DOI: http://dx.doi.org/10.5334/ai.0913

Flint knapping in an early Neolithic settlement: Hanau Klein-Auheim

Ulrike Sommer

Stone (or lithic) tools are among the most durable types of artefacts in the archaeological record, and major phases in human cultural evolution, such as the Palaeolithic, Mesolithic and Neolithic, are named after them. They are clearly an important and abundant source of information to archaeologists and much can be learned from them, as outlined in this article. But how important were they in the day-to-day life of people in the past?

Flint has been called "the steel of the stone age",[1] both to emphasize its fundamental importance as a raw material and the many different ways in which it could be shaped and used. It is made up mainly of silica (SiO_2). It is very hard and has a homogeneous grainless structure, which means that it should break in a predictable way when hit with another stone or a softer hammer such as a piece of antler or bone. The fragments thus produced often have very sharp edges. Flint can be worked (knapped) into blade-like implements to cut meat, skin or leather; planes to whittle wood, bone and antler; axes to dismember carcasses and chop down trees; and piercing instruments such as perforators, spearheads or arrowpoints. As flint is brittle, it breaks quite easily upon impact, and the edges become blunt after a while, especially if used to work soft materials such as leather or meat.

Flint and related silica-rich stones tend to occur only in specific geological layers, and they often develop cracks if exposed to frost or to sharp temperature differences, such as the hot daytime and cold night temperature in many deserts. Such cracks reduce the quality of the flint; so, although raw material was certainly picked up from the ground surface at the beginning of flint-tool production, and people made do with whatever material was locally available, both mining of and trade in high-quality flint started in the Upper Palaeolithic at the latest. The earliest flint mine known so far, Nazlet Khater in Upper Egypt, dates from about 32,000 years ago.[2] Here, and at other places in Asia, Africa and Europe, hunters and gatherers dug several metres deep to acquire unweathered high-quality flints.

For archaeologists who are interested in the earlier periods of prehistory, flints are very important: they are highly resistant to the ravages of time, each piece carries the traces of its production and sometimes its use, and, often, different types of flint have clearly distinctive colours and textures, allowing geologists to trace them to their source, and prehistorians to reconstruct prehistoric trade and exchange.

But, in reality, how important was flint for prehistoric communities? How much flint did a person need, and how did he or she go about acquiring it? In the following, I shall discuss what my excavation at the site of Hanau Klein-Auheim can tell us about the use and importance of flint in an early Neolithic settlement.

The LBK settlement of Klein-Auheim

The *Linearbandkeramik* (LBK) is the earliest pottery (5500–4900) found across an area lying between the Bug (in Poland and the Ukraine) and the Seine, the upper Danube and the great North European Plain (Fig. 1). This is an area of 900,000 km², but the actual settlements of these early farmers are found on only the most fertile soils of the loessic plains, although analyses of pollen indicate that the hills were used for grazing.

The settlement of Hanau-Klein Auheim is located in southern Germany, about 20 km east of Frankfurt on the gravels of the second river terrace of the Main. Soon after the settlement was abandoned by the inhabitants, it was buried by fluvial silts and finally by a sand dune. In settlements on better soils, the Neolithic occupation surface has usually been destroyed by erosion and constant agriculture, leaving only the deepest pits and some post-holes behind, but at Auheim it has been preserved.

Up to now, no LBK flint-mines have been discovered, although there is evidence for this period of mining for other materials, such as the shafts dug several metres into the hard rock of the Black Forest (Southwest Germany) in the quest for haematite (red iron oxide),[3] which was used both as a pigment and to temper pottery. Lacking mines, our knowledge of how the flint raw material was acquired and distributed relies entirely on evidence derived from the settlements themselves.[4]

The raw material used in Klein-Auheim was not flint from Cretaceous rocks, but orthoquartzite, which is a sandstone that has been cemented by silica. The grain of the resulting stone is not quite as fine as true flint and not as attractive as the semi-translucent black Upper Cretaceous (Senonian) flint of the Baltic and the western Paris Basin, but it is far more sturdy.

