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Understanding the Function of Coral Tools from Anse à la Gourde

An Experimental Approach

Harold J. Kelly and Annelou L. van Gijn

Introduction

Coral objects are found throughout the Caribbean in archaeological excavations. A magnificent example is the mask from Anse à la Gourde (Hofman et al. 2001). Other examples are the *zemis* made of *Acropora palmata* and *Porites* sp. found at Golden Rock on St. Eustatius and several Saban sites (Hoogland 1996; Steenvoorden 1992). However, coral fragments also were collected as raw material for the manufacture of tools. Sometimes these pieces of coral were not further modified; sometimes they were shaped into standardized artifacts. These tools have been recognized for some time and reported by various researchers (e.g., Rostain 1997; Steenvoorden 1992). Coral tools that were reported included grinders, metates, and rasps, functions that were basically inferred from morphological characteristics of the artifacts and by means of analogy to tools whose function was known. So far, however, use-wear studies of these tools by means of microscopic analysis are lacking.

In order to better understand the role of the coral tools in the technological system of the native peoples of the Caribbean islands, it was decided to examine a selection of tools for traces of wear (Kelly 2003). The tools derived from the site of Anse à la Gourde, a Saladoid-Troumassoid (A.D. 400–1400) site on Grande-Terre, Guadeloupe (Hofman et al. 1999; Hofman et al. 2001) (Figure 9.1). Tools of shell, flint, and hard stone from this site had already been microscopically studied, the results of which could be integrated with the study of the coral tools (Van Gijn et al. this volume).

No experiments with the use of coral tools were yet available in the Laboratory for Artifact Analysis of Leiden University. A first objective of the present research



Figure 9.1. Location of the site Anse à la Gourde on Guadeloupe.

was therefore to establish an experimental reference collection and to determine whether interpretable wear traces developed on the coral tools. The approach was subsequently applied to a selection of the coral tools from Anse à la Gourde. The second objective was to understand the role of coral in the technological system of the Amerindian inhabitants of Anse à la Gourde.

Methodology and Sampling

Use-wear traces on flint tools include use retouch, edge rounding, polish, and striations. Use retouch and rounding can be observed by stereomicroscope (Low Power microscopy), polish and striations by incident light microscope (High Power microscopy) (Van Gijn 1990; Van Gijn et al. this volume). Initially, it was thought that it would only be possible to look at macroscopic use-wear traces like abrasion and breakages. It was assumed that use-wear polish and striations would not be visible, considering the coarseness of the coral. However, as it was not possible to distinguish the traces from the various contact materials by stereomicroscope, it was decided to attempt to use the incident light microscope, with magni-

fications of 100–560x. As it turned out from the experiments, the corallite ridges within the honeycomb structure of the coral behaved very much like other fine-grained surfaces such as flint or shell, displaying clearly developed polishes with topographical features similar to the ones observed on flint tools (Van Gijn 1990). The topography and relative smoothness of the polish can be assessed within the spatial confines of these ridges. The only difficulty is that, in order to evaluate the extent, distribution type, and limit of the polished zones, one has to “jump” as it were from one ridge to the next to obtain an idea of the extent of the wear. Polish does not develop on the coarse-grained interstices between the corallite ridges. Contrary to our expectations, therefore, the macroscopic wear such as edge removals and rounding was sometimes difficult to distinguish. It was decided to concentrate on High Power analysis, using the stereomicroscope only to obtain an overall view of the macroscopic wear and to detect residue.

The polish was described the same way as on flint tools, making use of the same attributes such as polish brightness, topography, directionality, and so forth. Problematic was the limit of the polish, in other words, whether it gradually fades out or whether the polish stops abruptly. This is because of the fragmented polish distribution: only on the corallite ridges. A few extra attributes were added to account for the specific physical properties of coral, the most important one being the degree of beveling visible on the ridges (a hard contact material will “bevel” the top of the corallite ridge, whereas a soft material will round the ridge).

The use-wear analysis was performed using a Nikon Optiphot incident light microscope with magnifications in the range of 10–560x (equipped with differential interference contrast [DIC] and polarizing filter) and a Wild stereoscopic microscope (10–160x). Photographs were taken with a Nikon DXM1200 digital camera. Some of the tools were cleaned in distilled water in an ultrasonic cleaning tank in order to remove adhering dirt, but the majority of the tools were just wiped clean with alcohol to remove finger grease. Chemical cleaning was not done in order not to damage the artifacts.

