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# Tracing traces from present to past : a functional analysis of pre-Columbian shell and stone artefacts from Anse à la Gourde and Morel, Guadeloupe, FWI

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Yvonne Lammers

# TRACING TRACES FROM PRESENT TO PAST

a functional analysis of pre-Columbian shell and stone artefacts from Anse à la Gourde and Morel, Guadeloupe, FWI

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# Tracing Traces from Present to Past

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# Tracing Traces from Present to Past

## a functional analysis of pre-Columbian shell and stone artefacts from Anse à la Gourde and Morel, Guadeloupe, FWI

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# Preface

The every-day life of prehistoric people has been my main fascination since my first visit to the Historical Archaeological Research Centre in Lejre, Denmark in 1980. During my studies this interest concentrated around the possibilities of functional analysis to reconstruct domestic activities. As a student-assistant at what used to be called the 'Lithic Lab' I examined flint tools for traces of wear and helped with extending the experimental reference collection. In 1997 and 1998 two late Mesolithic wetland sites were excavated near Rotterdam (Louwe Kooijmans (ed.) 2001a, 2001b). Organic preservation was excellent here and bone and antler tools were perfectly preserved. It was thus possible to perform a functional analysis not only of the flint and hard stone tools (Van Gijn *et al.* 2001; Van Gijn and Houkes 2001) but also of tools made of bone, antler and teeth (Oversteegen *et al.* 2001). This permitted us to study the technological and functional relationships between different categories of artefacts, hereby tracing the technological choices made by past tool makers and users. I took part in this research as a junior-specialist. This 'integral' approach towards tool use was given an Aspasia-grant by the Dutch Organisation for Scientific Research in 2000: The usewear analysis of prehistoric artefacts: an integral approach towards the study of material culture (NWO-ASPASIA-programme 015.000.095), directed by Dr A. L. van Gijn, Faculty of Archaeology, Leiden University. Just before that, the Caribbean section of the faculty was conducting a large-scale excavation at two sites on Guadeloupe, in cooperation with the DRAC-Guadeloupe under supervision of André Delpuech, Corinne Hofman and Menno Hoogland. The present study was part of this research, and is now incorporated into the Aspasia-programme because the excavations provided an overview of a toolkit consisting of implements made of flint, stone, shell and coral. Although I was specialized in European prehistory, the possibilities of the combination of experimental archaeology, ethno-archaeology and functional analysis especially captivated me. In this frame-work, the present study was undertaken.

# 1. Introduction

In the last decade, functional analysis has shifted from an almost sole concentration on flint towards a method applied to virtually all artefact categories in order to reconstruct technological systems (Van Gijn *in press*). The present study was carried out in the light of that shift, concentrating on the role of shell tools in the Caribbean. Although shell implements have received much attention in Caribbean archaeology, the number of studies that deal with the actual function of tools is limited. Moreover, most researchers arrive at functional interpretations on the basis of analogies and from morphological characteristics of the tool that they can see with the naked eye (Antczak 1998; Brokke 1999; Jansen 1999; Jones O'Day and Keegan 2001; Rostain and Dacal Moure 1997; Serrand 1995, 1997, 2002; Van der Steen 1992; Taverne and Versteeg 1992). Some researchers in the Caribbean use low magnifications to interpret the wear traces (Cartwright *et al.* 1991; Lundberg 1985). In some cases this is done in the light of an ongoing debate whether it is possible to distinguish between food-debris (or shell waste) and expedient tools (Armstrong 1979; Dacal Moure and Croes 2004; Jones O'Day and Keegan 2001; Keegan 1981; Versteeg and Rostain 1997). High power functional analysis may elucidate the manner of manufacturing as well as the variety of functions of these tools and may shed light on the role of shell in the technological system. The experience with shell material in functional analysis is however modest and requires methodological studies.

The primary objective of this study was to examine the role of shell artefacts in the technological system of the sites studied. In Caribbean archaeology shell is an important raw material for tools, probably due to the scarcity of flint and suitable stone in the area. Both flint and stone had to be obtained from different islands, but were still imported in considerable quantities. The focus of the study was therefore on the technological and functional analysis of the shell artefacts. In addition, samples of the flint and hard stone tools were studied. To reach an overview of the complete available toolkit, the research on coral and secondarily used pottery sherds carried out by others were also incorporated in the interpretation of the results. Archaeological, ethnographic and ethnohistorical data were studied to obtain an indication of domestic tasks carried out in the Caribbean in the pre-Columbian period.

The study is focused on two archaeological sites: Anse à la Gourde and Morel, both situated on Guadeloupe, FWI (Fig. 1.1). These sites were excavated on a large scale over several years and resulted in an enormous amount of information. Both are situated along the coast of Grande-Terre and have a comparable habitat. Morel is the oldest site, dated to the Early Ceramic period, the Huecan Saladoid and Cedrosan Saladoid phases. Anse à la Gourde was inhabited in the late Cedrosan Saladoid and occupied again during the Late Ceramic period, specifically during the Mamoran Troumassoid. The knowledge on subsistence activities and domestic crafts is limited to the results of the faunal analysis and the morphological characteristics of the artefact assemblage. Functional analysis of the complete toolkit makes it possible to study functional and technological interrelationships between various artefact categories. Indirect evidence for craft and subsistence activities involving perishable materials can be obtained as well. This integral approach was the main component of the Aspasia-project in which the present research was incorporated (see preface). Such an approach makes it possible to gain more insight into the technological systems of past societies and the social implications of these systems (Bleed 2001; Lemonnier 1993; Schiffer 2001).

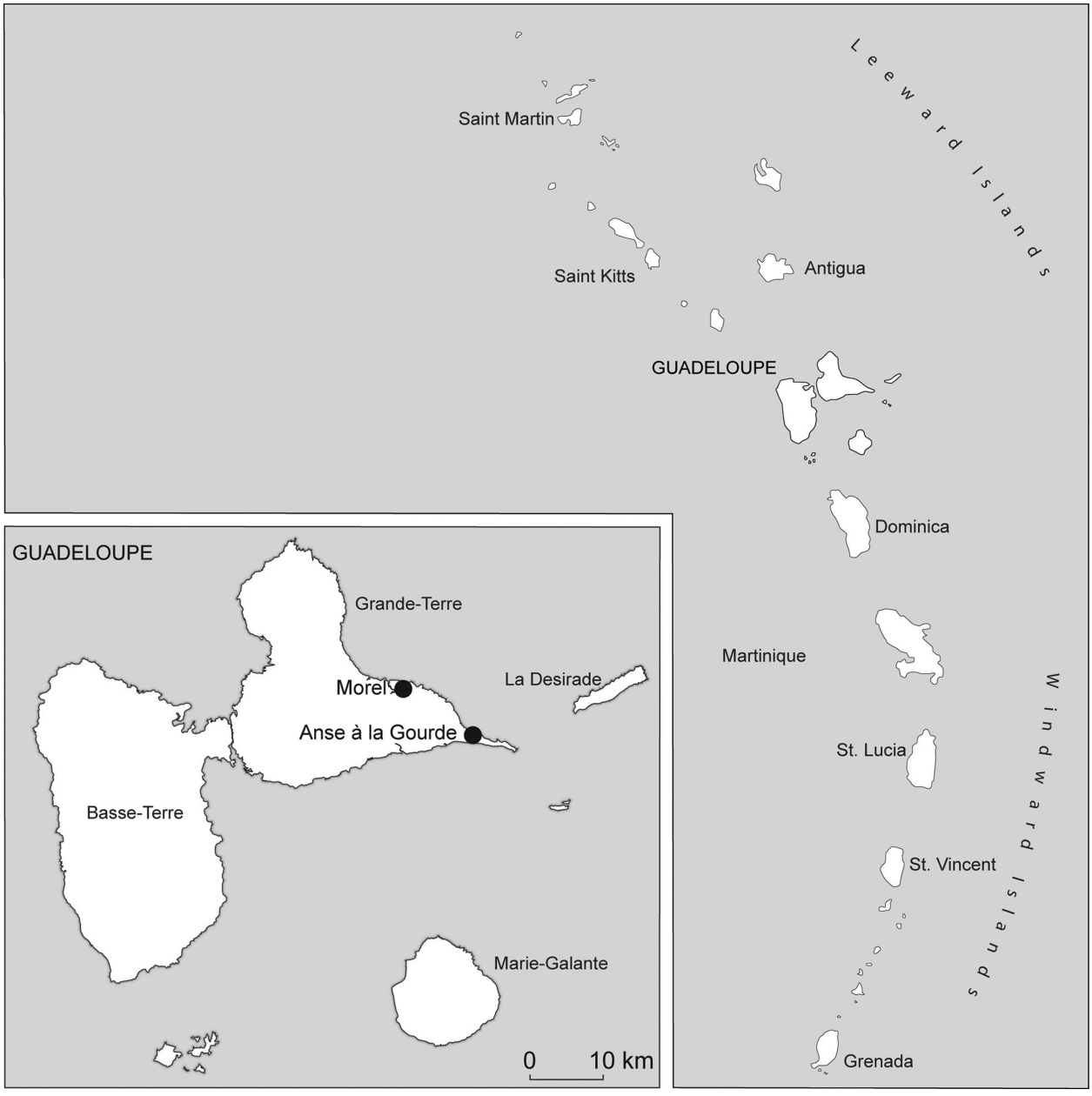


Fig. 1.1 Map of Lesser Antilles and Guadeloupe with studied sites

The Caribbean area is especially suitable for an archaeology of technology: the find assemblages are rich and varied and contain a range of artefact categories. They therefore are especially suited for an integrated approach using functional analysis. Furthermore, the area provides a variety of contextual data sources that enhance the possibility to interpret domestic household activities. Archaeological, palaeobotanical, ethnohistorical and ethnographic data provide an additional source of information for the replication of tasks and processes in order to set up experimental reference collections. Although almost no descendants of the former inhabitants are to be found on the islands, the cultural link with people still living on the mainland

of northern South-America is apparent. Many of their traditional crafts have survived and although they are sometimes adapted to modern times, many interesting customs can still be observed. In the older written sources in particular, detailed attention was paid to domestic crafts and activities and they proved to be an important source of information. In the ethnohistorical sources mention is occasionally made of manufacturing techniques or ways of hunting and fishing. Although these sources seldom mention tool-use, they give a fair idea of the situation right after the period of first contact. Based on these data, a reference collection was created of experimentally reproduced and used tools. Through the analysis of the complete toolkit available, it is possible to make inferences about the choices made by former inhabitants with respect to raw materials, artefact production, use and discard.
Besides the primary objective to examine the role of shell artefacts, the second goal of this research was to study the choice of raw materials for the production of artefacts, including both tools and ornamental implements. In this approach the study of technological and typological aspects of especially the shell ornaments was incorporated, as well as the evaluation of the diachronic changes in manufacturing processes of tools and ornaments. Furthermore, it was attempted to determine whether the use of imported flint and hard stone tools was based on the physical restrictions of the available raw material at the sites. The necessity of obtaining raw materials from other islands would shed light on relationships with these islands.
The third goal was to identify the domestic tasks and craft activities that took place at the sites studied. Related to this objective is the evaluation of diachronic changes in activities as well as possible craft specialisation.

The description of the study is presented in the following framework. Chapter 2 focuses on the technical aspects of usewear analysis and the influence of taphonomical processes. It specifically concentrates on the study of traces on shell material and the related problems. In chapter 3 the experimental program is presented. It is organized around the information found in the contextual data on worked materials. Chapters 4 and 5 describe the artefacts and their usewear traces from Anse à la Gourde and Morel respectively, concentrating on shell, stone and flint. A short description of the coral and pottery tools is also presented. Finally, in the concluding chapter 6, the possibilities and limitations of functional analysis on shell tools are discussed as well as the functional and technological interrelationships between the various artefact categories.

# 2. Functional Analysis – Methods and Techniques

The function of artefacts cannot be derived from typo-morphological studies alone. Several studies in functional analysis (or: usewear analysis) have demonstrated that the way a tool was used is not specifically or exclusively related to the form of an artefact (a.o. Van Gijn 1999). To interpret a tool's function a microscopic study of the traces of wear resulting from use is required. In this chapter the methodological framework of this study will be presented and specified for each artefact category that was subject of this study.

## 2.1 Introduction

Usewear analysis was developed in the sixties to study flint tools from European and Asian sites for traces of use, after Semenov's Russian publication was translated to English (Semenov 1964). Semenov applied the same procedures on flint, stone and bone implements. Initially, the western-European tradition was however focussed on flint. The development of functional analysis on materials other than flint started relatively recently. Now, pioneering work is carried out and reference collections are made of almost all artefact categories, including chert (Nieuwenhuis 2002), obsidian (Hurcombe 1992), hard stone (Van Gijn *et al.* 2006; Procopiou and Treuil (eds.) 2002), bone and antler (Maigrot 1997, Van Gijn 2006), coral (Kelly 2003), pottery (Lopez Varela *et al.* 2002) and metal (Bridgford 1997; Roberts and Ottaway 2003).

## 2.2 Usewear traces

Usewear analysis is based on the observation that the configuration and appearance of wear traces is related to contact material and motion. Originally, there were two main different approaches to usewear analysis: the low power and high power approach. Semenov (1964) used magnifications up to 100 times (low power). Keeley (1974, 1980) introduced the high power method, using higher magnifications, occasionally up to 400 times. For a while, preferences were either for the low or high power method, but more and more it is understood that the two different approaches lead to interpretations on different levels (Grace 1990, 1996, see also Ch. 2.8). Moreover, most high power specialists incorporate the low power approach into their standard procedure (Van Gijn 1990). In some cases residue analysis is included as well (Fullagar 1994, Nieuwenhuis 2002). Clearly, the combination of all facets leads to the most reliable results, although residue and phytolith analyses seem to be a specialism on their own.

The results of usewear analysis should be regarded as interpretations instead of as determinations. The analytical results are based both on the observed attributes as well as the experiences gained during the experiments. To be certain that individual researchers and groups of researchers are able to interpret traces on different materials, blind tests should be organised. The need for more researchers to work on the same material is therefore apparent.

Since the functional analysis of materials other than flint is still in a rather experimental stage, no consensus seems to have been achieved on which phenomena can be defined in the description of wear traces. It is however agreed upon that a combination of information sources should lead to the best results. Therefore ethnohistorical, ethnographic, palaeobotanical, petrographical, experimental and residual data should be involved in the formulation of the results of the analysis of these tools (Lammers-Keijsers *in prep.*; Nieuwenhuis 2002; Procopiou *et al.* 2002).

### 2.2.1 Flint and hard stone

Using the high power approach, one can distinguish four types of wear traces: polish, striations, edge rounding and edge removals. Within these phenomena several attributes are further specified: e.g. polish texture,

topography, brightness and edge removal distribution (Van Gijn 1990). They form a diagnostic pattern, which leads to an interpretation of the task for which the implement was used (Keeley 1974, 1980; Vaughan 1981). There has been much debate about whether polish is formed as a result of a chemical (Anderson-Gerfaud 1980) or a mechanical reaction (Yamada 1992). In general a consensus has more or less been reached that a combination of processes takes place, resulting in an increased reflectivity of the flint surface.
The wear-trace analysis of hard stone tools traditionally has been given less attention than the study of flint tools (but see: Adams 1989, 2002; Fullagar 1994; Fullagar *et al.*1998; Van Gijn and Houkes 2006; Hamon 2004; Procopiou and Treuil (eds.) 2002; Viallon 2001). This is probably because the research of wear traces on hard stone tools is not like any other material. Many hard stone tools are ground into shape and they consequently display traces of manufacturing. Ethnographic studies show that stone tools often served multiple purposes, which creates overlapping traces from different worked materials. Furthermore when querns are studied, one has to take into consideration that the worked material was rubbed onto the stone using an active handheld stone. Although the worked material might influence microscopic traces, the more visible traces are merely the result from abrasive processes between the two stones themselves (Adams 2002; Hamon 2004).
In the Caribbean area, several combinations of different artefact categories are also conceivable: using coral and stone together to form a quern (mano/metate) or a stone pestle in a wooden mortar to bruise plants. The number of experiments that should be carried out to create an overview of traces is therefore relatively large. Furthermore, some experiments are very time-consuming, because they intend to replicate traces resulting from prolonged activities such as grinding and milling.
Most researchers use the low power technique, sometimes in combination with high power (Adams 2002; Fullagar *et al.* 1998; Gonzalez and Ibanez 2002; Hamon 2004; Viallon 2001). Adams claims that the traces appearing on ground stone tools are the result of a combination of processes: adhesive wear, abrasive wear and surface fatigue, which lead to tribochemical interactions. Adhesive wear in its early stage is visible under very high magnifications and is the result of particles loosening from the surface due to frictional heat. When the pressure increases, the higher elevations of the stone particles collapse, resulting in surface fatigue. The loosened particles resulting from both adhesive wear and surface fatigue become abrasive agents that cause abrasive wear. These alterations are visible as a sheen (or polish) on the scale of the individual granular elements of a stone.
Because the object of this research was foremost concentrated on the study of shell artefacts, it was decided to study the traces on hard stone tools applying only the low power approach. Furthermore, we did not have the right equipment when the research started. In a later phase, the high power technique was occasionally applied when polishes were found. Although this approach does not lead to detailed inferences, an impression of the activities carried out with the tools is certainly achieved.

### 2.2.2 Shell

Molluscs that have been used as a raw material for the production of artefacts can be divided in two classes: Gastropoda and Pelecypoda (Bivalvia). Gastropoda have a flat foot and a coiled shell, Pelecypoda have two valves that are held together by calcified teeth and a ligament (Nieweg 2000). In this study, the animal itself will not be further described, because its skeleton is simply treated as a raw material for the production of artefacts. Figures 2.1 and 2.2 show the terms that are commonly used in malacology for the different parts of the skeleton of gastropoda and bivalvia. The shell skeleton consists of two crystalline forms of calcium carbonate: aragonite and calcite. The organisation of the crystals in their microstructure in aragonite may be prismatic, nacreous or porcelaneous. Calcitic microstructures are either prismatic or foliated. Both may occur in crossed-lamellar and homogeneous microstructures. Most molluscs have three structural layers: an outer organic layer (periostracum), the prismatic layer and a homogeneous inner layer. Some have a fourth crossed-lamellar layer.
The species that is most commonly used for the production of artefacts is *Strombus gigas* (see Fig. 2.1). This mollusc is herbivorous and mainly ingests algae, turtle grass (*Thalassia testudinum*) and sand.

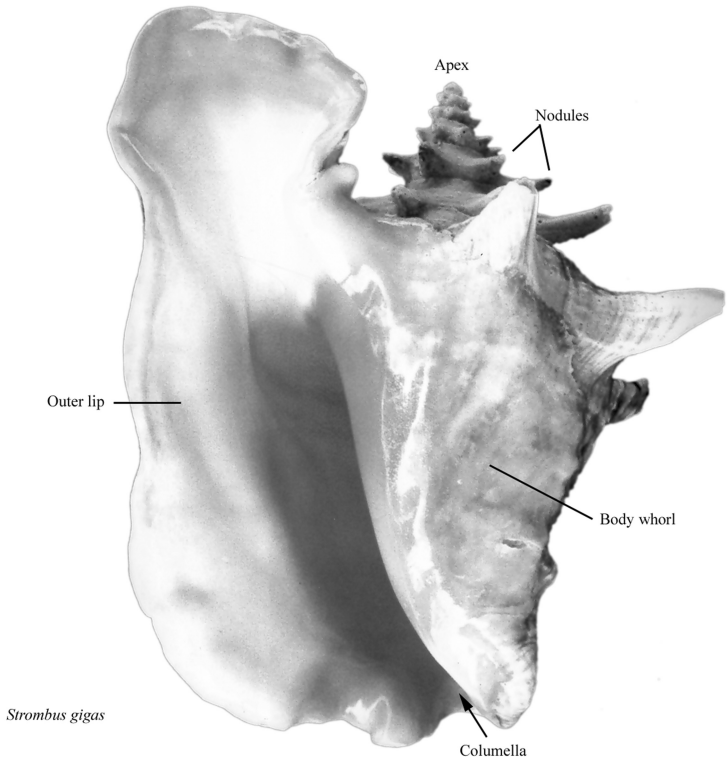


Fig. 2.1 Gastropod terms

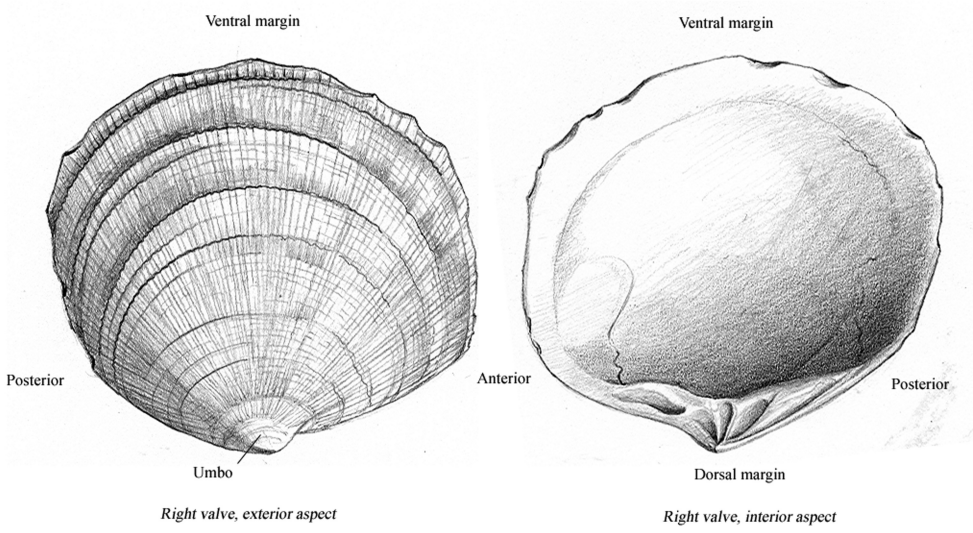


Fig. 2.2 Bivalve shell terms

Of the four stages in its life (juvenile, sub-adult, adult and old), the last two phases are the most important for the provision of raw material. The flared lip of the shell is fully developed and the maximum length may attain 30 cm in the adult phase. An old specimen will loose some of this length as a result of natural erosion and abrasion but the flared lip will continue to grow in thickness and might reach a thickness of over five cm (Appeldoorn and Rodriguez 1994).

Like traces on flint, wear traces on shells can be studied by means of low and high power approach. Occurring phenomena are likewise polish, striations, edge removals and edge rounding. Experimental results show that these phenomena are in many aspects comparable to those on flint (see Ch. 3). Because the study of polish is basically the study of the reflectivity of the abraded surface, the coarseness of that surface is a determining factor in the visibility and comparability of wear traces. Although shell is softer than flint, flint and shell have a comparable density which makes it possible to compare the polish. In contrast to most flint implements however, many shell artefacts display manufacturing traces from grinding and polishing. The interpretation of the manufacturing process of celts and ornaments is therefore an essential part of this study. Experimental results show that manufacturing traces can be studied like usewear traces. They display distinguishable differences in appearance (see Ch. 3).

Striations are formed as a result of abrasive particles between the tool-surface and the contact material (Van Gijn 1990; Keeley 1974; Semenov 1964). Edge removals, additives (intended or not) and pieces of the contact material can produce linear scratches, displaying directionality, and thus the motion exerted. The amount, density and morphology of the striations is linked with the worked material. The number of worked materials that create striations is limited. In the absence of striations, the distribution of the polish, the directionality in the polish and the edge removals can also indicate the direction of use.

Edge rounding is found as a result of virtually all contact materials, although softer materials such as hide cause more rounding than hard materials such as bone. This can be explained by a combination of reasons: softer materials have more direct contact to the tool surface (they are more pliable), where as hard materials only make contact with protruding points on the surface. In addition, hard materials in general create more edge removals during the working process. The implement thus 'looses' part of the already formed polish over and over again, which prevents the polish from getting to a further developed state before the artefact is discarded.

Edge removals that result from use give an indication of the hardness of the worked material and of the directionality of the motion. Location, distribution, termination, orientation and size are the attributes that are taken into account. In general, harder materials lead to medium to large removals, soft materials create smaller scars. Specific motions lead to different scar-distribution patterns on either one or both sides (ventral and dorsal) of the edge. These attributes together indicate whether the scars were indeed the result of use and not of secondary processes, such as resharpening, trampling, post-depositional processes or excavation damage. Scars on implements with an intentionally retouched edge can obviously not be interpreted on the basis of these attributes. Bivalve shells are particularly difficult to interpret. None of the studied bivalve shells was intentionally abraded or ground. Many displayed retouch however, which can be explained as the result of use, intentional modification or a selective sampling strategy in raw material. Because shell does not display the regular break patterns as flint does, even intentional retouch will look quite irregular. Experimental experience however shows, that with some practice, it is indeed possible to make quite accurate retouches and to distribute these relatively regularly. Toth and Woods (1989) however, on the basis of experimentation, claim that the difference between natural (rolling, trampling) retouch and human-inflicted retouch is too irregular to be recognised.[1] However, the oysters that they studied are a very special shell type, with a foliaceous (leaf-like) structure that is much more subject to irregularity than other bivalve shells with a more homogenous structure. The Caribbean species considered to have served as tools (e.g. *Codakia orbicularis*, *Tellina fausta*, *Lucina pectinata*) belong to this last homogeneous group. Furthermore, Toth and Woods only make mention of the use

1 Although their goal was to recognize cut marks on bones; they were not specifically interested in recognizing shell tools and they were not concentrating on the Caribbean area.

of other shells to serve as percussor, while I experienced the use of stone pebbles far more efficient (see Ch. 3). Antczak (1998) also doubts the diagnostic possibilities of edge removals and striations, based on a similarity between bivalve shells on the beach and in the excavation. Barton and White (1993) however successfully studied bivalve shells for traces of wear in Oceania, positively identifying traces of plant working. They examined pieces gathered from a local beach to study the damage. Only 25 % were damaged and in only two cases the damage displayed was regular. A study of shells in Oman (Charpentier *et al.* 2004) demonstrates the same pattern: although the retouch does not display the clear characteristics of feather, step and snap fractures, they are clearly intended and distributed evenly.[2] The same experience was met within this study. I seldom found heavily retouched shells on the beach or near the shore and the damage appeared overall to be relatively fresh, randomly distributed over the edge and limited to one or two retouches in total. Polish and striations on these artefacts are very limited and only occur on protruding points.

## 2.3 Taphonomic processes and post-depositional modifications

### 2.3.1 Flint and hard stone

Processes that influence the appearance of the surface start their work immediately after the discard or loss of an artefact. They are either of a chemical or mechanical nature (Van Gijn 1990, 51-57), varying between a minor diminishing effect on the visibility of traces to a total destruction of the surface. Chemical alterations include patination and friction gloss. Mechanical alterations are the result of trampling or excavation and research processes. There has been much debate about the formation of these different alterations, and the origin of some of them is still unclear (Van Gijn 1990; Keeley 1980). Taking all possibilities into account very few assemblages seem to lead to totally representative results. Alterations can cause polishes from soft materials to disappear and edges to be rounded or damaged. Many alterations are distinguishable from traces resulting from use. Patination and friction gloss can generally be determined with the naked eye or by using high power analysis. Edge rounding and retouch as a result from respectively chemical processes or trampling are located on different areas of the implement and vary in distribution. Even when an assemblage might not be in an ideal state of preservation, the application of low and high power techniques might shed more light on the function of a tool, than based on typology alone.

Like flint, hard stone is subject to post-depositional processes such as trampling, patination and abrasion. The effect on the visibility of traces seems however much smaller than on flint tools and most authors make no mention of problems come across. Many studies are carried out using the low power approach, whereas the latter processes problematise the analysis predominantly on a high power scale. Furthermore, artefacts are often large in size, which provides more opportunity for the researcher to study unaffected parts of the surface.

### 2.3.2 Shell

Shells are subject to a wide variety of taphonomic processes from their lives in the sea until they are excavated as an artefact in an archaeological site. Summarizing a range of studies undertaken by palaeontologists, biologists and archaeologists Claassen (1998) attempts to register all processes that influence archaeological shells and shell artefacts. Basically, a distinction can be made between processes that take place in the sea and on the land. In archaeological contexts, a distinction can be made between shells that are discarded individually and shells in midden deposits. Although the entire sequence of events taking place on a single individual is complex, it is clear that several taphonomic processes can be distinguished.

The main processes that take place are encrustation, perforation/fragmentation, abrasion, dissolution and chemical conversion. Encrustation is the absorption of shells, dead or alive by other aquatic animals to support

2 A pilot study carried out by Laurence Astruc and myself unfortunately revealed that on the microscopic level, the secondary modifications of the bivalve shells were such that the polishes could not be interpreted.

their skeletons. These activities lead to erosion and pitting of the shell. Perforations are caused by sea animals drilling into living shellfish to consume the animal itself, or to obtain calcium. Perforations by animals (*Natica sp., Policines sp.*) are in general very small and cylindrical or conical (Carucci 1992, cited in Claassen 1998; d'Errico *et* al. 1993) and are located on relatively thin sections of the bivalve shell (pers. comm. Quitmeyer 2004). For the use as a perforation for suspension these spots are often not really suitable because of their centre-position, too far from the edge. Fragmentation occurs when the shell is severely damaged by perforation or when the dead shell is washed in strong currents, impacted by waves. Break patterns depend on the structure of the shell. Because every species has its specific weak spots natural waste products will show distinct similarities. Especially when the fragments are water-worn they are easily misinterpreted as standardized artefact types.

Abrasion can be the result of exposure to the tides or waves or of bio-erosion. In the tides, larger light shells will deteriorate faster than heavy smaller shells. Speed of abrasion is proportional with sediment grain size. Abrasion is visible as a 'water-worn' appearance with rounded edges and polished surfaces (Parsons and Brett 1991:44). Abrasion from tides and waves develops first at the umbo, followed by the posterodorsal margin and the post-umbonal slope (Claassen 1998: 58). Bio-erosion abrasion is the damage done by food and shelter-seeking animals. Especially hermit-crabs can heavily abrade the gastropod they carry along by dragging the shell over the surface.

Dissolution occurs in the presence of either salt or fresh water. Tropical waters are relatively favourable, because of their high saturation level of calcium and a high magnesium calcite (Alexandersson 1979, cited in Claassen 1998). Aragonite layers dissolve, but the dissolution creates a build up of cementation. During the dissolution process shells loose their colour and lustre, get thinner, particularly on the edges and perforation around the muscle scar may happen. Eventually all shells will disintegrate into their original crystalline structures. In a terrestrial setting an acidic environment combined with rainwater will lead to dissolution, after having formed calcium bicarbonate. Because the amount of water that enters a midden is relatively small, the density of calcium carbonate is relatively high. Therefore shells from a midden are more or less protected from this state of disintegration.

After death of the shell spontaneous chemical conversion of aragonite into calcite may occur at temperatures at or below 30°C. Layers may also recrystallize (in alkaline environments) or be replaced by another mineral (permineralisation), such as dolomite, silica (in acidic environments), hematite or pyrite (Land 1976, cited by Claassen 1998).

Lastly, humans may also have a large effect on the state of shells. Shells are opened to extract the animal, they are cooked as a whole, heated for lime or temper etc. In addition, whether they were used fresh or after a period of decay is of consequence for the development of usewear traces. Fresh, living shells are covered with the periostracum, which starts decaying quickly after the collection of the shell, making it rather dirty. The soft state of this layer determines the development of traces, but it would deteriorate directly after use or even due to use. It is unlikely that for instance in the preparation of food a shell in this state would be used. Dead bivalve shells can easily be picked up on and in the shallow water near the shore. It is therefore more likely that they were used in this state. Both Antczak (1998) and Nieweg (2000) mention the fact that the number of bivalve shells is rather small compared to the abundance of *Cittarium pica* and *Strombus gigas* (and Chitonidae). Both argue that it is likely that they were not part of the structural diet. A step further would be to say that the bivalve shells were collected merely to serve as tools and that they might have been collected in a dead and clean state. These aspects will be dealt with further in Chapters 4 and 5.

All the abovementioned natural processes occur between the moment the animal comes to life and the moment the shell artefact is brought into a laboratory. The disintegration once the animal has died is unstoppable. Aragonite is more vulnerable than calcite and shells containing aragonite are therefore damaged and deteriorate more easily than shells with calcite. However, in positive conditions it may take several thousands of years, even for aragonite layers, to reach the state of total disintegration. These conditions apparently also applied to the sites studied. Many of the shell artefacts were found in the shellmidden, where the level of calcium

was favourable. The relative freshness of the studied sample is shown in the sometimes perfect condition of Cypreaeidea and *Cittarium pica* and in the colour that other occurring species (*Chama sarda, Spondylus sp.*) display (Nieweg 2000). The processes described in this paragraph do not therefore negate the utility of the study. However, if one wants to apply usewear analysis on other samples, the impact of these post-depositional surface modifications should be evaluated.

## 2.4 Functional analysis in the Caribbean area

In the Caribbean area, the application of usewear analysis is limited to a small number of cases (Briels 2004; Kelly 2003; Lundberg 1985; Viallon 2001; Walker 1980, 1983). Still, it is commonly recognised that usewear analysis should be applied and could contribute to solving certain specific questions in Caribbean archaeology (Serrand 2002).

### 2.4.1 Flint and hard stone

The emphasis in the study of flint and stone material from the pre-Columbian period lies in technological and typological analyses. Many, especially ceramic sites contain only a small number of lithic remnants. Most sites show a comparable set of artefacts, encompassing flakes, core tools and used water worn pebbles. The form, the wear traces, the nature of the material and the residues may lead to an interpretation of function. Most researchers however make use of the standard typo-morphological relation between form and function (Knippenberg 1999, 2006; De Waal 1999). In a smaller number of studies usewear analysis is applied (Briels 2004; Lucero 2003; Rodriguez Ramos 2005; Viallon 2001; Walker 1980). Some authors try to distinguish between used and unused material (Bartone and Crock 1991; Berman *et al.* 1999; Crock and Bartone 1998) on the basis of the presence of use-retouch, registered by the naked eye. Petrographical analysis was used in a few cases to determine the origin of the raw material in order to be able to reconstruct the use of raw material sources and exchange patterns (Knippenberg 1995, 1999, 2004, 2006).

### 2.4.2 Shell

Shellfish were of paramount importance in the local diet. Consequently many studies have focused on subsistence (Antczak 1998; Mitchell 1983; Nieweg 2002, Serrand 2002). Other studies were directed at the typo-morphological description of shell ornaments, celts and so forth (Antczak 1998; Brokke 1999; Cartwright *et al.* 1991; Jansen 1999; Jones O'Day and Keegan 2001; Linville 2004; Rostain and Dacal Moure 1997; Serrand 1995, 1997, 2002; Van der Steen 1992; Taverne and Versteeg 1992). The realisation that unmodified shells were used as tools is only a relatively recent one. Such tools are difficult to recognise amongst the great quantity of food debris. An additional complication is the fact that shells also tend to fracture due to pressure from trampling and so forth. A functional analysis is therefore essential to distinguish the tools (Armstrong 1979). Especially *Strombus gigas* collumellae are considered as tools (Armstrong 1979, Dacal Moure *et al.* 2004; Keegan 1981, Lundberg 1985). Jones O'Day and Keegan (2001) discovered re-occurring shapes in pieces of different *Strombus* parts and tried to make a typology of expedient tools for the Bahamas, Turcs and Caicos, Haiti and Jamaica. Dacal Moure and Croes (2004) made an extensive description of re-occurring shapes on Aruba.

## 2.5 Sampling

Studying implements for traces of wear under a metallurgical microscope takes much time. For flint flakes, the average number of artefacts that can be studied in one day is about eight pieces. Therefore, unless the assemblage is rather small, only a sample of artefacts can be studied. Generally, a sample is taken of retouched

formal tool types, complemented with a selection of unmodified artefacts and a selection of apparently unmodified material. Depending on the research questions and the availability of time and money, the sample is taken at random from the entire site or is concentrated around certain structures. For the study presented here, the aim of the analysis was to get an overview of the tasks carried out at the two sites. Since the emphasis of the study was on the use of shell tools, the largest sample was taken from this artefact category. In addition, samples of flint and stone tools were studied. As only few usewear studies have been conducted on Caribbean tools, it was considered that information on different artefact types would be valuable, even if there was no precise contextual data for the artefacts. Unfortunately some of the most beautiful shell and stone artefacts lacked precise contextual information, but they were still included in the sample. With respect to the shell artefacts it was decided to include all bivalve shells in the selection because their usage is still highly enigmatic and their number is relatively very small. Only 0,3 % of the total weight of the studied shell food remains are bivalve shells. It is therefore unlikely that they were predominantly collected as part of the diet. Several celts were selected, including blanks and unfinished specimens. A random selection of the shell ornaments was taken to study manufacturing traces and to search for indications of wear.
The selection of the flint and stone tools was made in cooperation with Stevens and Knippenberg. Frank Stevens studied the typology of the flint and stone tools of Morel (Stevens 2001). Sebastiaan Knippenberg studied samples of the flint and stone tools of Anse à la Gourde (Knippenberg 2006). To make a selection, all implements were studied for the presence of possibly used edges, based on archaeological and experimental experience. During the sampling possible tasks (including manioc grating) were kept in mind. Since Knippenberg's sample for sourcing excluded some interesting artefacts, I did not limit myself to his sample because some artefacts were considered likely to have been used. Some retouched pieces were not selected because of the bad state of conservation. Burned and patinated pieces were also excluded.

## 2.6 Registration

As stated at the beginning of this chapter, usewear analysis leads to interpretations rather than determinations. During the development of usewear analysis the need for standardisation and qualification of traces became evident (Van den Dries 1998). It is almost impossible for different specialists to formulate the same descriptions for each attribute of polish. Attempts at quantification by profilometry or image analysis, have so far not lead to a satisfying solution (Grace 1996). During a working visit to the CNRS laboratory in Valbonne, France, a short study was dedicated to the possibilities of image analysis, computer software that enables us to make dimensions of all kinds of features in a picture. In my opinion the lack of the variety in attributes makes the use of these dimensions too limited. Moreover, the variability in appearance of the traces seems to be without limitation, due to the extensive variety in tool shapes and degree of polish formation. Only the use of neural networks and expert systems can finally lead to conclusions drawn from the researcher's entries (Van den Dries 1998). Since these networks are only in a preliminary stage, the Laboratory for Artefact Studies[3] makes use of a registration system, which was developed by Van Gijn (Van Gijn 1990, 12-20). This system was supplemented with some variables traditionally used by French researchers. In some cases variables needed to be added or adjusted for the description of shell artefacts (see Appendix 1). The original division in Possibly Used Areas and Actually Used Areas was abandoned. Since the gathering of flint and the preparation of shell implements took so much effort, implements are always 'possibly used' in the Caribbean area. All artefacts were described typologically and the usewear analysis led to a functional interpretation.

### 2.6.1 Flint and hard stone

Typologically, Knippenberg (Anse à la Gourde, 2006) and Stevens (Morel, 2001) described the artefacts of flint and stone, both using the same system. Knippenberg studied a sample of artefacts originating from the shell

3 Faculty of Archaeology, Leiden University

midden. Part of my sample was described by him, but I also studied a sample of artefacts from the living area. Those were described typologically by myself. The usewear traces were registered by a system of descriptions of wear attributes (Van Gijn 1990, Juel Jensen 1993). This system is thoroughly described in Van Gijn' s work (Van Gijn 1990, 12-20) and does not need to be repeated here. Small changes were made though[4]: hafting traces were incorporated in the list of possible motions (hafting) and contact materials (in tar, in wood, in hide etc.) and a number of contact materials were added. Over the years the separate description of attributes was considered to be very time consuming and in stead of writing down all codes for each variable, only the final interpretation (motion, contact material) and the degree of wear are registered (Appendix 1 shows all variables and their codes). The paper version of the data sheets however contain sketches of the dorsal and ventral side of the artefacts, next to which descriptive notes on the nature of the traces are made. The interpretation is in this way refined with extra observations. Location, distribution, brightness, texture, topography and width are the attributes that are taken into account. Of every used edge the angle was measured approximately 2 mm away from the edge, which represents the original edge angle. Together with the registration of the profile (Van Gijn 1990, 17: shape of the aspect) this provides the possibility to gain insight in the selection criteria of the users. Since there is so little standardisation in flakes, this in particular is a valuable variable.
The usewear traces on stone tools are not described in codes because the variety in typology and appearance of traces prove to be so large that it is difficult to capture the phenomena in code lists. Furthermore, since only the low power technique was applied, the interpretation of use stayed fairly descriptive, making a system of codes superfluous. Although the Laboratory now uses the descriptive code system when high power analysis is conducted on stone tools, the artefacts for this low power study were described in words. Furthermore, the large variety in implement shapes makes it difficult to create a system as exact as the polar systems for flint and bivalve shells. Sketches of all aspects of the implements (sometimes up to six) provided the possibility to mark the exact locations of wear traces as well as zones with manufacturing marks.

### 2.6.2 Shell

For the typological description of shell tools no formal registration system was in use when the research was started. Since the variety in shell artefacts is vast, no shared typology is present either. For the description of shell implements on the artefact level, I developed a typology, concentrating on the variety in the assemblage itself and on the pre-Columbian artefacts mentioned and described in the literature (Antczak 1998; Brokke 1999; Cartwright and Drewett 1991; Dacal Moure and Croes 2004; Jansen 1999; Jones O'Day and Keegan 2001; Linville 2004; Lundberg 1985; Rostain and Dacal Moure 1997; Serrand 1995, 1997, 2002; Van der Steen 1992; Sutty 1978; Taverne and Versteeg 1992). In this paragraph the variables are presented; a list of all possible entries can be found in Appendix 2.
Artefact type: implements are given a descriptive name. I tried initially to avoid function-related names for each artefact category, but this proved to be almost impossible. I therefore decided to use the names most common in Caribbean archaeological literature (e.g. Hofman and Hoogland eds. 1999; Serrand 2002; Versteeg and Schinkel 1992; Versteeg and Rostain 1997). It has to be kept in mind that these names are misleading and that the actual function of the artefact might be different.
*Shell species*: Of all artefacts the shell species was registered if possible. Because many objects are ground pieces from larger shells, it is not always possible to specify exactly which species were used. Sometimes only the genus could be registered.
*Length, width, thickness and completeness*: Of all artefacts, dimensions of the maximum length, width and thickness were taken. For beads, the diameters of the perforations were also measured. Weight was not registered because -for example- bivalve shells with the same dimensions but differences in conservation have different weights. Any comparison based on weight would therefore be disputable. If an artefact was not

4 These changes were made over the years in the Laboratory for Artefact Studies

complete, the specific reason for breakage was registered as well, if possible. Stress caused by manufacturing processes or use may lead to breakage.
*Type of finish, bead preform*: This variable includes a description of whether an artefact was ground, polished or not smoothed at all. For celts polished or ground zones were registered. Beads were described according to three aspects: drilling, flattening and rounding.
*Perforations, indentations and incisions*: Perforations, indentations and lines were counted and described. Perforations can either be achieved by abrading, pounding, sawing or drilling. When complete perforations are made by drilling, there are four possibilities in the shape of the perforation: conical, biconical/equal, biconical/unequal and cylindrical. The systems developed by Haviser (1990) and Linville (2004) were not used because the recovered perforation types did not fit in these two systems completely. Figure 2.3 shows the description of the different shapes. The types were not numbered to avoid confusion with other systems. Incisions are divided in lines in circles, frog shapes, straight lines and indentations. Indentations can be either cylindrical or cone-shaped. If the decorations cannot be described in these terms because of their uniqueness, they are described in the remarks.

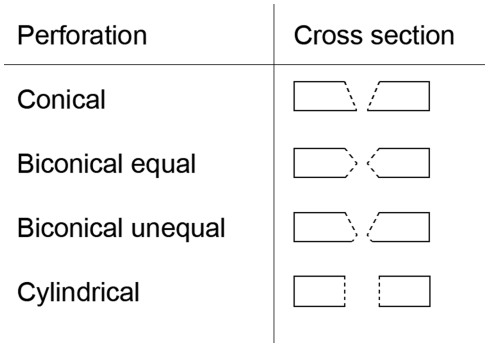


Fig. 2.3 Scheme of types of perforations in shell beads

*Shape of celt, profile of celt, edge of celt*: because of the variability in shapes, the shape of celt was described in three categories. 'Shape of celt' describes the overall shape of the celt. Variables are oval, pointed, rectangular, rectangular flat and shell-shaped/twisted. 'Profile of celt' describes the shape of the sharp edge of the celt, looking at it in profile. Variables are asymmetrical, symmetrical and shell-shaped. 'Edge of celt' describes the edge from a dorsal or ventral view. Variables are curvilinear, rectilinear with angular corners and rectilinear with round corners. Many shell celts are in fact lips from *Strombus gigas* that are knapped roughly in shape and are then ground on one side to create a sharp edge. I added the description of the profile of the edge because I wanted to make an outline of the diversity in axe-shaped and adze-shaped celts. Since many lips display a twisted longest centre 'axis', the way to describe the profile of the edge can however be a little misleading. Although the edge itself may look asymmetrical, the overall appearance in respect to the whole length of the celt may give the edge a symmetrical aspect. In those cases the edge is described as shell-shaped.

For the functional description of the shell artefacts the flint registration system (see appendix 1) was used. For the analysis of the bivalve shells I added a variable 'macro traces', in which an interpretative indication is registered of the macroscopically visible edge damage. Both the type of damage (retouch, abrasion, etc.) and the possible cause of the damage are registered (natural, use-related, post-depositional).
The description of ornaments and artefacts was put into the same database. For ornaments the descriptions were adjusted to fit into the regular variables of contact material (stone, coral, flint) and motion (manufacturing by cutting, by grinding etc.). Because of the wide variety in artefact shapes the locations of the traces were

registered descriptively or on sketches of the artefacts. For bivalve shells, I created a polar system for the description of location (Fig. 2.4), based on similar systems for flint (Van Gijn 1990) and shell (Claassen 1998, 203; Lima *et al.* 1986). I also created a system to describe the studied angle of a bivalve shell edge (Fig. 2.5). Practice shows that for bivalve shells the angle in which the edge is studied is a crucial factor. Originally for this study the ventral and dorsal side were studied under a 90° angle, similar to how flint is studied. It turned out that the edge itself should be considered as a diagnostic area, as well as the corners of a bevelled edge. Study of the edge should therefore take place under different angles. Thus, it is possible to study all facets of the edge with a 90° angle between the light-source and the surface studied.

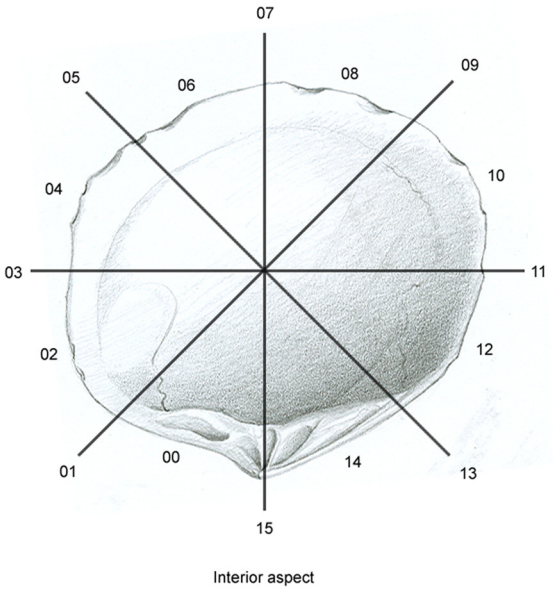


Fig. 2.4 Polar coordinates bivalve shell

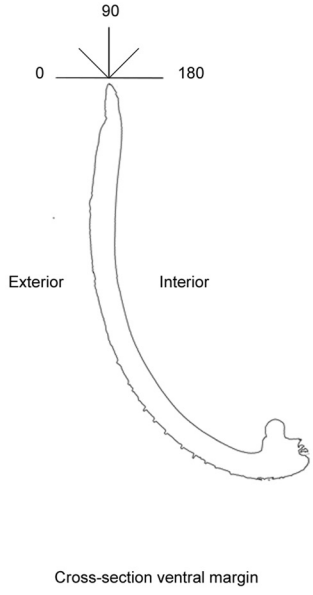


Fig. 2.5 Polar scheme angle of study bivalve edge

## 2.7 Instruments

In other usewear studies it has already been stressed that the use of comparable microscopes is essential (Grace 1996). All artefacts in this study were scanned with the aid of a Wild stereomicroscope with oblique light or a Nikon stereomicroscope with vertical light. Magnifications ranged between 10x and 65x. To study the appearance of polishes, use was made of a Nikon-Optiphot, a metallurgical microscope with 5x, 10x and 20x objectives and 10x and 15x oculars, resulting in magnifications of either 75, 150 or 300 times. This is generally assumed to be the best magnification to identify polishes (Van Gijn 1990; Moss 1987). For shell, most of the time use was made of a GIF-filter, because the white implements reflected so much light that it was hard to study the surface. Flint was studied both with and without this filter. Stone was studied without filters, mainly using the stereo microscopes. Although the Nikon stereo is easier to use, I preferred the Wild microscope because its oblique light provides a better image of the topography of the surface. Furthermore, the microscope is attached to a free arm, which means that it can be used for artefacts of all sizes. During the course of the present study the Laboratory also obtained a metallographic Optiphot with a free arm, providing for the first time the possibility to study celt and bivalve shell edges under 300x magnifications. This microscope makes the use of imprints nearly superfluous.

A digital camera (Nikon Digital Still Camera DXM 1200) was attached to the Nikon stereomicroscope and the Nikon Optiphot, using the programme ACT-1. A microscopic picture is however a shot of one horizontal plane, while in practice, the polish is studied during continuous change of focus. By changing the focus slightly, one can obtain an impression of the topography of the polish. Distribution and exact location of the polish are studied by moving the piece, which can also not be recorded in a picture. The focussing problem might be resolved in the future with the possibility of microscopic 3D pictures. A series of pictures of the same spot in different focus levels can be combined in a special program and be transferred to a 3D picture, which can be viewed in the program at different angles. Although this is now in a rather archaic state this could very well take usewear analysis to a different level. For now only SEM-pictures seem to provide a good image of the topography of an artefact. With a system of 3D-recording we will be able to actually see the variety in surface level with a metallographic microscope as well.

## 2.8 Cleaning

To get a clear view of the actual surface of an implement and to be certain that the traces themselves are studied, sometimes extensive cleaning is needed. Not all raw materials can however be treated with chemicals and alternatives have to be sought.

### 2.8.1 Flint and hard stone

Together with the changing views on the nature of usewear traces on flint, ideas on cleaning artefacts prior to analysis have shifted over the last decades. When archaeological tools are studied, in many cases most of the organic residues will have disappeared. In specific context condition however it is known that certain residues can survive millennia. Experimental tools will of course always display much residue. Nowadays many usewear specialists agree that both archaeological as well as experimental tools should be cleaned in order to be able to compare the traces. In some cases weak chemical solutions of HCl and NaOH are needed. In many cases it is not even really necessary to clean the archaeological implements with chemicals, especially when the site conditions were such that it is unlikely that organic materials have survived. Alcohol to wipe off finger grease and in some cases the use of an ultrasonic tank to remove soil will suffice. A low power study of the artefacts before and afterwards will settle the necessity to take samples of residues and the use of chemicals to remove remnants. On both the tools from Anse à la Gourde and Morel this procedure was applied. In most cases the use of the ultrasonic tank was not needed.

Articles on studies of ground stone tools almost always lack descriptions of cleaning procedures. It is most likely that no special actions were conducted to clean the surfaces of the studied material. In many studies however ground stone tools are submitted to residue analysis in combination with usewear analysis, and are therefore cleaned to abstract phytoliths etc. after examination.

When the ground stone tools of Anse à la Gourde and Morel were studied, all tools were washed in the field and cleaned with alcohol in the lab when they were studied with the high power technique. The Laboratory for Artefact Studies was starting to develop a reference collection for residue analysis, but this was not yet ready to work on tropical materials on a large enough scale.

### 2.8.2 Shell

Since there is so little experience in usewear analysis on shell tools, there is no standard procedure for cleaning. Claassen (1998) works from a more biological point of view and suggests using stiff brushes, dental tools, ethyl acetate and chlorine. These methods are considered too damaging to be used for microscopic research. She further suggests restoring the lustre of the surface using mineral oil or Vaseline, which of course is not suitable either in the case of usewear analysis. Further suggestions on hardening shells that have deteriorated badly do also not apply to usewear analysis, because it can be expected that those specific shells

are not suitable for this kind of study anyway. All shell tools form Anse à la Gourde and Morel that were studied under the microscope were soaked in water for a few minutes to remove most of the dirt. Some of the Anse à la Gourde tools and all of the Morel tools were then cleaned in the ultrasonic tank for approximately two hours. After that, edges were cleaned using a 90 % alcohol solution to wipe off finger grease. No chemical cleaning took place.

## 2.9 Levels of interpretation

To conclude, a remark should be made that the usewear analysis of different raw material categories of tools leads to interpretations on different levels of certainty and precision. Since the results of functional analysis always have to be categorised as interpretations, some interpretations might have a higher probability than others. The explanation lies in a combination of aspects originating in the nature of the raw materials themselves. Flint tools are often freshly knapped and are generally efficient for the duration of one task. The knapping produces no manufacturing traces. The raw material is dense and homogeneous. Flint displays wear traces much faster and shows a better development of characteristics. This leads to inferences with a higher probability. Bivalve shells are generally not intentionally modified and have a high density and homogeneous structure as well. Shell is however more susceptible to influences from post-depositional processes. Shell implements are therefore more likely to be too damaged to be studied with high power techniques. Polished artefacts, such as shell and stone celts have the problem of the presence of manufacturing traces. Traces of use will overlap these traces, which might give a indistinct picture. The coarseness of hard stone tools makes it more difficult to study these implements under high magnifications. In addition, tools made of hard stone may have been used much longer than flint or shell tools. Furthermore, in the light of the present study, we will see that hard stone material had to be imported from relatively long distances. These factors lead presumably to multiple use, resulting in overlapping traces, and therefore to a lower level of inference. It is virtually impossible to replicate the type of traces resulting from multiple uses experimentally. If we want to compare the results of different artefact categories, we have to keep these limitations in mind. Residue analysis and more experiments might solve some of the problems.

# 3. The processing of raw materials: ethnohistorical, ethnographical, archaeological and experimental data

For the application of the method of usewear analysis, it is necessary to build an experimental reference collection of replicated tools. The choice for the replication of certain activities is based on archaeological evidence from the sites studied. This includes direct evidence in the form of palaeobotanical and biological data. Data derived from ethnohistorical sources and ethnographic references are used as an additional source of information. In this chapter the various domestic tasks that could have taken place in the past will be described, with special emphasis on the use of the raw materials that are worked during the activities. It is explicitly not a complete inventory of all descriptions available in historical references. The sources mentioned are examples of information that can be obtained on tool use. The examples are followed by a presentation of the experiments and the resulting wear traces.

## 3.1 Methods and data sources

### 3.1.1 Analogical reasoning and experimental archaeology

Analogical reasoning is a common scientific approach, in which, based on given similarities between two entities, new characteristics are attributed to both entities (Van Reybrouck 2000). In archaeology this takes shape in the use of models derived from other sciences for the description and explanation of archaeological figures and phenomena. The discussion whether this is a legitimate approach has been ongoing since the introduction of the New Archaeology (Asher 1961; Gould 1978, 1980; Gould and Watson 1982; Watson 1979; Wylie 1982). It was then argued that archaeology could not do without anthropology (Binford 1967, 1978). Later this was countered with the idea that archaeological data should speak for themselves. In the specific case of functional analysis, the use of analogies has however been regarded as crucial (Van Gijn and Raemaekers 1999: 44; Owen 1999: 17). Van Gijn and Raemaekers argue that it is impossible to practise archaeology without the use of analogies and that anthropological analogies should be used in a more playful way, referring to the post-processual idea of culture as text (Shanks 1992; Shanks and Tilley 1987; Tilley 1990). The arguments against the validity of the use of analogies are based upon the concepts of uniformity and unambiguity (Van Reybrouck 2000). An analogy is uniform when the process in the past and the one in the present are identical. When there are no possible alternative explanations for the archaeological data to have been caused by different actions, the analogy is unambiguous. Clearly, both aspects of uniformity and unambiguity are hard to prove by scientific reasoning. By using an experimental approach it is however possible to test analogies (Kobylinski 1989; Lammers-Keijsers 2005; Mathieu 2002). The justification for the use of experimentation in science in general lies in the assumption that technical processes can be replicated and will always follow the same natural laws. For experiments in historical sciences this assumption is extended to the concept of uniformitariarism, derived from geology (Lyell 1990 [orig.publ.1830]). This concept entails the supposition that processes do not change over time. In other words, each cause will have the same consequence, whether performed in the present or in the past. In an ideal situation one should be able to gain knowledge on technological and functional aspects of past societies by replicating processes and material culture in experiments. One could argue that the experiments (and their results) in themselves form the 'analogy' that is applied to the archaeological data (Beyries 1999; Longacre 1992).

