# 8 Stone, procurement and use

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*A variety of stone objects was found at Schipluiden. All the stone had to be imported from distant regions. The types of stone represented point to a predominant source in the Meuse riverbeds or terraces, but some smaller gravel may have been collected closer by. Modified implements include grinding stones, querns, hammer stones and axe fragments. The grinding stones were used mostly to polish flint. A phytolith study of querns yielded evidence of the processing of cereals. One piece of pyrite was recovered from a burial along with some flint strike-a-lights.*

## 8.1 Introduction

Stone objects other than flint artefacts usually receive little attention in archaeological research, partially because the majority of the stone objects were not modified into classifiable implements. Another reason for the lack of interest in stone objects is the fact that stone, in contrast to flint, is a rather heterogeneous category in terms of manufacturing techniques (or lack thereof), use and even ideological significance. Unmodified net sinkers, for example, constitute a marked contrast with highly elaborate stone grave goods. Nevertheless, research into hard stone assemblages can provide information about topics such as mobility, exchange contacts, ideology and daily activities. Stone is and was not available locally in the western part of the Netherlands, in particular the delta, and had to be imported. This means that every piece of stone found at the site was selected somewhere and transported to Schipluiden, presumably with a specific application in mind. For a better understanding of the action radius of the Schipluiden people it was considered essential to try to identify the sources of the stones. Knowledge of those sources would provide information about external contacts or mobility, and therefore also about the cultural affiliations of the people at the site. Research into hard stone objects may also yield data on subsistence. For example, querns may provide evidence of agricultural activities. Evidence of various craft activities such as bead manufacture and axe grinding indicates that a site was used by complete households over a long period.

## 8.2 The material

A total of 4770 pieces of stone other than flint were collected by hand. Most were recovered from the 1m² units (94%), a much smaller proportion from sections and pit fills. The 4-mm sieving programme produced an additional quantity of about 900 pieces of stone, predominantly very small, angular pieces without traces of manufacture or use.[1] This corresponded to approx. 55 kg of stone. It should be realised that this sample represents a total of about 11,000 stone objects contained in the excavated volume, since only 8% was sieved.

It was decided to restrict the analysis of the hard stone to a selection of the more informative material in view of the number of stone objects in absolute terms and in relation to the planning. For this purpose a lower limit of 2 cm maximum dimension was chosen. Pieces of stone with smaller dimensions are often very hard to classify and the stone type is difficult to determine. This resulted in a selection of 1728 pieces, 1725 of which were manually collected and only three (all pieces of pyrite) derived from the 4-mm sieve residue (table 8.1). This means that the material analysed represents almost full recovery of this >2 cm fraction, and

| | trench 10 pilot | | total excavation | | >2 cm selection |
|---|---|---|---|---|---|
| excavated volume | 10 m³ | 60 m³ | 80 m³ | 1000 m³ | |
| collected by hand in Units | | 81 | | 4518 | 1630 |
| idem from pit fills | | 4 | | 253 | 95 |
| *total* | | *85* | | *4771* | *1725* |
| 4-mm sieve | 286 | | 3059 | | 3 |
| 4-mm sieve, extrapolated | | 1716 | | 38,237 | |
| *Totals* | | *1801* | | *43,008* | *1728* |

Table 8.1 Number of stone objects found using different collection strategies. The extrapolation demonstrates the total number of artefacts >4 mm originally present in the excavated volume.

| | N = | sum | % | sum |
|---|---|---|---|---|
| sedimentary | | | | |
| general | 339 | | 19.6 | |
| quartzitic sandstone | 498 | | 28.8 | |
| micaceous sandstone | 36 | | 2.1 | |
| conglomerate | 5 | | 0.3 | |
| lydite | 13 | | 0.8 | |
| vein quartz | 210 | | 12.2 | |
| limestone | 3 | | 0.2 | |
| *total* | | *1104* | | *63.8* |
| metamorphic | | | | |
| general | 2 | | 0.1 | |
| quartzite | 159 | | 9.2 | |
| amphibolite | 7 | | 0.4 | |
| slate | 3 | | 0.2 | |
| phyllite | 15 | | 0.9 | |
| schist | 28 | | 1.6 | |
| gneiss | 68 | | 3.9 | |
| *total* | | *282* | | *16.3* |
| igneous | | | | |
| general | 19 | | 1.1 | |
| basalt | 1 | | 0.1 | |
| granite | 227 | | 13.1 | |
| diorite | 3 | | 0.2 | |
| syenite | 1 | | 0.1 | |
| gabbro | 1 | | 0.1 | |
| diabase | 3 | | 0.2 | |
| porphyry | 15 | | 0.9 | |
| *total* | | *270* | | *15.8* |
| mineral | | | | |
| pyrite | 40 | | 2.3 | |
| marcasite | 1 | | 0.1 | |
| *total* | | *41* | | *2.4* |
| indet. | | *31* | | *1.8* |
| *Totals* | | *1728* | | *100* |

Table 8.2 Worked stone, raw material frequencies.

that only *c*. 33 pieces (approx. 2%) will have been missed in the excavation.[2]

Also included in this sample are pieces <2 cm showing one or more worked facets and the smaller pieces of pyrite/marcasite, the only minerals deliberately collected. Excluded are the semiprecious stones jet and amber (N=54) that were used for the manufacture of beads; they will be separately dealt with in the next chapter.

The variety of stone found at Schipluiden is quite large, ranging from common stone types such as quartzitic sandstone to quite unusual ones such as amphibolite, porphyry and various more exotic types, some of which could not be classified beyond basic rock type (table 8.2). However, the stone types most frequently encountered – quartzite, quartzitic sandstone, sandstone and quartz – are the same as at other Hazendonk sites such as Wateringen 4 and Hazendonk. Another remarkable feature is the considerable number of stone objects bearing traces of manufacture or use (N=559; table 8.3). However, the modified and used objects (N=278) represent only 16.1% of the manually collected material, a percentage comparable to that obtained at Wateringen 4 (13.2%; Molenaar 1997).[4]

## 8.3 Methodology

### *8.3.1 Technological analysis*

The variables described include dimensions (in cm), weight (in grams), primary classification (flake, core, etc.), raw material (according to the specifications of Archis, the digital national reference collection set up by the Archaeological State Service, Amersfoort, the Netherlands), typology (according to the Archis list), modification, degree of burning, fragmentation, grain size, patination and the extent and character of the cortex. All stones were carefully examined for traces of modification, produced during either manufacture or use. This was done using a stereomicroscope, which was also used in the identification of stone types (magnifications in the range of 10-64×).

### *8.3.2 Use-wear analysis*

High power use wear analysis of hard stone tools is relatively new. Most research to date made use of stereo-microscopy only (Hamon 2004a, b; Dubreuil 2002; Van Gijn *et al*. 2001; Van Gijn/Houkes 2001). There is a very practical reason for the lack of high-power use-wear studies of stone tools and that is the limited work space of metallographic microscopes that excludes virtually all stone tools from analysis. The purchase of a metallographic microscope with a free arm made such a study of the Schipluiden stone tools possible. Re-examination of the experimental tools also made clear that polish and striations could be distinguished and that traces varied according to the different tasks carried out.

A total of 60 implements were selected for a use-wear and residue study. The selection aimed to cover all typological categories, such as grinding stones, querns, hammer stones, axes, cooking stones and simple flakes. All the implements were first examined by stereomicroscope (with incident and oblique lighting) in order to locate any residues and obtain a general view of the polished zones, striations or directionality in the polish, and edge removals. The implements were then studied by incident light metallo-graphic microscope with magnifications ranging from 100 to 560 ×. Photographs were taken with a digital camera. None of the implements were chemically cleaned, but some were immersed in the ultrasonic cleaning tank (in distilled water) to remove adhering dirt.

| artefact type / raw material | implements (modified) | | | | | | | | | | | | debitage | | | | | totals | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | grinding stone | quern | rubbing stone | axe | axe flakes | hammer stone | retouchoir | anvil | Geröllkeule | ornamented stone | used (unspecified) | totals | blade | flake | block | burnt | indet. | totals modified | not modified | totals | % modified |
| sedimentary | | | | | | | | | | | | | | | | | | | | | |
| sandstone | 4 | 4 | 1 | – | – | 11 | 1 | – | – | – | 5 | 26 | – | 23 | – | 37 | 1 | 87 | 252 | 339 | *26* |
| quartzitic sandstone | 23 | 13 | 4 | 1 | 5 | 28 | 2 | – | – | – | 30 | 106 | 2 | 52 | – | 99 | 1 | 260 | 238 | 498 | *52* |
| micaceous sandstone | – | – | – | – | – | – | – | – | – | – | – | – | – | 1 | – | – | – | 1 | 35 | 36 | *3* |
| conglomerate | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | 5 | 5 | – |
| lydite | – | – | – | – | – | – | – | – | – | – | – | – | – | 1 | – | – | – | 1 | 12 | 13 | *8* |
| vein quartz | – | – | – | – | – | 19 | – | – | – | – | 1 | 20 | – | – | – | – | 1 | 21 | 189 | 210 | *10* |
| limestone | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | 3 | 3 | – |
| metamorphic | | | | | | | | | | | | | | | | | | | | | |
| general | – | – | – | – | – | 1 | – | – | – | – | – | 1 | – | – | – | – | – | 1 | 1 | 2 | – |
| quartzite | 13 | 4 | – | 4 | – | 21 | – | – | 1 | – | 12 | 55 | – | 29 | 1 | 4 | 2 | 91 | 68 | 159 | *57* |
| amphibolite | – | 1 | – | – | – | 3 | – | – | – | – | 1 | 5 | – | – | – | – | – | 5 | 2 | 7 | – |
| slate | – | – | – | – | – | – | – | – | – | 1 | – | 1 | – | – | – | – | – | 1 | 2 | 3 | – |
| phyllite | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | 15 | 15 | *0* |
| schist | – | 1 | – | – | – | 1 | – | – | – | – | – | 2 | – | 1 | – | – | 1 | 4 | 24 | 28 | *14* |
| gneiss | 2 | 2 | – | – | – | 1 | – | – | – | – | 10 | 15 | – | 4 | – | 1 | 3 | 23 | 45 | 68 | *34* |
| igneous | | | | | | | | | | | | | | | | | | | | | |
| general | – | 1 | 1 | 2 | – | 2 | – | 1 | – | – | 1 | 8 | – | – | – | – | 1 | 9 | 10 | 19 | *47* |
| basalt | – | 1 | – | – | – | – | – | – | – | – | – | 1 | – | – | – | – | – | 1 | – | 1 | – |
| granite | 1 | 9 | – | – | – | 11 | – | – | – | – | 11 | 32 | – | – | – | 3 | 2 | 44 | 183 | 227 | *19* |
| diorite | – | – | – | – | – | – | – | – | – | – | 1 | 1 | – | – | – | – | – | 1 | 2 | 3 | – |
| syenite | – | – | – | – | – | – | – | – | – | – | 1 | 1 | – | – | – | – | – | 1 | – | 1 | – |
| gabbro | – | – | – | – | – | – | – | – | – | – | – | 0 | – | – | – | – | – | – | 1 | 1 | – |
| diabase | – | 1 | – | – | – | – | – | – | – | – | – | 1 | – | 1 | – | – | – | 2 | 1 | 3 | – |
| porphyry | – | – | – | 1 | – | – | – | – | – | – | – | 1 | – | – | – | 1 | – | 2 | 13 | 15 | *13* |
| mineral | | | | | | | | | | | | | | | | | | | | | |
| pyrite | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | 40 | 40 | *0* |
| marcasite | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | 1 | 1 | – |
| indet. | – | – | – | – | – | – | 1 | – | – | 1 | – | 2 | – | 2 | – | – | – | 4 | 27 | 31 | *13* |
| *Totals* | *43* | *37* | *6* | *8* | *5* | *98* | *4* | *1* | *1* | *2* | *73* | *278* | *2* | *121* | *1* | *145* | *12* | *559* | *1169* | *1728* | *32* |

Table 8.3 Worked stone, raw material versus artefact type.

The collection of experimental hard stone tools of the Laboratory for Artefact Studies was used as a reference. It includes 51 tools used for a variety of activities, such as grinding seeds, polishing bone and antler, pounding ochre and flaking flint. A few extra experiments were performed for the specific context of the Schipluiden site, most notably polishing a flint axe, polishing jet and several experiments with the use of querns to grind cereals and other plant material.

### *8.3.3 Phytolith/residue analysis*

A total of six implements – five querns and one rubbing stone – were selected for phytolith analysis. Additionally, four soil samples were taken from pit fills (features 20-101, 10-140, 12-314, and 16-454. The stones were completely immersed in distilled water in an ultrasonic cleaning tank in order to remove all residues and were then centrifuged for 5 minutes at 3000 rpm. This procedure was repeated twice in order to compare the results after the first and second rinses to account for possible contamination of adhering sediments. No chemicals were used to extract the phytoliths. The soil samples were soaked for 10 minutes and were subsequently sieved in four steps (through 0.25 mm, 0.175 mm, 0.125 mm and 0.075 mm). The samples were then centrifuged twice for 5 minutes at 3000 rpm and the supernatant was poured away between the two sessions. The glass slides were examined under a transmitted-light microscope (magnifications up to 1000 ×). The phytolith analysis was performed in collaboration with Dr Channah Nieuwenhuis.

