Grinding technologies, social relations and the becoming of the northernmost TRB

Cecilia Lidström Holmberg

Zusammenfassung – Dieser Artikel gibt einen Überblick über die Mahlsteintechnologien des späten Mesolithikums und des frühen Neolithikums, spezifiziert für das östliche, zentrale Schweden (fig. 1). In diesem Gebiet wurden im Übergangsbereich vom Mesolithikum zum Neolithikum (ca. 4000/3900 cal. BC) kunstvoll produzierte „Sattelmahlsteine" hergestellt und genutzt. Die Einführung von Sattelmahlsteinen ist eng mit dem Auftreten der Trichterbecherkultur (Funnel Beaker Pottery, TBK) (4000/3900-3300 cal. BC) verbunden. Die Trichterbecherkultur erscheint gleichzeitig im südlichen Skandinavien um 4000 cal. BC. Ackerbau wird zur selben Zeit eingeführt. Aus der sozialen, historischen und kulturellen Sichtweise hinsichtlich der Technologie ergeben sich folgende Fragestellungen: wie fand die Art und Weise der Innovation der „Sattelmahlsteine" statt? Wer war in diesem Prozess beteiligt? Studien bezüglich der Kontextzusammenhänge und der Arbeitsschritte während der Mahlsteinherstellung bringen Licht ins Dunkel. Direkt von Beginn der Trichterbecher-Sequenz erscheinen Leitformen der lokalen Trichterbechergruppen. Die Herstellung der Sattelmahlsteine zeigt eindeutig Wurzeln des späten Mesolithikums (5400-3900 cal. BC). Design und Kontexte hingegen sind neue Eigenschaften des frühen Neolithikums. Sattelmahlsteine der Trichterbecherkultur zeigen enge Parallelen zu den Technologien der Linearbandkeramik (Linear Pottery Culture, LBK) (5500-4900 cal. BC). Es wird postuliert, dass Jäger und Sammler des südlichen Skandinavien ihre Lebensweise aktiv durch eine Übernahme von Externalitäten der LBK und deren Anpassung an lokale Gegebenheiten, veränderten.

Schlüsselwörter – Mesolithikum-Neolithikum – historische Perspektive – Mahl- und Schleifsteine – Sattelmahlsteine – Techniksoziologie – kultureller Wandel – soziale Beziehungen – Gender

Abstract – This paper presents an overview of grinding tool technologies of the late Mesolithic and early Neolithic, with specific reference to eastern central Sweden (fig. 1). At the mesolithic-neolithic transition (c. 4000/3900 cal. BC), elaborately produced saddle querns were made and used in this area. The introduction of saddle querns is closely connected with the appearance of Funnel Beaker Pottery Culture (Trichterbecherkultur, TRB) (4000/3900-3300 cal. BC). TRB culture appears simultaneously within southern Scandinavia at c. 4000 cal. BC. Agriculture is introduced about the same time. From a social, cultural and historical perspective on technology follows: what shaped the innovation of saddle querns and who were engaged in the process? Studies of contexts and operational chains involved in grinding tool production shed light on these questions. Local TRB lead-artefacts appear right from the start of the funnel-beaker sequence. The making of saddle querns shows roots back into the late Mesolithic (5400-3900 cal. BC). However, design and contexts are new traits for the early Neolithic. TRB saddle querns have close parallels with the technology of Linear Pottery Culture (Linearbandkeramik, LBK) (5500-4900 cal. BC). This suggests that southern Scandinavian hunters and gatherers actively refigured their way of life by incorporating LBK externalities into local configurations.

Keywords – Mesolithic-Neolithic – historical perspective – grinding and pounding tools – saddle querns – social technology – cultural change – social relations – gender

Introduction

The presence and recognition of grinding and pounding tools of stone, or 'ground stone' artefacts, as new tools for the Neolithic have a long tradition in Scandinavian archaeology (Montelius 1885, 1906, 1919; Müller 1907; Glob 1952; Florin 1958). In contemporary archaeology, Neolithic grinding tools are similarly frequently labelled 'news', 'innovations' or even 'clues' to the introduction of agriculture and cultural change. Mesolithic grinding tools are similarly discussed as 'innovations'. Despite the long attention, grinding and pounding tools constitute a surprisingly anonymous and neglected category of archaeological artefacts within Scandinavian and North-European Stone Age archaeology (Lidström Holmberg 1998, 2004; Persson 1999, 78).

Concerning the early Neolithic LBK, grinding tools or querns are overall seen as a new tools connected with the adoption of agriculture and the Neolithic (Barker 1985; Zimmermann 1988; Hodder 1990; Gronenborn 1997, 1999; Bogucki 2000).

Detlef Gronenborn (1999, 141) particularly specifies that tools for processing domesticated plants, sickle blades and 'saddle querns' appear with the LBK, and are not found in late Mesolithic contexts in central Europe. Peter Bogucki (2000, 202) similarly states that 'ground stone' implements, such as polished axes and querns, appear in central Europe in connection with the earliest LBK farmers.

For the early Neolithic TRB of southern Scandinavia, David Liversage (1981, 142; 1982, 15) concludes that 'querns' and axe polishers represent new artefact categories introduced with the

TRB in Denmark. Saddle querns appear at the beginning of the TRB sequence and the objects have no antecedents in late Mesolithic Ertebølle culture, at least not in northwest Zealand. In view of that, it is concluded that querns give "clues as to the source of the Neolithisation of the region". Douglas T. Price and Anne Birgitte Gebauer (1992, 102, 105, 107) similarly announce that 'grinding stones' are introduced into southern Scandinavia as Neolithic 'innovations' alongside TRB pottery, polished flint axes, domesticated cereals and animals. However, they propose that cereals were of relative unimportance for several hundred years after the introduction of TRB culture, and that changes in food production occurred only gradually.

In an MA thesis on saddle querns in Ireland, Anne Connolly (1994, 30f) concludes that 'saddle querns' of various shapes appear in Ireland with the Neolithic. The early Neolithic of Ireland is, as in Great Britain, not connected with TRB culture. Similarly, Peter Woodman (2000, 246) finds a correlation between quern tools and the formation of Neolithic Ireland. No 'saddle querns' are recovered from Mesolithic sites. As a side remark, Clive Bonsall with colleagues (2002, 19, note 2) also mentions 'grinding implements' as new tools introduced into the British Isles in the early Neolithic and with TRB culture in southern Scandinavia. In contrast to Price and Gebauer, the presence of grinding tools are said to reflect an increased importance of cultivated seed crops.

A common view held by archaeologists studying LBK Europe and the TRB of Southern Scandinavia is consequently that grinding tools are innovations and used for cultivated crops. That grinding tools cannot be taken as direct evidence of agriculture is rarely discussed (but see Barker 1985). Nor is it discussed what the term 'innovation' actually means. In the area south of the Baltic Sea, grinding tools belong to a technology descending at least from Palaeolithic times onwards (De Beaune 2000, 2004). Different grinding and pounding tools are also part of the Mesolithic tool inventory as we shall see below (cf. Zvelebil 1994). In what way are Neolithic grinding tools 'innovations?

No doubt the stereotypic image of the Mesolithic has been one of nomadic hunters and gatherers, while the Neolithic traditionally has come to stand for village-based agro-pastoral farmers (Zvelebil 1998, 25). The notion of the Mesolithic and Neolithic as separate entities has created an epistemological border between the two that clearly has had consequences for archaeological interpretations (cf. Barret 1994). From a historical perspective, such a split is highly problematic. There cannot be a divide of past and present as the past always informs the here and now. Discussions of the Neolithic thus have to include the Mesolithic, rather than set it aside.

Brian Hayden (1993, 196) consequently argues that grinding tools are Mesolithic 'innovations'. He sees grinding tools as objects signalling a technological advance towards agriculture. The Norwegian archaeologist Egil Mikkelsen (1984) on similar grounds proposes that flat netherstones of sandstone and pebble tools from late Mesolithic sites in southern Norway were used to grind both axes and plants for food. The existence of grinding tools is proposed to have paved way for the Neolithisation. Marec Zvelebil (1994, 56) strongly argues for a use of plant foods in the Mesolithic (cf. Clark 1976). He states that the lack of grinding tool equipment at Mesolithic sites is due to an archaeological neglect, reinforced by the Mesolithic/Neolithic epistemological divide.

Grinding tools from both periods are apparently taken as 'innovations' and considered indicative of some sort of economic, historical, social and cultural transformation. The label 'innovation' has however had curiously little impact on the study of Mesolithic and Neolithic grinding tools. Very little systematic archaeological research has, up until recently, been conducted on these artefacts and their object situations. This neglect has its base in a range of background assumptions, rather in the archaeological material. For some reason, archaeologists fail to bear in mind that an innovation is no utilitarian thing alone, but the result of a historical and social process where social interaction and cultural decision-making lead to the shaping of a new technique (Lemmonier 1993, 4). Without the social in the 'innovation', grinding tools are set aside from social and cultural practice. Grinding tool 'innovations', like other technologies, need to be analysed with questions of cultural decision-making strategies and social interactions asked (cf. Dobres 2000; Dobres/robb 2000). From a historical perspective on the social practice of technology, one needs to examine not only what is new in an innovation, but also what past is made part of that new and how (Sahlins 1999, 2000; Lidström Holmberg 2004).

Research histories and archaeological assumptions

Certainly, the neglect of grinding tools has a lot to do with perceived low-form variability, undeveloped schemes of artefact classification, and inconsequent terminology (Kraybill 1977; Zimmermann 1988; Lidström Holmberg 1998; Hamon 2007). Characteristically, grinding tools are often classified as archaeological 'other' or 'varia'; a 'left-over category' enclosing informal artefacts with low amount of diagnostic criteria for classification. The placement of grinding tools into the 'other' category has not assisted in improving the value of grinding tool artefacts to archaeological interpretations of the past.

Classifying grinding tools as non-diagnostic 'other' and at the same time as a technological 'innovation' further encloses a true contradiction in terms. Normally, archaeologists take technological 'innovations' seriously, as it is assumed they have important things to inform us about people's social life, actions and interactions. Why have Stone Age grinding tools for so long been set aside from studies of social life and practices of culture?

The strange combination of awareness and neglect of grinding tools is in fact early established in the history of Stone Age archaeology. In Scandinavian archaeology, the study of grinding tools early emerged as two different approaches to these artefacts. In Stone Age archaeology, grinding tools become utilitarian objects connected with crop processing, while Bronze Age grinding tools are involved in symbolic models of interpretation.

In 1885, Oscar Montelius (1885, 26f) argued that quern slabs, 'steinerne handmühle', from a Neolithic megalith-burial are direct evidence of agriculture. This is supported by archaeological finds of husbandry and crop growing in Neolithic Switzerland and an ethnographic image of a woman grinding cereals. Some years later, Montelius (1906, 14f) concluded that evidence of agriculture in the Stone Age is: bones from domesticated animals, imprints of cereals in pottery, flint sickles, and different quern slabs 'handmühle' of 'oldest form'. Crop growing and animal husbandry are also suggested as evidence of social interaction with agricultural people to the south. It is not surprising that people in Stone Age Sweden kept domesticated animals and grew crops as people in Europe did this. Cereals and animals are further suggested to represent priceless gifts (cf. Jennbert 1985).

From new finds of quern slabs and large grinders in Denmark, Sophus Müller (1907, 137, 155, 148ff) also concluded that 'kvaernstene' and 'løber' belong to Early Neolithic Scandinavia. Neolithic querns are found deposited in pits at settlement sites and in burial contexts. Müller comments that it is impossible to understand why Neolithic querns have not been found earlier. It is argued that the conspicuous lack of Neolithic querns is something related with neglect and not with past reality. Querns are simply not taken into the museums, Müller says. As querns are not brought into view, archaeologists use finds of round pebble tools 'knusesten' to explain how grain was ground. The interpretation of pebble tools as querns is strongly refuted by Müller, who concludes that pebble tools have rough crush marks that do not correlate with grain grinding.

Later, Montelius (1919, 19f) stirred up the link between grinding tools and agriculture. He states that a quern slab 'handkvarn' may be no direct evidence of agriculture as 'curious finds have shown that people in different parts of Europe still today uses roasted acorns as food'. As evidence of Stone Age agriculture he now lists: cereal imprints in pottery, apples and barley grains recovered from the Neolithic site Alvastra (cf. Browall 1986; Malmer 2002), flint sickles, and 'one or another quern slab' found in such circumstance that it can be attributed to the Stone Age. Domesticated animals and cereals are still considered priceless gifts, given Europe by the Orient.

Up until Sten Florin's (1938, 1958) exposition of saddle querns from the early Neolithic sites Östra Vrå, Mogetorp and Brokvarn in eastern central Sweden, there is sparse attention to grinding tools in Swedish Stone Age archaeology.

To sum up, earlier archaeologists draw attention to grinding tools, both as settlement-finds, as pit deposits and in burial contexts. It is however apparent that grinding tools are only referred to in terms of diet. Even though querns are found in burial contexts and despite cereals being considered priceless gifts, grinding tools simply equal the ordinary.

Long before the breake-through of postprocessual archaeology, Bronze Age archaeology in contrast opened up for grinding tools as symbolical objects (Lidström Holmberg in prep.). Through the study of burial- and sacrificial rituals, Bronze Age grinding tools soon came to be discussed in terms of agricultural offerings and as symbols of life-power (Rydbeck 1912; Sverdrup 1927). Through time, such alternative models of interpretation is reinforced within Bronze Age research, shaping a

tradition of symbolic interpretations of grinding tools for this period (Fendin 2000; Kaliff 2007).

