to proximity to settlements and trade routes than that at Sandbekkdalen. We find it highly unlikely that pre-Roman Iron Age production of items like grave urns and other soapstone objects were restricted to the very remote mountainous area of Kvikne, as long as large and easily accessible soapstone resources occur close to settlements and coastal areas elsewhere, e.g. in Hordaland (western Norway) and Helgeland (northern Norway) where several deposits are well exposed in the immediate vicinity of the intertidal zone (Helland 1893; Karlsen & Nilsson 2000). On the contrary, we suggest that similar production may have been widespread in the pre-Roman Iron Age; however, traces of the ancient quarrying were in most cases erased by the very extensive exploitation of soapstone in the Viking Age and Middle Ages. This is supported by a recent provenance study by one of the authors (TG) based on the geochemical characteristics of soapstone quarries and vessels from archaeological contexts of pre-Roman Iron Age or late Bronze Age in northern Norway (material provided by Stephen Wickler, Tromsø Museum see Wichler et al. this vol.). From just the four vessels studied it is clear that at least two other soapstone quarries – distinctly different from the Sandbekkdalen soapstone – must have been exploited in that period. Future provenance work on a regionally wider selection of pre-Roman soapstone artefacts is likely to increase the number of possible sources considerably. From this perspective, the Sandbekkdalen quarry at Kvikne may be regarded as a fortuitous remnant from the earliest phase of 'industrial-scale' exploitation and utilisation of soapstone resources in Norway, still in existence only by virtue of its remote location and difficult accessibility in later times.

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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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