### 3.1.2 Ethnohistory and ethnography

In addition to the archaeological context, ethnographic data and ethnohistorical sources can provide information about possible activities carried out at the sites studied. In principle, the use of anthropological

analogies in the direct-historical approach (Van Reybrouck 2000) is most suitable for archaeological research in the Caribbean area. Unfortunately, the modern people of most islands have no historical connection to the original inhabitants anymore, due to the relatively rapid decimation of the indigenous population after Columbus arrived in the Americas. One of the exceptions to this rule are the Carib from Dominica, who live nowadays in reserved territory. Douglas Taylor (1938) presented a description of their crafts and activities showing that although many Carib traditions have been preserved, a Creole influence also exists. The island St. Lucia is, like Dominica, less influenced by European and Creole tradition than most other islands. Apparently St. Lucia was not considered attractive for colonisation in the period following the European expansion, although this volcanic island is for instance rich in raw materials. It was only by the 18th and 19th centuries that the French and English set their eyes on the possibilities of the natural harbours this island provided. Because of the constant changes in power between the French and the English, local inhabitants were able to develop quite autonomously. Still, the customs and activities of the present rural population must be considered as the result of a mixture of different traditions. The encountered traditional domestic craft activities are therefore to be regarded with caution.

Considering the fact that these traditions are subject to so many influences, the use of ethnohistorical analogies in the Lesser Antilles is limited. Consequently, Caribbean archaeology depends to a large extent on information abstracted from historical sources. In the early centuries following the arrival of Columbus, several missionaries wrote down their finds and experiences when encountering native inhabitants. For the development of a reference collection for usewear analysis some of these reports are very valuable, since they contain detailed descriptions of domestic craft activities. The priests Labat (1931 [orig.publ. 1742]), and Breton (1978 [orig.publ. 1647], 1892 [orig.publ. 1665], 1900 [orig.publ. 1666]) for example undertook voyages to the Caribbean islands, resulting in various journals and a dictionary, containing descriptions of customs and traditions. Of all sources it has to be taken into account that the descriptions might be coloured by political or religious motives (Biet 1896; Caillé de Castres 1694; De la Borde 1886 [orig. publ. 1674]; Du Tertre 1973 [orig. publ.1667]; Menezes 1979 [orig.publ. 1873]; Moreau 1994 [orig.publ 1620]; Rochefort 1665). For the rather neutral subject of tool use one might however assume that this influence is of lesser importance.

Studies of the last century on the mainland of northern South America also reveal detailed information about domestic craft activities of Amerindians who are culturally related to the original inhabitants of the Caribbean islands (e.g. Ahlbrinck 1931; Carneiro 1983; Hartmann 1986). In the 1940's in the handbook of South American Indians, Steward (1948) assembled many descriptions by various authors of so-called 'Indian tribes' and their customs throughout South-America, like the Warau, the Kalina and the Arawak. Jens Yde (1965) conducted an extensive study among the Wai Wai of British Guiana, concentrating to a large extent on domestic craft activities.

Both these historical as well as the anthropological sources give detailed descriptions of activities carried out. Exact descriptions of the tools and the way they are handled, which are the main focus of interest for the application of usewear analysis, are unfortunately too often limited or even absent. Still, the descriptions of the tasks themselves provide us with a better view on activities carried out in comparable settings and environments.

### 3.1.3 Archaeology

The analysis of botanical and faunal samples from various archaeological sites also provides us with detailed information on the organic materials available to the Amerindians at the time of occupation of the sites studied. Several studies reveal that materials were brought from island to island, from the period of the first colonisation of the Lesser Antilles onwards, including certain plants, trees and animals (Molengraaff 1994; Newsom 1993; Newsom and Molengraaff 1999; Newsom and Wing 2004; Stokes 1997; Wing n.d., 2001). As a result of this, the environment changed considerably. Manioc fields were created using slash and burn techniques, new animals were introduced and the existing flora and fauna were used intensively (Carlson

1999). Studies on artefact production and exchange such as that by Knippenberg (2006) demonstrate that raw materials for the production of stone and flint tools were also brought from island to island and available to be used in daily activities.

### 3.1.4 Experiments

The experiments, which form the reference collection for usewear analysis are often based on anthropological data. Following both Van Gijn (Van Gijn 1990) and Richter (Richter 1992), in usewear analysis a distinction can be made between two types of experiments. Generalized experiments or hypothesis-forming experiments involve experiments in which an array of materials as broad as possible is worked in as many different motions as possible. These artefacts form the base of the reference collection. Problem-oriented experiments or hypothesis-testing experiments should be carried out when certain artefacts of a specific site do not have an equivalent in this basic collection (Van Gijn 1990: 24). To be able to map variables, several tests need to precede the actual experiment. In this light, hypothesis-forming experiments could also be regarded as a kind of pre-test in which one tries to gain control over the various factors that play a role in the final experiment (Lammers-Keijsers 2005). Subsequently, it provides a possibility to get skilled in the specific material, which is necessary to perform the experiment on the suitable level. To strengthen the analogy, experiments should obviously be replicated several times.
The Laboratory for Artefact Studies of the Faculty of Archaeology, Leiden University where this study was undertaken, has at its disposal a reference collection of experimental artefacts made from flint, stone, bone, antler, chert, obsidian, shell and coral. Many experiments were carried out within the framework of research of European prehistoric artefacts. In addition to this collection, experiments were carried out with tools made from shell, flint from Antigua (see also Briels 2004), stone from La Désirade, coral (Kelly 2003) and pottery sherds (Van Gijn and Hofman *in prep.*).[1] Both generalized and problem-oriented experiments were performed. Especially for the 'new' category of shell tools many unregistered trial experiments took place to get acquainted with the relatively unknown limitations and possibilities this material comprehends. Depending on the characteristics of the raw material of the tool an additional division was made between manufacturing and functional experiments in order to be able to distinguish between traces resulting from manufacture and use. Complex activities were reduced to controlled experiments, making motion and worked material a constant aspect for each experiment, unless the intention was to study the traces resulting from a complete domestic task.

To study the wear traces of the flint and hard stone artefacts it was possible to rely on the existing reference collection. Basic activities, such as working bone, wood and cereals on an array of stone types are included in this collection. A modest number of additional experiments on these materials was carried out. In addition, flint from Antigua and hard stone pebbles from La Désirade were used on specific tropical materials that do not have a European equivalent, such as tropical shells, manioc, calabashes, flint from Antigua, and tropical woods (e.g. gayac and campêche/logwood). Flint tools were produced using the original bipolar technique, with direct hard percussion, using flint from Antigua. In order to carry out the research on the shell implements a complete new reference collection of experimental tools was created. Fresh and old *Strombi* were used for the manufacture of axes, adzes, wedges and chisels and *Codakia orbicularis* was gathered on the shores of La Désirade and used with and without natural and artificial retouch. Materials such as fish, plants, calabashes, wood, manioc and skins were worked. Celts were hafted as axes and as adzes and used both on fresh and burnt wood. Because of the availability of raw materials, most experiments were performed in the Caribbean area, during the fieldwork campaigns at Anse à la Gourde of 1998, 1999 and 2000.

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1 Although not all described experiments were carried out by myself, they were carried out under my supervision, during different periods of fieldwork on site, in Lejre and at the university.
Part of the flint experiments were carried out by Iris Briels in the context of her MA thesis (Briels 2004). The coral experiments were carried out by Harold Kelly and are described in his MA thesis (Kelly 2003).

The domestic tasks reproduced in the experiments were selected based on a combination of ethnohistorical, ethnographical and palaeobotanical data. These complete domestic tasks were 'simplified' to experiments in which variables as contact material, motion and time were controlled. In a few cases, the same tool was used to fulfil one complete task or production sequence. To perform all actions necessary for one single task involves the execution of various motions on an array of contact materials (e.g. the production of a container out of calabash, using one tool only). Many tools were used for a considerable time period, taking into account several conditions. Flint and stone were not so easily available at the sites studied, as they had to be imported from other islands. It was assumed that flint and stone tools would therefore be used for at least the duration of one task or even longer (e.g. grinding stones). For hard stone, this is a well-documented in the ethnographic sources, even if there are material sources nearby. It was further considered that shell tools other than bivalve shells need so much time to make, that it is highly likely they were not easily discarded. After use, the experimental pieces were cleaned and studied in the laboratory for the presence of traces. Residues, if present, were removed and preserved as much as possible to enlarge the reference collection for residue studies.

## 3.2 Plants

People tend to take full advantage of all the surrounding possibilities in their environment, resulting in a comprehensive system of employing the available plants and trees. Edible plants were either gathered in the wild or cultivated in small fields near the village. In the following paragraph an overview is given of the many functional plants in this area. Some plants that are described were not used in actual experimentation, because it was not possible to obtain them. The descriptions of the purposes of these plants demonstrate however the variety of actions that must have existed in plant working. Often, it is underestimated by archaeologists how much rubbing, crushing and milling movements[2] are needed for food procurement and other domestic crafts.

### 3.2.1 Ethnohistory and ethnography

#### 3.2.1.1 Wild edible plants

A great variety of plants was collected for consumption. Many of them were just gathered and did not require other processing. Fruits such as pineapple (*Ananas comosus*, *Ananas sativis*, *Ananas ananas*) or zanana, guave (*Psidium guajava*) or kuya:pa, hog plum (*Spondias mombin* and *Spondias purpurea*, Anacariaceae) or mombin, manilkara tree, mamey apple (*Mammea americana*), soursop (*Ananona muricata*), prickly pear cactus (*Opuntia dillenii*) or bata and avocado pear (*Persea americana*) or zaboca were mentioned by Breton (1978 [orig.publ.1665]). The fruits or edible parts of these wild plants could be handpicked and probably did not involve tools. Some of them originally came from the mainland and were brought to the islands by the indigenous people of the mainland.

In contrast to fruits, other wild plants took considerably more time before they were ready for consumption. Fruits of palm trees (Palmae) and mastic-bully (Sapotaceae) were an important food resource, but since they have a hard shell, they had to be crushed using stones. Palancoid grasses and sterculia (Sterculiaceae) were gathered in the wild and were ground on querns (Molengraaff 1994; Newsom 1993; Stokes 1998).

#### 3.2.1.2 Cultivated crops

In addition to the plants that were collected in the wild, some crops were cultivated and grown in small home gardens or fields. Oviedo (1959 [orig. publ. 1526]) mentions seeing manioc (*Manihot sp.*), arrow root (*Marantha arundinacea*), tania (*Xanthosoma sp.*), sweet potato (*Ipomoea batatas*) and wild yam (*Rajana cordata*) being cultivated in small fields not far from the settlements.

2 The Laboratory of Artefact Studies already possessed a small collection of stones used in these movements. Considering the nature of the possibilities of usewear analysis on stone material it was assumed that these examples would suffice.

Bitter manioc (*Manihot esculenta*) or kiere is one of the most important food products of the Meso-American region.
Since bitter manioc contains toxic levels of cyanogenic glycosides, it is not edible without intensive preparation. The procedure is not likely to have changed over time: first the root is peeled, then the material is pulverised with the aid of a manioc grater. Peeling was probably done with a bivalve shell. Las Casas (1560) mentions Indians peeling manioc with a clam-like shell. 'Clam' is a common name for a bivalve shell. The Xingu seem to use shells even up to recent times to peel roots (Hartmann 1986: 118). Nowadays, the grater boards are inserted with small pieces of metal, but originally small flint flakes were used (e.g. Kruse 1999: 93/101; Roth 1929; 1970: 277-283; Versteeg and Rostain 1997). Roth in particular gives an extensive description of the production of these grater boards in the beginning of the 20th century in British Guiana. According to him the flakes for these boards were produced by women, although normally flint knapping was done by men. The boards themselves and the finishing of the boards by pouring resin over them belonged to the men's tasks. The average size of boards was between 60 and 90 cm's. Flake size ranged from 3 to 5 mm's, inserted at distances between 5 to 7 mm's. A mixture of resin and beeswax was used to make the connection between haft and stone secure (Roth 1970: 278). Roth makes no mention of the flakes being hammered in to tighten the connection. In the island context most likely use was made of Yellow Mangue resin or mani (Boomert 2000: 325), although Boomert mentions several types of possibly used resin.
After scraping the manioc roots, the fluids must be squeezed out of the remaining pulp in a basket or matapi. Subsequently the remnants are sieved and can either be used directly or be dried as flour, which can be used to bake bread on griddles in a later phase. The juice is reported to have been served boiled as the base for beer and pepper pots in the Guyanas (Roth 1970). Other root crops like sweet potato (*Ipomoea batatas*) and arrowroot or toluman, although not toxic, were probably grated and squeezed to produce flour as well.
The last cultivated crops mentioned here are different types of pepper (*Capsicum spp.*) or áti. These were, according to Breton (1892 [orig.publ. 1665]), cultivated in the home gardens. According to Harris (1965: 74), *Capsicum annuum* (annual pepper) was brought from the mainland. Pepper was an important spice in pepper pots, a common stew-like dish of meat or fish and vegetables, simmered in water.

#### 3.2.1.3 Containers

Calabash (*Crescentia cujete*) has been used as a raw material for the manufacturing of containers to hold fluids or dry materials since early times. Calabash grows in low and dry areas, spreads problematically through seeds, but can easily be multiplied by cultivation. From seeds acid-containing oil can be extracted. The pulp of the fruit is poisonous and leaves black stains on tools and hands while being extracted from the fruit shell. After the inner part is removed, calabashes can be used as containers. After the pulp is extracted, the drying fruit shell hardens into a very thin, light, wood-like material (De la Borde 1886 [orig. publ. 1674], Moreau 1994 [orig.publ 1620]). Pieces of this dried and cleaned calabash shell are also recorded to have been used as spindles and as scraping tools in pottery production. In some cases the fruit is boiled and dried, then cut in half and scraped out (Nieuwenhuis 2002: 45). Nieuwenhuis also mentions that generally the outside skin has to be peeled off for the production of gourds into containers. This did not prove to be necessary for the calabashes used in the experiments for this study. It is however possible to decorate the vessel by removing part of this skin.

#### 3.2.1.4 Leaves and fibres

An array of plants and leaves and roots of trees are used for the manufacture of basketry, rope and twine, and thatched roofs. Most types of split leaves and extracted fibres are dried and bleached in the sun. Leaves are mostly woven into basketry or made into mats for thatching roofs. Sometimes a frame is made from branches, between which leaves are woven. Twine is spun by rolling fibres on the naked thigh with the flattened palm of the hand.

Rope has been made from different types of raw material. Lianas such as Stigmatiophyllum puberum or mibi and Merecuja sp. or liane-pomme were used (Taylor 1938: 128). Century plant or agave (*Agave karatto*, *Agave americana*) has been exploited since early times throughout the Americas. It was used to make rope and textiles. Fibres can be extracted by beating the leaves with wooden clubs (Wescott 1999: 148). These fibres can be used in making baskets or for the production of strong rope. The pulp of agave was also used for food and soap and for medicinal purposes (Barlow 1993). Taylor mentions that a soaking and rotting process is needed to extract the fibres, comparable to the preparation of hemp and nettles. Once disengaged, the fibre is submitted to the same processes as Bromelia (*Bromelia sp*.) or la pitte. Bromelia was, according to Breton (1892 [orig.publ. 1665]) a cultivated plant which provided a strong fibre that could be used in hammocks but could also be used under wet conditions. Sometimes it was made stronger by smearing gum-resin on the twine. To extract the fibres 'the leaf is drawn through a noose of maho or other cord attached to a projecting limb. An even pull with both hands on a short round stick over which the leaf is folded disengages the fibre and leaves the green pithy matter in the noose' (Taylor 1938: 133-134). The leaves of ananas (which is also called la pitte) are treated the same way to extract the fibres. These fibres are used to make various types of string used in fishing and the production of basketry. The raw fibre can be easily stripped from the leaves and can be spun on the thigh after drying. On the Fiji islands shell bivalves are used to extract fibres in a scraping motion from *Aloe vera* (Tabualevu *et al.* 1997). *Aloe vera* is commonly used in the Meso-American region, but it was never transported to the Caribbean region.

Larouman or arouma (*Ischosiphon arouma*) is used for the manioc sifter and squeezer. A circular frame about two feet or more in diameter is made using a forest liana, across which a basket mesh is woven, using strips of the larouman reed. This reed is cut and tied in bundles of 70 to 100 stems and brought down to the coast, where it is spread out on the beach to dry in the sun for several days. Without this process during which it acquires a red colour the stems would soon become brittle and unworkable. Put in a mud hole for several days it gets black. Before use, each stem is split in 4 or 6 strands which are then drawn between a knife blade and the finger until the pith is removed and they are fine enough for the intended work (Taylor 1938: 127).
American grass (*Gynerium sagittatum* or *Arundo donax*) or mabulu are sugarcane-like reeds, found in the direct vicinity of water, that provide leaves used in small decorative baskets and hats. Although the leaves are less strong than Larouman, they are of a purer white after peeling, scraping and bleaching, which makes them especially attractive. The harder core-stem is used for thatching roofs. The light, straight, mature upper stems, on which the flower grew, were used for arrow shafts. Dried Khus-khus grass (*Vetiveria zizanioides L.*) is also, at least nowadays, used for making woven utensils and rope in St. Lucia (pers. comm. I.Briels 2003).
Leaves of balizier (*Heleconia bihai*, *Heleconia Caribbaea*) and Latanier (*Coccothrinax martinicensis*) or alatini were used for thatching roofs (Taylor 1938: 128). The centre of the unopened latanier-leaf was used in a semi-fresh state for the manufacturing of basketry. Balizier was also used for baskets and mats. Latanier is mentioned by Breton (1892 [orig. publ.1665]) as palm of the Antilles. Diverse Palmae species or Yattahou that have been recorded in archaeological context were used for comparable purposes. Euterpe dominicana and Euterpe globosa, appearing on higher altitudes have edible (pieces) of leaves and can be used to cover roofs of huts and houses. Euterpe montana was cut, peeled and scraped and divided in two or three parts before being twined.
Taylor also mentions the use of cotton, which was spun using a spindle of wood and calabash (Taylor 1938: 133). It is however not certain, whether cotton originally occurred on the islands or when, if it was not, it was brought there.
Breton (1978 [orig.publ.1647]) and Caillé de Castres (1694) mention the use of Mahaut or Maho, a collective noun for all trees with a certain bark that could be peeled of and be twined to varied thicknesses. This type of rope was used to tie together wooden constructions, roofing thatch and to attach hammocks, head straps for carrying loads, anchors and net ropes. Mahaut includes various plant families: Cordia (Boraginaceae), pavonia and hibiscus (Malvaceae), triumfetat (Tiliceae) and sterculia (Sterculiaceae).

#### 3.2.1.5 Colorants and medicine

Roucou or annatto (*Bixa orellana*) originates from the Amazon and was introduced on the islands. It was used for the manufacturing of body and food colorants and as protection against insects and sunburn. The leaves are used against vomiting and to stop inflammations of the lungs/bronchia. The powder of the seeds is used against asthma. The plant in itself is used as an antidote against the cyanogenic glycosides of manioc (Longuefosse 1995). In the Guyanas this colouring of the body is believed to be helpful against bad spirits. Roth (1970) states that Roucou was used in the layer of wax poured over a grater board to secure the flakes to finish off the board. Taylor (quoting Labat, 1931 [orig.publ. 1742]) mentions the use of roucou to conserve bodies after death (Taylor 1938: 121; Moreau 1994 [orig.publ 1620]).

The red particles surrounding the seeds are loosened either by rubbing or soaking and either dried and kept as powder or mixed with oil or gum (Wells 1982). In this context the use of the oil of Carapa guianensis is mentioned (Taylor 1938: 135). Sheldon mentions that the Carib he visited were almost always painted in roucou and that such ornamentation was considered important for formal visits. He also mentions having seen dead people ornamented in the same manner (Sheldon 1820: 370-378).

Other colorants are the leaves of a small tree called bois tan (*Picramnia antidesmoides*), which are used to colour the roots of a specific type of lianas called mibi (*Anthurium palmatum* or *Monstera pertusa*) used in making a kind of round spiral Carib basket (Honychurch 1986). Harris (1965) mentions further Génipa (C) (*Genipa americana l.*) giving a black paint and Indigofera suffruticosa, which provides a blue dye. Breton (1892 [orig publ.1665]) mentions Comati (*Eugenia anastomosans*) of which the bark can be used to give colour.

In the category of medicine, tobacco (*Nicotiana tabacum*) should be mentioned. Tobacco leaves were used in numerous ways. They were dried, shredded and inhaled as powder, blown on ailing infants by midwives, pressed and drunk as juice, chewed and used as magic charms and rolled and smoked as cigars.

Many of these colorants and medicines were probably rubbed and pounded between stones and it has to be considered that querns and/or rubbing stones were also used for these purposes.

#### 3.2.1.6 Poison

Several types of plants can be used to stupefy fish in the water, which causes them to rise to the surface, where they can easily be grabbed. Although the fish are literally poisoned, this poison is not dangerous for human consumers. Taylor (1938: 145) mentions the use of the leaves of the shrub nivrage (*Phyllanthus conami*) and the fruit of the babarra-tree. Other species used are shrubs like *Clibadium surinamense* and *Phyllanthus brasiliensis*, that are nowadays used in the Guyanas and which stun only small fish. *Tephrosia sinapou* is a little stronger; the latex of *Euphorbia cotinifolia* is the most toxic species. Neither are commonly used anymore. Other poisons that are used nowadays are ribbed lianas of *Serjania paucidentata* and wood of *Talisia hexaphylla/guianensis* (Van Andel 2000). But of all Longocarpus sp. is considered to be the most effective for catching fish. Of these species, mostly the roots are gathered and pounded. The shredded fibres are soaked and stirred in the water until, within several minutes the fish come to the surface.

For hunting land mammals, curare is the poison most frequently used by the indigenous people in the Guyanas and Amazonia. This poison is however obtained from a specific Liane (*Strychnos toxifera*), which does not occur on the islands. Manchineel (*Hippomane mancinella*) might have been an alternative (Boomert 2000: 331). The leaves also contain a highly poisonous sap, which causes blisters at the slightest contact (Harris 1965: 139). No experiments were carried out with this specific material, but these plants and their necessary preparation for use also have to be taken into account while studying rubbing and querns or comparable alternatives made of coral.

### 3.2.2 Archaeology

Palaeobotanical data show that various types of plants were introduced by the new inhabitants during the colonisation of the islands – they were not necessarily tended afterwards. However, other plants were grown in small gardens and harvested. According to Newsom (1993) and Berman and Pearsall (2000) people transported and established plant resources successfully from the mainland to the islands from their first migration during the Archaic Age onward. As a result many changes in the original environment of the islands occurred, including the expansion of certain native plants adapted to open space as a result of the clearing of virgin forests for planting areas. Although we might not have a complete picture of the actual setting around the two sites on Grand-Terre, we may assume that a great variety of plants were used.
It is generally assumed that bitter manioc was introduced on a modest scale in the pre-Saladoid period before it eventually became the most important staple crop (Keegan 2000; Newsom 1993). The appearance of manioc is however difficult to prove (Piperno 1998): it produces hardly any pollen, it leaves no phytoliths and it does not carbonize when it burns. The only archaeological evidence therefore is the occurrence of numerous griddles, nowadays still used for the baking of cassava bread. Piperno also mentions the possibility of the analysis of querns after the appearance of starches (Piperno and Holst 1998).
Another cultivated crop, maize (Zea mays), was probably also brought from the mainland (Newsom 1993). It is remarkable that it does not seem to have been such an important part of the diet as in Mexico, where it originates. Several explanations have been put forward to explain this situation: either there was restricted access to maize based on social hierarchy, or maize did not abide well in these environments, or other root crops were so commonly used that a necessity for maize exploitation was lacking (Stokes 1998).
To conclude, there is evidence that calabash was brought from the mainland to the islands in an early phase (Newsom 1993). At the underwater Taino site of La Aleta, Dominican Republic, two vessels of calabash were recovered, one plain, one incised with designs typical of pottery belonging to the Chican Ostionoid subseries (Conrad *et al.* 2001: 12).

### 3.2.3 Experiments

The wide variety of plants that were exploited in the past, necessitate an enormous number of possible experiments. Many plants were however impossible to obtain. Some plants do not involve the use of tools

Fig. 3.1 Peeling manioc

Fig. 3.2 Scraping manioc, expiriment and in ethnographic context (Surinam 2000)

before they are consumed and are therefore ignored here. Experiments on flint have demonstrated that the main difference in plant polishes is the distinction between siliceous and non-siliceous plants. Tools used on siliceous plants generally exhibit a very bright gloss, with a domed or flat topography and a smooth texture, distributed in a band along the edge. Tools used on non-siliceous plants generally display a less well-developed and less distinctive polish. The presence of bark may complicate this distinction.

3.2.3.1 Non-siliceous plant: tubers

The experiments involving the use of non-siliceous plants were concentrated around the processing of tubers. Because of the difficulties in obtaining bitter manioc (*Manihot esculenta*), it was also decided to do some experiments (peeling roots) on the more easily accessible yam (*Discorea sp.*), which is also rich in starch (Fig. 3.1). It was deemed that the skins were so polluted with sand, that the abrasive action during the experiment would mainly be the result of the sand and much less of the root itself. Several bivalve shells and pieces of flint were used to peel the roots. A grater board for the pulverising process was used only on manioc. Three grater boards were made: two to obtain insight in the effectiveness of the traditionally used hafting and of the haft consolidating resins. One of these (Exp. 492) held only nine pieces of North-European flint, but proved to be quite effective. The other board contained 19 flakes of North-European flint and 3 pieces of *Strombus gigas*. Unfortunately, the flakes proved to be too big and the hafting depth insufficient. The board was however used for 60 minutes, which was long enough to develop polish on the pieces of *Strombus*. A third grater board was constructed based on descriptions and pictures of modern and archaeological boards (e.g. Kruse 1999: 93/101; Roth 1970: 278; Versteeg and Rostain 1997 and examples in the Ethnographic Museum, Leiden, The Netherlands), containing approximately 185 flakes and measuring 26 x15 cm (app. ¼ of a normal board). For two (more or less inexperienced) women it took three days to knap the flint (from Antigua) and haft the flakes in the wooden board. Perforations in the board were made using modern tools, since it shortened production time without having effect on the experimental pieces. Instead of mani resin from the Yellow Mangue tree (*Symphonia globulifera*), birch resin was used, mixed together with beeswax, as described by Roth (1970: 278). Directly before use, the board was soaked, in order to tighten the hafts and prevent chips from falling out during the grating process. Eventually the grater board was used for over 100 minutes and although some chips did fall out during the process, it proved to be very effective (Fig. 3.2).

Scraping manioc leaves very clear traces on flint, which differ slightly from the traces on the shell tools. Both surfaces show a bright, flat, rough polish, with rounded edges. Flint shows occasional striations, shell shows a small number of craters. The pieces from the grater boards show distinctive perpendicular directionality and the same flat and rough polish. A note of caution should be expressed on the expedient flakes of *Strombus* that were used in the grater board: although traces did develop on a microscopic level, no signs of use (micro-retouch or abrasion) could be recognised with the naked eye. This possible tool type would therefore be almost impossible to differentiate from production or other waste in shellmiddens, but would be present in a random sample.

3.2.3.2 Non-siliceous plants: soft plants

Next to the processing of tubers a small number of experiments were carried out on Agave, soft grasses and lianas. A bivalve shell tool was used in a transversal motion to make liana more flexible, flint was used to cut soft grasses and liana and to scrape Agave. The tools were effective and did not deteriorate noticeably during the experiment. Again, the shell tools were mainly effective along the most protruding part of the edge. The polish is therefore mainly distributed around this spot. Agave did not leave distinguishable traces, except for a very weak polish. Considering the traces from soft plants found on flint, weak polishes were to be expected (Juel Jensen 1993; Van Gijn 1990).

Fig. 3.3 Preparing Roucou with experimental bivalve shell

Two experiments were carried out on Roucou (Fig. 3.3). A bivalve shell and a piece of flint were used for 60 minutes to crush the seeds in a container of gourd to extract the colorants. Because it is necessary to use something to crush the seeds on, two contact materials were used during the experiment: the seeds and the calabash. The traces that developed on the surface are therefore to be interpreted with caution: the polish is bright and distributed in isolated spots on the surface and the edge on both flint and shell. The appearance of the polish could however also be very well caused by the wood-like texture of the dried calabash surface.

Fig. 3.4 Incising calabash

Fig. 3.5 Scraping inside calabash

3.2.3.3 Siliceous plants: calabash

Calabashes were worked in a fresh state, while they were green, picked directly from the tree. The outside skin was scored with flint flakes (four pieces of Antiguan flint) and one bivalve shell (Codakia orbicularis) (Fig. 3.4). Three expedient tools of shell pieces (two inner whorls and one 'flake' of Strombus gigas) as well as a flint flake were used as wedges to split the calabashes in two along the scorings. To split the calabash the flesh was torn apart and largely removed with the hands. Then the rest of the flesh was removed either with bivalve shells (4x Codakia orbicularis) (Fig. 3.5) or flint scrapers (2x). In some cases the entire cycle of events was performed with one single tool (one Codakia and one flint flake).

On the edges of one of the *Codakias* used for incising the outer skin, a clear and distinctive siliceous plant polish developed, showing a significant similarity to that on the flint tools used for this purpose, except for the presence of striations. The polish is bright, flat, with a clear directionality and striations. Striations in flint polishes are mostly attributed to wood-working. The striations occurring in these shell experiments might be the result of the contact with the wood-like structure of the calabash shell. The bivalve shells that were most effective in making the incision on the outer skin had (naturally) retouched edges. In the process of incising, the most protruding edge removal became the active part, resulting in the development of most of the wear traces. Flint tools used for this purpose show many small edge removals and the same type of polish, with occasional striations. The tools that were used to scrape the inside do not show any traces when only used to remove the first layers of the soft fleshy part of pulp. They display few traces when they are used to scrape off the remainder of the pulp. The contact surface consists mainly then of the relatively hard inner surface of the fruit. The traces on these bivalve shells and flint scrapers resemble wood working, displaying small retouches and a bit of bright polish. This can be explained by the fact that the fruit shell is drying and hardening while the task is performed. Tools that are used long on this inner wood-like shell display heavy edge rounding, which completely alters the shape of the edge. The tools that were used for the whole manufacturing sequence display a palimpsest of traces that would probably be interpreted as siliceous plant/wood-working. During the experiment the contact between the juices that come free and oxygen result in the formation of a black residue on the hands and on the tool. It is not possible to remove this residue from the shell with water.

3.2.3.4 Siliceous plants: reeds and liana

Reed-like grass was cut with a *Codakia* bivalve shell and several pieces of flint. Reed-like grasses left traces comparable to experiments performed on European grasses on both flint and shell tools. The band of flat polish is highly reflective, showing hardly any striations, with a smooth texture. The polish is most intense around

the retouch, where the shell tool is most effective. One piece of flint was used on liana which left a greasy, siliceous plant-like polish.

3.2.3.5 Plants: summary

The variety of plants processed is enormous, according to ethnographic sources, representing both subsistence and domestic craft activities. Plants were used to produce baskets, sieves, squeezers, ropes, colorants, fish poison and containers. They had to be peeled, scraped, split, cut, ground or rubbed. Edible roots had to be peeled and grated, seeds had to be crushed or ground. The toolkit used in plant processing was therefore comparably varied. Tools made of flint, shell, hard stone, coral and secondarily used pottery sherds could all serve a function in these activities. The traces found during the experiments showed the comparability between traces on flint and shell, with a similar distinction between siliceous and non-siliceous plants (Fig. 3.6 and 3.7)

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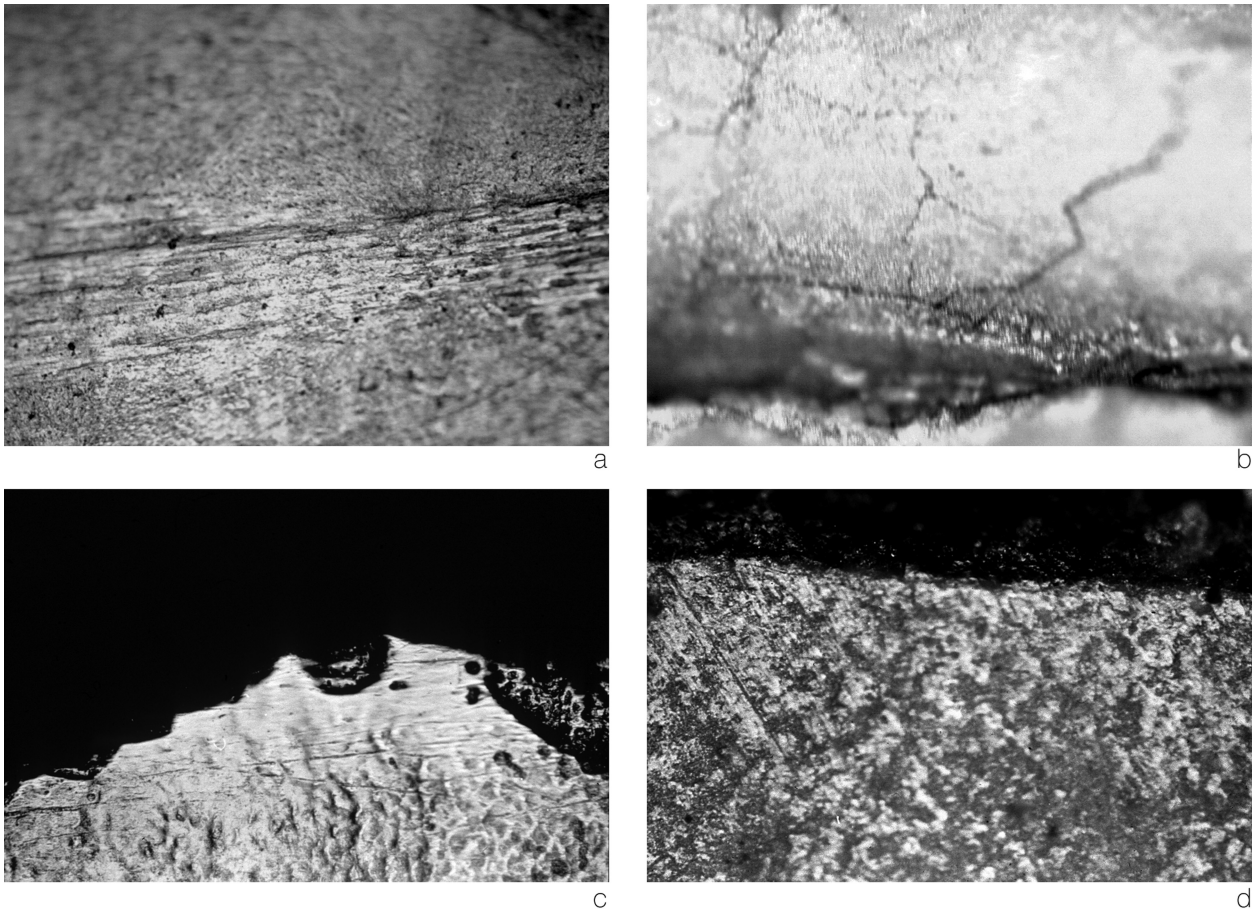


Fig. 3.6 Traces of plant and woodworking on shell tools:

a: cutting sugarcane (exp. 627), orig. magn. 200x,
b: scraping inside calabash (exp. 610), orig. magn. 200x,
c: cutting skin calabash (exp. 609), orig. magn. 200x,
d: scraping wood (exp. 630), orig magn. 200x.

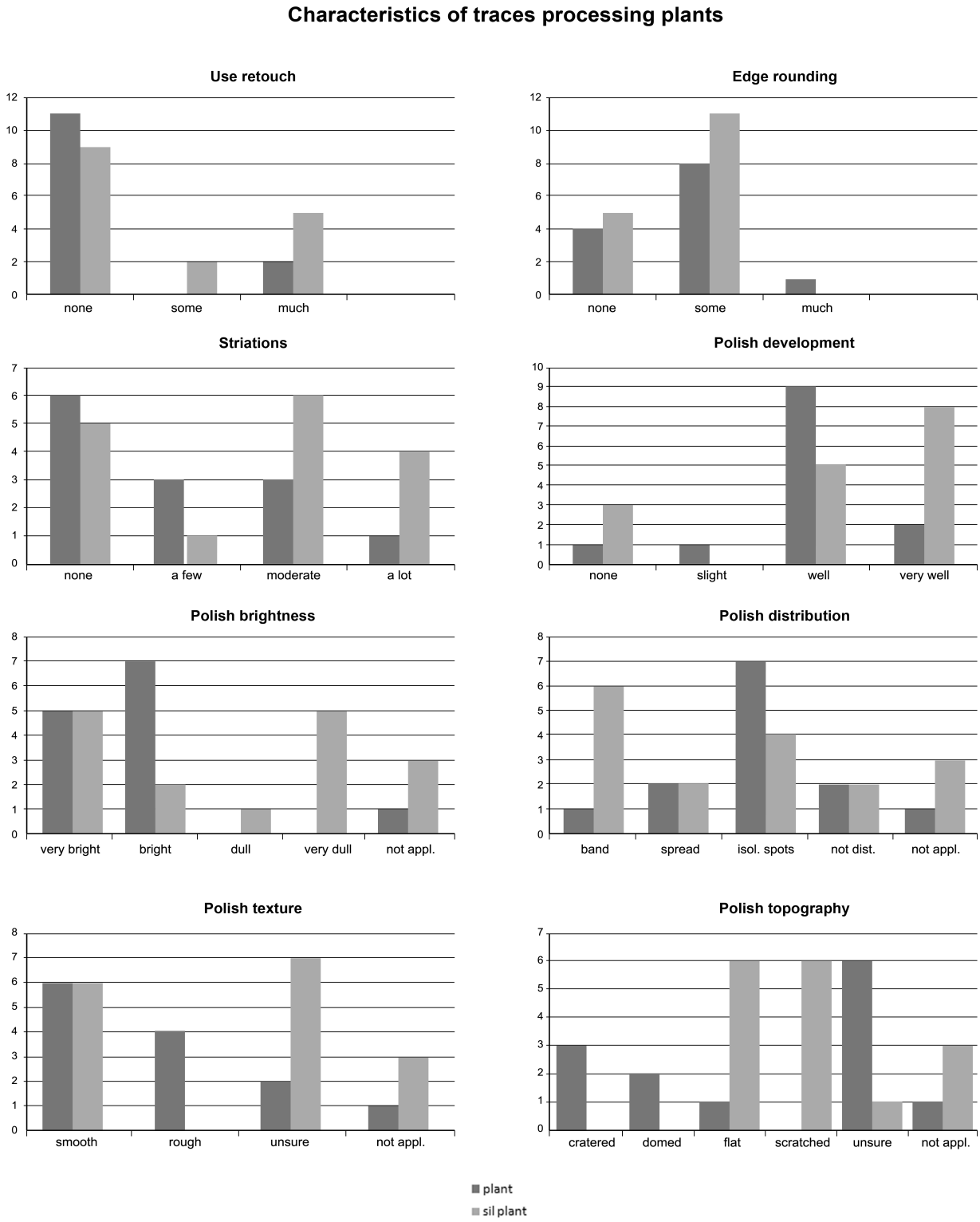


Fig. 3.7 Experimental plant working traces on shell tools, description of characteristics

## 3.3 Wood: logs and branches

### 3.3.1 Ethnohistory and ethnography

As stated above, ethnographic data are often not precise enough to get insight in exactly the way tools were used. An exception to this rule is however the use of celts. Apparently for most researchers and travellers the stone and shell celts were so intriguing that they are described quite accurately. Du Tertre (1973 [orig. publ.1667]) describes Carib canoe building as follows: '…Both types are made from whole trees which they trim, dig out, and then complete, with implements bought from Europeans, such as axes, adzes and other tools. Prior to the trade with Europeans they spent entire years making their boats. They felled trees or burned them at the base. They hollowed out the log with stone axes and with a small fire, which progressed a little at a time all along the log hull until it had reached the desired shape… ' (translation McKusick 1960).[3] The Warao Indians of the Orinoco Delta and Northwestern Guyana still produce their canoes in a comparable fashion. They use especially red cedars and silk cotton trees, which are felled by kindling a fire around the base. The log is hollowed out by burning and chopping the charred wood. Fire is also used to harden the log and to create steam in order to widen the sides (Boomert 2000: 66).
In general it can be summarized as follows: celts were mainly used for the felling of trees, either to clear the land or to build canoes and houses. They are mainly recorded to be hafted as axes and were used both on fresh and on burnt wood. In some cases they were handheld and used as wedges, sometimes as a secondary use. Short hafts for adzes are also reported. Versteeg and Rostain (1999) distinguish two types of hafting: 'hafting by inclusion' and 'non-inclusion hafting'. Hafting by inclusion means that the celt is inserted in a shaft hole. Non-inclusion hafting means that the celt is attached against one side of the shaft. In both cases additional aid is made of ropes and resins to make the connection between the axe and the handle more secure.
It has to be noted that there are no records on the use of shell celts on the mainland. The Carib on Dominica did not use shell or stone celts anymore when Taylor visited them. Since we do not possess data on shell celts, we have to rely on the descriptions of stone tool uses. The similarity in shape between stone and shell axes is quite apparent. Furthermore, many existing traditions in craftsmanship were adapted to the possibilities of the islands during the colonization of the Caribbean region. In other words people seem to have used the raw material that was most readily available, and used new tool materials next to a fewer number of tools made from original materials.

#### 3.3.1.1 Houses and canoes

Several types of trees present on the islands were suitable for building houses, smaller structures and canoes. The Silk Cotton Tree or Kankan tree (*Ceiba pentandra*) was used for both purposes (Taylor 1938: 76), but is also considered as a tree with symbolic relevance. In the ideological world of various ethnic groups on the mainland the world is considered to exist around a tree, the Axis mundi, which is strongly associated with this specific tree (Boomert 2000). Balizier (*Heleconia bihai* and *Heleconia Caribbaea*) (Harris 1965: 76), Acouma/áakuma(C) (*Sideroxylon foetidissimum*), bullet wood (*Manilkara nitada*) or bálata (Breton 1978 [orig. publ. 1647]), red cedar (*Cedrela odorata*) (Harris 1965: 76) and mahogany (*Swietenia mahagoni*) were all used for houses and canoes. Campêche or logwood (*Haematoxylon campechianum*) originates from the south of Mexico, but was introduced on the Antilles early in the Ceramic Age (Newsom and Wing 2004). It delivers a hard wood, suitable for making posts. The wood is also used as a colourant and as the base for an antibiotic tincture against liver diseases, diarrhoea, fever, eczema and as a blood staunching remedy (Longuefosse 1995). Nowadays the root is still used as a raw material for small tools such as 'basketry needles' (pers.obs. Les Grand Fonds, Guadeloupe). White gum (*Darryodes excelsa*) is one of the largest trees in the tropical rainforest zones of the islands and, next to the flammable and fragrant gum, provided long straight posts for

3 Although the use of metal axes must have undoubtedly sped up the process, European experiments in canoe building with stone axes reveal that it does not take entire years to make a canoe. An indication would be five days, with four persons for a canoe of 3,5 meters long (replica canoe of Pesse, Drents Museum 2001).

the construction of dugout canoes. Branches were used to strengthen and stiffen fishing line made of Bromelia (Taylor 1938: 133). Trumpet wood or Bois-canon (*Cecropia shreberiana Miq*) originates from Central America and can be found on the islands between Puerto Rico and Saint Lucia. It is a light, strong bamboo-like type of wood with very straight stems, which are especially suitable for light temporary structures and arrow shafts. Leaves can be used to produce a tonic with anti-diarrhoea working (Longuefosse 1995).

#### 3.3.1.2 Fuel

Many types of wood will have served as construction wood as well as fuel. In archaeological sites burnt remnants may indicate use of wood as fuel, but ashes and coals could also be evidence of incidental burning. Wood from Mangrove contexts is especially suitable for burning; many branches, relatively dry and thin are to be found in these parts. Red mangrove (*Rhizophora sp*.) or palétuvier (Breton 1892 [orig. publ.1665], Newsom 1993), buttonwood (*Conocarpus sp.*), black mangrove (*Avicennia sp.*) and white mangrove (*Languncularia sp.*) were all present in the Lesser Antilles in the period of study (Molengraaff 1994, Newsom 1993). Although much of it was probably collected as driftwood or brushwood, it is not unlikely that the collection and preparation of firewood involved the use of celts and knives.

#### 3.3.1.3 Fire makers and torches

Fire was made mostly with the wood on wood technique (Moreau 1994 [orig.publ 1620]), but in the Guyanas record is made also of red and green jasper stones and flint that were used to make fire (Roth 1970). Torches are made from pounded wood of Tree fern (*Licania hypleuca*) in combination with gum from White Gum (*Dacryodes hexandra*) or beeswax (Taylor 1938: 135). Resinous wood of Amyris elemifera (Harris 1965) and bois chandelle (*Amyris sp.*) is also used as torches.

#### 3.3.1.4 Other purposes

Gayac (Tree-of-life) (*Guaiacum officinale*) originates in the Antilles and is reported to have been used for different woodwork and medicinal purposes. The core of the stem and thicker branches consists of a very tough black wood, suitable for relatively small durable wooden objects, such as bowls and mortars. The alburnum has a much softer consistency and is not really suitable for the manufacturing of objects. Medicinal uses involve the use of extracts and tinctures to fight syphilis, diarrhoea, rheumatism and consumption (Breton 1978 [orig.publ 1647], Harris 1965: 77, Longuefosse 1995). The White Cedar tree (*Tabebuia heterophylla pallida*) or bamata: is used for the same purposes but this wood is also specifically resistant to sea water and is therefore especially suitable for the sides of canoes, built out of planks. There is however some discussion on the place and moment of the first appearance of these side boards (McKusick 1960), and it is possible that they were not used on Guadeloupe in the sites under investigation in this thesis. Latanier (*Coccothrinax martinicensis*) or alatini occured on the islands during the colonisation phase. This palm still grows in the lower coastal bluffs and cliffs of Dominica (Taylor 1938) and was used for the manufacturing of bows.

### 3.3.2 Achaeology

Although actual finds of archaeological wood remains are scarce due to preservation conditions, it is obvious that different kinds of wood were used for a variety of purposes: e.g. posts, hafts, possibly kitchen ware, basketry (branches), seats and benches and ritual paraphernalia such as amulets. On the site of Morel the base of a post was found, which displays marks of chopping. Conrad *et al.* (2001) describe 20 wooden artefacts for the Taino-site La Aleta in the Dominican Republic, comprising two duho's (ceremonial stools), six bowls, one vessel, four hafts assumed for shell and stone axes, one macana war club, one piece of a paddle and one small crocodilian figurine. To this date, none of the pieces have been identified, although the macana appears to have been made from a palm species. Some wooden artefacts were also recovered in the Pitch Lake site on Trinidad,

including a shaman stool, two weaving sticks and two vessels. The type of wood has not been identified (Boomert 2000).
There is not much archaeological evidence for hafting, while the number of stone and shell celts is considerable. In Surinam and the Guyanas a total of approximately 15 hafted axes have been found (Versteeg and Rostain 1999).

### 3.3.3 Experiments

In total 63 experiments were carried out on wood[4], divided over a selection of different types of wood, most of them available during prehistoric habitation for their use from ethnographic data. In some cases tough European wood such as dead oak was used, when there were no possibilities to perform the experiments in a tropical setting.
The experiments on wood must be dealt with according to the differences in the way the tools were made. The bivalve shells were used with and without retouch, while the celts had to be polished into shape and therefore display manufacturing polish.
Traces of wood-working on flint are defined by a reticulated or band-like distribution of a smooth and bright polish with a domed topography. Sometimes striations occur, when a transverse motion is applied. Almost all shell experiments were carried out in a transverse motion, because tropical hard wood is too tough to be cut with shell tools. Because some experiments were carried out in Europe, alternatives for tropical woods were found in e.g. dead oak.

Fig. 3.8 Scraping branches with bivalve shell

Fig. 3.9 Groove and splinter technique with flint on Campêche

4 This number of experiments was carried out in the context of this study, using tropical wood or equivalents and tropical tools, such as flint from Antigua. The Laboratory has a wide range of other wood working experiments.

3.3.3.1 Wood: roots and branches

Shell scrapers were used on mahogany, rose wood, calabash branches, Ficus branches and roots, prune, gayac, privet (*Ligustrum vulgare*), unspecified barky wood and an unidentified red hard wood from Basse-Terre (Fig. 3.8). Some bivalve shells were used unmodified; others were used after the whole edge had been removed in one blow or after being retouched. Although the tools were successfully used for debarking, they were not effective in whittling or removing large pieces of wood. On both gayac and campêche, scrapers were used to remove the bark and to shape the wood. This was only modestly successful after several hours of work. The experiments with flint on these wood-types were more effective: although it turned out to be very time consuming (app. 80 min.), it was possible to use the groove-and-splinter technique in a successful way (Fig. 3.9). There is however no evidence this technique was applied. Pieces of flint were further used effectively to saw dried trumpet-wood, red gum, mahogany, white cedar and one unidentified species. One bivalve shell was used to collect resin from the white gum tree but this did not require pressure or scraping and did not leave any traces. The gum would have been just as easily obtained using the bare hands and for instance leaves to collect the gum in.

The bivalve shells with the intentionally retouched edges were most effective, especially when they were resharpened during the work as well. Scrapers with a completely removed edge (in one blow) get blunt and inefficient more quickly. They display some edge rounding and use-retouch (Fig. 3.10 and 3.7). Unmodified bivalve shells display hardly any use-retouch and little edge rounding. Furthermore, these scrapers are not so effective. The polish brightness varies between very bright and dull, but most experiments displayed a dull

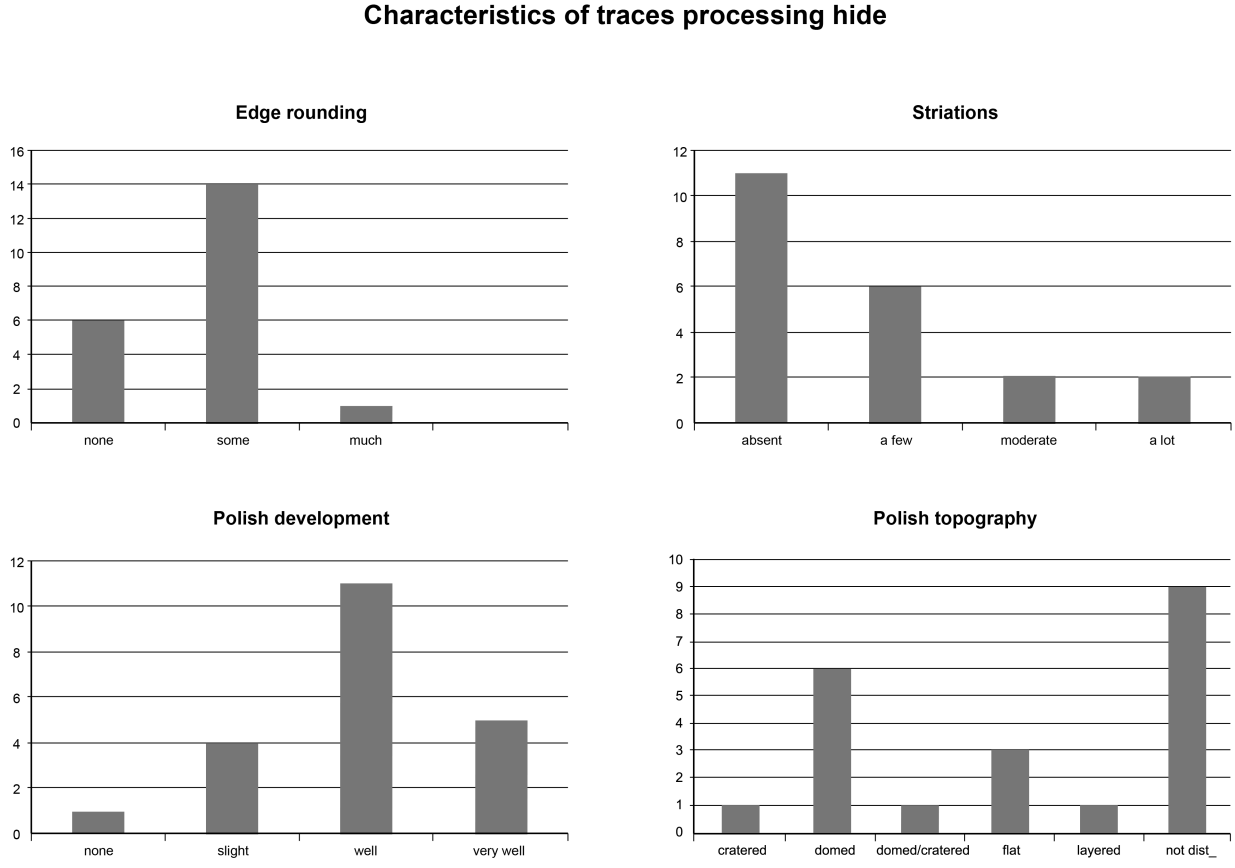


Fig. 3.10 Experimental wood working traces on bivalve shells, description of characteristics

polish with a smooth or, more often, uncertain texture. The polish is distributed in isolated spots on the edge, displaying a domed topography. The differences in polish development can be explained by the effectiveness of the tools in general. The more effective bivalve shells display more polish.

3.3.3.2 Wood: logs

Celts had to be replicated to chop down trees or to produce canoes. *Strombus gigas* was used in several unregistered trial experiments of knapping and polishing to get some experience with aspects like hardness and deterioration of the 'unknown' material of shell (Fig. 3.11). For these trial experiments mainly 'old' shells were used, since law restricts the consumption of conches. Four fresh ones were used in knapping and polishing experiments and they turned out to be softer and easier to work. They did however not necessarily provide better material from which to make celts. Both old and fresh shells occasionally suffer from a bad cohesion between the layers, resulting in chips coming off during polishing. Apparently, the quality of the shell varies a great deal per individual and seems less related to the state of freshness (see also Ch. 2).

After this first stage in total 12 celts were produced by knapping and with the aid of a sanding machine. An electric device was used in view of the time it would take to make axes by hand. It was believed to be more important to get an impression of the deterioration of the tool during use on different kinds of materials. All were finished by hand, using sand and water on polishing stones or pieces of coral. One celt was completely

Fig. 3.11 Manufacturing shell celts: removing lip, shaping lip, polishing lip

Fig. 3.12 Use of experimental celts as axe and adze on fresh and burnt wood

polished into shape with a coral grinding stone with the addition of sand and water. This took almost nine hours. Immediately after the production of the axes, casts were made of the surface around the sharp edge. Subsequently, the celts were used unhafted as a chisel or wedge; others were hafted as either an axe or an adze, using the inclusion and non-inclusion method.
A haft from the Dominican Republic, mentioned above, was replicated and the perforation was adapted to make it fit for a shell axe. This might not have been necessary if more resin was used to fill up empty spaces. The tools were used on fresh and burnt woods including gayac, mahogany, white gum and ficus and on hard European wood, more specifically burnt oak and dead elm (Fig. 3.12). Regarding the exact motion performed, an unconventional way of chopping was chosen: it is recorded by Yde (1965) that the Wai Wai use small blows that do not enter the wood deeply, in order to protect the axe from breaking and deteriorating fast. The wood is in fact not cut but more or less shattered. In this way it takes much more time to fell a tree, but the axe can be used much longer. Burning of the stem speeds up the process considerably and diminishes the amount of stress on the axe. It is well known by indigenous people that the most vulnerable part is the transverse section of the axe; this is the spot where axes tend to break when too much force is applied. During the experiments, none of the axes broke, but the hafts did not always survive. This could very well be explained by the lack of experience of the user in this particular way of chopping. One axe was used on fresh Ficus, two on fresh gayac, one adze on burnt white gum and three axes, one wedge and one adze were used on fresh and burnt wood of unknown species.

