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 It is explicitly not a complete inventory of all descriptions available in historical references.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-Keijzers 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 uniformitarianism, 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; Longaere 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
analogy 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 Archeology

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
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*, Anacariables) or mombin, manilkara tree, maney 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 (*Maranta arundinacea*), tania (*Xanthosoma sp.*), sweet potato (*Ipomoea batatas*) and wild yam (*Rajana cordata*) being cultivated in small fields not far from the settlements.

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\(^2\) 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 used 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 Merécuça 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 *Gênipa (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 stunt 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
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 (*Dioscorea 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 x 15 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).
3 - THE PROCESSING OF DIFFERENT RAW MATERIALS

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).

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.
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).

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.
Characteristics of traces processing plants

- **Use retouch**
- **Edge rounding**
- **Striations**
- **Polish development**
- **Polish brightness**
- **Polish distribution**
- **Polish texture**
- **Polish topography**

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). 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).
3 - THE PROCESSING OF DIFFERENT RAW MATERIALS

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 hyleuca) 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 martincensis) or alatini occurred 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 Archaeology
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 wood⁴, 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.

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Fig. 3.8 Scraping branches with bivalve shell

Fig. 3.9 Groove and splinter technique with flint on Campêche

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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

![Characteristics of traces processing hide](image)

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 lose 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.
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
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 materials 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](image)

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.
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 **ARCHAEOLOGY**

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.
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. 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*

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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.
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.

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.