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ARK SHELL NETSINKERS: FACT OR FICTION?

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INTRODUCTION

Modified shells frequently occur in archaeological contexts in the Pacific. Based on numerous ethnographic analogies, the archaeological literature describes many of these as 'tools' of one sort or another. Observations on the fragmentation and preservation of shells on beaches, however, often revealed that several 'tools' can occur naturally, apparently as the result of wave action. The main problem thus posed is to distinguish in archaeological assemblages between those shells where the modification is clearly anthropogenic and those where it is biogenic and based on the physical and mechanical properties of the shells. If the modification is anthropogenic, we will also have to distinguish between modification in the course of opening it to get at the food inside, and modification fitting the shell to serve as a tool. This distinction appears important since in the absence of direct evidence such tools are often taken as evidence for the presence of horticulture or fishing. A shell often implicated are arc shells (*Anadara antiquata*) with a hole pierced through their mantle or umbo, which are interpreted as vegetable peelers or net sinkers. Shells with a hole through the umbo are by far the most common occurrence and, interpreted as netsinkers, have often been used a conclusive evidence for net-fishing (see below). However, as the following discussion will show, this argument is not at all conclusive.

In the following I will survey the ethnographical literature to establish a tool typology, and will classify and describe the fragmentation pattern of natural breakage and will describe some experiments designed to simulate such breakage.

BIOLOGY AND DISTRIBUTION

Anadara antiquata (Linnaeus 1758; Pelecypoda: Arcidae) occurs throughout the tropical Pacific and the Indian Ocean (Dodge 1952:149-151). In the tropical Pacific it occurs in the Caroline Islands of Micronesia (Bath 1985), but not in the northern Marianas (Vermeij et al. 1983) nor in Hawaii (Kay 1979). *Anadara scapha* is considered a synonym for *A. antiquata* (Dodge 1952:149). *A. antiquata* thrives on intertidal reef flats, preferably on sandy or sometimes muddy substrate

(Cernohorsky 1972:215-216; Kirch & Yen 1982:294; Swadling & Chowning 1981). It is confined to the tropical and subtropical waters, its geographical distribution correlating roughly with a minimum sea-temperature of 15° C.

ETHNOGRAPHIC OBSERVATIONS ON *ANADARA* SHELL TOOLS

Ethnographically, arc shells (*Anadara antiquata*) and their close allies in size (*Anadara trapezia*), as well as parts thereof, have been used for a wide variety of purposes. The following compilation is based on a wide review of the ethnographic literature, but is bound to be incomplete. The use of *Anadara* as personal ornaments is specifically excluded (cf. Banks Islands; Ward 1979:10-7). Poulsen (1970) writing on Oceanic shell tools noted that ethnographers studying a culture usually do not view the material culture of a population with the same eyes as archaeologists do and thus their information is rather often of limited value, especially if no illustrations are given.

The ethnographic record in the Pacific shows the following uses for *Anadara* sp. shells:

Net sinkers

A hole is punched, ground or drilled into the umbo of the shell. Through this hole a string is threaded to fasten the shell at the base of a net. Examples are known from Merir in the western Carolines (Eilers 1935:390; 390 fig. 171); the Siassi Islands off New Britain (Lilley 1986:382); New Ireland (Tischner 1981:140); Mailu on the Papuan south coast (Irwin 1985:223); and New Caledonia (Gifford & Shutler 1956: 85; Plate 3a). However, Gifford's informants on Yap stressed that archaeological specimens shown to them were not net sinkers (Gifford & Gifford 1959:192).

It should be noted that net weights of shell were common throughout the Pacific and that a variety of shells other than *Anadara* was used (plus, of course, stone). Usually they have a hole punched or drilled in the umbo or the mantle. Notched specimens similar to stone sinkers are not known to the author. The fact that netsinkers are made of great variety of shells implies that ethnographic references cannot be used in the present connection, unless they depict or specifically mention *Anadara*. The references given above conform to this.

Vegetable scrapers and paring knives

The shell has a large hole ground or punched in at the umbo or the middle of the shell. Specimens are known from the Loyalty Islands (Sarasin 1929:90); Pohnpei (Fischer et al. 1977:7-8;15); the Banks Islands (Ward 1979:10-3).

Note again that vegetable scrapers were made of a range of common Pacific shells. This implies that only those ethnographic references depicting or specifically mentioning *Anadara* can be used here.