The interpretation of the polish is complicated by the manufacturing traces that were left on the surface during the stage of manufacturing. To overcome this problem, the celts were studied before use, as well as after. Polishing traces appear unexpectedly rough under the microscope. Although use was made of sand and water to create a smooth surface, only the higher ridges appear to have been really smoothed. The lower areas of the surface remained rough and dull. During use, some remarkable phenomena occur: depending on the individual shell of which the tool was made, the edge of a tool used on fresh wood will either quickly deteriorate and show use-retouches or show no macroscopic damage at all. The edges that deteriorate quickly loose their sharpened edge in the first couple of blows. Subsequently, they seem to stabilize into a useful, but heavily damaged edge. Polish develops in the retouches during this stage. Seen under the microscope the pieces that do not show retouch immediately seem to lose their original gloss a little bit; the gloss is more spread, with streaks of a duller polish (Fig. 3.13 and 3.14). The edges are heavily abraded. These phenomena must be attributed to the differences already observed in the manufacturing process.

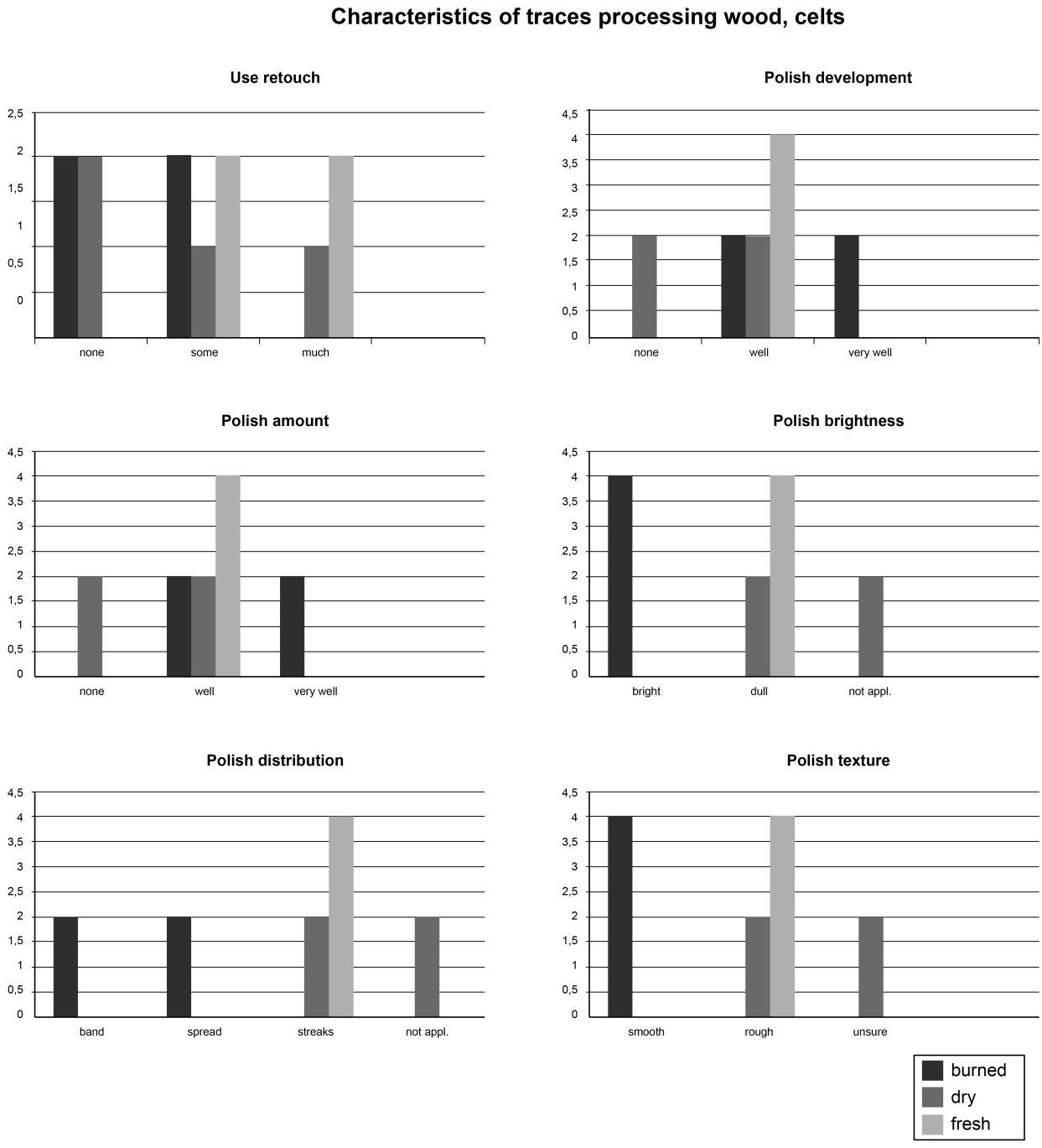


Fig. 3.13 Experimental wood working traces on shell celts, description of characteristics

When used on burnt wood, a celt hafted like an adze showed lots of high gloss on the contact surface, but not on the other side. A celt hafted as an axe used on burnt wood, did not show this highly developed gloss. This might well be explained by the fact that using these axes involves a different way of cutting. None of the celts showed striations, which is commonly associated with wood-working traces on flint. Again the specific

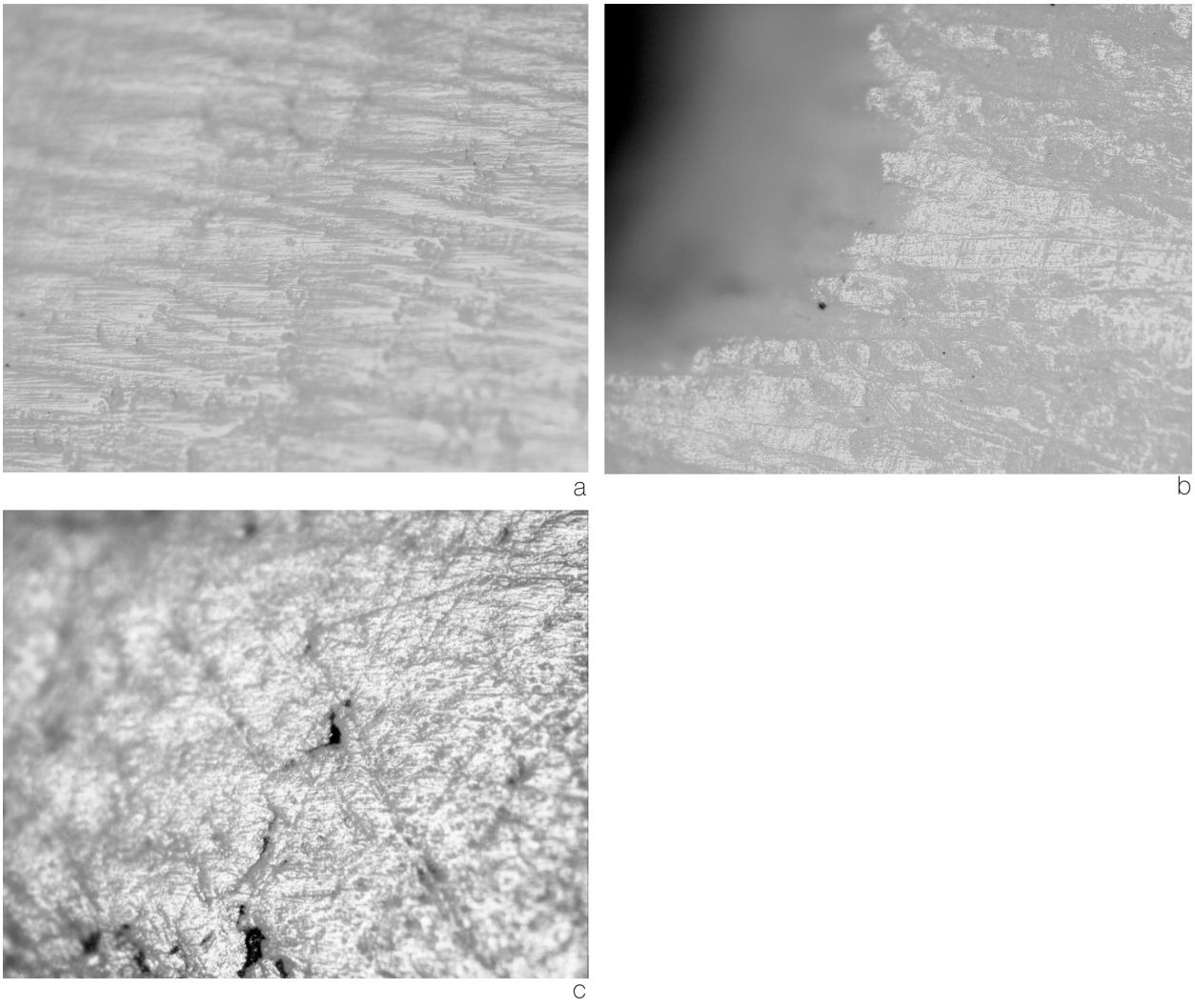


Fig. 3.14 Traces of woodworking on celts:

a: adzing burnt wood (exp. 772), orig. magn. 200x,
b: felling fresh tree (exp. 634), orig. magn. 200x,
c: cutting/felling burnt tree (exp. 641), orig. magn. 200x,

cutting motion and the use of burnt wood could be the cause of this absence. The polish topography was not distinctive in all cases, probably because of the mixture of use- and manufacturing traces. Furthermore only in two cases the polish was really well developed.
It is obvious that certain differences between traces from burnt and fresh wood can be observed. The amount of use-retouch, the amount of polish, the polish brightness and the polish texture are all distinctly different. Further research should involve experiments in the multiple use of a hafted axe. Very common on the mainland as well as on the islands nowadays is the use of a machete, which is used for many tasks. An experimental axe should therefore be used in a haphazard way on wood, branches, fruits, shells and meat for instance. So far this has not been done.

## 3.4 Animal material: hides, meat and bones

### 3.4.1 Ethnohistory and ethnography

Animals provided food, small hides and raw materials for tools and beads. The undoubtedly important role of animals and their preparation is not reflected in the ethnohistorical and ethnographical sources however. No records on the use of tools in the manufacturing of bone implements are known to me. Information on hide-working is not easily found. According to Nieuwenhuis a distinction should be made between different climatological environments for South America (Nieuwenhuis 2002: 43). In the tropical island setting there is clearly less need for the preservation of hides and the use of leather than in cooler regions. Furthermore the island fauna did not include larger mammals than agouti (*Dasiprocta leporina*). Steward mentions that people from the Guyanas used hides for sandals, drum sheets, pubic coverings, pouches and straps (Steward 1948 Vol. 3: 844-845). It is also mentioned that tanning or preserving hide as we know it, do not exist. Roth however mentions apart from the 'conspicuous absence of leatherwork', also drums, coverlids of quivers and 'obsolete Orinoco shields of Manatee hide' (Roth 1921: 129, 87). He is therefore doubtful about an exhibition in 1862, where 35 different types of bark were exhibited that were supposed to have been used in the tanning process. It is recorded that fish was smoked, roasted, salted and dried or cooked in pepper pots (Steward 1948: 527; Grouard 2001a). Except for removing the intestines, hardly any work needed to be done in the preparation phase. Scales were most probably removed during the preparation process, bones mainly while eating. It is however likely that for some purposes, fish was cleaned in a fresh state beforehand. Historical illustrations sometimes depict racks with drying fish over a fire, indicating how fish were prepared and conserved.

### 3.4.2 Archaeology

The faunal remains studied in the area show evidence for the presence of, among others, rice rats, agouti, sea turtle, manatee, shark, crabs, molluscs and various types of fish (Delpuech *et al.* 2000; Nieweg 1999, 2001; Grouard 2001b). Considering the results of the analysis from other sites in the Lesser Antilles in the same period, we assume that animals formed an important part of the diet. They also provided raw materals for the production of ornaments and tools. Furthermore, since many animals are associated with symbolic values, the use of them might have carried a functional as well as a symbolic value.
On the site of Anse à la Gourde, several pieces of bone and teeth were found showing decorations (Grouard 2003). A piece of Manatee bone shows incisions and several shark teeth have drilled perforations. Turtle bone is also decorated. The use of bone for small objects and ornaments is common on a small scale throughout the whole region, but is hardly described in ethnographic or historical contexts. On the mainland as well as on the islands bone snuff inhalers were found in archaeological contexts.
Fish was a very important component of the daily diet, considering the large numbers of fish bones in all Caribbean sites (Stokes 1998; Keegan 2000; Grouard 2001a). It is however unclear how much tool-use was needed in catching and preparing fish. Catching methods included presumably the use of fishing nets, traps and hooks. Use was made of net-weights in the shape of stones or shells to keep the nets from floating. In Florida a bundle of shell was found with fibres still attached to them, indicating they were used as net weights (Marquardt 1992). Shell hooks were found both in Anse à la Gourde and Morel and will be described in the chapters in question.

### 3.4.3 Experiments

Traces from working animal material are specifically related to certain tool zones. Bone polish is defined by comet tails and a very bright bevel when the tool is used for scraping. Traces from hide-working display a rough, greasy and cratered band along the edge. Fish traces are often overlooked, because they do not develop, or because they show a considerable likeness to working bone in a longitudinal motion (Van Gijn 1986). Streaks of polish are the result of removing hard and resistant scales.

Unfortunately many species are nowadays in danger of extinction and are therefore protected. Hence, it is difficult to perform experiments on some of the species that in pre-Columbian times were commonly present (e.g. turtle, manatee, certain shellfish, including *Strombus gigas*). Although the limitations of this approach are obvious, it was decided to carry out experiments on other, more easily obtainable mammals and animals that were occasionally at hand.

#### 3.4.3.1 Hide working traces

Bivalve shells were used on deer (n=2), goat (n=1) and rabbit hides (n=9) in a scraping motion to clean the remnants of flesh and epidermis from the inside of the skins. On one occasion ochre was rubbed into the skin using the outside of the shell and once ochre was used as an additive to speed up the process of scraping whilst conserving the skin. In addition, three pieces of Antigua flint were used. The flint implements display traces similar to traces found on experiments with European flint: a band of bright, rough and greasy polish with mostly, a cratered topography.

Hide traces on shell largely resemble the traces on flint (Fig. 3.15 and 3.16). The polish is greasy and rough with a variation in brightness. The best angle to observe traces on bivalve shells is 90°(Ch. 2), sometimes the traces are also visible under a lower degree angle. The distribution is limited to the edge itself and the polish is visible as a band over and along the edge. The topography is cratered or domed. The addition of ochre caused clear mineral traces in one experiment, the other experiment lacked the development of polish. The traces are diagnostic for hide-working due to the distinctive distribution of the polish. The mineral additive of ochre resulted in striations.

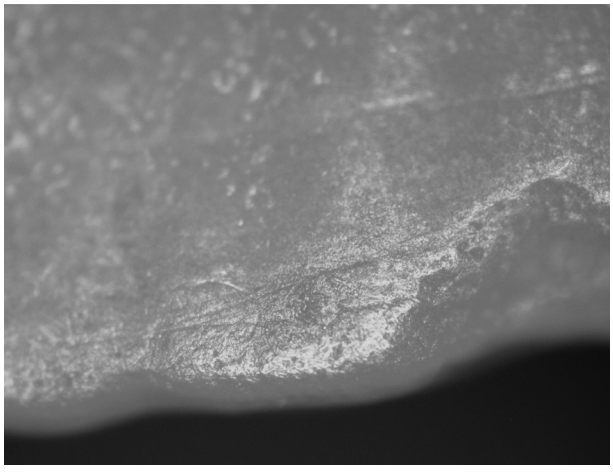

Fig. 3.15 Traces of scraping rabbit skin (exp. 685), orig. magn. 200x

#### 3.4.3.2 Traces of bone working

Three bivalve shells were used on (turtle) bone and several pieces of Antigua flint were used to bore through dentine. The bivalve shells were not very effective; only small dust-like scraps could be removed from the surface. The effect is more comparable to polishing. When the outside surface of the shell was used for this purpose, it proved to be inefficient. Making an incision using a bivalve shell was also attempted, but this turned out to be virtually impossible. Flint tools used to cut or scrape bone display a distinctive bright polish with comet tails and edge removals. The Antigua flint tools used on turtle bone displayed comparable traces. On the shell tools however, traces did not develop sufficiently to be distinctive for bone-working. The radial ribs (the curves on the outer surface of the shell) were abraded, but did not show a distinctive polish. A longer period of use would probably have lead to the development of bone-working traces.

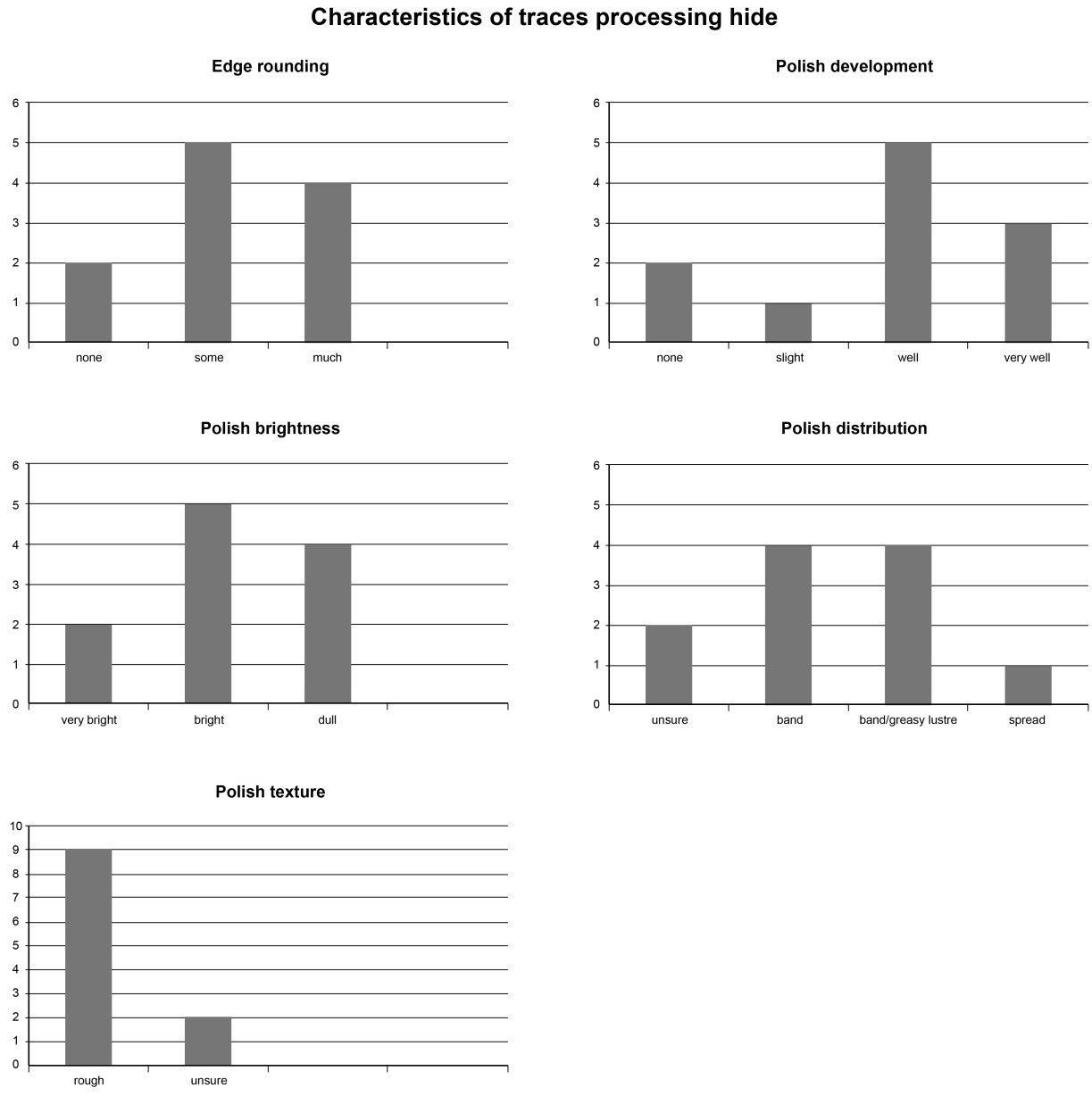


Fig. 3.16 Experimental hide working traces on shell tools, desciption of characteristics

### 3.4.3.3 Fish working traces

Two experiments using flint were carried out on fresh red snapper, removing the entrails and scales (Fig. 3.17). Four *Codakia* bivalve shells were used for the same purpose. The bivalve shells proved in particular to be very efficient for descaling. Fish polish is generally not easily recognised (Van Gijn 1986; 1990) and is often hard to distinguish from bone polish, possibly also because of the frequent contact between the tool and the fish bones. The Antigua flint tools showed the same characteristics: isolated spots of very bright polish. The shell tools used for descaling showed spots of bright polish in a thin line along the edge in two of the four experiments.

The characteristic streaks found on flint were not recognised. The presence of gloss caused by the animal, and the type of streaking could be hard to distinguish. On the other two tools no polish developed.

Fig. 3.17 Descaling fish with experimental bivalve shell

## 3.5. Mineral, coral and shell

### 3.5.1 Ethnohistory and ethnography

The most intensively used mineral material was clay for the production of ceramics. Tools found in ethnographic studies include calabash and shell scrapers as well as stone pebbles (Fig. 3.18). These tools are used in all stages of pottery production, but foremost on leather-hard clay. Ethnohistorical sources do not satisfactorily describe the used tools. Unfortunately no mention is made of the tools used in example bead-making for example. It is assumed that bow drills or pump drills were in use, at least for the later period, because of the large number of beads found on sites like the bead manufacturing site at Grand Turk (Carlson 1995).

The sources show that many of the hard materials, such as semi-precious stones, were worked taking considerable perseverance and patience (Roth 1927; Boomert 2000). To us, such tasks sometimes seem too difficult or even impossible to perform, since they appear to be time consuming and tedious.

### 3.5.2 Achaeology

The archaeological evidence in this category is large as it is represented by the majority of implements found both in the site of Morel as well as in Anse à la Gourde and throughout the whole region: pottery and tools made from shell, coral and minerals. Unfortunately, many artefacts are finished using sand and water or stones to smoothen the surface, destroying other manufacturing traces in the process. Traces of manufacturing are therefore often to be expected on unfinished pieces only. They are found regularly however, because most manufacturing techniques involve much stress on the raw material, resuting in fractures and other damage.

Fig. 3.18 Polishing stones from ethnographic context (Surinam 2000)

### 3.5.3 Experiments

Traces of working leather-hard clay are correlated with the type of clay and especially the type of temper that was used. Flint experiments that were carried out on chamotte-tempered clay revealed deep and wide striations in a very bright polish, which was distributed in a band along the edge (Van Gijn 1990, 46).

#### 3.5.3.1 Clay

For the experiments on clay, use was made of clays that resemble the recovered pottery from Anse à la Gourde.[5] In this way the development of polish should be comparable to the expected polishes on the archaeological tools. Seven *Codakia* bivalve shells were used on leather-hard clay, as well as one piece of Antiguan flint. The bivalve shell tools showed a dull, rough texture with a cratered and corrugated topography (Fig. 3.19 and 3.20).
Several small pebbles from La Désirade were used as polishing stones on dried clay pots and show smoothed extensively polished areas of use.

#### 3.5.3.2 Shell and coral

Twelve pieces of Antigua flint were used on different shell species (*Strombus gigas*, *Chama sarda*, *Cypraecassis testiculus*, *Cittarium pica*). The performed motions included incising for the production of ornamental lines and sawing for the production of perforations in tinklers. Many small edge removals appeared on the edge, together with a bright rough polish, distributed in isolated spots on the very edges of the tools. During the process the particles that came off the shell often became abrasive, resulting in a polish with small striations, clearly displaying the directionality of the action.
One piece of *Strombus gigas* shell was used in a sawing motion on another piece of shell, which was not effective. A *Strombus* columella was used to remove the inner whorl of several examples of *Cypraecassis*

5 Recently experiments in the reproduction of ceramics from Anse à la Gourde were conducted in the Ceramic Laboratory of the Faculty of Archaeology, Leiden University (Hofman and Jacobs 2001; 2005). Where possible, our experiments were combined.

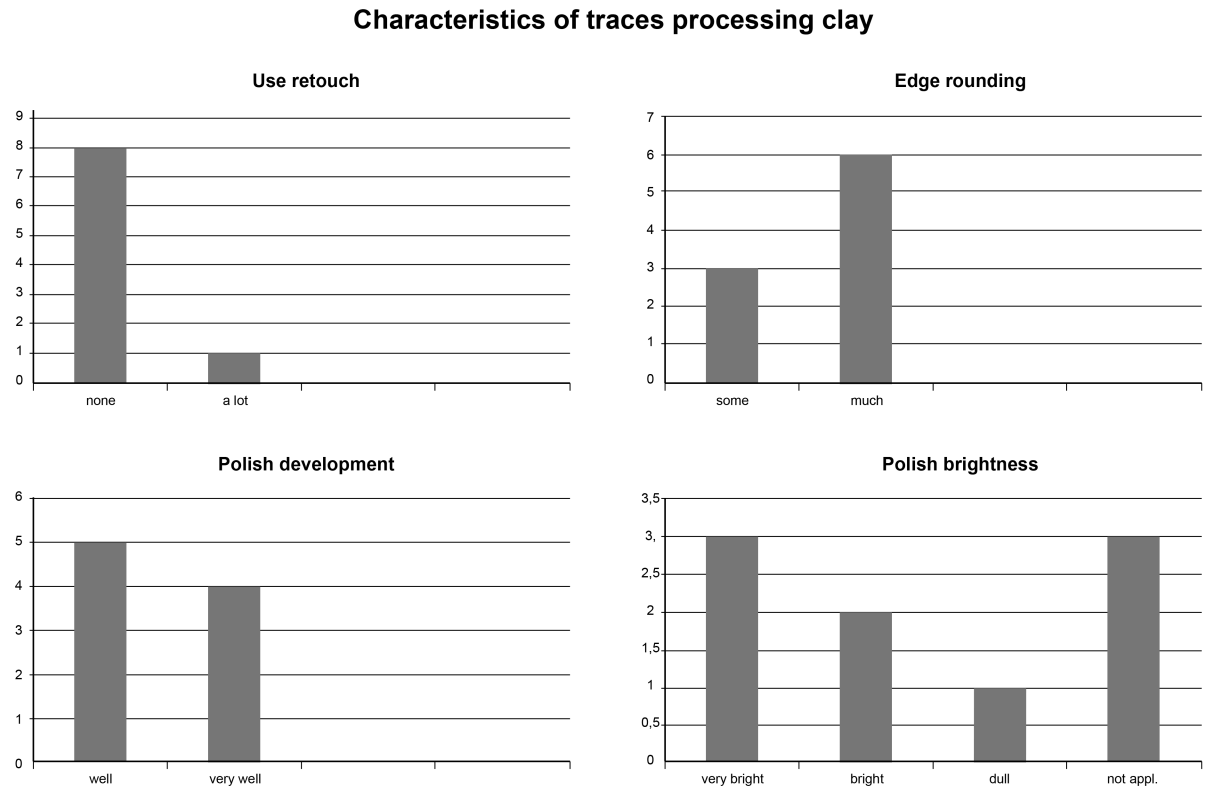


Fig. 3.19 Experimental clay working traces on shell tools, description of characteristics

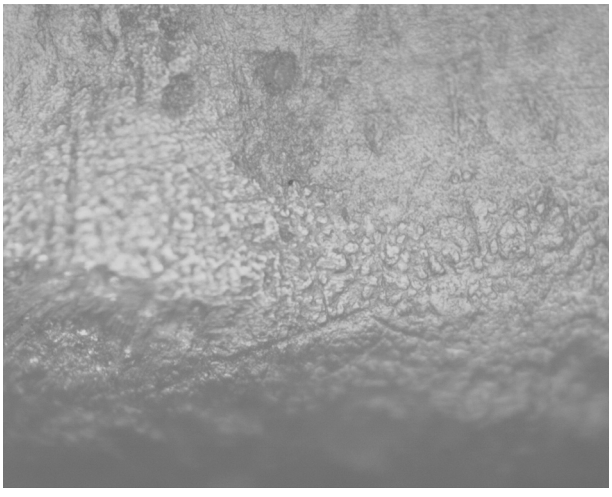

Fig. 3.20 Traces of scraping clay (exp. 627), orig magn. 200x

*testiculus* for the production of bell-shaped pendants, resulting in a distribution of traces directly on the tip and away from the tip where the thickest outer layer of the worked shell was in contact with the shell tool. *Strombus gigas* lips were ground and polished on hard stone, beach rock and stony coral. Depending on the

individual (fresher conches are softer), the creation of a sharp edge took between 4 and 20 hours. Adding sand and water speeded up the process considerably. The end result was a sheen with clear directionality on both stone and coral. Beach rock was not effective, so the experiment was ended after 60 minutes. The traces on the shell could not be differentiated, probably due to the large amount of slurry (sand and water) that I used to speed up the polishing process. The gloss on the shell tools is rather dull and distributed in ridges, whereas the deeper parts are almost lacking polish.
Several attempts were made to create beads. Blanks were produced by knapping both *Chama sarda* and *Strombus gigas* into rough shapes and smoothing them between two stones, two stony corals (Fig. 3.21) and a combination of a stone and a piece of coral. Fine volcanic sand (from the black beach in Basse-Terre) or sand from the local beach and water were added to form an abrasive slurry. This resulted in smooth, abraded surfaces on the stones and stony corals, with in some spots a sheen, which might have developed more if the tools had been used over a longer period. Subsequently, the blanks were drilled, using drills made from fishbone (not effective), wood (not effective) and flint (regular flakes and very tiny pieces). Very tiny triangular pieces of flint, hafted in a pen shaped shaft, proved to be very effective and resulted in perforations very similar to the archaeological ones. A bow drill was applied, using regularly shaped flakes, but most probably due to the inexperience of the applicant this was not successful (Fig. 3.22). Others have used this type of drill successfully to produce perforations in shell (Carlson 1995). Others made successful use of a pump drill (Pauc 1996; 2000). The flint tools all displayed a bright mineral gloss, distributed on the protruding points of the drill.

Fig. 3.21 Polishing *Chama sarda* with experimental coral tools

Fig. 3.22 Experimental tools used to drill shell

In line with the study of manufacturing traces, a single experiment was conducted on coral, using a flint flake. Incising coral caused much edge damage and the isolated spots of polish as well as the thin line along the edge are rough and matt with deep striations.

### 3.6 Concluding remarks

Based on the combination of palaeobotanical, ethnographic and ethnohistorical data, experiments were carried out with different types of tools on different types of raw material. The resulting experimental traces include polish, rounding, edge removals and striations. Taking into account the natural differences, in most cases usewear traces on shell tools are very similar to traces on flint tools. Only manioc shows a different topography of polish. Although it is therefore still absolutely necessary to have an experimental reference collection of shell tools, it was obvious that use can be made of the knowledge we have of the formation of polish on flint tools. The experiments have demonstrated that the intentional retouch of the edge of bivalve shells makes the tool more productive. Use could also be made of edges with natural retouches, occurring on shells that were

collected empty on the beach. The removal of the complete edge in one blow makes the artefact sharper but less resistant to deterioration. Polishes are specifically located on the edge itself and have to be observed as such, under the described 90° observation angle (Chapter 2). It is therefore essential to use an incident-light microscope with a free arm, which enables the study of large objects. Residues of a variety of materials could be extracted from the surfaces of the experimental tools.

The study of ethnographic and ethnohistorical sources has provided a broader frame of reference which is needed to study the functional aspects of the toolkit. Unfortunately, the information in the ethnographic and archaeological examples does not provide enough insight in tool use to give an idea of preferences for tools made of specific material classes to perform specific domestic tasks on specific raw materials. Furthermore, in many cases the experiments also do not reveal natural differences between raw materials, although each material has its own limitations. Shell is softer than flint, coral is softer than stone. Flint is often sharper and thinner than shell. For tasks that do not exceed the possibilities of an artefact, such as plant-working and fish processing, there would have been no need for the former user to distinguish between tool raw material, based strictly on functionality. Shell celts provide the same possibilities as stone celts. On the other hand, the experiments have demonstrated that flint and hard stone tools are an essential part of the toolkit. Materials such as bone and hard wood are virtually impossible to cut or saw without flint. The abrasive surface of hard stone grinding and rubbing tools and the durability of pounding stones cannot be replaced by coral artefacts. The inhabitants were dependent on other islands and other locations on Grande-Terre to obtain these necessary goods, since these raw materials were not available near the site.

# 4. Anse à la Gourde

## 4.1 Introduction to the site

### 4.1.1 Geographical setting

Anse à la Gourde is situated on the eastern part of Grande-Terre, the north-eastern island of Guadeloupe. Grande-Terre is an uplifted limestone formation of marine origin, while Basse-Terre, the southern island, is volcanic. The site is located on a narrow piece of land which is approximately 500 m to 1000 m wide and ends at the Pointe des Chateaux. The bay itself is protected from the sea by a reef barrier. The beach rises rapidly to low coastal dunes with an altitude of 3 to 4 metres above sea level. Behind the dunes is a small depression, which is covered with vegetation. Behind this depression the calcareous substrate rises to an altitude with a maximum of 21 meters. This substrate or bedrock sometimes surfaces but is mainly covered with a sandy deposit that varies in thickness between 10 and 250 cm. The site is located on the north of the peninsula, facing the Atlantic Ocean. From there, both the north of Grande-Terre and, to the east, the islands of La Désirade and Petite-Terre are visible and easily accessible over sea. On the other side of the peninsula one has maritime connections to the Petit Cul-de-Sac marine, Basse-Terre (the volcanic part of Guadeloupe) and the island of Marie-Galante.

This part of the Guadeloupean archipelago at present has an arid climate, with an average rainfall of 1000 mm per year, resulting in a xerophile vegetation. Due to meteorological conditions, regularly occurring hurricanes and so-called ground seas cause considerable damage to the coastline (Hofman et al 2001; Pater en Teekens 2004).

### 4.1.2 History of research

The site of Anse à la Gourde was first mentioned by Edgar Clerc, the Director of Antiquities at that time and Maurice Barbotin around 1970. It was decided to conduct an excavation under Pierre Vernin in 1975, after several test-pits had revealed the importance of the site. Unfortunately, there are no reports or publications available from this investigation. In 1984 a salvage investigation was carried out by Pierre Bodu, who concluded that the site covered three occupation phases between 600 and 1500 AD. This excavation was described in a small report (Bodu 1984a). Finally, after a prospection in 1995, initiated by André Delpuech of the DRAC Guadeloupe, a six year, large scale excavation project was started, in the framework of the international cooperation between the DRAC Guadeloupe and the Faculty of Archaeology, Leiden University. In the framework of this cooperation several specialists are included to study the faunal remains, different material categories and inhumations (Delpuech *et al.* 1995/1996; 1996a; 1996b; 1997; 1998a; 1998b; 1999a; 1999b; 2000; 2001a; 2001b; Hofman *et al.* 2001a; 2001b).

### 4.1.3 Environmental history

The study of Anse à la Gourde is embedded in a more general research programme which focuses on the archaeological, geomorphological and environmental changes of the whole archipelago. It is observed that along the Atlantic coast of Grande-Terre a series of fossil marine terraces is situated at an altitude of 3 to 5 m above sea level. On these terraces several archaeological sites were discovered, including Anse à l'Eau, Anse à la Gourde, Anse Sainte-Marguerite and Morel.

A geomorphological study in the Grand Cul-de-Sac marine, to the west of Grande-Terre (Feller *et al.* 1992) shows that the sea level rose rapidly between 7000 and 4000 BP (3.4m/1000y). This rise decreased between 4000 BP and 1000 BP (0.8m/1000y). It continued to rise for at least another 1.8 meters. These tendencies lead to the following reconstruction of coastal transformation during the periods of habitation, taking into account the considerable influence of tropical storms on the coastline (Delpuech *et al.* 1999b: 158). In the first

phase, before AD 600, the sea level was one or two meters lower than at present, resulting in a coastline 50-100 meters farther to the north. The present bay had not been formed yet and the area consisted of a saline, obstructed by a sandy coastal bar from the sea. In the second phase, between AD 600 and AD 1000, the coastal bar was ruptured as a result of the increase in sea level. Consequently the sea was allowed to invade the saline, leading to the development of a mangrove in the south west of the saline. During this phase most of the offshore bar, as well as the clayish saline deposit-layers were destroyed by marine erosion. Evidence from the area suggests that this phase was a very dry period throughout the Amazonian and Caribbean region (Beets *et al.* 2006; Callaghan 2002: 9; Curtis and Hodell 1993: 135-145). It is assumed that this drought was the cause of the formation of coastal dunes in the northern part of the settlement area. The rapid abandonment of the site at the end of that phase should also be considered as a reaction to drought. In the final phase, after AD 1000, only the reef barrier remains to separate the bay from the sea, creating a lagoon with a new sandy beach and coastal dunes. The site is located at that time behind these dunes. The further accumulation of sandy layers in the midden deposit suggests a continuation of drought in this phase. Since this last occupation phase (AD 1000- AD 1200/1400) the coast line seems to have remained stable. Still, it suffered from some erosion and a rising sea level. Occasionally tropical storms and hurricanes sped up the process considerably. Recent research on the influence of hurricanes on the formation and destruction of coastal sites in the Caribbean (Imbert *et al.* 1996; Crock and Petersen 2001; Delpuech 2004) shows that these processes can leave massive volumes of sediment but may also cause severe damage to sites. This might even be of even bigger consequence than the gradual increase in sea level. Another phenomenon related to transformation of coastal sites is called ground seas, which scour beaches and erode site margins, without leaving clear evidence (Crock and Petersen 2001; Littman 2002).

### 4.1.4 Archaeological data

On the basis of the ceramic assemblage, two main culture phases are made out (Hofman *et al.* 2001b; Pater and Teekens 2004; Rouse 1992), dating between 450 cal yr AD and 1350 cal yr AD. The first phase is related to the late Cedrosan Saladoid subseries. This material is generally found in the northern part of the excavated area. The largest part of the settlement in that phase was probably located more to the north, an area that is now lost to the sea. Only the southern part of this area could be excavated.
The end of the Saladoid period is marked by the abandonment of the settlement, due to the rupture of the off shore coastal bar and the rapid formation of dunes, caused by dry and windy conditions between 800 cal yr AD and 1000 cal yr AD (Beets *et al.* 2006). When conditions returned to a wetter climate, the settlement was relocated behind the dunes. Pottery styles in that phase can be associated with the Mamoran Troumassoid as well as the Suazan Troumassoid. In this phase the major occupation of the site took place. The settlement was formed by a doughnut shaped midden, surrounding a residential area of approximately 100x200 meters, with house structures, burials and a plaza.

## 4.2 Shell artefacts

The extension of the shell midden around the plaza of the site indicates that molluscs constituted a significant part of the prehistoric diet. Only a small amount of these remains of food have been used as a raw material for artefacts. To give an indication: one 2x2m test unit (Zone 64, Sector 58, Square 00/01/10/11) produced 2061 shells (MNI) with a total weight of almost 60 kg. The same testpit held 14 shell artefacts. All shell material was analysed by a malacology-specialist (Nieweg 2000). On the basis of macroscopic features artefacts were identified, often in cooperation with myself. All bivalve shells modified or not, were considered artefacts (Lammers-Keijsers 2001). The artefacts included in the sample studied (with the exception of the bivalve shells) are elsewhere named ‘shell artefacts with a relatively high level of modification’ (Serrand 1997, 189).

Different subdivisions of shell artefacts can be made, relating either to typological or functional aspects. A typological distinction can be made between so-called automorphic and xenomorphic forms (Linville 2004), which can be either formal or expedient. Automorphic implements are made from a complete shell, while xenomorphic artefacts are made of part of a shell. Formal artefacts are implements made of shell that have undergone an extensive transformation. They display a recurrent, more or less standardized shape. Expedient artefacts are pieces of shell or complete bivalve shells that have undergone, at most, minor modifications such as retouch (Jones O'Day and Keegan 2001). Concerning function one may discriminate between tools and non-tools or 'ornamental' artefacts.
Although many excavations on other islands have resulted in a variety of expedient tools (see Ch. 2), they did not seem to be abundantly present in this excavation. The material from one excavation unit in the shell midden was searched for more intensively for the presence of expedient tools. The unit did not contain pieces with macroscopically visible traces of wear. Therefore, a random sample of 20 pieces was selected and studied for microscopic wear traces. Two implements displayed some edge rounding that might be attributed to use, but both were doubtful. None of the selected pieces displayed clear evidence of use. The experiments have already demonstrated that many usewear traces are only visible on the microscopic scale. It is therefore virtually impossible to recognize expedient tools in a large shell midden.

### 4.2.1 Ornaments

Artefacts that have not served a function in domestic activities are categorised as non-tools or ornaments. Anse à la Gourde revealed a rich variety of such artefacts, which is quite unique in the Lesser Antilles. Most of these are xenomorphic in shape, which means that the the original shape of the shell is not visible anymore. There are also automorphic pendants, which display minor changes to the original shell shape. A sub-division was made between beads and pendants, adornments and three-dimensional objects.

#### 4.2.1.1 Beads and pendants

The majority of the shell artefacts can be categorised as beads and pendants. Shell beads are alleged to have held a great trading value in the Taino period (Carlson 1995) and the Anse à la Gourde assemblage seems to reflect that same idea. It remains unclear whether the emphasis on these artefacts lay in their symbolic or their ornamental value. In any case, the beads and pendants did not display signs of long-term wear, as found in Neolithic European context (Verhaegen 1998). Only one discoid bead shows signs of such. Typologically a distinction can be made between beads and pendants. Beads are defined as polished ornaments with a roughly central perforation, with a symmetry along the perforation's longitudinal axis (Serrand 1997; Linville 2004). Pendants are defined as finished artefacts with a suspension trimming (perforations, grooves, notches) that is off-centre, to be able to wear the ornament as a pendant on a string.

*Discoid beads*

The discoid beads are made from *Chama sarda*, *Strombus sp.* and pieces of mother-of-pearl. Eight beads of mother-of-pearl were found, which were all in a bad condition. They are very thin and fragile. They are all finished but they do not show standardisation in shape or size. The 195 *Chama sarda* beads in different stages of the manufacturing process and the large number of *Chama sarda* fragments show that these beads were made at the site. All stages of manufacturing are present and there does not seem to be a standardised production process (fig. 4.1). The different steps in the production sequence (flattening, rounding, drilling) are performed in various orders. There is a variation in perforation types, dimensions and order of production steps (Table 4.1). The sizes vary between 2 and 14 mm in diameter and 1 and 5 mm in thickness. The perforations resemble the experimental perforations created with tiny pieces of hafted flint. The six cylindrical perforations are confined to the thinnest beads, where a cone is unlikely to develop or to be recognised. Twenty of the blanks with indentation are broken, indicating that they were broken in making the perforation. The perforation

is the most risky stage of bead making. The bead blanks were therefore mostly flattened and rounded after drilling, when the risky part was fulfilled. This is demonstrated in a relatively high number of blanks that are just flattened fragments of *Chama sarda*, ready to be perforated and rounded. Furthermore 745 unmodified fragments were recovered. Many of these beads and fragments are found in features and burials (especially in male(?) burial F1945), indicating the importance of these beads.

Fig. 4.1 Different stages of manufacturing Chama sarda beads

| Perforations | flattened | rounded | flattened and rounded | drilled | flattened and drilled | rounded and drilled | finished: flattened, rounded and drilled | total |
|---|---|---|---|---|---|---|---|---|
| none | 58 | 2 | 12 | - | - | - | - | 72 |
| abraded | - | - | - | - | 1 | - | - | 1 |
| pounded | - | - | - | - | 1 | - | - | 1 |
| one side, conical (indentation) | - | - | - | 1 | 22 | - | 1 | 24 |
| complete, cylindrical | - | - | - | - | 1 | 3 | 2 | 6 |
| complete, conical | - | - | - | 1 | 28 | - | 9 | 38 |
| complete, biconical even | - | - | - | - | 12 | 2 | 8 | 22 |
| complete, biconical uneven | - | - | - | 2 | 20 | - | 9 | 31 |
| Total | 58 | 2 | 12 | 4 | 85 | 5 | 29 | 195 |

Table 4.1 Perforation types in *Chama sarda* beads versus production step, number of beads

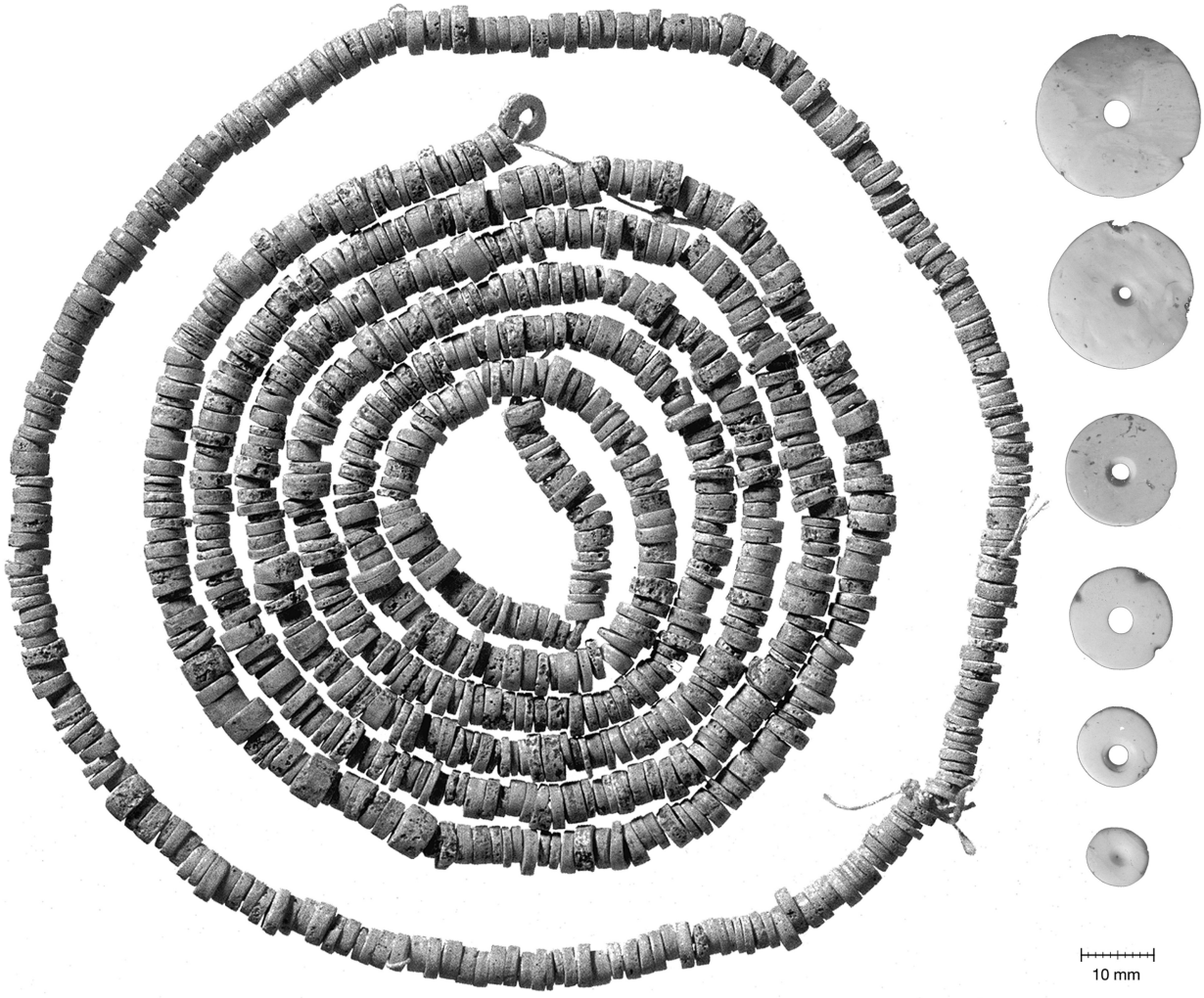


Fig. 4.2 Hipbelt and loose beads of *Strombus sp*.

In contrast to the *Chama sarda* beads, no production waste (e.g. partially drilled broken blanks) of *Strombus*-beads was found. In total 1115 beads of *Strombus* were recovered of which 1087 were associated with one burial (F311). The excavation of the female skeleton revealed that these beads belonged to one long chain, positioned over the pelvis (Fig. 4.2). The 28 remaining *Strombus* beads were found randomly over the site and display a distinct variety in dimensions and used techniques. All beads from the string show a remarkable uniformity, which reveals a standardisation in the manufacturing process. Blanks were made from the lip of *Strombus sp.* and polished until smooth. After this initial stage biconical holes were drilled with flint. The cones are clearly unequal, with a dominant side and an opposite side that has been merely touched with a flint tool to finish the edges. The width of the perforation depends on the thickness of the bead, because the cone gets wider when the drill has to go deeper. Even the thinner beads show a relative wide cone, suggesting that use was made of a pump drill or a bow drill. This method was also observed in the late-ceramic bead manufacturing centre on Grand Turk (Carlson 1995; Littman and Keegan 1991). Carlson assumes that a bow drill must have been used, because a pump drill would create too much pressure. Pauc (1996) however mentions good results with the use of a pump drill on Cardium sp. in replicating Neolithic shell beads. My experiments revealed that a handheld hafted drill is the most precise, and creates the narrowest cone (see

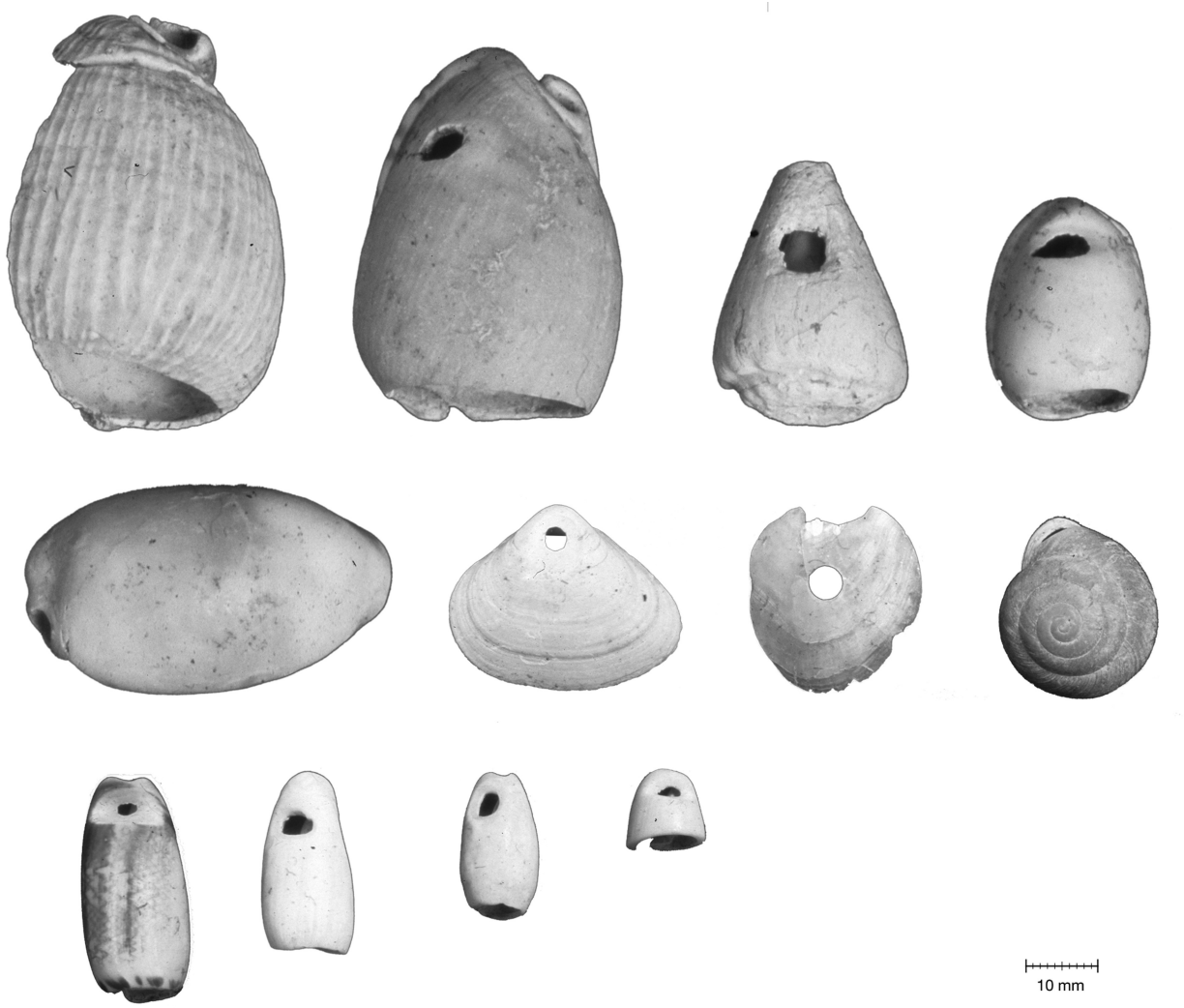


Fig. 4.3 *Tinklers* and pendants, bivalve shell with perforation.

Ch. 3). The difference in the perforations of *Chama sarda* and *Strombus* beads can therefore be explained by the use of different techniques: the *Chama sarda* beads were made with a hafted handheld drill, while the *Strombus* beads were made with a bow- or pump-drill. The economic production-technique of the *Strombus* beads is also represented in the last stage of manufacturing. Although the beads vary in thickness between less than 1 and 4 mm, there is less diversity in diameter, which varies between 4 and 6 mm divided in groups of exactly the same dimensions. This demonstrates that the beads were rounded by rolling them over a stone while they were strung on a thread.
The difference in technique might be explained by the woman not being local but originating from the northern islands. DNA and stable isotope research is being conducted to the relationships, which may shed light on the origin and descent of the inhabitants (Hoogland and Panhyusen 2003).

*Pendants (Fig. 4.3)*
Tinklers are the most common type of pendants. Tinklers are bell-shaped pendants that, as ethnohistorical illustrations show, were worn around the lower legs, just beneath the knees or around the upper arm. They

made a tinkling sound while walking and dancing and could be regarded as a complementary element to the music (Van der Steen 1992, 99). It was suggested by Sutty (1978) that beads were used inside the shell to enhance the sound effect, but as Clerc (1974) already had described, tinklers make a distinct sound by themselves when they are threaded on a string. 'Normal' tinklers are made from a bell-shaped shell type (e.g. *Oliva sp.*) of which the complete apex (top) and columella (inner whorl) are removed to create a hole. Experiments showed that this could be done by pounding, boring and grinding with the aid of a stone or a small *Strombus* apex. On the opposite side a perforation can be made by pounding or sawing or be created by grinding the shell on a flat surface until a perforation appears in the base (Francis 1982; 1988, 28; d'Errico *et al.* 1993, 248; Taborin 1993, 260). Other tinklers do not have a side perforation and they might have been worn as normal pendants, or in the way Sutty suggested, with the aid of an extra bead. The fibres running through the shell would however reduce the tinkling sound. Van der Steen's definition of a tinkler also includes the use of the shells inside containers, such as calabashes or gourds to create a rattle. An apex perforation and the removal of the inner whorl would suffice for this type of use, making this solution very plausible. The wear that is to be expected from the contact between the shells themselves and between the shells and the container was not found. In total 115 so-called tinklers were recovered, 69 with both side perforation as well as a apex perforation, of which *Oliva reticularis* (n=40) and *Cypraecassis testiculus* (n=18) dominate. The apex was removed from 39 bell shaped molluscs, four only have a side perforation. Three tinklers of *Oliva reticularis* were found in burial contexts (F199, F218, F466).

| side perforations | apex perforations | Conus regius | *Conus sp.* | *Cyprae sp.* | Cypraecassis testiculus | Oliva reticularis | uncertain | total |
|---|---|---|---|---|---|---|---|---|
| abraded | abraded | - | - | - | - | 1 | - | 1 |
| abraded | pounded | - | - | - | 1 | - | - | 1 |
| abraded | uncertain | - | - | - | - | 3 | - | 3 |
| pounded | abraded | - | - | - | 5 | 1 | - | 6 |
| pounded | pounded | 1 | - | - | 8 | 2 | - | 11 |
| pounded | uncertain | - | - | 1 | - | - | - | 1 |
| sawn with flint | abraded | - | - | - | - | 3 | - | 3 |
| sawn with flint | pounded | - | - | - | - | 3 | - | 3 |
| sawn with flint | polished | - | - | - | - | 2 | - | 2 |
| sawn | abraded | 3 | - | - | 2 | 10 | 1 | 16 |
| sawn | pounded | - | 1 | - | 2 | 5 | - | 8 |
| sawn | pounded-abraded | - | - | - | - | 1 | - | 1 |
| sawn | polished | - | - | - | - | 8 | - | 8 |
| sawn | uncertain | - | - | - | - | 1 | - | 1 |
| uncertain | uncertain | - | - | - | - | - | 4 | 4 |
| total | | 4 | 1 | 1 | 18 | 40 | 5 | 69 |

Table 4.2 Tinklers with two holes versus shell species, number of tinklers

Side perforations are either sawn with flint (very sharp line, clearly longer than perforation) or sawn/abraded with flint/stone or coral (broad line with an abraded area around the perforation). In both cases a groove-shaped perforation is created displaying a clear directionality of the production movement. In some cases the side perforations are pounded, resulting in more or less round perforations with ragged edges. Apex perforations are pounded (very rough ragged edges), abraded (abraded edges, also inside the edges) or polished on a flat surface (sharp edges, flat base). Experiments have demonstrated that the use of the columella of *Strombus sp.* leave abraded edges similar to the ones recovered in archaeological contexts.

| | Shell *species* | | | | | | |
|---|---|---|---|---|---|---|---|
| apex perforation | *Conus regius* | *Conus sp.* | *Cyprae sp.* | *Cypraecassis testiculus* | *Oliva reticularis* | *Olivella sp.* | total |
| abraded | 3 | - | - | 2 | 3 | 1 | 9 |
| pounded | 4 | 4 | 2 | 11 | 6 | - | 27 |
| sawn | - | - | - | - | 3 | - | 3 |
| total | 7 | 4 | 2 | 13 | 12 | 1 | 39 |

Table 4.3 Perforations in tinklers, apex perforation only versus shell species, number of tinklers

The variation in the sample demonstrates that there were two main tinkler types: broad, fairly round ones (*Conus sp.* and *Cyprae sp*.) and slender long ones (*Oliva sp.*), both either with or without apex perforations. The apex perforations vary within the types, although a small majority of *Cyprae/Conus* tinklers have pounded perforations, while most of the *Oliva* tinklers have an abraded apex perforation. The side perforations display a more distinct difference in technique: the majority of *Cyprae/Conus* tinklers have a pounded side perforation, while almost all *Oliva* tinklers have a sawn perforation.
There does not appear to be a functional or technical reason for the difference in perforations; the sawing technique might have been applied on all species. The pounding technique is quicker, but there is more risk of destroying the shell. In general the *Cyprae/Conus* tinklers look relatively plain compared to the *Oliva* tinklers. The two types are not specifically distributed over the site and cannot be related to either the early or later period of habitation. It is therefore assumed that both types were produced alongside each other with different techniques.

