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The State of Preservation of Shell Material in Midden Sites

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Abstract

THE results of a series of experiments designed to gauge the amount of fragmentation and movement of exposed shells under present-day conditions considered in conjunction with a detailed study of the survival rate of prehistoric shells led to the conclusion that significant numbers of the latter can be lost in antiquity. To date no account has been taken of this possibility in quantitative studies of shell middens, and it is suggested here that such future studies should give this aspect of midden analysis some consideration.

INTRODUCTION

ALTHOUGH the potentiality of shell middens for reconstructing aspects of the ecology and economy of prehistoric societies has been recognised for over a century, the sampling problems involved have received little recognition. A detailed examination of faunal material from a series of shell middens excavated at Wilson's promontory, Victoria, Australia, suggested that a considerable number of individual shells, in some cases up to 50 per cent of the sample, have not survived. The purpose of the present paper is to consider the factors contributing to the differential preservation of shellfish.

Material and Methods

Field experiments were undertaken in eight locations, each with different degrees of exposure to the wind. In each case, shells were found in the process of being eroded from the midden matrix. A grid system was laid out over the area, and the number of individual shells per species in each six foot square was mapped, in order to permit the calculation of contours of equal shell density and the extent of individual shell movement. Shells of certain species were removed from selected areas in the grid, cleaned on the upper side only, painted red for easy recognition and replaced in pre-recorded positions. The extent of fragmentation for individual

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shells was also noted. Measurements of two variables, the length and angle of movement for each shell, as well as the finite fragmentation were subsequently recorded at intervals of 2, 4, 6, 8, 21 and 42 weeks.

These field experiments were carried out in conjunction with detailed studies of the condition of shells from excavated contexts. The ratio of the number of whole shells to the number of equivalent shells per species (the total weight of shell, divided by the average weight of one shell of that species) was determined for a sequence of occupation levels in the soil and for the excavations as a whole. The ratios of the number of opercula of *Subninella undulata* to the equivalent number of *Subninella* as ascertained from its shell fragments were similarly determined. Since the operculum of *Subninella* is infinitely more robust than the shell itself, this ratio is held to be a valid measure of the number of *Subninella* destroyed subsequent to or upon deposition. For the purpose of this exercise the whole/equivalent ratios (abbr. W/E) and operculum/*Subninella* ratios (abbr. O/S) of the total excavation have been used.

Analysis of Results

The field experiment showed that areas with the greatest degree of exposure to the wind witnessed most shell movement, and conversely, that the areas of densest surface shell concentration were located in the most sheltered areas. In all cases, the shell movement was in the same general direction as the prevailing wind. It was also clear that the different species have different tendencies to move. This is demonstrated in the Table I below where the species have been ranked on a scale 1-7 for tendency to move.

TABLE I.—Shell species ranked in order of tendency to move.

Shell	Operculum	*Cellana*	*Dicathais*	*Subninella*	*Plebidonax*	*Brachidontes*
Ranking	1.7	2.3	2.5	2.8	3.3	4.6

TABLE II.—The Ratio of number of shells of each species fragmented to total number at beginning of experiment.

Shell	*Notohaliotis*	*Cellana*	*Dicathais* & *Subninella*	*Brachidontes*	*Plebidonax*	*Operculum*
Ranking	1.00	0.33	0.25	0.14	0.13	0

Table II shows the results of the fragmentation study. It should be made clear that numbers of shells examined in this study were too few to give definitive results. The study suggests, however, that certain species have different tendencies to fragment and that shells less prone to movement have a greater survival rate.

An analysis of the excavated fauna gave an O/S ratio of about 2:1. The W/E per species are shown in Table III. It is evident from these results that species are affected differently and that considerable numbers of shells have been lost. Comparison of the ratios shown in Table III with those in Table II show striking similarities, i.e., those species which move the most have the lowest W/E ratios.

TABLE III.—Whole/Equivalent Ratio per species for various excavations.

Species	Excavation YW9A/6 W/E	Excavation YW11/1 W/E	Test Pits YW9A/3 & YW9A/5 W/E
Polynices sordidus	0.97		
Notocypraea augustata	0.95	0.67	0.33
Austrosuccinea australis	0.84	0.93	0.81
Operculum	0.79	0.78	0.77
Poneroplax costata	0.76	0.46	0.83
Austrocochlea adelaidae	0.73		
Velacumantis australis	0.59		
Ostrea angasi	0.48		1.00
Cellana tramoserica	0.41	0.36	0.54
Scutus antipodes	0.40		0
Dicathais textilosa	0.29	0.10	0.13
Austrocochlea constricta	0.23	0.05	0.16
Notohaliotis ruber	0.23		0.50
Plebidonax deltoides	0.16		
Subninella undulata	0.13	0.15	0.06
Cabestana spengleri	0.12		
Brachidontes rostratus	0.02	0.43	
Mytilus planulatus	neg.		0
Overall Ratio	0.54	0.49	0.59

Conclusions

It has been demonstrated that wind action moves and fragments shells contained in prehistoric middens. Destruction, however, may also result from human and animal activity, and from chemical decomposition.

Speed (1967: 87) showed quantitatively that there were differences in the degree of fragmentation of mollusca in different layers of an excavation in the Bonteberg Shelter in South Africa. She suggested that the actual composition of the deposit and intensity of occupation are major factors in determining the degree of fragmentation.

It is argued that future quantitative analysis of shell material will need to take into account the probability that differential shell fragmentation has occurred since the midden in question was formed.

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