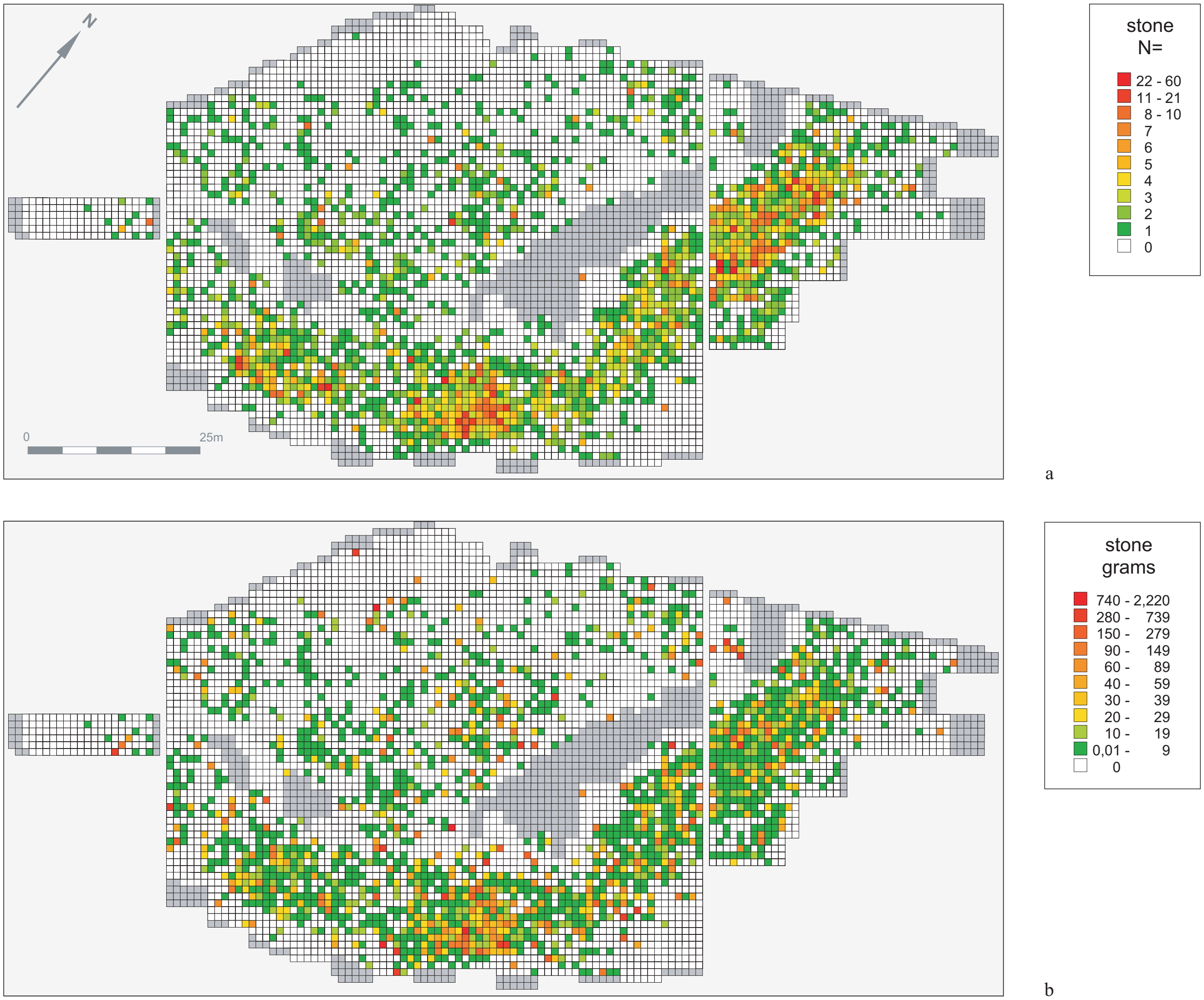



Figure 8.1 Distribution patterns of the stone artefacts per square metre; number of finds (a) and total weight (b).

## 8.4 Taphonomy

### *8.4.1 Deposition*

The general distribution of the fragments of stone implements corresponds to the distributions of the other find categories, with a concentration along the southeastern margin of the dune and a diffuse spread all over the dune area. Stone objects were however also found on top of the dune, where very few finds of the other categories had survived (fig. 8.1). Considering stone's resistance to weathering and colluviation, we may consider the amount of stone found to be representative of the original quantity, except in the eroded central zones (chapter 4).

It would seem that the southeastern margin of the dune should indeed be considered a dump zone, where material was deposited away from the central habitation area. Intentional deposition of stone objects seems to have been confined to the small pyrite nodule in the hand of the dead man in grave 2 (chapter 5).

### *8.4.2 Preservation*

All the stones have a fresh appearance, without traces of weathering or patination, with the exception of pieces of igneous stone, especially granite, which often crumbled as a result of weathering. A considerable number of artefacts still showed their natural, rolled outer surface. All the stone has a dark colour, ranging from varying shades of grey to almost black. This may be due to the peaty, humic deposits in which the material was found.

Fragmentation was common, with a considerable number of objects displaying fracturing marks or even complete fragmentation (for example those of granite). This fragmentation seems to be attributable to cultural, not natural causes, such as pounding granite or quartz for the production of temper for pottery, or the production of flakes from discarded grinding stones.

Quite a few of the stone objects display signs of burning (35.8%). Some of these objects can undoubtedly be interpreted as cooking stones, while others were probably burnt by accident.

The wear traces are well preserved. Patination was observed in a handful of cases (N=8). The surfaces of the fractures look very fresh, with sharp edges in the case of the majority of the tools examined. It should however be noted that use-wear analysis of hard stone tools may not always yield the same detailed information as a functional analysis of flint because of the coarser grain size of most types of hard stone. A coarser grain size results in a slower development of wear traces than is the case with fine-grained or translucent flint. Sometimes hard stone tools were rejuvenated by pounding, which will have removed any wear traces previously present. This is for example frequently the case with querns and sometimes precludes identification of contact materials. The direction in which an implement was used is however usually identifiable. No residues were observed, except on a few coarse-grained tools classified as querns, which seemed to show some sort of deposit. They were selected for phytolith analysis.

## 8.5 Raw materials

### *8.5.1 Variety of stone*

The assemblage includes a great variety of stone types, including sedimentary, metamorphic, and igneous stones (table 8.1). The assemblage is generally characterised by a dark grey colour regardless of the type of rock, presumably a result of the matrix in which most of the stones were embedded (fig. 8.3). The largest category of stone is that of quartzitic sandstones. The degree of metamorphisation of these sandstones varies from very little (almost sandstone) to very much (almost quartzite). Sandstones (fine and coarse) are also very common; both fine-grained and coarser-grained varieties are represented. Some of the sandstones contain considerable quantities of muscovite and were identified as micaceous sandstone. Five artefacts were identified as arkotic sandstones.

Quartzites are common among the metapmorphic stones. A remarkably large number of the quartzites contain blue quartz crystals. Gneiss is a common stone type. Many of the gneiss pieces are quite large. Schist was also found, including micaceous schist. Other metamorphic stones encountered in smaller quantities are slate, amphibolite and phyllite.

The assemblage also includes a variety of igneous rocks. The most frequently encountered igneous rock is granite, with a total weight of over 1100 grams. The granite is often severely fragmented. This is largely due to taphonomic factors because granite is sensitive to weathering under moist conditions. Granite was however also used to temper pottery, and might have been crushed intentionally (see below). Some of the concentrations of fragmented granite may even be interpreted as disintegrated sherds that were tempered with granite. Porphyry is the second largest group of igneous rocks, represented by a total of 15 objects. Three objects of diorite were found, and three of diabase. Gabbro and syenite were each identified once.

Pyrite was found quite frequently (N=40) and is probably associated with the large number of strike-a-lights in the flint assemblage (chapter 7). One piece was identified as marcasite. Only three pieces of pyrite were retrieved from the sieve, implying that we missed about half of the pyrite originally present at the site. Vein quartz was also abundant, especially in the size fraction below 5 mm. The small pieces of vein quartz were usually rounded and formed part of the natural sediment. The larger pieces must all have been imported. A total of 210 pieces of vein quartz were contained in the coded sample >2 cm. They included broken specimens as well as some larger pebbles.

### *8.5.2 Sources*

At present, no natural sources of stone are to be found in the presumed territory of the site, and essentially nowhere in the extensive Holocene sedimentation area commonly referred to as the 'Rhine-Meuse delta' (fig. 8.2). Gravels are to be found only in the riverbeds, but they are beyond normal reach today and this was most probably the case in the Neolithic, too. The coastal beaches are nowadays also devoid of stone, and there are no indications in older deposits suggesting that this was any different in the Neolithic.[3] Old gravel deposits below the North Sea floor are covered by Late Glacial coversands reworked into the younger sea sand, where they are beyond reach of waves and currents. The situation in the Middle Neolithic – when the sea level was 6 to 4 m lower – was not different in this respect. Only reworked gravel beds may have been more readily accessible (Van der Valk in prep.). It is likely that small nodules, measuring c. 3 cm. in diameter, of quartz, quartzite and quartzitic sandstone could be collected nearby. More thorough research into possible stone sources is clearly needed.

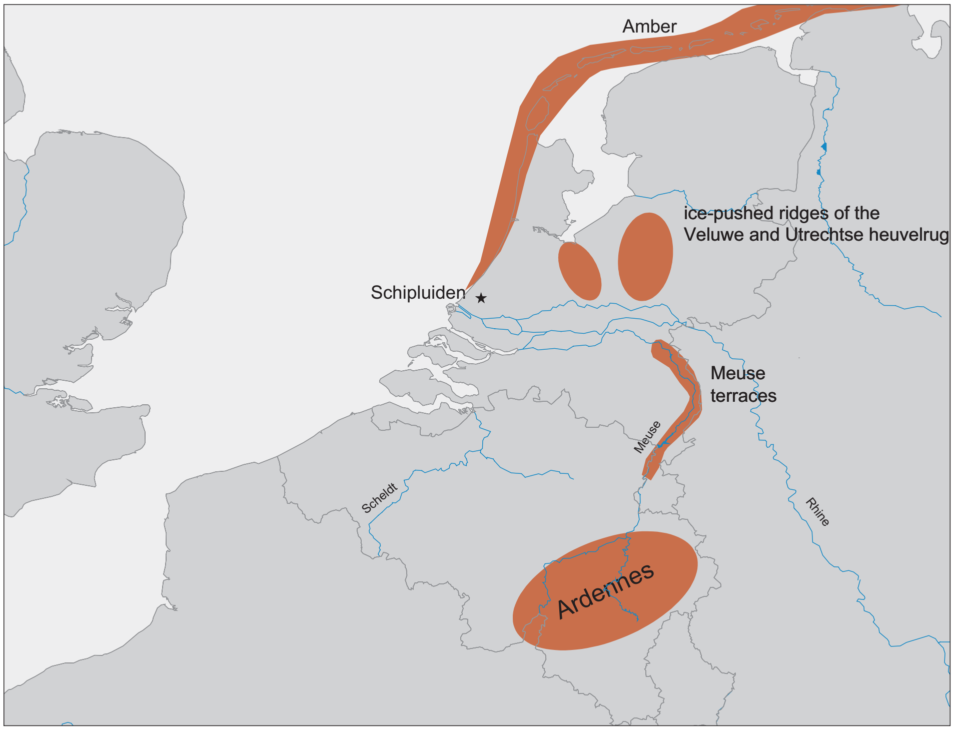



Figure 8.2 The stone sources mentioned in the text.

Although all the hard stone was evidently brought to the site from distant sources, it is for several reasons not easy to pinpoint those sources. In the fist place, the assemblage could be a mixture of materials from various areas. Secondly, the material does certainly not reflect the composition of the sources in a representative way, since prehistoric people will have selected specific stone types for specific uses. Thirdly, all potential sources are secondary deposits (river gravels, boulder clays), occurring over vast geographic areas. This means that we will have to work with specific 'guide types' for the various sources, which may however be missing in our assemblage because they were not selected. For example, the absence of jasper – a typical Rhine gravel component – does not mean that Rhine gravels were not exploited.

The margins of the nearest upland – the coversand landscape of Noord-Brabant – lay 50 km from the site at that time (fig. 14.2). This area has however not been investigated sufficiently to be able to say which stone types could be collected here. The nearest certain sources of pebbles and boulders lay 75 km to the east, in the Utrechtse Heuvelrug, an ice-pushed ridge consisting of Middle Pleistocene Rhine and Meuse gravels with some local Saalian boulder clay relics. Other potential sources lay between 110 and 140 km from the site: the boulder clay outcrops of the former island of Urk (IJsselmeer region), ice-pushed river gravels and patches of boulder clay in the Veluwe region and Meuse terrace gravels to the south of Nijmegen. We must realize that prehistoric people in the wooded flat landscape of this country were dependent on the rare natural exposures of stone-bearing deposits, for example at points where the outer bends of the main rivers had eroded ice-pushed ridges or terraces and brooks had cut into the deposits.

The represented range of stone types generally indicates a southern origin for the majority of the materials. Many of the stone objects show at least part of a naturally rolled surface, indicating a source in a pebble bed along river banks or seashores or in terrace deposits. The great variety of stone types points to the Meuse riverbeds and terrace deposits as the most likely source (J.G. Zandstra, pers. comm.). The Ardennes contributed pebbles of phyllite (Cambrian), vein quartz from the Devonian and Carboniferous, diabase (Bosch 1982) and probably also amphibolite (Van der Lijn 1963, 77). The blue quartz crystals observable in many of the dark grey quartzitic sandstone and quartzites also point to the Meuse as the most likely source (P. Cleveringa pers. comm.).

The Scheldt is not a possible source, because this river only cuts through Mesozoic deposits and carries a limited variety of stone types. The only stone types that would have been available in the Scheldt basin are sandstones. There is no evidence of a source in the Rhine beds or terraces: Taunus quartzites, *Buntsandstein* and yellowish sandstones – all of which are typical of Rhine river deposits – are absent.