The remaining artefacts in the category of pendants can be categorised as non-standardized xenomorphic ornaments. They are made from *Strombus sp.* (n=6) and (sweet-water)/ mother-of-pearl pieces (n=11). Some (n=4) display decorations in the shape of circular lines (Fig. 4.4). One fragment of a pendant of mother-of-pearl was found in burial F2214.

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Fig. 4.4 Decorated sweetwater pendants

(n=4) display decorations in the shape of circular lines (Fig. 4.4). One fragment of a pendant of mother-of-pearl was found in burial F2214.

*Bivalve shells with perforations*
Seven bivalve shells (*Lima scabra*, *Tivela mactroides*) have a perforation near the umbo. In six cases this perforation was created by abrading the shell on a flat coarse surface until a perforation appeared. On the last implement a perforation was pounded. None of the edges displayed usewear. In south-western Florida, in the Calusa culture, comparable artefacts were found as net weights (with the remaining net remnants still attached) (Marquardt 1992). However, one would expect to find larger numbers if it was common to use these bivalve shells for that purpose. They might be interpreted as pendants, but no abrasion by threading was observed. Similar objects were found in Hope Estate (Serrand 2002) and on sites on Aruba and Antigua (Linville 2004).

*Perforated tops*
'Perforated tops' are generally considered beads. A perforated top can be defined as the perforated apex of a Conus sp. Although they might have been gathered to serve as beads they are in fact not really artefacts. The perforations and edges of these tops are irregularly shaped and seem to have been created by taphonomical processes. This gives these 'beads' a water-worn appearance. Their significant number (n=29) indicates that they may still have been gathered on purpose to serve as beads. Two were found in graves (F200 and F332), several were found in features.

### 4.2.1.2 Adornments

Adornments are defined by Serrand (1997) as finished artefacts, perforated or not, of which the shape and trimming result in a possibility to be applied or fixed (ligatured, pasted, sewn) on a support (human body, clothes, objects). Here, the definition is narrowed down to unilateral ornaments, including applications and decorated pieces and excluding bilateral discs. Discs are either described as bead blanks, inlays or geometric objects, although they might have been attached to a support as well.

Fig. 4.5 Adornments: applications

Applications (Fig. 4.5)
Applications are likely to have been sewn onto clothing or belts. They might have been part of necklaces as well. They vary in the number of perforations and slightly in shape. All perforations are unequally bi-conical, with the largest cone at the dorsal face of the ornament. All the objects have a highly polished dorsal face and a less well-polished ventral face, which was clearly not the side for display. Most adornments are rectangular in shape (n=11) and have two perforations (n=10). They vary slightly in dimensions (length 15 to 32 mm). One rectangular object has no perforations but has four triangular incisions. They are made from *Strombus sp.* as well as mother-of-pearl.

Six artefacts of *Strombus* have a double triangular 'bowtie' shape. Only two of them are perforated. They are very similar to each other and quite different from the afore-mentioned applications. It may be argued whether they should be in the same functional category. Other functions could be sought in a more functional sphere, e.g. they could have also served as reels in fishing gear. Microscopically no indications for use were found. Two automorphic applications of a completely different type were made from *Cyphoma gibbosum* and *Cyprae sp.*. They were made by removing the backside of the shell by means of rubbing over a rough surface. This is a well-known method to create a flat back on cowrie-like shells, all over the world, also recovered in Morel (see Ch. 5).

*Decorated pieces (Fig. 4.6)*
Six geometric pieces of *Strombus* are categorised as 'decorated pieces'. They are decorated on one side with lines and cone-shaped indentations, made with flint implements. Comparable artefacts occur regularly in small numbers throughout the Antilles on Antigua, Aruba, Grenadines and Guadeloupe. They have no perforations but they are clearly unilateral, and are therefore considered to be meant as adornments.

Fig. 4.6 Decorated pieces

*Inlays and discs (Fig. 4.7)*
Discs may be interpreted as blanks for beads or as finished products, possibly serving as inlays. Most bead blanks do however not show a rounded, clearly finished edge as in discs. Some display indentations of about 2 mm wide and 1 mm deep. Indentations may be interpreted as unfinished perforations but could also have served to contain dye in inlays, to give shell pieces used as eyes in statues more expression. A head-shaped object carved out of coral was discovered on the site which shows the use of red pigment to emphasize the eyes. If the difference between bead blanks and discs or inlays is based on the rounding of the edges, 16 artefacts can be considered as discs, made from both *Strombus sp.* (n=13) as well as mother-of-pearl of *Pteria sp.* (n=3). Three other pieces of mother-of-pearl have the shape of an eye and might be interpreted as inlays. No residue of a type of glue (resin, wax) was found although this is not necessarily needed or it may not have been preserved. One *Strombus*-implement is clearly a unilateral disc, with circular placed indentations (2 mm wide, 1 mm deep) and two circular lines on one side.

4.2.1.3 Three-dimensional objects
The variety in this category makes Anse à la Gourde a site without parallel in the region. *Strombus* shell was used as a raw material for carved naturalistic or figurative representations, such as sharks, frogs and jaguar teeth. These types of artefacts are generally interpreted as mythical, because of the symbols they represent. Their variety displays the complexity of the religion. The similarities with symbol representations on the mainland display the continuing influence of the mainland and the contact that was maintained through trading networks (Knippenberg 2006). The adaptation of the specific island environment is demonstrated in the choice of shell as a raw material for symbol representation, while on the mainland stone and bone were used (Boomert 2000).

Fig. 4.7 Inlays and discs

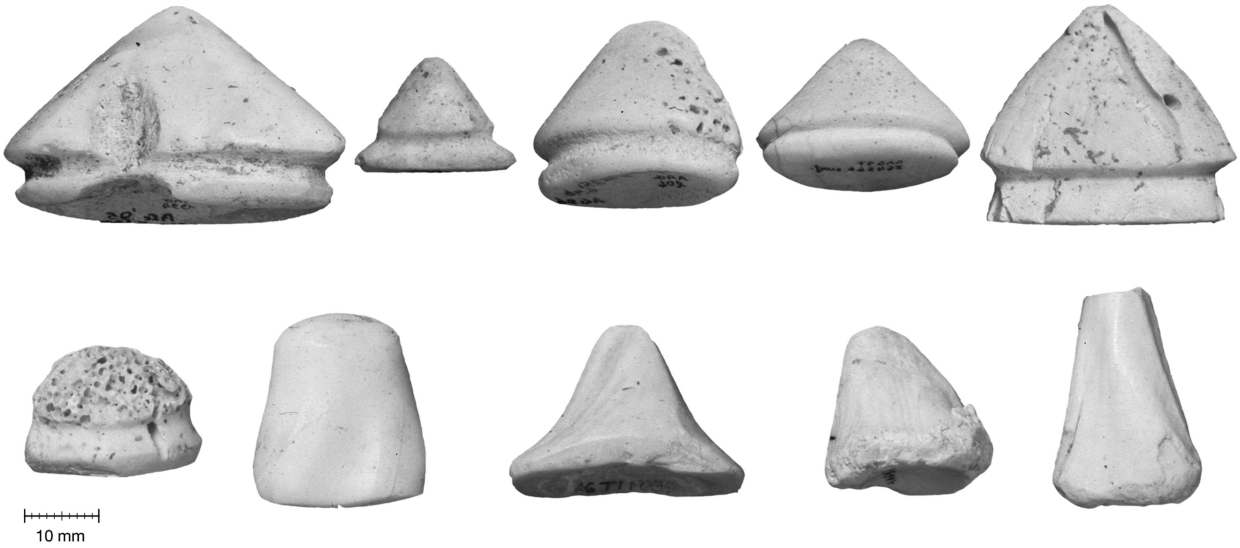



Fig. 4.8 Three-pointers with (above) and without pedestal

*Three-pointers or modified nodules (Fig. 4.8)*
Throughout the Caribbean region, three-pointed stone objects are frequently found and interpreted as mythological symbols (or zemis) associated with e.g. agricultural fertility (Siegel 1997; Boomert 2000). The term zemi relates both to gods and idols as well as to their representation. According to Siegel (1997) zemis were used in ecstatic trances, séances and curing ceremonies. They are not commonly reported to have been made of shell. They are mentioned for sites on Aruba (Linville 2004, 171), Saba (Hoogland 1996), in Hope Estate (Serrand 2002, 159) and Golden Rock (Van der Steen 1992). On Guadeloupe they seem to be rather common (Clerc 1974). They all seem to have been made from the nodules (see Ch.2) of *Strombus gigas*. In Anse à la Gourde 21 modified nodules were recovered. Two types can be made out: three-pointers with a pedestal, and three-pointers without a pedestal. If a pedestal is present the underside is either ground flat or displaying a natural or intentionally abraded indentation.
The eight examples of nodules with pedestal are predominantly highly modified, displaying the characteristic three-pointed flat shape with a narrow foot or pedestal. Four of these have an artificial hollow pedestal, possibly by enlarging a natural indentation. The other four have a flat underside. Nine of the three-pointers without a pedestal (n=11) show little or no modification. The natural shape of the nodule is maintained, displaying the natural hollow in the base, and in the top if present. Six display water-worn edges and were unmodified. Only two pieces without pedestal are completely polished nodules, on which nothing of the original surface is visible. These examples are both rounded, with rounded tops and a flat base. They do not display the characteristic, three-pointed shape as the pieces with a pedestal.
The system developed by Clerc (1974) would indicate that the three-pointers with pedestal date to before 560 AD, those without from the period after that time. Most of the implements described here are too irregular to fit into this system, because the nodules are not sufficiently altered in shape. However they cannot be regarded as half-products. Serrand (2002) argues that nodules with few modifications were intended to be finished, but for Anse à la Gourde, this seems unlikely. The unmodified nodules do not have the right shape to become finished three-pointers.

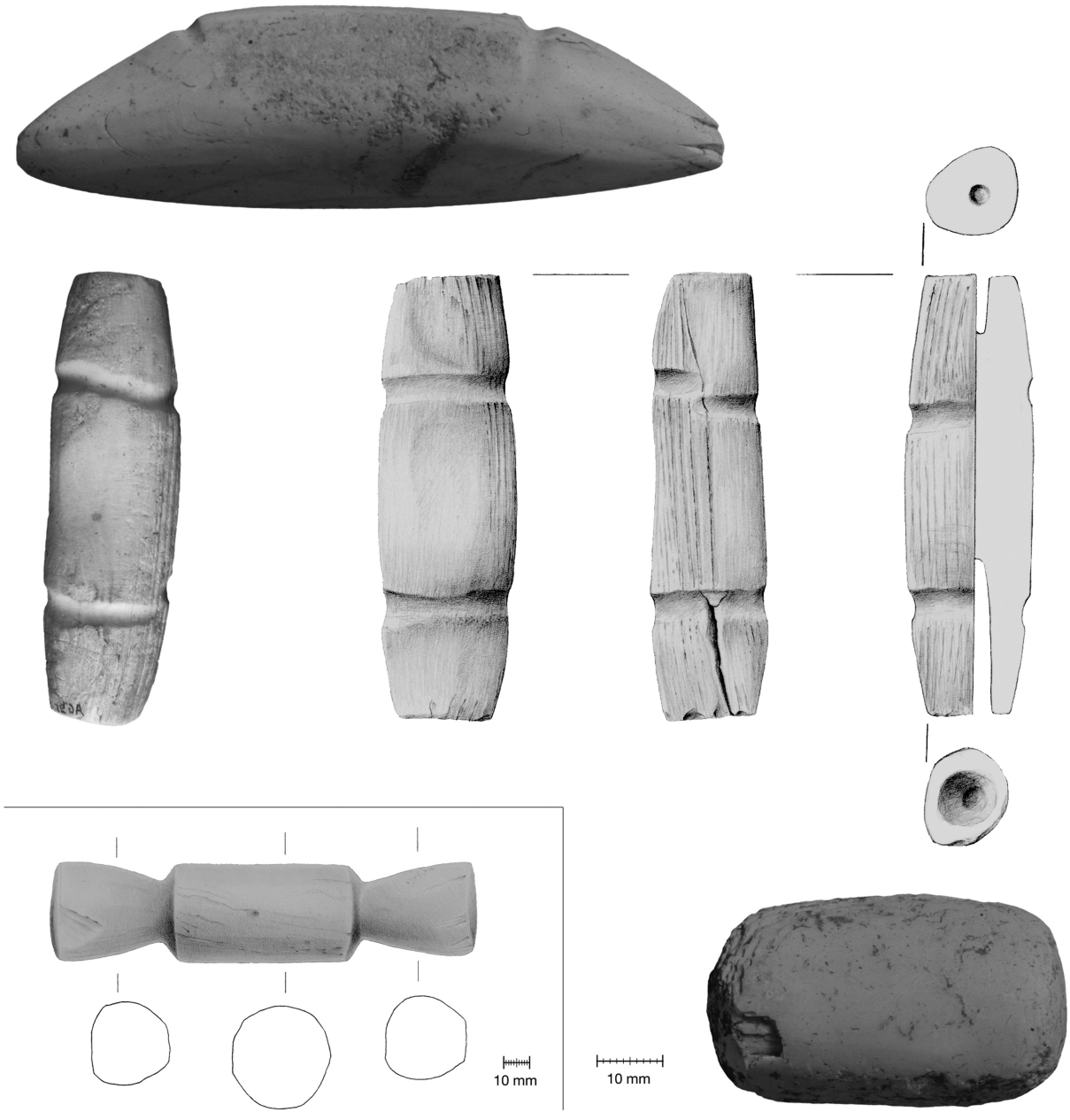



Fig. 4.9 Polished cylinders

*Polished cylinders (Fig. 4.9)*
A fascinating artefact category are pieces of the lip of *Strombus gigas* that have been polished into a cylindrical shape. Comparable artefacts are mentioned from Golden Rock (Van der Steen 1992), but are otherwise rare. The shape and weight of the objects would make them suitable as pestles. This would however result in macroscopically visible usewear traces. The shallow hollows on some of the examples have been suggested to be the result of use in a bow drill (Museum Edgar Clerc, Le Moule, Guadeloupe). These objects are however

to be considered as non-tool artefacts, because no apparent traces of use were found and since there are no ethnographic parallels known to me. A distinction between sub-types can be made on the basis of several characteristics. Most of the artefacts (n=10) are completely polished into a pure cylindrical shape out of a *Strombus* –lip. They are on average 64 mm long and 24 mm wide, displaying only small pieces of the original surface. Two implements have incisions, approximately 17 mm from their upper end, and both also display deep perforations in both ends. One broke during the process of drilling, when the perforations did not meet in the middle of the length axis. The other artefact is complete, but the perforations did not reach each other either: one perforation is cone-shaped, the other perforation is cylindrical. Of the eight remaining polished cylinders, only three display shallow cone-shaped and cylindrical perforations (<4 mm). None of them have incisions. Four of these perfect cylinders were found together in feature 453.

Two other polished artefacts have an a-typical shape, with pointed extremities. One of them (Shell 49) displays a shallow circumcision halfway, a reason to tentatively include them in the category of the polished cylinders. It seems unlikely that they were intended as beads, with the exception of the one broken example that was obviously intended to be perforated. Some definitely seem to be finished objects (completely polished, displaying incisions).

Fig. 4.10 Spatula

*Spatulas (Fig. 4.10)*
Two complete spatula-shaped objects and four fragments were found. The two complete ones have perforations in the end as if they were worn on a string; both are made from the bivalve shell *Anadara notabilis*, resulting in a striped appearance. One of them was found in feature 1157. One of the fragments is made from the same shell type. Spatulas were used in cleansing rituals for vomitory purification (Boomert 2000, 451). On Cariacou a comparable artefact was discovered, though made from *Charonia variegata* (Sutty 2001/2002).

*Rounded shell fragments (Fig. 4.11)*
Fragments of *Strombus gigas* can be rolled (on the beach) and be transformed into pebble-shapes. In total 36 such pebbles were collected, 21 of which were from grave 304, which gives rise to the idea that these ‘pseudo artefacts’ were specifically collected. The average dimensions are 24 mm length, 18 mm width and 7 mm in thickness. Serrand (2002) found similar objects at Hope Estate. They do not show distinctive angles or usewear traces, excluding the possibility that they were gathered and used as polishing stones.

*Animal representations*
Animals played an important role in the worldview of the ethnographically studied mainland indigenous peoples and similar assumptions are made for pre-Columbian times. Sea mammals are interpreted to be associated with the underworld and the feminine (Boomert 2000, 474). Two shark pendants were discovered,

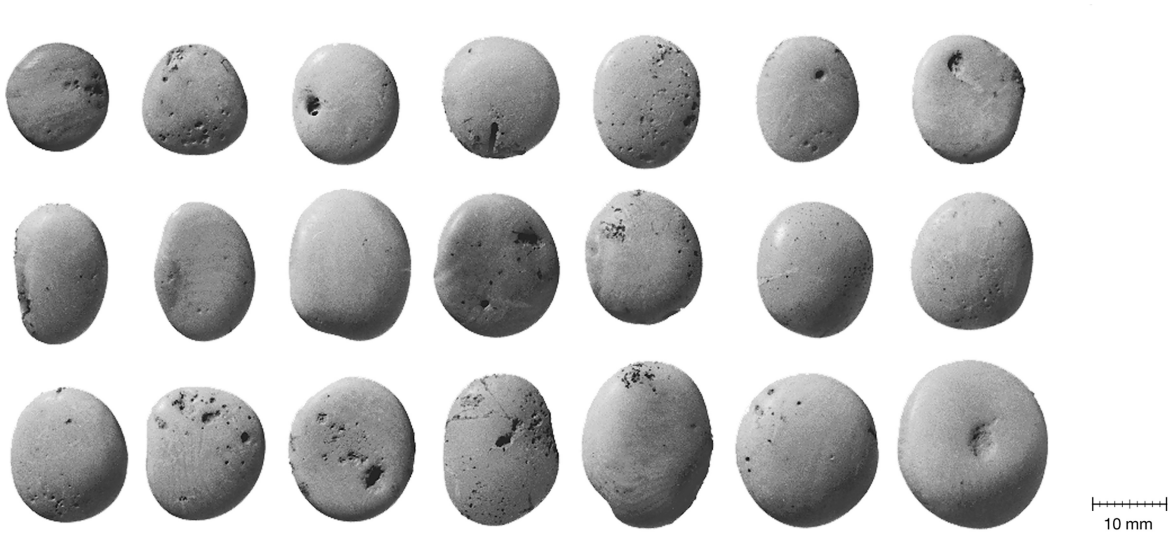



Fig. 4.11 Rounded shell fragments

one complete and finished (Shell 27), the other one (Shell 7000) broken in making a perforation from both sides (Fig. 4.12). It is unclear whether sharks were regarded as mammals or as fish, but we may assume that they were regarded as fish. Frogs are associated with water and fertility and therefore play an important role in symbolic expressions. They are often shaped in semi-precious stone throughout the Antilles and are found in the shape of adornos on ceramics. A motif, which regularly occurs on different artefact categories, is a combination of lines and indentations that are interpreted as folded frog legs. This motif is found on a highly polished top of *Strombus*. Three more or less realistic shell frogs were recognised, two complete and one broken (Fig. 4.13). They do not resemble each other, but all have perforations and might have been worn on a string as pendants.

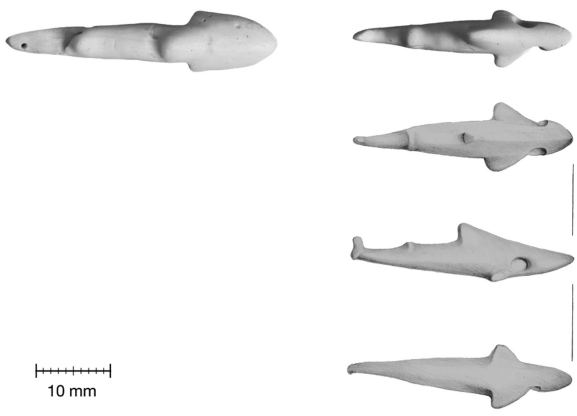



Fig. 4.12 Animal representations: sharks

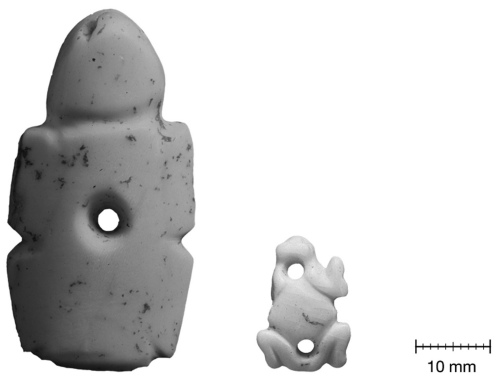



Fig. 4.13 Animal representations: frogs

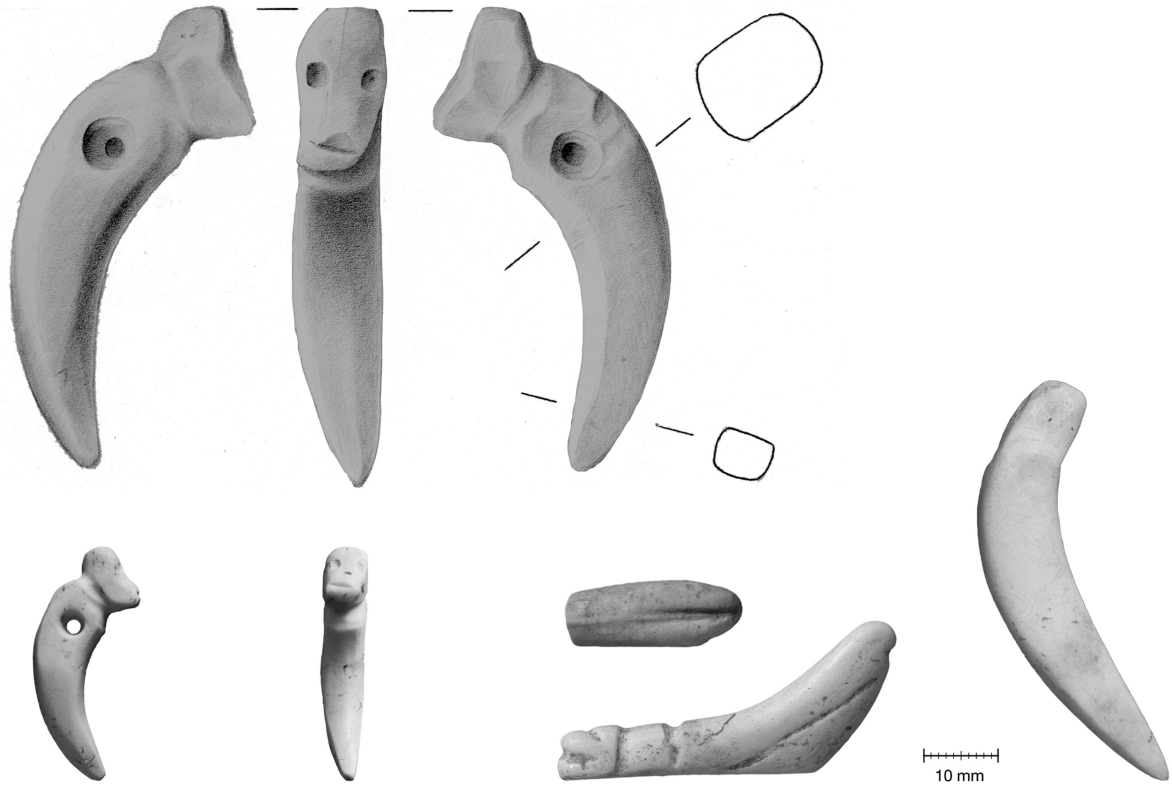



Fig. 4.14 Tooth with monkey head, drawing scale 2:1, parts of teeth or snakes, 'Jaguar' tooth

Three tooth-shaped objects were all made from the lip of *Strombus sp.* (Fig. 4.14) One resembles the size and shape of a jaguar canine (Shell 7003, length 53 mm). On the mainland the jaguar is associated with the regulation of the right quantity of rains and consequently with controlling the fertility of fields, waters and forests (Boomert 2000, 465). It is therefore an important symbolic animal; its teeth were worn as pendants as a representation of the animal and its ascribed powers. Boomert (2000) suggests that the jaguar was replaced by the dog on the islands, where it gained positive symbolic connotations (see also Roe 1993). The second shell tooth is smaller (Shell 43, length 31 mm) and might be intended to resemble a jaguar as well as a dog tooth. It is perforated and has a monkey head on the blunt end. The monkey is also associated with the underworld and the feminine. There is no evidence that either monkey or jaguar were ever present on the islands, which would make a complete transition to a concentration on dogs reasonable. The third tooth-shaped shell object resembles a dog fang (Shell 193, length 23 mm). Furthermore, Anse à la Gourde did reveal several perforated dog teeth, which would support this idea. The jaguar tooth-shaped shell objects however clearly mark the persistent affinity with the mainland, while the combination with the use of shell as raw material marks the adaptation to the island habitat. Two other objects could be interpreted as teeth, but might also be interpreted as a representation of snakes.

Fig. 4.15 Anthropomorphic representations: chin with mouth

*Anthropomorphic representations*
Two broken decorated pieces of *Strombus* (Shell 3070, Shell 7070) were originally part masks or face-shaped pendants (Fig. 4.15). Both pieces must have been part of a mask similar to that from Morne Souffleur, La Désirade (De Waal, 2006.). A chin with mouth decoration has remained, and a part which should have been positioned next to the eyes. Whether they were part of the same mask remains unclear, as they were found quite far from each other. Not much is actually known about these masks or face-shaped objects. They are too small to be worn as masks; the Morne Cybele object measures 12 x 7 cm. They are however considered to have been regarded as valuable objects, possibly serving as pendants for so-called caciques or headmen. Others are known from the Anse du Coq-site, Marie-Galante (Hoogland and Hofman 1999) and from the Rendezvous Bay and Sandy Hill sites in Anguilla (Crock and Petersen 1999). Many display decorations of indentations and circular lines around the eyes, interpreted as headbands associated with high status. It is assumed that these objects served a function similar to the three-pointers, functioning as protective charms (Garcia Arévalo (1997: 114).

*Geometric objects*
The last category of three-dimensional shell artefacts consists of an assemblage of objects which are more or less geometrically shaped. A very unique object is a small triangular bar (gauge?) (35 x 16 x 12 mm) of *Strombus gigas*. It does not display any traces of use or wear. Grinding and polishing marks on the surface indicate it was shaped on a stone or coral surface. Only one comparable object is known to me, in the museum in Moule, unfortunately without any context. A large and heavy disc, a possible ‘earplug’ (Fig. 4.16) and a special conical shaped object, all of *Strombus sp.*, belong to this category as well. Their functions are unknown as they do not display usewear traces and no equivalents are known from ethnographic context. The conical shaped object is decorated with the so-called frog-incisions and lines (Fig. 4.17). A comparable artefact is kept in the Museum Edgar Clerc, originating from Morel (see Ch. 5) and on the Grenadines (Sutty 2001/2002).

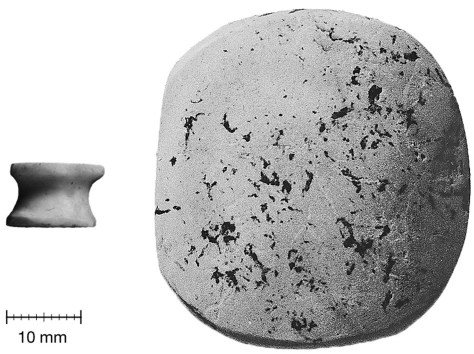



Fig. 4.16 Geometric objects: earplug and heavy disc

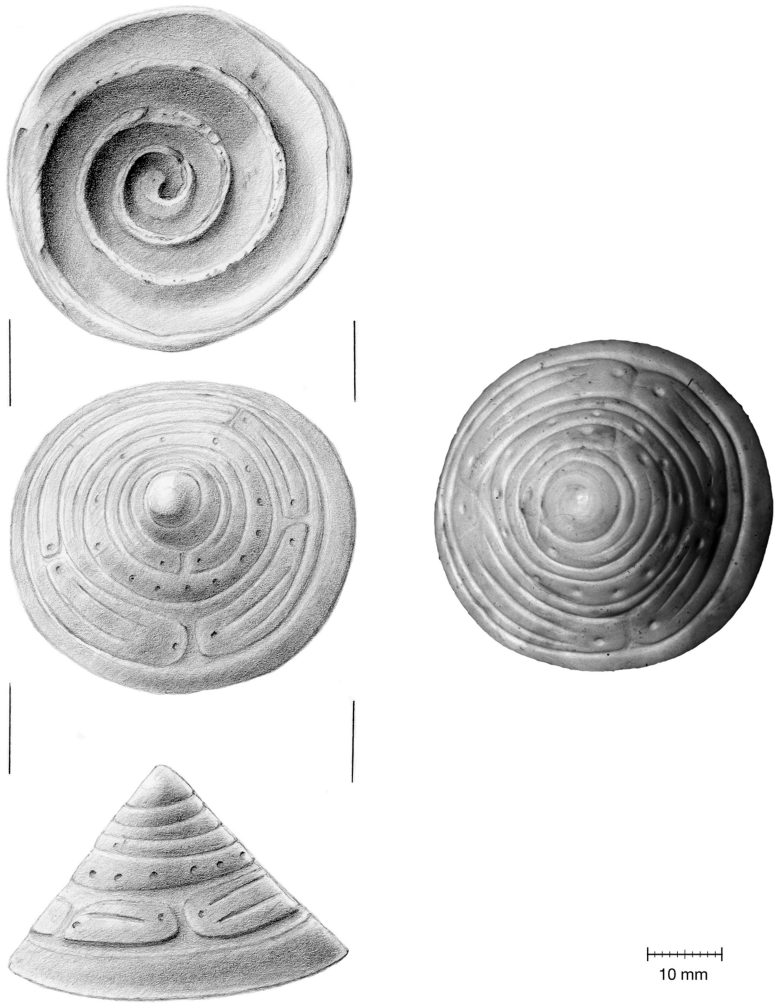



Fig. 4.17 Geometric objects: conical shaped object

### 4.2.2 Tools

#### 4.2.2.1 Bivalve shells

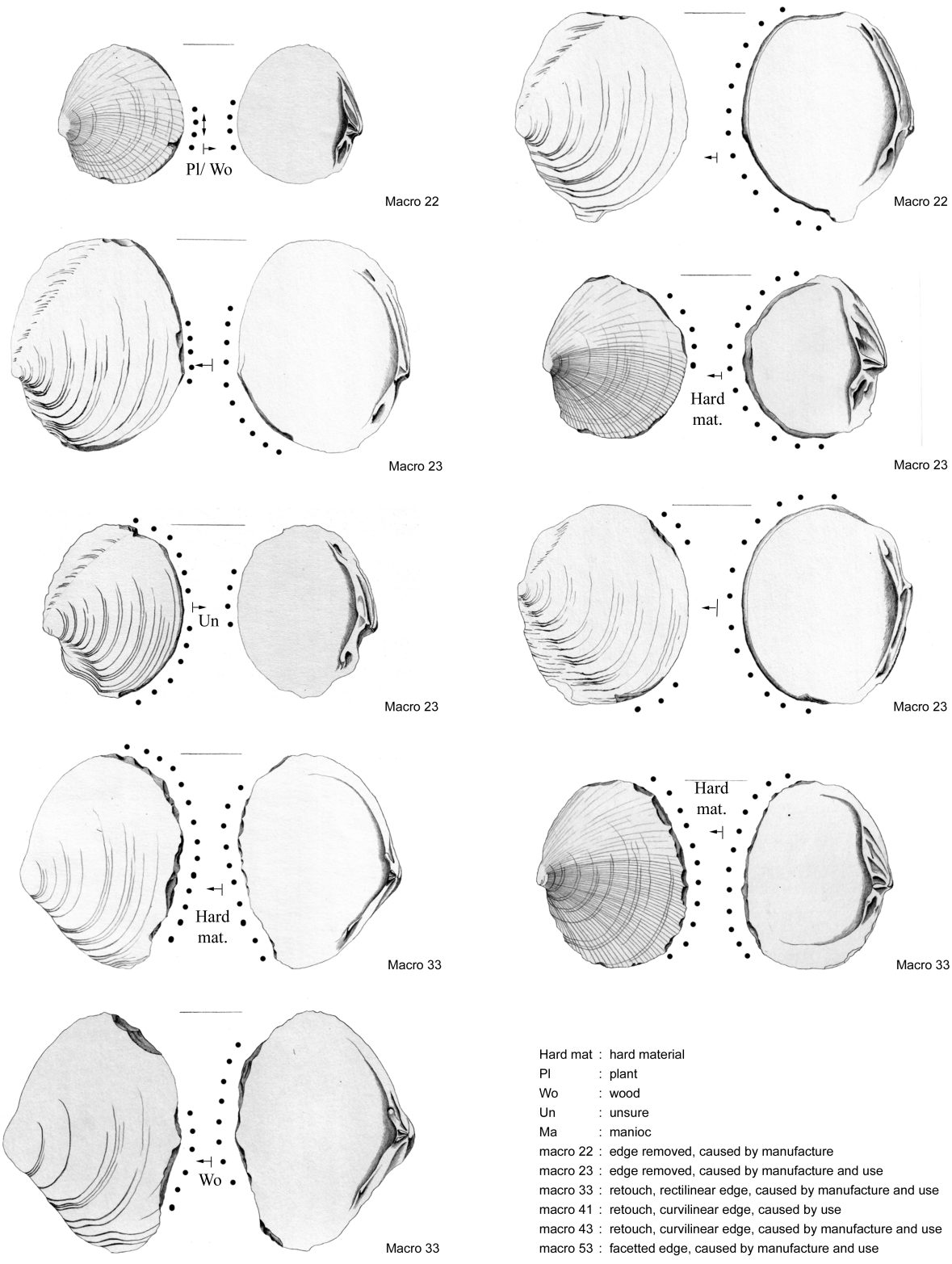
Unmodified bivalve shells occur in several sites throughout the Caribbean. Many researchers acknowledge they were most probably used as tools. The relative small number of bivalve shells (n=180) in the total of shell remains in Anse à la Gourde suggest that these molluscs were primarily gathered as tools and not as a food resource. This is underlined by the presence of natural boreholes in some of the bivalve shells, showing that they were collected after death. Other bivalve shells have man-made perforations (n=9). Eight of these display no traces of use. Although they were initially treated as tools, they are now categorised as pendants (n=8) and will be discussed there. The majority of these pendants (n=6) belong to other species than the bivalve shells interpreted as tools (Spisula sp. and an unidentified species). The undecorated sweet water bivalve shells are also not considered as tools, because they are assumed to be too fragile to be used. The remaining 162 bivalve shells belong to six different species: *Arcopagia fausta*, *Codakia orbicularis*, *Laevicardium sp.*, *Lima scabra*, *Lucina pectinata* and *Tellina radiata*. Apart from *Tellina radiata*, these species have a more or less comparable shape, with a round robust edge and a relatively flat outer surface. Both the macro-traces as well as the microscopic usewear traces were studied to interpret their function.

Artefacts which show many secondary modifications are not normally included in the sample for usewear analysis, but in this case all bivalve shells were included, although not all of them were in such a condition that the polish could be studied. This resulted in a relatively high number of pieces 'without traces' and pieces labelled as 'not interpretable'. Only a small number of the bivalve shells seemed however to be damaged on a macroscopic level. Edge-damage and intentional retouch could therefore be interpreted for most bivalve shells, even though the polish could not always be interpreted.

Five tool types could be distinguished among the bivalve shells on the basis of the macroscopic usewear analysis (Table 4.4) (Fig. 4.18-4.20). The first type (1) is the unmodified valve, displaying no macroscopic traces of use (n=25). The second type (2) is a bivalve shell of which the entire rim is removed in one blow, which leaves a sharp edge to be used for various purposes. They either display no traces (n=11) or heavy edge rounding (n=14). The third type (3) displays a heavily retouched rectilinear edge, which is straight along location 0311 (see Ch. 2). In most cases this is interpreted as the result of intensive use and re-sharpening by retouch (n=14). The fourth type (4) is again heavily retouched, either along the entire edge or rather located on location 0509 (see Ch. 2). These bivalve shells still display their original shape with a curvilinear edge. Of 28 implements this damage is so irregularly distributed that it is interpreted as the result of use. Most bivalve shells in this category were interpreted as displaying both intentional as well as use-retouch (n=52). The fifth type (5) displays a facetted edge. This might be a sub-type of the second type (but not of type 3 or 4), of which the edge was first completely removed and then worn down further into this specific shape by use. The heavily abraded edges of the implements in this fifth category are however distinctly different from the merely rounded edges of the second type.

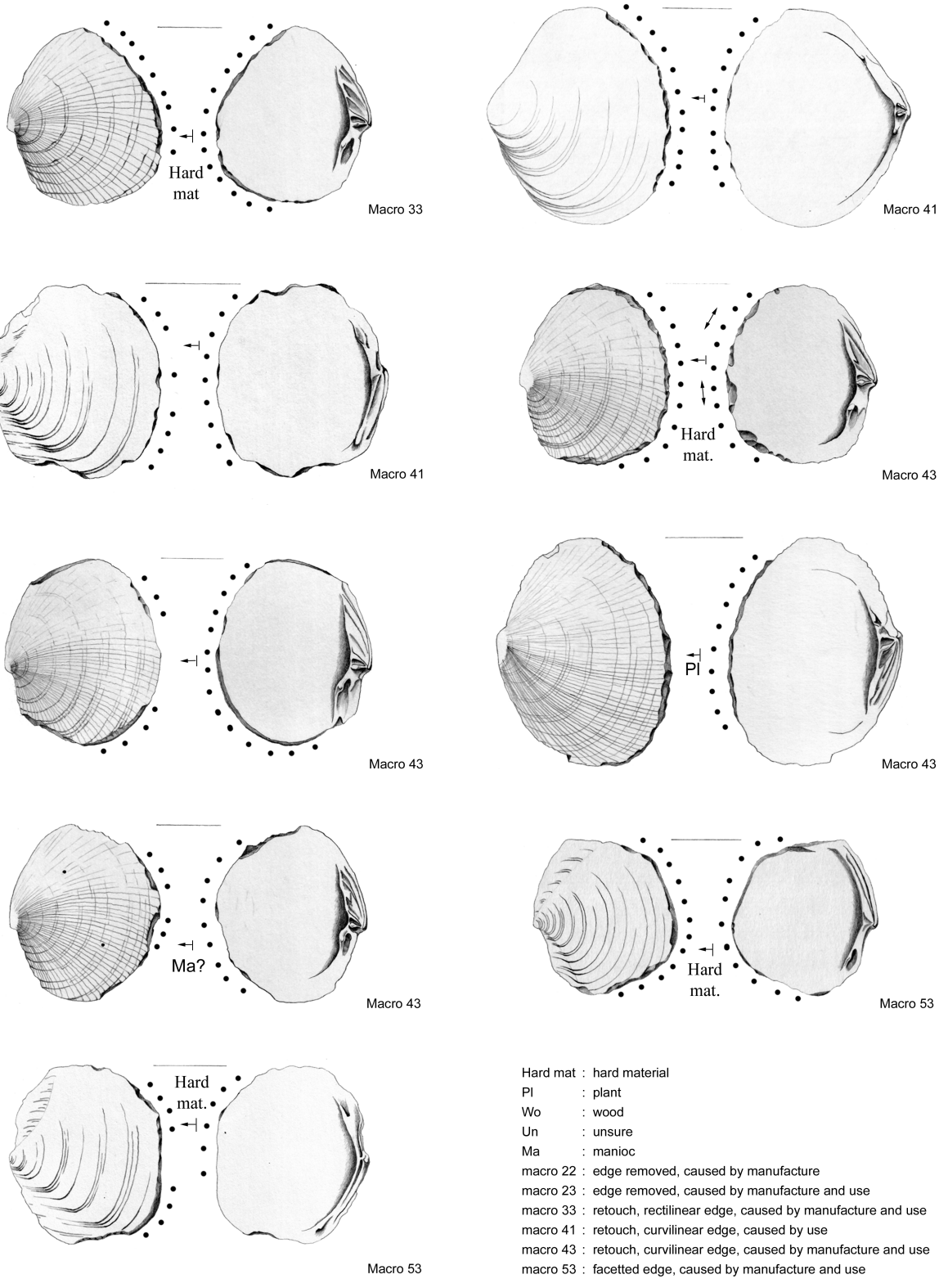
| appearance | Cause | *Arcopagia fausta* | *Codakia orbicularis* | *Laevicardium sp.* | *Lima scabra* | *Lucina pectinata* | *Tellina radiata* | indet. | total |
|---|---|---|---|---|---|---|---|---|---|
| not modified | | 1 | 16 | 1 | - | - | 1 | 6 | 25 |
| edge removed | manufacture | 1 | 8 | - | - | 2 | - | - | 11 |
| | manufacture and use | - | 6 | - | - | 8 | - | - | 14 |
| retouch, rectilinear | use | - | 2 | - | - | - | - | - | 2 |
| | manufacture and use | 4 | 10 | - | - | - | - | - | 14 |
| retouch, curvilinear | use | 4 | 4 | - | 1 | 4 | 15 | - | 28 |
| | manufacture | - | 1 | - | - | 1 | - | - | 2 |
| | manufacture and use | 3 | 32 | - | - | 17 | - | - | 52 |
| | uncertain | - | - | - | - | 1 | - | - | 1 |
| facetted edge | manufacture and use | - | 2 | - | - | 7 | - | - | 9 |
| uncertain | | - | 2 | - | - | 1 | - | 1 | 4 |
| total | | 13 | 83 | 1 | 1 | 41 | 16 | 7 | 162 |

Table 4.4 Shell, macrowear types versus shell species, number of bivalve shells




Hard mat : hard material
Pl : plant
Wo : wood
Un : unsure
Ma : manioc
macro 22 : edge removed, caused by manufacture
macro 23 : edge removed, caused by manufacture and use
macro 33 : retouch, rectilinear edge, caused by manufacture and use
macro 41 : retouch, curvilinear edge, caused by use
macro 43 : retouch, curvilinear edge, caused by manufacture and use
macro 53 : facetted edge, caused by manufacture and use

Fig. 4.18 Used bivalve shells, drawings scale 1:2




Hard mat : hard material
Pl : plant
Wo : wood
Un : unsure
Ma : manioc
macro 22 : edge removed, caused by manufacture
macro 23 : edge removed, caused by manufacture and use
macro 33 : retouch, rectilinear edge, caused by manufacture and use
macro 41 : retouch, curvilinear edge, caused by use
macro 43 : retouch, curvilinear edge, caused by manufacture and use
macro 53 : facetted edge, caused by manufacture and use

Fig. 4.19 Used bivalve shells, drawings scale 1:2

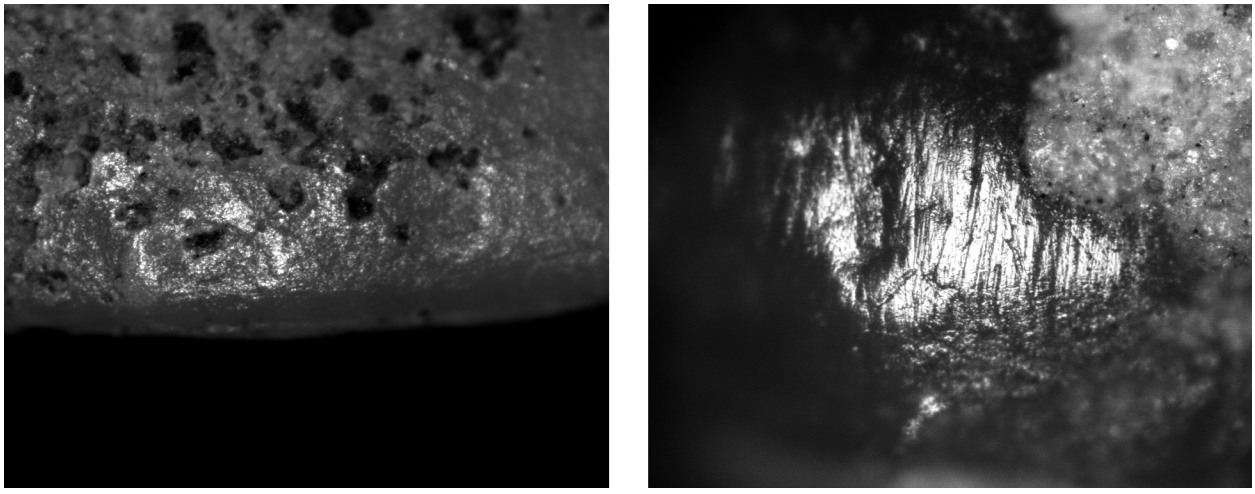


Fig. 4.20 a: Shell 167, scraping inside calabash, orig. magn. 100x b: Shell 132, scraping sil. plant, orig magn. 200x

The microscopic traces (Table 4.5 and 4.6) show that most bivalve shells have been used in a transverse motion, which could be inferred from both the location of the use-retouch as well as the directionality in the polish. Use-retouch is always located on the exterior, while the polish occurs mainly on the edge itself and along its interior (angle of observation 45°). It can be concluded therefore, in combination with the distribution of traces along the edge, that most bivalve shells were used with the interior towards the body of the user while the motion was carried out towards the body as well. Scraping plant material and debarking wood are the most frequent activities inferred. No correlation between macro-traces and the worked material, as inferred by macrowear could be detected. This means that the use and preparation of the bivalve shells was not standardized. The experiments have demonstrated that there is a variety in edge damage on the macroscopic scale, depending on for example the type and shape of worked wood and the exact location of the edge location used. The results of the use wear analysis of the archaeological tools demonstrate the users had their individual preferences concerning intentional retouch, probably an ad hoc decision made during the work.

| Motion | *Arcopagia fausta* | *Codakia orbicularis* | *Laevicardium sp.* | *Lima scabra* | *Lucina pectinata* | *Tellina radiata* | indet. | total |
|---|---|---|---|---|---|---|---|---|
| not interpretable | 2 | 27 | - | 1 | 5 | 3 | 6 | 44 |
| longitudinal | 1 | 2 | - | - | - | 8 | - | 11 |
| longitudinal/ transverse | - | 2 | - | - | 2 | 3 | - | 7 |
| transverse | 9 | 49 | - | - | 30 | 2 | 1 | 91 |
| transverse/diagonal | 1 | - | - | - | 1 | - | - | 2 |
| display | - | - | 1 | - | - | - | - | 1 |
| uncertain | - | 3 | - | - | 3 | - | - | 6 |
| total | 13 | 83 | 1 | 1 | 41 | 16 | 7 | 162 |

Table 4.6 Shell, shell species versus motion, number of bivalve shells

| | | worked material | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| appearance | cause | plant, plant/ wood | wood | bone | hide | mineral | medium hard material | hard material | uncertain | not interpretable | total |
| not modified | | - | - | - | - | - | - | - | - | 25 | 25 |
| edge removed | manufacture | 1 | 1 | - | 1 | - | - | 2 | 2 | 4 | 11 |
| | manufacture and use | 1 | - | - | - | - | - | 1 | 5 | 7 | 14 |
| retouch, rectilinear | use | - | - | - | - | - | - | - | 1 | 1 | 2 |
| | manufacture and use | 1 | 2 | - | - | - | - | 3 | 2 | 6 | 14 |
| retouch, curvilinear | use | - | - | - | 1 | - | 2 | 13 | 2 | 10 | 28 |
| | manufacture | - | - | - | - | - | - | - | - | 2 | 2 |
| | manufacture and use | 4 | 3 | 1 | - | 1 | - | 5 | 11 | 27 | 52 |
| | uncertain | - | - | - | - | - | - | - | - | 1 | 1 |
| facetted edge | manufacture and use | - | 1 | - | - | - | - | 2 | 3 | 3 | 9 |
| uncertain | | - | 1 | - | - | - | - | 1 | 1 | 1 | 4 |
| total | | 7 | 8 | 1 | 2 | 1 | 2 | 27 | 27 | 87 | 162 |

Table 4.5 Shell, macro-traces versus worked material, number of bivalve shells

The majority of the *Tellina radiata* implements (n=16) (Fig. 4.21-4.22) were used as knives (11/16) in a longitudinal motion on medium hard to hard material (Table 4.6). The implements show retouches both on the exterior as well as on the interior. The secondary modifications on the surface however hampered the study

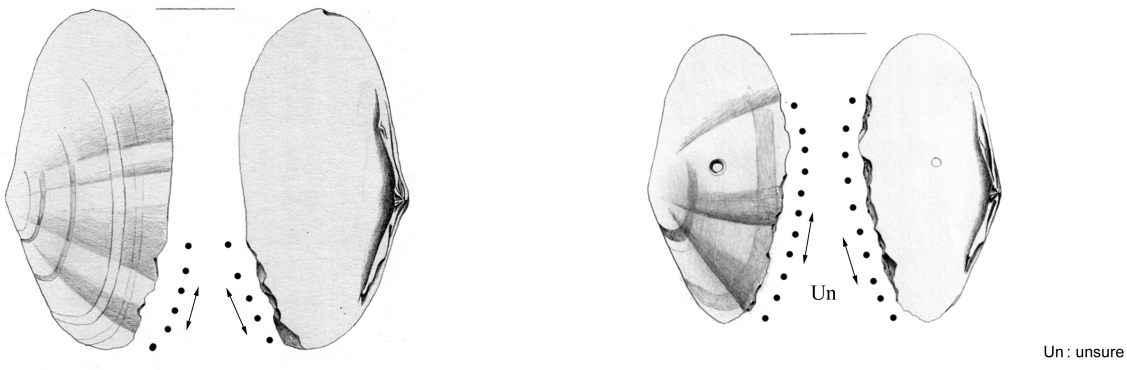



Fig. 4.21 Used *Tellina radiata* shells, drawings scale 1:2

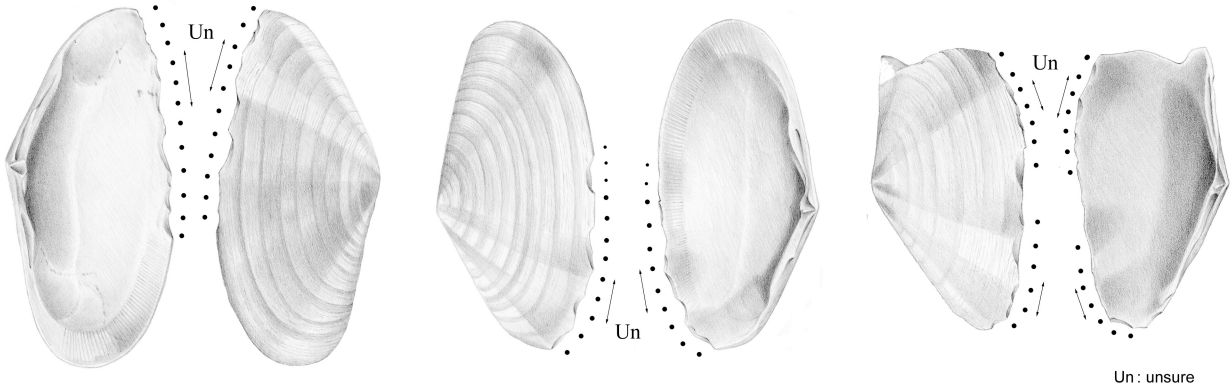



Fig. 4.22 Used *Tellina radiata* shells, drawings scale 1:2

of polish, because this shell species is relatively fragile compared to the other bivalve species. The worked material could therefore only be interpreted as a relatively hard material. Activities could be cutting branches, for which this shell type would be just strong enough, as experiments have demonstrated. The majority are left valves (n=11) displaying traces at location 0607, indicating they were held in the right hand. Three pieces display longitudinal traces along the whole edge. The shape of the edge suggests that the implement was used in two ways (with location 0607 and 0708, turning the tool upside down). Two were certainly collected empty, because they show natural perforations. Two have man-made perforations – one of them displays traces of use as a knife along the whole edge. Four bivalve shells of *Tellina radiata* were found in burial contexts (three in F350, one in F454).

| worked material | *Arcopagia fausta* | *Codakia orbicularis* | *Laevicardium sp.* | *Lima scabra* | *Lucina pectinata* | *Tellina radiata* | indet. | total |
|---|---|---|---|---|---|---|---|---|
| plant | 1 | 1 | - | - | 1 | - | - | 3 |
| manioc | - | 2 | - | - | - | - | - | 2 |
| siliceous plant | - | 1 | - | - | - | - | - | 1 |
| wood | 1 | 4 | - | - | 1 | - | - | 6 |
| calabash | - | 2 | - | - | 1 | - | - | 3 |
| bone | - | - | - | - | 1 | - | - | 1 |
| hide (+min?) | - | 2 | - | - | - | - | - | 2 |
| mineral | - | 1 | - | - | - | - | - | 1 |
| medium hard material | - | - | - | - | - | 2 | - | 2 |
| hard material | 5 | 8 | - | - | 4 | 10 | | 27 |
| uncertain | 3 | 33 | - | - | 24 | 1 | 1 | 62 |
| no traces/ not interpret. | 3 | 29 | 1 | 1 | 9 | 3 | 6 | 52 |
| Total | 13 | 83 | 1 | 1 | 41 | 16 | 7 | 162 |

Table 4.7 Shell, shell species versus worked material, number of bivalve shells

One single example of *Laevicardium sp.* was found. The implement does not display any edge damage, but it looks like it has been procured or carried around, with a high gloss all over the protruding edges. The gloss or polish is not comparable to the dull polish water-worn artefacts display. Since no experiments were conducted with this species or in the field of procurement, no interpretation can be given. The one specimen of *Lima scabra* was too damaged to allow a functional inference.

