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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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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

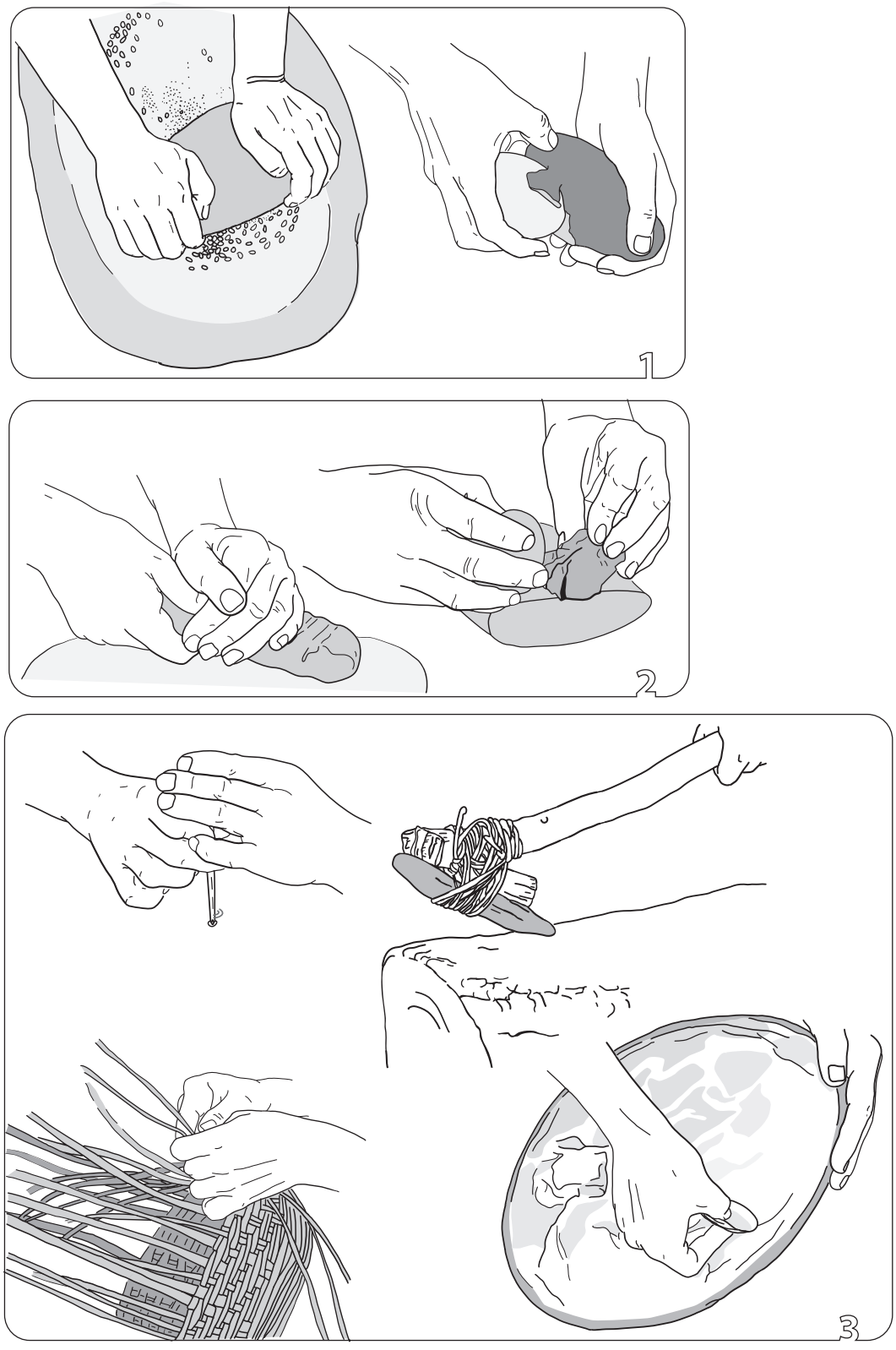

Fig. 6.1 Domestic activities: a variety of performed tasks

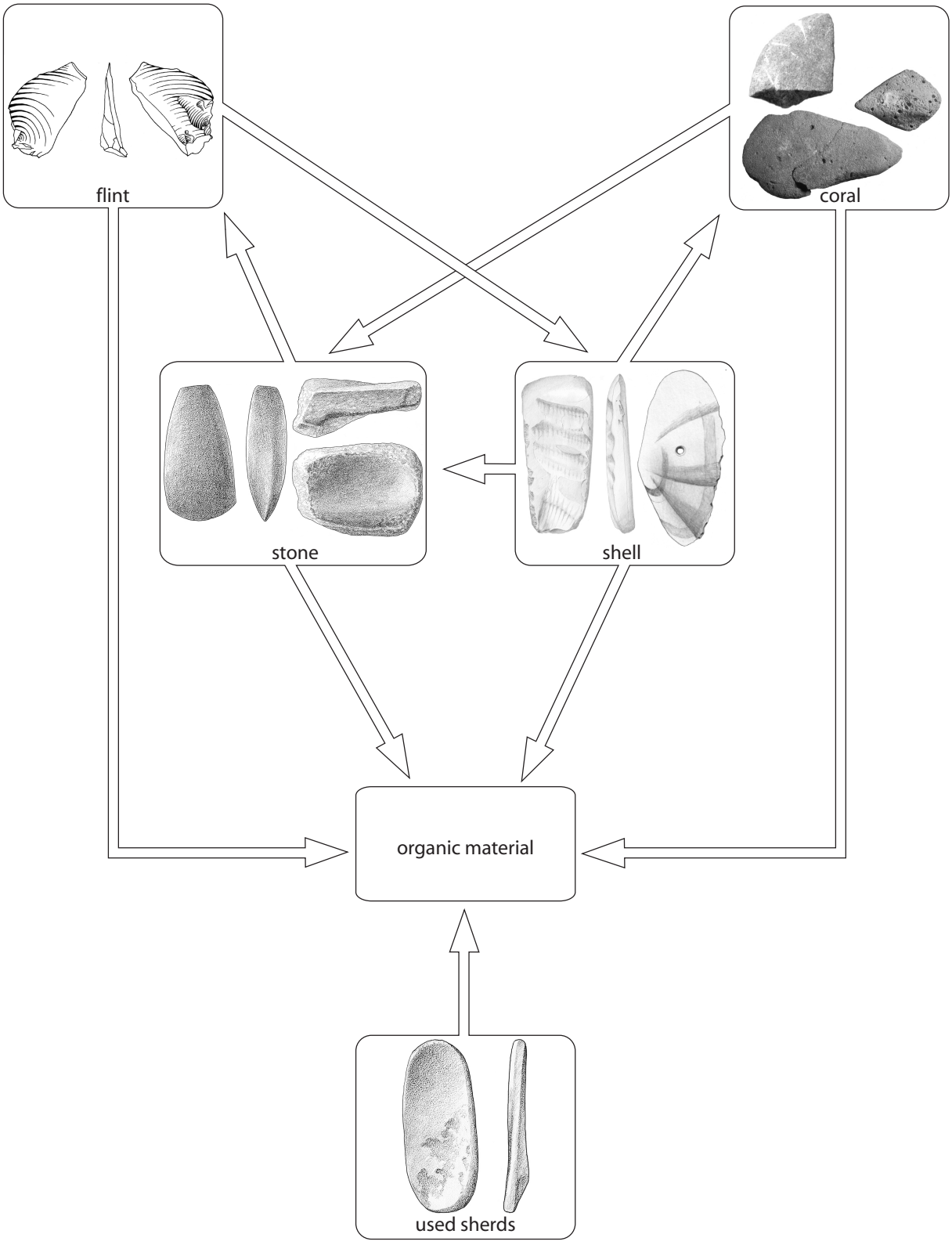

Fig. 6.2 Artefact production: the technological system

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.