LUCINID SHELL DISTRIBUTIONS AND THEIR USE IN THE RECOGNITION OF DISTINCT TAPHOFACIES, SAN SALVADOR ISLAND, BAHAMAS

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Taphonomic processes may modify an organism's remains, to a greater or lesser extent, after it dies but before it becomes incorporated into the rock record. Amongst those processes which affect potential fossil shells are fragmentation, encrustation, wear, and transport away from the habitat of the organism. This last phenomenon is the main focus of this preliminary study. By analysis of the distribution and preservation states of living bivalves of the family Lucinidae and that of their dead shells, it is possible to characterize specific environments by their associated taphofacies, which should be recognizable in the rock record.

Shell samples were collected from modern sediments at various localities around San Salvador, in the Bahamas. The species considered here are: Divaricella quadrisulcata, Linga pensylvanica, Codakia costata, and Codakia orbicularis. The environments sampled include marine grass beds, shell gravels, tidal channels, open sandy bottoms, and veneers of sediments on hard substrates. Such environments occur in a variety of settings, in protected bays, off exposed shorelines, among patch reefs, and in a tidal inlet.

Field observations of the physical environment, sediment size, and predominant larger organisms were obtained at each locality where a shell sample was sieved from the sediment. Lucinid shells were picked from these samples, and the numbers of shells in each size category were counted for each species.

These data can be analyzed and related to environments in several ways which provide a basis for different kinds of paleoecological inferences. The presence or absence of an individual species may be indicative of a specific environment, but more often it reflects only the fact that the species lived somewhere in the vicinity. Most shell samples are quite heterogeneous in the species they include, not least because it is very easy to introduce a single shell of a species that lives in another environment, but it is virtually impossible to remove every shell of an indigenous species.

A further level of resolution can be obtained by determination of the relative abundances of the species in each sample. For instance, two types of Thalassia meadows, exemplified by samples PC17 and PC18 are differentiated by their predominant lucinid species, Divaricella quadrisulcata and Codakia costata (Figure 1).

More information can be gleaned from of these species distributions if recurring size-frequency distributions of the shells are taken into account. Distinctive size-frequency distributions of shells of Linga pensylvanica characterize grass beds and higher energy environments. Small shells are well represented in grass bed assemblages, such as sample PC10, while large shells are more abundant in shell concentrations from scour zones, as in sample EB1 (Figure 2). Larger shells are characteristic of high energy gravels in general, where they are simply sedimentary particles. The larger, heavier shells are left behind as a lag by winnowing.

However, these size/taxon data also show unexpected differences between generally similar environments. In two samples from Pigeon Creek tidal channel, shells of Linga pensylvanica are biased toward larger sizes, but much more so in PC13 than in PC9. This difference reflects shells in the process of being transported (PC9) and the lag which is left after these have been removed from the original assemblage. Here two distinct, subtly different taphofacies can be recognized.

Size distributions can also be compared across taxa in a given sample. In untransported assemblages, species exhibit quite different characteristic size distributions, while sediment sorting in transport gives rise to assemblages in which several different species exhibit a similar size distribution. So, in grass beds such as that from which sample PC18 was obtained, quite different size-frequency distributions are observed for the different species, while the shells of three species are concentrated in a single size interval in sample PC9, which was taken from a shell bed undergoing active transport (Figure 1).

Aside from the size/taxon criteria that have been discussed here, other consequences of taphonomic processes, such as fragmentation, abrasion, and encrustation of the shells, are also correlated with the habits of the living lucinids and the processes by which their shells are deposited. These variables will be analyzed in the next phase of the study.

Distinctive taphofacies can be more precisely defined by comparison of greater numbers of species, especially across higher taxa. Comparison of the results of this study with analogous work of L. Ferdinand on shells of predominantly epifaunal arcoid bivalves should make it possible to distinguish very different post-mortem histories. Comparison of the data provided by these two groups should lead to more precise descriptions of taphofacies and and their relations to distinctive modern environments. Once this has been accomplished, these results will provide a basis for the interpretation of similar patterns in the fossil record.