Flint knapping areas of the Hanau Klein-Auheim site

During the excavation of the Hanau Klein-Auheim site, two flintknapping areas were identified by a concentration of worked stone along with querns that had been re-used as anvils by the flint-knappers. A detailed quantitative analysis of 18,463 artefacts from the main occupation layer allowed the identification of 15 more knapping areas (Fig. 2).

There have been many experimental and ethnoarchaeological studies showing what knapping floors can look like immediately after the process has been completed. In a prehistoric context, however, most of the endproducts, often long and regular pieces of flint called blades, would have been taken elsewhere for further modification and use. So the identification of knapping areas in an archaeological site usually has to rely on refuse. Barring a convenient volcano covering the village in ash in a frozen moment in time as people go about their daily tasks, most remaining waste products will be swept away, thrown at dogs, trampled or picked up for casual use. The hammerstones and antler billets used in the knapping process will be taken away to be re-used elsewhere.

Despite such processes, a high density of stone artefacts is a useful indication of

Figure 1 *Distribution across Europe of settlement sites of the Linearbandkeramik (LBK).*

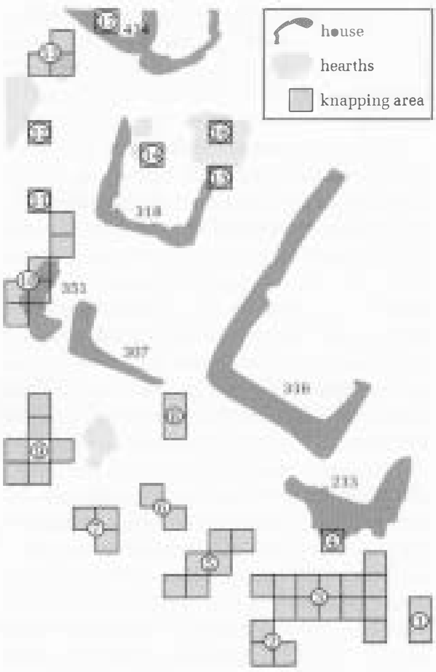


Figure 2 *The* LBK *settlement of Hanau Klein-Auheim (Germany), showing houses and stone-knapping areas (each unit excavated is 1 m²).*

flintworking, as this generates much refuse. Normally, there are 2–4 pieces of refuse for each blade produced.[5] This refuse consists of broad, thick pieces called flakes, shatter (broken pieces) and the remains of the lump of stone all this was detached from, the so-called core. Another clue is provided by pieces that were detached to control the shape of the core during the production process. In the end, concentrations of small pieces of angular refuse,[6] which were without re-use potential and which were trampled into the soil, and thus stayed at their place of origin, turned out to be the best evidence we had of knapping floors. Another important clue was the size range of the artefacts. The end-products, blades and flakes intended for the manufacture of tools (also called blanks) tended to be of fairly uniform size, but the production debris had a much greater size range. Thus, areas with a high variance of the size of artefacts were inferred to be knapping places.

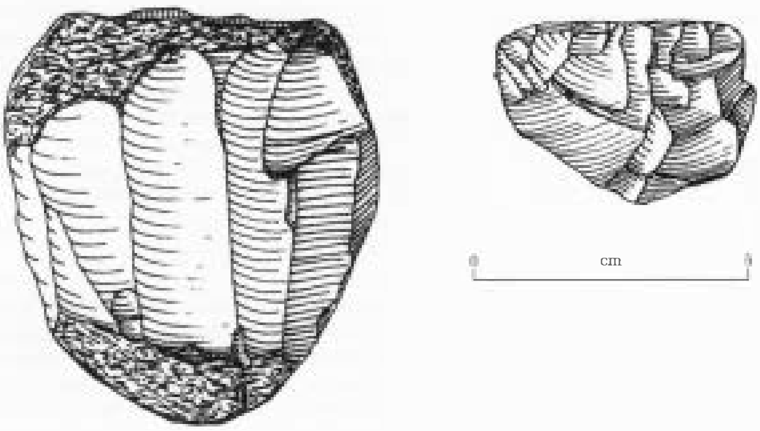
Free for all?