#### 4.2.2.2 Celts (Fig. 4.23)

*Production process*

The largest category of tools are the celts. 'Lips' or 'wings' of conch (*Strombus gigas*) in different states of finish are found on many pre-Columbian sites and are described in the literature as 'celts', 'adzes', 'axes' and 'celt-hammers' (Cartwright *et al.* 1991, 101; Van der Steen 1992, 101). 'Celts' is used in a more general way, without referring to the way of use or implying whether the tool was hafted or not. Traditionally axes and adzes differ in form and way of hafting: axe blades are symmetrical and hafted with the edge in line with the handle; adze blades are asymmetrical in cross-section and hafted transverse to the handle. Celts can be made very casually, merely by sharpening the cutting edge and grinding the sides till the full shaping, according to a preconceived form, in which the original shape of the lip becomes completely invisible. The natural lip shows a twist around the long axis as well as a curve from top to base. For shell celts it is therefore not always obvious whether a symmetrical or asymmetrical shape was intended. Modification of most celts is restricted to a sharpened cutting edge and ground sides, while the natural shape of the lip remained unchanged. Some

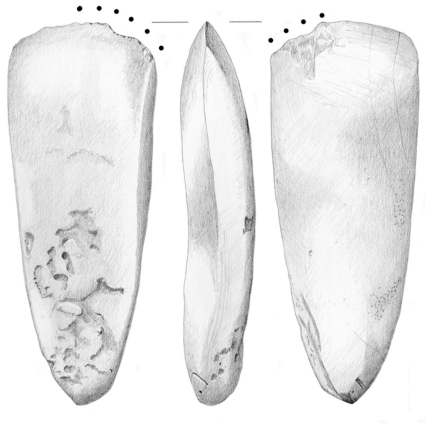
Fig. 4.23 Celts, scale 1:2

researchers consider these examples as half products (Serrand 2002). It may be safe however to assume that these tools were considered as finished products by their users, in view of their large number and heavily damaged edges. It is possible that both axes and adzes were hafted in different ways or that they were used unhafted as wedges indicating the typological distinction to be irrelevant in terms of function.
All manufacturing stages appear to be present at Anse à la Gourde. The chaîne opératoire can be reconstructed as follows. First, the lip was separated from the shell by hitting the mollusc right under the apex. Then, the lip is knapped roughly into shape by retouching all around the edges. In the final stage the celt is polished or ground into shape including a sharp edge.
Most implements are of a 'shell-shaped' form, with a curvilinear edge which follows the natural axis of the shell-lip (Fig. 4.24-4.26). Nine implements are clearly shaped as adzes, 35 tools have a symmetrical edge and can be considered as axes. No formal tool types seem to exist (Table 4.8). The majority of the 'celts' that are completely polished into shape are symmetrical and should therefore be formally called axes (8/11). One of them has two cutting edges, which seems to be a unique piece.

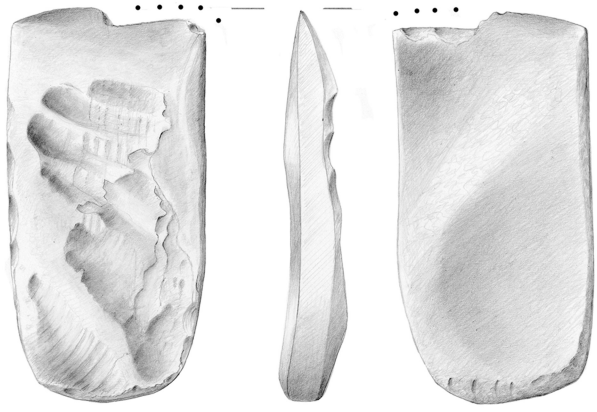
| profile | edge | rough lip | oval | oval/pointed | pointed | rectangular | rectangular flat | shell-shaped/ twisted | uncertain | total |
|---|---|---|---|---|---|---|---|---|---|---|
| none | | 27 | - | - | 2 | - | - | - | - | 29 |
| asymmetrical | curvilinear | - | 2 | - | 2 | - | - | 1 | - | 5 |
| asymmetrical | rectilinear, angular corners | - | - | - | 1 | - | - | - | - | 1 |
| asymmetrical | rectilinear, round corners | - | 1 | - | 1 | - | - | - | - | 2 |
| shell-shaped | curvilinear | 1 | 8 | - | 1 | 1 | - | 46 | - | 57 |
| shell-shaped | rectilinear, round corners | - | 1 | - | - | - | - | - | - | 1 |
| symmetrical | curvilinear | - | 6 | - | 7 | - | - | - | - | 13 |
| symmetrical | rectilinear, angular corners | - | 3 | 1 | 1 | 2 | 2 | - | - | 9 |
| symmetrical | rectilinear, round corners | - | 2 | 1 | 6 | 2 | - | - | 2 | 13 |
| total | | 28 | 23 | 2 | 21 | 5 | 2 | 47 | 2 | 130 |

Table 4.8 Shell, shape of edge versus shape of celt, number of celts

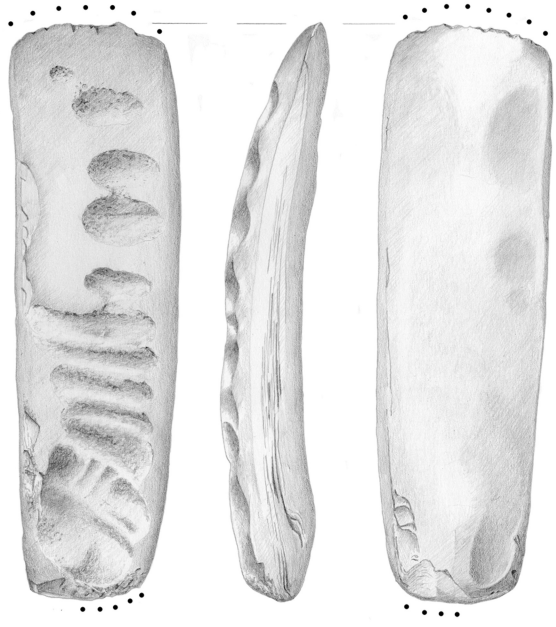
The finish varies considerably regarding both the extent and the degree of surface-modification. 'Ground' surfaces are still relatively rough, but are clearly modified by a grinding movement on a hard stone or coral implement. 'Polished' surfaces are created by grinding and polishing with the addition of sand and water to smoothen the surface. The part of the lip that is either ground or polished varies between not at all and completely (Table 4.9).



pointed
symmetrical profile
curvilinear edge
used as axe on fresh wood



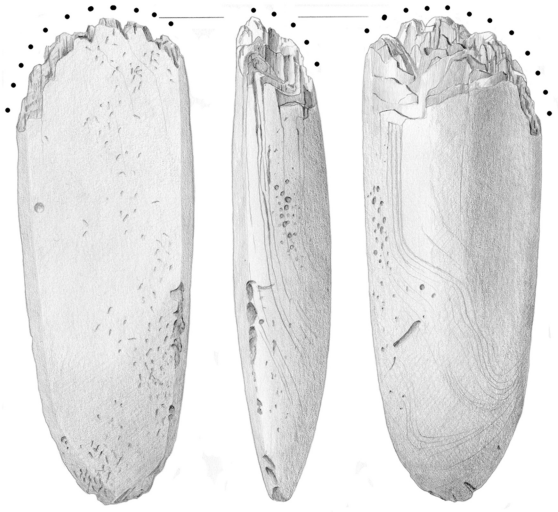
rectangular flat
symmetrical profile
rectilinear edge with angular corners
used as axe on fresh wood



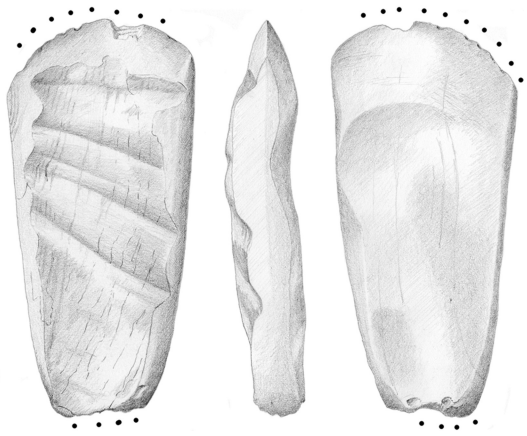
oval celt
shell shaped profile
rectilinear edge with round corners
used as wedge on fresh wood

pointed celt
asymmetrical profile
curvilinear edge with round corners
used as adze on burnt/fresh wood

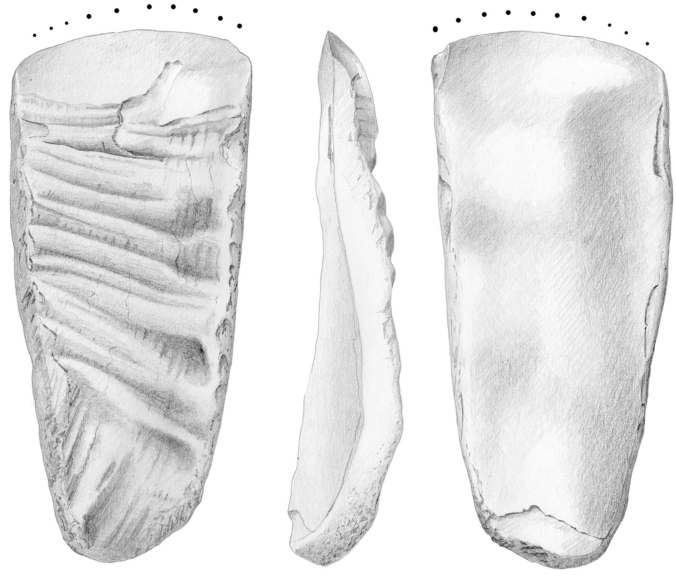
Fig. 4.24 Shell celts *Strombus Gigas*, drawings scale 1:2



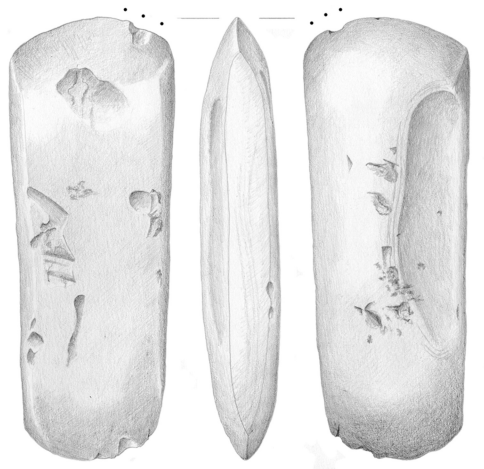
oval celt
asymmetrical profile
curvilinear edge
multiple use



pointed celt
symmetrical profile
curvilinear edge
multiple use as wedge/axe

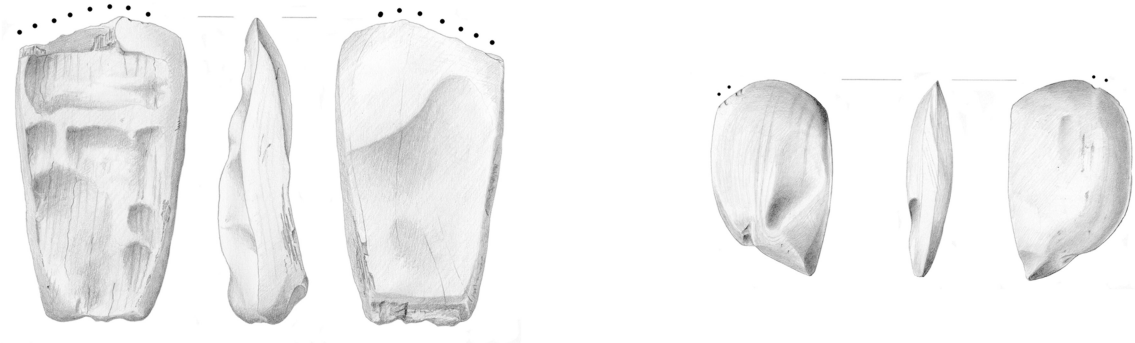


pointed celt
shell shaped profile
curvilinear edge
used as adze on burnt wood



two sided axe
almost completely polished
probably not used

Fig. 4.25 Shell celts *Strombus Gigas*, drawings scale 1:2



oval/pointed celt
symmetrical profile
rectilinear edge with round corners
used as axe on fresh wood

pointed celt
symmetrical profile
curvilinear edge
used?

Fig. 4.26 Shell celts *Strombus Gigas*, drawings scale 1:2

Celts that are completely polished into shape and do not display any part of the original surface (Type 11), are relatively rare (n=11). A larger number of implements is only partially ground and partially polished and display for instance the natural ridges of the lip (Type 8, 9 & 10). They are however distinctly brought into a celt-like shape and have manufacturing traces on all aspects of the surface. Ground sides make the celt more suitable for hafting as well as for hand-held activities. They are definitely also to be considered as finished implements. In the majority of cases (Type 4-8) only the edge of the celt is however ground or polished. The natural smoothness of the side of the lip is either left unmodified or only ground. The lips that display no modification, are roughly knapped or partially ground, and do not have a shaped edge are considered as unfinished celts.

| type of finish | not distinctive/ not present | asymmetrical | shell-shaped | symmetrical | total |
|---|---|---|---|---|---|
| none (unmodified lip) | 10 | - | - | - | 10 |
| roughly knapped | 14 | - | 32 | - | 46 |
| partially ground | 3 | 1 | 16 | - | 20 |
| edge ground | - | - | 1 | - | 1 |
| edge polished | - | - | 1 | 1 | 2 |
| edge and medial part ground | - | 2 | 1 | 5 | 8 |
| edge and medial part polished | - | - | 3 | 4 | 7 |
| totally ground | - | 1 | 3 | - | 4 |
| partially polished and rest ground | 1 | 2 | 1 | 1 | 5 |
| totally ground/almost completely polished | - | - | - | 16 | 16 |
| completely polished | 1 | 2 | | 8 | 11 |
| total | 29 | 8 | 58 | 35 | 130 |

Table 4.9 Shell, type of finish celts versus symmetry of edge, number of celts

*Usewear analysis*

Of the 130 celts, 81 were studied for microscopic traces of wear. Five of the 'roughly-knapped lips' were included in the sample. The ten unmodified rough lips, probably intended for the production of celts, were not included (Fig. 4.37)

The results show that there is no relationship between the symmetry of the edge and the inferred way of use. A small number of symmetrical edges (n=5, 15 %) display more traces of wear on the dorsal side, indicating that these tools were hafted as adzes. One of three asymmetrical edges displayed similar traces on the ventral and the dorsal side, indicating the tool was used as an axe. Both table 4.10 as well as table 4.11 display therefore a distinction in types based on the distribution of the polish and the appearance of wear traces and not on formal typological differences.

None of the artefacts display hafting traces or remains of hafting-residues. It is difficult to explain the absence of resins or wax, because on the water-worn pebbles residue of resin or wax was indeed found (see Ch. 4.4). The use of a glue-like substance is however not explicitly necessary, as was demonstrated in the experiments. If the celt is hafted properly in the shaft, it will not fall out because each blow makes the hafting more secure. If non-inclusion hafting is applied (Chapter 3), ropes of plant fibres would suffice, as the experiments have demonstrated. The use of resin or wax to keep the ropes together would not necessarily leave residue on the celt itself. Traces of friction between the haft and the implement were studied intensively for flint tools (Rots 2002, 2004). Her studies show that hafting traces can be distinguished, but she claims that they are often overlooked. It is highly likely that hafting traces were not recognized on the shell celts, because they would occur in the most problematic zone where manufacturing traces and the natural surface are both visible. Eight celts are broken over the short middle axis. This is a well-known fracture, known to occur on hafted stone axes when too much force is put on the implement in one blow. The celt breaks just before or in the haft.

The celts that are completely polished into shape seem to display few or hardly any traces of wear. They might have functioned in a more symbolic way. In particular, it is celts that are only partially polished or ground which display wear traces and are heavily used. Many celts display traces from contact with wood, either fresh (n=15, or burned (n=10). The function of these celts is clearly not limited to burnt wood, as is sometimes suggested (Boomert 2000). The majority display traces that cannot be further interpreted. This mainly concerns shell-shaped, twisted celts. Many of them display traces of battering on the proximal end of the celt. They are for that reason tentatively interpreted as wedges. It cannot be excluded that they were also used as hafted implements. When wood has to be cut away from the inside of a canoe, an axe can be used as a wedge. It is then beaten into the wood by hitting on the but to split the wood to be removed.

Fig. 4.27a Shell 2011, celt (see fig. 4.25 bottom right) displaying no traces but result of polishing

Fig. 4.27b Shell 3079, cutting felling fresh wood

| use interpretation | asymmetrical | shell-shaped | symmetrical | total |
|---|---|---|---|---|
| adze | - | 1 | 5 | 6 |
| axe | 1 | 4 | 14 | 19 |
| axe (two sided) | - | - | 1 | 1 |
| axe/adze | - | 1 | 2 | 3 |
| axe/wedge | - | 1 | - | 1 |
| wedge | - | 19 | - | 19 |
| chisel | - | - | 1 | 1 |
| possibly used | - | 4 | 1 | 5 |
| secondary use | - | - | 1 | 1 |
| no traces | 2 | 15 | 8 | 25 |
| total | 3 | 45 | 33 | 81 |

Table 4.10 Shell, interpretation of use versus symmetry of edge, number of celts

The celt should be considered a multifunctional implement, used frequently and intensively. The effort that has to be put into the production of both a celt and a haft is considerable, making it a valuable and curated tool. This is corroborated by the heavy edge-damage indicating that different raw materials were worked. These celts may have had a function comparable to the adzes used in Irian Jaya (Pétrequin and Pétrequin 2000). There, the adze is used to cut branches, clear the land or a pathway as well as to slaughter animals. We may assume that the functionality of this implement at Anse à la Gourde was not limited to the clearing of the land, the felling of trees and the building of canoes, but extended to the slaughter of big sea mammals and fishes. The bones of these animals were indeed found and it is unlikely that these animals were taken apart with bivalve shells or flint flakes.

| use interpretation | uncertain (mixture of polishes) | burned wood | fresh wood | total |
|---|---|---|---|---|
| adze | 2 | 4 | - | 6 |
| axe | 2 | 5 | 12 | 19 |
| axe (two sided) | 1 | - | - | 1 |
| axe/adze | 1 | 1 | 1 | 3 |
| axe/wedge | 1 | - | - | 1 |
| wedge | 19 | - | - | 19 |
| chisel | - | - | 1 | 1 |
| not worked | 10 | - | - | 10 |
| possibly used | 5 | - | - | 5 |
| secondary use | 1 | - | - | 1 |
| no traces | 15 | - | - | 15 |
| Total | 57 | 10 | 14 | 81 |

Table 4.11 Shell, interpretation of use versus worked material, number of celts

Fig. 4.28 Fishhooks

4.2.2.3 Other tools

*Fishhooks*

Nine fishhooks were recovered, all made of *Cittarium pica* (Fig. 4.38) This shell type is relatively sturdy and is covered with mother-of-pearl. The reflective surface attracts fishes. Two types can be distinguished: one with a round hook and of a relatively large size (average 40 x 19 mm) (n=2), one smaller with a pointed hook (average 21 x 6 mm) (n=7). All are highly polished into shape and show cut marks from flint in the inner curve of the hook. Six were found in features, one of these in association with burial 332. The total number is relatively small, indicating that other ways of fishing must have been more common.

A very intriguing object (Shell 8013) is a hook on top of a square with four perforations, made of *Strombus gigas*. It might be interpreted as a fish lure (Fig. 4.29). A similar object was found on Barbados (Cartwright *et al.* 1991). Two are known from Cariacou (Sutty 2001/2002). One is also displayed in the Museum Edgar Clerc, (Moule, Guadeloupe), but no other examples are known to me. The artefact is in a bad condition for usewear analysis but it is clear that much abrasion took place along one of the long sides of the square.

*Gauges and spoons*

Three pieces of *Strombus gigas* are roughly rectangular in form, and range in length between 63 and 72 mm and between 23 and 33 mm in width (Fig. 4.30). One was found in association with feature 510. Very similar objects are interpreted in Florida as so-called gauges or measures to be used in the production of fishing nets

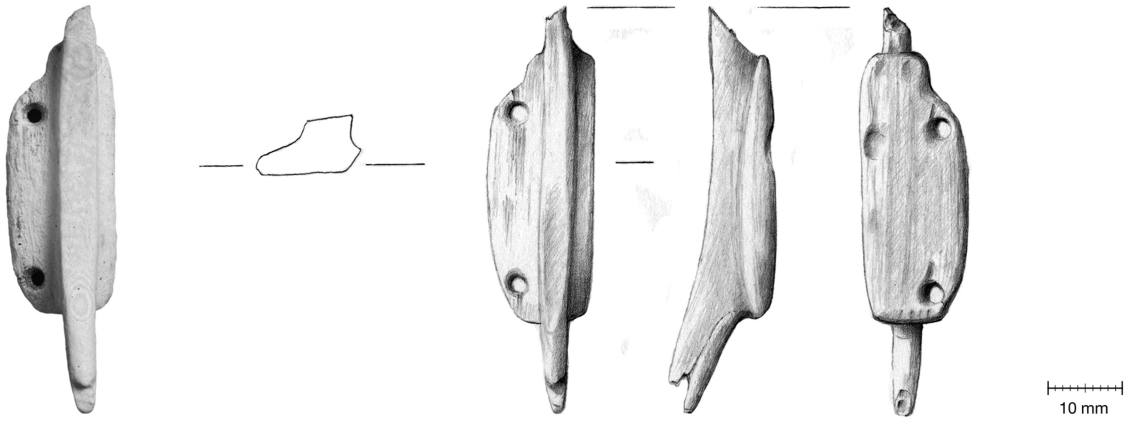



Fig. 4.29 Fishhook?

(Marquardt 1992), which to my opinion is a likely interpretation.[1] Similar pieces are described by Serrand for Tanki Flip as small plates, possibly used as burnishing tools. Linville (2004) describes comparable rectangular shaped artefacts for Aruba. Linville states that the highly symmetrical shape and finished form suggest that they are not simple tools. Gauges should however not be considered as simple tools, but as tools that have a relatively long use and are at least kept for the duration of the time it takes to make a fishing net. Furthermore, their functionality improves with an increasing smoothness of the edges (pers. comm. fisherman, Exloo 2005). It is difficult to see whether the edge-rounding of these implements results from manufacturing or from use scraping/burnishing. The traces they display do not fit traces on the experimental bivalve shells used on leather-hard clay. They merely display polish on the protruding ridges, similar to the experimentally recreated polished surfaces of beads and celts. They should therefore be interpreted as manufacturing traces.
The gauges are not to be mistaken for the so-called spoons of *Talparia zebra*, which are much more curved (Jansen 1999; Van der Steen 1992; Serrand 2002). Although the gauges display a natural curved back, the overall appearance is too flat to compare them to these spoons. Only one example of a spoon (or scraper) was recovered at the site, although several unmodified complete and broken shells of *Talparia zebra* were found.

Fig. 4.30 Spoon (left) and measure, production waste

1 I studied these implements during a study trip at the Florida Museum for Natural History with the high power technique. They displayed a high gloss, without striations, which could be the result of frequent contact with plantfibres.

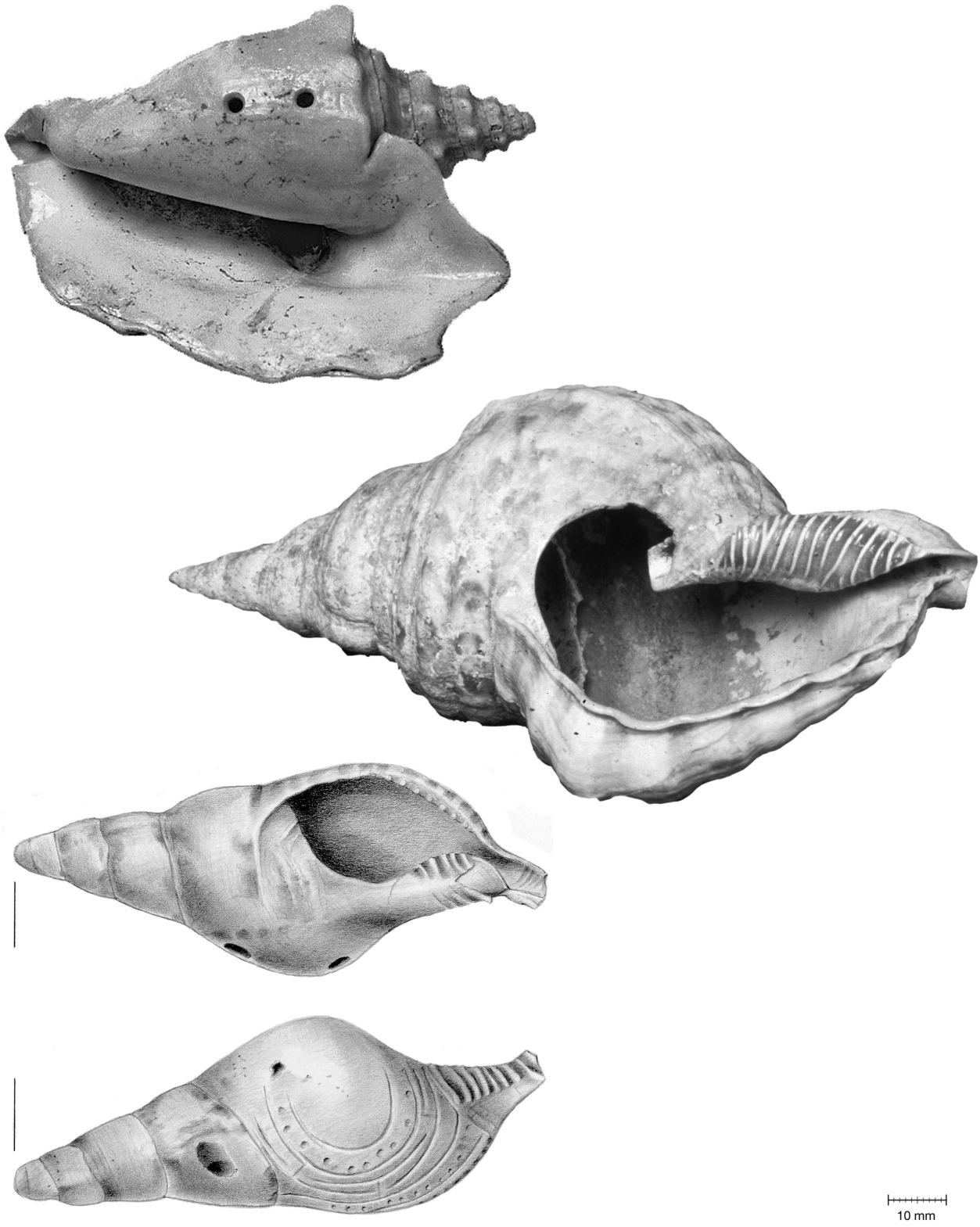



Fig. 4.31 Containers

*Containers*
Three vessels or containers of *Charonia variegata* were collected (Fig. 4.31). The molluscs were modified by removing part of the inner whorl and by roughly broadening the aperture (opening). Containers like this are quite common and were found on sites throughout the Lesser Antilles. A fourth specimen is made from *Pisania pusio*, is relatively small and is decorated with lines and indentations. It also has two perforations. This artefact might be interpreted as a cup, considering its size. A small cup with two perforations from a *Strombus* juvenile was found as well. Three *Cittarium pica* gastropods might be argued to belong to this category. Their inner-whorl is not removed but they display one or two artificial perforations.
The perforations can be interpreted as perforations for strings, but it is also suggested that these vessels should be interpreted as snuff inhalers. The perforations would than be either used to sniff hallucinogenic drugs or tobacco. Boomert however argues that these vessels are especially suitable to contain liquids. According to him it is more likely that they were used with hollow reeds for pouring pepper- or tobacco juice into the nostrils (Boomert 2000, p. 480).

*Awls*
Two pieces of *Strombus gigas* are roughly shaped as tools resembling awls (Fig. 4.32). The points are polished and display a smooth gloss. They were probably used in basketry production. They appear to be made as expedient tools from *Strombus* tool production waste, displaying few similarities in shape other than functional attributes.

### 4.2.3 The distribution and context of shell artefacts
Implements made of shell were found throughout the site. It is remarkable that ornamental artefacts without damage were found in the shell midden, between the features as well as in the postholes and burials. Unfortunately, the most beautiful decorated pieces originate from a test unit excavated in the first year of which the cultural layers were only approximately recorded. From the horizontal distribution it may be concluded that these artefacts should be dated to the earliest phases of occupation. The ceramics have demonstrated that in that phase the site was located nearest to the present coastline and has most probably largely disappeared

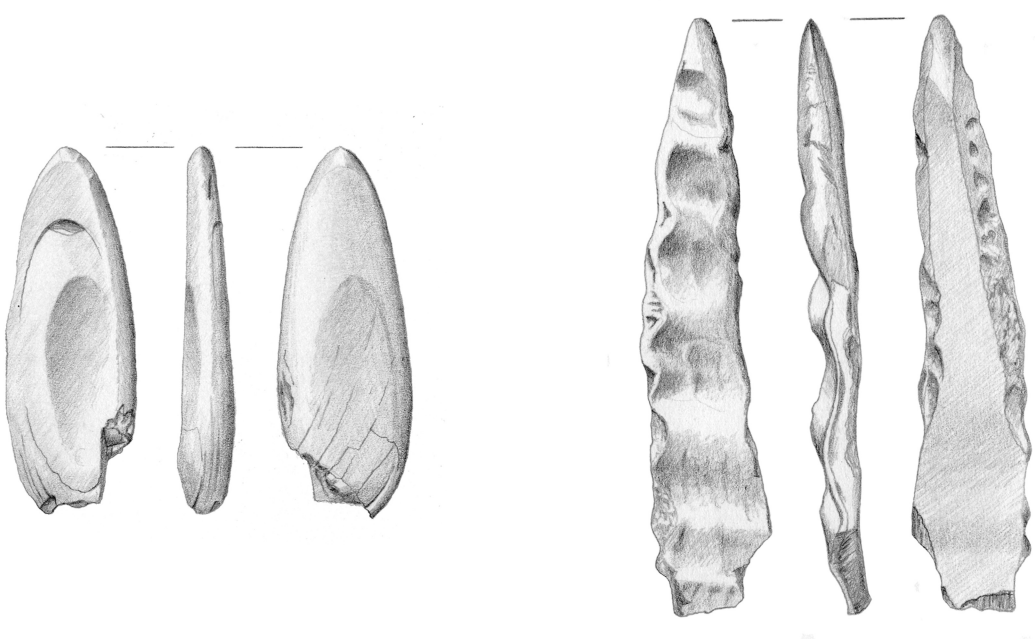


Fig. 4.32 Awls

into the sea (Delpuech 1999; Hofman *et al.* 2001; Pater and Teekens 2004). Some sectors held large numbers of *Chama sarda* fragments and beads in several stages of production. These might be interpreted as specific areas where bead production took place, although these fragments are not limited to these areas. The house structure reconstructed by Duin (1998) has *Chama sarda* fragments in all interpreted postholes. He therefore interprets this house as a bead-making house. The female burial with the *Strombus* hip belt is linked to this house, according to Duin, and she would therefore be the bead maker. In my opinion this is not very likely, because of the very clear difference in production process. It is moreover very difficult to link the burials to the reconstructed house structures, because of the specific vertical density of the different cultural layers and the density of the features. It is nonetheless remarkable that several burials contain shell artefacts.
There is not a specific, reoccuring combination of shell artefacts to be recognised. The 21 naturally formed pebble-shaped *Strombus* fragments were found in a female grave. Beads occur both in male as well as in female graves. Bivalve shells seem to be restricted to female graves. Considering the knowledge we have from ethno-historic contexts on the division of labour between the sexes this is to be expected, since the usewear traces found involve mainly female tasks. Remarkably, a fishhook was found in association with a female burial (F332) as well, although women were not likely involved in fishing. The interpretation of these findings should be regarded with caution because it remains uncertain whether these artefacts are burial gifts or not.

#### 4.2.4 Shell artefacts, a summary

Anse à la Gourde revealed a rich variety of shell beads, adornments and three-dimensional objects. Many of those are made from *Strombus sp.* and were shaped by grinding and polishing, using stone and coral grinding tools with the addition of sand and water. The shell tools are also diverse: celts (axes, adzes and wedges), bivalve shell-scrapers and knives, fishhooks, gauges and spoons were made of a limited range of shell species. These species can all be collected rather easily around the reefs. The usewear traces demonstrate that the celts were used intensively. Many (30 %) display traces of working wood, both burnt and fresh. They were hafted both as axes as well as adzes. Battering on the opposite side of the edge implicates that celts were also used as wedges. The majority of the celts studied (70%) display an uninterpretable type of polish, probably the result of multiple use. It is suggested that this may be the result of multiple usage, comparable to the modern use of a machete. The presence of shark and manatee bones in the excavation demonstrates that the former inhabitants were in need of sturdy tools to slaughter these animals. It is unlikely that this task was carried out with the aid of a bivalve shell or flint flake. These tools (bivalve shells and flint flakes) display traces predominantly from plant and wood working. Bivalve shells were mainly used in a scraping or transverse motion. One species (*Tellina radiata*) was used exclusively in a longitudinal cutting motion, most probably to cut plant. The number of bivalve artefacts is remarkable. Two hundred valves, of which some were clearly gathered after the death of the animal, indicate that these shells did not form an important part of the diet. More likely they were foremost considered as a raw material for tools.

### 4.3 Flint and stone artefacts

#### 4.3.1 Flint artefacts

A sample of 34 flint artefacts was selected out of 242 flint artefacts studied by Sebastiaan Knippenberg (2001; 2006), based on the presence of possible working edges (see Ch.2.5). These artefacts were found in test units in the periphery of the site and it was therefore decided to study an additional sample from the habitation area as well. All pieces displaying Possibly Used Areas and a fresh surface were selected (n= 77, approx. 30 %). In total 111 pieces of flint were studied for traces of wear, approximately 20% of the total number of flint artefacts (Fig. 4.33-4.36).
Of the studied implements, six turned out to be ‘not interpretable’, because of severe secondary modifications. Almost 46% (n=51) of the tools did not display traces. Five artefacts were used on two sides, 49 displayed

traces on one edge, resulting in 59 used edges. Most of the used edges display a degree of wear of a moderate intensity. The implements predominantly demonstrate traces of plant and wood working, specifically of siliceous plants. Six artefacts were interpreted as pieces used in a manioc grater board. They display traces of wear that resemble the experimentally replicated traces and have the required shape. Knippenberg (2006) argues that he could not detect pieces with adequate usewear, but since the traces are not visible under magnifications under 200x, this is not a surprise. The pieces that were used on shell display traces that can be interpreted as use in incision and decoration. A relatively large number of artefacts do not display traces. This however does not necessarily mean that a large number of flint tools were not used, as stated in Chapter 3. Soft plant working and the processing of meat and fish are easily missed.

| motion<br>material | long. | long./<br>transverse | long./<br>diagonal | transverse | transverse/<br>diagonal | transverse/<br>wedging | boring | diagonal | indet. | total |
|---|---|---|---|---|---|---|---|---|---|---|
| plant/wood | - | - | - | 1 | - | - | - | - | - | 1 |
| non siliceous plant | 2 | 1 | - | 1 | - | - | - | - | 1 | 5 |
| siliceous plant | 9 | 1 | 1 | 5 | - | - | - | 1 | 2 | 19 |
| manioc? | - | - | - | 2 | 1 | - | - | 2 | 1 | 6 |
| wood | 1 | - | - | 1 | - | 1 | - | - | 1 | 4 |
| hide | - | - | - | 1 | - | - | - | - | - | 1 |
| mineral | - | - | - |  | - | - | - | - | 1 | 1 |
| shell | 3 | - | - |  | - | - | 2 | - | - | 5 |
| soft animal material | - | - | - | 1 | - | - | - | - | - | 1 |
| medium hard vegetal material | - | - | - | 1 | - | - | - | - | - | 1 |
| uncertain | 4 |  |  | 3 |  |  |  |  | 8 | 15 |
| total | 19 | 2 | 1 | 16 | 1 | 1 | 2 | 3 | 14 | 59 |

Table 4.12 Flint, worked material versus motion, number of used edges

Regarding the applied motions it should be noticed that a comparable number of tools were used in a longitudinal and transversal motion. It is therefore not possible to argue that flint was exclusively used for cutting while bivalve shells were used for scraping. Flint tools were apparently used for activities that could also have been carried out with bivalve shells. Flint was therefore not considered to be such a valuable raw material that it should be reserved for tasks that really needed the sharpness and strength of flint.

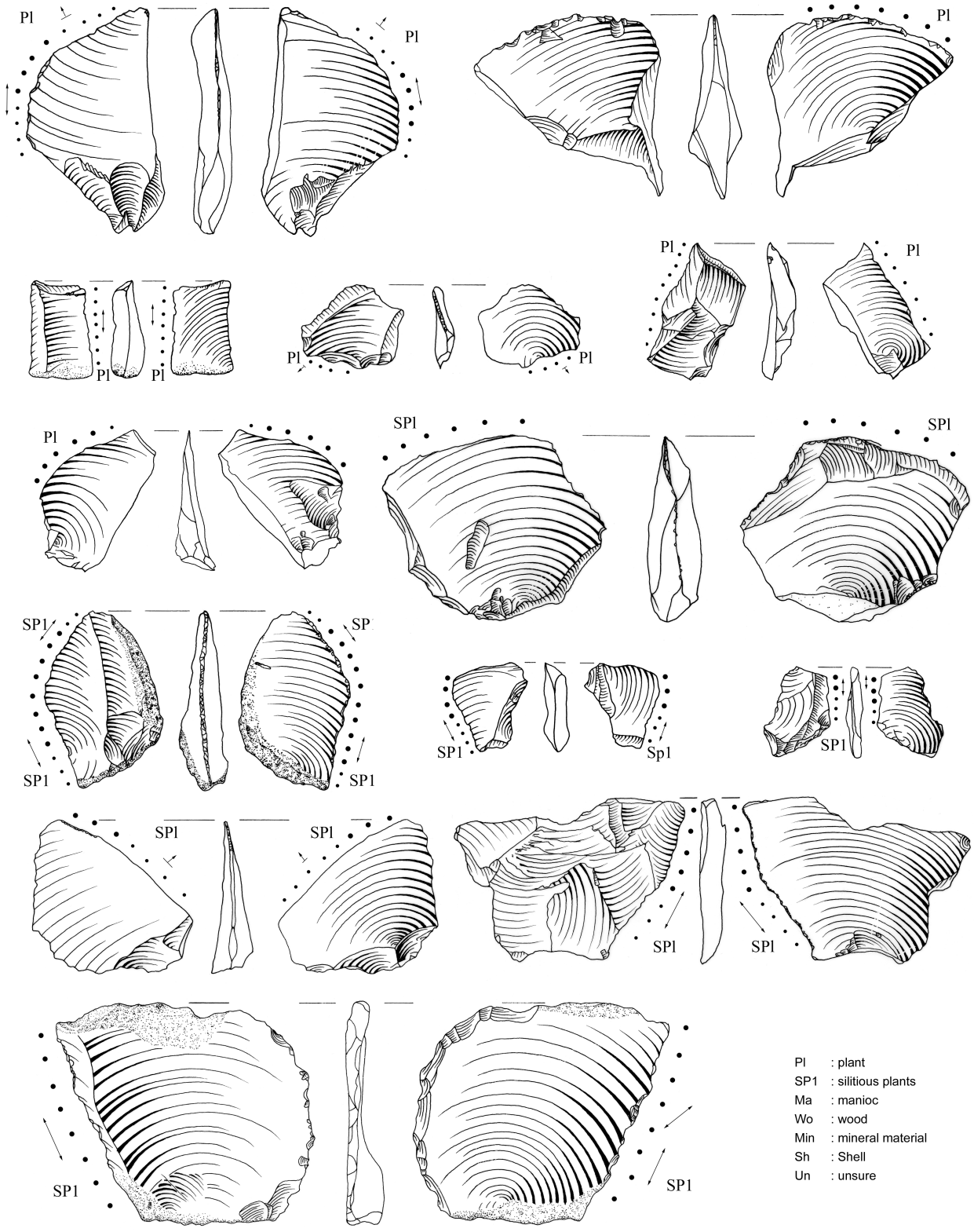



Fig. 4.33 Flint tools, usewear traces depicted in drawings, drawings scale 1:1

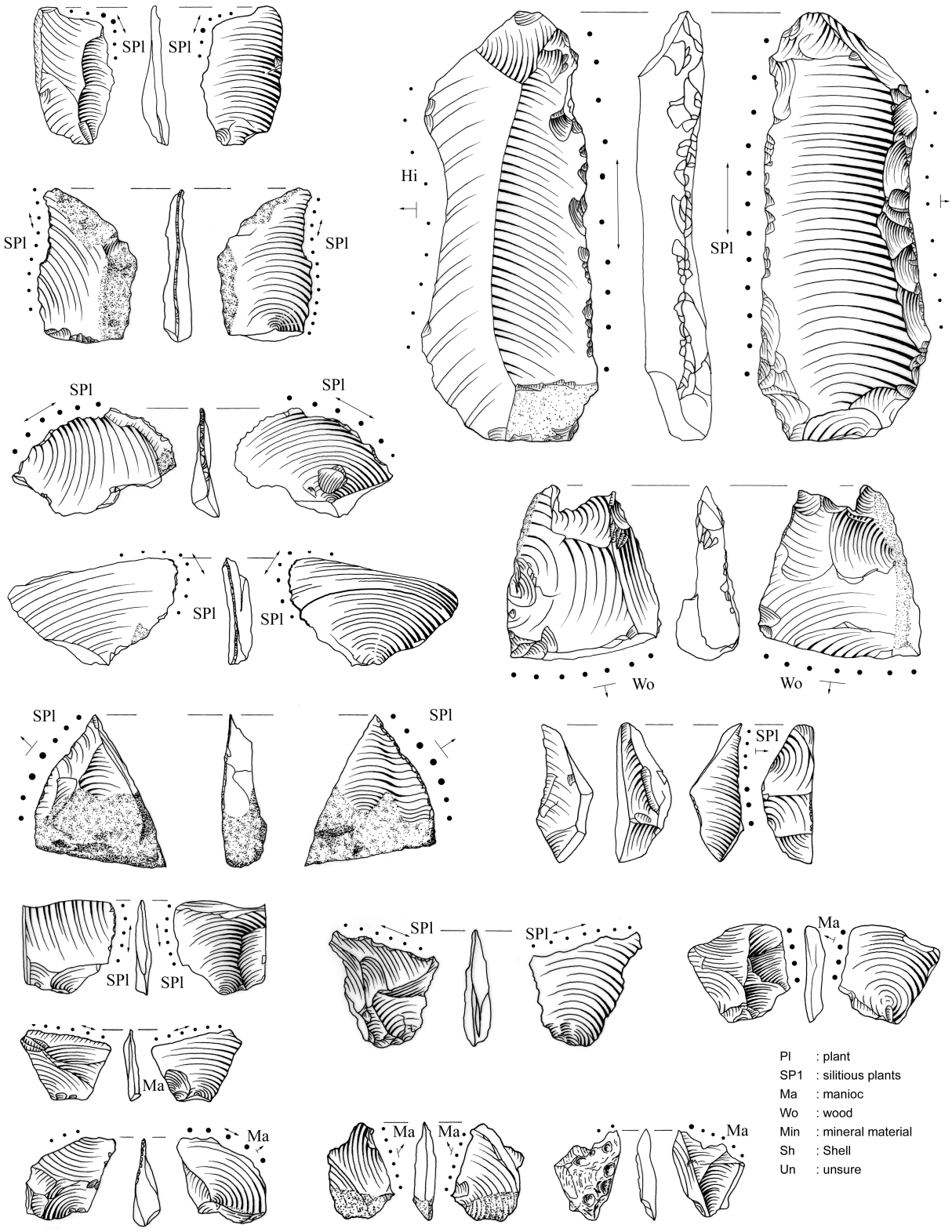



Fig. 4.34 Flint tools, usewear traces depicted in drawings, drawings scale 1:1

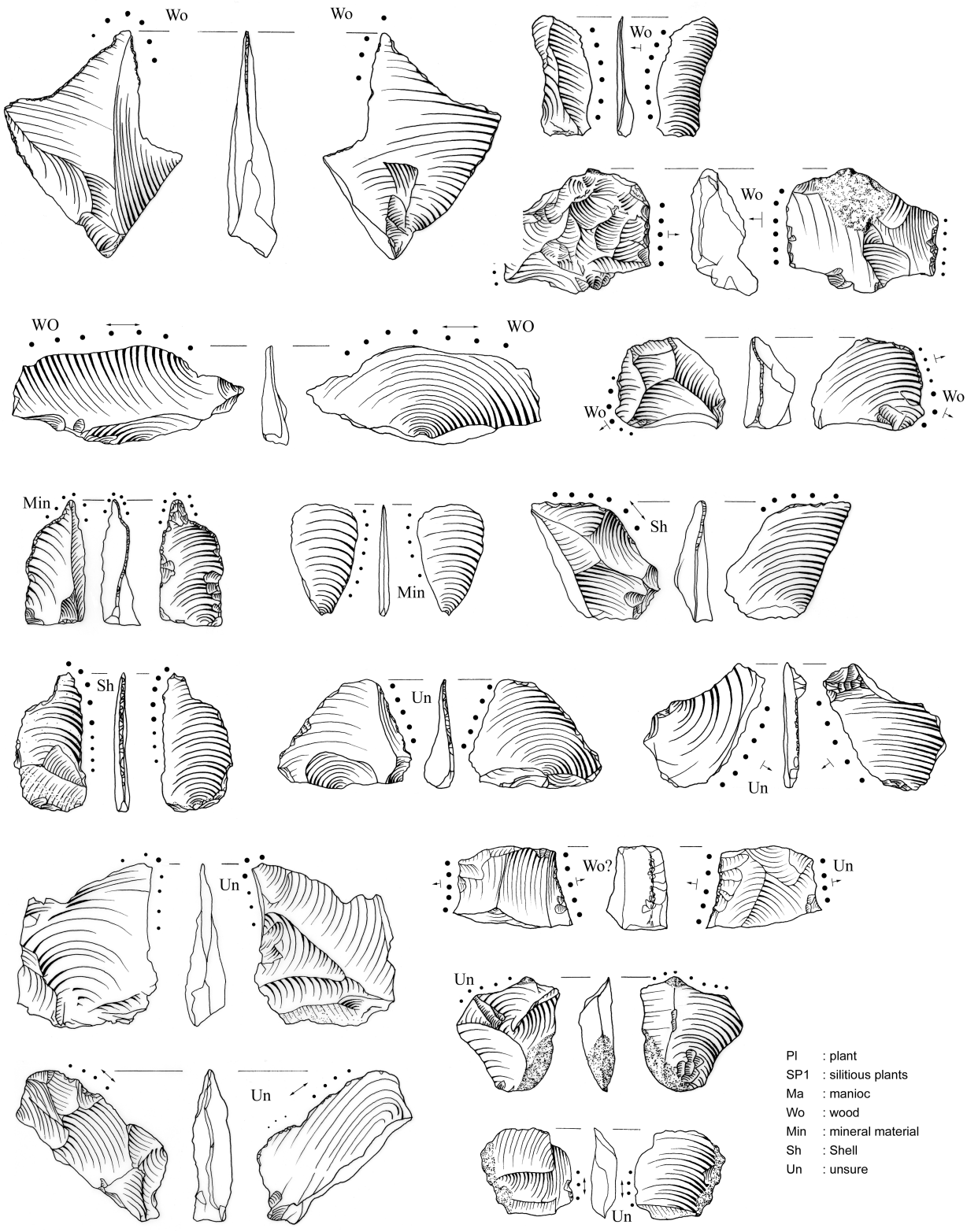



Fig. 4.35 Flint tools, usewear traces depicted in drawings, drawings scale 1:1

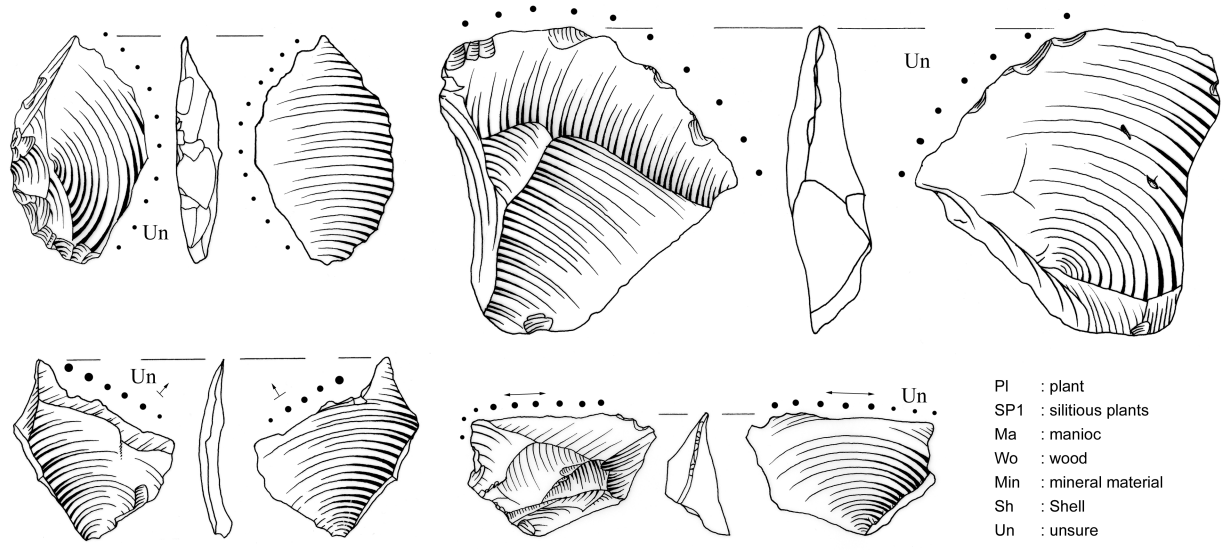



Fig. 4.36 Flint tools, usewear traces depicted in drawings, drawings scale 1:1

### 4.3.2 Typology versus function

Blades and blade fragments seem to have been especially used for longitudinal motions, mainly on plant material (7/12). Flake and flake fragments are used in different motions on all types of material. The modest number of artefacts displaying traces of shell working might relate to the lack of formal borers. Most flakes and blades seem to be too roughly shaped to create the lines and indentations found on the shell tools. However, as the experiments have demonstrated, much smaller flint flakes do produce similar decorations. Such small flint flakes could however easily been missed or even been crushed in the sieve-residue.

| motion | blades and blade fragments | flakes and flake fragments | flake/blade cores | total |
|---|---|---|---|---|
| longitudinal | 3 | 16 | 1 | 20 |
| longitudinal/ transverse | 1 | 1 | - | 2 |
| longitudinal/ diagonal | - | 1 | - | 1 |
| transverse | 4 | 10 | - | 14 |
| transverse/ diagonal | - | 1 | - | 1 |
| transverse/ wedging | - | 1 | - | 1 |
| boring | 1 | 1 | - | 2 |
| diagonal | 2 | 1 | - | 3 |
| uncertain | 1 | 13 | 1 | 15 |
| total | 12 | 45 | 2 | 59 |

Table 4.13 Flint, artefact type versus motion, number of used edges

| material | blades and blade fragments | flakes and flake fragments | flake/blade cores | total |
|---|---|---|---|---|
| plant | 2 | 2 | - | 4 |
| non-siliceous plant | - | 3 | - | 3 |
| siliceous plant | 6 | 13 | 1 | 20 |
| manioc | 1 | 5 | - | 6 |
| wood | - | 4 | - | 4 |
| hide | 1 | - | - | 1 |
| mineral | - | 1 | - | 1 |
| shell | 2 | 3 | - | 5 |
| soft animal | - | 1 | - | 1 |
| medium vegetal | - | 1 | - | 1 |
| uncertain | - | 12 | 1 | 13 |
| total | 12 | 45 | 2 | 59 |

Table 4.14 Flint, artefact type versus worked material, number of used edges

### 4.3.3 Hard stone implements (Fig. 4.37-4.45)

The stone tools studied (n=96) were selected on the basis of intentional modifications or macroscopic usewear traces. The majority of the artefacts were studied with the low power technique, the incident light microscope was used only occasionally. The artefacts represent a total of 138 used zones: ten implements were used on three sides and 22 on two sides. The hard stone tools can be divided typologically into ground stone, other (use-) modified rock and use-modified water-worn pebbles (Knippenberg 2006).

Of the querns and the shaped grinding tools, 33 examples were studied. The grinding tools or querns are subdivided in pieces with flat and concave surfaces used for grinding and (passive) pounding activities. It is not possible to distinguish between grinding and milling with only low power technique. The implements are almost all heavily worn. The flat surfaces will have served as polishing stones for shell ornaments and tools. Considering their size they were probably held steady between feet or legs. Two are exceptional in shape. They are made from a moderate grained, light green unidentified (possibly igneous rock) stone type. They are heavily abraded and display a convex surface, resembling active grinding tools or manos. They were studied under the incident light microscope, but no polish was observed. It is however obvious that these artefacts were intentionally shaped or got their form as a result of use. More research should therefore take place. This type of tool is relatively unknown to the region. Only Morel produced fragments of comparable artefacts (see Ch. 5 and Knippenberg 2006). Two ground stone axes were studied under the microscope. Both displayed clear traces of chopping and hafting. Traces of hafting are present on the sides, where the stone was roughened intentionally to secure the haft, as well as accidentally, as a result of friction between the haft and the stone. Both axes seem to have been resharpened. One of them displays a steep angle on the edge, which seems to indicate that the axe was resharpened while in the haft.

The water-worn pebbles that were studied (n=61) all displayed macroscopically visible signs of use. The activities that were carried out with these pebbles include pounding, grinding, rubbing, milling and polishing. The studied pebbles have been used quite intensively (degree of wear between medium and heavily worn), while there are so many other pebbles found without traces of use. Three combination-tools were recovered.

