Reconstructing the life history of querns: the case of the LBK site of Geleen-Janskamperveld (NL)

Annelou van Gijn and Annemieke Verbaas
Laboratory for Artefact Studies, Leiden University, PB 9515, 2300 RA Leiden, The Netherlands (a.l.van.gijn@arch.leidenuniv.nl or www.artefactstudies.com)

Abstract
Querns constitute the most important category of hard stone tools from the early Linear Bandkeramik site of Geleen-Janskamperveld, located in the south of the present-day Netherlands. Technological, use-wear and residue analysis are employed to study the life cycle of this important agricultural implement. The results show that these tools had a very special life history and must have been had a special significance in the past.

1. Introduction
Geleen-Janskamperveld (Geleen-JKV) is one of the earliest Linear Bandkeramik (LBK) settlements found in the Netherlands (fig. 1a,b).

Fig. 1a - Location of Geleen-Janskamperveld in the Netherlands (after Van de Velde 2007)
It can be dated between 5300-5100 cal BC and has been almost completely excavated in 1990-1991 (Van de Velde 2007). Quite a large number of hard stone tools were found in the pits situated along the houses, amongst which adzes (Bakels 2007), hammerstones and querns (Verbaas & Van Gijn 2007). It is the latter which form the subject of this paper.

Querns are an important tool for the agricultural communities of the LBK as they constitute the primary processing implements for the cereals and other crops that were grown by these early farmers. It is therefore not surprising that we also encounter them as grave goods in LBK cemeteries like the one at Elsloo (De Grooth & Van de Velde 2005). This indicates that they were considered important enough to be given along to the dead. This special significance of querns is corroborated by the occasional finding of pits that were carefully packed with querns and quern fragments. These pits must most likely be interpreted as votive depositions (Jadin 2003). It seems clear therefore that the querns were not only important utilitarian tools for subsistence purposes, but had a special significance as well in a more ideological sphere. Often objects with a special ideological significance also display evidence for a special biography (a.o. Fontijn 2002; Wentink 2008; Wentink & van Gijn 2008). In this paper we examine the life history of the querns in order to understand their significance for the LBK agricultural communities.

2. Use wear analysis and the importance of a combined high and low power approach

2.1 Methods

Use-wear analysis on stone tools is a relatively new development, in contrast to use-wear analysis on flint implements. Until recently it was limited to the so-called low power analysis, using a stereomicroscope (Dubrevil 2002; Hamon 2006; Van Gijn et al. 2001; Van Gijn/Houkes 2001). In the analysis of flint this low power
approach is often combined with a high power approach with the use of a metallographic microscope (Van Gijn 1990). Experiments have shown that the high power approach is effective on hard stone tools as well (Verbaas 2005; Van Gijn/Houkes 2006; Knippenberg 2007; Van Gijn/Verbaas 2008). One reason that the metallographic microscope has hardly been used for querns and other hard stone tools is the limited working space of this type of microscope, allowing only rather small and light-weight objects to be studied. The solution to this problem was a microscope with a free arm, which gives the possibility to look at stones of virtually any size. This study made use of a stereomicroscope with both incident and oblique lightning and a metallographic microscope with incident light. Micrographs were made with a digital camera, a Nikon D-1200. Some querns were cleaned with alcohol to remove dirt and grease or were immersed in distilled water in an ultrasonic tank.

2.2 Sample
A total of 200 querns and quern fragments has been found at Geleen-JKV, constituting 25 % of the total hard stone assemblage and 46 % of the total number of modified hard stone tools (fig. 2).

Only two complete querns were encountered. These two complete querns show no resemblance to the quern fragments found and seem to be of another type altogether. The quern fragments can be subdivided in two types: large and flat (N=37) and bread shaped (N=24). The remaining 124 fragments are fragmented to such an extent that these can no longer be assigned to one of these categories. Only two manos were recognized, but more can possibly be found among the fragments.

Of the 200 querns and quern fragments found, 20 were selected for use-wear analysis. The querns from Geleen-JKV have a relatively fresh appearance, displaying almost no weathering or patination. The use-wear traces are generally well preserved, allowing the use of the high power method.

3. The life history of the querns
3.1 The ‘conception’ of the quern: selecting the raw material
The main raw material used for querns is sandstone of an average grain size, but some quartzitic sandstone and occasionally micaceous sandstone was also used. This material could probably be found in the riverbeds of the Meuse and possibly also in the smaller brook valleys nearby. It is impossible to
reconstruct the original shape of the selected nodules as the querns and quern fragments have been completely shaped during the manufacturing process and subsequent use. However, it is likely that flat and slightly elongated stones were favoured most, as these already would provide the rough shape needed for producing the quern.