A major problem is the sourcing of the igneous rock fragments: do they derive from Middle Pleistocene Meuse gravels to the south or from northern boulder clay outcrops? In this context it should be borne in mind that the Moselle formerly belonged to the catchment area of the ancient Meuse, until it was tapped by the Meurthe. The Moselle cut through the Vosges and carried granites and other stone types that the present-day Meuse gravels no longer contain (Bosch 1982; Van der Lijn 1963). Material from the Vosges, such as pebbles of granite, porphyry, lydite and a schistose gneiss with large amounts of biotite, can therefore occasionally be found in the Middle Pleistocene Meuse deposits. Some of the igneous material may also have had a northern origin or it may have been collected to the east, in the boulder clay occurrences of the Veluwe, the Utrechtse Heuvelrug or the more distant areas mentioned above. Clear northern indicators are however absent (J.G. Zandstra pers. comm.). The fragmentary condition of most of the granite pieces (270 with a total weight of only 1100 grams) at the site is however a major drawback for a positive identification of characteristic Scandinavian erratics. Red granites containing many feldspar crystals are most likely of northern origin, but they are not included in the assemblage. White granites are more problematic because they have also been reported for the Meuse riverbeds of southern Limburg (Bosch 1982) and in the ice-pushed river deposits of the 'old Meuse' near Amersfoort (Van der Lijn 1963). The same holds for diabase, which is normally considered a northern stone type, but has also been reported for the Meuse riverbeds. The few pieces of gneiss and diorite can probably be safely considered to be of northern origin, but they may also have been picked up quite close to the areas where the Meuse material was collected, in the rivers area to the east, where Saalian ice-pushed ridges were eroded by the rivers.

Pyrite was long considered a rare commodity, which had to be transported over considerable distances. The Triassic chalks around Winterswijk are often mentioned as a possible source of pyrite, as are the Ardennes (Van der Lijn 1963, 27). This mineral may however be more common than frequently assumed and occurs, if in very small quantities and in a highly fragmented state, in the Meuse beds and along the brooks of Noord-Brabant (P. Cleveringa, pers. comm.). More research is needed to establish the size and kind of pyrite occurring in these areas, but radial pyrite seems to be rare. The pyrite found at Schipluiden displays such a radial pattern. Nodules of radial pyrite are confined to the Ardennes and the chalk of Normandy and southern England (Van der Lijn 1963, 27). This type of pyrite quickly crumbles into a fine powder, an observation that led researchers to assume that it does not survive water transport. Considering the fact that the imported flint was obtained from central and southern Belgian sources (chapter 7), it is likely that the pyrite was procured in the context of the same mobility pattern or exchange relationships. This makes a source in the Ardennes the most likely.

This suggests that the inhabitants of Schipluiden travelled long distances to obtain the stone raw materials they needed. Small pebbles of quartz, quartzite and quartzitic sandstone may have been collected nearby, but most of the implements were made on larger pieces of stone, all of which had to be transported to the site. In the absence of results of detailed fundamental research into sources, it is very difficult to say with any certainty exactly where the different stone types were procured, but a source in the Meuse valley is the most likely. This may have lain as far north as the ice-pushed ridges just north of the main rivers where material of the 'old Meuse' was deposited and where some northern erratics could also be collected. Some of the larger pebbles were more probably obtained further south, either from the Meuse terraces or from the gravel beds. If our assumption that the Ardennes were the most likely source of high-quality radial pyrite is correct, then some of the other stones may also have been collected in that same general area, even though stone types typical of the Ardennes, such as Revinien quartzite, were not selected.

Although the distances from Schipluiden to the sources of raw material may seem very long – up to 200 km – they are not unusual for coastal communities, as has also been demonstrated for the Late Mesolithic occupants of the site of Hardinxveld-Giessendam Polderweg (Van Gijn *et al.* 2001). At Polderweg a large, angular piece of schist was found that most probably came from the northern Ardennes. Northern material deriving from boulder clay deposits was absent at this site. The site of Hardinxveld-De Bruin (Van Gijn/Houkes 2001) showed a spectrum of stone types that could be collected closer by, at distances of around 45-70 km from the site along the ice-pushed ridges of the Veluwe region.

## 8.6 Tool typology and function

### *8.6.1 Introduction*

Stones were frequently used without any further modification. This holds for net sinkers, hammer stones, weights of various kinds and anvils. Across the world examples of the use of unmodified stones abound (*e.g.* Oswalt 1976; Stewart 1996). Such tools are notoriously difficult to identify, also because wear patterns may not be clear. Hammer stones can of course be identified by the presence of pounding marks, but net sinkers are much more difficult to identify as wear traces are at best very ambiguous. Use-wear analysis can sometimes yield information, but not all apparently unmodified stones can of course be subjected to such time-consuming research. Another problem with the analysis of stone objects is the fact that the objects are often highly fragmented, due to either burning or intentional reduction in

| motion \ contact material | plant unspec. | cereals | wood unspec. | bone | miniral unspec. | soft stone | flint | granite | unknown use | indet. | totals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| cutting | – | – | 1 | – | – | – | – | – | – | – | 1 |
| scraping | – | – | 1 | – | – | – | – | – | – | – | 1 |
| chopping | – | – | – | – | – | – | – | – | – | 1 | 1 |
| wedging | – | – | 1 | – | – | – | – | – | – | – | 1 |
| pounding | – | – | – | – | – | – | – | – | – | 16 | 16 |
| grinding | – | – | – | – | – | 1 | 19 | 1 | – | 7 | 28 |
| polishing | – | – | – | 1 | – | 1 | – | – | – | 1 | 3 |
| rubbing | 1 | – | – | – | 1 | – | – | – | – | 4 | 6 |
| milling | – | 6 | – | – | – | – | – | – | – | – | 6 |
| crushing | – | – | – | – | 1 | – | – | – | 1 | 1 | 3 |
| hafting | – | – | – | – | – | – | – | – | – | 1 | 1 |
| indet | – | – | – | – | – | – | – | – | – | 4 | 4 |
| *Totals* | *1* | *6* | *3* | *1* | *2* | *2* | *19* | *1* | *1* | *35* | *71* |

Table 8.4 Functional analysis of 44 stone artefacts with 71 used zones: inferred contact materials versus motions. The frequencies represent the number of used zones and *not* the number of artefacts, as some implements may display more than one used zone.

| artefact type \ contact material | plant unspec. | cereals | wood unspec. | bone | miniral unspec. | soft stone | flint | granite | unknown use | indet. | totals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| axe | – | – | 1 | – | – | – | – | – | – | 3 | 4 |
| hammer stone | 1 | – | – | – | 1 | – | – | – | 1 | 15 | 18 |
| grinding stone | – | – | – | – | – | – | 18 | – | – | 4 | 22 |
| stone with grooves | – | – | – | 1 | – | – | – | – | – | 1 | 2 |
| quern | – | 6 | – | – | 1 | 1 | – | – | – | 3 | 11 |
| cookingstone | – | – | – | – | – | – | 1 | – | – | 1 | 2 |
| flake | – | – | 1 | – | – | – | – | – | – | – | 1 |
| unmodified stone | – | – | – | – | – | 1 | – | 1 | – | 4 | 6 |
| indet | – | – | 1 | – | – | – | – | – | – | 4 | 5 |
| *Totals* | *1* | *6* | *3* | *1* | *2* | *2* | *19* | *1* | *1* | *35* | *71* |

Table 8.5 Artefact type versus inferred contact material. Note that grinding stones were predominantly used on flint, while many querns were used for processing cereals. The frequencies represent the number of used zones and *not* the number of artefacts.

the past. Numerous stones display only a tiny part of a worn facet, from which it is difficult to reconstruct the shape of the original tool.

The majority of the stones found at Schipluiden show no signs of modification (N=1169, *i.e.* 67.6%; table 8.3). A total of 200 artefacts (11.6%) could be classified into typological categories. The use-wear analysis of a sample of 60 implements produced a total of 71 used zones on 44 tools (tables 8.4 and 8.5). A total of 12 artefacts did not show any traces of wear, three implements could not be interpreted and one may have been used. Some of the implements displayed more than one used zone, especially the grinding stones. Below, various categories of tool types will be discussed from a technological and a functional viewpoint.

Figure 8.3 Grinding stones and their fragments. Note the predominantly dark grey colour of the implements.

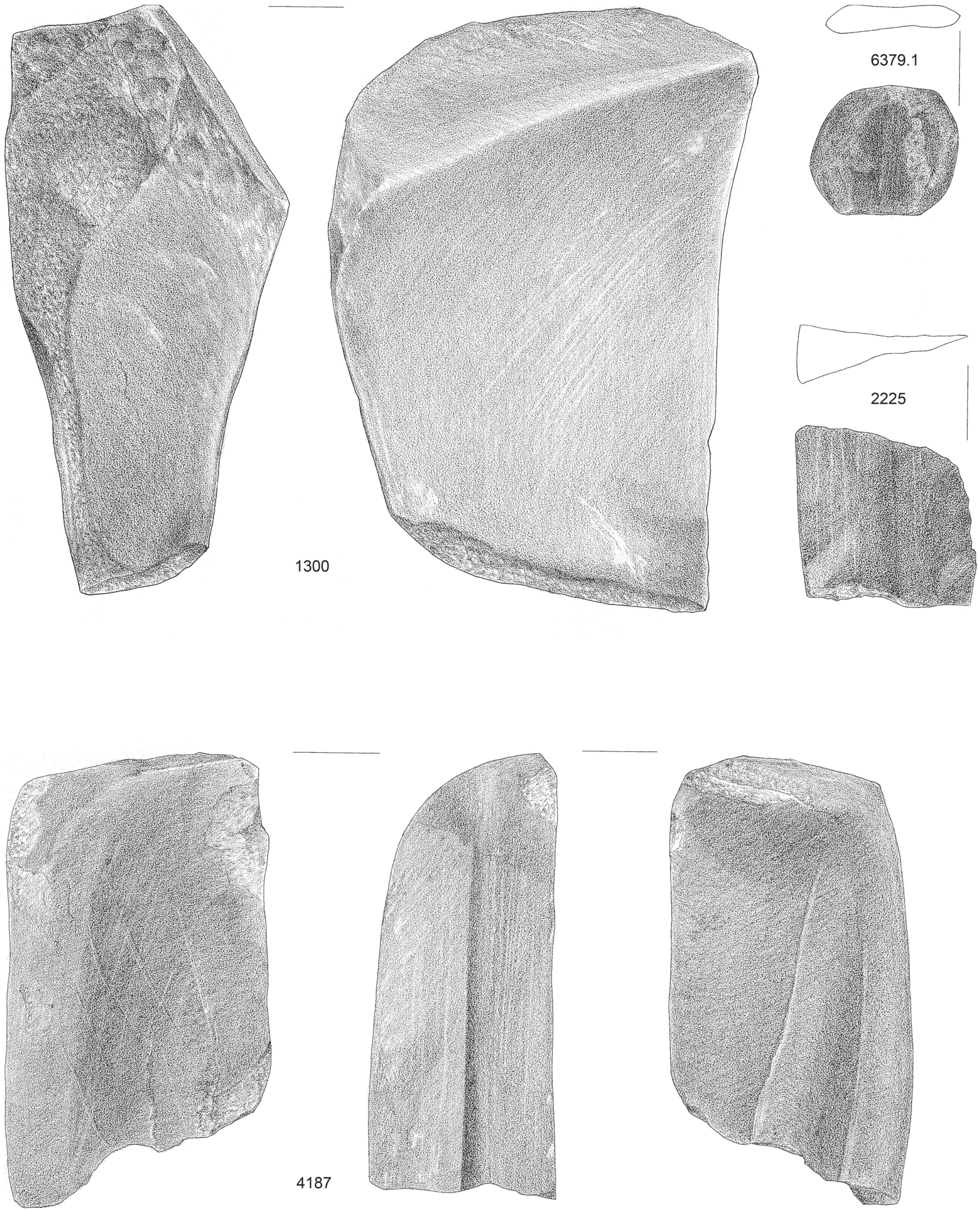
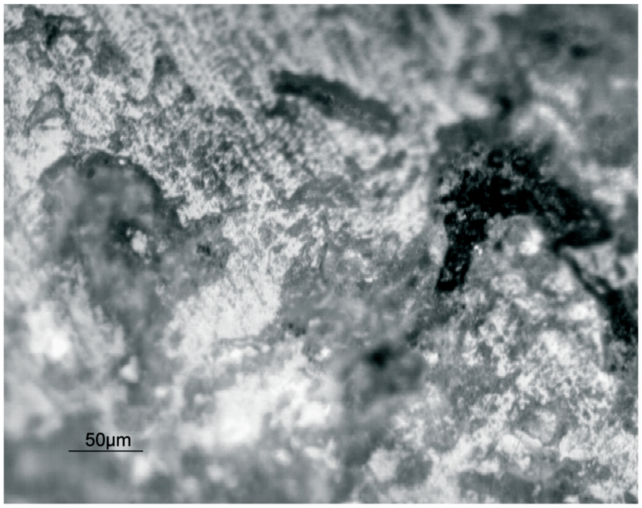
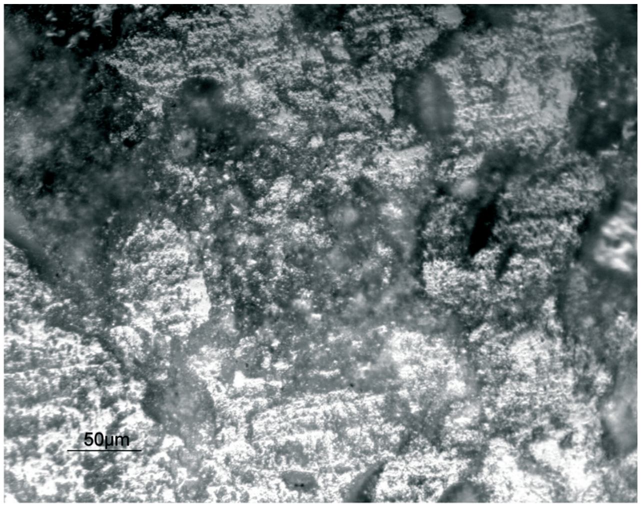


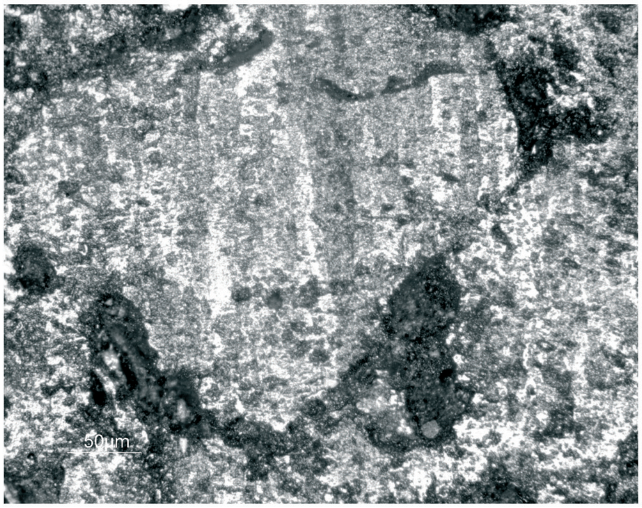

Figure 8.4 Grinding stones (scale 1:2).