A large number of coral artifacts were found in Anse à la Gourde, not all of which could be subjected to a time-consuming microscopic analysis. It was therefore decided to focus on one type of tool: the tools with abraded angles made on *Porites* sp. The 52 *Porites* sp. artifacts selected displayed varied shapes and types of abraded angles (Figure 9.2). A categorization into different groups was made according to morphological similarities between the artifacts in terms of tool shape, degree of angle, occurrence of one or multiple abraded angles, and one- or two-sided abraded angles. The objective was to assess whether this morphological variation reflected differences in function. In addition, a few abraded implements of *Acropora cervicornis* were included in the sample (see Van Gijn et al. this volume, Figure 8.6c).

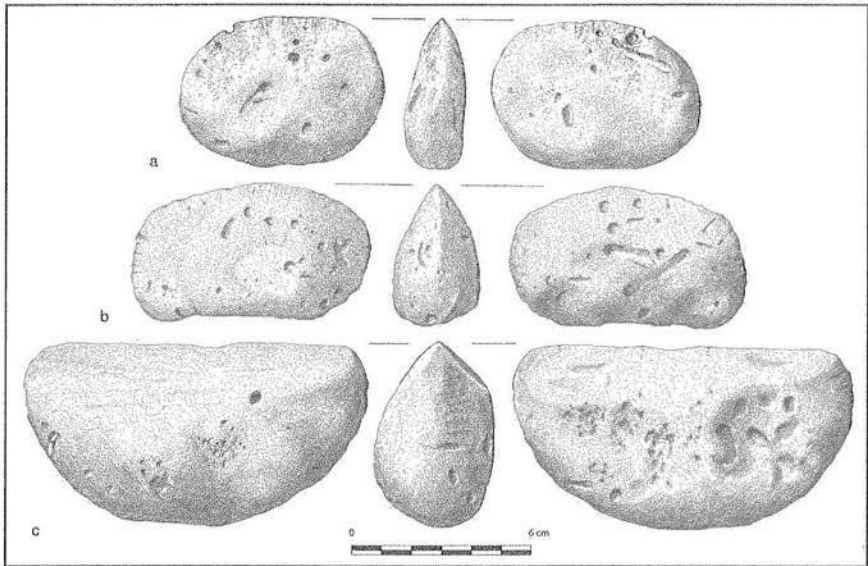


Figure 9.2. Angled abraded *Porites* sp. artifacts.

The Experiments

At Anse à la Gourde three types of coral predominated in the assemblages: *Porites* sp., *Acropora palmata*, and *Acropora cervicornis*. They each have different properties, making them appropriate for different kinds of tools. The *Acropora palmata* has thick flat branches that form excellent blanks for grinders and metates. It is also very hard and resistant. *Acropora cervicornis* grows in branches that have a rough surface, comparable to *Acropora palmata*. Fragments of these branches are very suitable as rasps to polish wood, shell, and bone, as well as for scaling fish (Steenvoorden 1992). *Porites* sp. is softer than the previously described species and can therefore more easily be modified into tools and objects than *Acropora palmata*. We concentrated on *Porites* sp. and *Acropora cervicornis* because they were the species the most common coral tools at Anse à la Gourde were made of: that is, scrapers (or angle abraded tools) and rods, respectively.

Coral has abrasive properties that most stones, shell, and wood lack. Because of the corallite ridges, surrounded by softer interstices, it resharpens itself during use, a bit like vesicular basalt. However, it does not provide a very sharp cutting edge. For cutting purposes flint, and to a lesser extent shell or hard wood, is a very wanted raw material.

The *Porites* sp. artifacts from Anse à la Gourde showed a wide range of shapes along with clear usage patterns such as abraded angles, polish traces, residues,

striations, and hammer traces. Our assumption was that they were probably used for a wide variety of tasks. The experimental program therefore focused on a broad range of activities in order to obtain a wide variety of use-wear traces for the reference collection.