3.2 The ‘birth’ of the quern: the production process
Traces of manufacture were often encountered. First, the sides of the querns were flaked into shape to create a regular shape for the quern. A total of 157 flakes without any further traces of modification were found, many (N=152) of these of the same raw material as the querns. It is thus very likely that the production of the querns took place on the site. The bottom sides of the querns do not show traces of modification other than rounding due to the long use life of a quern.

We have no clues as to the original size of the querns. The two complete querns show no typological resemblance to the fragments and thus cannot be used as evidence for the original quern size. We can however extrapolate the original quern size from the size of the quern fragments: upon discard the querns seem to have been roughly 25-30 centimetres in length and around 12 centimetres in width. After shaping the quern, the top surface was picked to create a roughened surface to facilitate the grinding. This practice was repeated many times during the use life of the quern in order to rejuvenate the implement by removing the smooth surface that developed during the grinding process. The grinding surface of the querns may initially have been flaked too, but the subsequent picking, long use life and rejuvenation of the quern top may have removed traces thereof.

3.3 The ‘life’ of the quern
The 20 querns that were microscopically examined produced a total of 44 used zones. This means that most tools had two zones with traces of wear. This high incidence of use is not surprising since querns already display extensive wear traces on a macroscopic level (in fact these traces form the basis for their typological designation as ‘querns’).

All of querns examined showed traces of use, for the most part from grinding cereals, executed in a longitudinal direction, parallel to the long axis of the implement. This activity results in a granular, domed polish that is spread over the surface in small linked spots. The gloss is matt and is mainly formed on the higher parts of the stone (fig. 3a,b).
Often short striations can be observed with a clear directionality, parallel to the longer axis of the quern. Under a stereomicroscope fresh and sharp fractures are visible. On two querns traces of pounding were found, indicating a secondary use of the quern as hammer stone. The bottom sides of the querns also show traces of wear, but without the clear directionality that is visible on the actual used surface. These traces resemble those resulting from contact with cereals, but have a slightly different character, sometimes almost resembling polish from hide (fig. 3c,d). The gloss on the bottom side of the querns seems to be caused by friction with the flour that gets underneath the quern while grinding and from the surface the quern is placed on to catch the cereals and flour that falls off the quern, most likely a hide. The bottoms of the querns are highly worn and rounded. Since this side of the querns is not rejuvenated during use, they give a good indication of the long use life of the querns.

The process of grinding seeds also involves contact between the mano and metate. This was evident on two querns that displayed traces of a combination of cereals and stone. The traces from contact with stone did not resemble any of the traces obtained experimentally by polishing the raw materials used for chisels (such as basalt), so chisel production or maintenance can be ruled out. Rather, the traces seem to be result of stone on stone contact between mano and metate.

Although the traces from milling cereals are very distinctive, they are not spread evenly over the quern surface. During grinding the central part of the surface of the quern is most
intensively used, receiving the largest amount of pressure. This gradually results in the development of one or two raised borders (fig. 4).

Fig. 4 – Fragment of a large and flat quern with a raised border (drawing Erick van Driel, Leiden).

Because the central part is the most heavily worn, it will also be the part that will need the most intensive rejuvenation to become effective again, further wearing out exactly this part of the implement. The polish is more developed at the original edges of the quern where rejuvenation was probably less intense than on the central part of the stone.

Due to rejuvenation of the grinding surface, use-wear traces are removed during the use life of a quern so no extensive gloss can build up. This rejuvenation can be accomplished by pounding the sandstone quern surface with a hammer stone. Considerable force is needed to do so. The flint blade cores frequently encountered in LBK context often display pounding marks (Van Gijn 1990). Experiments with replicas of these cores show these exhausted cores to be eminently suitable for this purpose. Because of their pointed butt ends and the fact that flint is much harder than sandstone, it is possible to roughen a smooth sandstone quern surface relatively quickly (Verbaas 2005).

Rejuvenation is also evident from the presence of eleven flakes with remnants of a quern surface on the platform. These flakes originate from the rejuvenation of the quern surface. The flakes with fragments of the quern surface seem to have accidentally come off during rejuvenation or by intentional breakage after discard.

3.4 The ‘death’ of the quern
Almost all the querns retrieved were fragmented. Fragmentation is often believed to be accidental, but many stone tools are not so easy to break. They are very tough and substantial force has to be applied to fracture them. It can of course be proposed that these tools were broken during rejuvenation of the work surface. However this would result in the snapping in half of the original quern at the centre of the tool where it was rejuvenated most intensively and was therefore the thinnest. Such breaks do occur but, in addition, we see fragmentation of much thicker parts of
the original quern, where breaking could not have been accidental. In order to quantify the degree of fragmentation, the number of fractured surfaces was counted for a selection of 102 quern fragments. A total of 63 quern fragments display more than one fractured surface, with a maximum of four. If this high degree of fragmentation is not accidental, there has to be another explanation. One explanation could be that the querns were fragmented in order to reuse the fragments for other purposes. However, only three quern fragments were reused, two as manos and one as a polishing stone. Fragmentation in order to obtain stone fragments for the production of other types of tools can thus be ruled out as well.