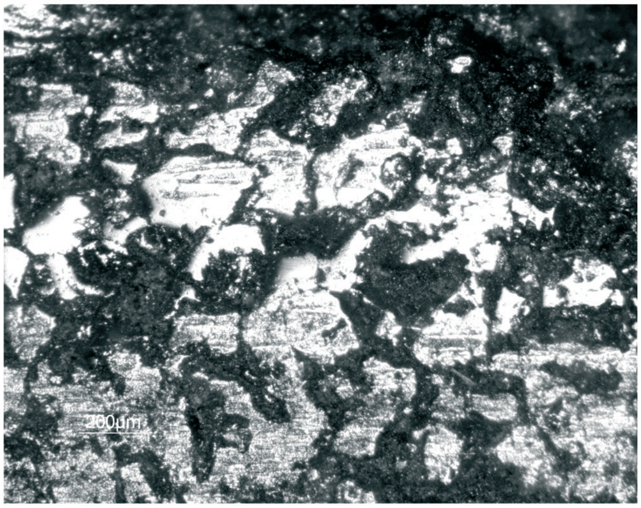
a 1300



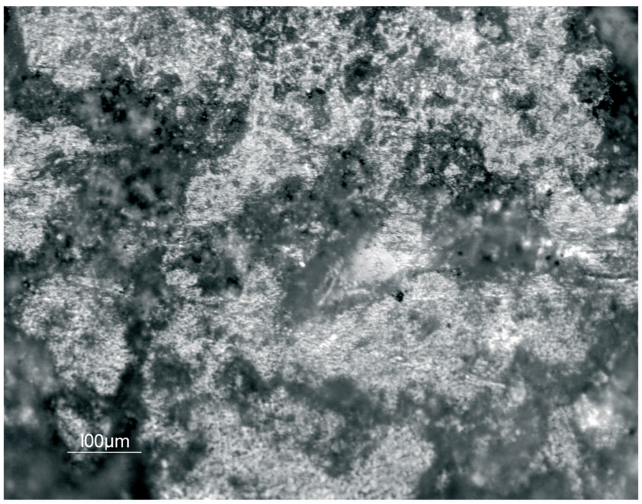
b 4187



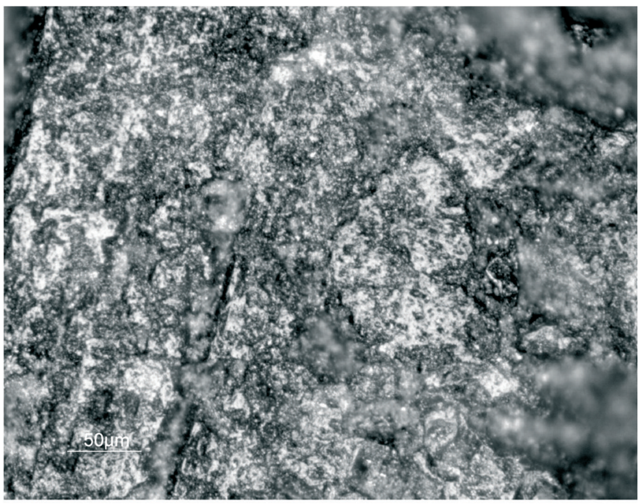
c 6380



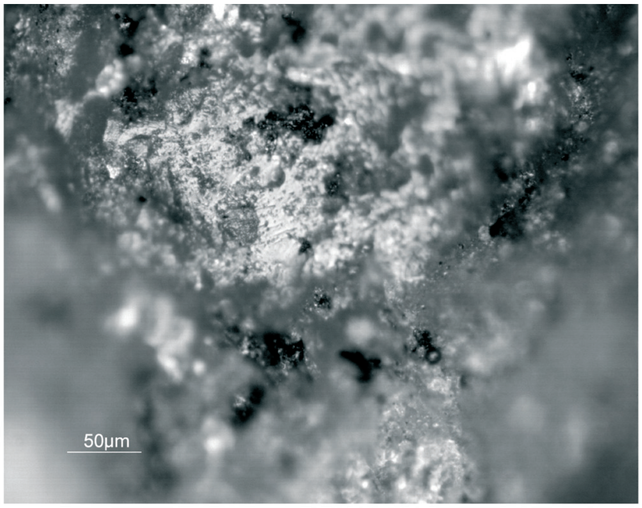
d 6379



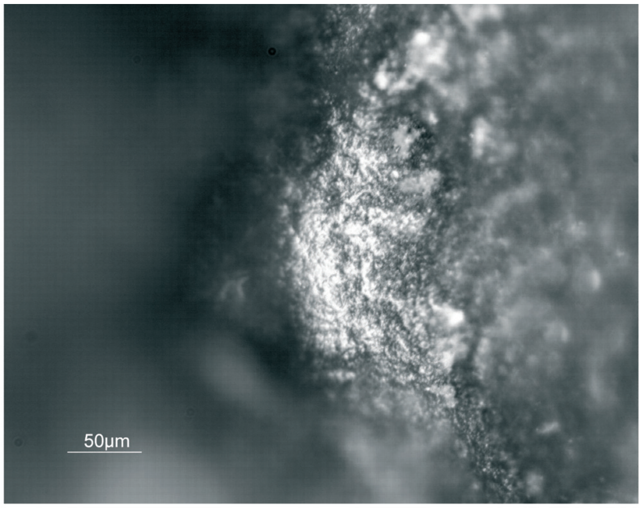
e 2038



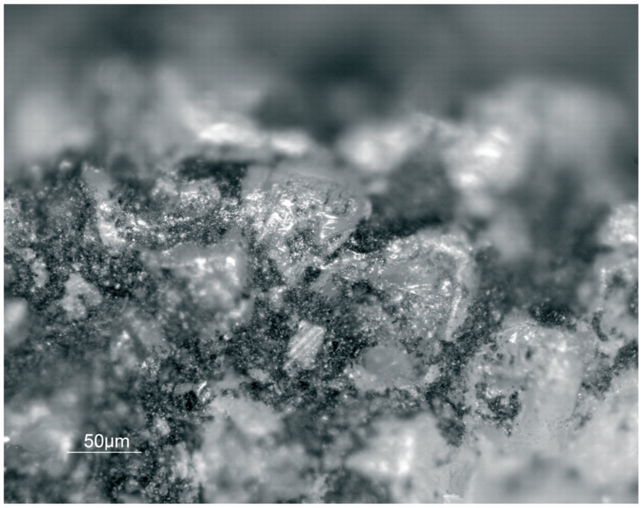
f 9215



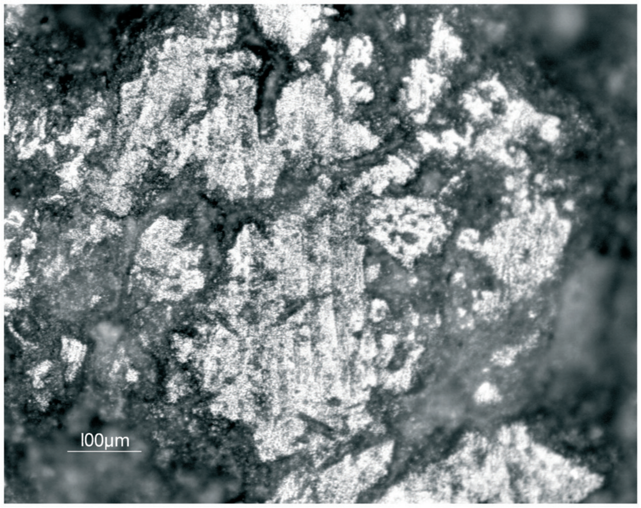

g 553




h 2226




i 8936




j 10384

Figure 8.5 *(cont)* Use wear traces observed on various stone tools.
g traces formed in pounding plants (200×)
h probable wood cutting traces (200×)
i probable wood scraping traces (200×)
j traces interpreted as resulting from grinding or sharpening stone, possibly granite (100×)

◂Figure 8.5 Use wear traces observed on various stone tools.
a-c polish and striations interpreted as resulting from grinding flint (200×)
d traces interpreted as resulting from the grinding bone (100×)
e-f traces interpreted as resulting from processing cereals (e 100×; f 200×)

*8.6.2 Grinding stones* (figs. 8.3-4)
Fragments of grinding stones were common at Schipluiden (15.8% of the shaped implements). Grinding stones are characterised by one or more facets with a highly polished surface and linear scratches that are clearly visible with the naked eye. They were made predominantly on a very dense, dark grey quartzitic sandstone and dark grey quartzite. Although some aspects of the tools still display their original natural surface, the tools were also intentionally flaked to give them the desired shape. This could be deducted from the presence of flake scars around their outlines.

Some larger fragments show that a characteristic grinding stone was used on several sides. Eight implements had more than one used surface. Three large broken implements were used on three sides (nos. 1300, 4187, 6803) and three on two sides (nos. 2205, 6380, 6436). Even one small fragment (no. 5899) has two used aspects. Two tools displayed one facet with a groove (nos. 2225, 6379.1; fig. 8.4). The use-wear traces, which were clearly visible with the naked eye, were found to overlie manufacturing traces where present. In cases in which more than one used facet were present, they were usually functionally different, with one aspect having a very narrow, almost gouge-like wear pattern, presumably formed in the polishing of the sides of axes. The other one or two aspects display a flatter wear pattern, reflecting the grinding or polishing of the ventral and dorsal aspects of the axes and the rounded edges.

A total of 14 grinding stones or fragments were microscopically studied for traces of wear. The great majority seem to have been used for polishing flint, as they bear a very flat, bright, metallic and highly striated polish (figs. 8.5a-c). The sheen is easily distinguished with the naked eye, as is the directionality in the polish. This frequent grinding of flint can be associated with the many axe fragments encountered among the flint assemblage (chapter 7), indicating that such axes must have played a significant role in the technological system. This is also demonstrated by the fences (chapter 11) and the many postholes of wooden structures found at the site (chapter 4). Apart from the flint grinding tools, one small grinding stone was used on bone. It displays a narrow gouge with two pointed ends that will have been ideal for sharpening awls or needles (no. 6379.1; fig. 8.4). The polish has a different texture, being much smoother than that formed in flint grinding and having a less clear-cut direc-tionality (fig. 8.5d).

Figure 8.6 Querns and quern fragments made on various types of stone, such as sandstones and quartzitic sandstones.