The experimental tools were made on coral gathered far from the site to exclude the possibility of using probable archaeological coral pieces. Since the *Porites* sp. artifacts from Anse à la Gourde appeared to have been used both unmodified and modified, the experiments were divided into two sets. The first set consisted of experiments based on the natural shape of the coral; the second consisted of experiments with modified *Porites* sp. (angled abrasions). These angled abrasions were made either one or two sided, depending on the aim of the experiment. Both sets of tools were used on the same type of contact materials. Additionally, the modified *Porites* tools were also used in experiments for which an unmodified piece would not be suitable, that is, cutting and incising calabashes and de-barking of branches, tasks for which a ground cutting edge is needed.

Contact materials included various types of (tropical) hardwood, shell, seeds, stone, ochre, clay, various plant species like calabashes, charcoal, and bone. The motions included cutting/sawing, scraping, sanding, rasping, polishing, incising, crushing, and pounding. Each tool was used an average of 30 minutes. If no traces were visible after the first 30 minutes of use, the tools were used another 30 minutes and observed again. The maximum time the tools were used was 1.5 hours.

A total of 37 experiments were carried out on the *Porites* sp. coral (Figure 9.3). The experiments not only served as a means to build up a reference but, more importantly, also provided insight into the way in which coral handles and behaves on different types of materials.

Microwear Analysis of the Experimental Tools

Contact with hard materials as shell, coral, and stone all caused a flattening of the corallite ridges (referred to as beveling) and a similar polish distribution (Figure 9.4b). Other attributes of wear, however, such as polish brightness and amount of striations, varied between the three materials. Contact with shell caused a bright polish, whereas rubbing coral with coral resulted in a dull, rather rough polish. Moreover, the corallite ridges of the tools used on shell developed deep gorges with a rounded bottom. Both materials produced a polish distribution that could be characterized as “streaks” (Figure 9.4b). So even though the wear traces from contact with these three hard materials overlapped to some extent, other characteristics were associated with specific contact materials. However, it may not always be possible to differentiate between these contact materials in archaeological context.

Another inorganic contact material, clay, resulted in quite different traces. The

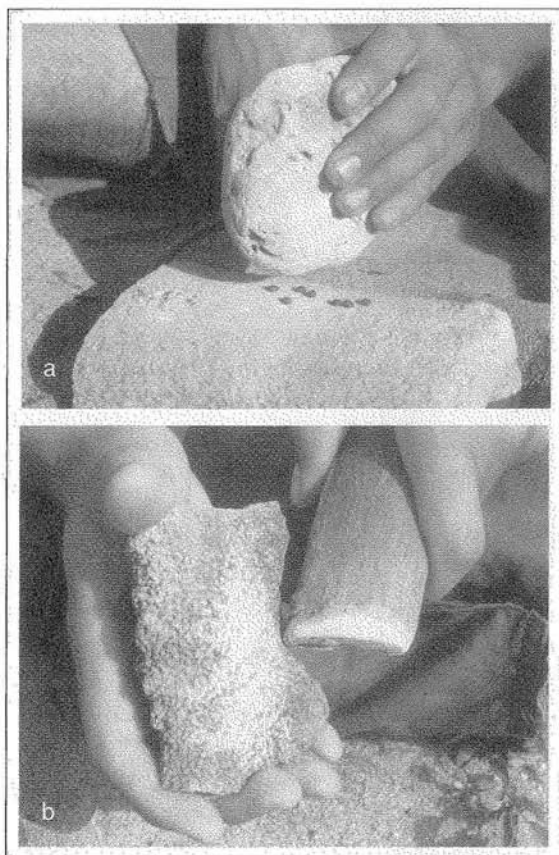


Figure 9.3. Experiments with coral tools. a: pounding seeds; b: rasping hard wood.

wear traces obtained from experiments on clay were characterized by the development of rounded (rather than a beveled) corallite ridges in combination with a bright polish with flat topography, a lot of randomly oriented striations can be discerned in the polished zones.