The different approaches to grinding tools have seemingly little to do with a marked difference in archaeological contexts. Grinding tools from both periods are recognised as part of special contexts, like burials and structured deposits. The difference hence outlines two separate epistemologies rather than past realities (cf. Barrett 1994; Zvelebil 1998). In the history of archaeology, utilitarian/dietary approaches to grinding tools has come to characterize Stone Age research, while symbolical approaches to grinding tools has come to characterise Bronze Age research. Stone Age grinding tools are seen as keys to subsistence, while Bronze Age grinding tools are given a wider social and symbolical object's value (cf. Renfrew 2004).

The impact of these two epistemologies is noticeable in Scandinavian and North-European Stone Age archaeology. Grinding tools in Bronze Age contexts open up questions of rituals and symbolism, while grinding tool 'innovations' in Stone Age contexts open up questions of subsistence. Socio-symbolic interpretations of grinding tools are overall refuted within Stone Age archaeology up until the breake-through of post processualism (e.g. Hodder 1990; Lidström Holmberg 1998; Pryor 1998; Wright 2000; Hamon 2004; Boyd 2005; Hernek 2005).

Underlying the neglect of Stone Age grinding tools is also the assumption that grinding tools represent the ordinary, domestic and functional work of women (Conkey/Spector 1984; Bruhn Olsen 1991; Hurcombe 1997; Lidström Holmberg 1998; 2004). Certainly, this female gendering of querns has one of its legs in the long ethnographic interest in Stone Age archaeology (cf. Montelius 1885). That grinding tools are seen as female gendered is also particularly lucid in Stone Age archaeology. Neolithic querns are overall taken to correspond to women's labour and the space and place of female gender (Van De Velde 1979, 1992; Hodder 1990; Lüning 2000b, 124f; Wright 2000). This gendering of querns reproduce even though archaeological data suggest that Neolithic querns are 'ambivalent' in terms of gender and even cross-cut gender and age categories (Lüning 2000a, 202; Kahlke 2004; Lidström Holmberg in prep.).

With grinding tools assumed domestic and ordinary, the context of recovery further tends to be downplayed in favour of the interpretation of grinding tools (Lidström Holmberg in prep.). Grinding tools carefully deposited in a pit make the pit into a settlement context as the grinding tool is taken as domestic refuse. In sharp contrast, a pit with an axe will provide the pit a ritual interpretation as the Neolithic axe is associated with the special (Andersen 1997; cf. Bradley 2005). The label ordinary domestic contribute with similar interpretations of grinding tools in burials, which either are seen as deposited as settlement refuse or at the best as markers of women's labour (Van De Velde 1979; 1992; Kossian 2005, 106).

Through the archaeological use of social theory, domestic life has further come to be reinforced as a stabile home for cultural continuity and time-reversal' practices, rather than an arena for tension and negotiation of past cultural orders (Bourdieu 1977; cf. Sahlins 2000). Archaeological uses of theories of cultural reproduction reinforce the conventional assumption of domestic (female) grinding tools as submissive to processes of cultural change (Lidström Holmberg in prep.).

It is vital to bear in mind that notions of querns as female gendered objects is based on ethnographical works without sufficient grounds to assume this for prehistorical contexts in general. Certainly, women all over the world have spent hours and hours of time grinding cereals and other substances in finer fractions. Ethnographical works show that large querns were moreover manufactured, used and maintained by women, who also quarried the raw material (Haaland 1995, 1997; Schneider 1996). A social technology of grinding tools may however enclose a multiple authorship that cross-cut gender and age categories (cf. Strathern 1988; Finley 2003). Ethnoarchaeological accounts also support other social relations of technology. Men may for example quarry the raw material and shape the quern preform, while skilled, elderly women conduct the final manufacture of a quern primarily used by young women and children (Gronenborn 1995; Baak 2003). Grinding tool-use further enclose a wide range of secondary practices, such as skin preparation, grinding of resin, plaster, ochre temper for pottery, and the polishing of axes (Lidström Holmberg 1998; Boyd 2005; Hamon 2007). With such a complex life-biography, grinding tools cannot be assumed to have a strict attribution to one gender category alone (cf. Gosden/Marshall 1999). The focus on technology should thus be on social and embodied relations of practice rather than attribution of objects to gender (Lidström Holmberg in prep.).

There is little doubt that the technological anonymity of grinding tools combined with a 'women-at-home ideology', set aside from social and ritual life, has reinforced the utilitarian tradition

of Stone Age research (Gero 1985; Bradley 2005). Taken together, this has had profound implications for how archaeologists perceive, excavate and interpret grinding tools. Held to be ordinary refuse from women's daily life it is perhaps no surprise to find that Stone Age grinding tool are overlooked during excavations and arbitrarily mentioned in archaeological publications. The above chain of assumptions further explains why the label 'innovation' has had so little impact on the archaeological study of grinding tools, especially to the cultural process of Neolithisation.

During the past two decades, technological and typological studies of grinding tool artefacts have however increased within archaeology (Hersch 1981; Zimmermann 1988; Spears 1990; Wright 1992, 1994; Lidström Holmberg 1998; 2004, Adams 1999; 2002; Pavlů 2000; Wright/Baysal 2005). Initially, experimental studies of tool-function and use were intimately connected with this renewed interest in grinding tools, especially apparent in German archaeology (Hennig 1966; Bauche 1988; Lüning/meurers-balke 1986; Meurers-Balke/Lüning 1990; Teegen/Hellmich/Schulz 1990). My own first work on grinding tools was inspired by this 'school' of archaeological experimentalists (Lidström Holmberg 1993). Functional analyses of grinding tools through microscopic use-wear studies and residue/phytolith analysis have also formed a closely interrelated and increasing subfield of research (De Beaune 2000; Risberg Et Al. 2002; Gijn/Houkes 2006; Hamon 2007; Lidström Holmberg in prep.). Analyses of raw materials and quarrying have further come to form an increasing matter of concern (Pavlů 2000; Graefe 2004; Lidström Holmberg in prep.). Grinding tools in Neolithic burial-contexts have also received new attention (Farruggia 1992; Lidström Holmberg 1998; in prep.), as has the structured deposition of grinding tools in various other contexts (Lidström Holmberg 1998; 2004; Pryor 1998; Hamon 2004).

The renewed focus on grinding tool technology has close connections to ethno-archaeological studies of grinding tool manufacture and use initiated in the 1970´s and 1980´s. Ethno-archaeology points out that grinding tool enclose a multipart operational technology with organised sequences of manufacture (Hayden/Nelson 1981; Hayden 1987; Haaland 1995; Mc Bryde 1997; Mulvaney 1998; Schön/Holter 1998). Ethno-archaeological studies from the 1990´s onwards also call attention to the role of long-distance transportation, social relations and gender to raw material quarrying, manufacture and social/symbolical use (Haaland 1997; 1999; Gronenborn 1995; Schneider 1996; Mcbryde 1997; Baak 2003). Seen from ethnography, grinding tools are objects with profound significance in the social and cultural life of people, and employed in a range of life-generating and transforming rituals (Lidström Holmberg 1998; in prep.). If grinding tools are to be valued as social and cultural objects rather than utilitarian things devoid of social life, archaeological assumptions of Stone Age grinding tools as 'ordinary' has to be stirred up.

Studies of grinding tools from different geographical areas show that Neolithic querns are elaborately manufactured objects, designed by means of flaking, pecking and smoothening techniques (Hersch 1981; Liversage 1981; Zimmermann 1988; Wright 1994; Schneider 1996; Lidström Holmberg 1998; 2004; Graefe 2004; Takaoğlu 2005; Gijn/Houkes 2006; Hamon 2007). The social process of innovation resulting in such elaborate technology urges to be more deeply examined. Needed are not only systematic and methodological studies of Mesolithic and Neolithic grinding and pounding tools, but the insight that grinding tools inform on matters of social relations and cultural formation (Lemmonier 1993). A social archaeology of Mesolithic and Neolithic grinding tool technologies is therefore requested.

A social archaeology of processes of innovation and transformation further requires a dynamic, historical and hybrid perspective on culture (Sahlins 1999, 2000). People both can and do change their culture, simply speaking because that is all they ever do (Sahlins 2000, 12, 287). Culture is a hybrid course of action, it trespasses borders and is in the continuous process of becoming. Therefore cultures, like the TRB or the LBK, cannot be seen as bounded entities. Sometimes cultural change is rapid, sometimes very slow yet always in motion. The question is thus not what culture is, but how culture is made and what culture does. There is however the possibility that a culture of things will never again be the same (ibid, 290). In this respect, the introduction of saddle querns in the Early Neolithic TRB can be taken as solid sign.

Terminology

Noticeably, the term 'ground stone' commonly used in archaeology is not a satisfactory term to categorize elaborately flaked and pecked grinding tools. The term is however still commonly used, especially in American and East Mediterranean archaeology (Wright 1992; 2000;

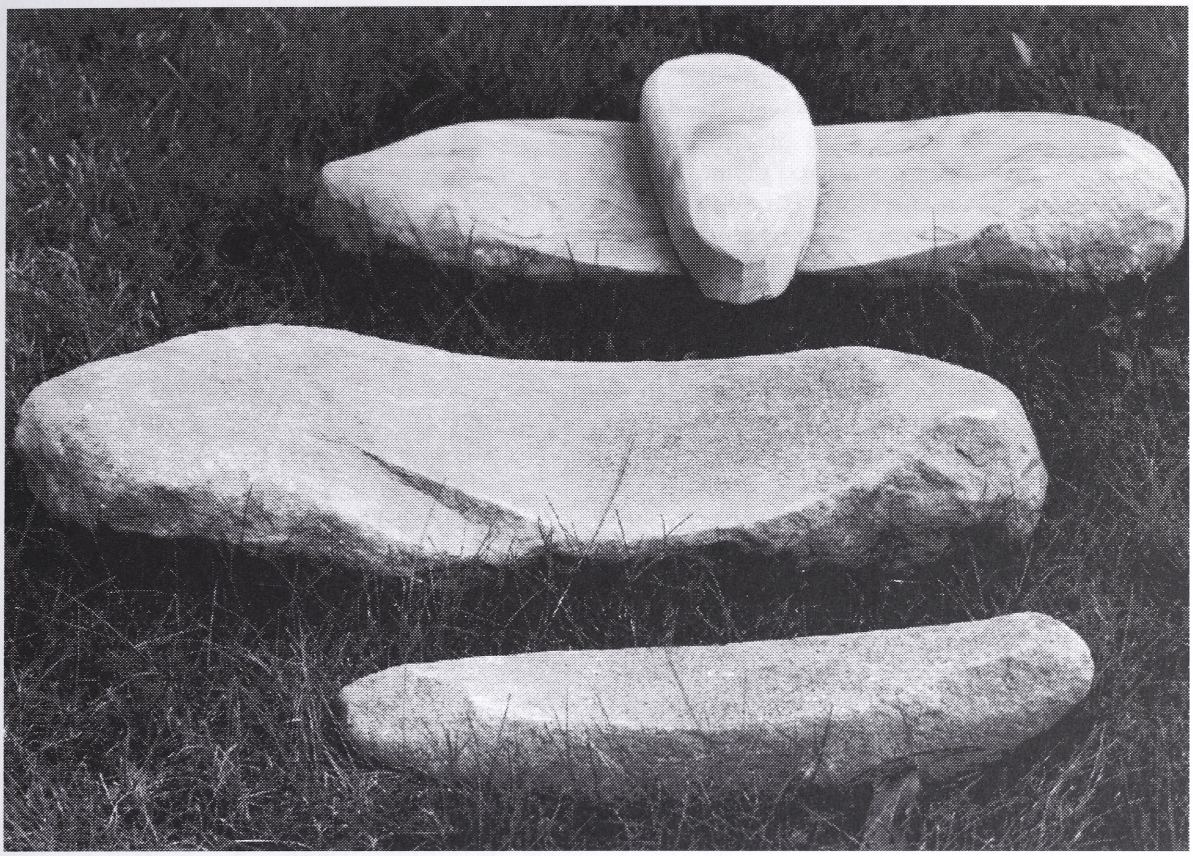

Fig. 1 An elaborately produced, large-sized Neolithic saddle quern slab detached from its loaf-shaped grinder. Both tool parts are made of coarse, arcosic sandstone. Note the beak-shaped ends of the grinder. A replicated copy used for grinding experiments shows how the quern was found during excavation.

Adams 2002; Boyd 2005). In the cultural context of North-Europe and Scandinavia, the term 'ground stone' is extra problematic as it has come to refer to polished axes and other 'ground' stone tools rather than tools for grinding. I will not use the term ground stone in the following text. Instead, I will talk about grinding and pounding tools as a general category of tools used for the processing of different substances into finer fractions, and querns as a particular grinding tool-set originally designed for the processing of cereals and other plants. The recently launched umbrella-term of macro-lithic artefacts is well-suited to enclose both grinding tools and querns (Hamon 2007, 1; cf. Spears 1990, 495; macrocrystalline artefacts). From Adams (2002), I have borrowed the term netherstone to specifically discuss flat stone slabs of various shapes displaying a multiple use-wear with marks from polishing, grinding, pitting, pounding and/or crushing. A grinding tool not possible to classify as a quern but with grinding/polishing wear is a netherstone. Unmodified pebble grinders can be used with netherstones but not with saddle quern slabs.