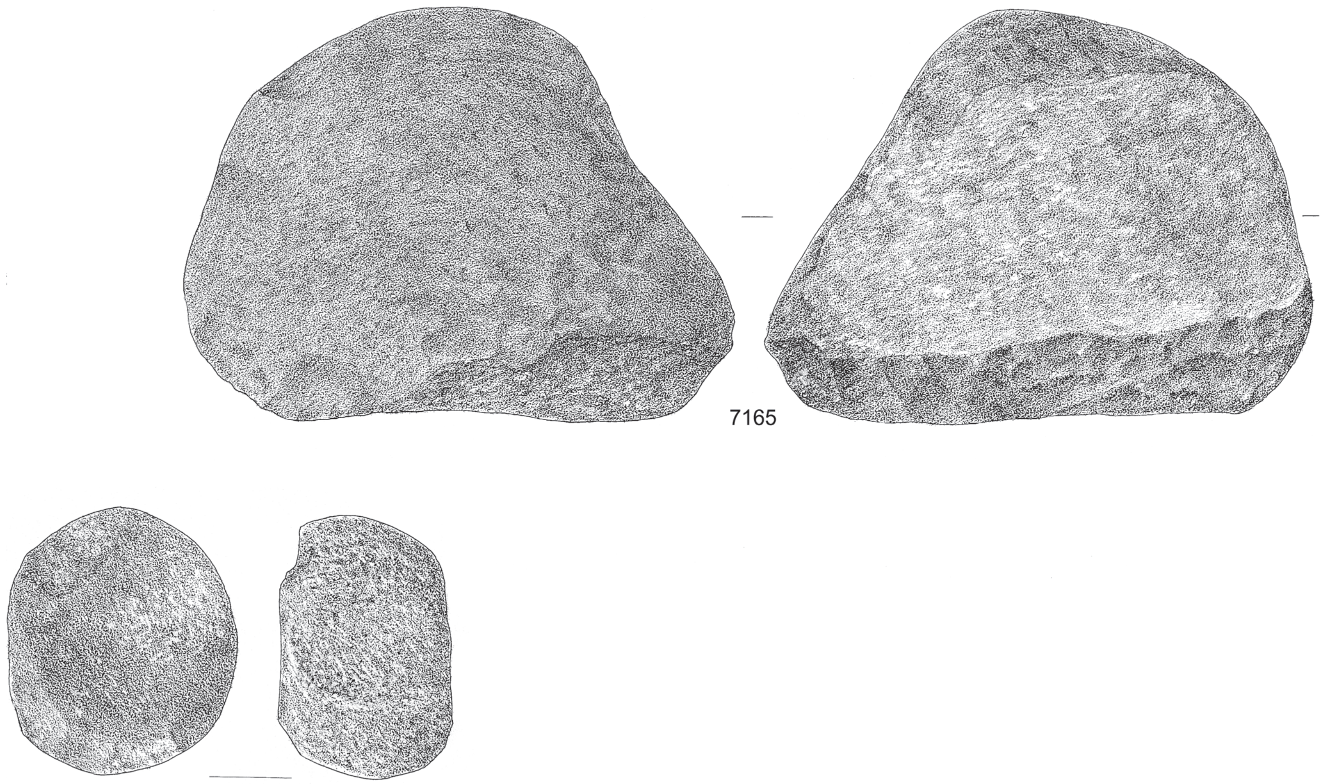



Fig. 8.7 Quern and rubbing stone (scale 1:2).

The tool may have been used to sharpen the bone awls during their use and may have formed part of the toolkit used in basketry and rope making (see chapter 10). Its small size will have made it an easy tool to carry around.

Quite a number of grinding stones displaying one or more facets of use were later fragmented by removing some large flakes. Although some grinding stones may have been broken during use, it is likely that fragmentation was mainly intentional, probably because the grinding stones constituted an ideal source of stone for the production of flakes. Some of the large flakes were then used for sawing wood. Attempts to refit the flakes resulted in only one joint. It is strange that so few refits could be made, considering the severely fragmented state of most of the grinding stones. This could mean that the flakes were taken away from the site for some cutting or sawing task. According to this scenario, grinding stones will have been discarded after having been used maximally, probably because ample fresh flakes could still be struck from the depleted grinding stones.

*8.6.3* *Querns and rubbing stones* (figs. 8.6-7)

A total of 37 querns and quern fragments were found. The querns are characterised by a flat or slightly concave surface and a regular shape, probably obtained by pecking. The used surface feels smoother than the other surfaces of the tool. It is clearly visible with the naked eye, but does not display gloss. Two complete querns have a slightly oblong shape. The most preferred stone types for querns were first of all quartzitic sandstone, followed by granite (including in one case – no. 2857 – biotite granite) and quartzite (for example no. 2038). One quern was made on a coarse-grained stone containing large olivine minerals; this stone is certainly crystalline and was tentatively identified as diabase (no. 7165, figs. 8.7 and 8.15 upper right hand corner). Some of the querns display manufacturing traces in the form of pecking marks along the outer circumference and base.

The sample of querns selected for use-wear analysis contained nine implements. The use-wear traces were not always easy to distinguish because of the nature of the raw material selected: a coarse-grained stone. Where it could be made out, the polish was rough and matt, with short striations and a clear directionality parallel to the implement's longest axis and resembling experimental polish from milling cereals (figs. 8.5e-f). One quern was probably used on both aspects (no. 2857). Some of the querns and quern fragments showed no identifiable traces of wear. This does not mean that these implements were not used; it is just that the coarse-grained stone made wear-trace analysis using high-power microscopy virtually impossible. In such cases we had to rely on low-power microscopy, which can reveal the extent of rounding, smoothing and other more general patterns of wear, but does not allow examination of polishes and fine directionality within the spots of polish.

Besides the querns, six other implements were classified as rubbing stones. They were round, with pounding traces along their circumference and two parallel, flat, worn surfaces (no. 553, fig. 8.7). Such implements are sometimes classified as hammer stones on the basis of the observable pounding marks, but those marks are actually only associated with the shaping of the artefact by pecking. The Schipluiden tools do not have a clearly visible smooth surface like the stones classified as grinding stones, but localised patches of gloss are nevertheless visible with the naked eye. Similar tools were found at Kraaienberg (Louwe Kooijmans/Verhart 1990). This type of tool has also been found in Late Neolithic and Bronze Age contexts (Kolhorn: Drenth/Kars 1990; Aartswoud: Van Iterson-Scholte/De Vries-Metz 1981; Boog C-Noord: Niekus/Huisman 2001; De Bogen: Van Gijn *et al.* 2002; Eigenblok: Van Gijsel *et al*. 2002).

Two such implements were studied for wear (nos. 553 and 1520, fig. 8.5g). They were both found to display a smooth, highly reflective polish with a directionality indicating a rotating movement. The polish was interpreted as the result of plant processing. The fact that this type of tool was used in a rotating motion on plant material suggests that this type of 'hammer stone' should actually be interpreted as the rubbing stone of a quern.

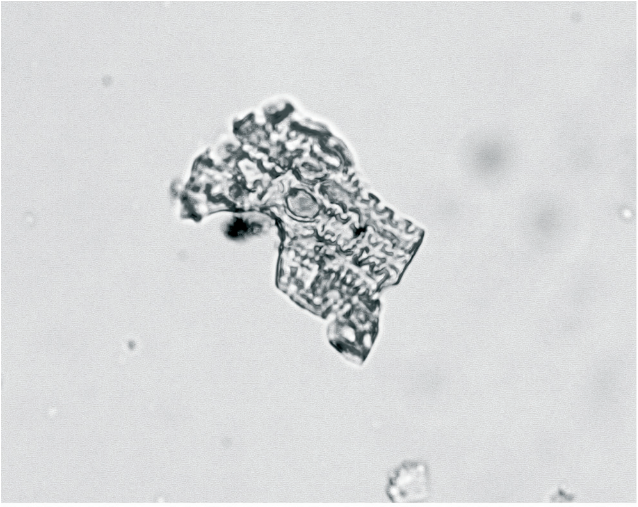
### *8.6.4 Phytolith analysis of the querns* (fig. 8.8)

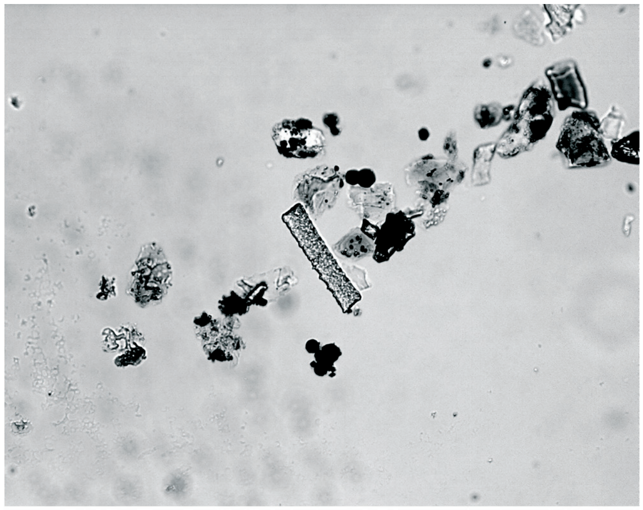
Five querns were selected for phytolith analysis (nos. 2038, 2857, 7165, 8393, 9215). All five samples revealed phytoliths typical of Poacaea, *i.e.* wild grasses or domestic cereals. Various characteristic phytoliths were found both on the tools and in the soil samples, such as dendriforms, hairs, hair bases, stomata and rods. The following information is partly based on the expertise of Patricia Anderson and Pascal Verdin (CRA, Valbonne, France). In two cases (tools nos. 7165 and 8393) some of the phytoliths appeared to be of the Hordeum type, an inference based on the shape of the cell margins in the spodograms (fig. 8.8a).[5] Two querns (nos. 2038 and 2857) showed bilobate phytoliths of the Panicoid type, probably from a wild grass. The last tool (no. 9215) showed only crushed rods deriving from Poacaea (cereals, grasses), which could not be further differentiated. Although it is not usually possible to distinguish between wild and domesticated species, the size of the phytoliths seems to point to domestic cereals. Interestingly, many of the phytoliths display signs of processing. A considerable number of phytolith rods have lost their spikes and seem to have been ground (no. 2857, fig. 8.8b). Some of the grinding seems to have involved dehusking of the grain on the querns, as testified by the presence of spodograms of leaf sheaths (no. 7165, fig. 8.8c). However, the presence of these chaff fragments is not necessarily attributable to dehusking, as quite a bit of chaff may have ended up on the quern along with the grain (Procopiou *et al*. 2002). There were numerous crushed and fragmented leaf and stem fragments, which probably formed part of the same winnowed fraction as the (hulled) grain (no. 7165, fig. 8.8d). One sample showed a processed dendriform phytolith of a glume, indicative of the process of flour making. The use of the querns for making flour is also demonstrated by the presence of tiny broken phytolith fragments.

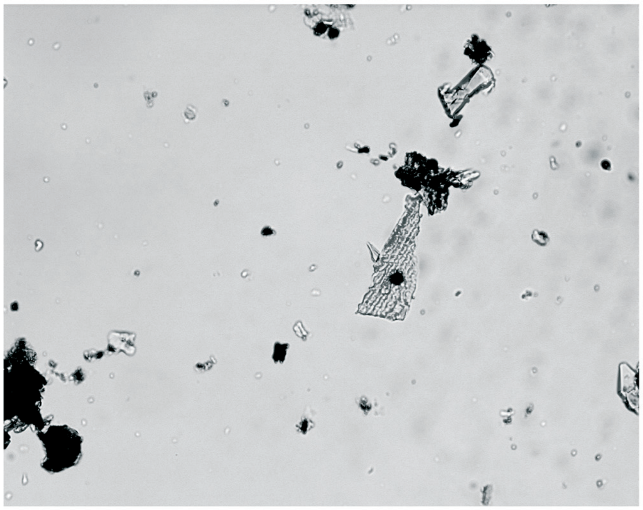
The analysis of the soil samples from four pit fills showed a similar picture. The phytoliths were found to be comparable with those observed on the stone tools in terms of both type and size. The phytoliths found in the soil samples were extremely well preserved, probably because they became covered with sediments soon after deposition. Sample 1416 from feature 10-140 – a shallow well – contained phytoliths from cereals, suggesting dehusking (fig. 8.8e). The sample from feature 16-454 (sample 4279) was found to contain dicot leaves,[6] which were highly fragmented due to processing (fig. 8.8f). The presence of phytoliths in these pits may initially come as a surprise. But if winnowing was practised at the site, fragments of stems and leaves will have been blown around and will have become trapped in the waterlogged pits. It is also possible that processing waste was dumped in the pits while they were silting up.

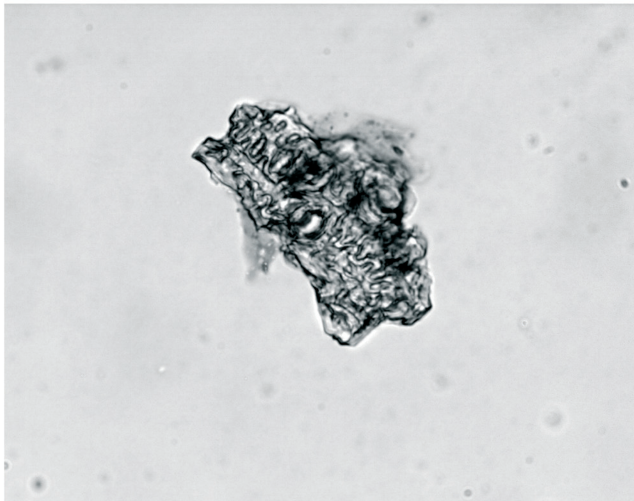
The phytolith analysis of the querns and the soil samples from pits showed that the inhabitants of Schipluiden certainly

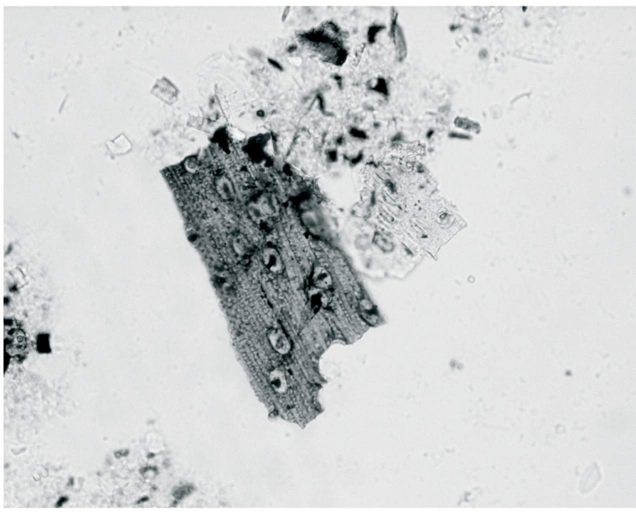
Figure 8.8 Phytoliths observed on querns and in pit fills.
- a spodogram of the Hordeum type (length 70 μm)
- b rods with abraded spikes (length 70 μm)
- c spodogram from cereals, showing evidence of processing (length 80 μm)
- d glume phytoliths (length 70 μm)
- e phytoliths from cereals, indicating dehusking (soil sample, length 190 μm)
- f leaf phytoliths with stomata, fragmented due to processing (soil sample, length 50 μm)

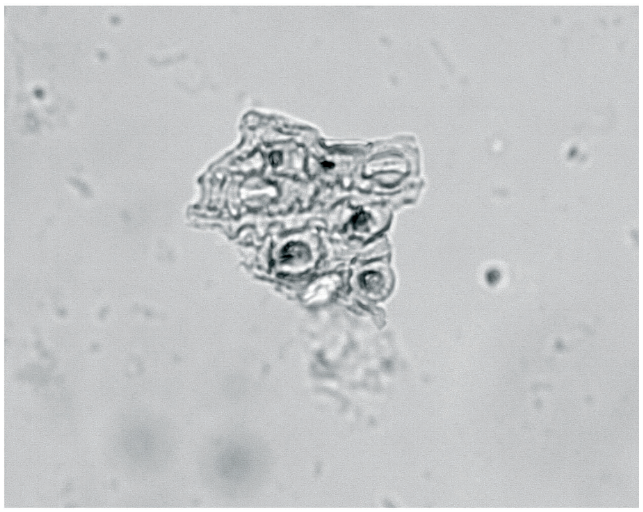

a 7165


b 2857


c 7165


d 7165


e 1416


f 4279

processed seeds to make flour. Whether wild grasses were also processed is not altogether clear as the phytoliths of wild grasses and cereals are virtually the same, but the fairly large size of the phytoliths points to domestic cereals. Processing of wild grasses by hunter-gatherers was however not unusual in prehistory (see Fullagar/Field 1997). The fact that phytoliths were also found in the pit fills indicates that winnowing was done at the site. These data corroborate the archaeobotanical evidence of the local growing of cereals (chapter 18), an inference further supported by the presence of flint sickles (chapter 7).

