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ABSTRACT

Seasonal occupation of sites and utilization of resources by aborigines is a subject of growing importance to prehistoric archeologists; however, relatively few satisfactory techniques are available for making the necessary determinations. Recent research in New Zealand has indicated the potential value of bivalve mollusks in subsistence-settlement pattern studies. A method for seasonal dating of prehistoric sites involving growth ring analysis of freshwater mussel shells and the potential application of this method in Ozark archeology are discussed.

INTRODUCTION

Because of the increasing concern in recent decades for explanation of the processes underlying cultural development and interaction, there has been a shift from research on individual sites and artifacts to studies involving whole areas and the various relationships among sites and their environments. Such studies necessarily pertain to the spatial and living arrangements of groups of people over a period of time. This new dimension in archeology has been appropriately labeled "settlement archeology" and has been the subject of much discussion during the past decade (Chang 1968, Trigger 1967, Willey 1968). However, the reconstruction of the settlement patterns of prehistoric hunters and gatherers has posed a particular problem to archeologists because such groups periodically shift their residences to exploit seasonal resources more efficiently. Such shifts have been documented ethnographically as well as archeologically (Schoolcraft 1854, Steward 1938, Swanton 1946, Thomas 1973, Winters 1969).

To assess adequately the subsistence-settlement system of any given prehistoric group, one must determine the variety of site types, their functions, and, most notably for the purposes of this discussion, the duration and season of their occupation. Faunal analysis has been one of the more useful archeological tools for determining seasonal shifts in residence patterns, although few specialized techniques are available which can offer reasonably accurate reconstructions. The purpose of this paper is to introduce the fundamentals and potential archeological applicability of one technique which involves analysis of freshwater mussel shells excavated from prehistoric sites. Also, its particular relevance to Ozark archeology is discussed briefly. Research is being conducted by the author toward the testing of this method at an Ozark bluff shelter; it is hoped that more concrete results soon will be available.

METHOD OF ANALYSIS

The basic objective of the method is to ascertain by growth ring analysis the season of death of freshwater mussels gathered by prehistoric peoples and thus the season of the mussels' use. Before the actual analytical procedures are described, a brief discussion of mussel shell structure and growth is provided as a basis for understanding the procedures.

Structure of Mussel Shells. The shell of a freshwater mussel has two parts, a left and a right valve, held together by a ligament. Each valve is composed of three layers of secreted material: the periostracum or external covering which protects the underlying portions of the shell from damage and erosion; the thin middle or prismatic layer composed of vertical prisms of calcium carbonate; and the relatively thick nacreous (mother-of-pearl) or inner layer which consists of a large series of thin calcium carbonate sheets or plates that lie upon each other and are parallel with the surface of the shell (Murray and Leonard 1962, Parmalee 1967, Pennak 1953). Growth of the shell is accomplished by the secretion of shell substance on the three layers by cells near the margin of an organ called the mantle. The primary function of the mantle, along with sensation and respiration, is secretion of shell material for growth.

Upon any change or fluctuation in environmental conditions (for instance, the drastic drop in air temperature during winter), the margin of the mantle withdraws within the shell to such an extent as to sever its formerly uninterrupted growth connection with the margin of the shell. When growth resumes after such an interruption, there is essentially a doubling up or overlapping of the outer two shell layers (i.e., the periostracum and prismatic layer). In other words, growth does not begin again exactly where it left off, but at a slight distance from that point. This phenomenon is manifested by a dark band or ring. Although any relatively severe disturbance of the organism (e.g., handling of the mussel by humans) can cause such an interruption of the growth process, interruption rings corresponding to the season of winter differ from those corresponding to more singular disturbances; the former show several repetitions or duplications close together and the latter do not. Thus, winter bands in shells tend to appear darker and broader (Chamberlain 1930, Coker et al. 1920, Lefevre and Curtis 1910). The technique to be outlined is an attempt to recognize these winter recession or interruption rings so that the approximate season of death of the organism can be ascertained.