Contact with materials such as wood, plant material, and bone showed some overlapping similarities in terms of resulting use-wear traces. However, each of these materials also provided specific features of wear. Working bone resulted in a dull to bright polish and a cratered and pitted polish topography (Figure 9.4c). A variable number of randomly oriented striations are also visible. The wear traces that resulted from the experiments with wood were characterized by the occurrence of rounded to very rounded corallite ridges (Figure 9.4a). Furthermore, a bright to very bright, smooth polish with a domed topography developed, with

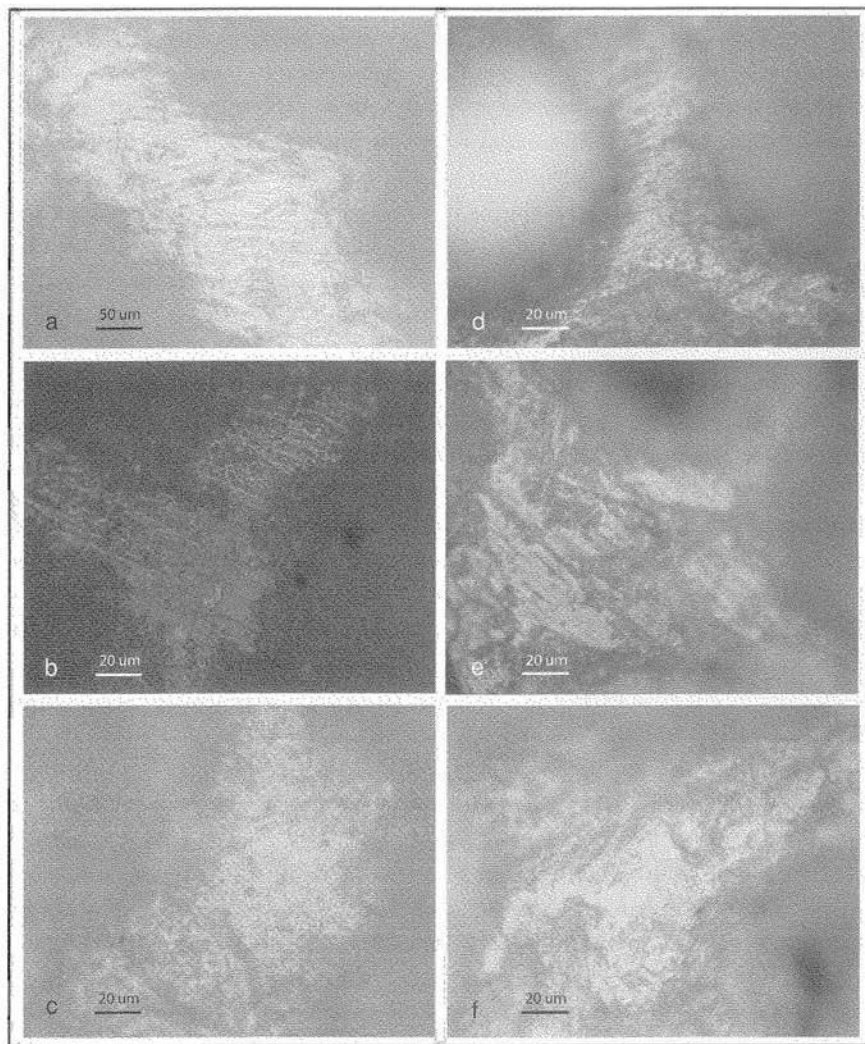


Figure 9.4. Matching experimental and archaeological use-wear traces. a: polishing tropical hardwood for 45 minutes (original magnification 200x); b: sanding *Strombus gigas* shell lip 30 minutes; c: polishing the shoulder blade of turtle for 90 minutes; d: scraper of *Porites* sp. with polish interpreted as having been used on wood; e: scraper of *Porites* sp. with traces from working shell; f: scraper with traces resembling experimental bone working traces (original magnification of Figures 9.4b–f 500x).

a clear directionality, as well as a limited number of striations. Experiments with plant materials resulted in a rather variable corallite ridge shape, ranging from rounded to slightly flattened. The polish was bright to very bright and striations were generally absent. Topographical features in the polish included the presence of small craters.

To conclude, use-wear traces that resulted from experiments carried out on hard materials such as shell, stone, and coral were clearly different from the wear traces that resulted from experiments on softer material types such as wood, plant, bone, and clay. Characteristics specifically related to the hard materials are a flat to very flat or beveled corallite ridge, streaked polish distribution, a rough texture, and the occurrence of a lot of striations. The softer contact materials resulted in more rounded corallite ridges and a smooth, bright polish with a clear directionality. Striations do occur but in lesser quantities.