A quern-set consist of two tool-parts manufactured to fit together. The upper part of a quern set will here be called grinder (in Swedish: löpare, cf. läufer, molette, handstone, mano), while the lower part of the quern is called quern slab (in Swedish: underliggare, cf. unterlieger, meule, grinding slab, metate). The word quern or quern-set is used when discussing the two parts joined as a complete tool (in Swedish: malsten, cf. mahl/mühlstein, moulin, grinding stone, milling stone).

From 'loafs of bread' to manufactured TRB saddle querns

In the 1930´s, Swedish archaeologists harshly argued over the Mesolithic-neolithic transition and the introduction of agriculture in eastern, central Sweden, a debate of which some text lines were luckily never taken into the printers. At the centre of debate were a number of Neolithic sites newly excavated by Axel Bagge and Sten Florin (Florin

1938; 1958). The sites yielded finds of funnel beaker pottery, thin-butted axes of flint and greenstone and artefacts looking like 'poorly fermented loafs of bread'. The debate continued – were the 'brotförmige' objects polishing tools or agricultural tools for the grinding of cereals and plants. Based on ethnographic parallels, Florin (1958) proposed that the artefacts were quern slabs used for cereal processing. Left in the archaeological oblivion for over half a decade, recent technological analyses of grinding and pounding tool assemblages from Mesolithic and Neolithic sites in the area positively confirm that the 'loafs of bread' are elaborately produced grinders of saddle querns (**fig. 1**) (Lidström Holmberg 1993, 1998).

The introduction of saddle querns of this specific design is closely connected with the appearance of a material culture complex since the 1930/40´s labelled Funnel Beaker Pottery (Trichterbecher, TRB) Culture (Becker 1947). The northernmost TRB area however was for long unknown. With the excavations of Bagge and Florin it became apparent that the Neolithic of eastern, central Sweden had to be set in connection with agriculture and the TRB complex further south (Florin 1958; Becker 1947, 185). Florin claimed that agriculture was introduced into the area by local hunter/gatherers. Bagge on the other hand argued that agriculture was introduced with immigrants moving in from the south. The mesolithic-neolithic debate has been a major matter of concern in Stone Age archaeology for about 150 years (Fischer/Kristiansen 2002; Knutsson 2004).

Probably initiated in Poland at c. 4200 cal. BC, TRB culture appears simultaneously within southern Scandinavia up until eastern central Sweden at c. 4000 cal. BC (**fig. 2**) (Midgley 1992; Persson 1999; Hallgren/Possnert 1997). Datings of domesticated animals, charred cereal grains and saddle querns from TRB sites shows that agriculture is introduced about the same time (Becker 1947; Hallgren Et Al. 1997; Persson 1999; Price 2000; Rowley-Conwy 2004).

As lead-artefacts of TRB culture archaeologists commonly include funnel beaker pottery, collared flasks, clay-discs, point/thin-butted axes, and polygonal battle axes (Midgley 1992). Large querns of stone connected with the processing of agricultural products were early also recognised as part of the tool inventory, but not as lead-artefact. All TRB lead-artefacts including large saddle querns are recovered from the early Neolithic of the northernmost TRB (Hallgren et al. 1997; Lidström Holmberg 1998; Persson 1999; Segerberg 1999; Malmer 2002).

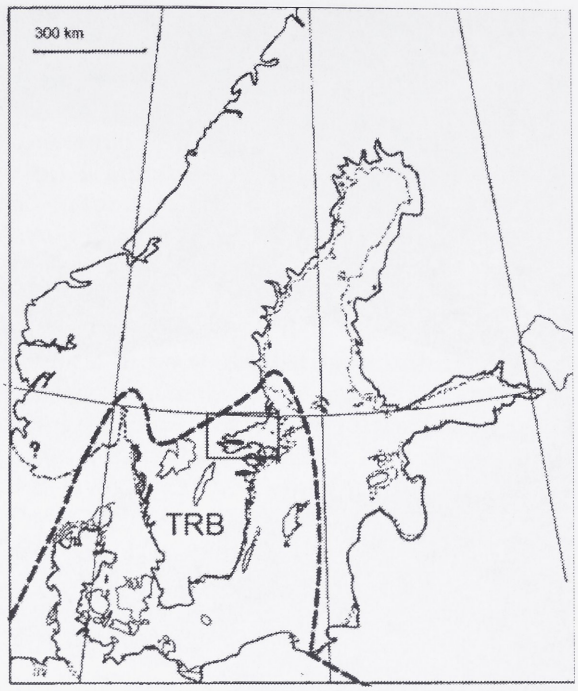

Fig. 2 The northern area and border of TRB culture with eastern, central Sweden marked and the early Neolithic shore-line outlined (modified after Hallgren 2003).

In discussions of TRB and agriculture, querns have not been taken seriously into debate. While referred to as innovations, there is seemingly a widespread supposition that as grinding tools can be used for many things, they cannot be support for agriculture. A wish to emphasise the northern TRB as hunter/gatherers rather than agriculturalists often reinforces this premise. While it is accurate to argue that grinding tools can be used for a wide range of practices, design, size, use-wear traces and residues on saddle querns, all speak in favour of a strong link between large querns and cultivated crops (Hamon 2007; Lidström Holmberg in prep.). Flat to saddle-shaped saddle querns are currently known from many, but not all, early Neolithic TRB sites in eastern central Sweden (Lidström Holmberg 1993; 1998; 2004; in prep). Some sites include only single finds of saddle quern, while other sites contain over fifty querns and more. The presence of large, manufactured saddle querns inform on the introduction of cultivated crops, new practices and worlds of thought.

TRB culture within this area encompasses two types of sites. Inland sites located at some distance away from the sea include, apart from wild game, remains of cattle, sheep/goat and cultigens such as barley, wheat, beans and vine-grapes. Coastal

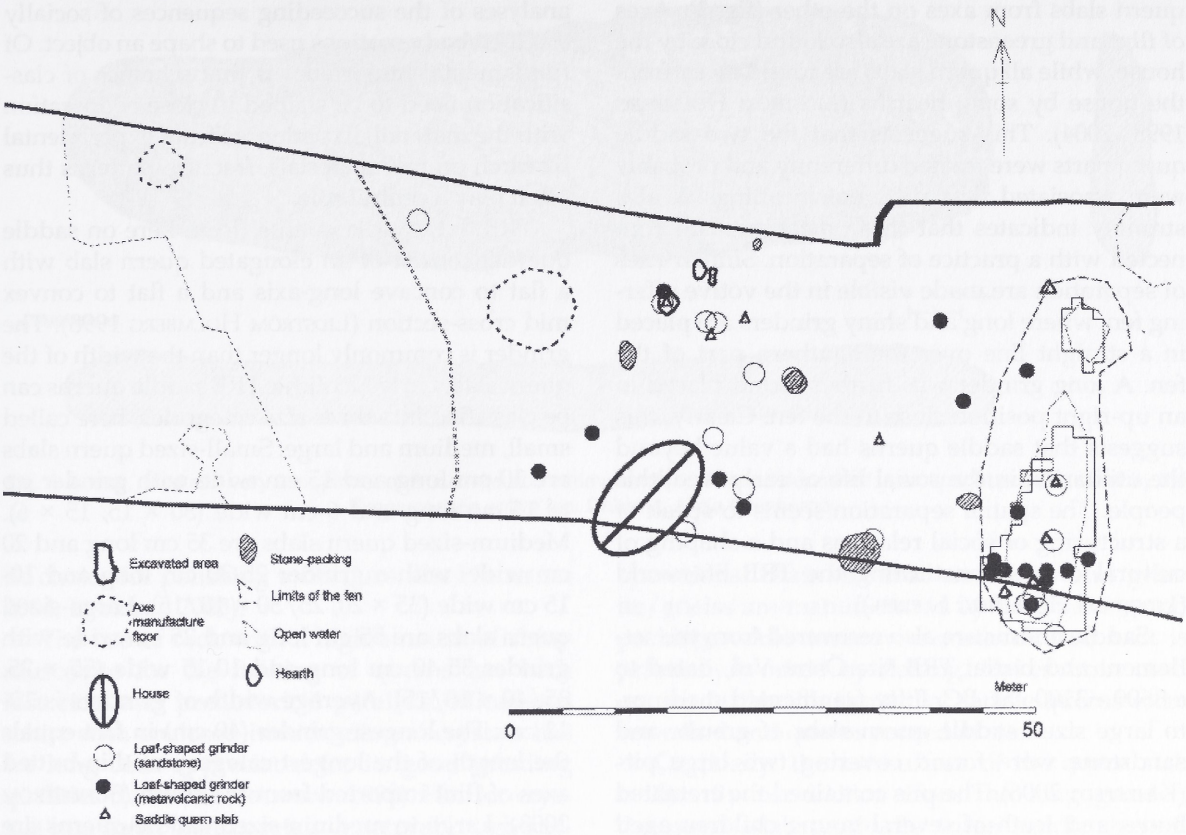

Fig. 3 Spatial separation of saddle quern slabs from grinders at the TRB site Skogsmossen. Note the structured deposition of grinders in a straight line across the southern part of the fen.

sites located close by the sea, or immediately on the sea-shore, are dominated by wild game, fish and seal (Welinder 1998).

At inland TRB sites with more than one saddle quern, agriculture is often indicated by the presence of charred cereal grains, imprints of cereals in pottery and bones of domesticated animals (Florin 1958; Hallgren et al. 1997; Welinder 1998; Persson 1999, 94f; Rowley-Conwy 2004). The location away from the sea-shore can be taken as further indication for crop growing (Persson 1999, 108). Bones from wild game, seal, fish, and hazelnuts on these sites show that fishing, hunting and gathering was a component alongside agriculture (Welinder 1982; Segerberg 1999). Coastal TRB sites commonly include only single finds of saddle querns. Saddle querns found on early TRB coastal sites are further small-sized saddle querns, which are possible to move around. Finds of saddle querns and other TRB artefacts on both inland and coastal sites show that both site-types are connected with TRB culture, and that people may have travelled between these sites on a seasonal basis.

Saddle querns encompass a complex life-biography and are recovered from a wide range of contexts in the early Neolithic TRB. The two parts of the saddle querns are deliberately separated, found deposited in pits, placed in upright or inverted positions, deposited in burials and water (Lidström Holmberg in prep.) The earliest find of a single saddle quern slab in a pit-hearth comes from a coastal site dated to the Mesolithic-Neolithic transition c. 4000 cal. BC (Hallgren 1996). Over fifty saddle quern slabs and loaf-shaped grinders of sandstone and shiny muscovite-rich metavolcanic rock are recovered from inland settlement site Skogsmossen, dated to c. 3900-3300 cal. BC. It is considered the best dated TRB site in eastern, central Sweden with a find material that encloses both domestic animal bone and charred grains of barley and wheat (Hallgren/Possnert 1997; Persson 1999, 107). The site contained the remains of a house and a votive offering fen located some twenty-five meters away (Hallgren et al. 1997, 2000). Within the dwelling space it is possible to visualise a rather distinct spatial separation of quern slabs from grinders on one hand, and

quern slabs from axes on the other (**fig. 3**). Axes of flint and greenstone are also found close by the house, while all quern slabs are found away from the house by some hearths (Lidström Holmberg 1998, 2004). This suggests that the two saddle quern parts were treated differently and probably were associated with different meanings. It also strongly indicates that these meanings are connected with a practice of separation. Similar rites of separation are made visible in the votive offering fen, where long and shiny grinders are placed in a straight line over the southern part of the fen. A long grinder was further found placed in an up-right position close to the fen. Clearly, this suggests that saddle querns had a value beyond the utilitarian in the social life of early Neolithic people. The spatial separation seems to speak of a structuring of social relations and a shaping of cultural orders constituting the TRB life-world (Lidström Holmberg in prep.).

Saddle querns are also recovered from the settlement and burial TRB site Östra Vrå, dated to c 3500 - 3100 cal. BC. Fifty fragmented medium- to large sized saddle quern slabs of granite and sandstone were found covering two large pits (Kihlstedt 2006). The pits contained the cremated bones and teeth of several young children aged between 1-7 years old, deposited in concentrations at the bottom of the two pits. One pit contained carbonised wheat grain. The saddle querns, some newly manufactured, must have been brought to this place of burial. The amount of quern slabs deposited shows that the burial ceremony must have included the participation of a large collective. It further shows that also large querns were transported if thought necessary. The quern slabs show traces of deliberate fragmentation, a meaning-laden practice associated with saddle querns also at other TRB sites (Lidström Holmberg 1998, in prep.). Certainly, TRB saddle querns were used in a social and culturally informative way. They were also elaborately produced.

The operational chain of TRB saddle querns

A mix of modified design theory and chaîne opératoire is useful in seeking out sequences of saddle quern manufacture. The idea that tools are produced to solve a practical problem is central to design theory (Horsfall 1987; Adams 2002). Systematic studies of raw materials, fracture-patterns and debris from manufacture play a central role in studies of the operational chain (Dobres 2000; Apel 2001). The emphasis is on in-depth-analyses of the succeeding sequences of socially ascribed body motions used to shape an object. Of fundamental importance is that schemes of classification need to be shaped in close cooperation with the material. Experiences from experimental research on raw materials, fracture-patterns thus often play a central role.