How was access to the raw material sources organized? Was it controlled by a specific person or family, or could everyone just take what he or she needed? Unfortunately, the exact source of the Auheim quartzite has not yet been identified; it may well have been destroyed by Roman and Medieval quarrying. Revealingly, however, the different knapping floors had quite different proportions of cortex types, that is, the outer layer of a quartzite nodule or slab. By prolonged exposure on the Pleistocene surface, some nodules had acquired a hard brown desert varnish, whereas others were friable, sandy and completely unweathered on the outside. Obviously, although of the same geological origins, they came from different sources.

Possibly different groups or individuals had fixed rights to different parts of the raw-material source, and used separate but closely adjacent parts of the site for flint working. Alternatively, access to the lithic raw material was free to everyone, and each knapping place represents just one episode of use, with an individual visiting the source, selecting a suitable piece of material and working it into blanks and tools, and leaving his or her waste behind. The excellent preservation of the knapping floors indicates that they have not been subjected to much trampling and other disturbance processes and therefore must have been activities that took place towards the end or after the end of the settlement as such, in a rather short period of time.

The cores themselves (Fig. 3) were also far from uniform. Among them there were many regular pyramidal cores, bearing narrow parallel scars left by the removal of many blades, chubby cores from which small and rather irregular flakes had been removed in a haphazard way, and huge discoid cores for the production of large fat flakes. Some very irregular blocks were not really suitable for tool production, but had been used nevertheless, often in a very inept way. They looked like the work of beginners, maybe children learning how to knap (Fig. 4).[7] It is tempting to speculate that the pyramidal cores were the products of specialists, whereas the small cores represent the output of non-specialists who were merely in need of an *ad hoc* unspecialized tool or simply a sharp piece of stone. Most scholars agree that there were no full-time craft specialists in the early Neolithic,[8] and because the different core types show different distributions across the site, the shape of the core might simply have been determined by the type of blank needed at the moment.

Refitting the artefacts, putting the pieces of stone back together in the order in which they were detached (rather like doing a three-dimensional puzzle), shows how the reduction of a core was organized (what has been termed the *chaîne opératoire*),[9] how the platform and the working face of a core were prepared and kept in shape, and which pieces are missing. By mapping the distribution of the refitted pieces, it is possible to investigate their subsequent history as well. In practice, it is rarely possible to do a refitting study of all the finds in a settlement, as this needs much laboratory space and even more time. At Klein-Auheim, only one knapping area has been refitted so far (Fig. 5). The knapping technique used here did not rely on a formal core at all, the worker simply used the natural edge of a tabular block of raw material and produced blades and flakes with minimal attempt at preparation. This is a technique that works only with tabular raw material (because it has a naturally flat surface from which to work) and was probably developed locally. It remains to be seen if the same technique was used in the other knapping areas as well. It would certainly be the most time-efficient way of producing blanks and probably served to make blades to supply other settlements.



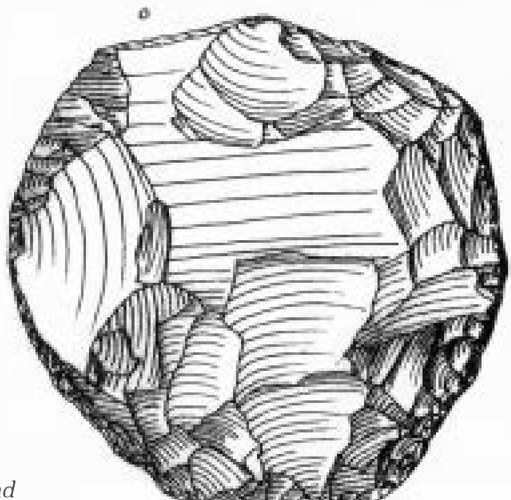


Figure 3 *Different* LBK *core-types in Klein Auheim (drawn by Ulrike Sommer and Birgit Gehlen).*

