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ON THE DIET OF PIGS FORAGING ON THE MUD FLATS OF TONGATAPU: AN INVESTIGATION IN TAPHONOMY

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INTRODUCTION

The survival of faunal assemblages in the archaeological record has been the focus of several studies, which shall not be reviewed here. In general it is necessary to distinguish between the animal and the human factor, both interacting with each other (Colley 1991; Solomon 1991). This paper will be concerned with the animal factor and mainly with pigs.

In the analysis of archaeological midden materials it is commonly assumed that the matter contained in the middens stems from human actions. If we ignore large-scale modification, such as bower-bird mounds, animal action is commonly seen as a factor *reducing* the matter of an *open* midden, rather than increasing it (Walters 1984; see below; closed midden, such as caves are a different matter cf. Geering 1991).

TAPHONOMIC AGENTS IN TONGA

In an earlier paper (Spennemann 1991) various taphonomic agents in Tonga were identified and discussed. Of all the domestic animal species, only pig and dog play a major role as taphonomic agents in modern Tonga. In this respect the observations and results of this study also can be applied to prehistoric times. It was observed that humans intentionally fed almost all food remains and waste, i.e. almost everything edible, to the pigs or dogs. The more 'valuable' items, such as fish, fish skin, fish bones, chicken bones, pig bones, left-overs of starchy foods, overripe papayas, cooked or half-cooked vegetables and the like, were fed predominantly to the pigs. As additional diet, pigs were given fresh coconuts, cut in half. Besides being fed intentionally, pigs were left to scavenge for food. They were seen roaming either alone or in groups through the entire village and the adjacent plantations where they scavenged everything edible. As a rule, pigs were seen returning to their home compounds every evening.

As part of the 1985/86 fieldwork the bones left by the dogs and pigs in the compound of the author were regularly picked up and examined. On the whole, only robust fragments remained. These were, in particular, shaft fragments of long bones from cattle and horse and femur and humerus fragments of pigs. In one instance a dog was observed with a large part of a pig skull. All that

remained the next morning was the row of maxillary teeth. The skull had been chewed away to within 5 mm of the alveoles, and even the roots of the teeth showed chewing marks. Chewing marks on bones found on the beach or in the bush repeated and confirmed these observations. Chicken and fish remains and even cleaned fish bones were chewed and completely destroyed (cf. Colley 1986; Colley & Spennemann 1987, for a scavenged reference skeleton). Bones left behind by pigs tended to be even smaller. However, no systematic observations could be made due to the few occasions on which such remains were encountered.

THE RESEARCH QUESTION

Dogs and especially pigs were also observed licking the empty shells of freshly eaten shellfish. It was unclear whether pigs would eat and thus destroy empty shells. However, beyond the village boundaries, pigs were also frequently seen burrowing on the mud flats and reef flats off Tongatapu. The type of food sought after could not be determined. It was assumed that it was mainly worms, sea slugs and, possibly, shells and crabs. Swadling and Chowning (1981) describe pigs foraging on the reef flats of an island off New Britain, Papua New Guinea, and chewing shells. Since small shells are commonly not collected by people, the possibility existed that the archaeological midden composition was distorted by mollusc remains incorporated in the midden by the way of pig excreta. In addition, broken thin walled shells might have come from such a source.

Both *ethnographic* and *ethological* studies report bone chewing, and its effect on bones, for various carnivorous animals (Hill 1977, Mann *et al.* 1990 and Rodriguez & Bass 1985), such as wolves (Binford 1981; Kippel *et al.* 1987), Foxes (Hagland *et al.* 1988), leopards (Binford 1984), hyenas (Binford 1984), jackals (Binford 1984), dingoes (Walters 1984; Solomon & David 1991); porcupines (Binford 1984) and a variety of non-carnivorous animals, such as camels (Johnson & Haynes 1985), goats, and deer (Sutcliffe 1973, 1977). The literature on this subject is too expansive to be referenced properly in the context of this paper. Various *experimental* studies have been conducted on the effect of bone-chewing by dogs (Jones 1984, 1986, Lange 1983, Payne & Munson 1985), dingoes (Solomon 1986), humans (Solomon 1986) and rodents (Jones 1986). In view of this number of studies it is surprising that the effects of pigs on faunal assemblages are barely known. Gladikas (1978) described scavenging of an Orang Utan carcass by pigs. Spennemann (1991) reviewed the ethnological evidence from Tonga. The only experimental study known to the author focussing on pigs is concerned with the survival of fish bones (Jones 1986). Since pigs constitute the main domestic animal in most parts of Oceania, more such studies are needed.

THE STUDY

As an assisting study it was initially planned during the 1987 field-season

to collect and dissolve the excreta of pigs burrowing on the mud flats. To conduct the study as far as possible under controlled conditions, it was intended, if feasible, to keep some pigs, starve them temporarily and then feed them with fresh but empty shells, fresh complete shells, fish, various bones and so on. Their excreta would then be collected and analysed. This was not possible, however, and more casual methods of observation had used, as described below. From the taphonomic point of view it was perceived to be of considerable interest to know, whether -

i) pigs actually do eat shells;

ii) which shell species are searched for and eaten; and

iii) whether the remains of these shells are still recognisable in the pig excreta;

i) Do pigs actually eat shells ?