TRB flat/saddle querns (from here on saddle querns) consist of an elongated quern slab with a flat to concave long-axis and a flat to convex mid cross-section (Lidström Holmberg 1998). The grinder is commonly longer than the width of the quern slab. Early Neolithic TRB saddle querns can be classified into three size categories, here called small, medium and large. Small-sized quern slabs are 30 cm long and 15 cm wide with grinder up to 15 cm long and 6 cm wide (30 × 15, 15 × 6). Medium-sized quern slabs are 35 cm long and 20 cm wide, with a grinder 25-30 cm long and 10-15 cm wide (35 × 20, 25/30 × 10/15). Large-sized quern slabs are 55 cm long and 25 cm wide with grinder 35-40 cm long and 10-15 wide (55 × 25, 35/40 × 10/15). Average width of grinders is 10-12 cm. The longest grinder (40 cm) in fact equals the length of the longest category of thin-butted axes of flint imported from the south (Sundström 2003). Large to medium-sized saddle querns are often but not exclusively found at inland TRB sites, which also include cultivated cereals. Small-sized querns are more often, but not exclusively found at coastal sites.

The beginning of a saddle quern life starts when a person or several persons decide to make a tool to be used for a specific purpose (Hayden 1987, 188, 228). From a social and cultural idea of a desired form, function, aesthetics, the technician starts off by selecting an acceptable or ideal raw material. Raw materials chosen for TRB saddle quern manufacture can be grouped into four major categories; heterogeneous arcosic sandstones, muscovite-rich metavolcanic rock with enclosed crystals of quartz (cf. micaceous schist), gneiss/granites and greenstones. Raw materials were generally quarried locally or at a walking distance away. Saddle querns of coarse, arcosic sandstone dominate TRB sites in the northern and eastern part of the study area, whereas mica-rich metavolcanic rock dominates in the western area. Saddle querns of gneiss/granite are more common in areas to the south. Neolithic quern makers/users further chose coarse-grained raw materials for saddle querns, but fine- to medium grained, hard and homogenous sandstone for polishing tools and whetstones. In the Mesolithic of this area, fine-grained hard sandstone is a characteris-

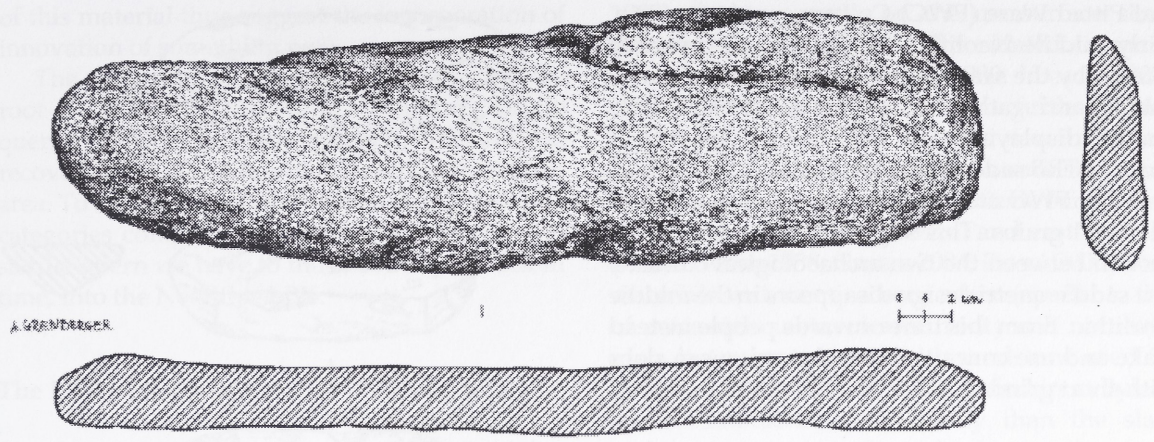

Fig. 4 A long, used and very thin grinder of muscovite-rich metavolcanic rock found deposited in an upright position close by the Skogsmossen votive fen. Drawing: Alicja Grenberger.

tic choice for polishing tools (Lidström Holmberg 2004; Lindgren 2003).

The use of rock with a high amount of shiny muscovite for the making of querns has both historical and prehistorical parallels. Micaceous schist with enclosed harder mineral crystals has for long been appreciated for its good grinding qualities (Lidström Holmberg 1998). Harder crystals in a softer matrix retain a natural rough surface during the grinding. This means that the surface does not have to be pecked as do quern slabs of sandstone. However, the efficiency of the material is one thing, the aesthetics and shiny lustre another variable for choice. As water depositions, long and shiny grinders may well have given the rituals carried out at Skogsmossen an added effect (**fig. 4**).

Flaking, pecking and smoothening techniques are succeeding stages in the operational chain (cf. Lidström Holmberg 2004). Both quern slab and grinder are elaborately produced objects, manufactured to fit together as one tool-set. The initial preform is formed by knapping techniques. Flakes and preforms recovered from some TRB sites show that saddle querns and polishing tools were manufactured on-site (**fig. 5**). The grinder is thereafter carefully pecked into a comfortable loaf-shape, as are the sides of the quern slab. Similar pecking techniques were enclosed in the operational chain of late Mesolithic and early Neolithic greenstone axes. The whole surface of the quern slab is also pecked to a rough texture. As demonstrated by experiments, a rough surface is compulsory for a quern to be an efficient working tool (Lidström Holmberg 1993, 1998). The use-surface of saddle querns made of metavolcanic rock shows much less traces of pecking. Other differences in the operational chain are that sandstone and granite/gneiss are manufactured by both flaking and pecking, while muscovite metavolcanic rock is primarily worked by flaking. Flakes from used querns further illustrate that saddle querns were reworked and querns reused at sites.

Originally, the use-surface of the quern slab is flat. By use-friction from the long grinder, the quern slab gradually turns saddle-shaped. Similar transformation is visible on the grinders, which get characteristic and easily identified beak-shaped ends by hard stone-to-stone contact with the slab's margins. The friction further leaves clearly visible smoothly polished margins on the long sides of the slab, which facilitate the classification of saddle quern slabs. The elaborate design, large size, use-wear traits and micro silica residues recovered on the tool surface show that TRB saddle querns were originally manufactured and used for the processing of cereals (Lidström Holmberg in prep; cf. Hamon 2007). Saddle querns were secondarily also used for a range of other functions. Quern parts reused for the polishing of stone tools get a concave cross-section with smooth polish and uni-directional striations.

Saddle querns of the type described above were seemingly not in use in the early Neolithic of Scania, nor are such tool-design represented at the Swedish west-coast (Lidström Holmberg in prep.). Instead, concave or bowl-shaped quern slabs with short pebble grinders are recovered in these regions (Larsson 1984). This suggests a regional variation in grinding tool technology within the wider TRB area, which most probably has a history in the geographical variationsof the Mesolithic (Lidström Holmberg in prep.) After c. 3300 cal. BC, TRB material culture go out of sight

and Pitted Ware (PWC) Culture come into view. Early middle Neolithic PWC sites are generally located by the sea and dominated by wild game, fishing and gathering (Welinder 1998). Saddle querns displaying the very same operational chain as TRB saddle querns occur in low numbers at earlier PWC sites, as do sparse finds of cultivated cereal grains. This suggests a very close connection between the two archaeological cultures. The saddle quern design disappears in the middle Neolithic. From this time onwards people instead make and use concave, bowl-shaped quern slabs with short grinders.

The social and historical process of innovation

From a historical and agency perspective on technology and culture follows the question what shaped the introduction of large and elaborate saddle querns. Who may have been engaged in the social process, and what transformations emerged with this new technique (Lemmonier 1993; Zvelebil 1998; Dobres/Robb 2000; Hallgren 2003; Lidström Holmberg 2004; Knutsson 2004)?

With Linear Pottery Culture and late Mesolithic society as historical substrates to the becoming of the TRB, the role of social technology and history to cultural change can be discussed.

To be noted from the above is a regional variation in raw material choice and differences in schemes of production existed from the onset of the early Neolithic TRB. This suggests that the making of TRB saddle querns was guided by past Mesolithic traditions of social technology. The use of sandstone shows one connection to the late Mesolithic, another is the technique of pecking (see below). Most lead-artefacts of the northernmost TRB in fact occur as local designs of manufacture from the onset of the TRB sequence. The operational chain of thin-butted axes of greenstone and tools of quartz shows continuity into the late Mesolithic (Callahan 1987; Apel/Sundström 1998). Local TRB pottery designs also appear right from the start of the local funnel-beaker sequence (Hallgren 2000a, 2003, 30). The rapid appearance of TRB material culture, with locally produced saddle querns and novel TRB objects in local designs, suggests that TRB culture was initiated by local hunter/gatherers. The northernmost TRB thus seem to enclose local hunters and gatherers incorporating a new object world while at the same time innovating and transforming this new into something of their own (cf. Sahlins 1999, 411).

What then can be considered entirely new?

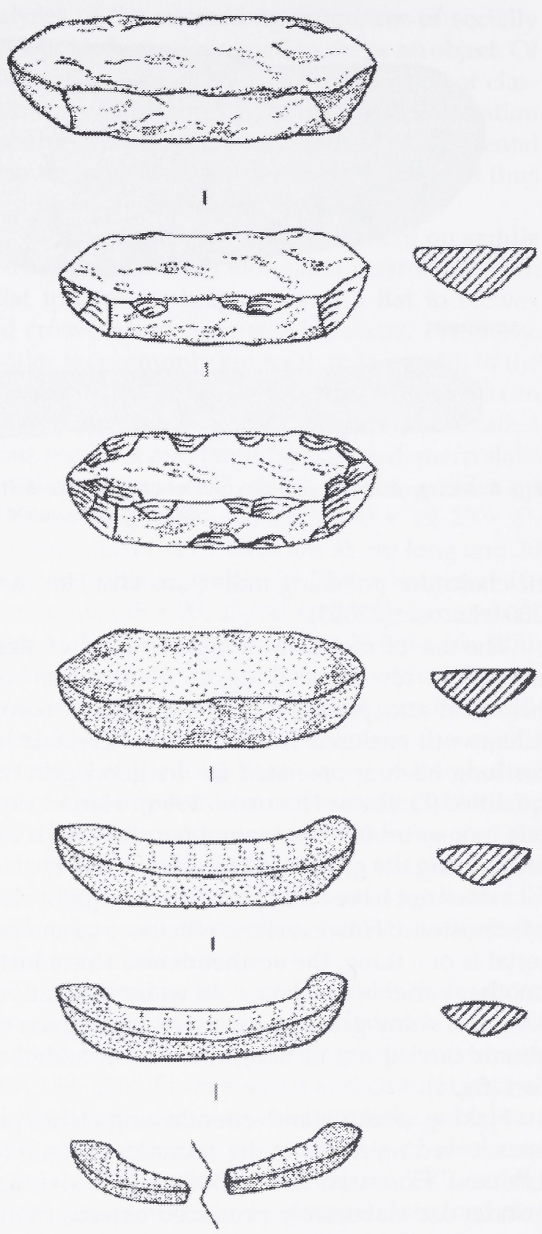

Fig. 5 The operational chain connected with a loaf-shaped grinder of sandstone. Grinders transform through use-life and often break when c. 4 cm thick. Large grinders have a weight of c. 4 kg, while large quern slabs weigh 20 kg or more. Drawing: Alicja Grenberger.

Sheep and goats, barley and wheat are not native in the flora and fauna of southern Scandinavia and must have been brought into these areas (Persson 1999, 116). Thin-butted axes of flint were also incorporated as ready-made objects imported from the south (Sundström 2003). What is new in the saddle quern? From a raw material point of view it can be noted that there is little evidence of a use of muscovite-rich materials in the stone tool technology of the late Mesolithic. TRB saddle querns

of this material thus suggest the incorporation of innovation of something new.

The design of saddle querns further has no root in the local Mesolithic tradition. Saddle querns of the largest size category are also not recovered within the wider Scandinavian TRB area. To find saddle querns with a design and size categories comparable to the northernmost TRB saddle quern we have to move south and back in time, into the Neolithic LBK.

The LBK past substrate (5500-4900 cal. BC)

Roughly about the same time as late Mesolithic hunter/gatherers in eastern central Sweden and late Mesolithic Ertebølle culture emerged along the Baltic coast in southern Scandinavia, Linear Pottery Culture (LBK) was established in central Europe. The LBK appears at c. 5500 cal. BC, a thousand years before the TRB emerges in southern Scandinavia (Bogucki/Grygiel 1993; Gronenborn 1999). Social interactions between Ertebølle groups and the LBK are documented archaeologically, but present an image of material complexity and regional variation (Fischer 1982; Jennbert 1985; Klassen 2002). While late Mesolithic hunter-gatherers did not produce large quern tools, the LBK most certainly did.

Long, loaf-shaped grinders and flat/saddle-shaped quern slabs are part of the LBK grinding and pounding tool inventory from the oldest LBK (Farruggia 1992, 104; Gronenborn 1997). Whereas the earliest LBK lithic technology (blades and microliths) and net-works for raw material distribution derive from late Mesolithic hunter-gatherer traditions, the saddle quern is suggested to come with in moving agriculturalists from the south-east (Gronenborn 1999, 168f). No studies on this topic has however been conducted.

Within the Neolithic LBK, querns are found as structured deposits and discard at settlements, burials, and enclosures. LBK querns are however most strongly connected with the long house, its hearths, lateral ditches and pits (Boelicke 1988; Hodder 1990; Gronenborn 1997; Lüning 2000 B; Pavlů 2000; Hamon 2004). Use-wear analysis of grinding tools from late LBK sites in the western part of the LBK area shows a strong correlation of large querns to the grinding of cereals (Hamon 2007, this volume).

