

TAPHONOMIC HISTORIES OF THE SHELLS OF ARCOID BIVALVES,
SAN SALVADOR ISLAND, BAHAMAS

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Detailed taphonomic analysis of molluscan shells can be used to infer life habits of extinct taxa, and to reconstruct the biological and sedimentary processes by which the shells were modified prior to burial. Bulk samples including dead shells belonging to six living species in four arcoïd bivalve genera, Barbatia, Glycymeris, Striarca, and Arca, were collected from a variety of substrates around San Salvador Island, Bahamas. Post-mortem modifications of individual shells indicate the variety of pathways along which they are modified between the death of the organism and final burial (see Figure 1). Quantitative analysis of the proportions of shells of a given species with different taphonomic histories record processes acting in the depositional environment and the extent to which the shells have been reworked in place or transported from their habitats.

The shells exhibit two predominant kinds of post-mortem modification, fragmentation, and encrustation. Bivalved shells may be disarticulated and they may be broken as a result of predation, impact on hard rock surfaces or corals, or by tumbling under high energy conditions. The breakup of shells may be effected by biological as well as sedimentological processes. Shells of Barbatia cancellaria are commonly chipped along the ventral margin, adjacent to the byssal gape. In contrast, fresh shells of Glycymeris pectinata are fractured across the valves. These patterns reflect different predator behaviors and different shell morphologies. The activities of boring organisms, notably sponges, greatly increase the potential for shells to be fragmented by physical processes.

Varying degrees of encrustation are observed in our samples. Considering a shell as a sedimentary particle, we can apply fluid dynamic principles to predict its potential mobility. Encrustation increases the stability of a shell, thereby reducing the likelihood that it will roll or move by saltation. Encrustation may protect the shell from both abrasion and fragmentation. In many species, superposition of encrustations laid down by different organisms can be used to define a series of stages of shell modification prior to burial. Pre-mortem and post-mortem encrustations can frequently, but not always, be distinguished. In general, the extent and sequence of encrustation are related to the amount of time that elapsed between the death and final burial of the shell. However, species such as Barbatia cancellaria are heavily encrusted when alive and lose that encrustation to post-mortem abrasion in certain environments. This analysis, which will be continued during the summer of 1988 and concluded in 1989, will demonstrate that taphonomic processes are species-specific, depending on the habits and habitats of the species, as well as their shell characteristics. This opens up the possibility of developing more precise paleoenvironmental interpretations from taphonomic data.

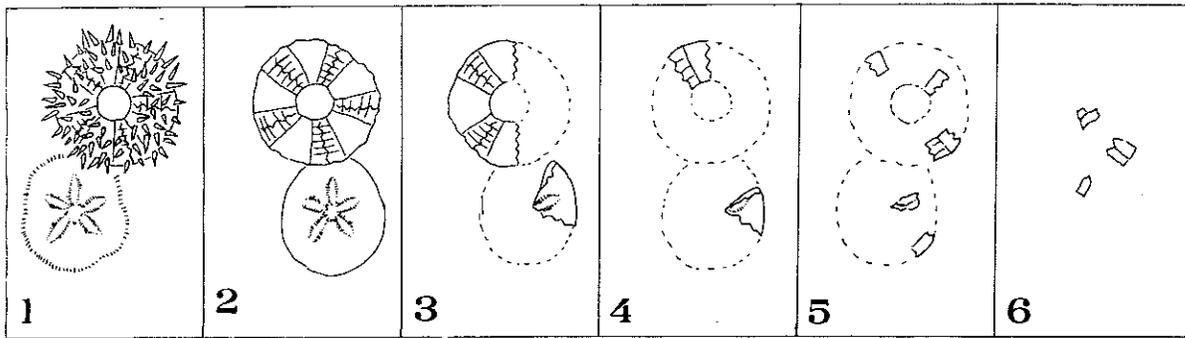


Figure 1. States of echinoid disintegration (according to criteria described in text).

Table 1. Locations of echinoid species at Fernandez Bay.