### *8.6.5 Hammer stones*

A total of 98 hammer stones were found. They include all implements with pounding marks on one or more sides. The complete hammer stones can be differentiated into one-sided hammer stones (N=13), bipolar hammer stones (N=12) and hammer stones with multiple used sides (N=10). Three implements display pounding marks all round. The stone type used most frequently is quartzitic sandstone, followed by quartzite and granite. Some nodules of vein quartz also display traces of pounding, but in this case the pounding was most probably intended to cause fragmentation, *e.g.* to obtain pottery temper.

The shape of the hammer stones varies somewhat, but most are rounded, with the impact traces located on a protrusion. A total of 20 such implements were studied for traces of use. Most of the hammer stones examined revealed traces of pounding, but no clues were detected as to the contact material involved. No residues were encountered and high-power microscopy was difficult due to the grain size of the stones. Two assumed hammer stones (nos. 5492 and 6258) revealed evidence of rubbing or grinding rather than pounding, but in these cases the contact material could not be specified. Three implements showed no traces of use. One quartz pebble was actually probably pounded itself rather than that it served as a hammer stone. The intention was probably to pound it into temper.

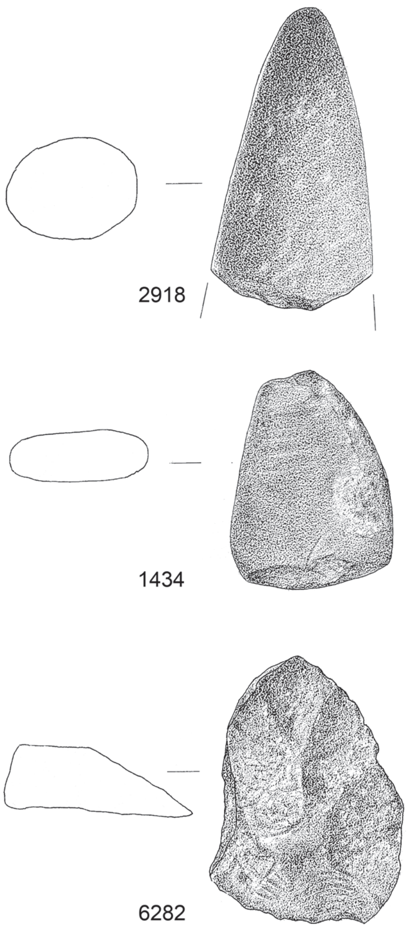



Figure 8.9 Axes and axe fragments (scale 1:2).

### *8.6.6 Axes and axe flakes* (fig. 8.9)

Stone axes and axe fragments were found in smaller numbers than flint axes and axe fragments (chapter 7). This may be partly attributable to the fact that flint axes break more easily than stone axes, but stone axes may indeed originally have been less common. Both types of axe will have been used both off-site and on-site in chopping wood and wood construction work, as demonstrated by the posts used for the fences (chapter 11). So they will have been damaged, broken and even discarded off-site as well as on-site, unlike other implements such as querns and grinding stones that were for the most part discarded on-site.

Only one complete polished stone axe was recovered, along with the butt end of one flake axe and five axe flakes. The complete axe (no. 1434) is very small and displays a considerable amount of edge damage, plus a polish indicative of woodworking and pounding marks at its butt end. It is made of quartzite and probably served as a wedge in woodworking, considering the impact damage at the butt end and the typical wood polish on the cutting edge. One pointed butt end of a typical Michelsberg axe with an oval cross section made of an unidentifiable crystalline stone was found (no. 2918). The stone was completely polished and showed no traces of hafting or wear. The third axe resembles a flake axe made of flint, and for convenience it was referred to as such (no. 6282). Flake axes of flint are a typical feature of Belgian Michelsberg assemblages, but were completely absent at Schipluiden. The stone axe was made of quartzite and was very roughly flaked to an axe-like shape.

The five axe flakes were not secondarily modified into another tool. One (no. 9056) was secondarily used as a hammer stone after its removal from the axe. No cutting

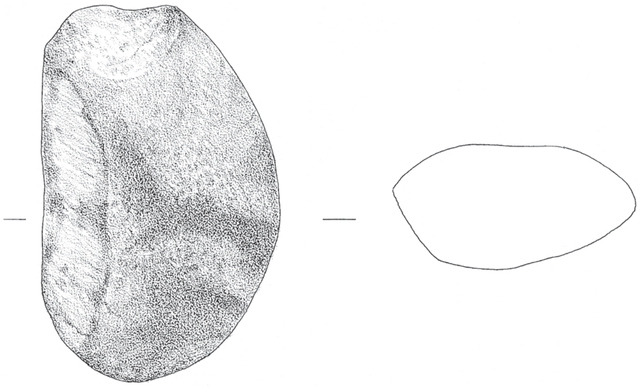


Figure 8.10 Flake with use-wear traces (scale 1:2).

edges of stone axes were found. The presence of other parts of stone axes indicates that greater numbers of such axes were originally present at the site; they were either lost off-site or taken elsewhere.

*8.6.7 Burnt stones*

A large number of stones displayed signs of burning (N=145). Quite a few of these stones were angular blocks broken from larger stones. They may have been used for the construction of hearths or as cooking stones. The majority are of quartzitic sandstone or sandstone. Stones of the former type were suitable for use as cooking stones while sandstone was often chosen for the construction of hearths. Burnt stones constitute the only spatially distinct category of finds (fig. 8.12a). There were two distinct clusters of burnt stones, both on the southeastern slope, one at the southern end and the other slightly further east. It is possible that it concerned processing areas involving fire but the stones may have also have been dumped, considering the location of the two concentrations in relation to the house clusters (chapter 4).

*8.6.8 Flakes and fragments* (fig. 8.10)

Apart from the axe flakes and flakes with a polished facet (originally deriving from a grinding stone), a large number of flakes of hard stone were recovered (N=121). Most of the flakes showed a well-developed bulb of percussion, indicating the use of hard hammer percussion. Quite a number of flakes without facets of polishing traces on their dorsal aspects were of the same stone type as the grinding stones: a dense dark grey quartzite or quartzitic sandstone. This observation supports the assumption that spent grinding stones were intentionally reduced to flakes. Two flakes (no. 2226 of quarzite and no. 8936 of quartzitic sandstone) display traces of use. The first seems to have been used to cut wood (fig. 8.5h), the other to scrape wood (fig. 8.5i). The polish was visible on the quartz crystals and was characterised as smooth, slightly domed and with a clear directionality. It is theoretically possible that the flakes found at the site, especially those of very dark grey quartzite or quartzitic sandstone, actually represent the waste formed in shaping the grinding stones and possibly the querns. As mentioned above, our refitting efforts were not successful; long-term use and possible resharpening may have changed the original shape of such tools beyond recognition, making refitting virtually impossible. It is therefore impossible to conclude whether the flakes should be considered manu-facturing waste or whether they are the products of intentional reduction of rejected grinding stones. The latter option is the more likely as some of the larger flakes display polished areas.

It is remarkable that so many broken stone tools were found and that none of them could be refitted. Quite a few broken fragments must therefore have left the site. In theory it is possible that for example the broken grinding stones were brought to the site in a broken form, as a source of raw material. This is however considered less likely because some of them are still rather large, with very fresh wear traces. If these stones formed part of a stock, the wear traces would have been modified. But even then we should have been able to refit at least some fragments. The fact that we achieved almost complete recovery of the remains as they were left on the dune following the site's abandonment precludes an explanation along the lines that the stone tools were discarded elsewhere at the site. Alternative explanations must therefore be considered, such as use of broken artefacts as net sinkers or to weight down fish traps. Evidence of such off-site uses is seldom found. A significant percentage of the stone tools were definitely discarded off-site, having been used for various off-site subsistence activities.

*8.6.9 Unmodified vein quartz and granite*

A considerable number of fragments of broken quartz and granite were found. Granite is evidently completely fragmented by weathering, and a large proportion of the granite fragments may be attributed to this process. Another explanation for the presence of such large quantities of fragmented quartz and granite could be that those two stone types were used to temper pottery. In order to test this hypothesis, eight sherds selected by Raemaekers (chapter 6) were analysed for the presence of minerals and were compared with a random selection of broken granite and quartz. This analysis showed that the blue quartz crystals that are so prominent and distinctive in many of the quartzites and quartzitic sandstones were also contained in the pottery temper. Sherds nos. 2654, 3391, 3463 and 4404 all contained blue quartz minerals. The latter three were tempered with crushed granite and, besides the quartz, they also contained biotite (3463) or mica (3391) and pink feldspars (no. 4404). Sherd no. 729, which was also tempered

| raw material | N= phase 1 | phase 2a | phase 2b | phase 3 | totals | % phase 1 | phase 2a | phase 2b | phase 3 | totals |
|---|---|---|---|---|---|---|---|---|---|---|
| sedimentary | | | | | | | | | | |
| general | – | 37 | 46 | 90 | 173 | . | 15.7 | 19.7 | 21.7 | 19.4 |
| quartzitic sandstone | 4 | 50 | 66 | 155 | 275 | . | 21.2 | 28.2 | 37.4 | 30.8 |
| micaceous sandstone | – | 4 | 2 | 13 | 19 | . | 1.7 | 0.9 | 3.1 | 2.1 |
| conglomerate | – | 1 | – | 2 | 3 | . | 0.4 | – | 0.5 | 0.3 |
| lydite | – | 1 | 2 | 3 | 6 | . | 0.4 | 0.9 | 0.7 | 0.7 |
| limestone | – | 1 | – | – | 1 | . | 0.4 | – | – | 0.1 |
| (vein) quartz | 1 | 41 | 28 | 29 | 99 | . | 17.4 | 12.0 | 7.0 | 11.1 |
| metamorphic | | | | | | | | | | |
| general | – | 1 | – | 1 | 2 | . | 0.4 | – | 0.2 | 0.2 |
| quartzite | 1 | 25 | 22 | 36 | 84 | . | 10.6 | 9.4 | 8.7 | 9.4 |
| slate | – | – | – | 1 | 1 | . | – | – | 0.2 | 0.1 |
| phyllite | – | – | 5 | 1 | 6 | . | – | 2.1 | 0.2 | 0.7 |
| schist | – | 5 | 4 | 8 | 17 | . | 2.1 | 1.7 | 1.9 | 1.9 |
| gneiss | – | 9 | 13 | 7 | 29 | . | 3.8 | 5.6 | 1.7 | 3.2 |
| igneous | | | | | | | | | | |
| general | 1 | 1 | 3 | 4 | 9 | . | 0.4 | 1.3 | 1.0 | 1.0 |
| basalt | – | 1 | – | – | 1 | . | 0.4 | – | – | 0.1 |
| granite | 2 | 37 | 28 | 48 | 115 | . | 15.7 | 12.0 | 11.6 | 12.9 |
| diabase | – | – | 1 | 1 | 2 | . | – | 0.4 | 0.2 | 0.2 |
| porphyry | – | 7 | 4 | 2 | 13 | . | 3.0 | 1.7 | 0.5 | 1.5 |
| mineral | | | | | | | | | | |
| pyrite | – | 11 | 7 | 8 | 26 | . | 4.7 | 3.0 | 1.9 | 2.9 |
| marcasite | – | – | 1 | – | 1 | . | – | 0.4 | – | 0.1 |
| indet. | – | 4 | 2 | 6 | 12 | . | 1.7 | 0.9 | 1.4 | 1.3 |
| total | 9 | 236 | 234 | 415 | 894 | . | 100 | 100 | 100 | 100 |

Table 8.6 Raw material frequencies per occupation phase.

with granite, likewise contained pink feldspars and quartz, but of a white variety. Mica and biotite were quite commonly observed, for example in nos. 1510 (mica in combination with white quartz), 977 (biotite with white quartz) and 2654 (large biotite minerals and blue and white quartz). Three sherds contained white quartz only (nos. 710, 711 and 733).