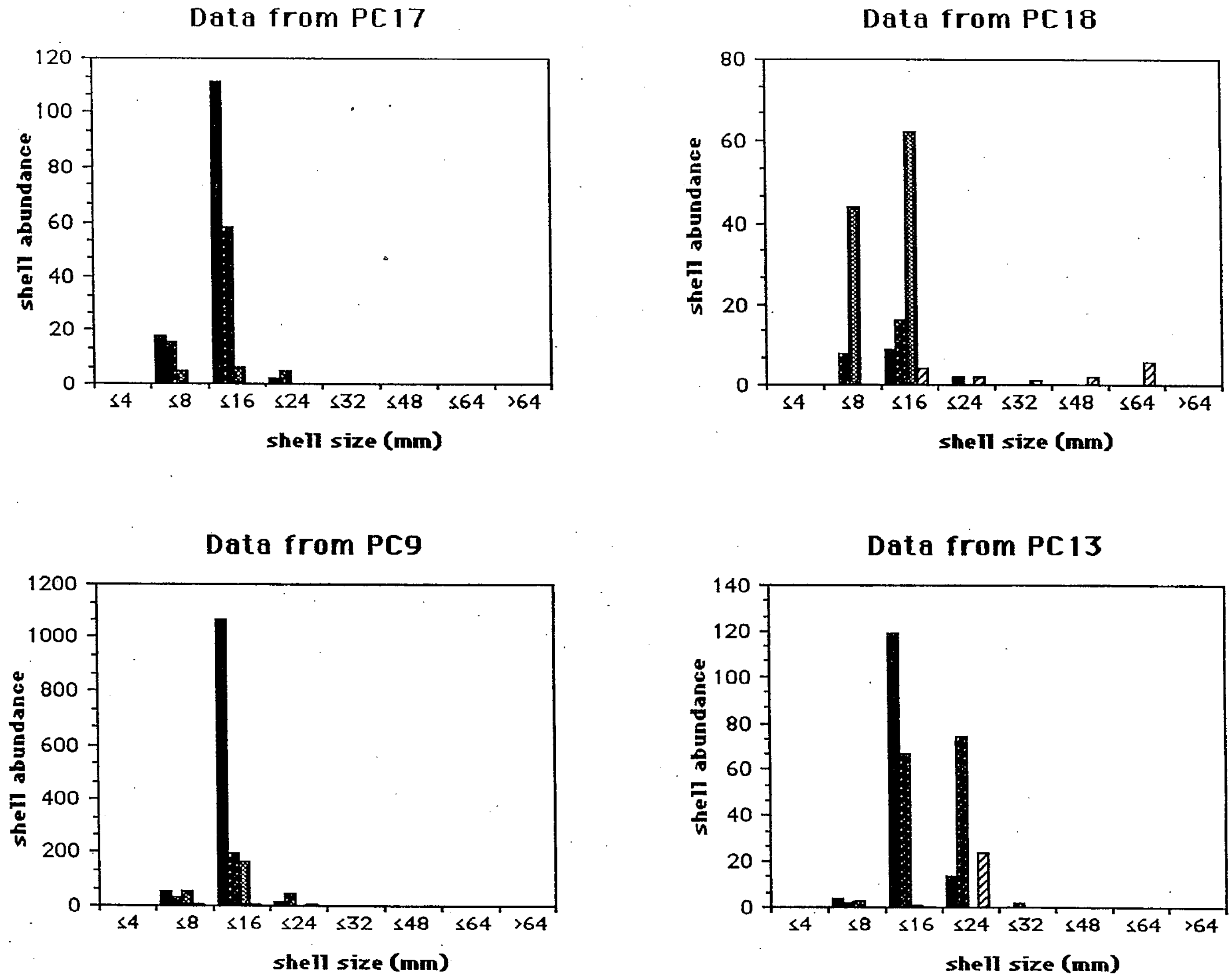

Figure 1. Graphs Displaying Absolute Shell Abundance Versus Shell Size For All Lucinoid Species Found on San Salvador Island, Bahamas

- Divaricella quadrisulcata
- Linga pensylvanica
- Codakia costata
- Codakia orbicularis