One pebble was used on two sides as a hammer stone and on a third zone as an anvil. Two pebbles were used both for rubbing/grinding as well as hammering. One small pebble did not show any signs of abrasion but displayed a band of black resin-like residue. This type of pebble might have served as a fishnet weight (see Ch. 5). The remaining pebbles can be either interpreted as hammer stones (n=19) or as rubbing stones (n=34). The hammer stones display coarse, relatively deep pits, randomly distributed over the corners of the more or less cubical pebbles. The rubbing stones display a variation in used locations: they are either used very intensively (all the way around, multiple sides, cubical shaped) or on one location only (one sided, bipolar). The traces consist of small, evenly distributed pits that make a roughened surface. The pebbles that show traces all around in angular facets might very well have been used on the grinding stones with a concave surface. Seven pebbles display traces of diagonal rubbing in the middle of a corner of the longer edge of the pebble. The spots are very similar to each other but cannot be related to a specific task, so far. They occur both as a single use on one pebble (n=6) and as one of several uses on a multiply used pebble (n=1). One tool was interpreted as a pestle, because of the wear traces in combination with its natural shape. Although no stone mortars have been recognised, calabash or wooden mortars may have served.

| typology | anvil traces | chopping | grinding | polishing | pounding | pounding/ rubbing | rubbing | hafting | uncertain | total |
|---|---|---|---|---|---|---|---|---|---|---|
| anvil | 1 | - | - | - | - | - | - | - | - | 1 |
| axe | - | 2 | - | - | - | - | - | 3 | - | 5 |
| hammer stone | 1 | - | - | - | 29 | - | 1 | - | - | 31 |
| hammer stone/ anvil | 1 | - | - | - | 2 | - | - | - | - | 3 |
| pebble with resin | - | - | - | - | - | - | - | 1 | - | 1 |
| pestle (bipolar) | - | - | - | - | - | 2 | - | - | - | 2 |
| quern | - | - | 18 | 2 | - | - | 2 | - | 1 | 23 |
| quern (bipolar) | - | - | 6 | - | - | - | - | - | 4 | 10 |
| rubbing stone | 1 | - | - | - | - | 3 | 11 | - | - | 15 |
| rubbing stone (multiple) | 4 | - | - | - | 4 | 5 | 28 | - | - | 41 |
| whetstone | - | - | 1 | 2 | - | - | - | - | - | 3 |
| uncertain | 1 | - | - | 2 | - | - | 1 | - | - | 3 |
| total | 8 | 2 | 25 | 6 | 35 | 10 | 37 | 4 | 7 | 138 |

Table 4.15 Stone, tool type versus motion, number of used locations

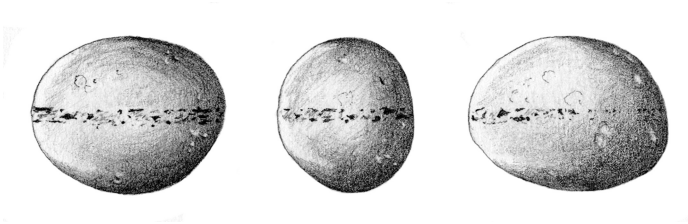


Fig. 4.37 Water worn peble with residue, drawings scale 1:1

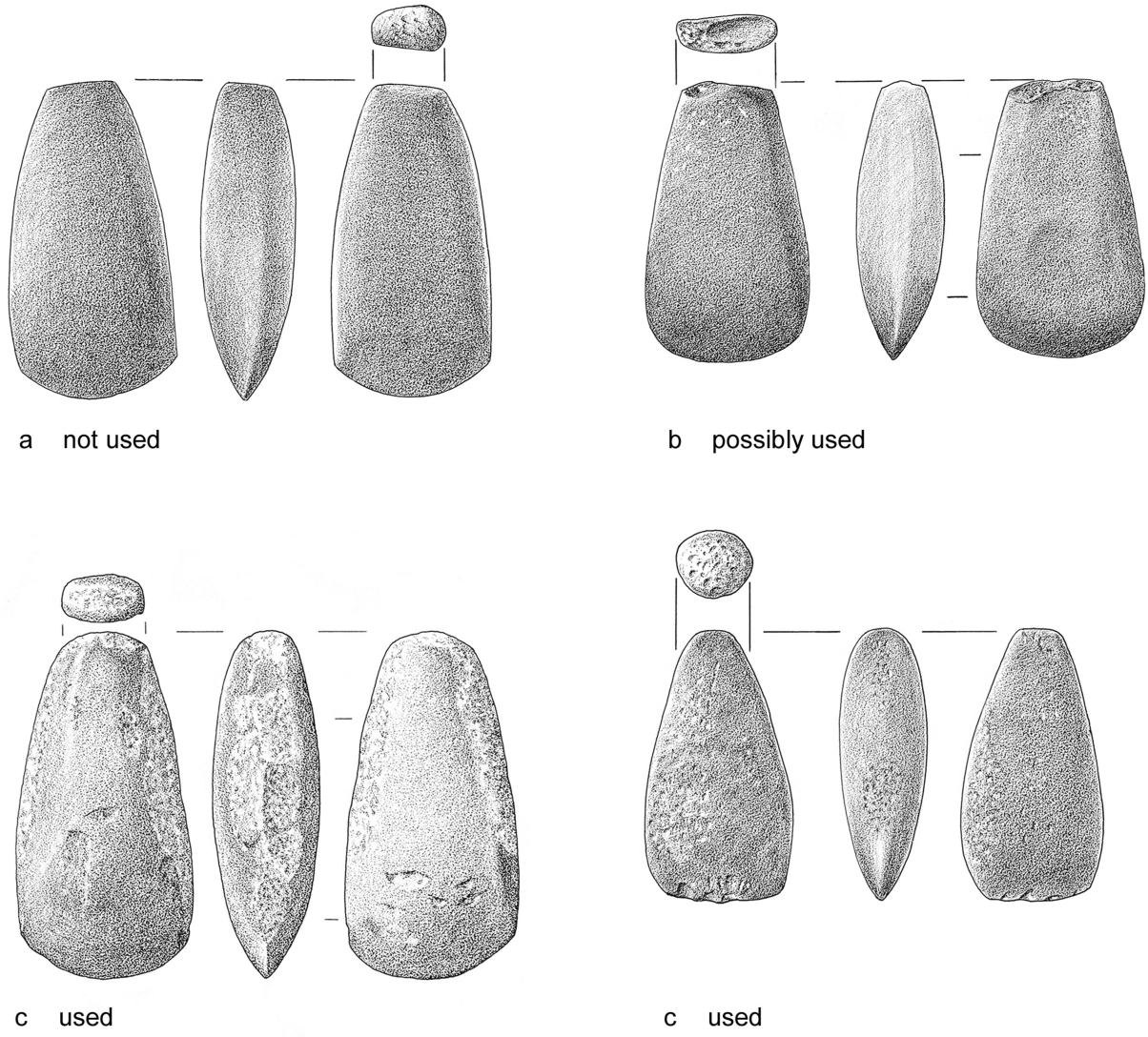



Fig. 4.38 Celts, drawings scale 1:2

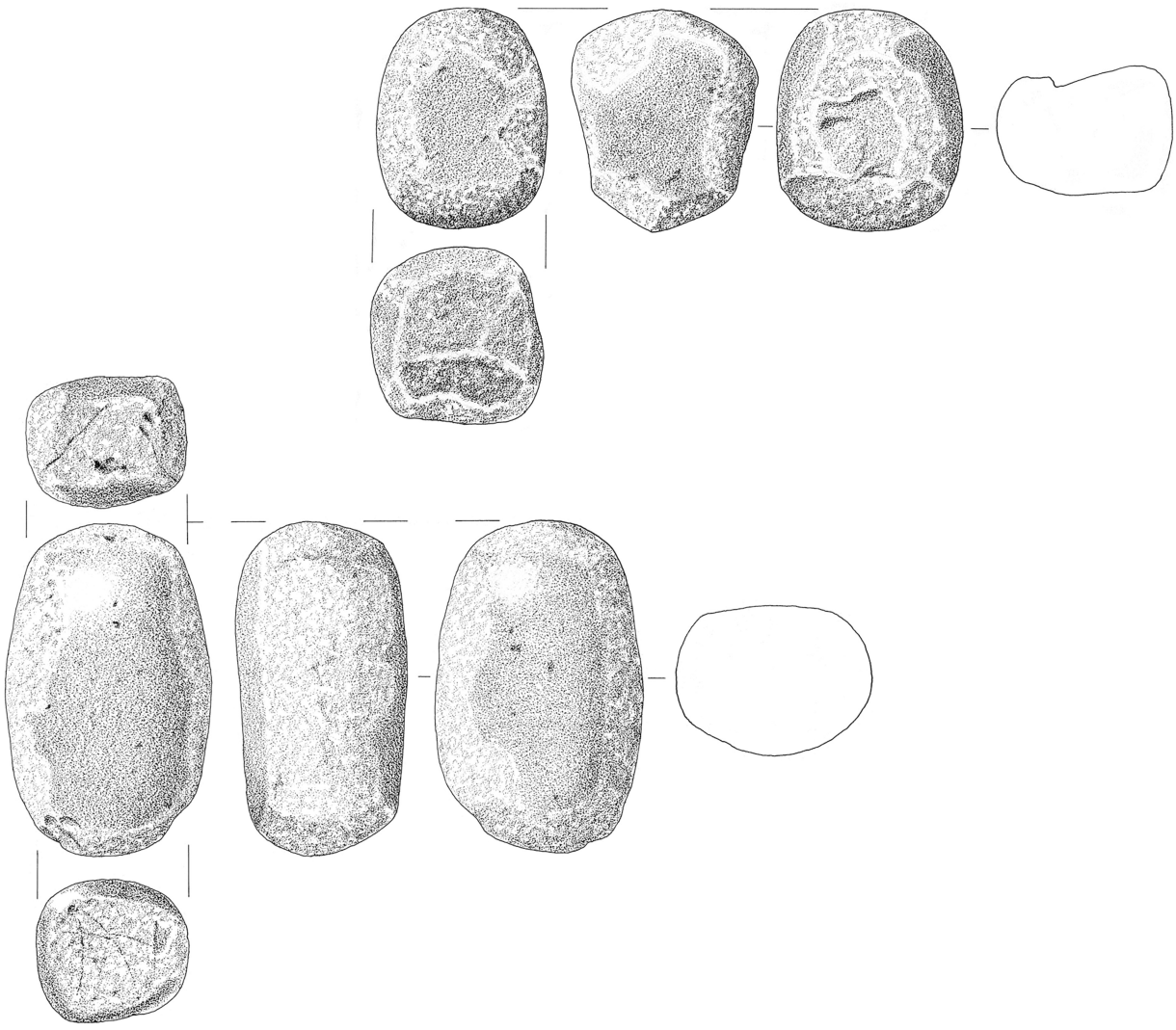


Fig. 4.39 Rubbing stones, drawings scale 1:2

Fig. 4.40 Rubbing/pounding stone with diagonal traces, drawings scale 1:2

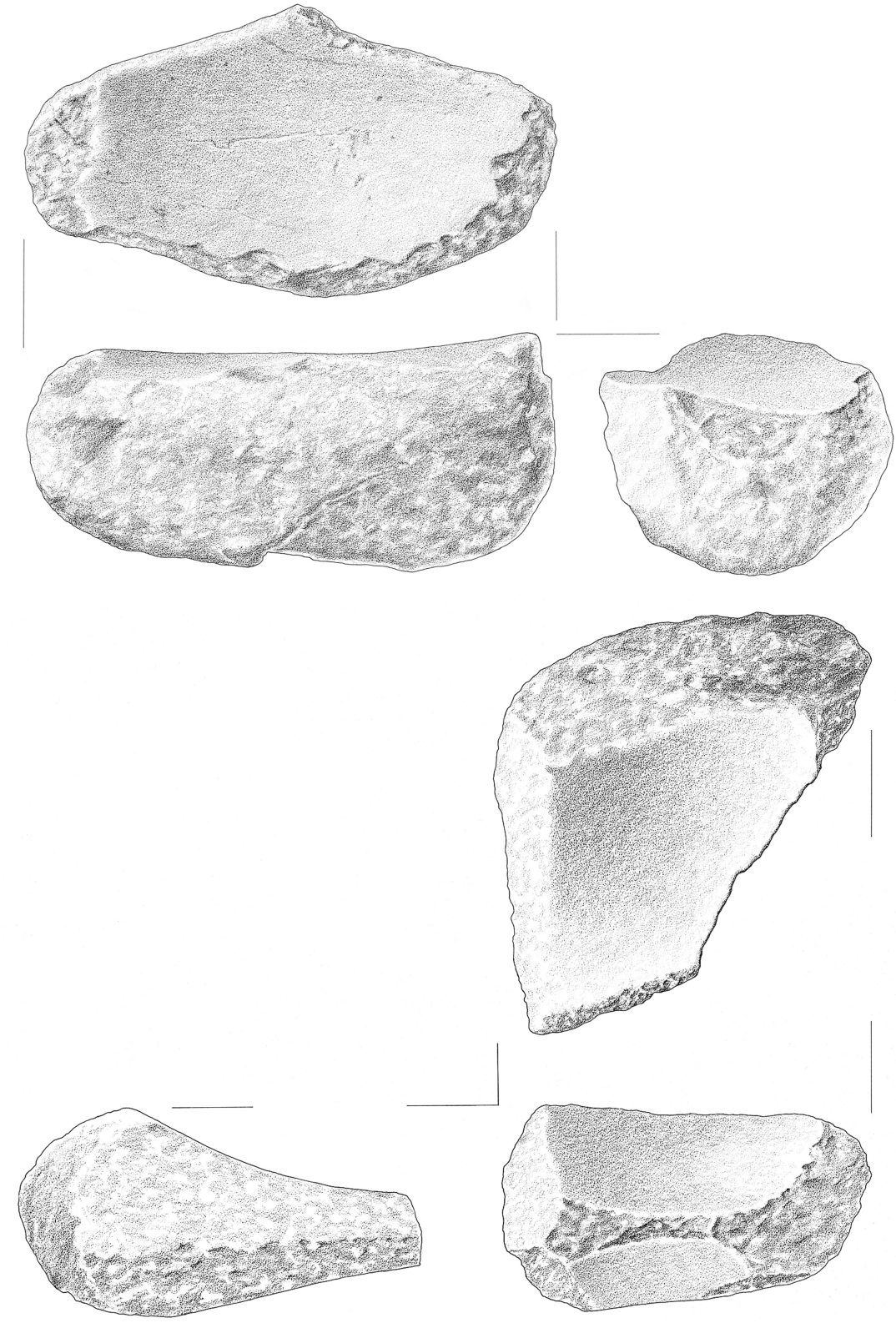


Fig. 4.41 Querns, drawings scale 1:2,5

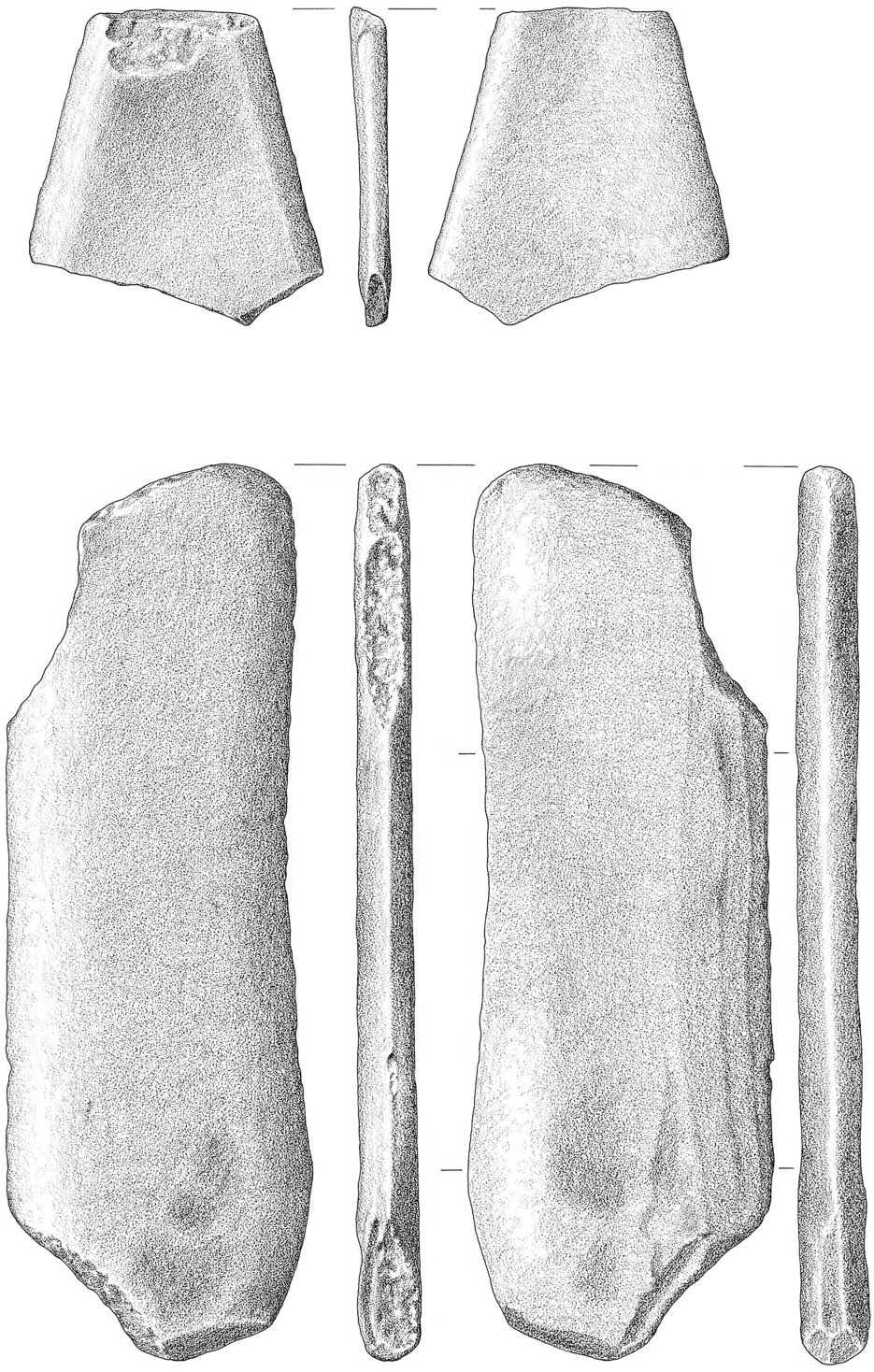


Fig. 4.42 (Fragment of) mano/metate, drawings scale 1:2

Fig. 4.43 Combination tool, rubbing/pounding/anvil, drawings scale 1:2

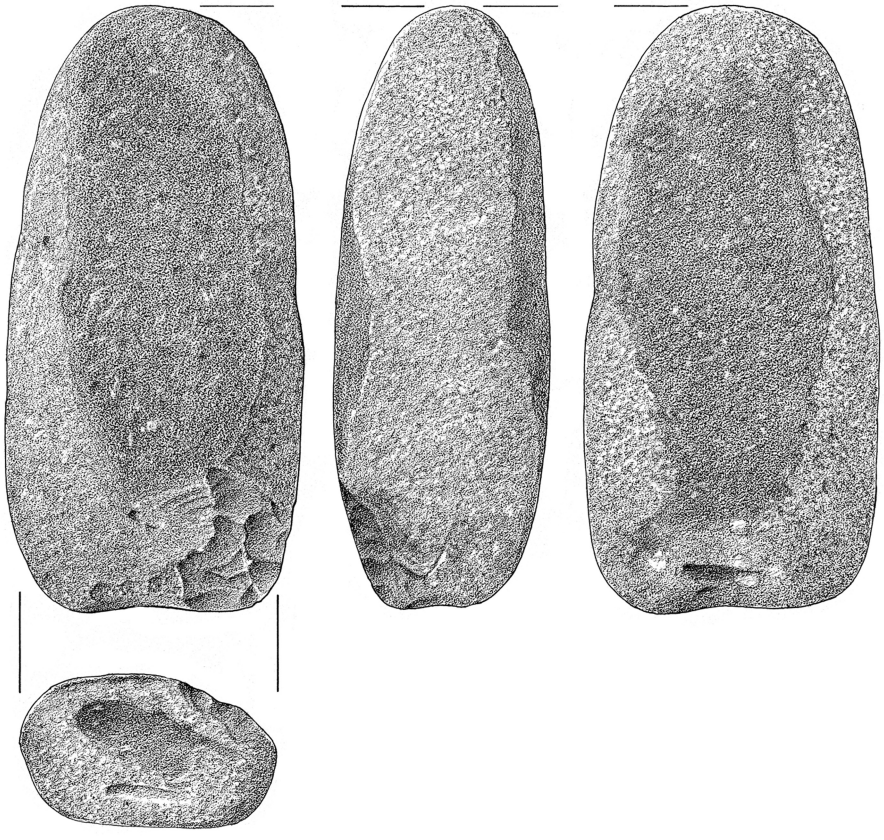


Fig. 4.44 Rubbing stone, drawings scale 1:2

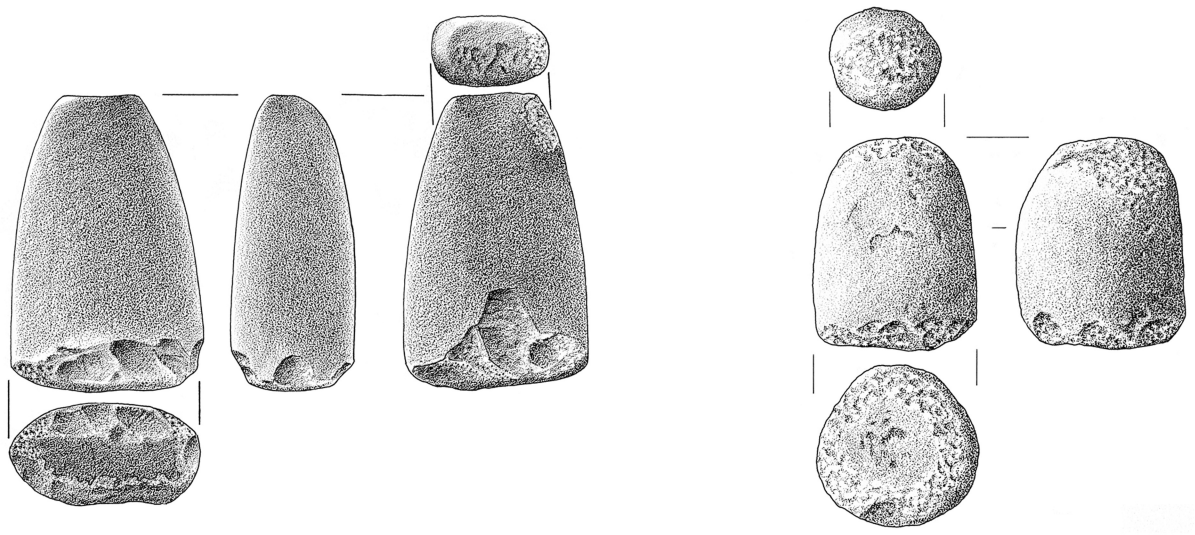


Fig. 4.45 Pounding stones, drawings scale 1:2

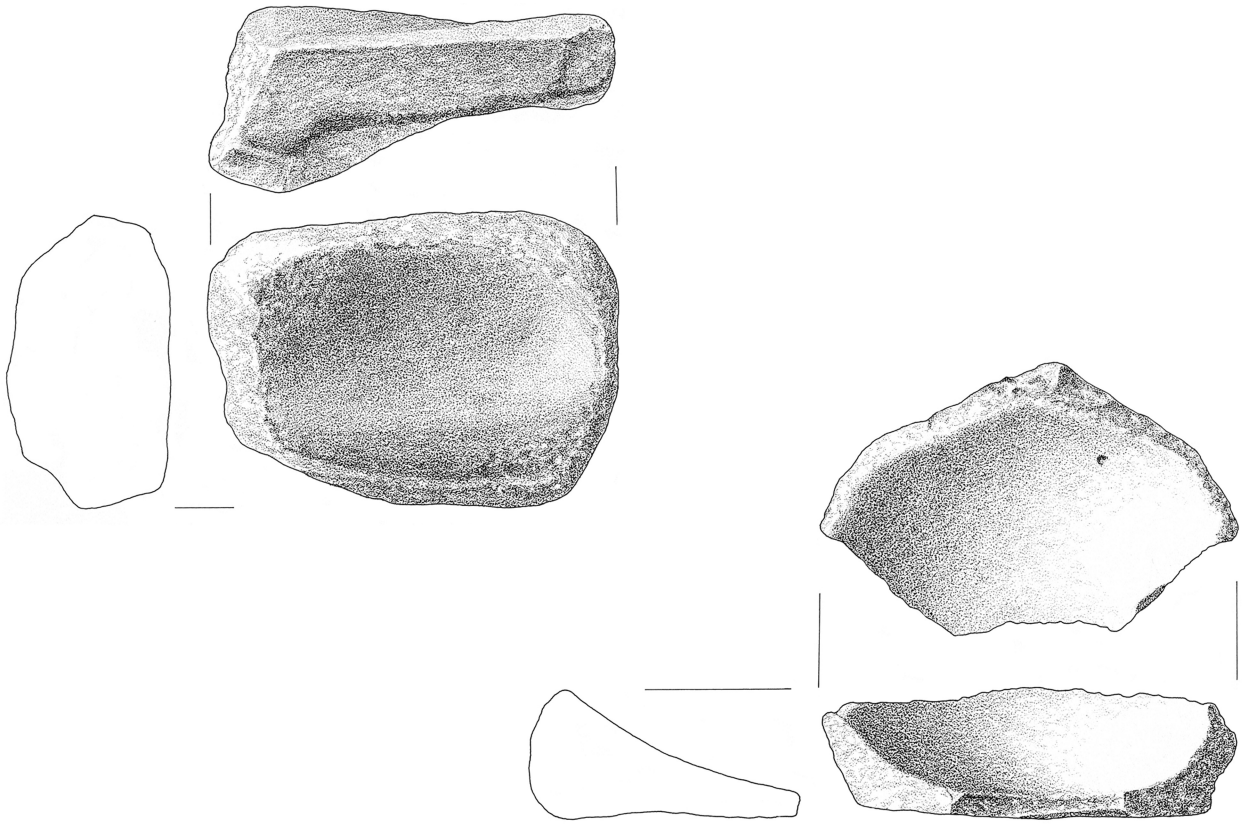


Fig. 4.46 Rubbing/grinding stones, drawings scale 1:2

### 4.3.4 Hard stone and flint artefacts, a summary

The flint flakes were used both in a cutting and a scraping/transverse motion, predominantly on plant, occasionally on wood. A few flint flakes display traces of cutting shell. These traces were also found on experimental pieces used to make bell-shaped beads (tinklers). The stone tools were used for pounding, rubbing, grinding and polishing. Because only the Low Power approach was used on this material, the information on worked materials is limited. It is however obvious that the stone tools were used to knap flint, to polish shell tools and ornaments, but most importantly to rub and grind seeds, plants and medium hard materials.
The applied motions and the attested functions of the hard stone artefacts and flint tools demonstrate again that the processing of plant material was one of the most frequently occurring domestic activities.

## 4.4 Coral artefacts

Part of the coral artefacts were studied by Harold Kelly (Fig. 4.46). A pilot study in the possibilities of usewear analysis on coral artefacts was carried out in the frame-work of his Master thesis, supervised by A.L. van Gijn (Kelly 2003, 2004; Kelly and Van Gijn *in press*). Coral artefacts are described here briefly; they form part of the toolkit and play an important role in the technological system of the site. On many Caribbean sites large numbers of corals are excavated. In most cases these are not studied intensively, although it is recognised more and more that these stony corals were used as a raw material source for tools and ornaments (Hofman *et al.* 2001; Rostain 1997; Versteeg and Schinkel (eds.) 1992). Little research has been done and it is not completely clear which post-depositional processes influence the shape and state of coral artefacts. Furthermore, it cannot always be distinguished whether a tool was deliberately shaped before use or whether the final appearance is the result of abrasion during use. Due to these different aspects, it is very difficult to make a typology, although a start was made for this site (Kelly 2003). So far studies have been based on species differentiation avoiding the problems involved with a formal typology. Kelly and Van Gijn distinguished however different shapes within the *Porites sp.* artefacts, a division used mainly to bring some order in the large number of artefacts.

The types of coral that were used by the former inhabitants of the Caribbean are called stony corals. They belong to the order of Sceleractinia, which forms the major part of the reefs surrounding the islands. The Sceleractinia order is part of the Zoantharia subclass of the Anthozoa class (Humann 1999). The species most commonly used for the manufacturing of artefacts or for immediate use without modification are *Acropora palmata*, *Acropora cervicornis* and *Porites sp.*. These three coral species occur frequently throughout the Caribbean and live in moderately shallow water of between 0 to 80 meters deep. They are sedentary and grow in a polyp form. Their natural habitat makes them relatively easy to acquire. Pieces could have been picked up on the shore as well. The specific appearance of the corallite tubes makes the artefacts specifically efficient. As artefacts seem to resharpen themselves as the corallites break off, stony corals are especially suitable for sanding, rasping, incising, rough polishing and drilling. Its weight and relative toughness makes it suitable for hammering as well. Experiments performed by Kelly and myself have demonstrated that coral tools were in specific cases more effective than tools made of shell or flint. The coral abraders were experimentally very functional for rasping and drilling wood. Coral and stone implements appeared to be equally efficient for the polishing of shell beads and celts. Matching the experimental wear traces with the traces on the archaeological pieces proves however to be difficult.
Finally a study was made of a specific artefact type, which has an abraded edge. Whether this edge is the result of use or whether it was intentionally created to produce a specific working-edge, remains unsolved. Of the 51 *Porites sp.* implements that were studied for traces of wear, it was possible to interpret 23 pieces. Eleven of these were used on wood, three on plant, four on bone, five on shell and seven on clay (Kelly 2003). Eight *Acropora cervicornis* pieces showed a red residue, which was analysed and identified as clay.

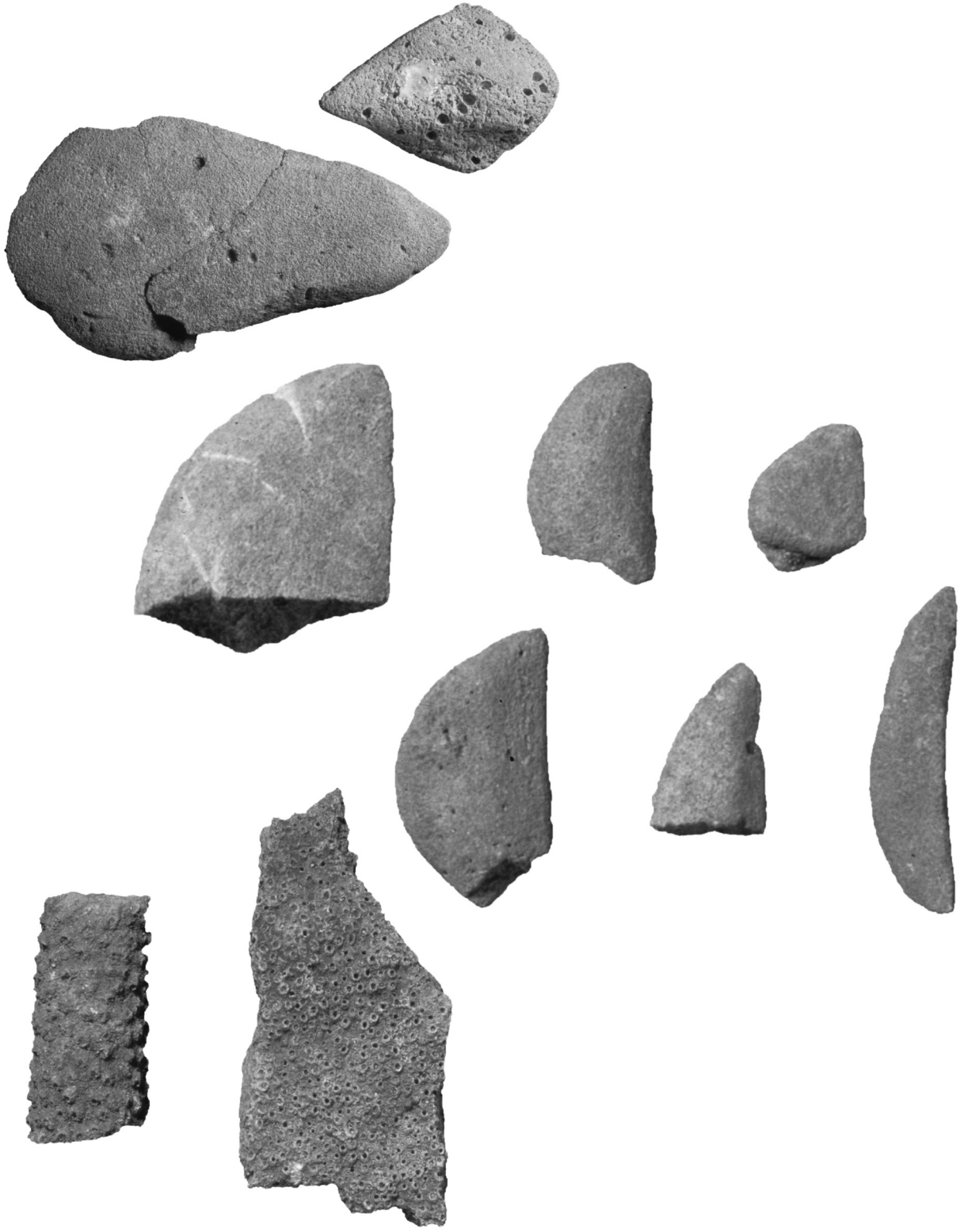


Fig. 4.47 Coral tools: pointed tools, abraded angle tools, tools with residue

## 4.5 Secondarily used pottery sherds

Until recently it was rarely recognised that pottery sherds might have had a secondary use as a tool after the pot was broken. Lopez Varela and Van Gijn (Lopez Varela *et al.* 2002) however found use traces on tools from the site K'axob, Belize. These tools showed clear similarities in shape to tools used by potters nowadays and were furthermore found in relation to a pottery production site. The experimental reference collection that was produced for the K'axob study focussed on activities related to pottery production.[2] The sherds of pottery from Anse à la Gourde that display traces of secondary use were also analysed by Van Gijn (Van Gijn and Hofman *in press*).

The matrix of the used tool appears to be extremely relevant for the end result of the traces. A rough, softly fired pottery type will have many more striations than a very fine, well-fired type. It is therefore important to create a reference collection based on the specific pottery type found in a site. In the study described, pottery tools were therefore replicated and used. Archaeological sherds from the site were used as well, because of the difficulties in obtaining the right temper. Although this is certainly not an ideal situation, this approach was followed because the sherds had a fresh appearance and showed hardly any traces of degradation.

One of the main problems with usewear analysis on this material is the amount of different types of traces that appear on the surface: traces of production, of use as a pot (stirring), of the actual secondary use and finally post-depositional traces.

The tools found in Anse à la Gourde appeared however to be in relatively good condition. They do not display traces of intentional modification, although it might be expected that they were slightly shaped before use. Three examples are completely rounded, but this might have been the result of extensive use. The wear traces are located mainly on the edges themselves and not so much on the sherd surface. The edges display polish, striations and severe edge rounding with a U-shaped cross-section, similar to traces found on experimental tools used for scraping clay. Together with the specific distribution and the directionality of the traces all tools were interpreted as implements used in the pottery production process for smoothing the in- and outside of leather-hard pots.

## 4.6 Conclusions

### 4.6.1 The production of tools and ornaments

Tools were made from several types of raw material, using a diversity of manufacturing techniques. Similar artefacts were made from different raw materials (shell and stone celts, shell and flint scrapers). The techniques used to manufacture shell artefacts were grinding, polishing, abrading, percussion (direct and bipolar), incision and drilling. Shell tools were made with the aid of flint flakes and by abrasion on hard stone or coral tools, with the addition of sand and water. Shell ornaments were shaped by abrasion on hard stone and coral tools, with the addition of sand and water. Beads were drilled with the aid of very small flint flakes and possibly with bone or wooden drills with the aid of sand and water.

Hard stone artefacts were shaped by pecking, hammering, grinding and polishing. Semi-precious stone was knapped with pounding stones, polished on passive hard stone tools with the addition of sand and water and drilled with unidentified drilling tools. Flint and chert were modified by percussion (freehand and bipolar). Coral tools were made by grinding. Pottery tools were most probably shaped as a result of use.

The difference in the attitude towards raw materials is expressed on an aesthetic level. Shell ornaments clearly received more attention than all other artefact categories (excluding pottery vessels). Similarly, stone and shell celts were often completely or partially polished, and required a relatively long production process. On the other hand, many stone tools (pebbles) and bivalve shells were used unmodified or with minor alterations (retouch). Coral tools and pottery sherds did not require much alteration either. Although experiments have

2 It was also tried to apply pottery sherds in the processing of hides and in scraping wood, but for both tasks the tools were not really effective.

demonstrated that the quality of the Antiguan flint is good for blade production, the applied techniques resulted in irregular flakes. The lack of a standardized typology in the tools makes clear that the inhabitants were satisfied with functional implements and that their symbolic values were expressed predominantly in their ornaments and highly decorated pottery. No specific specialist production seems to have taken place (see also Ch. 6).

### 4.6.2 Tools and their functionality

The different activities that took place in this settlement were carried out with a variety of tools. Considering the applied motions, a difference can be made between motions with dynamic loading (impact motions) and motions with static loading (abrasive motions). Impact motions include chopping, wedging, pounding/hammering and hoeing. Abrasive motions include cutting and sawing, scraping and whittling, boring, rubbing, polishing and grinding. These motions are connected to specific artefact types. Some artefact types have been used for different purposes (celts as axes and wedges), while more or less comparable tasks were also carried out with different artefact types (cutting plant with flint flakes and bivalve shells).

The use of the different tool types can be summarized as follows:

Celts were made of shell and stone. Both display traces of use, although the shell celts are present in larger numbers and were used more intensively. The artefacts display traces of working fresh and burnt wood, but also of multiple use. They were used both as axes and adzes, which could only be inferred from the microscopic usewear, not from typological differences. Several celts made of shell were used indirectly, as wedges, and were used, most probably with the aid of a wooden club.

Knives and scrapers (used in a longitudinal or transverse motion) were made of flint, shell, pottery sherds and coral. Flint flakes were used to cut and scrape and served as grater teeth. Bivalve shells were used as scrapers and knives. Pottery and coral tools were used to scrape. The variety of worked materials with these tools is wide. Vegetal, faunal and mineral materials were all worked in cutting and scraping motions. All tool categories were used on all raw materials, seemingly only influenced by the boundaries of their natural limitations.

Hammer and pounding tools were made of hard stone; polishing and rubbing tools were made of hard stone and coral. All were used on medium hard to hard vegetal and mineral materials.

Manos, metates, grinding tools and anvils were used on vegetal and mineral materials. These tools were often used for several purposes, probably over a longer period.

Most of the activities which took place concentrated on the processing of plants and wood and on the manufacturing of tools and ornaments of the various raw materials. Survey research in the area has demonstrated that Anse à la Gourde was one of the largest sites throughout its history. The availability of food, water and raw material sources in the near vicinity made this site an independent centre where the socio-political, ceremonial and subsistence activities took place (De Waal 2006). No sites for specialist work or specific ceremonies were found in the area, so it is assumed all activities took place at the site. The traces found on the tools emphasise this hypothesis; they reflect a technological system of a broad spectrum economy, covering a broad range of domestic activities. These activities will be described further in chapter 6.

# 5. Morel

## 5.1 Introduction to the site

### 5.1.1 Geographical setting and environmental history

The site of Morel is located 1 km east of the town of Le Moule on the northern coast of Grande-Terre, facing the Atlantic Ocean. The site is situated on a low coastal terrace, 1 to 4 m above sea level, which borders the plateau of Grande-Terre. The landscape has changed severely since the occupation by erosive processes, resulting in the erosion and disappearance of a 2-3 m thick layer of sand dunes. Hurricanes, natural erosion, sand pillage and looting caused the near complete destruction of the site. A comparison of aerial photographs from 1947 and 1993 shows that the shoreline has retreated approximately 50 meters. Geological research (Mol 1999) has revealed that the site was located in a saline environment during the period of occupation. Solution and precipitation processes under the influence of the regular inundation by seawater resulted subsequently in the transformation of beach sand into beach rock. The fact that several burials and artefacts were concretised in the beach rock demonstrate that it's formation took place after the first occupation phases.

### 5.1.2 History of research

The site of Morel has been known since the 19th century, but it was not until the mid-20 th century that serious excavations took place under the direction of Edgar Clerc. He excavated a relatively large area in a period when the sand dunes were still more or less intact. He distinguished four archaeological units, which extend from west to east and are superimposed in some areas over a thickness of approximately 2 m. These units were interpreted as occupation phases, which he called Morel I, II, III and IV (Clerc 1968). These phases were confirmed during excavations in 1965 (Bullen and Bullen 1973). In 1984 Bodu excavated at Morel and found ceramics from Morel I and II in situ (Bodu 1984b). Salvage excavations were carried out within the framework of the cooperation between the DRAC Guadeloupe and the Faculty of Archaeology, Leiden University (Hofman *et al.* 1999a; 1999b), after several hurricanes brought severe damage to the site in the 1990's.

### 5.1.3 Archaeological data

At Morel four occupation phases are distinguished, as Clerc (1974) had already discovered. Burials, postholes as well as numerous pieces of ceramic, flint and shell were found. The material studied for this thesis belongs to the oldest two phases, Morel I (Huecan Saladoid) and Morel II (Cedrosan Saladoid), excavated in 1999. The oldest phase is dated between 300 BC and AD 300, the second phase between 300 and 700 AD. Unfortunately, the post-depositional disturbance of the site does not provide the best conditions to distinguish stratigraphically between the two periods (Arts 1999; Hofman *et al.* 1999a). In addition, one of the most important research questions for this period is the question of origin and contemporaneity or succession of the pottery styles, better known as the 'La Hueca- problem' (Hofman *et al.* 1999; Oliver 1999). The pottery does therefore not offer a distinction between the phases. According to Clerc (1974), a distinction between Morel I and II is visible in the shell axes. Morel I is dominated by rectangular axes with a rectilinear edge. Morel II is, to his opinion, dominated by triangular shaped axes with curvilinear edges. It will be demonstrated in the following that the 1999 excavations did not reveal comparable results.

## 5.2 Shell artefacts

Some extraordinary and beautiful examples resulting from the earlier excavations are kept in Musée Edgar Clerc, Le Moule. These artefacts display a large variety of forms and are evidence of highly developed shell working skills. Similar pieces however were not recovered during the 1999 excavation, but resulted nevertheless in 122 artefacts, including i.a. 49 shell celts, 16 bivalve shells and 20 beads and pendants

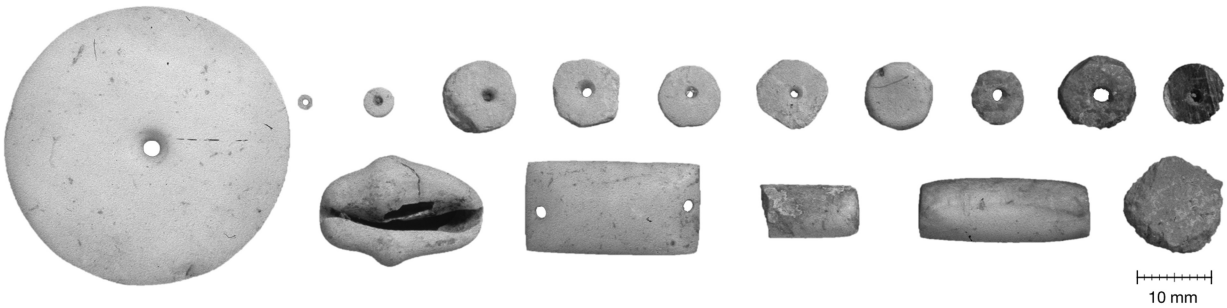



Fig. 5.1 Ornaments

(Lammers-Keijsers 1999). In total 23 artefacts were studied for wear traces using a high power technique, including two celts and all bivalve shell tools. Furthermore, all celts were studied using low power magnifications. The artefacts are divided into ornaments and tools.

### 5.2.1 Shell ornaments

Ornaments comprise beads and pendants, adornments and 'three-dimensional objects' (Fig. 5.1). The attribution of beads and pendants is obvious, for both other classes illustrations from the early stage of colonisation may be of help, but even so – as was demonstrated above – their function/way of use remains unclear. There is a wide range speculations as to their function and symbolic values. However, more and more research is conducted and the results are leading to a more distinct typological division (Linville 2004, Serrand 2002).

#### 5.2.1.1 Beads and pendants

*Discoid beads*

Beads are characterised by a central perforation. Twelve beads and two bead blanks were discovered. A distinction can be made in two shapes, which is mainly determined by the original shape of the shell: flat circular-shaped beads (10 beads and 2 blanks) and round conical-shaped ones (n=2). The flat circular beads all show double V-shaped perforations, which were made by drilling a flattened piece of shell from two directions, equally deep. One bead is made from *Chama sarda*; two are made from an undetermined type of shell with a distinctive reddish orange colour. Five beads are made from *Strombus sp.*. One white bead is very tiny (2x2 mm, 1 mm thick) and therefore its species cannot be determined. One of the bead blanks is made from *Chama sarda*; one is burned and is not interpretable.

Four of the *Strombus* beads do not seem to be finished, showing roughly shaped, unground edges, while the bead blanks have partially polished flat surfaces, rough edges and no perforations. The presence of these unfinished beads indicates that beads were manufactured at the site and that they were produced in the following sequence of production: first a shell was cut into roughly circular pieces, than partially polished, than drilled and at last the edges were finished by polishing (Carlson 1995, 100). The tiny bead was probably manufactured around a natural perforation in the shell.

Both conical-shaped beads were made form *Olivella sp.*, a shell species similar to the bigger *Oliva sp.*. The beads were made by sawing off both top and base and removing the inner whorl. One of them was decorated with a stylised frog incision, well known in the Caribbean region.

Pendants

No other pendants were collected than eight so-called tinklers. Four are real tinklers, displaying both a side- as well as a apex perforation. Two are made from Oliva sp., two of Cypraecassis testiculus. The four other 'tinklers' have no side-perforation (1 Conus regia, 1 Oliva sp., 2 Cypraecassis testiculus), but they have only

have their apex removed. They do not show evidence of having been used as Sutty suggested, as the 'stones' in a rattling gourd (see Ch. 4). In the Morel implements most perforations were made by pounding; only one side perforation was sawn. All apex perforations were roughly finished, leaving just two with a more or less straight base.

*Discs*
Two artefacts made from *Strombus sp.* have not been classified as beads, but their interpretation is somewhat problematic. One small piece (9x9x4mm) resembles a bead blank: it is flat, round and polished, but the edges are polished as well, which is rare for a bead blank. It is therefore regarded as a finished object with an unknown function.
The other piece is a larger disc (37x37x4 mm) with a 2 mm perforation in the middle. The perforation is unevenly double V-shaped and both sides of the disc are evenly polished. This artefact is not regarded as an unfinished bead because of its size. In general, beads do not exceed the maximum of 2 cm (Bender 1991). Larger discs are often interpreted as spindles, but the perforation in this object is rather small to put a wooden shaft through. Another possible function for this type of artefact is the use as a buckle for a belt with a loop at one end and the disc at the other, but again the perforation seems to be too small.

*Small cylindrical objects*
Two cylindrical-shaped and unperforated objects are made from the same distinctive reddish orange kind of shell as the two beads described above. One is complete (21x8x7mm), the other one is broken but must have been similar in length. The complete surface is polished. There are no signs of how these implements were worn or used but a hypothesis is that they form part of necklaces where these pieces were incorporated into the weaving pattern of the fibres.

#### 5.2.1.2 Adornments
An adornment is a shell artefact which was used to decorate clothing or statues, to be recognised by its flat, unilateral decorated/finished appearance. Applications have one or more perforations in order to sew the application onto the fabric. These specific adornments could also have been used in a necklace as spacer beads. In Morel two applications were found, one of *Strombus sp.*, one of *Cyphoma gibbosum*. The first one is rectangle-shaped with two perforations near the short edges. The front surface is highly polished shaping the surface in a shallow form of four triangles. This is a common type in the Anse à la Gourde assemblage (n=15). For the second application the outside of the Cyphoma shell was pounded to create a perforation, which was subsequently ground on a stone until the back was completely removed and the edges around the perforation were smooth. The smooth edges are the result of this grinding technique, which is well-known world wide for shell with a similar shape (Francis 1988, 28).
Two other pieces are presumably inlays, both manufactured out of *Strombus sp.*. They only differ in size (41/36 mm) and are both more or less eye-shaped. They are polished on both sides, one side is completely smooth, and on the other side the natural surface of the shell is still visible. The smallest one shows a conical perforation in the middle, of about 1 mm and made with a flint implement.

#### 5.2.1.3 Three-dimensional objects
Two pedestalled three-pointed zemis were made of *Strombus gigas*. They should date from before 560 AD according to Clerc (1974), but it is not possible to put them in the first phase stratigraphically.
One object of *Strombus*, of which the function remains unclear, is a long, thin piece, which is polished into shape (shell 17, 58 mm) (fig. 5.2). Considering the shape it might have been used in basketry production, but the lack of polish makes this option less plausible. It is therefore suggested that it is in fact an ornamental piece, e.g. a body piercing, but no equivalent in the region is known to me.

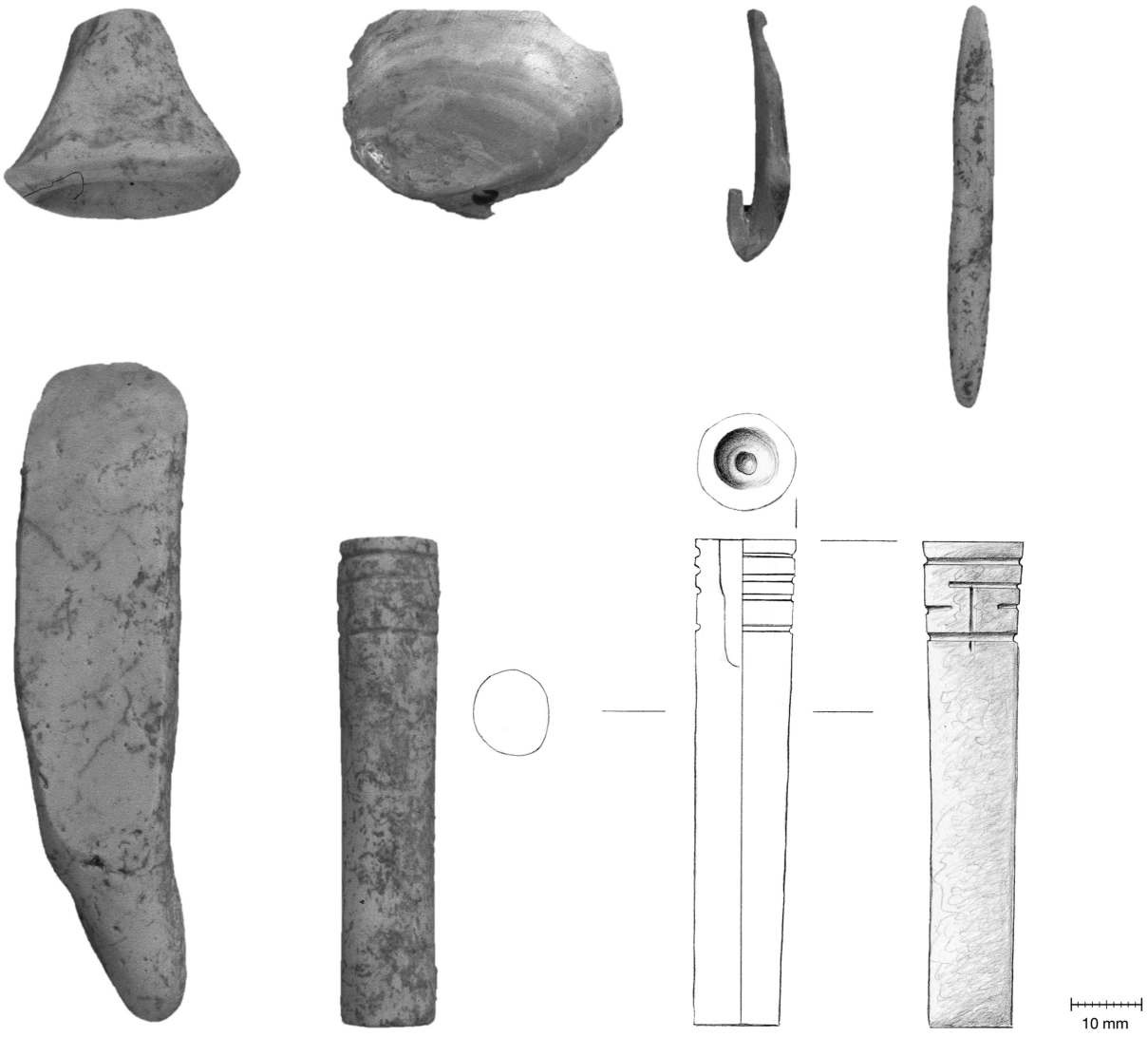
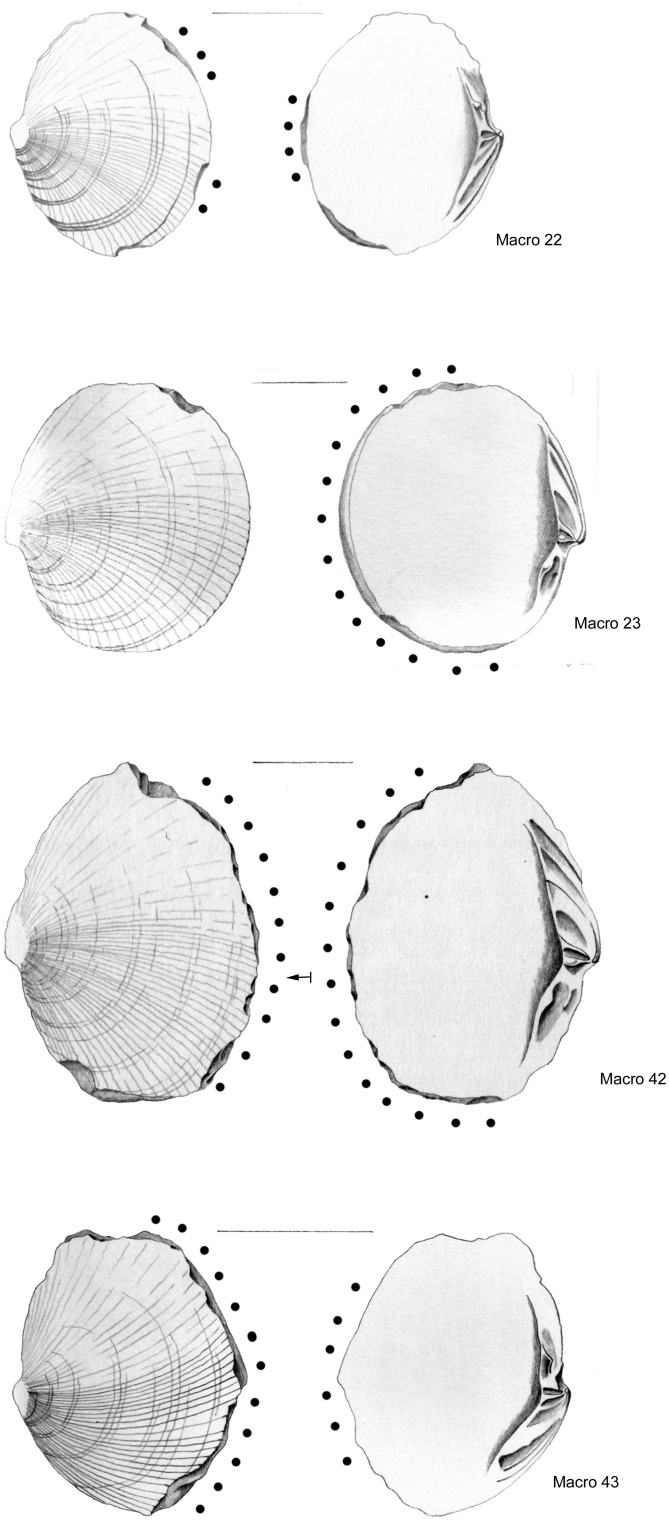



Fig. 5.2 Tools, drawing of decorated cylinder/haft with residue

### 5.2.2 Tools (Fig. 5.2)

#### 5.2.2.1 Bivalve shell tools

The relatively small total number of bivalve shells (n=18, *Codakia orbicularis* 14, Tellina radiata 2, Lima scabra 2) suggests that these specimens were not specifically gathered for consumption, although they are edible. Many of them show retouched edges and it is therefore assumed that bivalve shells were gathered to be used as tools (Fig. 5.3). They may have been used for several tasks: scraping wood, descaling fish, peeling manioc and cleaning calabashes. Some show macroscopically visible usewear traces, but to be more specific about their function, these artefacts had to be submitted to micro-wear analysis. All edges are, on the microscopic level, heavily polluted by post-depositional processes, such as soil formation. As a result of the formation of beach-rock, which has been taking place since the habitation of the site (Mol 1999), the artefacts are covered in sand that sticks to the surface and can be removed only with difficulty. The resulting damage makes it difficult to interpret polishes by high power technique.




macro 22 : edge removed, caused by manufacture
macro 23 : edge removed, caused by manufacture and use
macro 42 : retouch, curvilinear edge, caused by manufacture
macro 43 : retouch, curvilinear edge, caused by manufacture and use

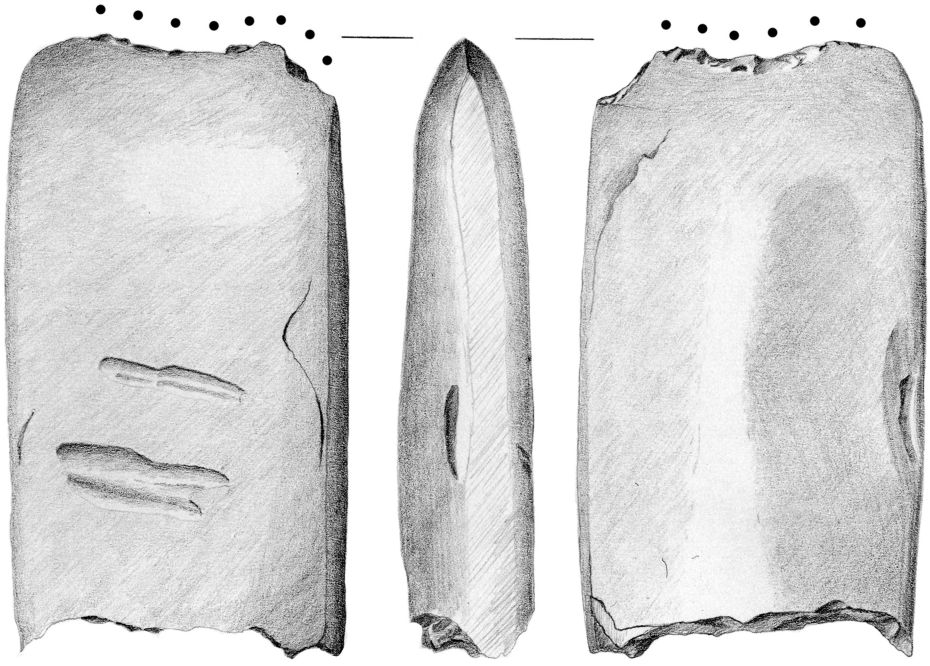
Fig. 5.3 Bivalve shells, drawings scale 1:1,5

A clear distinction can however be made between two types of edge transformation. Seven artefacts show edges with many retouches, while the original edge is completely vanished. These have been used in a scraping motion, towards the user, with the inner side of the shell inwards. They were used over a longer period on medium-hard and rough materials, such as branches.
The other category shows bevelled edges. The entire natural edge has vanished as well in these cases, but in a very regular way, displaying microscopically visible striations. These artefacts have been used in a transversal motion, probably in two ways, at a 90° angle between tool and worked material. The worked material was hard and flat or regular, allowing the edge to wear to a rounded shape. The shells were used for at least several hours, depending on the type of worked material. Materials could be hard wood or bone.