Coconut-grater heads

The shell, with a perforation as a fastening device, is reported as a coconut-grater head in: New Ireland (Finsch 1914:127); the Solomons (Foy 1904: Plate 13.12); Tuvalu (and the Admiralty Islands (Poulsen 1987: I 184); Luanguia, a Polynesian outlier off the Solomons (Sarfert & Damm 1929:134); Note the same caution as above. Fo a more detailed discussion of coconut grater heads in general see Davidson 1971:72-75).

Scrapers associated with bark-cloth manufacture:

Unmodified *Anadara* were used for scraping and smoothing the bark of the paper mulberry tree. Examples are mainly known from Samoa (Finsch 1914:126; Krämer 1902: II 301; Buck 1930:285; Edge-Partington 1895:plate 43.8). A similar practice is reported for Niue (Edge-Partington 1895:plate 67.10).

ARCHAEOLOGICAL FINDS INTERPRETED AS TOOLS

Specimens of *Anadara* shells with perforation of the umbo area are common occurrences in archaeological sites in the Western Pacific. They are usually interpreted as:

Net sinkers

Ant, Pohnpei (Ayers et al. 1979:100, not illustrated, no reason for positive identification given); Yap (Gifford & Gifford 1959: 192; Plate 41 c, d; but see comment on page 192); Solomons (Foy 1904: Plate 13.12); Palau (Osborne 1979:41; Figure 22e); Takayama et al. 1980:15; Plate 11.2,3); Saptwakai (Bath 1985:138, but see below); Tol, Truk (Takayama & Intoh 1978:fig. 19.6); Fauba, Truk (Takayama & Seki 1973:54); Lesu, New Ireland (White & Downie 1983:202 fig 4c); Mailu, Papuan south coast, Papua New Guinea (Irwin 1977:302; 1985:223); Buka, North Solomons, Papua New Guinea (Specht 1969:296); Siassi Islands off New Britain Papua New Guinea (Lilley 1986:382; fig 9.16); Banks Islands, Vanuatu (Ward 1979:10-7); Vanuatu (Shutler & Shutler n.d.: Plate 7B); New Caledonia (Gifford & Shutler 1956: 85; Plate 7.g,h.); Tonga (Poulsen 1987:I 184).

Perforated *Anadara* have occasionally been identified as:

Vegetable scrapers or paring knives

Tongatapu, Tonga (Poulsen 1987:184); shell middens near Noumea, New

Caledonia (Sarasin 1929: plate 2,14); Buka, North Solomons, Papua New Guinea (Specht 1969:296); Banks Islands, Vanuatu (Ward 1979:10-6); Tol, Truk (Takayama & Intoh 1978:45, but discussion as to whether they are net sinkers);

Coconut-grater heads

The perforation can be seen as a lashing device for the use of the shell as a coconut-grater head. Such interpretations have been advanced for Tongatapu, Tonga (Poulsen 1987: I 184) and Mangaasi, Vanuatu (Garanger 1972:51).

Poulsen, 'conscious of the danger of confusion' (1987:I184), tries to differentiate between net sinkers and paring knives on the basis of the location of the perforation. If the umbo is perforated it is a likely to be a net sinker, if the the body of the shell, a paring knife.

I note, however, that although most archaeologists see perforated *Anadara* as net sinkers or scrapers, this is not necessarily the case. As Bath (1985:138) correctly argues: 'If the perforations in archaeological specimens of *Anadara* are cultural, then these 'net sinkers' should be found in non-midden deposits and predominantly in littoral sites. However, if the perforations represent natural or accidental breakage associated with the use of *Anadara* as a diet item, the specimens would be found in midden deposits and in both coastal and inland sites.' Observations in Tonga have shown that umbo perforation can occur in many ways.

PERFORATED *ANADARA* SHELLS IN BEACH DEPOSITS:

Monuafe

Monuafe is a low-lying islet on the fringing coral reef just off Tongatapu. The islet measures about 60 by 150 m and is at its highest point ca. 0.6 m above HWL. It is currently uninhabited and has been set aside as a natural reserve. Fishing and shell-fishing are prohibited. All shells used in this sample were collected on the beach, both in the intertidal zone and in the rubble accumulated at the high tide mark. The island was the site of a former settlement, and oven-stones and heavily water-worn sherds of Fijian pottery have been found in the reworked beach debris. It seems as if the entire island has been reworked by successive storm surges. Only the heavier archaeological materials have survived. However, given the preservation of the shells described below, the shells recovered are distinctly modern and do not originate from the former settlement.