Pigs were closely watched foraging on the mud flats. It could not be seen whether pigs actually *ate* shells, as one could not get near enough to the pigs without disturbing and frightening them. Local informants all agreed that pigs do eat shellfish while foraging. However, it could not be ascertained beyond all reasonable doubt whether the informants knew this from personal observation of the pigs' feeding, from observation of the contents of pigs' entrails while slaugthering, or whether they merely assumed this to be the case. While the author is inclined to believe the informants, this judgment is based more on trust than on actual proof.

ii) Which shell species are searched for and eaten?

Local informants said that *ohule* (*Atactodea striata* Gmelin 1791) and *mehingo* (*Quidnipagus palatam* Iredale 1929) are involved. These shellfish species are the most likely ones given their habitat, relative abundance on the Tongatapu mud flats and thinness of their shell.

iii) Are the remains of these shells still recognisable in the pig excreta?

To analyse this question it was necessary to collect and dissolve pig excreta.

Origin of the sample

During excavation work at site TO-Nk-15, Maka'unga, Tongatapu, pig excreta were collected. The village of Maka'unga is located on the western shore of the lagoonal mouth and is separated from the mud flats by a road. Pigs of the village regularly go to the mud flats at low tide to forage and to wallow in

puddles and tidal pools. The excreta collected stem from these pigs. The collection consisted of two sample bags (total 1372.7 g) of wet pig excreta (still fresh) and three sample bags (total 1644.6 g) of dried pig excreta (old material).

Sample processing

Both samples were soaked in fresh water for approximately 48 hours and stirred frequently until they dissolved, producing considerable smell. The material was then put through a 1-mm mesh (mosquito screen) and hosed down. The fraction larger than 1 mm was systematically searched for any non-plant remains.

RESULTS

The bulk of the pig excreta consisted of incompletely digested grass remains, with the occasional bit of paper. The non-plant remains in the sample can be grouped into fish, crustacea, molluscs and other. These are set out in Table 1.

Fish

The fish bones, which could be attributed to the Labridae (wrasses) with varying degrees of accuracy, may stem from a single fish. The centra of the vertebrae were collapsed, compressed and indented, which is indicative of chewing (Jones 1986). The only cerratohyal also showed distinct traces of chewing. It could not be ascertained whether the pig scavenged a dead labrid at the shore or was fed the scraps ofa human meal, as has been observed by the author on other occasions.

Crustacea

The bulk of this portion of the remains consisted of numerous fragments of legs and carapace of small mud crabs. The species of crab has not been determined but seems to be a member of the Ocypodidae. These crabs live in burrows on the mud and sandflats and can be seen foraging at low tide.

Molluscs

The molluscs found in the excreta were commonly thin-walled. Exceptions are *Bulla* sp. and *Cypraea* sp. The fragments were commonly fairly small (5 x 5 mm) and no intact or broken but re-assemblable shells were encountered. Given the amount of excreta collected, it seems unlikely that pigs chewed and swallowed large amounts of molluscs. This does not preclude that molluscs may have formed a major part of the diet foraged for on the mudflats. Thin-walled shells can be cracked, the meat extracted, and the shells spat out.

Other

The fragments of *Halimeda* are most probably due to the pigs feeding on seaweed and seagrass.

CONCLUSIONS

The molluscs found in the excreta were commonly thin-walled. Exceptions are *Bulla* sp. and *Cypraea* sp. The fragments were commonly fairly small (5 x 5 mm) and no intact or broken but re-assemblable shells were encountered. Given the amount of excreta collected, it seems unlikely that pigs chewed and swallowed large amounts of molluscs. This does not preclude that *Atactodea striata* or *Quidnipagus palatam* may have formed a major part of the diet foraged for on the mudflats. Thin-walled shells can be cracked, the meat extracted, and the shells spat out.

The surprising discovery was the large number of fragments of small crabs. It appears that the pigs were in fact hunting for these crabs. Given the fragility of the crab remains, it is unlikely that they would be recovered archaeologically from midden deposits, as excavation methods, such as sieving through 1 mm mesh, would be destructive of them. In addition, the crab remains are so thin-walled that they possibly would not survive geochemical erosion.

In view of this, it seems that pig excreta would have had little, if any impact on the faunal assemblage in an archaeological midden and thus can be excluded as a *major* taphonomic factor to be reckoned with in the analysis of Tongan faunal assemblages.

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Table 1: **Remains recovered from pig excreta at Maka'unga, Tongatapu.**

FISH	
LABRIDAE (?)	1 cerratohyal
	1 quadrate
	1 articular
	2 vertebrae, squashed
	1 interoperculum
	5 spines
	7 unidentifiable cranial fragments
CRUSTACEA	
	numerous leg pieces of small mud crabs
	some carapace fragments
	a fragment of a crab claw
MOLLUSCA	
	small fragments of *Quidnipagus palatam*
	small fragments of *Modiolus modiolus*
	small fragments of *Atactodea striata*
	small fragments of *Bulla* sp.
	small fragments of *Cypraea* sp.
OTHER	
	small fragments of coral
	small fragments of pumice
	small fragments of *Halimeda* algae