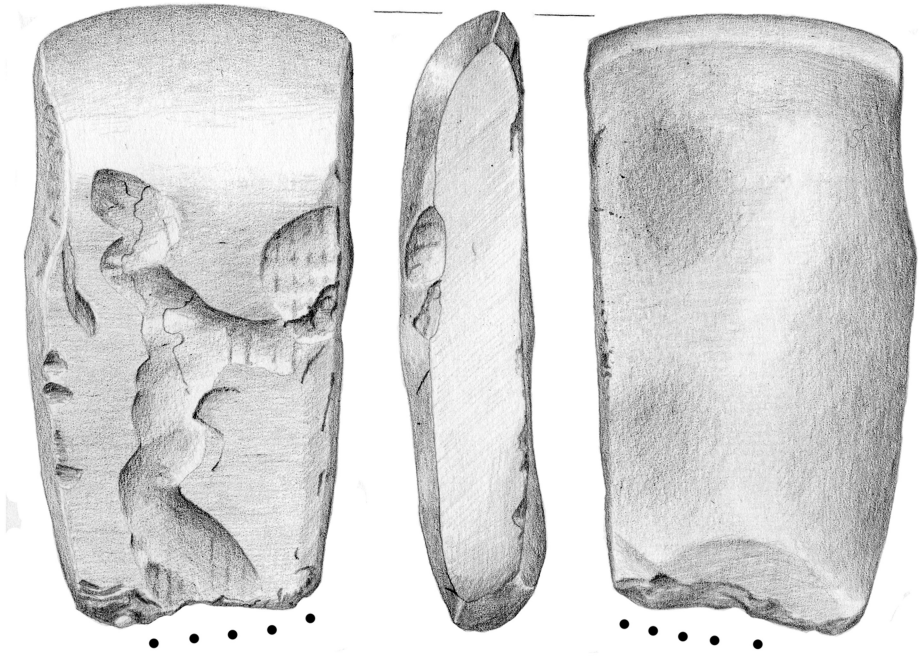
5.2.2.2 Celts and chisels

In total 50 worked lips of *Strombus gigas* were found, of which 80% (n=40) show use damage (Fig.5.4-5.6). Five are severely damaged as a result of use. Two celts were analyzed applying a high power technique; both show traces of use. One (shell 111) seems to have been broken during use, although the edge does not show traces. The other one (shell 110) has use-retouch on the edge. There are no traces of hafting, nor traces of impact on the distal end, which could be an indicator of use as a wedge. The traces on the latter indicate the implement was hafted as an axe, although its edge is asymmetrical in side view.
All other celts were submitted to low power research. A division was made based on three categories: the shape of the complete axe, the shape of the edge of the axe in dorsal view and the shape of the edge in side view. There does not seem to be a specific interrelationship between those categories except for one category of 13 relatively heavy shell-shaped axes with a curvilinear edge. For these artefacts a minimum of polishing was carried out, leaving the natural state of the artefact intact as much as possible. All others were made from relatively thin *Strombus* lips (average 14 mm). This might explain that many edges are not symmetrical (axe) or asymmetrical (adze) but follow more or less the shell axis in order to make the lip most effective when hafted. Five implements show a distinctive break pattern resulting from friction during use in a haft. Five axes display use-retouch on only one end of the edges, which can be interpreted as indication that these shell celts were hafted as axes. Two of them have asymmetrical edges. Only one out of all the celts (shell nr 45) shows traces of resharpening, displaying a very steep angle overlaying a shallow one.
Artefacts of *Strombus sp.* or of Cassis tuberosa that are less wide and relatively thicker than celts, are typologically categorised as chisels. Two pieces were discovered. Both are made from *Strombus gigas*, one is complete and polished for the main part; the other is broken and only partially ground. The smallest chisel (shell nr 22) was analysed microscopically and shows very few wear traces. The edges show some use-retouch but no edge rounding, the proximal end shows some battering but no traces of hafting. All traces indicate that this tool was probably used for fine woodworking. The fact that the implement is relatively small, and the relative limited number of traces, could indicate that it was resharpened by polishing and was discarded shortly afterwards.

Fig. 5.4 Celt



rectangular flat celt
symmetrical profile
rectilinear edge with rounded corners
used as adze
broken during use



rectangular celt
asymmetrical profile
slightly curvilinear edge
used as wedge

Fig. 5.5 Celts, drawings scale 1:1

Fig. 5.6 Celts

#### 5.2.2.3 Cylinder-shaped hafts

A decorated polished cylinder made out of a *Strombus*-lip probably functioned as a haft. The object seems to be only part of a tool; it is approximately 7 cm long with a perforation of approximately 1 cm deep in one end (shell nr 20). Black residue in the perforation, possibly of Yellow mango tree (*Mangifera indica*) (Boomert 2000, 235), makes this option more likely. The handle or haft displays so-called 'frog' incisions that were carved with the aid of flint. The shaft hole was made with a hollow drill, considering the shape of the base of the perforation. A piece of the artefact was broken off near the perforation, possibly due to pressure exerted on the haft by both the hafted tool and the person handling it, resulting in friction between hafted tool and haft. The exact shape of the inserted tool remains unclear, but a possibility is a tool made of hard wood, like gayac (Guaiacum officinalis) or campêche (Haematoxylon campechianum) root. This would of course not have been preserved. Tools of this type (unhafted), such as weaving needles used in basketry production can be found nowadays in the Grands Fonds, Guadeloupe (pers. obs.1999).
Another piece of *Strombus* that was found might be of this same type of tool, but the fragment was too small to be certain.

#### 5.2.2.4 Fishhook

The 1999 excavation produced one small fishhook. Not many of these fishhooks are known. At the site of Anse à la Gourde nine were found and all, including the one from Morel, are made from *Cittarium pica*. This shell species seems to have been used for this purpose only, although one bead seems to have been made from this shell type as well. This fishhook (shell nr 19) displays rough manufacturing traces and its tip is broken of. It was probably made on a coarse sandstone or on a finer stone with the addition of sand/shell material. In my personal experience, the shell is not easy to work. The fact that it is one of the few species in the Caribbean containing mother of pearl, which attracts fishes by the reflection of light, and that it is sturdy enough for a fishhook, might however have made the hard work worthwhile.

### 5.2.3 Artefacts without context, Museum Edgar Clerc

It was decided during the fieldwork to make a partial inventory of the shell artefacts found in earlier excavations and over the years on the beach around the site. The artefacts described above are limited in number, while it is known that many more shell implements originated from this site. Although they were not studied in detail, the following summary gives a good impression of the variety of shell artefacts.

#### 5.2.3.1 Ornaments (Fig. 5.7)

In the category of beads and pendants, the museum collection has several tinklers with either one or two perforations, made of several species. The perforations are either sawn or pounded. Furthermore, two bivalve shells with abraded perforations (*Tivela sp.*) are alleged to have come from Morel. Two perforated discs may be categorised as large beads or pendants. One is decorated with indentations, one with a circular line near the edge. Several three-pointers were found in Morel, earlier thoroughly described by Clerc (1974).
Adornments are abundantly represented: several applications with perforations and perforated plates, in shapes very similar to the ones found in 1999 and in Anse à la Gourde are represented in the collection. One is exceptionally large and may be compared to the double-triangular shape applications of Anse à la Gourde. Decorated pieces, as described for Anse à la Gourde in chapter 4, are represented by examples with and without indentations. They are all in the shape of half a circle.
Some three-dimensional objects were found, including a pelican head, a frog, and several polished cylinders. One is very similar to those without decorations found in Anse à la Gourde, with a conical perforation in one of the ends. Another cylinder displays shallow indentations on both ends and has decorations in the shape of lines, circles and dots. A third cylinder displays a blunt, pointed end and no perforations, but decorations at one end with comparable lines, circles and dots. These incisions show a resemblance to the headband decorations

Fig. 5.7 Artefacts without context, Museum Edgar Clerc

found on anthropomorphic representations as described in chapter 4. A fourth cylinder displays frog-shaped decorations on both extremities. Furthermore, several small, broad cylinders (approximately 35 mm in height, 30 mm in width), also occurring in stone, originate from Morel. To conclude, a beautifully decorated zemi should be mentioned. It displays the same frog-shaped incisions as seen on other artefacts.

#### 5.2.3.2 Tools

The collection of the museum contains approximately 20 so-called 'spoons' of *Talparia zebra* and other bell-shaped molluscs, described by several researchers (Jansen 1999; Linville 2004; Serrand 1997; Van der Steen 1992). The function of these tools is unclear and since none of the museum artefacts was submitted to micro-wear analysis no inferences can be postulated here. The many *Strombus*-celts originating from Morel strengthen the idea that the earlier celts were thinner. Many of them are broken as if they were hafted when in use and suffered too much impact. Two gauges are part of the collection, as well as a fish lure or application. Similar fish-lures or applications were also found in Anse à la Gourde, on Barbados (Cartwright *et al.* 1991) and the Grenadines (Sutty 2001/2002).
The last artefact described here is a probable spindle whorl of the apex of *Strombus sp.*. It is heavily damaged. The apex is completely polished into a smooth cone and decorated with lines and 'frog'-shaped incisions. It shows remarkable similarities to the cone-shaped artefact of Anse à la Gourde, which displays the same decorations. The top of the Morel example is however perforated and could therefore have served as a spindle for cotton. On the Grenadines at Grand Bay, Cariacou a very similar spindle whorl with comparable decorations was found (Sutty 2001/2002).

### 5.2.4 Summary

The implements excavated in 1999 do not represent the full array of shell artefacts. With the additional information from the museum, especially on ornaments a picture is formed which is more in line with the expectations of a Saladoid site. There is a large variety in decorated or ornamental objects, comprising three-pointers, applications, decorated pieces, polished cylinders with frog-shaped incisions and three-dimensional objects. The tools are mainly represented by celts, which are generally thin and rectangular-shaped. The wear traces indicate that they were hafted as axes. The bivalve shells suffered from the formation of beach rock, but it was still possible to distinguish two types of abraded edges, resulting from use. One is associated with scraping medium-hard and rough materials such as branches, the other one with scraping hard relatively smooth materials such as bone and wood. Hooks associated with catching fish and a spindle whorl, displaying the characteristic frog-shaped decoration, were found as well.

## 5.3 Flint tools

A selection of 152 pieces (12,5%) of the flint artefacts described by Stevens (2001) and Knippenberg (2006) was made, based on their suitability for wear-trace analysis and the presence of suitable working edges. To obtain a representative sample a selection was made in which most typological categories are represented, the emphasis lying on flakes and flake fragments, proportional to the whole assemblage (361 complete flakes, 24 complete blades, 567 flake fragments). Many of the flake fragments do not seem to have sharp working edges. The condition of the artefacts for usewear analysis is not optimal and many surfaces display post-depositional traces to various degrees on a microscopic level. In the end only 68 artefacts were suitable for usewear analysis and of those, only 36 artefacts (52,2%) showed clear traces of use. Four artefacts (182-1, 223-3, 269-2, 656-4) were used on two different sides of the artefact (locations), one blade fragment (384-4) displays usewear traces on three sides (Fig. 5.8-5.11). All other artefacts show traces of use on one edge only and appear to have been single purpose tools. In total 42 edges showed traces of use. Of the 32 pieces that are described as 'interpretable, no traces', some might have been used for purposes that did not leave visible traces (such as cutting meat), as was described in chapter 2.

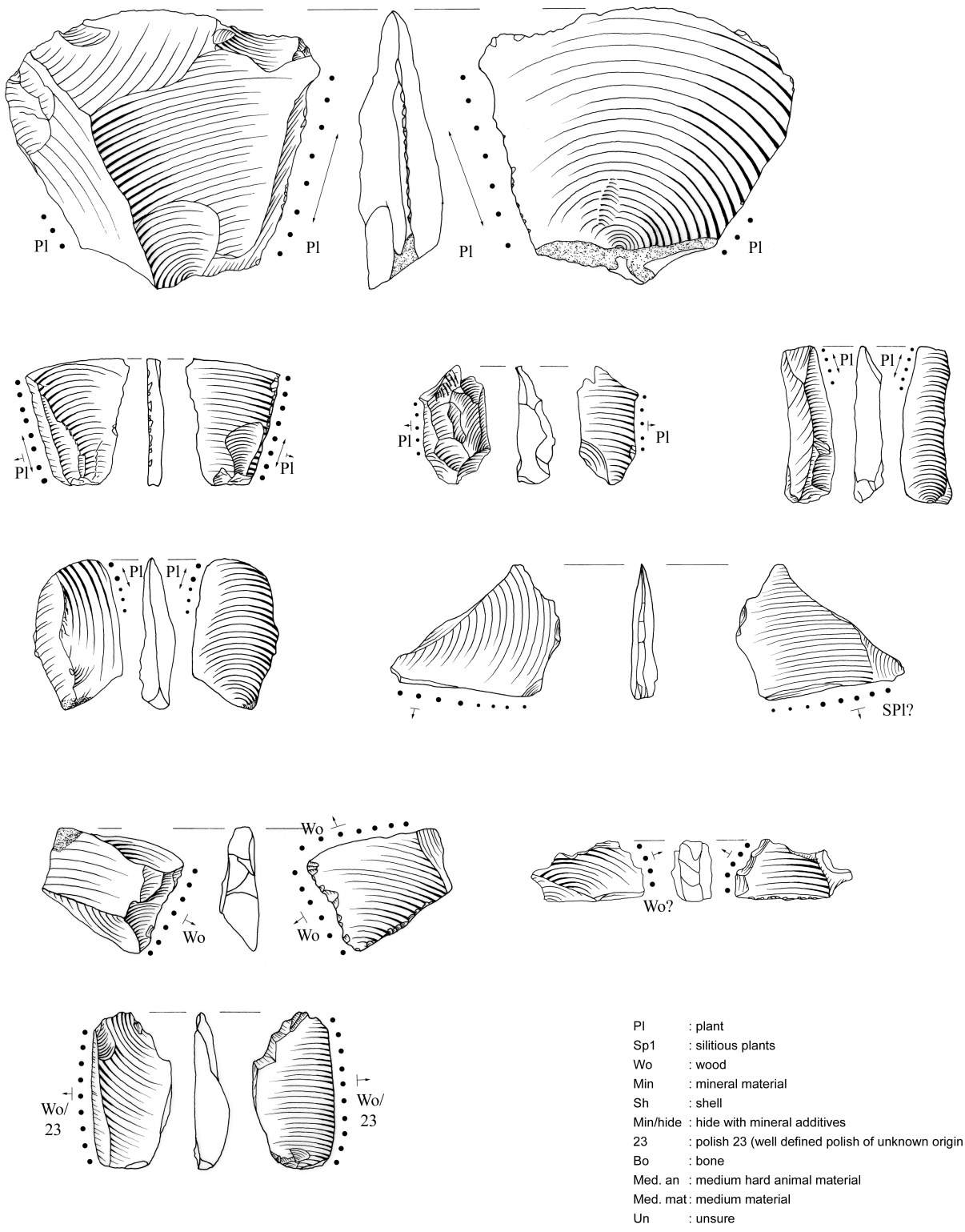



Fig. 5.8 Flint tools, usewear traces depicted in drawings, drawings scale 1:1

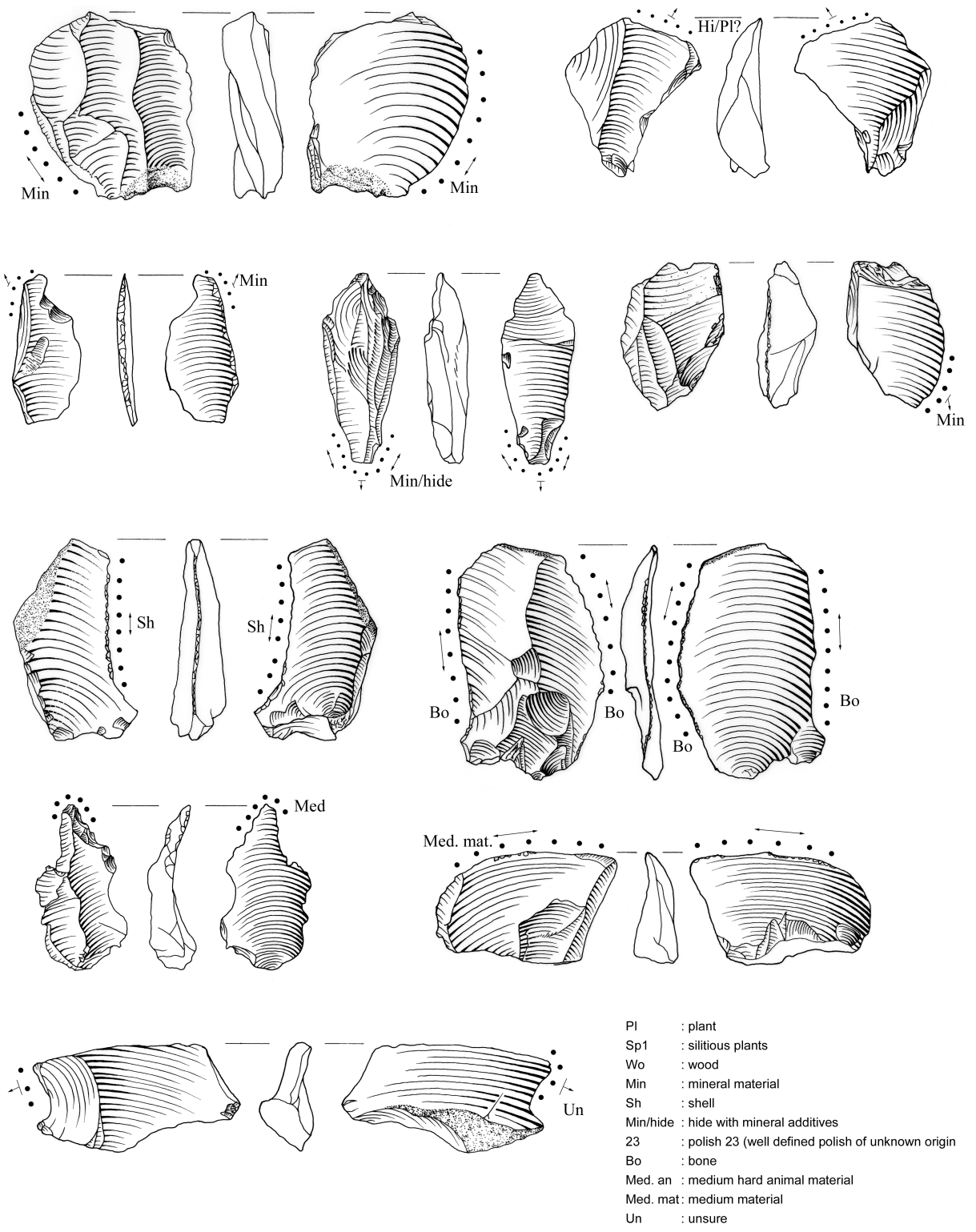
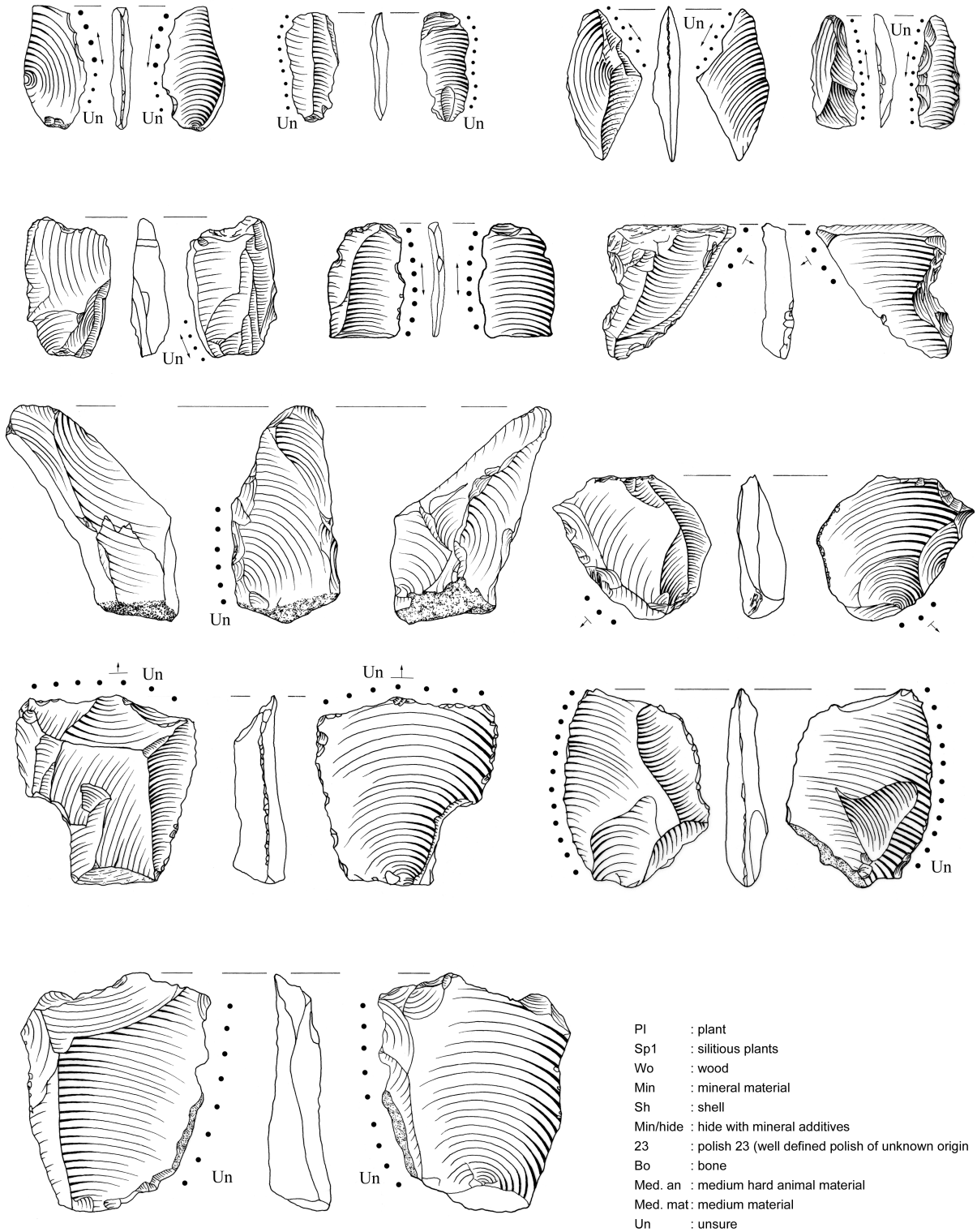



Fig. 5.9 Flint tools, usewear traces depicted in drawings, drawings scale 1:1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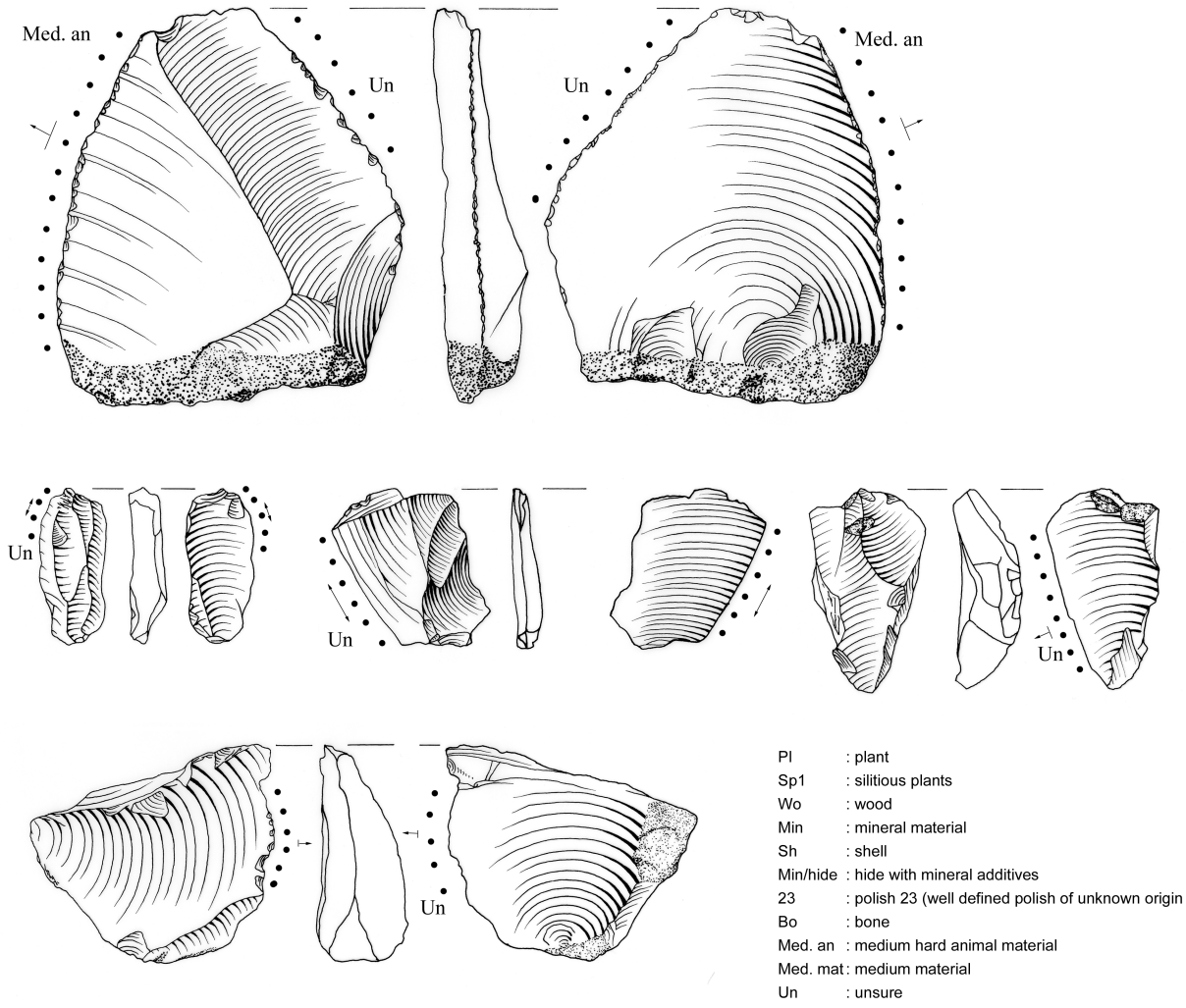


Fig. 5.11 Flint tools, usewear traces depicted in drawings, drawings scale 1:1

### 5.3.1 Worked materials and motions

Of the 42 edges with usewear traces, 13 (representing 11 implements) were used on plant and wood. Ten of these (23,8% of the total number of used edges) were used in different motions on siliceous and unspecified plant material, probably to extract fibres from leaves or to flatten branches in order to make them more suitable for further processing. Ethnographic sources show the importance of the use of basketry to collect shells, roots and tubers. Plants and plant fibres were also used to produce sieves and squeezers for manioc, hammocks, fishing nets and rope. Wood played an important role in the building of houses and canoes. The artefacts used on wood can be interpreted as wedges for the building of canoes and knives for fine woodworking. The tools that were used on medium-hard and hard material might have been used on wood as well, although the traces on those artefacts are less distinct. The flake (269-2, two sides) that was used on bone, was most likely used to incise bone artefacts. Decorated bone artefacts were recovered for example at the site of Anse à la Gourde (Hofman *et al.* 2001a), although on a modest scale. Apparently, considering their numbers, shell ornaments

played a more important role. This is represented in this sample by the relatively high number of edges used on mineral material and shell (14,3 %). Unspecified mineral material includes shell, leather-hard clay and soft stone, but in this context shell is the most probable worked material. Only one working edge displayed traces of hide working, as expected. Ethnohistorical sources seldom mention the use of hides and furthermore, the mammals available in the area at the time of occupation, were relatively small for the provision of skins.

| motion / material | longitudinal | longitudinal/ perpendicular | perpendicular | drilling | diagonal | wedging | uncertain | total |
|---|---|---|---|---|---|---|---|---|
| plant | 1 | 1 | 3 | - | 1 | - | 1 | 7 |
| plant/hide | - | - | 1 | - | - | - | - | 1 |
| siliceous plant | 2 | - | - | - | - | - | - | 2 |
| wood | - | - | 1 | - | - | 2 | - | 3 |
| bone | 2 | - | - | - | - | - | - | 2 |
| hide | - | - | 1 | - | - | - | - | 1 |
| mineral | 2 | - | 2 | - | - | - | 1 | 5 |
| shell | 1 | - | - | - | - | - | - | 1 |
| medium hard material | 1 | - | 1 | 1 | - | - | 1 | 4 |
| hard material | - | - | 1 | - | - | - | - | 1 |
| uncertain | 4 | - | 5 | - | - | - | 6 | 15 |
| total | 13 | 1 | 15 | 1 | 1 | 2 | 9 | 42 |

Table 5.1 Flint artefacts, worked material versus motion, number of used edges

### 5.3.2 Typology versus function

There are no clear relationships between certain tool types and specific motions or worked materials. Approximately 48% (n=30) of 63 complete, unretouched flakes and flake fragments shows traces of use, resulting in 34 used edges. Some implements displayed macroscopically visible use-retouch. Of the eight studied blades or blade fragments, six (75%) displayed traces, two of them on two edges. The blades seem therefore to have been used relatively more intensively, but the number of studied artefacts is rather small. Both flakes and blades display a variety of worked materials and motions, although the blades and blade fragments were used especially in a longitudinal motion. None of the studied core artefacts (n=6) displayed usewear traces.

## 5.4 Hard stone tools

Stone implements other than flint were studied primarily by use of the low power technique, in view of their coarse-grained surface. The high power technique was only additionally applied in a few cases. Almost all pieces of stone collected (n=936) are regarded as artefacts (95,3%), although not all pieces show signs of manufacture. The raw materials did not occur on the site and were brought there intentionally from other islands (Knippenberg 2006). The artefacts include 548 unmodified water-worn pebbles (58,5%). In Caribbean

archaeology, these pebbles are often classified as polishing stones, but they may have served various functions. The remaining artefacts (n= 388) comprise core-tools (n=97), debitage (n=275) and bead fragments (n=16). The core-tools were further classified typologically on the basis of their general morphology (Knippenberg, 2006; Stevens 2001). Many stones are however merely small fragments and as such not classifiable. The typology for stone tools in the Caribbean area is moreover hardly standardized. The typological description of stone tools is therefore often determined by their presupposed function. To verify these assumptions on function, a sample of 57 artefacts was selected for usewear analysis. The selection was based on the presence of suitable working areas on the tools and the occurrence of macroscopically visible residue. Furthermore a random selection of water-worn pebbles without residue was included as well as a selection of the modified semi-precious stones.
The 30 artefacts with traces of use displayed 45 used zones of mostly heavily worn surfaces. Both the fact that they were used on multiple sides and the degree of wear indicate that hard stone tools were used intensively.

### 5.4.1 Celts and fragments of celts

Stone celts are polished into shape and are therefore difficult to study for micro-wear traces. In Morel in total eight celts and fragments of celts were collected (Fig. 5.12). Three celts and two fragments were selected for usewear analysis. Two edge fragments (70-91-73-I, 276-2) do not show any traces. An explanation would be that the celts were damaged in the early phase of usage and are therefore lacking traces. Two more or less complete examples clearly show traces of use (70-91-74-II, 79-99 IRT MEAS). Both seem to have been used as wedges. One of them was first used as a hafted axe resulting in macroscopically visible rough friction zones on the sides. Originally these sides were polished. Considering the wide angle of the cutting edge and its specific shape, it was probably resharpened while hafted. It was secondarily used as a wedge, resulting in a battered appearance of the butt caused by severe blows and retouches caused by dynamic impact on the edge. The last celt studied (70-91-73-I) did not display any traces. Three solutions are plausible: the traces are not visible because they had not developed enough; the celt might have never been used at all or it was resharpened and repolished, destroying possible traces of earlier use.

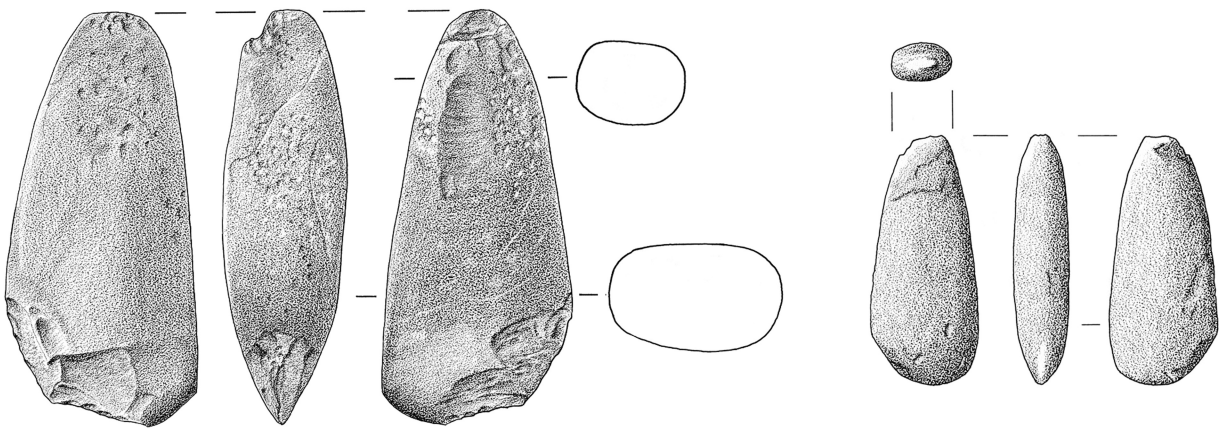

Fig. 5.12 Used celts, drawings scale 1:2

### 5.4.2 Unmodified large pebbles with traces of use

Typologically, the only division made in this category is the distinction between hammer stones and stones used for grinding/abrading/polishing. In general it can be stated that artefacts that appear to have been

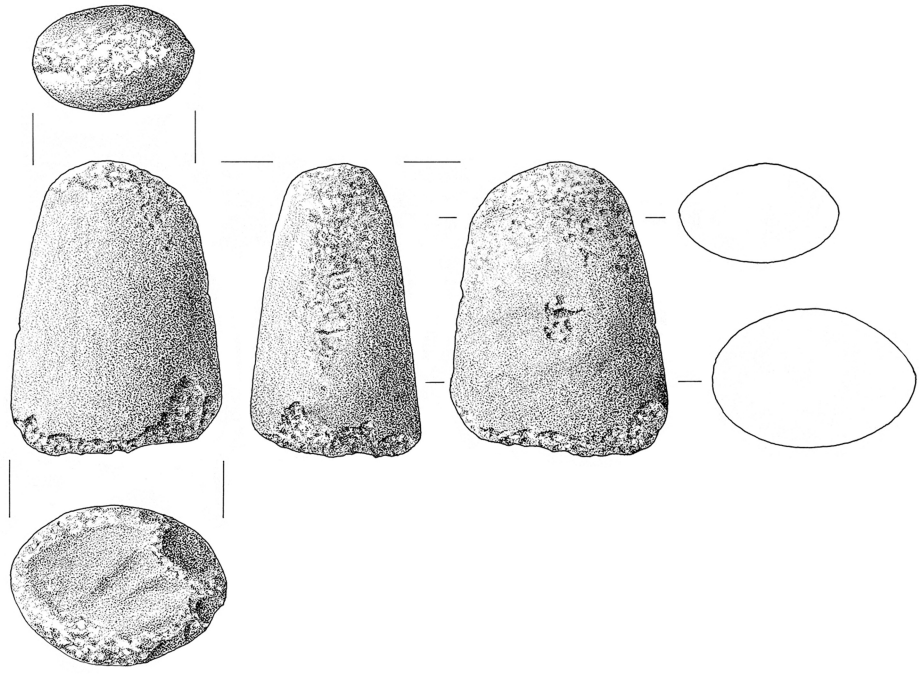

Fig. 5.13 Pounding tool, drawings scale 1:2

used actively (large pebbles) are called hammer stones. Stones that appear to have been used passively (with a relatively large smooth surface) are classified as grinding/abrading/polishing stones (Fig. 5.13). This distinction can however be subdivided further on the basis of usewear analysis. Many stones that are commonly regarded as hammer stones are often in fact used for rubbing activities. In general the variety of actions that were undertaken regarding rubbing is highly underestimated. Leaves, branches, seeds., roots, soft stones and animal parts, all had to be rubbed, crushed and mashed to make them suitable for e.g. food preparation, the creation of pigments or the production of basketry. Unfortunately, presently it is not possible to distinguish between those activities[1], certainly not with the applied low power approach. One can however differentiate between categories of active rubbing/hammering/grinding stones that display a variety in the topography and distribution of traces. A specific category are the querns (Fig. 5.14). Querns consist of a combination of an active part (mano) and an inactive underlying part (metate). Rubbing stones that are used to crush materials need an underlying inactive part as well. The distinction that is made in this context between manos and rubbing stones is based on the difference in smoothness of the surface: a mano should only be used in a longitudinal abrasive motion, resulting in a smooth, abraded flat surface. A rubbing stone can also be used for pounding harder materials, resulting in small pits in the surface that does not need to be flat. Furthermore, the shape of the artefact is taken into consideration: flat bipolar stones that can be easily hand held are regarded as manos, where as larger flat one-sided stones are regarded as metates. One example could be interpreted as mano (221-1) (Fig. 5.15). Implement 564-1 was used as an inactive milling device (metate). The metate is slightly deepened in the centre and has a very smooth surface. The absence of deep irregularities suggests that the stone was not secondarily used for pounding or crushing hard materials.
Polishing stones can be used both actively and passively. Again, the difference is based on morphology. Small pebbles with polishing traces are used actively (see section small pebbles). Larger flat stones with traces of

1 With more experimental knowledge and residue analysis this will however change, although the problem of multiple overlapping use over longer periods remains (Hamon 2004,Verbaas 2005)

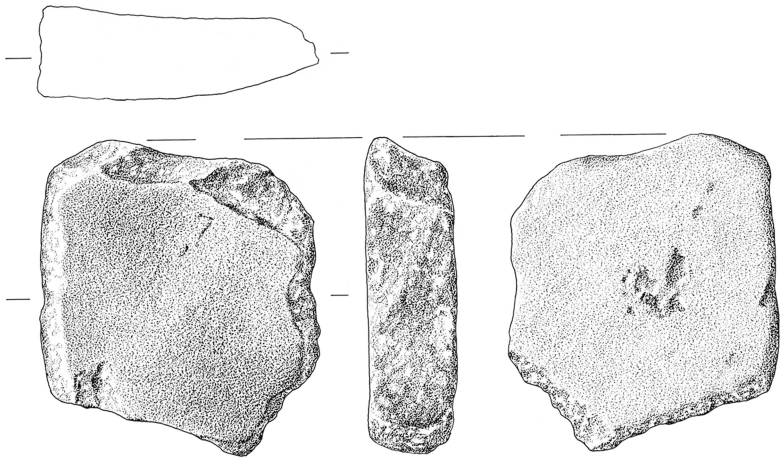

Fig. 5.14 Fragment of a quern, drawings scale 1:2

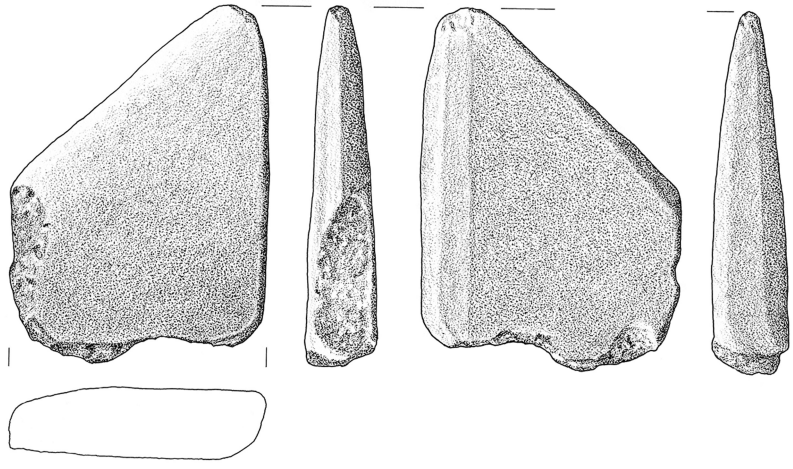

Fig. 5.15 Fragment of mano?, drawings scale 1:2

polishing in the centre of a smooth surface are regarded as passive polishing stones. One piece of stone of the studied selection shows fine polishing traces (229-5). It is a fragment of a polishing stone of igneous rock and it was studied with both low and high power technique. It shows traces of polishing, but it is not clear whether it was used to polish stone or shell implements.

Two artefacts show rubbing and pounding traces all around (557-6, 701-1), which results in a very specific shape. This shape also occurs in the combination artefacts (see below). The shape is the result of intensive use in a repetitive abrasive motion, carried out from different angles. In this way the tool could be used over a longer period, most probably for working medium-hard materials. The deeper pits in the facets indicate however that the stones might also have served in impact motions. The angular appearance of the working areas has also been observed on the passive stones used by an experimental flint knapper, applying the bipolar technique. The Long Island flint artefacts in Morel were produced with this technique.

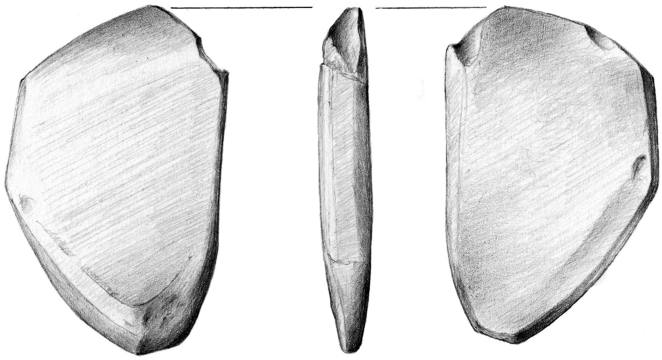

Fig. 5.16 Used flake of sandstone, drawings scale 1:1

One flake of sandstone (451-4) (Fig. 5.16) was used in a transversal scraping motion on medium-hard material. The edges and surface are very rounded, but they do not show many striations or gloss. The artefact has no equivalents, but its shape shows a remarkable resemblance to some of the secondarily used pottery sherds (Van Gijn and Hofman *in press*)

Finally, one of the stone artefacts (455-1) originally displayed a natural three-pointed shape, but as a result of use in a diagonal movement on hard material, the top has been scraped away. Similar traces are recently noted on smaller artefacts of Anse à la Gourde. No experiments that have been carried out so far lead to the same results. It remains therefore unclear whether the tool was used actively or inactively. The size of the Morel example suggests that it was used standing on the broadest side, while moving the worked material over the top. The traces do not resemble polishing or grinding traces, but are interpreted as the result of rubbing rough materials. The diagonal directionality is specifically noticeable. Since the damage is rather intensive, the tool needed to be supported by something to hold it in place. As there were no such traces found, the tool was most probably held between the legs.

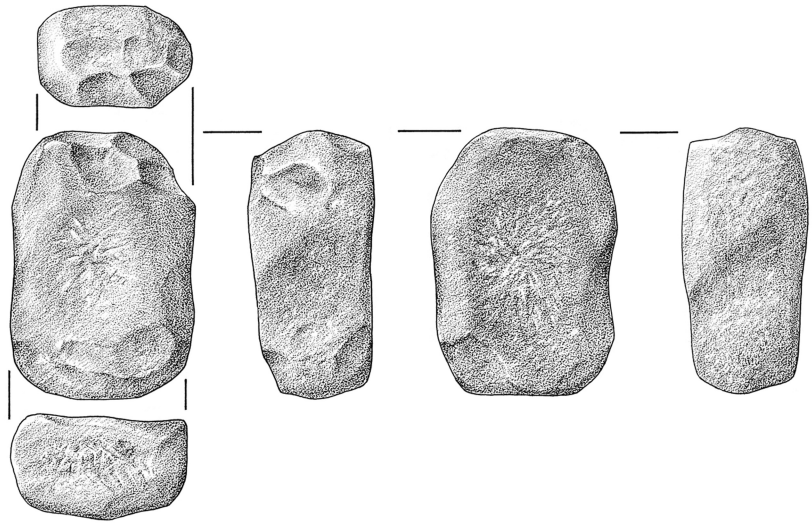

Fig. 5.17 Combination tool: rubbing, hammering, avil traces, drawings scale 1:2

### 5.4.3 Combination tools

Two artefacts (524-5, 557-5) show a combination of traces and had a multi-purpose function (Fig. 5.17). Both show traces of use as an anvil on two flat sides. All around they display traces of rubbing and shallow hammering. These traces result in a specific facetted angular shape of the stone. This type is also known from the European Bronze Age and seems therefore to represent a specific type, linked to certain activities, which cannot be specified so far (Van Gijn *et al.* 2002, 527). A suggestion is the use of this tool as a pestle in a wooden mortar for crushing seeds.

### 5.4.4 Small pebbles

Of the 548 water-worn pebbles 29 examples were selected, including several pieces showing residue. They all show a highly polished surface, but it cannot be said if they were used for polishing activities. Vredenbregt (2002) mentions the use of pebbles to polish pottery in the last stages of manufacturing with the Kari'na of the Lower Maroni river in Surinam (see Ch. 3, Fig. 3.18). These pebbles have a high symbolic value however and are therefore used for several decennia. They have an angular appearance showing multiple facets. Many women also used pebbles that were less treasured and used over a shorter period. They had however the same facetted appearance (pers. com. Vredenbregt 2005). None of the Morel pebbles display these. One pebble (524-5) was used as an anvil and shows traces of rubbing. Eight (339-2, 384-5, 468-4, 475-6, 479-1, 526-3, 772-6, 70.90.18.I-IV.1) show bands of spots of black residue, which resembles black resin (but this was not chemically researched). It is suggested that these pebbles were used as small net-weights and that they were braided into the edges of a fishing net. Two of these bands show fibre imprints (479-1, 772-6), which makes this suggestion more plausible (Fig. 5.18). Boomert (Boomert 2000, 235) mentions the use of resin of the

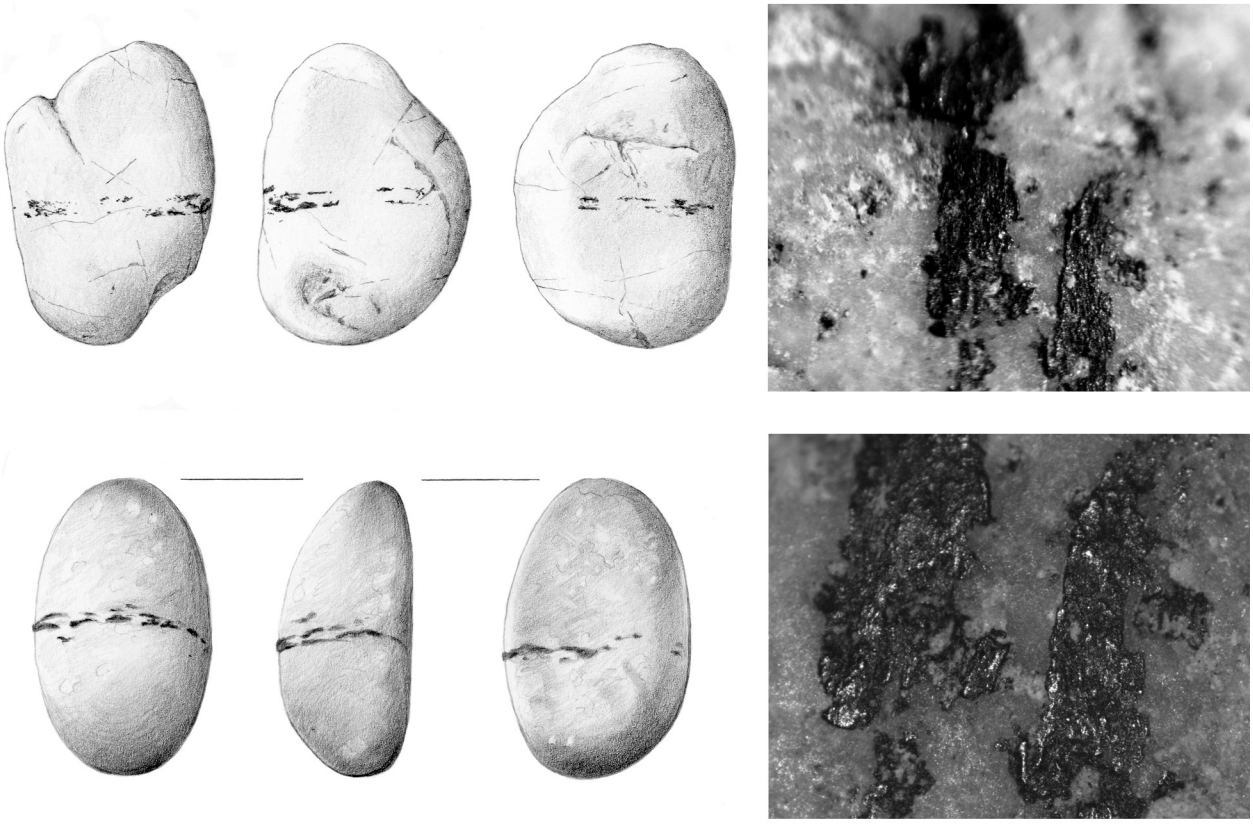

Fig. 5.18 Water worn pebbles with residue, drawings scale 1:1, pictures orig. magn. 50x

Yellow Mangue tree to wax fishing lines and the fastening of detachable arrow points to shafts. In both the sites of Anse à l'Eau and Anse à la Gourde pebbles with a comparable residue were found.

Several pebbles show a more brownish residue, which easily could be mistaken for the black bands. These artefacts however show less 'residue' and the spots are more randomly spread over the whole surface. It is therefore likely that these traces are post-depositional. Some pebbles seem to have black inclusions of a comparable substance, but after microscopic analysis it is relatively easy to distinguish between intentional, natural and post-depositional residues.

| typology | anvil traces | polishing/ grinding | hafting | pounding | rubbing | scraping | wedging | total |
|---|---|---|---|---|---|---|---|---|
| axe | - | - | 2 | 2 | - | - | 2 | 6 |
| hammer stone | 2 | - | - | 2 | 6 | - | - | 10 |
| *mano*/*metate* | - | 2 | - | - | - | - | - | 2 |
| pebble with resin | - | - | 15 | - | - | - | - | 15 |
| rubbing stone | 3 | - | - | - | 4 | 2 | - | 9 |
| whetstone | - | 1 | - | - | - | - | - | 1 |
| uncertain | - | - | - | - | 2 | - | - | 2 |
| total | 5 | 3 | 17 | 4 | 12 | 2 | 2 | 45 |

Table 5.2 Stone, tool type versus motion, number of locations

### 5.4.5 Ornaments

All ornamental pieces were studied to learn more about their manufacturing process. One carnelian bead preform (505-3) shows the initial stage of knapping roughly in shape, all amethyst beads seem to have been finished. One amethyst bead (two pieces: 70.91.23.I & 792(79.99.63.III)-3) is in an extraordinary condition: it is highly polished and shows no damage (other than breaking) at all. Unfortunately it does not display any manufacturing traces other than polishing.

One tiny black artefact (<1 gram) was made from an unknown material, most probably jet, although no sources are known to me in the region. The ornament is a piece of a frog-shaped object, in shape comparable to the frogs of *Strombus* and jadeite found earlier on Morel (both in collection Museum Edgar Clerc).

## 5.5 Coral and pottery tools

### 5.5.1 Coral tools

In the 1999 Morel campaign 665 pieces of coral were collected, weighing 12,5 kg in total. Only five pieces are interpreted as artefacts. They do not show any resemblance to artefacts from other material categories or to coral artefacts from Anse à la Gourde. It is therefore not possible to give a technological or typological description. Coral tools seem to have been used specifically for their abrasiveness. The corallites that resharpen themselves during the activity are especially suitable for working soft to medium-hard material. In Morel, two artefacts have a similar appearance; both seem to have been used as the active part in a rubbing or milling

movement. One of them is a piece of Acropora palmata (Coral nr 3, Z70, S91, Sq26, LII). The other one is a piece of Porites sp.(Coral nr 2, Z70, S90, Sq43, LIII). It remains unclear whether they were shaped before use. Another tool of Porites sp. (Coral nr 5, Z70, S91, Sq 52, LI) is in contrast more likely to have been shaped by abrading and polishing until it had a blunt point on one side. The rest of the piece was not shaped. Although the shape in itself seems to be highly efficient for drilling of for instance wood (Kelly 2003), the tool point does not display evidential traces to support this option.
One small piece of Acropora cervicornis (Coral nr 1, Z70, S91, Sq 38, LII) is covered with a reddish brown residue and on one side the corallites are slightly smoothed, as result of a scraping motion in the longitudinal direction of the artefact. The residue consists most likely of clay particles and it completely covers the surface. No other piece shows this residue. In the site of Anse à la Gourde approximately eight pieces were however discovered with the same residue, which was interpreted as clay material, resulting from use in pottery making (Kelly 2003, pers.obs. L. Jacobs). In the Golden Rock site on St. Eustatius, pieces of Acropora palmata, a metate and a pottery sherd showed similar traces of residue, interpreted as a result of pottery manufacturing as well (Steenvoorden 1992; Versteeg and Schinkel 1992, 127). This Morel example can be assumed to have played a role in pottery production as well.

### 5.5.2 Secondarily used sherds (Fig. 5.19)

The microscopic analysis of tools made of broken pottery sherds is still in a very preliminary stage. Pottery sherds, displaying traces of wear were however studied by Van Gijn (Van Gijn and Hofman, *in press*). It was only possible to examine them with a stereomicroscope due to the bad preservation conditions. No formal tool types were found; the criteria for a tool are limited to the presence of an abraded edge. All tools (n=16) were used in a transverse direction. In some cases striations and a smooth, bright polish were attested. Four different types of abraded edge were distinguished: Type 1 has asymmetrically rounded edges. This type shows the most resemblance to experimental pieces used to scrape clay. The asymmetry is either caused by differences in hardness of the opposing sides of the sherd or by a specific preference of the user to hold it in a particular way.

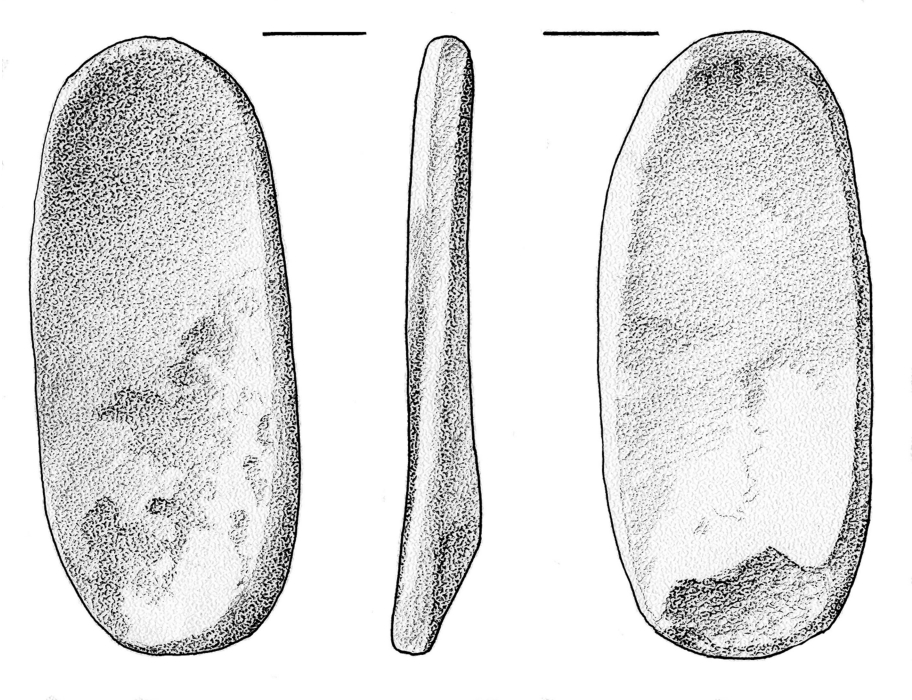

Fig. 5.19 Secondarily used pottery sherd, scale 1:1

Type 2 has symmetrically worn edges with a square cross-section. Type 3 has symmetrically worn edges with a U-shaped cross-section. Types 2 and 3 were used from both sides. The shape of the cross-section is related to the hardness of the sherd; harder sherds display less rounding, resulting in square cross-sections. Type 4 has facetted edges. The tools displaying these facets were probably used in a relatively late stage of pottery production, on leatherhard clay, making the edge wear down in facets instead of only slightly rounding it. Most tools seem to be involved in the pottery production process. Unfortunately, their bad condition allowed only one sherd to display a characteristic, diagnostic polish to be interpreted as the result of scraping clay.