Like TRB querns, LBK querns are elaborately produced objects. Flaking and pecking are common techniques of manufacture of both quern slab and grinder (Farruggia 1973, Zimmermann 1988). Pecking marks on the use-surface show that the quern was carefully curated to maintain a rough surface (Pavlů 2000; Hamon 2007). Like TRB querns, LBK querns are further manufactured from carefully selected raw materials. Coarse and often heterogeneous sandstone and granites are common, with sandstone being a central raw material in the central and eastern areas (Zimmermann 1988; Graefe 2004; Pavlů 2000). Raw materials such as micaceous schist (similar to that of mica-rich metavulcanic rock) are not common, but were together with sandstone used for querns at Bylany (Pavlů 2000). Grinders at Bylany were manufactured differently than the slabs and further seem to have been moved around the site separated from the quern slabs (ibid, 85, 280; cf. Skogsmossen). Raw materials for quern production were quarried locally or at distance (2-5 km) away from the living site (Kulczycka-Leciejewiczowa 1997, 222; Pavlů 2000; Graefe 2004). Grinders seem to have been of special concern. Flakes from quern tool production show that querns were manufactured on-site. Fragments with used surfaces also show that querns were reworked on-site (Farruggia 1973, 130).

From the LBK site Langweiler 8 in Germany, Andreas Zimmermann (1988, 723-787) has produced a classification of Neolithic LBK grinding tools. Three morphological designs of querns are pointed out, labelled form 1, 2 and 3 (**fig. 6**). The classification is based on the curb of the mid cross-section and long-axis of quern slabs and the existence of beak-shaped ends on long grinders. Form 1 represents what I refer to as a saddle quern (Lidström Holmberg 1998). Like TRB saddle querns, LBK querns of form 1 consist of a quern slab with a concave long-axis and a flat to convex mid cross-section. The convex curb of the mid cross-section is caused by friction from a grinder longer than the width of the quern slab. The upper back of the grinder is often pecked into a loaf-shape, which gives it a comfortable grip (Pavlů 2000, 76). A manufactured quern slab of form 1 has originally a flat upper surface, which gradually turns saddle-shaped during use-life. Similar transformation by friction is visible on the long grinder, which get a curbed long-axis and characteristic beak-shaped ends. As discussed, loaf-shaped grinders with more or less beak-shaped ends are characteristic for the northernmost TRB area (cf. Lidström Holmberg 1993, 1998).

Form 2 consists of a flat quern slab maintained flat as the grinder is as long as the quern slab is wide. A quern slab of form 2 has the same shape as a slightly used quern slab of form 1. The same

goes for modestly used grinders, which initially are flat and get beak-shaped ends only through use. This makes form 1 and 2 difficult to separate, which is why I do not refer to form 2 as a separate category of classification. Following Adams (1999), I refer to flat/saddle querns as one category labelled saddle quern. Form 3 in the schema of Zimmermann represents what I call a bowl-shaped quern slab (**fig. 6**). Due to friction from a grinder shorter than the width of the quern slab both cross-section and long-axis are concave in outline.

A regional variation in quern tool technology has also been proposed for the LBK complex (Zimmermann 1988, 726; Pavlů this volume). The form 1 saddle quern is the dominant tool design within the central and eastern LBK area, with regional and chronological variation in tool size (Hennig 1966; Zimmermann 1988; Farruggia 1992; Graefe 2004, Pavlů 2000). Form 1 saddle querns are also recovered from Early Neolithic TRB sites in Poland, which further is the area where TRB culture is thought to have initiated (Zimmermann 1988, 726; Grygiel/Bogucki 1997; Midgley 1992).

Form 2 and 3 is proposed a more northern orientation within the LBK area, including the areas north of the LBK and southern Scandinavia (Zimmermann 1988, 726). Flat to bowl-shaped querns with smaller grinders are common within the north-west LBK area (Hamon 2007; Pavlů this volume). Bowl-shaped quern slabs are likewise found in north-west Europe later in the Neolithic, c 3500 cal. BC (Gijn/Houkes 2006, 179). With the introduction of TRB culture, hunter/gatherers along the Baltic coast of northern Germany also made use of bowl-shaped querns (Hertz et al. 2002, 328, see below). Bowl-shaped querns are also part of the early Neolithic TRB in Scania (Larsson 1984). The suggestion of a northern orientation of bowl-shaped querns at large seems applicable. It does however not come true for the northernmost early Neolithic TRB area. Here, the large flat/saddle quern analogous to form 1/2 is the leading quern tool design from the earliest TRB (Lidström Holmberg 1998; in prep.).

Studies of LBK querns according to size thus point towards a cultural and geographical as well as temporal variation in technology (Hennig 1966; Farruggia 1992; Pavlů 2000; Hamon 2007). This speaks in favour of a social transmission of quern tool technology over generations, creating geographical traditions of social technology.

Three size categories of querns are noted for the north-western LBK area (Hamon 2007, 3, this volume). Longer grinders and quern slabs seem

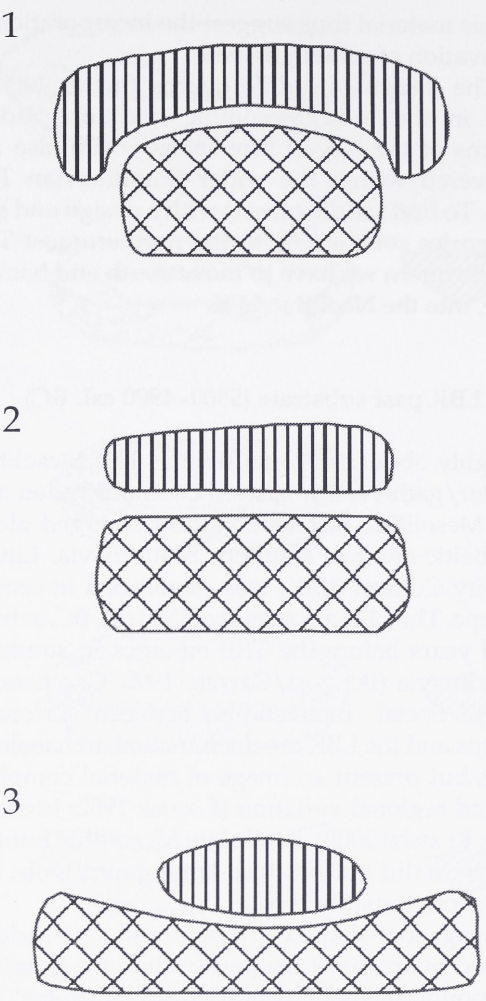

Fig. 6 Andreas Zimmermann's classification of LBK querns forms 1, 2 and 3. Note the convex mid-section of quern slab and beak-shaped grinder ends of form 1 (modified after Zimmermann 1988, 725).

to have been preferred in the central LBK area (Hennig 1966, 73, Farruggia 1992; Graefe 2004, 49f). A decrease in grinder size from older LBK to the post-LBK (Hinkelstein) phase has however also been noted (Farruggia 1992, 103ff, 107). This includes a shift from long and narrow saddle querns with long and loaf-shaped hand stones in the earlier parts of the LBK, to shorter and wider quern slabs with lighter and shorter grinders to the end of the LBK. In the eastern LBK we seem to find the longest saddle quern slabs and grinders of the LBK (Pavlů 2000, this volume).

To compare LBK size-dimensions with TRB saddle querns, it can be noted that the size of TRB quern categories to some extent are similar to those of the western LBK area. The largest saddle quern category of the TRB is however far larger than the largest quern size of the western LBK. TRB grind-

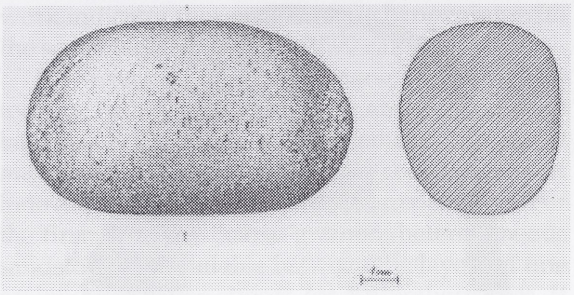

Fig. 7 A pebble grinder with mixed use-wear marks of pecking, crushing and grinding. Pebble grinders come in different size categories but rarely exceed a weight of 500 gram. Drawing: Alicja Grenberger.

ers are also overall much longer. Grinders and quern slabs of the central LBK area show greater similarity in size with the TRB. The largest saddle quern size, as represented at Skogsmossen but also other TRB sites, is however most comparable with the even larger saddle querns in the eastern LBK area.

The similarity in quern tool technology indicates that TRB saddle querns are agricultural objects. A historical connection between the northern TRB area and the LBK area is further made visible. This connection cannot however be understood without an insight into the roughly contemporary late Mesolithic substrate, and the interactions between late Mesolithic Ertebølle groups in southern Scandinvia and farming cultures to the south.

The Mesolithic substrate (5400-4000 cal. BC)

Mesolithic Ertebølle groups located along the southern shores of the Baltic Sea in southern Scandinavia were most likely well aware of the agricultural life-style of the LBK. They lived only a short boating-distance (100 km) over the Baltic Sea from by the northern fringe of the LBK (Grygiel/bogucki 1997; Klassen 2002). The water routes most certainly facilitated social interaction between hunter/gatherers and the LBK (Fischer 1982; Jennbert 1984; Gronenborn 1999; Malmer 2002). Domesticated animal bones from late Mesolithic Ertebølle/Ellerbek sites located along the Baltic coast of southern Scandinavia, and the occasional imprints of cereal grains in pottery interpreted as Ertebølle pottery, suggests that agriculture in some shape was incorporated prior to the TRB (Jennbert 1984; Persson 1999). Yet, Ertebølle hunter/gatherers did on the whole not make and use saddle querns. To my knowledge there are no documented finds of saddle querns from the late Mesolithic Ertebølle (Lidström Holmberg in prep.).

A netherstone from the late Mesolithic site Tågerup in Scania has recently been suggested as a saddle quern (Karsten/Knarrström 2003, 178). The eco-material from the site indicates a rich menu of fish, meat and vegetables. The netherstone is thus taken as evidence of a late Mesolithic advance in food production (Mikkelsen 1984; Hayden 1993; Zvelebil 1994). Despite its 'saddle-shaped appearance' this object shows little technological similarity with saddle querns. It is most probably a polishing tool, perhaps also used for wild seeds (Lidström Holmberg in prep.)

The lack of saddle querns however does not mean that Mesolithic grinding and pounding tools does not exist. Certainly, Mesolithic grinding tools are underrepresented in the archaeological record (Zvelebil 1994; Lidström Holmberg 2004). Palaeobotanical studies support plant food consumption in the late Mesolithic (Kubiak-Martens 1999). Grinding and pounding tools have further been used by Mesolithic hunter/gatherers to process ochre and other substances (Sulgostowska 1998).

Four general categories of grinding and pounding tools can be identified from the late Mesolithic of Scandinavia; 1) small, non-modified cobble netherstones, 2) flat and thin irregular netherstones, 3) shallow concave or bowl-shaped netherstones/quern slabs, and 4) hand-sized pebble tools/grinders (Lidström Holmberg 2004).

Cobble netherstones are natural, water rolled stones about 10 cm wide and 15 cm long. Use-wear traits suggest a multiple grinding/crushing use. Microsilica analyses of residues recovered from cobble netherstones suggest a possible function of this grinding tool for the grinding of minerals or shells from shellfish (Risberg et al. 2002, 20) or perhaps edible algae (Persson 1999, 63).

Pebble tools/grinders are found throughout the Mesolithic and Neolithic (Mikkelsen 1984; Lidström Holmberg 2004; Hernek 2005) (**fig. 7**). As indicated by contexts and a mixed use-wear marks of pecking, crushing and grinding found on these artefacts, they were used for a wide variety of practices, including stone tool production. In Danish and Norwegian Stone Age archaeology, pebble tools have however since long been discussed as cereal grinders. Connected with flat netherstones they have further been used as evidence for a late Mesolithic advance in plant processing technique, paving way for the Neolithisation (Müller 1907; Mikkelsen 1984; cf.

Hayden 1993). Pebble tools however occur at sites dated well before late Mesolithic, which suggests that pebble tools cannot be approached in terms of a pre-adaptation of agriculture (Hernek 2005; cf. De Beaune 2000). With its mixed use-wear, there is so far no unswerving support for pebble tools as cereal grinders.

Flat and thin netherstones of various shapes are found at late Mesolithic sites in southern Scandinavia, as well as in Mesolithic Finland (Andersen 1975; Mikkelsen 1984; Eriksson 2007; Lindgren 2004). The preferred raw material is fine-grained, homogenous sandstone or quartzite. In eastern central Sweden sandstone is available as boulders and in bedrock. Sandstone must have been quarried and brought to the sites. Netherstones sometimes show traces of manufacture by flaking. Flakes from production have however not been identified at Mesolithic sites and the quarries are unknown. Size and shape of flat netherstones are variable, from irregular and rounded to rectangular and with weights from under 1000 gram for fragments up to 15800 gram for intact artefacts. Netherstones display a smooth use-wear caused by circular motions over the slab. A wavy appearance of the use-surface is often caused by this motion (**fig. 8**). Short linear striations with no clear-cut directionality and randomly placed pits sometimes accompany these tools. The latter shows that flat netherstones were used as anvils, for example of bipolar reduction of quartz. The use-surface is not roughened by means of pecking. All netherstones have a flat to concave cross-section, and repeatedly demonstrate a similar use-wear on the two, opposite flat sides. Use-wear traits overall indicate that the netherstones were used for the polishing/grinding of stone or bone tools (cf. Gijn/Houkes 2006, 178f). The lack of surface-treatment supports this view.