In the samples several *Anadara* were noted which had a hole in the umbo. Some of those shells were heavily water worn and exhibited only a small hole in the umbo, which looked as if it had been artificially perforated. Other shells,

however, which were not excessively water worn also had a hole in the umbo and had roughly the same appearance as intentionally smoothed `artefactual' shells.

PERFORATED *ANADARA* SHELLS IN MODERN MIDDEN DEPOSITS:

Maka'unga

In the course of a study on the the relative shell size of *Anadara* shellfish populations, a modern (1987) shell sample was collected at Maka'unga, northeastern Tongatapu. The sample was lying at the modern concrete seawall of Maka'unga and formed a small and very discrete midden dump, originating from one dumping event only. All complete or semi-complete shells exhibiting the greatest length (anterior-posterior) were picked up. The shells were very fresh as all had the periostracum still adhering. During measurement shells were noted with a hole through the umbo. Out of a total of 399 measurable shells in the sample, 13 were broken with the umbo section missing (3.25%), and an additional 7 had a hole through the umbo (1.75%). Many the broken shells had only the umbo section missing. Personal inspection of numerous fishing nets in Maka'unga village showed that lead netsinkers are used today. This is confirmed by fishermen who say that they have not used shell netsinkers at all or for decades. Since food-preparation of *Anadara* is exclusively by cooking or steaming, the hole cannot have originated from it.

Thus it seems that perforation of the umbo resembling that of a net sinker can occur in the process of midden formation. The effect of trampling also cannot be excluded.

THE EXPERIMENT

To investigate this problem, a small experiment was set up. A total of 200 complete shells from the Maka'unga sample was retained. The shells were put into a bucket in batches of 100 shells. The bucket was emptied out 2 m above ground onto a concrete floor. None of the shells of the first batch broke, with some minute chipping on the edges. Of the second batch, one of the shells had a hole broken through the umbo, but no other breakages occurred. Thus the frequency of breakage is 0.5%, based on the limited experiment.

To investigate the issue further, breakage under severe impact was tested using a hammer on various parts of the shell with about the same force. Although the experiment was not carried out under laboratory conditions, which were unavailable in Tonga, the results are suggestive. Shell valves lying with the curved side (outside) down were not affected. These would be pushed away, or would break only at the margins, with small ends chipped of. Only a severe blow at full force would shatter the shell. Shells lying inside down were easily broken, if the hammer hit the top of the umbo. If the force was directed towards

the margins of the shell, the breakage was less, mainly consisted of the edges being chipped.

In addition, walking over and stamping were tested. While normal walking on the shells produced no further damage except for chipping of edges, stamping on could shatter them, if they were lying outside down. Shell lying inside down remained unaffected.

However rough and ready these short experiments were, they suggest that

1. The weak point on an *Anadara* shell is situated at the umbo.
2. *Anadara* shells are fairly strong and are unlikely to be broken while trodden on.
3. The umbo will break only if the impact has a small focus of force.
4. The umbo can break if shells are poured or thrown onto a shell heap.

CONCLUSIONS

While the ethnographic observations reviewed above document at length that *Anadara* was used as tools, namely as nets sinkers and vegetable scrapers, observations of natural beach deposits and a modern rubbish heap showed that some of the breakage patterns exhibited on tools may also be due to mechanical factors, and so be biogenic rather than anthropogenic in origin. The experiments have shown that considerable force is needed to punch in the umbo. Nonetheless, this pattern occurs naturally in the process of beach accumulation and midden dumping.

WHERE DO WE GO FROM HERE?

While the ethnographic observations document a wide range of applications for shell tools and show the outstanding importance of shell tools in many domestic activities, natural mechanical properties of the shells can create a `tool-like' appearance. At present there is no way to distinguish between anthropogenic and biogenic breakages from their general appearance and macroscopic morphology alone.

There is an abundance of Oceanic shell material in the ethnographic collections of museums world-wide. It is very likely that this issue will be clarified once detailed use-wear studies of artefacts of known use held in museum collections are undertaken and the results compared with observations on material from archaeological sites. As long this is not done, any anthropogenic explanation in terms of intentional modification of the shell is potentially erroneous. In the case study outlined above, this applies particularly to the so-called production waste of octopus lures (type D), which are often as proof for

the exploitation of octopus.

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