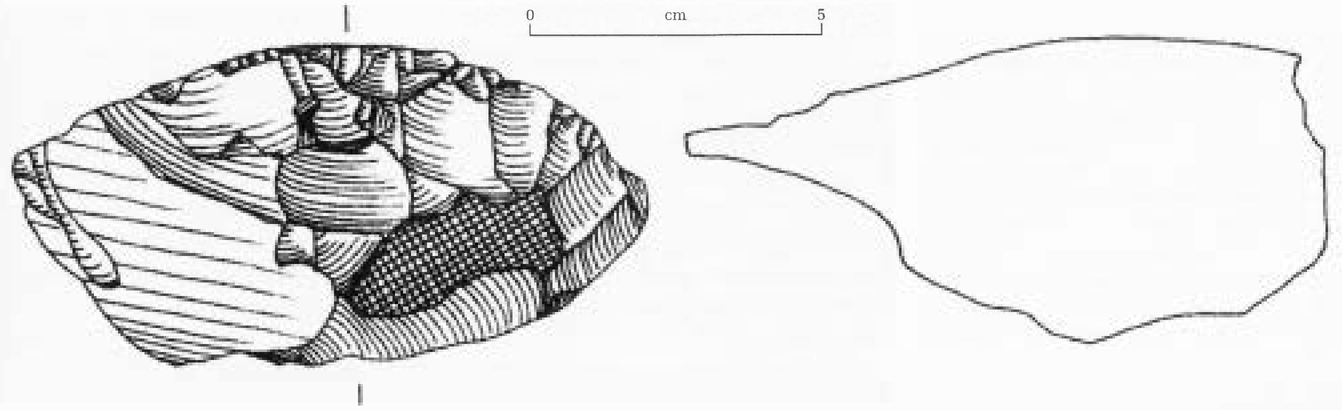


Figure 4 *A beginner's core, Klein Auheim (drawn by Ulrike Sommer and Birgit Gehlen).*

LBK-artefacts made out of Auheim quartzite are found across an area of about 1,000 km^2 in the lower Main basin.

All in all, there were at least four different methods of working the local siliceous stone, and their selection seems to have been entirely dependent on what end-product was required. So, even if the methods used by the Auheim flintknappers were not very sophisticated, they were quite efficient and well adapted to the material at hand.

Carrying coals to Newcastle?

Based on the analysis of excavation of numerous LBK settlements in the opencast-mining areas between Cologne and Aachen, Andreas Zimmermann has calculated that an average North Rhenish LBK family used up 13 lithic artefacts per year.[10] This is based on the number of artefacts actually recovered in the excavations, an estimated loss of 75 per cent of all artefacts to erosion, and a use-life of LBK houses of 25 years. This figure is obviously highly speculative, as we simply do not know how long an LBK house lasted; and, although it is possible to gauge the depths of soil lost to erosion by comparison with the few settlements with better preservation, we have no idea at all of the depth distribution of artefacts in the pits or of how many of those in use ever ended up in a pit at all. If Zimmermann's estimate is approximately correct, then very few flint implements were in daily use at any one time, and most of the domestic tasks must have been carried out without them.

Most LBK settlements are located in areas without direct access to flint sources, and long-distance transport of lithic raw materials is quite common in the LBK. Pink radiolarite from Szentgál in Hungary is found in Austria and southern Germany, more than 750 km distant,[11] chocolate-coloured flint from Poland was brought to the Czech Republic and to Austria, and Slovak obsidian (volcanic glass) to sites in Poland.[12] This is normally taken as an indication of the high value of flint and other raw materials. But very often, only a few of these exotic materials are present, while siliceous stones from other sources show a rather steep fall-off: they were exported, but not over great distances. This does not fit a simple distribution model based on distance and demand.