Critical remarks as to the function of flat netherstones have been raised in archaeology. Due to a contextual correlation between netherstones, pebble tools and stone axes at late Mesolithic sites in southern Norway, Egil Mikkelsen (1984, 93) argues that netherstones had a multiple function for the grinding of axes, wild seeds and/or ochre for paint respectively. The hypothesis has hitherto not been backed up by use-wear analysis or other archaeological data. Ethno-archaeological accounts from Australia may be valuable in this respect as flat netherstones with wavy appearance are used for the wet-grinding of wild hard seeds (Mulvaney/Kamminga 1999, plate V).

Microsilica analysis of residues recovered from

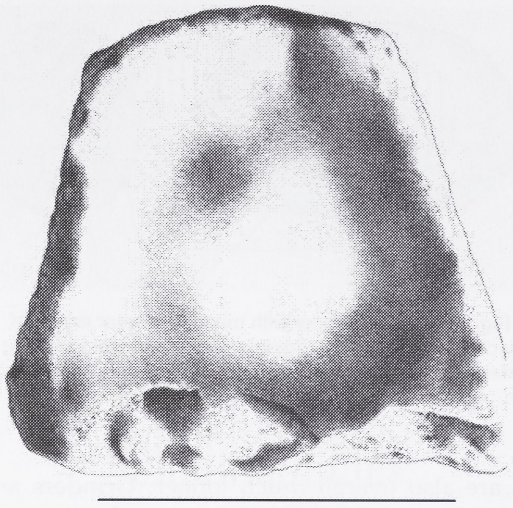

Fig. 8 A late Mesolithic double-sided netherstone of fine-grained sandstone. The shape is produced by flaking. Note the smooth and circular use-wear with raised centre. Scale bar is 20 cm. Drawing: Mattias Petterson / Societas Archaeologica Upsaliensis.

wavy Mesolithic netherstones show traces of grass (Eriksson 2007; Lidström Holmberg in prep.). The use-wear however indicates stone tool polishing. As suggested by ethnological accounts, polishing grass increase the abrasive effects of sandstone polishing tools. Flat netherstones are further often found in contexts close the shore-line or actually placed in the water. Both grass and water would facilitate the polishing of axes. Pecked and polished green stone axes with a rounded body are characteristic for the late Mesolithic of this area (Lindgren/Nordqvist 1997, 59f). A rounded axe-body correlates well with use-wear visible on the flat netherstones. Taken together, flat netherstones were most likely used as polishing tools.

Mesolithic sites dated to before 4500 cal. BC show a contextual relationship between flat netherstones of sandstone, bipolar quartz reduction, pecked and ground green stone axes and sometimes also preforms and flakes from greenstone axe production. Pebble tools are however not contextually correlated with flat netherstones in this area (Lindgren/Nordqvist 1997, 61; Lindgren 2004; cf. Mikkelsen 1984). Interestingly, a contextual correlation of greenstone axes to flat netherstones is much less apparent at sites dated after 4500 cal. BC, as shown in a thesis by Christina Lindgren (2004, 248ff). After 4500 cal. BC, netherstones are spatially separated from the manufacture of green stone axes, in turn spatially separated from quartz tool production. The separation of technological practices into different areas of

work indicates that something is happening with the social technology after 4500 cal. BC.

No investment in netherstone technology or tools resembling saddle querns are noticed in the late Mesolithic. The change in netherstone context may nevertheless be linked to the social process of innovation by which saddle querns emerge. For the first, layers of coarse-grained, heterogeneous sandstone are available between the layers of fine grained sandstone chosen for flat netherstones. It was this material that was chosen by TRB saddle quern makers. It is highly probable that people continued to use these sources in the Neolithic, but for the innovation of a new product - the saddle quern. Secondly, the pecking of axes and the pecking of saddle querns of sandstone into shape constitute the very same manoeuvre of the body. This strengthens the notion of local hunter/gatherers using their knowledge of sandstone, polishing tools and axes to experiment with quern tool manufacture.

Flat netherstones with a wavy use-surface seemingly disappear with the early Neolithic. So does overall the pecked and polished green stone axe with a rounded body. At the latest phase of the late Mesolithic or at the mesolithic-neolithic transition c. 4000 cal. BC, a few shallow bowl-shaped netherstones/quern slabs however come in view. At the same time, the first saddle quern of sandstone appears in the archaeological record, as do TRB pottery and thin-butted axes of flint and greenstone (Hallgren 2000b; Sundström 2003).

Shallow bowl-formed netherstones/quern slabs are only recovered from a few sites in eastern, central Sweden, all which belong to the latest phase of the late Mesolithic or the Mesolithic/Neolithic transition c. 4000 cal. BC (Lidström Holmberg in prep). Of the Mesolithic grinding tool categories discussed, this is the only type of netherstone that can be called a quern slab. A few examples of shallow, bowl-shaped netherstones are also found from the early Neolithic TRB. The raw material is commonly granite/gneiss. Traits of manufacture show that bowl-shaped netherstones are formed with flakes taken along the sides. A bowl-shaped quern slab is round or oval in plan, and can be about 38 × 28 cm in size (**fig. 9**). The used surface is often rather smooth with use-wear striations in different circular directions. This shows that the body motions used with bowl-shaped quern slabs is comparable with flat netherstones used for axe polishing. Use-wear is not possible to differentiate due to the coarse-grained texture of the raw material (cf. Gijn/Houkes 2006, 179f). A multi-purpose function can however be suspected. No

Fig. 9 A bowl-shaped netherstone/quern slab. The used surface is rather smooth with use-wear striations in different circular directions. Photo: Jenny Holm.

direct evidence of pecking or re-roughening of the use-surface is noted. Taking body motions as part of the operational chain, the circular motion suggests continuity into the Mesolithic past of axe manufacture. The circular grinding of both pecked axes and plants further indicates a cross-cutting of technologies and practices. Such cross-cutting coupled with a negotiation of social relations may well be the very vehicle for technical innovation and cultural change.

Bowl-shaped netherstones/quern slabs are occasionally documented at late Mesolithic Ertebølle/early Neolithic TRB sites of the Baltic coast. A few bowl-shaped quern slabs of coarse granite are recovered from the site Wangels in Schleswig-Holstein (Hartz et al. 2002, 328). Cereal grains, one identified as emmer wheat, were further found from a funnel beaker pottery sherd. The site has produced absolute datings assigning it to the final part of Ertebølle and the beginning of Funnel beaker culture c. 4100-3900 cal. BC. The authors see the querns as evidence of agriculture and TRB within this hunter/gatherer area.

Two grinding tools that are possibly part of bowl-shaped querns are further recovered from the late Mesolithic Ertebølle site Löddesborg in Scania (Jennbert 1984, 96). Both are unfortunately collected as stray-finds and lack context. Due to finds of cereal imprints in pottery defined as Ertebølle, the author however suggests that these objects may have been used for the grinding of cereals into porridge, bread or beer. Mesolithic

people of southern Scandinvia are further suggest to have adopted cereals as 'fertile' gifts from the LBK area, exchanging these gifts within the social networks of Scandinavian hunter/gatherers. Bowl-shaped quern slabs are also recovered from early Neolithic TRB sites in Scania (Larsson 1984).

It is worth noting to note that the few bowl-shaped netherstones/quern slabs so far recovered from the area of eastern central Sweden, show a contextual connection with hearths and/or house. This is hardly a coincidence. Past changes in spatial context, from netherstones with axe production before 4500 cal. BC, netherstones separated from axe production after 4500 cal. BC, and at c. 4000 cal. BC netherstones next to hearths, are most surely indicative of a transformation of both practice and social relations. A structuring of everyday social relations can be a vital source for wider cultural change (Sahlins 2000). It can thus be suggested that the above contexts can inform on the social process of innovation leading to the introduction of saddle querns, and the active formation of TRB culture (Lidström Holmberg in prep.).

Saddle querns and cultural transformation

Like wavy netherstones, the bowl-shaped quern with its circular body motion soon comes out of sight in this area. Instead, people begin to make and use large saddle querns. The saddle quern becomes the leading tool for the processing of plant foods. A large saddle quern slab with a long grinder is an efficient grinder of cereals, with 1 kg dried cereal grains ground into flour in between 30-45 minutes (Lidström Holmberg 1993; Welinder 1998, 196). As demonstrated by other experimental studies, grinding techniques (rather than pounding) is most beneficial in the processing of cereals (Wright 1994, 242).

Functional analyses of LBK querns add force to the use of large querns for cereal grinding (Hamon 2007). Phytoliths classified as barley-type are also recovered from some TRB saddle querns (Lidström Holmberg in prep.). No doubt large TRB saddle querns were originally manufactured to process the newly incorporated item from the south, cultivated grains.

The innovation of saddle querns further bring about a new body technique. Saddle querns are used with a back-and-forward or reciprocal body movement, in contrast to the circular motions used with flat and bowl-shaped netherstones. Reciprocal body motions were also needed to polish the locally produced thin-butted TRB axe of greenstone. Thin-butted TRB axes show no traces of circular grinding, as do the pecked and ground greenstone axes of the late Mesolithic. With the early Neolithic, the last part of the operational chain of grinding tools as well as axes thus changed.

The earliest TRB saddle quern found was deposited in an up-right position within a hearth located a hut area (Hallgren 1996; Lidström Holmberg 1998). Similar to bowl-shaped quern slabs, the first saddle quern also connects with hearth and house. This combine of new tool design, new body motion, and new contextual relationships indicates the incorporation of much news, but transformed from within the old. One side of the quern slab quern slab was further used for the processing of plant foods, while the opposite side was used for the polishing of axes. This well exemplifies the cross-cutting of new body motions linking thin-butted axes with saddle querns. The small sized quern slab is made of coarse arcosic sandstone. Slightly later TRB saddle querns from this area are also made of this raw material. This suggests the formation of a new tradition of social technology, but with roots in the Mesolithic.

In the somewhat later TRB contexts with finds of saddle querns, the above relationship of querns to hearth and house is much less clear. In fact, the saddle quern now seems to have become part of an active and dynamic negotiation of social relations, with reinforced rites of separation. The Skogsmossen site, with its separation of quern slabs from grinders, axes from quern slabs and spatially ordered offerings of long grinders is a compelling case in point. The dynamic use of saddle querns probably inform on gendered social relations and the cultural orders of the TRB. By this I mean the meaningful ways by which people structured their relations and construed the existence within which individuals and groups could act (Sahlins 2000, 12; Connell 2002, 9). Spatial patterns of separation, made visible also at other TRB sites, can be interpreted as the materialization of inner tensions and perhaps even conflicts within TRB social life. With reference to grinders and quern slabs it seems that at least one cause of tension has to do with the house (Lidström Holmberg in prep.). What may be the cause of such spatial and structural tensions?

Refiguring Life

From studies of the late Mesolithic substrate it can be concluded that Ertebølle hunter/gatherers did not make and use saddle querns, but used other grinding and pounding tools. The same goes for late Mesolithic people in eastern central Sweden. With the co-existing and interaction of Ertebølle culture with different early farming cultures for a time-span of around 1500 years, one has to ask why they did not manufacture and use large querns, especially if some had also started to use cereals for food, porridge or drink.

From an efficiency point of view, it can be argued that hunter/gatherers may be in no need of time-consuming large querns (Wright 1994). Intensified plant food processing does not necessarily need a change in stone technology (Adams 1999, 476). Large grinding tools are not always more efficient than small pounding and grinding tools. Ethnographical accounts indicate that processing and consumption of large quantities of plant foods require tools, but not for any practical necessity large grinding tools. Digging sticks, birch-bowls, pebble stones, bone and stone axes are well suited to process wild plant foods (Lidström Holmberg in prep.).

A practical explanation is however not the only model of understanding the lack of Mesolithic querns. An operational gesture of daily life practice is only reworked if it is considered somehow beneficial to do so. To adopt or invent a new tool, the new technique and its associated practices consequently have to be supported by belief. The survival of a gesture is likewise dependent on the belief invested in it, practically, symbolically and/or ideologically (De Certeau 1988, 202f).

From studies of the LBK substrate we have learnt that saddle querns were manufactured to be used for cereals. The strong contextual connection of LBK querns with the long house, its hearths, lateral ditches and pits has also been mentioned (e.g. Boelicke 1988; Pavlů 2000; Hamon 2004). Associated with the house it is close at hand to suggest that the LBK quern can be taken as practical icon or symbol for house and crops. Southern Scandinavian hunter/gatherers were most likely aware of these connections, through direct contact interaction or story-telling. Most likely, hunter/gatherers saw the LBK as a life-world different from their own, and perhaps as one not supported by hunter/gatherer belief. It is possible but difficult to move around with large querns. The incorporation of this technique would lead to a more settled life. Perhaps the norms and values of the agricultural quern of the house were therefore not at all in accordance with the cultural belief and cuisine of hunter/gatherers doing-cooking and thinking life (De Certeau 1988, 209). Unsupported by belief, practically, socially and ideologically, hunter/gatherers had no need to change their gestures. It is even highly plausible that hunters and gatherers actively came to resist its incorporation (cf. Klassen 2002, 305). As the incorporation of something new always contributes to a transformation of cultural gestures (De Certeau 1988), the choice of not innovating large querns was a wise choice. By an agency of resistance, hunter/gatherers successfully were enabled to modify their life-style slowly and by choice rather than necessity. There came however a point in time when hunter/gatherers came to rapidly refigure both the resistance towards large querns and their way of life.