The Archaeological Tools from Anse à la Gourde: Matching Traces

The *Porites* sp. angle-abraded artifacts were classified into nine different groups. This classification was based on the basis of general shape, the shape of the edge (straight, concave, or convex), and the occurrence of single- or double-angle abrasion on the artifact.

In order to test the hypothesis that the angle-abraded tools made of *Porites* sp. were indeed used for a variety of activities, 52 artifacts were selected. Each typological group was treated separately to examine its functional homogeneity. Traces on the archaeological tools were compared to the experimental ones in order to infer the probable contact material and the movement applied (e.g., longitudinal or transverse).

Unfortunately, 18 archaeological implements displayed postdepositional surface modifications that made a functional analysis impossible. It is not entirely clear how these secondary modifications developed. More research into the taphonomic conditions under which use-wear traces on coral tools are affected is first needed. On three other tools the traces could not be matched to experimental equivalents and were classified as unknown. It may actually involve multiple usages, causing the superimposition of different types of traces making identification impossible. The traces on one tool were insufficiently developed to allow a functional inference. In all other cases it turned out to be possible to match the traces on the archaeological tools with those seen on the experimental reference samples (Figure 9.4d-f). Eleven tools displayed polish attributes closely resembling those on experimental woodworking implements (Figure 9.4d). Seven artifacts were most likely involved in scraping clay. Five tools were interpreted as shell-working imple-

ments (Figure 9.4e), six as bone-working implements (Figure 9.4f), and three as plant-working implements.

It turned out that there is little relation between tool form and function. Characteristics such as similarity between tool and edge shape, amount of abraded angles, and degrees of abraded angles of tools are not specifically related to one contact material or motion. This may relate to our own classification system, based on etic criteria that probably did not correspond to the emic approach of tools of the inhabitants.

Conclusion

The experimental use of coral tools and subsequent analysis of the resulting wear traces indicates that use-wear analysis of coral artifacts can be carried out successfully. Coral has a totally different contact surface—corallite ridges in a honeycomb structure on which the traces develop—as compared to materials such as flint that display a flat smooth surface. Nonetheless, wear traces that resulted from use of coral on a specific type of material were clearly visible and comparable to traces that occur on materials such as flint. The High Power approach proved to be more efficient compared to the Low Power approach during the analysis of the experimental tools and artifacts. Low Power analysis did prove to be very useful as a means to get acquainted with the surface of the coral (e.g., characteristics and distribution of the corallite ridges), possible wear traces, and residues. However, it was through High Power analysis of the experimental tools that the potential of microwear analysis on coral became clear. Not only was it possible to obtain insight into the general hardness of the contact materials (e.g., soft, medium, or hard), but it was also frequently possible to reach a more detailed inference regarding the contact material (e.g., clay, bone, and shell). The experimental program was not only important to build up a reference collection, it also gave insight in the manner in which the coral handled and the types of probable tasks for which it was suitable. Furthermore, the experiments also provided an insight about the tool life (i.e., length of use vs. degree).

Taphonomic processes such as dissolution or abrasion of the corallite ridges complicate the analysis and interpretations of the artifacts. Even so, postdepositional surface modifications can frequently be distinguished from wear traces. On the one hand, postdepositional traces usually are located across the entire tool, whereas the use-wear traces are limited to the functional edge. On the other hand, traces seen outside the abraded angle should not immediately be categorized as postdepositional traces. They could also be handling traces (recognized on some of the experiments).

The present research constitutes a methodological innovation in that it dem-

onstrated the possibilities of use-wear analysis on coral tools. It also provides a more in-depth view of the manner in which the Amerindians interacted with their surroundings in the sense of resource exploitation. Last, the use-wear study gave coral a place in the technological system of the native peoples of the Caribbean islands. It turns out that they used coral tools for various activities. They carefully selected their tools for specific purposes and obviously had a thorough knowledge of the physical properties of the various raw materials from which their tools were made. Coral tools therefore played a vital role in carrying out various activities and formed an integral part of the technological system. Their rough surfaces, ideal for rasping, scraping, or polishing, make them very suitable for such tasks as the grinding or sharpening of shell tools or objects of very hard wood types. It makes clear that the inhabitants of Anse à la Gourde had a flexible technological system in which tools made of different materials were to some extent interchangeable.