The raw materials recovered at Klein-Auheim are a case in point: although 96.6 per cent of all artefacts were made of quartzite and a low percentage of other local raw materials, 0.6 per cent consisted of flint from the Upper Cretaceous period from the southern Netherlands, about 300 km away. The overwhelming majority of the latter flints had been made into formal tools, such as scrapers, and most showed traces of heavy wear. But why would the inhabitants of Klein Auheim, who habitually threw away pieces of stone that would have been quite desirable to the flint knappers starved of raw material only 100 km farther south (who laboriously tried to utilize even the smallest available pieces of raw material), have sought to acquire Dutch flint material and use it in preference to the local quartzite?

There is some indication that lithic raw materials should be considered not only in basic utilitarian terms. In the Australian Western Desert, for example, certain raw materials were linked to the heroes of the Dreamtime or came from the region in which a man was born and from which he claimed totemic descent, and thus were used preferentially to other, more local materials, irrespective of quality.[13]

There might have been other processes at work as well. The philosopher Georg Friedrich Hegel claimed that society is established only when individuals meet as owners of property and acknowledge each others' right of possession by entering into

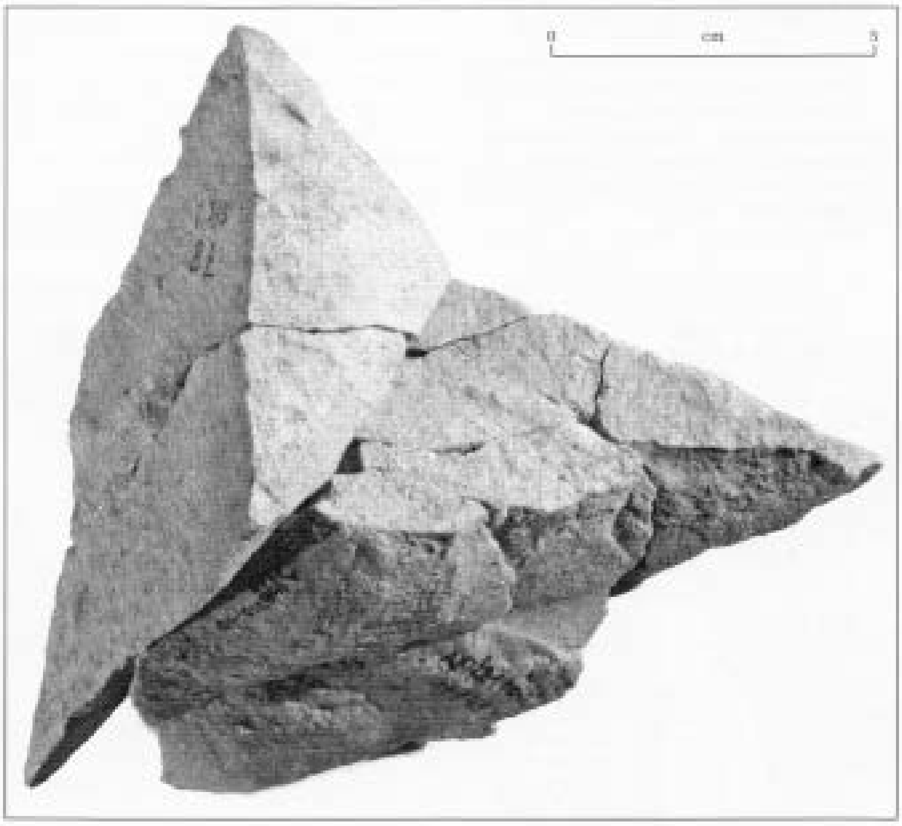


Figure 5 *Refitted flint from knapping area 8 (see Fig. 2).*

reciprocal relations of exchange.[14] Thus, "abstract law" is changed into a praxis, the "ethical life" (*"Sittlichkeit"*), which is the explicit acknowledgement of other individuals and their rights in the context of a formal contract. On a less abstract level, many ethnologists have shown how relations of exchange work to ensure social cohesion both within and between communities.[15] Sometimes it may not matter exactly what is exchanged, but rather the fact of the exchange itself. In Neolithic terms: even if you had a sufficient supply of raw material, you could not afford to keep out of the exchange circle, which probably served to circulate other things, both tangible and intangible. Marriage networks, ritual ties and the general maintenance of peaceful relations between settlements and family units might have been dependent upon, and substantiated by, the circulation of lithic raw materials.