At 4000 cal. BC, locally manufactured saddle querns were introduced in the northernmost TRB area. By engaging LBK externalities in local configurations, making elements of this external world their own, hunters and gatherers actively sought change (Sahlins 1999, 411). The adoption of very large saddle quern with long, sometimes over-dimensioned grinders used by the house can be seen as a solid sign of this new scheme for change. The shift from resistance of querns, grain, and increased settled life, to the adoption of a large saddle quern symbolising these very values was no easy transformation. Rapid transformation can cause a lot of problems, perhaps especially between people of different generations. Tensions may cause conflicts between past and present, young and old, between those that look back and those that look ahead, between men and women. As hunter/gatherers become the TRB, it is no wonder that spatial rites of separation materialize within early Neolithic social life.

Final comments

Taken together, it has been argued that deeper studies of Mesolithic and Neolithic grinding tools from a social and historical perspective on technology provide insights into cultural formation and change. The social process of innovation leading to the introduction of saddle querns trespass the dichotomy of a Mesolithic and a Neolithic, and connects hunters and gatherers to the becoming of the northernmost TRB. Regional variations in the grinding tool technology of the Scandinavian TRB area suggest that TRB culture was shaped

from variations already existing in the Mesolithic. The becoming of the northern TRB was thus not a whole-sale adoption of a Neolithic 'package', but a historical process. Seen from the perspective of saddle querns, the change towards agriculture is rapid rather than gradual. Subtle changes in late Mesolithic contexts of daily social relations however suggest that transformations in social life precede the rapid materialization of the TRB. Having close social interaction with the LBK, southern Scandinavian Ertebølle people form an active link between northern hunter/gatherers and the agricultural world to the south. As hunter/gatherers actively incorporated the saddle quern they used history in the present for a future.

Acknowledgements

This text is reworked from a paper given at the EAA conference in Zadar, Croatia, 2007. I would like to thank the organizers of the session, Caroline Hamon and Jan Graefe, and all session participants for the rare opportunity to have such interesting debate on grinding tools in Neolithic societies.

My sincere thanks also to *Societas Archaeologica Upsaliensis* (SAU) research foundation, which made my stay in Croatia possible.

References

Adams, J. (1999): Refocusing the Role of Food-grinding Tools as Correlates for Subsistence Strategies in the U.S. Southwest. American Antiquity 64/3, 1999, 475-498.

Adams, J. (2002): Ground Stone Analysis. A Technological Approach. Salt Lake City 2002.

Andersen, N. H. (1997): Sarup 1. The Sarup Enclosures 1. Moesgaard 1997.

Andersen, S. H. (1973-74): Ringkloster. En jysk indlandsboplats med Ertebøllekultur. KUML 1973-74.

Apel, J. (2001): Daggers Knowledge and Power – The Social Aspects of Flint-Dagger Technology in Scandinavia 2350-1500 cal BC. Coast to Coast book 6. Uppsala 2001.

Baak, P. (2005): Maalstenen bij de Dogon (Mali). Paleo-Aktuell 14/15. Archaeologie in 2002 & 2003. Groningen 2005, 122-128.

Barker, G. (1985): Prehistoric farming in Europe. Cambridge 1985.

Barret, J. C. (1994): Fragments from Antiquity. An Archaeology of Social Life in Britain. Oxford 1994.

Bauche, R-D. (1988): Gebrauchsspuren an neolithischen Mahlsteinen. Arch. Inf. 11, 1988, 152-160.

Beaune, S. A. de (2000): Pour une archéologie du geste: Broyer, moudre, piler, des premiers chasseurs aux premiers agriculteurs. Paris 2000.

Beaune, S. A. de (2004): The Invention of Technology. Prehistory and Cognition. Current Anthropology 45/2, 2004, 139-162.

Becker, C. J. (1947): Mosefundne lerkar fra yngre stenalder. Studier øver tragtbægarkulturen I Danmark. Copenhagen 1947.

Boelicke, U. (1988): Die Gruben. In: Boelicke, U./von Brandt, D./Lüning, J./Stehli, P./Zimmermann, A. (eds.), Der bandkeramische Siedlungsplatz Langweiler 8. Rhein. Ausgr. 28. Köln 1988, 300-394.

Bogucki, P. (2000): How agriculture came to north-central Europe. In: T. D. Price (ed.), Europe's First Farmers. Cambridge 2000, 197-218.

Bourdieu, P. (1977): Outline of a Theory of Practice. Cambridge 1977.

Boyd, B. (2005): Transforming food practices in the Epipalaeolithic and Pre-Pottery Neolithic Levant. In: Clarke, J. (ed.), Archaeological Perspectives on the Transmission and Transformation of Culture in the Eastern Mediterranean. Oxford 2005, 106-112.

Bradley, R. (2005): Ritual and Domestic Life in Prehistoric Europe. London, New York 2005.

Bruhns Olsen, K. (1991): Sexual Activities: Some Thoughts on the Sexual Division of Labour and Archaeological Interpretation. In: Walde, D./Willows, N. D. (eds.), The Archaeology of Gender. Proceedings of the 22nd Annual Chacmoool Conference. Calgary 1991, 420-435.

Callahan, E. (1987): An Evaluation of the Lithic Technology in Middle Sweden during the Mesolithic and Neolithic. Aun 8. Uppsala 1987.

Conkey, M.W./Spector, J. (1984): Archaeology and the study of gender. In: Schiffer, M. B. (ed.), Advances in Archaeological Method and Theory 7. San Diego 1984, 1-38.

Connell, R. W. (2002): Gender. Cambride, Malden 2002.

Connolly, A. (2004): Saddle Querns in Irland. Ulster Journal of Archaeology 57, 2004, 26-36.

De Certeau, M./Giard, L./Mayol P. (1988): The Practice of Everyday Life 2: Living and Cooking. Minneapolis, London 1988.

Dobres, M.-A. (2000): Technology and Social Agency. Outlining a Practise Framework for Archaeology. Oxford 2000.

Dobres, M.-A./Robb, J. (2000): Agency in Archaeology. London, New York 2000.

Eriksson, M. (2007): Senmesolitiska cirkelnötta slipstenar med upphöjd mitt från Stormossen. In: N. Stenbäck (ed.), Stenåldern i Uppland. Arkeologi E4 Uppland-studier 1. Uppsala, Stockholm 2007, 289-304.

Farruggia, J.-P. (1973): Steinmaterial. In: Farruggia, J.-P. /Kuper, R./Lüning, J./Stehli, P. (eds.), Der bandkeramische Siedlungsplatz Langweiler 2. Rhein. Ausgr. 13. Bonn 1973, 106-133.

Farruggia, J.-P. (1992): Les outils et les armes en pierre dans le rituel funéraire du Néolithique Danubien. BAR Internat. Ser. 581. Oxford 1992.

Fendin, T. (2000): Fertility and the Repetitive Partition. Grinding as Social Construction. Lund Arch. Rev. 6, 2000, 85-97.

Finley, N. (2003): Microliths and Multiple Authorship. In: Larsson, L./Kindgren, H./Knutsson, K./ Loeffler, D./Åkerlund, A. (eds.), Mesolithic on the Move. Papers presented at the Sixth International Conference on the Mesolithic in Europe. Stockholm 2000, 169-176.

Fischer, A. (1982): Trade in Danubian Shaft-Hole Axes and the Introduction of Neolithic Economy in Denmark. Journal of Danish Arch. 1, 1982, 7-12.

Fischer, A. /Kristansen, K. (2002): The Neolithisation of Denmark, 150 years of debate. Sheffield 2002.

Florin, S. (1938): Vråkulturen. Kulturhistoriska studier tillägnade Nils Åberg. Stockholm 1938.

Florin, S. (1958): Vråkulturen. Stenåldersboplatserna vid Mogetorp, Östra Vrå och Brokvarn. KVHAA. Stockholm 1958.

Price, D. T./Gebauer A. B. (1992): The Final Frontier: Foragers and Farmers in Southern Scandinavia. In: Gebauer, A. B./Price, T. D. (eds.), Transitions to Agriculture in Prehistory. Madison, Wisconsin 1992, 97-116.

Gero, J. M. (1985): Socio-politics of Archaeology and the Woman-at-Home Ideology. American Antiquity 50, 1985, 342-350.

Glob, P. V. (1952): Danske Oldsager II, yngre stenalder. Copenhagen 1952.

Gosden, C./Marshall, Y. (1999): The Cultural Biography of Objects. World Archaeology 31/2, 1999, 169-178.

Graefe, J. (2004): Altneolitische Mahlsteine im südlichen Niedersachsen. Jahrbuch des Römisch-Germanischen Zentralmuseums 51/1, 2004, 25-92.

Gronenborn, D. (1995): Ethnoarchäologische Untersuchungen zur rezenten Herstellung und Nutzung von Mahlsteinen in Nordost-Nigeria. Experimentelle Archäologie Bilanz 1994. Archäologische Mitteilungen aus Nordwestdeutschland, Beih. 8. Oldenburg 1995, 45-55.

Gronenborn, D. (1997): Die Steinartefakte. In: Lüning, J. (ed.), Ein Siedlungsplatz der Ältesten Bandkeramik in Bruchenbrücken, Stadt Friedberg/ Hessen. UPA 39. Bonn 1997, 257-332.

Gronenborn, D. (1999): A Variation on a Basic Theme: The Transition to Farming in Southern Central Europe. Journal of World Prehistory 13, 1999, 123-210.

Grygiel, R./Bogucki, P. (1997): Early Farmers in North-Central Europe: 1989-1994 Excavations at Osłonki, Poland. Journal of Field Archaeology 24, 1997, 161-178.

Haaland, R. (1995): Sedentism, Cultivation, and Plant Domestication in the Holocen Middle Nile Region. Journal of Field Archaeology 22/2, 1995, 157-174.

Haaland, R. (1997): Emergence of sedentism: new ways of living, new ways of symbolizing. Antiquity 71/272, 1997, 374-385.

Haaland, R. (1999): The ways of women: Sedentism and the importance of hearth centered activities. In: Fuglestvedt, I./Gansum, T./Opedal, A. (eds.), Et hus med mange rom. Stavanger 1999, 65-81.

Hallgren, F. (1996): Sociala territorier och exogamirelationer i senmesolitisk tid. En diskussion utifrån boplatsen Pärlängsberget, Södermanland. Tor 28, 1996, 5-27.

Hallgren, F. (2000a): Lineage Identity and Pottery Design. In: Olausson, D./Vandkilde, H. (eds.), Form, Function & Context. Lund 2000, 173-191.

Hallgren, F. (2000b): My place or yours? In: Larsson, L./Kindgren, H./Knutsson, K./Loeffler, D./Åkerlund, A. (eds.). Mesolithic on the Move. Papers presented at the Sixth International Conference on the Mesolithic in Europe. Stockholm 2000, 28-35.

Hallgren, F./Djerw, U./Geijerstam af, M./Steinecke, M. (1997): Skogsmossen, an Early Neolithic settlement site and sacrificial fen in the northern borderland of the Funnel-beaker culture. Tor 29, 1997, 49-111.

Hallgren, F./Possnert, G. (1997): Pottery design and time. The pottery from the TRB site Skogsmossen, in view of the AMS-datings or organic remains on potsherds. Tor 29, 1997, 113-136.

Hamon, C. (2004): Le statut des outils de broyage et d'abrasion dans l'espace domestique au Néolithique ancient en Bassin parisien. Notae Praehistoricae 24, 2004, 117-128.

Hamon, C. (2007): Functional analysis of stone grinding and polishing tools from the earliest Neolithic of north-western Europe. Journ. Archaeol. Sci. 2007, 1-19.

Hartz, S/Heinrich, D./Lübcke, H. (2002): Coastal Farmers – the Neolithisation of northernmost Germany. In: Fischer, A./Kristiansen, K. (eds.), The Neolithisation of Denmark. 150 years of debate. Sheffield 2002, 321-340.

Hayden, B./Nelson, M. (1981): The Use of Chipped Lithic Material in the Contemporary Maya Highlands. American Antiquity 46/4, 1981, 885-898.

Hayden, B. (1987): Lithic Studies Among the Contemporary Highland Maya. Tucson 1987.

Hayden, B. (1993): Archaeology. The Science of Once and Future Things. New York 1993.

Hennig, E. (1966): Beobachtungen zum Mahlvorgang an ur- und frühgeschichtlichen Getreidemühlen. Studien zur Technologie. EAZ 7, 1966, 71-87.

Hernek, R. (2005): Nytt ljus på Sandarnakulturen. Om en boplats från äldre stenåldern i Bohuslän. GOTARC Series B. Archeological Theses 38, Coast to Coast Books 14. Gothenburg 2005.

Hersch, L. T. (1981): Grinding Stones and Food Processing Techniques of the Neolithic Societies of Turkey and Greece: Statistical, Experimental and Ethnographic Approaches to Archaeological Problem-solving. Ann Arbor 1981.

Hodder, I. (1990): The Domestication of Europe. Structure and Contingency in Neolithic Societies. Oxford/Cambridge, Mass. 1990.

Horsfall, G. A. (1987): Design Theory and Grinding Stones. In: Hayden, B. (ed.), Lithic Studies Among the Contemporary Highland Maya. Tuscon 1987, 332-377.

Hurcombe, L. (1997): A viable past in the pictoral present? In: Moore, J./Scott, E. (eds.). Invisible People and Processes. London, New York 1997, 15-24.

Jennbert, K. (1984): Den produktiva gåvan. Tradition och innovation i Sydskandiavien för omkring 5 300 år sedan. Acta Archaeologica Lundensia Series in 4/16. Lund 1984.