The pottery was evidently tempered with a range of materials reflecting the range of stone types represented in the lithic assemblage. The close resemblance of the ranges of available raw materials and employed stone tempers suggests that the granite-tempered pottery was made locally, which was indeed also the conclusion obtained for all the pottery in general in the diatom analysis (chapters 6 and 14).

*8.6.10* *Pyrite* (fig. 8.11)

A total of 40 pieces of pyrite and one piece of marcasite were found, among both the sieved material (N=3) and the material collected by hand (N=37). Although none of them display modification traces, they are treated as special tools here because they were brought to the site for a specific purpose, notably to make fire. Pyrite contains sulphur (it is a sulphur dioxide) and was used to make fire in combination with strike-a-lights made of flint. The flint assemblage comprises a considerable number of such strike-a-lights (chapter 7). Marcasite, a mineral chemically identical to pyrite and with similar functional properties that is difficult to distinguish from the latter without detailed analysis, has been reported for Wateringen 4 (N=6, 1.3% of the total number of stones, contemporary site of Ypenburg also yielded pyrite plus at least one strike-a-light (Van Gijn, pers. observ.). Earlier finds of very similar radial pyrite are some pieces from Hardinxveld-Polderweg phase 1/2 (5100 cal BC) and De Bruin phase 2 (5100-4800 cal BC) (Van Gijn *et al*. 2001, 165, 171; Van Gijn/Houkes 2001, 199, 204).

| N= | phase 1 | phase 2a | phase 2b | phase 3 | total phased | not phased | site total | % phase 1 | phase 2a | phase 2b | phase 3 | total phased | not phased | site total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| grinding stone | – | 6 | 5 | 11 | 22 | 21 | 43 | | 2.6 | 2.3 | 2.7 | 2.5 | 2.5 | 2.5 |
| quern | 1 | 6 | 4 | 9 | 20 | 17 | 37 | . | 2.6 | 1.8 | 2.2 | 2.3 | 2.0 | 2.1 |
| rubbing stone | – | 1 | – | 2 | 3 | 3 | 6 | . | 0.4 | – | 0.5 | 0.3 | 0.4 | 0.3 |
| axe | – | – | – | 2 | 2 | 6 | 8 | . | – | – | 0.5 | 0.2 | 0.7 | 0.5 |
| axe flake | – | 2 | 2 | 1 | 5 | – | 5 | . | 0.9 | 0.9 | 0.2 | 0.6 | – | – |
| hammer stone | 1 | 25 | 9 | 10 | 45 | 53 | 98 | . | 10.7 | 4.1 | 2.4 | 5.1 | 6.2 | 5.7 |
| retouchoir | – | – | – | 1 | 1 | 3 | 4 | . | – | – | 0.2 | 0.1 | 0.4 | 0.2 |
| anvil | – | – | – | – | – | 1 | 1 | . | – | – | – | – | 0.1 | 0.1 |
| Geröllkeule | – | – | – | – | – | 1 | 1 | . | – | – | – | – | 0.1 | 0.1 |
| ornamented | – | – | 1 | – | 1 | 1 | 2 | . | – | 0.5 | – | 0.1 | 0.1 | 0.1 |
| used (unspecified) | – | 10 | – | 13 | 23 | 50 | 73 | . | 4.3 | - | 3.1 | 2.6 | 5.9 | 4.2 |
| *Subtotal worked* | *2* | *50* | *21* | *49* | *122* | 156 | *278* | | 21.4 | 9.5 | 11.8 | 13.9 | 18.4 | 16.1 |
| burnt stone | – | 3 | 17 | 49 | 69 | 76 | 145 | . | 1.3 | 7.7 | 11.8 | 7.9 | 9.0 | 8.4 |
| blade | – | – | – | 2 | 2 | – | 2 | . | – | – | – | – | – | 0.1 |
| flake | – | 8 | 28 | 31 | 67 | 54 | 121 | . | 3.4 | 12.6 | 7.5 | 7.6 | 6.4 | 7.0 |
| block | – | – | 1 | – | 1 | – | 1 | . | – | 0.5 | – | 0.1 | – | 0.1 |
| indet. | – | 3 | 6 | 3 | 12 | – | 12 | . | 1.3 | 2.7 | 0.7 | 1.4 | – | 0.7 |
| not modified | 7 | 170 | 149 | 280 | 606 | 563 | 1169 | . | 72.7 | 67.1 | 67.6 | 68.9 | 66.3 | 67.7 |
| *Totals* | *9* | *234* | *222* | *414* | *879* | *849* | *1728* | . | *100* | *100* | *100* | *100* | *100* | *100.0* |

Table 8.7 Types of stone implements by occupation phase, in numbers and percentages.

Among the most remarkable finds from Schipluiden are the grave goods from grave 2, consisting of one piece of pyrite in association with three flint strike-a-lights in the deceased's right hand (chapters 5, 7). The combination of pyrite and flint strike-a-lights as burial goods has been previously noted for the Bandkeramik of Bavaria and was also observed at the Niedermerz cemetery closer by (Nieszery 1992).

## 8.7 Diachronic differentiation

The number of stones that could be dated to a specific phase was too small to allow the detection of significant diachronic differences. No differences in terms of raw materials are observable across the occupation phases (table 8.6; fig. 8.12). The range of raw materials represented for phases 2 and 3 (including Unit 11) is of course wider because the number of stones dating from these phases is much greater. Otherwise the main stone types represented for each phase (sedimentary rocks, quartzitic sandstone, quartzite and granite) show roughly the same percentages.

The percentage of hammer stones is around 10% for phases 1 and 2a and seems to show a drop afterwards in phases 2b and 3. The relative numbers of burnt stones

Figure 8.11 Fragments of pyrite nodule, mostly of radial pyrite. Some of the pyrite has crumbled (magnification 2×).

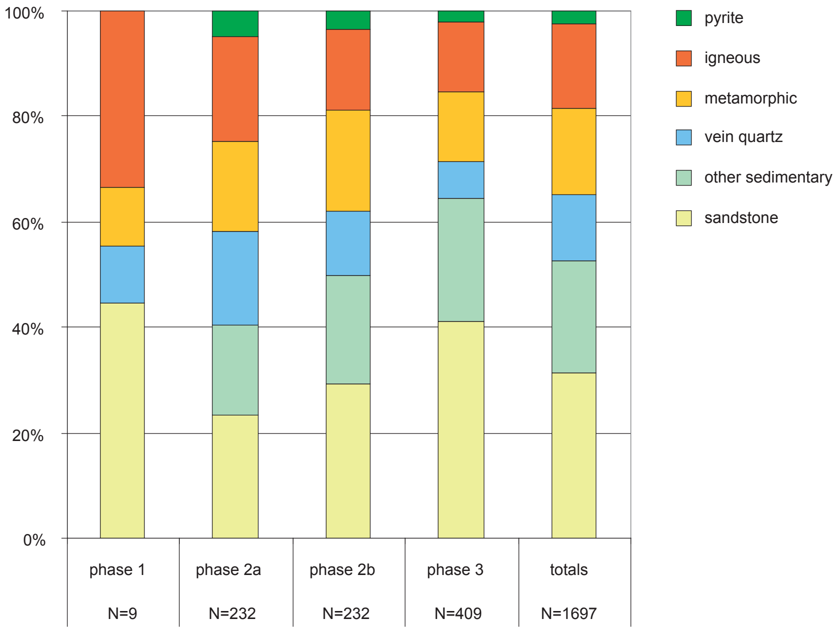
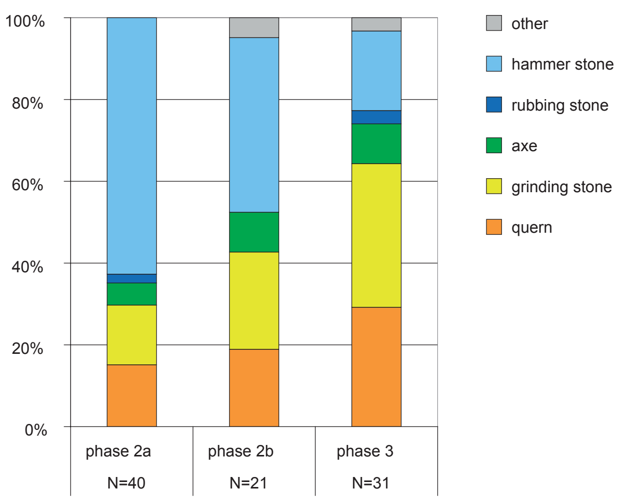



Figure 8.12 Raw material composition of the stone assemblage per phase

| | | phase 1 | phase 2a | phase 2b | phase 3 | total phased | not phased | total site |
|---|---|---|---|---|---|---|---|---|
| N= | | 9 | 236 | 234 | 415 | 894 | 834 | 1728 |
| mean length | cm | 6.5 | 3.8 | 3.4 | 3.6 | 3.6 | 4.2 | 3.9 |
| mean width | cm | 4.7 | 2.8 | 2.7 | 2.7 | 2.7 | 2.8 | 2.8 |
| mean thickness | cm | 2.2 | 1.9 | 1.3 | 1.3 | 1.5 | 1.5 | 1.5 |
| mean weight | grams | 128.8 | 54.7 | 28.2 | 27.8 | 36.0 | 37.4 | 36.7 |

Table 8.8 Mean dimensions of stone artefacts per occupation phase.



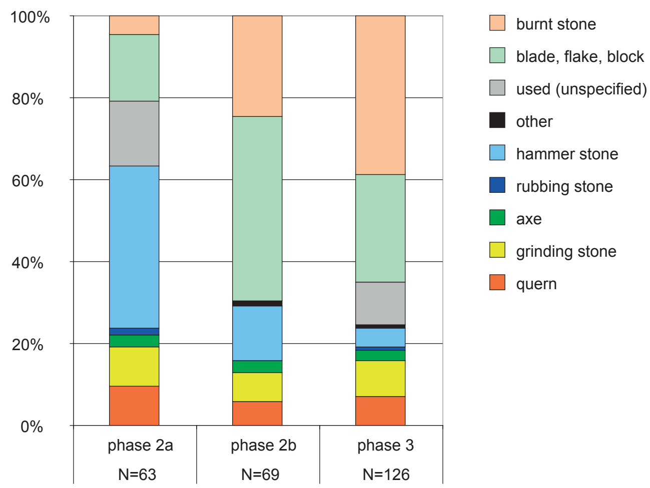




Figure 8.13 Implements, worked and used stones per phase.
a all worked stone
b implements only

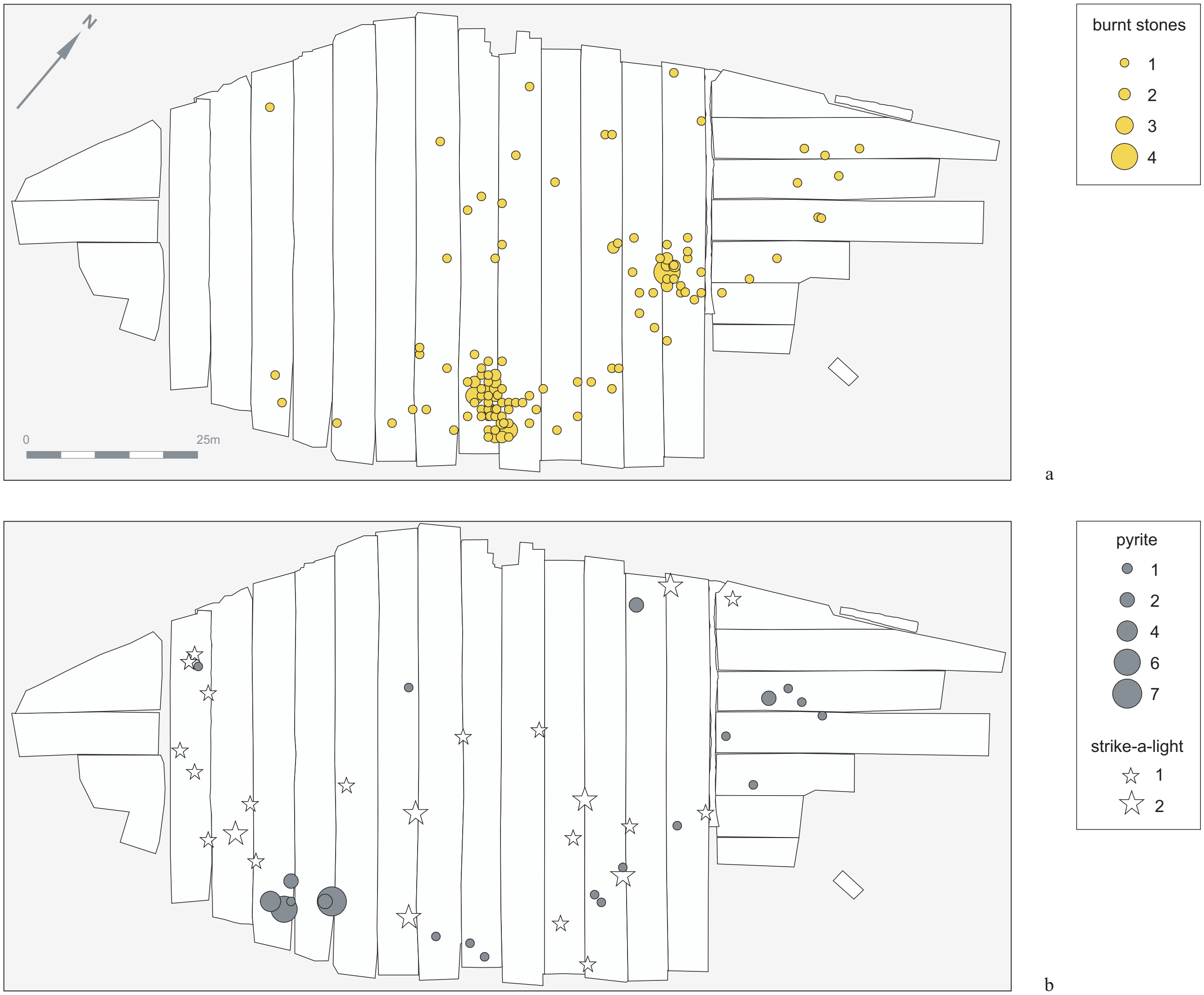



Figure 8.14 Distribution patterns of selected stone categories.
a burnt stones, interpreted as cooking and hearth stones
b pyrite and flint strike-a-lights

(cooking stones and/or hearth fragments) on the contrary seem to show an increase through time from zero in phase 1 to 11.8% in phase 3. It is not clear what meaning should be attributed to this observation (table 8.7; fig. 8.13).