Sampling Considerations. Though a technique based on recognition of winter recession rings in mussel shells would be most valuable for extracting seasonal data from archeological sites, it would be adequate only for determining whether or not a site was occupied at a particular time during the year. It would leave unanswered the question of whether the site also was occupied at other times of the year. For a more thorough picture of the subsistence-settlement patterns of sites, all other forms of evidence, faunal and otherwise, should be considered in conjunction with the data provided by this and other techniques.

In addition, for more accurate pertinent seasonal data, several "indicator" species to be used for the procedure should be determined on the basis of environmental and habitat data of the various species. These species not only should have been easily accessible to the prehistoric Indian populations, but also should have been within a class that prefer more insulated environments so that external ecological influences would have been minimized (Murray and Leonard 1962). Obviously, a compromise must be reached between these two seemingly opposing characteristics.

Preparation and Analysis of Samples The technique is based essentially on work done in New Zealand with saltwater bivalves by Coutts and others (1970, 1971). The basic preparatory procedure is summarized in Kummel and Raup (1965). The valve to be analyzed is cross-sectioned through the umbo axis (i.e., the axis of maximum shell diameter from the hinge) with a diamond-bladed saw, and one half is mounted in plaster of paris to secure it. The cross-section then is ground and polished by use of a lapidary wheel. Next it is etched with a 5% dilute solution of hydrochloric acid to remove impurities and prepare the surface. This step is followed by the application, drying, and removal of a liquid acetate peel. The removed peel is stained if necessary to bring out details and is secured to a slide so that it can be photomicrographed. The resultant photograph is used to obtain an estimation of the approximate date of death of the specimen by measuring the distances from the margin of the shell to

the last winter growth interruption ring.

Measurement obviously must be taken of the distances between all of the annual rings of a given species so that the time gap between the laying down of the last winter ring and the death of the organism can be approximated. However, it is first necessary to determine whether there is any consistent metrical relationship between the consecutive winter rings of a given shell, for as the organism increases in age, its growth decreases and the distances between rings tend to lessen. There are indications from the results obtained in New Zealand and from the Chamberlain study that it would be feasible to distinguish metrically between consecutive rings. This step would necessarily be accomplished for each species by correlating the measurements taken from a sample of modern-day mussels with similar measurements taken from excavated specimens of the same species (Coutts 1971). It might also be possible to observe daily growth rings within the cross-section and thus increase the accuracy of the technique, but such rings could be determined only by microscopic examination. The results obtained from the analysis of each specimen are compared with those of others in order to calculate an approximate season or time of mussel collecting by the inhabitants of the site in question.

POTENTIAL USE IN OZARK ARCHEOLOGY

Such a method would be of great value for Ozark archeology because relatively little is known about the subsistence-settlement patterns of the prehistoric inhabitants of this region, as is indicated in the cultural syntheses of the region (McGimsey 1963, Scholtz 1969, Wolfman 1974). This lack is due partly to the overemphasis during past decades on excavation of bluff shelters and partly to the difficulties of locating open sites in this region. There is even general disagreement as to the nature and length of occupation of the bluff shelters themselves (Cleland 1965, Freeman 1960). More precise methods for determining occupation duration and season would be instrumental in defining site types and site functions. This information in turn would expand knowledge so that more reliable predictions of site locations might be made for the region.

The significance of the method might be said to go beyond Ozark prehistory and even subsistence-settlement pattern studies in that it is another indication that archeology is continually expanding its scope by adapting and refining techniques of other disciplines for the study of prehistory. The understanding of the behavioral processes involved in the interaction of cultural systems with each other and their environments depends upon the understanding of the nature of the interaction in question (in this case, the subsistence-settlement system of a prehistoric population). Therefore, one of archeology's major goals today should be to develop and refine such analytical techniques so as to interpret more precisely the nature and workings of prehistoric cultural systems.

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