Kahlke, H.-D. (2004): Sondershausen und Bruchstedt. Zwei Gräberfelder mit älterer Linienbandkeramik in Thüringen. Weimarer Monographien zur Ur- und Frühgeschichte 39. Weimar 2004.

Kaliff, A. (2007): Fire, Water, Heaven and Earth. Ritual practice and cosmology in ancient Scandinavia: An Indo-European perspective. Riksantikvarieämbetet. Stockholm 2007.

Karsten, P./Knarrström, B. (2003): The Tågerup Excavations. Skånska spår – arkeologi längs Västkustbanan. National Heritage Board. Archaeological Excavations Department, UV Syd. Lund 2003.

Kihlstedt, B. (2006): Boplats och graver från tidigneolitikum vid Östra Vrå. UV mitt rapport 2006:7, Riksantikvarieämbetet. Stockholm 2006.

Klassen, L. (2002): The Ertebølle Culture and Neolithic continental Europe: traces of contact and interaction. In: Fischer, A./Kristiansen, K. (eds.), The Neolithisation of Denmark. 150 years of debate. Sheffield 2002, 305-320.

Knutsson, H. (2004): Coast to Coast – Arrival. Results and Reflections. Proceedings of the Final Coast to Coast Conference 2002. Coast to Coast book 10. Uppsala 2004.

Kossian, R. (2005): Nichtmegalithische Grabanlagen der Trichterbecherkultur in Deutschland und den Niederlanden. Veröffentlichungen des Landesamtes für Denkmalpflege und Archäologie Sachsen-Anhalt – Landesmuseum für Vorgeschichte 58/1. Halle/Saale 2005.

Kraybill, N. (1977): Pre-Agricultural Tools for the Preparation of Foods in the Old World. In: Reed, C. A. (ed.). Origins of Agriculture. Hague, Paris 1977, 485-521.

KUBIAK-MARTENS, L. (1999): The plant food component of the diet at the late Mesolithic (Ertebølle) settlement at Tybrind Vig, Denmark. Vegetation History and Archeobotany 8, 1999, 117-127.

KULCZYCKA-LECIEJEWICZOWA, A. (1997): Osiedla Neolitycznych Rolników na Śląsku. Instytut Archeologhii i Ethnologii Polskiej Akademii Nauk. Wrocław 1997.

LARSSON, M. (1984): Tidigneolitikum i Sydvästskåne. Kronologi och bosättningsmönster. Acta Archaeologica Lundensia Series in 4/17. Lund 1984.

LINDGREN, C./NORDQVIST, B. (1997): Lihultsyxor och Trindyxor. Om yxor av basiska bergarter o östra och västra Sverige under mesolitikum. In: LARSSON, M./OLSSON, E. (EDS.). Regionalt och interregionalt. Stenåldersundersökningar I Syd- och Mellansverige. Riksantikvarieämbetet Arkeologiska Undersökningar Skrifter 23. Stockholm 1997, 57-72.

Lemmonier, P. (1993): Technological Choices: transformation in material cultures since the Neolithic. London 1993.

LIDSTRÖM HOLMBERG, C. (1993): Sadelformade malstenar från yngre stenålder "Grind my dear one, let her grind". Unpublished report 2, Flatenprojektet. Uppsala, Stockholm 1993.

LIDSTRÖM HOLMBERG, C. (1998): Prehistoric Grinding Tools as Metaphorical Traces of the Past. Current Swedish Archaeology 6, 1998, 123-142.

LIDSTRÖM HOLMBERG, C. (2004): Saddle Querns and Gendered Dynamics of the Early Neolithic in Mid Central Sweden. In: KNUTSSON, H. (ED.), Coast to Coast – Arrival. Results and Reflections, Coast to Coast book 10. Uppsala 2004.

LIDSTRÖM HOLMBERG, C. (in prep.): Refiguring Life. Saddle querns, gendered dynamics and the becoming of the northernmost TRB. Coast to Coast Books 17. Uppsala in prep.

Lindgren, C. (2000): My way or your way. On the social dimension of technology as seen in the lithic strategies in eastern middle Sweden during the Mesolithic. In: LARSSON, L./KINDGREN, H./KNUTSSON, K./LOEFFLER, D./ÅKERLUND, A. (EDS.). Mesolithic on the Move. Papers presented at the Sixth International Conference on the Mesolithic in Europe. Stockholm, Oxford 2000, 177-183.

LINDGREN, C. (2004): Människor och kvarts. Sociala och teknologiska strategier under mesolitikum i östra Mellansverige. Stockholm Studies in Archaeology 29, Coast to Coast books 11. Stockholm 2004.

LIVERSAGE, D. (1981): Neolithic Monuments at Lindebjerg, Northwest Zealand. Acta Archaeologica 51, 1981, 85-152.

LÜNING, J. (2000a): Neolithikum. In: VON FREEDEN, U./VON SCHNURBEIN, S. (HRSG.), Spuren der Jahrtausende. Archäologie und Geschichte in Deutschland. Frankfurt am Main 2000, 110-140.

LÜNING, J. (2000b): Steinzeitliche Bauern in Deutschland. Die Landwirtschaft im Neolithikum. UPA 58. Bonn 2000.

LÜNING, J./MEURERS-BALKE, J. (1986): Archäologie im Experiment. Archäologie in Deutschland 1, 1986, 4-7.

MALMER, M. (2002): The Neolithic of South Sweden. TRB, GRK, and STR. The Royal Swedish Academy of Letters History and Antiquities. Stockholm 2002.

MCBRYDE, I. (1997): 'The Landscape is a Series of Stories'. Grindstones, Quarries and Exchange in Aboriginal Australia: a Lake Eyre Case Study. In: RAMOS-MILLAN, A./BUSTILLO, A. (EDS.), Siliceous Rocks and Culture, 1997, 587-607.

MEURERS-BALKE, J./LÜNING. J. (1990): Experimente zur ur- und frühgeschichtlichen Landwirtschaft. Experimentelle Archäologie in Deutschland 4, 1990, 81-92.

MIDGLEY, M. S. (1992): T.R.B. Culture: the first farmers of the North European Plain. Edinburgh 1992.

MIKKELSEN, E. (1984): Neolitiseringen i Øst-Norge. Universitetets Oldssakssamling Årsbok 1982/1983. Oslo 1984.

MULVANEY, K. (1998): The technology and Aboriginal association of a sandstone quarry near Helen Springs, Northern Territory. In: FULLAGAR, R. (ED.), A Closer Look: Recent Australian Studies of Stone Tools. Sydney 1998, 75-94.

MULVANEY, J./KAMMINGA, J. (1999): Prehistory of Australia. Washington, London 1999.

MÜLLER, S. (1907): Nye fund og iakttagelser fra sten- bronze- og jernalder. Aarbøger for Nordisk Oldkyndighet og Historie. Copenhagen 1907.

PAVLŮ, I. (2000): Life on a Neolithic Site. Bylany – Situational Analysis of Artefacts. Prague 2000.

PERSSON, P. (1999): Neolitikums början: undersökningar kring jordbrukets introduktion i Nordeuropa. Coast to Coast books 1. Uppsala, Göteborg 1999.

Price, T. D. (2000): The introduction of farming in northern Europe. In: Price, T. D. (ed.), Europe's First Farmers. Cambridge 2000, 260-300.

Pryor, F. (1998): Farmers in Prehistoric Britain. Stroud 1998.

Renfrew, C. (2004): Towards a Theory of Material Engagement. In: de Marrais, E./Gosden, C./ Renfrew, C. (eds.), Rethinking materiality, the engagement of mind with the material world. Cambridge 2004, 23-31.

Risberg, J./Bengtsson, L./Kihlstedt, B./Lidström Holmberg, C./Olausson, M./Olsson. E./Tingvall, C. (2002): Siliceous microfossils, especially phytoliths, as recorded in five prehistoric sites in Eastern Middle Sweden. Journal of Nordic Archaeological Science 13, 2002, 11-26.

Rowley-Conwy, P. (2004): How the West was Lost. A Reconsideration of Agricultural Origins in Britain, Ireland, and Southern Scandinavia. Current Anthropology 45, 2004, 83-113.

Rydbeck, O. (1912): Undersökning af bronsåldershögar i Köpinge nära Ramlösa Hälsobrunn i Skåne. Fornvännen. Stockholm 1912.

Sahlins, M. (1999): Two or Three Things That I Know About Culture. Journal of the Royal Anthropological Institute 5, 1999, 399-422.

Sahlins, M. (2000): Culture in Practice. Selected Essays. New York 2000.

Schneider, J. S. (1996): Quarrying and Production of Milling Implements at Antelope Hill, Arizona. Journal of Field Archaeology 23/3, 1996, 299-311.

Schön, W./Holter, U. (1988): Zum Gebrauch von Reib- und Mahlsteinen in der Ostsahara. Arch. Inf. 11/2, 1988, 156-159.

Segerberg, A. (1999): Bälinge Mossar. Kustbor i Uppland under yngre stenåldern. AUN 26. Uppsala 1999.

Spears, C. S. (1990): Macrocrystalline Stone Artifacts. In: Tringham, R./Krstić, D. (eds.). Selevac. A Neolithic Village in Yugoslavia. Monumenta Archaeologica 15. Los Angeles 1990, 495-520.

Strathern, M. (1988): The Gender of the Gift. Problems with Women and Problems with Society in Melanesia. Berkeley 1988.

Sulgostowska, Z. (1998): Continuity, Change and Transition: The Case of North-Eastern Poland during the Stone Age. In: Zvelebil, M./Domańska, L./Dennell, R. (eds.), Harvesting the Sea, Farming the Forest. The Emergence of Neolithic Societies in the Baltic Region. Sheffield 1998, 87-94.

Sundström, L./Apel, P. (1998): An Early Neolithic axe production and distribution system within a semi-sedentary farming society in Eastern Central Sweden, c. 3500 BC. In: Holm, L./Knutsson, K. (eds.), Third Flint Alternatives Conference at Uppsala, Opia 16. Uppsala 1998, 155-191.

Sundström, L. (2003): Det hotade kollektivet. Neolitiseringsprocessen ur ett östmellansvenskt perspektiv. Coast to Coast book 6. Uppsala 2003.

Sverdrup, G. (1933): Fra gravskikker til dødstro i nordisk bronsealder. Skrifter utgivna av det Norske Videnskaplige Akademie i Oslo 2. Oslo 1933.

Takaoğlu, T. (2005): Coşkuntepe: An Early Neolithic Quern Production Site in NW Turkey. Journal of Field Archaeology 30/4, 2005, 419-433.

Teegen, W.-R./Hellmich, E./Schulz, G. (1990): Getreidemahlen auf einer Trogmühle. Experimentelle Archäologie in Deutschland 4, 1990, 113-121.

Van de Velde, P. (1979): On Bandkeramik Social Structures. An analysis of pot decoration and hut distributions from the Central European Neolithic communities of Elsloo and Hienheim. Leiden 1979.

Van de Velde, P. (1992): Dust and ashes: the two Neolithic cemeteries of Elsloo and Niedermerz compared. In: Bakels, C. C. (ed.), The End of Our Third Decade 1. Analecta Praehist. Leidensia. Leiden 1992.

Van Gijn, A./Houkes, R. (2006): Stone, procurement and use. In: Louwe Kooijmans, L. P. /Jongste, P. F. B. (eds.), Schipluiden. A Neolithic Settlement on the Dutch North Sea Coast c. 3500 cal. BC. Analecta Praehist. Leidensia 37/38. Leiden 2006.

Welinder, S. (1982): The hunting-gathering component of the central Swedish Neolithic Funnel-Beaker culture [TRB] economy. Fornvännen 77. Stockholm 1982.

Welinder, S. (1998): Del 1. Neolitikum – Bronsålder 3900 – 500 f.Kr. Det Svenska Jordbrukets Historia 4 000 f. Kr – 1 000 e. Kr. Jordbrukets första femtusen år. Stockholm 1998, 12-236.

Woodman, P. (2000): Getting back to basics: transitions to farming in Ireland and Britain. In: Price, T. D (ed.), Europe's First Farmers. Cambridge 2000, 219-259.

WRIGHT, K. (1992): A classification system for ground stone tools from the prehistoric Levant. Paléorient 18/2, 1992, 53-81.

WRIGHT, K. (1994): Ground-Stone Tools and Hunter-Gatherer Subsistence in Southwest Asia: Implications for the Transition to Farming. American Antiquity 59, 1994, 238-262.

WRIGHT, K. (2000): The Social Origins of Cooking and Dining in Early Villages of Western Asia. Proceedings of the Prehistoric Society 66, 2000, 89-121.

ZIMMERMANN, A. (1988): Steine. In: BOELICKE, U./VON BRANDT, D./LÜNING, J./STEHLI, P./ZIMMERMANN, A. (HRSG.), Der bandkeramische Siedlungsplatz Langweiler 8. Rhein. Ausgr. 28, 1988, 596-787.

ZVELEBIL, M. (1994): Plant Use in the Mesolithic and its Role in the Transition to Farming. Proceedings of the Prehistoric Society 60, 1994, 35-74.

ZVELEBIL, M. (1998): What´s in a Name: the Mesolithic, the Neolithic, and Social Change at the Mesolithic-Neolithic Transition. In: EDMONDS, M./RICHARDS, C. (EDS.), Understanding the Neolithic of North-Western Europe. Glasgow 1998.

Cecilia Lidström Holmberg
Department of Archaeology and Ancient History
Uppsala University
Box 626, SE-751 26 Uppsala
Sweden
cecilia.lidstrom_holmberg@arkeologi.uu.se