We propose that the fragmentation is due to the intentional destruction of the querns after their use life is finished. This intentional fragmentation is a feature that we frequently see in so-called ritual context (see for examples Chapman 2000). Crop growing, with which querns are of course intimately associated, is of old surrounded with taboos and magical practices to ensure the fertility of the land and the abundance of the crops. Offerings are made to the gods and the ancestors to ask for favourable conditions. We propose that the fragmentation of the querns can be seen from this perspective: the querns had to be destroyed, had to die so to speak.

This proposition is supported by another striking feature seen on the quern fragments: they frequently display remnants of ochre. Again, this is a common feature in other LBK sites (Zimmerman 1988) and has also occasionally been noted for other agricultural tools (De Beaune 1987; Van Gijn et al. 2006; Van Gijn/Verbaas 2008). Most researchers assume that the ochre traces on the LBK querns are due to the use of these querns for grinding ochre. However, the ochre on the quern fragments of Geleen-JKV is not only present on the top of the querns (their actual grinding surface), but also on the bottom, the sides and, most noteworthy, on the fractured surfaces (fig. 5).

![Fig. 5 – Ochre on the fracture of a quern (photograph Quentin Bourgois, Leiden)](image)

There are no signs of use-wear polish and striations on the stone surfaces that can be linked to the grinding and crushing of ochre, so the ochre must have been intentionally applied after the fracturing of the stone. Ochre is frequently seen as a symbol of blood, and thus of life, and used in ritual context. In LBK society it is occasionally applied in graves, where ochre is given as a grave gift in the form of nodules,
or spread in powdered form under or over the body of the dead (Modderman 1970; De Grooth & Van de Velde 2005). The combination of intentional fracturing of the quern and the application of ochre thus seems to have a symbolic and ritual significance, marking the final ‘death’ of this agricultural implement and the last step in its life history.

4. Conclusion
The querns clearly have a distinct life cycle. The sandstone cobbles from which they were produced were obtained in the gravel deposits of the river Meuse and transported to the settlement. The presence of production flakes of sandstone indicates that the querns were manufactured locally. The querns were shaped by percussion, probably with a hard hammer. We find manufacturing flakes throughout the settlement. The querns were subsequently used for grinding cereals. The quern was most likely placed on a piece of hide or leather and was regularly rejuvenated during its use life. At some point, its use life ended. Because several querns were not exhausted when they were discarded, it is not clear why their use life was ended. All fragments differ substantially in terms of their thickness, indicating that exhaustion cannot have been the sole reason to end the use life of the querns. It is more likely that we will have to seek the explanation in the cultural sphere. It could be that the quern was handed down from generation to generation and that the end of its use life was not so much dependent on the state the quern itself was in, but the life circumstance of its owner(s) (for example, a death in the family, the abandonment of an old family house or the construction of a new one).

After its use life ended, the querns seem to have been broken. We suggest that this fragmentation was intentional and had to do with ending the life of the quern. The fractures and other surfaces were subsequently rubbed with ochre, akin to the way ochre was applied in the human graves. The fact that these querns were not just discarded after their use life, but were made unusable by breaking them and were then covered in ochre, indicates their special significance for LBK society. Although the majority of the quern fragments were found in the features, there is no evidence that querns were deposited in pits as special depositions such as has been observed in LBK and Blicquy context in Belgium (Jadin 2003, 457) and in the Paris basin (Hamon 2006, 148). Instead they derive almost all from the elongated pits that line the walls of the houses. This may suggest that they were intimately connected with the life cycle of the house and its inhabitants.

The quern fragments constitute the most important category of hard stone tools in Geleen-JKV. The study of their life cycle has provided crucial information on the significance of this type of tool. They not only formed an essential implement in the agricultural chaîne opératoire, processing the seeds of various cultivated cereals, but also were attributed a special significance. They seemed to have undergone a special ritual after their actual use life came to an end. Obviously, we will never know what their exact significance was to these past people. However, this unusual treatment of an agricultural tool par excellence
indicates that cropping practices were surrounded by rituals, suggesting that agriculture played an important part in the ancient belief systems.
References


Prehistory of the Netherlands, Amsterdam, 203-249.


Verbaas, A. 2005 Stenen werktuigen en hun gebruik, een onderzoek naar de gebruikssporenanalyse op steen als methode en de stenen werktuigen van Geleen Janskamperveld, MA thesis Leiden.