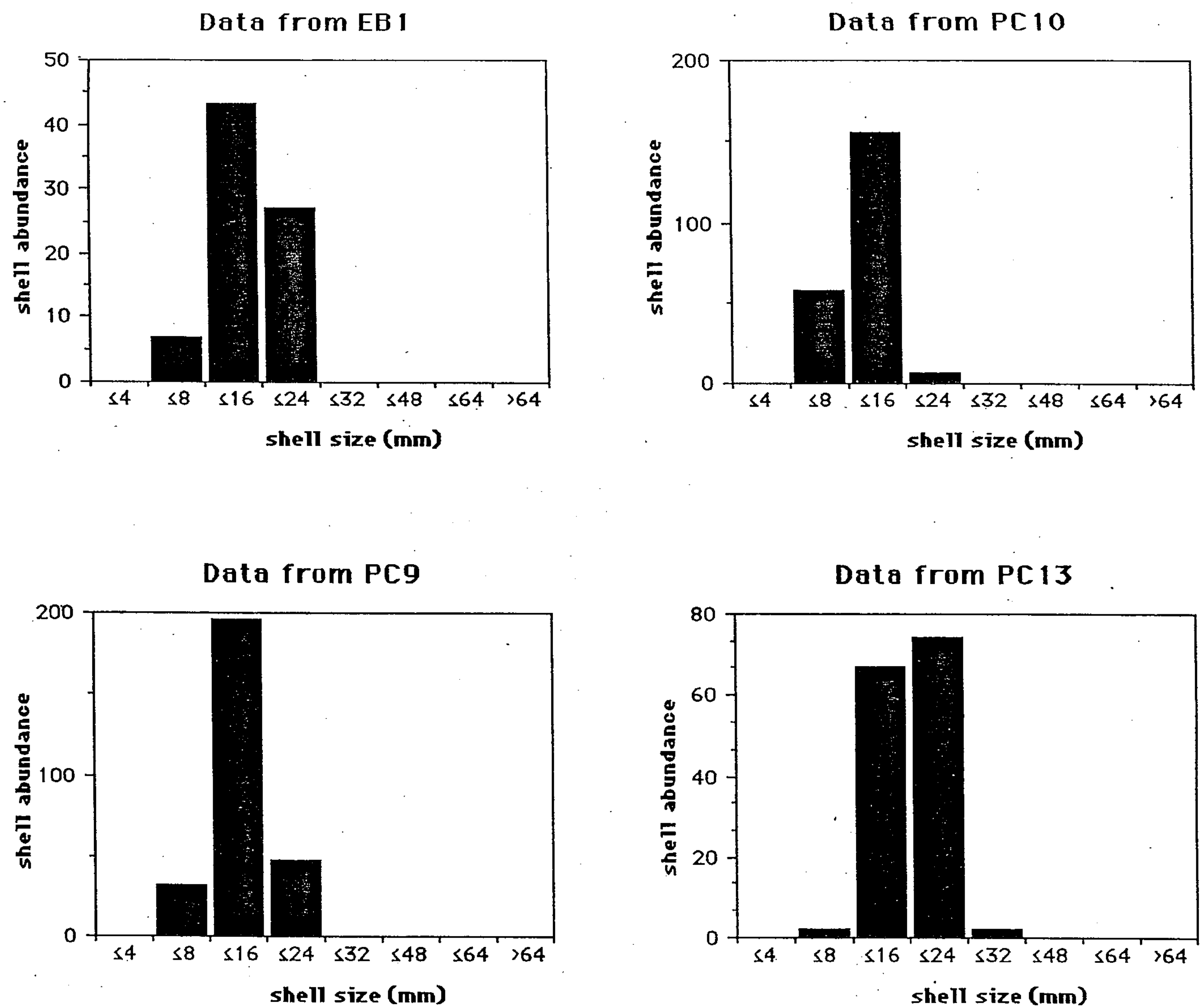

Figure 2. Graphs Displaying Absolute Shell Abundance Versus Shell Size
For the Species Linga pensylvanica Found on San Salvador Island, Bahamas