Dist. (m)	Depth (m)	Echino- metra	Trip- neustes	Dia- dema	Euci- daris	Clyp- easter	Meoma	Leodia
3	+1.5	-	4(3),5(4)	-	-	1(4)	-	1(4)
5	+1.25	1(1)	1(3)	-	-	1(6)	1(1)	-
7	+1	-	1(2)	-	-	-	-	-
10	0	7(L)	2(L)	-	-	-	-	-
12	-0.25	27(L)	1(L),1(1)	-	-	-	-	-
14	-0.5	-	2(L),1(1)	-	-	-	-	-
16	-0.75	7(L)	3(L),1(3)	-	-	-	-	-
18	-0.5	21(L)	1(L)	-	-	-	-	-
22	-0.5	50(L)	1(L)	-	-	-	-	-
26	-0.75	40(L)	1(3)	-	-	-	-	-
30	-1.5	33(L)	-	-	-	-	-	-
34	-1.5	21(L)	-	-	-	-	-	-
38	-2.0	14(L)	-	-	-	-	-	-
43	-2.25	23(L)	-	-	-	-	-	-
45	-2.25	30(L),1(2)	-	-	-	-	-	-
47	-2.0	26(L)	-	-	-	-	-	-
50	-1.5	9(L)	1(L)	1(L)	-	-	-	-
54	-1.5	4(L)	1(2)	2(L)	1(1)	-	-	-
60	-1.5	-	1(4)	-	1(L)	-	-	-
64	-2.0	-	1(5)	-	-	-	-	-
70	-2.5	-	1(4)	-	-	-	-	-
84	-2.5	-	1(2)	-	-	-	-	-
90	-2.75	-	1(4)	-	-	1(4)	-	-
100	-3.0	-	-	-	-	1(6)	-	-
104	-3.0	-	-	-	-	-	-	1(6)
109	-3.5	-	-	-	-	1(6)	-	-
124	-4.5	-	-	-	-	-	-	1(5),1(6)
130	-4.75	-	-	-	-	2(5)	-	-
133	-4.75	-	-	-	-	-	-	1(5),2(6)
141	-4.75	-	-	-	-	1(4)	-	-
TOTAL LIVE			12(L)	11(L)	3(L)	1(L)	0(L)	0(L) 0(L)
TOTAL FRAG			2(1,2)	21(1-5)	-	1(1)	7(4-6)	1(1) 4(4-6)

Dist. = horizontal distance from beginning of transect; Depth = depth below sea level at low tide; 1,2,3... = number of individuals of each species observed; (1,2,3,4,5,6) = disintegration state (according to Fig.1), and (L) = live individuals.