If we return to the metaphor of flint as the "steel of the stone age", it turns out to be highly misleading. In an early Neolithic LBK context, flint was both less and more than steel is in modern society. It probably did not really count among the basic necessities of life, something people could not do without. But it might well have been one of the substances, the use and exchange of which helped to create and sustain the society as such.

Notes

1. *5000 Jahre Feuersteinbergbau: die Suche nach dem Stahl der Steinzeit, Ausstellung im Deutschen Bergbau-Museum Bochum vom 24 Oktober 1980 bis 31 Januar 1981*, G. Weisgerber (Bochum: Deutsches Bergbau-Museum, 1999).
2. *Palaeolithic quarrying sites in Upper and Middle Egypt*, P. M. Vermeersch (Leuven: Leuven University Press, 2002).
3. G. Goldenberger, A. Maas, G. Steffens, H. Steuer, "Hematite mining during the Linear Ceramics culture in the area of the Black Forest, South-West Germany" in *Man and mining – Mensch und Bergbau: studies in honour of Gerd Weisgerber*, Th. Stöllner, G. Körlin, G. Steffens, J. Cierny (eds), 179–86. *Der Anschnitt* supplement 16, 2002.
4. *Production and management of lithic materials in the European Linearbandkeramik: Gestion des matéraux lithiques dans la Rubané européen*, L. Burnez-Lanotte (ed.) (Oxford: Archaeopress, BAR International Series 1200, 2003)
5. D. Cahen, "Technologie de la débitage laminaire", within "Les fouilles de la Place Saint-Lambert à Liège", M. Otte (ed.), *Études et Recherches Archéologiques de l'Université de Liège* **18**, 171–98, 1984.
6. Found only by wet sieving all of the excavated sediment.
7. N. Finlay, "Kid knapping: the missing children in lithic analysis", in *Invisible people and processes: writing gender and childhood into European archaeology*, J. Moore & E. Scott (eds), 203–212 (London: Leicester University Press 1997).
8. "The organisation of flint tool manufacture", in *Studies on Neolithic flint exploitation, socioeconomic interpretations of the flint assemblages of Langweiler 8, Beek, Elsloo, Rijckholt, Hienheim and Meindling*, M. E. Th. De Grooth, 27–51 (Den Haag: Scorpio, 1994).
9. *Le geste et la parole*, A. Leroi-Gourhan (Paris: Albin Michelle, 1964).
10. *Austauschsysteme von Silexartefakten in der Bandkeramik Mitteleuropas*, A. Zimmermann (Bonn: Habelt, 1995).
11. See p. 110 in *Silexartefakte der ältestbandkeramischen Kultur*, D. Gronenborn (Bonn: Habelt, 1997).
12. *Rohstoffe, Technik und Typologie der neolithischen Feuersteinindustrien im Norden des Flußgebietes der Mitteldonau*, M. Kaczanowska (Warszawa: Drukarnia Uniwersytetu Jagiellońskiego, 1985).
13. See p. 406 in D. F. Thompson, "Some wood and stone implements of the Bindibu tribe of central Western Australia", *Proceedings of the Prehistoric Society* **30**, 400–422, 1964; and p. 161 in R. A. Gould, D. Kostern, A. Sontz, "The lithic assemblages of Western Desert aborigines of Australia", *American Antiquity* **36**, 149–69, 1971.
14. *Georg Wilhelm Friedrich Hegel: elements of the philosophy of right*, A. W. Wood (ed.) (Cambridge: Cambridge University Press, 1991)
15. *Stone Age economics*, M. Sahlins (London: Tavistock Publications, 1974).