## 5.6 Conclusions

The studied artefacts from the 1999 excavations and the artefacts found washed upon the shore in the previous decades form together a representative sample, which demonstrates that the variety in tools and ornaments must have been comparable to the wealth of artefacts in Anse à la Gourde. The condition of the tools and the well-known under-representation of specific worked material categories in usewear analysis result, unfortunately, in a distorted spectrum of former activities. Still, from the tools that were suitable for interpretation, valuable conclusions have been reached.

Both flint and stone were used intensively, which is to be expected since this material had to be brought to the site from considerable distances (Knippenberg 2006). Stone tools show traces of rubbing, hammering, polishing, grinding and wedging and have served as axes, net weights and ornaments. The one example of a hard stone metate was used as a quern only, at least in the last stage before discard. Other stone tools were clearly used for multiple abrasive activities, such as scraping, milling, grinding, polishing and rubbing. It was not possible to draw inferences on specific worked materials by use of the low power technique, although the wear indicates that the materials worked were medium hard to hard, suggesting that plants, seeds, shell, colorants, bone and leather-hard clay were processed.

Flint tools display traces of all types of worked material categories and all types of motions.

Although the bivalve shells suffered the most from the formation of beach-rock in the site, they distinctly represented two different types of tools. They can be interpreted as tools to work soft materials such as plants, siliceous plants and the outside of calabash, and tools to work harder materials such as the inside of calabash, wood and bone. The small number of coral tools is difficult to interpret, because none of them displays the characteristic abraded angles like the ones from Anse à la Gourde. One of them was probably used in the pottery production process since it displays residue, which is interpreted as clay. In Anse à la Gourde, the same type of residue was attested on comparable artefacts.

Considering the entire toolkit it must be stressed that, as in Anse à la Gourde, flint and hard stone tools were indispensable to carry out the domestic activities taking place at the site. The sharpness of flint and the strength and weight of stone are not equalled by local raw materials. Incising shell, bone and tough wood requires flint flakes. Pounding tools cannot be made from coral, which is too britlle and lack the capacity to absorb shocks like stone.

The domestic activities covered the whole range of what one would expect in a broad spectrum economy: tools for the preparation of food, for wood, shell and stone working, for fishing and fibre preparation are all present. People did not have preferences for specific tools besides their natural properties: tools were used for their suitability for the task, regardless of the raw material. This particular ad hoc approach to tool use will be dealt with further in chapter 6.

# 6. Towards an integral approach in the Lesser Antilles

## 6.1 Introduction

The primary objective of this study was to examine the role of shell artefacts in the pre-Columbian technological system by means of an explorative usewear study. Below, first the methodological aspects of usewear analysis in general and specifically of shell implements will be evaluated (Ch. 6.2). The results of the analysis from the other tool categories make it possible to examine the role of their relationship and of shell implements in particular. The following paragraph (Ch. 6.3) focuses on the choice of raw materials for tools and ornaments. The reconstruction of these choices in the technological system was the second objective of this study. It will be demonstrated how functional analysis contributes to our knowledge of the technological choices made. Furthermore, it will be shown how a distinction can be made between cultural preferences and physical constraints. Data from different contexts, including archaeological, palaeobotanical, ethnographic and ethnohistorical information was gathered to form the basis for an experimental reference collection. The results also formed the basis for the reconstruction of domestic crafts and subsistence activities, the third objective of this study. In the fourth paragraph (Ch. 6.4) a description of the variety in household activities will be described. The diachronic changes that were observed are also presented there. To conclude some suggestions for further research will be presented (Ch. 6.5).

## 6.2 The possibilities and limitations of functional analysis

### 6.2.1 Low and high power, form and function

In earlier studies of shell artefacts, ascribed function was based on analogy, morphology and the presence of functional edges. In particualr the so-called recurrent forms or expedient tools have been debated (Armstrong 1979; Dacal Moure *et al.* 2004; Jones O'Day and Keegan 2001; Keegan 1981, 1984; Versteeg and Rostain 1997). In some cases low magnifications were used (Cartwright *et al.* 1991; Lundberg 1985). In my opinion however, only high power analysis sheds light on the actual use of a tool, while the low power approach may only lead to a hypothesis on the possible function of an artefact or to low level inferences. Polish can only be interpreted with the high power technique. Although well-developed polishes might be visible with low power, the diagnostic features are only observable with high power. The choice for one of both methods depends on the quality of the material (suitability for high power analysis) and the questions asked. The method makes it possible to overcome the traditional form/function relationships. In the case of the pre-Columbian assemblages of Morel and Anse à la Gourde virtually the entire tool-kit consists of artefacts without a formal typology. Part of the shell implements, the majority of hard stone tools, all flint artefacts and the coral and used pottery sherds have not been made in a standardized way. Functional analysis makes it possible to classify these tools on the basis of inferred function instead of morphology. Functional analysis makes it moreover possible to add an organic component to the archaeological evidence. The traces preserved on the tools give us information about these materials, which otherwise do not normally survive.

### 6.2.2 The so-called recurrent forms

In the specific case of shell tools, bivalve shell implements and other expedient tools are especially interesting for functional analysis. It is generally accepted that the majority of the bivalve shells should be interpreted as tools, but there are no indications about the tasks performed since they hardly show modifications. It has been demonstrated that traces are visible on both the micro- and the macroscopic scale and that they can be distinguished from secondary modifications and manufacturing traces. The macroscopic use modifications may still be interpretable even in the case of minor secondary modifications, although we have to be content with

less detailed inferences of tool use. Use-retouch and intentional retouch can be separated on the basis of their distribution and regularity. Secondary modifications are distributed randomly over the shell surface and consist of rounding and unevenly distributed edge removals.
The so-called recurrent forms that were found in Anse à la Gourde were always weathered and worn as the result of taphonomic processes. The sample of these tools studied with the high power technique displayed no evidence of use. They should be considered as discard of food or shell artefact production. It is very likely that these recurrent shapes are the result of recurrent natural and/or anthropogenic breakage patterns that are related to the form and robustness of the various shell species. Trampling and abrasion, and especially rolling in the coastal surf are more plausible explanations for these shapes, rather than intentional modifications. Microscopic analysis should be applied to collections of these presumed 'tools', especially in sites where the tools with intentional modification are lacking. A microscopic pilot-study of expedient tools from the Bahamas, Turcs and Caicos, Haiti and Jamaica (Jones O'Day and Keegan 2001) was carried out by myself. It has revealed that high power analysis provides the best method to distinguish between 'actual tools' and 'recurrent shapes'. Although the shapes may occur regularly, only a small percentage indeed show traces of use. However, real expedient use (in the sense of the execution of one short task) does not leave diagnostic traces.

### 6.2.3 Methodological observations

There are many similarities between the usewear analysis of flint and shell artefacts. The experimental reference collections of both artefact classes display strong parallels in the microscopic traces and the distribution and characteristics of the polish. Thus, for the interpretation of shell artefacts use can be made of the experimental flint collection. The environmental setting of the sites studied however, asked for experiments focused on specifically tropical domestic activities and the processing of local materials. Another specific difference between shells and most flint artefacts is the fact that many shells are shaped by polishing, resulting in an abundance of manufacturing traces. These traces have to be separated from the traces that develop as a result of use. Experiments were directed at tool production as well as tool use. Celts especially display a mixture of traces. So, experimental tools were studied microscopically before and after use. The results demonstrated that a distinction can be made between manufacture and use on a high power level.
Unfortunately, taphonomic processes have a much greater effect on the surface of shell tools than on flint tools, resulting in retouch and abrasion. These secondary modifications can now be recognised however, when the combination of microscopic and macroscopic traces is studied. In the case of the sites studied it was apparent that the tools found in Morel suffered from the formation of beach rock in the site. Consequently, it was harder to interpret these shell tools than the ones from Anse à la Gourde, resulting in a less refined level of inference.
It should be stressed that functional analysis extends beyond the registration of usewear traces in view of the differential expression and preservation. Specific worked material categories, such as fish and meat are often underrepresented, the duration of use might have been too short to leave diagnostic traces and traces may have been lost because of resharpening or the occurrence of severe edge damage. Entire organic tool categories (wood, calabash) may be missing in the toolkit and expedient tools may not have been recognised. To approach the problem of expediency a quantitative approach towards the development of traces on shell implements is required, as was done for flint (Van den Dries and Van Gijn 1997). To give the functional data a social meaning they should be regarded in their context. The archaeological information provides data on available material sources. Ethno-historical and ethnographic data present ideas on the actual tasks carried out. 'Cutting siliceous plants' can thus be interpreted as being part of the domestic task of 'making basketry'. Experimental data can be regarded in the same manner, providing hypotheses on possible activities.

## 6.3 The choice of raw materials for tool and ornament production

The second goal of the present study was to explore the preferences in raw materials for the production of tools and ornaments. Samples of flint and hard stone tools were therefore studied as well, in addition to the study of the shell artefacts. Studies of a sample of the coral tools (Kelly 2003, Kelly and Van Gijn *in press*) and the secondarily used pottery sherds (Van Gijn and Hofman *in press*) were incorporated in the analysis as well.
'Missing material categories' should be kept in mind to reconstruct a full technological system. Calabashes, turtle shell and wood could have served as raw material for tools, but they would not have been preserved. Expedient tools made of shell such as columella tools are found on other islands in the region (Dacal Moure and Croes 2004; Jones O'Day and Keegan 2001) but may very well have been missed during the excavation. The quantity of shell remains from the excavated midden in Anse à la Gourde was so large that it was decided to study a sample only. Flint tools with an important function, in for example, bead production, or manioc grating, might have been so small that they were lost in the large number of finds. Small pieces of flint might get lost or get crumbled in the residue when the excavated features were sieved. It is however still possible to study the larger part of the toolkit. Flint, stone pebbles and rocks, shell, stony coral and secondarily used pottery sherds all have served as raw materials and are preserved in the archaeological record. The physical properties of the different raw materials vary and this determines to some extent the choice of materials for tool production for specific tasks. Predictions of these activities can moreover be made using additional information sources, especially ethnohistorical and ethnographical reports. Experiments can test these assumptions and it may be assumed that specific choices might have been culturally or traditionally determined in case of equivalent physical properties. Obviously, the choice of the raw material to be used for a specific tool type was first and foremost specified by its properties and shape. An abrasive stone or coral surface is required to polish a shell celt. One needs a sharp edge to peel manioc. But, although each material has its own characteristics (abrasive, sharp, strong, heavy), there is an overlap in functionality as well. Shell celts can be ground on a hard stone tool as well as on a coral slab stone. Peeling manioc can be carried out with either a bivalve shell or a flint flake. The experiments have demonstrated that shell tools are not efficient to work hard materials such as bone and other shells or for fine woodworking activities. Flint tools are the only alternative for these tasks. Coral tools are not efficient in impact motions. Shell celts and stone tools may both serve as an alternative. Hard stone tools are however most useful for tasks requiring weight or abrasiveness, such as rubbing, grinding and pounding.
The results of the present functional analysis have demonstrated that for the materials that can be processed with different tools, no preferences for certain tools could be identified. Hard stone tools were used most intensively, considering their high average number of used zones. This might be expected taking the long-term efficiency of a stone surface into account and the constraints of importing this raw material to the site. Flint was mainly brought from Antigua, stone pebbles and rocks had to be imported from La Désirade or Basse-Terre. Grande-Terre itself did not provide functional stone material because of its calcareous nature. Experiments with beach rock demonstrated that this material has almost no functional qualities. Shell appears therefore to have been considered a valuable addition, serving as the main locally available raw material for tools and ornaments. Flint and hard stone remain indispensable, because of both their sharp cutting edges and heavy, durable abrasive surfaces, with resistance against impact. It took considerable effort to obtain these raw materials from other islands, but the usewear traces do not display an embedded procurement of these tools. Activities that might have been carried out with locally available material were performed with flint and stone as well.
The experiments have demonstrated that shell celts are efficient enough to cut fresh and burnt wood, to be used as wedges or as hoes. So, in my opinion, from a technical perspective, there was no need for stone celts. The fact that stone celts were produced at a limited number of sites (Knippenberg 2006) and the exchange of these implements between the islands suggest that cultural preferences played a role for this artefact category.

## 6.4 Domestic activities and craft specialization through time (Fig. 6.1)

The third aim of this study was the reconstruction of the domestic activities at Morel and Anse à la Gourde and to identify the diachronic changes in these activities. It is difficult to go from the observation of wear traces to the interpretation of an activity carried out with the implement (Juel Jensen 1993). On the hard stone tools only the low power technique was moreover applied. High power research should be carried out for inferences on worked materials, but this type of research has hardly developed (see Ch. 2.2.1). Still, with all the additional knowledge available in the Caribbean area, a general picture of most activities executed at a site can be reconstructed. At last, questions on social motives might be answered by means of the reconstruction of the functionality of artefact categories and the specific choice of tools (Rostain and Dacal Moure 1997, Van Gijn *et al. in press*).

Studies of biological resources in the region (Newsom and Wing 2004) demonstrate that subsistence activities shifted only slightly from the Archaic Age to the post-Saladoid period. The research on vertebra and crustacea of Morel (Nokkert 1999) and Anse à la Gourde (Grouard 2001b) demonstrates a shift from a focus on land animals towards a more marine diet. The shell research of Nieweg (1999 and 2001) do however not show an important shift. It has to be taken into consideration that Morel was only excavated partially. By means of functional analysis it was hoped to find new data on subsistence activities.

Both Morel and Anse à la Gourde display a more or less comparable image of the activities carried out. The comparison is unfortunately slightly hampered by the difference in quality of the condition of the artefacts as well as the sites themselves. It should be taken into account that the results of the low power analysis of the hard stone tools should be regarded as hypotheses in the description of the reconstructed activities (see Ch. 2.8).

### 6.4.1 The production of tools

The way artefacts interrelate within the technological system is for both sites comparable (Fig 6.2). Most tools are made at the site and their production does not require much time or skill. The production of shell celts involves a multiple toolkit. First, the wing was separated from the rest of the shell, using a hammer stone or other shell. Subsequently, the blank was knapped roughly into shape probably with the same tool. Finally the celts were ground and polished on hard stone or coral grinding tools with the aid of sand and water. Shell celts got thicker in the later periods and the polishing traces became more restricted to the sharp cutting edge, which was also attested on Antigua (Murphy 2004).

Obviously, the production of bivalve shell scrapers requires very few tools, because they were either used unmodified or with a retouched edge. Retouch was created with either hammer stones or expedient shell tools, such as columella-tools.

Flint flakes were produced locally, by means of the bipolar technique (Knippenberg 2006). Pre-cores were mainly imported from Antigua. Hammer stones and anvils on pebbles from La Désirade were used to further modify these cores. No intentional retouch was found. The retouch on a small number of flakes could be interpreted as the result of use or of post-depositional processes. Traces, interpreted as manioc scraping indicate that flint flakes were set into wooden grater boards. Other flakes were used unhafted.

The hard stone tools were made by pecking with hammer-stones, but many, especially pebbles, were just gathered and used without further modifications.

In the pottery production process shell, stone, coral and pottery sherds were involved. It may be assumed, on the basis of ethnographic references (Vredenbregt 2002) and experimental research (Hofman and Jacobs 2004), that this was supplemented with tools made from calabash. It is likely that for the production of adornos use was made of wooden implements as well.

The production techniques of several organic implements are attested only by the usewear traces on the tools used. As stated before, it is virtually impossible to distinguish between traces of processing plant material. The high power analysis of the shell and flint tools however has demonstrated an important emphasis on plant

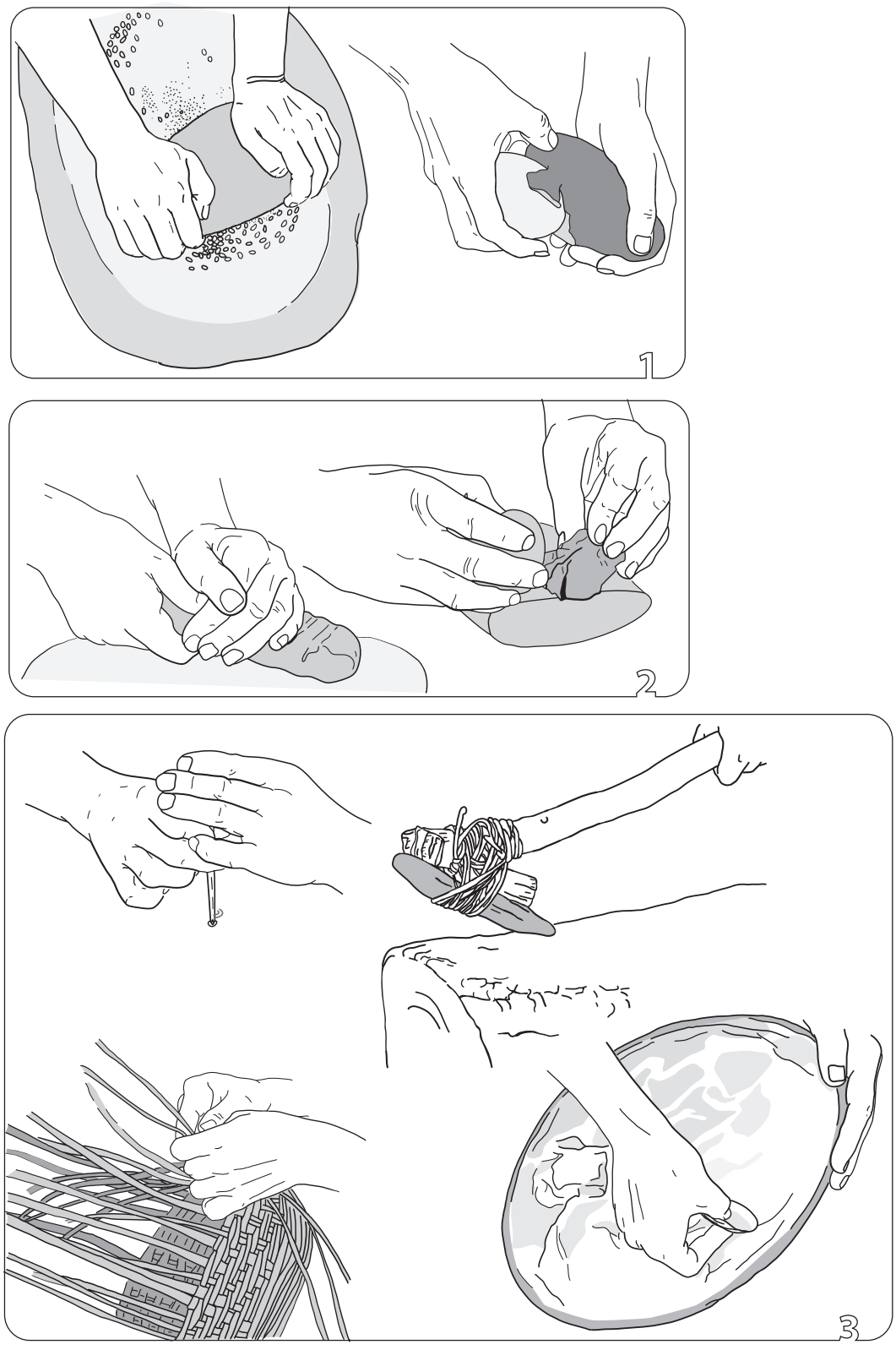


Fig. 6.1 Domestic activities: a variety of performed tasks

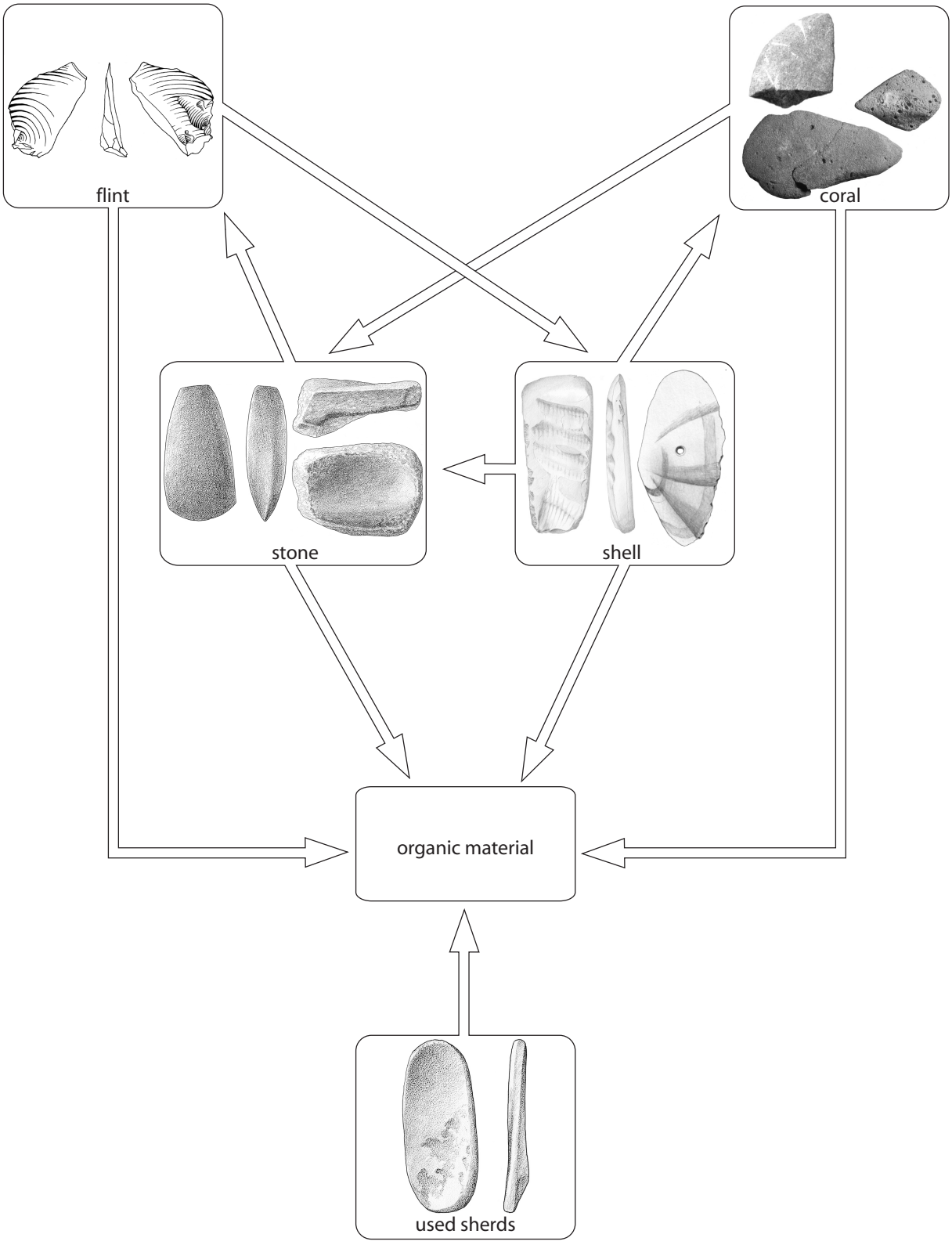


Fig. 6.2 Artefact production: the technological system

working. The low power analysis of the hard stone tools revealed many traces of rubbing, to be associated with plants and branches. These data, the ethnographic parallels and the experiments, demonstrate that rubbing stones were used to extract fibres from plants to make ropes and lines. Branches to be used in basketry were possibly prepared with rubbing and pounding stones and probably with bivalve shell or flint scrapers to remove the bark. Calabashes were cut in half with the aid of flint flakes to produce containers and bivalve shells were used to scrape the inside clean.

### 6.4.2 Subsistence activities

The majority of the tools were used for plant and wood working. This was however expected, because the circumstantial data had already suggested that most activities were directed at the processing of these materials. Shell and stone celts were used to chop trees and to shape wood roughly. Coral and hard stone tools were possibly used in the same activities. Bivalve shell scrapers and flint flakes, demonstrating traces of wood working were probably used for cutting and scraping smaller wooden implements. Part of the flint implements and bivalve shells displaying traces of plant working were probably used in subsistence activities. Flint was also used in grater boards for the processing of manioc. The hard stone tools interpreted as grinding/milling stones or querns were probably used for processing seeds, cereals and fruits. High power analysis might shed more light on this, although it is highly likely that the hard stone tools with a flat surface had multiple functions and are therefore difficult to interpret. For now, it is not possible to distinguish whether the majority of traces are the result of subsistence activities or of domestic crafts. More experiments (Van Gijn *et al. in press*) and residue analysis may lead to a higher level of inferences (Kealhofer *et al.* 1999; Nieuwenhuis 2002; Pearsall 1989; 1994)).

The evidence for the processing of animal materials (bone, hide, meat) is very limited, something which was anticipated. Firstly, the possibilities for usewear analysis to recognise traces of processing soft animal products are limited. Still, traces of working bone and hide are almost always visible (Van den Dries/Van Gijn 1997) and were not found on the artefacts studied. Secondly, in the archaeological record bone material is often preserved, but decorated or modified pieces are rare. Furthermore, the presence of mammals with useful skins is limited (agouti, rice rat). Finally, there is an almost total lack of indications in the ethnographical context for the use of these materials.

The toolkit for hunting and fishing activities is represented by the presence of net gauges or measures made of shell, small pebbles with resin-like residue interpreted as net weights and shell fishhooks. It is remarkable that Morel contains specific evidence for net-fishing, including net-weights and measures, while the emphasis in the faunal remains is terrestrial (Nokkert 1999). Anse à la Gourde only has a few measures and no net-weights, yet the fish remains indicate specifically that nets were used, since all individuals exceed a certain dimension (Grouard 2001a). The number of fishhooks is however also limited and it may be safely assumed that the net-weights of Anse à la Gourde were simply not recognised.

There is no evidence for projectiles. None of the flint flakes displayed traces of impact. The only evidence for the possible use of spear throwers are small carved pieces of *Strombus gigas* in the Museum Edgar Clerc, originating from Morel, elsewhere interpreted as such (Nicholson 1980).

### 6.4.3 Symbolic artefacts and ornaments

At both sites the production of ornaments was concentrated on shell as a raw material. The number of shell species, which were used for ornaments, is limited. Beads were made locally, predominantly of *Chama sarda* and *Strombus sp.* but also from conical shaped shells such as Conus sp., Oliva sp. and Cyprae sp.. The manufacturing steps of *Chama sarda* beads did not follow a standard procedure. Valves were knapped into a round shape and polished on either a hard stone or coral grinding-tool. The shaping of the rough blank was carried out with hammer stones or columella tools. Perforations were drilled with tiny pieces of flint, hafted in hand-held pen-shaped hafts. The beads were finished with the aid of an abrasive surface, most probable a

grinding stone or coral slab stone. The approximately 1200 beads in the hip-belt in the female's grave in Anse à la Gourde were made from *Strombus sp.*. Because no production waste or half fabricates of this bead type were found, it is assumed that this belt was not made locally. In contrast to the locally made beads, the beads in the hip-belt clearly demonstrate a standardized production sequence. It is concluded that they were firstly knapped and polished into rough blanks. Next they were perforated with a pump- or bow drill, resulting in strongly v-shaped perforations. Finally the beads were strung and then ground together on a grinding stone. This explains why they vary little in diameter, while the thickness is irregular.
Adornments and three-dimensional objects (e.g. zemis, sharks, frogs) are predominantly made of *Strombus sp.*. These species can be obtained relatively easily in the fishing grounds around the reef. Fragments of *Chama sarda* and complete Oliva sp. are furthermore easily found along the shoreline. There does not seem to be an important shift in the use of species through time, nor in the production techniques. Bead production might be an exception, although the difference in production technique may be explained by the difference between locally made and imported beads (see Ch. 4.2.2.1). The variety in ornamental objects with decoration seems to decrease slightly over time. Knippenberg (2004) states that imported semi-precious stone beads became less abundant in the Late Ceramic period, as is demonstrated by the assemblages of Morel and Anse à la Gourde. The precise origin of these stones remains unclear, but there are no known sources on Guadeloupe. The unpolished knapped bead of cornaline in Morel indicates that at least some of these artefacts were imported as rough-outs. It has been previously suggested that they were imported as finished beads at other sites (Haviser 1999; Knippenberg 1999). They might have been replaced by shell ornaments, but the decrease in variety in unique objects mentioned above does not really support this idea. More importantly, the most richly decorated ornaments seem to originate from the older phases. The context in which most of the implements were found does not indicate a specifically symbolic value. The majority of ornamental artefacts was found in the shell midden and on the original surface, indicating no specific characteristics of discard locations. Shell artefacts were only in a few cases found associated with human burials. The most striking examples are three polished cylinders found in a male grave and a hip belt of 1200 beads draped around a female pelvis, both at Anse à la Gourde. Complete *Strombus gigas*-shells were found at both Morel and Anse à la Gourde in association with a grave. Either a grave was not commonly regarded as the appropriate place to deposit valuable items or the shell ornaments were not considered as such in that context.

### 6.4.4 Summary

To conclude, it can be stated that the pre-Columbian inhabitants took full advantage of the available toolkit, without specific preferences when different raw materials have the same qualities. All ethnographic and historical sources show that the emphasis of daily activities lay on the processing of plant fibres, branches, bark and wood and much less on animal products, which is clearly represented by the traces in the studied sample. A similar emphasis on plant processing was also found for Archaic Age site of Plum Piece on Saba (Briels 2004). Apparently the supposed shift from a predominantly hunter/gatherer society in Archaic Age towards a more horticulturist society in the Ceramic Age did not change the emphasis on specific domestic activities. The only evidence for a change in tools is a higher number of grinding stones in the Late Ceramic period in Anse à la Gourde (Knippenberg 2006), indicating a slightly stronger concentration on the use of Palancoid grasses and Sterculia. The presence of flint flakes, possibly originating from a manioc grater board, in Anse à la Gourde may be interpreted as an additional indication of a focus on horticultural products. These observations seem however to be minor differences in the overall picture. A tentative conclusion would be that this would demonstrate that the majority of plant working should be sought more in domestic crafts then in subsistence activities.
The tools used were rather selected on an ad hoc base, constrained only by the natural restrictions of the raw material of the tool and not by cultural preferences. Tools were made locally, as part of the daily household activities. The lack of specialisation is demonstrated in the absence of standardized tool types in virtually all artefact categories (Torrence 1989). Although the celts may display a more or less standardized shape,

the remaining shell and hard stone tools do not reveal a distinct typology. The techniques of the production of flint flakes and bivalve shell tools could be interpreted as expedient. It is still uncertain whether the coral tools were intentionally modified or have obtained their shapes as a result of use (Kelly and Van Gijn *in press*). The secondarily used pottery tools were mostly shaped in the course of their use and were not intentionally modified beforehand. The shell ornaments show a large variety as well. Groups of artefacts can be distinguished, such as 'applications', but there is a wide variety of dimensions, decoration and overall appearance within these groups. Following Torrence's (1989) concept of specialisation, this might demonstrate the presence of a skilled craftsman making very personal objects. The presence of a skilled craftsman is in my opinion in this case unlikely, considering the small number of these objects and the long time-span in which they were produced. Furthermore, within the timespan of this research, enthusiastic students have demonstrated that the production of shell ornaments does not require many skills to create something beautiful. I would therefore suggest that the production of ornaments was not more than a part-time task, not necessarily limited to a skilled craftsman.
The modest extent of specialisation and the use of a partly expedient approach towards tool production should not be considered as a lack in social or cultural development. It is a demonstration of the possibility to take advantage of all possibilities offered. This flexibility is a common aspect of the pre-Columbian communities in the Lesser Antilles. Through time people seem to have adapted from a mainland setting to an island environment, altering it and taking with them essential means of subsistence necessities such as plants and animals (Newsom and Wing 2004). The use of raw materials shifted from an accent on stone to shell and coral, although stone remained important for the tasks that could not be performed without hard stone or flint tools. In addition, some of the hard stone artefact types played an important social role (Knippenberg 2006).

## 6.5 Suggestions for further research

The variety of artefact categories studied is expanding with respect to methodology and consequently so too is the possibility for an integral approach in functional analysis. For the specific case of the analysis of shell implements there is a special need for more experiments to obtain a better understanding of the observed traces. Experiments should also involve the assessment of the influence of taphonomical processes on both the macro- and the microscopic level. This would have an additional value for the category of expedient tools especially, as explained in the beginning of this chapter. A quantitative analysis of the development of wear traces on shell implements would make it possible to identify expedient tools used for a short period of time only.
Secondly, after decades of debate, it is still not entirely clear how wear traces develop. The method still relies on visual comparison. In my opinion, the future of usewear analysis lies in a better understanding of the development of wear traces on different materials. The chemical and physical processes that take place during use on the tool surface should be studied and the short and long term influence of raw materials should be determined. The method would benefit greatly from an understanding of these processes. We might ask ourselves whether this should be carried out by archaeologists, though.
Archaeologically, there is a wish for a diachronic view of the development of technological systems. Therefore, sites from various regions within the Lesser Antilles and from various periods have to be analysed. Because the method takes so much time, more specialists are needed to carry out time-consuming analyses. The specific advantage of this work in the Caribbean area is the availability of ethnohistoric sources, a complete review of which would yield more information on domestic activities. Thus, functional analysis will provide us with a picture of the daily routine and the specializations of the past peoples of the Lesser Antilles.

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# Appendix 1: Code list use wear traces

| Code | Secondary modifications |
|---|---|
| 1. | absent |
| 2. | light |
| 3. | medium |
| 4. | heavy |
| 5. | burned |
| .0 | interpretable |
| .9 | uninterpretable |

| Code | Degree of wear |
|---|---|
| 01 | no traces |
| 02 | lightly worn |
| 03 | medium worn |
| 04 | heavily worn |
| 05 | lightly worn and possibly resharpened |
| 06 | probably used |
| 08 | not interpretable |
| 09 | unsure |

| Code | Applied motion |
|---|---|
| 10 | longitudinal |
| 11 | cutting |
| 12 | sawing |
| 13 | shaving |
| 20 | transverse |
| 21 | scraping |
| 22 | planing |
| 23 | whittling |
| 30 | boring/piercing |
| 31 | boring |
| 32 | piercing |
| 40 | diagonal |
| 41 | graving |
| 42 | splitting |
| 50 | dynamic activities |
| 51 | chopping |
| 52 | wedging |
| 53 | pounding |
| 54 | adzing |
| 55 | hoeing |
| 56 | milling |
| 80 | hafting |
| 81 | hafting, bitumen/tar |
| 82 | hafting in hide |
| 83 | hafting in bone |
| 84 | hafting in wood |
| 85 | hafting retouch |
| 89 | hafting, unsure |
| 99 | unsure |

| Code | Worked material |
|---|---|
| 10 | plant unspecified |
| 11 | non silicious plants |
| 12 | silicious plants unspecified |
| 13 | reeds |
| 14 | cereals |
| 15 | grasses |
| 16 | manioc |
| 20 | wood unspecified |
| 21 | hard wood |
| 22 | soft wood |
| 23 | willow |
| 30 | bone/antler |
| 31 | bone |
| 32 | antler |
| 33 | tooth |
| 34 | horn |
| 35 | bone/wood |
| 36 | ivory |
| 40 | hide unspecified. |
| 41 | dry hide |
| 42 | fresh hide |
| 50 | soft animal material |
| 51 | meat |
| 52 | meat+bone |
| 53 | fish |
| 60 | mineral unspecified |
| 61 | soft stone |
| 62 | shell |
| 63 | soft clay |
| 64 | fired pottery |
| 65 | soil |
| 66 | pyrite |
| 80 | unknown /well defined |
| 81 | polish 23 |
| 82 | polish 10 |
| 99 | unsure |
| 9910 | soft material not specified |
| 9911 | soft material animal |
| 9912 | soft material vegetal |
| 9913 | soft material inorganic |
| 9920 | med material not specified |
| 9921 | med material animal |
| 9922 | med material vegetal |
| 9923 | med material inorganic |
| 9930 | hard material not specified |

| Code | Worked material |
|---|---|
| 9931 | hard material animal |
| 9932 | hard material vegetal |
| 9933 | hard material inorganic |
| 9940 | unsure not spec. |
| 9941 | unsure animal |
| 9942 | unsure vegetal |
| 9943 | unsure inorganic |

| Code | Macrowear shell tools |
|---|---|
| 1. | Not modified |
| 2. | Edge removed |
| 3. | Retouch, rectilinear |
| 4. | Retouch, curvilinear |
| 5. | Facetted edge |
| 9. | Uncertain |
| .1 | Manufacture |
| .2 | Use |
| .3 | Manufacture and use |
| .9 | Uncertain |

## Description of experimental artefacts

| Code | Natural retouch |
|---|---|
| - | none |
| -/+ | some |
| + | much |
| ++ | a lot |

| Code | Intentional retouch |
|---|---|
| - | none |
| -/+ | some |
| + | much |
| ++ | a lot |

| Code | Use retouch |
|---|---|
| - | none |
| -/+ | some |
| + | much |
| ++ | a lot |

| Code | Edge rounding |
|---|---|
| 01 | none |
| 02 | some |
| 03 | much |
| 04 | a lot |

| Code | Striations amount |
|---|---|
| 01 | absent |
| 02 | a few |
| 03 | modarate |
| 04 | a lot |
| 09 | unsure |

| Code | Polish topography |
|---|---|
| 01 | not distinctive |
| 02 | domed |
| 03 | flat |
| 04 | corrugated |
| 05 | pitted |
| 06 | cratered |
| 07 | comet tails |
| 08 | scratched |
| 09 | unsure |

| Code | Polish distribution |
|---|---|
| 01 | greasy lustre |
| 02 | isolated spots |
| 03 | thin line along edge |
| 04 | band along edge |
| 05 | band away from edge |
| 06 | melting snow field |
| 07 | spread |
| 08 | streaks |
| 09 | bevel |
| 99 | unsure |

| Code | Polish texture |
|---|---|
| 01 | smooth |
| 02 | rough |
| 09 | unsure |

| Code | Polish brightness |
|---|---|
| 01 | very bright |
| 02 | bright |
| 03 | dull |
| 04 | very dull |
| 09 | not applicable |

| Code | Polish development |
|---|---|
| - | none |
| -/+ | slight |
| + | well |
| ++ | very well |

# Appendix 2: Shell artefact description, variables and possible entries

**Artefact type**

**ORNAMENTS**

Beads and pendants
- Discoid bead
- Pendant
- Tinkler
- Tinkler, apex perforation only
- Bivalve shell with perforation
- Perforated tops

Adornments
- Application, no holes
- Application, one hole
- Application, two holes
- Decorated piece
- Inlay
- Disc

Three-dimensional objects
- Three-pointer without pedestal
- Three-pointer with flat pedestal
- Three-pointer with hollow pedestal
- Polished cylinder
- Spatula
- Rounded shell fragment
- Miscellaneous
  - Animal representations
  - Anthropomorphic representations
  - Geometric objects

**TOOLS**

Bivalve shell
Celt
Container
Fishhook
Gauge
Gouge
Spoon

**Shell species**
Arcopagia fausta
Cassis tuberosa
Chama sarda
Charonia variegata
Cittarium pica
Codakia orbicularis
Conus sp., Conus regius
Cyphoma gibbosum
Cyprae sp., Cyprae zebra
Cypraecassis testiculus
Lima scabra
Lucina pectinata
Oliva reticularis
Pteria sp.
Strombus sp., Strombus gigas
Tellina radiata
Unsure, unsure, red/orange

**Incisions**
circular lines
frog shape
lines
lines and dots
other

**Bead preform**
complete: flattened, rounded and drilled
drilled
flattened
flattened and drilled
flattened and rounded
rounded
rounded and drilled

**Holes**
abraded
complete, biconical, equal
complete, biconical, unequal
complete, conical
complete, straight
one side, conical
one side, straight
pounded
sawn

**CELT DESCRIPTION**

**Shape of celt**
oval
pointed
rectangular

rectangular flat
shell shaped / twisted

**Profile of celt**
asymmetrical
shell shaped
symmetrical

**Edge of celt**
curvilinear
rectangular, angular corners
rectangular, round corners

**Type of finish**
edge and medial part ground
edge and medial part polished
edge ground
edge polished
none
partially ground
partially polished and rest ground
totally ground
totally polished

**Completeness**
broken
broken during production
complete
distal part
edge
edge / medial part
medial / distal part
medial part
split

# Samenvatting (Dutch summary)

**Speuren naar sporen vanuit het heden in het verleden,
functionele analyse van pre-Columbiaanse werktuigen van schelp en steen, afkomstig uit Anse à la Gourde en Morel, Guadeloupe, FWI**

Gebruikssporenanalyse of functionele analyse is een methode die in de afgelopen tien jaar een enorme ontwikkeling heeft doorgemaakt. Terwijl deze techniek voorheen met name op vuursteen werd toegepast, onderzoekt men nu tevens diverse andere artefactcategorieën, waaronder been, gewei, natuursteen, obsidiaan en koraal. Het hier gepresenteerde onderzoek past binnen deze veranderde onderzoekstraditie omdat het zich richt op de functionele analyse van schelp, een materiaal dat niet eerder werd onderworpen aan deze methode.

De belangrijkste doelstelling van deze studie is de reconstructie van de rol die uit schelp vervaardigde artefacten speelden in het technologische systeem van Anse à la Gourde en Morel, twee vindplaatsen uit de pre-Columbiaanse periode op Guadeloupe. Schelpdieren speelden in deze periode een belangrijke rol in de voedselvoorziening, maar waren tevens een belangrijke bron van ruw materiaal voor veel artefacten. Hoewel de schelpartefacten relatief veel aandacht krijgen in de Caribische archeologie, is het aantal studies dat zich richt op hun functie beperkt. Het relatief grote aantal artefacten en het feit dat er daarnaast bovendien werktuigen van geïmporteerd vuursteen en natuursteen werden gebruikt, maakt echter een functionele analyse erg interessant. Alleen door een dergelijke analyse uit te voeren kan men inzicht vergaren in de materiaalkeuze bij werktuigproductie en –gebruik (het technologisch systeem), de tweede doelstelling van dit onderzoek. De functionele analyse van het gehele werktuigenassemblage wordt daarom in deze studie belicht, een benadering die ten tijde van het onderzoek in het Laboratorium voor Functionele Analyse van de Universiteit Leiden tot ontwikkeling kwam. Een derde doelstelling is tot slot inzicht te krijgen in het spectrum van activiteiten dat zich in en rond de nederzettingen afspeelde. Daarbij werd ook gekeken naar veranderingen door de tijd heen en mogelijke aanwijzingen voor specialisatie (hoofdstuk 1).

Gebruikssporenanalyse is gebaseerd op het feit dat specifieke handelingen karakteristieke slijtagesporen achterlaten op het gebruikte werktuig. Er zijn verschillende overeenkomsten tussen de functionele analyse van vuursteen en schelp. De experimentele referentiecollectie van beide categorieën laat sterke overeenkomsten zien in de microscopische sporen, de verspreiding en de karakteristieken van de glans. Daarom kan er, tot op zekere hoogte, gebruik gemaakt worden van een referentiecollectie van vuursteenwerktuigen bij de analyse van schelp. De tropische setting van de bestudeerde sites maakt het echter noodzakelijk experimenten uit te voeren op specifiek tropische materialen, in specifieke handelingen die met schelp worden uitgevoerd. Daarnaast is een belangrijk verschil tussen artefacten van vuursteen en schelp het feit dat veel schelp werktuigen door polijsten en schuren in vorm worden gebracht, wat resulteert in een overvloedige hoeveelheid productiesporen. Deze sporen moeten onderscheiden kunnen worden van de gebruikssporen. Daartoe zijn alle experimentele werktuigen voor en na gebruik bestudeerd. Helaas hebben taphonomische processen een veel grotere invloed op schelpartefacten dan op die van vuursteen, wat resulteert in retouche en gesleten oppervlaktes. Deze secundaire veranderingen van het werktuigoppervlak kunnen echter wel herkend worden wanneer de combinatie van macroscopische en microscopische sporen wordt bestudeerd. Omdat de werktuigen uit Morel erg geleden hebben onder de formatie van beachrock zijn zij moeilijker te interpreteren en heeft de analyse tot meer gematigde uitspraken geleid.
Het moet benadrukt worden dat functionele analyse verder gaat dan de interpretatie van werktuigen alleen. Er moet rekening gehouden worden met het gemis van organische werktuigen (kalebas, hout) die mogelijk aanwezig geweest zijn. Daarnaast moet meegewogen worden dat sommige bewerkte materialen (vlees,

vis) zo weinig sporen achterlaten dat zij over het hoofd gezien kunnen zijn. Tot slot moet er rekening gehouden worden met het feit dat artefacten mogelijk in het veld niet als zodanig herkend zijn. Andere sites in de regio maken melding van zogenaamde 'expedient' werktuigen, stukken schelp die zonder bewerking werden gebruikt. Deze zijn op Anse à la Gourde en Morel overigens vrijwel niet aangetroffen, ook niet in een zorgvuldig bestudeerde steekproef waarin alle stukken microscopisch werden geanalyseerd. Wel zijn veel pseudo-artefacten gevonden: stukken schelp die steeds dezelfde vorm vertonen en daarom vaak als werktuigtype worden geïnterpreteerd. Het microscopisch onderzoek van deze stukken laat echter zien dat zij gevormd zijn door repeterende breukpatronen waarna hun randen ten gevolge van natuurlijke processen afgerond zijn. Werktuigen waarvan de randen door gebruik zijn afgerond vertonen duidelijk andere sporen (hoofdstuk 2).

Om archeologische werktuigen te interpreteren wordt gebruik gemaakt van een nieuw vervaardigde experimentele referentiecollectie, die wordt samengesteld op basis van contextuele bronnen. In het Caribisch gebied zijn die bronnen uitgebreid voor handen. In hoofdstuk 3 wordt een overzicht gegeven van informatie uit archeologische, etnohistorische en etnografische bronnen naar aanleiding waarvan er verschillende experimenten zijn uitgevoerd. Het hoofdstuk is onderverdeeld naar de materialen die werden bewerkt, in de voor gebruikssporenanalyse traditionele verdeling van plantmateriaal, hout, dierlijk en mineraal materiaal. Om de gebruikssporendata een sociale betekenis te geven moeten zij in hun context worden geplaatst. De archeologische informatie levert data over beschikbare materialen voor werktuigproductie. Etnohistorische en etnografische bronnen verschaffen ideeën omtrent de daadwerkelijk uitgevoerde handelingen. Het snijden van silicahoudend plantmateriaal kan zo geïnterpreteerd worden als onderdeel van de productie van manden. Ook experimentele data kan op die manier beschouwd worden: als een bron van hypothesen over uitgevoerde activiteiten.

Hoofdstuk 4 en 5 beschrijven achtereenvolgens de artefacten aangetroffen in Anse à la Gourde en Morel. Voor de schelpartefacten kan er een onderscheid gemaakt worden tussen ornamentele objecten en werktuigen. Tot de ornamentele objecten worden die artefacten gerekend die geen actieve, uitvoerende functie hebben. Zij worden verder ingedeeld in kralen en hangers, versieringen en driedimensionale objecten. Kralen werden gemaakt van Chama sarda en Strombus gigas, waarbij het erop lijkt dat alleen Chama sarda-kralen lokaal werden vervaardigd en op een niet-gestandaardiseerde wijze. Hangers worden in grote getale gemaakt van elipsvormige schelpen en hebben gefungeerd als belletjes. Versieringen zijn platte objecten, vaak met doorboringen die mogelijk bevestigd werden op kleding (gordels, banden). De categorie van driedimensionale objecten is het meest gevarieerd: artefacten in de vorm van kikkertjes, haaitjes en geometrische figuren worden hier alle toegerekend. Van veel van deze objecten is de functie onduidelijk, maar zij dragen in ieder geval een duidelijke symboliek die elders in het Caribisch gebied en op het vaste land van Zuid-Amerika ook wordt aangetroffen. Met name voor Anse à la Gourde is deze categorie van ornamentele objecten zeer uitgebreid, al blijkt uit vondsten van de afgelopen decennia op het strand bij Morel dat de oorspronkelijke verscheidenheid aan objecten daar ook zeer divers was.
Wat betreft de werktuigen kan er onderscheid gemaakt worden tussen tweekleppige schelpen, bijlen en overige werktuigen. Met name de tweekleppige schelpen zijn voor functionele analyse interessant omdat alleen via die methode achterhaald kan worden óf deze schelpen gebruikt werden en, als zij gebruikssporen vertonen, wat hun functie was. Velen blijken gebruikt te zijn om planten mee te bewerken. De bijlen zijn op verschillende manieren gebruikt geweest: ze werden geschacht als dissel of als bijl of werden ongeschacht gebruikt als wig. Ze werden gebruikt op verbrand en onverbrand hout en als multifunctioneel werktuig. Onder de overige werktuigen vallen onder andere vishaken, containers en priemen.
De werktuigen van vuursteen zijn gebruikt om planten te snijden, schelp en hout te bewerken en enkele stukken hebben mogelijk gefunctioneerd in een maniokrasp. Werktuigen van natuursteen zijn gebruikt om te wrijven, te malen en te slaan. Door de methode van analyse (bij een lage vergroting) zijn de mogelijkheden

van interpretatie voor deze werktuigen beperkt. Er is sprake van veel multifunctionele objecten die over een langere periode zijn gebruikt. Werktuigen van koraal en hergebruikte aardewerkscherven vulden de mogelijkheden aan: de ruwe aard van het koraaloppervlak maakt dit materiaal bij uitstek geschikt om te schuren. De aanwezigheid van een groot, plat, gesleten stuk duidt daar ook op: het vertoont sporen van het slijpen van schelp (Strombus gigas, waarschijnlijk voor de productie van een bijl).

In hoofdstuk 6 worden de verschillende materiaalcategorieën naast elkaar beschouwd en met elkaar in verband gebracht. De pre-Columbiaanse bevolking benutte het spectrum aan materialen volledig. Men had geen voorkeur voor specifieke werktuigen, zolang het ruwe materiaal over dezelfde functionaliteit beschikte.
De gebruikte werktuigen werden op een ad hoc basis gekozen; de beperkingen in die keuze werden opgelegd door de beperkingen van het ruwe materiaal waarvan de werktuigen gemaakt waren, niet op basis van cultureel bepaalde voorkeuren. Werktuigen werden lokaal gemaakt, als onderdeel van de huishoudelijke activiteiten.
Het gebrek aan specialisatie komt tot uitdrukking in de afwezigheid van standaardisatie in werktuigtypen. Het is met name wat betreft de ornamentele schelpartefacten wel mogelijk categorieën te onderscheiden, maar daarbinnen heerst een grote vorm- en formaatvariatie. De productietechniek voor vuursteenartefacten is zeer eenvoudig het gebruik van tweekleppige schelpwerktuigen kan worden beschouwd als expedient. Op basis hiervan en van de relatief beperkte hoeveelheid vergelijkbare artefacten over een lange tijdsperiode wordt geconcludeerd dat de variatie wordt veroorzaakt door individuele productie. Artefactproductie was onderdeel van de dagelijkse bezigheden en werd hoogstens gezien als een part-time specialisatie.
De relatieve beperktheid in specialisatie hoeft niet te worden beschouwd als een beperking in sociale of culturele ontwikkeling. Het is eerder een demonstratie van de capaciteit effectief gebruik te maken van het brede scala aan voorhanden zijnde mogelijkheden. Deze flexibele houding is een algemeen goed onder de pre-Columbiaanse bevolking. Men ontwikkelde zich van vastelandbewoners naar eilandbewoners, waarbij men enerzijds de nieuwe leefomgeving trachtte aan te passen door het meenemen van bepaalde elementen van de vastelandcultuur, en men zich anderzijds aanpaste aan de nieuwe omgeving door gebruik te maken van de aanwezige natuurlijke bronnen. Zo verschoof hun gebruik van ruwe materialen van steen naar voornamelijk schelp, van land- naar zeedieren.
Opvallend, vanuit dit perspectief, is de aanvoer van stenen bijlen. Uit experimenten is gebleken dat de bijlen van schelp en bijlen van vuursteen vergelijkbaar zijn in functionaliteit, wat de aanvoer onnodig lijkt te maken. Het vuursteen was echter wel onmisbaar: diverse taken kunnen niet uitgevoerd worden zonder dit harde, scherpe materiaal. De aanleiding om bepaalde ruwe werktuigmaterialen van andere eilanden te verkrijgen kunnen dus zeer verschillend zijn en uiteenlopen van een puur noodzakelijke tot een misschien meer sociaal culturele aanleiding.

Alle etnografische en historische bronnen laten zien dat het zwaartepunt van de dagelijkse activiteiten lag bij het bewerken van plantenvezels, twijgen, bast en hout en veel minder bij het verwerken van dierlijke producten. Dit is ook duidelijk tot uitdrukking gekomen in de resultaten van de gebruikssporenanalyse. Zowel de artefacten van Morel als van Anse à la Gourde laten een vergelijkbaar beeld zien op dit punt (hoewel de vergelijking helaas bemoeilijkt wordt door de relatief slechte conservering van het materiaal uit Morel en het grote verlies aan data, doordat de site langzaam door de zee opgeslokt wordt).
Een vergelijkbare nadruk op plantbewerking is eerder vastgesteld voor de Archaïsche periode op Plum Piece, Saba. De vooronderstelde verschuiving van een voornamelijk op jager/verzamelaars gebaseerde gemeenschap naar een meer op tuinbouw gerichte samenleving heeft kennelijk niet geleid tot een grote verandering in dagelijkse bezigheden. De enige aanwijzing voor een diachronische verandering in werktuiggebruik is het relatief hogere aantal maalstenen in de late ceramische periode in Anse à la Gourde. De daar aanwezige vuursteenafslagen die mogelijk van een maniokrasp afkomstig zijn, duiden tevens op een meer op landbouw gerichte omgeving. Deze constateringen lijken echter slechts een ondergeschikte rol te spelen op het totaal aan activiteiten. Een voorzichtige conclusie zou daarom kunnen zijn dat de meeste plantgerelateerde activiteiten

zich afspelen op het vlak van ambachtswerkzaamheden in plaats van op het vlak van bezigheden die te maken hebben met de voedselvoorziening.

Het gebruik van functionele analyse als basis voor de reconstructie van een technologisch systeem is in dit onderzoek zeer zinvol gebleken. Er is een overzicht ontstaan van het activiteitenspectrum, waarbij het duidelijk is dat zogenaamde toolkits voor specifieke activiteiten bestaan uit artefacten afkomstig uit verschillende materiaalcategorieën. Bij de meer traditionele benadering waarbij maar één materiaalcategorie wordt bestudeerd, zou een dergelijk onderzoeksresultaat niet naar voren komen. De functionele analyse van een technologisch systeem vraagt dus om een holistische benadering.

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## Curriculum Vitae

Yvonne Marie Jacqueline Lammers-Keijsers was born in Roosendaal (The Netherlands) on October 15th, 1974. Her interest in (experimental) archaeology was founded during a holiday in Denmark in 1980, when she visited several sites and the Historical Archaeological Research Centre in Lejre. During high school she was very active in the Dutch Youth Organization for History and was director of the section for experimental archaeology in the organization. In this position she spent most of her free time at experimental archaeological centres in The Netherlands (HOME, Haps, Archeon), guiding children through an iron-age experience. She received her high school degree (Gymnasium b) at the Gertrudis Lyceum in Roosendaal in 1993, after which she started her archaeological studies at Leiden University. During her studies she was the student-assistant of Dr. A.L. van Gijn. In 1998 she graduated in Prehistory of North-Western Europe and in Theoretical and methodological approaches in Archaeology. After working as a junior use-wear specialist at the Laboratory for Artefact Studies for two years on commercial projects for the Betuwe-railway, she was incorporated as a PhD-student in the NWO-Aspasia programme of Dr. A.L. van Gijn (2000-2005). Due to the arrival of children in 2001 and 2003, this occupation was prolonged in 2006. This thesis is the result of the research. Currently she is working at the Foundation for Dutch Heritage: Erfgoed Nederland in Amsterdam, as Chief-editor of Archeobrief, the Dutch journal for professional archaeology.