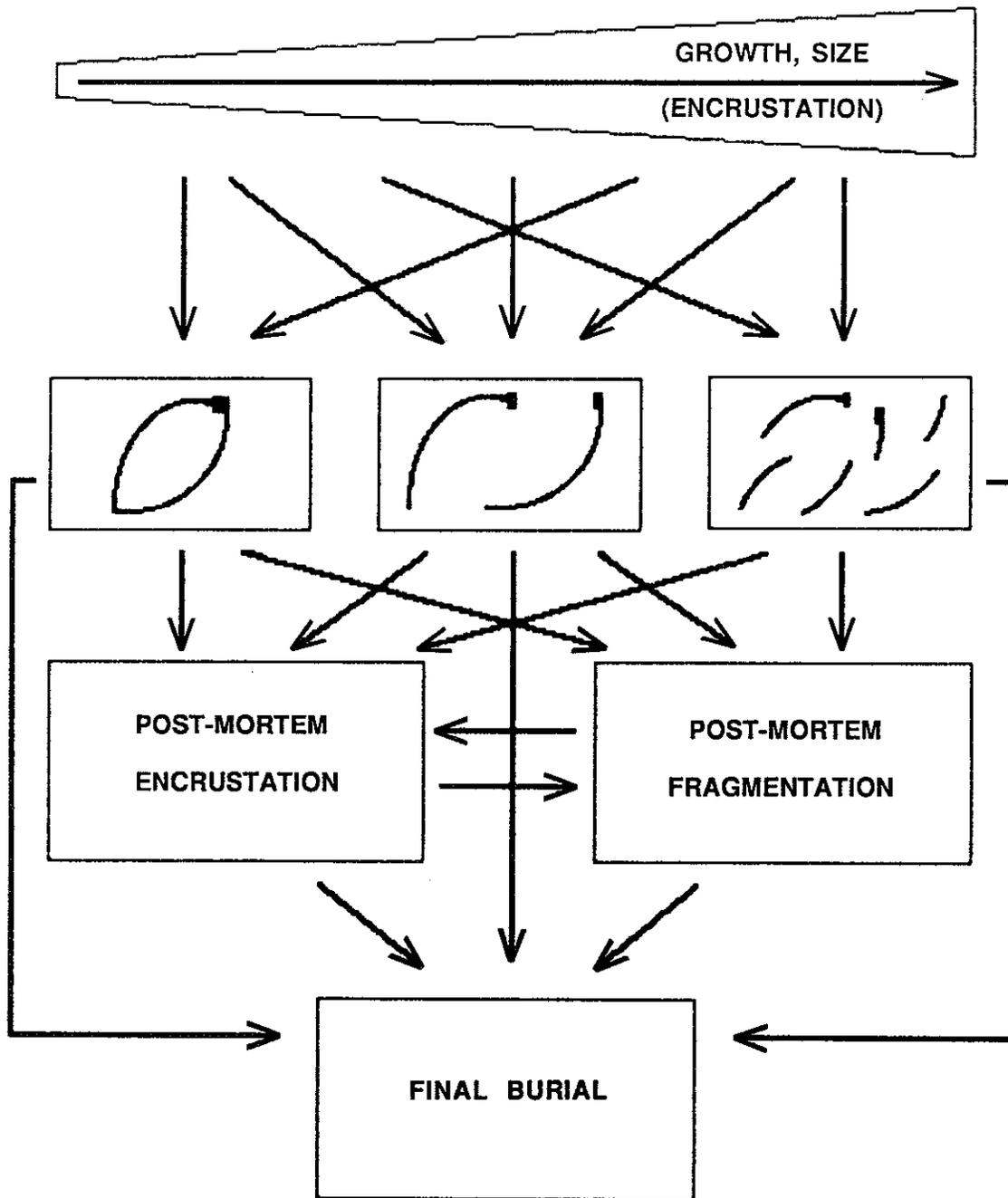


Figure 1. Multiple taphonomic pathways along which bivalve shells are modified prior to final burial.

Pleistocene Molluscan Faunas on San Salvador Island, Bahamas

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In June and July of 1987, Pleistocene age bivalves and gastropods were collected on San Salvador Island in the Bahamas. The distribution of these molluscan fossils has been examined and characterization of fossil assemblages and depositional sites has been attempted. There are 18 sampling sites from 3 general locations. Thirteen sites are at the Cockburn Town fossil reef complex, representing coral rubble, *in situ* corals, beach, and shallow intertidal facies. Three sites are at Quarry A: a beach/rocky shore/shallow intertidal environment (Bain, 1985), and 2 sites are at Quarry E: a tidal delta related environment (Teeter, 1985).

The sites were carefully chosen with several considerations: 1. large amount of shell material; 2. many whole shells (for more easily identifiable specimens); 3. good preservation; and 4. representative of the outcrop. Sketches and/or stratigraphic cross sections were made of each site, pictures were taken, and finally the bulk samples were taken using a hammer and chisel.

After the fossil shells were retrieved from the rocks, identified, and counted, the data was quantitatively analyzed in order to examine fossil distribution. Clustering methods were used to describe probable fossil assemblages. Similarity coefficients, both distance and cosine theta, were used for the locations. Only distance coefficients were used in the analysis of the species data. (Harbaugh and Merriam, 1968) A discussion of the results of this analysis follows. Each major division (assemblage) defined by clustering is discussed separately.

The Barbatia cancellaria assemblage contains 18 species, only 2 of which are bivalves. (Figure 1) All the species are found at location QA1A, a beach deposit. (Figure 2) All but two of the species (Littorina nebulosa and Nerita peloronta) are found at this location in their greatest numbers. L. nebulosa and N. peloronta join the cluster at the furthest point, perhaps a result of their not being most abundant at QA1A. Based on present occurrence, over two-thirds of the species are rocky shore - rocky intertidal inhabitants. Several live on or in the intertidal sand. The beach deposit is very close to the rocky shore and shallow intertidal deposits in Quarry A.

In the second assemblage consisting of 8 different species, bivalves dominate and Laevicardium laevigatum is the most abundant. All the members of this assemblage are found in their highest numbers at location CR4A, a coral rubble zone. Mollusk remains were found suggesting life position. From the states of preservation of the shells, it is apparent that this site is made up of partially *in situ* fossils and partially storm fill/washed in shells. The species from this assemblage are probably fill material, but as indicated by many *in situ* valves, may not have travelled far from their original habitat after death. Only a relatively small percentage of shells from CR4A were broken or in other ways damaged.

The third cluster group is the Cerithium litteratum assemblage, a gastropod dominant assemblage. (Figure 1) All but 4 species are found at location CR5A in their highest numbers. The Cerithium litteratum group is being clustered mainly on the basis of the species' occurrences at CR5A and CR5B, a shelly coral rubble zone containing Acropora palmata and A. cervicornis. (Figure 2) The presence of many well preserved shells and an entire urchin (CR5B) suggest that the fossils did not travel far before being deposited and were most likely subjected to rapid burial (Dodd and Stanton, 1981).