The stone objects from phase 1 appear to be the largest, but this is due to the way the material was collected, namely by machine instead of by manual shovelling. The average weights of the stone objects are 129 grams in the case of phase 1, 55 grams in the case of phase 2a, 28 grams in the case of phase 2b, and 23 grams in the case of phase 3 (table 8.8).

## 8.8 Spatial distribution

The great majority of the stone objects were found in the deposits along the southern margin of the dune. As stone is readily preserved, stone objects were also found across the area of the dune itself, if in smaller numbers (chapter 3). None of the tool types, nor the types of raw materials, including pyrite, show any concentrations. The only exceptions are formed by the burnt stones of quartzite and quartzitic sandstone, which appeared to be concentrated in two clusters (fig. 8.14). It could not be made out whether they are primary activity areas, or just dumps of the adjacent yards.

## 8.9 Conclusion

### *8.9.1 Stone use and group size*

The stone assemblage of Schipluiden displays a great variety in terms of both raw materials and the represented range of tool types. The raw materials selected and brought to the site are largely similar to those found at the nearby sites of Ypenburg and Wateringen 4: at both sites sandstone, quartz and granite were reported to have been the most abundant (Koot/Van der Have 2001; Molenaar 1997). As the material from Ypenburg has not yet been published, it is difficult to draw comparisons. The number of modified stones found at this site does appear to be very small (Koot/Van der Have 2001, 113). The range of implements found at Wateringen 4, including hammer stones, grinding stones and querns, corresponds to that of Schipluiden. At Wateringen 4, the total number of stones was 471, 62 of which were implements, modified by intent and/or use, representing 13.2% of the assemblage, which is comparable with the 15.8% of Schipluiden. Contemporary sites further east such as Kraaienberg and Gassel also yielded relatively many unmodified stones (pebbles and blocks), reflecting the easier access to the stone sources (Kraaienberg: 3.1% modified, Louwe Kooijmans/Verhart 1990; Gassel: a small number of the total of 627 stones, Verhart/Louwe Kooijmans 1989).

All in all, it seems that the quantitative difference between Wateringen 4 and Schipluiden lies in the differences in group size and duration of the occupation. Schipluiden was occupied for around 250 years, by several households, whereas Wateringen 4 was probably occupied for only half a century at the most ("at least two house generations", Raemaekers *et al*. 1997, 150) and by a single household. The Wateringen inhabitants used 7.13 kg of stone in 50 years, whereas those of Schipluiden used around 55 kg. Assuming similar patterns of consumption and discard for both sites, this comparison lends further support to the interpretation that several house-holds were present at Schipluiden.

### *8.9.2 Lithic sources*

No larger stones were available in the vicinity of Schipluiden, so virtually all the raw material had to be imported. Only small nodules of gravel, quartzites, quartz and quartzitic sandstones, with a diameter of at least 3 cm, may have been collected along the coast. The people carefully selected the most suitable stone types for making specific tools or for carrying out specific tasks. The black, homogeneous dark grey quartzitic sandstones are perfectly suitable for grinding and polishing flint axes. All of the grinding stones are made of the same raw material. The stone has a very dense structure and is fine-grained. The selection of types of stones for the manufacture of querns was more ad hoc. A range of different stone types were used for this purpose, all of which

Figure 8.15 Toolkit used to harvest and process cereals: three flint sickle blades and two querns, interpreted as having been used to process cereals. The quern in the right top hand corner is made of a crystalline stone containing olivine, possibly a diabase.

Figure 8.16 Grinding and sharpening flint axes (grinding stone no. 1300 and axe no. 845).

were suitable for the intended task. Stones were evidently selected from the gravel deposits with a specific function in mind, implying that the users had a thorough knowledge of the physical properties of the different raw materials.

The presence of non-territorial raw material at Schipluiden provides some insight into the inhabitants' range of communication, via either mobility or long-distance exchange contacts (fig. 8.2). Unfortunately, due to the lack of detailed research into stone sources in the Netherlands and adjacent parts of Belgium, it is very difficult to identify sources where raw materials may have been obtained in the past. We have to be content with general areas of origin. It is likely that virtually all the stone types represented in the assemblage were to be found in either the riverbeds of the Meuse or its terraces. The igneous component may include northern material, but it cannot be positively identified. Rhine gravel is completely absent. River pebbles may have been accessible at points where the rivers had cut into ancient Meuse deposits, for example in the ice-pushed river deposits of Utrecht, the Veluwe region and the environs of Nijmegen. Some, at least, of the Schipluiden stones may have been collected in these areas. Another option is a source further south, along the course of the Meuse in Limburg. The larger stones, such as the grinding stones, may have been collected here. This is also the area from which some of the flint was obtained (chapter 7). The pyrite may have been collected in the Ardennes, or less likely along the chalk coastline of northern France. Both areas lie around 200 km from Schipluiden. Sandstones may also have been obtained from the Scheldt basin in the south, along with the flint that was imported from Hainault (chapter 7). No quartzitic sandstones or quartzites are however known from that area (P. Crombé, pers. comm.). Whether the inhabitants obtained the stones via down-the-line exchange systems or whether they organised expeditions to collect the material themselves is hard to determine. Considering the fact that the distances to be covered were relatively small (between 75 and 150 km to Limburg), the latter option is the more likely. The collection of stone may have taken place in the context of social gatherings. The substantial importance of the 'southern connection' indicated by the raw materials and also the character of the burial customs (chapter 5) suggests strong ties between the communities to the south including those in the coastal areas. In many ethnographically documented societies raw material procurement is part and parcel of the social network, and social ties between various communities are structured through the procurement and exchange of raw materials over long distances (*e.g.* McBryde 1997).

Figure 8.17 Polishing bone awls on a small grinding stone (awl no. 8362 and grinding stone no. 6379.1).

### *8.9.3 Activities*

The activities involving hard stone tools carried out at the site were varied, and support the interpretation of the site having been occupied for a long time by a fairly large group of people. Woodworking was performed with axes and large crude flakes. Only one small complete axe was found. It was used as a wedge on wood. There is no evidence to suggest that the axes were used to chop trees. This may have been done predominantly with flint axes. Large flakes removed from rejected grinding stones were used for coarse woodwork such as sawing and shaving. The hard stone woodworking tools thus complemented the flint axes used to chop wood and the small bone chisels that were employed in shaping wooden objects (chapters 7 and 10).

Seed processing took place at the site, as testified by the presence of querns used to grind Poacaea, *i.e.* cereals and wild grasses (fig. 8.15). Several querns show polish and striations suggesting that they were used in cereal processing. The five querns sampled for phytolith analysis all produced fragments of glumes and stems. Although it is not always possible to identify phytoliths to the species level, most of the Schipluiden samples do seem to derive from barley. The size of the phytoliths suggests that the cereals were cultivated. Wild seed may also have been processed, either intentionally or accidentally, as suggested by the presence of Panicoid phytoliths. The phytoliths were very rounded and rolled, their natural protrusions having disappeared. This suggests that the grains were processed into flour and not boiled whole to make porridge. The presence of glumes on the querns supports the assumption that crops were grown locally (see chapter 19). Some of the rubbing stones and a few hammer stones with pounding marks along their entire outlines were probably used to pound and grind other plant materials such as nuts or seeds.

Many hammer stones were found at the site. Some, at least, of these stones were most probably used in flint knapping, considering the coarse pounding marks and the stones' sheared surfaces. Hard hammer percussion is evident in the flint assemblage (chapter 7). Unfortunately, it was not always possible to specify the activities in which the hammer stones were used.

The presence of a number of grinding stones used to polish flint axes (fig. 8.16) indicates that axes were maintained and suggests that blanks were processed into finished tools on site. Although the grinding stones may have served mainly for (re)sharpening imported flint axes, the shapes of the used areas on the grinding stones, comprising the three different aspects of an axe, suggest that flint axes were also shaped locally. This is supported by the observation that local, dark coloured 'sea flint' (section 7.5) was also used for their production. Making flint axes is rather time-consuming. Experiments have shown that polishing an average flint axe involves about 6-8 hours of heavy work (Madsen 1984). Our own experiments suggest an even longer time, *i.e.* several days for a large flint axe, but polishing stone axes take considerably less time. This is supported by ethnographic fieldwork in Papua New Guinea. Because it takes so long, it is often done communally as a social activity, if possible close to the occupied area (Burton 1984; Pétrequin/Pétrequin 1993). The fact that this activity took place at Schipluiden implies that the inhabitants spent considerable time at the site, and that they probably constituted a fairly large group of people. One small, round grinding stone was used to polish bone (fig. 8.17). It probably served to sharpen the bone awls that played a role in basketry, coiling and rope making (chapter 10). Being so small, and hence portable, it probably formed part of the toolkit used for basketry and related plant-processing activities.

The presence of pyrite indicates that stones played a role in fire making. In combination with flint implements – the strike-a-lights – pyrite creates sparks to start off a fire. One piece of radial pyrite was found in the hand of the man buried in grave 2, along with three flint strike-a-lights (chapter 5). As argued elsewhere (chapters 5 and 7), this combination of grave goods may be seen as an indication that this man had a special role in the community during his life, possibly akin to that of the shamans known from northern latitudes.

Crushed stone, especially quartz and to a lesser extent granite, was also used to temper pottery (chapter 6). All the broken, angular quartz is probably to be interpreted as tempering material. The quartz was brought to the site as small nodules. Many of the small nodules found at Schipluiden display pounding marks, indicating that they are not hammer stones but were intended for use as tempering material.

There is no evidence of the polishing of jet and amber beads, which is odd, as the beads show the facets formed in polishing. Especially the grinding and polishing of jet leaves very distinct, characteristic traces, which were not encountered during the use-wear analysis. Such traces may of course occur among the material that was not studied for use-wear analysis. Stones also played a role in cooking and hearth construction, as testified by the large number of burnt stones, especially sandstones.

The roles of stone tools in the toolkits used to carry out various tasks testify to the users' knowledge as to what constitutes a suitable tool for a specific task. An examination of a technological system from a more holistic point of view, including an analysis of wear traces on flint tools, but also on stone, bone and antler objects, shows which types of tools people in the past chose for their tasks. The choices they made indicate the users' knowledge of the physical properties of different raw materials in relation to the tasks at hand, and can also reveal cultural choices. Unfortunately, few assemblages have been studied from this point of view, making it virtually impossible to make comparisons. Stone does however appear to have played a more prominent role in the technological system than observed at the Late Mesolithic sites of Hardinxveld. The range of uses to which the stone tools were put is larger, including seed grinding, bone polishing and flint axe production and maintenance.

The large variety of activities demonstrated and the fact that stone tools formed integral parts of various toolkits composed of tools made of different raw materials indicate the presence of complete households that lived at the site for an extended period of time. Although we must exercise due care in extrapolating present-day gender roles – even in more or less comparable societies – to the past, it is nevertheless highly likely that cereal processing – the grinding of seeds – was done mainly by women. Polishing axes is on the contrary invariably a male task. The data presented here do not warrant any statements about the exact length and season of occupation. They only indicate the likelihood of a long-term stay, during which all sorts of tasks involving complicated toolkits had to be carried out.

Although it seems that most stones were put to specific uses in full account of their specific properties, their procurement may on the contrary have been imbued with great social and ideological significance. The same holds for 'exotic' materials such as pyrite, jet and amber, as demonstrated by the burial goods and ornaments (chapter 9). The long-distance contacts that this procurement entailed may have been vital for the continuous occupation of a site as remote as Schipluiden.

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## notes

1 In the field module the natural coarse fraction (4-6 mm) of the dune sand, also that recovered on the 4 mm mesh, was included in the records. This fraction was subtracted in this presentation, using the ratio obtained in the trench 10 pilot study (natural:artefactual = 201:85).

2 The 4-mm sieve fraction represents about 8% (1/12) of the excavated volume.

3 Present-day beaches are 'polluted' with recent building materials. The odd flat pebble has been found in older beach deposits.

4 It should be noted that the total numbers of stones found at Wateringen 4 and Schipluiden may not be entirely comparable due to differences in the employed excavation strategies. When the small stones (<5 mm) of Schipluiden (found in the sieving) are omitted from the calculation, the percentage of modified stone artefacts at this site becomes much higher.

5 A spodogram is a sheet (ranging in size from 10-20 microns to macroscopic dimensions) of silica-incrusted plant tissue, usually of the epidermis, in which the phytoliths (the silica incrusted cells) have survived in anatomical association.

6 Dicot leaves are the leaves of Dicotyledons, a genus of flowering plants having two cotyledons (embryonic leaves) in their seeds, which usually appear at germination.

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